



# CHEESE BITS

**W3CCX**  
CLUB MEMORIAL CALL

ARRL  
Affiliated  
Club



Volume LXVII

January 2024

Number 1

## PREZ

### Tower Climbing Tips January 2024

**SEZ:** About 15 years ago, I decided to stop putting up temporary radio towers and move to a permanent tower. An attractive tower became available from the estate of a silent key. One of the key selling points to my XYL, Carol, was that this tower, a Hy-Gain HG-52HD could be cranked down and lowered to horizontal for antenna installation and maintenance. This eliminated the need for me to climb my tower to undertake these tasks.

About five years later, I heard laments from various Pack Rats about how they could no longer climb their Rohn 25 towers to perform maintenance. By that time, Carol had passed so my implied promise to not climb radio towers no longer restricted my activities. I contacted Phil K3TUF, a graduate of professional tower climbing training. He pointed me to a firm in Florida which sold tower climbing harnesses. I paid my money and acquired the harness shown in the picture. Phil then taught me the elements of safe tower climbing.

Why use a harness instead of a climbing belt? If you should slip, a properly attached harness will leave you hanging head-first. With a climbing belt, you could find yourself upside down. If you examine the picture carefully, you will also see a pair of lanyards with oversized

“D” ring clamps. One of those clamps should always be attached to tower as you ascend or descend so if you should slip, your amount of travel is arrested. An appropriate helmet is also shown in the picture.

Two other items greatly improve your comfort while working on towers. You might be tempted to climb a tower in sneakers but boots with a steel shank are much more comfortable. You also should acquire a “Grillon” positioning lanyard. The lanyard attaches to a pair of steel rings sewn into the harness and is looped around the tower. With a positioning lanyard in use, you sit in your harness, which take most of the weight off your legs.



Other accessories used by radio tower climbers include canvas bags that can be raised and lowered with tools, bolts, and other parts supplied by your “ground crew”. I also have some bungee cords that are designed to keep hand tools from falling to the ground if you should lose your grip. I also have some inexpensive HT radios used when tower

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222.98/224.58 MHz (PL 136.5) Hilltown, PA

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144.300 (FN21be), 222.060 (FN20tk), 432.300(FN20tk), 903.300 (FN21be), 1296.300 (FN20dh), **2304.300** (FN20dh—under repair), **3456.300** (FN21be under repair), 5760.300 (FN21be), 10,368.017 (FM29jw) **Note: red = temporarily off the air;** see <https://www.packratvhf.com/index.php/on-air> for details)

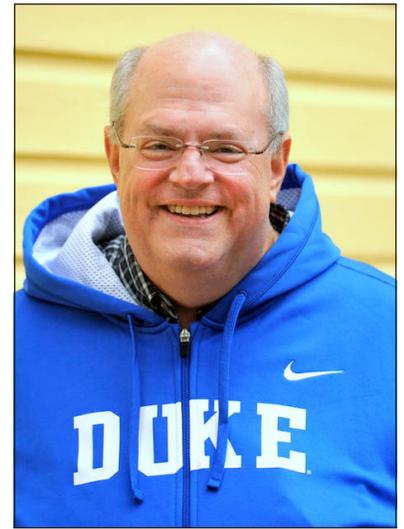
**MONDAY / TUESDAY NIGHT NETS**

**VHF/UHF Monday:**

<u>TIME</u>	<u>FREQUENCY</u>	<u>NET CONTROL</u>
6:45PM	224.900 MHz	KB3MTW Michelle Even Mondays K3JJZ El Odd Mondays
7:00 PM	Packrat Talk Group	KA3WXV George See Packratvhf-dot-com ON AIR for details
7:30 PM	50.150 MHz	N3RG FM29ki Ray
8:00 PM	144.150 MHz	W2KV FN20os Dave
8:30 PM	222.125 MHz	KC3BVL FM29jw Jim
9:00 PM	432.110 MHz	WB2RVX FM29mt Mike

Visit the Mt Airy VHF Radio Club at: [www.packratvhf.com](http://www.packratvhf.com) or [www.w3ccx.com](http://www.w3ccx.com)

climbing. A \$30 HT that falls to the ground is much less painful to replace than nearly any Android or iPhone. I also have a good collection of ropes and pullies but have not yet acquired a “gin” pole or “rooster head” to help lift antennas from the ground.



