The *Microvolt*

January 2023

Abbreviations and Security, January 2023 meeting

Prologue

Publication: *The Microvolt* (USPS 075-430) is the official publication of the Utah Amateur Radio Club, Incorporated, 632 S. University Street, Salt Lake City, UT 84102-3213. It is published monthly except August. Subscription is included with club membership at $20 per year. Single copy price is $1.50. Periodicals postage paid at Salt Lake City, Utah. Postmaster: send address corrections to *The Microvolt*, c/o James Bennet, 4960 W 5400 S Kearns UT 84118.

Deadline for submissions is the 24th of each month prior to publication. Reprints are allowed with proper credits to *The Microvolt*, UARC, and authors. Changes in mailing address should be communicated to the Club Secretary: James Bennet, 4960 W 5400 S Kearns UT 84118.

Club: 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 non-profit organization under the laws of Utah. It holds a club station license with the call W7SP, a memorial call for Leonard (Zim) Zimmerman, an amateur radio pioneer in the Salt Lake City area.

Meetings: 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, generally in room 1230 or 2230, sometimes in 2250 or 105.

Membership: Club membership is open to anyone interested in amateur radio; a current license is not required. Dues are $20 per year, including a *Microvolt* subscription. *The Microvolt* and membership cannot be separated. Those living at the same address as a member who has paid $20 may obtain a membership without a *Microvolt* subscription for $12. Send dues to the Club Secretary: James Bennet, KK7AVS, 4960 W 5400 S Kearns UT 84118. Let the Secretary know if you prefer the electronic edition of *The Microvolt* instead of the printed version.

Contributions: Monetary contributions are gladly accepted. Send directly to the Club Treasurer: Chuck Johnson, 1612 W. 4915 S. Taylorsville, UT 84123-4244. For in-kind contributions, please contact any board member to make appropriate arrangements.

Repeaters: UARC maintains the 146.62- and 146.76- repeaters. The repeaters are administered by the UARC Repeater Committee. Comments and questions may be directed to any Committee member. The Lake Mountain repeater (146.76-) is IRLP node 3352. Instructions for IRLP use are on the club website http://www.utaharc.org.irlp,

Ham Hot-Line: The Utah Amateur Radio Club (UARC) has a Ham Hotline, 583-3002. Information regarding Amateur Radio can be obtained, including club, testing, meeting, and membership information. If no one answers leave your name, telephone number and a short message on the answering machine, and your call will be returned.

UARC 2023 Board

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Repeater Engineer: Clint Turner, KA7OEI	801 566-4497

For late breaking news listen to the UARC Information Net Sundays at 21:00 on 146.62 or set your browser to:
http://user.xmission.com/~uarc/announce.html

We are grateful to the management of XMission, our Internet Service Provider (ISP), for the donation of this Web-Page service.

For account information go to:
http://www.xmission.com/ Or call 801 539-0852

Latest News

UARC meetings

UARC meetings are held on the second Thursday of each month except for July (annual steak-fry) and August (vacation). Meetings are held in the "Warnock Engineering Building" on the campus of the University of Utah. Watch the UARC website for the room and topics.

We encourage attendance of the live meeting, but we will also do our best to stream the meeting live on UARC's YouTube page: https:/www.youtube.com/c/UtahAmateurRadioClub.

From there, look for the feature that is marked "live." The meeting should commence at 7:30. There should be some chatter on the channel by about 7 P.M. and you can connect in that period to make sure everything is working.

Upcoming Amateur Radio Events

Utah VHF Society Swap Meet. Saturday, February 25, 2023 at the Davis Legacy Center. Open for sellers at 8 AM, buyers 9 AM MST.

Our Cover

Shawn Evans K9SLE lectures on emergency training, and Jeri Brummet W3JRI on computer security in the ham shack and snow covered antennas to remember in the heat of summer.

License Classes

Utah County:

In-person license classes will be offered at the City of Orem during 2023. Each course will cost $10. Register at: http://psclass.orem.org/. These are "homework" courses; You'll be expected to complete an assignment (and email me the results) by the start of every class period, even the first one. No course textbooks are required. Then again, these courses will be casual, hands-on, and fun for those who remain awake.
Please contact Noji (nojiratz@hotmail.com or 801-368-1865) with any questions about the courses.

