

PACK RATS'



PACK RATS

CLUB CALL: W3CCX

MT. AIRY VHF RADIO CLUB, INC.

CHEESE BITS



MT. AIRY VHF RADIO CLUB., "THE PACK RATS", PHILADELPHIA, PA. W3CCX
NET FREQUENCIES: 50.150, 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 18966

SCANNED TO PDF BY BERT, K3IUV, 2013

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November 1993

NUMBER 11

THE PREZ SEZ

Thanks to the many Packrats who participated in Hamarama this year both the conference and fleamarket came off nearly flawlessly! Conference chairman John KB3XG is to be congratulated for orchestrating a FB conference again, with a stellar line up of speakers, 85+ conference attendees, and a record 60 attendees at our Saturday evening banquet. Chairman °XG even piloted two of our speakers from New England so that they could make it to the conference. The banquet activities included a very enjoyable slide presentation by Al, K2UYH, and the coveted assortment of VHF door prizes - everyone walked away with at least one door prize. Sunday's fleamarket was highly successful despite less than perfect weather in the morning and our move back to the Drive In. A job well done!

Hamarama '93 was just another example of what Packrats can do when we set goals, form a plan, and work diligently to accomplish that plan. Last month we talked about setting goals as a club for our January contest effort. Hopefully by now you've decided how you'd like to improve your station and are working on getting on that new band. At our October meeting several club members showed just how easy it is to get on 432 and 903 these days using the No-Tune transverters and simple construction techniques. Ron, WA3AXV, gave a talk on propagation and how we can best optimize our station's performance for long-haul contacts.

Gary, WA2OMY, outlined our transverter Building Blitz - we will be gathering at Gary's throughout November with the goal of assisting Packrats in building complete transverters for the 432, 903, 1296, and 2304 bands. A group purchase has already been made for No-Tune transverter kits however late-comers can still participate by calling °OMY or myself immediately. If you are in need of station improvements, repairs, or antenna work, there are Rats ready to help - just ASK. And if you know how you can encourage or assist another Rat with a project, why not offer your help? There's a tremendous pool of both technical and manpower resources available within the Packrats - let's work together to make our goals a reality.

73, Paul Drexler, WB3JYO

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DEADLINE FOR ARTICLES AND SWAP SHOP IS THE MONTHLY MEETING DATE. NON-COMMERCIAL SWAP SHOP ITEMS-FREE OF CHARGE.

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PACKRAT 222 MHz REPEATER - W3CCX/RPTR

222.98/224.58 MHz, Churchville, PA

OFFICERS: 1991-1992


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 K3ESJ, Bill Jaxheimer (1 YR)
 WA3AXV, Ron Whitsel (2 YRS)
 WB2YEH, Bob Fisher (2 YRS)

MONDAY NIGHT NETS

<u>TIME</u>	<u>FREQ.</u>	<u>NET CONTROL</u>
7:30 PM	50.150 MHz	K3EOD
8:00 PM	144.150 MHz	W2EIP
8:30 PM	222.125 MHz	WB2YEH
8:30 PM	224.58R MHz	K3ACR
9:00 PM	432.110 MHz	WA3AXV
9:30 PM	1296.100 MHz	WA3NUF
10:00 PM	903.100 MHz	N3AOG

COMMITTEE CHAIRMEN

LADIES' NIGHT: WA3YUE 215-666-1558
 JUNE CONTEST: WB3DNI 215-672-5289
 HAMARAMA: WB3JYO 609-538-1687
 VHF CONFERENCE: KB3XG 215-270-3158



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Calendar of Coming Events - November 1993

- 1 Check into the 6 Meter Net on 50.150 MHz at 7:30 PM EST.
- 1 Check into the 903 MHz Net on 903.100 MHz at 10:00 PM EST.
- 2 Election Day
- 5 Predicted peak of the Taurids meteor shower at 0047 UTC.
- 6-8 ARRL November CW Sweepstakes. See Oct. QST, page 122 for rules.
- 6-8 ARRL International EME Competition. See Sept. QST page 93 for rules.
- 7 TRANSVERTER BUILD, DEBUG, AND PACKAGING SESSION at the QTH of Gary, WA2OMY. Call 215-539-6409 for directions. Bring any other "ailing" equipment that you may have. Second session tentatively scheduled for Nov. 13 (PM).
- 8 Check into the 2 Meter Net on 144.150 MHz at 8:00 PM EST.
- 8 Check into the 1296 MHz Net on 1296.100 MHz at 10:00 PM EST.
- 11 Veterans Day
- 11 Packrat board of directors meeting at the QTH of Dave, WA3JUF. Call 215-795-2648 for directions. All interested parties invited.
- 13 Central Pennsylvania Repeater Assn Hershey Hamfest at the Hershey Armory, 28th Infantry off 422 on Baum Ave., Hershey, PA. TI on 145.47(-) and 145.29(-). VE Testing.
- 15 Check into the 220 MHz Net on 222.125 MHz or 224.58/R at 8:30 PM EST.
- 17 Predicted peak of the Leonids meteor shower at 1015 UTC.
- 18 Regular meeting of the Mt. Airy VHF Radio Club at the Southampton Free Library on Street Rd. in Southampton, Pa. All VHFers are encouraged to come and enjoy the evening with us. You need not be a member. Do you need to attend this meeting to qualify for club contest minimum attendance? Come anyway and bring a friend.
- 20-22 ARRL November Phone Sweepstakes. See Oct. QST, page 122 for rules.
- 22 Check into the 432 MHz Net on 432.110 MHz at 9:00 PM EST.
- 22 Check into the 903 MHz Net on 903.100 MHz at 10:00 PM EST.
- 25 Thanksgiving
- 27-29 CQ World-Wide DX Contest - CW. See Oct. QST, page 124 for rules.

VISITORS AT THE OCTOBER MEETING

N3PER, Ken Bromberger, Buckingham, Pa.
KB3ANO, Denise Burstein, Warminster, Pa.
KD4LAN, John Mayger, Horsham, Pa.
no call, Kurt Robinson, Morrisville, Pa.
N2PTT, Leo Eger, Titusville, NJ
N2NGU, Eric Carpenter, Titusville, NJ

PROPAGATION REPORT

The report on band conditions follows: On 9/24/93 N3CX worked W9ZIH (EN52) on 432 MHz tropo. Dave also reported that he worked W8WZG (EN81) on 432 and 1296 MHz.

That is all the propagation info I have been given. To report any propagation call my work phone at (908) 243-3888. If I'm not there, leave a message, as I'm traveling a lot lately and it will get to me so I can get it in the report.

