PACK RATS'

CHEESE BITS

CLUB CALL: W3CCX

MT. AIRY VHF RADIO CLUB, INC.

*** SEASONS GREETINGS! * SEASONS GREETINGS! * SEASONS GREETINGS! * SEASONS GREETINGS! ***
MT. AIRY VHF RADIO CLUB, "THE PACK RATS", PHILADELPHIA, PENNSYLVANIA W3CCX
NET FREQUENCIES: 50.125, 144.150, 222.125, 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

VOLUME XXXIII DECEMBER 1991 NUMBER 12

THE PREZ SEZ

With the Holiday Season fast approaching I want to wish all of you Happy Holidays. This year has been fast paced for me and loaded with change and many pleasant surprises. The six meter band has allowed some of the avid DX chasers some real treats over the last month. The month of December 1991 may well be the last chance to work superior DX this cycle. Most of the DX is present during the day light period and we've been working into Europe, Africa, South America and the Pacific. You fellows who are retired or on vacation have had great daily opportunities during the week. We six meter ops who work during the week are limited to the Saturday and Sunday pile-ups!

A surprise which even exceeded the DX was the large turn-out at our November club meeting! Hopefully, all of you will find the time to make more than the minimum required meetings to qualify as contest eligible. As a club, the Pack Rats are made up of many special interest groups. Some of us are interested in a particular band such as six meters. Others thrive on the microwave bands, and others don't know what they want, so they try different bands, give up and try again. Some have just plain lost interest or burned out for one reason or another. But, we all have one thing in common - a curiosity in VHF/UHF and microwave frequencies. This interest has brought us together as a group and allowed the club to flourish through the exchange of ideas on how to improve our station performance and operating skills. Each member adds something special to our group and all are important. If you live close to another club member, take time to pay them a visit. Talk over your projects and work on them together. Use the club meeting as a forum to exchange ideas and meet new members. I will look forward to seeing you all at the monthly meetings.

With the holiday season fast approaching, the VHF Sweepstakes contest is only two meetings away. Are you planning to operate? We need a good turn-out to qualify in the unlimited club category. Now is the time to ask for help. Contact your team captain.

73, William T. Murphy, WØRSJ

PACK RATS: IS YOUR TEAM READY FOR THE VHF CONTEST? ONLY A LIMITED TIME LEFT TO GET THE STATION IN SHAPE AND MAKE THE REQUIRED TWO CLUB MEETINGS! CALL FOR ASSISTANCE IF NEEDED!

Pack Rats CHEESE BITS is a publication of the Mt. AIRY VHF RADIO CLUB, INC. Philadelphia, Pa. and is published monthly.
SUBSCRIPTION RATE - $7.00 PER YEAR

We operate on an exchange basis with other publications. Anything that is printed in CHEESE BITS may be reprinted, unless otherwise stated, provided proper credit is given.

DEADLINE FOR ARTICLES AND SWAP SHOP IS THE 20TH DAY OF THE MONTH. NON-COMMERCIAL SWAP SHOP ITEMS - FREE OF CHARGE.

SUBSCRIPTION/ADVERTISING MANAGER:
WB2YEH, BOB FISCHER
7258 WALNUT AVENUE
PENNSAUKEN, NJ 08110
(609) 665-8488

EDITOR:
WC2K, RICK CONNOR
412 CARRANZA ROAD
TABERNACLE, NJ 08088
(609) 268-0736

CONTRIBUTING EDITORS:
W3IIT, HARRY BROWN
3012 POTSHOP ROAD
NORRISTOWN, PA 19403
(215) 584-4846

WB3JYO, PAUL DREXLER
24 MAIN BLVD
TRENTON, NJ 08618
(609) 538-1687

TYPIST/PRODUCTION ASSISTANT:
JANICE CONNOR

AWARDS CHAIRMAN:
W2EIF, JOE KILGORE
(609) 783-9478

CLUB HISTORIAN:
W3CL, HARRY B. STEIN
(215) 887-5052

TRUSTEE OF CLUB CALLSIGN - W3CCX
WA3AXV, RON WHITSEL
(215) 355-5730

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

MONDAY NIGHT NETS	NET CONTROL
7:30 PM - 50.125	W3CL + K3EOD
8:00 PM - 144.150	W2EIF
8:30 PM - 222.125	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	N3AOG

VHF CONFERENCE CHAIRMAN:
KB3XG, JOHN SORTOR
(215) 766-2643

HAMARAMA CHAIRMAN:
K3EOD, AL BOBLITT
(215) 742-3312

OFFICERS: 1991 - 1992

PRESIDENT:	WØRSJ BILL MURPHY	
VICE-PRES:	WB2YEH BOB FISCHER	
REC. SECY:	WA3AQA WALT ZUMBACH	
TREASURER:	WA3JUF DAVE MASCARO	
COR. SECY:	WB3JYO PAUL DREXLER	
DIRECTORS:	WA3AXV RON WHITSEL	(1 YR)
	K3EOD AL BOBLITT	(1 YR)
	N3AOG DICK COMLY	(2 YRS)
	WA3NUF PHIL MIGUELEZ	(2 YRS)

