# All Things Digital

Amateur Radio for the 21st Century

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# THE WEB SOFTWARE DEFINED RADIO (WEBSDR)

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It's 4 a.m. and you've just finished building/fixing your antenna/transceiver; if you're like I am, sleep is not an option. But every "normal" Ham is asleep on your side of the world and you can't beg or buy a contact to the other side—what to do? In my case, I just "tune" my computer to one of the many Internet SDR (software defined radio) servers that form the WebSDR and test away (Figure 1)!

**FIGURE 1: WEBSDR MAIN PAGE**

**A WebSDR is a Software-Defined Radio receiver connected to the internet, allowing many listeners to listen and tune it simultaneously.** SDR technology makes it possible that all listeners tune independently, and thus listen to *different* signals; this is in contrast to the many classical receivers that are already available via the internet.

More background information is available here. Questions and comments can be sent to PA3FWM, the author of the WebSDR software and maintainer of this site; but please check the frequently asked questions first.

WebSDR servers can register themselves automatically on this site, leading to the below list of currently active WebSDR servers.

Currently there are 64 servers active, with 315 users and 98912 kHz of radio spectrum.

Filter band: Any and region: Any

| Location and URL | Frequency range | Antenna | |
|---|---|---|---|
| WebSDR at the University of Twente, Enschede, NL<br>http://websdr.ewi.utwente.nl:8901/<br>JO32KF; 137 users | 0.000 - 29.160 MHz | Mini-Whip | 1 |
| 160/80/40 at University of Eindhoven NL, by Maxwell Foundation<br>http://susanne.esrac.ele.tue.nl:8080/<br>JO21RL; 20 users | 1.804 - 1.996 MHz | 1m Active magnetic loop | 2 |
| | 3.494 - 3.686 MHz | Horizontal 80m loop | |
| | 3.654 - 3.846 MHz | | |
| | 7.004 - 7.196 MHz | 40m dipool | |
| 160m, 60m, 80m and 40m SDR's from Nantwich in Cheshire<br>http://hackgreensdr.org:8901/<br>IO83RA; 17 users | 1.804 - 1.996 MHz | 204 foot long double size G5RV | 3 |
| | 3.600 - 3.792 MHz | | |
| | 5.237 - 5.428 MHz | | |
| | 7.022 - 7.214 MHz | | |
| Russia, Moscow region, Protvino: RV3DLX and RN3DKT<br>http://rn3dkt.ru/<br>KO84OU; 10 users | 6.985 - 7.177 MHz | Double Bazooka N-S | 4 |
| | 3.595 - 3.788 MHz | City-Windom CW80100 | |
| | 14.004 - 14.196 MHz | CITY_Windom CW80100 | |
| WebSDR in C3 Ordino - ANDORRA PRINCIPALITY - ARDAM Ham Radio Association - RX 4 pcs FuncubePro+<br>http://ardam-andorra.no-ip.org:8901/ | 7.008 - 7.200 MHz | Half wave Dipole. | 5 |
| | 3.556 - 3.748 MHz | | |
| | 14.043 - 14.235 MHz | | |

Most SDRs are a hybrid mix of hardware (analog and digital circuitry) controlled by computer software. SDRs receive radio signals and down-converts them into two discrete (left and right) stereo audio channels: the “I” or in-phase (0-phase shift) which is a cosine wave and “Q” or quadrature-phase (90-degree phase shift) which is a sine wave. Mathematical [algebraic] manipulation the IQ channels produces both visual and audio results on your computer’s display/speaker(s), not of just one signal but of many simultaneous signals across tens of kilohertz or more! The SDR is usually simpler and less expensive than its analog equivalent (often smaller, “smarter”, lighter, and less power “hungry”)—only the software changes when you want to add new features or fix problems—the hardware remains the same.

Usually, only one person at a time can operate any kind of mechanical/electronic device because we humans tend to think and work sequentially and rarely can juggle more than two or three tasks at the same time so computers just loaf along (and could be doing something else) waiting for us! Many people realized, by using the resources of the Internet, they can build an open, resource-sharing, world-wide network of computers and ancillary hardware (an “extranet”) performing a common task.

