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Build, Tune, Explore with OpenWebRX+

Web-Connected Software-Defined
Radio Made Simple



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Enter the (Frequency) Matrix

In the 1999 cyberpunk action film “The Matrix”, Cypher introduces Neo to the Matrix code, a cascade of symbols (mostly stylised katakana)¹ representing on screen the activity going on inside the digital world, commenting “you get used to it: I don’t even see the code – all I see is blonde, brunette, redhead...”.

The waterfall is a bit like that: the coloured vertical strips show signal activity on each frequency, and with a bit of practice we can tell what’s going on, just by looking at these strips. After a while we can tell what kinds of signals are there, without having to listen to them:

- AM and FM broadcast stations appear as continuous strips, as they transmit non-stop. The carrier frequency usually is usually the strongest part of the signal, appearing in red down the middle, with yellow or greenish edges showing the upper and lower sidebands with the audio;
- two-way radio signal strips stop and start as the operators take turns talking. If they are using a single sideband mode, the strongest part of the signal is usually on the left (for lower sideband) or right (for upper sideband).
- Morse code signals also start and stop: we can even see the “dots” and “dashes” if we rotate our head anticlockwise;

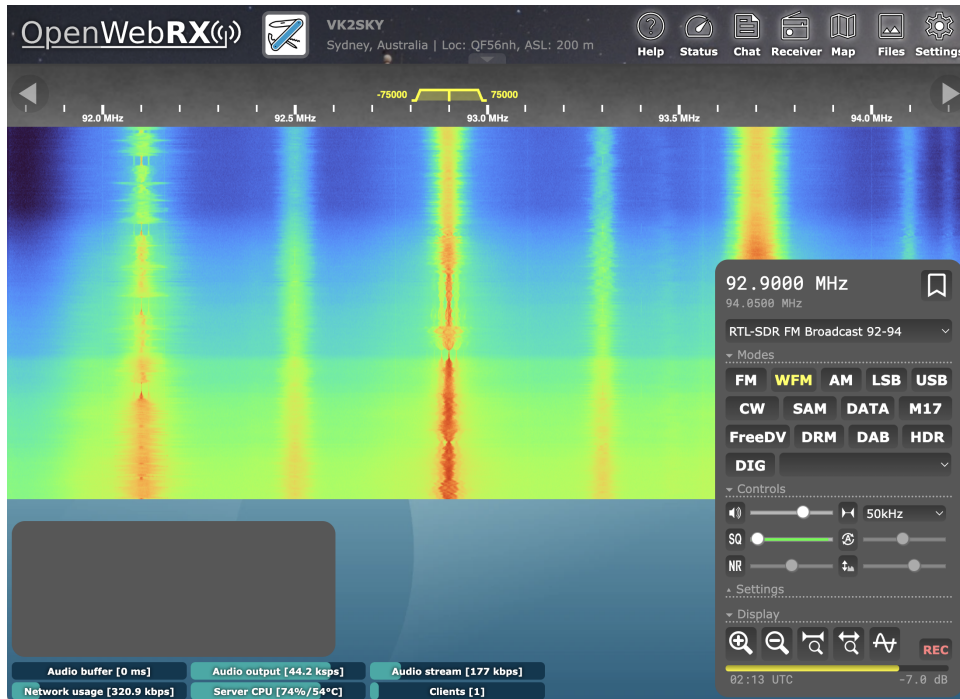
...and so on. The online Signal Identification Guide² is the place to go to see the huge variety of these “waterfall signatures”, to hear samples, and to learn about how and where these modes are used.

As we saw when we set up and tested our first band profile, clicking on these vertical stripes tunes to the station occupying that frequency.

The Art of Noise Reduction

In [Paint the Waterfall, on page ?](#), we configured the waterfall to automatically adjust its colours to adapt to the background noise level. Using the FM broadcast band profile, we can see this in action when we refresh the receiver page:

1. <https://www3.nhk.or.jp/nhkworld/lesson/en/letters/katakana.html>
2. https://www.sigidwiki.com/wiki/Signal_Identification_Guide



Notice how the background colour at the bottom of the waterfall (the “oldest” part) is an intense red (very strong signal) on a greenish yellow (mid-strength signal) background. Closer to the top of the waterfall, the red has reduced to reddish yellow, and the background is blueish, indicating little or no signal.

