VHFER

LEARN BY DOING

50 MC. AND UP

Volume 5, No. 6

Nov. - Dec., 1967

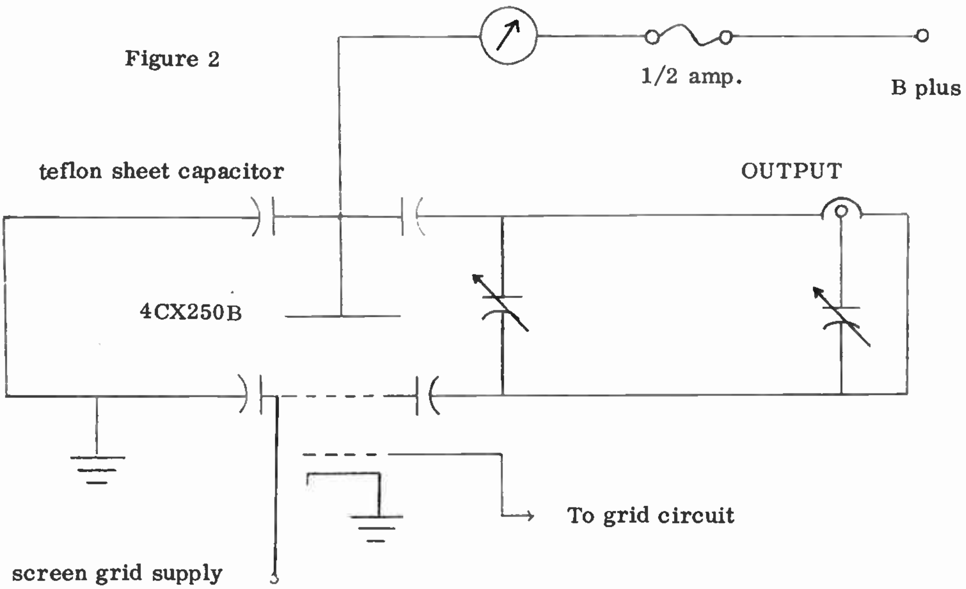


Figure 2

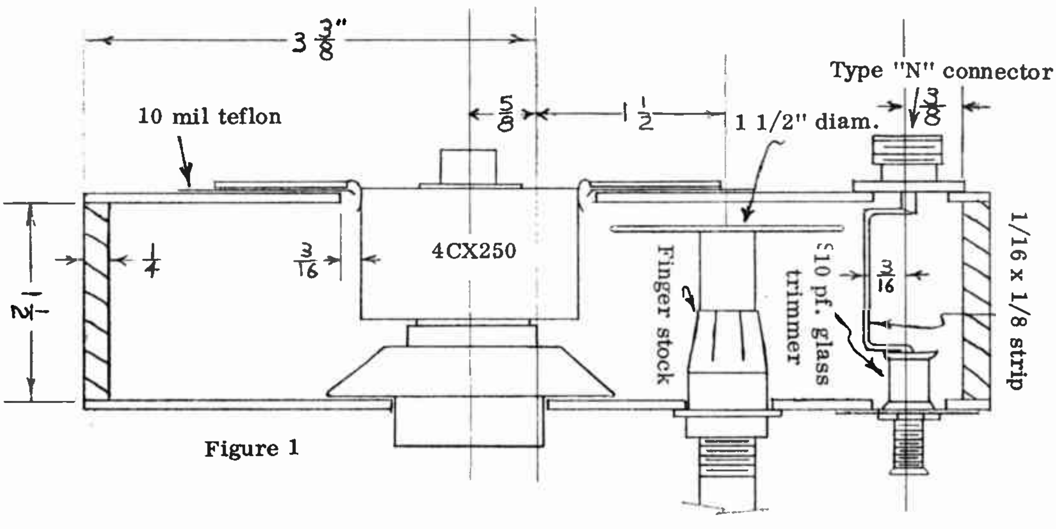


Figure 1

HIGH EFFICIENCY 432 PLATE CIRCUIT

MEASURING NOISE FIGURE--ACCURATELY

by Peter Laakmann, WB6IOM*

With the advent of amateur radio systems incorporating antennas that look at cold sky, low-noise front end design has taken on a new meaning. While in conventional over-the-horizon systems a receiver noise figure of 2 db is considered excellent and not worth improving on, systems that look at cold sky can be improved much more than 2 db by a better front end.

For example, if you now have a front end with a noise figure of 3 db and you reduce its noise figure to 1 db you can realize as much as a 6 db S/N increase with a zero noise antenna. With a parabolic antenna at microwave frequencies and low feedline loss you should realize at least 4 db improvement. It is easily seen that small changes in receiver noise figure can pay large dividends in, for example, moonbounce systems. However, the object of this article is not to discuss the sources of microwave system noise but the measurement of relatively low noise figures with simple amateur means. Most standard handbooks cover the aspect of system noise calculation well enough.

The usual excess thermal noise generator (diodes, lamps, tubes) produce a noise output that is never less than that of a resistor at 300 degrees Kelvin. When measuring a system with a noise temperature of 75 degrees (typical of a good parametric amplifier) the noise input from the generator is so much larger that any noise from the amplifier is lost in inaccuracies due to gain changes and the random nature of noise.

The system described here makes use of a cooled termination (liquid nitrogen), a weak signal generator and any type of a.c. voltmeter. Any type of amplifier can be measured, even a parametric amplifier, without an isolator or circulator. The measurement is as accurate as the a.c. voltmeter's relative calibration. Gain changes of the system or bandwidth of the receiver do not have to be known.

The principle of the cooled-load technique is to compare the system noise output between a load at ambient temperature (300°K) and one at 77°K. With a noiseless front end the output noise should drop 6 db. This basic technique is rendered almost useless by the fact that the impedances of the two terminations used are never exactly the same. A slight change in impedance can cause very large changes in gain that can destroy all chances of accuracy. This is particularly true of tunnel diode or parametric amplifiers but it also applies to most transistor front ends.

The author's contribution to the basic substitution technique is the insertion of a weak signal source in series with both the hot and cold load. This signal is constant and provides a convenient monitor of gain, or a way of measuring signal plus noise to noise directly. The weak signal source is coupled through a very small capacity to the inner conductor of the 50-ohm line. The coupling reactance is so large that the impedance of the load is not affected. By the usual Thevenin's transformation the signal can be thought of to originate from a voltage source in series with the termination. If the impedance of both terminations is close to 50 ohms the voltage source is practically the same for both loads. Even if the two terminations differ by 10% from each other the maximum noise voltage error can not exceed 10%. It is a relatively easy matter to measure vswr or reflected power for most amateurs so that finding two terminations close to 50 ohms should be no problem. Not all terminations work well in nitrogen so be sure you check the reflected power when the termination is cold.

*8001 Airlane Avenue, Los Angeles, Calif. 90045

The weak signal adapter is constructed from an "N" straight adapter or whatever fits your amplifier. A small hole is drilled in the center to accept the center pin of a chassis type "BNC" with some clearance. The pin should just slightly protrude to the inside. The threaded portion of the BNC is then soldered to the outside of the adapter. The cable going into the nitrogen should be as short as possible as any part not covered by nitrogen produces noise at a higher temperature. RG/58 or its teflon counterpart is about as large a size as can be used without boiling of the nitrogen at too rapid a rate. With a full bottle the set-up is good for about 2 hours of measurements. With no attenuator cable inserted, the liquid will boil off at about 3 inches per day, so two bottles are good for a weekend of measurements. When storing the liquid nitrogen, be SURE to drill a small hole in the cover of the container to let the gas escape.

MEASURING PROCEDURE:

1. Check the impedances of both terminations through the test adapter. They should both be as close to 50 ohms as possible.

2. Connect the 300°K load and tune in the weak signal source. Adjust the weak signal source level for a S/N ratio of 10 (20 db) if the dynamic range of your receiver allows. At a 20 db S/N ratio the noise adds only 1% to the rms signal level so it can be neglected. If you have to work with a lower S/N ratio this can, of course, be taken into account. Use the largest possible bandwidth and make sure that your receiver is not overloading or is on AGC. Record the signal level output and the noise level output (tune away from signal or turn the signal off.)

3. Connect the cold load and adjust the receiver RF gain for the same pilot signal reading on the voltmeter. Read the noise level.

4. Repeat steps 2 and 3 and average the readings.

5. Compute the receiver input noise temperature. Note that noise temperatures, contrary to noise figures, add up.

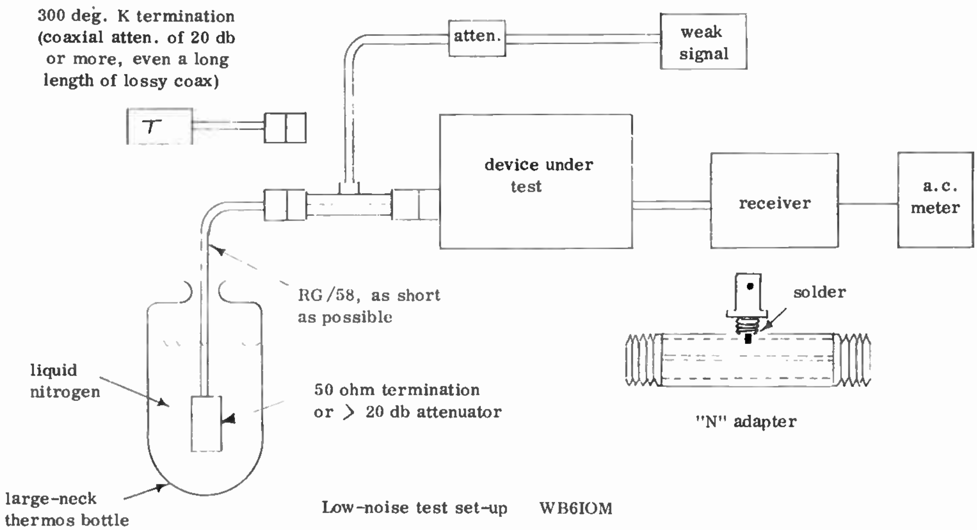
$$\left(\frac{V_n\ (300)}{V_n\ (77)}\right)^2 = \frac{300 + T_r}{77 + T_r}$$

The left side is the noise power ratio at the output of the receiver, while the right side is the temperature ratio. T_r is the noise temperature of the receiver. You may convert the noise temperature to noise figure by remembering that noise figures are given relative to a 300°K source.

$$NF\ (db) = 10 \log \frac{300 + T_r}{300}$$

Editor's Note: I called a distributor of liquefied gases to see about the price of small quantities of liquid nitrogen and found it is about $2 a liter (quart). But the catch is that you need to rent a container for about $2 a day. An ordinary vacuum thermos is a hazard. A good part of the nitrogen will be used cooling down the container. So it looks like you should be prepared to spend about $6 or so.

A contrary opinion is given by the author who says that ordinary wide-mouth thermos bottles are used in the aircraft plant where he works and that there is no trouble and that the liquid nitrogen is not as dangerous as most people think. Don't put your finger in it but if you should spill some it rapidly boils away. You MUST put a hole in the lid of your thermos to let the gas escape or you will have an explosion in short order, just as you would if you filled a bottle with water, stoppered it and then heated it.



Low-noise test set-up WB6IOM

THIS IS THE LAST ISSUE OF VHFER

In the last issue we mentioned our problems of continuing VHFER. Primarily it was a matter of requiring more time than I could spend because of our growing medical electronics business and also because we couldn't get articles. Jim Fisk, a well-known VHF man is editing a new ham magazine from New Hampshire. He has agreed to take over the VHFER subscription list and send you his new magazine (not strictly VHF) until your VHFER subscription expires. Anyone who wants his money back instead, clip the address label from your last VHFER and send it to us for a refund. I realize the expiration dates on many magazines are confusing because we changed the coding when we changed from monthly to every other month, and again when the rate was changed. We have not accepted subscriptions for the past month or so. All those who sent in money will get their checks back or a refund.

I want to thank all of our subscribers for their support of VHFER. It is not for lack of subscriber interest that we are stopping. We think we did quite well in building and maintaining a good subscription list considering the technical nature of the mag.

We will still be selling converters, though they will not be pushed. Probably new designs will come along during the lulls in business. There was no advertisement in this issue because of lack of space.

For late VHF information and skeds you can check into or listen to either of two VHF nets on Sun eve. One is at abt. 10 PM CST and another at 9 PM PST. Both on about 3810 kc.

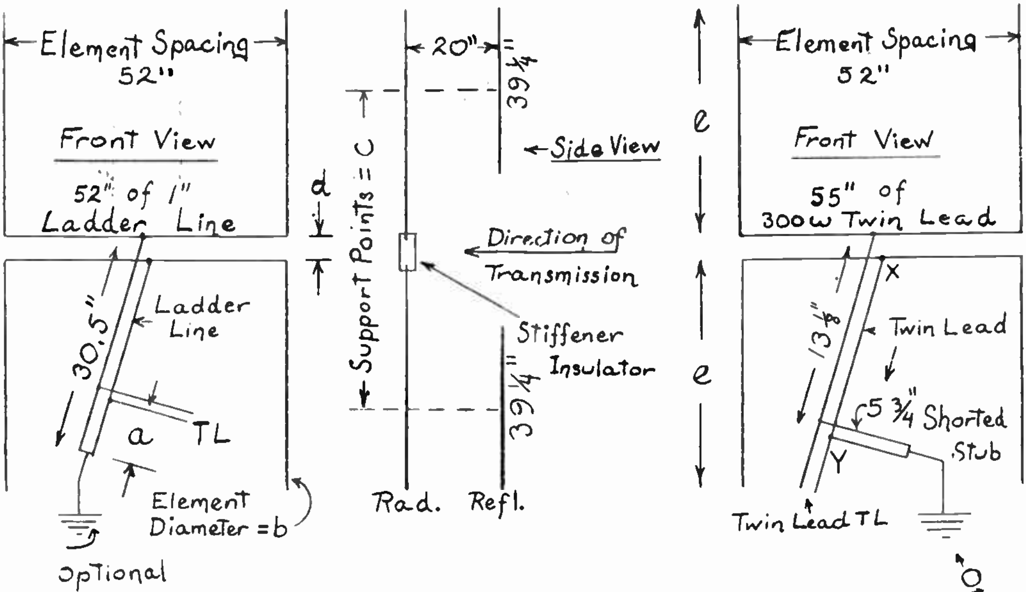
NOTE: The notice below is required of all second class mailers. But do not be misinformed. This is the last issue of VHFER. We are discontinuing publication.

VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U.S. & Possessions, $1.50 per year. Canada & Mexico, $1.75 per year. Other countries, $2 per year. Second class postage paid at Beaverton, Oregon 97005.

W6GD ANTENNA NOTES
continued from last issue

Fig. 5 EIGHT ELEMENT ARRAY USING EXTENDED DIMENSIONS

11 db Gain



Shown above are two front views utilizing different types of feeding and phasing harness.

Clamp all elements directly to wooden supports; reflectors at their mid points and radiators off-center. With 1" ladder line, or twin-lead harness, use 1" end-to-end radiator spacing and 57 1/2" between support points. When 2" line is used for harness, space radiators to 2" apart, end-to-end, and use 58 1/2" between support points. A slight twist at center point to permit a practicable take-off for the line at each end. The dimensions shown below for 1" ladder line also hold for #12 wire spaced 2". Both have impedance of 470 ohms.

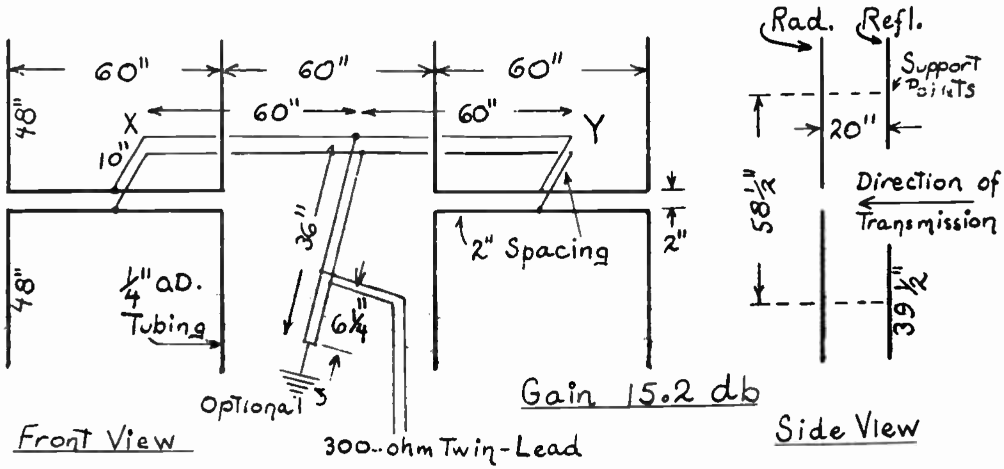
This array has one db less gain than a 16 element array with conventional lengths and spacings. Gain of latter is 12db, not 14 db, as claimed. Polar pattern as follows: First null 51 degrees off center of beam. Next lobe off end, but fairly weak. Minor lobes in rear quadrants.

Plastic line stiffeners were used at X and Y in twin-lead harness. If they are not used a slightly different SWR may result.

a				b	c	d	e
150Ω	200Ω	300Ω	470Ω				
3 1/4	4 1/4	5 3/8	6 3/4	1/4	58 1/2	2	48
3 1/4	4 1/4	5 3/8	6 3/4	1/4	57 1/2	1	48
		5 1/2	6 1/4	3/8	57	2	46

All Dimensions in inches.

Fig. 6   16 ELEMENT RECTANGULAR ARRAY WITH EXTENDED DIMENSIONS



Stub and tap dimensions courtesy W6EJL.

Clamp all elements directly to wooden supports. Note that reflectors are clamped at their mid-points but that radiators are supported off-center.

Precise antenna tuning procedure may show slightly different reflector dimensions than 39 1/2", but this value is sufficiently close.

Polar pattern: First null 19 degrees off center of beam. Second null 42 degrees off center. Nulls off ends. Minor lobes in rear quadrants.

If array is designed with half wave (40") broadside spacing, pattern will be as follows: First null 30 degrees off center of beam. Second lobe 48 degrees off center. Nulls off ends. Minor lobes in rear quadrants.

Method of feeding latter type same as shown above except that dimension X-Y will be 80" instead of 120". Stub and tap dimensions will be entirely different than those shown above and must be determined by procedure outlined in these notes. Use 470 ohm phasing lines.

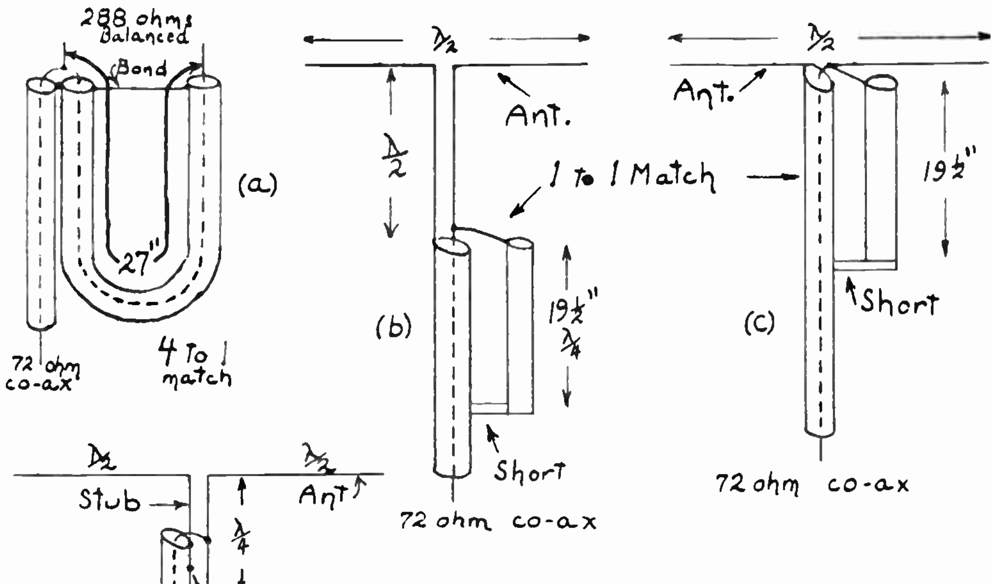
The center impedance of these extended dimension arrays is usually reactive; hence it is impossible to attempt impedance matching by varying the phasing line spacing. The type of stub shown above is the most practicable for this general type of impedance matching.

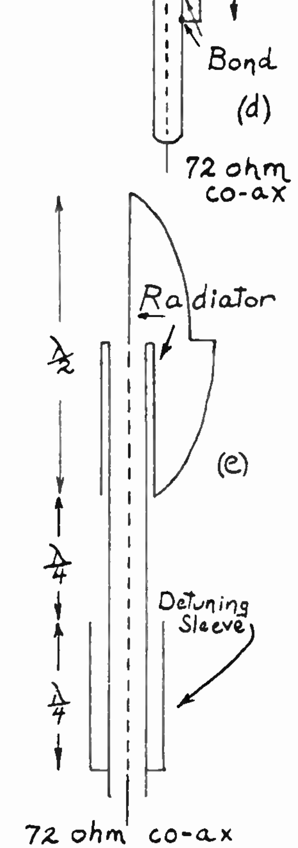
The first nulls in these arrays are extremely deep and sharp and provide an excellent method of cutting out QRM.

Note: For all these rotating antennas use half or full wave sections of flat 300 ohm twin-lead between the antenna and the main line, for the flexible section. Don't allow them to touch the pole. Use a good brand of twin-lead. Do not use perforated twin-lead for this purpose as it deforms easily. Be sure to allow for the proper VP of the twin lead.

The MICROWAVE DIRECTORY of hams in Calif. & in Seattle is available from K6KBE at 492 Lomer Way, Milpitas, Calif. 95035. There are about 25 hams on the present list with more being added. This is a Xeroxd list so please don't write for it unless really interested. It is free.

Fig. 7





(a) Use with 300 ohm balanced load, including a J antenna. Steps up impedance 4 times and changes from unbalance at 72 ohms to balance at 288 ohms (essentially 300). The loop must be one half wave long. Allow for proper VP. Will cover entire 144 - 148 mc range.

(b) and (c) Two adaptations of another type of balun, actually a decoupling section. The quarter wave bar should be about same O.D. as co-ax, and spaced 1" to 2" on centers. Too close spacing reduces impedance and effectiveness. Another form is a co-axial sleeve about 3 to 4 times the O.D. of the co-ax. See (e). This type has only a 1 to 1 transformation ratio.

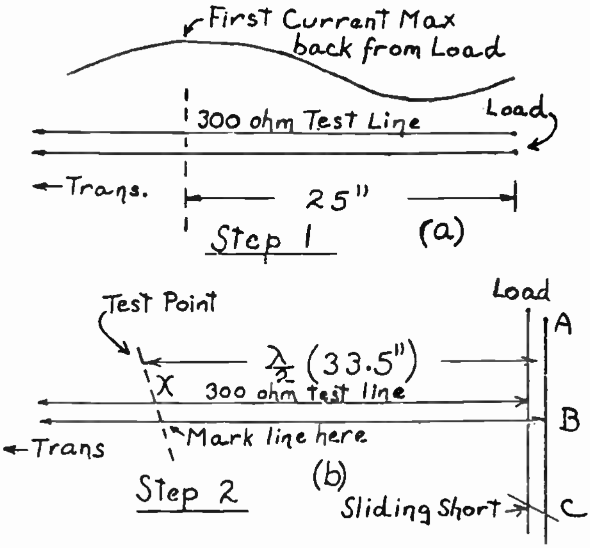
(d) (From G.V. Dale) This arrangement permits matching a 72 ohm co-ax to a balanced full wave (or extended full wave) antenna, providing the stub is the correct length for the antenna used. Tap the center conductor on the stub at the 72 ohm point. Bond the outer conductor securely to the stub at two or more places, as shown. This arrangement may be used on any antenna utilizing this type of stub, including the "J".

(e) Co-axial antenna with detuning sleeve. This sleeve decouples the outside of the line from the antenna. Indiscriminate arrangement of the line below this point may still permit direct radiation from the antenna into the line.

* * * * *

Use twin-lead sparingly for VHF, particularly where the line lengths are appreciable. The loss is relatively large, and rain causes a definite impedance change. One inch to two inch line has definite advantages, if carefully used.

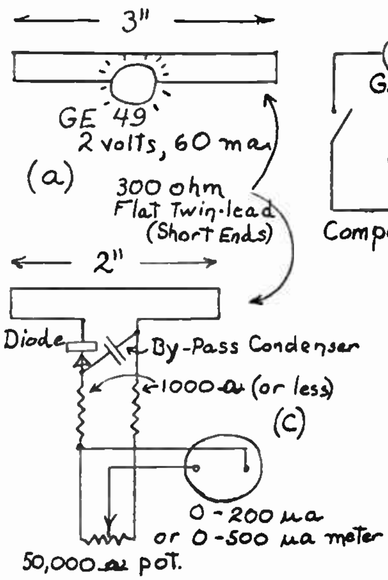
Fig 8 METHOD OF TERMINATING A BALANCED LINE TO ANY BALANCED LOAD

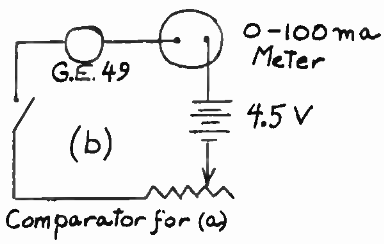


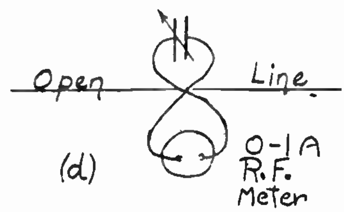
Step 1. Locate first current max point back on test line from feed point on any antenna system. The value of 25" used here is for example only.
Divide distance back to first max by VP of twin-lead (82%). This gives 30.5".

Step 2. Make up a stub A-C of ladder line (or larger wire) equal to 30.5", plus about 4" for adjustment. Connect A to load point on antenna; put sliding short at C; and tap test line on at B. Mark test point X, 33.5" from B (one electrical half wave on this type of line).
Follow detailed instructions in Section 9.

Fig. 9 STANDING WAVE INDICATORS







(a) Mount test loop on plastic holder and slide along similar type line. Keep in perfect register at all times.

(b) Use comparator circuit to indicate relative current in test loop (a) at max and min points.

(c) This is a more sensitive and more accurate device.

(d) Resonant indicator for open wire lines having 2" spacing or greater. Pick-up coil consists of small "figure 8" inductance (as shown) coupled to but not touching one wire of the line at a time. Resonate circuit (detune slightly if too much reading is obtained). Keep plane of pick-up loop at right angles to plane of two wires of line. This device will read current standing wave in each wire independently. Mount device in small plastic frame with slides or small wooden wheels and move along one wire at a time. Each loop of the "figure 8" inductance should not be over 3/4" in diameter. Use more turns in each half of "figure 8" for lower frequencies.

This completes the W6GD Antenna Notes series by the late Oliver Wright. Unfortunately, the modifications and additions promised did not arrive by our printing date.

A HIGH-EFFICIENCY PLATE CIRCUIT FOR 432 MEGACYCLES

H.E. Holshouser, Jr. K4QIF*

The 4X250 and 4X150 series of esternal anode tubes have become quite popular for use at 432 megacycles. Often, the most serious problem encountered in the design and construction of such amplifiers is the efficient transfer of power from the plate of the tube to the load. Coupling to a conventional tuned line type circuit can be quite tricky, and when measurements are made with reliable equipment, results can be quite disappointing.

The circuit to be described is a radial development of quarter-wave stubs with simple capacitive tuning across the high impedance points. There have been some compromises made in the design for the sake of simplicity and ease of construction. However, judging from the final evaluation, there is little degradation in performance.

Cavity Construction

Basically, the cavity is constructed from a brass or copper cylinder with an inside diameter of 6 1/4" and a length of 1 1/2", and two flat side-plates of brass or copper. It is advisable to use material at least 1/8 inch thick and preferably 1/4" thick for the cylinder and material 1/8" thick for the side walls. Extreme care must be taken to insure a tight fit between cylinder and the cavity walls. This joint is at a high current point, and a sloppy fit would degrade efficiency. It would be a good investment to have the ends of the cylinder milled flat at a machine shop. The walls are secured to the cylinder by use of a liberal amount of machine screws. The necessity of mechanical rigidity will demand the heavy construction described above.

The tube and socket assembly are mounted in the cavity on a center line 5/8" from the center line of the cylinder. Figures 1 (front cover) and 1a are largely self-explanatory as to dimensions. The hole cut in the top wall of the cavity should clear the tube anode on all sides by 3/16". Care should be taken to avoid any sharp edges on this hole to retard arcing.

The plate of the tube is coupled to the top wall of the cavity by use of a fabricated by-pass capacitor. The capacitor is constructed from a 3 7/8" square brass plate with a hole cut in the center which is lined with finger stock to contact the plate of the tube. Again, the edges of this plate should be smooth and free from sharp edges. The capacitor dielectric is 10 mil Teflon. The capacitor plate may be secured to the cavity wall in a number of ways so long as adequate insulation is maintained. The author used a Teflon bushing in each corner.

The tube socket may be any of the Eimac SK-600 series with the built-in screen by-pass capacitor. No chimney is needed, but you must force-ventilate the tube.

Tuning

The cavity is tuned to resonance by a disc-type capacitor across the high-impedance points of the walls as shown in Fig. 1. Adjustment is accomplished by use of a lead screw. The author used finger stock to insure good electrical contact and hold lost motion to a minimum. The edges of the capacitor disc should be smooth and rounded.

Output Coupling

Power is coupled out of the cavity by use of a tuned link as shown in Fig. 1. The link was constructed from 1/16" x 1/8" brass strap and formed and mounted as per the drawing. The output tuning capacitor is a small glass piston trimmer. Any small capacitor with a maximum capacity of about 10 pf. should be satisfactory if the dielectric is of high quality. Do not attempt to use a plastic trimmer here as its losses will prove too great and the device will quickly be ruined.

The grid circuit will be left as a matter of choice to the constructor. The author used a circuit similar to that presented in the ARRL VHF Handbook. It is simple and works well.

No neutralization was employed as the 4CX250 is largely self-neutralizing at 432 Mc. There was some flutter in grid current as the plate was tuned through resonance but no tendency toward instability was apparent.

A few words of caution might be in order. It is advisable, with this type of circuit, to use a half-amp. fuse in series with the B plus line and plate meter. In the event of an arc this will save a plate meter.

You should constantly monitor the screen current and do not, under any circumstances, exceed the manufacturer's ratings. Do not attempt to load this amplifier into a load that is not essentially flat (resistive.) Otherwise there may be arcing, especially around the tuning capacitor, and the life of the final tubes will be shortened due to excessive screen dissipation. The circuit was designed for a 50-ohm load, however a 75-ohm load seems to be perfectly acceptable.

Results

Running at an input of one-half KW, with 1750 volts on the plate and 255 volts on the screen, the plate efficiency was measured to be 63%. At lower plate voltages the efficiency will increase somewhat. At 800 volts the efficiency is 74% with the screen current within limits.

Failure to achieve expected efficiency is probably the result of over coupling to the load. This will be exemplified by a very shallow plate dip and probably screen current of reverse polarity. Generally a decrease in output tuning capacity will remedy this. The author has found by experimentation that maximum efficiency occurs with the output capacitor adjusted so that the screen current is near zero.

One final word of caution: Use good quality coax in coupling from the final. Even RG8/U Polyfoam heats considerably.

Editor's note: If your plate supply should fail or the fuse in the plate circuit should blow while you have excitation applied, screen current could quickly become excessive and ruin the tube unless you use a screen supply that limits maximum screen current. In my rig I use a resistive string from the high voltage with VR tube "catchers" at a voltage above where the screens should run or at about the same level. The VRs limit the maximum voltage that can be applied to the screen and the resistor string to high voltage limits the maximum current that can be drawn and also assures me I have no screen voltage when there is no plate voltage. The VRs are lit only when there is no excitation and therefore no screen current. They are not used to "regulate" screen voltage. Other methods are given in the various handbooks.

*3800 Yaupon Street, Chesapeake, Va. 23703

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to all of you who have contributed articles and information to VHFER in the past. Special thanks go to Victor Michael for his Moonbounce Newsletter series, to our un-paid but very willing helper Marilyn Wiseman for her Open Bands column, Al Olcott, K7ICW. Special thanks also go to Wayne Green, who gave us un-ceasing special help in both getting VHFER going and keeping it going. Editorial staffs of all three major ham magazines and several of the smaller ones have been very kind.

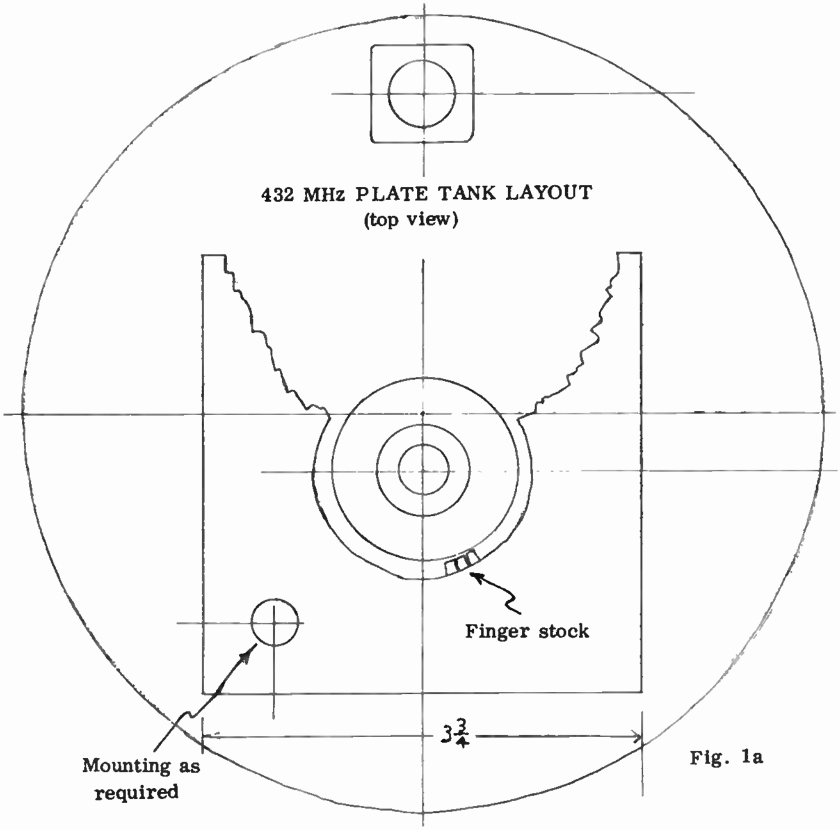


Fig. 1a

PLANAR TRIODE TUBES FOR UHF AMATEUR SERVICE

Robert I. Sutherland, W6UOV

Planar triodes (or lighthouse tubes) are well suited for amateur use in the UHF spectrum. Various surplus versions, such as the 2C40, 446B and 2C39 have been used at frequencies up to 1300 Mc. A new planar triode, the 3CX100A5 is now available for improved service in this frequency region.

The 3CX100A5 is relatively unknown to the amateur fraternity, but its older relative, the 2C39A, has been long a favorite UHF tube of the "surplus hounds." The 3CX100A5 is an improved, modern version of this old World War II tube, dressed up in a brand-new ceramic and metal envelope. This tube, and its twin, the 7289 fit into the amateur picture very nicely as a straight-through amplifier, a doubler, or as a tripler in the frequency range of 1000 to 3000 Mc. In addition, it is not expensive, and various glass versions of the older 2C39/2C39A/2C39WA can often be obtained at give-away prices on the surplus market.

The following data covers grounded grid operation of the 3CX100A5 as a UHF power amplifier and multiplier. Because of the high power gain of the tube, grounded grid circuitry is desirable, since intercoupling between the input and output circuits is reduced to a minimum, and neutralization is not required. This data can be used to estimate the performance of the 2C39 glass family of tubes by noting that the useful power output of this style tube will be somewhat less (depending upon the frequency) by an amount up to 25 percent at 2.5 kMc. as shown on the graphs.

Various 3CX100A5 tubes were run in a coaxial cavity capable of tuning from 1000 Mc. to 3000 Mc. A series of measurements was made using a representative sample of standard production tubes, with the tube under test operating as an amplifier, doubler and tripler. Drive and output power were carefully measured for each test, and appropriate filters were used to eliminate feedthrough and harmonic output and therefore was measured as such. When the tube is operated as a doubler or tripler, the feedthrough power is at the driving frequency and is undesired. In actual use, it is necessary to eliminate this power from the output circuit of any grounded-grid frequency multiplier. High-Q tuned circuits or wave filters will do the job.

A graph of average tube performance is shown in Fig. 2 of the UHF grounded-grid amplifier circuit. Grid drive, grid bias, and plate loading were adjusted to provide maximum power output while maintaining the plate current at 100 ma. Average potentials for tubes tested are indicated on the graph. At 1300 Mc., for example, the 3CX100A5 is capable of a power output of about 47 watts at an efficiency of 47%. The power gain of the tube is 8 decibels, indicating a required drive level of about 7.5 watts as measured at the input of the coaxial fitting to the cavity. Power output gradually decreases as the frequency of operation is raised. At 2400 Mc. power output (at 100 watts input) drops to 25 watts, and grid driving power increases to 10 watts. Power gain at this frequency is 2.5. The comparative curve for the 2C39A tube over the same frequency range is shown by a dotted line on the graph.

The same sample of tubes used in previous tests was used in performing the gain and power output measurements for the doubler configuration. Excitation was applied at half-frequency and the same precautions were followed as in the case of the amplifier. Test conditions were adjusted for maximum power output at a plate current of 100 ma. At 1300 Mc., power output is about 27 watts, with a circuit efficiency of 27%. Power gain is 5.4 decibels. Accordingly, a drive power of about 8 watts is required. At

2400 Mc., power output is 13 watts, with a drive power of about 9 watts. Power gain drops to unity at a frequency of about 2700 Mc. The tube is still useful as a frequency doubler to this frequency, however, as a power output of 10 watts can be obtained. The 2C39A curve is shown as a dotted line on the graph (Fig. 3.)

The same tubes and general test techniques were used to determine the operating parameters of this tube as a frequency tripler. Drive power was applied at one-third output frequency and the circuit was adjusted for maximum power output. At 1300 Mc, 17 watts of power were obtained with about 10 watts driving power. At 2400 Mc., power output was about 8 watts. Driving power was about 12 watts (Fig. 4.)

A complete socket for the 3CX100A5/2C39 tube tube is a rare bird indeed. Most equipment has the tube sockets built directly into r.f. cavities. Collet rings for the tube, however, may be bought from Instrument Specialties Co., Little Falls, N.J. The catalog numbers are: Plate collet, #97-70; grid collet, #97-72; cathode collet, #97-76; filament collet, #97280. The Braun Tool and Instrument Co., 140 5th Avenue, Hawthorne, N.J., can supply the following: Plate collet, #134-53; grid collet, #134-51; cathode collet, #165; filament collet (none). A complete socket assembly may be purchased from Jettron Products, Inc., 56 Route 10, Hanover, N.J.

Conclusions: The planar triode tubes of the 3CX100A5 family perform well in the frequency range encompassing the 1215 Mc. and 2400 Mc. amateur bands. Efficiency is good, considering the frequency of operation. Radio Engineering by F.E. Terman indicates that a doubler will provide about 65% of the power output of a straight-through amplifier, and a frequency tripler will provide about 40% of the power output of the amplifier. These figures agree closely with the data shown herein. A pair of 3CX100A5's should make quite a dent in the 1215 Mc. band. See you on the high end!

Type	Manufacturer	Comment
2C39A	Eimac, Machlett	Glass or ceramic construction
2C39WA	"	"
6897	General Electric	Not interchangeable electrically in most high frequency sockets with 3CX100A5 or 7289
2C41	Machlett	Not interchangeable physically with 3CX100A5 or 7289
381	Eimac, Machlett	3CX100A5 type, rated for pulse service (Eimac-glass or ceramic)
3CX100A5	Eimac, Machlett General Electric	All ceramic construction
7289	Eimac, Machlett, General Electric	Identical to 3CX100A5
3CX100F5	Eimac	Identical to 3CX100A5 except heater voltage is 26.5 volts

Figure 1 - Planar Triode Tubes

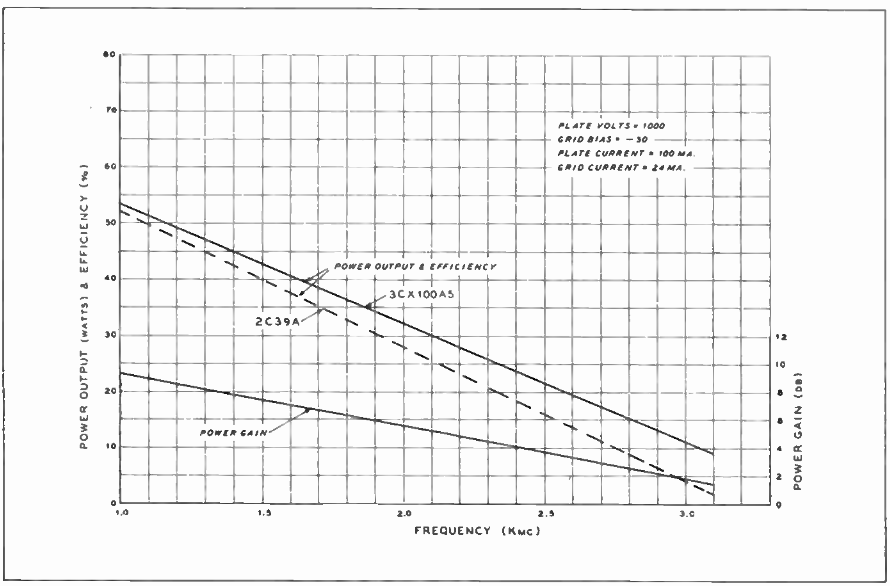


Figure 2. 3CX100A5 grounded grid amplifier; typical power output, gain and efficiency. Glass 2C39A power output shown by dashed line.

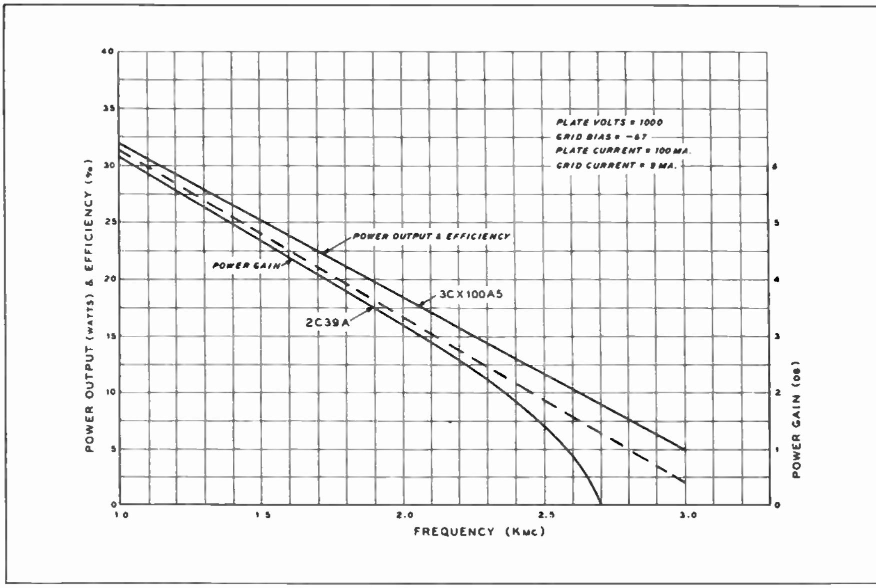


Figure 3. 3CX100A5 grounded grid doubler; typical power output, gain and efficiency. Glass 2C39A power output shown by dashed line.

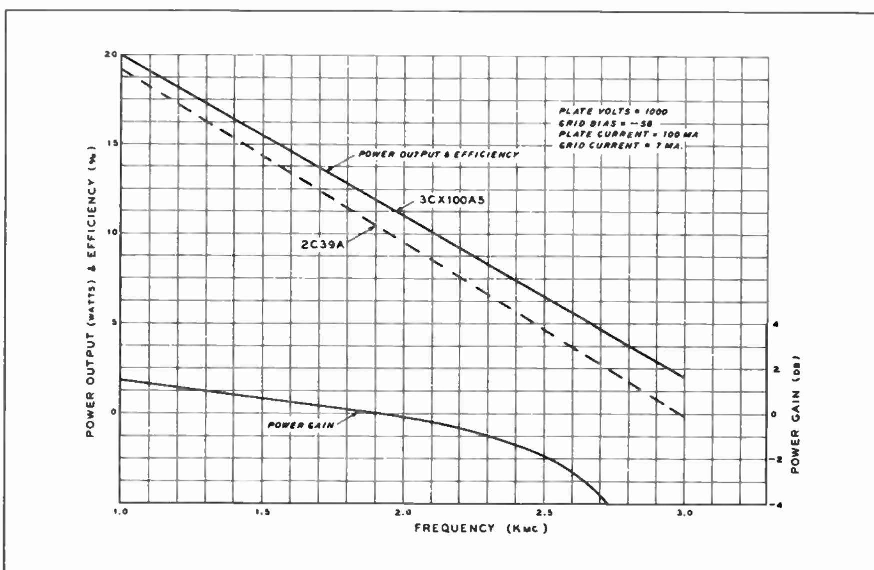


Figure 4. 3CX100A5 grounded grid tripler; typical power output, gain and efficiency. Glass 2C39A power output shown by dashed line.

OPEN BANDS

by Marilyn Wiseman, K8ALO

As the year comes to an end, I'd like to thank all who have sent reports in. Hope next year is as successful. Best Season's greetings and sincere good wishes to you for happiness in the New Year. See you next year. My address: Box 103 Petersburg, Ohio 44454.

50 MHz:

Oct. 7-29	K7ICW (Nev) wrkd WØJXK/7 (Idaho), WA7FJQ, WA7FLB, K7YVS, WA7FPO (Ariz), K7MWC (Wash), plus 7 Calif stations. Hrd W5SFW, W5LHD, WB6NMT, WA6AKM.
Nov. 4-23	K7ICW (Nev.) wrkd WA7CJO, WA7FLB, WA7FPO, K7PRS (Ariz), K6GJD, K6ODV (Calif). Hrd WA7FPU, WA7FJQ, plus 4 Calif. stations.

50 MHz Meteor Scatter:

Oct. 8	K7ICW (Nev) hrd W5LHD (Tex).
Oct. 15	K7ICW (Nev) wrkd WØJXK/7 (Idaho) 700 mi.
Nov. 4	K7ICW (Nev) wrkd K7EBW, K7FRS, WA7CJO, K7PRS (Ariz), WA5EWV, W5LHD (Tex), K6IBY (Calif) hrd W6PUZ/7 (Wash), K5OOJ, K6RIL, K6GJD, WA6RGL.

144 MHz Tropo:

Sept. 20	W1YTW (Me) wrkd VE1AFB (Nova Scotia)
Oct. 1-29	K7ICW (Nev) wrkd W6DQJ, W6YVO, K6IBY (Calif)
Oct. 31	W1YTW (Me) wrkd K4QIF, WB4HIP (Va), W3HB, W3LUL (Md).
Nov. 2-26	K7ICW wrkd K7RKH (Nev), W6DQJ, W6YVO, K6JYO, K6HAA (Calif).
Nov. 25	K5BDQ (Tex) wrkd WA5HVZ, W5ZJO (La), WA5FTN/4,WAØQDP/Mobile (Fla.) 725 mi., K4ZNE, WA4LIP, WA4AZE (Ala) State #6.

144 MHz Aurora:

Sept. 20	W1YTW (Me) wrkd K3CFA, W3BYF (Pa), VE3ASO (Ont), W8FEH (Ohio).
Dec. 1	W8NUB (Ohio) wrkd W2CRS (N. Y.) Also hrd WØNXF (Neb). Jim says the intensity was rather low, but sufficient enough for him to wrk N. Y.

144 MHz Meteor Scatter:

Oct. 20	K7ICW (Nev) wrkd WØLCN (Minn) 1385 mi.
Oct. 21	K7ICW (Nev) wrkd WØLER,WØLCN (Minn) 1385 mi.
Nov. 17	W1YTW (Me) wrkd K4EJQ (Tenn) Frank says this was the only contact made of three skeds. This contact made 34 states for K4EJQ. K7ICW (Nev) wrkd WØLER (Minn). K1HTV (Conn) wrkd WA9DOT (Wisc). WN9UHB (Ill) ran a sked with K1HTV (Conn) but only hrd parts of the call on short bursts.
Nov. 18	WN9UHB (Ill) wrkd K1HTV (Conn). Donna has wrkd Ill, Ind, Iowa, Ky, Mich, Mo, Ohio, Wisc, and Conn so far. She also wants to try moon-bounce on 432 MHz, but will experiment with some back fire arrays on 2 meters. Note: This may be the first XYL novice to attempt m/s with any success.

Note: It is probable that Open Bands will be continued about as it is in the new magazine. I presume you can still send material to Marilyn. Column continued on the back cover.

432 MHz:

Oct & Nov.	K7ICW (Nev) hrd W6DQJ (Calif) no contact completed.
Nov. 8	W3RUE (Pa) wrkd K2YCO 235 mi.
Nov. 21-23	W3RUE had partical contact with W4FJ (Va) 240 mi.
Nov. 25	W3RUE (Pa) wrkd W4API, W4EXI (Va) 180 mi.
Nov. 27-29	W3RUE (Pa) had partical contact with W4FJ (Va).
Nov. 29	W3RUE (Pa) wrkd W8MNT (Mich) 270 mi.
Nov. 30	W3RUE (Pa) wrkd W4FJ (Va).
Dec. 4	W3RUE (Pa) wrkd KØDOK (Mo) This is first 432 MHz Pa. and Mo. contact. This gives Ted 12 states, 6 areas. He heard KØDOK for about 1 1/2 hrs peaking at 579. Also wrkd W9BRN 325 mi., W8DED 250 mi., W8HUX 270 mi., W8RQI 220 mi.

Skeds Wanted

W1YTW	Frank L. Dennett P.O.Box 102 Kittery, Me. 03904 is interested in 144 MHz skeds for all major showers. Short distance skeds east of Miss. prefered due to low power Xntr 200w into single 4CX250 final. Ant 32 ele colinear. Rcvr 417A conv. into R 4A freq. 144.029 - 144.194 MHz.
K4EJQ	J.G. "Bunky" Botts, Rt 2 Box 72, Bristol, Tenn. 37620 wants 432 MHz skeds with stations in Ga., W. Va., and Ky. Power 100 watts using 10/10 J beam, H.B. transistor ccc ahead of HQ180. Skeds would be from mtn. top QTH on Sun. and Thurs. nights. Bunky says he can meet skeds at most any time and can wrk 144 MHz for back up skeds. Freq. 144.035 - 432.018 CW on 432 MHz.
WN9UHB	Donna Hicks, 12754 Irving St., Blue Island, Ill.60406 wants 144 MHz SSB m/s skeds. Equip. 75w 20A, PH heterodyne unit. Drake R-4 416 B Pre.amp. 6N2 Conv. 100''tower with RG 17 A/U coax. 20 ele telerex Long John Freq. 144.008.
K1HTV	Richard Zwirko, 19 Lancer Dr., Thomasonville, Conn.06082 wants 144 MHz skeds for all major showers with stations in Kans., La., N.Dak., Okla., and N.E. Tex. Also SSB skeds with anyone needing conn. 500 w CX250 11/11 yagi 3/4" aluminum cable SB101 6360 mixer CN 144 Nuv. Conv.
W4WQZ	G.R. "Jerry" Lappin, 4047 Skyland Dr., Kingsport, Tenn. 37664 would like m/s or tropo skeds on 144 MHz. Particularly interested in SSB m/s propagation. Xmtr 2 4CX250's 1 KW CW and USB rcvr HB conv. 2 grounded grid 417A into SX117 Ant. 10/10 Skybeams 50'. QTH hill-top 500' above surrounding area. Also interested in 432 MHz skeds. Xmtr. Varactor Tripler 20 W CW output Rcvr HB conv. TIXM05 front end into SX117. Ant. Quad Tilton yagi 45'. Jerry says this should be augmented in the near future with 500W 4CX250 amplifier.

Published by Parks Electronics Lab.
419 S.W. First
Beaverton, Ore. 97005

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Volume 5, No. 4

July-August, 1967

W6GD ANTENNA NOTES

A 432 DX MAN'S CONVERTER

MODEL 432-3

NEW FEATURES:

- --All solid-state design
- --Zener-regulated a.c. power supply
- --Extremely low-noise front end-- 4 d.b. or less.
- --High image and I.F. leak-through rejection
- --Excellent frequency stability.

This converter uses the Texas Instruments TIXM10 transistor. It is the replacement for the former TIXMO5. We believe them to be superior to the transistors we formerly used. Their replacement cost is low, an important factor if you're careless with r.f. This converter has a single tuned r.f. stage, something our previous converters and preamps did not have. It cuts down on interference from other stations adjacent to the 432 band. We do not make a preamplifier for 432 at present.

I.F. ranges available put 432 MHz at 26, 27, 28.1, 28.5, 29, 30.5, 50 and 51 MHz. We do not make lower I.F. ranges because of image problems. The 28.1 and 28.5 ranges are for ham band only receivers. 432 activity can be both sides of 432 so you should choose an I.F. that lets you tune down to about 431.5 anyway.

Only type BNC connectors are furnished because SO-239 and phono types are not as good at this frequency.

Converters are available from stock.

ORDERING INFORMATION: Price is $55.00 postpaid. Add 35¢ for Special Handling, a fee charged by the post office for faster delivery. Add $2.50 for Air Mail.

A SERIES OF ARTICLES ON ANTENNAS

As you are probably well aware of the fact that we have long proclaimed that the weakest link in most ham VHF stations is the antenna, you can probably imagine the personal satisfaction we obtain from bringing you information to help you improve that weak link. Publication of antenna contest results should have opened the eyes of some of you to the terrible inadequacies of many commercial antennas. The winners of these contests have invariably been the extended-expanded colinears. The man responsible for the design of this type antenna was the late Oliver Wright. He had written quite a bit of material about antennas in the form of notes, which we are publishing with the permission of Mrs. Wright. There will be references to figures or diagrams not given in the same issue. You will have to bear with us there, awaiting the next issue because we prefer to publish the notes just as they were written. Mr. Wright worked at Stanford Research Institute. Hank Olson, W6GXN, has worked at S.R.I. for a number of years and knew Oliver Wright well. We asked Hank to write the introduction to this series of articles on antennas. LP

Oliver Wright, W6GD, was involved in amateur radio from its very early years, and contributed to the radio art throughout his life. As 6GD, Oliver was shown in QST with the first amateur mobile rig in the early 1920's. [1](See QST for May, 1964, p. 76)

Oliver worked for the American Telephone and Telegraph Co., principally in California and New Jersey. In New Jersey he was associated with the club station W3BBO, which was noted for its huge antenna farm and potent signals on the H.F. ham bands. During the course of his work for A.T.& T., Oliver worked with a number of the well-known names in the antenna field like Sterba and Beverage.

In the San Francisco Bay area, as W6GD, Oliver's amateur activities were almost entirely on 2 meters (occasionally on 10 meters when it was "open" to New Jersey). His main interest was in VHF antennas and their measurement.

Oliver was a frequent speaker at the local amateur radio clubs in the bay area, and one of the initiators of the VHF Antenna Measuring Contests that are now an annual event in California. In memory of Oliver Wright, W6GD has been adopted as the call of the UHF Society in northern California, the organization which conducts the annual antenna measuring contests.

Oliver Wright died in the spring of 1956, leaving his "Antenna Notes" as a legacy for the surviving VHF enthusiasts. Copies of the Antenna Notes have been unavailable for many years, but in great demand. Finally, now they are to be reprinted in their original form in the VHFER magazine. H. Olson, W6GXN

VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U.S. & Possessions, $1.50 per year. Canada & Mexico, $1.75 per year. Other countries, $2 per year. Second class postage paid at Beaverton, Oregon 97005.

VHF ANTENNA NOTES -- WITH THE ACCENT ON TWO METERS

by Oliver Wright, W6GD

These notes have been prepared with the hope that they will be of some help to amateurs intending to build and operate VHF antennas. While the techniques and dimensions presented deal particularly with the 2 meter band, the basic principles involved apply to the other bands in general. The illustrated examples are based solely on 2 meter dimensions, but may be adapted to the other bands, within reason. Arrangement of this material is in note form rather than as a narrative, and is of necessity very abbreviated. This material is the result of personal study, experimentation, operation and general experience with numerous types of antennas on frequencies from 4 to 148 mc.

1. Antenna dimensions given in these notes are based on the actual wavelength in free space at 146mc, which length equates to 81 inches. Element lengths are modified by the diameter-to-length ratio, end loading etc., and are mainly based on 1/4" diameter. Element diameters greater than 1/4" will usually require a shortening in the length of the driven elements. Smaller diameters will not be affected appreciably. It is not correct to change both radiator and parasitic element lengths by the same amount when varying the diameter. The new lengths for the parasitic elements must be determined experimentally.

2. Open wire lines, and this includes twin-lead, should be treated with a certain amount of respect. For best results they should be separated by at least five times their own spacing from other lines or objects insofar as practicable. Don't use twin-lead as casually as lamp cord.

Transpositions in open wire lines are not necessary, other than for correct phasing between radiators. In the main line from the transmitter they serve no particularly useful purpose. If they distort the shape or spacing of the line, or require extra insulators (to achieve these transpositions) they will most likely cause additional line irregularities. When turning corners in open wire lines, changes as abrupt as 90 degrees are permissible if the line is rolled on its side to permit banking around the turn, thus maintaining equal wire lengths on each side. Excess insulation or hardware on the line at such a point should be avoided. Wherever possible avoid the use of spreader insulators that are held in place with metal tie wires. They cause considerable wave reflection. Tie the insulators on with cord or else melt them onto the wire á la ladder line.

Any insulators on transmission lines, including stand-offs, should be used sparingly. Where there is a large standing wave on a line, insulators at current maximum points will have less effect than those at current minimum points. Excess insulators cause reflections due to capacitance, and to shunt leakage paths when wet or dirty.

3. When using "ladder line" it is desirable to remove two thirds of the insulators, leaving one every 18 inches, where possible. Such modified sections must then be pulled taut and kept that way. Where the line must be left slack do not remove any insulators. The 1 inch spaced 470 ohm line is preferable to that with closer spaced 300 ohm line which is more apt to become seriously deformed with handling and flexing. The wider spaced line, when properly handled, is more efficient than the twin-lead, having appreciably less attenuation loss and negligible radiation loss.

4. For coupling transmission lines to rotating antennas, one half wave and one full wave lengths of flat 300 ohm twin-lead work very satisfactorily, if they are not overloaded electrically. Use first grade line, such as Amphenol, Belden, G.E., etc. Before cutting be sure to allow for the proper velocity of propagation (VP). The manufacturers' figures on the VP are extremely close. The sections will withstand years of rotation if not abused. These lengths of line have a 1 to 1 impedance ratio from end to end, hence the twin-lead impedance drops out of the picture, even when wet. Care should be taken to prevent the section from winding up against the metal pole or there will be an irregularity. A plastic fender on the pole will prevent this.

5. Don't connect co-axial lines to balanced antennas or to sections of balanced transmission lines, without suitable baluns at the junction points. If you neglect the balun, the outer conductor of the co-ax will radiate as a single wire line; and very possibly the open wire section will become unbalanced and radiate. In some extreme cases it has been found that around 75% of the power may be radiated from such a line. Co-axial lines are extremely susceptible to this sort of thing. The outside of the outer conductor acts as an un-neutralized third wire. Balanced open wire lines are not immune if unsymmetrically coupled to a radiator.

6. There are many misconceptions about radiation from open wire lines. It is not necessarily true that there is an appreciable increase in radiation from a line as the standing wave ratio increases. If the standing wave ratio on a well balanced line increases from 1 to 1 to a value of 3 or 4 to 1, the percentage increase in line radiation is extremely small. An unbalance in line currents, both in amplitude and position, causes far more line radiation. In other words, a line that is apparently well terminated but that has a phase shift between the wires (other than the required 180 degrees) will radiate considerable more than a line having a 4 to 1 ratio, but with no unbalance or shift. See QST, January 1954, Page 44, for additional information on this. However the statement that co-axial lines do not radiate under any circumstances is not correct. See Section 5 of these notes.

7. At the best, grid-dip meters, antennascopes, micromatches, etc., indicate only that certain impedances exist at the point at which they are inserted. The accuracy of this indication is usually debatable at 2 meters; unless you have some extremely high grade lab equipment. They cannot indicate anything particularly useful about the operation of the antenna as a radiator, such as tuning of the parasitic elements, general phasing conditions, etc. A micromatch might show the SWR but the accuracy is doubtful at this frequency. It won't show the standing wave position on the line, which knowledge is quite necessary in making workmanlike termination adjustments.

8. To measure standing wave ratio (SWR) on an open wire line, use a pick-up loop with a series tuning condenser and a 1 amp. R.F. meter. See Fig 9d. This device, if properly built and used, will measure current standing waves, independently on each wire of a two wire line having two or more inches spacing. Another way is to use a small untuned pick-up loop with a series indicator such as a small tungsten filament lamp, or a diode and microammeter. See Fig 9a. Note that the indicating device is cut into the loop at its mid point. This also reads the current standing wave, with the point being measured found directly under the take-off point for the indicator. With the resonant circuit it is possible that there will be a slight displacement error in the indication of the wave position. To check this turn the equipment upside down on the line. Any error

found between the two positions should be divided by two. It is possible to build a similar device for use on ladder line, but the problem of sliding it along past the insulators, and avoiding actual contact between the wires, is a little complicated.

On co-axial lines the most accurate way to measure voltage standing waves is by the use of a vacuum tube voltmeter probe on a section of slotted line. This apparatus also indicates amplitude and position of the wave; but such a device is not very common. If a micromatch is used it should be carefully checked at 146 mc against such a line; at a lab if possible. Again remember that the micromatch cannot tell wave position.

One reasonably satisfactory way of establishing approximate standing wave values on co-axial lines which are to be connected eventually to balanced loads is as follows: Connect a test section of flat 300 ohm twin-lead to the load and find the wave position and amplitude. If necessary apply impedance correcting lines or stubs and adjust either for a flat line or for one with a known value of standing wave, using one of the untuned pick-up devices shown in the sketches. Certain ratios of standing waves indicate definite non-reactive impedances at points where the current wave reaches a maximum or minimum value, known as a "max" or a "min" point respectively. A 2 to 1 current SWR on a 300 ohm line indicates 150 ohms resistance at the current max point and 600 ohms resistance at the current max point would be 200 ohms, and this point would match the output of a half wave balun made of 52 ohm co-ax line.

Don't use a field strength meter as a method of adjusting SWR. You may be surprised to find how little correlation there is. The adjustments you make may simply be tuning the output circuit of your transmitter. The <u>only</u> way the SWR can be checked properly <u>is on the line itself</u>. When the line has been terminated in the proper manner then a field strength reading may be used as an indicator while the output circuit is readjusted for maximum value. If you can't get the most output this way you had better work over your output coupling circuit, because there is something wrong with it. A neon bulb is a very unreliable and crude SWR indication. Don't trust it.

9. Here is a method of matching an unknown balanced load to a balanced line.

<u>A.</u> Connect a 300 ohm twin-lead test line to the load. Make a test run on the line with the untuned pick-up loop, in the vicinity of the load. Locate the first current max point back from the load. (If it is less than about 7 inches from the junction of line and load look for the next max point back toward the transmitter.) See Fig. 8a.

<u>B.</u> Cut a piece of ladder line, or other suitable line (such as #12 wire spaced two inches) to the same <u>electrical</u> length as the distance from the load point back to the max point selected. Allow about 3 or 4 inches extra length for adjustments. This length has to be corrected for the different velocity of propagation on the two lines. The VP on the twin-lead is about 82%. (Consult the mfgr's tables for value of VP or determine it yourself by actual measurement between adjacent current min points one-half wave apart. The accuracy is increased depending upon how many half-wave points are measured.)

Assume that the distance back to the max point selected "happens" to be 25 inches, as measured on the twin-lead. 25 inches divided by 82% gives 30.5 inches. This is the approximate length of the ladder line (or equivalent) stub that we are going to build and hang from the feed point on the antenna (our load), where the twin-lead was originally connected in (A) above. The ladder line's VP is almost 100%.

Make a strap-type sliding short to be placed on the ladder line, starting at the 30.5 inch point as a trial position. (Remember; the lengths quoted in this example were selected at random) Fasten the twin-lead test line to the stub about 6-9 inches above the short, at point "B" , using small, homemade copper lugs (or equivalent bent around the wires. Keep them as small as possible. Clips cause too much irregularity.

C. Measure back one-half wave on the twin-lead test line from point "B", and mark point "X". 33.5 inches is a good value to use on 2 meters for all lines having around 82% VP. (With a little experience you can determine this point yourself from other measurements, as mentioned above.)

At point "X" the impedance seen when measuring will be the same as at point "B", which latter is not a convenient place to measure with this type of indicator. Hence "X" will be our test point.

D. What we are now attempting to do is to adjust the position of the sliding short at "C" on the stub so that the stub will present only a resistive load to the 300 ohm line. The value of the load depends upon the position at which the line taps on at "B". If we deliberately pick a spot where the impedance should be higher than 300 ohms we will get a current min point at "B", and at point "X".

E. NOW — If the min point is found to be between "X" and the stub, shorten the stub by sliding short "C" upward slightly, and try again. If the min is between "X" and the transmitter, lengthen the stub slightly by sliding "C" downward. Keep this up until the min point falls at "X". If the position of the current min point is not well defined during these adjustments move tap point "B" upward slightly. When the min point is satisfactorily set, lock the short in place, as you're now through with this particular adjustment. The final length of the stub "A-C" should be within a few inches of the computed value; 30.5 inches in this example.

F. Next — Move the tap point "B" down to a position where the standing wave effectively disappears. If you are going to use a 300 ohm line, the job is finished. If some other value of line impedance is to be used, you have a little more work. If a 470 ohm ladder line is to be used, move the twin-lead tap point "B" up higher than the 300 ohm point until the measured standing wave ratio is 1.57 to 1. That's the place the 470 ohm line should be attached.

If a 200 ohm impedance is going to be used (the output of a 4 to 1 step-up balun using 52 ohm co-ax line) move the tap point down below the 300 ohm adjustment until an SWR of 1.5 to 1 is obtained — That's it.

Remember; the position of the short is the same regardless of the impedance of the line from the transmitter. A change of frequency might call for a slight change in the position of the stub; but if it is tuned at 146 mc and soldered in place there won't be too much SWR at any place in the 2 meter band. Solder Tap point "B" also.

G. If the final distance from tap point "B" to point "A" is greater than 40 inches it would be well to shorten "A-B" by 40 inches and readjust for final values. This applies to section "A-B" only. Section "B-C" should remain the same. (Except for any minor adjustments.)

To become familiar with the use of this technique try it out on the extended full wave antenna shown in these notes. Clamp the antenna horizontally on top of a 6 foot step ladder (with the phasing line running directly upward to the radiators). Your answers should agree fairly closely with those given in these notes. When you gain a little experience with the use of the SWR measuring equipment, try using the method in the 1953 ARRL Handbook, Page 317, under "Stub Matching." This is another way of arriving at essentially the same answer as above. Since the stub in this case will be of the same material as all of the main line, the dimentions may differ slightly from those you determined above. As a further point of interest note that in our problem above, the actual stub is the section "B-C". Sections "X-B" and "B-A" are part of the main line. Standing waves are a reflection phenomenon; hence no adjustment that you can make at the transmitter, other than varying frequency, can change them.

10. When making termination adjustments on a 2 meter array it is satisfactory to place it on its back, facing straight up, on an 8 foot wooden step ladder. This minimizes ground effect on the elements and obviates a lot of climbing while making these adjustments. CAUTION — Don't bump into the elements while crawling around. They're your eyes!

11. Don't use an R.F. meter in the short on a tuning stub, for termination adjustments. This is an unreliable method. An R.F. meter in the transmission line, as an indication of relative output power into the line, is an excellent idea. If the frequency, line adjustments and antenna tuning are unchanged, the relative values of line current will give an idea of the relative power going into the array. For example, twice the current will mean four times the antenna power, or an increase of 6 db. If any of these variables are changed, the values of line current cannot be compared. The idea is to get the maximum current under any given set of conditions. Don't try to compare these currents for different sets of conditions.

If an R.F. thermocouple ammeter is not available the next best device would be a low rating light bulb shunted along a section of one wire of the line, or a standing wave indicator placed across the line at a point where it can be watched while adjusting the transmitter (assuming an open wire line). See Section 8 and sketches of the standing wave indicating devices.

A field strength meter placed at a point where it picks up from the antenna only is a reasonable substitute for the above indicators, but is subject to reflected signals from people, cars, miscellaneous metallic objects, etc. If some one moves his car out of a nearby garage your reading will change.

12. Don't try to adjust the center impedence of an array by changing the spacing of the reflectors. You might do it, but at the expense of proper operation of the antenna. Every time a parasitic element spacing is changed a compensating change must be made in its length, to restore the correct phase lead or lag. Remember also that antenna adjustments will affect the load impedance as seen by the line; but that termination adjustments will not affect the antenna tuning or performance, unless by so doing you introduce some bad unbalance.

13. Don't build an antenna to be a "line terminator." Build it to be a radiator and concentrate on developing that function to the utmost. Apply your matching stub or bars afterward. The two functions are entirely separate.

A frequency shift from 144 to 148 mc is only a 3% change. Very few of these antennas, if any, "go out of tune" appreciably as a result of such a small frequency change. Slight changes of impedance, as well as magnified shifts of standing waves on the lines (which are usually several wavelengths long at 2 meters) produce changes at the transmitter which are all too frequently confused with a change of antenna properties. It is true that large diameter elements display smaller impedance variations for a given frequency shift, but is is doubtful that any distinct advantages will be gained by using larger than 1/4" O.D. tubing at 2 meters with the types of arrays discussed herein. Bigger tubing increases weight, wind resistance, wooden structure required and cost. For horizontally polarized arrays, particularly in regions where snow and ice are prevalent, either larger diameters or thicker wall tubing may be advantageous.

14. Don't EVER feed radiators in series with other radiators or through intermediate quarter-wave stubs. The elements will very seldom be in phase, or stay in the correct phase relationship. Their phase will change rapidly with frequency shifts; varying the antenna impedance, pattern and efficiency. Radiators should always be fed in parallel; that is, each driven element should be connected directly to the transmission line, or to a phasing line. The general methods of feeding multi-element arrays shown in these notes are believed to be the best and, in some instances the only suitable method; particularly with extended spacings.

15. The basic formula covering radiation from a wire shows that the amount of power radiated in any section is a function of the amplitude of the current flowing in the element at that point. In other words, most of the radiation is from the center section of a half wave dipole, and from the lower portion of a ground plane or of a center loaded whip. The far ends produce the fire and the current max sections do the work. Both are necessary though.

16. A good point to keep in mind is that you cannot achieve antenna gain without size. High gain does not come in small packages. Mere size, however, is not a cure-all. Don't get "element happy" and build super multi-element arrays until you know what you are doing. You may find that a lot of the elements are merely "going along for the ride." When horizontal polarization is used, such as on the 420 mc band, serious consideration should be given to the "Queen of the Antennas," the Rhombic. There are specific dimensions for rhombics for certain types of work, and the antenna will suffer if improperly designed, just as does any other piece of equipment. A properly designed rhombic needs no tuning adjustments whatsoever, and very little in the way of impedence adjustments, It will not be covered in these notes, but plenty of information is available elsewhere. It also must be of an appreciable size to be effective. Rotating a rhombic poses some tricky mechanical problems.

Remember this — A big antenna is not necessarily a good one. It may be improperly designed or tuned, in which case the energy may be wasted in a poor pattern or in high internal losses.

17. There is a certain difference of opinion as to the usefulness of adding directors to these multi-element arrays. They do give a slight increase in forward gain, and most likely improve the front to back ratio a bit, but at the expense of a nearly

doubled structure size and an appreciable increase in the Q of the array, both as regards tuning and feed point impedance. The difficulty of adjusting the array, and of holding it there with changes of frequency and weather conditions is increased.

For a given number of elements, broadside arrays usually produce more effective gain than end-fire arrays. However, a judicious combination of both types is desirable. A radiator and reflector (or even more parasitic elements) constitute an end-fire array. Two or more radiators fed in phase, either side by side, or end to end, constitute a broadside array. There should be one parasitic reflector for each driven element to obtain the most desirable characteristics. Such an array may not have the high front-to-back ratio of a Yagi, nor its sharp pattern, but it will maintain its high forward gain over a wider frequency range and is less susceptible to weather changes. This is known as the "rectangular" type of array, and is the type discussed in these notes.

18. Optimum radiator lengths, and broadside spacing between radiators, or groups of radiators are greater than the conventional half wave values. Optimum lengths are 0.625 wavelengths (measured at the proper VP on the tubing in use). Optimum broadside spacings are 0.65 wavelengths between adjacent elements, where there are no more than two rows (as in the 4 and 8 element arrays shown in these notes), and 0.75 wavelengths where there are 3 or more broadside rows (as exemplified in the 16 element arrays). These broadside values are based on the VP in free space and are not changed by different element diameters. Extended lengths cannot be used for parasitic elements. They must be of the proper tuned lengths. The center of each parasitic element must be placed directly behind the current maximum point on its associated radiator. This is illustrated in the 8 and 16 element arrays. The extended radiator lengths are not critical. Spacings between radiators and reflectors are one quarter wave, or 20 inches.

19. By judicious use of optimum lengths and spacings, and correct phasing and feeding methods, you can get the most out of a given number of elements. The table on Antenna Gains shows that a 16 element array with optimum dimensions has slightly more gain than a conventionally arranged 24 element array. Even though this extended 16 element array has a greater aperture than the 24 element structure it has less parts, weight, wind resistance and complexity of tuning.

Don't design antennas of this general type with units of 6 or 12 radiators. These are very unfortunate configurations to feed and are plagued by phasing and current distribution problems. Extended spacings in these units are particularly difficult to feed. A look at the Antenna Gain table will show, by interpolation, how little extra gain will be realized by the use of this number of elements. It is true that a 24 element array, extended both ways should have about 1.7 db gain over a similar arrangement of 16 elements, but the feeding problems would be serious. A 12 element beam would hardly be worth the trouble, when you can get what you want from an extended 8 or 16.

20. End-fire (out-of-phase) feedings of arrays is very difficult. Time-phasing by means of transpositions and odd length of phasing sections seem to give straight-forward results (on paper). Unfortunately the various reactions set up, and the different impedances present at junction points cause the power distribution between adjacent elements to differ by very large amounts.

21. Metallic supporting structures for multi-element rectangular arrays have some drawbacks. A metal pole up through the geometric center of a vertically polarized array seems to have no adverse effect on the operation. Metallic crossmembers at right angles to the plane of polarization of the elements cause little disturbance. However, complex structures with closed loops or isolated members, all of which might accidentally be tuned to or near resonance, can be detrimental to the pattern and gain.

Antennas of the general types shown in these notes do not need insulators to separate them from wooden supports, but long metallic sections in actual contact with end-driven elements can cause a serious distortion of the antenna properties due to redistribution of currents on the radiators. Use wooden or other non-metallic support for direct connection with all elements of the arrays shown in these notes. High grade insulation at these points would be a waste of money, and add unnecessarily to the weight and wind resistance. Of course it is understood that the elements are all supported at current maximum (voltage node) points. In the Yagi type of array, the use of a metal support down the center of the array is perfectly satisfactory.

22. Here is a simple but effective way to check the proper position for connecting extended driven elements to the supporting structure.

> CAUTION — SAFETY FIRST — Be sure there is no high voltage D.C. or R.F. on the antenna before trying this.

Support the elements at approximately the points shown in the sketches; then place a standing wave indicator on the line at a point where you can see it from the antenna. Energize the antenna and, with a screwdriver, touch the extended element near the support points. The SWR indicator should show little or no change. Keep tapping the screwdriver on the element while moving it either side of your starting point. The indicating device should show an increased kick as you deviate from the proper location. The point of minimum kick is the place for the support. This will be the current maximum point on the element. Try placing the SWR meter at slightly different positions on the line if you don't get some reasonable indication. If you have no SWR indicator have someone watch the plate meter. The parasitic, tuned elements should be supported at their mid-points.

23. When tuning antennas, use a field strength meter placed from 100 to 300 feet to the REAR. First make a temporary termination on the main line to avoid possible large impedance changes at the transmitter during antenna adjustments. Then adjust the length of the parasitic elements for minimum signal to the rear. If only a reflector is used with each radiator, proceed as follows:

Cut the reflectors very slightly longer then you believe to be the right amount (the $64 question) and then energize the antenna on 8 to 10 different frequencies fairly equally distributed from 144-148 mc. Measure the signal strength to the rear for each frequency and plot these points on a graph. Draw a line through each point. If the elements are anywhere near the right length there will be a dip in the strength of the signal to the rear. The bottom of the dip will indicate the resonant frequency for the reflectors. If the dip is at too low a frequency a simple proportional calculation will indicate how much to cut off each reflector. With a little caution you can avoid cutting off too much and thereby spoiling a bunch of elements. Don't worry about tuning the front curtain. It will take care of itself. If you are using extended elements you can't resonate them anyway. The change in gain to the front will vary much more slowly with frequency than does the indication to the rear. The chances are that you can't even plot the front curve sufficiently accurately because coupling adjustments at the transmitter may vary more than the actual forward output value of the antenna for each change in frequency. In other words, the gain to the front will change very little over the entire 4 mc bandwidth, and beyond.

