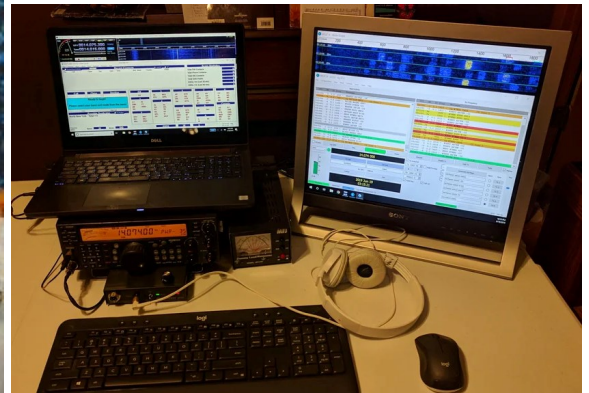


# Microvolt

Monthly newsletter of the Utah Amateur Radio Club

March 2025



## A diverse craft



To say that amateur radio contains many facets of interest is an understatement. It's a craft that contains many topics of adventure, each a field of study all its own. Some are highly technical, others are more socially oriented; some require a lot of physical effort while still others can be done quite casually. Likewise, amateur radio can provide solutions to the preparedness-minded, enable those that might otherwise be handicapped, and satisfy the curiosity of the eternal learner. To the licensed amateur who's immersed in any of them, it's just pure fun.

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# Cover – A craft of diverse interests

Here's a brief list of the many things one can enjoy in the craft and hobby of amateur radio:



## Nets

- [Local](#), [Social](#)
- [Faith-based](#) and [ERC](#)
- [EmComm](#)

## Gatherings

- [Clubs](#)
- [Socials](#)
- [Hamfests](#), [hamventions](#), [swap meets](#)

## Contesting

- [Field Day](#) / [Winter Field Day](#)
- [Worldwide DX](#) and [Sweepstakes](#)
- [QSO Parties](#)

## Logging

- [QRZ](#), [N3FJP](#), [LoTW](#)
- [eQSL](#), [N1MM](#)

## Awards

- [WAS](#) (on [Wiki](#))
- [DXCC](#) (on [Wiki](#))
- [WAC](#) (on [Wiki](#))

## Fox hunting

- [DFing](#) / [ARDF](#)
- [Hidden transmitter](#)
- [Necessary equipment](#)

## Digital radio

- [FT8](#), [FT4](#), [Winlink](#), [mesh](#), [LoRa](#)
- [RTTY](#), [PSK31](#)
- [YSF](#), [DMR](#), [D-STAR](#), [AllStar](#)

## DIY

- [Building](#) / [homebrew](#)
- [Experimenting](#)
- [Repair](#)

## Contacting methods

- [IRLP](#) (on [Wiki](#))
- [EchoLink](#) (on [Wiki](#))
- [DXing](#) (on [Wiki](#))

## Space

- [Satellites](#)
- [ISS](#)
- [Solar tracking](#)
- [EME](#) / [Moonbounce](#)

## Giving back

- Join [ARES](#)
- Join [RACES](#)
- Become a [Volunteer Examiner](#)
- Become an [elmer](#)
- [Teach ham radio courses](#)
- Serve in [events](#) and [weekend watches](#)
- [Monitoring](#)
- [Training](#), [sharing](#)

## Learning

- [Morse code](#)
- [Electronics](#)
- [Antennas](#)

## Prep

- [Radio](#)
- [Disaster](#)
- [Personal](#), [public](#)

## Administration

- Serve as a [club officer](#) or organizer
- Publish announcements on [social media](#)
- Support events by [setting up and taking down](#)
- Write [newsletter articles](#)

## Other

- [Spotting](#)
- Join [ARRL](#)
- [ATV](#)
- [Repeater](#) (frequency, tone, up) verification
- [Skywarn](#)

Maybe we've omitted your favorite amateur radio-related activity; no doubt there are other facets of the craft that are not on our list, and we'd love to hear what we might've missed.

*Microvolt editorial staff*

## Editorial – Your favorite radio mode



As mentioned in the cover story, there are many amateur radio sub-topics in which to interest yourself. Considering only the radio portion of the hobby, which are your favorite modes to play with? Just so we're on the same page, an amateur radio *mode* is simply short for *modulation method*, meaning the way a signal is encoded within the RF envelope prior to being sent out to a potential receiving station that's listening using the same mode. This signal can be voice, CW, digital, text, data, image, and more.