You can listen for extraterrestrial radio signals; track earth-unfriendly asteroids or hunt for comets; sift through millions of digital images or sounds; search through hundreds or thousands of years of geological data; study the effects of global climate change; upload/download various Amateur Radio data to/from global webserver database systems—all this and more—any time of the day or night! And more and more Hams run computer and radio equipment 24/7, connected to Amateur Radio and/or other extranets.

Sooner or later, someone was bound to create computer software to combine the Internet with individual SDRs (Ham and non-Ham) and share these resources with the rest of the world. Dr. Pieter-Tjerk de Boer, PA3FWM, (Ph.D., Computer Science) created Linux-based server software and freely distributes it to others to connect their equipment to the WebSDR server (Figure 2).

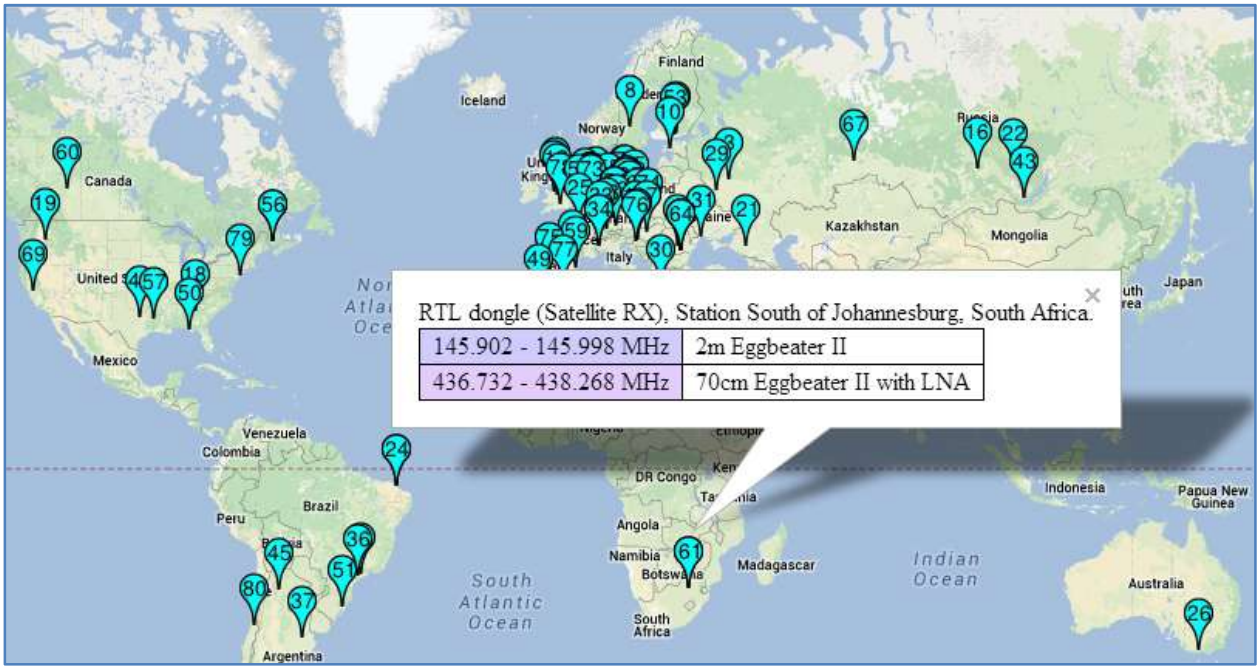



**FIGURE 2: WEBSDR GOOGLEMAP DISPLAY OF SDR STATIONS**

Because everything is processed and controlled via software, multiple users can access any WebSDR server at the same time, only limited by the server's Internet bandwidth and computer processing power (about 40-50 users for typical home-based systems), however, universities (with active radio clubs) can afford far more powerful computer systems and Internet bandwidths to easily handle hundreds of simultaneous users!

