



# THE RICHMOND HAM

Published Monthly by the Richmond Amateur Radio Club

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July 2024

## THE RICHMOND AMATEUR RADIO CLUB RARC Meeting in person!

Our monthly meeting is on Friday July 12th, 2024, 7:00PM, at the Bon Air United Methodist Church, 1645 Buford Road.

This months meeting will be in-person and also on Zoom.

<https://us02web.zoom.us/j/88518058584>

QR Code for Zoom Link



**This months program:** Will be by Rob Thomas, KC4NYK, on CW practice using Vband.

### RARC Meeting Minutes June 14<sup>th</sup> 2024

Meeting was started at 19:00 by president Rick Waller, KA4OHM.

Minutes approved by voice vote.

**Treasurer's Report:** Balance of \$17,964.08.

New Members: Joseph Duquette, K1MOX

**Old Business:** None

**New Business:** Win Grant, W4WIN, mentioned that The ARRL Roanoke Division director and Vice director will be visiting as many Field Day sites as possible. Great opportunity to meet your ARRL officials.

RATS will be having their Field Day activities at Laurel Park in Henrico.

Will Jackson announced his new call sign, KR4CE – congrats Will.

Business Meeting was closed at 19:10.

**Show & Tell:** Dan Brown, W4ERF, demonstrated the first section of a direct conversion receiver project. The VFO section using a clever homebuilt PTO.

Dave Stevens, WB4DES, showed Band Pass filters he had built for 2023 Field Day.

The meeting ended at 19:22 followed by a short break.

This month's presentation was by Win Grant, W4WIN, An overview of this year's Hamvention.

## RARC VE News

We have two different groups that provide testing.

One is free, but only offers testing sessions on the second Saturday of odd months except June (Field Day) replaces July. The next session will be on **Saturday September 14<sup>th</sup> 2024** at 10:am

**Chesterfield Library Bon Air Branch  
9103 Rattlesnake Rd**

**North Chesterfield, 23235**

The other one cost \$15.00, but offers testing sessions on the 1st Saturday of every month.

RARC offers Free VE Testing Sessions on the second Saturday of odd months except June (Field Day) replaces July. Currently all testing starts at 10:00 AM and is at: Chesterfield Library Bon Air Branch 9103 Rattlesnake Rd North Chesterfield, VA 23235.

Pre-registration Required. Walk-ins Accepted.

Pre-Registration required for Techs and for special needs applicants. Anyone taking the Tech exam needs a FRN from the FCC (Google obtaining a FCC FRN) and bring that info to the session. If you have questions about a session, please see our website, [www.rarclub.net](http://www.rarclub.net) or contact Allan, WA3J, at 804-399-8724, or [ve@rarclub.net](mailto:ve@rarclub.net)

KC4TS Cats Vet (Cats Volunteer Examination Team) offers VE Testing Sessions that cost \$15.00 on the 1st Saturday of every month. Currently all testing starts at 10:00 AM and is at: Gospel Light Church 2109 Anderson Hey Powhatan VA.

Check-in is between 10am and 12pm and we stay as long as needed to finish all the exams. Walk-in candidates are welcome! You just need a valid ID, an individual FCC FRN, and the testing fee of \$15 which goes directly to the ARRL (cash or check made payable to "ARRL VEC"). We can provide pencils and a very simple calculator or you can bring your own. See <http://kc4ts.org/> for more information.

**Club Info...**

RARC meets on the second Friday of each month at 7:00 PM, at the Bon Air United Methodist Church, 1645 Buford Road.

We offer 10-week license prep classes in September and March with exams following. Members provide VE testing sessions on odd-months during the year.

**Join the Richmond Amateur Radio Club.**

You don't have to have a ham license, just have a genuine interest in the hobby.

Annual Dues are:

80 and over \$0

Regular Membership \$22.00

Lots of information about the Club and our activities is available on our website, [www.rarclub.net](http://www.rarclub.net).

**QR Code to RARC Website**



**Nets**

RARC has the first and only D-STAR digital repeater in the area: 147.255 (+ 600), 443.7125 (+ 5) and 1284.0000 (-20). In addition to our Wednesday local D Star net (below), we link Module C (VHF) on Tuesday nights at 9pm, to REF 054C for the North Carolina D Star Net.

The RARC D Star Net meets on Wednesday nights at 8:00pm and is accessible on our three D Star modules, all of which will be linked together via REF 097B. So if you are in RF range of the repeater, you can join the net on any of the three RF modules and be heard by everyone.

If you participate in the net via DVAP, DV Dongle or a Hotspot (such as Pi Star), you should link your device to REF 097B rather than to any of our modules which will allow you to be heard by everyone.

Any questions, contact Win – W4WIN at [wingrant@gmail.com](mailto:wingrant@gmail.com)

<b>Sunday</b>	7:00 pm	50.135	USB
<b>Wednesday</b>	7:00 pm	28.475	USB
	8:00 pm	147.255	D-Star Rptr
<b>Thursday</b>	7:00 pm	52.525	FM

**MRA**

**Interested in information or support of the Metropolitan Repeater Association (MRA)?**

The sole business of the MRA is to own, operate and maintain the **145.430** and **224.42** repeaters.