Technician, General: Zoom, contact Morris Farmer AD7SR@arrl.net.

General: KK7AVS 147.16 mHz, positive offset, tone 127.3, every Tuesday 7 PM – 9 PM.

Extra: In person, contact Ron Speirs K7RLS@comcast.net.

Local Beacons, SDR

K7JL: 10 watts, 28.2493 mHz CW, Sandy.
KK7AVS: http://k7xrd.club SDR 33, 70 cm, 1.25M 2M 6M 10M 20M 40M, Kearns.

Is Amateur Radio becoming Computer Programming?

An on-off switch and a straight key were the first shack digital components. Today the main components of any radio transceiver are micro-computers and other specialized digital circuits. What's left? A few inductors and capacitors on the output of a power amplifier, a bit of amplification on the receiver side, the rest accomplished by zeros and ones. The real guts, the expensive parts, are the programs that run the things.

This implies it's no longer possible to build your own equipment without specialized knowledge not covered in the FCC license exams. To some extent this is true but my contention is that if you could build your receiver and transmitter in the 20th century you can perform the same in the 21st. The tools have changed, the components have

changed, but the electrons we're pushing around are the same ones we used then (unless you're really abusive, they don't wear out).

Let's look at some of the hardware and software components of the latest innovations: The Software Defined Radio (SDR) .The hardware components vary but they include digital frequency synthesizers, digital power amplifiers, analog to digital converters (ADCs), digital to analog converters (DACs), optical displays (LCDs, OLEDs), Field Programmable Gate Arrays (FPGAs), micro-controllers, Single Instruction Multiple Data (SIMD) computers, in addition to a decreasing number of discrete analog components. And let's not forget the really expensive parts: connectors and advertising.

No one built their own vacuum tubes. Designing your own integrated circuits is possible but manufacturing them in your garage requires very expensive equipment and chemicals you don't want around the house. But you can build SDRs out of commonly available parts at modest cost. Putting these parts on a printed circuit board isn't much of a problem for the serious Elmer. Many can be purchased on "development boards" that have power supplies, connectors suitable for big fingers, reference designs and videos. Perhaps the summit of these is the Raspberry PI, a complete computer system that runs a real operating system, for $15 or less. If you let the magic smoke out, a replacement costs less than a straight key. The internet abounds with DIY Arduino and PI projects that you can build with a minimum of tools.

You can use your computer for circuit design and layout, mechanical design, simulation, and ordering parts with Open Source (free) or you can spend lots of money for professional ones – the free ones are more user-friendly than the expensive ones designed for professionals using them every day.

Is this computer programming? It may not be misspelled names, semicolons and curly brackets but it's very similar to graphical languages and spreadsheets that are quite familiar. So if you're building something with modern parts, then the answer is, yes, you're computer programming.
Buy a fancy rig with waterfall display, digital filters, direct conversion, "100 watts in a box" and get on the air. Or buy a VHF portable or HT and start filling the ether. Either way, you're working with a computer – and it wants a lot of assistance; it's not Alexa. So yes, you're programming whether you think so or not.

All this shows that being computer-savvy to the point of some programming expertise is inextricably part of amateur radio whether you like it or not. The generation replacing us is comfortable with it; indeed, they can hold a social net better than we can. After all, what are cell phone towers? Just fancy repeaters.

Can you get by without computer skills? The coming generation of amateurs cannot and have little sympathy for those who don't or won't.

Julianne Pepitone, "The Uncertain Future of Ham Radio", July 10, 2020, IEEE Spectrum, *https://spectrum.ieee.org/ham-radio*

CQ Elmers

Jeri Brummet WJ3RI
Mike Ainsh KI7MTI

As your newly elected UARC Programming chairs, we wanted to share our thoughts and intended direction for the coming year's meetings, both on-line and in person.