For those of you who are out of the region, if the band is open and you want people to get on I can help. That is to get the message out immediately to the VHF Community in the Mid Atlantic Region. Call 1 800 258 0000. My PIN # is 2881997. Enter your phone number and 999 (so I will know that it's not a work call) and I will call you back. This is a Sky Pager number and I have it with me all the time.

Tnx and good DX
Bill Murphy, WORSJ, FN20JR

Microwave Update 1993 Report

The 1993 Microwave Update was held in Atlanta, Georgia on September 24 through 26, 1993. This conference was attended by about 100 avid microwave experimenters. Talks this year were given by Al Ward, WB5LUA, and Kent Britain, WA5VJB, on a Simple Approach to 24 GHz. Kent also showed ways to use old radar detectors and get on both 10 and 24 GHz cheap. Reed Fisher, W2CQH, gave a talk on Evanescent Mode Waveguide Filters. Rick Campbell, KK7B, gave a talk on his effort to develop a Single Board 1296 MHz Transceiver. Tom Williams, WA1MBA spoke on Contacts in the Upper EHF Bands. Tom's talk was identical to the one he gave at the Mid Atlantic VHF Conference. Jim Davey, W8NLC, gave a talk on Microwave Engineering Techniques. Randy Rhea, N4HI, gave a talk on "A Modern Sword for the Slaying of Dragons". Dave Kunkee, K0DI, showed us how to make Radiometric Measurements at 92 GHz. Al Ward, WB5LUA showed the group the APPCAD Tutorial. Bill McCaa, K0RZ, gave a talk on RF Radiation Exposure and Measurements. Editors Note: The old ANSI standard was under attack, and has been lowered. The FCC is addressing this in a NRPM that will affect most VHF, UHF and Microwave operation on the amateur bands. The new limit is 0.2 mW/cm sq in the 30-300 MHz Range. Zack Lau, KH6CP/1, gave a talk on "Microwave Transverters - Getting Them on the Air". Charles Osborne, WD4MBK, gave a talk on Radio Astronomy for the Amateur. The banquet speaker was KK7B, Rick Campbell. Rick expanded the horizon of amateur communications by reviewing old operating techniques and home brew equipment and showed us how easy it is to get on ham radio. Awards were presented for the lowest noise figure and Zack KH6CP/1 sweep the field. Al, WB5LUA, was in second place by only 0.01DB in one case. With some kind hearted ribbing, Zack told Al how to improve his design. All commented that the ARRL is certainly getting their act together.

I had a chance to renew some old acquaintance and make some new ones. I strongly recommend this conference. Next year it will be held in Estes Park, Colorado. I missed writing down the date but it will be in September. Bill McCaa, K0RZ, can be contacted for additional information. Editors Note: the conference is looking for sponsors and will probably move locations again some time, but for now it is back to it's roots in Colorado.

Proceedings of MICROWAVE UPDATE '93 and the Central States VHF Conference are available from the ARRL.

The Central States VHF Society will hold it's 1994 conference in Memphis Tennessee in July 29 and 30, 1994. For information contact Dave Meier, N4MW, at (901) 382-4919.

Bill Murphy, WORSJ FN20JR
Roving Packrat Ambassador

JANUARY VHF SWEEPSTAKES

By Phil, WA3NUF

The cooler temperatures and the falling leaves can only mean one thing, it's time to start working on your contest station. The club board of directors are all fired up to make this the biggest contest effort ever! If you haven't heard yet, our goal is to get every Packrat on a new band in January. The club will sponsor homebrew sessions with the help of our local Guru talent, special silent auctions to help you clear your garage of those old unused antennas (and maybe help someone else to put a new band on the air), AND MANY OTHER SURPRISES.

In case you missed the Conference, Warren Stankiewicz, NF1J, the ARRL assistant contest manager reported that the League was considering a change to the Rover rule. No guarantees, but we can at least hope. Rumor is that the contest weekend is January 22-23.

The annual contest questionnaire is in the mail, so fill it out and return it ASAP. Remember to check into the Monday night nets. See you at the meeting. Bring in an old antler and help it find a new home.

ANTENNA SILENT AUCTION

Everyone is into recycling these days and so are the RATS. At the November club meeting, bring your old antennas in for a silent auction. We know you've got them out in the back yard or in a heap in the back yard. They still work but are a couple of dB's down from the BIG one you put up last year. Your spouse and neighbors will appreciate you getting rid of them too and best of all, THIS WILL HELP ANOTHER RAT TO EITHER IMPROVE HIS ANTENNAS OR WILL HELP GET HIM ON ANOTHER BAND.

EQUIPMENT WORKSHOP SCHEDULED

The first of a series of building and testing sessions has been scheduled for Sunday, November 7 at the QTH of Gary, WA2OMY. The session is primarily orientated to the building and testing of no-tune transverters however it is open to about anything that you can lug in. If it needs fixing, tuning or even assembly, bring it in. If all you have is the bag of parts (or most of them), bring it in. If you have the basic boards built but don't have the test equipment or experience to complete the alignment, bring it in. If you need help in the control circuitry, bring it in. Lots of expertise and even parts and boards will be available. Signal generators and spectrum analyzers will be available for ALL of the VHF through the Microwave bands. If you need a ride or directions get on the repeater or call Gary at 215-539-6409.

GOT A TECHNICAL QUESTION?

A portion of the regular club meetings has been reserved to answering technical questions that you may have. We have a lot of talent, knowledge and experience and are glad to share it. At the October meeting, subjects discussed were "good GaAsFETS for use on 1296", "MMICs usable for active mixers", and "stacking distances for multiple antennas on a single tower". Everyone has a chance to learn something that will help now or in the future.

HAMARAMA REPORT

Hamarama 93 was another success and it was good to be back at the Drive-In. The fit of buyers and sellers with the available space was a perfect match. Approximately 1400 buyers were there and many were attendees from the Mid Atlantic VHF Conference that said that they hadn't been at another hamfest with so many VHF goodies available. Among the many rats that were there working were: K3ACR, KF6AJ, N3AOG, WA3AXV, N3BBI, K3DMA, WB3DNI, WA3EHD, K3EOD, K3ESJ, N3EVV, N3EXA, W3GAD, WA3GFP, N3GSA, W3GXB, WA3IAC, KB3IB, W3IIT, N3ITT, K3IUV, WA3JUF, WB3JYO, W3KKN, KA3MGB, N3NGE, WA3NUF, AK3O, WA2OMY, N3OZO, WORSJ, W3VIR, WB2VLA, KB3XG, WB3YEH, W4YHO, WA3YUE, and WB8ZAR.

