

**Using a Distant
Web-Hosted SDR
to Monitor
Your FreeDV+ Signal**

**by Rick Peterson, WA6NUT
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Monitoring Your FreeDV+ Signal

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1. INTRODUCTION

A Web-hosted SDR is an SDR receiver accessible via the Internet. Most of the Web-hosted SDR's cover some amateur frequencies, and they offer features like adjustable bandwidth, operation on AM, USB and LSB, an effective auto-notch filter, an "S" meter, and a waterfall or spectrum display. A Web-hosted SDR can be accessed by many users simultaneously. However, the tuning resolution is limited to steps of approximately 30 Hz (making the tuning of the received FreeDV+ video more difficult).

QST magazine published a helpful article on Web-hosted SDR's. The article, "Web-Hosted Software-Defined Radios," written by G. Keith Cambron, KC1ATT, is in the January 2018 issue, pp. 38-40.

The primary websites for Web-hosted SDR's are:

<http://www.websdr.org> and

<http://kiwisdr.com/public/>

Many SDR's can be accessed at the WebSDR website, including the following in the U.S. currently active and covering the 20M amateur band:

K3FEF at Milford, PA: <http://K3FEF.com:8901/>

KFS at Half Moon Bay, CA: <http://69.27.184.62:8901/>

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Figure 1, p. 12, shows the author's FreeDV+ signal received at the KFS WebSDR receiver at a distance of 890 miles. The Microsoft WNDSURF1.AVI test video is being transmitted along with FreeDV audio ("1600" mode).

Figure 2, p. 13 shows the WA6NUT signal received at the K3FEF WebSDR in Milford, PA (1,650 miles).

The WebSDR site includes an FAQ page providing practical tips for using the WebSDR receivers. Each WebSDR can accommodate 30+ users simultaneously.

The KiwiSDR site also provides many SDR's including the following:

W3PIE at Hopwood, PA: <http://kiwisdr.dlinkddns.com:8073/>

VE6JY at Lamont, Alberta: <http://ciw321.cfars.ca:8174/>

Note that each KiwiSDR receiver is limited to 4 users maximum simultaneously.

Figure 3, p. 14 shows the WA6NUT signal received at the W3PIE/WA3MJY KiwiSDR receiver in Hopwood (Jumonville), PA. WA6NUT is transmitting a "twirling license plate" video clip.

Here are some reasons you might want to monitor your FreeDV+ signal using a WebSDR receiver.

To check out the quality of your video and voice signal

To learn how to receive and tune a FreeDV+ signal

To demonstrate FreeDV+ operation to visitors to your shack or to friends via the Internet, or

Bragging rights for that FreeDV+ one-way DX contact!

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2. PRELIMINARIES

First of all, find a WebSDR at a location where your signal will be received at an S8-S9 level. The author has found that with S6-S7 signals, it's difficult to obtain correct colors in the received image. As the frequency is tuned from a pinkish image to a greenish image, the image at the transition point is very dark (with a stronger signal the image at that point can be fine-tuned, using the "Colour Balance" slider, for accurate colors).

Choose an SDR with a good receiving antenna. Antenna details are given on the individual page for each SDR receiver.

If you are transmitting with a transceiver using a master oscillator locked to a GPSDO, choose a Web-hosted SDR also locked to a GPSDO. It will simplify tuning the received video. The KiwiSDR site indicates which receivers are locked to a GPSDO.

Ideally, a Web-hosted SDR at the one-hop distance (800-900 miles) will receive your signal with the strongest "S" meter reading. For the author, the KFS WebSDR at 890 miles gives a generally consistent S8-S9 reading for my FreeDV+ signal (40 watts average output on 20M to a Cushcraft MA-5B mini-beam at 30 ft.). See Figure 1, p. 12. Reception at a significantly greater distance (i.e., the K3FEF WebSDR at Milford, PA at 1,650 miles distance) provides lower "S" meter readings (see Figure 2, p. 13).

3. SETTING UP

On your PC, enable the screen print function – it's useful to have hard copies of the screen – as a record of video quality and the settings used.

Method 1: Use the VB-Cable Application

This method is used by Gerhard Burian, OE3GGB, to monitor FreeDV on the 10 GHz band, using the Qatar-OSCAR 100 geosynchronous

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satellite and the Goonhilly Earth Station WebSDR.

<https://sourceforge.net/p/freetel/mailman/message/36734483/>

This method uses VB-Cable, a “Donationware” app you can download from:

<https://www.vb-audio.com/Cable/>

Note: the author was unable to get Virtual Audio Cable (VAC from Eugene Muzychenko) to properly interface with the FreeDV app.