First and foremost, we want members to have an active input into the presentations and programming. Our goal is to develop an active UARC programming committee made up of members from various backgrounds and interests to ensure that club members receive interesting

presentations and useful information. For this to work, we need several of you to step-up and participate: no experience necessary, just an interest in helping support our club and a desire to share your all consuming interest in amateur radio. Some of the things programming committee members will be doing include:

Drive the Welcome Wagon. As a programming committee members will meet and greet first-time and "stale" returning members. We are hoping to follow-up with these folks to encourage greater participation and grow our club. You might give them a phone call or e-mail to encourage their participation and learn their interests.

Grease the Elmer Machinery. UARC is the place to find advanced HAM info in Utah. Our goal is to have programming committee members update and expand the Elmer list on our website, and identify and recruit additional Elmers with varying degrees of expertise. There are new operating modes and equipment all in need of warm bodies.

We're seeking Elmers of all interests and abilities: from our traditional, amazing experts to those less-experienced, but eager to expand their knowledge by helping and working with others. The best way to learn something is explaining it to someone else. You don't have to be an electronic prodigy to help a fellow ham. Elmering another ham can mean anything from troubleshooting a persistent problem with a transceiver to soldering cables or lending a hand erecting an antenna. Finally, we are hoping to have an Elmer's Day event to run the afternoon of our annual Steak Fry. This will help "break the ice" by encouraging new members and old to mingle.

Give a UARC Presentation. There are thousands of topics. Your enthusiasm for a topic makes it arresting to the listeners no matter if they've heard it a thousand times or complex electronics they have no hope of understanding. Never given a presentation? We'll help you organize and practice it to get over any stage fright.

Interested in these ideas or have additional ones? Want to hear or give a presentation on a specific topic of interest to your fellow Amateur Radio colleagues? Contact Jeri-WJ3RI or Mike-KI7MTI by email or telephone, at a club meeting, or on the Sunday UARC Information Net.

An FM Crystal Radio that anyone can build

James Bennett, KK7AVS

Last August, as I was organizing the booth that Salt Lake Crossroads Amateur Radio Club had in the STEM Building of the Craft Lake City DIY Festival. I decided to build a cheap and dirty AM crystal radio set. It was a successful project. Kids and their parents were amazed that a radio could be powered by the signals reaching the radio via the antenna! So, it was with simplicity and DIY engineering in mind that I started researching more designs for AM crystal sets that could be built for kids, as a way of demonstrating how radio actually works.

At the same time I was looking at different FM circuits to understand how they work, and came upon the FM Sloper circuit [1]. Looking at the simplicity, it dawned on me that I might be able to build a very simple FM radio with readily available parts and tools. An FM slope detector circuit tunes just below the FM carrier frequency and converts FM to AM that is diode can convert to an audio signal.

I did some digging and found an article published by Larry J. Solomon in 2006 [2] that gave a description of his experiments. I looked at his ideas and set out to create a version that would work for my project: easy to construct, no batteries, no expensive parts. The circuit is quite

simple: a hand wound center tapped coil, a few capacitors, a diode, a resistor, a connector and some heavy gauge wire.

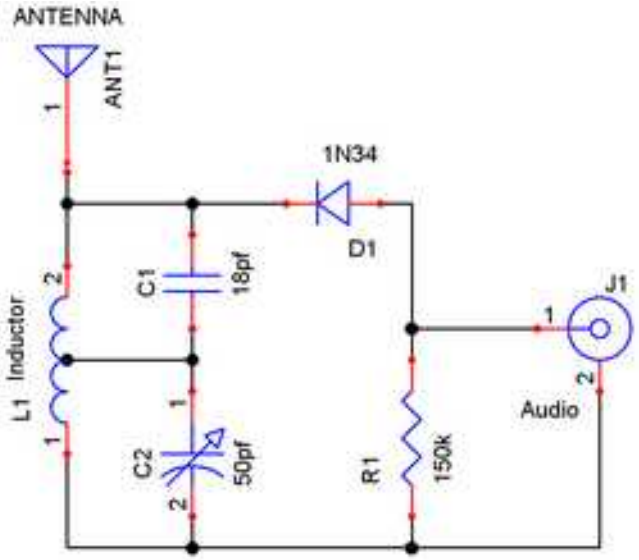


Figure 1: FM Crystal radio schematic

Parts list.