When I would climb tapered towers, I could not figure out where to place my feet. A Pack Rat, Warren WB2ONA, who climbs towers for a living, gave me some clamps that had been used to attach big fiberglass VHF/UHF antennas to towers. When bolted to the top section of a tower, the clamps provide a step as you climb or work on a tapered tower.

This column barely touches on the elements of safe tower climbing. Among other items that I could lend Pack Rats are some books on safe tower climbing and maintenance. While I enjoyed my amateur tower climbing adventures, I contracted a pair of chronic illnesses that have ended my climbing days. I had toyed with selling my tower climbing gear but will hold on to those items for use by Pack Rats who have a tower climbing chore that does not require a professional climber such as WB2ONA. If you have such a need, feel free to reach out to me.

**Michael KB1JEY**

# December (Holiday) Meeting Pictures

Photos by EI **W3JJZ**

Plenty of food and holiday spirit. The food went fast but the spirit lasted the entire evening.



Plenty of camaraderie



# December Meeting Pictures (continued)

There were things to swap and sell



# Attic Antennas Can Work AA2SD!

## Success on the 222 MHz Tuesday Activity Night

As a new operator living in a townhome with restrictions, I cannot put up a large VHF Yagi antenna, that's why I got into Roving and POTA. Recently I added a "stacked" pair of small ELK 2/440 Log Periodic antennas with a small tv rotor in the attic which works well for our local weekly Pack Rat Nets. I also built a "Cheap Yagi" 6-element 222MHz antenna using the boom from a discarded aluminum office easel stand, with elements from Harbor Freight brass welding rods with good success.

In my attempt to work the "Big Guns in the North East" I needed more gain and added a 12 element custom built 'N3RG" antenna from Ray, which was built to the K1FO design. To get this antenna into the attic I cut the boom in 3 locations, install removable safety pins, and carefully reassembled it back into place set up for Tuesday Night operation.

During my first Tuesday Night attempt on 11/29 I was able to work David K1WHS 324 miles in Maine, Ron WZ1V in Connecticut 164 miles, and Terry W8ZN using a 35 Watt Demi Transverter with a FT-991A. I also used ON4KST to coordinate contacts for the first time. A little more locally I worked W2INF John, WA3NUF Phil and KA3FQS Tom.

A special Thanks to Phil WA3NUF and Jim KC3BVL for the encouragement to give it a try on 222 during Tuesday, and Ray N3RG for the custom antenna build. For a Pack Rats Newbie this was an exciting event, and I appreciate all of the Pack Rat Club support and comradery.

I hope to work you all as a Rover during the Jan VHF Contest and work you on the air on Tuesday evenings on 222 MHz Night.



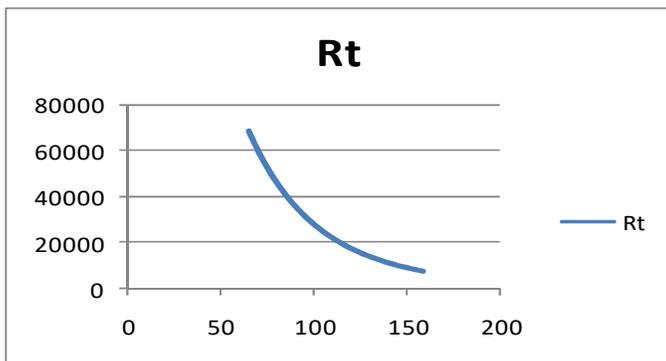
*222 MHz Activity Night There's been an informal 222 activity night in the Northeast (and beyond) every Tuesday night starting around 7 pm (or so) Eastern Time. ON4KST is being used by some to coordinate Q's when direct CQ's are weak.*