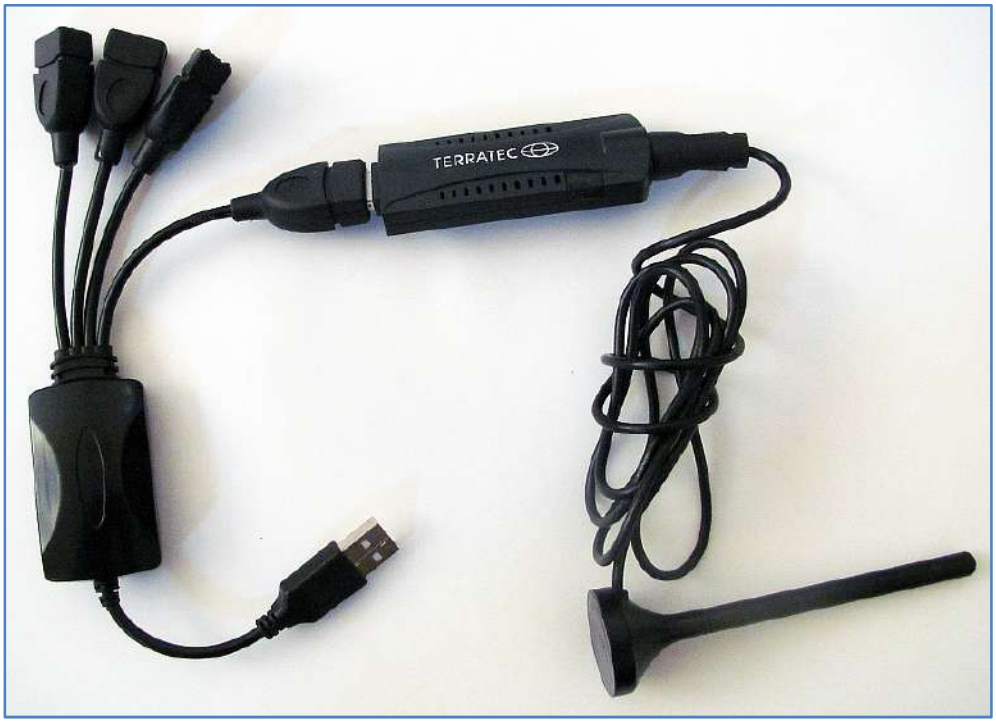
## USING THE WEBSDR

Anyone can access any WebSDR server using a web browser with Java support and more sites now support HMTL 5 (Hypertext Markup Language) for easier access; just point your browser to the main WebSDR website and go!

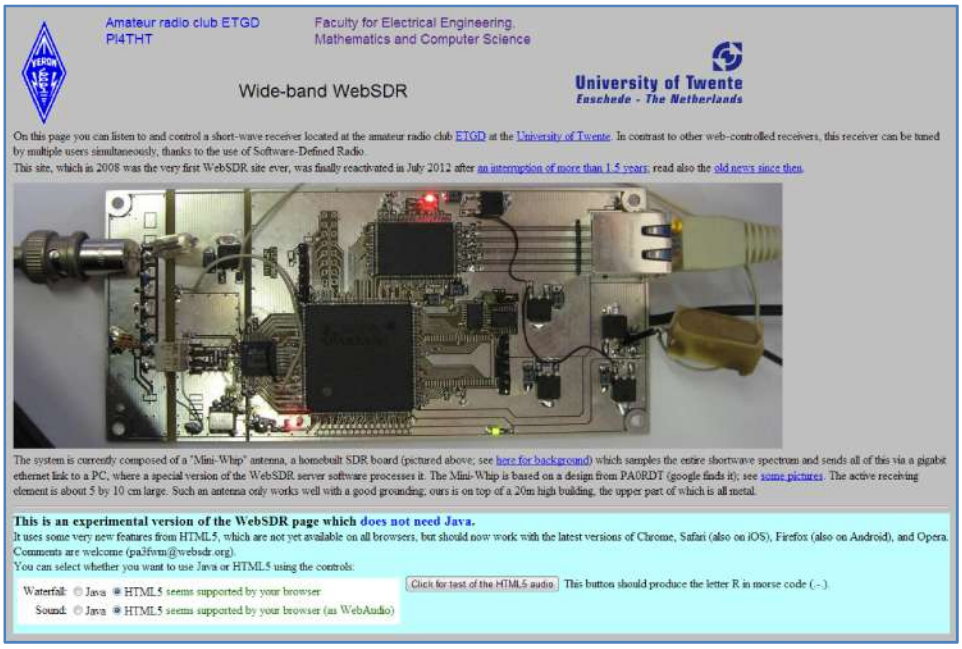
The servers all use a standard and simple GUI (“gooey” or graphical user interface) along with the ubiquitous waterfall signal display. By using your mouse or other interface (finger or stylus for tablets) you and everyone else connected can share simultaneous and separate control of any WebSDR! You can adjust the signal bandwidth, mode, frequency, display settings, store frequencies and log information, etc. Some sites are experimenting with mobile Android and iOS smart device support to accommodate their smaller screen size and specific operating features.