CALENDAR OF COMING EVENTS

By Harry Brown, W3IIT

DECEMBER

2	Chanukah
2	Check into the Pack Rat 6 meter net on 50.125 MHz at 7:30 PM EST.
2	Check into the Pack Rat 33 cm net on 903.100 MHz at 10:00 PM EST.
6-8	ARRL 160 Meter Contest. 0000 UTC Saturday until 2400 UTC Sunday. See November QST, page 80, for rules.
9	Check into the Pack Rat 2 meter net on 144.150 MHz at 8:00 PM EST.
9	Check into the Pack Rat 23 cm net on 1296.100 at 9:30 PM EST.
12	Pack Rat board of directors meeting at the QTH of Gary, WA2OMY. Call 215-539-6409 for directions. All interested parties invited. Meeting begins promptly at 8:00 PM.
14	Predicted peak of the Geminids meteor shower at 0622 UTC. A very good shower; predominently north-south propagation. Work new states and grids on 50 - 432 MHz.
14-15	ARRL 10 Meter Contest. 0000 UTC Saturday until 2400 UTC Sunday. See November QST, page 98, for rules.
16	Check into the Pack Rat 135 cm net on either 222.125 SSB/CW or 224.58/R at 8:30 PM EST.
19	Regular meeting of the Mt. Airy VHF Radio Club at the Southampton Free Library on Street Road in Southampton, Pa. Have you qualified to submit a Pack Rat contest log for the January contest by attending the minimum 2 meetings? Come out and enjoy an excellent program, Mario's Raffle, and refreshments.
22	Predicted peak of the Ursids meteor shower at 2249 UTC.
23	Check into the Pack Rat 70 cm net on 432.110 MHz at 9:00 PM EST.
25	Merry Christmas to all.

JANUARY

18-19	**THE CONTEST**. Everyone's help in getting at least 51 logs submitted this year is necessary to qualify the club for the Unlimited Class in ARRL club competition. See December QST page 99 or consult your contest package for the rules.

APPLICATIONS FOR MEMBERSHIP

MIKE ANDRAYO, N2DEQ
20 Sheffield Lane
Turnersville, NJ 08012
609-228-4274

JEFF DEPOLO, WN3A
420 S. 42nd Street
Philadelphia, Pa. 19104
215-386-7199

PROPAGATION REPORT

By Paul Drexler, WB3JYO

The long awaited Fall VHF F2 conditions have returned! Six meters has been open to Europe and South America on an almost daily basis. In fact, according to the 50 MHz diary of local station-W3IWU, DX propagation existed for the Delaware Valley continuously from October 12 through November 23 with the exception of only 3 days during that period. Even the Pacific DX was in for a four straight days from November 19 through the 22nd! VHFers were also treated to excellent aurora and Es openings early in November. Keep your ears to the bands!

The month of October concluded with several good 50 MHz openings. On the 26th, the band opened to northern South America; N3BBI and WC2K worked FY3FV, PT7NK, PY0FF, PZ1EL, PZ1AP, G4SMC/8R1, PT7BZ, and HC5K. In the midst of this opening, Mike and Rick found 7Q7RM on the band with a big signal from Malawi, Africa. Throughout the month of November, there has been daily mixtures of South American and African DX. The band has typically opened for the Philadelphia area as early as 1200 UTC and usually with strong signals from northern portions of South America. Then the propagation has spread to cover the entire continent lasting several hours. The African propagation has typically "mixed" in by 1400 UTC and operators have had their choice of direction until as late as 1600 UTC. These conditions have been present daily for nearly 25 straight days. Stations worked by Pack Rats on 6 meters were PY5CC, PY2DJC, PY2GR, LU1BAO, YN1CC, LU3EX, XQ3SIX (Chile), LU2DEK, LU1BQU, LU7DZ, HC8GR, CX4HS, ZP6CW, all from South and Central America. ZS9A (Walvisbaii, South Africa) 7Q7RM (Malawi), A22BW (Botswana), CN2JP (Morrocco) and others were worked across the pond. Pack Rats heard in the action were: KB3QM, W0RSJ, N3BBI, W3VIR, K3ESJ, N3EXA, W3UBO, WA3AXV, and WC2K. N3BBI worked into the Indian Ocean, FR5EL (Reunion Is), on the November 3! After a full day of DX on the 6th, some Sporadic E propagation developed in the evening and WA3EHD was heard working into W5 and W0 land, giving his new 20 watt homebrew rig a work-out. N3BBI reports working KH6IAA at around 1720 UTC, November 9, on backscatter with his array pointed South! On November 11, WC2K worked 9Y4VU and HK3AVR. On the 17th, the band opened briefly to South America and Africa with CN2JP and PJ9EE in with big signals around 1500 UTC. The BIG day came on the 19th when propagation to the Pacific began at around 1800 UTC. WC2K worked FO5DR (Tahiti) and ZL2KT (New Zealand) at 2126 UTC. N3BBI reports hearing 3D2PO (Fiji Island) but no 2-way was completed. On the 23rd, the band opened to 4 continents simultaneously - Europe, Brazil, Costa Rica, Ecuador, Azores, and Africa were worked up and down the East Coast.

An almost continuous and strong Aurora was in to the area from October 30 through November 1. Contacts were reported up to 432 MHz and the propagation extended as far south as MS, AL, and LA, and as far west as TX and OK. Many stations in many grids were worked from the Pack Rat area over the period, although very few club members were heard on the bands.