If both reflectors and directors are employed, this variable-frequency method cannot be used. Instead the frequency must remain fixed and the parasitic elements pruned in groups, i.e., reflectors first until they are tuned, and then directors (or vice versa). Cut the reflectors in small increments and measure the signal strength to the rear for each new length. Adjust for minimum signal to the rear. Then do the same with the directors. This procedure is slightly wasteful of material, but is the only satisfactory method when several elements are to be checked simultaneously and two more separate groups of parasitic elements are used.
Re-terminate the main line when finished tuning. See also Note 12.

24. Don't use "shock excitation" when testing antennas, either for tuning or termination adjustments. This method gives unreliable answers. Energize the antenna in a normal manner, through the regular transmission line.

25. There is no such thing as an antenna that "won't load up." Anything that has resistance will accept power, if properly coupled. What it does with it after that is a function of how well it was designed and tuned. To get power into the antenna, suitable impedance matching must be accomplished between plate tank and line input and, to a lesser extent, correct impedance matching must be provided between line and antenna.

Any indication of loading at the transmitter is extremely unreliable insofar as its connection with antenna performance is concerned. Good antennas can load poorly and defective antennas can load excellently. There is no resemblance between this loading and either the antenna impedance or antenna tuning.

Most transmitter output circuits (which are mainly plain untuned links) are limited in their ability to cope with certain line impedances; or even with properly terminated lines; hence the famous expression — "she won't load up." See QST, August, 1947, Page 26, for some good information on this. A link tuning condenser is very desirable.

26. Since plate current is no criterion of power delivered to the line, some form of R.F. indication is vital. A thermocouple ammeter in the line is the best. A diode pick-up device across the line, connected to a milliameter is also good. If the crystal causes TVI, use it only for adjustments, then remove. A vacuum tube diode might be used. A field strength meter loosely coupled to the antenna is fairly good.

27. It is admitted that a ground plane antenna is easy to put up at home or on the car, and is omni-directional. However, Kraus points out in his book, Antennas, McGraw-Hill, Page 420, that unless the diameter of the ground plane is infinite (a big order) the antenna has a high angle of reflection, and considerable loss along the horizon. In other words it has even less output than the half wave reference dipole at the radiation angle we desire. At 40 meters this high angle of radiation may be of some use.

---This series will continue in the next issue and give antenna designs as well as the drawings referred to in the text.

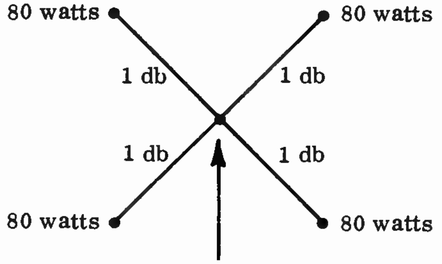
Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

This month we'll consider the Yagi antenna for moonbounce. It is probably the best overall choice because the number of antenna elements is reduced, thus the feed harness losses can be reduced and the number of power splits and matches required is reduced. This also reduces another source of loss--phase distribution over the aperture. At 432 this can be a problem, since small errors in harness dimensions can introduce out of phase components. Generally you would like to hold things under ten degrees. If you look at a wavelength of coax at 432, you can get some idea of the problem. You must be very careful in your physical measurement--hold close tolerance. The problem with the yagi is that you must test your individual antenna element for gain and pattern to be sure it is working. Then you can duplicate it (with care).

As an example of what might be accomplished with the yagi on 432, let's look at a possible design. W2CCY built one of the most successful yagi arrays for 432 I know of. Cliff built a box of 4 yagis six feet square and worked not only Arecibo but WA6LET on the big dish at Stanford. His antenna had to be working. What was the magic? None. Cliff is just a careful worker who didn't take any shortcuts. The first thing he did was build one of the yagi antennas described in the Orr VHF Handbook (8 foot boom). Cliff found that he had to trim the driven element from 12 3/4" to 12 3/8" and take 1/16" off each of the directors. That doesn't sound like much, but it is at 432 with a high Q device like a yagi. I can't recall the exact number but Cliff found the original dimensions gave him an antenna resonant around 430 Mc. and by the time he got to 432 performance was way down. Think for a minute what the result would have been had Cliff not measured the individual yagi element for his array.

Now each individual element (Yagi) in the array has a gain over a dipole of 16.1 db. This means a gain of 18.2 db over an isotropic source. Now a box of four such as Cliff built could have a gain of 24.2 db, eight would buy you 27.2 db, 16 would be 30.2 db and 32, 33.2 db. True in the larger arrays, some loss will be introduced by the feed harness. How much loss? Well, it turns out that it is not as bad as one might think. The point to keep in mind is that the total loss of all the coax is divided up over the array because you are splitting the power up. The simple diagram below will show you a practical way to compute this.



Total power to common point-------400 watts
Total power radiated --------------320 "

Loss 80 watts

or 1 db overall loss, NOT 4 db loss.

Now the 1 db loss I used above was for simple figuring. In practice at 432 for instance RG 8 A/U foam coax has just under 4 db per hundred feet loss. Thus the approximate 4 feet necessary to tie together each bay of the quad yagi array just described would have a loss around .16 db. If you carry this all the way into the bigger arrays, you find out that one to one and a half db is all the loss you will suffer from this source of loss. If cost is not a factor, the larger and more expensive coax can be used to increase overall efficiency. I think you'll find that even the expensive coax is still cheaper overall than the price of materials for a dish of comparable gain. For instance, to come up with the same gain as the 32 unit yagi array mentioned above you would need a dish about 45 feet in diameter. The yagi array would be 42 by 18 feet, and many times lighter in weight. Also another factor to consider is the lower wind resistance of the yagi structure. To be sure there are other antennas that could be considered. We have looked at them all and what I've discussed appear to be the most practical for the amateur.

Now we come to the real problem in a moonbounce antenna, the mount. The best antenna in the world is worthless if you can't point it accurately at the moon. In this connection I can tell you a lot of things not to do, because I've been trapped by all the pitfalls the amateur usually falls into. You must first look at what objectives you want to fulfill. There are many tradeoffs you can make to simplify things. The two extremes are an antenna that is fully steerable to any point in the sky that the moon will pass thru to a fixed array aimed at one point in the sky where the moon will pass on a couple of days in each lunar month. Obviously the first case is the ideal and also the most difficult and expensive.

The suggestion has been made to me by K2CBA and others that for a fixed mount antenna or one with a limited movement, the design center should be that which is used by the Arecibo antenna. Generally this centers around a GHA of 66 degrees 45 minutes and a Dec. of North 12 degrees.

While I'm in favor of building a larger array with a limited movement versus building a smaller array that is fully steerable, I would argue for a mount that had at least 20 degrees or perhaps even more declination scan so that the antenna could be used on a greater number of days of the lunar month. I looked up the greatest amount of declination change the moon can have. It turns out that it is plus or minus 28.5 degrees from the celestial equator. This max. dec. occurs once every 18.5 years. We are nearing the peak declination right now. An hour or two of HA time would be enough for practical work if it centered around Arecibo and all the antennas in the world did likewise. Of course for VK3ATN in Australia we have another problem. Again I think it would be simpler to design an additional mount for work with the VKs when they are ready than building one fully steerable mount.

The most important consideration to keep in mind when building the mount is that the moving force should be applied at a mechanical advantage point. On my dish the drive was applied at the end of a small axle shaft. This is the wrong place to do it. The axle could be torqued by the wind more than 20 degrees. All gear slop will mean a large movement of the antenna in degrees. Cables pulling the antenna from outrigger arms appears to be one solution. Large pulley type wheels (ten feet or more diameter) centered on very heavy pipe axles turned by a closed cable system might be another. Jack screws and hydraulic cylinders offer additional ideas. You will have to use your ingenuity. 73 Vic.

OPEN BANDS

by Marilyn Wiseman, K8ALO

A lot of contacts and new states resulted for many on 144 MHz, due to fine tropo openings and meteor showers during July and August. 50 MHz had good openings also. Thanks to all who sent reports in. Looking forward to yours. My address, Box 103, Petersburg, Ohio 44454.

144 MHz. TROPO

July 6	W5ML (La.) wrkd KØMQS (Ia.), WAØGFW (Kan.), KØIGN, WØLCN (Minn), WØEMS/Ø (Neb.) Art says signal strengths 559 to 579. Art got 2 new states from these QSOs. W9YYF (Ill.) wrkd W5HFV, W5ORH (Okla.), WØNXF (Neb.)
July 7	KØGEY (Iowa) wrkd W5WAX, W5ORH (Okla) K7UMC/5 (Ark.), K5WXZ (Tex.)
July 22	W9YYF (Ill) wrkd WØNXF, WØEMS/Ø Neb.
Aug 2	K1ABR (RI) wrkd K4QIF/4 (Va.) 400 mi.
Aug 5	W9YYF (Ill.) wrkd W5BAU/5 (Ark) state #28.
Aug. 6	K1ABR (RI) wrkd W8AEC (W. Va.) 350 mi, KØCER/4 (Va.) 420 mi.
Aug. 8	K2HLA (N. Y.) wrkd W8AEC (W. Va.), W4FJ, WØCER/4 (Va.) all cw. Dick says band opened from VE1 land south to western Va.
Aug. 11	W3OMY (Pa.) wrkd W1MEH , (Conn.)
Aug. 12	W9YYF (Ill.) wrkd W5BAU/5 (Ark.), W5HFV (Okla.).
Aug. 13	W9YYF (Ill.) wrkd K5WXZ (Tex) State #31.
Aug. 14	K1ABR (R.I.) wrkd VE3EZC (Ont.).
Aug. 15	K1ABR (R.I.) wrkd K4QIF (Va.), W8KAY (Ohio) 500 mi. W3OMY (Pa.) wrkd K1IED (Conn), W2ZFP (N.J.).
Aug. 16	K1ABR (R.I.) wrkd W8KAY (Ohio).

144 MHz AURORA

June 5	KØGEY (Ia.) wrkd K8UQA (Ohio).
June 6	KØGEY (Ia.) wrkd W8NUB, W8DGF (Ohio), K9AAJ (Ill.), WØMOX (Colo.)
June 25	WØNXF (Neb) wrkd W8KAY, W8NUB, K8AXU, K8DEO, W8DGF (Ohio), W9BRN, W9OJI, W9MAL (Ill.), WØLZO (Neb), WA9DOT (Wisc), KØIJK (Minn.), W5UGO (Okla), WØEYE (Colo.). Bob says that aurora openings this year have been so plentiful they're nothing unusual anymore. He wants to know where everyone is in the northwest areas. Bob now has 34 states in 10 call areas.

144 MHZ Meteor Scatter

July 27	W9YYF (Ill) wrkd W1AZK (N.H.) for state #27.
July 29	K1ABR (R.I.) wrkd KØMQS (Ia.) for state #26.
July 30	W1AZK (N.H.) wrkd W9YYF (Ill), WA9DOT (Wisc).
July 31	W1AZK (N.H. wrkd KØMQS (Ia.).
Aug. 10	K4EJQ (Tenn) wrkd WØNXF (Neb) for state #30. K1ABR (R.I.) wrkd W5GVE/4 (Ala.) State #27. K2HLA (N.Y.) wrkd W5BAU/5 (Ark) state #30.
Aug. 11	W9YYF(Ill) wrkd K1UGO (Me) state #29. K1HTV (Conn) wrkd WØLFE (Mo.) state #28. K1HTV (Conn) hrd KØMQS (Ia), WØBFB (Ia.).
Aug. 12	K1HTV (Conn) wrkd W5BAU/5 (Ark) state #29 & hrd K4IXC (Fla.) K1ABR (R.I.) wrkd W5BAU/5 (Ark) state 328, W5RCI (Miss) state #29. W9YYF (Ill.) wrkd WA5MFZ (N. Mex.) state #30.
Aug. 13	K2HLA (N.Y. wrkd W5RCI (Miss) state #31, W4WDH (Ga.) state #32. Hrd W5ORH full 15 sec. burst on Aug. 10---1400 mi. W9YYF (Ill) wrkd K4IXC (Fla.) K1ABR (R.I.) wrkd WA8PIE (Mich), WØNXF (Nebr.) state #30, W4WDH (Ga.) state #31. K1HTV (Conn) wrkd W5RCI(Miss) state #30, WØNXF (Neb) state #31, W4WDH (Ga.) state #32. Hrd W4VHH (S. C.)

Aug. 14 K1ABR (R.I.) wrkd W9UNN (Ill.). K4EJQ (Tenn) wrkd W5BAU (Ark) state #31. K1HTV (Conn.) hrd W9UNN (Ill.).

Aug. 15 W1AZK (N.H. wrkd W5BAU (Ark) for first Ark.-N.H. QSO.

COMMENTS ON METEOR SHOWERS

K2HLA (N.Y.) says this years Perseids showers seemed poor. Most of his m/s skeds were long haul, beyond 1200 miles, and he didn't hear anything from them. K1ABR in Rhode Island says "All here in the northeast seem to agree that Perseids was quite good this year. K1HTV (Conn.) had 35 hours of skeds made in advance with 11 stations in 8 states. He used a bit of automation by making tape loops with W xxx de K1HTV being played back on a tape recorder, which operated a keying relay. Rich has 32 states in 8 call areas. Best DX is 1252 miles.

432 MHz

June 11 K7ICW (Nev.) wrkd W6DQJ (Calif), K7RHK/7 (Utah).

June 25 K7ICW (nev.) hrd W6DQJ (Calif.

July 8 WØNXF (Neb) wrkd WØDRL (Kans) for first Nebr.-Kans. QSO on 432. Sigs were 599. This is state #5 for Bob in 3 call areas.

July 30 K7ICW (Nev.) wrkd K6HAA 185 mi. Sig 449.

<u>SKEDS WANTED</u>

WØNXF (Nebr.) wants M/S skeds on 144 for all coming showers as described in QST May '67 Page 78. Bob has KW Johnson Thunderbolt. 144.022. 5218 Prescott, Lincoln.

W5ML (La.) wants M/S skeds with anyone within 1400 mi . Art has 30 sec. sequence on-off, about 30-35 wpm. 500 watts input to pair of 4x250Bs with 1250 volts on plates. W2AZL converter with 417A to NC183D. 14 el. Yagi up 70 ft. Box 301, Rt. 1 Vivian, La.

K4EJQ (Tenn.) wants skeds with Minn. and Kans on 144 via Leonid M/S. Also open for tropo skeds on Thurs and Sat. nights from mountain top QTH. Rig on mt. is 150 W. 13 element Yagi, HQ 150 rcvr. and 417A conv. Bunky Botts, rt. 2, box 72, Bristol, Tenn.

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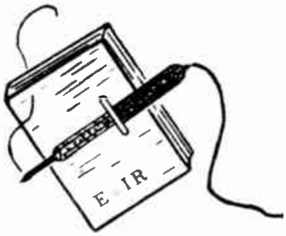

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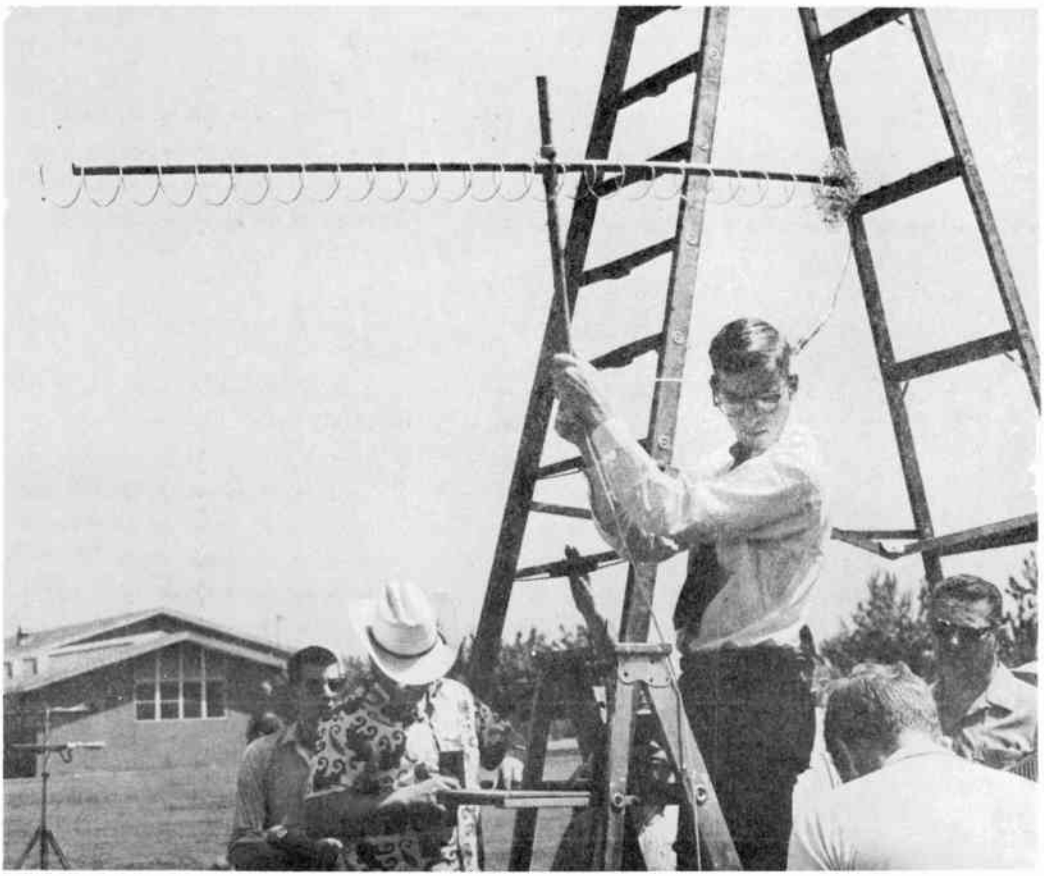
Volume 5, No. 3 May-June, 1967



WB6IOM and his 24 turn helix

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VHF ANTENNA CONTEST
by K7AAD

The antenna contest at the VHF Conference in Fresno this last May was quite improved over previous ones and though it leaves a bit to be desired it has come quite a way. Bob Melvin, W6VSV, is responsible for a good part of that. Bob has consistently provided good equipment for the measurements. This time he had a reference antenna built as described by a Bureau of Standards article which should eliminate some of the reflection problems possibly caused by the use of a dipole as we normally use it. Next year it is planned to have the signal source antenna on some sort of cherry picker or mobile mast that would be over 40 feet high so that all test antennas could be pointed upward at an appreciable angle above the horizon. Ground reflections are always a problem. But it is probably the big antenna that hasn't gotten a fair shake in the past. The big 432 arrays of the past were not there, tho their owners were. The shift was definitely to 1296. There were surprises in store for many antenna owners and spectators, as the following table and pictures will show. Credit for most of the pictures goes to George Chong, W6BUR. He is not responsible for bad press camera work on my part (making the half-tones for printing). First chart is 432, gains referenced to a dipole . (db)

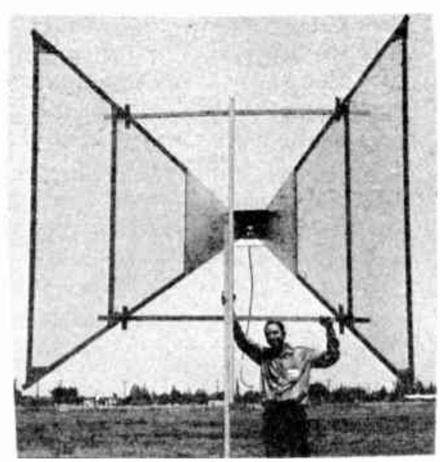
Entry #	Call	Description	Meter Reading	Gain
0	W6VSV	Bureau of Stds ref. ant. of known gain	0	7.7
1	WB6PDN	14 element J slot	0.5	8.2
2	WA6NCT	Dipole of questionable match	-7.7	0
3	WA6GYD	11 element Yagi	5.1	12.8
4	W6PUZ	11 element Tilton Yagi	5.3	13.0
5	K6HOU	"Clean Sweep" yagi, 6 elements	-0.5	7.2
6	K6HCP	Ref. dipole on beer can balun, optimized	-4.5	3.2
7	K6HAA	32 el. extended-expanded W6GD, 6AJF match	13.0	
8	W6BUR	11 el. Tilton Yagi	5.0	12.7
9	VE3DNR	9 el. quad	0.5	8.2
10	W6BUR	11 el. Tilton Yagi tested last year	3.8	11.5
11	W6PUZ	16 db W2CCY Yagi, 13 el	3.3	11.0
12	W6TZJ	Corner Reflector 90 deg. 2' x 3', dipole feed	0.5	8.2
13	WA6MGZ	LaFayette UHF TV dish, stock, beer can balun	-.5	7.2
14	WA6NCT	UHF TV corner reflector	-1.5	6.2
15	K6MIO	Cyl. parabola, 7 dipole colinear feed	5.5	13.2
16	WA6NCT	Dipole fed corner reflector	-1.5	6.2
17	K6MIO	7 dipole colinear (parabola feed)	2.0	9.7
18	K6HCP	LaFayette 4' dish, dipole feed	0.5	8.2
19	K6MIO	8' dish with homebrew ext. to 12.5 ft diam.	9.2	16.9
20	W6TZJ	16 el. Cushcraft with homebrew balun	2.6	10.3
21	W6ZOP	Large half horn	0.0	7.7
22	K6HAA	W6GD colinear 32 el	8.5	16.2

Discussion: Well a W6GD colinear won again. They always do. A lot of hams have asked where to get the design. Essentially its in the CQ VHF handbook. If Lanny wants to draw up a diagram & procedures we'd be glad to print it and it would make a number of readers happy. K6RIL & others also have "proven" antennas of this type.

I don't know why number 6 checked so good unless there was skulduggery which is decidedly not out of the question. Past contests have proven that. Maybe #7 is a recording error. I only print it as I got it. Notice that only one commercial antenna was brought that was a yagi type advertised for 432. There's a good reason. Get the hint? I notice #19 had slightly more gain than #22 but contest rules are that the antenna must be capable of being handled and directed by one man so I don't think #19 qualifies.

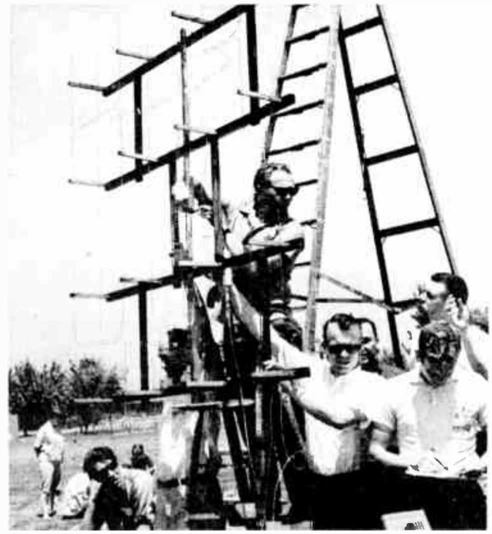
1296 CONTEST RESULTS

Entry #	Call	Description	Gain over dipole
1	std. ant.	9.95 db above isotropic	8.0
2	WA6KKK	60 degree horn	7.5
3	W6GDO	Brass dipole	-2.0
4		Dipole with solid reflector(splash plate)	2.0
5	W6GDO	32 element colinear (W6GD)	14.0
6	W6GDO	Inv. Disc cone AT344	-2.0
7	K6HCP	Clear Beam 4' dish with 3/8" mesh (TV type)	15.6
8	W6GDO	Stoddart standard dipole	0.0
9	WB6IAG	4' dish 1/2" mesh TV type (Clear Beam)	17.3
10	WA6MGZ	4' dish with foil	16.2
11	K6HMS	Solid Aluminum Horn	11.5
12	WA6MGZ	Same as 10 but different feed	16.1
13	WA6MGZ	Same as 10 but foil removed	12.4
14	K6HCP	Same as 7 with IAG feed	16.3
15	W6BUR	32 el colinear (silver plated)	12.8
16	WA6NCT	Zig-zag antenna	7.0
17	WA6GYD	32 element colinear	14.2
18	WA6NCT	Coffee can	3.1
19	WA6NCT	UHF corner reflector (stock TV ant & balun)	5.1
20	WB6IOM	24 turn helix, 3" diam., 3" spacing	8.2
21	K6HOU	8 element "Clean Sweep" yagi	7.8
22	W6BUR	32 el (same as 15 but new balun)	11.5
23	K6MIO	Big dish and std. ant. feed	17.1
24	K6MIO	12.5 ' dish with IAG feed	16.8
25	W6ZOP	Half horn monster	10.1

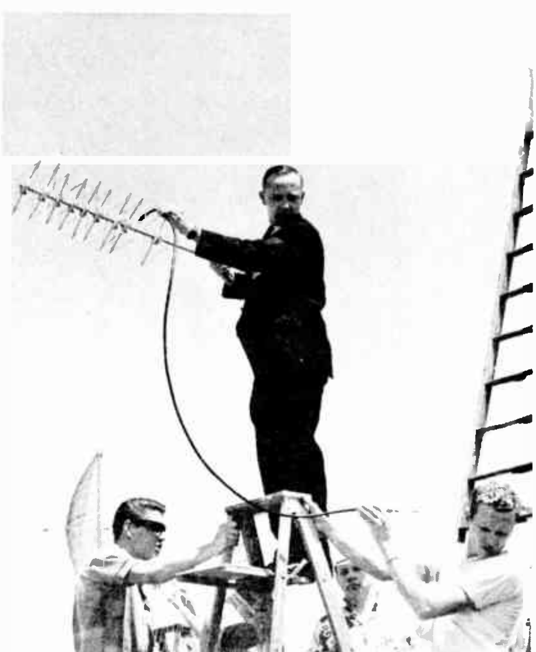


K6HOU's "swept" antenna and W6ZOP's half horn.

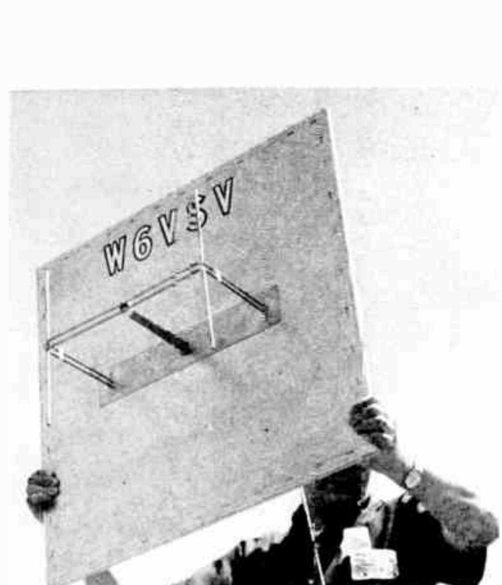
WA6MGZ's UHF TV antenna



K6HAA's 32 el collinear



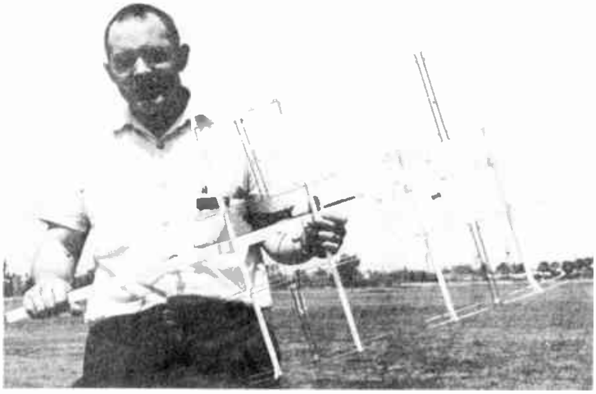
VE3DNR's quad



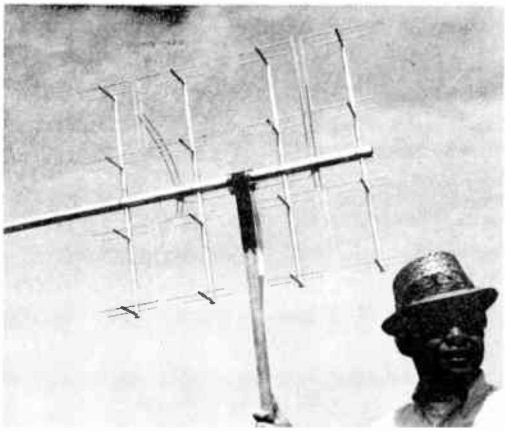
W6VSV's reference antenna

VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions, $1.50 per year, Canada & Mexico, $1.75 per year, others $2 per year. Second class postage paid at Beaverton, Oregon 97005.

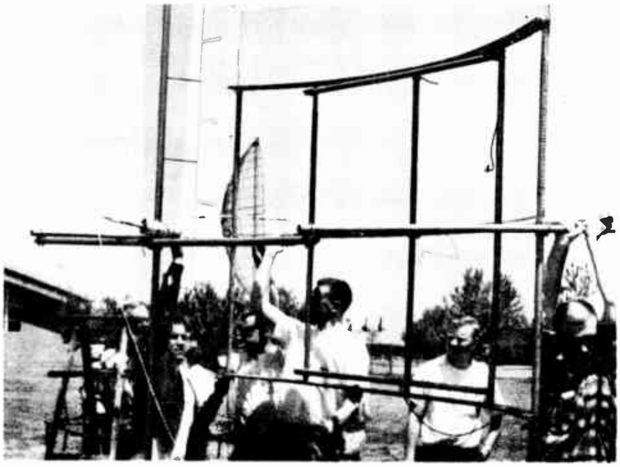
WA6GYD & his 32 el. colinear



W6TZJ & his corner reflector



W6BUR's 1296 colinear



K6MIO's cylindrical parabola

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

The first concept one must grasp is that antennas for moonbounce must of necessity be large in size and gain. In addition it can be said that the higher in frequency you go, the smaller in physical size the antenna can be made providing power output can be held constant and receiver noise figure (at the antenna terminals) held to values in the one to two db. region. Now of course trade-offs can be made--such as larger antenna gain can be used to make up for the lower equipment performance at the frequencies above 1 Gc. At any rate we have to think in terms of building antenna systems that have a lot more gain than most amateurs think about building.

There is a great temptation to think that the only type antenna to use for moonbounce work is a parabolic dish. There is something very esoteric about a dish that inspires great faith in the VHF man. Unfortunately on 432 and down the dish tends to be a waste in size and bulk. On 432 you would like to have something just over 30 db of gain (over an isotropic radiator) and on 144 something over 26 db. Since you get this antenna gain on both xmit and receive, a loss of one db means a two db loss in echo returns. So you see it is important not to fudge these figures very much in the downward direction. Any more gain is going to go up by the same factor of two, so get all you can.

Back to this problem of size vs. gain. There is a definite relationship between size and maximum gain obtainable from the size. You can calculate this factor as follows:

$$\text{Area Gain} = \frac{4\pi A}{\lambda^2}$$

A = area of antenna in square feet
AG = whole number power gain
λ^2 = wavelength in feet squared

This will tell you the maximum gain you can obtain for a given size antenna (in area) over an isotropic source. In very small devices such as a dipole or small yagi, this requires further interpretation. But for large antenna structures such as we have to consider, it is very workable.

Now you will note I said the maximum gain obtainable. There is no known way to do better than this, and in normal practice, antennas that are no more than one to two db down from area gain are considered excellent antennas. Now a dish (as used by amateurs) is always going to be at least three db down from area gain. Three db down means that the antenna is working only up to half its area in theory. This is the reason I make the statement that a dish from 432 down is not necessarily the best way to go. What I hope to point out is that driven arrays can be built for these frequencies that can achieve higher overall efficiencies.

SELECTION OF THE UNIT ANTENNA: This is where one must be very careful, as we all tend to have our favorite antennas. To further complicate things, there is a good case for all the various antennas. To determine the best route to go we must look at this large aperture we want to fill up with antenna elements and determine where the losses come in that reduce the actual gain over the full area gain. In the case of the parabolic dish, the tapered illumination and spill-over of the feed system reduce the efficiency. If we could build a feed that had constant illumination from the center to the edge of the dish and then complete cutoff, we could build close to a 100% aperture. As you can visualize, this is a rough assignment for which there is no simple solution.

With the driven arrays, the losses show up in a slightly different manner. The goal would be to fill the aperture with dipoles spaced so that the aperture of each antenna just overlaps. In addition the power should be distributed to each of the dipoles in equal amounts and in phase. Ideally there would be no loss in the phasing harness.

The colinear antenna comes close to meeting the above requirement. The only problem this antenna presents is in the necessary power distribution system. Since there are more individual elements in a system of this type, there will of necessity be a small increase in overall loss in the matching harness. The colinear has much to offer, however. It is a relatively low-Q device and therefore a broadband device. This all means that an amateur who doesn't have the time and ability to measure things carefully enough to go through the design effort for an individual antenna element (such as a yagi) can duplicate a colinear design and have confidence that it will probably work well with little adjustment. I have made this statement before--the best antenna I ever had for 432 was a 256 element colinear array of standard design. Next month we'll continue with the yagi.

MOONBOUNCE AT THE VHF CONFERENCE
by K7AAD

It might seem like we're overdoing this moonbounce stuff and maybe so, since very few of our readers are even slightly interested in attempting such. But if you look at a lot of the articles written in VHFER as a means of getting the most out of what you can afford, I think you'll benefit. K6MYC's experiences clearly show that the antenna makes the difference, because that's all he had that hundreds of our readers don't have. Here is the fantastic story.

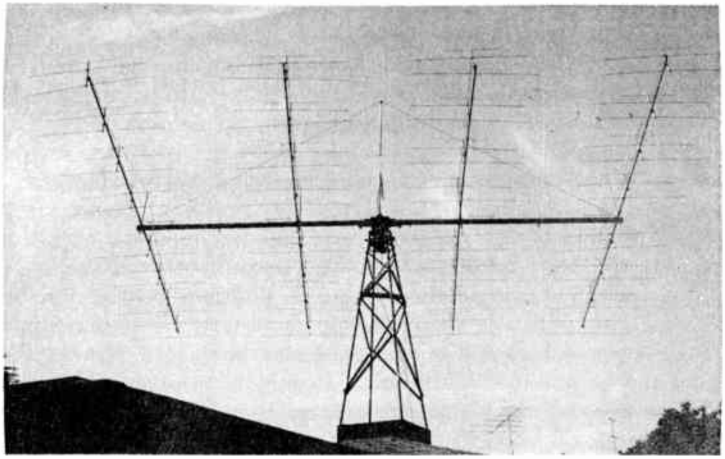
When K6MYC was setting up to work VK3ATN, which he did, he was working for his SECOND two-meter contact. The first one was just a few blocks away. Next, and this is even harder to believe, Mike's exciter and receiver was an SB-34, a mobile sideband rig--just like mine. I nearly fell out of my chair when I heard him say that. What he had that made the difference is an antenna, one any ham of average skill could build for probably $50. Of course he had a KW rig, but there are hundreds of those around and they aren't expensive. So what now is to keep a hundred other hams from doing moonbounce with their own gear now that K6MYC has shown how determination and brute force will do it. W6DNG's approach was different--one of meticulous care, getting the maximum of performance out of everything. Of course there was no guide, he was a pioneer. And with a lot only 40 feet wide and heavy traffic nearby, his techniques had to be different.

Both moonbouncers brought tapes of echoes and contacts to the VHF Conference in Fresno. Less imagination was required to hear the signals than previously. Bill (W6DNG) had some other tapes he left at home because "nobody would believe it, anyway." These are tapes of his contacts with OH1NL in Finland using FSK and gating a tone generator. FSK picks up 3 db right away and with other techniques Bill has used in the past I'll bet he does have good tapes.

During K6MYC's early attempts at an echo, he used a transistor converter with no success. The converter did test very good for noise figure. He borrowed a Parks converter locally and got echoes right away. Apparently the high intensity of r.f. signals in the bay area was causing cross-modulation in his transistor converter making it effectively very noisy. A cavity filter in front of it cleaned things up so that he could get echos through it. Maybe this would help some of the "advanced" hams using transistor converters in congested areas.

Here are some excerpts from K6MYC's letters to me. " My May skeds with F8DO were again a single-ended success as F8DO reports he copied us on 144.004 and Vic, WB6KAP, on 144.0047 for almost a solid hour. Neither of us heard a thing. We've also been running echo checks with Ken, K6HCP, who now has 2 28' boom yagis. So far Ken's heard nothing and we've heard our echos consistently but quite weak as the portion of the sky at the time of the tests was not its quietest. Last Sunday we tried again but neither of us heard a thing as our sky noise was about 6 db above normal. Ross, WB6DEX, heard his own echoes weakly and copied our signals briefly on two occasions. Following is a couple of sked times for VK3ATN, all GMT. July 31, 1738. Aug. 5, 2216. Skeds go plus and minus 12 min. from times listed." From June 21 letter, "First sked with F8DO we heard nothing. Second we heard a carrier on Marius' freq. for about 15 sec. with moon echo type fading. Last sked heard nothing. We had our own echoes at one time or another during each sked. My conclusion at this time is either Marius' 72 elements of 8-9 element Yagis does not have 20-21 db gain or he's not getting 500 watts to the antenna. I heard my own echoes over quite a range of amplitudes and with 22.5 db antenna certainly should hear even a signal that is 5-8 db down from me. Sked with VK3ATN went a little better, although Faraday appeared to be quite slow during this sked as I never heard my echos during a 40 minute attempt.

I've been making some interesting comparisons between a hopped-up 75A3 & audio filter and my SB-34. No matter what bandwidth I can achieve with the A3 system I can still hear the same weak signal thru the SB-34 speaker. When I finally lose the signal in the A3 system it is also gone in the SB-34. Apparently my ears give the SB-34 a 60-90 cycle bandwidth. A note from Ray, VK3ATN for all the 432 & higher bugs. Ray has a 50 foot dish under construction that should have a surface good to 2300 MHz. Ray expects to be on 432 with this antenna late this year. It will be polar mounted and able to track from horizon to horizon allowing much more time on the moon than his 2 meter rhombics. For more info tune to 21.415 MHz on Mondays at 0200 GMT, 7 pm PDT Sunday eves."



Here's K6MYC's array of Cushcraft colinears, one half of the orignal antenna used to work VK3ATN in Australia on 2 meters. WB6KAP has the other half.

BACK ISSUES OF VHFER

We regret that we are quite a ways behind in answering VHFER correspondence. We lost our part time man and have to get another. We have very few back issues left, probably not over 50 or so. There is a possibility we will improve that situation somewhat because some issues would be complete if we would print only one sheet (4 pages) of it. Our printing this time is 2400 copies. We appreciate your support, we need your articles.

MICROWAVE

In a few sections of the country, frequencies as low as 432 are without further challenge to a number of the experimenting types. Reasonable converters and transmitters can be built and antenna construction has improved tremendously. So for those looking for new bands to conquer microwave is about all that's left. The techniques are different. Hams working there are not appliance operators, and enthusiasm can be transferred easily when the right groups get together. At the VHF conference in Fresno this was quite evident to me. I was already to forget about making a living and just go full blast toward 1296. After a few days I returned to my senses. If I had an eight hour a day job it would be different, but I have only eight hours off and I have to get some sleep. So while we would LIKE to help and guide, it is presently out of the question. Perhaps we will have a 1296 converter by late fall. But I won't design it, because if I did it wouldn't be marketable. W7UHF is working on it. Don't hold your breath.

One of the enthusiasts I met in Fresno asked if I would assist him in compiling a directory of microwave hams. The problem is that these people are so few and far between except in heavily populated areas that there are people working alone who could be skedding--if they just knew who to contact. We will publish a list in VHFER at a later date. But for now, if you have OPERATING equipment (no dreams), please send your name and address and a little note about your interests to Leland M. Farrer, K6KBE, 492 Lomer Way, Milpitas, Calif. Home Phone is Area 408 262-2906. Information on sources of equipment is also wanted. Mel travels extensively in the eight western states and would be happy to visit anyone in that area when time permits.

Here is a report on Mel's activities: On June 4, Dick, K8KDX and I made two shots on the 5850 Mc. band. The first shot was a short one of 3 miles to check out the equipment and work out any alignment bugs. Copy was excellent, pinning the AGC level indicator on both I.F. strips. Power in both cases was approx. 500 millwats output. I was using a 4 foot dish and Dick was using a 2 footer. Both stations were polarplexers with 90 Mc. I.F. strips. The second shot was 20 miles and many problems arose---freq. drift because of a.c. power change, heavy fog layer, FM station leak-thru in the I.F. strip and errors in orientation. All in all a 10 minute contact was made. The directory is coming along with about 30 hams in the west listed.

A note of info. about a new antenna design for VHF from Electronic Design mag. In Vol. 15, #10 dated may 10, 1967 on page 33, a news release describes a short backfire antenna. Ed. note: Mel sent this info to us. Since Electronic Design is circulated to industry and I had a copy, I will stick my neck out and print this with the hope that Electronic Design will be understanding and not sue me for violation of a copyright. It is extremely interesting and I hope of benefit to some of our readers. I regret my picture will probably not reproduce well. I am not the best cameraman.

Short-backfire antenna may be uhf boon

A physicist at Air Force Cambridge Research Laboratories, Bedford, Mass., says that his recently developed "short-backfire" antenna could be a boon to home uhf television viewers as well as NASA satellite tracking stations.

It is based on Hermann W. Ehrenspeck's own "backfire" antenna—a relatively little-known approach to antenna design. According to its inventor, the backfire antenna operates on a combination of surface-wave and open-cavity principles and introduces gains of from 15 to 30 dB. Moreover, sidelobes are said to be reduced to below 20 dB, backlobes below 30 dB. One backfire antenna is claimed to have a gain of 23.5 dB above isotropic—higher than the gain of a commercial 16-element Yagi array or a 36-element cavity-backed slot array—typical tracking and telemetry antennas.

The name derives from the use of a large plane reflector opposite the feed of an endfire antenna like the Yagi. The signal is propagated along an array of dipoles, reflected from a flat plate and redirected across the dipole array. Thus, the main beam fires backwards and the dipoles serve double duty.

The double-reflector configuration is analogous to that of a laser cavity, which employs two end mirrors to build up the energy level.

As shown in the figures, the short-backfire antenna is the most abbreviated type conceivable—approximately one-half wavelength long—and consists of a 2λ-diameter flat plate with a circular quarter-wave rim, a dipole feed spaced a quarter-wave in front of this reflector, and a smaller disk spaced a quarter-wave in front of the dipole.

An array of short-backfire antennas uses far fewer elements to produce the same gain as other types with the same total aperture area. Thus, a short-backfire antenna $\lambda/2$ long can replace a 5.5λ, 27-element Yagi; an array of 8 short-backfire antennas (or 4 backfire antennas) can replace a monopulse array of 36 slot elements or 48 dipoles. Weight savings permit the use of a smaller, less expensive mount.

The element feeds can be cross or circularly polarized, and the short-backfire antenna is adaptable to monopulse arrays as well as pencil-beam operation. It is also said to perform excellently in feeding paraboloidal antennas.

Representatives of NASA's Goddard Space Flight Center, Greenbelt, Md., are reported to be interested in a network of telemetry stations using this antenna.

Ehrenspeck said uhf set owners could use "chicken-wire" short-backfire antennas for good reception. ■ ■

(continued on back cover)

EXCERPTS FROM THE OSCAR NEWSLETTER

EURO-OSCAR. Tests and evaluation of the satellite package received in April are still proceeding. Delay is caused by time required to exchange notes with DJ4ZC, the builder. Launch of this satellite is not imminent at this time.

AUSTRALIS-OSCAR is a beacon and telemetry system which radiates 100 mw on 144.050 MHz and 250 mw on 29.450 MHz. The signals will be modulated with audio frequencies which provide the telemetry data. Seven telemetry information channels are transmitted sequentially and are followed by a pair of HI's which serve as the identifier and which provide the reference point in the keying sequence. Antenna polariation will be linear. After some modification, environmental testing is expected to take several months. After that another 3 to 9 months is the normal delay between having a package available and the actual launching.

THE COST OF SUCCESS IS PREPARATION. It is not very likely that there will be a launch before the next regularly scheduled Newsletter (in October), but there is much that most of us need to do in preparation for whichever satellite is launched next. Antennas must be built, reworked, or adapted for the task. Receivers and low noise converters are to be obtained. Full duplex capability is to be achieved. This will not be too difficult to accomplish on the split-band operations such as the two-to-ten meter arrangement, but, when Euro-OSCAR is launched, the ability to transmit and receive simultaneously with only 1.8 MHz frequency separation will not be easy to attain. Such capability will be very helpful in satellite operations if it can be done, however. Certainly duplex operation gives the transmitting operator much more confidence in establishing contacts if he can hear his own signals being repeated back to him, and he can avoid unnecessary calls when the other station is already answering someone else.

VHFER NOTE: At the VHF Convention in Fresno I learned a few things about the OSCAR group that were interesting to me and I would like to pass them on to you. First, the problem the OSCAR group has is getting satellites, and not getting space on a launch vehicle. The ham satellites have to be built and tested to meet military specifications. The people who have the know-how to do that apparently do not care to get together & put a satellite package together, with rare exceptions. It certainly isn't for the average ham to do, but he can probably help a lot. The OSCAR group has among its members people who deal with military construction as a part of their jobs and they are available to advise. It would seem that clubs made up of employees of some of the large companies doing space work could band together to produce something. The TRW group did just that and it is a terrible shame the launch went sour. Should you be in a position to contribute in any way (even with an OSCAR membership at $5 I think), write Project Oscar, Inc. Foothill College, Los Altos Hills, Calif. 94022. (by K7AAD)

CENTRAL STATES VHF CONFERENCE

The Central States V. H. F. Conference will have its annual meeting August 19th and 20th at Western Hills Lodge, near Wagoner, Okla. For information or reservations contact Sam Whitley, W5WAX, 409 North "O" street, Muskogee, Okla. 74401.

PROBLEMS WITH PARKS CONVERTERS

It has recently come to our attention how noise figure can be clobbered by a ham changing connectors on the input. If you deform the coil, you've had it. Best rule is, DON'T.

OPEN BANDS

by Marilyn Wiseman, K8ALO

Aurora, aurora, aurora. This is the main topic for the month of May. Best aurora reports since I have been writing the column. Plenty of states worked or heard. Meteor scatter reports also up. Thanks to all who sent in reports. See you next issue. Looking forward to your report. My address: Box 103, Petersburg, Ohio 44454.

50 MHz Aurora:

May 25	WA7BTG (Wash.) wrkd W7ZFG, K7RWT (Ore.) K6RNQ, K6YIL (Cal.) K7ICW (Nev.) wrkd K7PLR (Ariz.), W7CNK (Wash.), K7VGB (Utah), WA5RYX (N.Mex.), WA6EXE, WA6SQI, WA6AKM, WB6GEN (Calif.) hrd K7TLX, W7DNV, KØJKY/7 plus Calif. stations.

144 MHz:

April 2-23	K7ICW (Nev.) wrkd W6NLZ, W6DQJ, W6YVO, K6MBY, W6DEJ, and WA6TBY. Al says a Nev.-San Diego hrd on 2 meter for the first time. Heard both ways (a difficult path).
April 13	K2HLA (N.Y.) wrkd K8UGA (Ohio) 500 mi.
May 9-30	K7ICW (Nev.) wrkd W6DQJ, W6NLZ, W6YVO, W6DNG (Calif.), K7RKH/7 (Utah).

144 MHz Meteor Scatter:

April 19	K2HLA (N.Y.) hrd W5GVE/4 (Ala.) ping, ect. no QSO.
April 21	K1ABR (R.I.) wrkd W9YYH (Ill.)
April 22	K1ABR (R.I.) wrkd K4QIF (N.C.).
April 23	K2HLA (N.Y.) hrd W5GVE/4. K1ABR (R.I.) wrkd W8TIU (Mich.). Dick says no new states for him but first R.I. for Mich. station.
May 1-6	Aquarids showers: K2HLA(N.Y.) wrkd W5GVE/4 (Ala.) 1000 mi. This was new state for both. Hrd W5UKQ (La.), WØNXF (Neb.), KØMQS (Ia.). Dick says not bad for minor shower. K1ABR (R.I.) had M/S skeds with KØMQS (Ia.), W5GVE/4 (Ala.), WØNXF (Neb.), no QSO developed. Dick hrd the Ia. and Ala. stations. Dick wrkd Rusty K4QIF (N.C.) twice during the period Jan. thru May. He will try tropo skeds with Rusty after Rusty gets set up in new QTH. After June 5, K4QIF will be in Portsmouth, Va. (450 mi. path). Dick also passes along this info. K1UGO will be in Maine for Aug. and Sept. only. He will M/S sked. Dick also reports he will continue daily M/S skeds with W4AWS (Fla.) 0710-0745 EDT. R.I. freq. 144.022.5. Fla. freq. 144.105 MHz. Dick says W4NUS (N.C.) has been known to wrk M/S, but hasn't had much news on him lately. K1HTV (Conn.) wrkd W5GVE/4 (Ala.) for st. #27. Hrd KØMQS (Ia.), K4IXC (Fla.), K4QIF (N.C.).
May 21	WØNXF (Neb.) hrd K1HTV (Conn.), W5GVE/4 (Ala.), W8AEC (W.VA), on M/S sked.
May 28	W9YYF (Ill.) wrkd K4IXC (Fla.). Jack says this sked kept every Sat.

and Sun. mornings. He says John comes thru every time but not all QSO's completed.

Attention Meteor Scatter Fans:

Read "Meteors, Comets and Meteorites", book by Gerald S. Hawkins (McGraw Hill Book Co., $2.50). Bob Berk WØNXF says this book is so darned good on meteor scatter info that he wanted everyone to know about it and thought many would be delighted with it.

144 MHz Aurora:

April 23 — K2HLA (N.Y.) wrkd K9UIF (Ind.) 800 mi. Dick says aurora lasted about 30 mins. but was very intense. Sigs. S 9 plus.

May 2-3 — Dick K2HLA (N.Y.) reports very weak aurora both nights, lasting many hours. No QSO's attempted. Dick says 144 MHz conditions during the winter months on East Coast very poor. Band started picking up about the middle of April.

May 3 — WØNXF (Neb.) wrkd WØLER (Minn.) 5-9 both ways. Bob says good opening but no other sig. hrd. He says WWV was sending U 5 at that time.

May 25 — W9YYF (Ill.) wrkd W3GKP (Md.), K1HTV (Conn.), K4EJQ (Tenn.), WØEYE (Colo.), W4HJZ, K4QIF/4, K4YYJ (N.C.), WØEKZ, WØALS (Kans.), W2AZL, WA2FGK (N.J.), K2GUG (N.Y.), W5WAX, W5HFV, W5ORH (Okla.), K3PGP (Pa.). W7FS (Wash.) wrkd W7MKW (Idaho), W7RQT (Utah), hrd W7UFB (Wyo.). Tnx to Kim WA7BTG for this info. WA7BTG (Wash.) wrkd K7ZFG (Ore.) K8AXU (Ohio) wrkd K1HTV (Conn.), W4HJZ (N.C.), K2MHG (N.J.), K5WXZ (Tex.), W5ORH (Okla.). K7ICW (Nev.) wrkd W7DTS (Idaho) for first Idaho-Nev. 144 MHz contact, K7ZIR (Ore.). K1HTV (Conn.) wrkd W9YYF (Ill.), K8AXU, W8DGF/8, W8QOH, W8NUB, W8FEH (Ohio), W4HJZ, K4QIF (N.C.), W3GKP, W3HB (Md.), W4FJ, W4OEA (Va.), VE3ASO (Ont.), W9BRN (Ind.), VE2HW, VE2JO (Que.) K3PGP (Pa.), hrd K4YYJ (N.C.), W4KVI (Va.), W8PIH (Ohio), W8AEC (W.Va.), K3CFA, K3IWK (W.Pa.) W3BDP (Del.), VE3EZC (Ont.).

May 26 — K8AXU (Ohio) wrkd WØFIL (Kans.), W5GVE/4 (Ala.). Al says the band was open from 3:30 p.m. to 4:00 a.m. EDT when he went to bed. Al hrd 24 states. WØNXF (Neb.) wrkd WA9DOT (Wis.), KØMQS (Iowa), W8TIU (Mich.), W5WXZ (Tex.), WA5MFZ (N.Mex.), WØEYE WØIC (Colo.), WØYMO, WØFIL (Kan.), W9PBP, W9BOZ, W9JGQ (Ill.), W5GUG (Ark.), W5ORH (Okla.) hrd W8KAY (Ohio), W8PT (Mich.) Bob says a wonderful aurora from 0000 to 0330 CDT. Bob now has 34 states.

May 28 — K1HTV (Conn.) wrkd VE3FKX (Ont.), K4SUM (Va.), W9YYF, W9PBP, W9BOZ (Ill.), W8HSZ (Mich.), W8QOB (W.Va.), WA9DOT (Wisc.). K8AXU (Ohio) wrkd KØMQS (Ia.), W1AZK (N.H.), WA9DOT (Wis.). Al says the band was open until he retired at 2:00 a.m. hearing 14 states. states. W9YYF (Ill.) wrkd W1MEH (Conn.), K1HTV, K1ABR (R.I.), K2LGJ, W2SFK, WA2CJK, K2DNR, K2TXB, K2GUG (N.Y.), W2AZL, W2BLV (N.J.), W4HJQ (Ky.), K4SUM (Va.), WØNXF, K7UMC/Ø (Neb.) KØIJN (Minn.). WØNXF (Neb.) wrkd WA8PIE, K8TIU (Mich.), W9YYF, W9UNN, W9ZIH, W9BOZ, W9MAL (Ill.), W9BRN, K9UIF (Ind.), W4HJQ (Ky.), KØIJN, WØLCN, WØRLI (Minn.) KØGEY, KØMQS (Ia.),

	K8UQG (Ohio). Bob says WWV was sending Geo MMMMM also U 3.
May 29	WØNXF (Neb.) wrkd W8PT, W8HSZ (Mich.). Bob hrd several Mich. Ill., and Ia. stations wrking far East Coast, with no W1's or W2's getting through to Neb. K1HTV (Conn.) hrd KØGEY (Ia.).
May 30	K1HTV (Conn.) wrkd W3BDP (Md.), K8DEO, W8KAY (Ohio), K3CFA (Pa.), VE1ER (New Brunswick), W9BRN (Ind.). Rich says May was an interesting month as far as 2 meter propagation is concerned. W9YYF (Ill.) wrkd K2YCO, K2GUG, K7UMC/Ø (Neb.) and many others within 300-400 mi. distance. K8AXU (Ohio) says the band was in and out from 9:00 p.m. till midnight EDT hearing 8 states. Al says he listened on 432 MHz band all 3 days not hearing any sig.
May 31	WØNXF (Neb.) wrkd W9UNN, K9SGD (Ill.), W8KAY (Ohio).

220 MHz Aurora:

May 25	K8AXU (Ohio) hrd W8PT (Mich.). Al says he wished there was more activity on 220 so the band could be used for good openings like this.

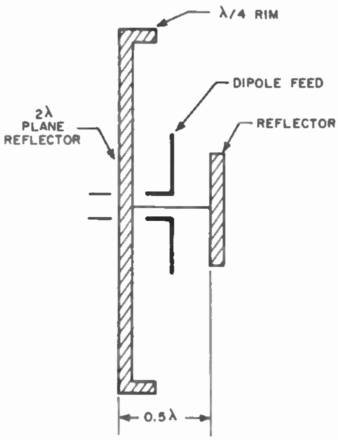
432 MHz:

May 11-28	K7ICW hrd and wrkd W6DQJ. Also hrd K7RHH (Nev.).
May 30	K7ICW wrkd K7RKH/7 (Utah) for the 1st Utah-Nev. 432 MHz QSO

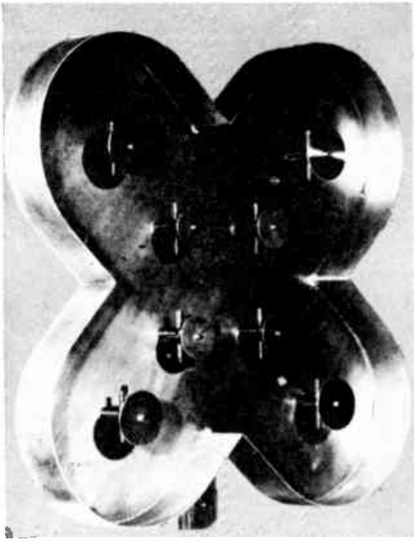
Skeds Wanted:

K2HLA	Dick Wilborg, RFD #1, Cutchogue, L.I., New York 11935 wants skeds with Ga., Miss., Ark., La. and Kans. Also looking for long haul skeds for August perseids meteor showers up to 1000 mi.
W9YYF	Jack Spencer, 205 Sherry Lane, Joliet, Ill. 60433, wants tropo or meteor scatter skeds on 144 MHz. Jack uses 4CX250 500 watts 8/8 J Beam.
WØNXF	Bob Berk, 5218 Prescott, Lincoln, Neb.68506, wants 144 MHz meteor scatter skeds with Idaho, Wyo., Utah, Ark., Miss., and others, freq. 144.022 MHz.
K1HTV	Richard Zwirko, 19 Lancer Dr., Thompsonville, Conn. 06082, phone no. 203-745-0428, looking for meteor scatter skeds with Miss., Ark., Kan., N.D. and N.E. Texas. Rich also says he's available for M/S sked for anyone needing Conn. Rig: 4CX250 F 500 watts. Ant. 11/11, rcvr. nuvistor converter into HQ170, M/S freq. 144.103 MHz. Also VXO 144.001 to 144.190. Rich also reports the East Coast VHF net meets on Sun. nights at 2100 EDT on 3815 Kc.
K4QIF	"Rusty" Holshouser, 3800 Yaupon St., Chesapeake, Va. 23706 wants 2 meter meteor scatter skeds everywhere as he just moved.

Ed. note: When you want a meteor scatter listing for the first time, please include a description of your equipment. The listing is intended for hams with good equip. A person answering your request has a right to know if you're properly set up. No one wants to get up at 3 a.m. & pound brass trying to work an 829B into an 8 ft yagi.



1. Short-backfire antenna uses two reflectors to build up energy level



2. Cloverleaf of short-backfire antennas form monopulse array

Published by Parks Electronics Lab.
419 S.W. First
Beaverton, Ore. 97005

WILLIAM R. ... 4-68-1
371 PRUSSIAN LANE
WAYNE, PA. 19087

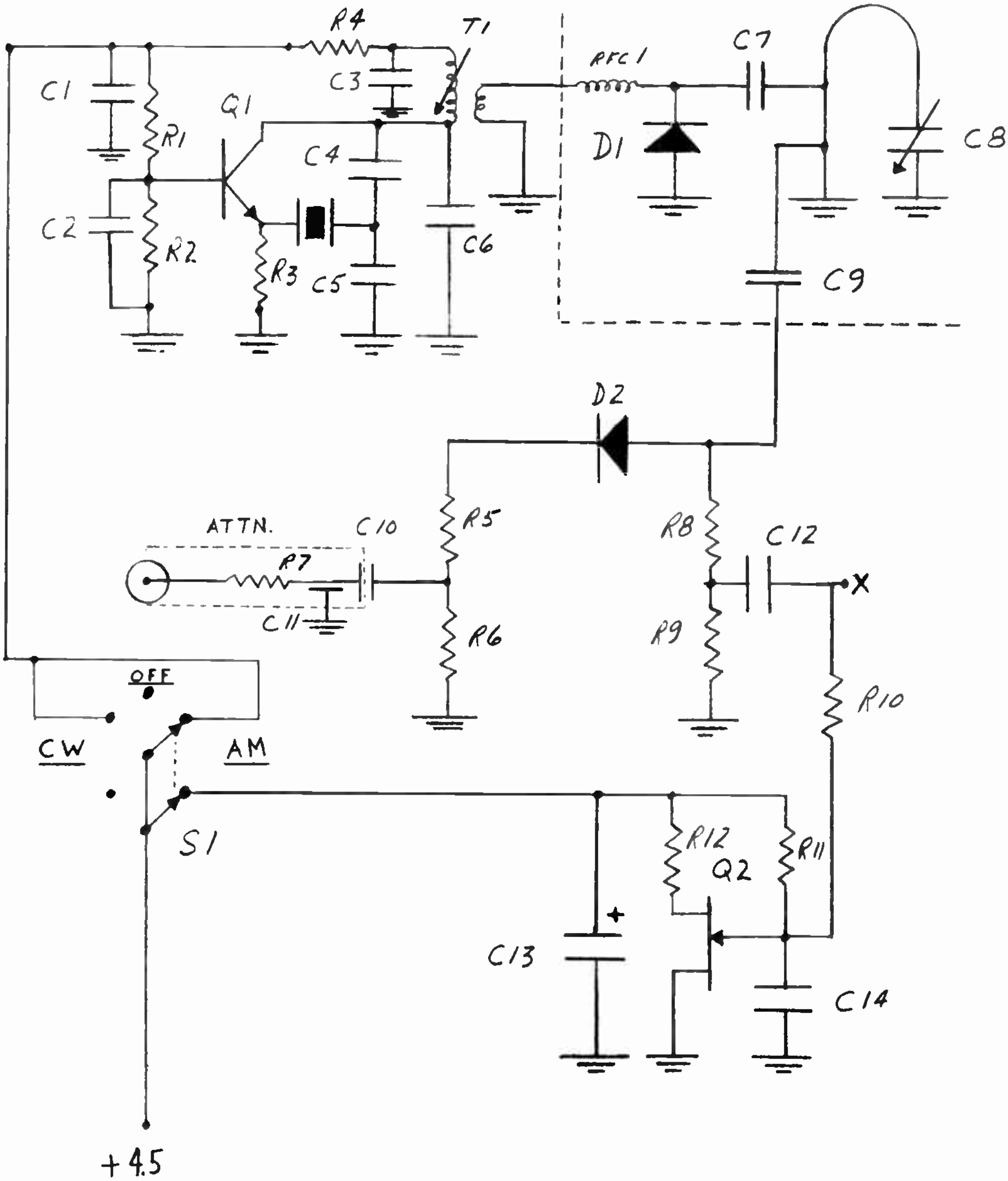
Return Requested

VHFER

50 MC. AND UP

LEARN BY DOING

Volume 5, No. 2 March-April 1967



432 MC. SIGNAL SOURCE

Nuvistor
CONVERTER

- Noise Figure less than 3 d.b. over full 4 Mc. Bandwidth.

$60.00 POSTPAID

Here is the converter that has been accepted by advanced hams all over the U. S. A proven performer for weak-signal work. I. F. ranges available put 144 Mc. at 7, 10, 14, 21, 22, 24, 26, 27, 28, 30.5 or 50 Mc. Choice of connectors: UHF in, phono out (shown) or BNC in and out. Available from stock.

Just think for a moment. How many brands of VHF converters are available today. Really there are only two principal manufacturers--one that sells through dealers and one that doesn't, (that's us). Yet if you look back in the ham magazines you'll see many ads of little companies that have made their little flurry, wild claims, and then laid down and died. Parks converters have been around for quite a few years. You don't stay in business if you don't have something people want. Of course hams talk to each other a lot, and they describe their equipment. A lot of the big DX names have Parks equipment--moonbouncers too. Give a listen on the bands and ask the DX boys about Parks converters. Many of you might think you'd be more likely to buy if we sold the converter as a kit at a lower price. No soap. We don't want our name linked with anything you put together yourself. I couldn't put one of our conv-verters together and be sure of how it really was working--without test equipment. And 99.999% of you couldn't either. We've made many hundreds of converters and I can tell you for sure a lot of them don't tune up right at first. A little difference in the way a coil is wound can make the difference between making specs and not making specs., and there are a number of other things that happen. If you buy a Parks converter you know you've bought a standard of performance, that it's been aligned and the noise figure checked to prove the converter meets or exceeds the advertised spec. And if you keep your c.p. hands off the slugs it will stay that way for hundreds of listening hours. While tube failure can happen, it is surprisingly rare. The little nuvistor keeps its noise figure well and it tolerates r.f. leakage from your rig. If you're waiting for a transistor converter that works better than ours, you may have a long wait. A db. is about the most you could gain, and you can't hear that. A pre-amp. could always be added. Parks converters are on the shelf with same-day shipment being the rule. Prices are postpaid, $2.50 more for air mail.

PARKS ELECTRONICS LABORATORY

419 S.W. FIRST AVENUE

BEAVERTON, OREGON 97005

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

As I write this newsletter, the Crawford Hill VHF Club has just completed the first of two weekends of tests on 432 moonbounce. Two good two-way contacts were made with European stations, and the TIXM05 preamp (as described first and exclusively in the VHFER) was given a real system check.

The Crawford Hill group using the call W2IMU/2 and the sixty foot dish they have access to, were on the air for several hours on April 15th and 16th. On the 15th they had an hour QSO with HB9RG. Hans reported their signals 10db over the noise in his audio filter. HB9RG's signal peaked about 6db over the noise in a 300 cycle bandwidth. It was reported to me that HB9RG has permission to operate with two KW and was doing so during the tests.

On April 16th an hour contact was made with G3LTF. Both G3LTF and HB9RG were using relatively small dishes (under twenty feet) with parametric amplifiers in the front end. G3LTF also used the VHFER type TIXM05 preamp. The W2IMU signal was also copied well by PE1PL in Holland, but PE1PL was not copied well in the USA due to low transmitter power on the Dutch end.

I had a long conversation with Dick, W2IMU, after the tests and his report of echo tests is most interesting. The system consisted of the following: antenna--60 ft. dish with gain of 36 db, transmitter power--500 watts to the antenna. Receiver had a TIXM05 regenerative type preamp for the front end mounted about 30 feet from the feed antenna.

In addition to the QSO work, echo return tests were run. These tests began at the horizon and continued to the zenith. Echo returns were exactly the same in signal strength from the horizon to straight up. The conclusion of this is that there is no penalty or advantage to working on the horizon on 432. The test was also run to determine the effects of libration spreading on the return echoes. This is the effect I described before which shows up as a very rapid type of QSB on the received signal. It, in effect, puts holes in a two second echo pulse. This effect shows up worse at the zenith than at the horizon. While there was some increase in the effect at zenith, Dick felt it was small at 432 and would have an effect only on signals that were very close to the threshold in detection.

One other effect was observed by G3LTF which is of interest. The dish at Crawford Hill is El-AZ mounted and is linear in polarization, which means that the polarization is constantly shifting with reference to the equator of the moon. G3LTF has his dish on a polar mount. He found he had to rotate the dipole feed antenna in order to bring the W2IMU signal up to peak value. There is an important conclusion to be drawn from this test. From 432 up, it is important to make sure that your polarization is in agreement with the station you are trying to work if linear polarization is in use. This is another reason I have been an advocate for the polar mount. An

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VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions, $1.50 per year, Canada & Mexico, $1.75 per year, others $2 per year. Second class postage paid at Beaverton, Oregon 97005.

antenna on a polar mount that has polarization horizontal to the equator of the moon will also be lined up with any similar antenna anywhere in the world over the full moon orbit.

Dick also was able to check the TIXM05 preamp in a practical system for the first time. The results were exactly as predicted. In previous tests a paramp was used with all the refinements except cyrogenic cooling of the diode. The 50 cent transistor was slightly better due to the reduced feedline loss. In addition, they are now experimenting with two preamps cascaded, and measurements indicate even better results. One of the side problems that was feared did not in practice develop, i.e., front end overload from out of band signals. The antenna site at Crawford hill is line of sight to the New York metropolitan area with it's multitude of radio services, TV, radar and what have you. The little preamp gave an excellent account of itself with no cross modulation effects observed during the entire testing period. This confirms all the tests I did at my own hilltop QTH.

While the Crawford Hill group will continue to operate on 432 when enough interest can be shown by other groups, they are continuing their efforts to get a system going on 1296. This is perhaps a more significant development than you might at first think. If you stop to consider that a 50 per cent efficient reflector type antenna of 300 square feet can give you your own echo returns, it will probably be feasible to work against the sixty foot dish with something like a six foot dish. For anyone with a small antenna problem and no place to build a bigger one, 1296 has much to offer.

I will admit that equipment is somewhat of a problem for most, but it is indeed getting easier. Melabs has available for off the shelf delivery a circulator for under $100.00. Similar units were selling to labs a year ago for over $300.00. Several of my friends here on the East Coast have been working with water cooling of 2C39's and getting good increases in power dissipation. While there is some noise stirring about transistors, the paramp is still the best route to go if possible.

While the cylindrical parabola has been talked about a good deal, little has been done about a big one for amateur work. I'm currently building an experimental one 24 ft. by 16 ft. I should have results in about two months. Dick, W2IMU, who is a real live commercial antenna expert assures me the line feed is not the problem most amateurs think.

In closing, I would like to throw out a request for help. One equipment problem in moving to the higher moonbounce bands that require a paramp, is a stable pump source. While solid state sources are an expensive solution, a phase locked kyystron is a cheap solution for the amateur. If you have done any experimental work along these lines, I would appreciate knowing about it for my own use and the use by many who are struggling to get going at the higher frequencies. What I would really like to have is an amateur version of the HP phase locking unit that works over a wide range of microwave frequencies, and thus could be used with a wide variety of pump sources.

For the printers, VHFER is printed on a Davidson 241-W. Sometimes I print it and sometimes a friend who is a professional (and a ham) prints it. That's why you see such wide variations in quality. Our last mailing was 2022 copies. A few months back we were printing 2,000 and had 400 left over. Now our back issues are in pretty sad shape--mostly gone.

432 MC SIGNAL SOURCE

by Richard W. Stroud*

After recently completing the construction of a 432 Mc converter, I was again faced with the problem which at some time confronts most UHF hams--How do you go about alignment without expensive test equipment? The old standby of plugging an 8 Mc crystal into a grid dip meter and tuning up on the harmonic is okay for rough alignment, but not what you want for getting right into the noise. Also, at least in the midwest, you can't sit around waiting for a weak signal on 432 without growing old fast.

The end result was the construction of the 432 Mc signal source shown here. This unit has been used to align many 432 Mc converters, and has been used as a signal source for antenna gain and pattern tests. When not otherwise being used it makes a good calibrator for 432 Mc and sits in a handy location at the UHF operating position.

The unit is comprised of a 2N706 crystal oscillator, 1N3857 tunnel diode multiplier and 2N491 unijunction audio generator. It is housed in a home built 4-1/4" x 2-1/4" x 1-1/2" "minibox". It operates from a 4-1/2 volt battery and current drain is 4 MA.

Although the unit is built for 432, the only necessary change to hit 144 or 1296 Mc would be the substitution of a suitable inductor at L1. The tunnel diode puts out rich harmonics far beyond 1296 and the Q of the inductor should be high to pick out the desired harmonic of the 9 Mc drive.

Modulation is essentially a sawtooth, the frequency of which is determined by the time constant of R11 and C14. If sine wave modulation is desired, audio from a more sophisticated A.F. oscillator may be fed in at point "X" (remove R10); however, the method shown here is quite suitable for receiver alignment and has the advantages of being self-contained and drawing practically no current. Modulation using the resistor values shown runs about 30 per cent.

Construction of the signal source is straightforward. Just keep the leads short and don't overheat the tunnel diode during assembly. It is best to use some sort of heat sink.

A 2-1/2" x 1-5/8" x 1/16" thick fiberglass board with rivet in terminals is used for mounting the crystal oscillator and unijunction oscillator components. A similar board 1-1/2" x 7/8" is used to mount the diode modulator components. The oscillator board is supported by 5/16" metal spacers above the chassis and the modulator board is spaced 3/32" from one of the shield sections. A shield is used between the oscillator board and the tank coil L1. A second shield is used between the tank and the output attennuator. A piston capacitor is used to tune the UHF inductance to resonance.

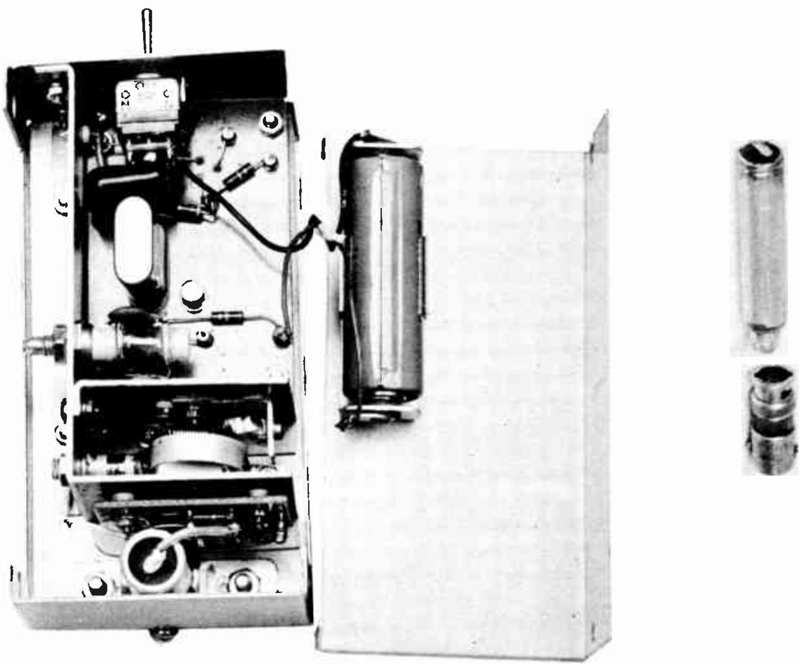
Teflon press-fit feed through terminals are used to route the RF and modulation signals through the shields. The tunnel diode is supported by a standoff terminal mounted on a small bracket bolted to one of the shield positions. The grounded side of the tunnel diode is connected to a ground lug under the standoff terminal.

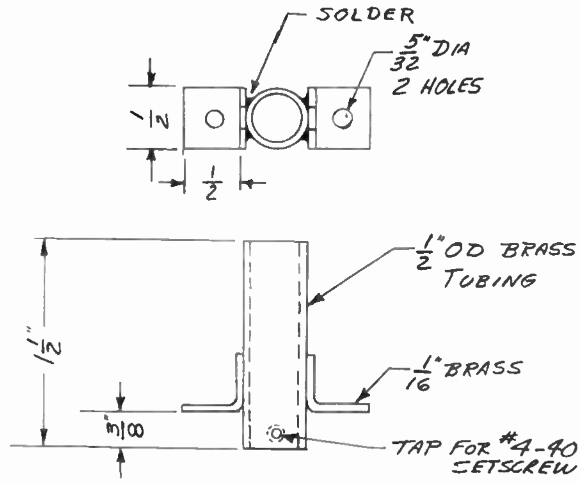
*Communications & Avionics Dept., Magnavox Company, Ft. Wayne, Indiana

The battery is mounted in a clip on the bottom cover of the minibox.

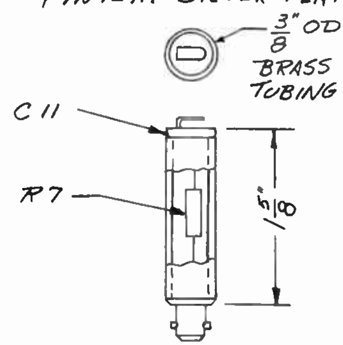
The piston attenuator is made of two telescoping sections of silver plated brass tubing 3/8" and 1/2" O.D. Two brackets are soldered to the 1/2" tube for mounting to the minibox with 6-32 screws. The inner section of the attenuator is 1-1/2" long and a "MNC" miniature panel connector is soldered into one end with a 51 ohm 1/4 watt resistor attached. A small button capacitor, C11, is soldered into the other end of the tube with the resistor lead sticking through the center of the capacitor. The resistor lead is then soldered and cut off. The outside capacitor tab is then bent back over the center terminal and aligned above a heavy wire lead extending from the junction of R5 and R6 (see photo). This forms capacitor C10. The output level is then determined by the ratios of the voltage divider made up of C10 and C11. The attenuator is adjusted by loosening the 4-40 screw and telescoping the piston to obtain the desired output.

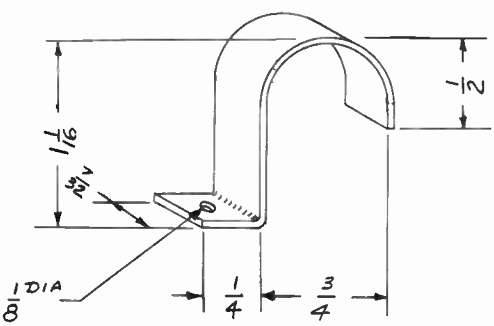
If it is desired to operate the unit without the attenuator for antenna alignment or gain measurements, a BNC panel connector, UG1094, with a short length of bus wire attached to make contact with the output lead, is inserted into the larger tubing in place of the piston and is held with the 4-40 screw. This gives a 432 Mc output of about 100 microvolts which is about right for "weak signal" antenna alignment. A quarter wave length of heavy bus wire or other suitable antenna is then connected to the coaxial fitting.





ATTENUATOR BODY
FINISH: SILVER PLATE





MATL: .032 BRASS
FINISH: SILVER PLATE

INDUCTANCE LINK L1

ATTENUATOR PISTON
FINISH: SILVER PLATE

The circuit diagram for the signal source is on the front cover. The parts list follows on page 8.