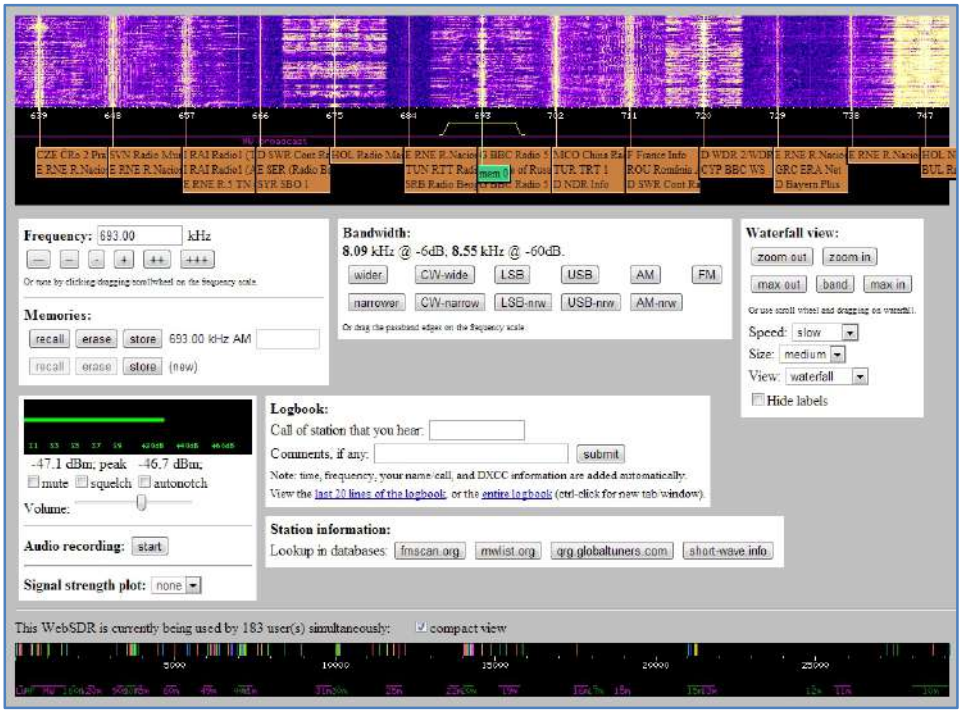
Servers with HMTL 5 support let you record and save audio. Some sites have only one SDR dedicated to a specific band, some have multiple receivers and many are using the new USB SDR dongles; these receivers have wide-band, multi-frequency capabilities in a very small, low-current powered package, and can connect and share through a USB hub with one wide-band antenna system (Figure 3)!

**FIGURE 3: PORTABLE VHF/UHF USB SDR WITH 4 TO 1 USB HUB**



The University of Twente (Enschede, The Netherlands) provides a wide-band Web SDR server that you can tune from DC to “infinity and beyond”! I like listening to commercial AM broadcasts and out of curiosity tuned to the “BBC Radio 5” marker on 693 kHz which has very interesting regional programs (Figures 4 and 5).




**FIGURES 4 & 5: UNIVERSITY OF TWENTE WEBSDR**

**NO "REAL" RADIO OR ANTENNA(S)**

Perhaps you live in an antenna restricted area or don't have a radio and want to know if there's something interesting "out there". With the WebSDR there's no complicated setup, learning curve, neighbour interference problems or extra cost involved. You aren't restricted to voice because you can also use many (often free) decoding programs (Fldigi, et al) with an audio loopback cable to help decode digital modes (Figure 6).

