PACK RATS' CHEESE BITS

PACK RATS

CLUB CALL: W3CCX

MT. AIRY VHF RADIO CLUB, INC.

MT. AIRY VHF RADIO CLUB., "THE PACK RATS", PHILADELPHIA, PENNSYLVANIA W3CCX
NET FREQUENCIES: 50.125, 144.150, 220.125, 224.58/222.98, 432.110, 903.100, 1296.100 MHz
AFFILIATED CLUB: AMERICAN RADIO RELAY LEAGUE ARNS
Meetings: Third Thursday of each month at 8:00 PM
Southampton Free Library, 947 E. Street Road
Southampton, Pennsylvania 19866

SCANNED TO PDF BY BERT, K3IUV,

VOLUME XXXII AUGUST 1990 NUMBER 8

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THE PREZ SEZ

First, I'd like to bring up the activity level on the low end of 220 MHz! Where is everyone? Let's all try to get on the band for activity night, at least! Tune 220.090 - 220.120 on Tuesday evenings from around 8 PM.

I hope everyone can make it to the Pack Rat family picnic meeting, at my house on Sunday, August 12. Starting time is about 1 PM and we'll have activities and fun till dark. Bring your swim suits!

I received a landline from our FN01 buddy WA3FFC. He was planning to be operating from the Chestnut Ridge site during the UHF Contest. Some of our club members were planning an expedition to Camelback Mountain for the contest. Hope you had an oportunity to spend some time in the event.

The Pack Rats are looking for a few good men! If you're interested in getting into an active VHF-UHF-microwave club, please get in touch with me! If you have a friend who seems to be interested in this part of the Ham sprectrum, bring him out to a meeting. Our club has a lot to offer for the new-comer and old-timer in the VHF and above bands.

TNX to everyone who helped out at the White Elephant Sale at Doc's QTH. We had a good meeting and very successful auction of lots of goodies.

That's about it for now; keep checking the bands for that big opening. If you hear the bands break open, put the word out on the club repeater or give a couple of one-ringers on the landline.

73, and listen for the weak ones!

Dave Hackford, N3CX

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PACK RAT 220 FM REPEATER - W3CCX/RPTR
222.98/224.58 MHz, CHURCHVILLE, PA

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K3EOD AL BOBLITT (2 YRS)

MONDAY NIGHT NETS	NET CONTROL
7:30 PM - 50.125	W3CL
8:00 PM - 144.150	W2EIF
8:30 PM - 220.125	WC2K
8:30 PM - 224.58/R	K3ACR
9:00 PM - 432.110	WA3AXV
9:30 PM - 1296.100	WA3NUF
10:00 PM - 903.100	N3CX

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(215) 766-2643

HAMARAMA CHAIRMAN:
W3ZD, DAVE ZIMMERMAN
(215) 675-4539

CALENDAR OF COMING EVENTS

By Harry Brown, W3IIT

AUGUST

4-5 ARRL UHF Contest. See July QST page 80 for rules.

9 Pack Rat Board of Directors meeting at the QTH of WB2OMY, Gary Hitchner. Call 215-539-6409 for directions. Meeting starts at 8 PM. All interested members invited.

10-12 International EME Conference at Trenton State College, Trenton, NJ. Contact: Allen Katz, K2UYH, for details at 609-443-3184.

12 The August meeting of the Pack Rats will be a family picnic with all Pack Rats, wives, kids, friends etc. invited. The picnic will be held at the QTH of N3CX, start time is 1:00 PM. Call Sylvia, Dave's XYL, if you wish to bring a covered dish to share. Tel: 215-679-7293. Bring your swim suits. Rain date is August 19.

12 Mid-Atlantic ARC Hamfest at the Bucks County Drive-In Theater, Route 611 in Warrington, Pa., 5 miles north of Exit 27 of the Pennsylvania Tpk. Talk-in: 146.66/.06 and 146.52.

12 East Coast VHF Society Hamfest at Trenton State College, Trenton State College, Trenton, NJ. Antenna gain measurements from 144 through 1296 MHz Admission: Free. Contact: Russ, K2TXB, 609-268-9586 for details.