This method is preferred, as the displayed video and FreeDV decoding are not corrupted by the decoded FreeDV audio being fed back to the sound card input. Also, the decoded FreeDV audio can be set to a sufficiently high level for comfortable listening and intelligibility.

First, download and install VB-Cable.

A. Settings for Windows Sound

Control Panel --> Hardware and Sound --> Sound --> Playback

Set “CABLE Input . . .” as the Default Device

Playback --> Properties --> Advanced

Set to 16-bit 48000 Hz

Recording

Set “CABLE Output . . .” as the Default Device

Recording --> Properties --> Advanced

Set to 16-bit 48000 Hz

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B. Settings for the FreeDV app

Tools --> Audio Configuration

Set "From Radio" to "CABLE Output . . ." WDM 48000

Set "To Speaker/Headphones" to "High Definition Audio" WDM 48000 (substitute the name of your motherboard sound card for "High Definition Audio").

C. Settings for WinWarbler

Config --> Soundcard

Set "PSK & RTTY Reception" to "CABLE Output . . ."

To restore your PC for normal sound card operation, set the motherboard sound card back as the Default Device in Windows Sound Playback and Recording.

Method 2: Connect an Audio Cable from Output to Input

In addition to the disadvantages previously given, this method must be used with care to avoid applying excessively high signal levels to the sound card input.

On your PC, connect a 3.5 mm stereo audio cable between the the output jack and input jack of the motherboard sound card. Keep the Windows Sound Playback level low enough to avoid excessive degradation of the received video and FreeDV audio (the FreeDV decoder audio output is mixed with the audio to the FreeDV decoder and video receive app).

SETTING UP (Cont.)

Next, go to the Web-hosted SDR site, and tune the receiver to your transmit frequency (usually 14236 kHz, the FreeDV "watering hole"

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frequency). Set the mode to USB and the bandwidth to 3.6 kHz or more.

Open three applications:

FreeDV ("1600" or "700D" mode, whichever you're transmitting):

Configure it for the soundcard input and output being used. Select the Spectrum display option.

RXfftDIFF7L: Check all the checkboxes and set the Brightness slider for 25% up and the Contrast slider for 100% up.

WinWarbler: In the Configuration menu, under Soundcard, select the soundcard being used. Use the default waterfall display.

Arrange the GUI's on your screen so that, on:

WebSDR or KiwiSDR: The frequency can be changed and the "S" meter is visible

FreeDV: The Start button is accessible, the SNR meter is visible, and the textbox and spectrum displays are visible

RXfftDIFF7L: The video screen is visible and checkboxes and Brightness, Contrast, Fine Tune and Coarse Tune sliders are accessible.

WinWarbler: The left corner of the top PSK text box is accessible, the AFC frequency readout value is visible, and the waterfall display is accessible up to about 2.2 kHz.

You should see noise or other stations in the FreeDV spectrum display and in the WinWarbler waterfall display. If you don't, or if the

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noise or signal level is too high, adjust the soundcard Record and/or Playback levels.

4. TUNING THE RECEIVED FREEDV+ SIGNAL

Next, you'll transmit your FreeDV+ signal to the Web-hosted SDR receiver you've chosen. Point your antenna toward the WebSDR's location. Configure your transmitting setup to transmit a video clip. Make sure the frequency is clear (on both your own receiver and on the Web-hosted SDR), then transmit the FreeDV+ signal (make sure you do a voice ID every 10 minutes -- or more often).

Now the procedure for tuning the WebSDR:

Tune the WebSDR for a reading on the WinWarbler AFC readout closest to 2.175 kHz:

- (1.) Click in the top PSK textbox, then click on the B58 subcarrier in the WinWarbler waterfall display (the B58 is the luminance subcarrier just to the right of the highest FreeDV subcarrier). The B58 subcarrier should become a yellow trace as the AFC locks (if the AFC didn't lock, repeat the process).
- (2.) Note the AFC readout value (in kHz). Calculate the difference from the reading and 2.175 kHz (in Hz). Use that calculated difference to correct the Web-hosted SDR tuning. For example, if the AFC readout was 2.195 kHz (20 Hz high), tune the SDR up 20 Hz, or 0.02 kHz (this may seem counter-intuitive). Or, if the AFC readout was 2.155 kHz (20 Hz low), tune the SDR down 20 Hz, or 0.02 kHz.
- (3.) If the Web-hosted SDR had 1 Hz tuning resolution, this procedure would work, giving an AFC readout value very close to 2.175 kHz. But, with Web-hosted SDR tuning in 30 Hz steps, you'll just have to settle for adjusting the WebSDR tuning to give a WinWarbler AFC readout value

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closest to 2.175 kHz (within ± 15 Hz, between 2.160 and 2.190 kHz). We'll use the RXfftDIFF7L "Colour Balance" slider to complete the process.

