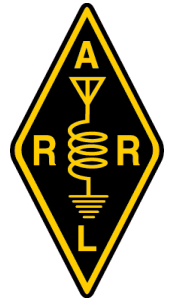




CHEESE BITS

W3CCX
CLUB MEMORIAL CALL

ARRL
Affiliated
Club



Volume LXVII

June 2024

Number 6

PREZ June 2024
SEZ: ?

Michael did not respond to my request for a Prez Sez column this month so for a third month in a row this column will be blank.

Tom **KA3FQS**

Nuf Said

Phil **WA3NUF**

Saw this posted in the NEWS club newsletter. We should also post this since the July 1st deadline is close at hand.

QST Magazine Decision Deadline for Life Members

After September 1st, 2023, and before July 1st, 2024, existing ARRL Life Members need to let the ARRL know they wish to continue to get their mailed magazine, or the implied default action is that they will be converted to a "Life Digital Member" to save the ARRL printing and postage

Packrats **CHEESE BITS** is a monthly publication of the
Mt. AIRY VHF RADIO CLUB, INC. –Abington, PA.

We operate on a .PDF exchange basis with other non-commercial publications. Anything that is printed in CHEESE BITS may be reprinted in a not for profit publication, unless stated otherwise, provided proper credit is given. Deadline for articles and swap-shop is the monthly meeting date. Non-commercial swap-shop items free of charge.

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W3CCX QSL CARDS:

Bill Shaw K3EGE

PACKRAT 222 MHz REPEATER - W3CCX/R

222.98/224.58 MHz (PL 136.5) Hilltown, PA

OFFICERS 2023-2024

PRESIDENT KB1JEY Michael Davis president-at-packratvhf.com
VICE PRES: WA2OMY Gary Hitchner vicepresident-at-packratvhf.com
CORR. SEC: WA3EHD Jim Antonacci correspondence-at-packratvhf.com
REC SEC: KA3WXV George Altemus secretary-at-packratvhf.com
TREAS: W3KM Dave Mascaro

DIRECTORS:

K3JJZ El Weisman
WA3YUE Bruce Loss
KB3MTW Michelle London
KC3BVL Jim Huebotter
Honorary Director Bob Fischer W2SJ

COMMITTEE CHAIRMEN

January Contest Ray N3RG
June Contest 2023: OPEN
June Contest Technical Chair Phil K3TUF phil-at-k3tuf.com
VHF / MUD Conference: Phil K3TUF / George KA3WXV
Awards Chairman OPEN
Quartermaster: Bert K3IUV bsoltoff-at-comcast.net
Membership Chairman: Michael KB1JEY kb1jey-at-arrrl.net

PACKRAT BEACONS - W3CCX/B

144.300 (FN21be), 222.060 (FN20tk), 432.300(FN20tk), 903.300 (FN21be),
1296.300 (FN20dh), 2304.300 (FN20tk), **3400.300** (Not operational),
5760.300 (FN21be), **10,368.017** (Not operational) **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 or www.w3ccx.com

Health & Welfare

Bob **W2SJ**

Club Member Al Katz, K2UYH was hospitalized recently as he was experiencing back and arm pain. He had some tests and has been released from the hospital. He is currently receiving treatments to improve this illness. Please send him an email, QSL card, or a phone call to let him know his Pack Rats family cares about him and we're sending our best wishes for a full recovery as soon as possible.

Note From the Editor

Tom **KA3FQS**

As usual thank you to those who contributed material for this edition of Cheese Bits

There is a new email address for submitting articles to the Cheese Bits. The address is cheesebits@packratvhf.com. Please use this address for future submissions as it helps me to keep newsletter communications organized.

As in the past, Melanie was kind enough to proofread this edition of Cheese Bits.

Nominating Committee Final 05/09/24

The Nominations Committee – Gary, WA2OMY, Bob, W2SJ, and Phil, WA3NUF, respectfully submit the Slate of Officers and Directors for the 2024-2025 term. Nominations will remain open until the membership election vote scheduled for June 21, 2024.