The aurora was a result of the extremely high levels of solar activity which caused all of the 50 MHz DX. Solar Flux levels for the month reached as high as 280 on the index. Magnetic flux (K index) hit the maximum of 9 once, and values of 6-8 on several occasions. It is interesting to note that as violent as the Sun has been for the past 45 days, the ball of fire has become extremely settled very quickly. Since November 26, the SFI has decreased to levels around 135 and and there has been no propagation on the 6 meter band reported since then to any place from anywhere. We expect another blast from the Sun during the first weeks of December, and that final storm may produce the last of the F2 DX for 50 MHz for Cycle 22.

Thanks to N3BBI, WA3AQA, and WC2K for contributing propagation news. Since I am not yet on the air at my new QTH, it is even more important that you pass any operating news along to me! 73, Paul

SWAP SHOP

FOR SALE: 2 meter ground plane, red head (hot!) 8ft mast, 30-40ft RG8-U $25. 220 MHz CushCraft vertical, never used, mast & 30-40ft RG8-U $25. Heath HD1410 keyer mint $49.
CONTACT: Caesar Arena, W2SVV
West Trenton, NJ
609-883-6336

FOR SALE: Kenwood TS-680S, 160-6 xcvr, good condx, $700. TE Systems 6M amp, 175W w/GaAs RX preamp $200. Tokyo High Power 2M amp, 160W, needs work, $90. CushCraft 4218XL 2M boomer $75.
CONTACT: Mike Pandolfo, N3BBI
717-325-3580 after 5 PM

FOR SALE: TOWER, 70ft crank-up. Tri-Ex HS-471. 4 sections, 440 lbs, 22ft nested requires guys. Tower is down and ready to haul. $500.
CONTACT: John Sortor, KB3XG
215-766-2643

FOR SALE: Cushman CE-2 communications analyzer, $200. 384 MHz L.O., $20.
CONTACT: Chuck Grabowski, WA2ONK
609-586-7180 after 5 PM

WANTED: 432 MHz RF amplifier, 500+ watts. Also need 4-way power divider, etc.
CONTACT: Woody Peitzer, AK2F, 10 Berry Lane, Randolph, NJ 07869
(201) 584-5709 (after 6:30 PM)

COMMERCIAL AD

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.

903/2400 MHz MESS
by Chuck Steer, WA3IAC

One of the biggest potential competitors to the cellular market looming on the horizon is Personal Communications Network (PCN). Using a small, portable, handset, a person would place a call just as with an ordinary home, street, office, or cellular telephone. The handset would communicate with a "microcell" (small transceiver with limited range) serving a single office, building or neighborhood block.

One company, Comcast Corp. in Philadelphia, is conducting experiments with equipment that will interconnect personal communications signals with microcells linked both to cellular networks and cable TV distribution systems. This is taking place currently in Trenton, NJ, Philadelphia, and in other cities.

Comcast Corp. is using 902 - 929 MHz, 2400 - 2483.5 MHz, 1850 - 1990 MHz, and 12700 - 13250 MHz in Philadelphia using callsign KG2XBP. Testing in Los Angeles, California is under callsign KG2XBO, and in West Palm Beach, Florida under callsign KG2XBQ. Other cities in which testing is underway are: Baltimore, Indianapolis, Milwaukee, Dayton, San Fransisco, Seattle, York PA, Pearl MS, East Providence RI, Brunswick ME, and West Palm Beach FLA.

TWT'S AND KLYSTRONS:

HOW THEY WORK AND HOW TO USE THEM-

PART II

by Dave Hallidy KD5RQ/2

In the first part of this article, I discussed the travelling wave tube (or TWT), how it operates, and things to look for when buying one at a flearnarket. In this, the final installment, I will cover the operation of the klystron, what to look for when buying one, and how we can test and use twt's and klystrons in our microwave stations.

THE KLYSTRON

The principles of velocity modulation as they were applied in the klystron were developed in 1933, by Dr. Oskar Heil. In August of 1937, Russell and Sigurd Varian had developed the first klystron and had it functioning as an oscillator. The klystron saw much use during the Second World War, primarily as the receiver local oscillator in RADAR equipment.

Klystrons are seen less frequently in amateur stations, probably because a large percentage of the klystron amplifiers built over the years were intended for extremely high power transmitters- units in the 10 to 50kW range. There have even been klystrons built with outputs in excess of one megaWatt! So, units which could be easily adapted for use in the amateur microwave station are not too common, though they do appear at flearnarkets and surplus stores with greater frequency today than even ten years ago, for the same reasons that TWTs are appearing- the replacement of commercial microwave links with fiber. Also, the dismantling of high-powered tropo links used by the military have put a number of 1kW 2GHz klystrons in the hands of some very lucky hams.

HOW KLYSTRONS AMPLIFY

Klystrons use the same principle of velocity modulation that is used in the TWT, but with some very different means of coupling the RF into the device, amplifying it, and extracting it from the output. Refer to Figure 3 for a generalized diagram of a klystron. As can be seen, just as in the TWT, a Cathode generates a stream of electrons. Also just as in the TWT, this stream of electrons is focussed by an Anode and is then accelerated toward the positive supply terminal, or Collector. The beam is kept in tight focus by a large external magnetic field, usually supplied by VERY LARGE permanent magnets surrounding the body of the tube. The spent beam is returned to the power supply by the Collector, just as in the TWT. But here is where the similarity ends.