The last step is to use the "Colour Balance" slider on the RXfftDIFF7L application. Adjust the slider for the best colors in the received image (if you're transmitting the WND SURF1.AVI video clip, tune for a yellow sail on the sailboard).

An alternative to the above last step is to adjust the transmitting frequency up or down a few Hertz to obtain the 2.175 kHz reading on the WinWarbler AFC readout. If the WinWarbler AFC locks on the B58 subcarrier with a readout of 2.160 kHz, INCREASE your transmit frequency by 15 Hz. If the readout is 2.190 kHz, DECREASE your frequency by 15 Hz. You can then fine-tune the colors in the image using the "Colour Balance" slider, if needed.

Since the FreeDV application has automatic frequency control (AFC), tuning for best video should give a FreeDV SNR reading of 10 dB or more. Note that the AFC range for the "700D" mode is limited to about ± 15 Hz max.

Use the volume slider control on the KiwiSDR or WebSDR display to control the signal level into the FreeDV app, video receive app, and WinWarbler.

To control the audio level from the FreeDV decoder, use the Levels slider control accessed as follows:

Control Panel --> Hardware and Sound --> Sound --> Playback

Select "Speakers" for your motherboard sound card ("High Definition Audio" for the author's setup) and click on the "Properties" button. Click on the "Levels" tab, and use the slider control at the top to control the volume level of the decoded FreeDV audio.

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Use your PC's screen print function to print out the screen, showing the video quality and the settings on each application.

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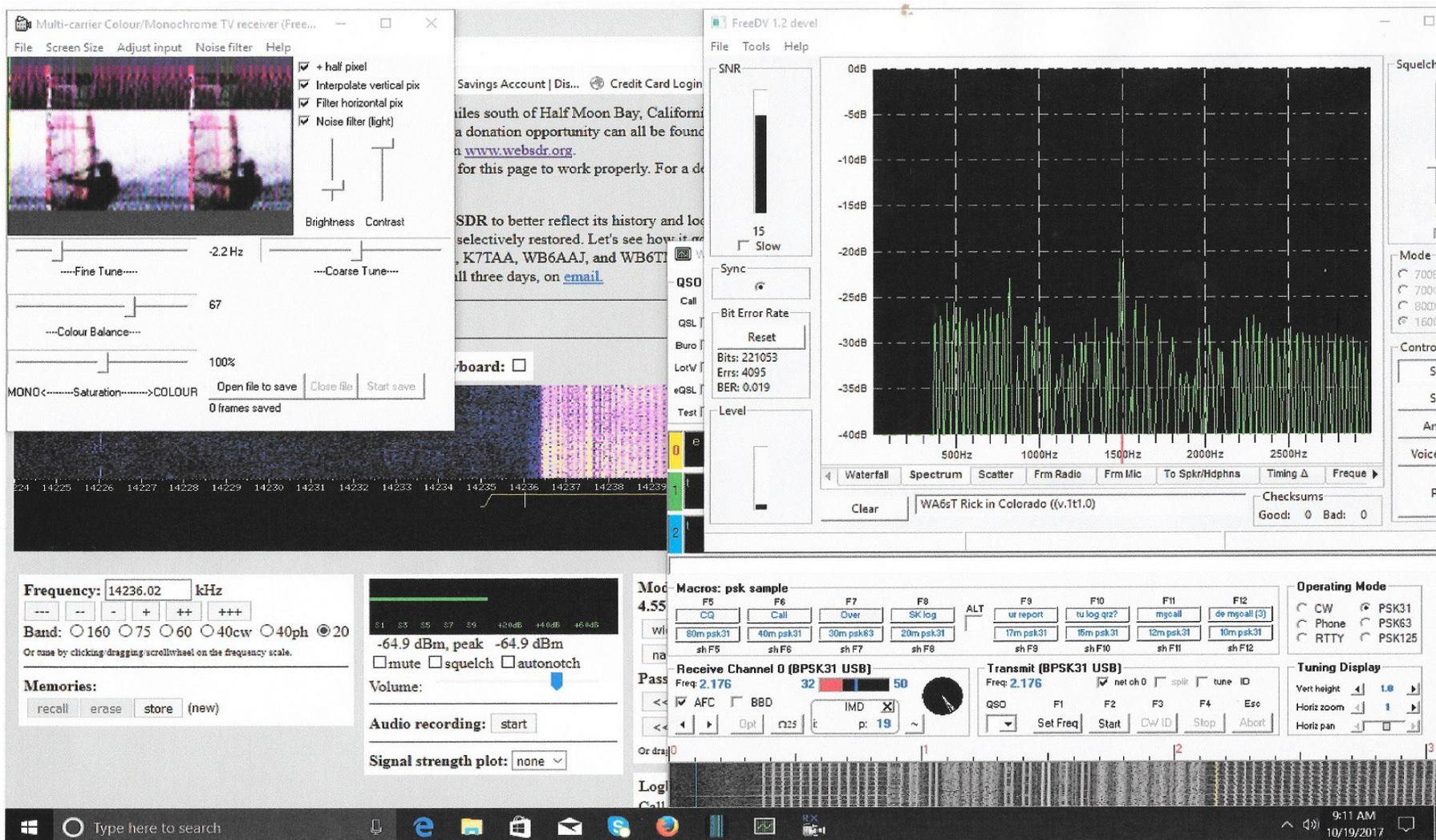