12 Perseids Meteor Shower will peak at 1759 UTC. Duration +/- 4-6 days. This is the king of the meteor showers and usually produces good propagation throughout the entire period.

18 Ramapo Mountain ARC Hamfest in Oakland, NJ. Talk-in: 146.49/147.19 and 146.52.

18-19 First weekend of the 5th ARRL Cumulative 10 GHz Contest. See page 82 of June QST for rules. 2nd weekend of the contest is September 15-16.

18-19 New Jersey QSO Party. See August QST, page 83 or August CQ page 79 for rules. [Participants may be subject to new NJ Ham Radio Contest Tax]

19 The Delmarva Hamfest will be held at the Delaware Technical Community College in Georgetown, Delaware. Talk-in: 147.075/.675, 146.52, 224.84.

26 Gloucester County ARC Hamfest at the 4-H Fairgrounds in Mullica Hill, NJ. Talk-in: 147.18/.78, 224.66/223.

SEPTEMBER

8-10 ARRL September VHF QSO Party. See August QST, page 82 for rules.

SUBSCRIBERS PLEASE NOTE:

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SWAP SHOP

FOR SALE: DSI 5612 frequency counter, 50 hz to 1.3 GHz, 10 MHz time base w/oven, like new, $130. CushCraft 3219 2-meter boomer yagi, excellent condx, $65. Have 2 Siemens TWTA's, model RW21 w/magnet assbly's, pulled from 2100 MHz service, 20 watt RF output, less power supplies. Trade ???

CONTACT: David Hackford, N3CX
(215) 483-2030 (w)
(215) 679-7293 (h)

FOR SALE: (Moving out of area): US Tower HDX MDPS 572, 72 ft motorized crank-up/fold-over heavy duty tower, includes 30 ft sked 80 mast, bearing, limit switches, all hardware, mint condx, $3500. CushCraft 220B boomer, $65. 19 el RIW 432 yagi, $30. Pair of Cush Craft 3219 boomers pwr dvdr, phasing lines, $125 or BO. SSB Elect. 432 remote GaAs preamp w/sequencer, $150. Mot HT-220/2-meters, HT-220/440, $100ea. RS color computer $50

CONTACT: Barry Cohen, N2BJ
(201) 712-1809 (w)
(914) 362-1955

COMMERCIAL ADS

LOOP YAGIS: 902 MHz 33 element $89 kit, $109 assembled and tested. 1296 MHz 45 element $89 kit, $109 assembled and tested. 1296 MHz 55 element "Super Looper" $99 kit, $124 assembled and tested. 2304 MHz 45 element $75 kit, $89 assembled and tested. Also available: element and hardware kits for above. 2 and 4-way power dividers. Discount on complete arrays. Solid state linear power amps, 13 VDC: 1296 - 8W in 35W out $315, 1W in 20W out $265, 4W in 70W out $695. GaAs FET preamps: 902 MHz .8dB NF $90, 1296 MHz .8dB $90, 2304 MHz 1 dB max NF $140. SHF SYSTEMS no-tune transverter kits, w/144 MHz IF now available for 903 through 3456 MHz. Write or call for complete catalog. DOWN EAST MICROWAVE, Bill Olson, W3HQT, Box 2301 RR-1, Troy, Maine 04907. For information and orders telephone (207) 948-3741.

JOBS AVAILABLE/HELP WANTED: Engineers, Technicians and Technical Support. Several openings in the following areas: UHF Cicuit Design, Digital Signal Processing, Data Communications Systems (like packet radio), and Change Control. If you would like to put your ham skills to work for you full time in a professional atmosphere, call Woody Peitzer, AK2F, at HEPCO, Inc., (201) 992-8660 between 7:30 AM and 5:30 PM Monday through Friday.