2024 – 2025 term Nominations Slate

- Official Slate for submission to the BOD on May 9, 2024
 - o President – WA3NUF
 - o Vice President – WA2OMY
 - o Corresponding Sect – WA3EHD
 - o Treasurer – W3KM
 - o Recording Secretary – WB2RVX (KC3BVL has accepted the role of alternate Recording Secretary filling-in when WB2RVX is unavailable)
 - o Directors
 - W2SJ – 2 yr. term
 - K1RZ – 2 yr. term
 - N3RG – 1 yr. term
 - WX3K – 1 yr. term

Testing the Club's New QRP Microwave Box

Pete **K0BAK**

The club owns a low power multiband-microwave transverter system that could be used for short-distance contacts by a rover. It includes small antennas for each of the six bands 33 cm through 3 cm, so it is self-contained except for power and a 144 MHz IF radio. The construction is impressively complex given the technology available when it was built decades ago. I do not know how old the box is or who to credit for its original construction, but I think some club members remember who that was. While I was in possession of the box, credit to Paul WA3GFZ and Gary WA2OMY for fixing multiple problems with it, which was difficult because of its complex and concentrated construction.

Bert K3IUV had taken it for roves to PackRat homes during the January contest, and I volunteered to take over when Bert couldn't do it anymore. While the box made quite a few high-point contacts that helped the club score, in every contest there were problems with one or more bands. On my January 2023 rove, although it tested well the day before the contest, the whole box was unable to make contacts early in my rove on the first day. After confirming it wasn't a simple problem, there was little appetite to fix the box. Gary WA2OMY volunteered to build a replacement box that would use modern technology improvements that would result in a less crowded and more serviceable box.

I am not technical enough to confidently describe the design of the new box, but I do understand it uses multiple frequency synthesis for the local oscillator. The box supports 903 through 5760 MHz (missing 10 GHz compared to the old box), including the move of the weak signal 9 cm band down to 3400. Like the old box, there is a simple band selector switch that makes running through the bands quick and easy. In a major operational improvement, there is a single N-connector output that can physically support a supplied printed circuit board log periodic that can be pointed out the rover vehicle's window, instead of one antenna per band of the old box.

My Subaru Forester station includes a passenger seat desk and an Icom IC-705 radio, both of which I picked partly with the new microwave box in mind (see picture). The 705 is a compact QRP SDR-based radio with a graphical signal display which includes all modes on 432, making it a great radio for the new microwave transverter box that takes a 432MHz 2.5W IF input. [For more details about my HF rover, see the web article <https://sites.k0bak.com/portable-ops/forester-mobile-station>]

As some of you know, the ARRL VHF contest rules were changed with regard to equipment needing to be **capable** of making contacts at a minimum distance of 5 km (changed from 1 km). There is also a new rule for a minimum rover-to-rover **contact** distance of 5 km. (See "STTN.6" in version 1.2 of the rules.) Leaving aside both the mysterious reason for this rule change, and the weird use of the word "should" making the rule seem optional, I was motivated to prove that Gary's wonderful new microwave box could be proven to meet the distance requirements. Unfortunately, ongoing serious foot infection problems kept me from "certifying" the box before now or participating in the January 2024 contest.

In a previous contest, I used the old microwave box to make contacts on most bands from the Shady Maple complex in East Earl PA (FN10xc) to superstation N3NGE, a distance of more than 10 km. The area around Shady Maple is significant to rovers because there are several "public" parking lots on a slightly high open spot, and it is less than two miles west of the FN20 border. To certify that the new

Testing the Club's New QRP Microwave Box

box could make the same distance, more than required by the updated contest rules, I asked Len, N3NGE, if we could schedule a time to test. He generously agreed to a day that worked with his schedule, and a time that could accommodate my IV antibiotic schedule and side effects. Around noon on May 24, I met Len at his home, greeted as usual by friendly dogs. We ran through his available bands easily in his driveway. Len suggested I operate at a church parking lot a little past the Shady Maple complex due to likely crowded parking at Shady Maple on the Friday before a holiday.

The operating location was a little farther from Len's station at 11.5km, and I was a little concerned that the heading to his station pointed right at the metal roof of the huge Shady Maple Smorgasbord building. However, we easily made SSB contacts on 903 through 2304, which he reported receiving at S4 to S5. Len did not have 3400 available, and although we made a contact on 5760 in his driveway he reported problems on his end when we tried the band from the church.

Despite the incomplete band coverage, in my opinion this was enough of a test to be confident that Gary's new box is capable of 5 km contacts. Thanks to Len for volunteering his time and awesome station for the test on what was a beautiful Spring afternoon.