Figure 1: WA6NUT signal received at KFS, Half Moon Bay, CA (WebSDR)

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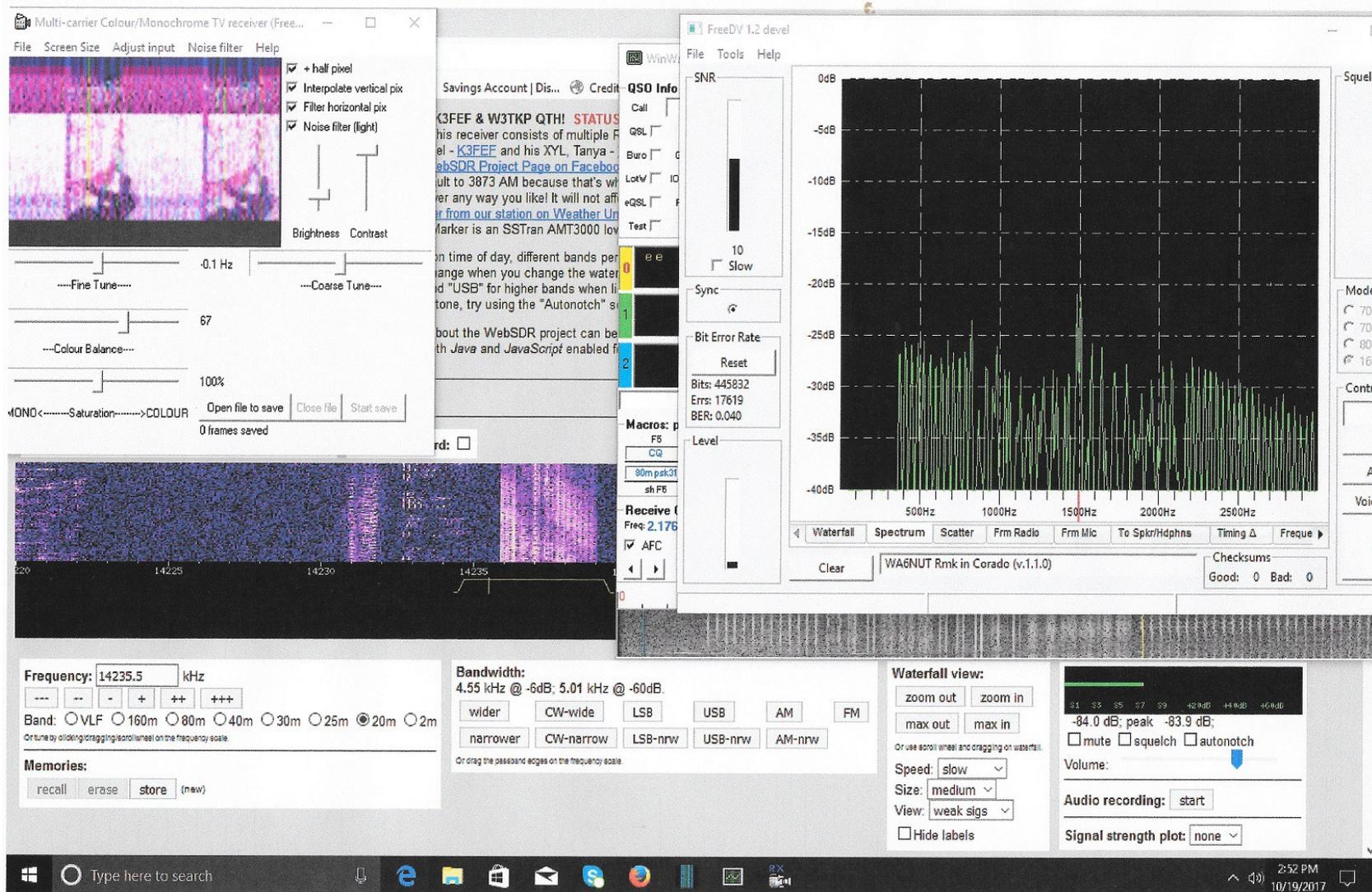