We thought that a short list of these amateur radio modes might entice you to branch out a bit and explore some that might be a little out of your current comfort zone.

### FM

[Frequency modulation](#) is probably the first radio mode you might have encountered as a new ham because it's the voice mode used on most 2-meter and 70-cm repeaters. It's the same mode used by your favorite FM broadcast station to listen to tunes or the news.

### SSB

[Single sideband](#) is the voice mode you'll likely hear the most when you're exploring HF (from 160 meters to 10 meters). It's a subset of AM, but a lot more efficient, as far as required power and occupied bandwidth.

### CW

Morse code is a language made of dots and dashes, and [CW](#) (continuous wave) is the mode typically used for the transmission of the language. While transmitting a continuous sine wave of a selected frequency, the operator opens and closes a switch (key) to form the dots and dashes that make up Morse code.

### FT8

[FT8](#) is a digital mode used to communicate with stations around the world using a weak signal algorithm, allowing the software to detect and acknowledge a communication that's normally far below the noise level of SSB. It's perhaps the fastest-growing HF mode in popularity, since it allows contacts even when sunspot numbers are unfavorable.

### Winlink

[Winlink](#) is an amateur radio messaging system for sending and receiving emails over radio waves. Not

technically a mode, Winlink uses sub-modes such as VARA, ARDOP, and AX.25 to encode its messages. It's been used many times during emergencies to communicate short messages to loved ones, friends, and officials.

### APRS

[Automatic packet reporting system](#) is very popular among those who want to track friends, marathon runners, and aircraft by GPS coordinates being sent. All that's required is a ham radio and computer with a sound card, and the software performs the rest.

### DMR

[Digital mobile radio](#) was a very fast-growing digital protocol for VHF voice communication seen as an answer to the proprietary standards of the day. Today, its growth has slowed, possibly due to its programming complexity and in part due to its characteristically "boxy" sounding audio.

### YSF

[Yaesu System Fusion](#) is a high-speed and versatile Yaesu-proprietary C4FM protocol that's known for clear sound reproduction and reliable data integrity. The installed base of YSF repeaters and users are growing, but at a conservative pace.

### JS8Call

[JS8Call](#) is a keyboard-to-keyboard messaging protocol that uses amateur radio frequencies to communicate the messages similar to the FT8 protocol.

### D-STAR

[Digital Smart Technologies for Amateur Radio](#) is an Icom-proprietary VHF and UHF digital mode, most commonly used for the 2-meter, 70-cm, and 23-cm bands. It enjoyed great popularity at one time, but recent years have seen its use diminish, possibly due

## Editorial – Your favorite radio mode

to inability of its expensive codec to be ported to radios of other manufacturers.

### AllStar

[AllStar](#) is a software-based system that connects amateur radios worldwide via the internet through a cell phone or computer using VOIP (voice over IP).

### PSK31

[PSK31](#) (phase-shift keying, 31 baud) is a popular digital mode for sending and receiving text messages during contests and Field Day due to its narrow bandwidth and usability during poor propagation conditions. Its usage is quickly being replaced by FT8 and JS8Call among major enthusiasts.

## Outdated or rare modes

There are a number of amateur radio modes that are not seeing nearly as much use as in past years, typically because their usefulness has been superseded by more modern modes and protocols.

### AM

[Amplitude modulation](#) is the same mode used by AM broadcast radio stations. Prior to the advent of SSB, AM ruled the amateur bands, but was soon replaced by the more efficient mode we use today. It's still permitted on amateur bands, but you'll rarely hear it.

### RTTY

[Radio teletype](#) is a mode that allows two computers with sound cards and RTTY software to communicate text messages over the internet. Once very popular, RTTY has largely been replaced by faster and more robust digital modes.

### PACKTOR

[Packet AMTOR](#) is a digital radio mode for sending text messages, and provides the underlying protocol for Winlink.

### JT65, JT9

[Dr. Joe Taylor](#) created several experimental weak-signal modes for decoding signals below the noise floor. These were forerunners of the currently popular FT8 and FT4.

### Olivia

[Olivia](#) is a digital protocol that uses MFSK to support RTTY for sending and receiving messages during less-than-ideal band conditions.



### ATV

[Amateur television](#) is a FSTV (fast-scan television) mode for transmitting images over amateur radio bands.