For information please visit our website at <https://sites.google.com/view/kg4mra/>



**50.215Mhz @ 8:00am daily Show and Tell!**

If you have an item, idea, latest and greatest, or whatever gizmo; please bring it to the RARC meeting. We have a table (usually) set up near the front where you can place your item and share/discuss it with others as they arrive. We also have a section of the agenda set aside for members to discuss their "Show and Tell" item(s). No need to be tentative; we are INTERESTED in what you are doing, how you are doing it and, in true Ham fashion, how much it costs!

**Articles Requested!**

Everyone has a story to share. Your first rig, your first contact, your most memorable QSO? How about a description of your shack with a picture? Old to the hobby – New to the hobby, there are lots of interesting stories out there to share. Consider writing and article for the newsletter. Any topic, any length any format, all will be welcomed. Any questions, send me an email at [wa1uqo@gmail.com](mailto:wa1uqo@gmail.com) or call @ 508-838-8353.

**Tired of winter? Cabin Fever got you down?**

Here is a list of upcoming hamfests and tailgate fests.

**August 3<sup>rd</sup>** – Roanoke Hamfest, Vinton, VA by the Roanoke Valley ARC.

**August 4<sup>th</sup>** – Berryville Hamfest by the Shenandoah Valley ARC.

**August 10<sup>th</sup>** – Tidewater Hamfest and swap meet in Portsmouth, VA

Mark your calendars and save all your loose change!

**Sept 14<sup>th</sup>** – 6M Tailgatefest, 2300 Dumbarton Road, Henrico, VA.

### **“Mac” Mc Neer, K4YEF, SK**

It is with profound sadness to announce the passing of Mac Mc Neer, K4YEF. Our sincere condolences to his family and friends. Mac was a very longtime club member and contributed much time and effort to the running and guidance of the club. 73 Mac.

### **Third Time Was the Charm Win Grant – W4WIN**

My wife and I recently embarked on a cruise out of Southampton England that made its first stop in Kirkwall in the Orkney Islands. This Scottish Island chain has neolithic stone monuments built 5,000 years ago that resemble those at the more famous Stonehenge site. Kirkwall is also the home of the Orkney Wireless Museum. On our two prior visits, the museum was closed and it appeared that would be true on our third visit which happened to be on a Sunday.

Knowing how much I wanted to visit the museum, my wife reached out to two very nice ladies who came on board our ship to provide information about the attractions and shopping on the island. Jo explained my disappointment at learning that yet again we were visiting on the one day a week when the wireless museum was closed. These delightful ambassadors for Orkney rang up one of the docents for the museum and we were told the museum would, indeed, be open for our visit.

We headed straight to little stone house in the center of Kirkwall where we met Robert Foden, the husband of Kim, GM4LNN, both of whom volunteer at the museum. I found an eclectic collection of all sorts of radios and electronics from the 1930’s to present. As you can see in the photos, there were consumer electronics as well as a number of WW1 and WW2 military surplus items.

They even have a replica of a 30 line “televisor” spinning disc television that Kim built based on a working model constructed by her father and uncle in the 1930’s to receive experimental television signals from London on medium wave. The only ham rig I spotted was

what appeared to be a version of a 1970’s era Yaesu FTDX-401.

The Orkney Wireless Museum will present you with a certificate if you send your name in Morse Code. They provide a “cheat sheet” with the Morse characters for the alphabet. Needless to say, that was not a problem for me!

John DeMajo would have enjoyed the Orkney Wireless Museum as much as I did. If you are in the neighborhood, make it a point to visit the museum. You might even come home with an official Orkney Wireless Museum cap.



THE RICHMOND HAM July 2024



## Belfast Repeater/CEPT Operating By Will Jackson, KR4CE

During the first week of June, I had the privilege of visiting Belfast, Northern Ireland, for the primary purpose of attending a Belfast Titanic Society event. As a result, I figured I'd bring my HT with me and try a few local repeaters. My first night was in Dublin, [Republic of] Ireland, so I just Googled Dublin repeaters thinking this would be easy like using Repeater Book. I found EI2TRT on 145.6 overlooking the River Liffey and some cool bridges. (Of note, it was quite the river trip for being born in the River City). But being a green HAM, I never could seem to get the Morse identifier going (and later found out why).

I had limited time in Dublin, so I focused solely on Belfast which was my ultimate destination anyway. Once training into Northern Ireland and settling into Belfast, I was also able to Google a repeater for there. I settled on GB3NI on 145.725 from my room overlooking the trains buzzing over the River Lagan and the giant yellow Harland and Wolff Cranes. However, I still could not get that Morse tone! It occurred to me that perhaps the published "transmit" and "receive" tone actually were conventionally backwards, unlike what a Chirp file says. And thus the problem, I had been putting the "receive" in as the first frequency all along (oops).