I bought a log periodic driven grid parabolic antenna (see picture) that ought to extend the microwave box's range, but it hasn't been tested yet. This antenna would not be necessary for the kind of short distance contacts the microwave box would typically be used for. However, I hope to test with the larger antenna after the June contest just to see what can be done. I am highly disappointed that I had to cancel my hotel reservation in Hazleton for the June contest due to side effects from IV antibiotics keeping me close to home; I had hoped to make W3CCX contacts using Gary's microwave box from at least two grids as well as lower band contacts from at least four grids.

Thanks to RF engineering genius Gary, WA2OMY, for building a microwave box for the club that should boost the club's and members' microwave scores for years to come. Congratulations Gary!



Poof Revealed

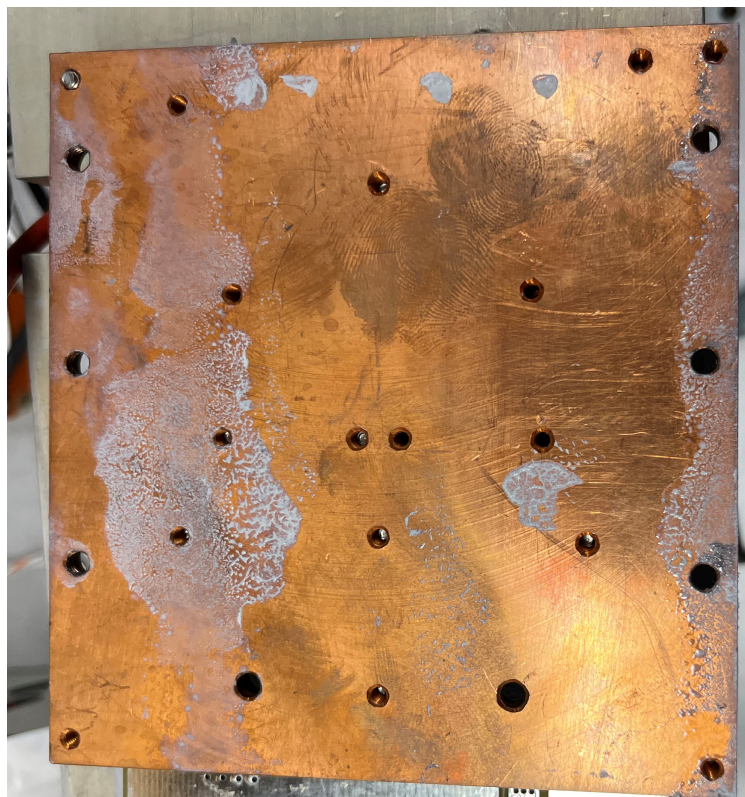
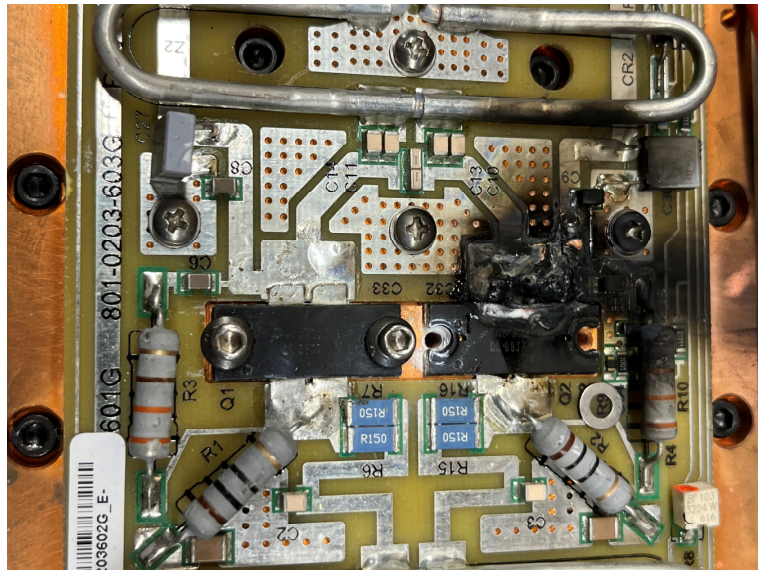
Tom **KA3FQS**

Last month I included the top picture at the end of the Way Back Machine mainly to fill some space but also to promote some light hearted conversation. KR1ST commented that it was time for the responsible party to fess up so that is what I am doing now.