## Other modes

The remaining modes can either be classed as experimental or underlying support for some of the other modes.

### IRLP

[Internet Radio Linking Project](#) connects VHF / UHF repeaters together using VOIP nodes on the internet. Typically, an operator gets onto a VHF repeater like usual, then punches in a DTMF code on his radio to reach the node number, and sometimes an access number. He or she can then communicate by voice with any other IRLP repeater across the globe.

### EchoLink

[EchoLink](#) allows a licensed amateur to use a cell phone that has the EchoLink app installed, to communicate by voice with any VHF / UHF repeater that has an EchoLink node installed.

### ASK

[Amplitude shift keying](#) is a low data rate mode that combines digital information with AM.

### FSK

[Frequency shift keying](#) is a low data rate mode that combines digital information with FM.

### MFSK

[Multiple frequency shift keying](#) is a variation of FSK that uses more than two frequencies, and forms the underlying protocol for many modern modes, such as FT8.

*Anything to add? Email [editor@utaharc.org](mailto:editor@utaharc.org)*

## Letters to the editor

Dear Editor:

It seems like every weekend there's a contest, and that's the only time I can get on HF and make new friends and ragchew. Why can't contesters be assigned to a contesting band, or limit the number of weekends they're allowed to run contests?

Mike in Bluffdale

Dear Mike:

With more amateurs becoming licensed all the time, yet the amateur spectrum is not expanding, the bands are definitely more crowded than ever. I recommend trying 17 meters, where contesting is generally prohibited. It's quite active when the sunspots are in our favor, like these days, because many have discovered that band as a respite from contesting.

Dear Editor:

The other day I was on 10 meters and heard a guy calling CQ, so I answered. He asked what my 10-10 was, and I told him I wasn't participating in the contest. He told me that I should not have answered his CQ and waste his time, knowing that a contest was in progress. I apologized and changed frequency, but was ready to give up the hobby right then and there. Now that I've had a chance to lower my rage, I have to ask: was I wrong?

Christopher in Malad

Dear Christopher:

When a person is calling CQ in a contest or event, he or she should always follow the CQ by "contest" or "Field Day" or similar, letting people know that only contest participants are invited to respond, if that's their intention. If the station calling CQ does not append with "contest" or similar, you are free to answer the call, just as you did.

Dear Editor:

I noticed that the minutes to the latest ARRL Board meeting got posted, so I read them. Not a single mention of the accelerating loss of ARRL members, much less any discussion about how to reverse it. Is it the League's intention to let them bleed out?

Dave in Salt Lake City



Dear Dave:

In several board meetings during the past couple of years they have indeed discussed the declining membership. One big problem that the ARRL has been trying to address is the tide of negative public perception. They do quite a lot of unseen work in our behalf, and yet constantly fight against social media posts by less-than-intelligent operators with a "what's in it for me" attitude. Many don't fathom the simple fact that there would be no amateur radio without the ARRL.

Dear Editor:

I'm brand new to ham radio, but I joined the club, and started trying out the club repeater. Some people tell me that they can hardly hear me when I'm on the radio, even when I speak up. Turning up my volume doesn't seem to help me sound louder, so what can I do to help people hear me better?

Laurie in Kaysville

Dear Laurie:

You're right about the volume control, because that only makes others sound louder to you. Many people seem blessed with an unusually quiet voice, but there are things you can do to make yourself sound louder. 1) Locate the microphone hole on your radio or hand microphone, and keep your lips within a few millimeters of it. 2) Turn up the microphone gain control, if your radio has one. 3) If you're using a Chinese-made radio, a Japanese brand might actually help you sound louder. 4) Try using a longer antenna or orient it properly. Increasing your output power doesn't always help, but it's worth a try.

Send your thoughts to [editor@utaharc.org](mailto:editor@utaharc.org)

## Club news

Marvin Match KA7TPH, club President, recently had surgery and wasn't able to make the monthly meeting, so Vice President Bruce Fereday KF7OZK conducted it in his place, and did a great job.



The February 2025 club meeting featured an online auction instead of a speaker presentation, and turned out to not only be fun and engaging, but profitable. Board member Jeri Brummett WJ3RI was our illustrious auctioneer, leading the bidding in good-ol' Southern style, complete with the drawl.



Thanks to the generosity of the bidders, UARC grossed about a thousand dollars.