Instead of using a non-resonant spiral of wire to slow the RF wave and couple it to the beam, the beam passes through the centers of a series of RESONANT cavities. There are usually three or four such cavities in a typical klystron, though there can be more- gain is dependent on the number of cavities between input and output. The input cavity is tuned to a frequency near that of the input signal. RF is coupled into this cavity by means of a simple loop. This sets up a circulating field within the cavity. The beam interacts with this field, and depending on the phase of the RF wave, the field either accelerates or retards the beam. This is velocity modulation. The modulated electron beam passes through an RF-neutral Drift Tube located between each of the cavities. Here, the

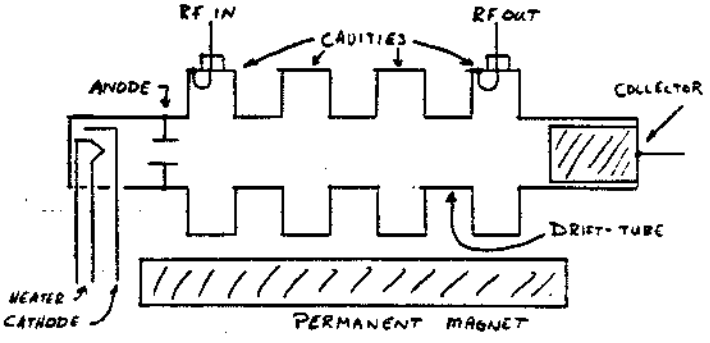


FIG 3. TYPICAL BEAM-KLYSTRON CONSTRUCTION

accelerated electrons will catch up to the electrons ahead of them. This forms bunches of electrons which then pass into the next cavity. This cavity is tuned to reinforce the previous action by setting up another circulating RF field. This field interacts more strongly with the beam than it did in the first cavity, causing larger bunches of electrons to form. As the electrons pass through each intermediate cavity, this interaction (or amplification) gets stronger, until the beam reaches the output cavity. Here, a very strong field is generated and is coupled to the output, again by means of a simple loop within the cavity.

Like the TWT, only a small portion of the DC Beam is actually converted into RF energy. The klystron (at least, one rated for CW service) will have a typical efficiency of 20-30%. This means that a large amount of Beam current can be expected to flow in a klystron designed for high output power- remember, that these devices all function because they employ the use of a highly accelerated electron beam, meaning that they use high levels of DC Voltage. Typical Beam Voltage values for a klystron operating in the 2 GHz frequency range at 1kW output power would be approximately in the 4-5kV range. Typical beam current for this tube would be in the range of

limit of 1.5kW. We're not likely to find the big ones out there because the companies that use them generally have them rebuilt when they weaken or fail. The large majority of klystrons which I have seen in the flea markets are called REFLEX klystrons. These are actually klystron oscillators. Usually their output power is in the 10-100mW range and they can be found for all frequencies between about 5GHz and 24GHz. They make great wideband FM transmitters for these bands and should not be overlooked simply because they're not high power amplifiers. I have seen several klystron amplifier tubes recently and have acquired one. The main thing to watch out for is that the device is complete. For example, I found a Varian VA-828 recently for a very good price. This tube is capable of 5kW CW output at 9.2-10.6 GHz, making it look desirable for EME at 10 GHz. The problem was, the focussing magnet was nowhere to be found! This is significant because it uses a magnet weighing 250 pounds and you can't just stick a bunch of freezer magnets around the tube and expect it to work. A tube to watch out for, and which does appear from time to time on the surplus market is the Varian VA-802. This klystron was produced in the early Sixties for military troposcatter work and is capable of 1kW output from 1.7 to 2.4 GHz, making it perfect for high power 2304 use. One thing you may have noticed in the two examples I've just cited is the much smaller operating bandwidth of a klystron versus that of a TWT. This is of course due to the fact that the klystron uses resonant cavities to amplify, and these cavities have limited tuning range. Don't expect a klystron not designed to cover a ham band to function in the nearest one, unless it happens to be within about 2% to 5% of its design range.

If you are lucky enough to come across a suitable klystron there are several things worth noting in order to make use of it. First, unlike the TWT, a regulated beam supply is not required. Second, most klystrons likely to be found will probably run far more than the legal limit of 1.5kW. This means that to run them legally, you must decrease the beam voltage, or the drive level, or both. Discovering the correct drive and beam voltage may take some experimentation. Another problem with really high powered microwave operation is where to find coax or waveguide to handle the power and where to find coaxial or waveguide switches which will switch that much RF. Those of us lucky enough to find the aforementioned VA-802 klystrons (rated for 1kW CW output) are running them at substantially below this level, at the 300-400 Watt level, to enable us to use standard coax and switching devices.

Once again, the price you should pay for a device of this type at a hamfest is "as little as possible". The greatest risk, other than the tube being dead, is that it won't be usable in the nearest ham band- check this out as much as possible before buying. Here, all the catalogs and old spec sheets you can find will be useful to help you make the decision to buy or walk away.