This was my homebrew project, electrically it worked well but there was a thermal management issue that reared its ugly head while George, KA3WXV, and I were doing some stress testing. The motivation for this testing was a report from WA3NUF that my signal dropped out briefly during 222 activity night. After a little more than 30 seconds of key down at 300 W output the power dropped to zero and a small fire was visible through the cooling air output in the chassis.

Inspecting the board we found that the drain lead of one of the FETs was missing as was the area of the PC board to which had been soldered. After removing the pallet from the heat sink it was obvious that we had not provided sufficient silicone grease to the heat sink to fill all the gaps between the heat spreader and the heat sink. It can be seen in the bottom picture that there are large areas that have no silicone grease especially the area under the incinerated FET.

Fortunately George had acquired a few of these amplifier pallets and was kind enough to donate a second one to the project. Talking to Phil, WA3NUF, about this he suggested that we use a fine grit sandpaper on a flat surface to make sure that the mating surfaces of the heat spreader and the heat sink were flat. This we did. I also purchased a 100 mm x 100 mm x 0.5 mm thermal pad to use in place of the silicone grease. These improvements seem to help judging by the fact that the heat sink now seems to be a similar temperature as the heat spreader in the area they are joined. I exchanged some emails about this project with John, KB3XG. John's concluding remark was, "You have verified my theory. The electrical design of a PA is trivial. The mechanical and thermal design and analysis will make or break the project." The part about the electrical design being trivial is easy for John to say but his comments about the thermal design appear to be very true.



Rats at the Hamvention

Tom KA3FQS

Tom, K3GM, George, KA3WXV, and myself, KA3FQS, attended the Hamvention this year. As it has been for the last few years, the Hamvention was held at the Greene County Fairgrounds. This is as it sounds a facility for having county fairs so there is very little in the way of paved areas and the indoor displays are spread between several buildings in contrast to the late Hara Arena.

It wouldn't be a Hamvention without rain and there was plenty Thursday night into Friday morning.



Friday afternoon the weather cleared but remained overcast so the flea market came to life.



Rats at the Hamvention

The weather cleared on Saturday and foot traffic picked up.



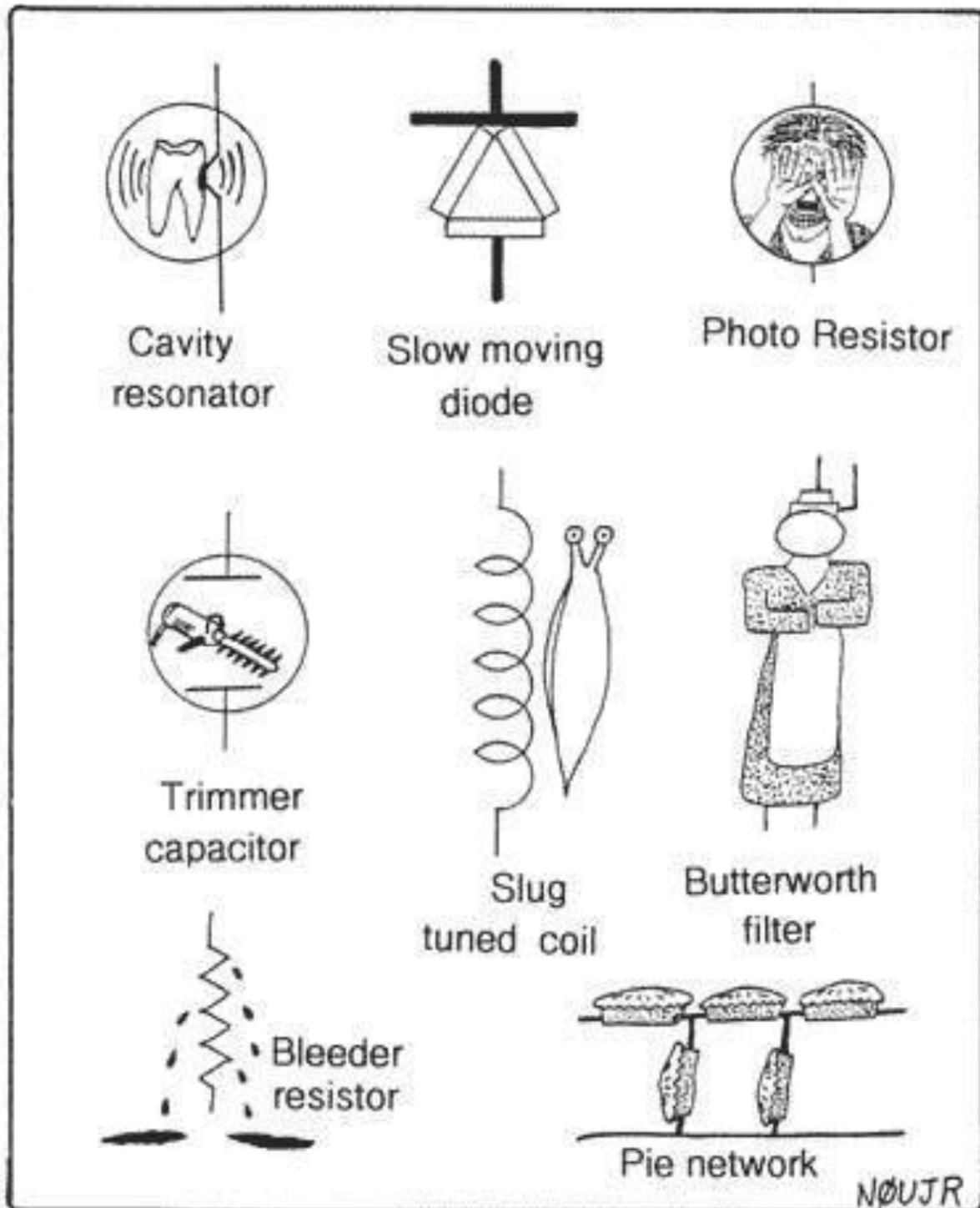
We met some fellow Rats at the Hamvention. Dave, K1RZ, was out early on Friday morning and stopped by our flea market space while it was still too wet to put things out. Bill, KU3A, had a flea market space not far from ours. Bill, WS3O, stopped by with his dad. We had dinner with Bill and his parents Saturday night.