SATELLITE LAUNCH TIME NEARS

OSCAR 5 may be launched early this summer according to an article in the May CQ. It will have a beacon at 145.95, a transmitting band between 145.880 and 145.920, a receiving band between 144.080 and .120. Frequencies in the transmitting band are inverted from those in the receiving band. 2 meter signals received are amplified and instantaneously retransmitted over a distance of several thousand miles (possibly) depending on the orbit. The satellite will operate continuously and has a life expectancy of about three weeks. If you're interested, see the article in CQ & get ready to go. An antenna you can point at the satellite will probably be of considerable help.

C1, C2, C12	- .01 Disc. Ceramic
C3, C9	- .001 Disc. Ceramic
C4	- 56 pf. Dura Mica
C5	- 120 pf. Dura Mica
C6	- 44 pf. Dura Mica
C7	- 1.5 pf. Q.C.
C8	- 8 pf. Piston Trimmer
C10	- Capacitor Tabs (See Text)
C11	- 15 pf. Miniature Button Feedthru Erie 2933-006
C13	- 5 MFD. Tantalum
C14	- .25 MFD. Paper
R1	- 12 K
R2	- 27 K
R3	- 300
R4	- 180
R5, R6	- 100
R7	- 51
R8, R11	- 10 K
R12	- 1 K
Q1	- 2N706
Q2	- 2N491
D1	- 1N3857
D2	- 1N341
CR1	- 9.000 MC Crystal
B1	- Eveready 333 or Equivalent
S1	- Miniature DPDT Center Off Switch
RFC1	- 12 T. #26 Enamel Close-wound on 1/8" Dia. Phenolic Form
T1	- ¼" O.D. Ceramic Form: Red Core: Pri- 24 T. #29 Soldereze: Sec- 4 T. #29 on Low End of Primary
L1	- Output Tank Inductance .032 Silver Plated Brass (See Sketch)

All Resistors 1/4 watt 5%

All Capacitors 10 V. Min.

. . . . AND ANOTHER

by Donald L. Hilliard, WØEYE

Much has been written in the past couple of years about 432 Mc. preamplifier design. I have built several myself during the past several months. Included in these were ones using TIXM05, 2N2857, 2N3783, 2N3399, 2N2398 transistors. I usually followed an article in which the author claimed very low noise figures and stated the device's gain in db. I usually didn't have much difficulty obtaining the stated gain, but never was I able to obtain the claimed noise figure. This is not to say that the device described could not produce the claimed noise figure, but that one could develop serious doubts about it. It is the purpose of this article to describe in detail a preamplifier for 432MHz. that is capable of a measured 3.4 db noise figure and has a gain of 14 db. A block diagram (Fig. 1) shows the setup used in establishing the 3.4 db figure.

Motorola recently announced a new transistor, probably for UHF television applications, for which they claimed a typical noise figure of 5 db at 800 MHz. It is the AF239. I obtained two of these devices (PNP germanium) and was pleasantly surprised when I plugged one into an existing preamp that used a 2N3399. The 2N3399 measured 4.8 db when used in the first RF amplifier shown in Fig. 1. The AF239 was then substituted and the supply voltage adjusted for minimum indicated noise figure. The HP340B indicated 3.4 db. Noise minimum occurred with the supply voltage adjusted to between 10 and 12 volts. At supply voltages below and above this range the noise figure deteriorated, quite slowly however. This would seem to indicate that the noise match was about optimum. Gain under the above conditions should be about 15 db, versus about 10 db gain for the 2N3399 in the same circuit. Occasionally an article on a preamplifier will appear in which the author will claim a very low noise figure. More often than not they are devices that are regenerative. Often such a device can be adjusted for almost any noise figure desired, including very low ones. Controlling the regeneration can be quite frustrating when the preamp is put into the station setup however, unless the input and output impedances are essentially the same as they were when the amplifier was being tested for noise figure. Small variations can throw the device into uncontrolled oscillation and the device becomes useless until this condition is corrected. This is the reason why I shy away from such devices. The unit described here is stable although care must be taken in construction to assure that a tightly fitting bottom plate can be used.

The circuit is a straightforward common-emitter one. It is quite similar to circuits that have appeared often before. Care should be taken to keep a minimum amount of inductance in the emitter circuit. The emitter bypass capacitor is placed as close as possible to the transistor socket. Much has been said about whether or not to use a socket. If a transistor should go bad for some reason during a contact with a new state, for instance, and you wish to change it, you want to change it then, not later after the aurora or tropo has gone. This is the reason for using a socket. I don't believe there is any deterioration in performance in using one in this design. Figure 3 gives dimensions of the mechanical construction.

The circuit is designed so that polarity of the supply voltage may be reversed and an NPN transistor used if one desires to compare the merits of various transistors. The bias resistors are connected on top of the unit on the three feedthrough bypass capacitors. This arrangement makes it possible to vary the biasing easily.

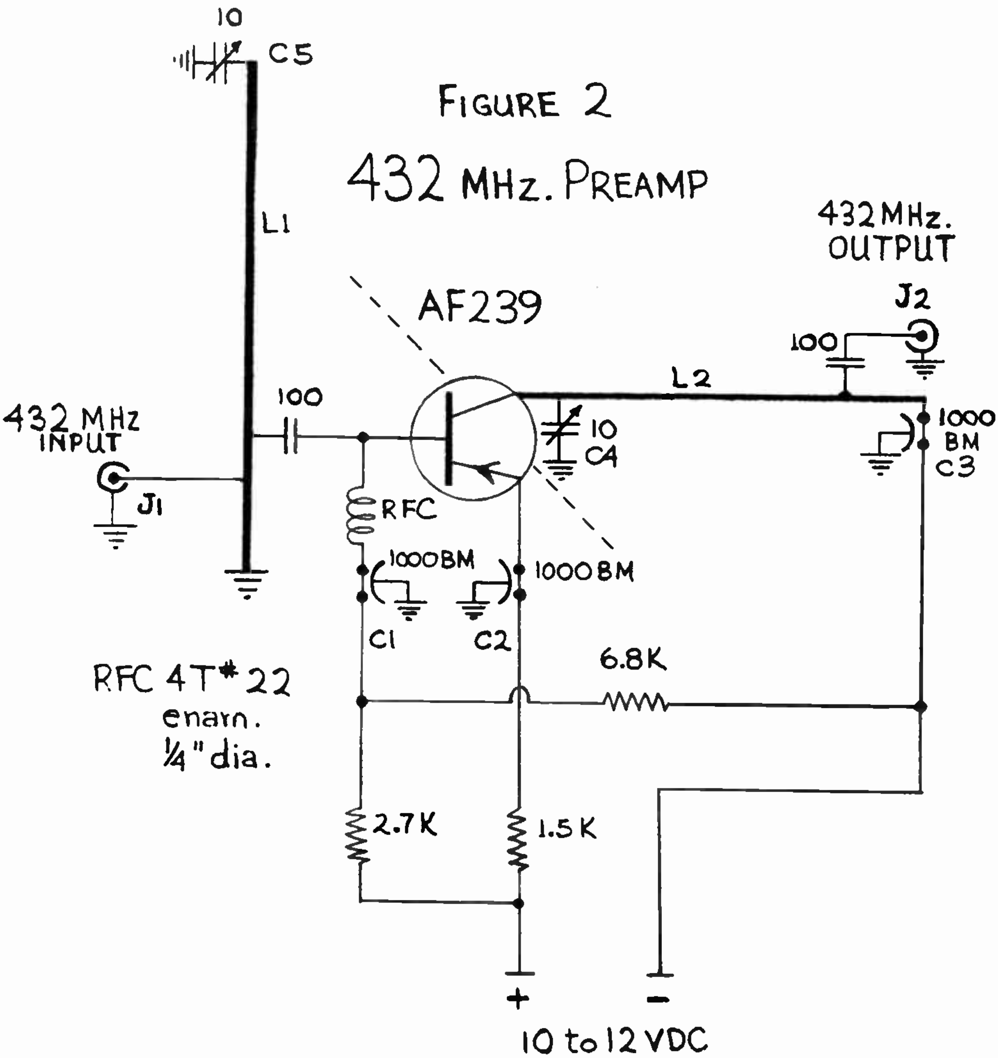
Capacitors C4 and C5 may be any high-quality piston type with a maximum capacity of

* P.O. Box 563, Boulder, Colorado 80302

about 10 pf. Input and output connectors are UG1094/U. Capacitors C1, 2, 3 are solder-in type button micas. Figure 4 shows the dimensions of both the input and output circuits. The base tap on the input circuit is 3/16" above the antenna tap. The transistor case lead on the socket is soldered to the internal shield. This shield is soldered to the chassis on all edges. The bottom plate has 3/16" lips which are tapped for 4/40 screws.

If a noise figure meter is not available for checking the device out, a good quality noise generator may be used or the preamp may be tuned for best SN using a weak signal. The AF239 should be obtainable from any Motorola dealer. He may, however, have to order it out special from Phoenix as it is a new device and until there is more demand he may not carry it in stock. The price is about $2.20 in single quantities.

I wish to thank Gerry Reeve, WØKEI, for suggesting that I try this transistor and also for his suggestions and help in making the noise figure measurements.



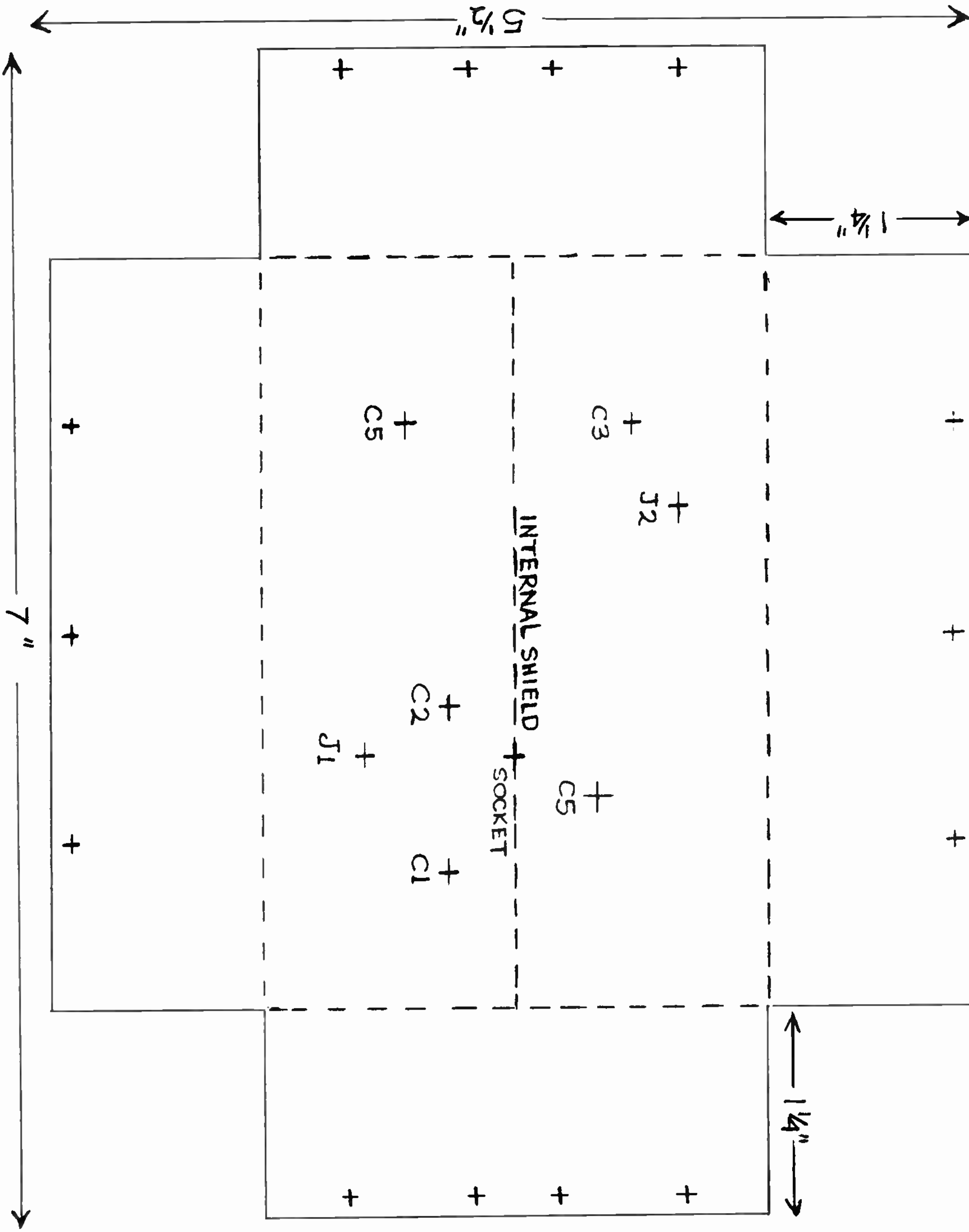


Fig. 3 Template for AF239 amplifier
Material 1/32" copper or brass
Bend 4 sides down

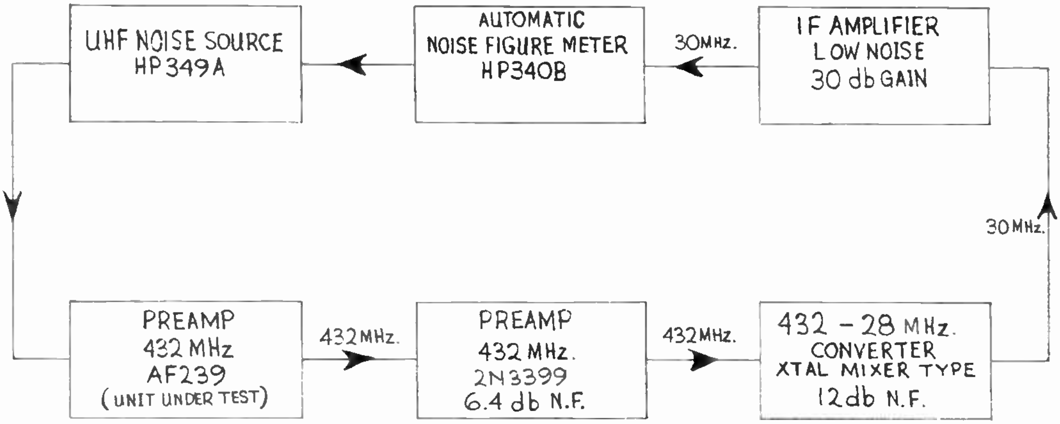
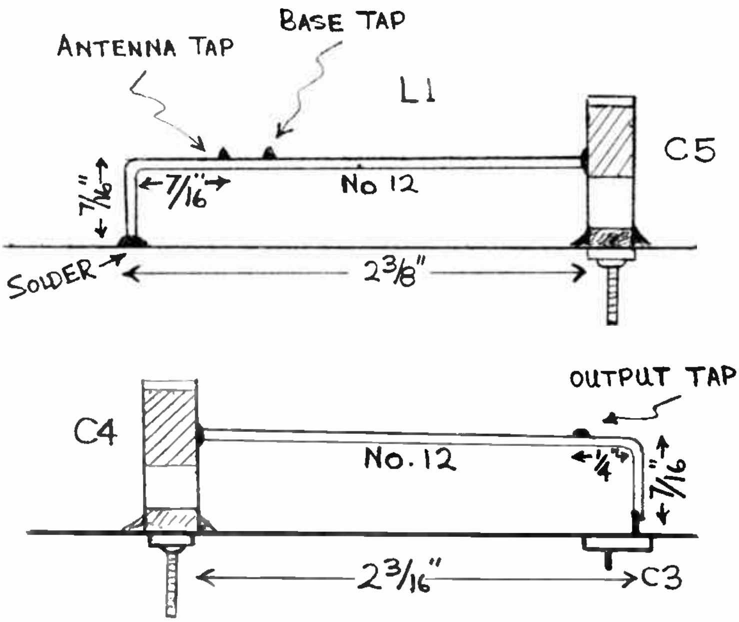


FIGURE 1

TEST SETUP USED



INPUT CIRCUIT

FIGURE 4

OUTPUT CIRCUIT

We would like to express our thanks to the three major ham magazines for their listings of our products in their New Products sections and for the kind comments we frequently see in the VHF columns of these and other ham magazines. I think they all know that catering to VHFers entirely is a bit rough. That free publicity helps keep our subscription level up around the "break even" level. Going to a magazine every other month has been a tremendous help. Getting higher level articles is not easy. The work is being done, but most of these people hate to write. We just couldn't get enough for a monthly publication. We get occasional letters asking us to take a stand for or against certain proposals or activities in hamdom. One policy we do have is to stay out of non-technical arguments. In other words, no politics. I am as opinionated as most of you but have my hands full and don't care to make enemies for VHFER. And as I see it, that's what would happen. We ain't mad at nobody.

OPEN BANDS

by Marilyn Wiseman, K8ALO

Not much to report this issue, due to poor band conditions. With the upcoming June VHF QSO party reports should increase. Usually during contests some excellent contacts are made due to increased activity. So keep your ears open. Looking forward to your report. See you next issue. My address: Box 103, Petersburg, Ohio 44454.

50 MHz Scatter:

Feb. K7BBO(Wash.) wrked K6RIL, K6IBY, K6JC, W6YKM, W6NLZ, W7UFB, WØEYE. K7ICW (Nev.) wrkd K6RIL, K6GJD, K6IBY, WA5FDJ, hrd W7UFB, WAØBLM, W5SFW, W5EUB wrking WA7FLB WØINA wrking WA7RVW.

March K7ICW(Nev.) wrkd W6NLZ, K6GJD.

144 MHz:

Feb. 5-26: K7ICW(Nev.) wrkd W6NLZ, K6GCD/6, WB6RRR/6, W6YVO, K6TSK, W6WSQ, K6HAA, W6DQJ, K6MBY, W6DNG.

Mar.5-28: K7ICW(Nev.) wrkd W6YVO, W6DNG, W6NLZ, W6DQJ.

144 MHz Meteor Scatter:

Feb. 6-7 K1ABR(R.I.) hrd WØNXF. Dick says daily m/s (random) with K4QIF (0800-0815) continuing. Dick hears him every day. Distance approx. 650 mi.

144 MHz Aurora:

Feb. 8 K1ABR(R.I.) wrkd K2GUG 450 mi, hrd W8DEO.

432 MHz:

Feb.12-26 K7ICW(Nev.) hrd W6DQJ 225 mi with no QSO resulting.

Mar.12-19-26 K7ICW(Nev.) hrd W6DQJ again no QSO accomplished, hrd both ways.

Mar. 28 K7ICW wrkd W6DQJ, finally good results in two-way QSO after about a year of effort.

Skeds Wanted

K2DNR Sam Popkin, Augusta Drive, Hopewell Jct., N.Y. 12533 looking for tropo and m/s skeds. Interested in Wisc., Ky., N.Carolina, S. Carolina and greater. Sam has 16 states with 120 watts. 11/11 yagis. 416B into BC 312. Freq. 144.012 1 Kc. Any reasonable hours good between 800 PM and 600 AM EST. Phone NR 914-226 5369.

WØNXF Bob Berk, 5218 Prescott, Lincoln, Neb. 68506 wants skeds for All showers. Major, Minor or Sporadic are welcome. Freq. 144.022 MHz.

K7BBO Dave Robinson will be portable 7 in Lewiston, Idaho June 8-18th. Will be running 1 Kw on both 6 and 2 meters. 6 meter SSB freq. 50.110 MHz. CW freq. 50.006 MHz. 144 MHz freq. CW and AM 144.086, 145.048. Dave will run skeds with anyone who needs Idaho either 6 or 2 meters. He will be on for June VHF contest on 4000 ft. mountain. Also on 75 meter freq. 3815 for anyone wanting last min. skeds.

W9DID Bob Sabon, 817 W. 34th St., Chicago, Ill. 60608 CW beacon will be operating on May 7, 14, 21 and 28th. Bearing: Boston, Mass. 1300 GMT to 1330 GMT. Dallas, Texas 1330 GMT to 1400 GMT. First 15 mins. transmitting on 32 ft. yagi, second 15 mins. transmitting on 4-15 ft. yagis (stacked array.) Freq. 145.002 running 500 watts. All reports QSLed.

K1YLU Gary Tater, 40 West St., Leominster, Mass. will be portable 1 western Mass. from Mt. Wachusett. Looking for skeds for June VHF QSO party with Ohio, W.Va., Md. and Del. for 6 and 2 meters, N.J., Pa., W.Va., and Del. for 220 and 432 MHz.

K1ABR Dick Bromley, 12 High View Drive, Cranston, R.I. 02920 still looking for 50 MHz scatter skeds Sun. morn. 0700-1000 EST. CW or SSB. Rig KW xtal conv. HQ 180 6 element wide-spaced beam, looking west and southwest. Also wants 144 MHz skeds. Rig is KW, ant. 32 element colinear, 717 A HQ 180.

Editor's Note: Listing in SKEDS WANTED is limited to those interested in meteor work, scatter or long-haul tropo work over difficult paths. You must supply information on your rig, antenna and anything else that would tend to show prospective skedders that you have an outstanding station. The aim of the listing is to help further the VHF art, giving those who want to do the difficult an opportunity of finding a similarly motivated ham at the right distance.

ODDS & ENDS

This seems an appropriate time for me to blabber on about a couple of points. First is the role of the big dish in moonbounce and distance records. I don't know that A.R.R.L. has set a policy about moonbounce and what records count and what ones don't. It hardly seems that a person who by nature of his job has access to a big dish and uses it for a moonbounce contact merits a listing in the record column of QST. Such work is commendable and does a lot to further the art--no doubt about that. It lets hams with equipment not quite up to par know how many more db they have to pick up. And it gives encouragement. Surely the psychological effects of the big dish at Arecibo(and Stanford and Bell Labs) were tremendous. But somewhere it would seem that A.R.R.L. has to draw the line and say what constitutes an "amateur" effort. Lets go back to the first amateur moonbounce that was a recognized two way. This was between Sam Harris & hams at Eimac. Perhaps you had the same thoughts as I--Sam had a big dish (30 feet I think) and I figured connections with some manufacturer of same gave him a really unfair advantage over us common people. But on visiting his place and talking to others I found I was all wrong. A friend of his had spotted that dish in a junk yard. Sam bought it for $150 I think, and some more for the mount which I don't think was used. The equipment of course he built. Everything was on his property. Certainly there is nothing in that situation anyone could criticize. At Eimac the boys had a rather small dish they had gotten surplus and they built the rig by paralleling a bunch of 2C39s. It was on Eimac property--and as far as I could see that was the size of Eimac's influence. No criticism there. That was a two-way amateur effort and a history-making one. K6MYC's antenna is described in this issue, and so was VK3ATN's some time back---strictly amateur all the way. W6DNG-OH1NL, again amateur all the way. W6DNG's latest contact with F8DO in France may be another "all amateur" contact.

It would seem that A.R.R.L. should soon decide, if they haven't already, what constitutes a true amateur achievement. Should they decide that moonbounce done at commercial or military installations does not count for distance records perhaps amateurs without access to such facilities will be more highly motivated to go to the considerable effort required, furthering the amateur art.

USA 144 MHz DX OPERATING FREQUENCIES

Three decimal place listings are assumed to be ± 500Hz, four places ±250Hz. VFO and VXO listings are assumed to be within ±750Hz.

Call	State	Freq.	Call	State	Freq.
K6GCD	Cal.	.002	W9WDD	Ill.	.050
K2GUG	N.J.	.003	WØYMG	Kans.	.050
W4WNH	Ky.	.003/.099	W7RQT	Utah	.055
W3BYF	Pa.	.005	WØEKZ	Kans.	.055
W9JGQ	Ill.	.005	W7OKV	Oreg.	.060
WB6KAP	Cal.	.009	WØBJV	S.Dak.	.075/VFO
W7JRG	Mont.	.009	WA9DOT	Wis.	.082
WØJYC	Colo.	.010	K1BKK	Vt.	.085
W5HFV	Okla.	.011	K5WXZ	Tex.	.085
W5UGO	Okla.	.011	K7BBO	Wash.	.086
K6HMS	Cal.	.011	W9BRN	Ind.	.087/VFO
W2AZL	N.J.	.012	WA5FMZ	N.Mex.	.088
K7ICW	Nev.	VFO/.013	K5TQP	N.Mex.	.088
K9UIF	Ind.	.013	W5GVE/4	Ala.	.088
W4FJ	Va.	.015	K7NII	Ariz.	.090
W1AZK	N.H.	.016	W9UNN	Ill.	.090
K4QIF	N.Car.	.018	WØEOZ	N.Dak.	.100
K2HLA	N.Y.	.019	WØLER	Minn.	.100
K6HAA	Cal.	.020	W5UKQ	La.	.105
K6LEW/5	Tex.	.020	WØBFB	Ia.	.110
W7FS	Wash.	.020	W7UFB	Wyo.	.113
K1OYB	Me.	.021	W7MFP	Utah	.120
W5ORH	Okla.	.022	K8AXU	Ohio	.125/VXO
W7OUE	Ariz.	.022	W8TIU	Mich.	.125
K7ZIR	Oreg.	.022	W5JWL	Ark.	.132
WØNXF	Neb.	.022	W5RCI	Miss.	.1485
K4EJQ	Tenn.	.026	W4TLV	Ala.	.153
WØJVB	Mo.	.0275	K1ABR	R.I.	.175
W6GDO	Cal.	.0280	WØLCN	Minn.	.180
W8PT	Mich.	.030	WØCUC	S.Dak.	.189
WØENC	S.Dak.	.033	KØMQS	Ia.	.200
W5ML	La.	.035	WAØFDY	Minn.	.210
K9AAJ	Ill.	.036	W8BKI	W.Va.	.257
K6KV	Cal.	.040	W8KAY	Ohio	.300
K9FGD	Ill.	.040	WØLFE	Mo.	.355
WØEYE	Colo.	.042	K7MKW	Ida.	VFO
W1JSM	Mass.	.046	WØDQY	Mo.	145.0415

Note: This list was compiled by Al Olcott, K7ICW. For corrections or additions write to Al at 510 S. Rose, Las Vegas, Nevada.

With spring coming on before too long we are expecting more activity to bring on more articles. We have a few hanging fire because of something not being clear or other things that might impede full utilization of the article. There are really very few articles turned down. My feeling is that garbage attracts garbage so we try to screen things fairly well without being dictatorial. We know full well that errors do creep in and that in some cases the author has been all wet on a point or two. But no one here pretends to know all the answers so as with any ham articles you take your chances when you build from them.

K6MYC MOONBOUNCE EFFORTS

The following is taken from a letter from Mike Stahl, K6MYC, who made a successful two-way moonbounce contact with VK3ATN in Australia using a 320 element colinear array mounted on a hillside near Stanford Univ. The antenna has been divided into two parts, half being with Mike at his home QTH and the other half with Victor Frank, WB6KAP (ex W7QDJ) in Woodside, Calif. in the hills above Stanford.

"Last month WB6KAP, using the other half of the big 320 element colinear array, was heard well enough by Ray, VK3ATN, to make a contact. No contact was made as Vic heard nothing. We, using a borrowed 75A3 & Parks conv. with a 2N4417 FET preamp did hear Ray's signals weakly and also Vic's echoes. Since that time we've been using our own receiver SB-34 and homebrew conv. & same preamp without success. We, WB6KAP & I and sometimes W6GDO (Jay), have had several skeds with F8DO (Marius) and 2 skeds with SU1AB (George), both of whom have received their own echoes. Of course you know of F8DO's success with W6DNG. The results of these tests have been mostly negative. Only F8DO reported that he has heard my signals weakly on two occasions. The last two skeds with Ray, VK3ATN, were again more successful. Vic was heard by Ray for 18 minutes and again good copy. Because of calibration problems we got on the wrong frequency about 2.5 kc. low. WB6DEX (Ross) reported hearing signals on 144.0885 which would have been us. Ray also heard signals but on two of his transmission periods which again was probably me (I also had a time problem.) Ray also reported hearing Ross' signals but weakly so he concentrated on Vic's sigs.

I've gradually been working out the bugs and have straigntened out many of my problems . Last nite after diddling the receiving system down to 2 db noise figure I received my own echoes. Bandwidth was 2.1 kc. and echoes peaked to about 2-3 db. over noise. I found for some reason yet unknown I could not hear my echoes thru my 100 cycle audio filter---accidentally heard them coming thru the speaker unfiltered. Power was just under a k.w., probably 500 watts to the antenna. The antenna presently is switchable polar or AZ-EL mount, with no AZ-EL limitations and a 36 degree elevation minimum in the polar mount.

That should bring you up to date, Loren. I must mention that WA6MIA (Ed) has helped me a great deal and provided some of the gear that I lacked. Next month results should be better all around and we'll keep you posted as to the results. See you in Fresno May 6 & 7. 73 Mike " Note: VHF convention at Tropicana Motel (Hiway 41). Serious VHF enthusiasts invited. No fees.

Published by Parks Electronics Lab.
419 S.W. First
Beaverton, Ore. 97005

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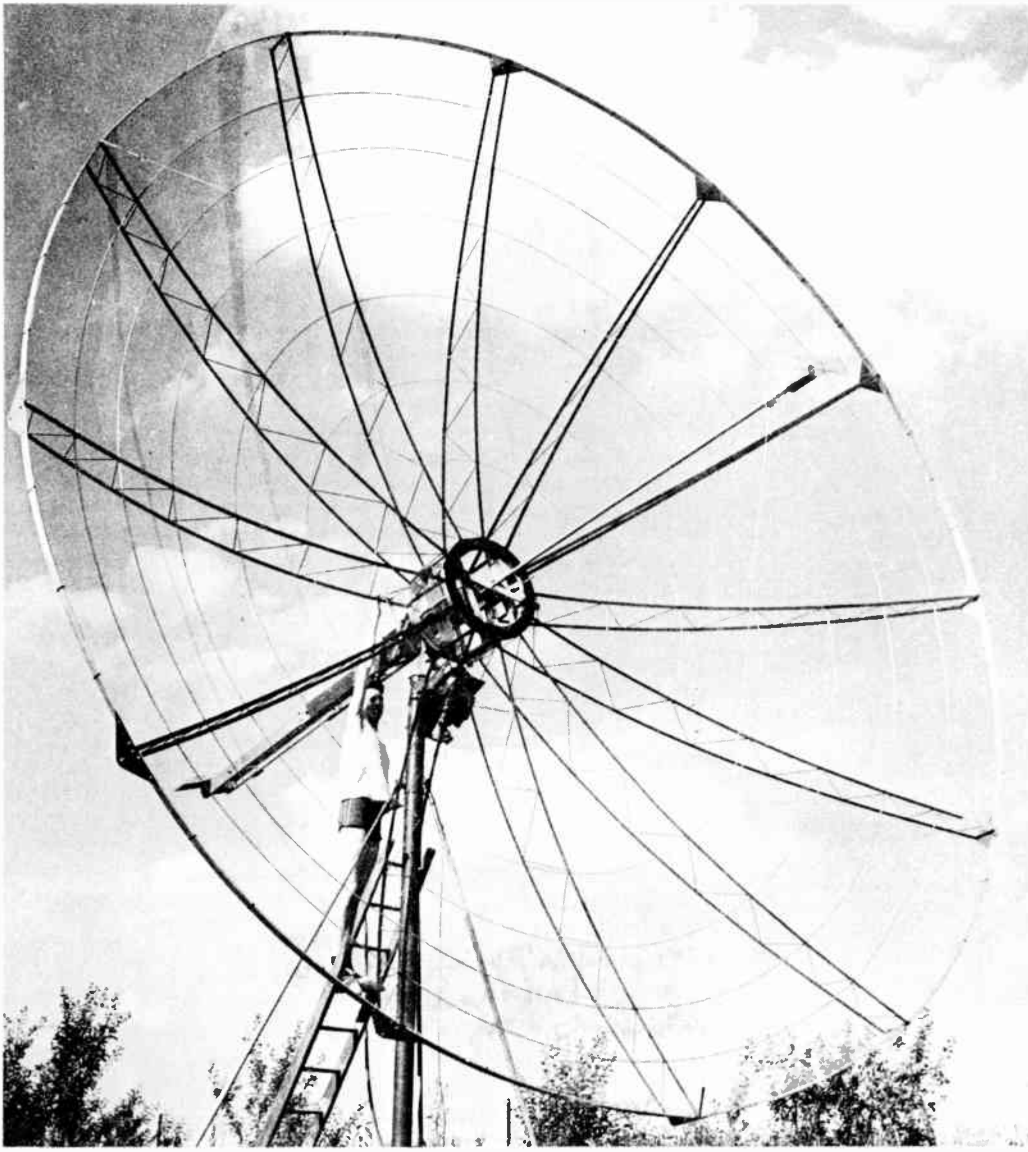
Volume 4, No. 8

Nov.-Dec. 1966



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This converter uses the Texas Instruments TI-XMO series transistor. We pick the best from the 01 and 06 types to give you performance equal to or better than the general run of the former TIXMO5, apparently no longer available---at least for now. From our tests these transistors are superior in performance to the 2N3399 we formerly used and cost much less. They're also less expensive for you to replace if you damage them with r.f. This converter has a tuned input, something our previous converters and preamps did not have. It cuts down on interference from other stations in the big cities.

ORDERING INFORMATION: Price is $55.00 postpaid. Add 35¢ for Special Handling, a fee charged by the post office for faster delivery. Add $2.50 for Air Mail.

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Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

In the "wee small" hours of the morning of November 28th 1966, a group of New Jersey moonbounce enthusiasts sat huddled around a Collins 51J4 receiver--their giant 60 foot dish aimed at the setting moon. At exactly 1010 plus 30 seconds the first weak signals came forth from the speaker. In the next three minutes the signals peaked to their strongest, and in another three minutes they faded back into the noise. In that historic six minute period the Crawford Hill VHF Club (operating K2MWA/2) made the first two-way two meter contact with VK3ATN in Birchip, Victoria, Australia.

Needless to say, the work of VK3ATN has been well written about in this column and in all the other amateur publications. Despite the fact that Ray was getting good echo returns from his stacked rhombic array in Australia, there were few "takers" on the U.S.A. side. There was the noble effort of K6MYC, but no two-way despite several months of trying. To be sure, the power limitation at VK3ATN was one problem, for he was hearing K6MYC quite well with 1KW on the K6 end of the path. Obviously it was going to take a really big antenna to do the job, and the antenna at the Crawford Hill Club is BIG---60 Feet Big!

I'm sure a run-down on the equipment in use will be of interest at this point. The Crawford Hill group had the legal limit of transmitter power with 650 watts output from a GE6183 in a half-wave-line circuit. Frequency was 144.088.

The receiver started out with a KMC transistor preamp and large coax input filter to subdue "out of band" signals. The preamp was mounted at the rim of the dish. 100 feet of RG58 connected the preamp to the converter in the shack. The receiver was in turn a Collins 51J4 that had a 3KC bandwidth. An audio filter with a 300 cycle bandwidth followed this. The receiving system input noise figure was 2.8 db with the coax filter. The antenna temperature was estimated to be 300 degrees K.; therefore, the system operating noise temperature was something greater than 600 degrees K or about 4.9 db.

The antenna was a 60 foot commercial parabolic antenna with crossed dipoles and reflectors--each dipole fed separately thru a phasing and switching harness which permitted polarization switching from right-hand circular to left-hand circular. Feedline consisted of 1 5/8" Styroflex from the focal point to the rim of the dish. On transmit an additional 75 feet of air line was used to the shack. On receive the preamp was mounted at the rim as described earlier.

The VK end of the QSO has been described before, but briefly, four stacked rhombics (leg length in excess of 300 feet) served as the antenna. The receiver had a noise figure in the 2 to 3 db region, and the transmitter was limited to 150 watts input.

Now the important part of all this is an evaluation of the results achieved with the systems in use. The VK's signals peaked at no more than 6 db out of the noise in the 300 cps band-width at the U.S. end, while the signals of K2MWA/2 were better than 18 db out of the noise at Ray's end. Since the K2MWA group was getting its own echoes back at about the same strength as they received the VK signal, you can plug in a few numbers and find out that Ray's stacked rhombic does indeed work--probably some 10 db better than the Crawford Hill dish--and the dish has an honest 26 db gain. Now will you believe me when I say it takes a really big antenna to get results?

The Crawford Hill club also ran some echo tests and tried listening without switching the sense of polarization. The result of the test is that you must be able to switch sense of circular polarization if you want to hear your own echoes. To work the VK on two meters you need a well-measured "state of the art" rig feeding a 26 db or better antenna.

Before we get off the Crawford Hill VHF Club, I would like to mention the people behind the operation. While he is probably too modest to admit it, W2IMU--Dick Turrin was the ring leader of the group. Of course he had a small but very ambitious group to ring lead--Ed Chinnock, W2FZY, Bill Schober W2JIB, and Roger Abson (who has no call--only because of license policy in the U.S.--Rog is from England). Dick and Rodger have both been to the W3SDZ QTH on several occasions to help with the rigging of our system.

Whenever a new record is set, there are always some guys around who will say, "I wish I had known about this before so I could have had a chance at it". Well, there was enough printed about the VK activity on two meters, but just in case there are some who still feel they were left out, I'm going to tell you what Ray would like to do next. He has now worked the USA on all amateur bands from 160 meters through two meters except for six meters. While I don't have all the details at this writing, Ray thinks his rhombic array can be tuned up for six. The antenna would aim a bit differently than it did on two, but would hit the moon in nearly the same position. It will take a really giant array to do the job. A gain in excess of probably 23 db will be needed on six meters--maybe more on account of the higher antenna temperatures involved. It will take a sizable bit of real estate to do the job. I can state further that the Crawford Hill Club will not be trying on six--in fact they probably won't be heard from again until they get their 1296 MC system working on the sixty-foot dish (when that happens a really small dish will be able to work them).

Dick has offered to help me design a stacked-rhombic array to make the six meter try with Ray. We won't be ready until spring on account of the weather, so anyone in the warmer parts of the country can easily beat us. In a way I hope someone else will pick up the challenge, as we are also working on our 1296 MC system. A side effort for six will slow this down.

Speaking of 1296, I think this is going to be the next best band to think about in tooling up a moonbounce effort. Experiments are now underway on the East Coast using a readily available klystron that can generate power on 1296 quite easily. The only difficult part is the power supply--about 10KV is needed at some reasonable amperage. Since the experiments are still experiments, I don't want to comment further. But if this all works out, information will be available in this column first.

VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions, $1 per year, others $2 per year. Second class postage paid at Beaverton, Ore. 97005.

I'm writing this a few days before Christmas, and even though this will reach you after the holidays, I want to wish all of you the very best in the New Year. I want to thank all of you who wrote to me. If I didn't answer your letter, it was the press of too much work on this end--nothing else. We are in the process of adding an FM Stereo station to the AM radio station I own, along with building an entirely new studio complex. Add to this the fact that we're still rebuilding the farm house and I spent several weekends speaking at Ham Conventions, and you can realize that even my wife and four children get a little discouraged about the amount of "spare" time I have. End.

K6MYC REPORT

Report on the Nov. 1 and 5 moonbounce attempt by K6MYC & VK3ATN.

For Nov. 1 both ends appeared ready but results on both ends were negative. Ray did not even hear his own echoes nor did we. It looked like a problem of Faraday rotation. This had been considered the best of the two days and all concerned were very discouraged.

Again on Nov. 5 all was in readiness and we began hearing our own echoes about 10 minutes prior to sked time (1600-1622 gmt) at 1558. We began calling Ray and continued until 1600. At approx. 160010 we began hearing ray's signals about 150 cycles above our freq. Copy was poor because of the effect of libration fading. We could tell from the pattern of Ray's transmission that he had heard us call at 1558-1600 and was answering us. No complete calls were copied nor was Ray's signal report to us copied. Because of the fading only portions of letters came thru. The next two transmit and listen periods went approximately the same way with our own echoes banging thru during breaks in our transmission. The rest of the sked we heard nothing. This has happened the last two months with our own echos beginning early (10-15 min.) before sked time and fading out about half way thru. We apparently have a slight azimuth skewing and this will be corrected by repositioning the array for Nov. 28 and Dec. 2 skeds. Later on Saturday, Nov. 5, during the 15 meter sked with Ray he disclosed that he had heard us at 1559 calling him but copy on his end was also poor although on our second and thir transmission periods he copied enough to get calls and our signal report to him. He did not, however, get his own echoes which confirmed that our receiving system was finally working as it should.

Next month (Nov. 28 and Dec. 2) according to Ray will be the best times for him since April when he received his best echos. Both days have the moon almost centered in his beam and the declinations for both days are almost identical (23 deg. 57' and 23 deg. 56'. Barring equipment failures we should make at least one good two-way at that time. K6MYC

Following is a letter from K6MYC to K7AAD received December 20.

Here's the results for Nov. 28 and Dec. 2 moonbounce tests. On Nov. 27, Ray asked me via our 15 mtr. sked if it would be alright if he concentrated on K2MWA/2 at the Bell Labs on Nov. 28 since this would be possibly the last time K2MWA/2 would be on 144 MHz. I consented & hoped that there would be time for two QSOs that day during Ray's 22 minute window.

We (Tay Howard W6UGL) and myself were out raring to go at 1:45 a.m. in drizzling rain. At the beginning of Ray's first transmission period we copied Ray & heard him calling K2MWA/2. We heard K2MWA answer on 144.088 but of course I was also transmitting during each of K2MWA/2's transmissions on 144.090 so it was difficult to copy their transmissions. At the times that we did pause to listen, their circularly polarized signals from their 60' dish were Q3-4 most of the time as was Ray during the first 4 of his transmission periods. Then Ray faded out & we didn't hear him again until the last minute of his window. We continued hearing K2MWA/2, so 2-3 minutes after Ray was gone we moved down to 144.088 & gave K2MWA/2 a call. He answered thinking we were VK3ATN & gave us a 3. We sent the same but knew he was not copying our call. Their next transmission they sent 2s & we sent the same on our transmission. We heard nothing after that. K2MWA/2 & VK3ATN did however make the first USA-VK land contact on two meter moonbounce. Unfortunately K2MWA had antenna problems & missed two transmission periods about in the middle of the sked & Ray spent valuable time trying to make sure that K2MWA/2 had heard him well enough for a legal two way. Thus Ray never took more than a few short listens for our signals on 144.090. Ray says at the times he listened he did not hear our signals. We were, however, receiving our own echoes right to our last transmission. Overall conditions were good & Ray's signals were the best we had ever heard from him & we wish to congratulate Ray, VK3ATN & all the boys at K2MWA/2 for finally making it on 2 meters.

Dec. 2--The moon was in exactly the same position and again we expected good conditions--Ray's signals were copied again on his first transmission & he had called us on our frequency so we knew he was hearing us. Spirits were high for a few minutes but signals got very little better on Ray's second transmission. On his third transmission he was almost gone and we hadn't even reached the mid point of the sked. We sent 2s our first 2 transmissions and that was as good as it got. So we'll have to try again and just hope for some good luck for a change. We (Ray & I) plan to try on Dec. 25 but the moon is not too favorable for Ray. End.

432 MHZ. TRIPLER PARTS KIT

Here is a parts kit for the 432 MHz. rig described in the Sept. '65 VHFER. You can buy all of it or any part. It's done in commercial fashion--nicely built. Over 30 of them have been sold from VHFER advertising. Remember, it's a tripler. Put in 144 and get out 432 up to 40 watts. Ad copy by K7AAD. Send all queries to Deane Kidd, W7TYR, 12235 S.W. James, Tigard, Ore. 97223

Kit of all parts and materials except 4X150 tube ----$40.00.
Same as above, less blower ---- $30.00.
Same as above less blower and socket ---- $20.00.
432 tripler wired and tested with 4X150 tube supplied by buyer, no blower -- $40.00
Blower -- 100 CFM 115 v. a.c. 60 cycle --- $10.00.
All prices shown are prepaid, parcel post within the U.S.

TESTS ON TWO 432 MHZ J BEAMS

by Loren Parks, K7AAD

As older subscribers to VHFER know, we have 432 antenna measuring contests on the west coast every year, the results of which are published in VHFER. I have an antenna that has been in 3 such contests (the Gibson yagi) which gives me a reference for comparison with "the best in the west." The antennas which win the contests are the big colinears. Quad yagis have come up rapidly in popularity with Ed Tilton's design published in QST. They work very well. Ones I've seen were built on a wooden frame--not the best thing in some climates. The ham who can't or doesn't want to build his own antenna has had a problem, whether he knows it or not. Commercial antennas for 432 entered in previous contests have had very poor gain. As I recall, we found two of the most highly advertised ham antennas actually had NEGATIVE gain at 432. It was later determined that they did have gain at 420 but there was nothing in the kit to indicate that they wouldn't work at 432. How many of these antennas are in service at 432 is hard to say. Certainly a lot of owners must have wised up and gotten rid of them when they found they had more gain off the back than the front. Keep in mind that the performance of a yagi antenna tuned for maximum gain falls off rapidly when you get above its design frequency. Its not nearly so bad on the low side.

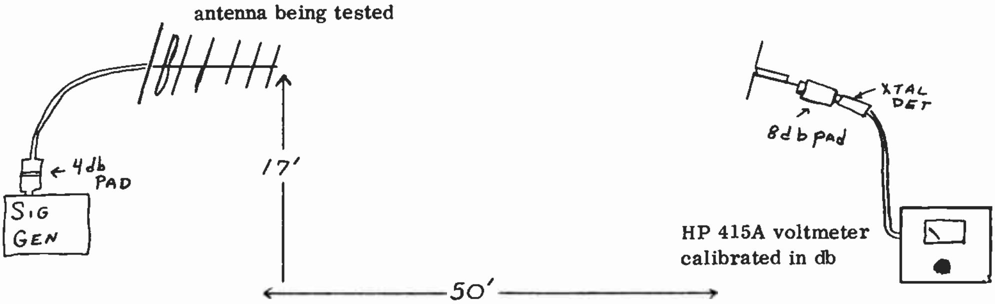
I have made a lot of yagi antennas for 6, 2, 220 and 432. 432 is by far the hardest to work with. 220 is easy. As a rule it isn't hard to get 10 db or so out of an antenna but above that it is really a fight--unless you use an aperture antenna such as the colinear or a quad of yagis and I've seen a number of those that were n.g. For these reasons I would certainly discourage antenna building at 432 for the beginner unless he follows the colinear design in the Frank Jones handbook (extended-expanded) or Ed Tilton's design. From what I have observed at contests there is only one commercial antenna that's any good at 432 and it is made in England by J beams and handled by Gain, Inc. of Chicago. You can find the ads in the ham journals.

The purpose of the tests I've just completed was to evaluate the 14 element J Beam for 432. Bill Roberts of Gain said this model wasn't their super-duper but he would stand or fall on the merits of this one. I assure you there is no collusion. I compared this antenna with a smaller J beam which didn't do so good in a contest and with my Gibson antenna and a copy of the Gibson a friend made plus comparison with a dipole to get a rough idea of the gain. By referring to previous contest results you can see how the J beams rate. I will describe how the measurements were made so if you think they are N.G. you can discount the whole thing. Let me say at this point that I am fully aware of the fact that there are more self-acclaimed experts on antennas than there are people who have attempted to measure antennas. There is something about no experience that makes some people all-knowing. Most hams don't have the know-how or equipment to do any kind of a job. And even with good equipment there are plenty of pitfalls. What I will describe is a method using reasonably good equipment under reasonable conditions to get a semi-quantitative or at least comparative result. You can see I'm hedging all over the place because I am fully aware of a number of criticisms that could be made, and rightly so. In spite of this I believe the results obtained are sufficiently accurate for amateur purposes. You are not concerned whether an antenna has 9.1 or 9.2 db gain over a dipole, but whether it has 6 or 9 db over a dipole. I would guess my measurements would be within 1 or 2 db of the true figure OVER A DIPOLE, not over an isotropic radiator which many ads quote (subtract 2 db to compare with dipole), (and another 3 or 4 db for advertising).

Antenna testing as done by hams usually suffers from one or more of the following sources of error.

1. Reflections from the ground or other objects which add or subtract from the directly received signal, depending on phase relationships.
2. Mis-matched terminations which cause the length of the transmission line to affect measured performance.
3. A bad readout, such as an un-calibrated S meter.

The method I used was to transmit with the antennas being tested (often a risky procedure) and receive with a dipole as shown below. The separation was such that energy from the beam striking the ground in front of the receiving dipole was negligible. With the dipole used to transmit and make the gain comparison this was not true.



The signal generator was terminated in a 4 db coaxial pad and then about 15' of RG 58/U was run to the antenna under test. The purpose of the pad is to more or less isolate varying antenna loads from the signal generator. It absorbs over half the output signal and provides a "more certain" 50-ohm source for driving the antenna. 10 db is a safer value to use butaat the time we didn't feel we could spare the power and it was pretty certain that the antennas were well matches so there would be minimal reflections on the line and therefore minimal effect of cable length on antenna performance. In an antenna contest I would put the pad at the far end of the line and use 10 db.

At the receiving end the dipole feeds an 8 db coaxial pad (Stoddart) and then a coaxially mounted germanium diode. The diode then is driven by a 50-ohm source almost irrespective of the impedance of the dipole. In this case I doubt that the pad is very essential. Its inclusion is to prevent possible objections. Nobody would say the pad hurts anything. Pad and detector are mounted right at the dipole. The RG 58 line carries only the 1 kc. modulation (no r.f.). The meter scale on the HP415A is calibrated for the square-law characteristics of a diode at low signal levels. Use of a 1 kc. tone eliminates possibilites of drift in d.c. amplifiers and also r.f. pickup from nearby FM and TV stations, which are bothersome at my locations using other methods. A transistor oscillator-multiplier can furnish sufficient signal strength. Tone modulation is about 30% at 1 kc. W6VSV has a nice one he built he should describe in VHFER.

First I transmitted with a dipole to get a DB reading on the meter at the receiving end. This was the reference. Since the meter is calibrated in decibels it was simply a matter of changing antennas at the transmitting end, peaking for maximum reading (which was always straight toward the dipole as far as I could see) and reading the meter. I kept the forepart of the antennas at a constant distance from the receiving dipole. The results are shown below. All antennas used 1/4" aluminum elements.

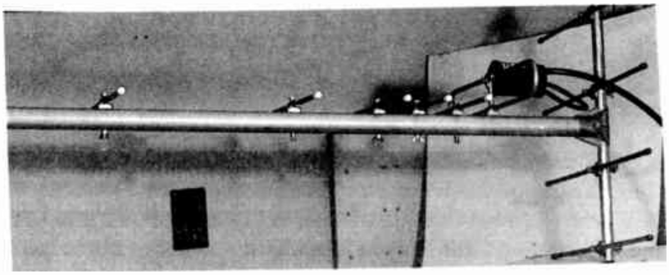
14 element J Beam	9 ft boom	12 directors,	4 reflectors	9 db over dipole
Gibson yagi	6 1/2 ft "	13 "	1 "	8 " " "
10 el. J Beam	5 ft. boom	8 "	1 "	7 " " "
copy of Gibson	6 1/2 ft "	13 "	1 "	6.7 " "

Now the painful part must be done--the interpretation. I should say that we first tried this with the transmitting antennas near the ground, shooting up at a 20 to 30 degree angle first and got similar results. We didn't keep a record as I was not satisfied that all were getting a fair trial. I re-tested the big J Beam after testing the others at the elevated transmitting location and got exactly the same result. I moved the antennas up and down and around to see if there were reflections bothering the readings and it seemed there was not much variation. I also moved the dipole around and got little variation.

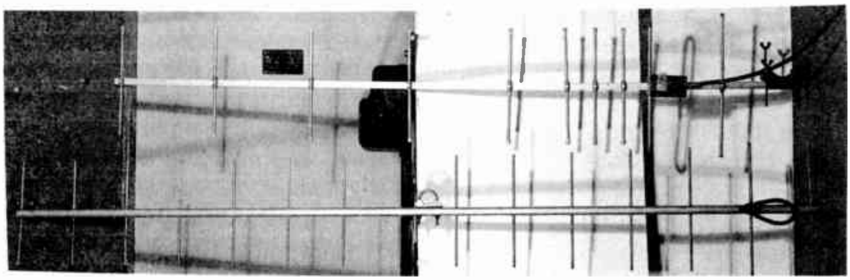
There is no question but what the 14 element antenna is best, as it should be, because of its longer boom. Now 1 db over the gibson may not sound like much for an increased length of 2 1/2 feet, but keep in mind that under ideal conditions you double the boom length to get 3 db increase. Realizing that much increase is another matter--it ain't easy. Percentage wise the Gibson is quite a bit longer than the small J Beam, and the difference shows. Why the copy of the Gibson didn't work out I don't know. I inherited it, I didn't build it. The guy who did is quite skilled at antennas and I don't know that I could have done any better or as well. It points up the difficulties at 432.

CONCLUSION: The first three antennas are performing about as well as can be expected. The J Beams are mechanically very well built. Assembly time was 10 to 15 minutes. There were absolutely no instructions with it, typical of this company. I must say it was almost completely pre-assembled so an idiot could put it together with only one or two questions. I wondered if I had the reflector assembly on right with the el ements forward. I figured if I didn't have it right it was their fault for not sending instructions. This is the best commercial antenna I've seen and I wouldn't hesitate to recommend it. It isn't going to perform like an extended-expanded 32 element colinear. It doesn't have the capture area. For its size it does OK. The Gibson antenna is no longer made.

Receiving dipole, coaxial 8 db pad and coaxially mounted crystal detector. The dipole is driven by the 1 to 1 parallel rod balun. Transmission line center in one leg of balun has had small segments removed from the polyethylene dielectric to make a match. Reference dipole is the same.

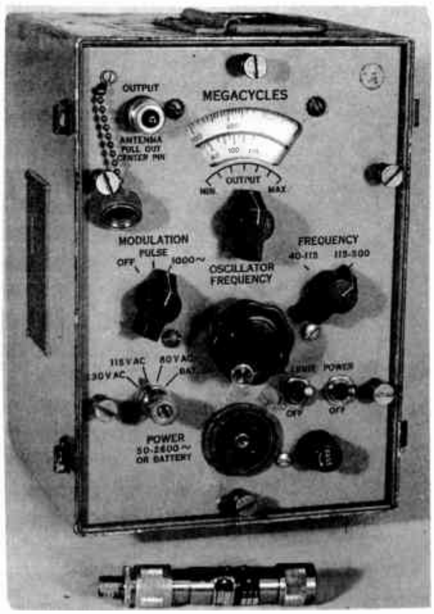


Part of the big J Beam (14 elements). They only count one of the reflectors as an element. The black plastic can is the housing for the coaxial balun assemblv.



The small J Beam (upper) and the Gibson Yagi.

The TS47A/APR, a real gem for antenna testing. 40 to 500 Mc. with 1 kc. modulation. Calibration is remarkably good at bands other than 432. We monitored the output frequency in a receiver using a crystal-controlled converter to be sure of being within a few kc. of 432. The drift is very low for a self-excited oscillator.



A STATION PROGRAMMER FOR METEOR SCATTER WORK

by Donald L. Hilliard, WØEYE*

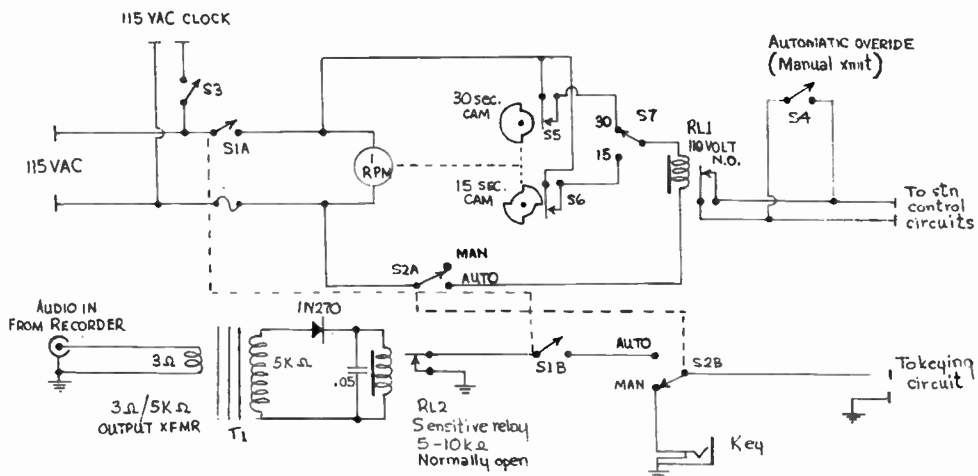
It is surprising that more meteor scatter enthusiasts don't use some method of automatic operation. A unit such as the one described here, plus a tape recorder, can take most of the work out of meteor schedules. This unit will sequence the station equipment at either a 15 or 30 second rate and when used with a tape recorder or other audio code device will do all code sending at the operator's choice of speed. This is truly automatic operation.

CIRCUIT DESCRIPTION

A one r.p.m. synchronous motor is activated by S_1 A. Two cams are attached to the shaft of this motor. The cams in the WØEYE unit are about 2 1/2" in diameter and made from 1/16" aluminum. A nibbler can be used to cut out the desired portion. Microswitches S_5 and S_6 are activated by these cams. Switch S_7 selects either a 15 or 30 second sequence. Relay RL_1 can have several sets of contacts to control several circuits if necessary. The B set of contacts on S_1 are used to open the circuit from the automatic keying relay. This set of contacts can be omitted from the circuit if one desires. Switch S_2 switches the transmitter keying circuit to either the automatic keying circuit or an external key. S_3 is used to set the station clock with WWV, a must for accurate sequencing. S_4 is used as a manual transmit switch when S_2 is in the manual position, such as when one must use break-in procedures.

The automatic keying portion of the circuit has been described in several journals previously. A tape loop with desired information is placed on a recorder and allowed to run continuously. Low impedance output from the recorder is fed to T_1 to step up the audio voltage which is then rectified by the 1N270 diode, filtered by the .05 capacitor and applied to the coil of relay RL_2. By adjusting the level on the recorder a very good reproduction of the code on the loop is obtained at RL_2, which is used to key the transmitter.

* P.O. Box 563, Boulder Colorado 80302



15 OR 30 SECOND METEOR SCATTER STATION SEQUENCER AND AUTOMATIC KEYER

OPEN BANDS

by Marilyn Wiseman, K8ALO

Plenty to report this issue. Thanks to all who have been so faithful keeping the mail box full. Hope the new year will be as successful. Best Season Greetings to all. Send your reports to me at Box 103, Petersburg, Ohio 44454.

50 Mhz. Scatter:

Oct.	K7BBO wrkd K7MKW (Idaho), W7UFB (Who.), plus 9 Calif. stations. WA7BTG (Wash.) wrkd W6NLO, W6GKO, K6NPC, K6RIL, WB6GKK (Calif.), K7ICW (Nev.) wrkd WØEYE (Colo.), WB6EIM/M, W6NLZ, WB6GKK (Calif.), hrd W7UFB, K7BBO, K7SVI, plus 5 Calif. stations. WB6GKK (Calif.), wrkd K7BBO (Wash.), K7CNK (Wash.), W7UFB (Wyo.) WØEYE (Colo.), WA5CZM (N.M.), K7ICW (Nev.).
Nov.	K1ABR (R.I.), wrkd K9KFR (Ind.), 600 mi. WB6GKK (Calif.) wrkd K7BBO(Wash.), WA5CZM (N.M.), W7UFB (Wyo.), W7CNK (Wash.), WØEYE (Colo.), K7ICW (Nev.), K6RIL (Calif.). K7BBO (Wash.) wrkd K6RIL, K6JC, K6HCP, plus many other Calif. stations. K7ICW (Nev.) reports small sporadic ES opening during leonids shower on the 15th and 16th. On the evening of the 17th, Al wrkd all call areas except W1, W2, W3's.

144 Mhz.

Oct. 2-23	K7ICW (Nev.) wrkd W6YVO, K6JYO, W6DQJ, W6NLZ, W6DNG, hrd K6TSK, K6HAA, W6NIZ.
Nov.	WB6GKK (Calif.) wrkd K6RIL, W6QWN, WB6IAG, WB6JEW all in San Francisco area, 400 mi. Gary has been running skeds Sun. morn., Mon. eve. with K6RIL,finding the path excellent with reports 459-559. Gary says 144 Mhz seems better than 50 Mhz.
Nov. 1-20	K7ICW (Nev.) wrkd K6IBY, K6JYO, K6MBY plus 4 other Calif. stations.
Dec. 1	K1ABR (R.I.) wrkd W8AEC (W.Va.) 450 mi.

144 Mhz. Scatter:

Oct. 3	K7ICW (Nev.) hrd K5WXZ (Tex.) 1064 mi. pings.
Oct. 19	W4CKB (Fla.) wrkd WA9DOT (Wisc.) orionids showers. K7ICW (Nev.) hrd K7ZIR (Ore.) 790 mi.
Oct. 20	K7ICW (Nev.) wrkd K6HAA (Calif.) hrd W7RQT (Utah).
Oct. 21	K7ICW (Nev.) hrd WØNXF (Neb.) 1100 mi., K7ZIR (Ore.). K7BBO (Wash.),hrd W6GDO.
Oct. 23	W4CKB (Fla.) wrkd W8PT (Mich.) orionids showers.
Nov. 3	K7ICW (Nev.) hrd W7RQT working K6HAA.
Nov. 5-6	K7ICW (Nev.) hrd WØNXF (Neb.) hrd call etc.
Nov. 7	K1ABR (R.I.) wrkd WA9DOT (Wisc.) 780 mi.

Nov. 17 (Leonids Shower)

1 K1ABR (R.I.) wrkd W5UGO/5 (Okla.) 1330 mi., W9IPA (Ill.), WØLER (Minn.) 1000 mi., WØDQY (Mo.) 1100 mi., hrd K4EJQ (Tenn.), W5WAX (Okla.), W4AWS (Fla.), K4IXC (Fla.), W4NUS (N.C.), W5UKQ(La.), KØEMO (Iowa), WØQDH and many more.

1 W1JSM (Mass.) wrkd WØCUC (S.D.) state #29 1300 mi, WØNXF (Neb.) state #30 1320 mi, K4EJQ (Tenn.) state #31 690 mi, W5UGO/5 (Okla. State #32, 1390 mi., K9AAJ, W9WDD, K9GZT (Ill), KØEMO (Iowa), hrd W4CKB, K4IYC, W4UHH, W4NUB, W8TIU, W9QXP, WA9DOT, W9IFA, K9SGD, KØMQS & many more. Don had skeds with several zeroes and fives, all reporting nothing heard.

2 K2HLA (N.Y.) wrkd K4EJQ (Tenn), W4NUS (N.C.), K9AAJ (Ill.), KØEMO (Iowa), WØLER (Minn.), W5WAX (Okla.), He heard W9IFA, W9WDD, W4MNT, W4CKB, W4TLA, W4AWS, W5UKQ, W5UGO/5, & W8PT.

3 W3GKP (Mc) wrkd W5UGO (Okla.) state #32, W5WAX (Okla.)

4 W4CKB (Fla.) wrkd WØNXF (Neb) state #25, 1300 mi, W3GKP (Md.) state 26, W3BDP (Del.) state #27, K4EJQ (Tenn) state #28, K4QIF, W4NUS (N.C.), W1HDQ, K1HTV (Conn.), W4LTU (Va.), W5UKQ (La.), W2AZL (N.J.). Bev says 10 of these stations were wrkd between 0620-0712 EST.

6 K6HAA wrkd WØBFB (Iowa), W5UGO (Okla.), WØYMG (Kans), W7RQT (Utah). WB6GKK wrkd K6BBO (Wash.), W7OKV (Ore.), hrd W7FS, K7ZIR, WA6STS.

7 W7JRG (Mont) wrkd W8QOH (Ohio) state #25. This was Ken's first Ohio station ever worked or heard. Hrd many others stations and considerable QRM.

.7 K7ICW (Nev) wrkd WØNXF (Neb.) for first Nev. Neb. 2 meter QSO, hrd WØBFB (Iowa) 1236 mi., WØEKZ (Kan) 1150 mi, WØEOZ (N.D.) 1215 mi.

7 K7ZIR (ore) wrkd W7RQT (Utah) 1 way of which was SSB, K6JYO (Fullerton) 2-way SSB, W6DNJ (L.A. area) & K6HCP (San Jose.) None of the contacts were on skeds.

Ø WØBFB (Iowa) wrkd K6HAA for first Iowa Calif & state #44. Hrd W2AZL, W1AZK, W2SFK off the back of the beam with S6 sigs. John has been on two for ten years and has never seen anything that would even approach the Leonids shower between 0400-0700 CST.

Dec. 14 (Geminids)

K5WXZ wrkd W8TIU, W5ORH (Okla.) wrkd W6GDO, W7RQT, W8PT, and K7ZIR (Ore.) wrkd K7ICW (Nev.)

Comments on the Leonids shower taken from a letter written by W4WNH/4.

The shower this year appeared different from last year's in several ways. First, there were <u>many</u> more stations on this year. It was impossible to count the number between 144.085 and 144.110. I could hear four in the 3.1 kc. passband of the 75A-3 at several settings of the dial. During the peak of the shower the panadaptor simply went wild, even tho there were more pings than bursts this year. During the peak period it appeared that there were often several pings per second, rather than the long bursts of last year. The pings were short and often very strong and very frequent. As many as ten signals would be seen on the panadaptor at one time. Then another ping would "grow another crop" on the scope. The pings were so short and so rapid at the peak that it sounded like a number of badly chopped signals. This and the QRM made copy difficult.

Skeds Wanted

WØBFB John R. Hinegardner, Mitchellville, Ia. 50169, would like 144 Mhz. skeds for Me., eastern Wash., Ore. and Idaho.
K4EJQ, J.G. "Bunky" Botts, Rt. 2, Box 72, Bristol, Tenn. would like to sked any station needing Tenn. Needs Fla., Ia., Ark., N.Y., Conn. Will answer all inquiries freq. 144.026 Mhz. c.w. 145.055 a.m. Sun and Thur. eve 1800-2330 EST.

K7BBO, Dave Robinson, 1716 S. 8th St., Tacoma, Wash. 98405 wants 144 Mhz. m/s skeds freq. 144.086 Mhz. Needs Ariz., Utah, Mont.

WA7BTG, Kim Coldevin, 3061 Northlake Way, Bremerton, Wash. 98310 wants 50 Mhz. skeds eve or after 0800 PST weekends. Freq. 50.016 Mhz. c.w. equip. HX30 to 4-250A SSB-CW Drake 2B - Parks conv. 8 ele HyGain 40'.

K1ABR, Dick Bromley, 12 High View Drive, Cranston, R.I. 02920 still looking for 50 Mhz. scatter skeds Sun. morn. 0700-1000 EST. CW or SSB. Rig KW xtal conv. HQ 180, 6 ele. wide space beam. Looking west and southwest. Also 144 Mhz. skeds rig KW 32 ele. Col. 717A-HQ 180.

K2HLA, Dick Wilborg, RFD #1, Cutchogue, L.I., N.Y. 11935 looking for 144 Mhz. skeds to Kans., La., Ark., Mo., Ga.

W3GKP, William L. Smith, 1525 Spencerville Rd., Spencerville, Md. 20868 wants 144 Mhz. skeds with Minn., N.D., S.D., Wyo., Colo., N. Mex., La., and points west. Willing to attempt via any propogation mode or build stuff for weak sig. readout. Any time or any day.

K4IQF, Rusty Holshouser, 1213 1/2 Dixie Trail, Raleigh, N.C. wants meteor scatter and tropo skeds with anyone. Freq. is 144.018. He moved and needs all states over again.

WØNXF, Bob Berk, 5218 Prescott, Lincoln, Nebr. wants half hour skeds with 15 sec. timing. His freq. 144.022. 1/2KW & ten el. Skybeam.

VHF NET

The regular Sunday night west coast VHF Net has expanded into a combination mid-west and west-coast net. The midwest section starts at about 10 PM CST, the west coast section at 9PM--not necessarily the same freq. The freq. is 3810 plus 10 to minus 5 kc. QRM can be pretty rough on Sunday night and it can be hard to find a hole. SSB is the mode used. Many who check in are meteor-scatter types and almost all are DX typesCheck-ins are from most sections of Calif., from Oregon, Utah, Nevada, Colo., Texas, Kansas and Okla, Mich., Indiana etc. Backward states like Washington are seldom heard from. This is the time skeds are made, reception during previous skeds is discussed, etc. Usually there are 10 to 20 stations represented during the evening. 3810 Kc. is being used more frequently for liason during showers and tropo skeds. If you're serious about 2-meter DX and live in the midwest or west you ought to consider getting set up for 3810, SSB.

COMPARATIVE TIME CHART

Pacific Standard Time		Zebra Time	Mountain Standard	Central Standard	Eastern Standard
(1 AM)	0100	0900Z*	0200*	0300*	0400*
(2 AM)	0200	1000Z*	0300*	0400*	0500*
(3 AM)	0300	1100Z*	0400*	0500*	0600*
(4 AM)	0400	1200Z*	0500*	0600*	0700*
(5 AM)	0500	1300Z*	0600*	0700*	0800*
(6 AM)	0600	1400Z*	0700*	0800*	0900*
(7 AM)	0700	1500Z*	0800*	0900*	1000*
(8 AM)	0800	1600Z*	0900*	1000*	1100*
(9 AM)	0900	1700Z*	1000*	1100*	1200*
(10 AM)	1000	1800Z*	1100*	1200*	1300*
(11 AM)	1100	1900Z*	1200*	1300*	1400*
(12 AM)	1200	2000Z*	1300*	1400*	1500*
(1 PM)	1300	2100Z*	1400*	1500*	1600*
(2 PM)	1400	2200Z*	1500*	1600*	1700*
(3 PM)	1500	2300Z*	1600*	1700*	1800*
(4 PM)	1600	2400Z*	1700*	1800*	1900*
(5 PM)	1700	0100Z#	1800*	1900*	2000*
(6 PM)	1800	0200Z#	1900*	2000*	2100*
(7 PM)	1900	0300Z#	2000*	2100*	2200*
(8 PM)	2000	0400Z#	2100*	2200*	2300*
(9 PM)	2100	0500Z#	2200*	2300*	2400*
(10 PM)	2200	0600Z#	2300*	2400*	0100#
(11 PM)	2300	0700Z#	2400#	0100#	0200#
(12 PM)	2400	0800#	0100#	0200#	0300#

* Same date as Pacific Standard Time Date

\# Next day (as compared with PST). For example: 2000 PST the 15th of the month would be 0400Z the 16th of the month, or 160400Z.

144 MHz MS FREQUENCIES
by Al Olcott, K7ICW*

The Leonids meteor shower brought out the need for a more up to date listing of operating frequencies for meteor scatter work. Here are frequencies reported to be in use by active stations, but not necessarily including every call because a complete listing at this time is not available. Those who are active and not listed could send me up to date info for inclusion in the next listing.

144 MHz:

Call	State	Freq.	Call	State	Freq.
K6GCD	Cal.	.002	WØYMG	Kans.	.050
K2GUG	N.Y.	.003	W7RQT	Utah	.054
W9JGQ	Ill.	.005	K5WXZ	Tex.	.085
WB6KAP	Cal.	.009	K1BKK	Vt.	.085
W5UGO	Okla.	.012	W5GVE/4	Ala.	.085
W2AZL	N.J.	.012	K7BBO	Wash.	.086
W4FJ	Va.	.015	K7NII	Ariz.	.090
K4QIF	N. Car.	.018	WØEKZ	Kans.	.095
K2HLA	N.Y.	.019	WØEOZ	N. Dak.	.100
W7FS	Wash.	.020	K5TQP	N. Mex.	.100
K6HAA	Cal.	.020	WØBFB	Iowa	.110
WØNXF	Neb.	.022	W7UFB	Wyo.	.113
K7ZIR	Ore.	.022	W7MFP	Utah	.120
W6GDO	Cal.	.028	W4TLV	Ala.	.153
WØENC	S. Dak.	.033	K1ABR	R.I.	.175
K9AAJ	Ill.	.035	WØCUC	S. Dak.	.189
W8PT	Mich.	.037	WØLFE	Mo.	.220
K6KV	Cal.	.040	W8BKI	W. Va.	.257
WØEYE	Colo.	.042	W8KAY	Ohio	.300
W1JSM	Mass.	.046	K7ICW	Nev.	VFO
W9WDD	Ill.	.050	K7MKW	Ida.	VFO

* 510 S. Rose St., Las Vegas, Nev. 89106

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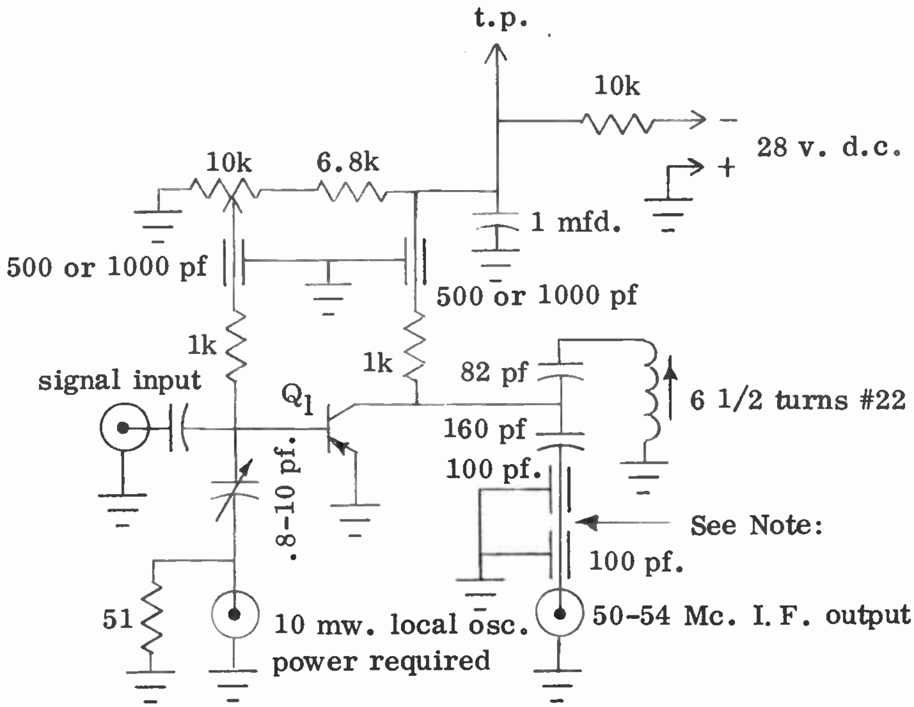
Return Requested

VHFER

LEARN BY DOING

50 MC. AND UP

Volume 4, No. 7 Sept.- Oct., 1966



Q_1 TIXM05 or TIXM10

Note: Inductor has been removed from this point.

Adjust pot for 10 volts at t.p. with local oscillator disconnected. Adjust local oscillator power until voltage at t.p. is between 6 and 8.

A MIXER FOR 432

A 432 DX MAN'S CONVERTER

MODEL 432-3

NEW FEATURES:

--All solid-state design
--Zener-regulated a.c. power supply
--Extremely low-noise front end-- 4 d.b. or less.
--High image and I. F. leak-through rejection
--Excellent frequency stability.

This converter uses the Texas Instruments TI-XMO series transistor. We pick the best from the 01 and 06 types to give you performance equal to or better than the general run of the former TIXMO5, apparently no longer available---at least for now. From our tests these transistors are superior in performance to the 2N3399 we formerly used and cost much less. They're also less expensive for you to replace if you damage them with r.f. This converter has a tuned input, something our previous converters and preamps did not have. It cuts down on interference from other stations in the big cities.

ORDERING INFORMATION: Price is $55.00 postpaid. Add 35¢ for Special Handling, a fee charged by the post office for faster delivery. Add $2.50 for Air Mail.

I. F. Ranges available put 432 Mc. at 26, 27, 28.1, 29, 30.5, 49 or 50 Mc.

Type BNC connectors only.

PARKS ELECTRONICS LAB.

ROUTE 2 BOX 35 BEAVERTON, OREGON

W2CCY 432 MHZ MIXER
by K7AAD

This article is a mixer in more ways than one. W3SDZ sent it to me with pictures, a diagram and a few notes as to what was what on the picture and diagram--no text. I'm writing some text for it because I think it has some good points that make it not only a useful experimental tool for use with your experimental preamps but a mixer the not-too-experienced ham can make work properly. For what they're worth, here are my comments on it.

1. The I.F. is 50-54 MHz., which means you can run it right into your low-noise 6 meter converter. If you use this mixer without a preamp it should work fairly well. I would guess noise figure at best would be about 10 db. It sounds worse than it really is. That was the best you could get with most tubes a few years back. It is OK for local work. Using a 50 MHz I.F. means any image is 100 MHz away and with an untuned input the farther the better. Of course if your oscillator chain is injecting other than 382 MHz. you could get other services within the tuning range of 50-54 MHz. Most activity is right near 432.

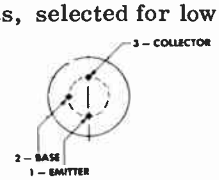
2. I like the method of setting up the mixer with so much current coming from forward biasing of the transistor and so much from local oscillator signal injection. It is often a problem getting a mixer to operate properly and this method is as good as any I know and requires nothing but a voltmeter. It might seem the 28 volts is a waste but you could use batteries temporarily as current drain is very low. Then once you know what voltage is best at the test point you could supply that voltage at the test point from flashlight batteries. Keep in mind the collector to emitter rating on the TIXM01 thru 10 series is 9 volts. I have used them in some oscillator service at 9 volts and had them go out on me after a while. I recommend the TIXM10 as it is available and as good as the best TIXM05s. You can get them from us if you wish at $2 for 3, postpaid, with a limit of 3. We are using them in our converters now. We find that there is much less trouble in getting the converters to meet noise figure specs and that many perform better than specifications --measureably better, not hearably better.