Figure 2: WA6NUT signal received at K3FEF in Milford, PA (WebSDR)

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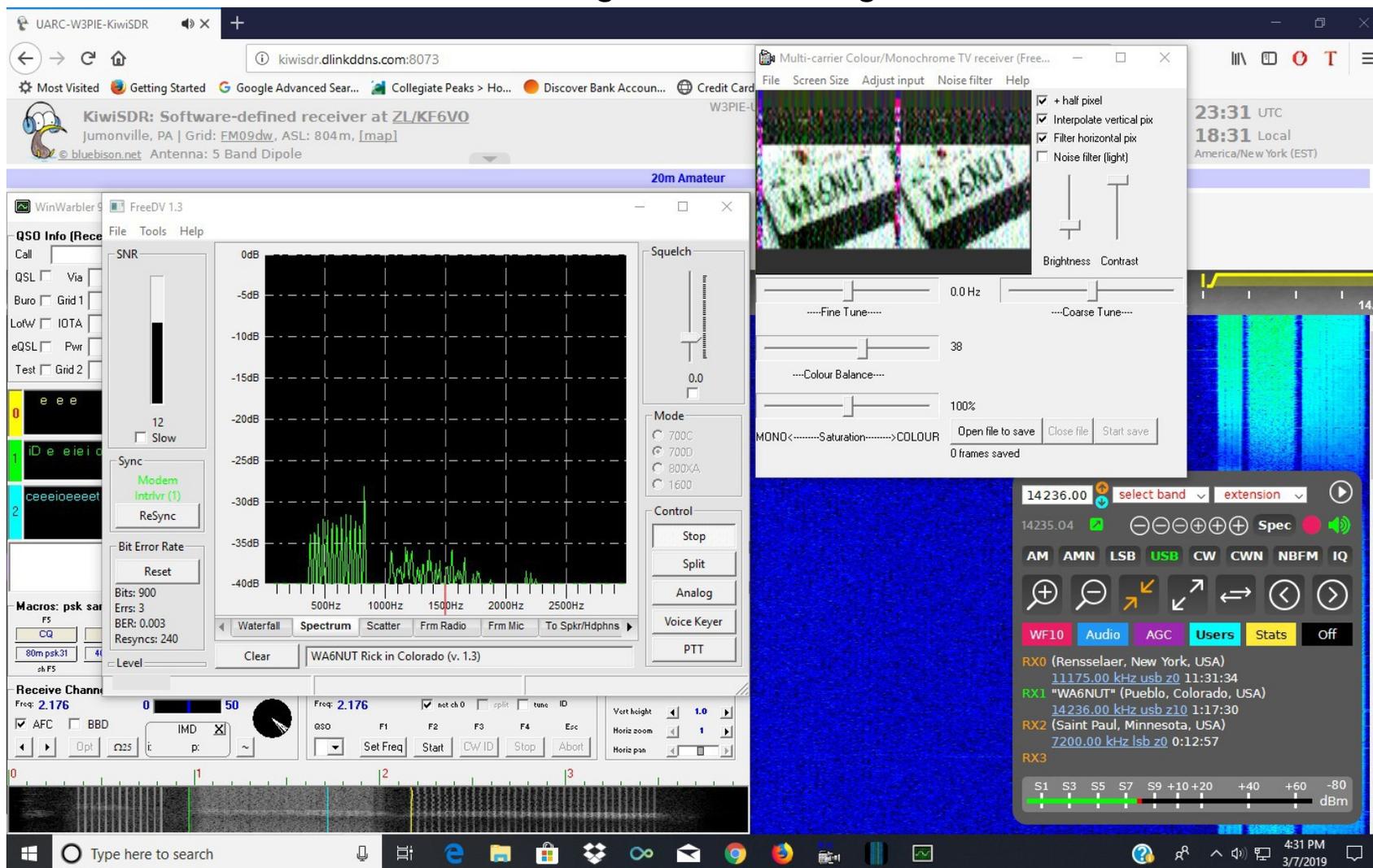


Figure 3: WA6NUT signal received at W3PIE/WA3MJY in Hopwood, PA (KiwiSDR)