On the way out the Honda Pilot was loaded to beyond capacity to the point where passengers had things on the floor between their feet. We had promised to pick up a noise figure meter for Gary, WA2OMY, but I was concerned that we could not fit it so Bill, KU3A, brought it back. Thanks Bill. Fortunately we did pretty well selling things and none of us bought anything really large so the ride home was more comfortable. We probably could have taken Gary's noise figure meter. This is the first time that I can remember coming home with more cash than I took out.

In the end the three of us had a good time.

Notes from our Editor Emeritus

Lenny **W2BVH**



Little known standard electronic symbols.

FT8 on the Go is Now Possible with a Android Phone

Ap FT8CN

Scott **AA2SD**

AA2SD/R Rover May 01 2024 - This new app is available for free called **FT8CN**. Developed by BG7YOZ and hosted by N0BOY allows the user to run FT8 natively on an Android phone. Using FT8 in the field for Parks on the Air, or Roving for a VHF contest can be challenging, as you have to bring along a PC, cables, and a sound card to make the connection. This new AP is Free today for download and still in the testing stages.

I recently tested the new app on my Android Phone. You connect FT8CN to your radio with a simple connection. Your Android Phone must be OTG compatible and your radio is required to have a built- in sound card like the FT-991A , or you can use an audio adapter like [Digi Rig](#).

Once connected this app performed flawlessly and I was able to make FT8 connections on 6, 15 and 20 Mts during my short test period. This app also includes a logging program, which allows you to download your contacts as an ADI file. I plan to test this app in the field during my next Rove on 6 M, in anticipation of the upcoming VHF Contest.

Check Releases to download the latest apk file.

<https://github.com/N0BOY/FT8CN>

Video of this Pocket Portable Ap from LY2H

<https://www.youtube.com/watch?v=EmM8Kv1uOOw>

FT8CN download page: <https://github.com/N0BOY/FT8CN>



The Wayback Machine

In CHEESE BITS, June,
1974. Vol. XVI, # 6

de Bert, **K3IUU** (*author's comments in italics*)

“Our Prez Sez”. Prez Dick Huntzinger, **W3FQD** reported that 63 people attended and enjoyed the recent “Ladies Night” at the Buck Hotel. (*I repeat, why don't we bring this idea back?*) He congratulated Ron, **WA3AXV** (now **W3RJW**) for his selection as “Packrat of the Year.” Ron was presented with a plaque at ladies night. Plans are underway for the June contest, where we will participate from the site at Hilltown. He listed the slate of officers for the upcoming election, and closed by requesting more activity on our new repeater (*a perennial cry*).