**Scott AA2SD**

# Amplifier Pallet Temperature Measurement and Display

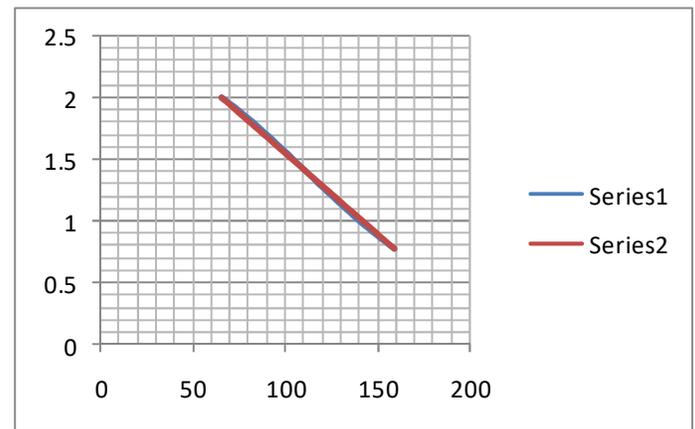
While George, KA3WXV, and I were playing with the 222 MHz amplifier pallet we discovered that it had a thermistor mounted on the pallet to report the device temperature. I had some experience with these devices as they are used to measure laser temperature in small communication lasers. They are referred to as NTC thermistors indicating that they have a negative temperature coefficient of resistance with temperature. There is a rather lengthy equation called the Steinhart – Hart equation that allows you to calculate the temperature of the thermistor from the measured resistance. This equation has some constants that vary from thermistor to thermistor and these constants were not provided for the thermistor in question. Since, unlike communication lasers where we need to know and regulate the temperature to fractions of a degree C, we are only interested to know about how hot the amplifier pallet is so we can assume that the data from the table we found on the internet ([www.bapihvac.com/wp-content/uploads/2010/11/Thermistor\\_50K.pdf](http://www.bapihvac.com/wp-content/uploads/2010/11/Thermistor_50K.pdf)) is probably close enough for this thermistor.

Plotting the resistances listed in the table versus temperature we get a graph shown in Figure 1.



The first thing we notice is that it has a negative slope as is implied by the NTC designation. The second thing we notice is that it is not linear so driving a display will require some signal processing but before you go running for a DSP there is an easy way to get a linear display from this data. It turns out that if we bias the NTC thermistor from a fixed voltage source through just the right value of resistor the voltage at the tap between the fixed resistor and the NTC thermistor becomes fairly linear as a function of temperature. This is shown by the blue line, Series 1, in Figure 2.

The red line, Series 2, in Figure 2 is a straight line drawn through the end points of the blue line. The slight bows of the blue line above and below the red line show the magnitude of error due to nonlinearity that is not entirely corrected by this circuit. These errors are less than the resolution of the proposed display device so will be ignored.



On the topic of display devices we plan to use an inexpensive 3 digit voltmeter the type which is available on line. To get this to work we need to scale up the thermistor voltage so that the voltage change due to one degree F temperature change is 0.1 V. To find the required gain we take our desired temperature span and divide it by the voltage span for this temperature span. George and I decided that the useful temperature span was from 65 degrees F to 159 degrees F. From a spread sheet we made using the published resistance vs temperature data and the resulting thermistor voltage when biased by a 2.5 volt reference through a 16.9k resistor we found that the voltage span was from 2.006 V to 0.775 V. The required gain is then  $(2.006 - 0.775) / (65 - 159)$  or -7.636. Since it is important not to load the thermistor voltage with any resistance we decided to use a non-inverting op-amp configured to provide a voltage gain of 7.636. This opamp will output 15.32 V when the thermistor senses 65 degrees F and 5.918 V when the thermistor senses 159 degrees F yielding a span of 9.402 V, or about 0.1 V per degree which will work well with our voltmeter display if we ignore the decimal point.