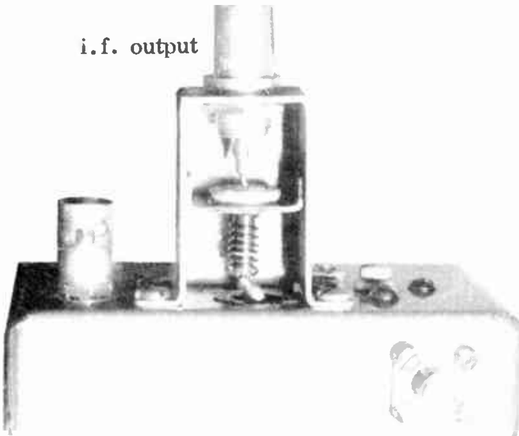
3. The size of the input blocking condenser was not given. I would guess it is between 5 and 20 pf, probably 10 to 15.

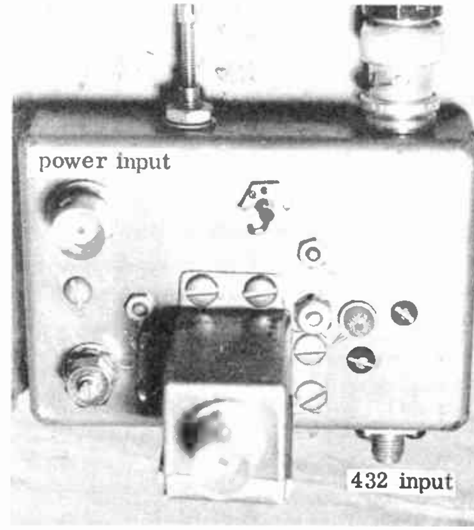
4. In general, bypass values are not critical, but the tank bypasses are critical because the two 100 pf. bypasses essentially make a tap on a capacitive voltage divider. The choke in the picture was apparently omitted subsequently.

5. When you have the mixer connected to your 6 meter converter you should get a noise increase when you apply power and a noise variation when you adjust the output slug.

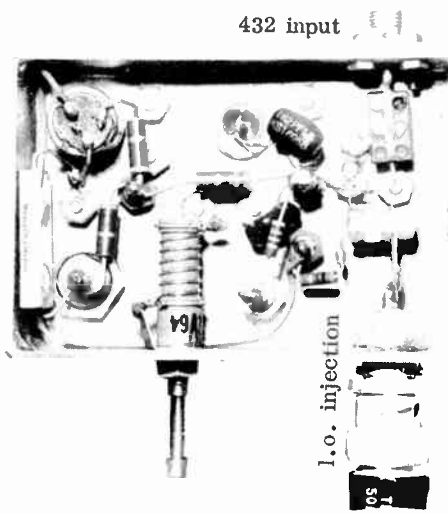
6. The transistor socket used is non-standard. I would use a socket and not solder to the leads as germanium transistors are easily damaged if you don't use a heat sink between the joint and the transistor. Bottom view basing for the TIXM01 thru TIXM10 is shown below. Transistors are made by Texas Instruments and available at Allied. The price recently nearly doubled--61¢ each in hundred lots. In the bigger cities the guys get together and buy hundred lots. TI changed the mold and they don't break like they used to . Incidentally, we use these in 455Kc i.f.s at 4.5 volts, selected for low gain, and don't have to neutralize. Output cap. is very low. End.
Diagram on cover, pictures on page 4 .







I goofed. After printing the preceding text, I found the copy W3SDZ had sent, paraphrased as follows: Real noise figure is about 9 db when you account for the image response. That's about all you need in the mixer with a couple of transistor r.f. stages. Cliff found some local oscillator energy in the first mixer he built, so he added a low-pass filer to the design of the mixer pictured. The filter can be built in two ways. The diagram lists 100 pf. feedthru buttons as they are easy to obtain. With these, the inductor is just a straight piece of wire. If you can obtain 20 pf buttons then you can duplicate the inductor as pictured.



With a simple change in the output inductor of the mixer, this unit can be used as a universal mixer on any of the VHF bands from 50 Mc. up to about 500 Mc. The philosophy of the design is what is important. Like building a component hi-fi system you can go to a more stable local oscillator, experiment with new R.F. amplifiers, etc. and still use the mixer unit without change. End.

VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions, $1 per year, others $2 per year. Second class postage paid at Beaverton, Ore. 97005.

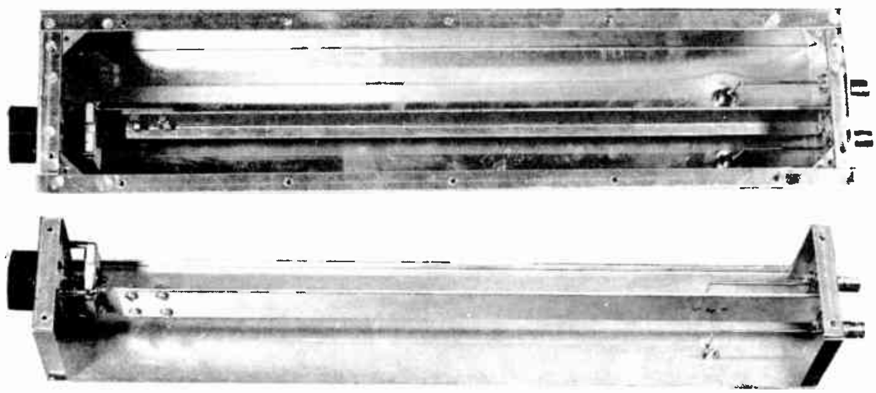
CAVITY FILTERS
by Denton Nelson, W7UHF

One of the biggest headaches VHF hams have today is interference from TV and FM stations. The blame might rightfully rest with the ham's converter, his antenna system (including his feed lines) or the TV & FM stations themselves (they aren't all perfect.) If these stations aren't actually radiating energy in the ham bands, the cause is often insufficient selectivity in the converter. A low-noise converter front end is over-coupled and is therefore very broad. The Parks converters are made with lowest noise figure the prime target and therefore the front ends are rather broad. It is not possible to get low noise, excellent front-end selectivity and still be priced competitively. The high degree of selectivity in the front end required by hams living near TV and FM stations must be obtained externally, and the cavity filter seems the best way to get it. A cavity filter isn't going to solve everyone's problems, but it may do a lot of good for a relatively small outlay of cash and effort----if it is made and used correctly.

There are two main reasons for installing a cavity filter in your VHF transmission line. One is to keep harmonics generated in the frequency multiplier stages of your transmitter from reaching the antenna. The cavity filter used in this manner passes the desired output frequency almost without loss and severely attenuates other frequencies removed by several megacycles. These "other" frequencies are often the ones that get into the neighbor's TV set. If you are running high power, you may find that placing the filter between the exciter and the final amplifier gives sufficient attenuation and doesn't require such a high voltage condenser for tuning. Placing a filter between a VHF SSB exciter and the final amplifier is a big help in reducing the unwanted outputs of the SSB mixers.

Two cavity filters are shown in Figure 1. A cavity filter is essentially a completely enclosed box with a rod or strip of metal in the center which is grounded to one end of the box and connected to a variable capacitor at the other end. The incoming signal is fed into the cavity thru a connector and to a wire loop which is grounded inside the box. The "Q" of the enclosed tuned circuit is very high and currents circulating within the box are quite large at resonance. Current is induced in a similar loop of wire on the opposite side of the center line which is the output. Since the filter is symmetrical, either loop can be used for input or output. The impedance at the condenser end of the filter is very high and large r.f. voltages can exist across the tuning capacitor when the filter is used in the line from the transmitter. Therefore a high-voltage type capacitor is required. But for receiving, any capacitor of the right capacity range will work.

A second reason for using a cavity filter is to prevent the multitude of commercial signals adjacent to the VHF ham bands from entering the receiving converter. If these unwanted signals are present in sufficient magnitude, they can mix and produce sum and difference frequencies that fall in the ham bands. These signals are commonly commonly called TV or FM birdies. Such strong signals can also cause cross-modulation with the ham band signals or mix with the harmonic outputs of the converter's local oscillator. If you can prevent these commercial signals from getting into the converter in the first place, and that's the purpose of the cavity filter, a lot of spurious signals can be reduced tremendously or just cease to exist. There is a price you must pay for this, unless you build a rather complex filter. And the price is that you will have to re-peak the filter as you move across the band if you want best receiver sensitivity. For this reason you may want to use separate filters in the transmitter and receiver lines to the antenna.



In using a cavity filter there are some precautions that should be observed. When a cavity filter is connected into a matched transmission line of the characteristic impedance for which the filter is designed, everything works fine. This is the case if you are using filters like those described in this article with a 50 ohm coaxial line and a matched antenna----when you're transmitting. But receiving is another matter. The input impedance of a converter adjusted for lowest noise figure is not equal to the characteristic impedance of the line (the source impedance) but is higher--typically 80 ohms at VHF for a 50 ohm source. You know that a transmission line must be terminated in its characteristic impedance to be purely resistive at its input. If it is terminated in another impedance, its input impedance depends on the nature of the termination and the length of the cable. The point of this is that if you use just any length of cable between the cavity filter and the converter, you may not be getting the performance of which the filter is capable.

It has been found experimentally that by using an interconnecting cable whose length is an electrical quarter wavelength, the transforming action of the cable eliminates most of the de-tuning effects of the mis-matched load. This phenomenon is illustrated in the tracings of Figure 2. The upper curve is the response of the Parks Model 144-1 converter. The sweep generator is a Heathkit TV alignment Generator. A ten d.b. coaxial pad isolates the sweep generator from the converter and provides the converter with a true 50-ohm resistive source. The center curve is the resultant response of filter and converter using the upper filter of Fig. 1 and a 24" length of RG 58/U cable between the filter and the converter. The filter is tuned for maximum response at 1 megacycle increments through the 2 meter band. Note the lack of symmetry in the response, and the broad double hump of one curve. In the lower trace conditions are the same except that the cable connecting the filter to the converter is only 13.5" long which is an electrical 1/4 wave at 2 meters. It is likely that this same condition exists when the filter is placed between an exciter and a final, so a multiple of a quarter wavelength is recommended for the coax line. Be sure to include the velocity factor of the coax in your calculations.

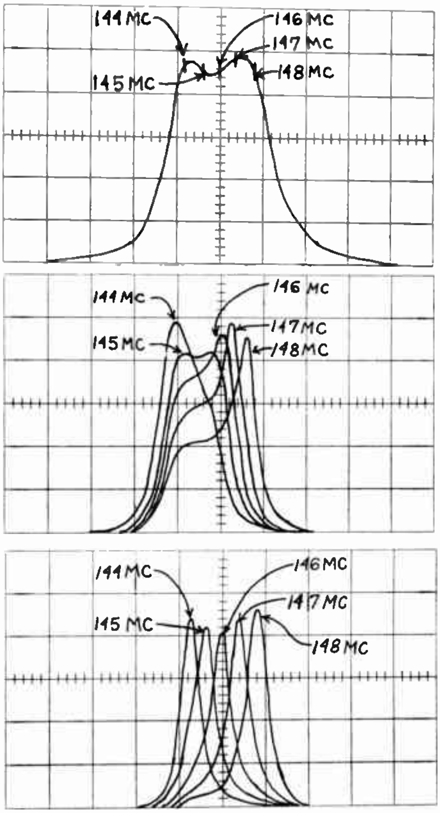


Figure 2

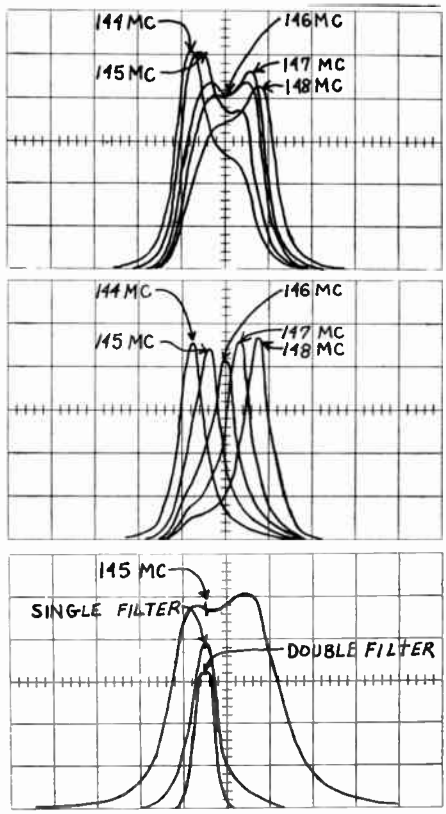


Figure 3

The upper curves of Figure 3 show the response of the filter built in the Bud Mini-slide box when 24" of cable is used. The detuning effects are not quite the same as before, but are still rather serious. The difference is probably due to a little different coupling and the smaller dimensions of the box. The center curves were obtained with the 13.5" interconnecting cable and re-tuning the filter in 1 Mc. increments. The lower curves show the response of the converter alone, that of a single filter with 1/4 wave connecting coax added, and then two filters cascaded ahead of the converter. Note how the sides of the smaller curve are pulled in. This increased attenuation nearby may be very helpful when the guy down the block is operating.

There are complications in cascading two cavities. There should be no interconnecting cable between the filters or the cable should be an electrical half wavelength long. Otherwise the resulting response curve will have a double hump which cannot be made into a single narrow peak by tuning. The distance between the peaks of the double hump depends on the length of cable used to connect the cavities together.

Normally, the insertion loss of cascaded cavities is additive. This effect is shown in the lower set of curves of Fig. 3. The smaller curve was made with two filters cascaded, each of which had an insertion loss of about 0.9 d.b. The quantitative difference in amplitudes between each set of curves was determined by substituting a 1 d.b. coaxial pad in the transmission line ahead of the filters. The attenuation cannot be determined directly from the waveforms because of the non-linearity of the diode detector.

One method of obtaining selectivity without sacrificing system noise figure is to place the filters between a low-noise r.f. preamplifier and the converter. It may be necessary to use some attenuation between the filters and the converter to prevent overloading of the converter when a strong signal is near the frequency you are listening to. A suitable coaxial cable type attenuator is described in this issue of VHFER.

From the photographs of Fig. 1, you can see that each end of the pickup probes is connected to a BNC connector. This was done so that the signal could be connected to either end of the probe while the other end was shorted with a grounding plug. The tests showed that it made no difference which end of the probe was grounded.

Since both ends of the probe were available, the signal was connected to one end of a probe and removed from the other end of the same probe. The second probe was open-circuited at both ends. This procedure made the cavity an absorption-type filter instead of a bandpass filter. Figure 4 shows the response curve obtained when the absorption filter was connected ahead of a two meter converter by means of a quarter wavelength of 50 ohm cable. The rejection notch can be moved through the pass band of the converter. There is also an insertion loss taken when the cavity is used as an absorption filter, about 1 d.b.

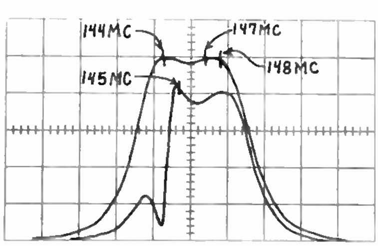


Figure 4

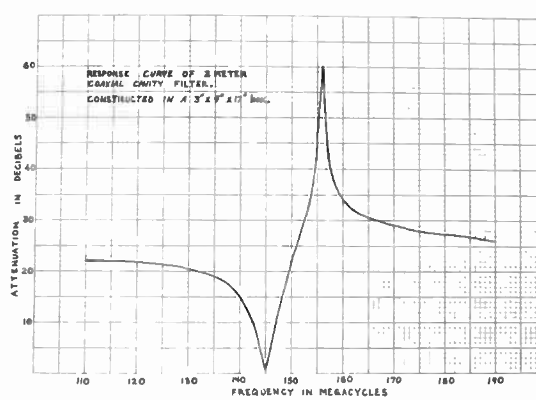
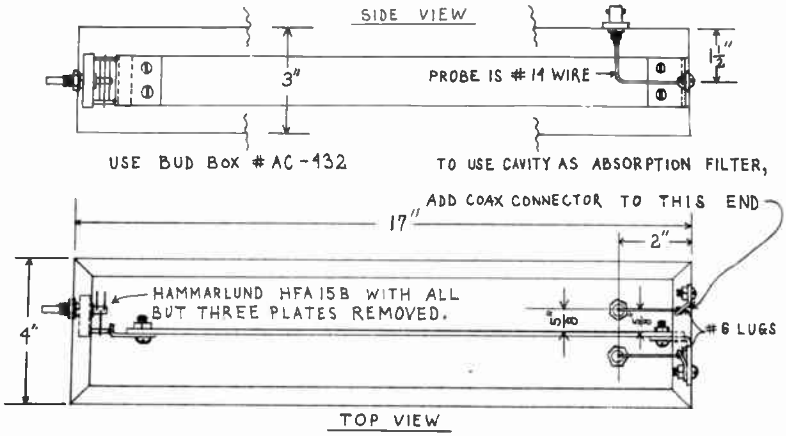


Figure 5

An absorption cavity can be cascaded with a band pass cavity filter for additional rejection of unwanted signals. The absorption cavity is connected to the band pass cavity with an electrical half wavelength of coax. At 220 Mc., TV interference is really a problem, and an absorption fiter set on the offending TV channel may reduce interference considerably.

2 METER COAXIAL CAVITY FILTER.

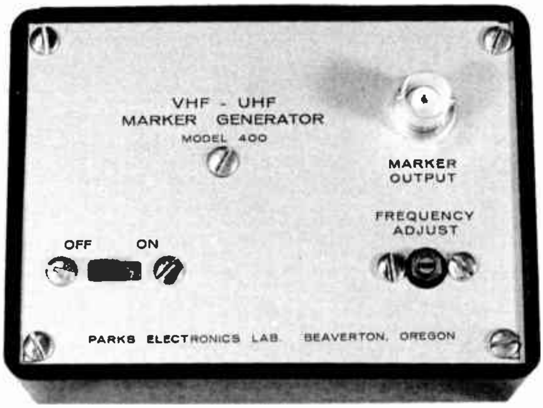


ODDS & ENDS
by K7AAD

Moonbounce Newsletter is not in this issue because it hadn't arrive at printing time. We still badly need construction articles as you can see from this issue. I recently bought the Heathkit Tunnel Dipper and find it far superior to their old tube model. It is much easier to pick up r.f. from low-power transistor oscillators and multipliers and of course it doesn't have warm up time or a cord. The calibration is not too good and the control of tunnel diode current is touchy but I feel I got my money's worth. If you're trying to build equipment without the aid of a grid dipper you're wasting an awful lot of time.

Some of our doctor subscribers to VHFER have asked what we make in the medical line. We are primarily in the field of heart and blood vessels with diagnostic instruments. We make mercury strain gage and impedance plethysmographs for peripheral vascular disease and surgical monitoring, experimental surgery, etc. We also make ECG radio telemetry and heart rate meters and totalizers for exercise studies of athletes and office exercise studies of older men with suspected coronary artery disease.

Another area that certainly needs something done about it is the 432 antenna field. Not everybody is capable of or wants to make his own antennas. I have wanted to be able to refer to a make that I thot was good and in doing so I know I would be subject to criticism if the thing didn't perform. Our antenna contest listings should have pretty well pointed out that a couple of the popular domestic makes are worse than a dipole--at least they were at the contest. Gain, Inc. has offered to send me one of their new long 432 jobs to evaluate since they (Bill) weren't too happy with the way the little one showed up in the contests. Well, I'm glad to do it for them and for any company. I won't just give a conclusion but tell you exactly how I made the measurement and if you think its n.g. you can forget the whole thing. But I hear a VE2 has a quad of the longest J-Beam yagis and says they seem to do what is claimed. Let's hope I get the same results.

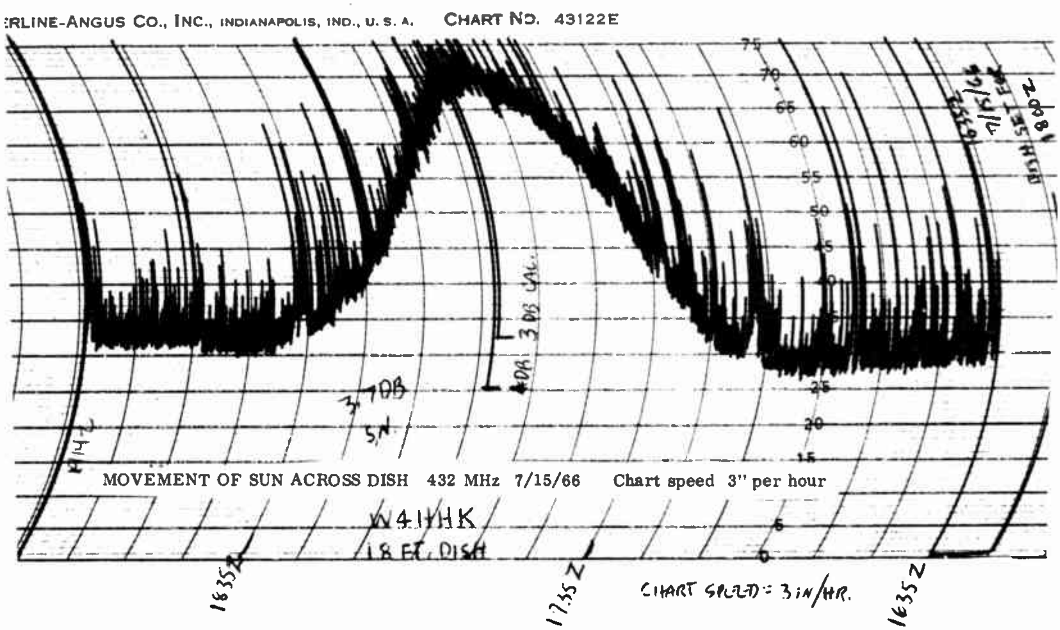


This marker generator puts out harmonics of 1 Mc. from 2 Mc. thru 1296. It uses a 1 Mc. crystal oscillator driving a tunnel diode. The tunnel diode switches at a very fast rate generating strong harmonics every 1 Mc. (the switching rate). Adjust against WWV and be sure of band edge calibration and 1 Mc. intervals. Can also be used as a weak-signal source for adjustment of antennas & converters. Operates from self-contained penlight cells. $25 postpaid.

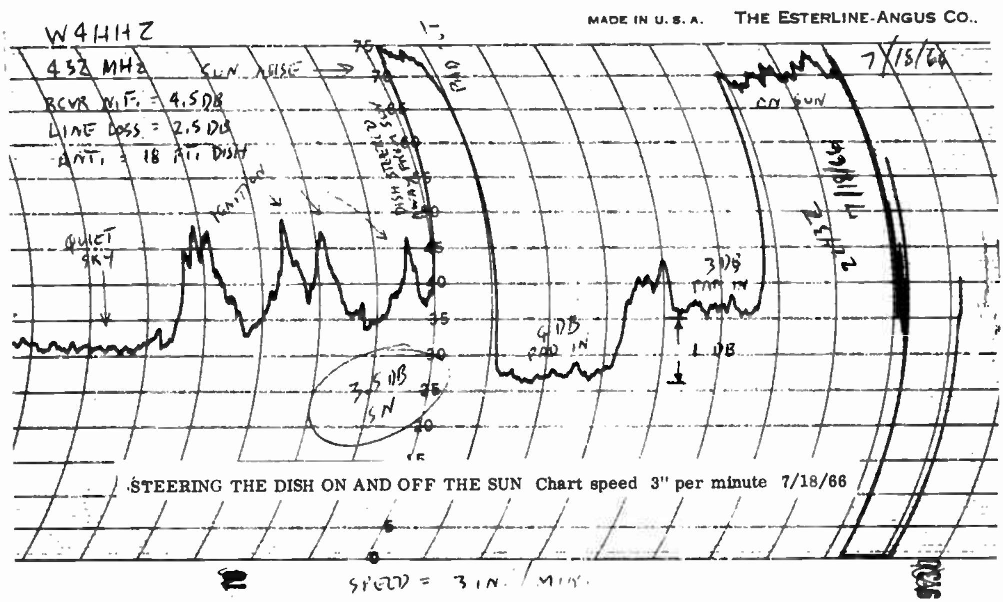
SUN NOISE

Paul Wilson, W4HHK, sent me the following information regarding his work with sun noise. The amount of noise increase you get when you sweep your antenna across the sun is a common test for big antennas. If you don't get any, you have troubles--at 432 anyway. You don't need a big dish like Paul's to get an increase in noise--it can be done with inexpensive Yagis. Paul's work is more quantitative and I think of interest to those of us who aspire to moonbounce and long-haul work. Here's a summary of equipment and method. Freq: 432, Feedline loss (caluulated) 2.25 db-2.5 db.) Receiver n.f. about 4.5. db. Recording method: Esterline-Angus chart recorder fed by rectifier connected to 500-ohm audio output of 75A3 receiver. BFO and AVC off. Commercial step type attenuator in 50-ohm line between converter and 75A3 receiver. Fixed 20 db pad on output of converter and 10 db pad on 75A3 input. Difference in db between sun noise and quiet sky noise measured by inserting appropriate attenuation to reduce sun noise to same level as quiet sky noise. Reading to nearest tenth of a db is given. Receiver selectivity is 3 KHz. An effort is made to maintain the system performance at the same level from day to day. Dish size, 18 ft.

Paul says that since mid May, sun noise values at his QTH have varied between 3.0 and 4.0 db. On three days, Aug. 29, Sept. 16 and Sept 20 levels of about 5 db were observed. This is a high level that is quite out of the ordinary. Also, during the first 15 days of October the level has held fairly steady at around 3.5 db with a gradual increase approaching 4 db the second week.



MOVEMENT OF SUN ACROSS DISH 432 MHz 7/15/66 Chart speed 3" per hour



STEERING THE DISH ON AND OFF THE SUN Chart speed 3" per minute 7/18/66

ODDS & ENDS

VHFER gets out on time this month. I leave for a trade show in London on Nov. 2 & will be gone almost a month so if you want more info on converters than what is on the shelf you'd better hold it a bit. If you see a repeat of material in here 2 years ago please forgive. We just aren't getting construction articles. I have been diddling with field effects at 2 meters but nothing conslusive yet. While they look good from the cross-modulation standpoint and n.f. is OK the gain is reported to be low. This is what I have noticed so far. Had a chat with W1OOP about it and he said RCA reported that you were better off to tap farther down on the input coil and use conventional transistors with a degenerative emitter circuit. Maybe not better off, but as well off. The TIXM12 is a cheapie for r.f. at VHF if you want to play. The TIXM10 seems the best of the cheap germaniums. See my mention of them in the mixer article. Henry also mentioned his tests with steep-skirted 6 kc filters and weak phone sigs. Said the sharp skirts didn't give as good copy as ones with a more conventional response.

SATELLITES

The first five paragraphs are from the OSCAR Newsletter received Oct. 24. The last paragraph is a personal communication to me. K7AAD

OSCAR 5. It is just about certain that OSCAR 5 will not be launched this year. Progress is being made on the DJ4ZC package, but additional work remains to be done before it is shipped to OSCAR Headquarters. Once it arrives, some finishing touches will be necessary before a launch can be requested. As soon as any definite launching information is available, it will be published in the quarterly Newsletter, or in a special notice if necessary.

Meanwhile, it is fair to assume that the DJ4ZC package will be the next unit to fly. This unit will be similar to OSCAR 3 and is expected to fly in an orbit similar to OSCAR 3. The input frequency will be 144.1 MHz (±20 kHz) and the output frequency 145.9 MHz (±20 kHz). The altitude should be about 500 nautical miles. The unit will be battery operated and should last three or four weeks. It is expected that the sensitivity of the DJ4ZC package will be higher than that of OSCAR 3, so very high transmitting powers should not be required.

With the amount of advance warning for OSCAR 5, there will be little excuse for anyone not being prepared when the launch occurs. Once the satellite has lifted off the launch pad, the limited life will allow very little time for improvements on your equipment or operating technique. If there were any lessons learned from the OSCAR 3 and 4 operations, it was that the stations with the best equipment and operating techniques were the most successful.

The operating techniques for OSCAR 5 will be similar to those for a DX contest on the lower bands and many of the same skills will apply. If your CW skills have grown rusty over the years, some routine operation on 20 or 40 meter CW might be in order, or better yet, get into one of the contests which are periodically run on those bands.

The amount of participation in OSCAR 5 by any individual or group will depend upon advance preparations and the time available for operating during the active life of the satellite. Remember, this unit will have a relatively low altitude. Passes will be in range of your station 5 or 6 times a day for durations of a few minutes up to a maximum of about 15 minutes each.

Word from WA6ZIJ is that the satellite his group is working on will be ready for launching after Oct. 30 next year. One of its several functions is to act as a repeater, taking in at 432 and coming out at 1296. Power output there will be 1.5 watts into a 3 element colinear. It will be powered mainly by solar panels and has a life expectancy of 5 years, the performance gradually deteriorating. It will be in a sub-synchronous orbit with a 28 day period. As I understand it, it will not be usable for 13 days out of 28. The satellite will be programmable from the ground for some of its functions. Unlike the last satellite up, which was a translator, this one will be a repeater which means it accommodates one QSO at a time.

2 METER MOONBOUNCE REPORT

The following two letters from K6MYC, Mike Staal, 13310 Carrick St., Saratoga, Ca. First one dated Sept. 12. " In response to a request by Ray, VK3ATN, I am forwarding the following results of our two-meter moonbounce attempts on Sept. 7 and Sept. 11. On Sept. 7, Bill, K6CLM, and myself both heard portions of letters for approx. 10 sec. during Ray's first xmit period, 1528-1530, and this was the first time that we had ever heard Ray's signals. However, for the next 20 minutes of the sked despite careful listening, no more signals could be heard. Ray's copy was completely negative from us and he heard his own echos very weakly until 1534 GMT. This was in sharp contrast to the past 3 months when he copied both his own and our signals almost consistently for the 20 minute skeds. Conclusion: Faraday rotation finally got us or the solar flare which occurred around Sept. 7 had an adverse effect on signals. On Sept. 11 we blew our linear during tuneup and lost considerable listening time attempting repair. Listened at the middle of the sked (best time) and heard letters during last ten sec. of Ray's transmission. Ray again heard nothing---not even his own echo. Ray says there may have been signals on 144.094 which to my knowledge is W6DNG's frequency for skeds. "

Oct. 18 letter. "The Oct 4 try was completely wiped out when a few days before we had 50 mph winds and the whole array came down leaving quite a mess of twisted and bent elements and broken phasing lines. Tuesday morning, Oct. 4, with much appreciated help we lifted the array back up on the supports and I spent the rest of the day putting things back in order. Oct 8 (Sat) K6HCP and W6UGL and I were out early to get things ready. Abt 15 minutes before sked time we tried for our own echos and for the FIRST time they were there and real good at that. So by sked time we were all quite confident that we would make it this time for sure. The sked time came and went with us tuning 400 cycles each side of our freq and hearing nothing. After the try we were all confused thinking things like Ray's xmtr must have failed, etc. On our 15 meter sked with Ray later that day we found out Ray heard nothing either (except his own echos) until about 4 minutes before the end of the sked. The signals heard were 2 Kc low and did not sound like our mechanical fist (which we weren't using) so the signals were passed over. Somehow on Ray's end or ours we had a 2 Kc frequency split and this we feel cost us success. But we're ready and confident for next month. Sked times are as follows: Nov. 1 1212-1234 GMT Decl. 24 deg 59 min. Nov. 5 1600-1622 GMT, Decl. 22 degrees 56 minutes."

VK3ATN writes"(July 21) Earlier this week I copied Q5 at times the 2 meter moonbounce of K6MYC/K6CLM (perfect copy for QSO purposes.) They unfortunately did not hear me because of high noise level. I have spoken with Sam Harris, W1FZJ/KP4 since and he was amazed at the strength of the echos which I re-played on 7 Mc. Eventually I'll get around to 432 and have also thought about 50 Mc. moonbounce. Possibly you may have some interested readers ." His address, T.R. Naughton, Box 80, Birchip, Victoria, Australia.

KW FINAL MAINTENANCE

Art Bates, W5ML, Vivian, La., sent this info on KW Finals with air sockets. Art says this kind of final with a blower underneath sends all kinds of dirt up to the air sockets, grease especially. These particles cling to the forked tabs and cause a loose contact or perhaps a semi-contact to the tube pin. When on the heater pins, you can guess how the heater voltage remains constant. Using cleaning fluid, he dips a pipe cleaner into the bottle and runs it thru and between the forked prongs. Then before the tubes are replaced, inspects the tension and closing up of the prongs. Also, you carefully use a new steel brush and go over the tube pins. Then wipe them clean. Art says he had trouble before and this is what he found. This should be done at least every 2 years.

OPEN BANDS

by Marilyn Wiseman, K8ALO

Reports up to a new high, mainly M/S, Aurora. Two fine Aurora openings during August & September. Many say September Aurora the best in years. Have plenty to report so will keep it short. See you next issue. Send reports to: Box 103, Petersburg, Ohio 44454.

50 MHz Scatter:

Aug.	W4GIM/3 (Md.) hrd WA5GQT.
	WA6GKK (Calif.) wrkd K7ICW, W7CNK, K7BBO, WØEYE, K7CIN and many Calif. stations. Gary says conditions good between 400-450 mi. He wrkd K6RIL twice each weekend, night skeds with W7CNK continue good.
	K7BBO (Wash.) wrkd WA6AWY, WA6SXM, WA6RWH during Perseids. Also wrkd K7ICW, W7UFB, plus 9 Calif. stations.
Sept.	K7BBO (Wash.) wrkd W7UFB, 10 Calif. stations.
	K71CW (Nev.) wrkd W7DAY, WØJXK/7, WØEYE, W7UFB, 4 Calif. stations.

144 MHz

Aug. 7-11	K7ICW (Nev.) wrkd W6DQJ, W6NLZ, W6DNG, K6IBY
Aug. 23	W5ML (La.) wrkd WA5KHE/5 (Tex.), W4ZCM (Ky.) W8GOH (Ohio), W5RCI (Miss.), W4EJQ (Va.), hrd many 4, 5's. WA4BVW (N.C.) wrkd E. Pa., W.Va., E. Ind., all over Ohio.
Aug. 26	WA4BVW (N.C.) wrkd Dayton,Ohio, also into Chicago area. Opening lasted about 1 hr.
Oct. 10	W7JCU/4 (Ala.) wrkd W4VHH (S.C.), W4WDH (Ga.), W5CKY (Miss.), W4UUF (Fla.), K5WXZ (Tex.). Dale wrkd 6 states, he says opening ran east and west. All sig S-9. hrd K5WXZ (Okla.).

144 MHz Meteor Scatter

July 30	W4CKB (Fla.) wrkd W5UGO (Okla.) 1st sked state #17.
Aug. 7	K7ICW hrd WØEKZ (Kans.) pings, calls.
Aug. 11	W4CKB (Fla.) wrkd W1MEH (Conn.) State #18, W8QOH (Ohio) State #19. K7ICW (Nev.) wrkd W7LHL (Wash.) first Nev.-Wash. QSO. hrd WØEKZ.
Aug. 12	K1ABR (R.I.) wrkd W4NUS (N.C.) 700 mi. Had sked with W5UGO (Okla.), but hrd only a few pings. W4CKB (Fla.) wrkd K9UIF (Ind.) State #20, K1BKK (Vt.) State #21. K7ICW (Nev.) wrkd WØEKZ (Kans.) first Nev.-Kans. QSO. hrd WØEYE (Colo.). K2HLA (N.Y.) wrkd WØNXF (Neb.) 1230 mi. for new State. W2AZL (N.J.) wrkd WØNXF (Neb.), W9MAL (Ill.), W4CKB (Fla.). Hrd WØEOZ (N.D.), WØMOX, WØEYE (Colo.). Had near miss with WØQDH, WØEKZ. W5UGO/5 (Okla.) wrkd WØEOZ, W8BKI, K6HMS, W3BYF, WØEYE. Hrd K7NII, K5TQP, W4CKB, K9UIF, K9AAJ, WØNXF. W1AZK wrkd WØNXF, WØLER, WAØFDY. W1JSM wrkd WØLER, W9IFA. W5WXZ

	wrkd K6JYO, K6HAA. WØEYE wrkd K6JYO, WØEOZ. W6GDO wrkd WØNXF, K5TQP, W7WVE. W6WSQ wrkd WØENC. WAØFDY wrkd K4IXC, W1AZK.
Aug. 13	W4CKB (Fla.) wrkd W9BRN (Ind.), W2AZL (N.J.) State #22. Bev says sked wrkd nightly with W4LSQ (Ala.), W4VHH (N.C.). K2HLA (N.Y.) wrkd W4NUS (N.C.) 500 mi. This was a new State for W4NUS.
Aug. 21	K7ICW (Nev.) hrd WB6KAP (Calif.) 500 mi.
Aug. 24	K7ICW (Nev.) hrd WØNXF (Neb.)
Aug. 28	K7ICW (Nev.) hrd W7WNE (Wash.) 950 mi.
Sept. 6-8	K7ICW (Nev.) hrd K5WXZ (Tex.) 1064 mi.

144 MHz Aurora

Aug. 29	K2HLA (N.Y.) wrkd VE3DAW (Ont.)
Aug. 30	Aurora noted this night but no reports. Hrd 1, 2, 3, 4, 8, 9, Øs.
Sept. 3	W2AZL (N.J.) wrkd W5RCI, W4HJQ, WA9DOT, W9BRN, K4EJQ, W4CPX, W4NUS, W4VHH, W9PBP, WA8NBD, W9UNN, plus many others W1, 2, 3, 4, 8, VE2, VE3's. Hrd W5UGO. Carl says he wrkd 10 states, hrd 21. W5ML (La.) wrkd W9IFA (Ill.). W5AKI hrd W9IFA plus one 8 call. K2HLA (N.Y.) wrkd W9BRN (Ind.), WA4ISR (Va.), WA9DOT (Wisc.) was a new state for Dick. Dick says this was best Aurora in years.

SKEDS WANTED

Send all SKEDS WANTED info to Marilyn Wiseman, Box 103, Petersburg, Ohio 44454

K7BBO	Dave Robinson, 1716 S. 8th St., Tacoma, Wash. 98405. Looking for 2-meter meteor-shower skeds. Dave's freq. 144.023-144:044 MHz. Also 6-meter scatter skeds, any day or any time c.w. freq. 50.004 MHz. SSB freq. 50.105 MHz or can go on any freq.
W7UFB	Casper, Wyo. on most every Sun. 50.005-50.105 MHz from 0730-0900 PDST.
W9DID	Bob Sabon, 817 W. 34th St., Chicago, Ill. 60608 wants skeds for Nov. Bob runs 500 W SSB freq. 145.002 MHz.
K1ABR	Dick, 12 High View Dr., Cranston, R.I. 02920 looking for skeds during any M/S. Dick will be on for sure during Nov. Leonids showers on 144 MHz.
W4CKB	Bev Cavender, Box 88, Lake Placid, Fla. looking for skeds on 144 MHz. Bev runs KW, long yagi freq. 144.081 MHz. Policy at W4CKB: "The first station in each new state wrkd via meteor scatter receives a box of tree-ripened citrus fruit prepaid from W4CKB orange groves."
K2HLA	Dick Wilborg, RFD #1, Cutchogue, L.I., N.Y. 11935 looking for sked with Ala., Miss., Ga., Tenn., Wisc., Minn., or any others. Freq. 144.038 MHz.
W4AWS	Art Hale, 1414 Oakley St., Orlando, Fla. 32806 interested in skeds for all major M/S on 144 MHz.
W5ML	Art Bates, Vivian, La., trying to break down the barrier to W8PT, Jack, Watervliet, Mich. They would appreciate any one in their line of fire to answer them if heard.

Ed. Note: I am very glad to see the increase in long-haul & meteor sked activity. Listings are restricted to those with high power (250 w. or more) and large antennas. Since we cannot know the equipment of all hams we must depend on our readers to let us know if the rules are not being followed. It isn't that we are against DX with low power, it's just that a line has to be drawn somewhere or everyone with a gooney bird and a Hy-Gain antenna will want a sked listing & there isn't that much space available. K7AAD

After all, nobody's perfect. I have heard ugly rumors that Parks 432 converters interfere with the family TV set on certain channels. Should there be a grain of truth in this whispering campaign let me suggest a remedy which I have heard from equally unreliable sources. Wrap the whole converter in aluminum baking foil or sheet copper you get at the hobby shop and ground it to the main converter ground. The panel is both coated and anodized on both sides so you have to make sure you tie the foil to something that is really a ground. If you think you might have TV signals getting in thru the plastic box try the same technique. We used to spray coat the insides but we got into cavity effects with the 432-2 and never could prove it did any good on the 432-3. Besides, spraying conductive coating is a real pain & expensive.

We have had a couple of kicks on crystal tolerance on our 432 converters. Maybe it's worth discussing a bit. Some people want them "right on the money" and in such cases we politely decline their business. There are easier ways of making money. Prime consideration should be frequency stability, it would seem to me. The earlier converters were not as stable as they could be and it was attributed to the fact that the crystal was exposed to temperature variations. Some hams turned the xtal socket upside down so the crystal would be in the box. The 432-3 has the crystal in the box and operates in the series resonant mode. This means you ain't gonna move it much no matter what you do. This is nice for s.s.b.but no good at all for lining it up to your receiver. Many of the better receivers have provisions for moving the pointer slightly. And you <u>must</u> have a marker of some sort to know exactly where 432 is. There have been some awful crystal problems in the last 8 months or so. Deliveries were so bad with our major supplier of xtals for the 432 converter that deliveries stretched out from a month to 6 weeks. With deliveries like that you don't work closely with the manufacturer to get the crystals right on. We were way behind and got xtals from other vendors where we could. Now we buy almost exclusively from Hunt Crystals which makes a very high quality unit but it takes about a month to get them. I believe they hold to .005%. But at the injection frequency for 432 that means it can be 20 kc. off and still within tolerance. I have heard of other crystals being 60 kc. off. If we need a special xtal in a hurry we get it from another vendor and since the vendor may not have proper information to work with the tolerance may be worse. I really pity the crystal manufacturer when it comes to dealing with people who want precise tolerance yet do not provide him with proper information about the circuit the crystal is used in. We send a crystal near the proper frequency and tell him how many kc. off it is in a certain direction whenever this is possible.

Published by Parks Electronics Lab.
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WILLIAM R. MANDALE 4-68-1
371 PRUSSIAN LANE (8)
WAYNE, PA. 19087

Return Requested

VHFER

LEARN BY DOING

50 MC. AND UP

Volume 4, No. 6 July-August, 1966

432 ANTENNA CONTEST

A 432 DX MAN'S CONVERTER

MODEL 432-3

NEW FEATURES:

- --All solid-state design
- --Zener-regulated a.c. power supply
- --Extremely low-noise front end-- 4 d.b. or less.
- --High image and I.F. leak-through rejection
- --Excellent frequency stability.

This converter uses the Texas Instruments TI-XMO series transistor. We pick the best from the 01 and 06 types to give you performance equal to or better than the general run of the former TIXMO5, apparently no longer available---at least for now. From our tests these transistors are superior in performance to the 2N3399 we formerly used and cost much less. They're also less expensive for you to replace if you damage them with r.f. This converter has a tuned input, something our previous converters and preamps did not have. It cuts down on interference from other stations in the big cities.

ORDERING INFORMATION: Price is $55.00 postpaid. Add 35¢ for Special Handling, a fee charged by the post office for faster delivery. Add $2.50 for Air Mail.

I.F. Ranges available put 432 Mc. at 26, 27, 28.1, 29, 30.5, 49 or 50 Mc.

Type BNC connectors only.

PARKS ELECTRONICS LAB.

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POLARIZATION CONSIDERATIONS IN THE 1215-1300 MHz BAND

By G.A. (Al) Olcott, K7ICW/AA7ICW*

Recently, discussions involving the seemingly age old problem of polarization usage has caught up with progress on 1296. One school proposes that horizontal should be used, another vertical, and yet still another, circular.

Right now the majority of activity on 1296 is being done by those who own surplus converted APX-6 rigs. These units are essentially modulated oscillators and have broad receivers, and some drifting is noted, but yet are not to be considered "wide band" by any measure. The actual output frequency of the APX-6 units centers around 1225 MHz. With further cavity shortening, 1296 MHz can be reached. Output power from 2 to 4 watts is normal. The normal band covered is 1215 MHz. Antenna polarization is horizontal and vertical.

The next group of operations is fundamental crystal control, or equivalent VFO or VXO systems, and the frequency coverage used is 1296 to 1300 MHz. Narrow band receiving techniques and stable operation is a necessity. 10 watts appears equal to a KW under these controlled conditions. Antenna polarization for this group is predominantly horizontal world wide.

A small but growing group of technical perfectionists are using <u>the</u> frequency 1296.000 MHz. This frequency was chosen as the primary moonbounce frequency. Ultra stability, high transmitter power, large antenna size and gain, extremely narrow bandwidth receiving equipment and elaborate state-of-the-art approach is the by-word here. A standard polarization for this group is still open to question, but best results have been obtained with circular polarization. Here the term "phase sense" enters the picture to complicate things. On any two-way path from a satellite, whether it be the moon or man-made, Faraday rotation takes place, and the theory says that the transmitted signal will be received in the opposite phase sense. This means that a station transmitting a signal horizontally polarized will get a good portion of it back vertically polarized.[1] Use of circular polarization will minimize this effect greatly, but present methods of producing circular polarization are inherent in that either right-hand or left-hand circular phase sense are generated. Signals transmitted right-hand circular should be received left-hand circular. Past operations have worked out that the higher E.R.P. (effective radiated power) station used right-hand circular for convenience of standardization. Usually, the station with the largest antenna gain qualifies here.

Worthy of mention is a group of stalwarts using both horizontal and vertical in the same antenna configuration, one polarization used for "polaplexer" principle. Briefly this consists of transmitting with one polarization that is separated by the I.F. frequency from the receiving frequency which is received simultaneously duplex on the opposite polarization.

One can see then, without getting into specifics of polarization causes and effects that there is more to this than meets the eye. Here are some comments taken out of context from some of the hams in California:

*510 S. Rose, Las Vegas, Nev. 89106

WA6MGZ. . . .A good reason to be horizontal is to be cross-polarized from unwanted 432 MHz energy radiated from vertical antennas via the 3rd harmonic on the West coast.

W6NLZ. . . . . Nearly all of the true 1296 gang in the L.A. area who have pioneered work on 1296 are horizontal.

WB6IOM. . . . Small antenna size without using relatively inefficient dishes can be had by using the circularly polarized helix array.

W6ZOP. . . . Horizontal and vertical polarization combined has been used by the San Bernadino Microwave Society in a "polaplexer" arrangement for years.

W6GDO. . . . . Vertical might be a better antenna for some using the APX-6 and similar equipment, especially to those located distantly from heavy activity and where observation of beacons such as TACANS and VORTACS can be used for "DX" indicators.

W6NGN. . . . . "I'm vertical."

E.P. Tilton, W1HDQ says that tropospheric bending work has been done with low power in the 1215 band over a land range of 400 miles. Generally speaking, the same polarization used at each end is most favorable. For signal levels produced by this medium, it is doubtful that one polarization or the other would be superior except over a mountain obstructed path. Theory says that vertical would be superior in this case.

For future work using OSCAR satellites and cross-band 432/1296 it is desirable to use circular polarization. However if linear polarization must be used, it will be most favorable that horizontal polarization be used on 1296 to eliminate unwanted 3rd harmonic energy from 432 generated from local vertical antennas, yours especially! Transistor burnout will be greatly reduced also, and I doubt that many can tolerate slightly elaborate double coax relay switching systems used by some on 432 to eliminate burnout. These additional lossy items used on 1296 may be intolerable to your N/F.

For those who use the APX-6, some attenuation of high-powered "garbage" such as radars, TACANS, VORTACS, etc., may be greatly reduced by use of horizontal polarization, but then again, the fringe area station might like the availability of these beacons to observe band conditions.

At certain geographical locations such as deep valleys or canyons, it has been found by some that one polarization of the other is most favorable to work outside the area. Some sort of polarization re-inforcement is taking place. Obviously, use of the favored polarization is then a necessity.

A word about noise. Even on an APX-6 receiver, man made noise can be heard. Most of this is extremely short range however and short lived. As transistors for 1296 become more available, the receiver front end N/F will get low enough in some locations that man made noise will be heard with regularity. It is common now to hear many complain about noise on 432 where it hardly was a problem 5 years ago. So the obvious now presents itself, use of horizontal polarization will attenuate man-made noise.

Interference is almost unknown on 1296, but as more and more get on the band with higher power and larger antennas, interference to something is bound to occur. Most government and commercial services use vertical polarization on near-by and harmonically related frequencies.

The critical factor of polarization is highly noticeable at 1296. A short distance separation between stations cross-polarized shows a tremendous signal loss. This is demonstrated in the practicality of the "polaplexer" principle. A poorly-designed, or poorly-fed antenna may have lobes in several planes which lead one to believe that the antenna is very useful for receiving various polarizations. The truth is that this type of antenna is only useful in the limited world of the user. Attempts to use this configuration on weak or DX signals will be disappointing or misleading. A station located on a ridge or hilltop may experience this. A particular location may be good for 20 db. of signal above the antenna gain, and just about anything used for an antenna would work. A properly-polarized antenna should mean the difference between little or no signal or copyable on an extended-range path.

In conclusion it can be said that the majority of users of the 1296 band use horizontal polarization. All others are using different polarizations for special uses such as moonbounce, etc. For space communications the value of circular polarization has been shown. Those who do not take advantage of this are doing things on a temporary basis, and plan to conform as soon as possible. From a physical or mechanical viewpoint, there is little difference between installations that shouldn't allow change to horizontal polarization easily for ground communications. The few using vertical are isolated groups with no liason with others outside their area. Usually it is a matter of arbitrary choice. The theoretical advantages of vertical in some specialized situations should be out-weighed in favor of standardized horizontal polarization which should result in more activity on the whole.

These arguments have been presented hopefully at an appropriate time. It is hoped that better usage and standard VHF contest usage will result from this discussion and that more constructive work by the majority past the APX-6 stage will be initiated.

[1] Editor's Note: Keep in mind that although some rotation on moon-bounced signals may exist, all 2 meter moonbounce work done by hams (not Arecibo) is with linear polarization (horizontal or vertical) and that the same polarization is used for both transmitting and receiving. L.P.

VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions, $1 per year, others $2 per year. Second class postage paid at Beaverton, Ore. 97005.

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

Well, another moonbounce season has just about come to a close, and it appears that other than the two meter work of VK3ATN little has been accomplished this year. Speaking of VK3ATN, the latest word I have is that two-way contact has yet to be established, although Ray is copying K6MYC with a good margin of signal for a two-way contact. The limited time on the moon for Ray's antenna is what is making the two-way a difficult chore, but I'm sure that it will be accomplished within the next few months. In discussions with Ray on 15 meters I find he would be interested in a six meter try after a two-meter two-way is accomplished. It also appears that the stacked rhombic array for fellows on the east coast might be the answer to a real first on six meters. Ray's present array, when tuned up on six meters, will hit the moon at a higher angle from his QTH, thus the hour angle will be lower here in the states. If you have some interest in this I suggest you write to Ray or talk to him on one of the HF bands. I haven't talked to Ray for some weeks now.

I haven't had much time to do anything in ham radio recently. I just purchased a 177 acre farm adjacent to our present QTH on top of the mountain. I now own the entire hilltop and we are in the process of rebuilding the farm house to house our expanding family. The most interesting thing about the farm is that it has a hill that slopes at nearly the perfect angle of 41 degrees to build a large fixed-reflector type antenna of any size I desire. Financial limitations will probably limit the size to around 150 feet. The weather will prevent any work before next spring, but I have every hope and intention of getting something started then.

I would like to take a few lines to make some comments about a subject that has been kicking around the VHF circles for some time now---integration techniques for weak-signal moonbounce work. This is a subject that I'm surely no expert on, but I have talked with everyone I know who is. What I have found out isn't very encouraging for moonbounce work on 432 and up. I don't want to take up too much space on the subject so I will have to summarize. It appears that a bandwidth of about 50 cycles is about as narrow a system you can count on for a moon-reflected signal. This can be obtained in a couple of ways. First, you can use a narrow audio filter with some sort of readout device such as a pen recorder or damped audio voltmeter. The other method was described by W2IMU in the last VHFER--simple ear integration. Either way it will work out to a 50-cycle system bandwidth. The problem with a narrower bandwidth and trying to use a moon-reflected signal to lock up a phase detecting system is simply that the phase of the return echo is distorted by the signal being reflected from different portions of the moon. This has all been determined by careful experiments done by labs with facilities that produce evidence you can't argue with. The reason I bring this up is to help you save time in your system planning for EME work. While we looked at various schemes for weak-signal work, we are now of the opinion that antenna gain is the place to look for system improvement.

When you consider everything, the antenna isn't the worst place to look for system improvement. I made an offer of some material on the antenna subject in the last issue of the VHFER. Many sent in the return envelopes, but I must admit I haven't gotten the information out yet. I had some material ready to mail, but so much more has come up in the meantime I have held off the mailing until I could get the additional material written. I hope to get this done after the Syracuse Roundup and include the results of W2IMU's antenna talk. Please be patient, those who have written for the information, and if you haven't written just send me a self-addressed envelope with postage for two ounces before Oct. 10th.

(continued on page 7)

CONSTRUCTION TIP ON 2 METER REFERENCE DIPOLE

Ed Cornwall, W7SBJ, of Seattle wrote me about his technique of making the reference dipole described in the April, 65 VHFER. It looks very good to me and certainly results in a stronger unit. It also looks it could be made with set screws to hold the elements. This is one of the problems with the silver-soldered one I made. It is kind of bulky if you want to send it to a friend by mail. Ed says, "I used hard-drawn copper tubing I had on hand. The problem developed that the soldering heat softened it too much to suit me. I dissembled it and strengthened the two 90 degree joints by using sweat-soldered Ts, cutting the excess third leg of the T off. (Fig. 1) The cut-off T gives a great deal of reinforcement and is better than a regular tubing elbow for the coax connection. The cut off arm makes an excellent "lead thru" and connection point for the center lead on the opposite side."

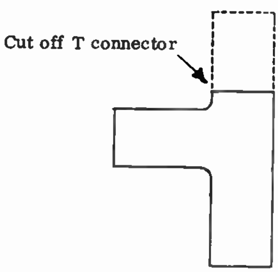


Fig. 1

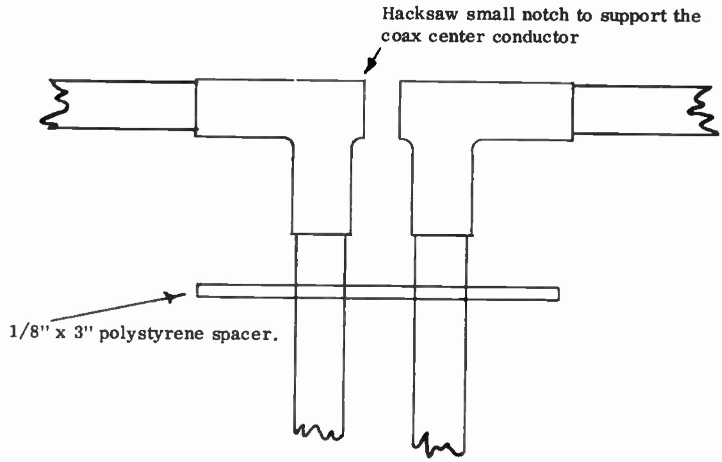
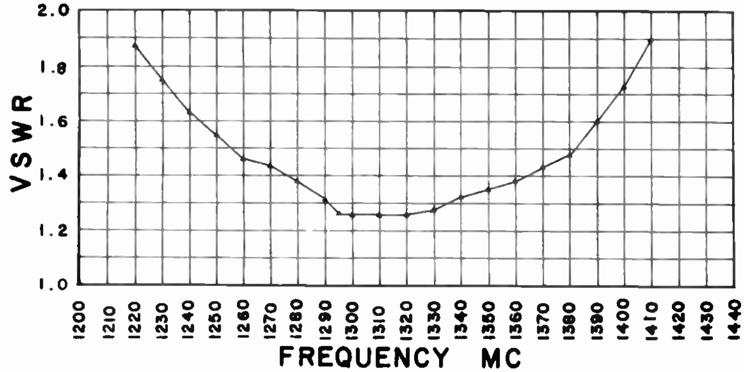


Fig. 2

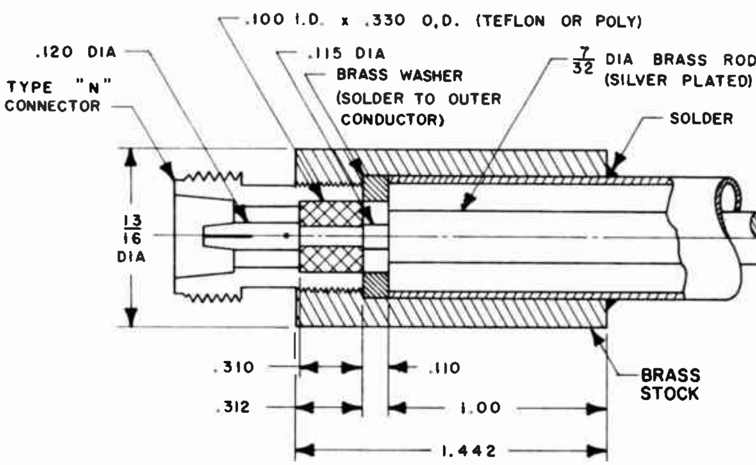
I received a letter from Ken Holladay, K6HCP, concerning his group's interest in 2304 Mc. moonbounce work. This is the first band where a small easy-to-build dish will work the EME path with reasonable signals. The equipment limitations will become more difficult for the average serious worker. The receiver has about the same difficulty as on 1296, but the transmitter and feedline get rather difficult. If the antenna is really your limitation I would strongly recommend you get in touch with K6HCP for some help in getting a 2304 system working.

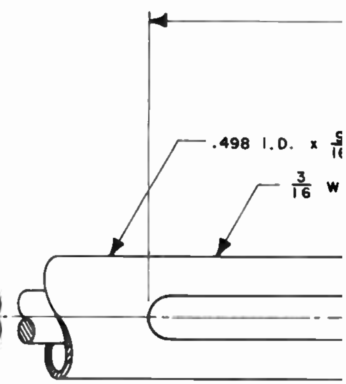
The annual Syracuse VHF roundup will be held again this year on October 8th. Dick Turrin, W2IMU and I will be each presenting talks about different phases of the moonbounce problem. I will be covering the more general aspects while Dick will talk on the antenna problem. I hope anyone within traveling distance will try to make this one as it is always a really outstanding affair with attendance usually over the 500 mark of serious VHFers.

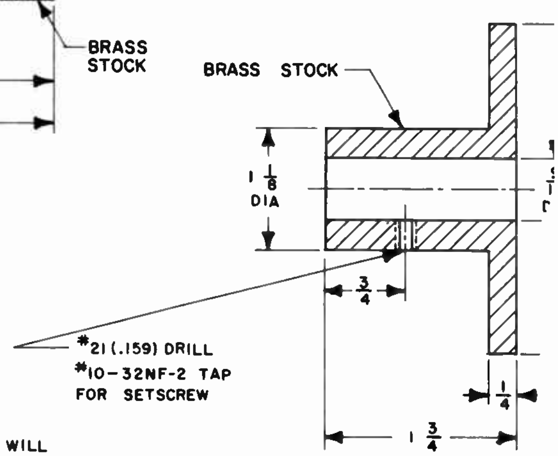
I'm out of time for writing this month, but I hope you will all keep in touch with your progress on EME work. Please be patient with correspondence from me over the next few months while we are moving to the farm.



VSWR OF 1296 MC UNIT WHEN MOUNTED IN 48" DIA DISH, FOCAL LENGTH 14 3/4". VSWR WILL VARY BUT SLIGHTLY IN OTHER DISHES.



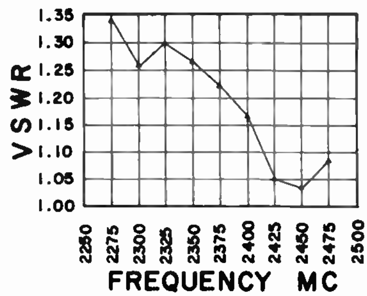




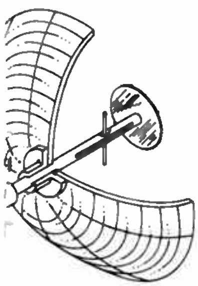
MOUNTING FLANGE
SCALE—FULL

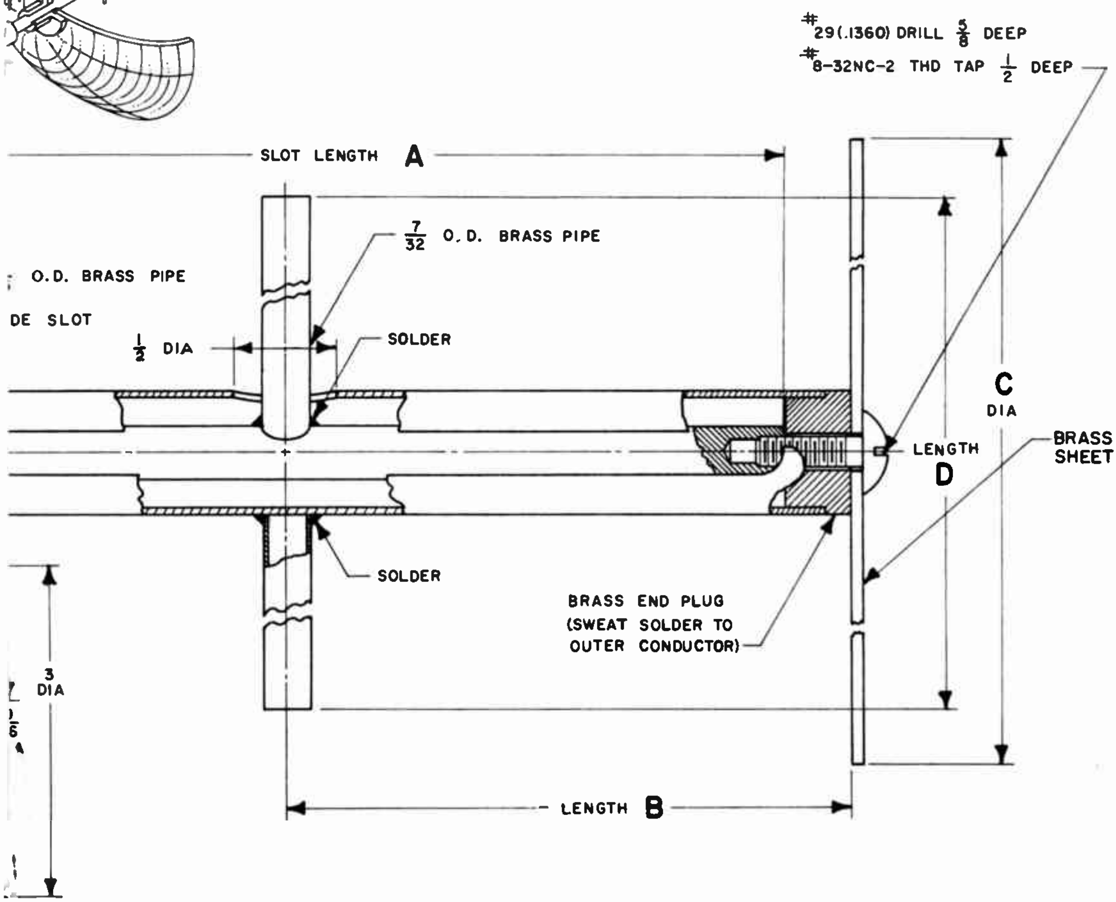
NOTES:

1. OVERALL LENGTH IS NOT CRITICAL, BUT APPROX. 20" WILL COVER MOST FOCAL LENGTHS.
2. FOCAL LENGTH OF PARABOLA = $\frac{(\text{DIAMETER})^2}{16 \times \text{MAX. DEPTH}}$
3. SEE CHART FOR DIMENSIONS A, B, C, D FOR FREQUENCIES 1220 MC. 1296 MC. AND 2400 MC.
4. ALL OTHER DIMENSIONS REMAIN THE SAME.



VSWR OF 2400 MC UNIT IN "FREE SPACE".





	1220 MC	1296 MC	2400 MC
A	2.673	2,602	1.42
B	4.840	4.557	2.48
C	4.732	4.456	2.42
D	4,529	4,265	2.36

LAUNCHER

DESIGN BY: D.K. GOSHAY W6MMU & R. WAREHAM WA6HJV

DRAWN BY	MODIFICATIONS BY
J.B CARLILE 6-6-66	G.A.OLCOTT-K7ICW
SCALE AS NOTED	MATERIAL AS NOTED

432 ANTENNA CONTEST RESULTS
by K7AAD

The results of the May 15 VHF confere nce at Santa Barbara, Calif. are summarized below. A few comments are probably in order so that readers don't jump to erroneous conclusions.

While different club members may (and do) have different ideas about the accuracy of measurements, I think there are some areas of agreement I can point out and shortcomings.

METHOD: Antennas to be tested are used as RECEIVING antennas. This method is simpler and has fewer chances for serious error.

The signal source is a transistor oscillator-multiplier (crystal-controlled) at 432 Mc. with 1 Kc amplitude modulation driving a moderately directional antenna, vertically polarized, and mounted about 10' high, as I recall.

At the receiving site, probably 150-200 feet away, is a Hewlett-Packard voltmeter with a db. scale and narrow-band 1 Kc amplifier. The antenna is connected to a plunger-type tuning stub and a 10 db. coaxial pad terminated in a coaxially-mounted germanium diode. Output is square law and the meter is calibrated for this. A reference dipole is used to establish zero db. The stub is used to peak the signal as read on the meter. Each antenna is oriented for maximum received signal by its owner at whatever reasonable height he chooses, say from 6 to 10 feet. Peak readings on the meter are recorded and these results are given below. A correction factor of a db. or less is probably not included and I assume from the data I have on hand that corrected figures may be up to 1 db. higher. Perhaps the signal was not at zero db. with the reference dipole but -.8 or so. These results are good compared to last time. Members have wised up. The previous year there were Z commercial yagis with less gain than the dipole and better reception from the back than from the front. Have you got one of those?

Now whether or not you believe the figures preceding, some things are obvious. The home brew 11 element yagis described by W1HDQ in QST put on a good performance. Three entrants had made them and all did well. The big extended - expanded colinears (W6GD) usually win but they were not brought down from the bay area of San Francisco (their home). K6IBY's big skeleton slot had been measured at appreciably higher gain on a commercial range. It is quite possible the larger antennas do not get a fair shake. Ground reflections are always a problem. Credit goes to Roy Brady and Bob Melvin for putting on the contest and to Frank Merritt for the pictures. If reproduction here is sad, it's my fault.

(continued on page 11)

TWO METER AURORA OPENING

Saturday eve., Sept. 3, was the date of an excellent aurora opening which made possible several 2-way s.s.b. contacts between northern Calif. and Washington and Oregon. Successful participants out here were WB6KAP, W6GDO, W7WVE and K7ZIR. Stations in southern Calif. were notified but signals did not extend that far down. C.W. signals were strong to W6GDO, up to S-9. K5WXZ heard stations in Illinois, Ohio and Nebraska. No doubt there was lots of d-x done in the east but reports have not come in.

Entrant	Antenna type	Recorded Gain (db over dipole)
K6OKC	J Beam 20 el skeleton slot	+8.2
K6HCP	Cushcraft 16 el colinear	+10.5
K7ICW	AT150/SRC dipole 200-450 Mc.	-.8
W6PUZ	H.B. W1HDQ Yagi (11 elements)	+12.2
WA6MGZ	H.B. W1HDQ 4 11 element yagis	+16.4
WØKJY/6	Modified Cushcraft 8 over 8 colinear re-test with new balun	+1.2 +6.6
K6IBY	H.B. 80 element skeleton slot	+13.5
WA6NCT	90 degree corner reflector	+4.0
W6PUZ	H.B. ground plane	-.75
W6BUR	H.B. W1HDQ 11 el. Yagi	+10.8
WA6MGZ	H.B. colinear 8 el. with screen refl.	+9.7
K6OKC	H.B. quad Yagi 4 ea. 11 el. yagis (44 el)	+11.2
W6ZOP	H.B. reflex	+7.0
W6HPH	H.B. stacked vertical diamond dual rhombic (this one stayed together)	+11.0

Al, K7ICW, holding his broadband military dipole.

George, W6BUR, peaks his W1HDQ Yagi while Roy, W6UXN, reads the meter.

Here's the reflex antenna with owner Paul, W6ZOP, (on left) aided by Hank, W6GGV (with glasses) on right.

W6OKC peaks his quad Yagi array.

ODDS & ENDS
by K7AAD

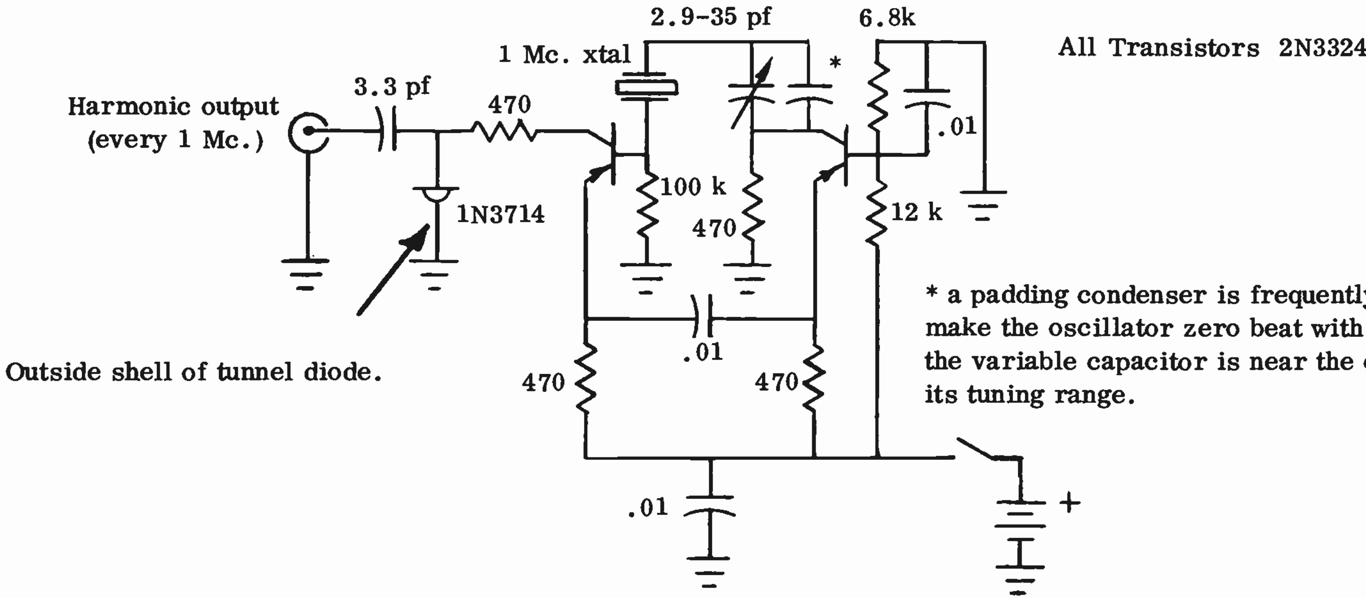
The noise blanker in the Nov. '65 VHFER got honorable mention in QST this month (Sept.) where it was reported that VK3ATN used it for his moonbounce tests (with the Parks pre-amp.) A couple of things should be pointed out in case any of you have been disappointed or misled. First, we shouldn't have called it a blanker as there is no gateing at all. It is a brute-force clipper. Second, when I use it with my production-line converter with a 14 Mc. I. F., I do not have enough gain to operate the clipper properly. I have to use a preamp ahead of the converter. Your ear should be able to distinguish between a clipped and un-clipped signal. The un-clipped has a rougher sound to it, while a heavily clipped signal is a smooth hiss. Of course using the preamp does mean more likelihood of overload from local stations and even non-locals a little ways up the band may put the clipper out of business. In order to prevent or minimize some of this overload I contracted to K7ZIR (who has made a batch of clippers for others) to make me a 7 Mc. unit which I though would give me better selectivity yet not be so narrow band that ringing of the tuned circuits would be a problem. Typically, I haven't tried it yet. I would think an even lower I. F. would work better.

PRICE CHANGES IN OUR AMATEUR LINE. As the Great Society lurches forward? it carries prices with it. Our costs have gone up considerably in the last few years since the two meter converter came out at $54.95. Labor is more expensive and darned hard to get. My only technician got called into service. It becomes more necessary to devote development time to our medical line. We're selling more ham gear than I like, and since competition is practically nil except for over-the-counter stuff to neophytes, the only logical conclusion is our stuff is priced too low. Our two products which take up the most time by far are the two meter converter and the 432. These are to go for $60 and $55.00 respectively. The 2-meter mobile preamp is going up to $20. All other prices stick, not because they are so profitable but because volume is so low it doesn't interfere with our work too much. Converter I. F. changes will be about double (including postage.) They take a lot of time and often a new set of coils. Get a quotation BEFORE you send in for re-do of the I. F.

(continued on back cover)

MARKER GENERATOR

We have sold a lot of marker generators with no diagrams accompanying them. At first, the people who bought had the issue of VHFER that described it, though the first diagram was not correct. For the benefit of diagram-less owners and others who would like to build we are printing the diagram just made up and we THINK it is correct. You may substitute transistors if you use high-freq. germaniums and perhaps juggle base current.



* a padding condenser is frequently needed to make the oscillator zero beat with WWV when the variable capacitor is near the center of its tuning range.

If you make solder connections to penlight cells, be sure to remove the bottom protective metal cover as it makes erratic contact with the battery case unless it has pressure on it.

OPEN BANDS

by Marilyn Wiseman, K8ALO

Vacation time is over as far as this QTH is concerned. Spent 2 weeks camping in New York State on Lake Ontario. Activity on 2 meters in Watertown area very poor. Had only 2 contacts. Reports sure piled up in the mail box while away. Hoping to hear from you. My address: Box 103 Petersburg, Ohio 44454.

50 MHz:

Note: For 50 MHz, please send SCATTER listings only. No skip. Had quite a few reports that were not scatter.

June 1-30 WB6GKK (Calif.) wrkd K7BBO, W7CNK, W7VGQ (Wash.), W5KCP, W5SFW (Tex.), WØEYE (Colo.), K7ICW (Nev.). Gary says scatter sig abt aver. E skip very gud. He wrkd over 100 East coast stations during the month.

July 1-31 K7BBO (Wash.) wrkd K7ICW (Nev.), K7TLR (Ariz.), WØEYE (Colo.), 16 Calif. stations.
WB6GKK wrkd W7CNK, K7BBO, WA7BTG (Wash.), K7ICW (Nev.), WØEYE (Colo.), W5KCP (Tex.). Gary reports W7CNK, K7BBO runs sked around midnight, finding conditions often as good as morning skeds.

144 MHz:

June 5-19 K7ICW (Nev.) wrkd W6DEE, W6DQJ, W6WSQ, W6YVO, W6NLZ, K6TSK (Calif.)

June 11 WA4PTK (Tenn.) hrd K8RZB, W8TYX, W8CYO, K4PYN, WA4ELH. Dave says the band was open abt 2 hrs.

June 12 WN3EOQ/3 (Md.) running 5 watts wrkd K1RYT/1 (vt.).

July 18 VE3DNR (Toronto) wrkd K8CGP (Ohio) 260 mi, WA8REM (Mich.) 330 mi, K8HNE (Mich.) 330 mi, WA8AAQ 260 mi, K8TCA (Mich.) 290 mi, WA9EVE (Wis.) 450 mi. hrd W9VIT near Chicago. Stan said the band appeared to still be open when last DX station went QRT abt 0100 EST.

July 24 K2HLA (N.Y.) wrkd K4QIF (N.C.) 500 mi, W4VHH (S.C.) 735 mi, this was K2HLA's #21 state on 2. K7ICW (Nev.) hrd K6HAA wrkd WB6KAP, W6GDO M/S. Al hrd pings only.

July 29 K7ICW (Nev.) wrkd W5UGO (Okla.) M/S, hrd pings only.

Aug. 5 W4AWS (Fla.) wrkd W1AZK M/S.

Aug. 11 W4AWS (Fla.) wrkd W1BKK (Vt.) M/S. This was a new state for Art. Art also runs nightly skeds with W4VHH (S.C.) 325 mi. Art says that Shelby, W4WNH, is moving QTH this month and will be QRT for awhile.

432 MHz

K8OXZ (Cleveland, Ohio) reports hearing K9UIF, K9WOB, W9ZIH in QSO with Toledo. Russ wants to know whats wrong with the boys in the Northeast on 432.

June 12 K7ICW (Nev.) wrkd K7RKH/7 (Ariz.) 37 mi. First Nev.-Ariz. QSO on 432.

July 10 K7ICW (Nev.) hrd W6DQJ (Calif.) 225 mi.

July 17 K6HAA (Calif.) hrd K7ICW 165 mi.

Skeds Wanted

K2HLA, RFD #1, Cutchogue, L.I., N.Y. looking for M/S skeds with Minn., Tenn., Wis., Ala., Ga., Miss. Dick runs 500 W 4CX250 B 32 elem. collinear, W2AZL, 417A conv. Freq. 144.038, QTH 100 mi. east of N.Y.C. on eastern tip of Long Island.