Eureka! Immediately the Repeater's Morse Identifier began, and it honestly was pretty satisfying having only used pre-made Chirp files before. The first time I did a transmission test, no one came back. But it was still a bit exciting for me. Some hours later though, I quickly got a response! It was super fun, and a Belfast person (I'm unaware of specific word for a Belfast resident) came back with "Mike India station," Belfast accent and all. Since I was operating off the CEPT agreement, I had to use MI stroke KR4CE. More on that later. Unlike our MRA Repeater on 145.143 in Richmond, this one gave a Roger beep but then the Morse after each transmission. I kept waiting, and finally my new friend politely informed me I can talk over it after the Roger. That was a relief. But it was interesting that Repeater did that. I'm not sure if other U.S. repeaters give their Morse every time or if that's a specific UK requirement, as I didn't want to violate their operating standard to step on it.

At any rate, the other operator was Bob, G16IVJ. We had a really nice rag chew, and you can tell I had quite a fun time with this! Another Op popped on quickly too to give a signal report, so it was neat how it's the same system of structure all over the world. Given I was there for a Titanic Society event and already a little emotional about that, by

chance Bob used the term "old man" at the beginning of our QSO. That actually was a bit nostalgic so it did touch me a little. But he wanted me to log in QRZ so we could keep in touch. It was a reminder, just like my visit to see my Titanic Society friends, that our hobby is profoundly human and that we have connections and friends all over the world whenever we're feeling lonely. It was quite peaceful and special in a jarring world.

Aside from the fun part, since I recently got my Extra, CEPT was referenced anyway on the test. This was pretty neat because I actually got to see one of those seemingly obscure regulatory goodies applicable to me! All you have to do is bring the FCC CEPT notice with you in addition to your official license. Who knew you actually needed your official license for something? This basically proves you're an operator, but you are subject to the country's own rules, not the FCC's. Reading the full actual CEPT notice (and not the FCC Bulletin) explains what class of license you get in each country. I didn't bother because I was using the repeater. If you're actually running power, this would be worth reading.

Aside from that, you simply prefix your U.S. callsign with the country code from the full CEPT Agreement sheet and then a stroke (or slant in CW). QRZ even has a feature where you can add your "borrowed" callsign into their database for others to find you. It's called something else, but this whole process is very streamlined and is very well thought out.

I was curious if my HT would cause a TSA problem, but not at all. Just in case, I had another copy of my license in my carryon. I'm not sure if anyone in the Club has flown with a full-on rig, antennas and all? I would be curious if the TSA said anything. Seems the answer is just to keep your license with it, and it's 100% allowed according to their app. As for me, I had no issues with this whatsoever.

As a new HAM, you guys can quickly see I really am developing quite the passion! You don't realize why it's worth getting your Extra, but I don't think you can operate on CEPT under General in certain countries. If you're like me and now interested in international travel, all the stops are out for HAMs in ways like that because I made the Extra investment. I never realized how much fun and intellectually curious I would become when John DeMajo and Bruce Mac Alister pushed me into this, but now I even bothered to figure out how to operate internationally! Not only that though, it was honestly a moving experience to me. It added something to an already emotional experience, and it reminded me of home and my HAM friends here as well.

If you're going somewhere internationally, I cannot recommend the extra effort to do this, especially if you're further along technically than me.

Stay tuned, as next Tuesday I get to operate as a guest on the amateur station on the RMS *Queen Mary* in Long Beach, CA! Thanks to Rick, K4OHM for the reminder to check on this. What an opportunity to compliment a visit to the birthplace of the most famous ocean liner in the world.

73 old men,  
Will, KR4CE



## The SWAP SHOP

Club members may list their wares in the newsletter. Send descriptive information to Armand at [wa1ugo@gmail.com](mailto:wa1ugo@gmail.com), or call me at 508-838-8353. The Swap Shop is presented in the newsletter as a benefit to our members. RARC takes no responsibility for items sold or traded in this newsletter. The ad will appear three times unless extended. Interested parties will contact you directly. ***You must be an RARC member to place an ad.***

**WANTED:** ICOM 706 MKII G . Contact Jon Bennett, NQ4A. [motexa@verizon.net](mailto:motexa@verizon.net).

### For Sale:

Comet CX-333 tri-band antenna. Used 3 years, still in very good condition and had a low SWR on all bands when decommissioned.

SPECS: Coverage: 2M, 1.25M, 70cm, VSWR: 1.5:1 or less, Max Power: 120 watts, Length: 10' 4", Weight: 3 lbs 8 oz , Connector: SO-239.

Construction: Heavy-duty Fiberglass, 2 sections

Asking \$90. Contact Dave White, W4IIA for information.