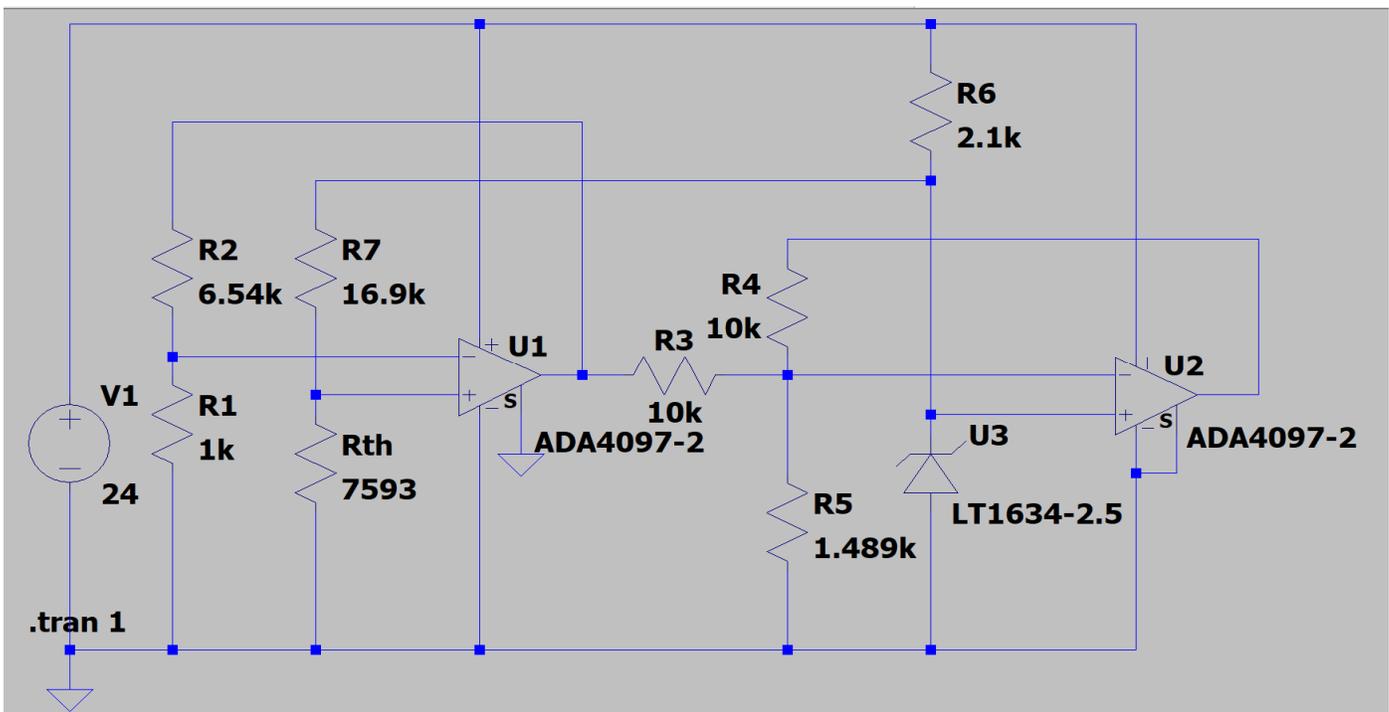
There are two problems to be solved, the slope is really  $-0.1$  V per degree F and there is a large voltage offset. To solve both of these problems we can use an inverting opamp and the same  $2.5$  V voltage reference that we used to bias the thermistor and series resistor. Since the absolute value of the gain is already correct the inverting opamp need only provide a gain of  $-1$ . To correct for the large voltage offset we need to sum in a voltage of  $21.82$  V. This is easily done in an opamp configured as an inverting amplifier and in this case was done with the already present voltage reference and one additional resistor.

The simulation schematic is shown in Figure 3.

A few notes about the schematic in Figure 3. The circuit operates from  $24$  V which was already present in the amplifier chassis to operate relays and the fan. This supply voltage is necessary to allow  $159$  degrees F to be represented as  $15.9$  V. This would not be possible on a  $13.8$  V supply. The supply voltage restricts the selection of opamps mostly to older devices that were designed in the days when most opamps ran from  $\pm 15$  V supplies.

Many opamps designed today have much lower maximum supply voltages. The other requirement for the opamp is that the input voltage range must come very close to the negative supply voltage and the output must swing close to the negative power supply. These are often referred to as single supply opamps. The opamp shown in the schematic was used because it fit the supply voltage and a SPICE model was in the library. I did not feel like importing a model for a more common opamp as it would not have made any functional difference in the circuit operation. To build the circuit we will use a more common LM358. Similarly the choice of the voltage reference was made due to SPICE model availability, the actual circuit will use a TL431.