Calendar. June 8-9, the VHF QSO party, and the club will again operate from Hilltown. Chairman Dave, **WA3JUF** (now **W3KM!**) asks for your help and ideas. Band chairman volunteered (*or appointed!*) as follows: 6, **WA3AXV** (**W3RJW**); 6/2-FM, **WA3NFV**; 2, **K1JDY/3**; 220, **W2EIF**; 432, **K3BPP**; 1296, **WA3JUF** (**W3KM**); and 2300 & up, **W3HMU**. June 20, regular club meeting at the Southampton library. A NASA film, “Mars Lander” will be shown. Election of officers, Mario raffle and silent auction all to take place. July 18, 1st outdoor meeting of the year will be the club auction at Dave, **W3ZD**'s QTH. August 11, the annual Packrat picnic at the Ft Washington State Park. Packrat Hamarama is scheduled for October 6

(another “thing that isn't there anymore.”)

New Products of Interest to

Hams.W3NSI, Lynn somehow always managed to find at least 3 interesting new items. This issue included:

1).Newtronics has a new two meter 6-db gain antenna, rated at 1 kw for FM use. Designated the Hustler Master Gainer, it will survive 100 mph winds (*like we get these days!*). Price is \$50.

2). Wilson model 1402SM hand held transceiver is a 6-channel FM unit. Available separately is a 12-watt amplifier that snaps onto the radio. The amplifier has a charger for the radio that operates from the auto lighter socket. Price for the rig is \$239, and the amp is \$99. **3).Antenna Specialists** released a 220 MHz roof-mount antenna, rated for 100 watts. Only 13” high, so no problems expected with garages! Priced at \$7.29

ARRL Night Report. The Atlantic Division Director Harry McConaghy, **W3SW** represented the league and reported on recent discussion between the league and the FCC. He presented the club with a gavel for 1stst place in the 1974 January VHF sweepstakes. Carl Jacobsen from **Clegg** spoke about the improved 220 MHz transceivers they are now offering.

VHF Report. Joe, **W2EIF** noted generally low activity levels, with a few short aurora openings. But the big news was the operation of **WA6LET** who operated a high-power amp into a 150-foot dish on two-meter cw and ssb. The dish was pointed at the moon in CA, and signals were heard and worked by many stations on the East coast. Some local ops recorded several hours of solid

... Wayback cont'd signals. Another test will be run some time in July, so you have time to prepare your receiving setup.

Official Bulletin Nr 480 from ARRL. May 9, 1974. The Senate adopted the bill presented by Senator Barry Goldwater (**K7UGA**, *an active Ham and staunch advocate for the hobby*) to designate June 17-23 as National Amateur Radio Week, and forwarded it to the House. Contact your Representatives to support this bill.

Membership. Application for membership received from **WA3NDE**, Hy Ecksel. 17 visitors were present at the last (**ARRL night**) meeting, including a couple from Tamaqua, PA, the home town of Frankie, **W3SAO**.

Tidbits. Stan Smith, **K3IPM** (now SK) received the high scorer award for the January VHF contest at our May meeting. Packrats placed second in the recent Itchycoo Park VHF contest. A map was included, showing the directions to our June contest site in Hilltown. Always well attended by members, because of the easy proximity to Philadelphia.

Technical Topics. Titled "A cheap and easy 220 Repeater Rig," this two-part article was authored by Bert, **K3IUUV** (*yes, that's me*). I described in detail a method to take an existing 440 FM carphone (*they were available cheaply as surplus from taxicab companies*) and modify it for operation as a 220-repeater rig. Last month described the receiver mods. This month showed the changes needed for the transmitter section. Included was the design of a special Plate cap and connector used to convert the original push-pull 5894 tripler to a "push"

doubler. The finished conversion provided a 220 FM rig at almost zero cost.