**FIGURE 6: AUDIO LOOPBACK CABLE FOR DECODING DIGITAL MODES**

**TESTS AND EXPERIMENTS**

Testing transceivers and antennas is another way to use the WebSDR because it lets you hear and see your signal as received at a remote site and can also tell you if a band is open to a specific part of the world even if it appears to be "dead". Or you can find out how low in power can you go and still see/hear your signal. You don't need another person at the other end of the line!

If you enjoy hunting for aurora or meteor scatter signals, doing astronomical research, decoding satellite telemetry or listening to satellite voice contacts, then the WebSDR is an invaluable tool, especially if you (or group) have a specific interest but lack the equipment and/or finances.

**ARRL/VOA RADIOGRAM AND UTILITY STATIONS DIGITAL BROADCASTS**

You can tune to the regular ARRL (W1AW) or VOA Radiogram digital broadcasts and use the free Fldigi software to decode the transmissions. The VOA Radiogram program conducts weekend digital broadcasts and actively solicits listener reports. Also, many "utility" stations like the Canadian and U.S. coast guard transmit MF/HF WEFAX (weather facsimile) text and satellite weather reports (Figure 7) to mariners as well as HF/VHF NAVTEX (navigational telex) MIBs (marine information broadcasts).

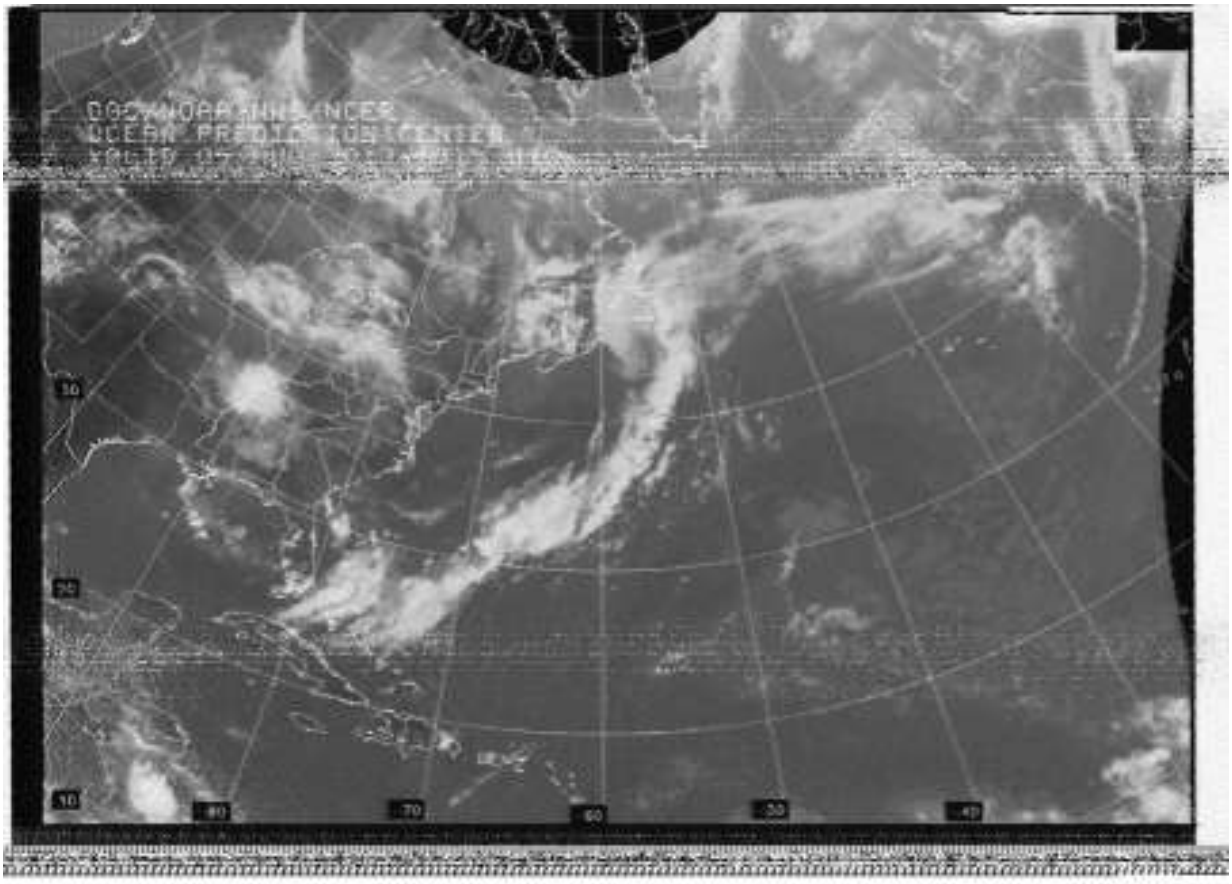


**FIGURE 7: CAPTURED WEBSDR WEFAX SATELLITE MAP TRANSMITTED BY BOSTON/NMF COAST GUARD RADIO ON 9108.1 KHZ (USB) DECODED BY FLDIGI**

**SATELLITES AND THE ISS**

Anton Janovsky's, ZR6AIC's blog and satellite WebSDR satellite server (Johannesburg) uses dedicated VHF/UHF "eggbeater" antennas, and supports HTML 5 for recording satellite signals (to process later) for those late night or early morning passes over South Africa.

Amateur Radio satellites transmit various combinations of SSB/FM/CW signals and digital telemetry. The ISS (international space station) makes scheduled voice contacts with school groups as part of the Amateur Radio on the ISS (ARISS) program. Russian crew members have been transmitting SSTV (slow scan television) images (Figure 8) on 145.800 MHz (FM) which you can easily capture/decoded with a free program called MMSSTV. A WebSDR satellite station makes it easier to "catch" the ISS because its orbit various over the course of any month and may not take it over your location.