You can see [the video presentation here](#). You can also view past club meeting presentations on [our YouTube channel](#).

(Photos courtesy James Bennett KK7AVS, et al)

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## UARC 2025 Spring Potluck

You don't want to let this one pass you by! The regular March meeting will be replaced by a potluck dinner, to which you and your family are invited. Starting 6:30 pm on Thursday 13 March 2025 at the [Salt Lake County Facilities Management Cafeteria](#), 2001 S State Street, Room S1-100, we'll gather and talk and eat. The club's not providing anything but a place and goodwill, so what you bring is what we'll eat. We'll need drinks, main courses, drinks, side dishes, drinks, desserts, drinks, and salads. Read the details on [the club website](#). We've also posted [a signup sheet](#).

# For your information

## UARC Spring 2025 Potluck

You and your family are invited to a potluck dinner 6:30 pm Thursday 13 March 2025 at the Salt Lake County Facilities Cafeteria, 2001 S State St, room S1-100. Details are posted [on our website](#). We've [posted a signup sheet here](#).

## Field Day 2025

Saturday noon 28 June through Sunday noon 29 June near [Payson Lakes](#). We plan to start setting up Thursday night about 6:00 pm.

## Steak Fry 2025

Our annual fun get-together is planned for Saturday 19 July 2025 at the [Spruces Campground, site GRP7](#) starting around 3:00 pm. (Spruces is approximately ten miles up Big Cottonwood Canyon.) Cost is \$15 per person. Details are posted [on our website](#).

## License classes

### *Salt Lake:*

**General** : Tuesdays 7:00 pm to 9:00 pm  
147.160+ MHz (127.3 Hz tone)

### *Provo:*

**Technician** : Saturday, 8:00 am to 1:00 pm  
Sat 15 Mar, Sat 19 Apr

Visit [HamStudy.org/sessions](https://HamStudy.org/sessions) to register (free)

**Provo Fire Station #2**, 2737 N Canyon Rd  
Email [nv7vham@gmail.com](mailto:nv7vham@gmail.com) for info

### *Orem:*

**Technician** : 4 Tuesdays, 6:30 to 8:30 pm  
Sep 16, Sep 23, Sep 30, Oct 07

Visit [psclass.orem.org](https://psclass.orem.org) to register (\$10)

**Orem Traffic Training Room**, 95 E Center St  
[HamStudy.org](https://HamStudy.org) account required  
Email [nojiratz@hotmail.com](mailto:nojiratz@hotmail.com) for info

### *Eagle Mountain:*

**General** : 5 Thursdays, 7 to 9 pm  
May 8, May 15, May 22, May 29, Jun 12  
Email [ki6oss6365@gmail.com](mailto:ki6oss6365@gmail.com) to register (free)  
**Eagle Mountain City Hall**, 1650 Stagecoach Run



## Exam sessions

### *Salt Lake County:*

- Email Garth Wiscombe W7PS [w7ps@arrl.net](mailto:w7ps@arrl.net)  
Feb 24, Mar 31, Apr 28, May 19, Jun 30, Jul 28, Aug 25, Sep 29, Oct 27, Nov 24
- Email Rick Morrison W7RIK [w7rik@arrl.net](mailto:w7rik@arrl.net)

### *Utah County:*

- Sat 15 Mar 2:30 pm : **Provo** : [signup](#)
- Wed 19 Mar 7:00 pm : **Provo** : [signup](#)
- Sat 22 Mar 10:00 am : **Eagle Mtn** : [signup](#)

## Club repeaters

**Farnsworth Peak** : 146.620– MHz (no tone)

**Scott Hill** : 146.620– MHz (no tone)

**Lake Mountain** : 146.760– MHz (no tone)

## SDRs and beacons

Northern Utah WebSDR : [sdrutah.org](https://sdrutah.org)

KK7AVS SDR : [k7xrd.club](https://k7xrd.club)

N7RIX SDR : <https://sdr.n7rix.com>

K7JL beacon 28.2493 MHz

## HF remote and club transceiver stations

If you'd like to learn how to get started using the remote stations, visit the [HF Remotes link](#) on [the club website](#):

<https://user.xmission.com/~uarc/HFRemote.html>

## How can I help?

Reach out to the club leadership by sending an email to [uarc@xmission.com](mailto:uarc@xmission.com). Also, add to this page by emailing [editor@utaharc.org](mailto:editor@utaharc.org)