SILENT KEY

John Tate, K3KTY, passed away in early October. John was a long term member of the Packrats and was a past president of the club in 1982.

TID BITS:

In the Oct. 93 issue of The VHF-UHF DXer, G4DDK continues his 6 meter transverter series with the transmit section and some changes to the receive converter.

Also in The VHF-UHF DXer, David, G4ASR also described an IARU conference held in Belgium for Region 1. 50 countries were represented at the conference. They are preparing for future conferences on frequency allocation. They have a VHF committee covering VHF up that had delegates from 24 countries. Does anyone know of similar efforts by the ARRL for our region?

Congratulations to Kent Britain, WA5VJB, for him and his shack on the cover of the Nov. Issue of CQ. Looks like VHF'ers are finally getting a little recognition.

In the "Above and Beyond " column in Nov. 73, Chuck describes microwave construction practices.

SWAP SHOP

FOR SALE: A GREAT Transceiver for driving those new no-tune transverters you're building. A Kenwood TS520S for \$325.00. Call Paul, WB3JYO at 609-538-1687.

WANTED: Two 3CX100A5's. Contact Bill Murphy, WORSJ at 215-252-3956.

WANTED: 50 Ft. of 9913 coax and a 2304 MHz Antenna. Contact Al, K2EOD at 215-742-3312.

WANTED: 903 MHz Rig. Contact John, W3CXU at 215-885-9839.

WANTED: 100 watt 6M Brick, Bird 25A slug, 903 Transverter. Where are those DEM kits? Call Dave, WB8DAR at 717-366-2220.

ARRL ACTIVITY SURVEY

Editors Note: The following note was taken from the Upper Midwest VHF/UHF Newsletter. I encourage you to quickly provide the information that Ed, KA1CV, has requested and to pass on the request through any other club newsletters or Packet or whatever. It is important in my judgement that the report be as complete as possible and to show that there is a large amount of activity above 900 MHz.

ARRL WANTS INFO ON AMATEUR RADIO ACTIVITY ABOVE 900 MHZ

From Internet:

I have been asked to document Amateur Radio activity in the upper UHF and microwave bands. I would like to ask newsgroup readers to email me information about their equipment and activities on Amateur frequencies starting with the 902 MHz band.

I would like few levels of responses:

1. A fast report on your equipment and activities. This can include digital modes, satellite, ATV, etc.
2. Immediate comments about your thoughts on the use of those frequencies, our future, the direction we are headed, the relative importance of the different modes (no CW wars, PLEASE!). This can include summaries of the things you are planning to do (or would like to do) when you get around to it, or a soapbox of the way you think things should be.

I will forward this information to several different people here on staff, for long-term use in our work before the FCC. Out of 45K readers, I should be able to get quite a few reports. Thanks to all who respond.

73 from ARRL HQ, Ed

Ed Hare, KA1CV
American Radio Relay League
225 Main Street
Newington, CT 06111
(203) 666-1541 - voice

INTRODUCTION:

Designing and building a push pull power amp is not as hard as you might think, electrically. The hard part, for me at least, is the mechanical aspect. I have a "friend" in the machine shop business, but I feel funny about begging for favors. This amplifier can be built in most ham shacks with a normal assortment of tools. The amplifier described here will conservatively put out a linear 120 watts on 3 VHF bands; 50 MHz, 144 MHz and 223 MHz. There's no tuning or switching required to cover them all.

DEVICES:

There are many articles that describe the good, bad and ugly attributes of the power MOSFET. I will condense this list to a few items that are of interest to the VHF'er.

MOSFETS:

- Save higher input and output impedances.
- Are easier to match to 50 Ohms.
- Have higher gain so you need less stages.
- Are voltage devices and easy to bias.
- Are not as linear as bipolars.
- Slow up easier than bipolars.

The last item requires a warning. It is not a good idea to run a MOSFET to the limit of the output curve. Be conservative when you do your preliminary design. Combining 2, 80 Watt parts will not give you 160 Watts even under ideal conditions. Play it safe and take a dB or 2 off the top. Run the amplifier at 100 to 125 Watts. You'll be able to withstand a bad VSWR or minor cockpit error. Typical devices that should be usable in this circuit are: Motorola MDP140, and MDP141 and Thompson SD1907 and SD1908-1.

TRANSFORMERS:

Many of you have seen the CTC type of amplifier for sale. Figures 1 & 2 show this typical design. This is a very broadband design and works great for short duty cycles. Anyone who has built one will tell you that the transformers get very hot. This is a conventional transformer design where the primary and secondary windings are completely isolated. All RF current must pass through the dielectric of the transmission line. The high current makes the transformer toasty.

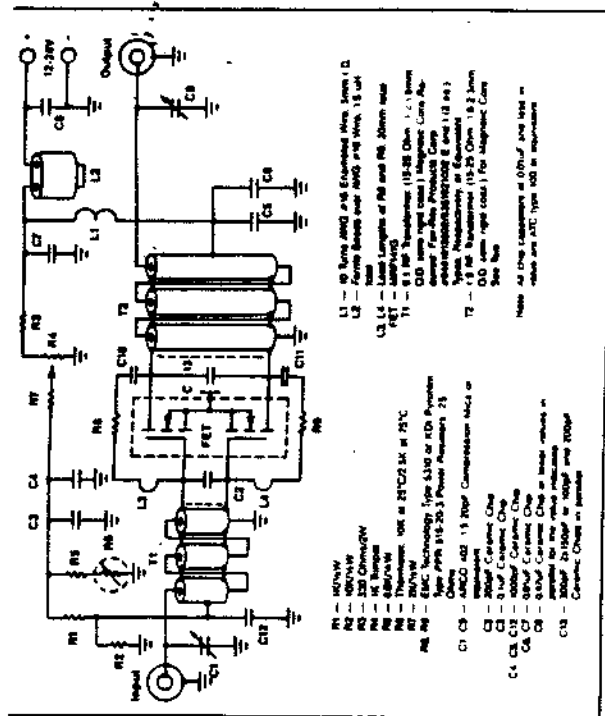


Figure 1 Schematic of the amplifier.