The simulation produces very accurate values because it uses exact component values. When building the actual circuit we don't have that luxury so we will need to put in a couple of adjustments. Specifically the value of  $R2$  should be decreased to about  $6.04k$  and a  $1k$  multi-turn pot should be placed in series with it to correct slope errors. Likewise the value of  $R5$  will need to be reduced to about  $1.21k$  and a  $500$  Ohm multi-turn pot placed in series with it to correct offset errors.



Tom KA3FQS

# *The Wayback Machine*

## In CHEESE BITS, 50 Years Ago

Nibbles from January 1974. Vol. XVI Nr 1 de K3IUW  
Bert  
*(author's comments in italics)*

**“Our Prez Sez”.** Prez Dick Huntzinger, **W3FQD** summarized the past years highlights as: “winning the 13<sup>th</sup> consecutive gavel for the January sweepstakes; a delightful ladies night in May; 3<sup>rd</sup> place in the June QSO party; a fun-filled picnic in August; acquiring our 220-MHz FM repeater in September; and a most successful Hamarama in October.” He noted similar activities planned for 1974, and “Chairman and volunteers are requested.” *(Nothing changes. The club still has need of workers. When was the last time you volunteered for a task?)*

**Calendar.** January 5-6, the VHF sweepstakes. January 7, report your contact and section count on the Monday night nets (*a Packrat reporting tradition*). January 17, Club meeting with topic “Crying Towel.” (*Another Packrat tradition. The winner would be the one with the saddest story!*) February 21, Club meeting, topic is “Homebrew” night. Bring and show off your pet project. Prizes for the most ingenuity, and the most miserable failure (*usually won by Doc, K3GAS*). October 6, long term planning for the next Hamarama.

**New Products of Interest to Hams.** **W3NSI**, Lynn always managed to find interesting new items. This issue included: **1).** 80-watt 2-meter FM amplifier kit. From **Dycomm**, normally sold wired and tested for \$150, but will be available as a kit for a short time. Price \$49.95. **2).** **Pace Communications** released the “Base Station Control Unit” for 2-meter operation. It will check SWR and power output in 3 ranges – 5, 50 and 500 watts. Has a built-in TVI filter. No price given. **3).** **Metrum** II 2-meter FM Transmitter/Receiver. From Motorola, two models are available (10-watts or 20 watts output). Priced at \$400 and \$500 respectively. (*Priced like commercial equipment.*)

**VHF Report.** Joe, **W2EIF** reported activity continues low, but some small openings were noted on 6-meters. A meteor shower on

December 13 provided some contacts with Alabama and other stations in the upper Midwest. Joe was heard by **W9YTF** in Chicago but didn't make the contact. He notes that a recent ice storm damaged many antenna systems and rotators, and hopes all get fixed by contest time! Late update. Joe made a 1296 MHz contact with Pete, **K1PXE** on December 21<sup>st</sup>. (140-mile path.)

**SIX Meter Report.** Rich, **K3ACR** reported an upswing in activity as contest preparations continued. He reminded the group of some of the nets that are available on six-meter SSB. Sunday morning starting at 9:30am, **K1MUC** conducts the Yankee net. At 10:00am, **WA3QLS** conducts the Delaware net on 50.150. And at 11:00am, the **East Coast VHF** SSB net is held on 50.175 MHz, with alternating net controls. A good chance to check out your gear.

**Construction, Simple PIV Diode Tester.** Walt, **K3BPP** submitted a design for a simple gadget to check the PIV (peak inverse voltage) of diodes that might be in your junk box. He suggested using the high voltage available from most oscilloscopes as a test source for the device.

**Official Bulletin Nr 457 from ARRL.** This bulletin noted that the **FCC** is proposing a new radio service for emergency medical use, and has recommended 38 spot frequencies ranging from 43 to 469 MHz. Three of the frequencies in the 449 MHz region are currently allocated to government radiolocation and amateur shared use. The document conveys a sense of urgency and a comment deadline of January 10 is listed. (*Interesting that no hint of the planned usage was shown.*)

**Official Bulletin Nr 458 from ARRL.** This bulletin noted that the **ARRL Board of Directors** meets twice annually to formulate the course of **ARRL** affairs. The first meeting of 1974 will take place January 17. This democratic process is effective only to the extent that the membership participates, so now is the time for all members to communicate with their division directors and express their opinions and desires. (*Still true 50 years later. Let your representative know of your thoughts.*)

.... Wayback cont'd

**Membership.** Change of address noted for Bruce Cooper, **K3WGJ**, now located in Ardmore.

**Tidbits.** Sid, **W3GEW**, was rushed to Jeanes Hospital after a harrowing ride through heavy fog on December 20. The Mascaros (**W3KM**) announced that David Jr. arrived on November 20<sup>th</sup>. Pete, **WA3OVH** and Lee, **K3MXM** supported the annual "send greetings by HAM radio" activity in several local hospitals to cheer up the patients on Christmas day.