USING TWT'S AND KLYSTRONS

You have just purchased a tube at a hamfest and now you want to use it. Let's say it's a TWTA (complete TWT amplifier) for 2-4 GHz and it's rated for 20 Watts CW output. The first thing to think about is: how much drive will it require and how will I switch it in and out for transmit/receive? We don't know the drive requirements (and they're likely to be much less in narrowband service anyway), but we can guess that the unit will have at least 30dB gain. This means that if we expect to get 20 Watts (or +43dBm) out of it on 2304, we can expect to drive it with no more than 20mW (+13dBm). Figure 4 is a block diagram of how we might configure this circuit. Be prepared to turn the drive down substantially from this level, by inserting enough attenuation between the driver and the amp that it should certainly not be over-driven. Since our transverter (in this example) is capable of 1/2 Watt output (+27dBm) we must insert at least 14dB of pad. An adjustable pad is nice, if available, because you can make changes "on the

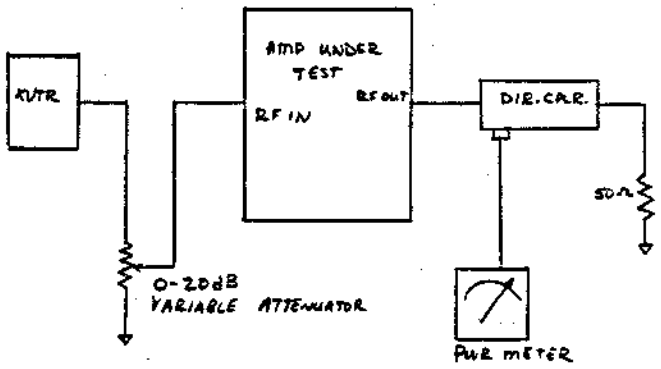


FIG 4. TYPICAL TEST CIRCUIT FOR TWT OR KLYSTRON AMPS

fly". Now that we have an input pad and a source of drive connected, connect up a device capable of indicating power at 2304 at the levels expected (at least 20 Watts) and a good dummy load, also capable of the power level to be measured.

Turn on the TWTA and allow it to warm up for the specified period of time (usually several minutes). If all is well with the amp, you will usually get some indication that the unit is ready-a light will come on, or you'll hear a click as the high voltage enable relay kicks in, or you'll see an indication of bed drive level changes (transverter output and/or input attenuation) to maximize the output. Don't be surprised if the output is much greater than the rated 20 Watts. In narrowband use, it is quite typical to see 2-3dB more output than is specified for broadband use. This means our 20 Watt TWTA may actually put out 40 Watts or so, with 10-20mW of drive! Try not to over-drive the TWTA, as overdrive will actually cause a REDUCTION in the output power, and the harmonic and spurious outputs will come way up.

Now that we've verified that the unit works well, let's figure out a way to disable it during receive. If the unit is an "Instrumentation Amplifier"- that is, one made by one of the test equipment manufacturers for lab use (H-P, Alfred, etc.) then it's very likely to have a switch on the front panel which turns the Beam on and off. If so, defeat this switch and bring the switch wiring out to a set of external relay contacts which would enable the high voltage during transmit periods. If it does

Now that we've verified that the unit works well, let's figure out a way to disable it during receive. If the unit is an "Instrumentation Amplifier"- that is, one made by one of the test equipment manufacturers for lab use (H-P, Alfred, etc.) then it's very likely to have a switch on the front panel which turns the Beam on and off. If so, defeat this switch and bring the switch wiring out to a set of external relay contacts which would enable the high voltage during transmit periods. If it doesn't have such a switch, it still will have a warmup timer circuit, with an output which turns on the beam (by closing a set of relay contacts, usually) after the appropriate warmup period. You can break this line and insert a set of contacts from an external relay in series with the timer output. This will enable the amp only after it has warmed up and the contacts are closed, indicating a transmit cycle. If none of these modifications can be made, the only other choice is to break the high voltage lead to the Cathode, using a vacuum relay rated for the voltage and current expected. This relay would be controlled by the t/r circuits in the transverter to connect high voltage to the Cathode during transmit.

CONCLUSION

In this article, I have discussed some of the theory behind the operation of TWTs and klystrons. I concentrated first on the TWT and TWTA, how they are constructed and how they may be used in the amateur microwave station. I also discussed ways to determine the usefullness of a TWT that might be found in the fleamarket of your local hamfest. Next I covered the klystron in the same detail as the TWT. I also covered typical operation of these tubes in our stations and any special equipment that might be needed to use these very unique microwave devices to maximum advantage.

One thing, above all, to remember when experimenting with TWTs and klystrons- BE CAREFUL! Very high DC voltages are present, as are dangerous RF voltages. I'm not saying this to scare you away from this work, just to make you aware and to advise you to use care. Good luck and see you on the microwave bands!

A TVI TIP

The best proof of your innocence in a TVI situation is having a TV receiver in your own house which is not bothered by your ham operations, and inviting the complainer to watch your TV while you are on the air.

Luckily, W2PAU could do this during the past several years. My 23-inch table model RCA color receiver (circa 1977), was almost bullet-proof. I admit to adding a high-pass filter in the TV antenna line, and a small rf bypass on the low level audio input circuit, to eliminate detection of my high-power VHF/UHF SSB and CW signals.

Time marches on---the newer generation of TV receivers offered better picture quality, stereo sound, cable channel tuning and a number of other improvements. I purchased a new TV with the same monogram (now with a French accent), had cable TV installed, and incorporated a VCR in the system. Now my domestic complaints started! No picture interference, but persistent audio detection, from just about every ham band, and usually louder than the program sound! The new TV set was the culprit.

I tried rf filters in the TV cable line, power line and antenna line, with no success. I slid a sheet of aluminum under the TV cabinet for an improved ground plane and used this for the filter ground returns. Still no improvement!

Opening the back of the TV set revealed one big printed circuit assembly, including the audio circuitry; a major deterrent to installing add-on filter devices near the audio components. The loudspeaker leads seemed a likely antenna, from the circuit board to the speaker on each side of the cabinet. Ferrite chokes and rf filters in these leads made no difference to the interference level. I was about ready to throw in the towel!