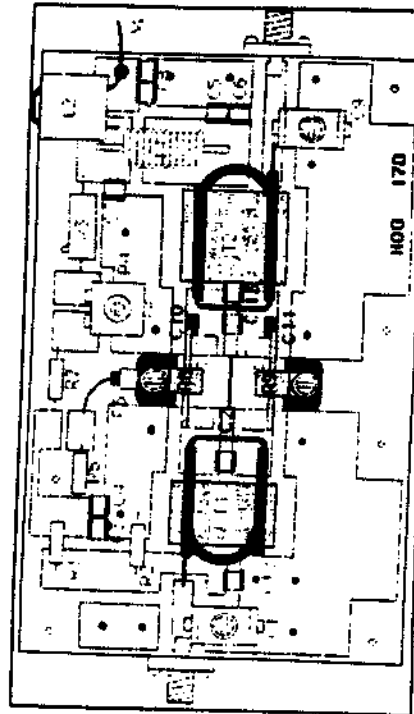
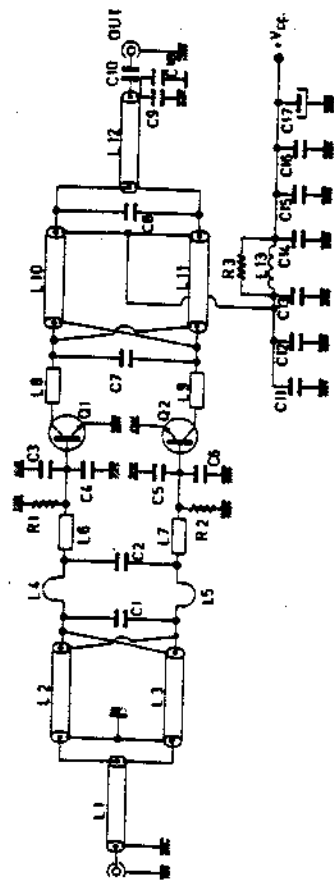


Figure 2 The component layout diagram. The only critical component



80-100 MHz; 200 W 28 V

Figure 3 FM Broadband Power Amplifier

Figures 3 & 4 show a transmission line transformer design. If you follow the schematic from device output to the output spigot, you will see a DC path between the 2 points. This type of transformer stays cool even at high power.

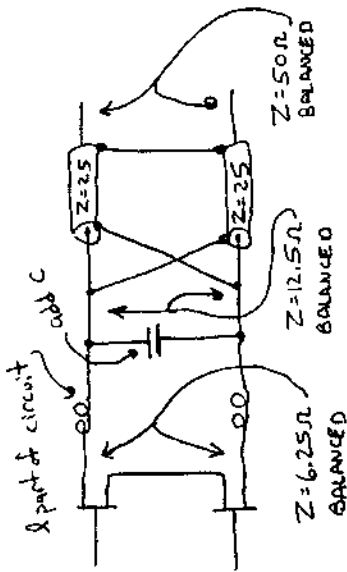
The single piece of coax (L1 & L12) is a 1:1 balun and splits the signal in equal parts separated by 180°. Other impedance ratio transformers are possible but the two 4:1 transformers (L2/L3 & L10/L11) are the simplest to implement.

Theoretically the maximum output power using a 4:1 transformer and 2, 78 Volt Devices is 125 Watts.

$$\text{Power out} = 2 \times (\text{Volts}^2) / (12.5 \Omega) = 125 \text{ Watts}$$

If you have a higher power device, you can design a single L-section from the device output to the 12.5 Ω port of the transformer. The inductor of the L-section is already part of the circuit by default since the devices are separated by a finite distance. Placing a capacitor across the 12.5 Ω port will lower the impedance that the device sees and give you more power.

$$\text{Power out} = 2 \times (\text{Volts}^2) / (6.25 \Omega) = 250 \text{ Watts}$$

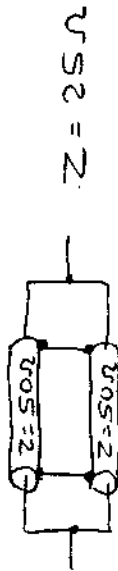


The impedance of the coax for a transmission line transformer is the square root of the 2 impedances.

$$1:1 \quad Z = (\sqrt{50\Omega \times 50\Omega}) = 50\Omega$$

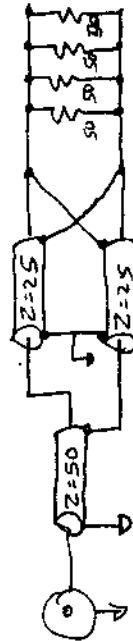
$$4:1 \quad Z = (\sqrt{50\Omega \times 12.5\Omega}) = 25\Omega$$

25 Ω coax may be hard to find at your local parts store or hamfest. I get my supply from MLC Distributors in Conshohocken, PA (215) 825-3177. I think it's about \$1/foot. If you can't find 25 Ω coax, parallel 2 pieces of 50 Ω coax.



The length of the coax used to fabricate the transformer should not exceed 0.1 wavelength at your frequency of interest. A longer length will degrade the transformation properties. The other number you must juggle is the primary inductance. The coax must be coiled to give a reactance of about 200 Ω at the same frequency. You can only get so many turns from a given length of coax. HF'ers use ferrite loaded transformers to allow for short electrical lengths and high primary inductance.

There are so many places to make mistakes during the transformer fabrication process and the devices are too expensive to pop. The transformers should be tested before the PFT is soldered into the circuit. Solder 4, 50 Ω resistors in parallel at the low impedance end of the transformer. Use 6 or 2 Meters as a source and measure the VSWR looking into the connector end of the amplifier. If you see better than a 2:1 VSWR, the transformer is OK.



BIAS NETWORK:

The MOSFET bias network is much easier to implement than an bipolar transistor. A voltage is applied to the gate at almost zero current. Four bias circuits are shown in Figure 5. Values are not critical, but set up the pot so no more than 3 to 4 Volts is present at the gate when the pot is at the V+ end. The bias network should be checked before the PFT is soldered into the circuit. The bias should be sequenced so the gate voltage is applied after the drain. I interface the bias network to my PTT circuit, and leave the drain supply on during receive.