804-501-8857

### For Sale

Below is a partial list of a SK Estate which Alan Swinger is selling on behalf of the widow. Although the SK's estate is in Hanover, VA, almost all items listed are at Alan's QTH for test and check out. Details and photos are available to anyone who contacts Alan directly at: [alan.swinger@gmail.com](mailto:alan.swinger@gmail.com).

-MFJ 409D Deluxe Keyer & Manual copy - \$85

-HF Go-Bag Complete HF Station: IC-718 & PS w/ MIC & Headphones, MFJ Versa Tuner II, Vibroplex Paddle, etc, w/ Manuals - \$785 OBO (Will consider selling individual pieces)

-Murch UT-2000A Transmatch and manual copy - \$190

-Heath 610 Station Console w/ manual copy - \$135

-400 ft roll of 1/4" steel Cable (Retail \$0.82/ft) - \$180

-Dummy Loads – have 2; oil filled can type - \$50 ea

-Other equipment includes Kenwood TS-830 & VFO 230, Swan 350 & PS, Drake line: TR3, TR4c, TX4s, R4s, RV3s and various AC4 and MS4 power supplies and speakers. These are all in various states of test and check-out but will negotiate if interested.

--500 ft of Anderson 50 ohm Heliex hardline (FSJ4-50) - \$800

and 8 PL-259 connectors (\$5 ea) and tool to mount available (\$40)

More to come later, including some Vintage Heath radios -SB-102, Mohawk, etc

73, Alan Swinger K9MBQ

Charlottesville, VA 22903

434-975-6237 (H); 434-760-0258 (Cell & Text)

## Thought For The Day

***A clear conscience is usually the sign of a bad memory.***

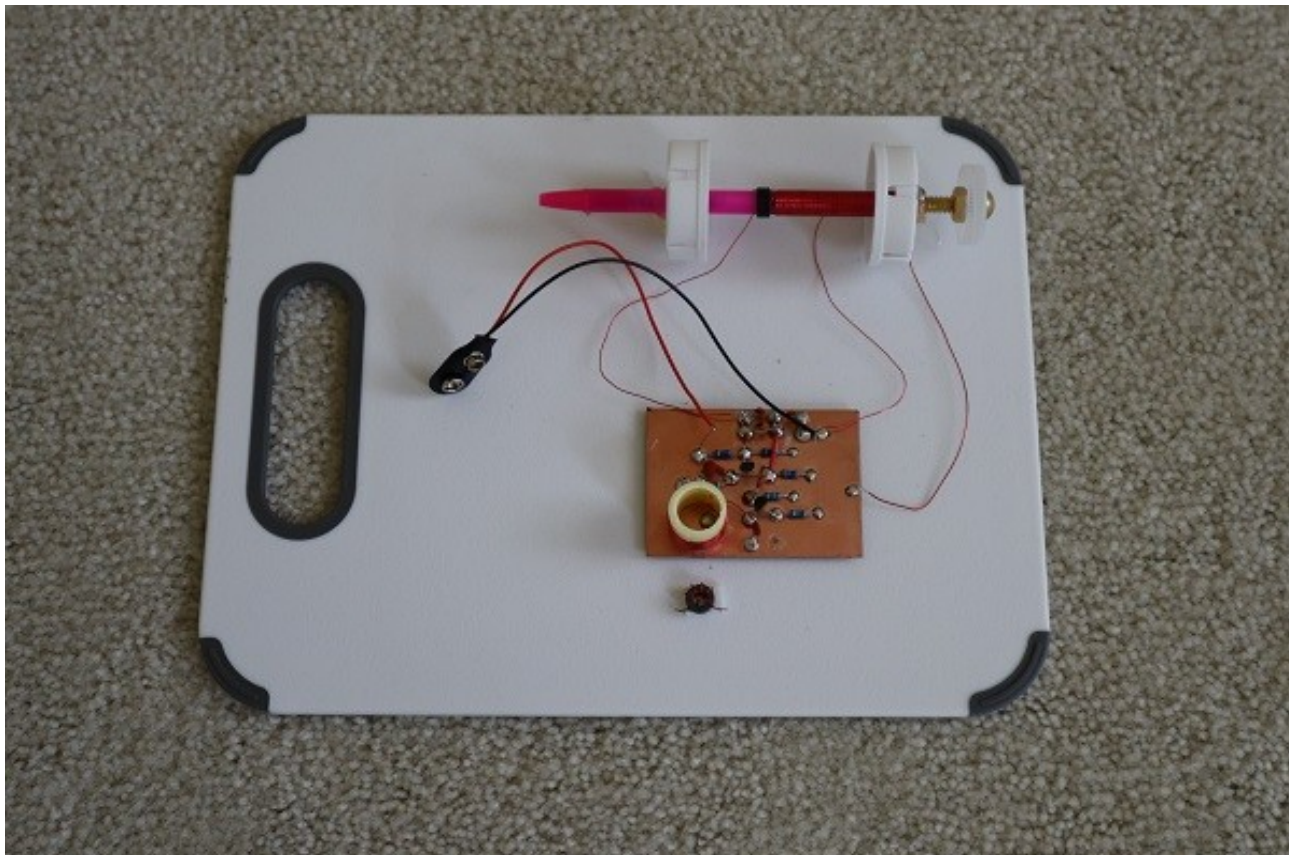
<b>Rick Waller</b>	<b>KA4OHM</b>	<b>President</b>	<b>(804) 971-5815</b> <a href="mailto:president@rarclub.net">president@rarclub.net</a>
<b>Darrell Basinger</b>	<b>WW4F</b>	<b>Vice President</b>	<b>(804) 672-7928</b> <a href="mailto:vicepresident@rarclub.net">vicepresident@rarclub.net</a>
<b>Dave Robinson</b>	<b>KJ4LHP</b>	<b>Secretary</b>	
<b>Ken Leidner</b>	<b>WV0L</b>	<b>Treasurer</b>	