## Spotlight – Ken Ainge W7PKA

Ken has always been interested in amateur radio. He says, *Like many people my age, I got caught up in the CB radio craze in the 70s. As a teenager I had a base station at the house. Then when I could drive, I put a mobile CB in my car. Late at night we would drive up to the mountains and see if we could get a skip QSO a few states away; it was great fun. I wanted to get a ham license but the Morse code requirement seemed too overwhelming.*

In college Ken majored in Communications with an emphasis on television. He put himself through college working at KBYU-TV operating the transmitter, often turning on the transmitter early in the morning to begin the broadcast day. *I'm sure most people don't remember a time when TV signed off at night and came back on in the morning*, Ken states. He also worked in the TV truck when KBYU was broadcasting live at sporting events.

Ken's first job out of college was working as a photojournalist for KTVN in Reno, Nevada. A few years later Ken took a photojournalist job with KTVX Channel 4 here in Salt Lake City. After four years at the station, he worked an additional eight years there as their engineer. Another several years of doing live broadcasts for microwave NTSC Television and Ken moved over to Skylink and spent his time covering the news with the up-link truck on the K<sub>u</sub> Band, which is the portion of the microwave band from 12 to 18 GHz.



Ken next worked at KTBX Channel 3 in Bryan, Texas. After a decade in television, he took a job in the Department of Technology Services for the State of Utah, working with computers, retiring after 20 years. Afterward, Ken decided it was time to get in to amateur radio. Using the HamStudy app, he passed the Technician exam in October 2024, and was licensed as KK7VSI. One month later, Ken passed the General exam, and then passed the Amateur Extra exam in December, after which he applied for and received the vanity call sign W7PKA. Ken says that the P is for Papa. That's what his kids call him. The K and A are his initials.

One of the things that Ken likes about amateur radio is meeting new people and participating on nets. He also loves to learn and says that there is always something new to learn, especially in ham radio. Ken became active in the Utah Valley Amateur Radio Club's New Ham Net on Thursday nights. When first licensed, the only radio he had was a Baofeng handheld, so he put up a Pockrus J-pole on his roof and joined the net. Later, Ken bought a Yaesu FT-991A.

He also installed a wire J-pole antenna for 10 meters in his attic since he is very active on that band. So far, he has made over 300 contacts with 38 countries. He says that VHF and UHF are fun, but making distant contacts on HF has been awesome, almost addicting. Ken hopes that by spring or summer he can put up a multi-band antenna on the roof of his house so he can use 40 meters and 20 meters. Ken is also interested in digital communications, and uses FT8 for sending short messages using the WSJT-X program. He is also keeping busy with mesh digital communications, using Meshtastic nodes. Ken is a member of UARC and the VHF Society. He also wants to help UVARC with the New Ham Net.

Ken collects coins and loves to spend time with his grandkids. He and his wife Cindy have one boy, three girls, and nine grandchildren. Ken is trying to get his family interested in amateur radio, so he's going to start with the FRS (Family Radio Service) and then help them get their GMRS license.

Ken, we welcome you to amateur radio!



– 73 from Linda Reeder N7HVF



## Tech corner – RTL-SDR waterfall by Airspy

Ever since they've seen the waterfall on the screens of their friends, numerous envious hams have wanted to know how to display something similar on their own screens. This short project will walk you through the steps of doing exactly that. Then, your computer screen will be the envy of other operators.

The two keys are the RTL-SDR dongle (a device that hangs off your computer USB port) and the Airspy software. Although I've listed the original silver V3 dongle below, the black V3 or V4 dongle will also work. The RTL-SDR device is known as an **SDR** (software-defined receiver), as its name implies, meaning that nearly all the radio functions (pre-amplification, oscillation, mixing, filtering, demodulation, etc.) are built into software (firmware, actually), and that it's intended for receiving signals, not transmitting them.



Furthermore, your financial situation might put a nice, expensive rig outside your reach for that pretty waterfall screen. For less than fifty bucks, you can have the entire HF world at your fingertips. It's assumed, however, that you have already installed an antenna capable of receiving the band(s) that you want to display. Then again, even if you don't have a proper ham radio antenna, a long piece of wire will also work, since this is a receive-only setup.