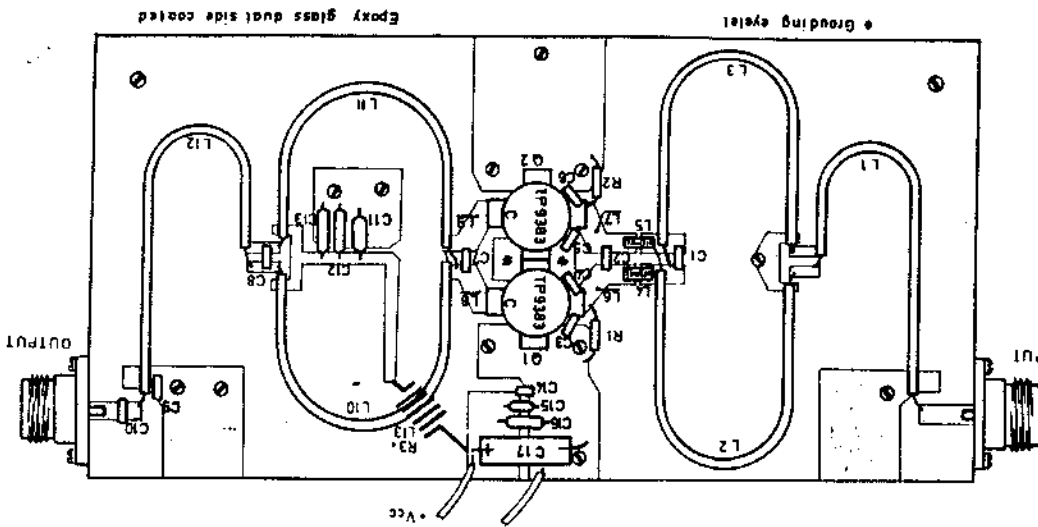


Figure 4 Component Layout

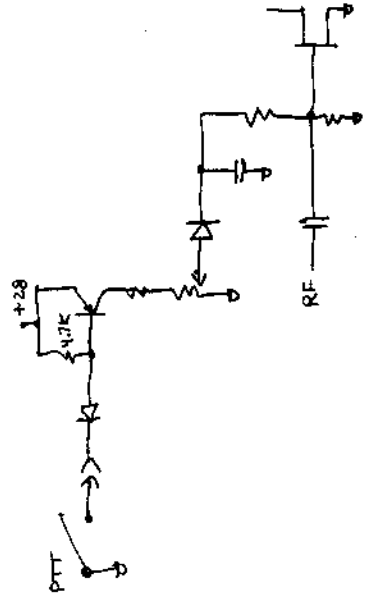
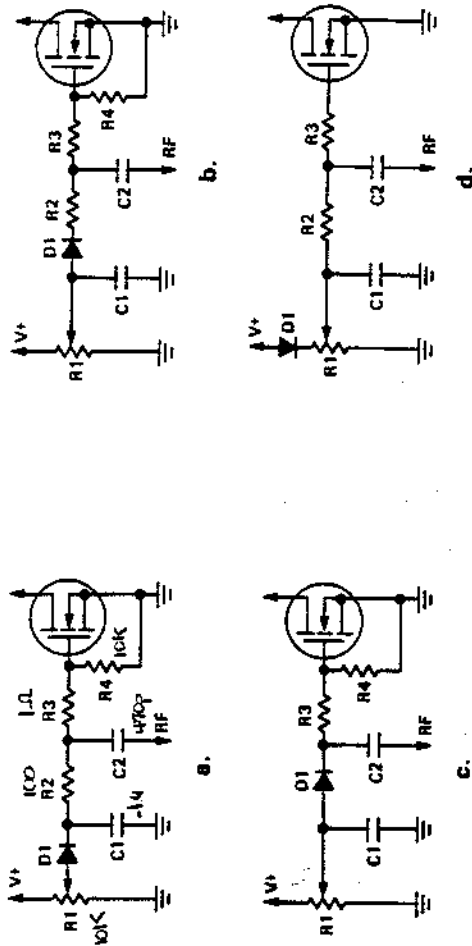


FIGURE 5 - Various Bias Configurations



FEEDBACK:

A simple resistive feedback network is necessary in a MOSFET circuit due to the extremely high gain of the device at low frequencies. The resulting oscillation would yield lots of power at unknown portions of the spectrum. The feedback resistor brings the low end gain down to a reasonable value, improves amplifier stability, and flattens the gain response.

The feedback resistor is the limiting factor in this design. A 10 or 20 Watt flange mount resistor is required if this amplifier was to be used at 100% duty cycle. Most of us use amplifiers under SSB or CW modulation. A 2 Watt carbon resistor will suffice.

MECHANICAL:

I stated in the introduction that minimal machining, with the exception of a few tapped 4-40 holes, was a priority. Attention should be given to the following items:

- 1). Make sure the heat sink is flat near the spot where the devices are to reside. I have seen heatsinks that look like rumble strips on a highway. The device needs to be in intimate contact with the heat sink or it will overheat and fail. (Probably during the contest) While you're at it, check the device flange. You may need to rub the flange lightly on a piece of fine sandpaper.
- 2). Do not use silicon grease like bathtub caulk. Use an extremely thin coating on the flange of the device. Mount the device to the heat sink, torquing each screw equally. Remove the device and inspect the coating of the silicon grease. If both surfaces are flat, the grease will be distributed evenly.
- 3). Grounding is the most important mechanical item. Use thin strips of copper tape to wrap the holes cut for the PFT's. Place ground feedthrus at each bypass cap and transformer grounding point. After the tape and feedthrus are in place, carefully file as much excess solder from the bottom surface as possible. If big lumps of solder are on the bottom of the board, an adequate ground will be impossible. Place screws at the input and output connectors and as close to each source lead as possible. It is very important to have the source leads mechanically connected to the board and heat sink to reduce unwanted inductance.

TESTING:

Place a load at the input and output ports. Solder a shunt capacitor (0.01 to 0.1 uf.) to each drain lead to prevent any oscillation from occurring during initial turn on. Bias the gates at 0 Volts. Limit the current of the drain supply to 100 ma. and apply 12 Volts. Current = 0 A. Increase the drain supply to 28 Volts. Current = 0 A. Slowly increase the bias voltage to 1 PFT, and increase current limit of the drain supply current as needed. Adjust the PFT drain current = 2 A. Slowly increase the bias voltage to the other PFT, and adjust the total (both PFT's) drain current = 4 A.

Remove the shunt caps from the drains and set up your bench to measure input VSWR and output power. Apply drain voltage and then gate voltage. Slowly increase the drive power to get 50 Watts out. Check the VSWR. Improve the VSWR by placing a chip capacitor across the low impedance end of the 4:1 input transformer. (See SBT's in Figure 6) This will cancel the stray inductance of the device and transformer leads. The cap should be somewhere between 25 and 50 pf. Use the same procedure on the output transformer but tweak for maximum output power. Use caution when placing the cap in a RF hot circuit. You could easily lose everything in a flash fire. Glue some test caps to wooden form or popcycle sticks for tweaking purposes. Increase the drive to get full output power. Re-check your selected capacitors by paralleling small values to determine if you need to increase or decrease the selected capacitor values at full output power.