- L1 4 turns #18 copper wire, 12 mm inside diameter with a length of 19 mm tapped at 2.5 turns.
- ANT1 7 inches #18 copper wire
- C1 18 pF ceramic (Digikey 445-CC45SL3AD180JYVNACT-ND)
- C2 50 pF variable
- D1 1N34A germanium diode (Digikey 1N34ABK-ND)
- R1 150k (Mouser 791-RC1/4154KTD)
- J1 Earphone jack – ceramic earphone (Jameco part number **2219583)**

The first challenge was finding the parts I'd need for the project. In my junk bin I had #18 enameled copper wire but no variable capacitor and no 150k resistors. Luckily I had two 300k resistors that could be wired in parallel for 150k. 12 millimeters is a little less than 0.5 inches so I wound the wire around a standard sharpie that measures 0.46". Using a fixed 68 pf capacitor and the hand wound inductor, I rigged together parts I did have and heard some murmurs through my crystal earpiece. Then, I heard "This is MY 99.5 FM"!!! The radio works and their transmitter is a few miles away, not just across the street.

Excited, I realized I didn't need to rig this thing together with the spare parts I used for the tuner. The Q was too high because of the heavy gauge wire, the device less sensitive and un-tunable without a variable capacitor. These are expensive

I searched for some simple ideas, and came across a design for a variable capacitor made out of a 2 ½ inch ¼-20 bolt, 2 nuts, some enamel coated wire and a support structure [3]. The nuts were soldered to a copper support though this could be wood or plastic – you just need to connect to the bolt.. Modifying the idea a bit, I put 20 turns of wire on the bolt to get my 50pF and put a tuning knob on. The key is to short both ends of the coil making a large surface area instead of an inductor. This coil and the wire on the bolt are the terminals of the variable capacitor. As the bolt is screwed into the coil, the surface area between the bolt and coil increases, thus increasing its capacitance.

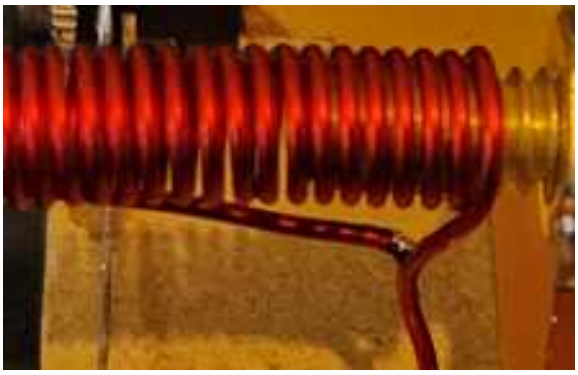


Figure 2: Tuning capacitor detail

Now it works flawlessly. Although the FM Slope detector circuit is not the most efficient way to demodulate FM, I can still tune in 4 or 5 FM stations with just a 7" antenna. With an added jack I can plug it into an amplifier to tune into the weaker stations in between.

I've heard this time and time again, but it's the truth: Practically any ham should be able to go to their junk parts bin, and make a simple radio, or QRP transceiver from scratch.

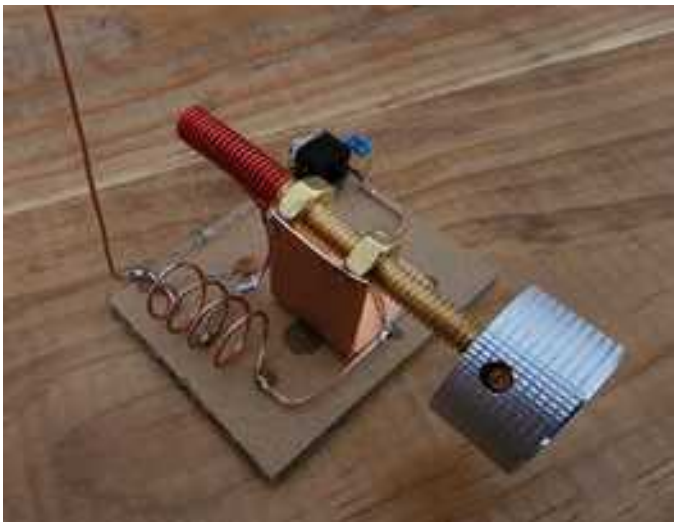


Figure 3: DIY FM Crystal radio

1. P. Horowitz, W. Hill, *The Art of Electronics*, Cambridge University Press, 2nd edition, 1989.
2. L. J. Solomon, *FM Crystal Radios?* 2006
3. J. Korszun, *How to make your own variable tuning capacitor*, Electronic Products, 2016, https://www.electronicproducts.com/how-to-make-your-own-variable-tuning-capacitor.