**Swap Shoppe. By W3ZRR. *(Always nostalgia. Now we use the club reflector.*** From Joseph Bawduniak, an EICO HF32 Mono Amplifier, \$22. A Knight Kit KG240 stereo Amp for \$14, a Lafayette record changer for \$10 and a 12" Wolverine Speaker for \$20

**Ads.** *This issue included 24 "business card" ads, and a notice that a new ad page would be in next month. It also included a full page with a map and a list of goodies from Electronic Exchange located in North Wales, PA. Interestingly, they had several Teletype machines listed for sale. These used to be tough to get. It also included the half page back cover ad from club member Ham Buerger. (An Astatic D-104 microphone with a PTT stand for \$25 and other goodies. I also note the current Cheese Bits Ad complement includes only 4 small ads, a ¼ page from Beko and a ½ page from Down East. If you'd like to join them, contact the ad chairman, Bob, **W2SJ**.*

**Miscellany.** *Postage for this issue was a single 8-cent "Flag" stamp. 7double sided, 8-½ x 11" sheets). (Don't forget, current postage is going to 68-cents in January, and a penny postcard now costs 51-cents!) As usual, many other "folksy" comments about members, their families, and activities were included in this edition of Cheese Bits. If interested, or for more detail on any of the above items, visit our website ([www.W3CCX.COM](http://www.W3CCX.COM)) and read the full issue scanned by **K3IUUV** (me), and posted on the website by Bill, **WS3O**, our webmaster. I have also posted the club Officers history, club Membership history, and Packrat Inventory (updated frequently) on the **W3CCX** website. These files are password protected, and only*

*accessible to registered members. Are you registered? I hope you enjoyed reading these bits of nostalgia as much as I did in writing the article. If yes, you might let me know. Thanks to those that did.*

*thirty, de **K3IUUV** (comments or corrections to: **K3IUUV@ARRL.net**)*



## A TRUE HAM RADIO EXPERIENCE

Our club bulletin is welcomed each month. I look forward to all the articles and most curiously the department devoted to nostalgic events, The Wayback Machine.

The Wayback machine, reminds us of interesting historical content and memories, but, could the Wayback Machine be our radios as well, that is in our radios? Could our inertes in electronics, and building a communicator capable to breach the time space continuum and reach back in time? Hollywood thought so and created a movie called *Frequency* (April 2000 with Dennis Quaid) where a Heathkit SB 100 provided the path between the past and the present. But there is more!

As I sit each month reading the Wayback Machine article in our club bulletin, I often think...can a Wayback machine really exist? reality, science fiction, or what?

But is there another more romantic , and nostalgic meaning to our Wayback desire?

Could this be our radios? or just a memorable desire to relive the safety, comfort, and the ordinary of the past?

A short time ago a friend of mine, who was not licensed at the time, but always wanted to be a ham, stopped by the shack. With him was his Heathkit HW-8. He built the rig many years ago, but other than populating the circuit board with components, and doing the point to point wiring he did not finish the project, and never knew what a good job he did. His reason for having the HW-8 with him was to gift it to me. He knew I had built, and still have, the HW-7 version and thought it would be nice for me to have the HW-8 for my collection. A very nice gesture.

Without use of the construction manual, or schematics I determined the rig was never powered up, nor aligned. I went through a few basic routines, and sequenced the alignment process. I was pleasantly surprised the old radio responded 100% to the alignment process, especially since this radio was built over 40 years ago. This was great, but we need to take it to the next step, on the air testing.

The HW-8 radio covers 80, 40, 20 and 15 meters, CW only. RF output of the rig is +/- 5 Watts.