The new TV receivers use electronic controls for volume, stereo on/off, loudspeakers on/off, audio muting etc. Thus, there are many possibilities for RF detection in the small signal audio or control circuits. The problem was - how to isolate those circuits from the rf fields? On the back of the plastic TV cabinet there is a group of phono-type connectors for "Hi-Fi" audio outputs (low level), and video in and video out. This cluster of connectors is near the antenna coax connector. None of the auxiliary jacks are in use at present. Perhaps the leads between the circuit board and the back panel were acting as antennas!

Why not try shielding? I found a piece of copper window screen about 8" by 12", placed it against the back of the TV, tucked it around the phono jack cluster and down and under the aluminum sheet "ground plane." The screen was connected to the metal sleeve of the coax connector with a spring clip. The "Hi-Fi" left and right jacks were connected to the wire screen by wrapping short lengths of bare copper wire around the jack shells and soldering the other end to the copper screen. The use of phono plugs would have made a shorter and stronger connection to the screen, but none were on hand at the time.

Results? A major improvement! No complaints at all during the CQ WW SSB Contest weekend. Considering that this trick does not require any TV internal modifications, and doesn't affect the appearance of the set, it's certainly worth trying. My kind of quick-fix; cheap and dirty!

Perhaps this experience will be of interest to other owners of similar TV receivers. SJRA

Miles Brown, W2PAU TNX "HARMONICS"

INDEX OF TECHNICAL ARTICLES IN PAST CHEESE BITS

ISSUE		SUBJECT	AUTHOR
DEC	1991	TWT's AND KLYSTRONS AND HOW THEY WORK (PART II)	KD5RO
NOV	1991	WEAK SIGNAL SOURCES FOR THE MICROWAVE BANDS	N1BWT
OCT	1991	TWT's AND KLYSTRONS AND HOW THEY WORK (PART I)	KD5RO
AUG	1991	50 MHz BANDPASS FILTER	WB3JYO
AUG	1991	3456 MHz NO-TUNE TRANSVERTER MOD	WA3JUF
MAY	1991	50 MHz PREAMPLIFIER	WB3JYO
APRIL	1991	"CRUNCH-PROOF" 50 MHz RECEIVE CONVERTER	WB3JYO
MARCH	1991	50 MHz SD1458 LINEAR AMPLIFIER	WB3JYO
FEB	1991	50 MHz SD1273 LINEAR AMPLIFIER	WB3JYO
JAN	1991	TRANSISTOR BIASING FOR LINEAR SSB AMPLIFIERS	WB3JYO
JAN	1991	MICROWAVE RF POWER MONITOR	WA3JUF
JAN	1991	50 MHz LINEAR AMPLIFIER	WB3JYO
DEC	1990	DIODE TRICKS - MICROWAVE SIGNAL SOURCES	NA2O
DEC	1990	50 MHz LINEAR TX CONVERTER - MIXER/SPLITTER	WB3JYO
NOV	1990	50 MHz LINEAR TX CONVERTER - LOCAL OSCILLATOR	WB3JYO
OCT	1990	50 MHz LINEAR TX CONVERTER - INTRODUCTION	WB3JYO
OCT	1990	LINEAR SSB TRANSVERTERS, TRANSISTOR SELECTION FOR	WB3JYO
SEPT	1990	10.3 GHz FEEDHORN	WA3IAC
AUG	1990	PRACTICAL FILTER DESIGNS FOR 2 - 10 GHz	K3SIW/9
AUG	1990	VHF/UHF AMPLIFIER MATCHING NETWORK COOKBOOK	WB3JYO
JULY	1990	BIPOLAR TRANSISTOR BASE BIAS W/ THERMAL COMPENSATION	WA3IWT
MAY	1990	MICROWAVE STATION INTEGRATION	AA5C
MARCH	1990	RELATIVE POWER INDICATOR	NA2O
APRIL	1990	EME PRIMER	WB2JHG
SEPT	1989	903 MHz DL6WU YAGI	N3CX
JUNE	1989	OVER-VOLTAGE PROTECTION	WA3JUF
MAY	1989	VHF/UHF WEAK SIGNAL SOURCES	WA3JUF
APRIL	1989	MECHANICAL DIMENSIONS	KA5JPD
APRIL	1989	CARE & USE OF GaAs FETs	WA3JUF
NOV	1988	3456 MHz POWER METER	WA3JUF
OCT	1988	TRANSISTOR BASE BIAS SUPPLY	WA3IWT
JUNE	1988	2304 MHz BEACON TRANSMITTER	WA3JUF
JUNE	1988	ISOLATED KEYING CIRCUIT	WA3JUF
MAY	1988	L.O. CHAIN FOR 3456 MHz	WA3JUF
APRIL	1988	800-950 MHz LINEAR AMPLIFIER	WA3JUF
APRIL	1988	HINTS & KINKS ON I.F. FEED-THROUGH	WA3JUF
FEB	1988	USING A CATV AMPLIFIER ON 903 MHz	WA3JUF
JAN	1988	HINTS ON XVERTER & AMPLIFIER SET-UP	WA3JUF
DEC	1987	2304 MHz DOUBLER	WA3JUF
NOV	1987	INTERDIGITAL FILTER & PWR DIVIDER	WA3JUF
OCT	1987	CONVERTING F-196/U CAVITY TO 220 MHz	WA2OMY
SEPT	1987	ADAPTOR RING FOR 4CX250B	N3CX
JULY	1987	3456 MHz 1 WATT AMPLIFIER	WA3JUF
JUNE	1987	903 MHz TRANSVERTER	WA3AXV
JUNE	1987	3456 MHz AMPLIFIER (part II)	WA3JUF
MAY	1987	3456 MHz AMPLIFIER (part I)	WA3JUF
APRIL	1987	HOW TO WIRE UP AN ELECTRIC CHAIR	N2SB
APRIL	1987	903 MHz FILTER	WA3AXV
APRIL	1987	GaAs FET PREAMPS FOR IC-451 XCVR	WA3JUF
MARCH	1987	FUSES	WA3JUF
JAN	1987	TRANSVERTER SWITCHING READOUT	WA3JUF
NOV	1986	7 WATT CLASS C AMPLIFIER FOR 2304 MHz	WA3JUF
OCT	1986	NBS ANTENNA COMPUTATION - 50.1 MHz	WA3AXV
OCT	1986	1-2 WATT AMPLIFIER FOR 2304 MHz	WA3JUF