K8OXZ, Cleveland, Ohio looking for sked with western Ohio, Manchester, Mich. on 432 MHz.

WB6GKK, 14081 Woodlawn Ave., Tustin, Calif. using Parks conv. Drake R4A SB 110A, Driving a 4-1000 A GG 1KW-CW & 2 KW PEP on SSB. 11 elem. 36' boom 60' freq. 50.006 CW, 50.107, 50.110, 50.113 SSB sked any morning of the week till 0830 PST.

W5GVE/4, Bill Nogues, 2601 Choctaw, Dothan, Ala. Freq. 144.085 MHz.

TWO METER E SKIP

Shelby Ennis, W4WNH, sent me a card on June 29 as follows: WA4SIQ, Maysville, Ky., just foned a report in. This morning (29 June) between 0557 and 0636 GMT John heard and/or worked W B6GMX, WB6FTD, WA6SQT, K7LCR, K7DU, KØCUX and an Idaho station. This was on 144 MHz fone!!!! (actually took place about 145.2 MHz.)

John reported the signals were weak and fluttery with the stations in and gone after about 3 minutes. He didn't have a chance to tune down to 144 and see what was cooking there. This would appear to be double-hop E_s - the first, to my knowledge, ever heard on 144. Looks like E_s has been good this year!

Ansel Gridley, W4GJO writes" It is my contention that the potential for E skip contacts on 144 is much greater than would be indicated by recorded contacts to date. There are really few operators who have shown much interest in this and far fewer who have worked at it scientifically as they have with meteor scatter. These "broadside" tries do work sometimes, as they did with W4QN into Texas about 1947, and as they did with Shelby. Certainly making noise on the band when there is widespread E_s activity, especially when it is in evidence through channel 6 TV is worthwhile. But until there is a lot of random activity on 2 meters, especially at odd hours, it seems that the likelihood of anyone being on in the right place is quite remote. The best method I know to set up likely contacts is to monitor 6 meters and watch for high-density E_s patches at an appropriate mid-point. Thus, for instance, if 6 meter stations 500-600 miles out are heard working very short skip (say 200-400 miles), it's a pretty good indication that the density in that approximate area is great enough to support 144 Mc. While 6 meters can be used as an order circuit, it would not be necessary if enough stations were on looking for this, as all they should need to do is fire up on 144 with the beam toward the E_s patch and call. If someone on the other side about the same distance is also doing this, that's all there is to it. This worked perfectly for W5SFW and me, when we easily worked on 144 after we both observed east Texas stations working other W5's in La., Okla., etc. And it worked just as well for Phil toward W8, VE3 etc., when he observed the same phenomenon at the appropriate midpoint. Yet, I don't think the technique is widely used even now, several years later."

MORE ON THE "FANTASTIC" ANTENNA

I have mentioned the Kmosko and Johnson long, long yagis for 2 meters in the past few issues. These were described in the Jan. 56 QST. W7UAB built both the short and long versions and had excellent success in tropo work to Calif. Recently we attempted moon-bounce with the 32 foot one with W6DNG in Long Beach. Bill heard signals several d.b. above the noise but not long enough to identify calls (or letters). He says there was no question but what they were genuine reflections. We heard very weak signals but could not identify them well enough to be sure they were off the moon. It has been frustrating to me that I could not work the DX W7UAB did though I used very similar equipment. I made only 5 minute tests for the most part and perhaps longer times would have given me better results because at times I have heard excellent tropo signals--something rare in this area except to Seattle. When rationalizing the poor performance of one's station, it is easy to say "my location just isn't good for that path" and there may be some truth to it. But aiming at the moon puts us all in about the same boat. If your signals can be heard off the moon, something must be working. W7UAB could not hear his own echoes. W6DNG has a much superior receiving setup I hope to describe to you sometime. K6HAA has heard his own echoes several times using the same 32 foot antenna but with the moon near the horizon. In a quiet location that can pick up several db for you.

The conclusion is pretty inescapable that both the 24 and 32 foot antennas really work. W7UAB found that a big advantage of the 32 foot one was that he got rid of more power-leak noise off to one side than he could with the 24 foot antenna. The big antenna does move around in the wind though.

W7UAB has given up radio for boats and sold almost all his equipment. I got the antennas. So far I still haven't worked Calif. It must be the season.

May I say to you who have joined us recently (I feel like a stock market letter writer), that if you bought your 2-meter antenna at the local radio store you probably have a dog. There are only 2 good commercial ones I know of. One is the Skybeam by J-Beam and the other is the big Telrex (17 ft I think.) As models change, performance may change. From antennas I've measured I don't believe any U.S. manufacturer knows what he's doing. Your antenna is probably the weakest link in your station. K7AAD

Published by Parks Electronics Lab.
419 S.W. First
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Volume 4, No. 5 May-June 1966

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Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

As a snowball increases in size, so has the number of people making an attempt to work VK3ATN on Two Meter moonbounce. This has come about due to the fact that Ray has built himself a super duper 144 Mc array down in Birchip, Victoria, Australia. The array is of the rhombic type with leg lengths in excess of 300 feet. Not only does Ray have one rhombic like this, but he has stacked four of them one above the other. Ray had to go to a really large, high-gain antenna because of a 150-watt input power limit in Australia. Ray can now hear his echoes very loud when the moon reaches a Greenwich Hour Angle of about 148 to 150 degrees and a declination of North 23 to 24 degrees. I have listed in the column a table of his schedules. While four days are listed each Lunar Month, presently only one or two days are best for schedules when the declination is between 23 and 24 degrees, but Ray is working on a system to steer the rhombics slightly so that the antenna will be usable for the full four days. The best place to get information about VK3ATN's activity is on twenty meters Thursdays at 1100 GMT on a freq. of 14.315 Mc. If twenty isn't open we go to forty meters at 1130 GMT with Ray transmitting on 7.090 and stateside stations around 7.227 to 7.230. SSB used on all schedules.

Presently I know of efforts that involve 512 elements at W1BU, 256 Elements at K6MYC and a 48 foot by 48 foot parabolic section by W6YK. Presently we are experimenting with long helical beams. I have built one 34 foot job which we are evaluating--if it comes up to it's theoretical performance, we intend to build three more and phase the four placed in line on a north-south line. Each unit will be mounted separately on its own ten-foot mount. I hope this will prove to be a workable antenna, as it was easy and inexpensive to build and mount the first one. I will have more on this antenna if it proves out. By the way the array will be steerable over at least a couple of hours on both the eastern and western horizon, but will take some work to rig it from east to west. At present it will be rigged for work on my western horiz. and up to about 35 degrees above it.

If you are playing around with antennas for moonbounce work, you may be interested in looking at things like sun noise and other cosmic sources. I personally have become quite interested in the possibility of using my own dish for some cosmic measurements which can give a better indication of antenna calibration and antenna gain than the sun. In some correspondence with Paul W4HHK, he sent me a table I'm reprinting in the column which may be of interest.

W6NLZ has written that he is currently hooking up his 1296 gear to his 18 foot az-el mounted dish. John says everything works fine, but now has to get proved out in the system. If you have any interest in 1296 work, John and the HB9RG group are the best prospects at this time. I may be able to move the system here at W3SDZ up to 1296, but I have been working virtually alone and there is a limit to how much I can get done. We are currently working on Two Meters, but you can be sure we will go to any band where there is activity. If you are doing anything, be sure to write.

COSMIC AND SOLAR NOISE *

Cosmic and solar noise levels for a half-wave dipole receiving antenna: **

Ideal Receiver (reference point):	0 DB
Galactic Plane:	- 6 DB
Disturbed Sun:	-12 DB
Quiet Sun:	-22 DB
Cassiopeia:	-40 DB

Note: From Fig. 2, Reference Data for Radio Engineers, 4th Edition, Int. Tel. & Tel. Corp.

Galactic Plane: Cosmic noise from the galactic plane in the direction of the center of the galaxy. The noise levels from other parts of the galactic plane are between 10 and 20 decibels below the levels given above.

Quiet Sun: Noise from the "quiet sun"; that is, solar noise at times when there is little or no sunspot activity.

Disturbed Sun: Noise from the "disturbed" sun. The term disturbed refers to times of sunspot and solar-flare activity.

Cassiopeia: Noise from a high-intensity discrete source of cosmic noise known as Cassiopeia. This is one of more than a hundred known discrete sources, each of which subtends an angle at the earth's surface of less than 30 minutes of angle.

The levels of cosmic and solar noise received by an antenna directed at a noise source may be estimated by correcting the relative noise levels with a half-wave dipole (from Fig. 2) for the receiving-antenna gain realized on the noise source. Since the galactic plane is an extended nonuniform noise source, free-space antenna gains cannot be realized and 10 to 15 decibels is approximately the maximum antenna gain that can be realized here. However, on the sun and other discrete sources of cosmic noise, antenna gains of 50 decibels or more can be had.

* Reference B. Lovell and J.A. Clegg, "Radio Astronomy", John Wiley & Sons, Inc., New York, N.Y.; Chapman and Hall, Limited, London, England: 1952. Also, J. L. Pawsey and R. M. Bracewell; "Radio Astronomy", Clarendon Press, Oxford, England; 1955.

** Copied from Fig. 2, P. 764, Reference Data for Radio Engineers, 4th edition, by Int. Tel. & Tel. Corporation

VK3ATN MOONBOUNCE SCHEDULES

			Base Time		Declination
July	15	-	2003	-	25° 32"
	16	-	2108	-	26° 44"
	17	-	2205	-	26° 00"
	18	-	2305	-	23° 20"
August	11	-	1734	-	24° 24"
	12	-	1849	-	26° 30"
	13	-	1949	-	26° 43"
	14	-	2043	-	25° 00"

To use table: Schedule Time begins 17 minutes before Base Time, and continues for 30 minutes.

VK3ATN's Operating Procedure:

He transmits on 144.090 Mc on the odd two minute periods of each hour regardless of the schedule starting times. Ray listens to pre-arranged scheduled frequencies during the even two minute periods.

144 MC. SPORADIC E OPENING

Shelby Ennis, W4WNH of Germantown, Ky. writes "I've finally heard my first E_s sig. on 144 MHz. E_s has been pretty strong on TV here several times--on 28 May, 1 June, and 6 June. On each of these days I put the V beacon tape on 144.100 MHz. But today, June 6, it broke loose.

At 1300 Z I had the usual 15-min MS sked with W4AWS in Fla. I received 25 S1s, 6 S2s, about normal for this time of year. At 1707 Z I put on a CQ tape, since Es was so strong on TV. W8KAY was weakly calling CQ south, so I put in a landline call to W4AWS & told him to listen on 144.300, as the skip seemed to be north-south. W4AWS said that he had been seeing Canadian stations on TV earlier. At 1727 I called W8KAY on 144 & told him to listen for W4AWS on .105. As we were signing, W4AWS called back on landline with W8KAY an S9 there. They quickly worked at 1733. I worked W4AWS via E_s at 1744 Z, his sigs a little weaker here than while he had been on with W8KAY, but still S7. Then W8YIO worked W4AWS. W8YIO had worked WØJYC via E_s on 1 June while W8KAY & I didn't hear a thing at 1700-1730 Z.

No other signals were heard and I couldn't get anyone else on. Even TV folded up about 1830 Z. But W4AWS was S9 for 10 minutes here, and readable for almost 30 minutes."

VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions, $1 per year, others $2 per year. Second class postage paid at Beaverton, Ore. 97005.

COMMENTS ON 1296
by Peter Laakmann, WB6IOM*

1296 Mc. offers some rather interesting possibilities and will probably see much more activity in the future. For those who want to go all out it probably is the easiest band to try moonbounce on, since the antenna aperture requirements are less. These were the thoughts I had when I started building about a year ago.

I am now to the point where the transmitter is in good shape, and will tackle the parametric amplifier and antenna in that order in the future. I felt that this was the time to share my experiences and thoughts with others. Perhaps they will be of help to those of you ready to tackle this band.

First of all, let's talk systems. Going SSB (linear) in the beginning will save a lot of rebuilding in the future. What happened on the lower bands is going to repeat on 1296, so why not take the step in the beginning. If you have an exciter (SSB) available it is realy easier this way, since all you will have to worry about is RF. Also, if you go linear there is only one multiplier chain to be built for your station. This is because your I. F. can be equal to your transmitter injection frequency.

Let's not kid ourselves, this is no band for an overtone rock. You only have to build one oscillator, so build a good one. Don't try to save money here. Use transistors, a low-frequency crystal, low power dissipation, and either put it into a proportional oven, or if you like garden work, bury it.

Now as far as frequencies go, I found a good one: 6.604166 Mc. There may be others, but this one has some rather attractive features. It comes out at 1268.000 Mc. There are no TV channels on the way up to disturb your peace. But here is the bonus: somewhere along the chain you can tap 158.5 Mc. If you have an exciter delivering at 28 and 14 Mc. you can work both 1296 and 144 Mc. This is unusual, since our bands are related harmonically but the injection frequencies for linear operation are not. Now, the 1268 output can drive your linear mixer and also tickle the 1N21 diode in your converter.

At first I was generating about .5 watt up there from a varactor quadrupler. This drove a varactor mixer to about 50 milliwatts output. Things really worked fine. With 2 stages of 2C43 amplification it delivered about 5 to 10 watts output. However, I wanted more power and when I got to about 100 watts output, I never really knew whether I was amplifying or oscillating at any one time. It began to dawn on me that I wasn't going to solve this one. You can't stop cavities from leaking, and you can't shield effectively up there without affecting your air circulation. Another point I want to bring up: varactor multipliers are bad enough, but when you couple them to a varactor mixer, most of the time you have a parametric oscillator. If this does not happen, the contraption is only linear under very unusual circumstances. There are good reasons for this, the most important one being that the load presented to the multiplier is not constant. Anyway this whole thing was a fiasco, and I ended up becoming extremely prejudiced against solid state up there and varactors in particular. Tubes looked better to me the more time I spent with that solid-state mixer. Since the answer as far as the regeneration is concerned is a higher-powered mixer, with less amplification afterwards, tubes are the only possibility anyway. (next page)

* 8001 Airlane St. Los Angeles, Calif.

The next thing I tried was a 2C39 cavity I took from a DME set that I got through Jay, W6GDO. I set it up like an ordinary plate modulator, driven at 1268 Mc. with about 10 W and modulated with about 70 W at 28 Mc. It takes a lot of air to keep it cool, but it does deliver about 10 W at 1296. Unfortunately this cavity is not very sharp, since it was designed for pulse service. The 1268 component is still only about 10 db down. This is OK if you go directly into the antenna from there.

Remember, this is a big band. The unwanted components are all contained within our band. However, if you drive another amplifier with it, you'd better filter the output. Otherwise the amplifier will rectify the signal and produce an enormous amount of 56 Mc. components. Enough in my case to drive my own TV set completely black on Channel 2. I am using a square cavity about 4.50 inches on the diagonal as a filter. Now when it came to devising a more permanent way of generating 10 watts on 1268 to drive this mixer, I couldn't overlook a 1N4388 in my junk box that was supposed to do it. I know this is a varactor, but I was willing to give it another try. It certainly is an easy way out, I thought. Well anyway, that diode is still in my transmitter. It did not show more than the usual jumping effects. With a big air-cooled heat sink on it, it is almost as stable as a tube. Drive for the varactor is about 25 W from a grounded-grid 2C39 at 317 Mc.

The amplifier I mentioned earlier, which follows the mixer, is a dual 2C39 in a square cavity. I won't go into details on this one now other than to say that it is all sheet metal, and can be soldered together over a gas stove if you have a wife who tolerates such infringements on her domain. It will appear separately in the VHFER. This amplifier delivers around 100W output with about 250 W input.

So far things are inexpensive. If you have to pay for the next tube in the amplifier chain, it won't be. That tube is a 7650 or 7651. Either way it retails for around $300. I was lucky and got one free. I built a similar sheet metal cavity for it and it delivers upwards of 350 watts output. You see, the power gain of that tube is actually quite small and you won't need it unless you are serious about moonbounce in which case you can't do without it. It also takes an expensive high-pressure blower and good solid kilowatt supplies. If you want to keep the tube alive, some fancy interlocks and temperature gauges are nice to have.

Now about temperature gauges. They can tell you some useful things about any VHF amplifier. Attach a thermocouple to the plate of the tube through a beryllium oxide or alumina washer. You can monitor cooling performance of your system, shut down the supplies automatically if the temperature is unsafe, measure power output quite accurately, and have another meter to watch.

If you are the tinkering type and like to design a cavity for a tube or tubes that you want to use, don't try to bypass the grid in a triode. Ground it. I tried bypassing on both the 2C39 cavity and the 7650. I have come to the conclusion that it can't be done. In a tetrode, ground the screen and bypass the grid. Before you even build such an amplifier you would know it couldn't oscillate. When you breadboard a cavity, use thin brass .015 thick, solder everything together, without bypass sheets, and use the present exciter and a flashlight bulb to find resonances in the input and output cavities. When things tune right, take down the dimensions and build it out of thick stock with bypass sections. This way you can design a brand new cavity in an evening.

Now about antennas. If you have a dish of 4 feet or larger diameter, use it. But there is little point in using dishes smaller than this. I believe a simple helical antenna a couple of feet long will do better. These can be built out of bamboo and #12 wire or clothesline. I don't know what I am going to use for moonbounce yet. I am still considering a large array of self-supporting helixes. Let's adopt a standard on helixes for ground-to-ground work. There is no preference for any particular polarization as long as everybody is using the same. So lets make it left circular (counterclockwise twist when looking in the direction of the helix.) End.

ODDS & ENDS
by K7AAD

The weekend of June 18, VK3ATN copied K6MYC for 14 minutes on 2 meter moonbounce . Got complete calls and signals were 5 to 6 db over the noise. MYC heard only letters---no complete calls. MYC's rig runs 500 watts and the antenna is a 256 element colinear with a transistor preamp mounted on it. W1BU is hard at the 2 meter moonbounce with a 128 element colinear. Info from W3SDZ.

You will note that there are two primary trends now in VHFER and supposedly among the more advanced hams. One trend is toward moonbounce, the other is toward 1296. I have been holding WB6IOM's article for a 1296 amplifier because I have nothing to drive it and probably you are in the same boat. I think we'll get it in next time.

VHFER articles in the past have been mostly concerned with receiving equipment. I fully realize the problems of the average ham in constructing transmitters that are more than a few watts. The biggest one is metalwork. Some time ago I talked about furnishing metalwork kits for high powered finals, but talk is cheap. The nearest we came to it was Deane Kidd's 432 tripler kit. 'We'means W7UAB, W7UDM, K7ZIR and W7TYR plus myself. These guys work at Tektronix and know how to build nice equipment. When they get stuff built for themselves that works right, it is usually too complex to furnish as a metalwork kit. Some of the simply built stuff doesn't work easily enough that the average ham could build it and be sure of making it work right. So the net result is that little progress is made.

I took the 220 converter described in the last VHFER to the VHF conference in Santa Barbara last month. I gave it to K6IBY of Costa Mesa to test for us because he is active on 220 and in an area that is really loaded with every kind of r.f. imaginable. Joe thought the biggest problem with it was that it needed more selectivity in the front end--probably a cavity filter or another r.f. stage with low gain. He thought it could use more gain too. I believe this is a variation in receivers. We had enough gain here to cover receiver noise or we wouldn't have been able to make the low noise figure. Probably there wasn't enough reserve. One of the problems at 220 is the neighbors' TV sets when they're watching channel 7. Local oscillator radiation. Sensitivity was good and there were no detectable birdies. Hank Meyer, W6GGV (who designed the converter) had two r.f. stages in it and we took one out. He said he would probably design a cavity filter for it.

Any of you planning to come to the northwest coast this summer ought to be told a bit about our summer climate. Portland and Seattle areas can have rain frequently thru July. Our nicest weather is often late August, Sept. and Oct. East of the Cascade mountains the weather is dry and more dependable (not exactly cool) but the mountain areas are very nice--no mosquitoes, no humidity, lots of lakes, good camping facilities. Expenses vacationing in Oregon are minimal if you have a tent or trailer. It just costs like everything to get here. No sales tax. The 9% they hang on us pays the bill.

We are at last out of 6up in the bundles of 10 to 12. Just odds and ends which will soon be chucked because of the space they take. Even VHFER is in a sad state with Feb. out of the 1966 and a few missing from 1965. If you want them, 20¢ each postpaid. We'll fill the best we can and refund balance in stamps.

Please don't order any 432 transistor preamps. They just don't work well with the newer transistors and we haven't gotten around to re-designing it. Don't think the 432-2 is outmoded by the new converter. It's still OK. We cannot do modernizing of any converters or repair anything not in current production. Too expensive for us.

VHF QSO PARTY REPORT

We have only 3 reports in, all from the west coast. This doesn't mean we are soliciting more reports because they would be too old by the time they could be published. We'll leave that to the bigger magazines. But to show you what happened in the west the following are given:

K7AUO/7, the Tektronix club, went to 3,000 ft. Roundtop Mountain in the Coast range about 40 miles from Portland. They earned 3,940 points, much of it due to working WB6KAP and W6GDO on two meters and W6GDO on 432, a distance of 475 miles. Signals were not marginal, but good solid copy on both bands, strength being about equal. 2 contacts were made on 10KMHz, both distances of about 40 miles to 2 locations in the Beaverton area.

W6GDO in Sacramento reports: 50 Mc. 49 contacts, 13 sections. 144Mc: 77 contacts and 10 sections. 220 Mc: 8 contacts, 4 sections. 432 Mc: 18 contacts, 7 sections. 1296: 2 contacts, 1 section. Distances were 100 and 165 miles to K6HCP and W6GD/6 in the Santa Clara Valley section. Jay reports that 50 Mc. scatter contacts upped his sections on 50 Mc. considerably.

W6GGV in the L.A. area reported "Generally conditions were dismal with essentially no sporadic E to liven up 50 Mc. even though there were a few very short 50 Mc. openings from here. Tropo signals were extremely poor as witness W6GDO's low signal strength into the L.A. basin area. The real surprise was 220 Mc. activity with local mountain-topping operation working as many as 35 contacts in all California sections. I worked 12 stations in five sections in less than 2 hours. 432 activity suffered from the same relatively poor tropo condition. There were lots of stations but nothing spectacular happened. W6NLZ worked W6GD/6 on San Benito Peak on 1296 with signals being 3-3 on a 5/5 scale at the L.A. end and 2 "S" units better at the W6GD/6 location. John was running 1 KW to a 15' dish and the W6GD/6 operation was using 10 watts to a 4 foot dish."

COAX CABLE FOR THE VHF MAN

by Carl A. Ebhardt W4HJZ*
Ragchewer Magazaine

For years the RG-58, 59, and 8 U coax types have been widely used for amateur transmission lines. As amatuers push higher into the frequency spectrum the limitation of the popular RG type cables becomes apparent. At VHF and UHF the more popular types of coax leave much to be desired. Recently new types of coax cables have come onto the market but little technical information has been published in amateur journals.

Here in North Carolina some very high performance coax is being manufactured. The Superior Cable Company in Hickory and Rocky Mount is making the cable mainly for the CATV market. However, its price and performance are such that it is worth attention from the VHF man.

Mr. W. T. Smith and Mr. W. L. Roberts of Superior Cable presented a very informative paper at the Region 3 Annual meeting of the I. E. E. E. in Winston Salem, North Carolina, on April 7, 1965. They have given permission to pass this information along.

PARAMETERS OF CABLE DESIGN

In considering a coaxial cable design, it is more convenient to divide the cable losses into its three component parts: (1) the center conductor, (2) the dielectric medium and, (3) the outer conductor (also called return conductor or shield).

Center Conductor

Center conductor losses in a coaxial cable ordinarily dominate losses from other sources. Accordingly, copper is almost always the metal employed for center conductors. The cost of silver prohibits extensive use as a conductor even though a slight reduction in loss can be achieved.

Because of skin effects, high frequency losses require only a thin conducting surface to possess low resistivity. However, mechanical considerations often preclude use of thin shells (or tubing) of high conductive materials. Plated composite conductors solve mechanical problems but may not offer adequate low frequency conductivity.

Cable bending characteristics can generally be improved by use of a stranded center conductor but should only be used where flexibility considerations are paramount since high frequency losses are almost always fifteen to twenty per cent higher than with a comparable solid (or smooth surfaced) conductor.

Use of hollow tubing becomes economically feasible only with rather large conductors. Mechanically, tubing can be employed to achieve a reduction in stiffness only for very thin wall tubing. The tubing wall thickness must be less than ten per cent of its outer diameter to obtain even a fifty per cent reduction in stiffness compared to

22 E. Rowan St.
Raleigh, North Carolina

the solid rod. Then buckling characteristics may become the limiting factor. Generally for a center conductor of less than about one-fourth inch, solid copper is the best choice. For large cables (center conductors one-half inch or larger), tubing is more favorable cost wise.

Outer Conductor (Shield)
The return conductor must provide adequate shielding to confine the R.F. energy within the cable and certainly should contribute as little as possible to cable losses. The return conductor, in conjunction with possible supplemental coverings, also serves to physically protect the cable dielectric.

Braided shields are useful where repeated flexing will be encountered. However, they provide relatively poor radiation shielding (which can be improved through use of multiple braids) and have substantial R.F. losses particularly at frequencies around 200 Mcs. and up (which cannot be improved through use of multiple braids).

If the outer conductor is essentially a solid sheet, losses are little affected whether the sheet is a solid tube or an overlapped tape (smooth or corrugated) so long as the tape is electrically thick and does not radiate noticeably at any seam or overlap present. Higher resistivity materials such as aluminum tubing can be used with minimal effects on cable losses, primarily because of cable geometry, i.e., the cable diameter is large compared to the center conductor.

A return conductor tape can be formed around the cable core by a process which allows continuous cable length to be produced economically. The edges may be butted or overlapped and the position may be maintained by virtue of additional coverings, by natural stiffness and "set" in the tape, or by sealing the seam through welding or other techniques.

It has been found that effective shielding in the VHF band may be attained with an overlapped tape if the lap is maintained without substantial gaps. Compared to a braided shield, about a 30db improvement in shielding effectiveness is obtained with an overlapped corrugated copper shield.

Corrugation of a shield in a suitable fashion immediately transforms an otherwise rigid, easily buckled shield, into a member which can be bent without specialized bending techniques. For ease in installation and future system reliability, it is desireable to corrugate a solid (tape or tube) shield if at all possible.

If the dielectric medium inside the shield is susceptible to moisture and other environmental effects, protection must be supplied by the shield and/or additional outer protective coverings. In many cases, an extruded non-metallic covering affords the required protection. In the case of a cable buried in permanently wet soil, additional protection offering a permanent hermetic seal may be necessary--if the cable dielectric is susceptible to moisture vapor effects.

Whatever technique is used, the diameter of the coaxial cable outer conductor must be maintained very uniform. Even extremely small diameter variation, if systematic, can give rise to impedance deviations at particular frequencies.

Dielectric

Low permittivity dielectric materials permit use of larger center conductor diameter for a given cable diameter and characteristic impedance. Air, with a permittivity of one, is a most desirable dielectric but some means of supporting the center conductor has to be added. Judicious use of support materials can result in a composite dielectric with a dielectric constant only slightly greater than one. The disc-insulated coaxial cable and, of more recent vintage, the balloon coaxial cable represent the most popular current techniques for obtaining dielectrics with a constant of 1.1 or below. Solid polyethylene has a dielectric constant of about 2.3 but offers the advantage of ruggedness and stability in the presence of moisutre, without auxiliary protection techniques such as hermetically sealed sheaths and pressurization techniques. Foamed polyethylene has become quite popular. It has a dielectric constant of about 1.5 and shows very good moisture stability in aerial applications. Without a suitable hermetic seal against moisture permeation, it is not sufficiently stable for direct burial in wet locations.

The high volume market for coax cable with low loss at VHF is the C.A.T.V. industry. A cable impedance of 75 ohms has been almost universally adopted. The value corresponds to the value yielding minimum high frequency attenuation for a dielectric with a permittivity of one(1) and whose inner and outer conductors are of equal conductivity. Higher permittivity dielectrics used in a 75 ohm design are not optimum, but the penalty is not too severe.

Leakage or conductance in a dielectric material is not negligible at frequencies greater than 100 mcs even for the best currently used materials. In a 75 ohm cable, a dissipation factor of 0.00012 presents a loss of about 0.1db/100 feet at a frequency of 210 mcs. For a cable with this dissipation factor, and 1db/100 feet total loss at 210 mcs, this is a very noticeable contribution. Furthermore, high frequency attenuation instability is generally found to be associated with changes in dissipation factor--most commonly resulting from the presence of moisture.

Moisture has been found to cause a five-fold increase in dissipation factor in conventional foam polyethylene (initially about 0.00025) where exposure is continuous either immersed in water or in an environment of greater than 85 per cent relative humidity. Humidity levels below 85 per cent show only small effects on the normal dissipation factor. The major part of this increase apparently is a result of moisture interacting with residue of the chemical blowing agents which are used to foam the polyethylene compound.

Solid polyethylene compounds currently in use have a dissipation factor in the order of 0.0002 over the VHF band. These compounds show no significant change in dissipation factor in the presence of water or water vapor. Because of their ruggedness and stability, they represent a better choice than a lower loss but delicate and unstable material for many applications.

Disc insulated cables need protection by means of pressurization techniques or hermetically sealed coverings to prevent leakage paths developing to the outer conductor. Balloon insulated cables do not have the direct surface leakage paths to the outer conductor as found in the disc cable. The cells of the balloon dielectric can, by design, be closed for non-pressurized applications or they can be spaced to allow gas flow along the length of the tube.

TABLE #1

Type E Cat. No.	Inner Conductor	Dielectric Material	Outer Cord.	Nom. Dia. Overall	Impedance ohms	Loss in d/b/100 50mc	144mc	432mc	Factory/Minimum Cost/Qty. in feet
RG-58 A/U	19 Strands Tinned Copper	Solid Polyethylene	Tinned Copper Single Braid		52	3.6	6.5	13	4.2 ¢/foot 2500 feet minimum order
RG-8 A/U	7 Strands Copper	Solid Polyethylene	Copper Single Braid		52	1.5	2.6	5.4	8.9 ¢/foot 1000 feet min. order
RG-17 AU	Solid Copper	Solid Polyethylene	Copper Single Braid		52	.65	1.2	2.4	40.6 ¢/foot 2500 feet min. order
"Superior 4920"	Solid Copper	Foam Polyethylene	Copper .005 Tape Corrugated	0.480	75	.65	1.15	1.9	9.5 ¢/foot 2500 feet min. order
"Superior 6020"	Solid Copper	Solid Polyethylene	Copper .005 Tape Corrugated	0.650	75	.65	1.15	1.9	15 ¢/foot 2500 foot minimum order
"Superior 4930"	Solid Copper	Foam Polyethylene	Copper .005 Tape Corrugated	0.650	75	.54	.9	1.55	15 ¢/foot 2500 feet min. order
"Superior 6030"	Solid Copper	Solid Polyethylene	Copper .005 Tape Corrugated	0.870	75	.54	.9	1.55	25 ¢/foot 2500 feet min. order
"Superior 3/8 Balloon	Solid Copper	Air and Pinched Polyethylene Tube	Copper Tape .005 Corrugated	0.480	75	.52	.85	1.45	Price on request
"Superior 4920"	Solid Copper	Foam Polyethylenc	Copper .005 Tape Corrugated	.870	75	.48 .35	.62 .7	1.1 1.32	35 ¢/foot 2500 Feet min. order

SIMPLE SUPER SELECTIVITY

Richard Turrin, W2IMU*

The human ear is an ingenious device and together with the brain form a marvelous audio receiving systcm. The system is basically broadband, encompassing a frequency range of some eight octaves. And yet it may be made extremely narrow band at the will of the operator without even turning a knob. Incredible, still most C.W. operators make use of this capability without understanding it and some simply are not disciplined enough to use it.

In the crowded amateur bands our ears are almost always subjected to more than one signal at a time; however, by concentrating on one of these signals it is possible to copy that signal provided that the QRM is not intolerable. The ear-brain system bandwidth may be reduced to the order of 50 cycles per second by concentration. You hear what you want to hear!!

In order to improve on the human sound detecting system a filter with bandwidth less than 50 cps must precede the ear. Possible, but difficult to use with the average transmitter-receiver frequency stability not to mention "ringing" of the filter. We can probably do better by leaving our receiver bandwidth set at one or two kilocycles and use our own built-in filter. Adjusting the b.f.o. for single-signal detection or making use of the single-sideband selectivity available in modern receivers is highly desirable since this reduces the QRM probability by one-half.

The 50 cps bandwidth of the ear-brain system seems incredible but is documented and may be easily demonstrated for a single tone in the presence of white noise.[1] Typically for a signal-to-noise ratio of unity, a pure tone in 3kc band limited noise would indicate a signal report of 569. A signal-to-noise ratio of -20 db or 100 times less signal power is barely discernable to a trained ear. In addition to being extremely narrow band, the ear-brain system is tunable over a range of about 200 to 1000 cycles with essentially the same bandwidth. Above and below this range the bandwidth increases. The system is therefore able to track a signal which is slowly drifting in frequency. It is interesting to note in connection with ear-brain bandwidth that a well trained musician can distinguish half-tones in the musical scale. A half-tone at 500 cps is about 30 cps.

It is also documented that two ears impressed with the same sound do better than one and that earphones degrade the system compared with a speaker in an acoustical chamber. A soundproof shack with sound absorbing walls is ideal, but alas earphones will reign in the average shack. A worthwhile investment would seem to be a comfortable pair of earphones with the properties of both good frequency response and low distortion.

The amplitude response of the ear is somewhat logarithmic and consequently will tolerate a wide dynamic range without overloading. The non-linear response how-

*Richard Turrin
Box 45 RR 2
Colts Neck, New Jersey

[1]Acoustics by Leo L. Beranek, p 394.

ever, gives rise to distortion products which are invaluable to a piano tuner but a nuisance to a C.W. operator. Fortunately these distortion products are much weaker than the weakest of any two original signals, the only one of any consequence being the difference frequency.

Another point worth mentioning is the insipid desire of most operators to tune their receivers so that the desired signal is heterodyned to a frequency of 1000 cps or higher. Nothing could be worse for two reasons. First, the ear-brain bandwidth increases above 1000 cps; and second, it is far easier to separate signals which differ in frequency let us say by 100 cps by heterodyning the signals to as low a frequency as possible. Indeed, if the undesired signal is heterodyned to "zero-beat" there will be little difficulty copying the desired signal. And this can be most desirably accomplished by careful tuning of the receiver and NOT by fiddling with receiver selectivity or mistuning the b.f.o. Keeping in mind that the receiver r-f gain be kept low and the a-f gain up to minimize overload distortion within the receiver.

A few brief notes have been presented concerning the ear-brain audio detecting system. The relationship to receiver selectivity and the C.W. operator has been stressed with the aim of enlightening a few and reassuring others of their natural capability. The next time you are thinking of buying a more selective receiver, put a little of the thought concentration on the signal you wish to copy and you will save the money and become a better operator.

A GATED AUDIO OSCILLATOR
by Loren Parks, K7AAD

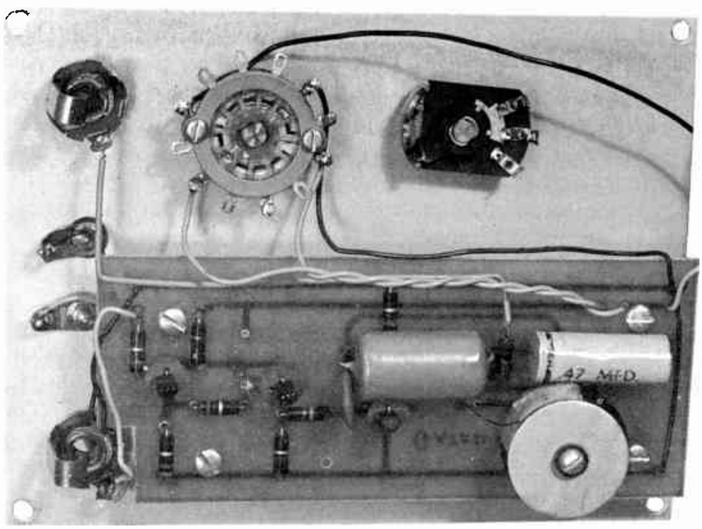
This article describes a simple audio oscillator which can be turned on and off by a gate, or change in a controlling input voltage. I built this device for weak-signal c.w. work---to give me a keyed audio note in response to slight changes in d.c. level. It worked very well, but unfortunately parts of the entire system didn't. The aim was to get a weak c.w. signal clearly readable via this gated oscillator and narrow-band power integration---a signal which was so weak that by ordinary methods it was only marginal copy or was so weak that I could do no more than determine it was there.

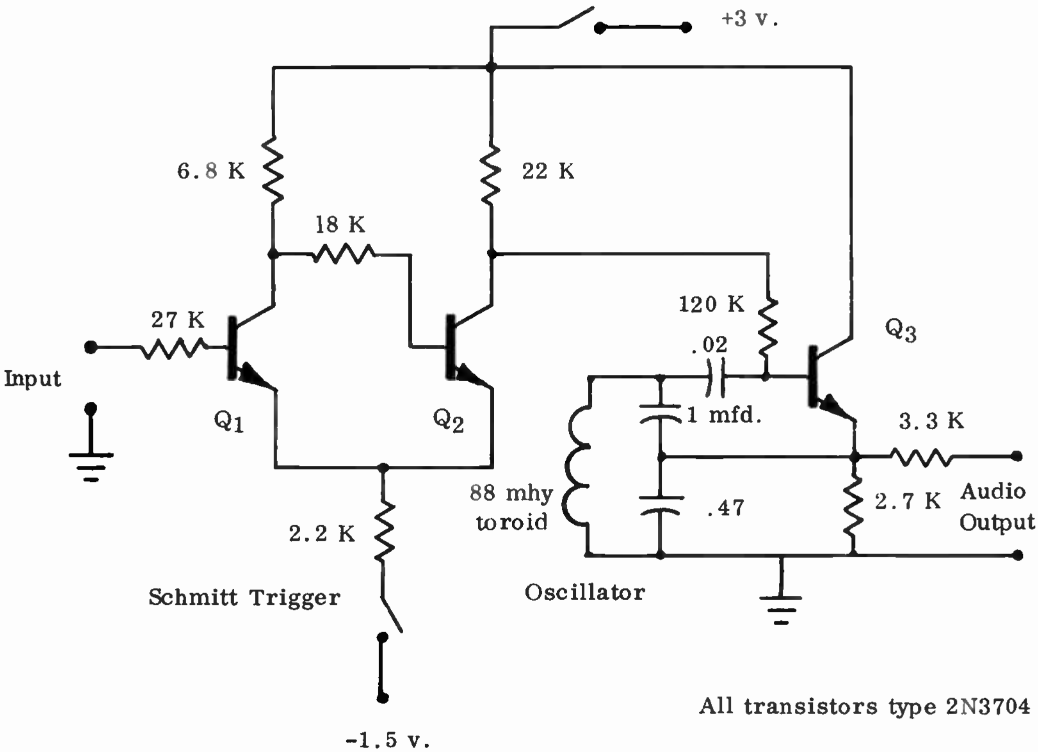
Let me digress for a paragraph and report what I see in my crystal ball. Extending VHF records, local or international, is the aim of many advanced VHF hams. Assuming you have the best in receiving equipment and the biggest (properly working) antenna you can put up, what then. You can go far into the noise in fairly wide bandwidth with a trained ear and a noise blanker or noise clipper. I believe the next step after clipping should be the very sharp audio filter, rectification, integration and gating. Now there are LOTS of problems, but I have succeeded in devising a simple system that would detect and read out on a meter the presence of a signal I absolutely could not hear. The stability and tuning problems are immense. My problem was in trying to AFC our 144-1 converter. Tuning is a BEAR. I wanted to devise a system to latch on to that weak signal and hold it. What I had worked just fair. It will take a re-designed oscillator and reactance modulator. A friend of mine reports success with FSK and a similar system and I believe his is inherently better than mine by 3 db. At any rate, this is what's coming and you need a gated oscillator if only to make weak signals much easier to copy.

The device has two parts: a simple audio oscillator and Schmitt's trigger circuit. The oscillator transistor, Q_3, is turned on or off by applying or removing forward bias on its base (the 120K resistor.) The collector of Q_2 (half of the trigger) swings between plus 3 and minus .5 volt. Some oscillators I've made do not like to turn off once they get going. This one is clean, probably due to the epoxy silicon transistor and back biasing. The TI 3704 is an inexpensive, high-performance VHF type we use as a workhorse. If you substitute, make sure the oscillator goes off and on without hesitation. You may have to juggle values.

Q_1 and Q_2 make up the trigger, which is a decision maker. It has two stable states-- Q_1 conducting fully and Q_2 turned off or vice versa. With the input at ground in my unit, Q_2 conducts heavily and the oscillator is therefore off. With an input voltage of plus .6 it goes on, at .47 plus it goes off. The voltage difference of .13 is called the hysteresis of the trigger. Fig. 1 shows the test set up for determining the on-off points. They will no doubt vary with different transistors. I juggled values to get suitable trigger points. The emitter resistor is quite important in establishing these points. 10 microamps of current at the input is required to activate the trigger. This means you should not drive this circuit with a high-impedance source if your are discriminating voltage levels as you would in the power integration described. The outside view of the device is on the cover. An inside view follows the text. One control is not yet connected. Binding posts are in parallel with the gate input jack.

Here are some figures on the effects of different source impedances. With a source of 22K it goes on at .83 volt, off at .71, hysteresis .12. With a 50K source on at 1.1 volt, and I forgot to record the turn off.





Gated Audio Oscillator

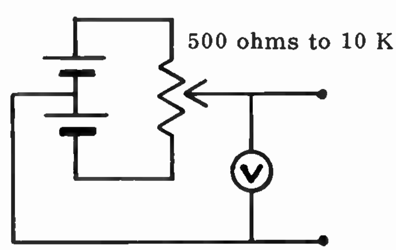


Fig. 1 Test set-up for determining trigger points.

OPEN BANDS

by Marilyn Wiseman, K8ALO

I guess I really goofed when I made the statement that "Nobody reads Open Bands any more". Reports and comments have proved me wrong. I'd like to thank everyone personally, but writing, housekeeping, a few hours of hamming and caring for four harmonics sure doesn't leave much spare time, so I guess this is the best way to say thanks. Looking forward to your report. See you next issue. My address: Box 103 Petersburg, Ohio 44454.

50 MHz Scatter:

April 2-30	K7BBO (Tacoma, Wash.) wrkd W6NZX/6 1300 mi., WB6GKK, W6ABN, WB6FSC, K6RIL, K6IBY, K6JC, K6UNR, W6CSB, W6NLZ, W6UXN, W6NIT. WB6GKK (Calif.) wrkd K6RIL, W6CSB, WA6RDX, Gary also wrkd K7ICW, K7RKH, WA6SQI while portable on Onyx Peak. K7ICW (Nev.) wrkd WØEYE, hrd K7BBO, K5TQP, W7UGO, W6NLZ, W6NVV.
May 24	W8JFI (Mich.) wrkd W4NUT, cw 1200 EST. W8JFT hrd by WØIRO (Minn.).
May 26	WB2KPD (N.J.) wrkd WA1CNG, K1ZGH, K1VOW (Mass.), K1OYB (Me.), WA4IAS (Va.), WA8FTA (Mich.), K8MLV (Ohio), hrd K1FRX, K1MTJ, K1HRM, WA3CAL, WA8MCC, K8MMM 1500-1900 EST.
May 1-31	K7BBO (Wash.) wrkd WØCUC, WØEYE, W7UFB, many stations in Calif. WB6GKK wrkd WØEYE, W7VGQ, WA7BTG, W7CNK, K7ICW, W5SFW, WA6SQI, Gary also had 16 QSO's with W5KCP, K7BBO 19 QSO's. K7ICW wrkd WØEYE, VE6OF, WØDPN, W5KCP, WA5CZM, WAØILH, W4CPX, VE4RE, also wrkd stations in Calif., Minn., Ia., British Columbia, Wash., hrd W7CNK, W7VGO, W5SFW, Calif., Tex., Okla., S.D., N.D., Neb., Kans., Me., Oreg., Mont., Idaho.
June 7	W8FTI wrkd K5AJW, R.T.T., W4LRN, WØEKM, WAØDUG, K6IBY, W6ABN.

144 MHz

April 3	K7ICW (Nev.) wrkd W6DQJ (Calif.) 0803 cw.
April 9	W4CKB (Fla.) wrkd W4UUF (Fla.) 425 mi. a.m.
April 10	K7ICW (Nev.) wrkd W6DQJ, K6JYO, W6NLZ, W6YVO 0808-0908 cw.
April 20-23	K7ICW (Nev.) hrd K7ZIR (Oreg.) 850 mi. M/S 0600-0700.
April 24	W4CKB (Fla.) wrkd W4VHH (S.C.) cw-a.m. 430 mi. This contact made almost nightly.
April 25	W4CKB (Fla.) wrkd W4LSQ (Ala.) cw.
April 26	W4CKB wrkd W4FJ (Va.) 750 mi. M/S full min. non shower burst.
April 28	K4SUM (Va.) wrkd W2NKO, W2IYW, WB2CYL. W8AXR (Ohio) wrkd W9BRA (Ill.) 480 mi. W3PGV (Pa.) wrkd K9CHS (Ind.).
April 29	K4SUM (Va.) wrkd WB2MTU, K2SWZ, WN2TOE, WB2JEP, WA2TOV, K2JNS, WA2UDV, W2LZZ. Joe said this was a good opening.
May 1	K7ICW (Nev.) wrkd K7ZIR (Oreg.) M/S cw 0930-1030. Al wrkd K7ZIR again at 2130-2140, also many Calif. stations.

May 14	W7JCU/4 (Ala.) wrkd W4SJF, W4WDH (Ga.) W5GVE/4 (Ala.) W5RCI (Miss.), W9AAG (Ill.) WA4LIP (Ala.). W5GVE/4 (Ala.) wrkd W5RCI (Miss.) 390 mi., W5IOW, W5UGO, W5WAX (Okla.) 750 mi.
May 15	WA8IDU (Ohio) wrkd K9SBP (Ill.) 539 mi., 0100 EST. hrd WØDQY (Mo.), 6 other 9's. W5GVE/4 (Ala.) wrkd W4IXC (Fla.) 380 mi.
May 18	W1AZK (N.H.) hrd W8WEN (Ohio) 2112 EST. 520 mi.
May 21	K7ICW (Nev.) wrkd K7ZIR (Oreg.) cw M/S 850 mi. 0900-1000. W5GVE/4 (Ala.) wrkd W4VHH. (S.C.).
May 31	W1AZK (N.H.) wrkd W9BRN (Ind.), W8PT (Mich.), K8WQA (Ohio), VE3DAW (Ont.).
June 2	K5PUG (Vivian, La.) hrd by U.S. Army Capt. a few miles north of Paris, France. Lem was calling CQ AM fone. Sig. S-9+10 running 522 Xmtr. 0200 C.S.T. This information sent to me by W5ML (La.) Art said it was sporadic E cloud very dense. He wants the sharp pencil boys to express an opinion.
June 6	W4AWS (Fla.) wrkd W4WNH (Ky.), W8YIO (Mich.) W8KAY (Ohio) 1230-1245 EST. This report sent in by W1AZK.

220 MHz

April 10	K7ICW (Nev.) hrd by K6IBY (Calif.) 260 mi. 2130-2200.

432 MHz

April 9	K7ICW (Nev.) wrkd W6PUZ/6 (Calif.) cw. This was first Nev. Calif. 432 MHz QSO. W6PUZ/6 running low output to 80 elm. Al running 5 W out to 44elem quad yagi. Al said W6PUZ/6 sig good also. W7QUK hrd K7ICW.
April 11	K4SUM (Va.) wrkd W2CCY (N.J.) 201 mi. Joe on am W2CCY cw.
Apr. 24-29	K4SUM, W4API (Va.) both wrkd W2CCY 201 mi., WB2EBM,WB2EGZ 150 mi.
May 14	W7JCU/4 (Ala.) reports hearing a number of signals on 432 at sunrise.

Sked Wanted

W5GVE/4 (Ala.) looking for skeds with Ohio. Bill's cw freq: 144.085 MHz.

W3GLC (Pa.) looking for skeds with N.S. Dakotas. Harry runs 500 w PEP 8/8 long john cw or SSB.

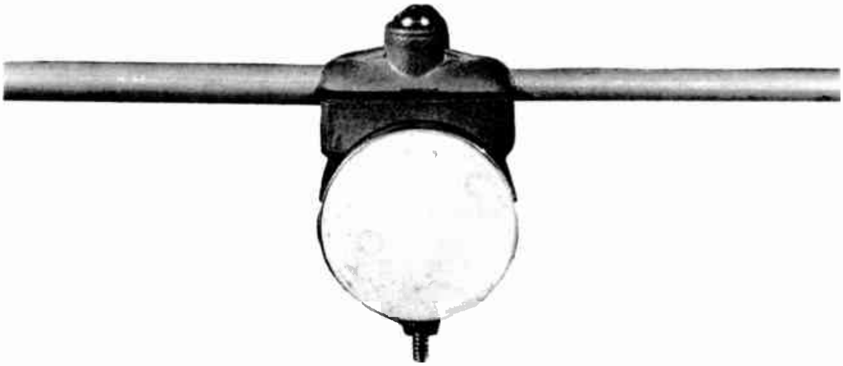
W4CKB (Fla.) looking for skeds with Ohio. Bev runs K.W. long yagi.

W1AZK (N.H.) looking for skeds with Neb., Kans., N.S. Dakotas.

W5ML (La.) looking for skeds N.E. North N.W. time 0630-0800, 2000-2200
144 MHz Motorola P.P. CX 250's cw freq: 144.035-144.090 MHz.
432 MHz CX 250 B 40 watts 32 elem 50'.

Information for Sept. VHF QSO Contest

KØMQS Dick and WAØFDY Al will be operating station WAØFDY/Ø near Wahpeton, N. Dakota. Freq: Transmit 144.210 MHz Rec. 144-145.5 MHz. Power: At least 500 w C.W. Fone as yet undetermined. Time: 1800 GMT Sept. 10 to 0400 GMT Sept. 12. For further info, both Dick and Al can nearly always be found on 7250 SSB between 0700-0900 local time Sunday mornings.



ANTENNA ELEMENT MOUNTS

If you like to build your own antennas, consider these mounts which will make your antennas more rugged and easier to build. An antenna made with these mounts is a whale of a lot easier to tune because you can change element spacing easily. Otherwise you have to drill big holes in the boom and just guess where the element would work best. Remember that on a Yagi there is an optimum element length and element spacing for maximum gain and a given element and boom size. Adjustment near the driven element is very critical. When you can move the elements along the boom and note the immediate effect on gain, you can easily see when you're getting somewhere.

Element mounts are in two pieces with holes in the middle that pass the mounting screw. Mounts are die-cast from Zamac and are iridite treated to resist corrosion. They are RUGGED. My 6-meter beam came down and broke the boom, but not the element mounts. I've never seen a broken one yet. The upper part has a V contour so it will fit snugly over elements from 3/16 to 3/8" in diameter. The bottom part fits 1 1/4" TV mast, available everywhere in 10-foot telescoping sections. The mounts will work well with 1 1/2" booms too. Choice of hole size for No. 8 or No. 10 machine screw. Four sets (to mount four elements) for $1 postpaid in U.S. & Canada. 25¢ for each additional set (to mount 1 element.)

Order from Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005

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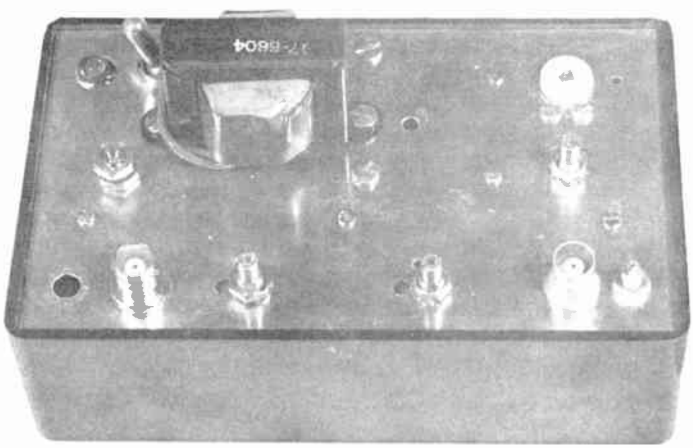
VHFER

LEARN BY DOING

50 MC. AND UP

Volume 4, No. 4 April, 1966



A 220 MHZ CONVERTER

A 432 DX MAN'S CONVERTER

MODEL 432-3

$ 49.95 POSTPAID

NEW FEATURES:

- --All solid-state design
- --Zener-regulated a.c. power supply
- --Extremely low-noise front end-- 4 d.b. or less.
- --High image and I.F. leak-through rejection
- --Excellent frequency stability.

This converter uses the Texas Instruments TI-XMO series transistor. We pick the best from the 01 and 06 types to give you performance equal to or better than the general run of the former TIXMO5, apparently no longer available---at least for now. From our tests these transistors are superior in performance to the 2N3399 we formerly used and cost much less. They're also less expensive for you to replace if you damage them with r.f. This converter has a tuned input, something our previous converters and preamps did not have. It cuts down on interference from other stations in the big cities.

ORDERING INFORMATION: Price is $49.95, postpaid. Add 35¢ for Special Handling, a fee charged by the post office for faster delivery. Add $2.50 for Air Mail.

I.F. Ranges available put 432 Mc. at 26, 27, 28.1, 29, 30.5, 49 or 50 Mc.

Type BNC connectors only.

PARKS ELECTRONICS LAB.

ROUTE 2 BOX 35 BEAVERTON, OREGON

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

They say the longest journey begins with one step and thus it is with setting up a station to work the EME circuit. It is my fondest hope that there will be enough amateurs throughout the world who will take that one step and all the rest along the way to getting a system going that can make the grade of hearing its own echoes. Once this is accomplished, nightly contacts with Europe from the U.S. can be commonplace -- the system and the people behind the systems will never be commonplace.

We have worked most of the winter toward solving some of the problems that can put an EME system on 432 within reach of the serious VHF worker without the financial problem being too great. The first answer came last month with the publication of the TIXM05 preamp. While I haven't had time to photograph and write up the details, the pair of RCA 8122's I have in a conventional push-pull amplifier are an inexpensive answer to the power generation problem. If you would like to try building an amplifier using these tubes, you can use the basic circuit and layout described in the 432 KW in QST of Aug. 64. The only modifications have to be made to the grid circuit, as the input capacity of the 8122 is much less than the 4CX300. With the receiver and the transmitter now in the reach of the average serious worker, there remains the antenna problem. Building and mounting a 27 foot dish such as I have in the field behind the house is difficult and expensive. With this in mind, we have discussed antennas of every description, size and shape. We came up with easy to build types, but they would be too difficult to mount. We came up with easy to mount types, but then the antenna would be difficult, expensive and large. When I speak of WE, I refer to Dick Turrin, W2IMU and your writer. Dick works at the Crawford Hill site of Bell Labs and his special area is antennas for both point to point work and satellite communication. Needless to say, Dick is a storehouse of knowledge on the subject. In addition he is used to making "good" antennas that do not compromise much. With this type of background, he gets a little impatient with some of my typical amateur type shortcuts. We had a few goals in mind in our antenna design program: first the antenna must be something a serious worker could build with as little help as possible. This meant the antenna should be built on the mount -- thus the mount would have to be near the ground. Second, the cost should be as small as possible -- something less than 500 dollars (as much less as possible). Third, the materials should be available to the general public and workable with simple tools. Fourth, the gain must be in at least the 30 db region on 432.

Dick has now come up with the basic idea for such an antenna. At this point we think it meets all the requirements I mentioned above. I'm not going to take up the space of the VHFER at this point to describe what we have so far, because we want to work out some of the fine points first. We also plan to build the antenna this summer if possible (I still have a couple of acres left that do not have antennas on them yet Hi! -- my wife just read that line -- I won't repeat what she said) and intend to photograph the project very carefully so we can write a real "nuts and bolts" type article on the subject. This all means you won't be able to build the antenna until next summer. I can offer two alternatives, first, I have written up a short memo on the subject with some sketches of what we have so far -- send me a stamped, self-addressed envelope and I will send you a copy of the memo. Put enough postage on the envelope for two ounces, as the memo takes up several pages. As soon as we have complete working plans for the antenna, I will send them along to the VHFER for publication.

A few notes about the TIXM05 preamp might be in order at this time. First of all the problem seems to be in getting the transistors. I ordered two hundred of the units direct from the Texas Instrument factory in February (I even paid for them) and I haven't received them as yet, but delivery has been promised for May 15. I can't be sure that this delivery date will be met. I have received many orders for some as per my offer in the last column. I started to answer these with a letter telling the story, but I finally got too many to answer. Here is the story -- I'm holding all the checks, cash and money orders -- if you can get some elsewhere, drop me a card and I will return your money. Otherwise, as soon as I get shipment from TI, I will forward the units ordered. We have now had time to really use our preamp and evaluate its performance on the dish. I am happy to say that it really works just as we had measured it on the bench. It makes a 4db improvement in sun noise measurements over a 3478 preamp and when it is mounted at the antenna to overcome our 1 db feedline loss we measure just slightly less than 10 db of sun noise with the 27 foot dish. The best we ever did last year with the old feed on the antenna and the 2N3478 preamp was just under 4db of Sun noise. This is quite a system improvement. While at this writing we haven't had a chance to make echo measurements, it appears that we should be in good shape to really "hear" echo returns this year. I hope to have a favorable report on this next month. If you have a system that can hear echoes, I sure would like to hear from you about some schedules.

I got so many letters asking for some more information about the sequencing system we use to protect out transistor preamps, that I thought I better give the details in the column. The schematic appears in Fig. I. Here's how it works. The relay is a Dow-Key with a 117 VAC coil. One side note about relays -- the Dow Key with type N connectors introduces no VSWR of its own as measured with a GR 1602B admittance bridge while with UHF connectors it is terrible at 432. In addition the isolation is beyond the range of the equipment we have to measure it with (-60db) and Dow Key claims 100 db which may very well be. We have switched 600 watts or rf through ours with no effect on the transistor preamps. The basic idea behind our sequencing system is to operate the ac coil on DC voltage, so a time constant can be easily achieved to delay the switching back to the receive position. The sequence of events is as follows: The main transmit receive switch applies 117 VAC to the system allowing RL-1 to make. The actual exciter output can't come on until RL-1 makes causing RL-2 to make. This also provides a fail safe device in case any component fails in the RL-1 circuit. After RL-1 closes it also switches in extra capacity across it's own coil. This capacitor now charges up with the DC voltage. When the TR switch is turned to receive, the 117 VAC is removed from the circuit which makes RL-2 drop out removing the voltage to the exciter -- thus RF drive is removed. RL-1 holds in until the large capacitor discharges enough to allow it to drop out. This delay can be adjusted by the size of the capacitor or by a resistor in series with it. I haven't given exact values of components, as it is best to adjust these to your individual relay.

VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions, $1 per year, others $2 per year. Second class postage paid at Beaverton, Ore. 97005.

That's about it for this month. I haven't heard of any of the large commercial antennas going to be used for MB this summer, so you had best start working on your own echo-producing system -- at least you can work yourself.

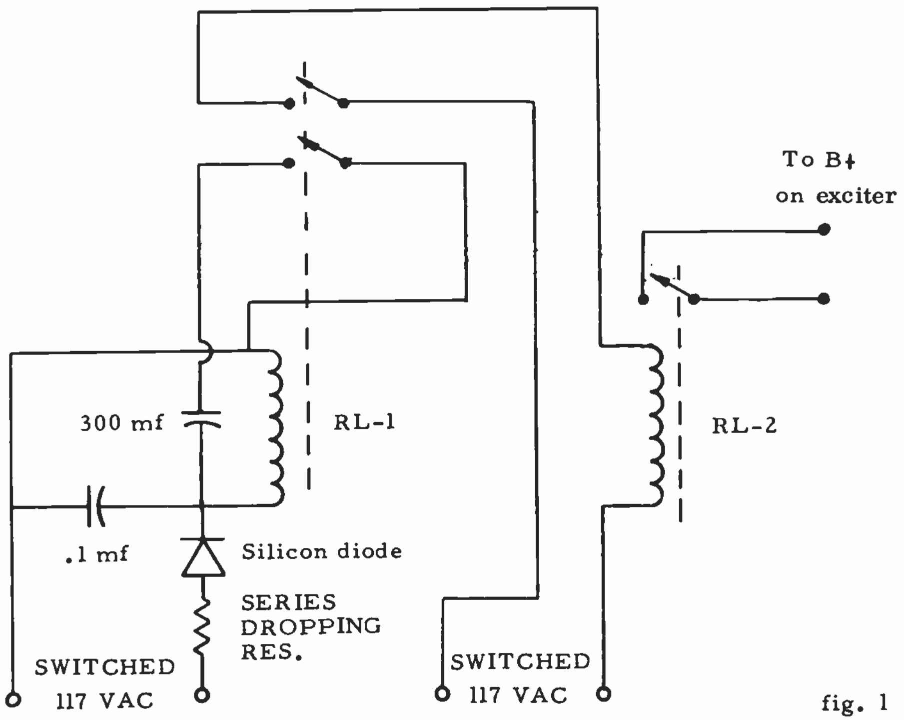


fig. 1

A.R.R.L. CONTEST SKEDS WANTED

The Tektronix Employees' Radio Amateur Club, K7AUO, will be on 2950' Round Top mountain during the June A.R.R.L. VHF contest. Round Top is 40 miles. N.W. of Portland, Ore. We plan to operate on 50 thru 432 MHz and on 10 GHz. Serious DX efforts will be made on 144, 220 and 432 MHz with high power and good antennas. DX frequencies will be 144.010, 221.500 and 432.000 MHz and 10.030 GHz (plus or minus 30 MHz.) Liason will be on 3810 (approx) KHz., SSB.

We are very interested in hearing from amateurs having high-power capability (300-1,000 watts) and good antennas on these bands, especially if they plan "mountain top" operations during the contest. Idaho, Utah, Nevada and Calif. are of most interest.

Write to Gene Single, 1080 N.W. 107 Ave., Portland, Ore. 97229 or make arrangements with a club member on the 3810 Sunday nite VHF NUT NET.

BACK ISSUES

We still have bundles of 11 back issues of 6-up magazine available for $2 postpaid. Also we have all VHFERS for 1965 except Jan. and May. The April issue is now available. Price of back VHFERS is 20¢ each, postpaid. Send cash, check or stamps in payment. If you have any questions about back issues, send a self-addressed card for reply.

OPEN BANDS

by Marilyn Wiseman, K8ALO

Reports down again. I guess no one reads "Open Bands" anymore. I was really disappointed, received only four reports. I can't comment on something I don't have. Hope reports pick up soon. Looking forward to your report. My address: Box 103 Petersburg, Ohio 44454

50 Mc. Scatter

The following stations heard or worked.

K7BBO (Wash) wrkd WB6GKK, K6IBY, K6JC, W6ABN, K6RIL. Hrd WB6FSC, WØEYE. K7BB0 has been running scatter skeds with WB6GKK with good luck. hrs 0600-1000 P.S.T. Next month they'll try skeds around 2330. Good luck boys. K7BB0 looking for 50 mc. scatter skeds to Ariz, Mont, Idaho, Utah, Wyo, or with anyone interested. Dave's c.w. freq. 50.101 mc.

WB6GKK (Calif) wrkd W5KCP, WØEYE, K7ICW, WA6SQI, W6CSB. WB6GKK has been running successful skeds with W5KCP on scatter.

K7ICW (Nev) wrkd W6NLZ, K6IBY, WØEYE, WA6AKM, W6GDO, W6ABN. Hrd K6UNR, K7BBO.

144 Mc.

5-28 K7ICW (Nev) wrkd K6CLM/6 meteor scatter. W6YVO, W6DQJ, K6JYO, K6TSK, W6DEE, W6NLZ. This was the only 144Mc. report.

432 Mc.

3-6 K7ICW (Nev) reports hearing Oscar 4. Orbit 186 Beacon + IDB.

4-1 WA5LGH (Corpus Christi, Tex) wrkd W5LDV (Houston) 220 mi, K5AOK (Victoria) 90 mi 2201-2213. Bill runs 20 watts am. 11 ele yagi 47'.

THE NOISE CLIPPER

If you're interested in weak-signal c.w., which is my prime interest, then you should give some thoughts to building a noise blanker like that in the Nov. VHFER or in the A.R.R.L. VHF manual. In my weak signal tests, using narrow bandwidth, I found the noise blanker (clipper) made quite a noticeable difference in my ability to find a weak signal down in the noise. Another thing I found was that my noise was not as constant as I thought and that apparently much of my noise is power leak noise. Now some power leak noise is obvious, but mine wasn't. In fact I didn't know I had any appreciable amount until the noise blanker started telling me I was mis-informed. I'm sure many of you are in the same boat. My improvement was at least 3 db, since with the blanker I could find and hold a weak signal that I otherwise could not find. I'm not sure how many db that is but it is significant enough for me. The shortcoming of such devices I've seen so far is that they are so broadband that a station up the band a few hundred kc puts you out of business if he's strong enough. I don't see why such broad bandwidth is necessary. I would think clipping at bandwidths of 10 kc would be quite adequate for the noise pulses are of short duration and the ringing time of the 10 kc circuits would be quite short compared to that of the narrow band I.F. circuits. Also one should be able to make it with transistors if he is familiar with the taming techniques. If you have done such, please send us the information.

W6GGV'S TRANSISTOR CONVERTER FOR 220 MHz.

Some months ago Hank Meyer, W6GGV, took it upon himself to design a basic converter whose layout was essentially the same for 144 thru 432 MHz. At least part of his motivation was to help us get into all solid state converters, so he designed it for production economy as well as performance. We have two of these converters here now, one for 432 and one for 220. We have been testing the 220 converter (with TIXMO1 transistors) and believe its performance is so good and the construction so simple that it would be a good building project for many of our readers. The parts cost is low and the parts are available from Allied Radio in Chicago. Probably everything but the transistors and the crystal can be obtained locally. Outside of the crystal, parts cost would be about $10 if you have a reasonable VHF junk box.

In this article I will bring out some points which may be of interest to you if you have had problems in building all-transistor converters. So if your interest doesn't happen to be 220, though I hope it is, you could possibly derive something from the article.

Some discussion of problems at 220 is in order because 220 is a different kind of band. Not that the propagation is so different, because it isn't. But the interference can be pretty bad in some areas, particularly in the big cities and near the coasts. For one thing; channels 12 and 13 are right below the band and they can give lots of trouble. They can get into the front end and be amplified so there is a signal level of volts by the time it gets to the mixer. This I have measured with our 220 converter using nuvistors at my QTH which is just a few miles from channel 12. We used a sharp, series tuned trap to minimize that. The converter to be described does not have a trap but does use two fairly sharp tuned circuits. It also uses only one stage of gain, which adequately covers mixer noise. A good rule to follow to minimize overload is to get your selectivity as close to the front end as possible. If you have to use two stages of r.f. to get the noise figure you want then you are increasing the overload possibilities. This converter with one stage of gain measures about 5 db with everything peaked up on a weak signal. This is the way most hams tune. Not the best, perhaps, but about the best most do. We didn't try to improve it over that because 5 db is a very respectable noise figure at that frequency and it came without much effort and with 50 cent transistors. There is adequate output to cover the noise of a decent communications receiver. It is possible that a cavity filter might be needed ahead of it in certain areas, especially if you're mountain topping near the big cities. If you use an I.F. lower than 26 Mc. you may put your image into a TV channel and that wouldn't be good because the lower I.F. then demands more selectivity of the r.f. tuned circuits and that can be hard to come by without going to a cavity filter. Good receivers are plenty stable at 26 or 28 Mc. and the tuning rate is OK. There is no point in going to a low I.F. if you can use a high one.

Another problem at 220 is pulse-type interference from other services. Maybe it's radar or positioning. All I know is it can raise heck. In some areas they minimize this effect by using polarization opposite to that of the interfering signals. I believe that noise blankers help with this--like that in Nov. VHFER but built for a proper I.F.

Stability at the higher frequencies can be a problem, and for that reason this converter uses a zener diode voltage regulator. While temperature compensating capacitors and other devices might improve stability it is good enough for most service as it stands.

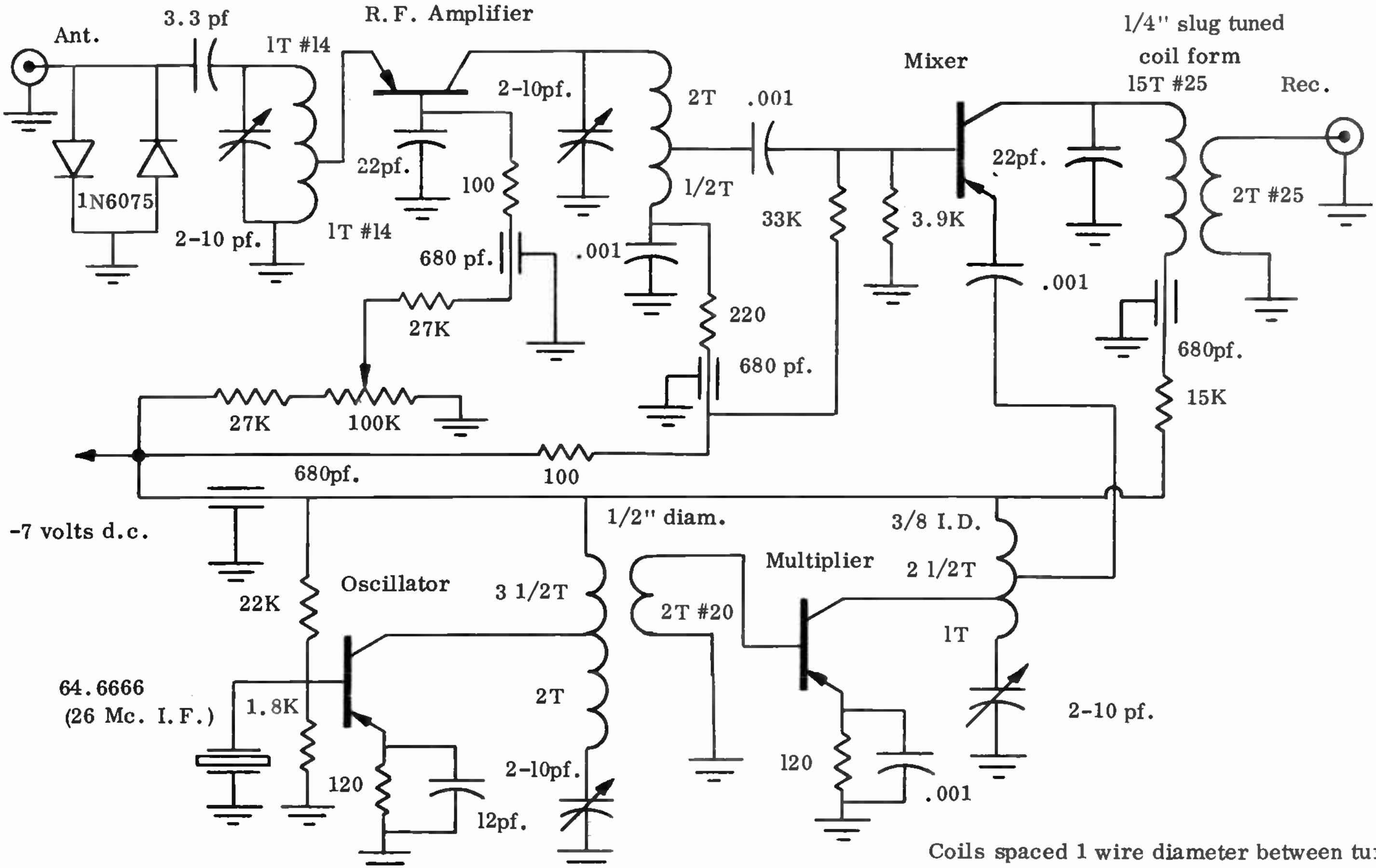
Self-oscillation at the higher frequencies both with tubes and transistors has been such a problem to so many builders that they give up and buy a converter. While the problem of self-oscillation did not occur in this converter (it passed reasonable stability tests) it is possible you could have problems. The inclusion of an r.f. gain control in the converter gives control over any tendency to self oscillation and also permits reduced gain for strong signals or where cross modulation is a problem. We found that the gain peaks nicely with the control and that there was no instability tendency. One common problem hams have with front end stability at high frequencies has to do with the impedance they hang on the front end. A marginally stable r.f. amplifier may work well with a broadband source impedance such as a 50-ohm resistor. But when you hang a balun on the front end, the balun looks like 50 ohms (if you're lucky) at the operating frequency but is reactive at other frequencies. A lot of the high-performance transistors now in use will oscillate at frequencies of 800 to 1200 MHz. They will use that reactance to advantage as a tuned circuit to make an oscillator and away you go. The r.f. amplifier may still work fairly well with that parasitic oscillation, but the tuning is invariably erratic & you hear little birdies going by from time to time. So beware of the balun near the converter. It can work fine, but sometimes it doesn't.

Another problem with transistor preamps or converters is r.f. damage from leakage thru the coax relay or from a harmonic of a high powered transmitter on another antenna near by. We added a couple of diodes to Hank's converter, back to back, and found no effect on the noise figure. We used the 1N6075 which is a very fast germanium diode. I couldn't find them in the catalog and I really don't know how much good they will do but suspect they are good insurance. Other fast germaniums would probably work as well. I wouldn't use silicons because they take too much voltage to get going. Maybe our diodes would do better in another part of the circuit.

I'm sure a lot of you have had trouble getting transistor oscillators to work right. Note that this circuit does not have a feedback capacitor from collector to emitter. Whether or not a small capacitor is needed depends on the transistor, the bias current and where the tap on the coil is. The TIXMO1 is so "hot" it didn't want a capacitor there. Odd tuning characteristics and spurious oscillations result from too much feedback. If there is not enough feedback, the thing won't go at all. If you do need feedback, use a "gimmick" capacitor made of two short lengths of enameled wire twisted together and adjust the number of twists for best operation. Sometimes odd oscillation characteristcs or erratic multiplier operation can seriously degrade the converter's noise figure. You'd probably be hunting for the problem in the r.f. stage or the mixer and of course never find it. You will see that there is no resistor in the emitter of the mixer stage. This is no error. In our 432 converter there is no resistor in the emitter of the multiplier. I won't theorize on why this is because I'm not qualified. But it works best that way.

The power supply uses a bridge rectifier and a 6.3 volt filament transformer. Any little silicon power diode with a peak inverse voltage of 50 or more will work here. The 50-volt kind are available for a nickel apiece. You should use the big filters and the zener diode if you want stable operation under varying line voltage conditions. The transistors do not like overvoltage for long periods. I've lost several in my medical telemetry equipment by not watching this, so I suggest you keep the voltage under control. Current drain is only 7 ma. so flashlight batteries would work fine for a long time.

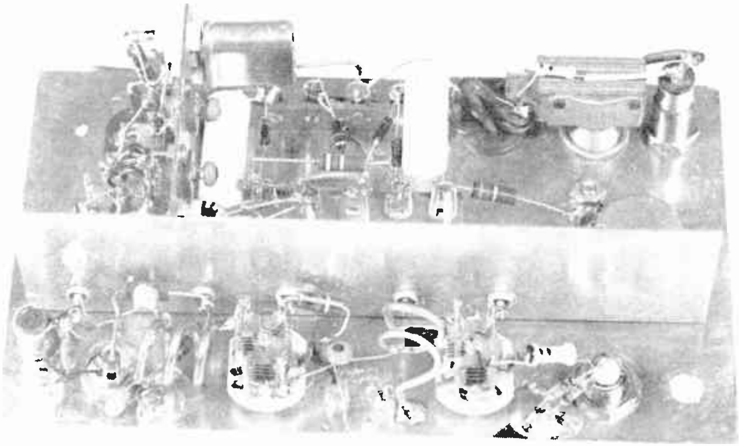
The converter is built on a thin brass panel with brass partitions bolted and soldered to the panel and to each other. The panel size is 3 1/2 x 6 inches and it fits in a plastic meter case box available from Allied radio and some distributors. The boxes are made by Harry Davies Molding Co. but sometimes marketed under other names.

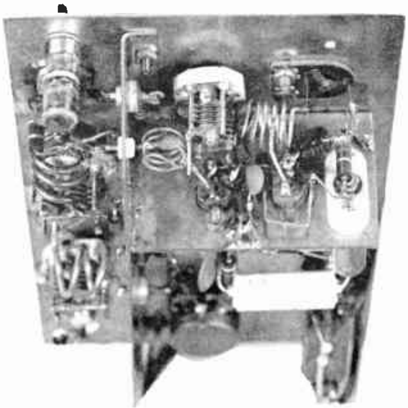


W6GGV 220 Mc. CONVERTER

Coils spaced 1 wire diameter between turns
R. F. amplifier coils #14 bare copper
All transistors TIXM01
Filter caps. Mallory MTA 100 E 15
1N6075 diodes available from Parks Elect. for 50¢ in stamps (for a pair) plus self-addressed, stamped envelope.

 If there were any change I would make in the layout it would be to relieve some of the crowding around the multiplier. Extend the brass plate to the end of the panel and move the oscillator tuning condenser and coil closer to the edge.