MICROWAVE UPDATE CONFERENCE 1990 (1991)

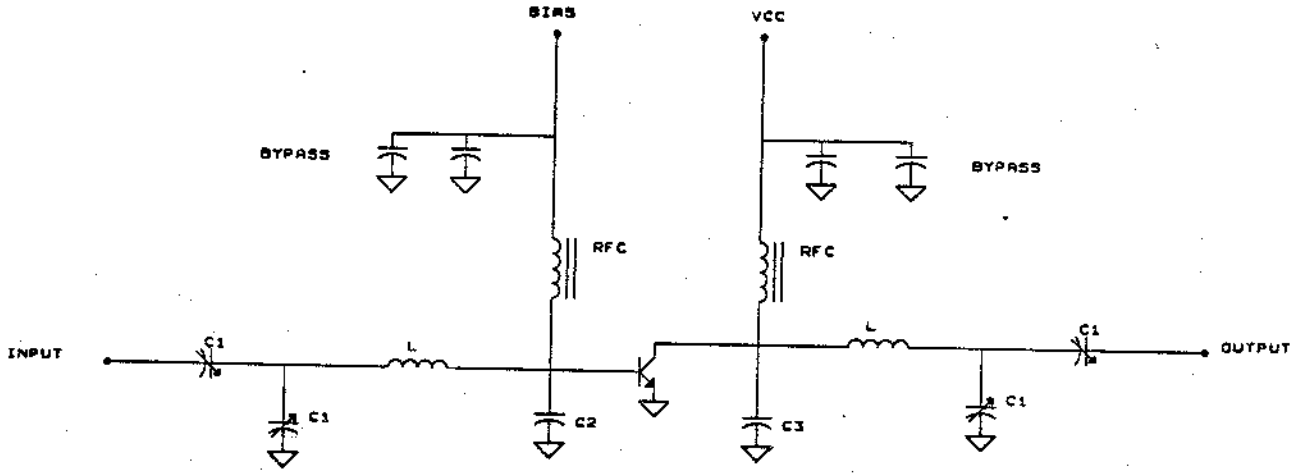
The Microwave Update Conference for 1990 will be held in Denver, Colorado, at the Ramada Conference Center on January 30, 1991 through February 2, 1991. For the 1990 (1991) Conference, the Colorado Front Range Microwave Society will be the organizing body and they've decided to hold the event in the Winter. This allows for the Conference to stand on its own and not compete with other VHF-UHF conferences traditionally held in the Summer. The Conference committee consists of Don Lund (WA0IQN), Keith Ericson (K0KE), Jim Starkey (W0KJY), Lauren Libby (KX0O), and Bill McCaa (K0RZ). In the past, the Microwave Update Colorado Conferences have been organized by Don Hilliard, W0PW. Don has recently retired and moved to his QTH in Missouri. More information will follow in upcoming CB.

- - - - - - -

Just had a QSO with Dexter, WA4ZIA, EM95 on 1296. Sez he's on 2304 and 3456 with some power and is anxious to work Pack Rats. Look for him on 432 on Wednesdays.

VHF/UHF AMPLIFIER MATCHING NETWORK COOKBOOK

The cookbook below may be used to design your own power amplifier from 50 thru 432 MHz. Values are for amplifiers in the 10 to 50 watt range. For lower power amplifiers eliminate C2 and C3; for power levels greater than 50 watts make the inductors smaller. Unelco "book" type capacitors are suggested for C2 and C3; silvered mica capacitors may be substituted. ARCO compression trimmers are suggested for C1. Note that the BIAS and VCC lines require two bypass capacitors in parallel. Use a silvered mica or book capacitor for a high frequency bypass (example: 500 pF for 144 MHz, 100 pF for 432 MHz) as well as a low frequency bypass (0.1 or 1uF tantalum). To make things simpler the base choke can often be a Ferronics VK-200 wideband ferrite choke.



FREQ	L	C1	C2	C3	RFC
50	5T #20 3/8" ID	50-300pF	150pF	200pF	10T #20 ON 100 OHM RESISTOR
144	3T #20 1/8" ID	10-100	100	150	8T #20 ON 100 OHM RESISTOR
220	1T #20 1/8" ID	7-40	47	56	6T #20 ON 100 OHM RESISTOR
432	1/4" ID HAIRPIN LOOP	4-20	22	33	VK-200 CHOKE

Use the values from the table as a starting point. Use your favorite bias circuit, apply RF and tune the input match for lowest input VSWR and then the output for maximum power.