Swap Shoppe. By W3ZRR. (*Always nostalgia. Now we use the club reflector.* For sale by Bill Murphy, **K3ZSG** (now **W0RSJ**), a Hallicrafters R274 receiver, an Ameco 621 VFO for 6, 2 and 220 and 3 Cushcraft antennas for 220. All in excellent condition No price given. Also, a Gonset Communicator IV (220) with extra crystals. From Doc, **K3GAS**, a Tektronix 513D scope for \$100 and an Ampex sound projector for \$125. And from Frank, **WA3DLD**, a Saturn 6 Halo for \$10, an Ameco TX62 6 and 2-meter transmitter for \$50, Lafayette VFO for 6 and 2 for \$20, a Heathkit 6'er with whip antenna for \$30, a 2'er for \$30 and several other items including a 40' tower.

Ads. *This issue included 24 "business card" ads, including many from HAM businesses that are "no longer there." Also included was the half page back cover ad from club member Ham Buerger; however, no sale details were included. I 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. (8 double sided, 8-½ x 11" sheets). (Don't forget, current postage went 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*

.... Wayback cont'd

*Bits. If interested, or for more detail on website (www.W3CCX.COM) and any of the above items, visit our website (www.W3CCX.COM) and read the full issue scanned by **K3IUUV** (me), and posted on the website by Bill, **WS30**, 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**)



Regularly Scheduled On The Air Events

VHF/UHF Monday - Every Monday except holidays and contest nights the following nets are held, 224.9 MHz FM Repeater at 6:45, Packrat Talk Group DMR net at 7:00 PM, 50.150 MHz USB NCS N3RG FM29ki at 7:30 PM, 144.150 MHz USB NCS W2KV FN20os at 8:00

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

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

KC3BVL UHF+ Wednesday Net—Packrat, Jim KC3BVL conducts a Wednesday 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

Links to other Activities

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>

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>

The Packrat web page now has a dedicated tab for the Fall Sprints <https://www.packratvhf.com/index.php/fall-sprints>. This page will be used for Fall Sprint announcements, Sprint Rules publication, sprint awards recognition and other sprint news of interest. Check back as work progresses.

Hamfest season starting and many Hamfests to attend.

45th Annual Sussex Hamfest July 14, 2024

Sussex County Fair Grounds, 37 Plains Road Augusta, NJ 07822

GPS Lat. / Long: 41° 08' 10.2" x 74° 43' 01.9" (decimal 41.136200 x -74.717233)

Indoor sales, Tailgating, VE Session, refreshments and Door Prizes.

- Admission \$8
- Indoor Tables \$25
- Tailgate Space \$25 includes One (\$8) Admission
- Each Additional person \$8

Phone: 973-862-8124 - Email: hamfest@scarcnj.org



International EME 2024 Conference—August 9th to 11th, 2024 TCNJ Trenton, NJ <https://eme2024trenton.org/>

Don't miss the International EME 2024 Conference, happening near Trenton, NJ (in Ewing). Hosted at The College of New Jersey campus, centrally located near Washington DC, Philadelphia and New York City, this conference is dedicated to exploring the fascinating world of Earth-Moon-Earth Communications (EME). Join us at the 20th EME Conference to learn from expert speakers in the field and discover the latest advancements in Moon-bounce.

We will be also offering a separate full one day (Friday) Intro to EME (EME101) course.

Visit the [EME101 page](#) for more information.

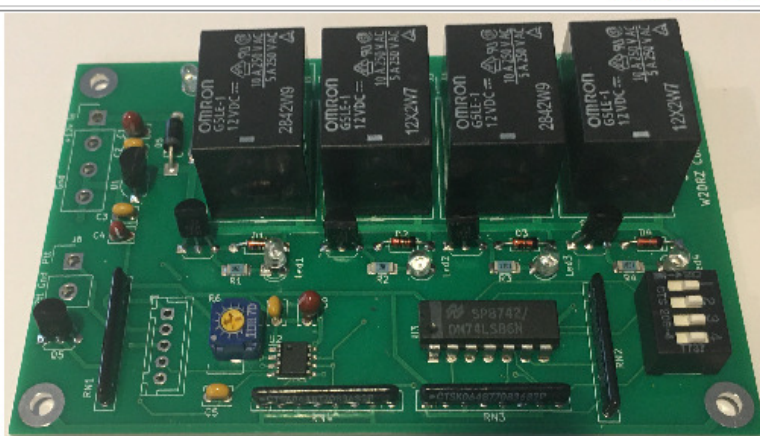
PLEASE SEND IN 2024 DUES

Club dues are due as of Jan 1st, 2024. Go to 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*

W2DRZ Controllers New Product Announcements

SEQ-3 Sequencer



Our Sequencers, SEQ1 and SEQ2, have proven quite popular and we have sold almost all that have been made. But we discovered a small problem with the original design that caused a random time delay when activating or releasing the PTT line. The delay is not very noticeable except when using slow sequence rates. But we felt that this required a new design. The new design uses an interrupt driven microprocessor that instantly responds to changes on the PTT input.