## High Schooler DC Receiver Project

(Part 1)

Dan Brown

W4ERF (Erfman)



A couple of friends and myself recently met together for a breakfast at a local restaurant to talk about the things and to solve the worlds problems. During the course of conversation, we talked about home brew radios and how we would like to build our own transceiver. We decided we would do it. It would be a learning experience for all of us. We also decided we wanted to do something that was not Arduino based. An Arduino DDS (Direct Digital Synthesizer) could be added later if we wanted but for now, we wanted to do everything with just hardware.

I've had the most experience building solid state circuits, so I took the lead. I did an extensive internet search and found that most of the projects on the internet were Arduino based. I did find a handful of older projects that looked promising but keeping things as simple as possible was a priority.

I reached out to Bill Meara and Pete Juliano from the Soldersmoke Podcast for advise. They immediately encouraged me to put the transceiver project on the back burner and start with something more simple like a direct conversion receiver. I wasn't thrilled with that idea because I had already built one and they told me I could build a few more stages and make the receiver into a transceiver.



After considering their advise I decided that building another direct conversion receiver that was not Arduino based would be a worthy endeavor and would give the other guys a chance to build something that wasn't overly complicated. The guys agreed.

Bill suggested that we build the High Schooler Direct Conversion receiver like they built with some of the school kids in their area. A right-up and circuit schematics can be seen at...

<https://hackaday.io/project/190327-high-schoolers-build-a-radio-receiver>

After taking Bill's advice, I started to work on the VFO portion of the receiver. It was based on a Colpitts Oscillator that uses capacitors to accomplish the in-phase feedback and the oscillation.

L1, C1 & C2 are the components that determine the frequency of the oscillator. The combination of the inductor L1 and Capacitors C1&C2 is known as a tank circuit. Look at it like water in a tank that is sloshing back and forth. This is what happens in the tank circuit. The energy keeps going back and forth between the inductor and the capacitors. This is known as the oscillation.

In the schematic (see Fig 1), C1 and C2 are in series and they are in parallel with L1.

When Capacitors are **in series** their combined capacitance is determined by the following formula..

$$C_{\text{total}} = \frac{1}{\frac{1}{C1} + \frac{1}{C2} + \dots}$$

This can be used for as many caps as necessary in series.

Capacitors **in parallel** add together.