WB3JYO 9-89

PRACTICAL FILTER DESIGN FOR THE MICROWAVE BANDS, 2-10 GHZ

By: Garry Hess - K3SIW/9
7873 Asbury Circle South
Hanover Park, IL 60103

1. The PROBLEM

Recent amateur VHF and microwave conference literature contains numerous articles on combline/interdigital filter construction for 2304 and 3456 MHz. Unfortunately, in my opinion construction of such filters is impractical for hams not equipped with precision machining equipment and the knowledge of how to use it. While I have successfully built such filters at 2304 MHz more or less "by eye", on occasion a strategically placed C-clamp has been necessary because the G-10 material bowed a bit. It takes very little build error to perturb the resonator coupling to the "useless" point.

Since I was interested in building 5760 and 10368 MHz transverters also, three options seemed left: (1) scrounge some commercial filters at hamfests [this was rejected as "cheating"], (2) build iris-coupled waveguide filters [this was rejected because the transverters were of microstrip design and transmitting back and forth to waveguide would be cumbersome; however, at 10 GHz with a 2 meter IF this is definitely the way to go for the preselector filter], and (3) discover some "new" approach. Thanks to my friend John Matz, KB9II, option (3) has been successfully pursued and is the subject of this article. Nine transverters from 2304 to 10368 MHz, and beacons at 2304, 3456, and 5760 MHz have been built using filters as described below.

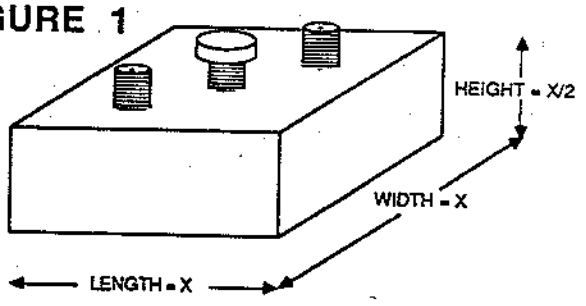
2. The SOLUTION

The filter approach used is based on a single waveguide cavity. This makes the dimensions larger than free-space and therefore enhances the "buildability". Although the filter involves a waveguide, there is no need to have on hand a stock of WR-90, etc. The cavity is simply a box of G-10 double-sided copper clad circuit board with input and output probes connected through the top of the filter. A single tuning screw serves to put the filter passband where its wanted. I refer to the filter as a waveguide cavity because the box in fact represents a section of waveguide with electrical short circuits at each end.

3. How to DESIGN IT

Figure 1 shows a side view of the filter.