INDEX OF TECHNICAL ARTICLES IN PAST CHEESE BITS

ISSUE	SUBJECT	AUTHOR
AUG 1986	903 MHz 2-WAY POWER DIVIDER	N3CX
JUNE 1986	1 WATT LINEAR AMPLIFIER FOR 2304 MHz	W3HQT
MAY 1986	MODIFICATIONS TO PACK RAT 144 MHz XVRTR	WA3JUF
APRIL 1986	.8 WATT LINEAR AMPLIFIER FOR 2304 MHz	WA3JUF
APRIL 1986	NBS ANTENNA COMPUTATION - 903 MHz	WA3AXV
MARCH 1986	330 mW LINEAR AMPLIFIER FOR 2304 MHz	WA3JUF
JAN 1986	MODIFICATION TO BIRD 43 WATTMETER SLUGS	WA3JUF
DEC 1985	COMBINING TRANSISTOR AMPLIFIERS AT 1296 MHz	WA3JUF
DEC 1985	1296 MHz 10 WATT AMPLIFIER	WA3JUF
NOV 1985	CHEAP MICROWAVE TERMINATION AND LOAD	WA3JUF
OCT 1985	2.5 WATT LINEAR AMPLIFIER FOR 2304 MHz	WA3JUF
AUG 1985	3 TO 30 WATT AMPLIFIER FOR 144 MHz	WA3JUF
JULY 1985	USING 'N' CONNECTORS ON 1/2" HARDLINE	WA3JUF
JULY 1985	MOBILE REGULATED HT BATTERY ELIMINATOR	WA2FXB
JUNE 1985	28 MHz POST AMPLIFIER	WA3JUF
MAY 1985	10 WATT 432 MHz LINEAR AMPLIFIER	WA3JUF
APRIL 1985	40 WATT LINEAR AMPLIFIER & SWITCHING SYSTEM	WA3JUF
MARCH 1985	CHEAP 1/2" HARDLINE CONNECTOR	W3HMU
FEB 1985	5 WATT 1296 MHz LINEAR AMPLIFIER	WA3JUF
FEB 1985	CHARGING ICOM BATTERY PACKS THROUGH TOP TERMINALS	WA3JUF
DEC 1984	1296 MHz AMPLIFIER SD1359	WA3JUF
NOV 1984	1296 MHz AMPLIFIER	WA3JUF
MAY 1984	METER SHUNTS REVISITED	WA3JUF
APRIL 1984	MODIFICATIONS TO W6PO 1296 MHz PREAMPS	WA3JUF
FEB 1984	1296 MHz 2-POLE INTERDIGITAL FILTER	WB3JYO
DEC 1983	28 MHz DIPLEXER CIRCUIT FOR DBM's	WB3JYO
AUG 1983	AUTOMATIC NICAD CHARGE/DISCHARGE UNIT	WA3JUF
JUNE 1983	OSCILLATOR DATA FOR L.O. CHAINS	W2EIF/WA3JUF
MAY 1983	BIAS MODIFICATION TO 220 MHz LINEAR AMPLIFIER	WA3JUF
MAY 1983	P.C. LAYOUT FOR 220 MHz LINEAR AMPLIFIER	WA3JUF
APRIL 1983	220 MHz AMPLIFIER SD1434	WA3JUF

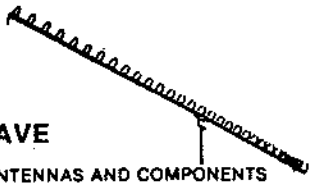
MESSAGE FROM THE EDITOR

Each year as I compile the list of technical articles, I realize what great resources we have available in the VHF-Microwave community and especially the among the Pack Rats. Those who spend their hamming time below 30 MHz tend to be moving completely away from technical interest and experimentation. Hanging a big-boy beam on a tower at the computer-derived height is high technology in the HF world! Interfacing computers with $4K transceivers and maneuvering through a contest program is a major accomplishment. Ironically, most HFers, who claim such operating greatness as to have now started a "Hall of Fame" for contesters and DXers, have seemingly lost touch with basic electronics, basic operating skills, and basic manners.

I suppose that explains why we VHFers continue to be joined each year by additional HF drop-outs; hams with a desire to restore the intrigue in their lives that brought them to ham radio in the first place. Their desire is to evacuate the bands of user/operators and join the ranks of the real antenna designers, the real equipment designers, and those who write technical computer programs for RF application.