If you have a spectrum analyzer handy, look for spurs as you increase the power from 0 to 100 Watts. Remove the input connector (open circuit) from the amplifier and look for any spurs. If you only have a Watt meter, look for any trace of output power in both the 0 drive and open circuit condition. If this is a problem, try adding some shunt resistance to the PFT gates. (25 to 50Ω)

CONCLUSION:

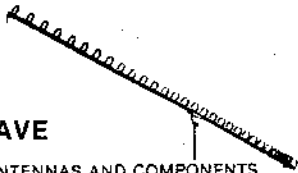
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AFFILIATED CLUB: AMERICAN RADIO RELAY LEAGUE ARNS

Meetings: Third Thursday of each month at 8:00 PM
Southampton Free Library, 947 E. Street Road
Southampton, Pennsylvania 18966

SCANNED TO PDF BY BERT, K3IUV, 2013

VOLUME XXXV

November 1993

NUMBER 11

THE PREZ SEZ

Thanks to the many Packrats who participated in Hamarama this year both the conference and fleamarket came off nearly flawlessly! Conference chairman John KB3XG is to be congratulated for orchestrating a FB conference again, with a stellar line up of speakers, 85+ conference attendees, and a record 60 attendees at our Saturday evening banquet. Chairman °XG even piloted two of our speakers from New England so that they could make it to the conference. The banquet activities included a very enjoyable slide presentation by Al, K2UYH, and the coveted assortment of VHF door prizes - everyone walked away with at least one door prize. Sunday's fleamarket was highly successful despite less than perfect weather in the morning and our move back to the Drive In. A job well done!

Hamarama '93 was just another example of what Packrats can do when we set goals, form a plan, and work diligently to accomplish that plan. Last month we talked about setting goals as a club for our January contest effort. Hopefully by now you've decided how you'd like to improve your station and are working on getting on that new band. At our October meeting several club members showed just how easy it is to get on 432 and 903 these days using the No-Tune transverters and simple construction techniques. Ron, WA3AXV, gave a talk on propagation and how we can best optimize our station's performance for long-haul contacts.

Gary, WA2OMY, outlined our transverter Building Blitz - we will be gathering at Gary's throughout November with the goal of assisting Packrats in building complete transverters for the 432, 903, 1296, and 2304 bands. A group purchase has already been made for No-Tune transverter kits however late-comers can still participate by calling °OMY or myself immediately. If you are in need of station improvements, repairs, or antenna work, there are Rats ready to help - just ASK. And if you know how you can encourage or assist another Rat with a project, why not offer your help? There's a tremendous pool of both technical and manpower resources available within the Packrats - let's work together to make our goals a reality.

73, Paul Drexler, WB3JYO

Calendar of Coming Events -November 1993

- 1 Check into the 6 Meter Net on 50.150 MHz at 7:30 PM EST.
- 1 Check into the 903 MHz Net on 903.100 MHz at 10:00 PM EST.
- 2 Election Day
- 5 Predicted peak of the Taurids meteor shower at 0047 UTC.
- 6-8 ARRL November CW Sweepstakes. See Oct. QST, page 122 for rules.
- 6-8 ARRL International EMX Competition. See Sept. QST page 93 for rules.
- 7 TRANSVERTER BUILD, DEBUG, AND PACKAGING SESSION at the QTH of Gary, WA2OMY. Call 215-539-6409 for directions. Bring any other "ailing" equipment that you may have. Second session tentatively scheduled for Nov. 13 (PM),
- 8 Check into the 2 Meter Net on 144.150 MHz at 8:00 PM EST.
- 8 Check into the 1296 MHz Net on 1296.100 MHz at 10:00 PM EST.
- 11 Veterans Day
- 11 Packrat board of directors meeting at the QTH of Dave, WA3JUF. Call 215-795-2648 for directions. All interested parties invited.
- 13 Central Pennsylvania Repeater Assn Hershey Hamfest at the Hershey Armory, 28th Infantry off 422 on Baum Ave., Hershey, PA. TI on 145.47(-) and 145.29(-). VE Testing.
- 15 Check into the 220 MHz Net on 222.125 MHz or 224.58/R at 8:30 PM EST.
- 17 Predicted peak of the Leonids meteor shower at 1015 UTC.
- 18 Regular meeting of the Mt. Airy VHF Radio Club at the Southampton Free Library on Street Rd. in Southampton, Pa. All VHFers are encouraged to come and enjoy the evening with us. You need not be a member. Do you need to attend this meeting to qualify for club contest minimum attendance? Come anyway and bring a friend.
- 20-22 ARRL November Phona Sweepstakes. See Oct. QST, page 122 for rules.
- 22 Check into the 432 MHz Net on 432.110 MHz at 9:00 PM EST.
- 22 Check into the 903 MHz Net on 903.100 MHz at 10:00 PM EST.
- 25 Thanksgiving
- 27-29 CQ World-Wide DX Contest - CW. See Oct. QST, page 124 for rules.

VISITORS AT THE OCTOBER MEETING

N3PER, Ken Bromberger, Buckingham, Pa.
KB3ANO, Denise Burstein, Warminster, Pa.
KD4LAN, John Mayger, Horsham, Pa.
no call, Kurt Robinson, Morrisville, Pa.
N2PTT, Leo Eger, Titusville, NJ
N2NGU, Eric Carpenter, Titusville, NJ

JANUARY VHF SWEEPSTAKES

By Phil, WA3NUF

The cooler temperatures and the falling leaves can only mean one thing, it's time to start working on your contest station. The club board of directors are all fired up to make this the biggest contest effort ever! If you haven't heard yet, our goal is to get every Packrat on a new band in January. The club will sponsor homebrew sessions with the help of our local Guru talent, special silent auctions to help you clear your garage of those old unused antennas (and maybe help someone else to put a new band on the air), AND MANY OTHER SURPRISES.

In case you missed the Conference, Warren Stankiewicz, NF1J, the ARRL assistant contest manager reported that the League was considering a change to the Rover rule. No guarantees, but we can at least hope. Rumor is that the contest weekend is January 22-23.

The annual contest questionnaire is in the mail, so fill it out and return it ASAP. Remember to check into the Monday night nets. See you at the meeting. Bring in an old antler and help it find a new home.

ANTENNA SILENT AUCTION

Everyone is into recycling these days and so are the RATS. At the November club meeting, bring your old antennas in for a silent auction. We know you've got them out in the back yard or in a heap in the back yard. They still work but are a couple of dB's down from the BIG one you put up last year. Your spouse and neighbors will appreciate you getting rid of them too and best of all, THIS WILL HELP ANOTHER RAT TO EITHER IMPROVE HIS ANTENNAS OR WILL HELP GET HIM ON ANOTHER BAND.