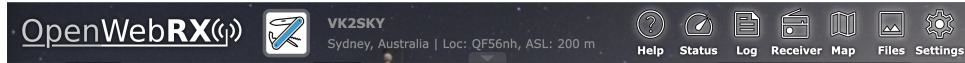
In fact there are only three signals real here, indicated by the green trace at the top left on 92.1Mhz, and the stronger (red) signals on 92.9 and 93.7MHz.

The other vertical traces could be “image frequencies” caused by the stronger signals overloading the SDR receiver. Images can sometimes be lessened by reducing the sample rate or making the antenna smaller so it is less sensitive. If you are close to the transmitters, sometimes you have to just live with the effect.

Master the OpenWebRX+ User Interface

Let’s take a look at the other parts of the OpenWebRX+ user interface. OpenWebRX+ has a large number of controls and settings, which can seem overwhelming at first, but we don’t need to know them all straight away. Most of the time we can get by quite just fine, picking a band profile, choosing a frequency of clicking on a station, and choosing the appropriate demodulator.

Starting at the top:



- Clicking on the OpenWebRX logo opens the main OpenWebRX web site in a new browser tab. The site contains documentation (for the “non-Plus” version, OpenWebRX, though much of it also applies to OpenWebRX+), links to the ReceiverBook³ directory, the OpenWebRX community forum, and more. If you encounter technical difficulties operating OpenWebRX or OpenWebRX+, the community forum is a great place to find solutions. There’s also an OpenWebRX Telegram channel.⁴
- Avatar image: this is the image we defined in [Put your Receiver in the Picture, on page ?](#); clicking on it (or anywhere between the avatar image and the Help button to the right), toggles the Panorama image that we defined along with the avatar.
- Continuing to the right we have the Receiver information we configured earlier:
 - Receiver Name
 - Location Name
 - Maidenhead Grid Square (to 6 character resolution)
 - Height above Sea Level
- The Help button opens the OpenWebRX+ documentation in a new browser tab; this documentation covers the many extensions and improvements specific to the “Plus” version of the OpenWebRX software.
- The next three buttons toggle parts of the screen on and off; this can be useful to reduce screen clutter; try each of them in turn and note the effects. We’ll come back to the individual panels shortly:
 - Status
 - Chat (or Log, if chat between users is disabled)
 - Receiver
- Map opens the map view in a new browser tab. We’ll return the Map in more detail when we come to plotting received data in [Chapter 5, Exploring with OpenWebRX+, on page ?](#).

3. <https://www.receiverbook.de/>

4. <https://t.me/openwebrx>

- Files: Some data modes, such as Slow Scan Television (SSTV), radio facsimile (FAX) and others, create local files so that the images or data can be reviewed later. Clicking the Files button opens the review page in a new browser tab.
- As we saw earlier when we first configured OpenWebRX+, Settings opens the Administrator login page in a new tab.

Next, we have the Frequency Scale which shows the range of frequencies being displayed in the waterfall.



We can also see several yellow labels, which indicate particular “spot” frequencies of interest. In the image above, the receiver is tuned to 147.000MHz, which in the Sydney area is VK2RWI, a popular Amateur Radio repeater. We can also see VK2ROT, another repeater closer to the city centre, and several others, whose call signs are a little too long to fit on their labels.

These markers show frequency bookmarks automatically downloaded each day from either RepeaterBook,⁵ or the EiBi Shortwave Broadcaster Database.⁶

Let’s have a closer look at VK2RWI:



Below the VK2RWI label, and above its frequency, is a graphical indicator showing the passband of the tuned signal. The passband is the narrow slice of radio spectrum that we are focussed on when tuned to a particular frequency.

5. <https://www.repeaterbook.com/>

6. <http://eibispace.de/>