Book Review

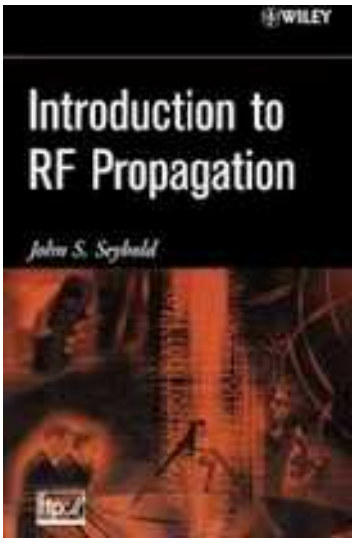
Introduction to RF Propagation, John S. Seybold, Ph.D., Wiley-Interscience 2005.

If you check Amazon books for yourself as author you may be surprised at what you've written. Checking for books on Radio Frequency Propagation shows several, all over $100 but used ones for some what less. I didn't write this one so have to reference it frequently.

We memorized different atmospheric layers for the amateur tests but the details and computer models weren't part of the deal. These are well represented and with minimal mathematical preparation, understandable. If you're lazy, you can just ignore the equations and still get your money's worth.

Why would you want to know more? I'm going to the mountains to assist with a marathon and need to communicate with a central site. Where and how high should I put the antenna for reliable communication? How much power should I use to communicate? I'm in a rain forest, what frequency works best? Will GPS work here? I'm putting up an antenna. Where are RF exposure limits exceeded?

These and many more questions are answered or programs and models examined. If you're a glutton for punishment, you can work out the exercises at the end of each chapter.



January Member of the month

Jed Marti KI7NNP
by Linda Reeder, N7HVF

This month we are featuring the new Microvolt editor, Jed Marti Ki7NNP. Jed enjoys writing and has written books on computer programming and computer simulation, conference papers, countless manuals, and technical reports.

Jed grew up in Minnesota and became interested in amateur radio through a neighbor and taking apart the family television. Jed liked the fact that you could do your own electrical work on your ham radio equipment and antennas. Jed obtained his novice radio license in 1968 as WN0UOF but had a hard time getting beyond 5 WPM (up to seven forty years later).

After college and graduate school at the University of Utah, Jed taught Computer Science for a few years and then moved to Venice California to work for a think tank (think Dr. Strangelove). Returning to Utah, Jed worked for Sarcos and then, with a friend, started an R&D company performing research for the Navy, Air Force, CDC, and DARPA. His last work centered around 10 gHz Frequency Selective Surfaces and LORA that rekindled his interest in amateur radio.

Jed decided to get his amateur radio license again because he didn't have to worry about Morse code.

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Jed used Ham Study for a couple of weeks and practiced taking the tests over and over. About 5 years ago he took the tests and passed the technician, general and extra class licenses.

Jed's favorite thing about amateur radio is building things. He built J-pole antennas and is now designing and building a 630M and 160M SDR. This is to be ready for home brew night in October but in the mean time he is obsessing about capacitors and inductors.

Jed is a board member and past president of the Utah Rocket Club (UROC). He builds rockets some which have on-board 70 cm telemetry requiring an amateur license to operate. You would be surprised how far you can transmit on 100 milli-watts when your antenna is 2 miles high. Jed enjoys, SCUBA, skiing, hiking, wood working, aviation (N733RJ), river rafting and sailing.

Jed is a member of UARC, the editor of the Microvolt and is also vice president of the Salt Lake Crossroads amateur radio club. He is also a member of AAAS, the ARRL the Utah VHF Society and IEEE.

Jed congratulations on being elected the Microvolt editor. We know you will do a great job. We wish you the best in your endeavors.
73 N7HVF Linda Reeder