EQUIPMENT WORKSHOP SCHEDULED

The first of a series of building and testing sessions has been scheduled for Sunday, November 7 an the QTH of Gary, WA2OMY. The session is primarily orientated to the building and testing of no-tune transverters however it is open to about anything that you can lug in. If it needs fixing, tuning or even assembly, bring it in. If all you have is the bag of parts (or most of them), bring it in. If you have the basic boards built but don't have the test equipment or experience to complete the alignment, bring it is. If you need help in the control circuitry, bring it in. Lots of expertise and even parts and boards will be available. Signal generators and spectrum analyzers will be available for ALL of the VHF through the Microwave bands. If you need a ride or directions get on the repeater or call Gary at 215-539-6409.

GOT A TECHNICAL QUESTION?

A portion of the regular club meetings has been reserved to answering technical questions that you may have. We have a lot of talent, knowledge and experience and are glad to share it. At the October meeting, subjects discussed were "good GaAsFETS for use on 1296", "MMICs usable for active mixers", and "stacking distances for multiple antennas on a single tower". Everyone has a chance to learn something that will help now or in the future.

HAMARAMA REPORT

Hamarama 93 was another success and it was good to be back at the Drive-In. The fit of buyers and sellers with the available space was a perfect match. Approximately 1400 buyers were there and many were attendees from the Mid Atlantic VHF Conference that said that they hadn't been at another hamfest with so many VHF goodies available. Among the many rats that were there working were: K3ACR, KP6AJ, N3AOG, WA3AXV, N3BBI, K3DMA, WB3DNI, WA3EHD, K3EOD, K3ESJ, N3EVV, N3EXA, W3GAD, WA3GFP, N3GSA, W3GXB, WA3IAC, KB3IB, W3IIT, N3ITT, K3IUV, WA3JUF, WB3JYO, W3KKN, KA3MGB, N3NGE, WA3NUF, AK30, WA2OMY, N3OZO, WORSJ, W3VIR, WB2VLA, KB3XG, WB3YEH, W1YHO, WA3YUE, and WB8ZAR.

INTRODUCTION:

Designing and building a push pull power amp is not as hard as you might think, electrically. The hard part, for me at least, is the mechanical aspect. I have a "friend" in the machine shop business, but I feel funny about begging for favors. This amplifier can be built in most ham shacks with a normal assortment of tools. The amplifier described here will conservatively put out a linear 120 watts on 3 VHF bands: 50 MHz, 144 MHz and 222 MHz. There's no tuning or switching required to cover them all.

DEVICES:

There are many articles that describe the good bad and ugly attributes of the power MOSFET. I will condense this list to a few items that are of interest to the VHF'er.

MOSFETS:

- Have higher input and output impedances.
- Are easier to match to 50 Ohms.
- Have higher gain so you need less stages.
- Are voltage devices and easy to bias.
- Are not as linear as bipolar.
- Slow up easier than bipolar.

The last item requires a warning. It is not a good idea to run a MOSFET to the limit of the output curve. Be conservative when you do your preliminary design. Combining 2, 80 Watt parts will not give you 160 Watts even under ideal conditions. Play it safe and take a dB or 2 off the top. Run the amplifier at 100 to 125 Watts. You'll be able to withstand a bad VSWR or minor cockpit error. Typical devices that should be usable in this circuit are: Motorola MRF140, and MRF141 and Thompson SD1907 and SD1908-1.

TRANSFORMERS:

Many of you have seen the CTC type of amplifier for sale. Figures 1 & 2 show this typical design. This is a very broadband design and works great for short duty cycles. Anyone who has built one will tell you that the transformers get very hot. This is a conventional transformer design where the primary and secondary windings are completely isolated. All RF current must pass through the dielectric of the transmission line. The high current makes the transformer toasty.

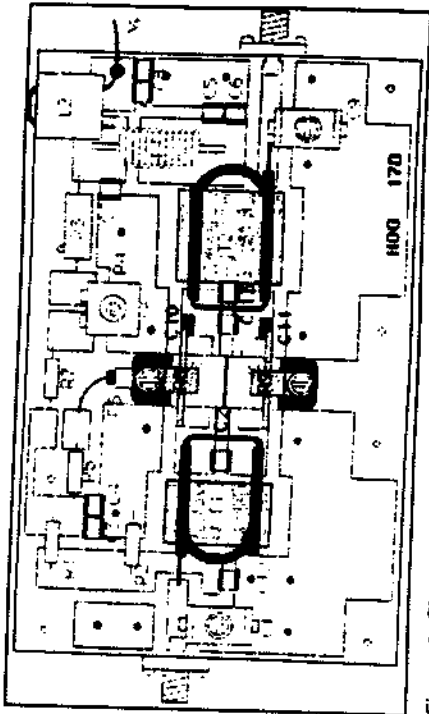
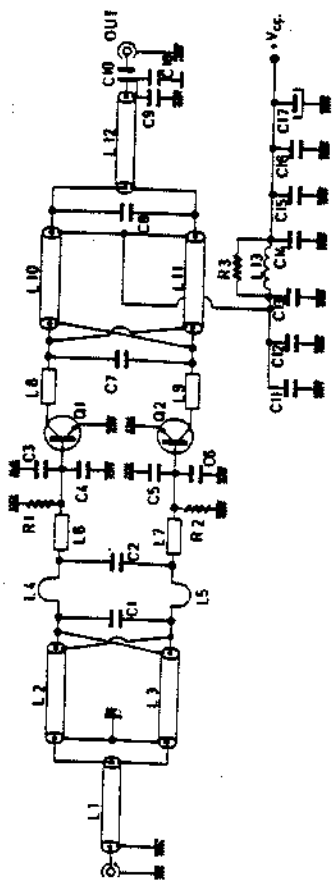


Figure 2 The component layout diagram. The only critical component



88-100 MHz; 300 W 28 V

Figure 3 FM Broadband Power Amplifier

Figures 3 & 4 show a transmission line transformer design. If you follow the schematic from device output to the output spigot, you will see a DC path between the 2 points. This type of transformer stays cool even at high power.

The single piece of coax (L1 & L12) is a 1:1 balun and splits the signal in equal parts separated by 180°. Other impedance ratio transformers are possible but the two 4:1 transformers (L2/L3 & L10/L11) are the simplest to implement.

Theoretically the maximum output power using a 4:1 transformer and 2, 28 Volt devices is 125 Watts.

Power out = $2 \times (\text{Volts}^2) / 12.5 \Omega = 125 \text{ Watts}$

If you have a higher power device, you can design a single L-section from the device output to the 12.5 Ω port of the transformer. The inductor of the L-section is already part of the circuit by default since the devices are separated by a finite distance. Placing a capacitor across the 12.5 Ω port will lower the impedance that the device sees and give you more power.