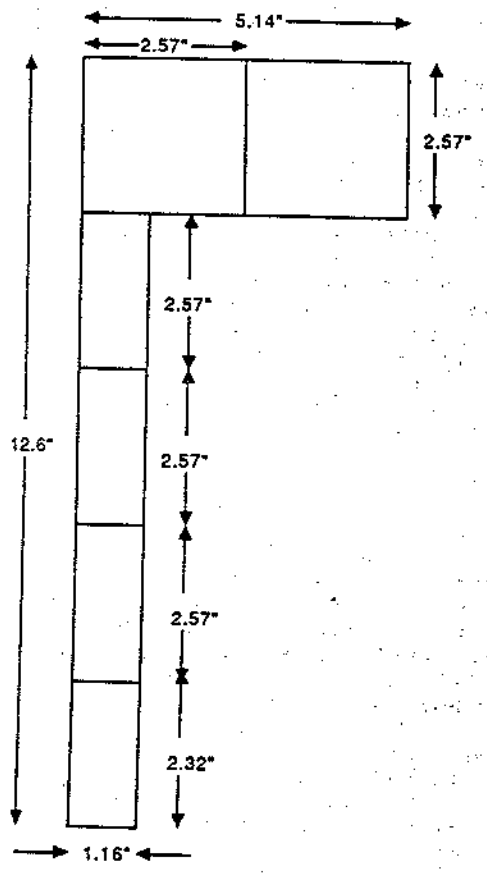
FIGURE 1



For simplicity we let the length equal the width. Also, we set the height (actually this is the length of a section of square waveguide) equal to half the length. This allows just a single waveguide mode to propagate. For a given frequency F, the dimension X, which equals the length, the width, and half the height, is given by the free-space wavelength divided by 1.414. This wavelength is simply the speed of light divided by F. Thus we have X in inches equal to about 8350 divided by the frequency in MHz. We have found it prudent to purposely work with a frequency that is 5% higher than the actual filter center frequency desired. The tuning screw can generally pull the resonant frequency down by about 10% without much impact on the bandwidth and insertion loss; hence build tolerance is quite loose.

For example, to design a preselector filter for 3456 MHz transverter we set X equal to 8350 divided by (3456 times 1.05 = 3629) and obtain 2.3 inches. Figure 2 shows how the four sides, top, and bottom might be dimensioned on a piece of circuit board. We have purposely included about a quarter of a inch excess for each side of the X-dimensioned pieces; only the side height of one-half X must be cut exactly.

FIGURE 2



4. How to BUILD IT

To build the filter we suggest first soldering the four sides to the bottom piece. All seams, inside and out, should be soldered. To prepare for attachment of the top, solder copper tape or thin copper strips over the tops of each side piece. Make sure the copper is soldered to both the inside and outside top of each side piece. All that's left now is to mount probes and a tuning screw to the top piece and then solder the box tight.

FIGURE 3

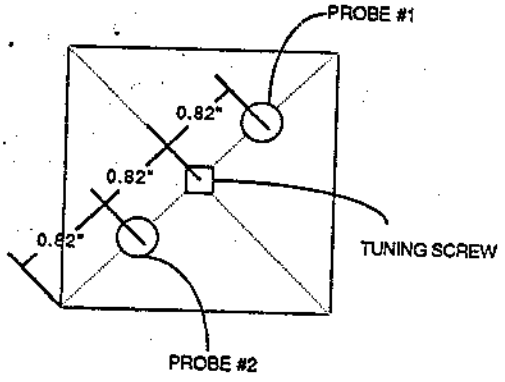


Figure 3 indicates how the probes and tuning screw are located on the top piece. My filters have used SMA bulkhead (4-hole flange) connectors for probes with the flange soldered to the inside of the top circuit board piece. The female threaded part extends through to the top via a large hole, but of course the flange is even larger so the inside of the box will be completely sealed. Up to 3456 MHz type N bulkhead connectors would also work but at higher frequencies they are too large to fit!

The length of center conductor used to couple in and out of the cavity determines the filter bandwidth and insertion loss. Short lengths produce light coupling and therefore minimum bandwidth, but this is done at the expense of insertion loss which is relatively high. At 3456 MHz we have found that cutting the center conductor (or adding a short length of copper wire if necessary) so that it extends 0.4 inches beyond the connector flange results in a -3 dB bandwidth of about 30 MHz and an insertion loss of under 0.5 dB. Decreasing the length to just 0.2 inches drops the bandwidth to only about 4 MHz (this is probably the limit of the material used since it implies a Q of nearly 1000) but the insertion loss rises to about 5 dB.

The tuning screw is secured by two nuts, one soldered to the inside of the top circuit board, the other tightened on the outside once the screw has been adjusted to establish the desired center frequency. Screws whose diameter is on par with an SMA connector have been used. Fine threads are helpful for tuning but not necessary; I have not had problems with 20 turns per inch.

5. PERFORMANCE

A probe length of 0.2 inches at 3456 MHz produces a filter with about 40 dB of rejection at 3312 MHz, the low-side injection frequency for a 144 MHz transverter. Along with readily available double-balanced mixers, this provides greater than 60 dB rejection of local oscillator leakage. Generally overload problems are minimal on the amateur microwave bands, so preamplifiers can be directly attached to the antenna relay and filtering done before mixing. With this arrangement, high insertion loss is not a concern.