These instructions are taken from a subset of those found on the [RTL-SDR Quick Start Guide](#). One problem is that the online instructions are somewhat technical and a little confusing, so the hope here is to help you navigate the setup quickly and easily. To do so, however, it's also assumed that you'll be installing the Airspy software onto Windows 10 or 11. Similar software is available for Linux and Mac (instructions at the end of the online Quick Start Guide), but I'm going to walk you through the Windows application setup.

### Parts list

One [RTL-SDR dongle](#)

One [SMA-Male to SO-239 jumper](#)

### Software installation

1. Open a browser and visit <https://airspy.com>.
2. At the top of the page, click **Download**.
3. After "Software Defined Radio Package (Change Log)" click the **Download** button.
4. Open your computer's Downloads folder, then Extract all the files of the sdrsharp-x86.zip file into your Downloads folder.
5. Double-click install-rtlsdr.bat.

	File Name	Date Modified	Type	Size
	install-rtlsdr.bat	5/28/2024 10:59 PM	Windows Batch File	1 KB
	libusb-1.0.dll	5/28/2024 10:59 PM	Application extension	105 KB
	msvcr100.dll	5/28/2024 10:59 PM	Application extension	760 KB

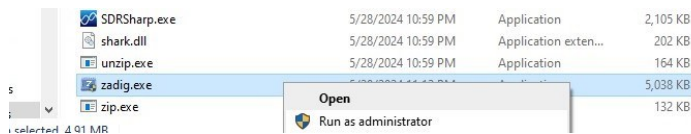
6. If you see a "Windows protected your PC" window, click "More info"; skip to 8 if you don't.
7. Click "Run anyway" near the bottom.
8. Once the download completes, after it displays "Press any key to continue. . .", press the space key.

## Tech corner – RTL-SDR waterfall, cont'd



9. Plug the RTL-SDR dongle into your computer's USB port, and wait until Windows tells you that it has detected a new device, and then that all its drivers are installed.

10. Locate the `zadig.exe` file in the folder where you extracted the first files, right-click it, then select **Run as administrator** and confirm that you allow the program to make changes.

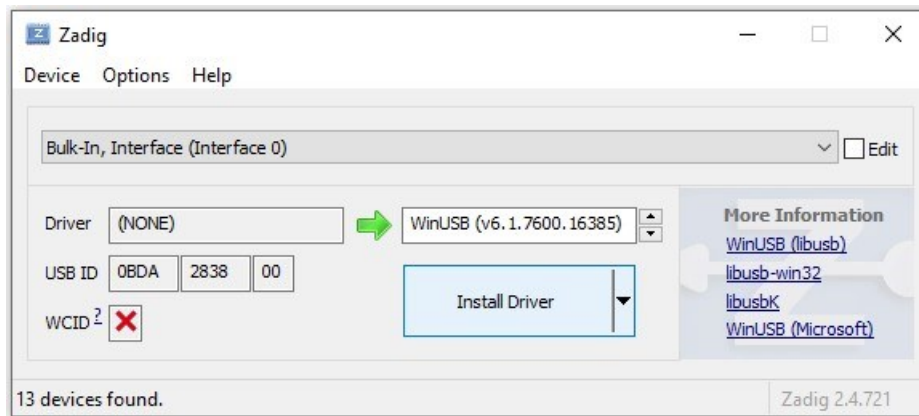


11. In the Zadig program, click the **Options** tab, then select **List All Devices**.



12. Click the long drop-down and select **Bulk-In, Interface (Interface 0)**.

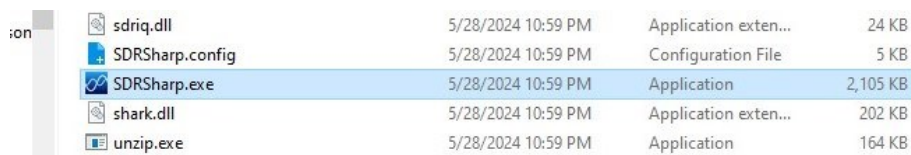
13. The Zadig window should show a) "WinUSB" to the right of the green arrow and b) "0BDA 2838 00" in the USB ID boxes.



14. Click the big box in the middle, which should read **Replace Driver** or **Install Driver**, then click through the warnings, if any should appear.

15. Once Zadig reports that the driver has been installed, click Close.

16. Locate the `SDRSharp.exe` file in the folder where you extracted the first files, and double-click it to open SDRSharp (if you see more than one, double-click the Application).