**FIGURE 8: ISS SSTV IMAGE CAPTURED/DECODED ON 145.800 MHZ BY MMSTV**

**EDUCATION**

Many primary and secondary schools don't have the resources to conduct even basic radio experiments or participate in related educational projects like recording and analyzing radio signals from the Sun or Jupiter (Project Radio JOVE), etc. But most classrooms do have computers with Internet access so the WebSDR can be a very useful and valuable tool for educators to combine this with any field of study: science, geography, history, politics, sociology, etc. the WebSDR can be working after hours with the ability to record signals so when classes come back in the morning you can see what you've "caught" which should appeal to and excite kids of all ages!

Anyway, the list can go on and on—only limited by your imagination! It should be obvious that the future of radio (in its many forms) is rapidly evolving and moving away from traditional analog radio and real-time operation. And you don't have to understand the WebSDR it to "drive" and enjoy it! It's free. It's fun. It's fantastic! What else do you need to know?

**MY FINAL**

In the next column, we'll take a look at the Broadband-Hamnet (BBHN) and mobile wireless EMCOMM (emergency communication) "mesh" networks and I've already written a series of software application tutorials to go with.—73

## REFRENCES AND RESOURCES

**Amateur Radio in the Classroom**
http://www.arrl.org/amateur-radio-in-the-classroom
http://www.nasa.gov/audience/foreducators/teachingfromspace/students/ariss.html#.VLxZRtLF-Sp

**ARRL (W1AW) Broadcasts**
http://www.arrl.org/w1aw-operating-schedule

**ISS AND ARISS**
http://www.arrl.org/amateur-radio-on-the-international-space-station
http://amsat-uk.org/2014/09/06/iss-sstv-on-suws-websdr
http://ariss-sstv.blogspot.co.uk

**Fldigi**
http://www.w1hkj.com

**MMSTV**
http://hamsoft.ca/pages/mmsstv.php

**Radio JOVE**
http://radiojove.gsfc.nasa.gov/help/index.html

**University of Twente WebSDR**
http://websdr.ewi.utwente.nl:8901

**VOA Radiogram**
http://voaradiogram.net

**WebSDR**
http://websdr.org

**ZR6AIC**
http://zr6aic.blogspot.ca