Many local oscillator arrangements depend on diode multiplication and a filter is required to select the proper harmonic. If, for example, we start with a 48 MHz crystal and go through a pair of active triplers, a signal at 414 MHz results. If a step recovery diode is driven with this signal the eighth harmonic is at 3312 MHz. A filter which rejects the seventh and ninth harmonics is needed. Because the harmonics are so far from the desired frequency a filter with 0.4 inch probes is preferable for this application.

At 5760 MHz the "box" is rather small and the impact of connector flanges and solder seams inside the cavity is apparent. Here probe lengths of just 0.1 inches still only give a rejection of 20 dB at the 2 meter lowside local oscillator frequency of 5616 MHz. Since I use single-ended mixers at this frequency isolation is insufficient for the transmitter. It is, however, more than adequate to reject image thermal noise and prevent the receiver noise figure from being degraded. I boost the isolation to 40 dB on transmit by using a pair of filters separated by a GaAs FET amplifier stage. In addition to amplification, the amplifier provides isolation between the two filters so they do not interact.

6. 10 GHZ

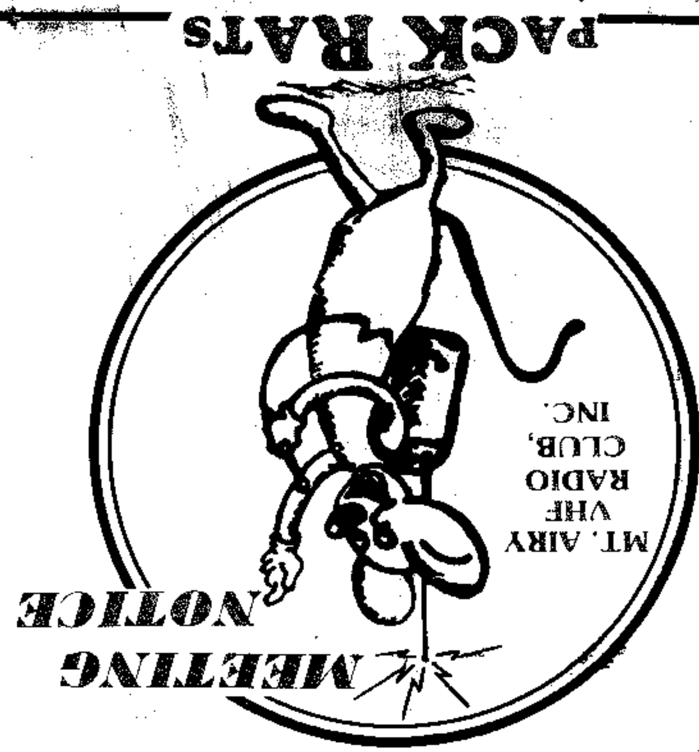
At 10368 MHz the waveguide filter tauted above just doesn't hack it, at least not with my inept construction! I have found a slightly different approach useful for picking off step recovery diode harmonics at 10 GHz. It might also be adequate for preselection if an IF of at least 432 MHz was used. The idea is to build a circular waveguide cavity and couple via probes mounted on flat endplates soldered to the circular section. The reason this is practical at 10 GHz is a bit of serendipity. Three-quarter inch copper sleeves are available in the plumbing sections of hardware stores. The inside diameter of such sleeves is about 0.85 inches, a diameter consistent with single TM mode operation at 10 GHz when the sleeve is 0.5 inches in length. SMA probe lengths of 0.1 inches produce a filter with under 1 dB insertion loss and a -3 dB bandwidth of about 100 MHz (Q of about 100).

7. WRAPUP

Hopefully the above will be of use to hams contemplating tackling the microwave bands on their own, rather than waiting for some commercial concern to build them a radio. Company up there would be much appreciated!

TNX "VHF/UHF AND ABOVE"

FIRST CLASS



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