17. If a message pops up that prompts you to install the .NET Desktop Runtime, click Download it now, then go through the steps to install it

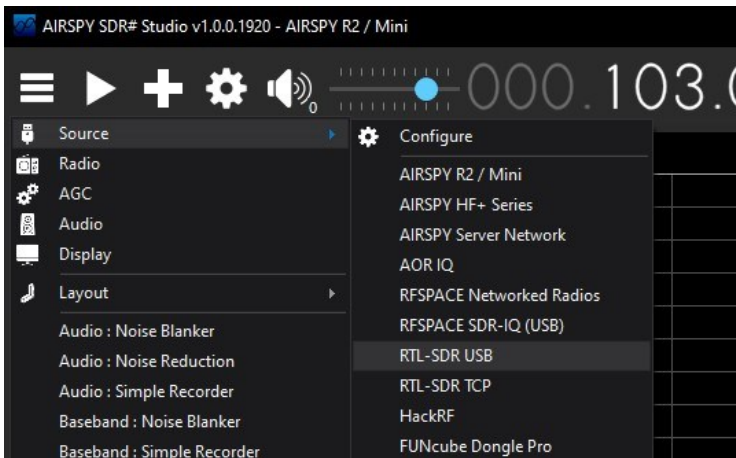
## Tech corner – RTL-SDR waterfall, cont'd



18. If you had to install the .NET Desktop Runtime, double-click SDRSharp.exe again.

19. Click the hamburger menu (the three horizontal lines in the upper-left corner).

20. Hover over Source and select **RTL-SDR USB**.



21. Click the **Play** button (right-pointing triangle), and the SDR will start.

### Hardware installation

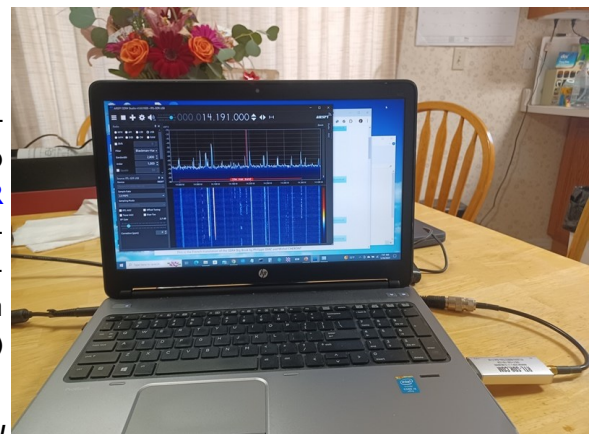
By now, you've already attached the RTL-SDR dongle to your USB port. Next, install a jumper to the SMA connector of the dongle, then your antenna coax to the other end of the jumper. You should start seeing signals appear on the AirSpy waterfall, but they're not likely tuned to any meaningful frequency.

### Software operation

1. Click on the large numerals to tune to your frequency of choice. When you click on the upper-half of each digit, the frequency changes to a higher frequency according to the order of the digit. The frequency changes to a lower frequency when you click on the lower half. For example, if the frequency shown is 103.000.500, and you click on the bottom half of the "3" digit, the display changes to 102.000.500, and so forth.
2. Near the upper-right corner, click Zoom and drag the slider up and down to adjust the displayed range. Play with the other settings under Zoom to adjust the display to your taste.
3. For amateur frequencies keep the Bandwidth to between 2,400 and 2,800.
4. Some tips for a better view or listening experience include lowering the RF gain, lowering the Offset, and lowering the Contrast.

### Summary

A software-defined radio is a radio receiver, complete with tuning and other controls, made from software and embedded onto a USB stick device. The argument can be made that the [web SDR](#) does precisely the same thing and more (because of its magnificent antennas), but the web SDR depends on the internet connection, and you have complete control of your own SDR. I'm pretty sure similar software exists for my Samsung (Android OS) phone, so that might be homework for me next time.