TUNE UP

1. Set the r.f. amplifier tuning capacitors to half-open position.

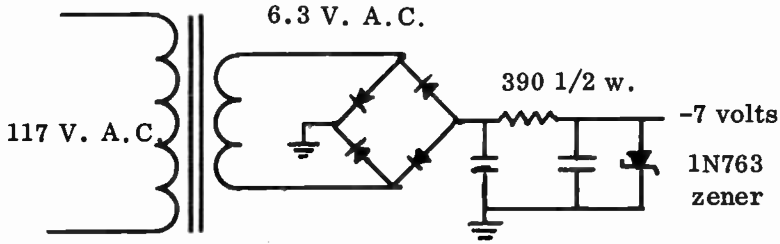
2. Put a VTVM probe on the emitter of the multiplier transistor and adjust the oscillator capacitor until the meter indicates a peak of about .25 volt. If it does not peak at one point in the tuning capacitor range, the oscillator probably isn't working. If there is erratic action, the oscillation may not be controlled by the crystal.

3. Put the VTVM probe on the emitter of the mixer and adjust the multiplier tuning for maximum voltage (about -1.75 v.)

4. Connect the output of the converter to your receiver and feed a fairly strong signal into the input. Tune the I. F. output coil for maximum noise at the frequency where you expect to hear the signal. If you can find the signal, peak the r.f. stage tuning capacitors.

5. Adjust the r.f. amplifier bias for maximum signal strength or best weak signal to noise reception.

Normal values: The voltage across the zener diode should be about -7 volts. Collector current in the mixer should run about 200 microamps.



Capacitors are Mallory 100 mfd. 15 v.

Power Supply for W6GGV 220 Mc. Converter

EXCERPTS FROM PROJECT OSCAR NEWSLETTER

OSCAR 4. Until recently, it was assumed that OSCAR 4 quit operating during orbit 211 (16 March) because no reception reports have been received since that time. However, a letter received on 14 April from ZL1WB reports tracking OSCAR 4 as late as 10 April. His observations since 19 March have been for short durations (not more than 15 minutes) and the signal was apparently quite weak. The present location of the orbit (perigee at northern most extreme and apogee at southern most limit) is undoubtedly responsible for the lack of northern hemisphere observations.

The short tracks reported by ZL1WB strongly indicate solar panel damage, but we presently do not know whether the problems are permanent (radiation damage) or temporary (temperature effects). Only time will tell. The lack of tracking reports makes it impossible to generate orbit predictions at this time. If OSCAR 4 continues to operate, it may be possible to get additional southern hemisphere tracking data and make new orbit predictions by the time northern hemisphere observers can again "see" the satellite.

OSCAR 5. Development of new satellite packages has been underway for several months. One group in Germany is actively working on a package with characteristics similar to OSCAR 3. Another group in Sunnyvale California is at work on a 2 to 10 meter package. There are some 432 and 1296 MHz beacon modules and a multi-channel telemetry package already built and ready to go. Work is also proceeding on another unit similar to OSCAR 4 that will be suitable for a near-synchronous orbit. There are two other groups, one in Australia and another in Canada, that are in various stages of proposals for launchable items. All in all, the future looks rather promising as far as amateur space activity is concerned. You will note that we bypassed the problem of launches. It must be understood by all concerned that any rides into space are obtained through the good graces of the launching agencies and are normally granted only on a space available basis - no pun intended. We must first get the equipment built. Then, and only then, can we approach the appropriate agencies for launch assistance.

4th ANNUAL WEST COAST VHF CONFERENCE
MAY 14-15

Time again for the west coast VHF D-X addicts to get together and swap lies, compare converters and preamps, measure antennas, hear tapes of d-x and listen to well-qualified speakers on VHF techniques. The informal conference will be held at the Miramar Hotel on highway 101 in Santa Barbara, Calif. The Miramar is on the ocean beach with lots of recreational facilities for the family. Room rates are as low as $5 singles, $8 doubles. No charge for anything but your meals at the convention. Remember that air excursion fares are lower now if you fly at the right time.

W8ROF's 432 YAGI

Lee Ewald, W8ROF, sent me information on his 432 yagi I thought you might be interested in. You probably are aware of the fact that the Yagi is in disfavor among a lot of 432 men because of poor performance. They favor the colinear, and with good reason. But it isn't that the Yagi is by its nature bad at 432, because it isn't. It's just that most designs are bad, the result of scaling from lower frequencies without scaling also the boom, etc. And we all know that anyone can build a colinear and make it work.

I wouldn't publish just anybody's antenna dimensions, throwing them out for anyone to try. Lee has made measurements on some other published designs with which west coast hams are only too familiar. So I believe his measurements are quite likely in the right ballpark and present them to you as outlined in his letter. L. Parks

Noting articles of late on 432 Yagis, I thought you might be interested in the design parameters that I arrived at after many weeks of experimentation. Building several long Yagis re ________, a loss of 3-5 db existed compared to the 16.1 db spec.

Finally, I came up with one that showed close to 16 db gain. I'm now using 4 of these spaced 2 wavelengths vertically and horizontally, and all indications show that this array is considerably better than my 64 element colinear. Dimensions are as follows:

SPACING	
R-D. el.	6 1/4"
De-D1	2 1/16
D1-D2	2 5/16
D2-D3	2 3/8
D3-D4	5 1/16
D5-D6	8 15/16
D6/D7	9 1/2"
D7-D8	10"
D7 thru D11	10" each

ELEMENTS

Reflector 13 3/8"
Driven El. 12 3/4"
D1 thru D11 11 15/16"

All elements 1/8" alum. rod

BOOM

1/2" square alum. tubing

DIPOLE

Delta matched as described by Ed Tilton in QST

Lee Ewald, 7453 Freda, Dearborn, Michigan 48126

MONITORING FOR SPORADIC E ON TWO METERS

Last July 4, eastern Europe had a two meter sporadic E opening of some two hours duration. During that time there was a contact betweing EI2W and YU1EXY, a distance of about 1400 miles. There have been a number of openings in the U.S., but possibly many more were missed. One of the advocates of constant watching is Shelby Ennis, W4WNH. He also runs his beacon stations whenever the skip is medium to strong on TV channel 5. He says, "Whenever there is evidence of a build-up (on 11 meters, 6 meters or TV), we try to keep the TV receiver going constantly to watch for a possible 144 Mc. opening. The XYL checks it regularly for me when there is a possibility of an opening and I am not at home."

W4WNH stresses the need for regularly monitoring some frequency, such as Channel 5, to watch for a build up. Then you need to transmit and monitor a known two-meter freq. as soon as things look at all possible. The openings are not predictable and are of short duration. W4WNH's operating frequency is normally 144.099 but during a possible E opening he moves to 144.100 and runs the beacon which says "V V V de W4WNH". Antenna headings may be anything, depending on what he hears at the lower frequencies. Power is 1 KW to a 16 el. colinear. More information is available from him at Rt #1, Germantown, Kentucky, 41044. Phone is 728-2746. Area Code 606.

Last month I wrote about our successes with the Kmosko and Johnson long Yagi described in QST ten years ago. As a result of numerous "on the air" tests since the last issue came out, I believe our former opinion was pretty valid. The path between Portland and Sacramento, Calif., never workable in the past, is now workable about 75% of the time. Variations in propagation are quite evident. We are not talking about pings, but signals which are in and out of the noise. The additional gain that antenna provides has made the difference between contacts and no contacts for W7UAB and W6GDO. We have not yet made a serious attempt at gain measurement. For those of you who don't go for the silver-plated steel elements, we used un-plated brass tubing. Probably not quite as good but adequate for the time being.

DELIVERY PROBLEMS WITH THE TIXMO5

We've had a number of articles on converters and preamps using the TIXMO5 and that is coming to a grinding halt right now. If you can't buy them you can't build the device so some sort of adjustment has to be made. I have had these transistors on order since ~~mid~~ mid-December. All I get is unfilled promises from times like "soon" to April 25 to June first. I don't believe anything they say anymore. I'll believe they're coming when I see them here and not until. All those who sent money in good faith for the transistors have either gotten it back or the later orders were held for possible filling at the April 25 target date. I offered the transistors on the assurances of the TI rep. that they would be able to get them to me by the time the mag. was out. So if you have money here you will probably get it back unless you request I hold it for eventual delivery of the transistors.

Now you may wonder how we're filling our converter orders if things are so tough. I'll tell you this much, darned few had a TIXMO5 in them (a green dot on the transistor). We had some TIXMO6s on hand which we found frequently did better than the general run of the MO5s. Then we were accidentally shipped some MO8s and they did well too. Of course we have had to do some selecting. Now we have MO1s and MO2s and when selected they are doing as well as the MO5 or at least well enough to meet the spec. we set up. I would hate to put a firm number on it but we suspect its about 4 db and at any rate better than the 2N3399s ran. How much difference your ear can tell is of course another story. Certainly not much if anything.

Now if you're building the converters and preamps we've described in VHFER or those elsewhere I would like to suggest how you can get along without the MO5. Try some of the others. The MO6 is probably the best of the others but I think they are now about as unavailable as the MO5. Then try the 08 and 01. One transistor you can get that is good is the TI-400 at 89 cents in singles. In some circuits it can be a little rough to tame but in r.f. amplifier and multiplier circuits it seems to work easily and well. I think it is about equivalent to the 2N3399.

Now there are a number of other transistors on the market and you can hear claims about how hot one is over another. Keep in mind that darned few have proper equipment and know how to really make an evaluation. Another thing is that there is no point in paying a premium for an ultra-low-noise transistor if you aren't set up to get down to the noise figure it is capable of delivering. You don't just build something and automatically have best performance in most cases. Even though we've made 2 or 3 hundred 432 converters we have to tweak up each one and prove it out with the noise generator. In time and with experience you get so you go thru a certain procedure which will get you close to optimum. But then you have to adjust it in with the noise generator's aid. The point I'm trying to make is, don't put off building for want of an MO5. Try something else and

VHFER CUT TO 6 TIMES A YEAR

The work behind a little magazine such as this is more than you can imagine. It is pretty much killing a week of my time every month, besides that of some of the help. VHFER is a non-profit magazine and I feel I can no longer afford to lose a week out of every month.

The next issue will be a May-June issue. The magazine size may vary, depending on what we get in and how much work it is to get it ready. The big problem is in getting a balanced selection of "clean" articles. By clean I mean something that is correct and if constructional, is well-explained and obviously written by someone who knows what he's doing. I like to have one or two constructional articles each time and the rest news and techniques. The constructionals are hardest to get. We have turned down a few articles which were well-done but used expensive tubes where inexpensive transistors would have done as good a job or better at a small fraction of the cost. An article should have the prospective builder in mind, realizing the limitations on his pocketbook and available constructional facilities. With some more advanced equipment design we realize that money and metal-working equipment must be available and we wouldn't reject something like that. The number of quality articles we receive is very small, and we appreciate each one. We do not pay for articles. I have two views on this. One is that it's throwing good money after bad. The other is that a person who writes for a few bucks to put in his pocket must need the money pretty bad. That means he's not making much at his job and there's probably a good reason for that. I realize there are some exceptions to this generalization. The authors we want are those few dedicated hams who get satisfaction from seeing others benefit from use of their designs.

My function as editor should be to screen the articles for errors and present a balanced magazine. If that was all I did there would be no problem. Instead I type, photograph, edit, proof, ghost-write, print and cart the stuff to the bindery in Portland, etc. The problem isn't money except that so much time goes into VHFER that it keeps me and my staff from working on our medical products which are our bread and butter.

As of now at least, those of you who paid $2 for a year will get 12 standard size issues for that or half as many double-size. In other words, you'll get what you paid for. Subscription rates as of now are $1 a year but may go back to two if we can get enough material to essentially double the size of the magazine.

If we could have 2 or 3 hams who could (and would) come up with an article every 2 or 3 months it would help a lot. We couldn't get along without the help of Victor Michael, Marilyn Wiseman and Al Olcott. Subscriptions keep increasing at about 100 a month recently. Total is about 1700. Advertising is $20 a page. How about some articles? Loren K7AAD

METEOR SCATTER SKEDS WANTED

Want 2 meter m.s. skeds. Have 32 states and need Kans., Nebr., Ark. and Vt. but will work others. Rusty Holshouser, RFD #1 Box 212 Salisbury, N.C.

Want meteor scatter skeds in La., N. Dakota, Montana, Wyoming, New Mexico. Lewis Munford Box 11 Bridgewater, Michigan.

TWO METER MOONBOUNCE

I talked with W6DNG the other night to get the dope on current 2 meter m.b. activity. Bill said there had been a couple of attempts by Australia and Europe but results were not good. The main problem is that hams on the other end can't or won't elevate their antennas. That 10 db or so you theoretically pick up going along the ground is probably n.g. in the cities so elevation is a must. Also it is too hard to make skeds at reasonable times. Tests continue with OH1NL in Finland with new techniques giving good results.

This marker generator puts out harmonics of 1 Mc. from 2 Mc. thru 1296. It uses a 1 Mc. crystal oscillator driving a tunnel diode. The tunnel diode switches at a very fast rate generating strong harmonics every 1 Mc. (the switching rate). Adjust against WWV and be sure of band edge calibration and 1 Mc. intervals. Can also be used as a weak-signal source for adjustment of antennas & converters. Operates from self-contained penlight cells. $25 postpaid.

Nuvistor

CONVERTER

$54.95 postpaid

- Noise Figure less than 3 d.b. over full 4 Mc. Bandwidth.

Here is the converter that has been accepted by advanced hams all over the U. S. A proven performer for weak-signal work. I.F. ranges available put 144 Mc. at 7, 10, 14, 21, 22, 24, 26, 27, 28, 30.5 or 50 Mc. Choice of connectors: UHF in, phono out (shown) or BNC in and out. Available from stock.

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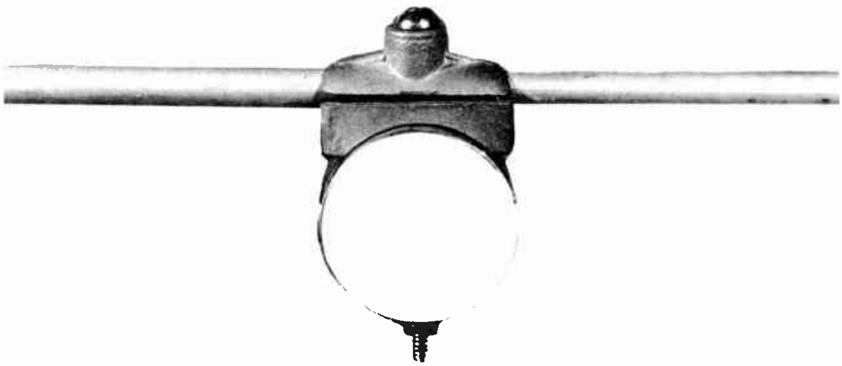

ANTENNA ELEMENT MOUNTS

If you like to build your own antennas, consider these mounts which will make your antennas more rugged and easier to build. An antenna made with these mounts is a whale of a lot easier to tune because you can change element spacing easily. Otherwise you have to drill big holes in the boom and just guess where the element would work best. Remember that on a Yagi there is an optimum element length and element spacing for maximum gain and a given element and boom size. Adjustment near the driven element is very critical. When you can move the elements along the boom and note the immediate effect on gain, you can easily see when you're getting somewhere.

Element mounts are in two pieces with holes in the middle that pass the mounting screw. Mounts are die-cast from Zamac and are iridite treated to resist corrosion. They are RUGGED. My 6-meter beam came down and broke the boom, but not the element mounts. I've never seen a broken one yet. The upper part has a V contour so it will fit snugly over elements from 3/16 to 3/8" in diameter. The bottom part fits 1 1/4" TV mast, available everywhere in 10-foot telescoping sections. The mounts will work well with 1 1/2" booms too. Choice of hole size for No. 8 or No. 10 machine screw. Four sets (to mount four elements) for $1 postpaid in U.S. & Canada. 25¢ for each additional set (to mount 1 element.)

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VHFER

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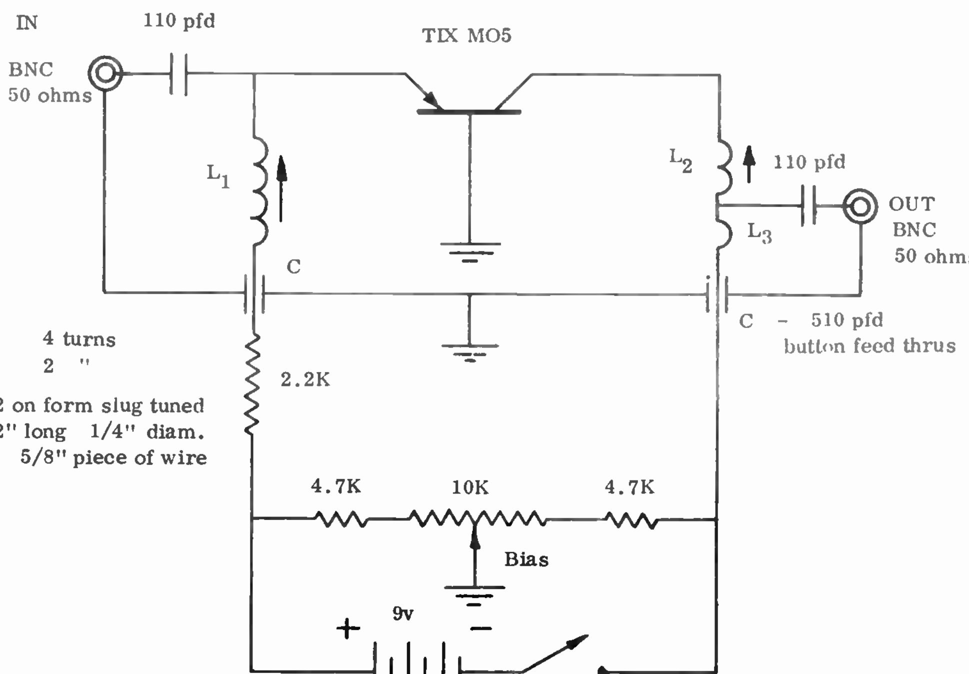
50 MC. AND UP

Volume 4, No. 3 March, 1966



L1 4 turns
L2 2 "
#22 on form slug tuned
1/2" long 1/4" diam.
L3 5/8" piece of wire

Specifications: (measured by W2IMU & W2CCY)

Noise Figure	2 db
Power Gain	23 db (50 ohms matched)
Bandwidth (-3db)	6 mc.
Total Battery Drain	2.5 mc.
Vce	approx. 4 volts

A 2 DB PREAMP FOR 432

A 432 DX MAN'S CONVERTER

MODEL 432-3

$ 49.95 POSTPAID

INTRODUCING: The new PARKS 432 MC. CONVERTER, Model 432-3.

NEW FEATURES:

--All solid-state design
--Zener-regulated a.c. power supply
--Extremely low-noise front end-- 4 d.b. or less.
--High image and I. F. leak-through rejection
--Excellent frequency stability.

This converter uses the Texas Instruments TI-XMO5 transistor. From our tests it is superior in performance to the 2N3399 and costs much less--less expensive to replace if you damage it with r.f.

ORDERING INFORMATION: Price is $49.95, postpaid. Add 35¢ for Special Handling, a fee charged by the post office for faster delivery. Add $2.50 for Air Mail.

I. F. Ranges available put 432 Mc. at 26, 27, 28.1, 29, 30.5, 49 or 50 Mc.

Type BNC connectors only.

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ROUTE 2 BOX 35 BEAVERTON, OREGON

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

Like the first shoots of flowers through the ground in spring, the first reports are starting to indicate that the 1966 Moonbounce season is about to begin. As reported in the last VHFER, a test was made on two meters between VK3ATN and WA6LET. Here is a brief rundown on the stations that have indicated to me they will be ready to participate. It seems that most interest will be centered on the 432 MC band. While I have one reservation about the use of 432 (antenna size) I would think it is still the best band to consider for amateur work at this time. As part of this column I am writing up a front end that can be used on 432. If mounted at the antenna, it will give you a front end noise figure that is about as close as you can come to antenna temperature limitations. Tubes are available to produce an efficient KW amplifier for 432, and relatively inexpensive low-loss feed line is available. Frequency stability can be accomplished with relative ease. While it is true that all of these advantages exist on two meters, the antenna size for reliable work has to be quite large. 1296 offers the advantage of a smaller antenna, but power output tubes are a problem, and the low-noise front end still requires a paramp. Things are looking better for the higher frequencies, but it will take a year or so for the laboratory developments that are going on right now to filter down to amateur application. Just one example of things to come is a diode mixer that will do an almost loss-free conversion, thus a noise figure equal to the i.f. noise figure. Right now they are getting X-band noise figures of about 3db. As I said in one of the first Moonbounce columns I wrote, the longer you wait for the frequencies above 1000 MC the cheaper and better you will be able to get going.

On the east coast this is what is happening:
K2UYH expects to continue to have available the sixty-foot dish at a military installation in New Jersey for a once a month test on either 432 or 144. K2MWA and the Crawford Hill VHF club will continue to have the use of a commercial 60-foot dish for weekend tests on 432, and have available equipment for two meters or just about any band where someone can show some interest. W1BU, operated by Pat Harris, has a good 432 setup working and can get 1296 gear fired up if someone can get on the other end. Here at W3SDZ we have a new feed which should bring the gain of our 27 foot dish up to normal gain on 432. With a new low-noise front end, we should have a system that can hear echoes about 10db better than last year. We are getting ready to replace the feed now, and after the usual calibration and echo tests, make schedules sometime in May.
In the Midwest: W9HGE still has his 432 setup going with a 20-foot dish. W8ROF writes that he has a 384 element driven array ready to go on 432.

In the South W4HHK still has the 18 foot dish up, and has mounted a transistor preamp at the feed point for listening tests on 432.

I have many unconfirmed reports of several new 28 foot dishes ready to go in Conn. and Mass. Also have reports about several other building projects, but nothing definite at this point.

VHFER magazine is published monthly by Parks Electronics Lab., Rt 2, Box 35, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions $2 per year, others $3 per year. Second class postage paid at Beaverton, Oregon

What I am about to write about now will undoubtedly raise some eyebrows--in fact some will disbelieve it until they try it. A group of amateurs here on the east coast developed a transistor preamp that will give a noise figure under 2 db on 432 Mc. The transistor costs 52 cents. As you can tell from the circuit and the picture, it is an extremely simple device to build. The amplifier has now been duplicated a dozen times with identical results every time. I have purposely delayed writing about it until now, as we wanted to be sure that it did what we thought it would do. It has now been checked by three separate labs with good commercial noise figure measuring equipment. In every case the number 1.8 db has been the result of the measurement.

As far as construction is concerned, the only point that is really important is the use of a transistor socket and relatively long emitter and collector leads. In other words, don't try to improve the layout shown in the photos.

The use of the preamp is where the catch comes in. This device is regenerative and behaves in a negative resistance manner. The input and output of the preamp must look into a matched load. It appears from all tests that a 6db reflection loss is adequate for most purposes. If you are doing any really serious 432 work, you should have a matched antenna (VSWR less than 1.5 to 1.) A 3db pad between the preamp and converter will provide the match on the output. The gain of the preamp is about 23 db and a 3db bandwidth of 6MC. More gain can be had, but noise figure starts to degrade. The best operation can be obtained with around 20 db gain.

With a good noise generator on the front end (52 ohm), adjustment is as follows: Feed some noise from the noise generator into the front end. You must then accomplish the most difficult adjustment, the adjustment of the collector tuning and the bias pot for maximum noise output. Then begin to try variations of emitter tuning for best noise figure. On the first try, it may take you a half hour or more to get the feel of how to tune it up. You might be able to make things go without a noise generator, but you will need at least a sweep generator or a weak signal source. The noise figure always seems to come out once the 20 db of gain is realized. Also be sure you don't let the preamp take off into oscillation.

The best precaution to take in the use of the preamp is to use two antenna relays as indicated in the diagram. This will prevent the preamp from going into oscillation when the antenna is switched off during transmit operation. While we aren't sure yet whether this is really necessary, it will make things simpler. We are going to mount ours at the antenna in a weather-proof housing. We presently have a .7 db feedline loss, so this means that we would have to have a 1db front end in the shack to equal the performance this preamp can give.

This preamp is simple to build, is inexpensive, will produce a noise figure under 2db with 23 db of gain for a single stage--in exchange for these advantages initial tuneup takes a little care and measurement to insure operation according to specs, and the antenna match must be good. Overload of the device from strong local signals might also be a problem, but for serious weak-signal work it is a device that comes close to the best commercial practice at a price that won't break your pocketbook. With transistors, as you probably know, accidents with RF can blow them or degrade the noise figure in short order. To replace a fifty-cent transistor isn't nearly as heart breaking as a 20-dollar job. These epoxy transistors do break easily so you must be very careful about bending the leads.

The TIXMO5 is in current short supply. I have a quantity on order from Texas Instruments that should be here by the time this column is printed. If you have trouble getting them from regular sources, I will also be able to make them available at two for a dollar. Include postage sufficient to cover shipment to your area.

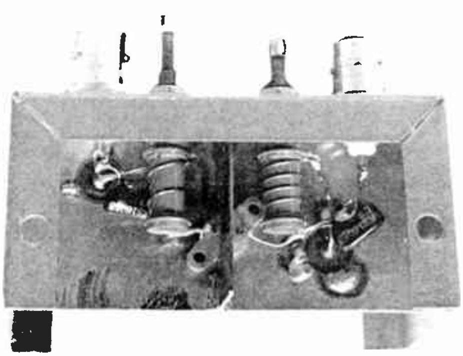
Credit for the development of this amplifier goes to the following people: W3VSV who came up with the original circuit, W2CCY and W2IMU, who did further development and testing of the circuit before making duplicates for the people who were interested , such as your writer.

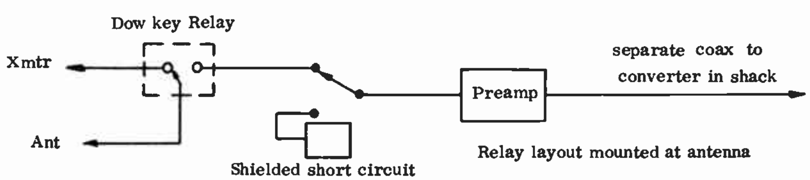
Are you ready to moonbounce? Write me so I can put you on my mailing list (no charge) that will announce all of our schedules, and schedules of any other tests I know about, by first class or airmail. Please don't ask to be on the list unless you are ready to go.

The diagram of the low-noise 432 preamplifier and its specifications are on the cover.

Tune Up:

Adjust L_2 for max. response (it alone controls center freq.)
" L_1 " best N.F. (very broad)
Set bias adjustment for max. gain
Input - Output impedance should be near 50 ohms resistive
Amplifier is conditionally stable without input termination
Input Termination must have reflection coeff. >6db for stability





THE W2CCY QUAD YAGI ARRAY

There have been so many unsuccessful yagi arrays tried on 432, that it would be easy to believe that a yagi won't work at 432. The results that W2CCY has achieved with his relatively small yagi array prove a yagi will work if you do the job right. Cliff started off with the design in the Bill Orr VHF Handbook. A measurement of the yagi built from the book dimensions produced an antenna that worked fine at 427 MC. I suspect that this is the greatest problem of long yagi design at 432; i.e. commercial antennas are not cut and tuned to 432, but rather are designed for some compromise frequency in the hope they will cover the whole band. After some careful measurements, Cliff has found that the yagi can only work over a bandwidth of less than 1%. At any rate, the dimensions given here are for 432.000. Cliff made several modifications to the basic design--measured and tested each modification--until he produced one very good yagi. The stacking was done in such a manner that each yagi is completely decoupled from the others. By using this philosophy of stacking, the feed impedance doesn't change when the antennas are stacked. This is important in order to hold the phasing line losses to a minimum. Figure 1 pretty well tells the story of how to build the yagi. At each yagi Cliff uses a regular coax balun to step the impedance down from 200 ohms to 50 ohms. Then, fifty-ohm coax lines are run from each yagi to a common matching point. Each line is a multiple of a half wave on 432, and about 6' long. This guarantees that the 50 ohms at each antenna will be transferred to the matching point. Cliff measured each line on a slotted line to match the lines within 1 degree. Actually about ten degrees difference in the lines can be tolerated. One interesting point about the baluns. The half wave phasing line part of the balun is made from RG59U. I questioned Cliff about this, since convention would have used fifty ohm coax and something of larger dimension. First off we examined the theory of the balun. If you do this, you will find the actual impedance along the half wave section of the balun is actually half the antenna impedance--in this case 100 ohms. Cliff could not locate any suitable 100 ohm coax, so he settled for 73 ohm cable. Since the loss in this phasing section goes up with VSWR, it can be seen that the 73 ohm coax is better than 52 ohm coax. Since only a half wave section is used in the balun, loss in the balun is very small. Next problem--it's power handling capacity. The power in this section of the balun is one half the total power being delivered to the individual yagi, and the power delivered to each yagi is one fourth the power out of the transmitter. When Cliff completes his ultimate full size yagi array of 24 yagis, only one twentyfourth of the total transmitter power will reach each balun. These baluns can take all an amateur can feed to them when used in this fashion. If you plan to use a balun of this type at the main feed point of your system, you have a completely different problem.

The most unique thing about Cliff's matching system is the power divider and matching section. It is made up of stock type coax couplings. You must use exactly the parts specified in figure two for everything to come out right.

The length of the fittings is an electrical quarter wave which transforms the 25-ohm impedance of the two lines from one bay of yagis to 100 ohms at the T connector which joins the two bays. The two bays in parallel then equal 50 ohms which matches the transmission line to the transmitter.

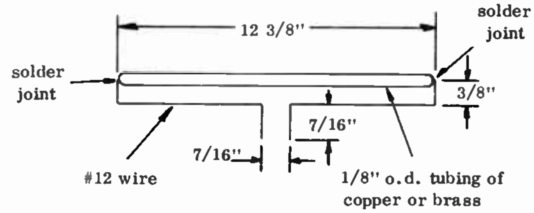
If you would like more information on Cliff's plans for expansion to a larger array using the same basic yagi element, I suggest you write directly to him. Cliff is an excellent worker on 432. He devotes his entire amateur efforts to this band. Cliff works as a commercial engineer by day, and takes a busman's holiday by his amateur efforts.

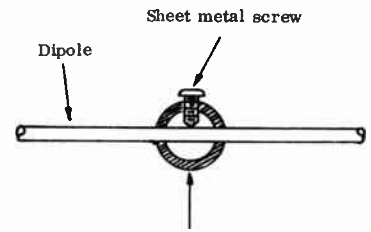
We have uncovered much to write about from our visit with W2CCY which will fill many columns in months to come.

Fig. 1 W2CCY 432 YAGI

	Element Lengths	Spacing from Dipole
Reflector	13 3/8	6 1/4"
Dipole	12 3/8	--
Director #1	11 15/16	2 11/32
2	"	4 27/32
3	"	7 11/32
4	"	12 5/8
5	"	23 1/4
6	"	33 7/8
7	"	44 1/2
8	"	55 1/8
9	"	65 3/4
10	"	76 3/8
11	"	87

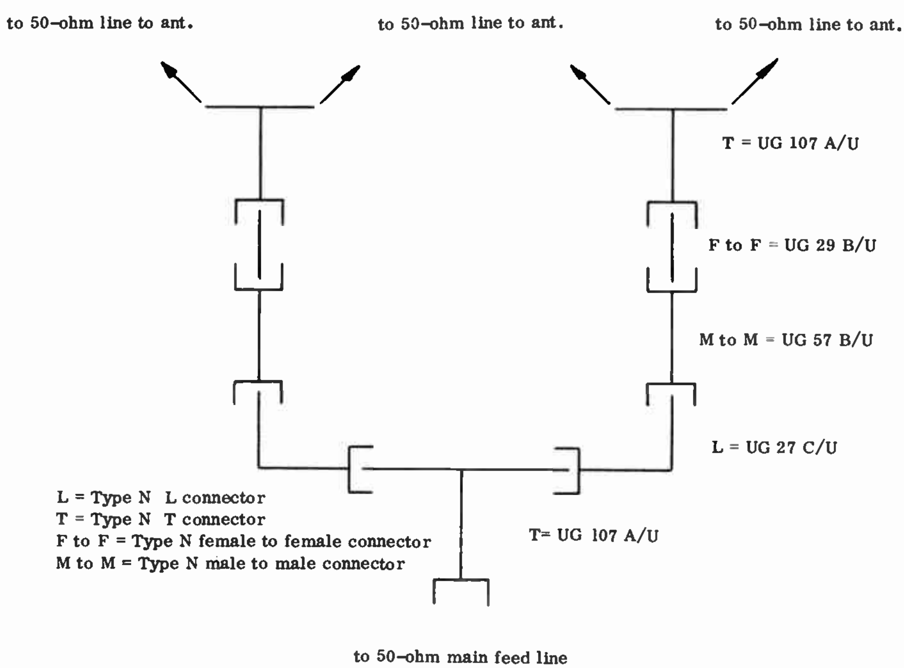
All elements except the dipole are 1/8" alum. rod.





Boom 8 ft. long alum. 1/16" wall, 1/2" o.d.

Method of fastening elements to boom.



Power divider and matching network. For larger arrays, additional networks can be added to each output port of the above network.

Figure 2.

continued on page 9

METEOR SCATTER OBSERVATIONS

by George A. (Al) Olcott, K7ICW/AA7ICW*

Meteor scatter or MS is going thru the annual doldrums this time of year. Except for minor showers, very little is usually accomplished until the Lyrids in April. The recent Leonids shower in Nov. 1965 has given this "sport" a shot-in-the-arm, but most avid fans know that this shower was an unusual one in that such conditions are not expected, and that this showing was the best in 33 years. Of course MS was unknown 33 years ago. Only a decade ago early amateurs in this field, including W2UK, W2AZL, W4AO, W4LTU and others, paved the way. Now, a reasonably set up station with only a fair CW ability can do well on major showers even without a KW rig.

What is needed now is more accurate predictions and utilization of these predictions, so that greater participation by more amateurs in "scarce" locations can be attracted. What constitutes a scarce location is open to question depending upon where you are, but in the U.S. right now it is Idaho and North Dakota. Additional activity in Washington, Wyoming and Nevada might be desirable.

Methods of predicting when MS is usable is still very much a guessing process. There are valuable guides such as Sky and Telescope Magazine or articles in various ham publications showing charts of showers and path times. None of these publications in my experience has been more than 50 per cent reliable and such data is highly interpretive Visual observations are generally worthless, because many showers occur in the daytime, and local weather conditions maybe adverse at night. Even then, only the overdense or very large meteors will be seen. Only one outstanding example of visual observations of a meteor shower can be recalled here, and that was the Giacobinids shower of Oct. 9-10 1946. Thousands of meteor trails could be seen by the naked eye all night and early morning of both days. If such a display again occurs, naturally signals should be nothing short of fantastic. It is recalled that a mid-western plains states amateur correlated visual observations with received signals on 50 mc. some years ago, but that situation is suited to ideal weather conditions and a rural location.

Along about the same time that Walt Bain, W4LTU and others were fooling around with this meteor stuff on 2M several eons ago, Stanford University (N. Calif.) was playing around with a 49.9 Mc. scatter circuit with the University of Montana. It isn't clear what they were trying to accomplish, but the circuit was regular and reliable and one method of meteor detection supplementing the equipment to accomplish the path comes to mind. Stanford was using a TV set coupled to a 4 bay stacked conical for reception of a TV station near the University of Montana on TV channel 2. During burst periods, the TV set indeed had a picture and sound which was useful for observing multipath effects, doppler shift and the like.

TV reception can provide a good indication of 144 Mc. shower probability. Bob Turk, W7LEE of Parker, Ariz., showed me his method about 4 years ago of utilizing a UHF M.P.T.A.I. translator which provided Phoenix TV on the VHF channels 150 miles away to the Parker, Ariz. area on UHF. Signals from TV stations other than the Phoenix area occasionally get into the repeater and override the Phoenix stations. This happens more often with sporadic E type signals, but when meteors are good, reception of TV signals in the 700-1500 mile range are received on bursts. Since the repeater is automatic, any signal received on the input 24 hours a day will key it on. Sometimes meteor showers key it on and off at a rapid rate.

* 510 So. Rose St., Las Vegas, Nev.

Don Hilliard, WØEYE of Boulder, Colo., has been using TV channel 5 as an indicator of MS activity. A channel 5 yagi has been used on his set to receive WMAQ, Chicago, Ill., WOI-TV, Ames, Ia., and WFRV, Green Bay, Wis. Actually any low TV channel will work for this purpose but channels 5 and 6 are best due to their proximity to the 2 meter band. A yagi or fairly high gain and directional antenna is necessary for this reception normally, with the yagi being best due to its frequency/bandwidth characteristics. TV sets with one I.F. stage or economy construction as used in some portables are unsatisfactory for this work. Poor noise figures, low stage gains, and poor sync stability contribute to mediocre results.

A study of TV station log listings such as Whites Radio and TV Log incorporated in Radio and TV Experimenter magazine would be desirable so that identification of on the air stations in specific directions can be achieved.

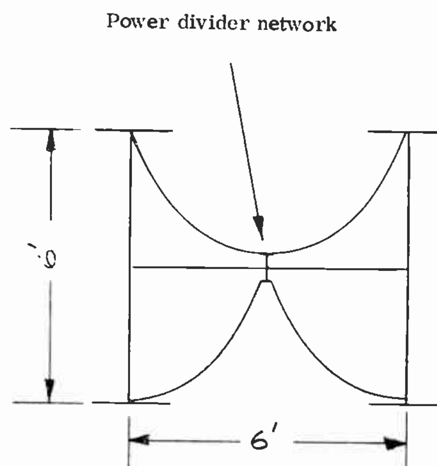
Other methods of MS activity identification need to be developed. Merely being in a TV fringe area is a big help when using the TV method of MS detection. A better approach is to improve equipment so that smaller but more frequent meteors may be utilized for amateur communications. European work along these lines consists of better use of diversity reception, little used in the U.S. Merely improving noise figure or raising antenna height is only going to increase effective range by a few hundred miles (a considerable factor to advanced MS amateurs) but will not get results during a poor shower or no shower as the case may be. Advanced MS enthusiasts are utilizing the minor meteor showers or periods of daily meteor increase such as sunrise, or combining MS skeds with likely tropospheric paths and not waiting around for the "band to open". End.

432 SKEDS WANTED

Ed. note: We don't normally list skeds wanted from such low power stations, but Doug's record of accomplishment was so outstanding we thought he deserved it. LP

"I operate 432 Mc. only with ten watts to a 6939 and a 128 element colinear antenna. So far I have N.Y., Pa., Mass., N.J., Ohio, Mich., Wisc., Ill. for eight states plus Ont. and Quebec. I would like to make skeds with anyone that is interested in early morning or daytime operation thru the week this summer or fall." D.M. Armes, K2ACQ, 5681 Locust St. Lockport, New York 14094.

Basic stacking of 4 antennas.



OPEN BANDS

by Marilyn Wiseman, K8ALO

Reports have dropped off considerably. Could it be everyone has spring fever so early? Maybe the old flue bug has a lot of you. I sure hope not. I spent 3 weeks in bed myself with it. I can't write a column without reports. Maybe all reports haven't appeared, but I do take the best from all letters received, as space is limited. So let's get on the bands, work, listen or do something and get those reports to me by the 15th. My address: Box 103, Petersburg, Ohio 44454.

<u>50 Mc. Scatter</u>

February's activity seemed quite slow. However the following stations did send reports:

K7ICW (Nev.) wrkd K6YIL, K6ZOA, W6YKM, WA6SUU/6, WB6LJN, K6RIL, WA6TXH, K6IBY, W6NZY, K6GJD, W6ABN ,K5OOJ W5UNU, WA5CDG/5, K5JFW, W5SFW (Texas), WØEYE (Colo.), K7BBO (Wash.). Hrd W7HDP (Mont.). Al also reports hearing the 49.8 Mc. signal from Stanford's big dish. This station is on from about 5:30 a.m. to 5 p.m. running lots of kilowatts, every day but Sunday.

WB6GKK workd K7BBO (Wash.), K7ICW (Nev.), WØEYE (Colo.), W5KCP (Tex.), WB6FSC.

<u>144 Mc.</u> (Minimum distance for listing 350 miles)

Feb. 6-27 K7ICW (Nev.) wrkd W6NLZ, W6YVO, K6JYO. These were weekly contacts.

Mar. 13 WA2WEB, the East Coast VHF Soc. Radio Club of Paterson, N.J., reports working the following: K1BKK, W2PTI, VE2BMQ, VE2TT, VE3ETO, K4GL/8 WA9ADM/8, K8UQA, W9BRN. Hrd K1OYB, K1TIC, K1VDZ, W1AEP, W1BMX, W1EKU, K1MTJ, W2LWI, K2HLA, W3BYF, W3MBN, W3PMG, K8AXU, W8WEN, W8EDV, K8MPH, W9ZIH, VE2FF, VE3EVW, VE3FRC. Operators working the club station were K2LME, WA2INB, WB2NCB, WB2OHH. As far as I can figure, a total of 9 states plus 2 canadian sections.

<u>432 Mc.</u>

K7ICW (Nev.) reports hearing Oscar IV throughout the month. Al copied his own signal through the translator at 1135 Feb. 19.

1296 CONVERSION OF THE "ARROW" CAVITY

by Pete Bauer, W6DXJ*

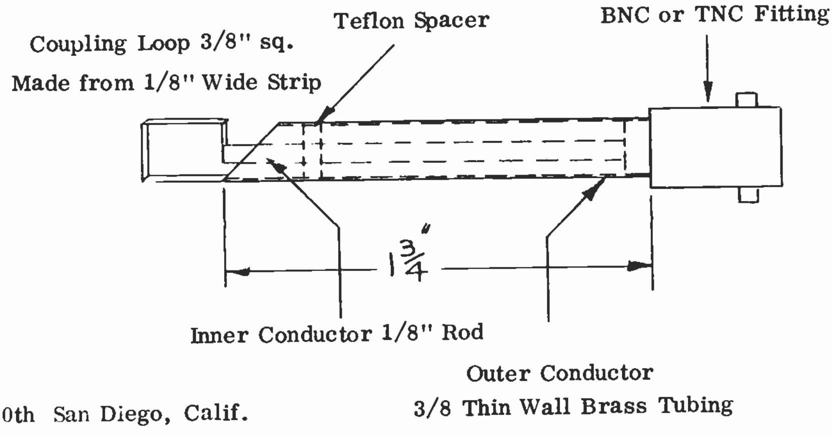
Arrow Sales of 2534 S. Michigan Ave., Chicago, has a 2C39 "Tripler Cavity" for $3.95 that is readily converted for operation at 1296 Mc. It can be operated either as a tripler from 432 Mc. or as a straight-through amplifier with as much as 17 db small-signal gain. The gain is about 8-9 db as a class C amplifier and about -3 db as a tripler. At the time this article was written they had about 50 units in stock at Arrow so there should be enough to go around.

The output cavity must be modified for operation either as a tripler or as an amplifier. It was originally designed to tune from 1.1 to 1.2 gHz (KMc.), but with the original filament chokes the tripler oscillates. This is probably why it hit the surplus market. The original chokes are about right for 6 meters.

OUTPUT CAVITY MOD. FOR USE AS TRIPLER OR AMPLIFIER

1. Disassemble
2. Unsolder the outer shell and grid contact ring. They are soft-soldered.
3. Shorten the inner conductor exactly 3/8 inch.
4. Remove 3/16 inch (NO MORE) from bottom edge of the outer shell.
5. Cutt off the top of the shell to make a final length of 2 1/4".
6. Remove the output coupling tube which is adjacent to the terminal strip by sawing it off. Solder a metal disc over the hole.
7. Cut the plate bypass down to 1/2". Save the teflon tape.
8. Remove the ferrite beads from the plate feed cable and save for later use.
9. Resolder the grid ring and outer shell maintaining the original offset referenced to the top of the line on the grid ring.
10. A 3/8" spacer must be used between the output cavity and the mounting bracket to preserve the cathode-filament circuit. (This is easier than shortening them 3/8")

The output coupling link terminates a short section of rigid coax made from 3/8 inch thin-wall brass tubing. The 3/8" tube telescopes into the remaining original output tube which may be crimped slightly to make a snug fit. The link protrudes into the output cavity and can be rotated for variable coupling. The figure below shows how the output coupling assembly is made.

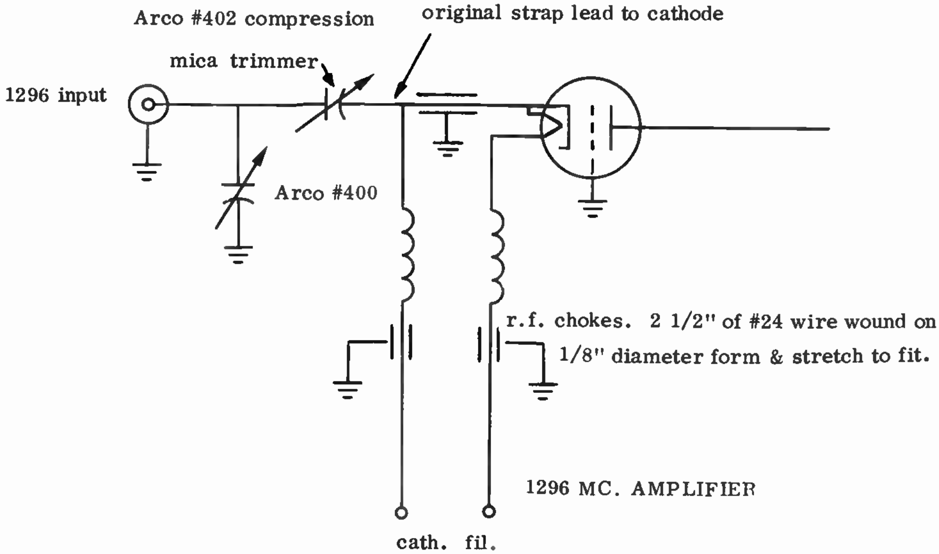


*6445 50th San Diego, Calif.

INPUT BOX MODIFICATION FOR AMPLIFIER OPERATION

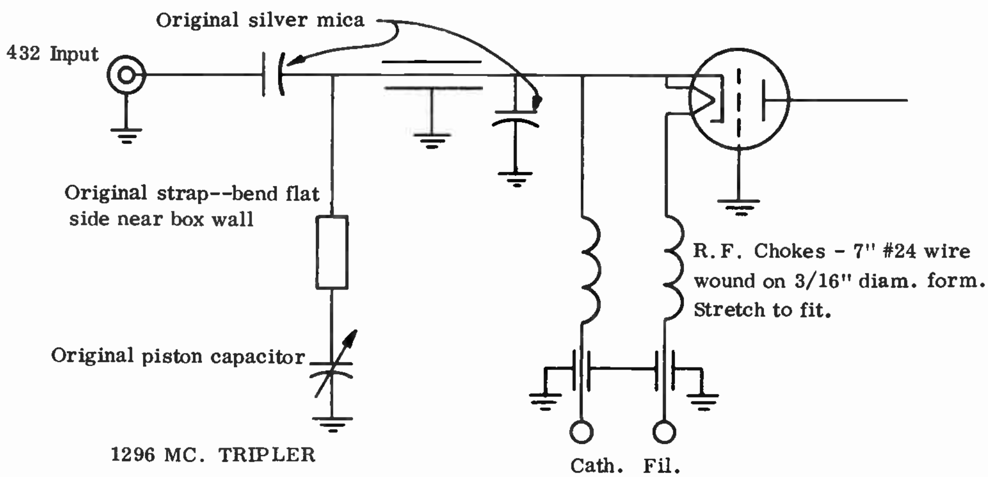
1. Remove all the components except the BNC fittings and the feed-through button mica capacitors from the input box.

2. Rewire according to the diagram below:



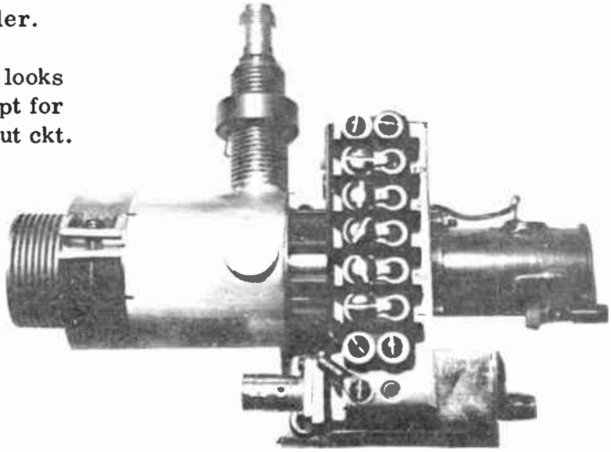
INPUT BOX MODIFICATION FOR TRIPLER OPERATION

1. Remove all resistors and chokes from the input box and the tube.
2. Remove the Johansson piston capacitor and silver-plated strap which connects directly to the BNC input fitting.
3. Rewire according to the figure below:

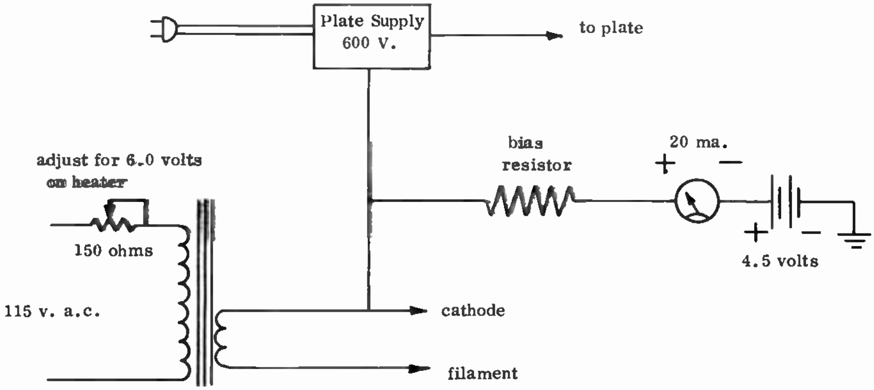


Cavity converted for
1296 Mc. tripler.

The amplifier looks
the same except for
a different input ckt.



The figure below shows how supply voltages are connected to the 2C39 or 7289. Since the grid is directly grounded, bias must be placed in the cathode circuit and a plate supply with un-grounded B- used. The grid bias resistor will be approx. 200 ohms for amplifier operation and 10,000 ohms for tripler operation. For proper operating bias it is best to refer to the manufacturer's data for the tube type you are going to use. Be sure to consider the cooling requirements. You will need a high-speed (7000 rpm) 2" squirrel cage blower and shroud for 100 watts dissipation.



BACK ISSUES

We still have bundles of 11 back issues of 6-up magazine available for $2 postpaid. Also we have all VHFERS for 1965 except Jan., April and May. Some of these are being reprinted and those of you who ordered but didn't receive will ultimately get them. Price of back VHFERS is 20¢ each, postpaid. Send cash, check or stamps in payment. If you have any questions about back issues send self-addressed card or envelope for reply.

CORRECTIONS

We offered TI XMO5 transistors last month but the delivery promise to us turned out to be N.G. so we have none for ourselves and all money has been refunded that was sent us. Our latest delivery promise is April 26 but maybe we can't rely on that. We have been using the TIX MO6 and find it equally as good or better in our circuits. We don't have enough to sell.

We made an error in Feb. VHFER in the slotted line conversion article. Figures 3 & 5 were inadvertently interchanged.

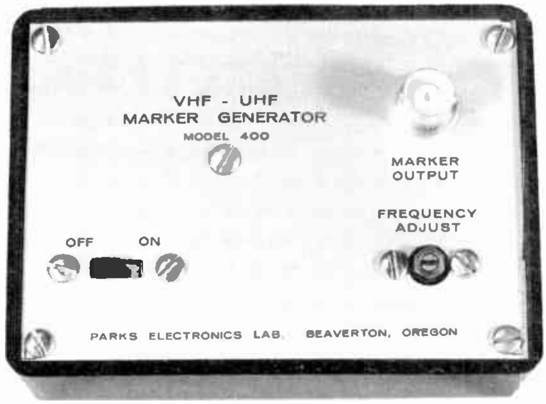
A FANTASTIC 2-METER ANTENNA
by K7AAD

Some people are awfully slow to get the word--like ten years. Count me among them. My interest in Yagi antennas has been high for the last few years and I pretty much know what has been published and don't hesitate to venture an opinion on the articles. Most of them stink, even though written by "commercials." It's amazing how their theory and complex equations manage to produce antennas with outlandish claims and equally poor performance, for the most part. At any rate one article in QST some ten years ago by Kmosko and Johnson stood out like a sore thumb. It was good work, no doubt about that. But the antennas looked awfully big. I found out recently how wrong I was about that. Here is how W7UAB carried the ball and forced me to wake up.

For two or three years we have been trying to break down the 2-meter path between Portland and Calif. W7UDM did it once with a Calif. station on a mountain top just over the border. I had heard discernible signals from W6GDO in Sacramento just once out of many attempts. W7UAB and others locally had heard signals that were copyable at times but nothing was getting through to the other end. With legal limits of a K.W. already attained and RG-17 U or better feedline , W7UAB decided there was only one way to go and that was the antenna. He too was impressed by the Kmosko-Johnson article in Jan. 56 QST, and did something about it. There were some problems getting it matched to the coax line, but eventually a tolerable match was attained and a contact with W6GDO was the result. This on the first attempt and on two subsequent attempts. Tom helped me build one which went up about 45 feet with a preamp under it. The article said, "the performance is something to behold." They were right. What a shock to hear those signals from Calif. Q5 -two of them at the same time (W6GDO and WB6KAP in the bay.) It was armchair copy on c.w. W6GDO made a recording of W7UAB's signal in Sacramento and played it back on our Sunday night VHF NUT NET. It was nothing short of fantastic. Every dot was there. No need to imagine anything. Both Jay and Vic used 15 element Telrex beams. The fellows here still using the 12 db antennas could not copy calls.

Now what's happening? The 12 db antennas have an honest, measured 12 db over a dipole. The Kmosko-Johnson antenna can't have more than 4 db over that. But the difference in reception was more than any 4 db. We don't know the answers yet. We have not measured the antennas yet because we still have some matching problems. The booms are 23 1/2 ft. Really, they aren't the monsters you would think. Materials cost is about $8. They are very narrow band devices. We swept mine and at 145 Mc. it was pretty much gone to pot.

The distance of some 500 plus miles may not impress you flatlanders. But our propagation isn't like yours. We don't have two meter openings except to Seattle that we know of. By next issue we'll know how often this can be duplicated. But with the other listeners serving as controls it seems pretty clear, its a fantastic 2-meter antenna. More next month.



This marker generator puts out harmonics of 1 Mc. from 2 Mc. thru 1296. It uses a 1 Mc. crystal oscillator driving a tunnel diode. The tunnel diode switches at a very fast rate generating strong harmonics every 1 Mc. (the switching rate). Adjust against WWV and be sure of band edge calibration and 1 Mc. intervals. Can also be used as a weak-signal source for adjustment of antennas & converters. Operates from self-contained penlight cells. $25 postpaid.

Nuvistor

CONVERTER

$54.95 postpaid

- Noise Figure less than 3 d.b. over full 4 Mc. Bandwidth.

Here is the converter that has been accepted by advanced hams all over the U. S. A proven performer for weak-signal work. I.F. ranges available put 144 Mc. at 7, 10, 14, 21, 22, 24, 26, 27, 28, 30.5 or 50 Mc. Choice of connectors: UHF in, phono out (shown) or BNC in and out. Available from stock.

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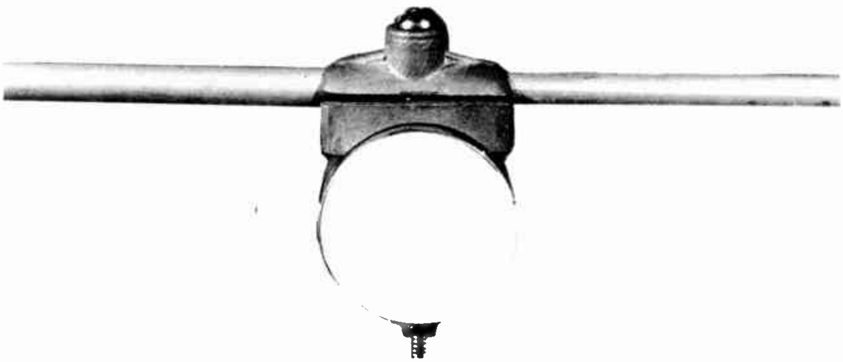

ANTENNA ELEMENT MOUNTS

If you like to build your own antennas, consider these mounts which will make your antennas more rugged and easier to build. An antenna made with these mounts is a whale of a lot easier to tune because you can change element spacing easily. Otherwise you have to drill big holes in the boom and just guess where the element would work best. Remember that on a Yagi there is an optimum element length and element spacing for maximum gain and a given element and boom size. Adjustment near the driven element is very critical. When you can move the elements along the boom and note the immediate effect on gain, you can easily see when you're getting somewhere.

Element mounts are in two pieces with holes in the middle that pass the mounting screw. Mounts are die-cast from Zamac and are iridite treated to resist corrosion. They are RUGGED. My 6-meter beam came down and broke the boom, but not the element mounts. I've never seen a broken one yet. The upper part has a V contour so it will fit snugly over elements from 3/16 to 3/8" in diameter. The bottom part fits 1 1/4" TV mast, available everywhere in 10-foot telescoping sections. The mounts will work well with 1 1/2" booms too. Choice of hole size for No. 8 or No. 10 machine screw. Four sets (to mount four elements) for $1 postpaid in U.S. & Canada. 25¢ for each additional set (to mount 1 element.)

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VHFER

LEARN BY DOING

50 MC. AND UP

Volume 4, No. 1 January, 1966

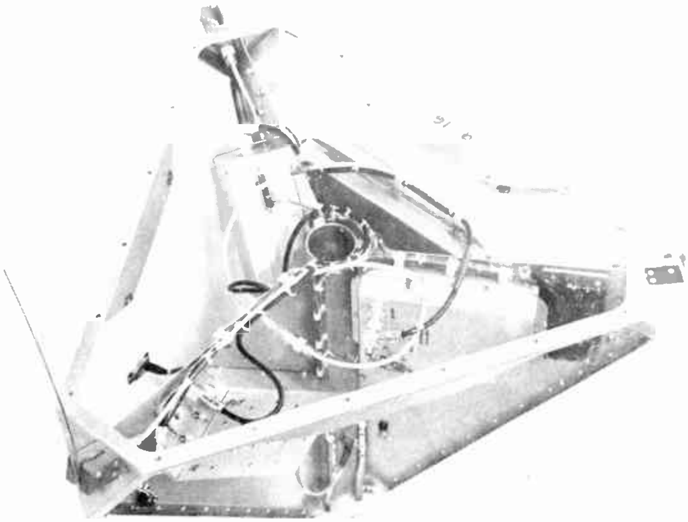


Figure 1

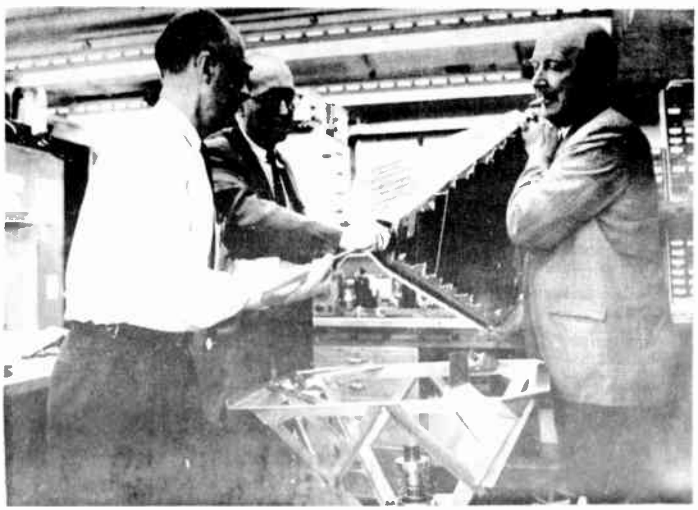


Figure 2

OSCAR IV

OSCAR NEWSLETTER

January 1966

OSCAR IV, the radio amateur repeater satellite was launched in orbit on December 21, 1965 at 1400 GMT aboard a Titan III vehicle from Cape Kennedy, Florida. The launch was observed by W6SAI, W6UF and K6GSJ. Liaison with Oscar Headquarters in California was maintained on 14 mc/s SSB via W6EE/4 located at Cocoa Beach, Florida. Oscar IV was ejected from the Transtage (final stage) of the Titan III vehicle at 2022 GMT. The Titan payload also included the LES 3 and 4 satellites and the OV2-3 satellite. Because of a malfunction in the Titan control system, the planned near-synchronous orbit was not achieved. Instead, Oscar IV was placed in a highly elliptical orbit having the following characteristics (as of orbit 15): Perigee, 103 nautical miles (188.5 km); apogee, 18,200 nautical miles (33,206 km); inclination, 26 degrees; period, 587.5 minutes. The period decays approximately 7.5 seconds per orbit. At start of orbit 15 (December 27, 1965) the equatorial crossing time (south-to-north) was 1824 GMT and the crossing point was 254° west longitude.

First reports indicate that the beacon sequence was essentially continuous. WA6BPZ (Sunnyvale, California) heard the Oscar IV beacon at 2028 GMT, six minutes after ejection. The beacon was measured at 431.928 mc/s and the translator passband at 431.940--431.945 mc/s. Translator input center frequency was checked at 144.1 mc/s. First reported reception of translated signals was by W6YK who heard WB6KAP, K4IXC and W4WNH on orbit Ø. First reported QSO via Oscar IV was W6YK--W4AWS on orbit Ø. K2MWA/2 reports the following European signals heard via Oscar IV: HB9RG, DL3YBA, G3LTF and DL9AR. VK2AAK reports VK7PF; and OH2AZT reports G3LTF, DL3YBA and OH2DV. Other reported QSO's include: DL9AR-DLØLB (orbit 2), W6GDO-K6HCP (orbit 5), W6GDO-W5WXZ (orbit 10), WA2WEB-K2MWA/2 (orbit 12), W6GDO-W6FZA (orbit 15). VK7PF reported hearing both ends of the W6GDO-W6FZA QSO! VK3ASG heard VK6HK for the first reception across Australia!

It is believed that Oscar IV was ejected from the Transtage of the Titan III vehicle with the satellite antennas pointing at the earth. Further data indicates that one of the sets of solar panels may have been damaged by excessive temperature during the six hour "transfer" flight. If so, the primary voltage supply of Oscar IV may be lower than normal, thus inactivating the "Clock" designed to switch the beacon transmitter on and off. As of orbit 15, the beacon signal had "captured" the translator for most of the time, only permitting the translator to function properly for periods of 15 seconds or less. The resulting signal from Oscar IV resembles a steady carrier at 431.928 mc/s, broken at irregular intervals by incomplete H-I identification signals, with occasional longer pauses during which it is possible to make use of the translator equipment. Reports also indicate that the translator may be useable even while the beacon signal is on.

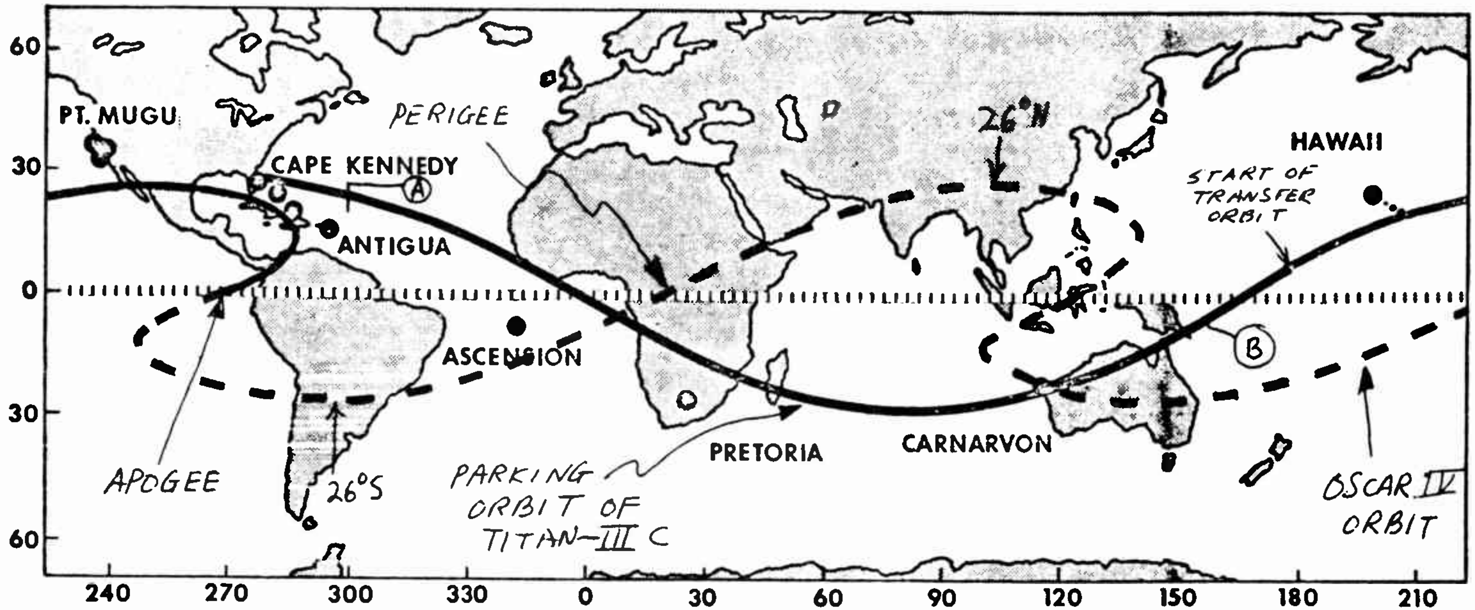
The following calls have been reported heard through Oscar IV; W6GDO, W6PUZ, W5AJG, W4AWS, W5WXZ, K7GIR, WA2WEB, W9AAG, KØRZJ, W8YIO, W6FZA, K7ZER, W7LIT, K6HCP, KØRZI, K2MWA/2, W4WNH, K2GUG, W9ZIH, K6HAW, W6YK, W6GHV, G3LTS, DL3YBA, OH2DV, W4GJO, W5HCJ, W9EGB, K6TSK, K9AAJ, W9TGB, WØIC, W4IKC, WB6KAL, WB6IOM, K6HAA, K2GUN, VK7PF, W5SLL, WØLER, K4FJT, K2VTW, DL3YBW, G3LTF, DL9AR, K7DZG.

Project Oscar requests reports of all calls heard, QSO's achieved, and signal strength reports of the beacon versus translated signals. Those experimenters having large antenna arrays are requested to give AZ-EL data: 10 to 30 readings at 1 to 5 minute intervals are urgently needed. Send all reports to Project Oscar, Foothill College, Los Altos Hills, California, U.S.A.

Oscar Headquarters station W6EE will broadcast prediction bulletins and news according to the following schedule: Thursday ard Sunday (GMT) only. Single sideband, 3835, 7235 and 14235 kc/s at 0400 GMT. CW, 3507.5, 7015 and 14030 kc/s at 0415 GMT. RTTY, 3625, 7040 and 14090 at 0445 GMT (remember, these times fall on Wednesday and Saturday evenings in the U.S.A.).

VHFER magazine is published monthly by Parks Electronics Lab., Rt 2, Box 35, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions $2 per year, others $3 per year. Second class postage paid at Beaverton, Oregon

THE OSCAR IV SUB-SATELLITE TRACK



This map illustrates the sub-satellite track of the Oscar IV orbit on the surface of the earth (dash line). The Titan III vehicle was fired from Cape Kennedy, Florida (solid line). First burn of the engines lasted to point A, placing the vehicle in a 95 nautical mile high "parking orbit" lasting to point B. At this point, the engine refired to place the vehicle in an elliptical "transfer orbit," starting west of Hawaii. The transfer orbit quickly lifted the Titan III Transtage to about 18,200 nautical miles altitude over the United States, the orbit being at an inclination of approximately 26° to the equator. At the apogee point over the Galapagos Islands, the Transtage engine was programmed to fire again, placing the stage in a near-synchronous orbit at a zero inclination angle to the equator. The last of these highly complicated maneuvers was not carried out, and Oscar IV was ejected in the elliptical "transfer orbit." The orbit is S-shaped about the apogee point as Oscar IV is traveling slowly over this portion of the ellipse and the earth observer "races ahead" of the satellite, only to "slow down" as Oscar IV picks up speed on the "downward" portion of the elliptical orbit. When Oscar IV is traveling on the "outward" portion of the orbit, it is north of the equator (to a maximum of 26°) and when the satellite is traveling on the "downward" portion of the orbit, it is south of the equator (to a maximum of 26°). Progression is 147.53° per orbit. This starting condition is gradually changing and the perigee (low point of orbit) is slowly drifting away from the equator.

Oscar IV designation: Spacetrack object 1902.
International- 1965-108-C

The following is taken directly from the OSCAR newsletter and is titled "Reading the Mail." It is re-typed because we couldn't copy it photographically with good enough quality for publication.

K7DZG: Sounds as if Oscar's passband is about 9 kc/s wide...W9AAG: Heard a VE3?? but some bird calling at 5 wpm ruined this one. Best signals heard were W6FZA and K7ZIR. Better luck next time on the taxi service-HI....K2GUN: Beacon is about +35 db over noise on orbit 2. Using Parks converter and 15L Quad....W4AWS: Heard W6GHV on orbit 5. Translator chopping signals badly....W5CKY: Parks converter and 8 x 8 J-Beam here. Chirpy, unidentifiable signals heard....W4GJO: Heard following on orbit 6--W6GDO, K5WXZ, W6HCJ. Orbit 7-W4WNH....KØIJN: Think I heard a VK station on Jan. 2!!... WA9HUV: Heard K6HCP on Dec. 21, plus many others. Using 64L array.... W8FAZ: Suggest you listen for Oscar at low point of orbit as signals are very strong. Don't forget to mention the satellite signals stop in shadow of the earth because of solar cell power supply. Many amateurs don't know this happens.... W6YK: Using 64 element J-Beam on 144 and 32 elements on 432 mc/s & Parks converter. Ran at about 25 wpm in QSO with W4AWS .. W2BLV: Heard W9ZIH and K9AAJ about +18 db over noise. The beacon seemed to be operating at the same time. Using 40 element colinear on 432 mc/s....W4WNH: Beacon +20 db over noise with relayed signals almost as strong. Using 6CW4 converter and helix on AZ-EL mount....W6ELT: On orbit 25, beacon +7 db over noise with W6PUZ heard in noise....K2ACQ: Using 128 element colinear on 432 mc/s. Heard K6HCP on orbit 3...WA9NKT: Only pieces of calls heard during orbit 20. W6GHV and K6TSK heard earlier. W1HDQ: Severe TV interference from local station but beacon heard +3 to +6 db over racket. Many fragmentary calls heard....W2IMU: Frequency shift keying (FSK) tests with K2GUN provided increased readability of signals. Major problem is deep fading. We recommend circular polarization for all ground antennas. Translator passband re-measured to show useful to plus or minus 15 kc/s from center frequency. Response is 15 db down at these frequencies....

VK7PF: Acquired beacon at 1047Z 24/12/65 on 431.928 mc/s. During the 55 minute track-in period the beacon frequency reached 431.932 mc/s. With acquisition, VK7PF began transmitting CW and was able to receive his translated signals clearly for almost the whole of the period. He was heard clearly by VK2AAK. VK7PF received portions of VK2AAK's call but no QSO resulted. VK7PF ran 100 watts to a 13 db antenna. Receiving antenna was twin 16 turn helix.

VK1VP: Orbit 11, tracked from 0754 to 1243Z. Using 30 watts output and 15 db antenna, could hear his signals clearly, but had to increase speed to 20 wpm as Oscar chopped signals badly. Beacon +20 db over noise and his signal +8 db over noise. Satellite was about 16,000 miles high at this time. Also heard VK2AAK this pass.

VK7PF: From 0144 to 0334Z, VK7PF copied a number of W calls, during the period of VK-W mutual visibility portion of orbit 15. He clearly heard W6GDO and W6FZA who were apparently in QSO through Oscar. At this time, Oscar was approximately 15,000 miles over the Pacific near 10 degrees south and 157.1 degrees east. VK3AEE also reported unidentifiable W calls about 0322Z. As far as is known, the VK-W reception is the longest recorded transmission through a communication satellite, including Syncom and Early Bird.

Please send your reports and comments to Project Oscar, Foothills College, Los Altos Hills, Calif. Thanks to all who have cooperated in this experiment and please pardon us for not answering mail at this time! We appreciate your letters and -- rest assured-- they are well read!

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

Parabolic Antenna Construction

As I promised last month, here is a discussion of how to go about constructing your own parabolic dish. This can't possibly be a nuts and bolt type of discussion, as available materials, size of antenna, available tools, and many other factors will influence your construction. What I propose is a discussion of how to determine "what" you have to do.

The first important consideration is the size of the antenna you wish to build. The real consideration here, is the band you wish to use. On 432, the minimum size antenna you should consider is 26 feet diameter. On 1296, the size is reduced to 18 ft., while you need a sixty foot size for two meters. If you want to work on 432, there is no point in building a 15 foot antenna, as you can do as well with a well made phased array. In the size catagory, you must also consider what the largest diameter dish you might eventually want to build. If you will take the time to give some serious thought to this, you can start with a minimum size and later increase the diameter in steps up to the ultimate full size. To understand this, let us look at Figure A. This figure shows you how to establish the parabolic curve. A practical note at this point might help. The simplest way to lay out the curve is by ray tracing. The idea is explained in the caption for Figure A. I placed two 4' x 8' sheets of plywood end to end to form a rectangle 4' x 16'. Then, parallel to the 4' edge and at an exact right angle to the front 16' edge, draw a line each 6 inches to form a grid of parallel lines. This will make it easier to form the right angle in the ray tracing. You will find that for a focal length over 15 feet, ray tracing the curve every six inches will yield a very accurate surface. I used #18 wire for the "ray string". The only thing to watch is the wire stretch. The way to check yourself is to go back to the first ray trace point to see if it is the same after you have completed all the other points. You will probably find that it will take a few runs to get everything accurate. Once the tracing is complete, you can use the outline to lay out any type of former of any material you desire.

In considering the size dish you wish to build, you must also give careful thought to the focal length you will use. As an example, you can build a thirty-foot dish with a focal length ranging from five feet to thirty feet. There are some pretty good reasons for using a focal length around 15 feet, and this is where we meet a term known as F to D ratio (F/D). F is focal length and D is diameter of dish. If you will examine this concept a moment, what happens to cause problems, is that the illumination angle changes with the F/D ratio. As the F/D gets smaller, the illumination angle increases and can get to a point where it gets extremely difficult to illuminate the entire surface of the dish. Figure B shows the illumination angle for F/D of the most practical values for amateur use. A look at E and H Plane patterns of even a simple dipole and reflector indicates that once you go below .5 F/D it becomes difficult to properly illuminate the entire reflector surface. You should think in terms of a focal length that will give an F/D of .75 for the smallest size dish you intend to build and .35 when it is at it's largest diameter. As an example, you could start by building a thirty-foot dish with a focal length of 22 feet. The F/D would be .73, and you could add extenders to bring the dish to 50 feet at which point the F/D would be .44. Later the dish could be extended further to 63 feet and an F/D of .35. The important concept to remember, is that the focal length of the dish determines the nature of the curve. Once you establish the focal length, you can extend the diameter, but the focal length will remain the same. Thus, the F/D will drop as the diameter is increased, so decide on the diameters of dish you will want, pick a focal length that will provide a reasonable F/D over that range, and you can start on your dish project.

Method of Former Layout for Parabolic Reflector

The line VF represents the Focal Length. Lay this line out full scale on a flat surface. Next lay out line AA' perpendicular to VF. As stated in the text, I used two 4'x8' sheets of plywood laid end to end using the 16' edge of the plywood to represent line AA'. Since only half the former need be traced, I used the bottom 4' edge of the plywood to represent line VX.

The next step is to fix a nail of other pivot point at F and attach wire to the pivot. Now stretch the wire from F to V and back to X. Carefully mark this point on the wire. Now by moving point X on the wire along line AA' to each of the grid lines mentioned in the test, and keeping line PS aligned with the grid lines. The point where the wire folds back at P is the point of the parabolic curve.

Thus, you see that all waves from an isotropic source at the focus that are reflected from the parabola arrive at line AA' with equal phase, forming a uniform plane wave.