Savings on board cost and component reduction have allowed us to reduce the price from the original \$67 to \$59 for the new SEQ3.

See our web pages for full information about these sequencers: www.w2drzControllers.k2txb.net/NewProducts.htm

Kenwood TS-2000 services

We are now able to offer some limited repair service for owners of the venerable Kenwood TS-2000 transceiver.

1. Repair failed back lighting of the digital display, by installing LED lights (with necessary circuit changes).
2. Replace old backup battery.
3. Adjust master oscillator to be within 20 Hz of correct frequency on 2 meters. (for higher bands the error will be greater due to increased drift with fan operation).
4. Fan Modifications.
5. Fix incorrect 1296 MHz output module bias, in early models.
6. Fixing other faults, details to be worked out, but on a case-by-case basis.
7. See our service page for more details: www.w2drzControllers.k2txb.net/Services

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Instant ON • Built-In Preamp Sequencer • Overdrive...Temp. & VSWR Protected

144 – 148 MHz	430 – 440 MHz	1270 – 1300 MHz	70 – 440 MHz
HLV-1000* 3,100	HLV-550* 2,900	HLV-350* 3,200	All models also available as LPD version with 1 mW P _{in} for SDRs
HLV-1400* 4,300	HLV-770* 3,150	HLV-800* 4,950	
HLV-2000* 5,250	HLV-1470* 4,580		

***P_{out} in Watts • WSJT Full Output Rated • 220 MHz and 70 MHz models on request**

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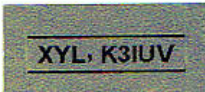
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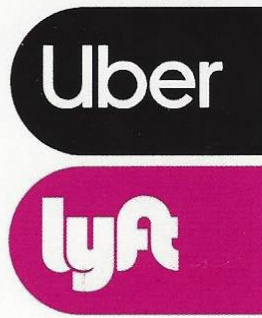
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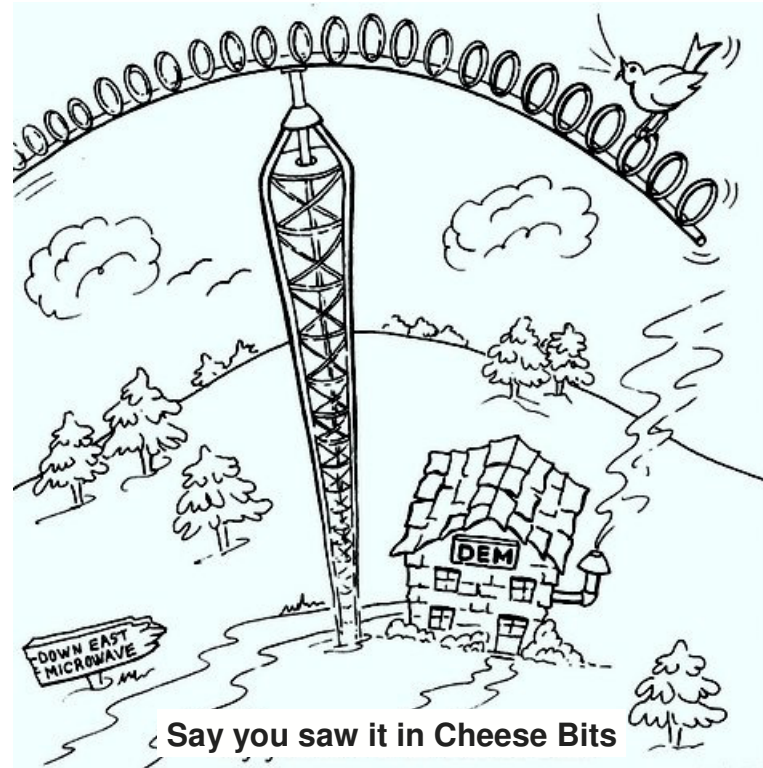
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