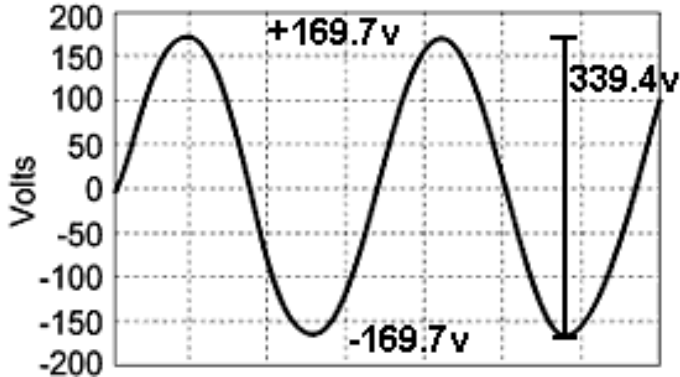


Noji Ratzlaff KNØJI

*My finished setup, complete with flowers*

## Strays – RMS

In the US, we say that our standard household wall socket voltage is 120 VAC (volts alternating current). Yet, if you were to look at its waveform on an oscilloscope, which displays a measurement of an electrical signal, it looks like anything *but* 120 volts:



The **RMS** (root-mean-square) value of an electrical quantity (voltage, current, power) came about through the desire to understand the *net effect* that quantity has on a load (the device or circuit that requires the energy). Calculating the *average* of an AC voltage to determine the net effect would not be very useful, because from the above graph it's apparent that the average voltage is zero volts, since it's negative for as long as it's positive.

Yet, when I stick my fingers in the light socket, it certainly doesn't feel like zero volts. In fact, this "feels like" effect is what we're after, and can be observed or measured in *the amount of heat* my finger might feel. So, the question becomes, **What steady (DC) voltage will provide the same net heat effect in a load as a given AC peak voltage?**

Heat is a quantity of *energy*, and the amount of heat or energy over a certain amount of time is known as *power*. Power is useful because it tells me not just how many buckets of heat are being dumped into my finger, but how fast my finger is burning up.

For example, if I poured a cup of boiling water on my hand all at once, I will probably get badly burned. But if I poured that same cup of boiling water on my hand, a hundredth of a drop at a time, over the course of a week, my hand will likely survive the hot bath. The amount of heat energy was the same in both cups, but the longer time all that energy hit my hand means my hand was exposed to much lower power, and so I felt it less.



Therefore, answering our question requires determining the amount of power (heat per time) the AC signal is being dissipated in a load, and calculating the equivalent DC voltage that would result in the same power (heat per time) dissipation. The following equation is that very calculation for voltages:

$$V_{rms} = \sqrt{\frac{1}{T} \int_{t_0}^{t_0+T} v^2(t) dt}$$

Because the given AC voltage is any function  $v(t)$ , this equation accounts for any kind of AC waveform, not just sinusoidal, which is what appears at our light sockets. For the common **sinusoidal case**, this entire RMS calculation simplifies to

$$V_{RMS} = \frac{V_p}{\sqrt{2}}$$

So, for a peak voltage (from the above graph) of 169.7 volts, what shows up at the wall outlet is  $(169.7 \text{ volts} / 1.414) \approx 120 \text{ VAC}_{RMS}$ .

Much (not all!) of our concern for energy consumption and **power transfer is calculated based on RMS values**. This includes transformers and RF transmission.

Noji Ratzlaff KNØJI

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The **Utah Amateur Radio Club** was organized under its present name in 1927, although its beginnings may date back as early as 1909. In 1928, it became affiliated with the **American Radio Relay League** (club #1602) and is a 501(c)(3) non-profit organization. It holds a club station license with the call sign W7SP, a memorial to Leonard "Zim" Zimmerman, amateur radio pioneer in the Salt Lake City area.

**The club meets each month** except July and August. The meetings are usually held on the second Thursday of the month at 7:30 PM in the University of Utah's **Warnock Engineering Building**, room 2230.

**Club membership** is open to anybody interested in amateur radio; a current license is not required. Dues are \$20 per year. Send dues to club secretary James Bennett, 4960 W 5400 S, Kearns, Utah 84118. Email address changes to [kk7avs@gmail.com](mailto:kk7avs@gmail.com)

**Tax-deductible monetary contributions** are gladly accepted. Send directly to club treasurer Shawn Evans, 1338 S Foothill Dr, #265, Salt Lake City, Utah 84108-2321. For in-kind contributions, please contact [uarc@xmission.com](mailto:uarc@xmission.com) to make arrangements.

**UARC maintains** the 146.620– and 146.760– repeaters, which are administered by the **UARC Repeater Committee**. Direct comments and questions to any committee member. The 146.760– repeater is on IRLP node 3352.

Call the **UARC Ham Hotline** at **801-583-3002** for amateur radio information, including club, testing, meeting, and membership information. Leave a message, and we'll make an effort to return your call.

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