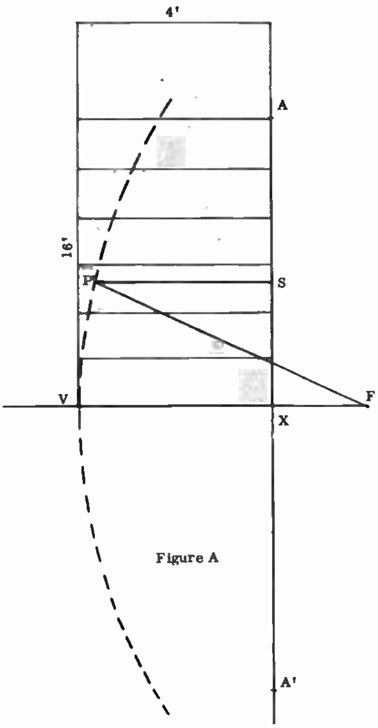


Figure A

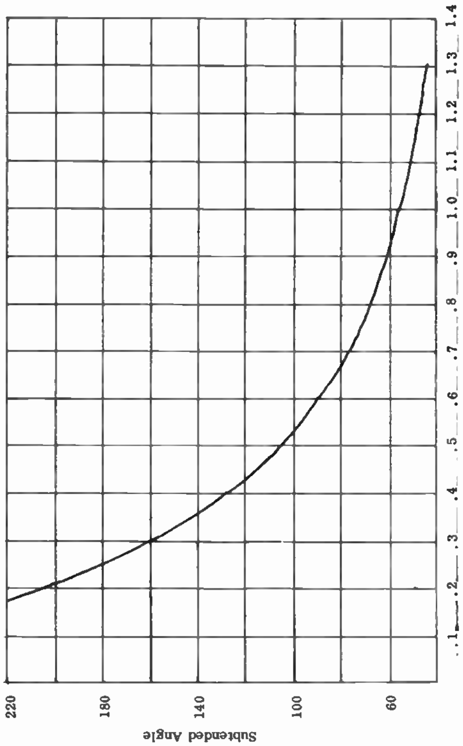


Figure B

Gain Table for Parabolic Antenna

FREQUENCY MC	Antenna Size in Feet 10	15	20	25	30	35	40	50	60	80
144	10.5	14	16.5	18.5	20	21.5	22.5	25	26.5	29
220	14	17.5	20	22	24	25.5	26.5	28.5	30	32.5
432	20	23.5	26	28	30	31	32.5	34	36	38.5
1296	29.5	33	35.5	37.5	39	40.5	41.5	43.5	45	47.5
2500	35.5	39	41.5	43.5	45	46.5	47.5	49.5	51	53.5

Gain is expressed in DB over isotropic

While the design information I have just given may be condensed, I think it represents most of the essentials. Any specific problems which may develop, drop me a line and I'll be glad to help. In addition, there are some good reference sources I'd like to mention for the advanced VHFER that can be a big help in antenna work for not only dish design, but general antenna work as well. One excellent book that covers just about all phases of antenna design and is fairly well up to date is Antenna Engineering Handbook by Henry Jasik and published by McGraw-Hill Book Co. This book is a good blend of both practical and theoretical information. Another excellent book on parabolic antenna work is the MIT Radiation Laboratory Series Volume on antenna design. It is available at a reduced price from Boston Technical Publishers, Inc., Box 111, Cambridge, Mass. 02139. It is #14 of the Series titled, "Microwave Antenna Theory & Design" by Silver-Price at $5.50, which used to be $12.50.

One other practical note concerning materials. I realize each person will have some personal preferences, but I can mention some materials that are good and others that are not so good for the reflector material. The general requirement of the reflector material is that the holes in it must not be greater than about .1 wavelength. When you use a material with a square hole, remember the hole size for RF is not the size of the square, but the diagonal across the square. This generally means that quarter inch square holes should be good through 1296 MC. While doing some planning for our new large aperature moon-bounce array, we made some measurements on aluminum window screen. This is far less expensive than hardware cloth and is much lighter. Some extremely accurate measurements were made at 10KMC. The results showed that the screen works very well even at this frequency, so it will work for any amateur work below 10KMC. The real problem no matter what material is used is surface tolerence. This is a bit harder to achieve with the aluminum window screen, ie: you have to support the window screen at more points than you do hardware cloth. My dish is covered with hardware cloth. The main disadvantage is cost and weight which can be overcome somewhat with the aluminum screen. One material which sometimes looks good, but really isn't is chicken wire. This material tends to develop problems of an electrical nature which are complex to explain — but make for some strange results at 432.

Next month I will take some time on the mounting arrangements that can make the dish point at the Moon. I've built several mounts — some good — some not so good, that we will examine in detail. I might suggest a look at my QST article of January 1965 on the principles of the polar mount, as I will pick up the mount discussion from that point on.

220 MC TRANSMITTING CONVERTER

by Dale Matthews, WA6TXH*

*513 K Street
Rio Linda, California

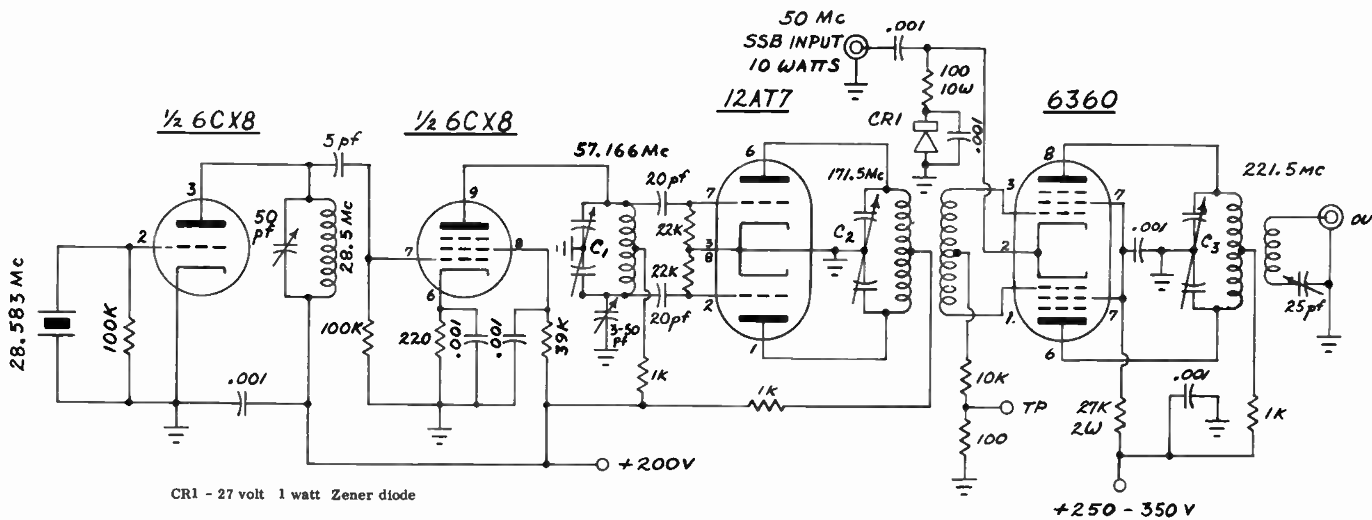
The converter described in this article was settled upon after trying several methods of obtaining 3-5 watts output on 221 MC SSB from a 6360 mixer. I have built three of these units and have obtained similar results from each unit. Several variations of each circuit were tried in an attempt to determine what difficulties could occur if the builder introduced some ideas of his own. No difficulties were encountered that were not easily met, and the end result was a stable 3-5 watts output on 221 MC, depending upon the voltage applied to the mixer unit.

The 6CX8 oscillator-doubler was used after it was found possible to obtain slightly more doubler output than with a 6U8 or 6EA8 type tube. The use of a GDO was invaluable in the construction of the units. All coils after the oscillator were wound on one fourth inch rods and then removed from the rod and placed in the circuit. This type of coil construction was well suited to the type of design used in this converter. The oscillator plate coil was wound on a three eights inch slug-tuned coil form and tuned with a variable capacitor. The variable capacitor could be omitted and replaced with a fixed value of approximately 30 PF and then resonated with the slug. The 3-30 mmf. variable in the bottom side of the 6CX8 doubler stage should be adjusted for maximum 6360 grid current by alternately tuning the padder and adjusting the main plate tuning capacitor. The 12AT7 tripler was found to give more than enough output to drive the 6360 mixer. A 6360 tripler was also used in one variation of the unit, however, the expense of the tube as compared to the 12AT7 did not warrant its use. The 6360 tripler, while giving more mixer grid current did not give any appreciably more output from the unit. The mixer grid current required to give suitable operation was in the neighborhood of one and one half to two milliamperes. The grid coil of the mixer is four turns of # twenty wire and adjusted to resonance by varying the spacing of the coil. Coupling was adjusted by physically varying the spacing between the tripler plate coil and the grid coil. Final tuning was done by observing grid current and then squeezing the coil until it hit resonance by a sharp increase in grid current. Unless you are lucky, there will not be any indication of grid current at first until you adjust the circuits to resonance. My method of preliminary adjustment consists of using a GDO as a wavemeter and peaking each circuit until I begin to get a reading on the grid meter and then adjust all circuits by the grid current meter of the mixer.

The output coil is two turns of number twelve wire one inch in diameter spaced one half inch. The output link is one turn of number twelve wire one inch in diameter. The one hundred ohm mixer cathode resistor consists of four, four hundred ohm two watt resistors in parallel. The mixing level was ten watts at fifty Mc. This gave five watts output on 221 Mc. with three hundred and fifty volts applied to the mixer plates. Two hundred and fifty volts produced about 2.5 watts. These readings were on a Bird Thru-Line wattmeter with a ten watt element into my eight over eight J beam. The converter in use now at my station is the same as described in this article with the addition of a straight through 6360 amplifier. This gives me ten watts to drive my 4X250B amplifier, which is plenty.

Some variations included using 14 Mc. as a mixing frequency and a different oscillator-multiplier chain. Some feed through of the oscillator was experienced at the mixer stage, but one straight-through stage eliminated this. Another version of obtaining bias was by inserting a twenty-seven volt zener diode in the ground side of the mixer cathode resistor and bypassing it with a .001 disc. This proved to introduce no problems as was anticipated, so I made the change in my converter.

I am holding weekly skeds on 220 Mc. with WA6GYD in Saratoga and find that so far I have not run into any difficulties in several months of operating. I hope to hear some more activity up there as it is not very crowded now and could well use some support. Good luck on your project.



CR1 - 27 volt 1 watt Zener diode

C1, C2, C3 - EF Johnson 160 - 208 Butterfly

WA6TXH

220 Mc TRANSMITTING CONVERTER

A GRID DIPPER FOR 432 MC.

by "Benny" Hudson, W5LGW

Someone has said that 432 Mc. is where the men are separated from the boys. Whether this is true or not I do not know, but at any rate, practically anything needed to get on this band must be home brewed. To a large extent this includes test equipment.

When I decided to try 432, one of the first things needed was a grid-dip meter. As all the commercially built jobs give up at around 250 Mc., I started a search of the magazines and handbooks for an article on such a weapon. The ones I found didn't suit for one reason or another. They were usually too spread out, the oscillator being one piece and the power supply and meter being located remotely. Some seemed unfinished in that they were just an oscillator.

The one to be described is strictly a one-band dipper tuning from 405 Mc. to 455 Mc. It is quite sensitive and gives a sharp dip at even one and a half inches from the tuned circuit. While the inductor does not plug in, this has an advantage of long-time accuracy. It can be calibrated with a frequency meter or lecher wires. If it should happen to not tune all the way to 450 Mc. due to variations in circuit layout, etc., another inductor about a 32nd of an inch wider will make it tune higher.

It is built in a Bud 5" x 2 1/4" x 2 1/4" box. Take the box apart and use the side with ends. (One piece has sides.) Using a file or grinder on the bend at one of the ends, weaken it until it can be neatly removed. Next, cut a piece of 3/16" plexiglass to fit the end of the half with sides. Drill and tap with 4-32 tap, two holes in the edge of one side of the plexiglass. Make matching holes in the box piece where the metal has been removed. With a little care in this you should now have a box that fits together as well as before but now having plexiglass in one end.

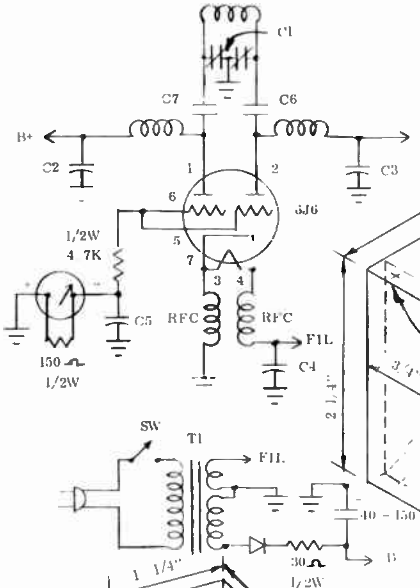
Next, using sheet copper, make the "Z" shaped chassis shown in the drawing. It is shaped thus to let the tube miss the meter and to put the pins closer to other components. Two points are important: get the hole for the tube socket and the one for the variable condenser located as shown. Also be sure that pins 1 and 2 on the socket are nearest this condenser. The button micas are mounted conveniently to serve as stand-offs for the RF chokes and grid resistor. All wiring on this chassis is done before installing it in the box. A matching hole is made in the mini-box for the butterfly condenser so that the 1 1/4" side of the chassis butts against the plexiglass. This will result in the shortest possible leads to the inductor.

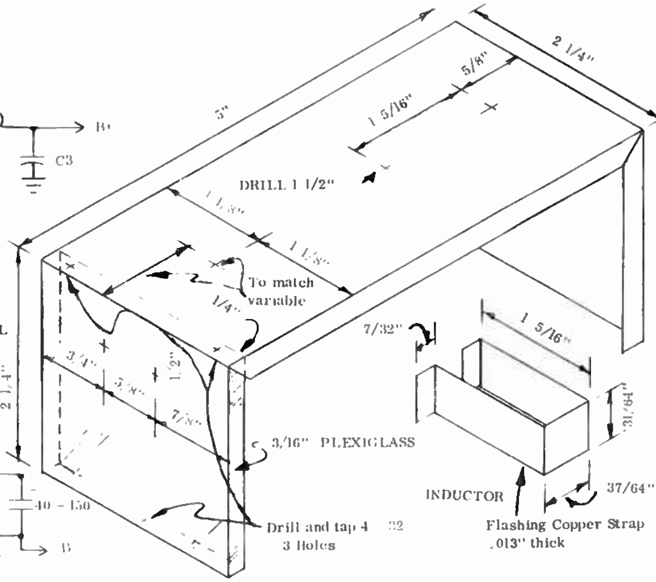
Use 8-32 brass or copper bolts to mount the inductor and GC solder lugs (5705 C) reached exactly from the bolts to the lugs on the variable condenser. The wire leads on the 5.6 pf. condensers were used to make a firm connection before soldering these in place.

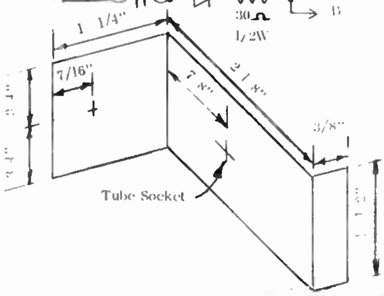
Any small meter could be used. A one mill meter would not require the shunt. The one used mounts in a 1 1/2" hole and is reasonably priced.

The power supply needs no description except to mention that the power transformer being on the outside was not an afterthought. The unit will run cooler with it here, thus eliminating drift.

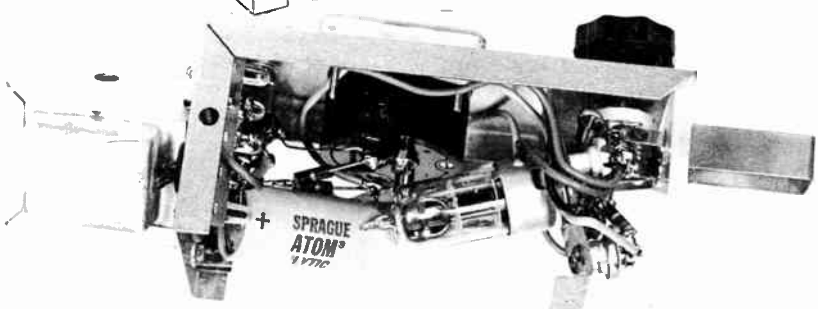
If the tube socket, the butterfly condenser and the copper strip inductor are mounted as described and shown in the drawing, the unit will tune the frequency stated. I have built two of them. End of text. See diagrams and photographs that follow.

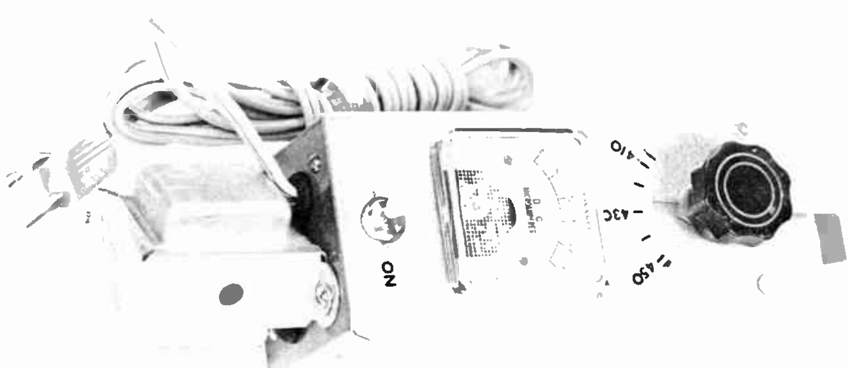






Chassis -- Bud CU-2104-A 5" x 2 1/4" x 2 1/4"
T_1 -- Merit P-3046
C_1 -- E.F. Johnson 160-203 1.4 to 5 pf. butterfly. 3 rotor. 2 stator plates.
C_2, C_3, C_4, C_5 --- 200 pf. button standoffs
C_6, C_7 5.6 pf. 5 ; NPO (Sprague 10TCC-V56)
Meter -- Monarch PMC 55 500 microamperes, or any 1 1/2" 1 ma. meter less 150-ohm shunt.
RFC -- 8" #24 formvar wound on 3/16" drill bit.
SW-- SPST toggle.





PICTURES OF OSCAR IV ON FRONT COVER

The pictures on the front cover are two of a set sent to us by the TRW Systems Amateur Radio Club of Redondo Beach, Calif. Captions for the pictures are below.

Fig. 1 shows the electrical components that comprise the TRW Systems RAC's Oscar IV Satellite. On the lower left, the large box is the 432 Mc. transmitter. Directly above the transmitter is the 144 Mc. receiver. Above the receiver, the small cylindrical module is the one-year timer furnished by Oscar, Inc. To the right of the receiver and below the timer is the box which contains the digital logic required for transmitting an identifying "HI" and a beacon signal each 10 minutes. Below the beacon logic is the Command Decoder enclosure. This box contains the logic that permits the Oscar IV transmitter to be turned off or on from a ground station. At the top three areas of the Oscar structure are the three antennas. These antennas provide the 144 Mc. input signal to the satellite receiver. At the bottom of the satellite (and of the photo) may be seen a portion of the 432 Mc. transmitting antenna.

Fig. 2 shows the Oscar Iv Satellite being assembled by three of the Radio Amateur Club members. From left to right are Herb Gleed, W6ZPX, who is shown placing the 432 Mc. transmitting antenna into position. He is being assisted by, second from the left, Archie Landry K6MSQ and D. Moore, who were responsible for much of the mechanical design. The launching cradle for the Oscar IV satellite is shown in the foreground. The launch and spin-up mechanism for Oscar IV is the spring in the center of the launch cradle shown at the bottom center of the photograph. The black covering on the satellite is made up of the solar cells which power it.

OSCAR IV AT PRESENT

This information may not be accurate but probably is. I think Oscar IV is unusable now for communications. For a while the fellows found that they could capture the repeater by leaving on their carrier and using f.s.k. The problem was that the beacon was running almost all the time. When it was attempted to use c.w. thru the satellite, the frequency instability of the repeated signal was so bad you couldn't copy. The beacon is still loud and clear tho as far as I know. You will recall that a number of predictions were made regarding frequency, bandpass characteristics, power required to get thru the satellite and the necessary receiver noise figure and antenna gain required to hear the signal. Most of those predictions turned out to be very much wrong. Part of it may have been due to the orbit but some others must have been a mis-calculation. At any rate it has been an extremely educational and interesting satellite with considerable value. Are you getting ready for OSCAR V?

MORE ON OSCAR in personal correspondence to K7AAD. From Art Hale, W4AWS in Orlando, Fla. "When I worked W6YK via Oscar 4, I was using your 432-2 barefoot and receiving via a 8/8 J-Beam. The beacon was about S2-S3 and W6YK peaked up to S-3. Was tilted up 55 degrees from horizontal and pointed about south. 800 watts on 144 Mc. 28 foot Yagi. PS W6YK was using one of your 432 Mc. preamps."

One of the most successful operators in any kind of 2 meter or 432 DX on the west coast is W6GDO in Sacramento area. Jay couldn't even elevate his 2 meter beam, but you'll see his call in the Oscar reports and here's what he did. I am pretty sure he does not have a California kilowatt. Just the ordinary mid-west type. He sent me this listing of confirmed QSOs thru Oscar IV.

Orbit Ø	W6YK-W4AWS	Orbit 2	DL9AR-DLØDB
Orbit 5	W6GDO-K6HCP	Orbit 10	W6GDO-K5WXZ
Orbit 12	WA2WEB-K2MWA/2	Orbit 15	W6GDO-W6FZA

Jay says the items necessary to work thru Oscar IV (before it went to pot) were full duplex capability (send 144.1, Rec. 431.944) with NO INTERACTION plus a second receiver continuously on the beacon. Jay uses a Parks 432-2 with a preamp made by W7UDM that uses a very low noise Motorola transistor. The contact between W6GDO and K5WXZ is a repeat of their Oscar III QSO. He says, "Al & I await Oscar V."

K2GUN in Scotch Plains, N.J. has been very active and I thought many of you would be interested in his commentsS Some are excerpts from a letter to Ed Tilton. " It was Dick, W2IMU, at the Crawford Hill Club (K2MWA/2) who first noticed that the beacon could be inhibited by a steady carrier and we ran tests with him on orbit 22. Using FSK here we found I could hold open the translator for periods of several minutes before my signal faded and the beacon recaptured the satellite. As long as the beacon is transmitting the translator is gated out of the circuit. The only time I can catch it is during the time it is sending HI. Of course if there are enough CW signals on during the HI the duty cycle will be large enough to accomplish the same thing but the pauses between letters, even at high speeds, will allow the beacon to come back on. I now have antenna separation and filters in front of the converter so I am able to listen on 432 while my carrier is on 144.1 Mc. I can listen to my own signals and copy others while holding back the beacon.

Good signals were heard from the following: Orbit Ø K6HCP, K2MWA/2, Orbit 2 UP2ON, W4WNH. I had a partial exchange with UP2ON. At the time I thought someone was telling me to move up 2 kc! The way the sigs were gated I got only portions of his call. This bothered me and when I got a chance I replayed the tape and sure enough, UP2ON is in there loud and clear. It is ironic because up until Oscar 3 I have spent a good portion of my 28 years of ham radio chasing DX on 20, etc. I guess I just didn't associate UP2 with 144/432 Mc. operation. Any other call would not have confused me. On orbit 5, KØRZJ, W9ZIH K6HAW, K6HCP, K2GUG heard. On orbit 17, HB9RG heard." Warren, K2GUN.

OPEN BANDS

by Marilyn Wiseman, K8ALO

Well, here I am back in the shack again. No column for December? Being laid up in bed from a fall prevented me from getting the column to Loren in time for publication. Things are back to normal again and I sure don't feel bad about that. News has been slow this past month. Hope reports pick up some. Be sure to send me your reports by the 15th. My address: Box 103 Petersburg, Ohio 44454.

50 Mc. ionospheric scatter

Dec. 1 K7ICW (Las Vegas, Nev.) wrkd K5OOJ, K5HVC (Tex.) hrd W5SFW, K5DOA, W5AQS 1900-1933

Dec. 4 K7ICW hrd K7BBO/7 (Wash.) WØEYE (Colo.), K5HVC (Tex.) and many 6s.

Dec. 5 WB6GKK (Tustin, Calif.) wrkd K7BBO (Wash.), K6RIL, WB6FSC 380 mi. 0900

Dec. 11 WB6GKK (Calif.) wrkd W7CNK (Wash.) K7ICW (Nev.) 1130-1230. K7ICW (Nev.) wrkd K7BBO/7 (Wash.) and many Calif. stations 0750-0929.

Editor's note: I'm cutting this a bit short this time because the same calls appear over and over. These fellows have good equipment and know how to use it. Anyone running a few hundred watts input with a half way decent antenna can get on the air Sat. & Sun. morning and make 500 to 1,000 mile contacts. The purpose of the scatter listing was to encourage others to get on in the rest of the U.S. and try east-west scatter. That hasn't happened. Aren't there any 500 watt type stations east of the rockies with operators who can handle c.w. at 5 words a minute? K7AAD

144 Mc.

Dec. 11 K7ICW (Nev.) hrd WØYMG in Wichita, Kans. 0600-0630

Dec. 19 K7ICW (Nev) wrkd W7HDP (Great Falls, Mont.) 0916

Jan. 1 W3PGV (Wilkinsburg, Pa.) wrkd W9YOI (Mundelein, Ill.)

Jan. 4 W8SKP (Chesterland, Ohio, W3EUJ (Pa.) wrkd. WA9HQB (Ind.) W3PGV (Pa.) wrkd W9YOI (Ill.), Hrd K9HMB.

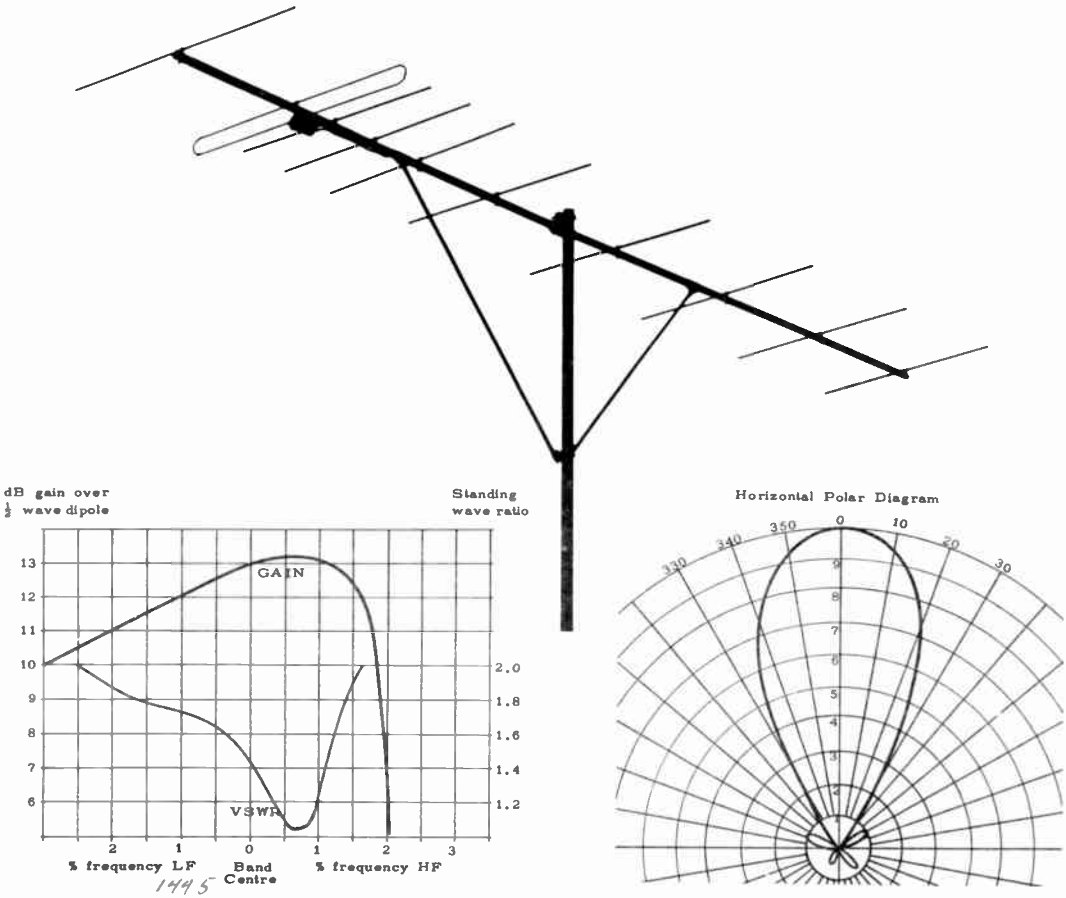
Jan. 9 W3ZJA (Pittsburgh, Pa.) wrkd VE1EF (Nova Scotia) 1810. W3PGV (Pa.) wrkd W4VCJ (Bluemont, Va.

432 Mc.

Jan. 1 WA9HUV (near Chicago) wrkd W3RUE (Pittsburgh)--reported by W9OKB.

Jan. 4 & 5 W9OKB (near Chicago) wrkd W8YIO, W8FWF, W8RLT (Mich.), W9BRN (Ind.) W8VOZ, K8REG (Ohio), W3RUE (Pa.)

SKYBEAM

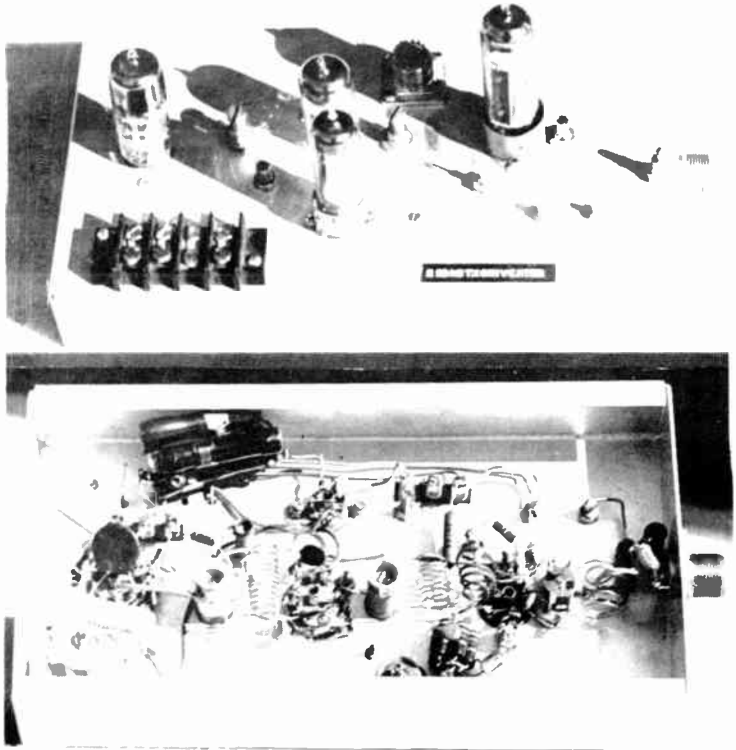


A PROVEN PERFORMER, this two meter SKYBEAM by J Beam Aerials, Ltd. of England. 13 db. gain over a dipole at 146 Mc., 15 db. over an isotropic radiator. Ruggedly built. Boom, elements and support rods of aluminum, 3 brackets of steel (plated). Available for feed with twin lead or coax. See the review in the May VHFER.

Write for literature and prices on this and other J Beams.

Gain, Inc. 27 E. 112th Place Chicago 28, Illinois

220 MC. TRANSMITTING CONVERTER DESCRIBED ON PAGE 8



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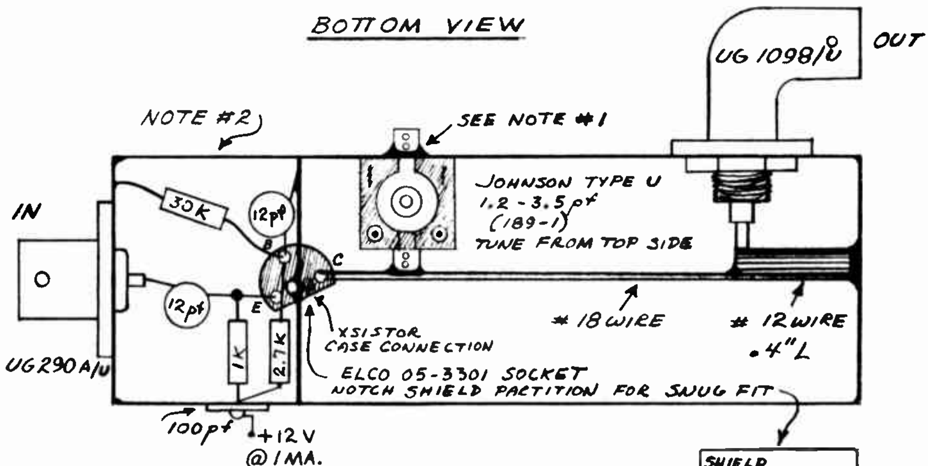
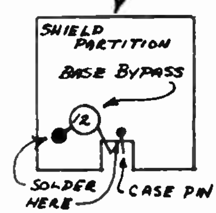
VHFER

50 MC. AND UP

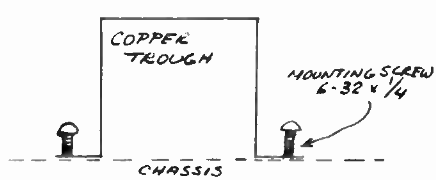
LEARN BY DOING

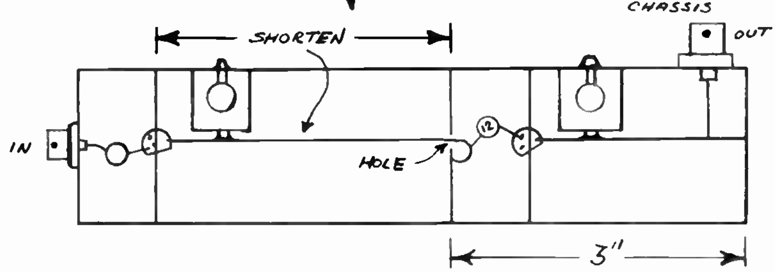
Volume 3, No. 12 December, 1965





1. Drill a small hole in the copper box.
   Pull rotor tab through side. Hold firm and solder.
2. Box is 1"x1"x3". Solder 2 end plates and 1 partition.
3. Suggested layout for cascade operation (2 stages) where integral construction is desired.





A 432 PREAMPLIFIER

NEW FIRM! NEW PRODUCTS!

WIDE BAND AMPLIFIER

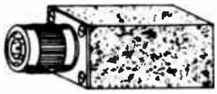
Modular, two transistor, silicon, wide band amplifier for preamplifier and general lab service are designed for use in 50 ohm coax systems. Frequency response is within one db from 10 to 250 megacycles. Gain over this bandwidth is guaranteed to be 10 db minimum. Typical noise figure is less than 5 db at 200 megacycles. Modules may be cascaded for increased gain without instability. Maximum input voltage for linear operation is 500 millivolts peak-to-peak. Model WB-1I is internally powered by two 9 volt batteries (supplied) and model WB-1E may be powered from an external source (not supplied). The amplifiers are housed in 4"x2"x15/8" minibox, grey hammertone enameled. Connectors: N, BNC, UHF or RF Phono. Price: $20.50 for either model, postpaid.*

RECEIVER PROTECTORS

Why buy protection? Semiconductors utilized in preamplifiers and converters can be severly damaged by leakage of transmitter power through inadequate antenna transfer relays. By placing a receiver protector between the relay and the protected unit this damage can be averted. Two model are offered: the RP-1 covering from 3 to 54 megacycles with better than 70 db isolation (also doubles as an in-line T/R switch with transmitters of less than 25 watts output), and the RP-2 for low noise VHF-UHF use with better than 40 db isolation from 50 to 450 megacycles. Neither needs tuning or creates harmonics which can cause TVI. Power for operation may be derived from transmitter or receiver. The RP-1 is contained in a 23/4"x 21/8"x15/8" minibox and the RP-2 in a 10"x2"x15/8" minibox; both are grey hammertone enameled. Connectors: N, BNC, UHF or RF Phono. Price: RP-1 $10.95, RP-2 $12.95. More information is available in brochure RP-1,2 free for the asking.*


LP-1NM


LP-1NF


MP-1NM

PRECISION COAXIAL TERMINATIONS

Two series of precision, 50 ohm, coaxial terminations are offered. The LP-1 series are capable of dissipating 1 watt and are useful for terminating test pieces, noise generators, directional couplers, and may be used for standards in VSWR bridges. VSWR of LP-1 series terminations is less than 1.05 from d-c to 1300 megacycles. The MP-1 series are designed for medium power; up to 12 watts continuous in 50 ohm coax without heatsink, and up to 25 watts with suitable heatsink. VSWR of MP-1 series terminations is less than 1.10 from d-c to 1300 megacycles. Connectors: type N only. To order suffix model number with M or F to indicate male or female; eg. LP-1NF. Price: LP-1 series $12.00 each, MP-1 series $22.50 each, both postpaid.* Ask for brochure PTC for more information.

BNC TERMINATIONS

Consist of a one-half watt, 5% carbon resistor enclosed in a carefully machined housing which is silver plated to ensure good RF conductivity. They are supplied with a 75 ohm resistor installed and a 51 ohm resistor to replace it for use in 50 ohm systems. The chain is 5½" in length. Brand new surplus. $1.75 each, postpaid.*

SILVER PLATED WIRE AND TUBING

Of pure copper, plated with 0.5 mil of high conductivity silver, they offer low loss for critical tuned circuits in converters, preamplifiers, transmitters,etc. Sizes are #16, 14, 12, and 1/8" OD tubing. Maximum length in one piece is 25 feet. Price for any size is 40¢ per foot. Minimum order $2.00.*

* Maryland residents include 3% state sales tax with order.

Radiation Devices Co.

PO Box 8450 Baltimore, Md. 21234

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

With winter ready to set in here in the Northern Hemisphere, most of the moonbounce activity has been reduced to talking and planning for next spring. There is one exception to the rule, K2UYH/2. Al and his moonbounce crew have obtained permission to use a commercial sixty-foot dish as a military research facility in New Jersey. They expect to be able to use the dish on weekends on a regular basis. At present, they are planning to use it about one weekend per month for moonbounce tests on 432 MC. Their first tests were made on November 29. There were some problems (as is to be expected on a first try of this nature), but they managed to hear their own echoes and were heard on a marginal basis by W4HHK. Paul heard their carrier just above the noise with his 18-foot dish. They are now in the process of working out some of their problems, and hope for the next try to come in the first part of January. Since operation time is usually not too definite until close to schedule time, I suggest you write to Al if you are interested. He plans to send postal cards just before each schedule.

At present, the K2UYH/2 operation is on 432 MC with an efficient 432 transmitter. The two meter exciter drives a 4CX300 tripler, which drives an RCA 7650 amplifier. Receiver is a Parks transistorized front end converter into a Collins R390. Plans are to have a paramp in front of the converter for the next tests. The antenna has both a 432 feed, and a feed that will work on two meters. If some interest can be demonstrated for two meter schedules, Al can make some two meter tests. Again, if you are interested, write to K2UYH. The address: Allan Katz, E. E. Department, Rutgers University, New Brunswick, New Jersey.

The activities here at W3SDZ have been rather limited due to a rather serious encounter with a virus infection. We spent two weeks in bed and another two weeks getting back to normal stride. This prevented our participation in the first K2UYH tests. Things are starting to get caught up, so after the holiday season, we expect to be ready for at least "weather permitting" type schedules.

Editor's Note: Vic promised an article on Parabolic Antenna Construction this month, and he submitted it as a part of his column. However we ran out of space and will therefore include it in next month's magazine which we HOPE to get out toward the first of the month.

OPEN BANDS column as of this last minute writing has not arrived so will have to go in next month.

VHFER magazine is published monthly by Parks Electronics Lab., Rt 2, Box 35, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions $2 per year, others $3 per year. Second class postage paid at Beaverton, Oregon

PHASE LOCKED LOOPS, PROMISE OR PRACTICALLITY

by Hank Olson, W6GXN*

There is something really fascinating about a device that, when tuned to a signal, "locks-on" and tracks the signal's variations in frequency as the propagation medium changes. But the fascination has hypnotized many engineers and amateurs far beyond any reasonable degree, to the point where any phase-locked receiver has an air of holiness about it in their eyes. In fact a phase-lock system is just another servo-mechanism and really ought to cause little more interest than the pneumatic servo (designed in the 1920's) that keeps the paper piano roll centered on a player piano, or a watt governor on an old steam engine.

To see just what a phase-locked loop really is, let's take a look at how it works; then we can discuss what it will and won't do.

The phase-locked loop is one of a class of detectors in which the signal being detected is of the same frequency and in a fixed phase relation with a locally generated signal. The methods of maintaining phase lock between signal and locally-generated demodulation voltage vary, and so there are several names by which such receivers are known. The Homodyne is the earliest name by which a phase-locked detector was known, and this one has been around since 1925.[1] This and succeeding similar detectors called "Synchrodynes" achieved phase-lock by injecting the signal into the local oscillation source. However, in the 1940 to 1950 period it was shown that a phase-detector and reactance tube could be used in a servo system to accomplish the same phase control as had previously been accomplished by injection locking. [2]

The elementary phase-locked loop shown in Figure 1 is composed of components familiar to most hams. The "phase-detector" is a device for multiplying two voltages together similar to the popular S. S. B. product detector. The "lo-pass filter" is the simplest type around: an "R-C". And the voltage-controlled-oscillator (V.C.O.) is what we often encounter in our F.M. broadcast receivers — an oscillator with a varicap or reactance tube across its tuned circuit.

From this elementary circuit, the variations and elaborations go in every direction, and we shall look at some of these, but first let's see what we have basically.

The phase-detector (being a product detector) multiplies a (strong) local signal by à (relatively weak) signal that we wish to detect. The fact that the local signal is the larger is only to assure that the device performs as a true multiplier, and is incidental to the explanation.

Consider the multiplication together of two signals, by our phase-detector, of the same frequency but in three different phase relationships. We can do this graphically as in Figure 2. Notice that the product of the signals "in-phase" produces an average positive value, and that the product of the signals "out-of-phase" produces an average negative value. But when the signals are in "quadrature" (90° out of phase with each other) the average output is zero since the product is simply a sine wave of twice that of either input frequency. Thus the output of a true multiplier is very reminiscent of the characteristic of our old friend the F.M. discriminator, but with 0° and 180° being the extremes, and 90° the center; see Figure 3.

In Figure 4, if the V.C.O. happens to have its output voltage in quadrature (90° out of phase) with the incoming signal, the output of the phase detector will be zero, and no correction will be applied (through the low-pass filter) to change the phase of the V.C.O. One will also note that a phase-detector characteristic of identical shape but opposite in slope exists for the 0° to -180° phase region. This makes the system really wonderful. Regardless of whether a correction voltage applied to the V.C.O. makes its frequency go up or go down, the system will still work properly. This is due to the ability of the phase detector to supply either slope as required for the sense of the V.C.O. This may seem odd to those familiar with A.F.C. circuits, where a reversed discriminator causes the oscillator to "push itself away" from any signal it approaches, but it really works that way!

In order that all the information be extracted from the incoming signal, a second phase detector is usually added with a 90° phase shift network, so that now we also multiply our two signals in-phase to produce amplitude information output. Actually, whether the two are in-phase or 180° out-of-phase is unimportant; it's only a question of whether we want our amplitude output positive or negative.

The basic phase-locked loop described above lends itself to many modifications as necessitated by convenience. Figure 5 shows how a particular V.H.F. converter, communication receiver combination could be made to operate as a phase-locking system.

In such a system, there is a progressive narrowing of the bandwidth as the signal goes through the receiver. At the antenna, the bandwidth (as restricted by the antenna's resonances) may be many megacycles. After the V.H.F. Converter this may only be several hundred kilocycles. And at the end of the communication-receiver I.F. amplifier the bandwidth is probably only several kilocycles. At this point we extract the pre-detected I.F. signal and put it into our phase-locked loop, which once again narrows the bandwidth. The effective bandwidth at the "phase-out" is twice the Lo-Pass filter's cutoff frequency. That is, if the low pass filter were as in Figure 6, consisting of 0.1 megohm and 1 mfd. it has a time constant of $(0.1 \times 10^6) \times (1 \times 10^{-6})$ or 0.1 sec. Therefore, its low pass bandwidth is 1/2 times $\frac{1}{0.1\ \text{sec}}$ or about 1.6 cycles per sec., and an equivalent I.F. bandwidth of 3.2 cps. This may sound like an awfully small bandwidth, but a number of systems are in commercial use which use even smaller bandwidths. Since the "loop-bandwidth" can be well above one-to-one even though the signal, as it comes out at the end of the communication receiver I.F., was well down in the noise. Also, the signal-to-noise ratio at the "amplitude-out" is the same as that in the I.F. output, since in Figure 4 no low-pass filter in the amplitude channel was shown. Any convenient low pass filter may be used after this (quadrature) detector to narrow the bandwidth of this channel, since it is not part of a servo loop and stability criteria need not be observed.

*3780 Starr King Circle
Palo Alto, California

The phase-lock system shown in Figure 5 uses A.P.C. (automatic phase control) of the oscillator operating at the frequency of the I.F., but any of the three oscillators in the system could be made the V.C.O. Figures 7 and 8 show the same system as modified to use A.P.C. of the communication-receiver local oscillator or the V.H.F. converter crystal local oscillator, respectively. The one thing that must be remembered is that regardless of which oscillator in the system is made the V.C.O., the others must be made stable to a degree such that they do not drift beyond the limits of loop bandwidth. This usually means that crystal control is used on any oscillator that is not to be A.P.C.'ed or manually adjusted. In a system wherein there are a large number of conversions, often all frequencies but the V.C.O. injection frequency are synthesized from a single very stable crystal oscillator. One particularly satisfactory configuration is to make the V.C.O. also the manually adjustable oscillator (for tuning), and crystal-control all the others.

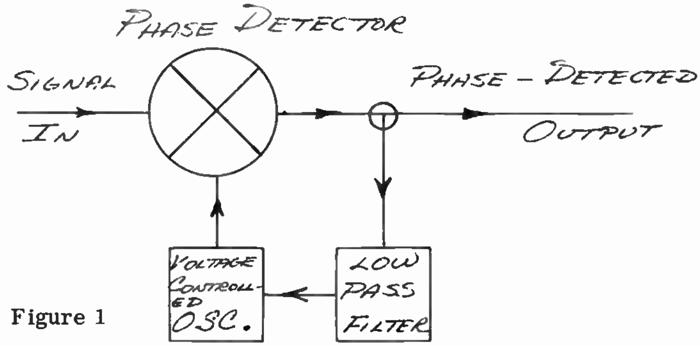


Figure 1

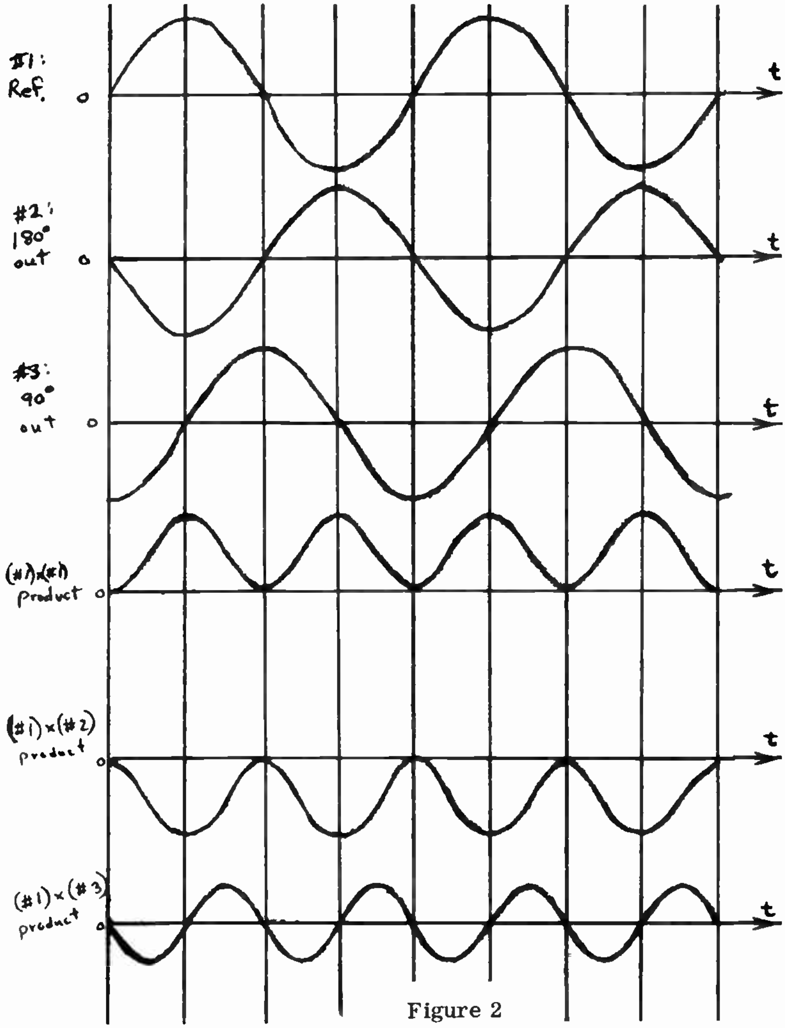
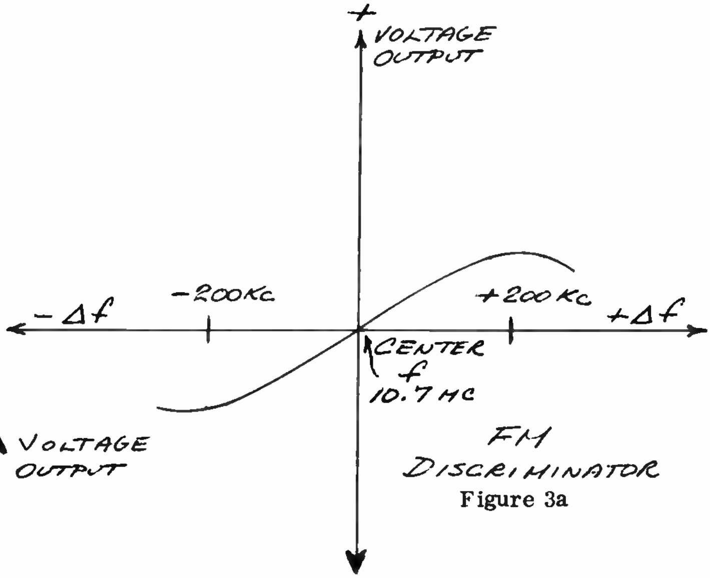
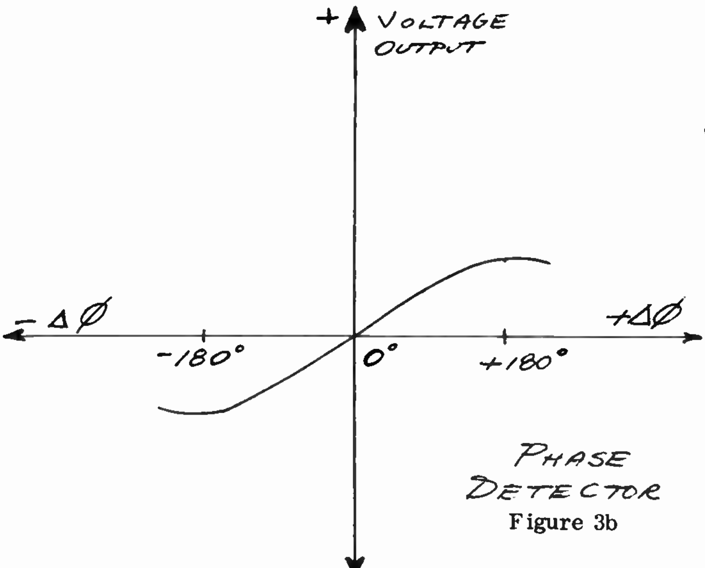


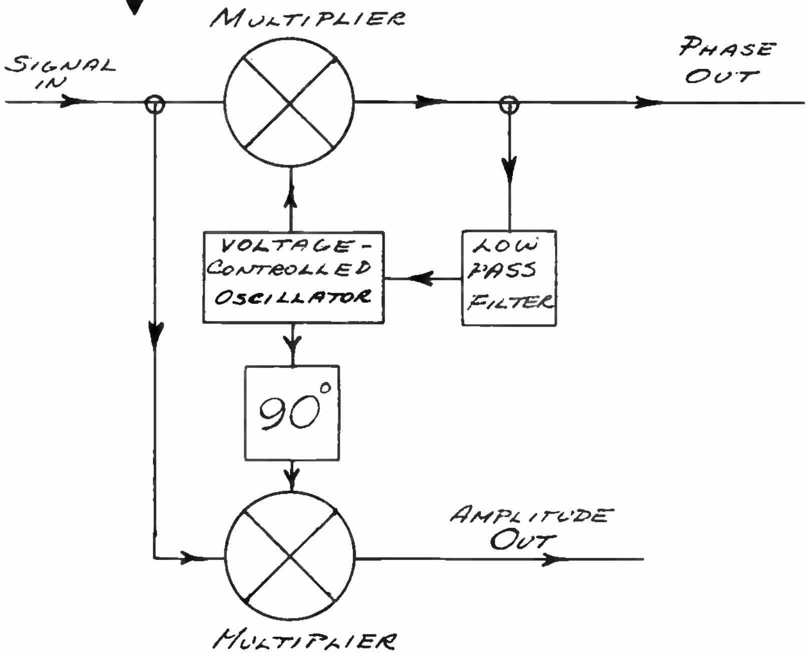
Figure 2



FM
DISCRIMINATOR
Figure 3a



PHASE
DETECTOR
Figure 3b



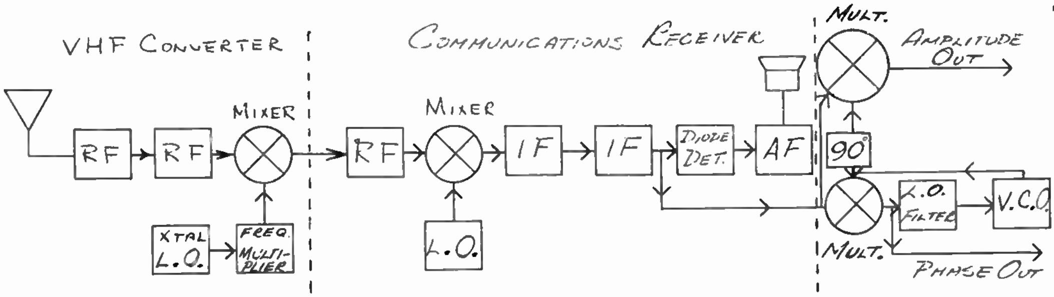


Figure 5

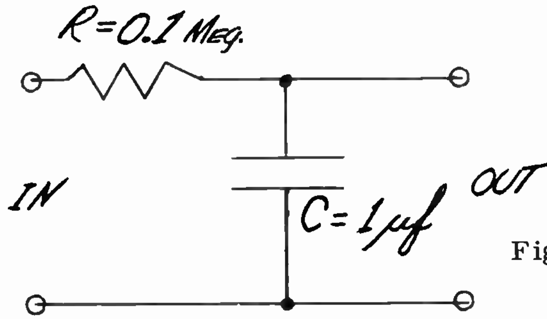


Figure 6

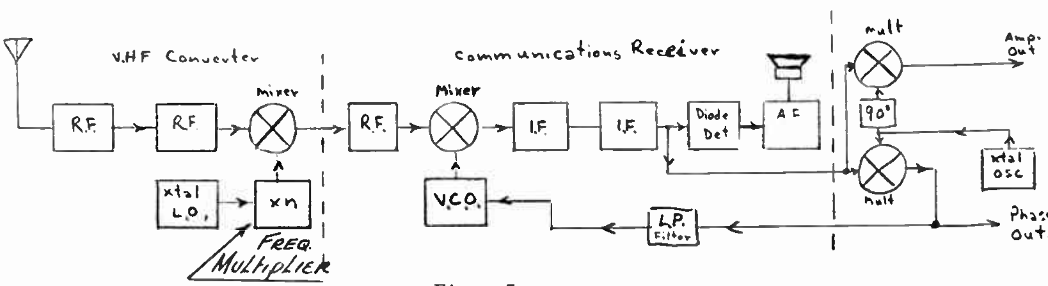


Figure 7

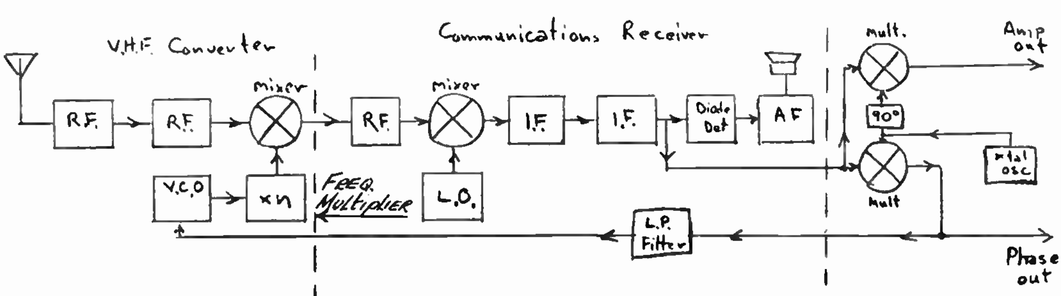


Figure 8

Such a system is shown in Figure 9, as it was built for satellite reception in our own shack. The phase detectors used in this system were direct copies of those modified from "Microlock" by W6VZA, and a standard Collins P.T.O. was converted to a V.C.O. by the simple addition of a varicap. [3] The system would not only lock on -140 dbm signals at 216 Mc, but the communication receiver (without the converter ahead of it) would nicely lock on to WWV at 20 Mc. Note that two of the three oscillators in the system are crystal-controlled.

A careful look at Figure 9 will reveal that a limiter has been added in the phase-detecting channel so that the loop is not amplitude sensitive. This is standard practice in phase-locked loops and was omitted in the previous explanation for simplification. Also, note the cathode-follower after the low-pass filter, which is a great convenience in several respects. It allows the low pass filter to work into a nearly infinite impedance, as it must if it is to function properly. Secondly, since most phase detectors have an output level of zero volts for a 90° phase relationship, the cathode follower provides a small positive voltage output for varicap bias when its input is at zero. See Figure 10 for the cathode follower levels; note that its plate voltage must be regulated, as variations in E_b will show up at the cathode and hence move the varicap voltage agound. In Figure 10, R3 provides a small variation in the varicap bias that is handy for adjustments. (It also changes loop gain, so adjustment range should be kept small.)

The small resistor R2 is a most important feature, which also was left out of the initial description of a phase-locked-loop. It is a rather small resistance compared to R1 and modifies the low-pass characteristic, as shown in Figure 11. As can be seen, the presence of R2 means that at high frequencies, where C is essentially a short, the filter is a voltage divider with an output to input voltage ratio of $\frac{R2}{R1 + R2}$. The presence of this small resistance usually will make the difference between success and failure of a phase-locked loop. Many designs that will work with no low-pass filter between phase detector and V.C.O., will not work when an R-C filter is added. In servo language this is known as "proportional plus linear" control.

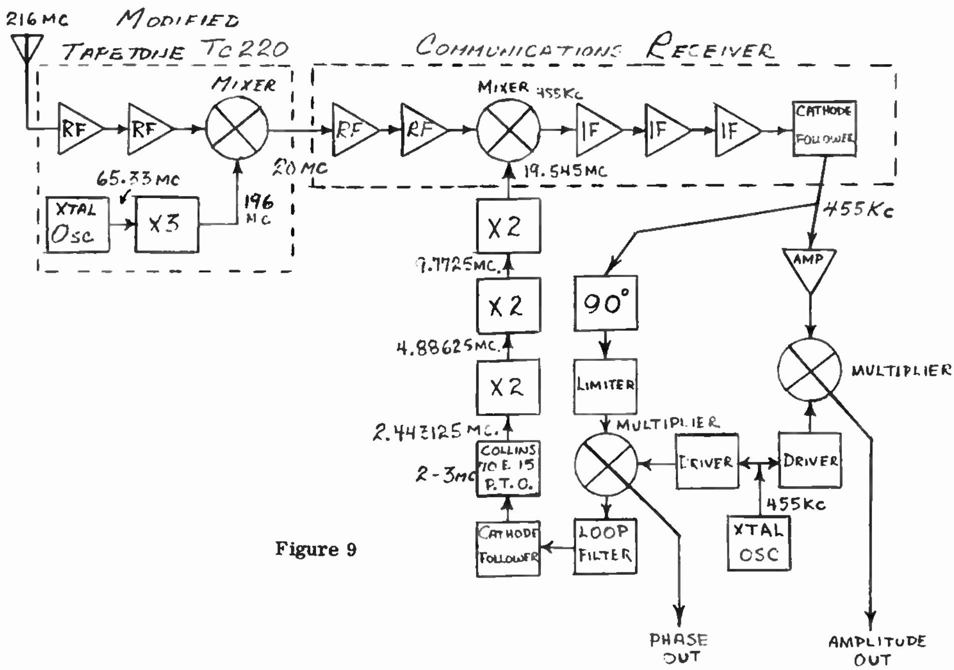


Figure 9

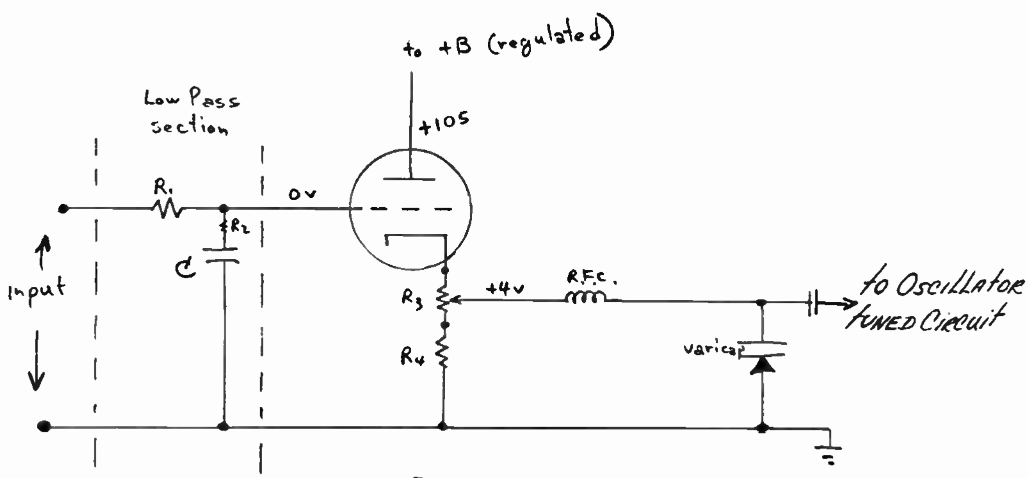


Figure 10

One other point of potential trouble in the phase-locked loop is the method of controlling the frequency of the V.C.O. If one puts a varicap in an oscillator circuit one must be sure that the oscillator R.F. voltage across the varicap is smaller than the varicap back bias. Otherwise, the varicap (a diode) can be driven into conduction, self-biasing sets in, and troubles result. A method of avoiding this is to use two varicaps as in Figure 12. The particular V.C.O. in Figure 12 is a crystal type used where only small amounts of shift are desired (nearly all the applications where phase locked loops are used). In this circuit the varicaps modify the serics-mode resonance of the crystal, much as the crystal V.F.O. operated in a recent article by Tilton. [4]

The phase-locked loop is very attractive as a weak signal detector because it gives the equivalent of a narrow pre-detection bandwidth even at a fairly high I.F. frequency. This means, for instance, that a 100 cps bandwidth system can be built whose lowest I.F. is say 7 Mc; making successive conversions to lower I.F.'s unnecessary. However, it has one rather annoying feature, it stays locked on a signal over a greater range in frequency than it will acquire lock to a signal. This can be a bit disturbing on radiotelegraph signals because if the signal is near the outer limit of locking (having drifted say due to doppler change) during a "dash", the system won't relock on the next "dash" or "dot".

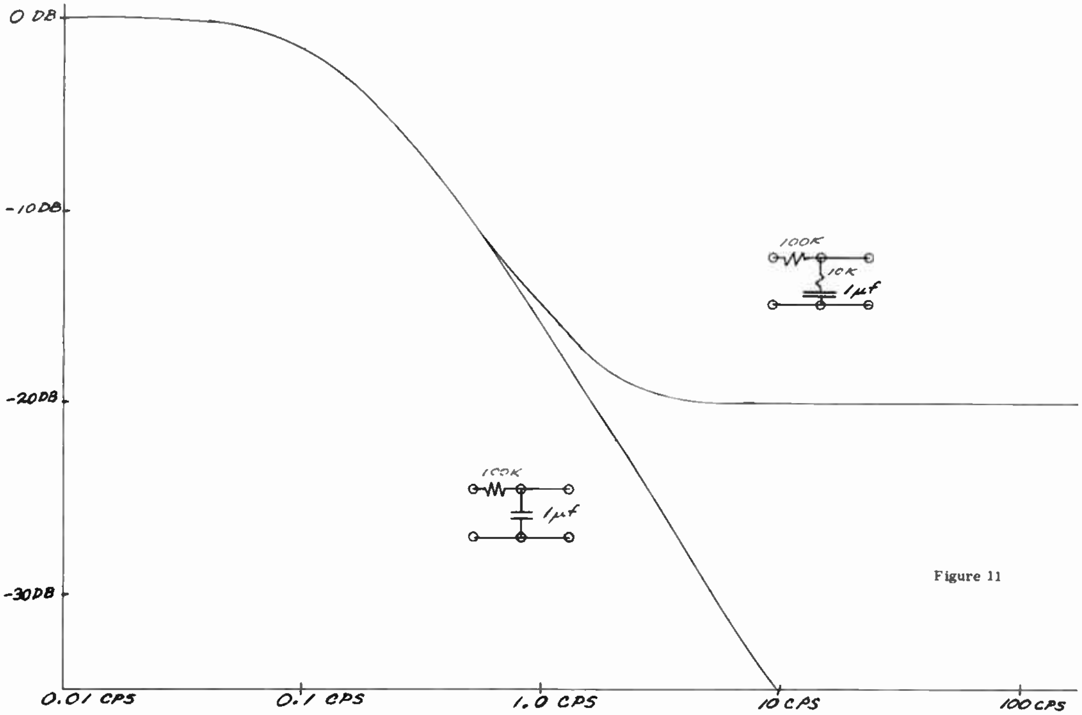


Figure 11

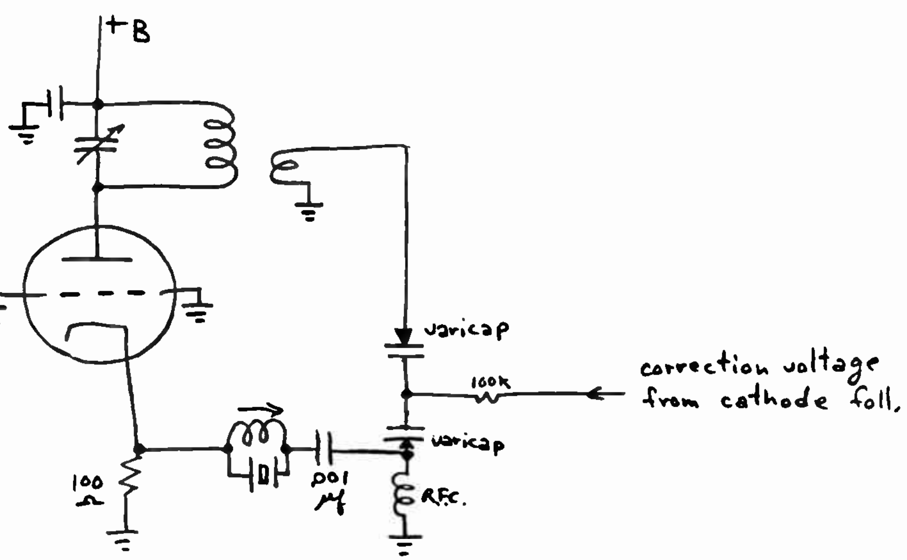


Figure 12

This inequality of hold-in range to pull-in range can be corrected by the "polylock" modification as described by Burhans[5] However, even when the pull-in and hold-in ranges are equal, it would be preferable if the loop didn't have to exert itself· relocking on each dot and dash of Morse code as signal arrived at the receiver. This is simply because the equivalent narrow predetection-bandwidth of the phase-locked-loop is not realized until phase-locking action is established.

The only two amateur articles that this author knows of which actually describe how to build phase-locked-loop circuits are oriented toward reception of the constant-tone signals from satellites.[3,5] Both of these articles are worth-while and should be consulted if you're interested in satellite tracking or more background on phase-locked loops.

What, then, can be done to keep the loop locked up all the time so that the benefits of its narrow bandwidth can be realized? One solution might be to send a pilot carrier near the information channel whose only purpose is to supply phase information to the receiver. Such a system is employed in commercial F.M. Stereo Multiplex quite successfully. This is also in effect the method used in S.S.B. Reduced Carrier, where a portion of the old A.M. carrier is left in the S.S.B. signal for a YRS-1 to lock on.

Such a system might make use of an ordinary S.S.B. transmitter with enough carrier reinserted (say, by unbalancing one of the balanced modulators slightly) to equal the level of a single tone's sideband. The single tone, say at 500 cps, is keyed. At the receiving end. a phase-locked loop locks to the carrier as usual. However, a second oscillator 500 cps removed from the frequency of the reference oscillator, which feeds the phase detector, is used to drive a product detector from the same I.F. signal. In this system, it is easiest if an oscillator other than the last (I.F. frequency) is made the V.C.O. Such a receiving system is shown in Figure 13. Of course, if L.S.B. transmission were used the auxiliary B.F.O. frequency would be 500 cps below 455.0 Kc. (454.5 Kc instead of 455.5 Kc.)

The assumption that underlies this mode is that the propagation medium will affect two signals separated by only 500 cps in nearly the same way. That is, a 432.0000 Mc spectral line will be doppler-shifted on an earth-moon-earth path very nearly the same as a 432.0005 Mc spectral line. In any case the <u>difference</u> in dopplers should be smaller than our 10 cps bandwidth.

Note that there is no 90° phase shift network in the system in Figure 13. This is simply because there is no phase coherence between the pilot signal and the information signal, and it would be superfluous.

Another method of keeping the loop locked up, yet transmitting information simultaneously, is to use <u>slow</u> phase modulation telegraphy.

Every first order phase-tracking loop (we have thus far limited our discussion to "first order" loops in which the servo error voltage is proportional to frequency error) has an ability to stay locked to a signal so long as: 1. The signal stays within the hold-in range and 2. The rate of change of phase does not exceed some factor α . If we then assign to a positive change in phase a "make" significance, and arrange our transmitter so that when we press the key down ("make") the transmitter phase <u>slowly</u> ramps up to a fixed "more positive" phase, we can transmit information. This will show up in the "phase out" part (Figure 4) at the receiver, and the quadrature channel can again be deleted. The slow ramping up (and back down) in phase is all important if the loop is to stay locked. This is simply so that the rate of change of phase never exceeds α .

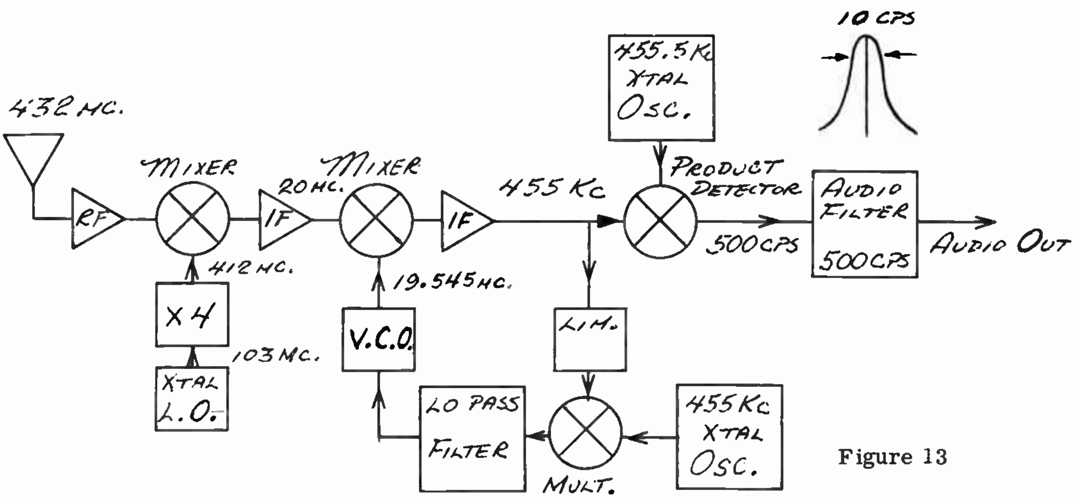


Figure 13

Both of the above methods of fully utilizing the inherently narrow bandwidths of phase locked loops are in the category of special purpose systems. That is, the two stations trying to make QSO are matched in modes in a rather special way. This prospect may seem not compatible with ham radio, but it is akin to V.H.F. - DX scheduling wherein many other details (time, sequence of calls, exact frequency, and whether telegraph, L.S.B. or U.S.B. is to be used) are exchanged prior to the actual attempt.

Implicit in all the above discussion of phase locked loops is that all the oscillators in the system must be quite stable (including the V.C.O.) with time. If they are not stable, then the locked loop has to "work harder" to keep up with these non-productive variations in phase and therefore we reducd the received information rate of which the system is capable. In short, the phase-locked loop is a swell gadget, but it's not meant to "take up all the slop" in a poorly designed system.

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OSCAR IV IS UP

OSCAR IV went up on Dec. 21 as planned but it wasn't ejected as planned because the missile engine or whatever didn't fire the third time and therefore it didn't get into the synchronous orbit. Confusion was rampant following the launch and even OSCAR headquarters was having trouble knowing where it was and what was happening. First contact through it we know of was W6YK working W4AWS. Its for sure that contacts were scarce as hen's teeth though many stations were heard thru the repeater. If you're one of the ones not hearing anything you aren't alone. K6HAA in southern Calif. reported signals about S-4 coming thru the repeater. He could not hear the repeater's receiver noise, just the signals and the beacon at ten minute intervals. His antenna is a 64 element extended-expanded colinear (as in CQ Handbook). Both W6YK and K6HAA used Parks converters. So did Parks but he didn't hear anything, nor did anyone else in this area I know of. Not knowing where to point and when to listen (at this writing) is a heck of a handicap. OSCAR project's frequencies on SSB are 3935, 7235, 14235 and 21335 at 8 PM PST. Chance to ask questions follows the broadcasts. The satellite is within range for about 4 hrs at a time, maximum I believe. Expected life is one to two years. Orbit is about 10 hours. It is always to the south of the U.S., never coming farther north than 26 degrees above the equator. Highest point is 18,200 and lowest 106 miles---very elliptical. Output center frequency is about 431.940 and the beacon is about 431.925---quite a deviation from original figures apparently due to propagation or doppler or something else beyond my understanding. Apologies for any misinformation. Listen to Project Oscar reports for more accurate and complete details. K7AAD

A TRANSISTOR PREAMPLIFIER FOR 432 MC.

by R. L. Measures, K6OKC*

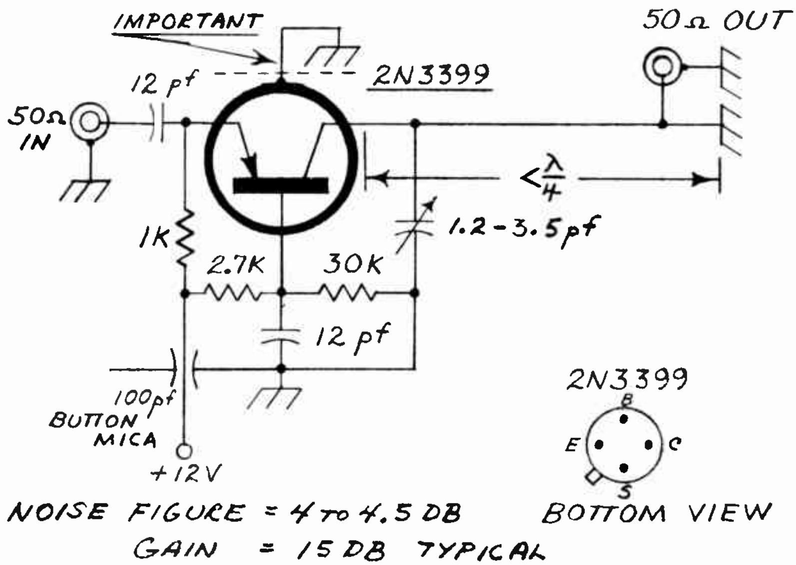
The transistor preamplifier is here to stay, in spite of the r. f. burnout problem (which can be whipped.) Especially now with Oscar IV to go into orbit shortly, a low-noise preamp will be necessary to permit copy of its weak 432 signal.

This preamplifier uses the Amperex 2N3399 which is relatively inexpensive ($2.55 singles from Newark, Chicago). While there are other transistors available now which perform as well (or a little better) there may be stability problems with some of them. The 2N3399 is a "proven performer." Other types you may get working are TI-X MO5, TI-400. The TI-400 is shielded but the TI-X MO5 isn't and may be a little wild.

One stage of preamplification is adequate for a good crystal mixer followed by a low noise 28 Mc. preamp. A small improvement can be secured by using two stages of r.f. amplification at 432, but the difference is less than 1 db. using a 1N21C mixer. You can't hear 1db.

WB6LLT made the converter described in the October VHFER and used one r.f. stage ahead of it. It is not notably worse than my 2 r.f. stage job. In fact the difference by ear is insignificant on a weak cw signal.

Sometimes instability is encountered with 2 r.f. stages. This can be caused by using a source impedance other than 50 ohms. If you use other than 50 ohm coax feed line, it might be wise to provide an alternative output after one stage of r.f. in case you have problems with two. A single stage preamp at the antenna is probably a good route to go. Keep in mind that too large a dose of r.f. on the transistor will cause the noise figure of the preamp to deteriorate even though the transistor doesn't burn out. It pays to have some sort of testing method to let you make sure everything is as it should be from time to time.



2N 3399 PREAMP FOR 432 MC.

See Additional Diagrams on Front Cover.