Thanks to all of the above listed technical article contributors as well as all of the many others in our part of the hobby who believe that there still remains vast undiscovered technical territory and possess the ambition to pursue it. Have a great year VHFers, and keep those technical articles coming!

DOWN EAST MICROWAVE



MICROWAVE ANTENNAS AND COMPONENTS

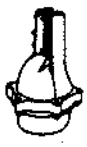
BILL OLSON
W3HQT

BOX 2310 RR1
TROY, ME 04987
(207) 948-3741

CRAIG HENDERSON
N8DJB

Ph. (419) 352-4465
Hrs. 10-5

C. A. T. S.
Rotor Parts & Repair



7368 S.R. 105

Pemberville, OH 43450

215-288-0325

W3HK

GEORGE S. VanDYKE, JR. P.E.

1737 Scattergood St.
Phila., PA 19124

The R.F. Connection
"Specialists in RF Connectors and Coax"

KA3QPG
Joel Knoblock
301/840-5477
Fax 301/869-3680

Order Line 800-783-2666
Suite 11, 213 N. Frederick Ave.
Gaithersburg, MD 20877

---

(302) 328-7728
ORDER LINE 800-441-7008

Delaware Amateur Supply
"AMATEUR SALES AND SERVICE"

PAUL WA3QPX
KATHY KA3IYO

71 MEADOW ROAD
NEW CASTLE, DELAWARE 19720

---

(215) 855-5800 DAY
(215) 343-2446 NIGHT

INDUSTRIAL
COMMERCIAL
RESIDENTIAL

WARRINGTON ALARM CO.
LOCKSMITH • BURGLAR • FIRE

BOB HERSHMAN

417 DAVISVILLE ROAD
WILLOW GROVE, PENNA. 19090-3493

215-342-5982 WA3HIT

Paul and Betty Rilling

INCOME DIVERSIFICATION

5830 Weymouth Street -Phila., Pa.19120

Gerry Rodski - K3MKZ 717-868-5643
6-10 PM

SSB ELECTRONIC U.S.A.
Call for Catalog

124 Cherrywood Dr. Mountaintop, Pa 18707

609-541-0120

Bob Fischer Company, Inc.
AERIAL LADDERS · UTILITY EQUIPMENT

BOB FISCHER
PRES.

28TH & LINCOLN AVE.
CAMDEN, N. J. 08105

ZD Engineering
Specialists in CATV Hardline Matching Transformers-Power Dividers and Related R.F. Devices
144 MHZ-1296 MHZ.
TO FIT 1/2, 3/4 AND 7/8 INCH HARDLINE.

PAUL H. DARWACTOR
(419) 424-8765

W8ZD

505 Baisley Ave.
Findlay, Ohio 45840

DESTINATIONS INC.
A FULL SERVICE TRAVEL AGENCY

HARRIET SOLTOFF
TRAVEL CONSULTANT

616 SOUTH THIRD STREET
PHILADELPHIA, PA. 19147

RES. (215) 947-4483

BROWSING - THURS. 7"to8"
SAT. 8"to4"

Day-Nite (215) 455-2121

FERTIK'S ELECTRONICS . . . . .
Components & Equipment

LEON FERTIK

5400 ELLA STREET
PHILADELPHIA, PA. 19120

RICHARD E. COMLY

ARROW
TOOL, DIE & MACHINE CO., INC.
2065 BENNETT RD. PHILA., PA 19116

(215) 676-1300
FAX 934-5237

---

(609) 268-0736

RICHARD CONNOR

RECON Communications

- COMMUNICATIONS TOWER MAINTENANCE
- ANTENNAS, FEEDLINES, TOWERS INSTALLED
- TOWER PAINTING, RE-LAMPING, RE-GUYING
- RF SYSTEM TROUBLESHOOTING
- LIGHTNING PROTECTION, GROUND SYSTEMS

Emergency Service

412 Carranza Road
Tabernacle, NJ 08088

---

(302) 328-7728
ORDER LINE 800-441-7008

Delaware Amateur Supply
"AMATEUR SALES AND SERVICE"

ROB WA3QLS
GAIL KA3ITH

71 MEADOW ROAD
NEW CASTLE, DELAWARE 19720

---

(215) 745-6173
(302) 686-7630
(215) 342-8832

COMPU-SIMPLE, INC.
COMPUTER APPLICATIONS FOR SMALL BUSINESS

ELLIOTT T. WEISMAN
Consultant

P.O. BOX 7161
WILMINGTON, DELAWARE 19803

RUTLAND ARRAYS

For the finest VHF/UHF antennas

1703 WARREN ST.
NEW CUMBERLAND, PA 17070

Call or write for our new catalog!
(717) 774-5298 7 - 10 pm EST

Hopkins & Yampolsky, P.C.

ATTORNEYS AND COUNSELLORS AT LAW
1814 SPRUCE STREET
PHILADELPHIA, PENNSYLVANIA 19103

STEVEN N. WHITE
WA3IAO

TEL. (215) 545-1300

FIRST CLASS

PACK RATS

MT. AIRY
VHF
RADIO
CLUB,
INC.

MEETING NOTICE

DICK HUNTZINGER
W3FOD
130 FAIRHILL RD.
CHURCHVILLE, PA 18966

M 12/91

Cheese Bits
412 Carranza Rd
Tabernacle,NJ
08088