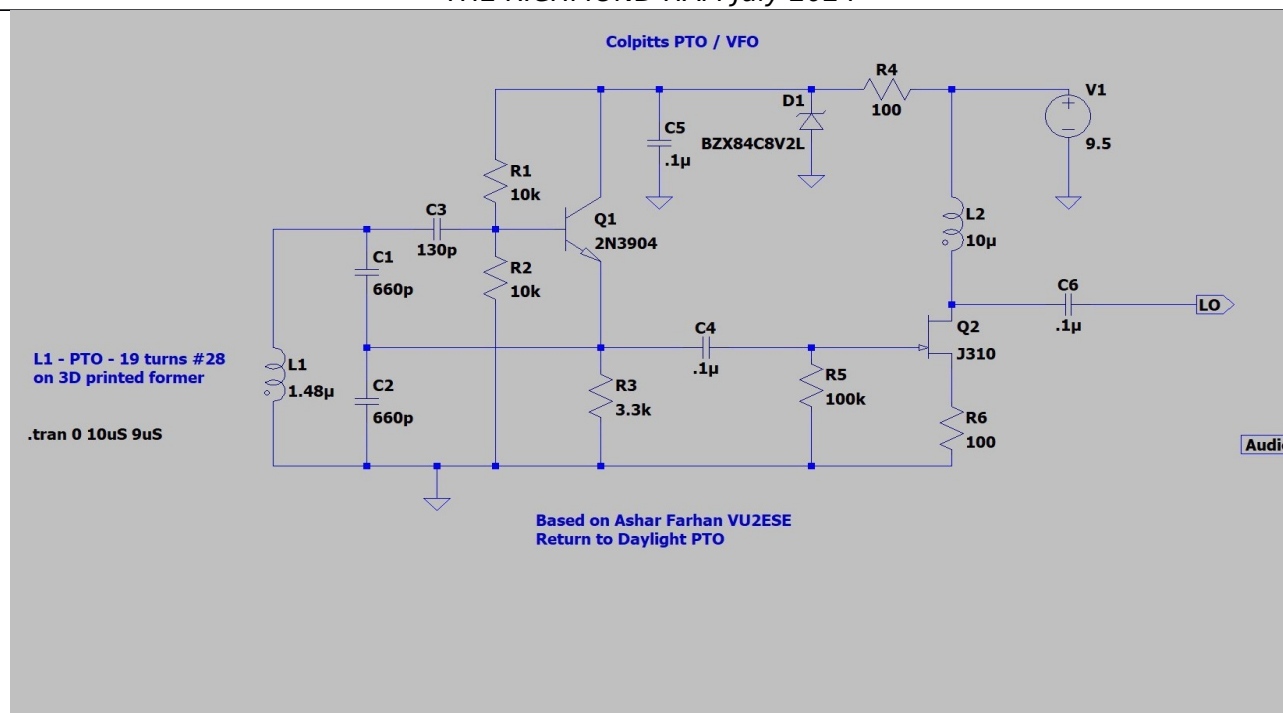
$$C_{\text{total}} = C1 + C2 + \dots$$

This can be used for as many caps as necessary in parallel.

In our circuit, capacitors C1 and C 2 are in series therefore their combined capacitance would be:

$$C_{\text{total}} = \frac{1}{\frac{1}{660\text{pF}} + \frac{1}{660\text{pF}}} = 330\text{pF}$$

$$\text{Combined capacitance } C_{\text{total}} = 1/((1/660\text{e-}12 + 1/660\text{e-}12)) = 330\text{e-}12 = 330\text{pF}$$



The formula for LC resonant circuits is:

$$\text{Resonant Frequency} = \frac{1}{2\pi\sqrt{LC}}$$

$$\text{Resonant Frequency} = \frac{1}{2\pi\sqrt{(1.48\mu\text{H} * 330\text{pF})}} = 7.202 \text{ Mhz}$$

In this case the Resonant Frequency =  $1/(2*\pi*\sqrt{(1.48\text{e-}6*330\text{e-}12)}) = 7.202 \text{ Mhz}$

1.48uH was chosen as the inductor value was because it would resonate with the capacitors at a frequency near the center of the 40 meter ham band. This circuit actually uses a variable inductor and it will provide enough variability to cover the entire 40 meter band.

The reason the two 660pF capacitors were placed in series to form a combined 330pF was to create a place for the signal at the emitter of Q1 to be fed back into the LC tank circuit, while at the same time blocking the DC bias voltage coming from the emitter of Q1 (Capacitors only allow AC to pass). This feedback provides the necessary energy at the right time to keep the oscillation going, otherwise the oscillation would become weaker each time the inductor and capacitors exchanged their energy. Just like the water sloshing around in a tank will eventually stop sloshing if no external forces are present to keep the oscillation going. The reason the oscillations stop is do to the inherent resistances in the system.

Be aware, when you “roll your own” inductor, you may end up with a different inductance than what is shown. You can either remove/add the windings to match the inductance on the schematic or change the values of the capacitors to achieve the frequency desired. Determining the values of the capacitors can be done by algebraically manipulating the  $1/2\pi\sqrt{LC}$  resonance formula or by using one of the many LC resonance calculators available on the internet.

Q1 is a BJT (Bipolar Junction Transistor). BJTs are current amplifying devices and their amplified currents can become voltages by passing their currents through resistors according to Ohm's Law ( $V=IR$ ).

The base of Transistor Q1 senses the oscillation coming from the tank circuit and causes the emitter current of Q1 to fluctuate in phase with the oscillation. The emitter current flows through R3 and causes a voltage to be developed across R3 per Ohm's Law

Capacitor C3 is a coupling capacitor and is not part of the tank circuit. It merely allows the alternating current (oscillation) from the tank circuit to be fed to the base of Q1 without allowing the Q1 DC biasing voltage to interfere with the tank circuit. (Remember, Capacitors block DC)

Capacitor C4 is another coupling capacitor that allows the signal (oscillation) seen at R3 to be routed to the input (gate) of the next transistor (Q2).

Q2 is a JFET (Junction Field Effect Transistor). It is a voltage to current device. Its functioning is based on how an electric field interacts with the silicon in the transistor to restrict the current flow through the transistor based on the relative voltage between the gate and source of the transistor. An in depth discussion of JFET operation is beyond the scope of this article.

Suffice it to say, Q2 is in a self bias configuration and this transistor stage is what provides the amplification for this circuit.

R4, D1 are used to regulate the supply voltage to the circuit and C5 is used to route any AC noise on the power supply to ground.

D1 is an 8.2 volt zener diode.