Well since I had a working "new" radio it was time to connect the antenna and kick some electrons around.

My band choice was 80 meters and I was using my shunt fed tower. While listening around 3.550 MHz I found a W9 station calling CQ. After his first call I keyed up the rig and called back, no answer: he called CQ again, I answered, again no return: then I remembered the HW series will hear both sides of zero beat, and I was apparently calling on the wrong side of the sideband. I quickly made the adjustment and immediately made contact. To keep in full nostalgic mode I was using my old J-38 straight key.

I was working W9RAS located in Cassopolis, Michigan and his handle was Sparky, really? Sparky! The Wayback machine was coming alive. Sparky informed me he was using an ARC5 receiver and home-brew transmitter, (no

doubt out of the ARRL handbook). The ARC 5 receiver is a WWII era HF receiver and was very popular in the 50's and into the 60's due to it's ease of modification and surplus availability.

I passed along my information to Sparky, and let him know he was the first QSO with a radio built 40+ years ago. After I passed it back I was more than awakened at what I was copying. Sparky, as it turns out, was a former Heathkit employee, and worked at the Benton Harbor, MI factory. Sparky did some design work on Heath radios but did a lot of customer service work and was especially adept at trouble shooting, especially fixing the Heathkit HW-8 series rigs. Sparky gained so much knowledge repairing these radios he was asked to help design the HW-9. Incredible!

We went back and forth exchanging other nostalgic stories, but soon the QSO came to end.

I wanted more than a log entry to remember this QSO, so the next day I mailed Sparky a request for his QSL.

I felt this story had to be shared with the original Heathkit builder, and so it was. I presented my friend the working radio, the story, and the QSL card. After all those years the radio sat unfinished, even I had it for a month or so before taking the time to check it out,.

And to believe, and experience **the exact moment in time** the HW-8 became alive the Wayback Machine made it's presence know, working a ham, a Heathkit employee named Sparky as the first and probably the only QSO the radio every made.

That night we bridged many years and many favorable memories still floating through the ether, courtesy of the Wayback machine.

See you in the Wayback machine, someday!

73

**AI K3WGR**

## International EME 2024 Conference

August 9<sup>th</sup> to 11<sup>th</sup>, 2024

TCNJ Trenton, NJ

<https://eme2024trenton.org/>

### EME101

#### *An Intro to EME*

A full day course Friday August 9<sup>th</sup>, 2024

TCNJ Trenton, NJ

<https://eme2024trenton.org/eme101/>

### 1296 MHz Activity Night

There's an informal 1296 activity night in the NY/NJ/PA/CT region (and beyond) every Monday night starting around 9:30 pm (or so) on 1296.110. No coordination, just jump in and say hello W2BVH

### KC3BVL UHF+ Tuesday Net

Packrat, Jim KC3BVL conducts a Tuesday night net with schedule as follows: 7:30PM—903.100, 8:00PM—1296.100, 8:30PM—2304.100

### KC3BVL VHF Friday Net

Packrat, Jim KC3BVL conducts a Friday night net with schedule as follows: 7:30PM-144.160, 8:00PM-50.160, 8:30PM-222.150, 9:00PM-432.160

Reminder: there are 3 FT8 VHF / UHF Activity Contests each month. For info see: <http://www.ft8activity.eu/index.php/en/>

For those interested in an online "Contest Only" event calendar for VHF+, see <https://www.qsl.net/n2sln/contestcalendar.html>

### Meteor Shower Calendar

Here's a Meteor Shower Calendar showing the dates for all the Meteor Showers in 2024. They're correct for our location in the Northeast. <https://www.timeanddate.com/astronomy/meteor-shower/list.html>

## January VHF contest Jan 20th ~ 22nd, 2024

Ray N3RG, our January contest chairman, has taken one last opportunity to remind us all to be ready.

The contest begins at 2:00 pm local time on Saturday and ends at 11:00 pm Sunday night. We've been preaching contest information for several months and now with less than two weeks to go, what more can be said? There's plenty of information on the Packrats website to review. If you need a refresher check out the following articles:

2024 January VHF Contest Presentation  
2024 W3SZ\_K1RZ Database Update

- Get on the air and make sure everything is working.
- Make schedules with stations you know you can work.
- Make no last minute changes...  
Go with what you have!
- Create a PLAN that works for you.
- Update your information in the W3SZ-K1RZ database.
- Work the rovers.
- Spend as much time as possible in the seat.
- Relax and enjoy yourself.
- Have Fun!