Power out = $2 \times (\text{Volts}^2) / 6.25 \Omega = 250 \text{ Watts}$

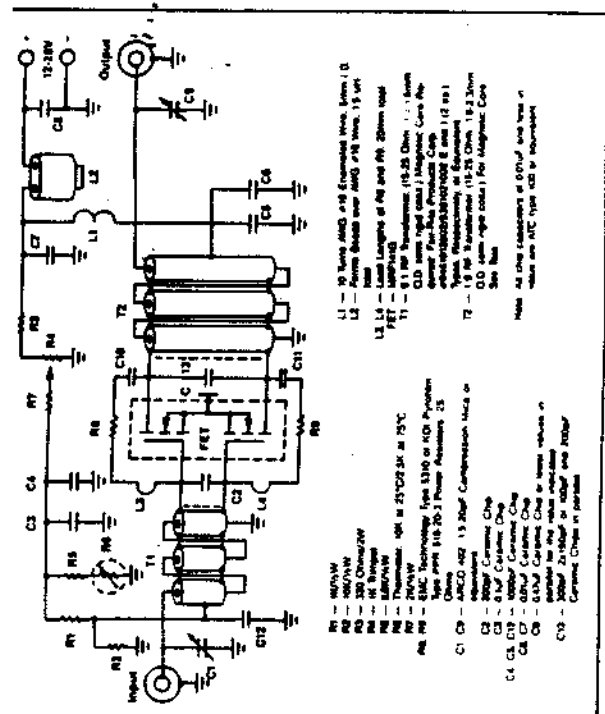
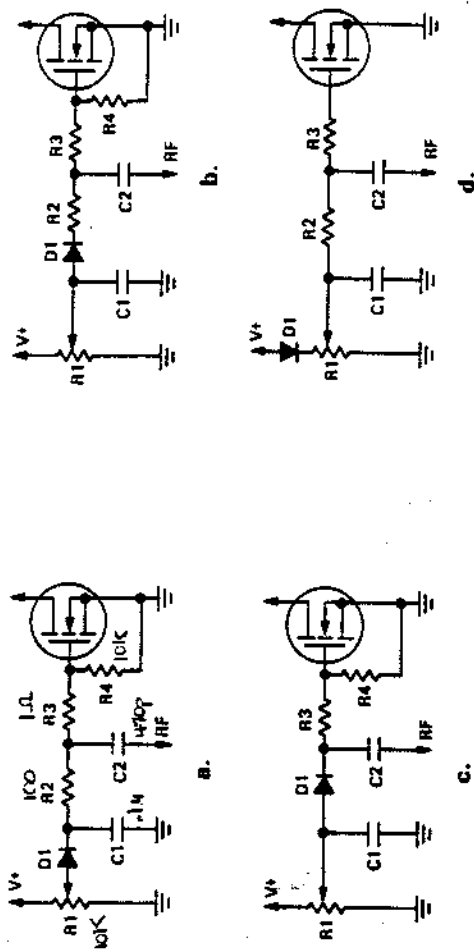


Figure 1 Schematic of the amplifier.

FIGURE 5 - Various Bias Configurations



FEEDBACK:

A simple resistive feedback network is necessary in a MOSFET circuit due to the extremely high gain of the device at low frequencies. The resulting oscillation would yield lots of power at unknown portions of the spectrum. The feedback resistor brings the low end gain down to a reasonable value, improves amplifier stability, and flattens the gain response.

The feedback resistor is the limiting factor in this design. A 10 or 20 Watt flange mount resistor is required if this amplifier were to be used at 100% duty cycle. Most of us use amplifiers under SSB or CW modulation. A 2 Watt carbon resistor will suffice.

MECHANICAL:

I stated in the introduction that minimal machining, with the exception of a few tapped 4-40 holes, was a priority. Attention should be given to the following items:

- 1). Make sure the heat sink is flat near the spot where the devices are to reside. I have seen heatsinks that look like rumble strips on a highway. The device needs to be in intimate contact with the heat sink or it will overheat and fail. (Probably during the contest) While you're at it, check the device flange. You may need to rub the flange lightly on a piece of fine sandpaper.
- 2). Do not use silicon grease like bathrub caulk. Use an extremely thin coating on the flange of the device. Mount the device to the heat sink, torquing each screw equally. Remove the device and inspect the coating of the silicon grease. If both surfaces are flat, the grease will be distributed evenly.
- 3). Wrapping is the most important mechanical item. Use thin strips of copper tape to wrap the holes cut for the FET's. Place ground feedthrus at each bypass cap and transformer grounding point. After the tape and feedthrus are in place, carefully file as much excess solder from the bottom surface as possible. If big lumps of solder are on the bottom of the board, an adequate ground will be impossible. Place screws at the input and output connectors and as close to each source lead as possible. It is very important to have the source leads mechanically connected to the board and heat sink to reduce unwanted inductance.

TESTING:

Place a load at the input and output ports. Solder a shunt capacitor (0.01 to 0.1 uf.) to each drain lead to prevent any oscillation from occurring during initial turn on. Bias the gates at 0 Volts. Limit the current of the drain supply to 100 ma. and apply 10 Volts. Current = 0 A. Increase the drain supply to 28 Volts. Current = 0 A. Slowly increase the bias voltage to 1 FET, and increase current limit of the drain supply current as needed. Adjust the FET drain current = 2 A. Slowly increase the bias voltage to the other FET, and adjust the total (both FET's) drain current = 4 A.

Remove the shunt caps from the drains and set up your bench to measure input VSWR and output power. Apply drain voltage and then gate voltage. Slowly increase the drive power to get 50 Watts out. Check the VSWR. Improve the VSWR by placing a chip capacitor across the low impedance end of the 4:1 input transformer. (See SBT's in Figure 6) This will cancel the stray inductance of the device and transformer leads. The cap should be somewhere between 25 and 50 pf. Use the same procedure on the output transformer but tweak for maximum output power. Use caution when placing the cap in a RF hot circuit. You could easily lose everything in a flash fire. Glue some test caps to wooden foam or popcycle sticks for tweaking purposes. Increase the drive to get full output power. Re-check your selected capacitors by paralleling small values to determine if you need to increase or decrease the selected capacitor values at full output power.

If you have a spectrum analyzer handy, look for spurs as you increase the power from 0 to 100 Watts. Remove the input connector (open circuit) from the amplifier and look for any spurs. If you only have a Watt meter, look for any trace of output power in both the 0 drive and open circuit condition. If this is a problem, try adding some shunt resistance to the FET gates. (25 to 50Ω)

CONCLUSION:

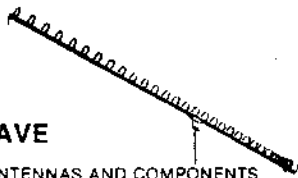
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