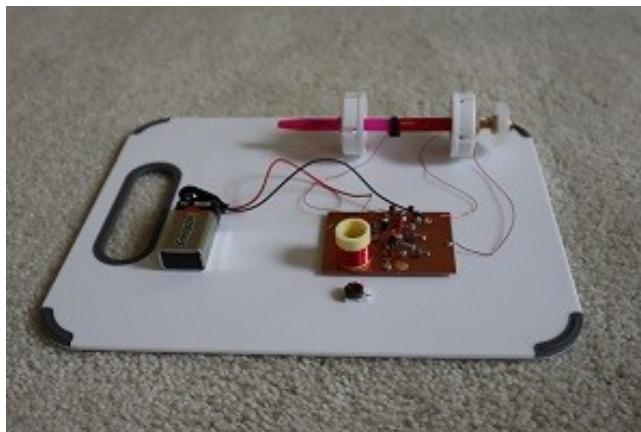
This diode would regulate the voltage going to oscillation portion of the circuit to about 8.2 volts even if the supply voltage was degrading over time. (ex. A 12volt battery could power this circuit with very little change until the battery discharged down to about 8.2 volts.) I am not sure why the regulated voltage is not also being applied to the Q2 stage. It would seem logical to want to keep the voltage to the entire circuit as stable as possible.

R4 is a current limiting resistor for D1. It is necessary because if the zener diode (D1) was connected to the power supply directly without R4, D1 would try to pull the power supply down to 8.2 volts. The power supply would likely exceed the power rating of the diode and the diode would fail.

R4 limits the current going to D1.

8.2 volts drops across D1, the rest of the voltage drop occurs across R4 in accordance with ohm's law.

### **Construction notes and lessons learned**



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The Manhattan or “ugly” technique was used to prototype this circuit. For a more detailed description of this technique refer to the RARC club newsletter (July 2023). The technique is described in the article “VWS 40 Meter Direct Conversion Receiver”. The link to the newsletter is below:

<https://rarclub.net/wp-content/uploads/2023/07/RARC-Notice-2023-07.pdf>

The most complicated portion of this build was the creation of the variable inductor.

The variable inductor originally used in the Home Schooler Direct Conversion Receiver was a 3D printed version that a brass nut and screw would be fitted into. The coil form was part of the 3D print and a specific number of turns of wire on the form would provide the inductance necessary. See the article referenced at the beginning of this article.

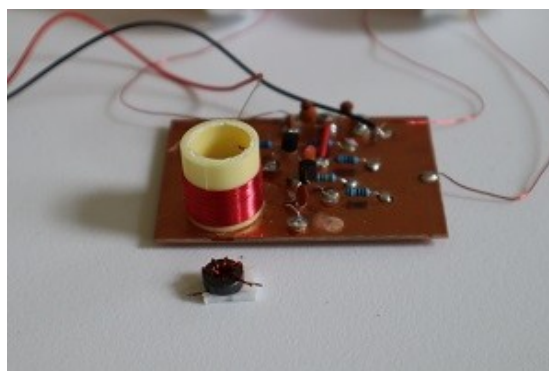
I didn't want to rely on a 3D printer for this key item and decided to make mine out of easily obtainable materials that anyone could easily find.

My variable inductor used a cheap plastic mechanical pencil as the coil form. This choice worked well because the 2.5 inch 1/4-20 brass screw fit perfectly into it. I fitted the pencil shaft into a battery operated drill and slowly used the drill to wind the wire onto the shaft. I arbitrarily wound the wire up the shaft for about an inch and a half while trying to keep the wire loops as close together as possible. I then took some super glue and ran it up the length of the coil on one side and then the other. This ensured the coils stayed in place and together. I used #26 wire, but any gauge would work.

I measured the inductance of my coil and it was about 13 uH (which is way more than the 1.48uH in the schematic.) Using a LC resonance calculator I determined that 36.5 pF would be the appropriate capacitance for resonance at 7.300 Mhz. I did the calculation using 7.300 Mhz because I wanted the brass screw to be screwed mostly in at the upper end of the 40 Meter band.

The 36.5 pF was a good starting point for choosing which capacitors to use. Remember the 36.5 pF is going to be the combined capacitance of 2 capacitors in series therefore each capacitor should be about 73 pF (which is not a standard value but 68 pF is). It is at this point that trial and error comes into play. I wanted 7.300 Mhz with the brass screw mostly inserted. I wanted to leave some of the screw out so it would be easier to grab onto and turn. I added capacitors in parallel to the top (C1) capacitor and to the bottom (C2) capacitor. I discovered that all I needed to do was add capacitors in parallel to the top capacitor (C1) to accomplish my desired frequency changes (Adding capacitors in parallel with C1 affected the frequency without majorly affecting the amplitude of the output. Adding capacitors in parallel with C2 changed the frequency but also lowered the output of the oscillator so I only added to capacitors in parallel with C1). It should be noted that using NP0 capacitors are preferred when trying to make a stable VFO. NP0 capacitors are not supposed to drift over a wide temperature range. Also, capacitor values typically have wide tolerances 20% or more, so don't be surprised if your frequencies don't exactly match your calculation. Keep tweaking until you get what you want.