We currently have 85 active members. Let's see as many logs as possible submitted.

Don't forget you have ten days from the end of the contest to submit your logs!

73 de,  
N3RG Ray

## PLEASE SEND IN 2024 DUES

Club dues are due as of Jan 1st, 2024. Go to [https://www.qsl.net/w3km/MtAiryRC\\_Dues.htm](https://www.qsl.net/w3km/MtAiryRC_Dues.htm) and use the "[check here](#)" link to see if you already paid. If not, enter your callsign and click on "PayPal" Dave **W3KM**

### 222 MHz Activity Night

There's been an informal 222 activity night in the Northeast (and beyond) every Tuesday night starting around 7 pm (or so) Eastern Time. ON4KST is being used by some to coordinate Q's when direct CQ's are weak. W2BVH



# W2DRZ Controllers, Products for the VHF Operator

Hello Cheese bits readers. I am working on some new designs for some of our products and will announce them here when they are ready. In the meanwhile, I have some current and some reconditioned items available.



The CT-2 Antenna controller board. See the [Overview](#) page. These are assembled and tested. For readers of Cheese Bits, the price is \$199 (mention the Cheese bits ad when ordering)

The LCD-1 display unit. This is a nice backlit LCD that shows hardware and firmware details on startup, and then shows current antenna position.

The ENC-1 enclosure. This is a nice box to hold the CT-2 controller and the LCD display unit.

The LC485-1 and LCD485-IDX level converter boards. These boards can be used to convert quadrature position sensor TTL outputs to RS485 protocol levels for sending over a distance between the sensor and the controller.

The SEQ-2 Station Sequencer. These are assembled and tested, except for mounting of the relays and optional installation of LED indicators. See the Products page for details. (\$55 for Cheese bits readers.)

I also have a few reconditioned and tested SEQ-1 sequencers. These use the older relays that are no longer available. The relays are rated at 10 amps, so they should last a long while in normal usage. These are a bargain at \$35 each.

For all products, see the [Products](#) page for prices and shipping.

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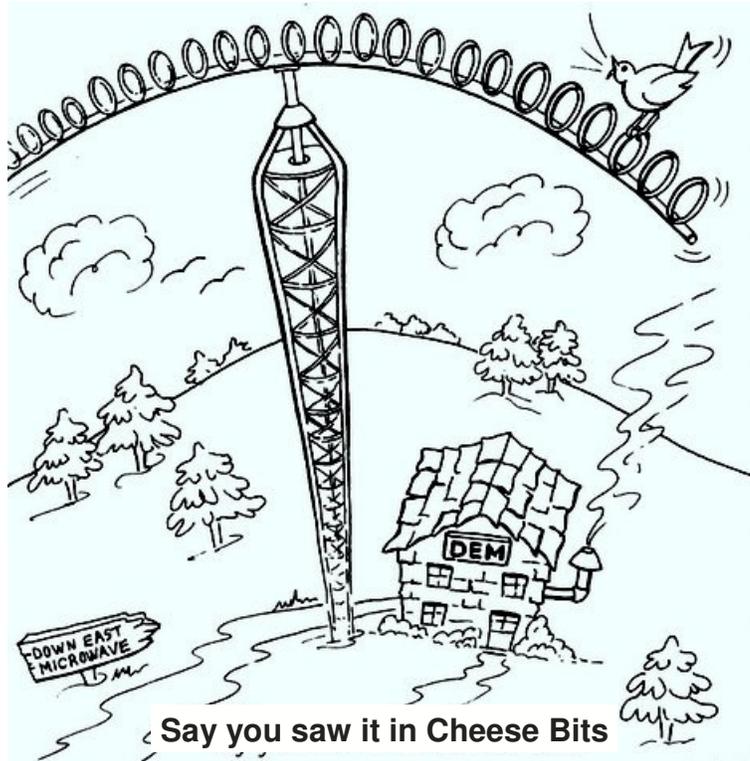
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