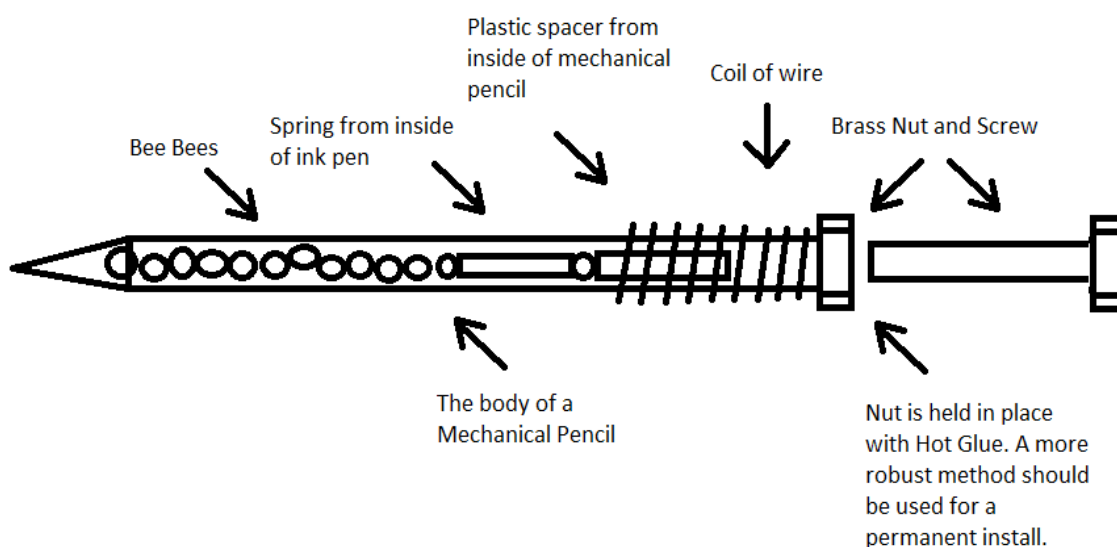
When all was said and done, my oscillator would vary from about 5.8 Mhz to 7.4 Mhz. This tells me that I my inductor coil had way more turns than necessary but it still performed its job perfectly over the entire 40 meter band... the rest is irrelevant.



The other issue worth mentioning was associated with the L2 choke. I didn't see anything regarding its construction so I used one of my rf toroids. I put a few turns on it and measured the inductance. Four turns gave about 9uH and it worked fine in the circuit. After thinking about it, I decided to make an air core choke instead so I wouldn't have to waste a toroid. Wire and a piece of pex tubing are also easier to obtain than rf toroids. I did about 20 turns and got 13 uH. The air core choke worked just as good as the toroid (see the pic for comparison of the air core and the toroid chokes).

The oscillator was working perfectly and it produced a very nice sine wave at approximately 3 volts. The only thing I didn't like was the feel of the screw as I threaded it into the nut that was attached to the front of the mechanical pencil shaft (I also used a couple of pill bottle caps to elevate the variable inductor. Everything is held together with hot glue.) The screw had a little play in it and I knew this would make fine tuning more difficult because of the backlash the play would allow. So I came up with an idea...

... I



would take the spring from an ink pen and use it to push the screw forward and remove the play between the nut and the screw. The mechanical pencil originally had a plastic tube inside it to guide the pencil led. I used that as an insulator to push against the screw and the spring pushed against the insulator. I then pushed the plastic point of the mechanical pencil back into the pencil shaft to hold everything together. It worked fine and the play was gone. The only problem was I felt clicking as I turned the screw. After thinking about it for a while, I came up with the idea to shorten the insulator push tube and insert bb's (Bee Bees) into the pencil shaft. The bb's roll around in the shaft as the screw is turned and the spring compresses. It operates smoothly now over the entire 40 meter band. If you unscrew the screw too far and the spring is no longer compressed, the play returns, but that is outside of the 40 meter band... so who cares? There was also a little hand capacitance that slightly affected the output whenever the screw was touched. Soldering a wire from the brass nut to ground removed the hand capacitance problem. The brass nut received the solder nicely.

My last modification was to drill a hole in a water bottle cap and push the brass screw through it. By tightening a nut up on the the underside of the bottle cap, I created a very nice knob to adjust the frequency.

This was a fun build and wasn't too difficult. Figuring out how to make-shift a variable inductor was the hardest part. I was very impressed at how well everything worked. It will be the foundation of my Home Schooler Receiver.

*THE RICHMOND HAM July 2024*

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If anyone else wants to follow along with this build, check out the link at the beginning of this article. Get out the soldering iron and go to it. I've got this far, so if you have problems with your VFO let me know and we'll try to figure it out.

Next up... is building the diode ring double balanced mixer.