*1121 Glenwood
Oxnard, California

TRANSISTORS AS I. F. PREAMPLIFIERS

by Henry Cross, W1OOP*

A sample I. F. preamplifier for 30 Mc. was constructed using three stages, unneutralized, of grounded-emitter amplification. For NPN testing the second and third stages were Fairchild SE-3001. For PNP testing Philco type 2N1747 were used. 12 volts was used on NPNs and 10-1/2 V (poled the other way) for PNP tests. The gain of this unit was sufficient to run directly into a HP340B automatic noise figure meter. The noise source was an HP345B, set up at 400 ohms in all cases. There was no transformation between the noise source and the base of the first stage, but there was a parallel-resonant tuned circuit (about 30 pf of tuning capacitance total) which (when it was tuned) seemed to have a small effect on noise figure. Collector current was adjustable. Bandwidth was several MC/s.

The data, somewhat digested, is given in table 1. Fig. 1 shows the amplifier. There was some trouble with instability in the amplifier for certain conditions of tuning, which were not close to the conditions for best noise figure.

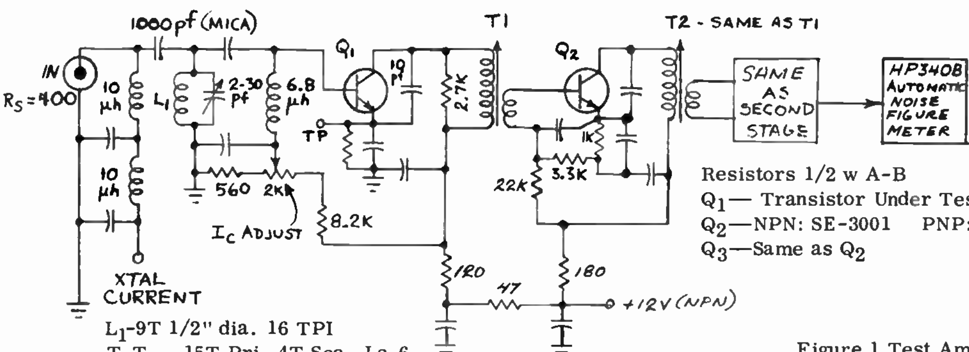
Conclusions: Transistors similar to type 2N2857 can give good noise figures in IF preamplifiers, although the variation at 30 mc in a type whose noise figure is controlled at 450 mc is more than 1 db, leading to a considerable variation in total NF for the crystal mixer receiver.

Also: the better mesa transistors seem quieter at medium to ultra-high frequencies, and may be preferred for some applications where temperature variations don't matter too much, but SOME of the silicon transistors are as quiet as the best third of the mesas.

Transistors as I. F. Preamps

Table 1 Condensed Data

Mfr.	Type	Number Tested	Ave. NF at 220 mc	NF at 30 mc (R_s = 400) Average	Best	Cost
KMC	2N2857	2	1.7 db	1.05	1.0	$18
RCA	2N2857	10	2.53 (2.0 best)	1.54	1.2 (worst 2.0)	
RCA	2N3478	8	2.31	1.26	1.0	$1.90
KMC	2N2663	5	2.43	1.7	1.2	$8.00
FSC	2N3563	5	3.95	2.9	2.5	
			Mesa types:			
TI	2N2997	4	2.7	1.05	0.9	$3.63
TI	TI-400	3	3.1	1.2	1.1	$0.94
TI	TIXMO5	2	1.97	1.3	1.3	$0.62
Philco	T2028	1		2.0		
Philco	2N2398	1	4.0	2.0 Obsolete Types		



Resistors 1/2 w A-B
Q_1— Transistor Under Test
Q_2—NPN: SE-3001 PNP: 2N1747
Q_3—Same as Q_2

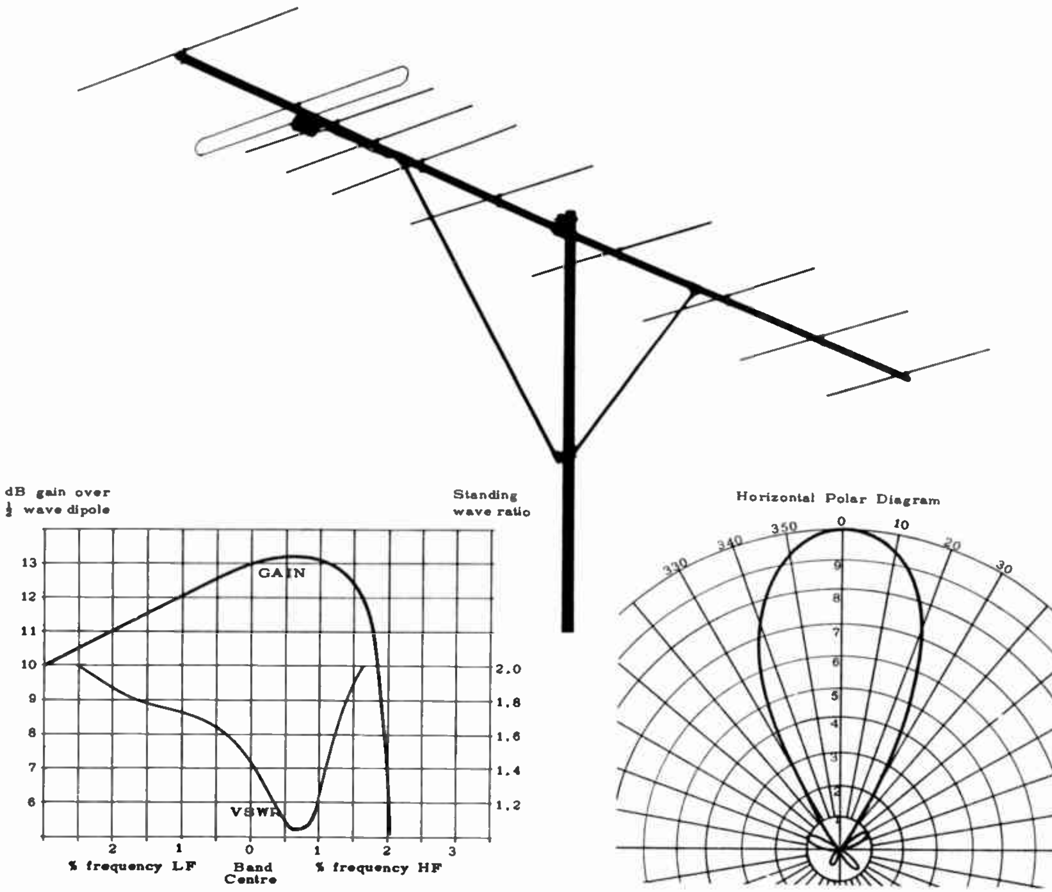
L_1-9T 1/2" dia. 16 TPI
T_1T_2— 15T Pri. 4T Sec. Ls-6

Figure 1 Test Amp.

*111 Bird's Hill Ave.
Needham, Mass. 02192

INDEX-1965

SKYBEAM



A PROVEN PERFORMER, this two meter SKYBEAM by J Beam Aerials, Ltd. of England. 13 db. gain over a dipole at 146 Mc., 15 db. over an isotropic radiator. Ruggedly built. Boom, elements and support rods of aluminum, 3 brackets of steel (plated). Available for feed with twin lead or coax. See the review in the May VHFER.

Write for literature and prices on this and other J Beams.

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Meteor scatter and long hall skeds wanted above 145 Mc. Long hall skeds wanted to the southern part of California. Write: James M. McKellips, WB6NFT, 316 Louie Ave., Lodi, California 95242.

Meteor Skeds Wanted. W4CKB, Lake Placid, Florida looking for skeds. Needs Ohio and others. Equipment: KW, long yagi up 70 ft. or 240 ft. above sea level, 75A3 and Parks Nuvistor Converter, Frequency — 144.080. Bev Cavender, W4CKB, Box 88, Lake Placid, Florida.

Meteor Skeds Wanted. Write: Donald H. Learned, Bear Hill Road, North Chichester, New Hampshire.

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VHFER

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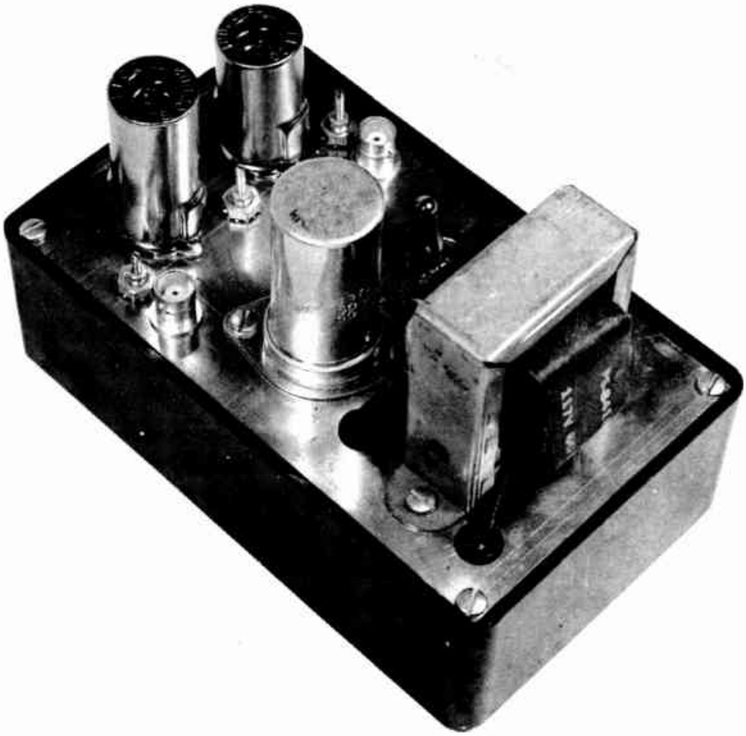
50 MC. AND UP

Volume 3, No. 11

November 1965



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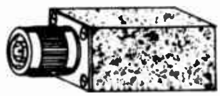
Modular, two transistor, silicon, wide band amplifier for preamplifier and general lab service are designed for use in 50 ohm coax systems. Frequency response is within one db from 10 to 250 megacycles. Gain over this bandwidth is guaranteed to be 10 db minimum. Typical noise figure is less than 5 db at 200 megacycles. Modules may be cascaded for increased gain without instability. Maximum input voltage for linear operation is 500 millivolts peak-to-peak. Model WB-1I is internally powered by two 9 volt batteries (supplied) and model WB-1E may be powered from an external source (not supplied). The amplifiers are housed in 4"x2"x15/8" minibox, grey hammertone enameled. Connectors: N, BNC, UHF or RF Phono. Price: $20.50 for either model, postpaid.*

RECEIVER PROTECTORS

Why buy protection? Semiconductors utilized in preamplifiers and converters can be severly damaged by leakage of transmitter power through inadequate antenna transfer relays. By placing a receiver protector between the relay and the protected unit this damage can be averted. Two model are offered: the RP-1 covering from 3 to 54 megacycles with better than 70 db isolation (also doubles as an in-line T/R switch with transmitters of less than 25 watts output), and the RP-2 for low noise VHF-UHF use with better than 40 db isolation from 50 to 450 megacycles. Neither needs tuning or creates harmonics which can cause TVI. Power for operation may be derived from transmitter or receiver. The RP-1 is contained in a 23/4"x 21/8"x15/8" minibox and the RP-2 in a 10"x2"x15/8" minibox; both are grey hammertone enameled. Connectors: N, BNC, UHF or RF Phono. Price: RP-1 $10.95, RP-2 $12.95. More information is available in brochure RP-1,2 free for the asking.*

LP-1NM

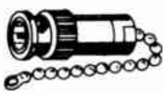
LP-1NF



MP-1NM

PRECISION COAXIAL TERMINATIONS

Two series of precision, 50 ohm, coaxial terminations are offered. The LP-1 series are capable of dissipating 1 watt and are useful for terminating test pieces, noise generators, directional couplers, and may be used for standards in VSWR bridges. VSWR of LP-1 series terminations is less than 1.05 from d-c to 1300 megacycles. The MP-1 series are designed for medium power; up to 12 watts continuous in 50 ohm coax without heatsink, and up to 25 watts with suitable heatsink. VSWR of MP-1 series terminations is less than 1.10 from d-c to 1300 megacycles. Connectors: type N only. To order suffix model number with M or F to indicate male or female; eg. LP-1NF. Price: LP-1 series $12.00 each, MP-1 series $22.50 each, both postpaid.* Ask for brochure PTC for more information.



BNC TERMINATIONS

Consist of a one-half watt, 5% carbon resistor enclosed in a carefully machined housing which is silver plated to ensure good RF conductivity. They are supplied with a 75 ohm resistor installed and a 51 ohm resistor to replace it for use in 50 ohm systems. The chain is 5½" in length. Brand new surplus. $1.75 each, postpaid.*

SILVER PLATED WIRE AND TUBING

Of pure copper, plated with 0.5 mil of high conductivity silver, they offer low loss for critical tuned circuits in converters, preamplifiers, transmitters,etc. Sizes are #16, 14, 12, and 1/8" OD tubing. Maximum length in one piece is 25 feet. Price for any size is 40¢ per foot. Minimum order $2.00.*

* Maryland residents include 3% state sales tax with order.

Radiation Devices Co.

PO Box 8450 Baltimore, Md. 21234

OSCAR IV DELAYED

Word as of Dec. 3 is that the Titan missile carrying Oscar IV is still on the revised schedule of Dec. 21. That is the earliest date, it may be later. Output frequency is 431.950 by last word here. 3 to 3.3. watts output. Receiver noise figure 2.8 d.b. You may have to elevate your antenna to 50 or 60 degrees or more to be able to track. Height is about 18,200 nautical miles.

FANTASTIC METEOR SHOWER

Leonids was really hot Nov. 16th K7ZIR called CQ and had four answers from four states on two. The contact that resulted from the CQ was in Montana. His neighbor W7UAB (Ore.) tail ended that QSO and made it also. ZIR worked 4 states in one morning. Others had good results too. Herés a sample of how things went:

K5WXZ	Texas	WA2FGK (N.J.), W4WNH (Ky.), W4VHH (N.C.), K7ICW (Nev.) W7JRG (Mont) and W8BKI (W. Va.)
W5UGO	Okla.	23 states heard on 2, 5 new ones worked. W1AZK (N.H.), WA2FGK (N.J.) on a CQ! , K7ICW (Nev.) in less than 1 min. of sked time, W7MFP (Utah), K7NII (Ariz.)
W6GDO	Calif.	WØEYE (Colo.), and WØMOX (Colo.)
K6GCD	S. Calif.	W7MFP (Utah), W7JRG (Mont.), WØEYE (Colo.) K7ZIR (Ore.)
K6HAA	S. Calif.	K7ZIR (Ore), WØEYE (Colo.)
K7ZIR	Ore.	K5TQP (N.M.), WØEYE (Colo.), K6HAA (So. Cal.) & K6GCD, W7JRG (Mont.)
W7UAB	Ore.	WØEYE (Colo.), K7NII (Ariz.), K7ICW (Nev.), W7JRG (Mont.) W7MFP (Utah)
W7LHL	Wash.	K7NII (Ariz.)
K7ICW	Nev.	WØENC (S. Dak.), K5WXZ (Tex.), W7UAB (Ore.), W7JRG (Mont.) W5UGO (Okla.)
W7MFP	Utah	WB6KAP (S.F. Area), K6GCD (So. Cal.), W7OUE (Ariz), W5UGO (Okla.), W7UAB (Ore.)
WØYMG	Kans.	K5TQP (N.M.)
W9WDD	Ill.	W1JSM (Mass.), W7PUA/2, W7JRG (Mont.), K7NII (Ariz.)

Pretty impressive for one shower. Most contacts were made on the 16th, a few on the 17th. Many schedules out west started about midnight. Don't get the wrong idea. This was a very, very exceptional shower. Supposedly with this one it happens so good only every 33 years. One astronomer we heard from said it may happen again next year. Be ready.

VHF NUT NET

There is a net on the appliance operators' band (about 3810 Kc.) every Sunday at about 9 pm PST. This collection of VHF addicts manages to exchange considerable information on skeds, new transistors, good and bum articles, select surplus and other vhf tidbits. It is strictly informal (a synonym for disorganized), lower sideband, and includes stations in Oregon, Calif., Utah, Ariz., Nevada., Colo. and Kansas. Sometimes it isn't worth wasting time on. Yet other times its pretty good. If you have high power on VHF and are a DX enthusiast, give a listen. If you are technically competent and have something to contribute, you're invited to check in. You'll hear calls such as K7AAD, K6GCD, WØEYE, W6GDO, W6NLZ, WB6KAP, K6KV and numerous others active in VHF. When propagation is right the east coast can check in and usually the midwest can. It is a problem to recognize the net. It is usually within 5 kc. either side of 3810. K7AAD

VHFER magazine is published monthly by Parks Electronics Lab., Rt 2, Box 35, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions $2 per year, others $3 per year. Second class postage paid at Beaverton, Oregon

AN I.F. NOISE CLIPPER

By Tom Curran, W7UAB*

Many articles have been written about methods of detecting weak signals in the noise. Some of these work fairly well and others were just somebody's wild idea that was never actually made to work. Improved reception through noise always costs something in the way of performance. This method is no exception to this rule. Since I didn't do the original design on this circuit I probably don't know as much about it as the designer, but I have built it and used it to good advantage. I think I can be objective about it. It took me two hours to build and a few dollars in junk box parts.

The problem I had was trying to copy very weak 2-meter tropo signals from the San Francisco area (WB6KAP) when the Fords go by. Fords seem worse than others about ignition noise. The solution came through WØ EYE who sent me Mel Baer's circuit (W6WSQ).

The basic difficulty here is the inability of the communications receiver to handle impulse noise, such as that from spark discharges radiated from automobiles and arcing or corona from power lines. A spark discharge causes an electromagnetic radiation with a very fast rise time. The duration of the discharges is quite short, but the intensity is so high that it excites the tuned circuits of the converter much more than the signal does. Once the input tuned circuit is excited the rest of the system responds, amplifying and lengthening the pulse. Most of the lengthening occurs in the selective (high Q) circuits of the receiver I.F. Though the initial pulse wave may have lasted only a fraction of a microsecond, the wave train that results from it may last a millisecond or more. When this wave train is rectified at the I.F. output and amplified, the pulse can be heard.

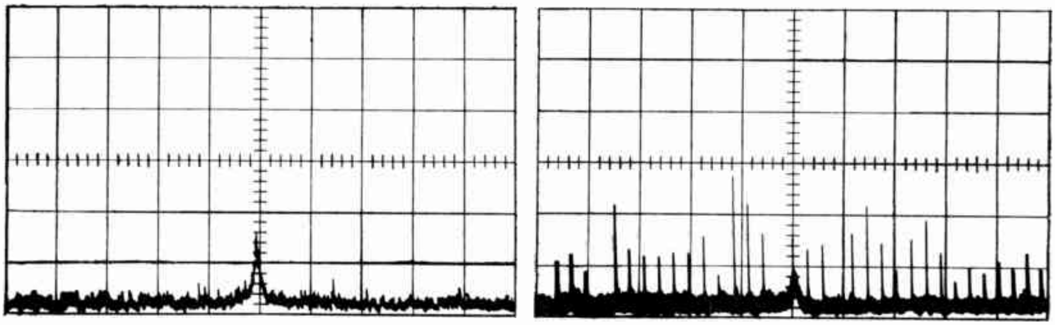
It would be nice if we could clip these noise pulses at the input to the preamp. or converter, but diodes don't start conducting at fractions of a microvolt of forward bias. A pulse or signal has to be quite a few millivolts high for the diodes to work right. So the output of the converter must be amplified and that is what the circuit to be shown does. At the output of this amplifier the pulses can be clipped to approximately the same level as the signal, even though they had a thousand times more peak amplitude than the signal. When all the garbage coming through the I.F. has been "equalized", the frequency selective circuits can operate to give prominence to the desired signal. The dramatic difference is shown in the photographs of the CRT on a spectrum analyzer (next page.)

As to how well it works, the strong impulse signals like those shown I can't hear at all with the clipper in. Very weak impulse noise I can still hear, but it isn't so objectionable. It blends in with the background noise but doesn't dominate. The reason for the better performance on the higher amplitude impulses is that the diodes can work more effectively on the larger signals. You might wonder if there is any deterioration in weak signal performance when there is no impulse noise. I have made several tests with weak signals under quiet conditions and find the readability to be the same whether the I.F. clipper is used or not. This is because on weak signals the diodes aren't clipping at all. My I.F. is 14 Mc.

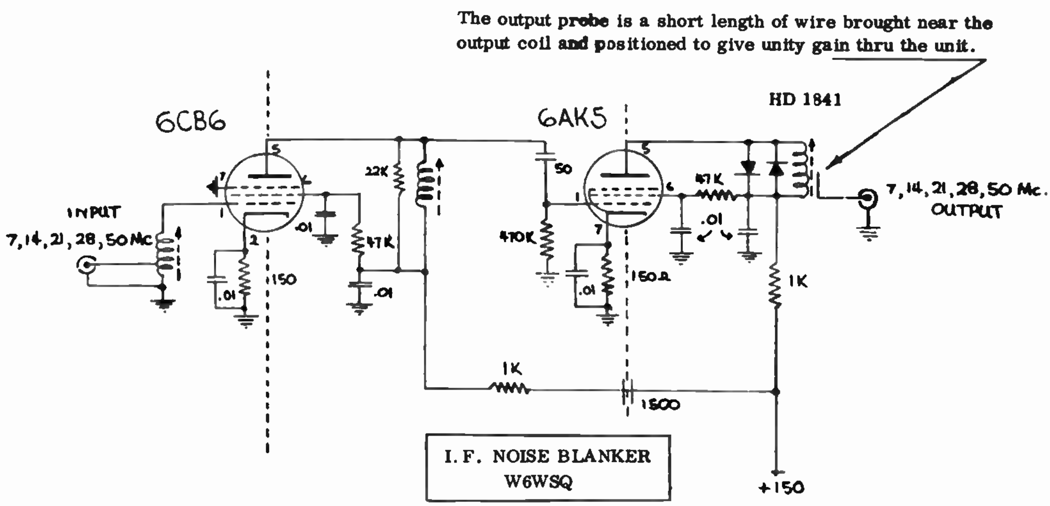
The circuit is a 2-stage r.f. amplifier with a pair of very fast back-to-back diodes across the output. The diodes used by W6WSQ were not available to us, but the Hughes HD 1841 worked very well. These are listed in Newark or Allied catalogs at 88¢ each. Don't use just any germanium diode or you won't get the results you should.

*7965 S.W. 87th Portland, Ore.

Here is the price you must pay for this improved reception through impulse noise. If there are other locals on the band, forget it. Their signals will drive the amplifier and diodes into saturation and you are out of business. Everything goes quiet. I limit use to early morning and late evening skeds when the locals aren't on. In theory, if you use a very selective filter at any place ahead of the clipping diodes you can get by with some local activity provided it isn't too close to the frequency you're listening to and not too strong. I use a cavity filter ahead of the converter and this helps quite a bit except for stations 100 kc. or so away. K7ZIR also built one of these clippers and finds it helps considerably to reduce power leak noise.



A visual comparison of impulse noise with and without the clipper. The signal is in the center. The gain ahead of the spectrum analyzer is approximately the same in both displays.



OPEN BANDS

by Marilyn Wiseman, K8ALO

Band conditions have been excellent this past month. Distances worked were well above the average. Even though old man winter is just around the corner this doesn't mean openings can't occur, so keep your ears open. You might be surprised. Looking forward to your report next month. My address: Box 103, Petersburg, Ohio 44454.

144 Mc.

Oct. 3 K7ICW (Las Vegas) wrkd W6NLZ, K6IBY, K6TSK, W6DNG tropo 0810-0835.
Oct. 9 W4CKB (Fla.) wrkd K2HLA (N.Y.) c.w. meteor showers. K5WXZ (Garland, Tex) hrd W4CKB wrking N.Y. Signals were 599. K7ICW wrkd WØENC in Rapid City, S.D. 2000-2100. The two meter band opened up between Fla. and Tex. La. joined in this opening on Oct. 10th.
Oct. 10 K7ICW (Nev) wrkd W6NLZ, W6YVO, K6HAA, K6IBY, K6GCD c.w. tropo 0810.
Oct. 11 W4CKB (Fla.) had 36 QSOs with W5, K5, WA5s. Bev. reports most signals were well above S9. Two Texas stations were running Two'ers.
Oct. 13 K7ICW (Nev.) wrkd WØENC (S.D.) c.w. meteor showers 0600-0700. Hrd K5HMN Aero Mobile wrk W7GNP on A3, area between Phoenix and Tucson, 300 mi. plus. W4CKB (Fla.) wrkd W4NHW (Ky.) 0600. K1ABR (R.I.) wrkd W8WEN (Ohio), K3OBU, W3HC (Del) W3MBN (Pa.). K1ABR reports condx gud to SW and West.
Oct. 19 K7ICW wrkd WØENC (S.D.) c.w. meteor showers 0530-0700.
Oct. 24 K7ICW (Nev.) wrkd K6IBY, K6GCD c.w., Hrd W6NLZ, K7ZIR (ore.) 825 mi, K6GCD wrking W7UAB (ore.)

432 Mc.

Oct. 9 W4GJO (Sarasota, Fla.) wrkd W5LDV, K5LLL (Houston) 825 mi, W5AJG (Dallas) 970 mi., W5LUU (San Antonio) 1025 mi. (Is that a record?)
Oct. 10 W4GJO (Fla.) wrkd W5FSC, W5LDV, K5LLL (Houston) 825 mi, K5AOK (Victoria) 930 mi., W5AJG (Dallas) 970 mi., W5LUU (San Antonio) 1025 mi.
Oct. 11 W4GJO (Fla.) wrkd W5AJG (Dallas) 970 mi., hrd W5HPT (Ft. Worth) 990 mi.
Oct. 18 W8YIO (Manchester, Mich.) wrkd W2MDE (Hicksville, L.I. N.Y.) 560 mi, W7PAU/2 (Denville, N.J.) 475 mi.
Oct. 19 W8YIO (Mich) wrkd W2MDE (N.Y.) 560 mi., W3MMV (York, Pa.) 405 mi.

BACK ISSUES OF VHFER

Many of you have asked about back issues and we have had to ignore your inquiries because of the high cost of answering. Also we couldn't send any. But now we have re-printed some of the earlier issues--those since January of 1965. We have some August, Sept. and November of 1964 issues and all those of this year available to you at 20¢ each, postpaid. The earlier issues have more 2 meter articles and very little 432 but also have some articles on test equipment, finding the weak spots in your station, etc. Send check, cash or stamps. Any not used will be refunded. We still have some bundles of 12 6 up magazines available at $2 per bundle, postpaid. These are not continuous, just what we have. A good value. We also have results of an antenna contest held in the S.F. Bay area a couple of years ago available for a self-addressed, stamped envelope. 432 antennas only--home made and commercial.

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

The only active moonbounce work to report at this writing took place October 16th and 17th. Tests were conducted from K2MWA/2 at the Crawford Hill site of Bell Labs. The antenna was a commercial sixty foot dish that develops 35.5 db gain — feedline loss was 1.5 db — receiver noise figure was 2 db (paramp) and transmitter output was 350 watts. With this setup they were receiving their own echoes some six to eight db above the noise level in a 300 cycle i.f. bandpass. (This figure may not sound like much, but note I said above noise level. Above threshold they were in excess of 20 db. I will discuss this in a later column. They worked W1BU with W1HIV operating. They heard Q5 signals from W9HGE and our station W3SDZ. W9HGE and I heard K2MWA, but felt the signal was not of sufficient level to warrant communication. My signal was also heard by Pat at W1BU. Both W9HGE and myself were using our transistor preamps instead of our paramps. In this case the paramps probably would have made the difference in a contact. In addition, we have carefully measured the gain of my dish, and found it to be down 3 db from it's theoretical possibilities. (This problem will also be discussed in more detail.) All tests by the way were on a frequency of 432.000. Announcement of the test was sent to all on my mailing list of active stations.

Since I've become involved in Moonbounce experiments, I receive almost daily letters telling me that the writer is "ready to make some moonbounce tests with you O. M.". Then, the letter goes on to say, "the antenna here is a brand X yagi or a six foot dish etc." I don't for a minute mean to berate these writers —I'm sure they are sincere. What is hard to understand is how this optimistic view of moonbouncing could become so widespread. Perhaps the KP4BPZ tests have something to do with this. The thing to remember is that KP4BPZ had 58 db of antenna gain on one end of the path. — W1BU has copied KP4BPZ some forty db out of the noise in a sharp filter with a 29 db antenna. This all means that you should be able to hear the KP4BPZ signal with a dipole antenna — in fact I know two people that did just that during the last test. In practice this means — if you are going to get signals back and forth (or hear your own echoes) on 432, you must have an antenna with at least half the gain of Arecibo. If your antenna gain falls below 29 db, you only hear your echoes on a marginal basis — when it falls below 26 db, you DON'T hear your echoes.

Let me make something very clear at this point. There are those who would lead you to believe you might be able to work moonbounce with a small antenna and meager equipment if you will but keep endless schedules. I can agree that after you listen to the noise out of a narrow audio filter for a long period of time — you will indeed think you are hearing signals that are not there. I don't believe in black magic. The old saw about the bumble bee not being able to fly — I don't buy either. It is much more than mathematics that proves out the fact of the path loss involved for successful moonbounce communication. The government, and countless private labs have conducted well documented practical studies of the pathloss on various frequency bands adjacent to most of the ham bands. In every case the experimental results were close to theory. I bring this point up only to save you time — you must build a large array if you intend to work moonbounce below 1296. Above 1296, the antenna size goes down, but the equipment problem gets more difficult for amateurs.

The routes to making (or acquiring) a large antenna are as endless as the imagination of the amateur mind. There are of course some considerations to deal with. These will vary from amateur to amateur. What I propose to do in the next several columns is examine the various antenna systems that can be made to develop the necessary gain for a successful moonbounce effort. In each case the antenna described can be built by an amateur. It will take a lot of work, but there is no easy road to hearing your own echoes.

On two meters to 432 the colinear antenna or an array of small yagi antennas is a practical approach. When you examine gain for antenna size, you will find that for antenna gain less than 20 db — a colinear array can't be matched. An array of this type is about 100% efficient for its aperture area. A dish antenna by contrast is only 50% efficient for its aperture area. Now, it would be easy to draw the wrong conclusion from this statement. Why not stay with the colinear array and forget dishes. What happens is simply this — as you go for more gain you reach a point where gain starts to taper off above twenty db. When you get to thirty db of gain, phasing line losses and out of phase components bring the efficiency below fifty percent. From 30 to 70 db gain, the reflector type antenna takes over. The interesting thing is that it's efficiency gets better above 15 db gain and remains constant around 50% to 70 db. I don't know of any antenna that does much above 70 db. What happens is a variety of problems limit the maximum gain attainable with any antenna system. The choice of array you chose is up to the individual. The expanded extended colinear described in the Frank Jones VHF hand book is a good start. I used a conventional colinear type array with 256 elements that produced my own echoes on occasion, and an exchange of signals with Sam operating W1BU. We are reasonably sure that the antenna was developing it's theoretical gain of 26 db. My equipment was not as refined during the experiments with that antenna, but it is still standing and we might make some more measurements on the antenna before it is dismantled.

K2CBA has developed a small yagi antenna and incorporated it into a large stacked array that works very well. It hears sun noise with a ten foot square aperture. It would appear that four of these arrays slightly bigger than 20 x 20 might be capable of hearing echoes on 432. If you are interested in this array, I suggest you write to Jud for details.

I have run out of space a paragraph or two back, so I must close things out. Next month we'll have complete details of how to design and build a parabolic antenna that will get you echoes on 432 and up. In months to come an antenna that is 75% efficient for it's aperture size and a steering system for it that requires only half the amount of movement for a given amount of scanning. If you're doing anything in the moonbounce field, let us know about what you're doing.

A VHF-UHF SIGNAL SOURCE

by Louis Hutton, K7YZZ*

Recent articles in VHF'er and 73 Magazine have described both battery and conventional powered marker signal generators. This unit is a battery operated solid state signal source with RF output on 144.150 mc, 432.450 mc, and 1297.3 mc. It is used by the author as a signal generator to aid in adjustment of the "tin can converter."

The transistorized oscillator-tripler is built on a copper clad phenolic circuit board 4-1/2" x 2-1/2". An aluminum chassis 4-1/2" x 2-1/2" x 1" forms a cabinet for the oscillator-tripler with the phenolic circuit board acting as the cover. The output of the tripler is fed to a 432 mc half wave trough line, through a 1N82 diode. This trough is made of 18 gauge copper with a 1/4" copper gas line center conductor. The trough is 1" x 1" x 7". The 1N-82 is tapped up on the center conductor 1-1/4". The center of the line is tuned with a home made tuning capacitor made from two copper plates 3/4" in diameter. One plate is soldered to the line, the other, on the end of a 6-32 x 3/4" round head machine screw. A 6-32 brass nut is soldered to the trough to provide threads for the adjustment screw. The output link of the 432 mc trough line is brought out 1-1/2" from the end of the line opposite from the crystal diode end.

The 1296 mc trough line is 1" x 1" x 3-5/8" with the 1N-82 diode tapped up 5/8" from one end of the 1296 mc line, and up 2" on the 432 mc line. The output line is brought out 3/4" from the other end of the line. The tuning capacitor construction is the same for the 1296 mc trough line as was for the 432 mc line.

A grid dipper operating in the "diode" mode or other wave-meter is useful in tuning up the oscillator-tripler.

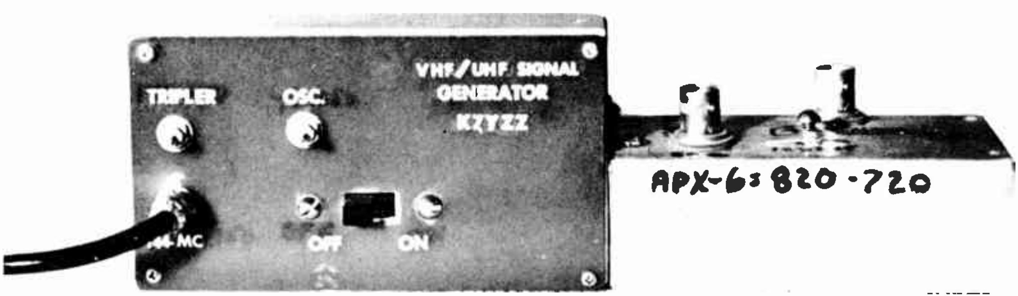


Figure 1

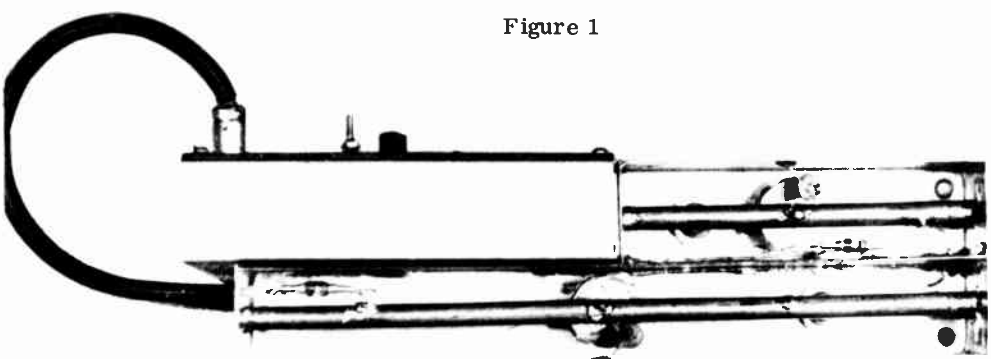


Figure 2

* 12235 S. E. 62nd
Bellevue, Washington 98004

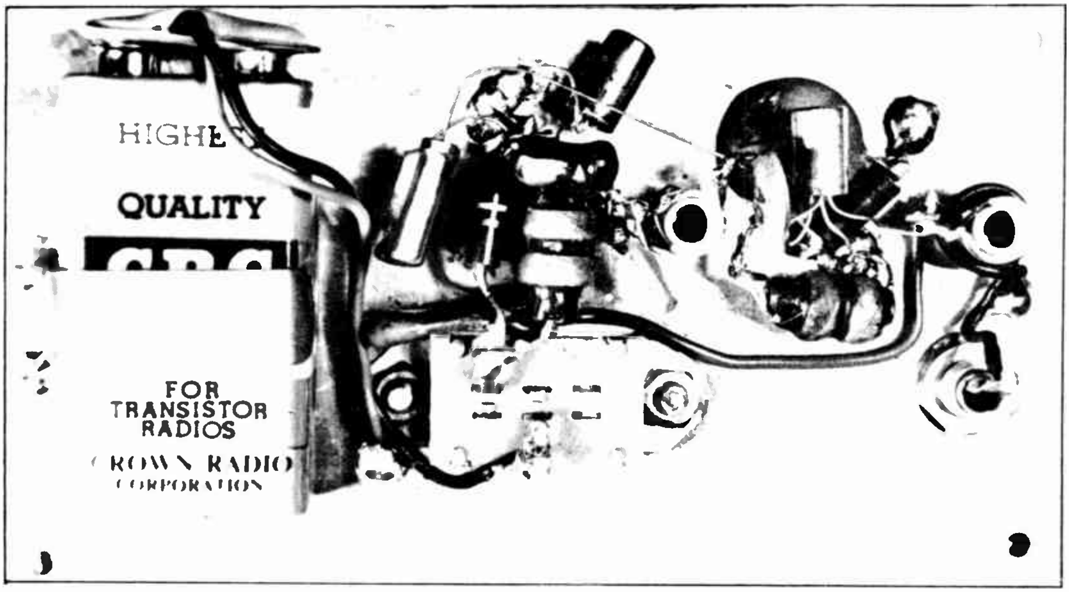
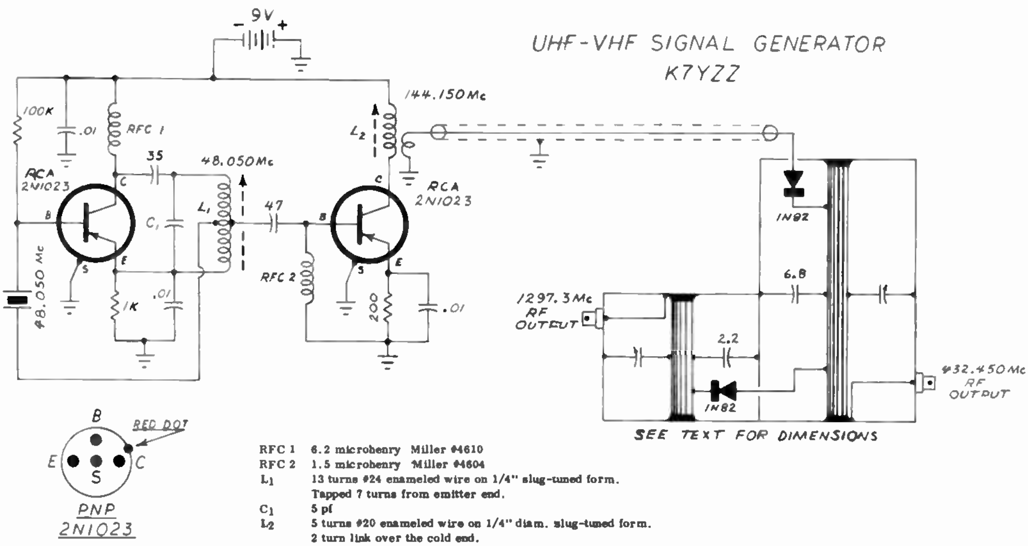


Figure 3



RFC 1	6.2 microhenry	Miller #4610
RFC 2	1.5 microhenry	Miller #4604
L_1	13 turns #24 enameled wire on 1/4" slug-tuned form. Tapped 7 turns from emitter end.	
C_1	5 pf	
L_2	5 turns #20 enameled wire on 1/4" diam. slug-tuned form. 2 turn link over the cold end.	

Figure 4

BUTLER CRYSTAL OSCILLATOR WITH VARIABLE CAPACITANCE DIODE TUNING

by Paul M. Wilson, W4HHK/A4HHK

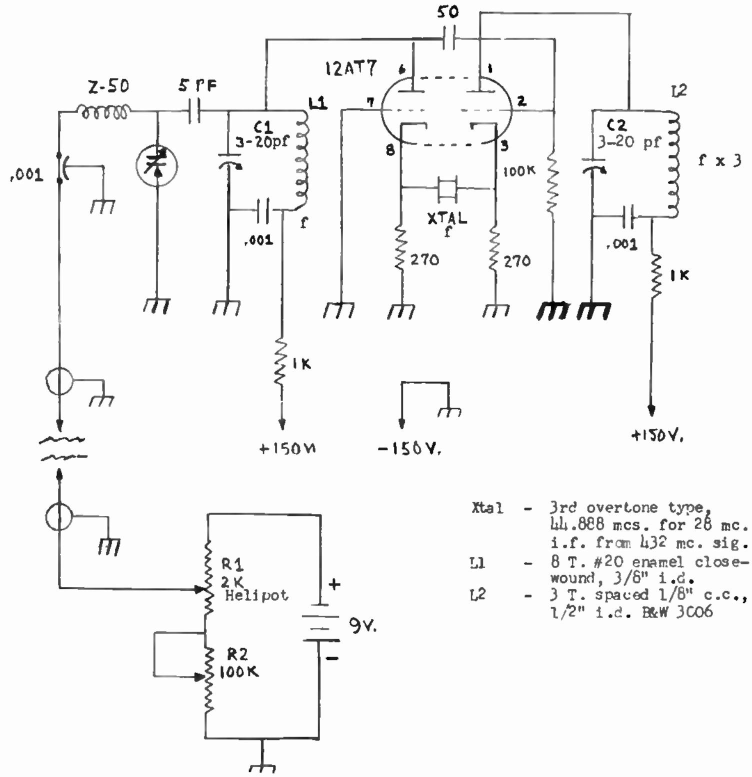
The communications receiver used as the tuneable i.f. for a crystal-controlled v.h.f. converter does not always provide adequate bandspread. Much bandspread is especially needed in ssb work and the reception of weak c.w. signals. An easy way to obtain a slow tuning rate is by varying the frequency of the converter crystal oscillator by means of a variable capacitance diode. A multi-turn potentiometer, used to vary the diode bias, will change the crystal frequency for fine tuning of the signal.

In the circuit shown, the diode is connected across the oscillator plate circuit, making use of the fact that tuning this circuit will pull the overtone crystal frequency. The amount of tuning or bandspread is adjustable, within limits, by the setting of the limiting potentiometer, R2. The tuning control is potentiometer R1, a ten-turn Helipot. A tuning range of about 3 kcs at 432 Mc. is achieved when the tuning potentiometer is 2 K ohms and the limiting resistance is 82 K ohms. In addition to the ratio of R2 to R1, the exact tuning range will depend on a number of variables such as circuit L/C ratio, stray capacity, crystal characteristics, and order of frequency multiplication of the crystal frequency.

The diagram shows a portion of the oscillator/multiplier used by the writer in a 432 Mc. converter. A 12AT7 is used in the familiar Butler oscillator circuit. L1 is tuned to the crystal frequency by C1. The crystal is a 3rd overtone unit made by International Crystal Co. The ninth harmonic of a 44.88 Mc. crystal gives a 28 Mc. i.f. signal from a 432 Mc. signal. L1 is capacitively coupled to the grid of the second half of the 12AT7 by a 50 pf. capacitor. L2 is tuned to the third harmonic of the crystal frequency by C2.

The variable capacitance diode, a Varicap V-12, is connected in parallel with C1. This diode is made by Pacific Semiconductors. It has a range of 5.2-31 pf. and a maximum working voltage of 25 volts. Capacitance at 4 volts d.c. is 12 pf. The cathode end, marked with a band, connects to the plus terminal of the battery circuit. a 5 pf. silvered mica capacitor serves as blocking condenser to keep 12AT7 plate voltage off the diode. An Ohmite Z-50 r.f. choke and a .001 mfd. feedthrough capacitor are used to isolate the tuned circuit from the external bias circuit. A shielded cable such as a length of RG-58 connects between the control point and the Varicap circuit. The 2 K Helipot is mounted at the operating position. A matching dial enables the operator to read one part in one thousand for ten turns of the potentiometer. A few kilocycles of tuning by this arrangement is extremely slow tuning. In adjusting the value of limiting resistor, R2, a relatively low value should be avoided in order to minimize battery drain. A battery is the simplest means of providing bias voltage. True, the voltage will slowly decrease over a period of weeks, but hum and regulation problems are eliminated. Battery life will almost equal shelf life if the total resistance is on the order of 82 K ohms (current drain about 0.1 ma.)

Initial adjustment is as follows: Set R 1 at mid-range and R2 at maximum resistance. Connect a fresh 9 volt battery to the Varicap circuit and apply power to the 12AT7. If the remainder of the converter is operating at this time, adjust the tuning of C1 until a test signal of known frequency is tuned in at the approximately correct i.f. frequency on the communications receiver serving as tuneable i.f. Check the range of the Varicap tuning by varying the resistance of the Helipot, R1, from one extreme to the other and note the amount of frequency the i.f. signal is shifted. Adjust the limiting potentiometer, R 2, until the desired range is obtained. The writer has made no attempt to achieve linear tuning or to make use of this circuit in an automatic frequency control system, but such is worth considering. This circuit gives the slow tuning rate desired, and has worked very well. It was in use during the July 3, 1965 moonbounce test when the writer made a 432 Mc. contact with KP4BPZ. Helipots and dials are expensive when bought new, but are frequently available on the surplus market at reasonable prices. The Varicap diode retails for a few dollars. End.



BUTLER CRYSTAL OSCILLATOR WITH VARIABLE - CAPACITANCE - DIODE TUNING
by Paul M. Wilson, W4HHK

432 REPORT
by Ansel Gridley, W4GJO

The following is taken from a letter to VHFER: WA4BYR, W4UWH and I are all on 432 nightly, using SSB and CW and from 300-500 watts output. Lou has a 32 el. long-long Yagi which performs as good or better than his 64 el. extended-expanded colinear. So far as I know, that's the best Yagi performance anywhere. Although this is theoretically sound, it's not easy to get a Yagi to perform this way at 432. Lou used this Yagi successfully twice in EME contacts on SSB with Arecibo.

In this part of the country, it appears that our reliable range on 432 is in excess of 300 miles, but unfortunately we have few stations in that area well-enough equipped to prove it. However, W4BCL in St. Simons Island, Ga. is about 300 miles and his 4X250 puts a signal in here every night on his skeds with W4UWH.

The boys from across the state, even with 2-5 watts out into good antennas, normally peak to S9 here nightly at from 150-200 miles and are solid AM copy. On normal nights there is much rapid QSB, but never into the noise. W4UWH at 66 miles can reduce his power in steps and can easily be copied on SSB at 400 microwatts! So you can see that 432 really works in these parts.

We had another Texas opening last week-end (W4GJO is in Fla.) with signals up to S9 plus 30, peaking best in mornings and evenings, but in virtually all day long. These 1000 mile signals are hard to believe. Too bad we don't have similar ducting frequently in other parts of the country. 432 would really be something to behold.

THE SAN JOSE ANTENNA CONTEST

by Fred Brown, W6HPH*

July fifth was a bright, sunny, pleasant day at the Santa Clara County Fair Grounds, scene of the 1965 Annual West Coast VHF Convention 432 and 1296 mc Antenna Measuring Contest. This contest was held coincident with and as a part of the San Jose A.R.R.L. National Convention.

Altogether, twenty 432 mc and nine 1296 mc antennas were tested. It was one of the biggest and most successful antenna contests so far held in the West.

Results weresimilarto previous antenna contests. The commercial antennas turned in their usual dismal performance, and as usual the winners were the large extended-expanded arrays. Of course, this is not so surprising since nearly all of the large arrays were of the extended-expanded type.

First place in both contests were won by the same entrant: Will Jensby, WA6BQO. Will won the 1296 contest with a 4-1/2 foot dish, which, not surprisingly, was the largest 1296 antenna. His 32 element extended-expanded bed-spring was only the second largest 432 antenna, however, being surpassed by one 64 element W6GD design that placed a near second in gain.

Other high-lights of the contest were a commercial antenna entered by K6HCP which had more gain off the back than off the front; and a large Rhombic entered by W6HPH which disintegrated during measurement.

Editor's Note: The 10-element Skybeam entered by K7AAD and the Telrex entered by K6KV were purchased expressly for the contest to show the standings of commercial beams under identical test situations. The Hy-Gain antenna entered by K6HCP was brought for the same purpose. This antenna had a slight modification (a tuning stub) and therefore was not exactly as the manufacturer had supplied it. However, in my opinion, the miserable performance is characteristic of an antenna not properly designed and has nothing to do with the stub. As I recall, both the Hy-Gain and Telrex had some forward gain at 420 Mc--but who works 420? No instructions came with the Telrex for use at 432. It would be a mistake, in my opinion, to treat these measurement data as accurate to laboratory standards. However, the numbers should be indicative of some of the problems and relative performance of antennas for 432. All antennas were terminated in an 8 or 10 d.b. coaxial pad and all were used to receive. The 432 source was a colinear with a tone-modulated signal. The reference dipole was made by WB6JZY especially for the contest. K7AAD.

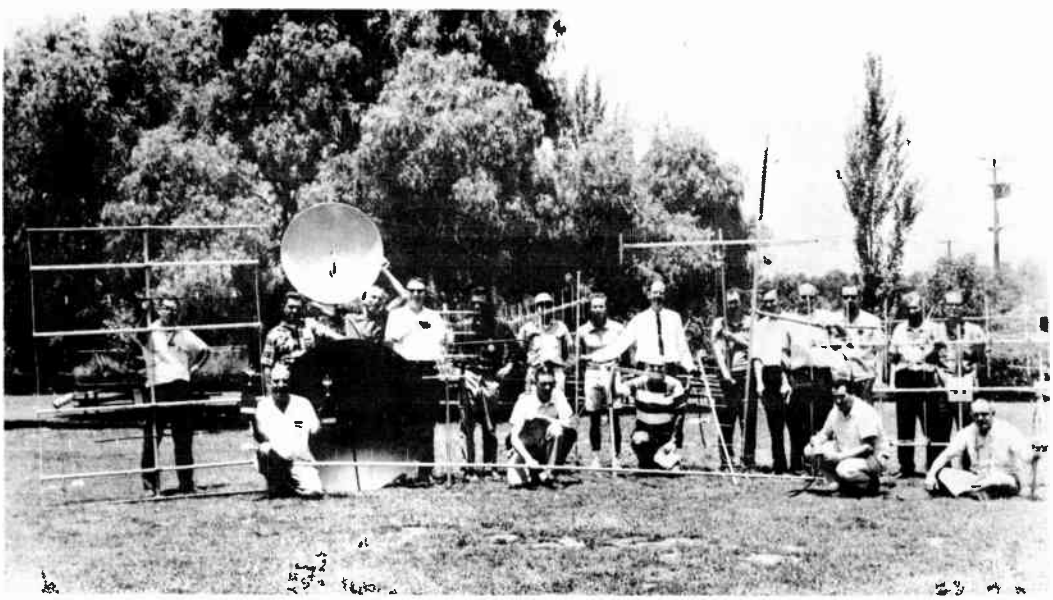
RESULTS: 1296 Mc.

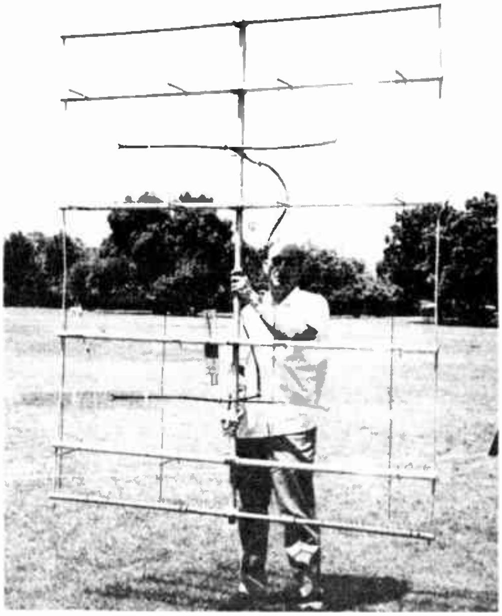
ENTRANT	GAIN, DB/DIPOLE	ANTENNA TYPE	MANUFACTURER
WA6BQO	22.0	4-1/2 Foot Dish	Surplus
W6DFU	17.5	32 Ele. W6GD style	Home
WA6GYD	16.5	32 Ele. W6GD style	Home
K6HM	15.5	30^o Pyramidal Horn	Home
W6HPH	15.1	60" Yagi	Home
WA6MGZ	8.1	Oil Can	Shell Oil Co.
WA6BQO	8.0	Waveguide adapter	Surplus
W6HPH	7.7	Dipole and plane reflector (6db theoretical)	Home

*Pine Cove
Idyllwild, California

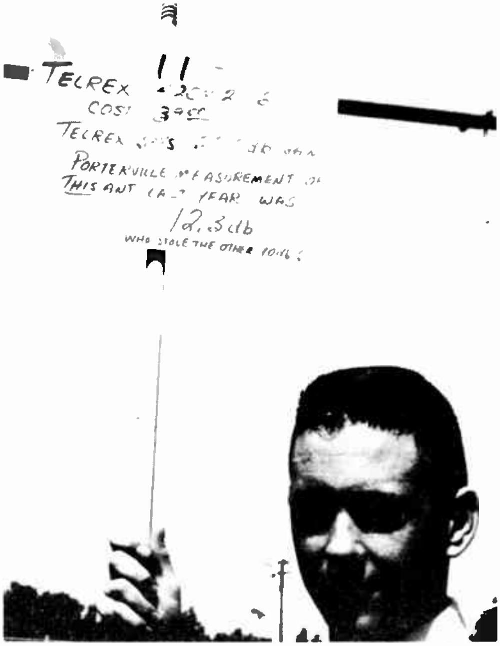
RESULTS: 432 Mc.

ENTRANT	GAIN, DB/DIPOLE	ANTENNA TYPE	MANUFACTURER
WA6BQO	18.6	32 Ele. extended-expanded bed-spring	Home
K6RIL	18.5	64 Ele. W6GD style	Home
W6VSV	18.2	32 Ele. W6GD style	Home
W6HPH	10.5	30 Foot Rhombic	Home
WA6VGR	10.2	20 Ele. J Slot	J Beam
K6JC	9.5	17 Ele. J Slot	Home
W6GDO	9.2	16 Foot Yagi	Telrex 420M2116
K7AAD	9.1	8 Foot Yagi	Gibson
WA6BAN	9.0	8 Ele. W6GD style	Home
K6HCP	9.0 off back 1.0 off front	13 Ele. Yagi	Hy-Gain
WA6QQI	9.0	10 Ft. Yagi	Home
K6SDZ	8.5	64 Ele. Broadside	Cush-Craft
K6IBY	8.2	20 Ele. J Slot	J Beam
K7AAD	7.5	10 Ele. Yagi	J Beam
W6IMX	7.2	16 Ele. Extended	Home
W6HPH	6.9	7 Ele. Yagi	Home
WA6KKK	5.0	Twin 13	Home
K6KV	-12 off front +6 at angle	15 Ele. Yagi	Telrex





Winner Will Jensby displays his 432 colinear with chicken wire screen reflector.

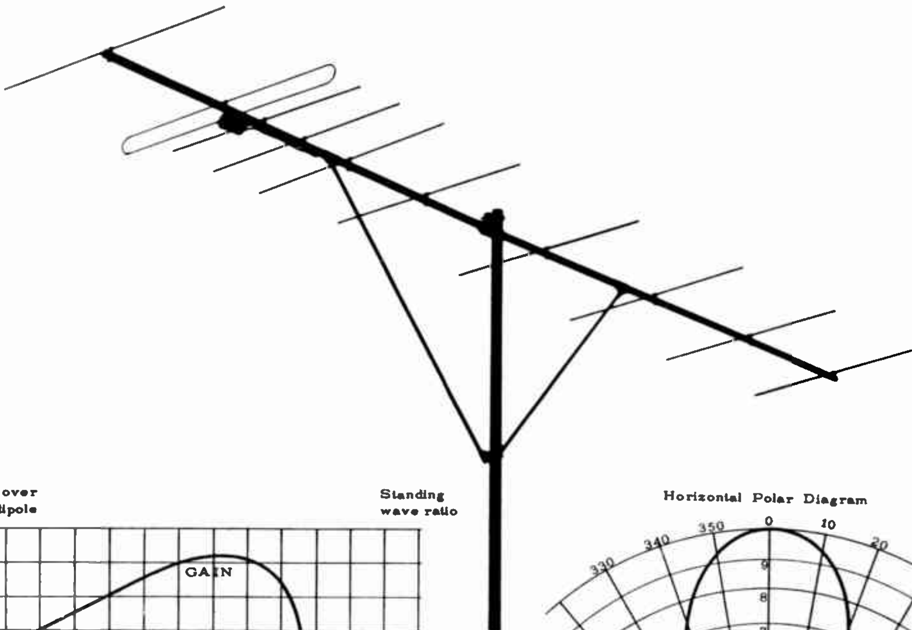


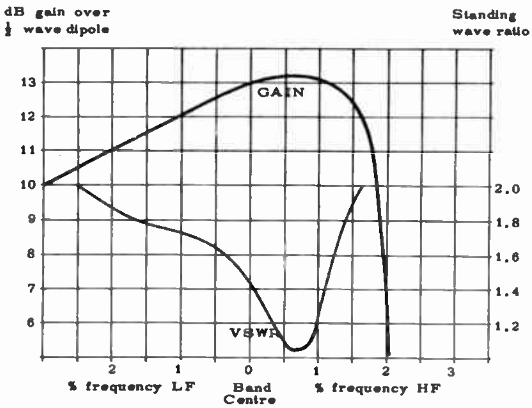
Jay O'Brien looks for the thief who stole the "other 10 db" from his long Telrex. The 10 db is the difference between claimed and measured gain.

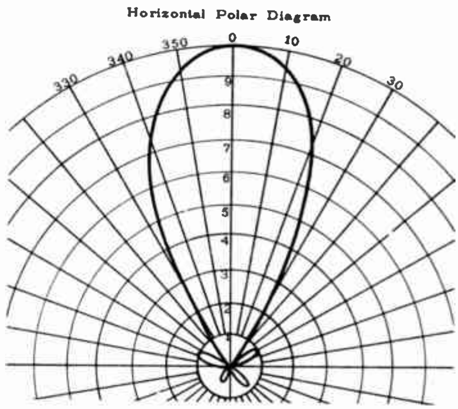
Transmitting setup. Dish for 1296 and colinear for 432.

Fred Brown peaks the signal with his yagi at the measuring line.

SKYBEAM







A PROVEN PERFORMER, this two meter SKYBEAM by J Beam Aerials, Ltd. of England. 13 db. gain over a dipole at 146 Mc., 15 db. over an isotropic radiator. Ruggedly built. Boom, elements and support rods of aluminum, 3 brackets of steel (plated). Available for feed with twin lead or coax. See the review in the May VHFER.

Write for literature and prices on this and other J Beams.

Gain, Inc. 27 E. 112th Place Chicago 28, Illinois

STATEMENT OF OWNERSHIP

VHFER Magazine is published monthly at 15395 N.W. Cornell Road, Beaverton, Oregon, by Parks Electronics Laboratory. The company is owned by Loren E. Parks. Editor is Loren Parks, Assistant Editor, Fred Brown. As of this date VHFER magazine is sold by subscription only except for sample copies which average about 50 per month. 2,000 copies are printed per month. There are 1436 paid subscribers. The balance of the issues are retained for sale as back issues. I certify that the preceeding statements are correct and complete. 11/25/65 Loren E. Parks

Loren E. Parks

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VHFER

LEARN BY DOING

50 MC. AND UP

Volume 3, No. 10 October, 1965

W3SDZ AND HIS 27' DISH

METALWORK for the 432 tripler described in the Sept. issue of VHFER can be obtained from Deane Kidd, W7TYR, 12235 S.W. James, Tigard, Ore.

ODDS & ENDS
by K7AAD

by K7AAD

After my other article on OSCAR in this issue was printed, I received an OSCAR Newsletter which gives some more information I didn't have. I gather that some of the material I am about to repeat is not solidified and may be in error. In other words, it is tentative data.

6 1/2 hours after blast-off, the parent Titan IIIc vehicle will reach a semi-synchronous 18,200 nautical mile orbit having a 30 degree eastward drift per day, with a 0 degree inclination angle. The OSCAR IV satellite will be separated from the parent vehicle and activated over Ecuador and will be within radio range of the USA. At this instant, radio coverage will extend 81 degrees north or south latitude. It is contemplated that the OSCAR IV package will be spin-stabilized, with satellite axis and transmitting antenna parallel to the axis of the earth. OSCAR IV will be completely solar powered, having a life of about one year. The preceeding from Project Oscar Headquarters.

The beacons seem to be the most undecided part--which one or ones will go. Several groups are working on satellite packages for OSCAR IV and subsequent satellites. As I understand it, thru the grapevine, the TRW radio club package goes in OSCAR IV and there is a beacon at 431.920. The translator is gated by the beacon signal about once every 10 minutes for a period of about 32 seconds for 12 seconds of c.w. carrier followed by one HI repeated twice.

It appears you will have to have some fairly high power on 2 to do the job. Power, of course, isn't enough by itself. You have to have antennas and I will tell you as much as I can in a nutshell without opening myself up to lawsuits. All the following is my OPINION and is derived from antenna gain measurements I have made, antenna contest results, reports from hams who do the outstanding DX work on 2 and 432 and from competent hams around the U.S. I believe the J Beam people of England are the most savvy and honest about antennas of the popular makes. They are handled by Gain, Inc. (our only advertiser though this hasn't much to do with it except that I wouldn't take their ads if I thought their products were poor.) I don't say I go along with all claims or all their theories but I do know their two meter "Skybeam" is a darned good antenna and others have reported excellent results from the original or copies of it. The Telrex 2 meter beams have a pretty good reputation for performance--but not for fulfilling gain claims. (in my opinion). My 2 meter antenna will be 2 Skybeams stacked. I am solvent enough I could buy better antennas if I thought there were better ones at a higher price, but I don't.

At 432 there is a problem. I don't know of any antenna you can buy which will do the job on OSCAR 4 unless you make an array of them. And I've seen some pretty sick manufactured arrays of Yagis. At the last antenna contest in San Jose (A.R.R.L. National Conv.) there were two highly-advertised commercial antennas for the 420 Mc. band which showed NEGATIVE gain with respect to a dipole at 432. At 420 they probably had some gain, but at 432 they sure made good attenuators. No instructions about operating at 432 came with them. I took the Skybeam for 432 and my Gibson Yagi and I would say the Skybeam did right for its size though something may have been wrong with the set-up because I have taken the Gibson to several contests (I never change it) and it didn't measure as well against the colinears as it always has before. This is one reason for the delay in the reports plus the preparation time element. Remember that a properly adjusted Yagi is fairly good below its design frequency but rapidly goes to pot above it. I went into this in some detail in an earlier issue of VHFER. The 432 colinears in Frank Jones Handbook (CQ) are very good and will deliver the gain about as specified. There are good 432 Yagi designs & we may get one in this issue by K6OKC. If not, next time. K7ZIR has an array of Yagis for 432 which bring the receiver noise up 6 db or so when swept across the sun.

(Cont'd. Next Page)

There is the possibility you won't need the big arrays to receive because of someone's miscalculation. I recall several letters and on-the-air reports of how well certain big antennas were hearing KP4BPZ's signals on CW. W7UDM and W7UAB were hearing the same CW signals 100% copy without strain on a hand-held dipole. They could not copy the ssb that way 100% but could get some of it. All of this says a lot of people have awfully sick equipment and OSCAR IV will undoubtedly provide the same opportunity of demonstrating how poor your set-up really is when we get reports from a number of stations. No more can you blame your mediocre or poor performance to your poor location or weather. VHFER should be the first magazine out to give reports.

The delay in getting VHFER out is due to overwork and understaffing here. We normally publish near the end of the month and are shooting for the middle of the month, but never seem to make it. We've had business increases like the rest of the electronics industry and have to put profitable things first to survive. Then I had an unexpected trip to Smogville (have you ever gone to bed with your eyeballs burning in their sockets?) which further delayed things. There are more hours of work in this little rag than you can imagine.

VHFER content has been heavy on 432 lately. The reason is that 432 material is about all we're receiving at the present time. I can't put in what I'm not sent. We have 1296 stuff in the works and would like to get 220 and test equipment articles (like a 432 dipper). VHFER can only be what its readers make it. Not all of you are capable of contributing,. and you should know how you stand technically. If you believe you are "with it" in a certain area of electronics, let us know what type of thing you would care to contribute. My job is to screen material (I occasionally slip up), get it printed and in the mail. We do everything except the binding and trimming here.

The converter article in this issue by K6OKC is something you should seriously consider building if you aren't set up. In Calif. they have converter contests (as well as antenna ones) and OKC came out on top in one a few months ago. He didn't include the preamp. because there were other designs around. He likes the 2N3399s best. I hope we haven't made any mistakes in the drawings or the text. I am seriously considering changing our 432 converter to one very similar to the OKC one because of our high production costs. I'm afraid we're losing money on every one we sell.

There is a pretty new Motorola transistor out, the 2N3783 ($45 each) that is significantly better than the 2N3399 and by significantly I mean a db or more. They spec. it at about 3 db I think. Our problem with it has been to prove that using that transistor in another preamp. we can tell any difference in discernibility of a weak signal over our 2N3399. So far we can't and I suspect our test set up wasn't good enough. This is also a problem in testing antennas. I ran a series of tests a couple of years ago on a 220 path to Seattle (mountains between) on signals just in and out of the noise. I used three different antennas, a home-made Yagi, an 8 over 8 J beam and a Cushcraft colinear. Field strength measurements were radically different but this may have been due to improper padding between antenna and transmitter. However, using a Transco solenoid operated radar lobing switch (very rapid switching among 3 antennas) a signal barely discernible on 1 antenna was also the same on the other two. If it was lost on one, it was lost on all three. I could use some help on this problem from some of you more savvy than I. Measuring something as being better is one thing. Proving it in practice seems quite another in some instances. End.

VHFER magazine is published monthly by Parks Electronics Lab., Rt 2, Box 35, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions $2 per year, others $3 per year. Second class postage paid at Beaverton, Oregon

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

This is the first column of what we hope will becomc a new dimension for the VHFER and perhaps VHF and UHF operation by amateurs. While I don't want to waste valuable space with a long discussion of my personal philosophy of Amateur Radio and the purpose of this column, I do feel a brief discussion of both can be of benefit in this first column effort.

Here we are in the year 1965, and as radio amateurs I feel it is time to return to something radio amateurs once were. In this way we can move ahead to some new and exciting frontiers. I believe that in the amateur radio ranks there should exist at least 25% of the one percenters who are willing to test their operating ability, technical knowhow, and equipment system on moonbounce experiments. If this is indeed true, then this column will be justified.

There is no royal road to a working moonbounce system. When I use the word system, I'm putting my finger on the key to the moonbounce problem; you have to develop a system for the purpose. This means you must learn how to assemble the hardware, and then evaluate the system. The Moonbounce Newsletter will be devoted to this sole purpose. I have access to a great fund of knowledge on the subject, and I'm in communication with a great number of people who know much more than I do about the subject. And, perhaps you have solved some problems that will help others. Together, I think we can come up with a column which will really show what ham radio CAN be all about, so let's try!

As I write this column, I just spent a weekend with Dick Turrin, W2IMU, an antenna engineer at Bell Labs who helped design the Andover, Maine Telstar antenna, Rodger Adson, an engineer at Bell Labs, and Cliff Schaible, W2CCY, also of Bell Labs. Together we proofed out portions of my system with the use of some laboratory test equipment. We proved some rather interesting things in our checkout - - two are significant.

The first thing we discovered is that you don't have to have a laboratory of test equipment to build a good moonbounce system. As for example: the input admittance of my homebuilt noisc generator looked a trifle better than an expensive laboratory job. The feed for my dish measured an almost perfect resistive 50 ohms. My preamp. with a two-dollar transistor produces a s/n ratio that is only 2.5 db worse than a parametric amplifier that costs thousands of dollars to make. Now, I'm not saying moonbounce is easy--no indeed. I've already said it is hard. What I want to say is this-- you don't have to have a fortune in money, a laboratory of tcst equipment or donations of large dishes to get a system going. What you do have to have is a burning desire inside your mind that will let you think of nothing else. You must eat sleep and drink ham radio, and you must work hard--harder than you ever thought you could.

This is what burned inside the mind of Paul Godley as he sat in a cold, damp tent along the Scottish coast in the year 1921 and heard the first amateur signals across the atlantic. It was what burned inside the mind of Sam Harris as he heard the first weak 1296 Mc. signals from the moon in 1960. Now it is 1965, and the desire is burning in the minds of many to do something with ham radio above the level of discussing how nicely the panels on Brand X match Brand Y earphones. The sound of 432 Mc. signals coming over a path of almost 500,000 miles from KP4BPZ has been the spark that has lit the fire.

Following the KP4BPZ tests, it became apparent to me that there had to be better communication among the people interested in Moonbounce. I spent many dollars in phone calls trying to find out who was doing what. As I accumulated this information, I decided to share it with others, thus the Moonbounce Newsletter was born. This media was able to get advance word of the WA6LET test out to interested parties well in advance of other publications. We also started to put in technical information about how different problems were being solved by the various moonbounce crews. I was taking care of the cost of printing and mailing myself, and it wasn't long before costs got out of hand. The mailing list grew from 15 to over fifty, with most of the people interested in the technical information. From here on, all technical information I can get together, along with progress and accomplishments in the field of moonbounce will be published in this column of the VHFER. However, I will also keep a list of ACTIVE moonbounce stations. If a special test is planned by anyone that will not make the VHFER column in time, I will print a special bulletin and send it either first class or air mail to those on the mailing list at my own expense. All I ask in return, if you have a workable system, is to send me the following information to be included in the special list. Name, address, call, phone number at home (and at work if it is permissible to contact you at work.) Also include a description of your system, and results of your sun noise measurements and echo returns.

Continued on Page 6

Now for the second item of significance our moonbounce crew found out about our system this past weekend. From here on the Newsletter deals with technical facts. Over the past few weeks we have been running noise figure and signal-to-noise ratio measurements on all the 432 Mc. front ends we have around. Briefly, we found that our transistor preamp. (RCA 2N3478) produced a ten db improvement over our converter (Tapetone WTC432 - 1N21E mixer - 6BC4 i.f. strip- with a "measured?" n.f. of 7.5 d.b.) Our parametric amplifier did anything from 2 db worse to 2 db better, depending on the mode we could get the thing to tune in. Most of the time it did exactly the same as our transistor preamp. This weekend we made careful measurements of all of these front ends with two noise generators that are of the high-quality laboratory type. I know these figures will sound rather conservative, but they were made according to lab standards by fellows that use the same equipment everyday in one of the best labs in the country. My transistor preamp measured about 5.5 db. n.f. A rather elaborate paramp with an expensive circulator was measured at 3 db. In actual S/N measurement through the entiresystem the paramp could do no better than 2.5 db better than the transistor preamp. The conclusion to be reached here is this. With inexpensive transistors you can come within 2 or 3 db at most of a good paramp. With expensive transistors you can equal all but the most exotic 432 front ends. If you have a Parks transistor preamp or a homebuilt equivalent, work on a bigger antenna. You can always come back to the front end for another db or so, and the longer you wait the cheaper the transistors will probably get.

One of the most often asked questions among the moonbouncers is, "How much sun noise do you hear?" This is a good question, and is an area where you can find out a great deal about your system. As you probably know, the sun is a huge noise generator that travels in a path across the sky very similar to that of the moon. This allows us to use the sun for both system measurement and antenna calibration. I'm going to include here an equation for determining system performance from sun noise measurements. If used with some care, it can tell you a great deal about your system performance.

$$\frac{G_p}{F_p} = 290\,\frac{L_p}{K}\left[\left(\frac{E_s}{E_R}\right)^2 - 1\right]$$

E_s = Audio voltage when antenna is at peak of sun noise.
E_r = Audio voltage when antenna is on cold sky.

G_p = Antenna gain as a power ratio
F_p = Noise figure of front end as pwr ratio
L_p = Line loss as a power ratio
K = Factor to account for sun temperature at different frequencies.

2.9 at 144 Mc.	2.7 at 432 Mc.
2.8 at 220 Mc.	.65 at 1296 Mc.

Example of how to use the sun noise equation: Assume 3 db sun noise measured, 8 db front end noise figure and 1 db line loss.

$$\frac{G_p}{6.310} = 290\,\frac{1.259}{2.7}\left[\left(\frac{1.413}{1}\right)^2 - 1\right]$$

$$\frac{G_p}{6.310} = (290)(.466)(.997)$$

$$\frac{G_p}{6.310} = \frac{134.7}{1} \quad ; \quad G_p = 849.96$$

ANTENNA GAIN IN db = 10 Log 849.96 ; OR 29.3 db

You must remember the formula is based on a quiet sun. This is a fairly good time during the sunspot cycle to do this sort of measuring, however the temperature of the sun may still vary. The safe way to check things out is to look at your sun noise over a period of at least a week without changing any equipment in your system. If the readings vary, take the lowest reading. If the readings were consistently the same, you were probably looking at a quiet sun. Be careful of the noise figure you use for the front end. As I stated earlier in this column, your measurements may be a bit liberal. As a note of interest, we found that the 5722 noise generator tube has about 3 db excess noise on 432. It is perfectly ok on six and two, but has this characteristic around the 400 to 500 Mc. region.

One other very important area in using this formula is the matter of measuring the actual increase in the noise power output of your receiver. You will get highly exaggerated readings if a diode is used as the detector in your receiver. We found that the SSB product detector in my 75A4 is quite linear in its response. The AM detector is not. You had best check your readout system by inserting known pads in the IF line of your receiver system. It is not difficult to do. Make up three pads. Two 10 db pads to use on each end of the I.F. line and a three db pad to insert between these pads for half-power measurement. It is important that the ten db pads be used so that the three db pad will be looking into a pure resistive load in both directions. No matter how accurate the three db pad is, it will not attenuate three db unless it is driven from and works into its design resistance.

Continued on Page 7

OSCAR IV GOING UP
by K7AAD

It's high time for VHF enthusiasts to get ready for the new OSCAR--quite different from the ones before. The reason is that OSCAR will be there to use for days at a time, continuously. Formerly it was there just for short passes. But this time it is in an equatorial orbit, which makes it almost stationary. It will progress eastward at about 15 degrees per day. That means you will be able to use it for about a week at a time if you can tilt your antenna. If you can't tilt then you'll lose lots of operating time. But you need not have an elaborate tilting mechanism because you'll only need to change your antenna angle about once a day. Any mechanical means is OK, even if it means climbing the tower with a wrench.

Nothing said here previously or hereafter should be construed as official. My information came thru the grapevine. If you want accuracy you'll have to consult the bigger magazines. Keep in mind the following: 1. OSCAR may not be able to hitch a ride, though it presently looks like all is clear there. 2. Something may happen that at the last minute it doesn't work. 3. Perhaps once it gets up it won't work or won't work as planned. But if it does get up, and if it does work right, it sure is going to have a big effect on VHF operations.

OSCAR IV is a repeater. It receives between 144.100 and 144.110, only 10 kc. wide. It transmits at about 431.935 (be sure you can tune it.) The measured output power the other day was 3.5 watts. It is powered by solar panels. It will have to shut off in about a year using a chemical timing device unless they can get a command type shut off built into it by launch time----Dec. 2. Engineering time is the problem. CW will be the only usable mode. A number of QSOs can be accommodated. You may get more of your repeated signal back to earth if you use the wee hours when fewer hams will be trying to use the satel lite. On two meters you will need 100 watts and a 16 "element?" antenna. I don't understand that either. On 432 you'll need an 18 db antenna and a receiving set up with a 7 db noise figure or better. You better junk those store-bought antennas that claim fantastic gains. They aren't going to do the job. At the antenna contest a couple of well-advertised Yagis (not advertised in VHFER) actually had negative gain on 432---less gain than a dipole. At 420 they may have worked OK. Lots of you have them. That's one reason why you can't get out of your back yard. You'd do better using a wet noodle. Crystal mixer front ends will have to be preceeded by at least two stages of gain, preferably transistors. You may need to protect them from 2 meter r.f. I would do final tweaking with a weak signal coming from in front of the antenna.

OSCAR IV will be 18,000 miles high. Again, Dec. 2 is the target date. Time to get going.

The actual readout device is usually an audio voltmeter, db meter or VU meter across the audio output of the receiver. The receiver AVC should be off, the audio gain advanced to full on and the R.F. gain advanced to over-ride any audio hum by at least a six db contribution of receiver noise. Now, sweep your antenna across the sun for a maximum reading. Then continue the sweep to find a cold spot in the sky for your background reference. The difference is your sun noise measurement. Some will advise comparing against a standard resistor. I have found this method to be misleading, as the gain stability of transistor and parametric amplifiers is not constant enough to give reliable readings.

I've tried to cover the sun noise problem as well as I can. If you have specific problems or questions, please send me full details of your problem and we'll try to work it out.

Some interesting things coming up in this column will be a description of my 432 KW amplifier and a really big moonbounce antenna. My final uses inexpensive tubes, requires no lathe or brake work and develops 62% efficiency. Dick Turrin is working on the antenna design, and details will be right here in the VHFER. Keep working and let us know what you are doing.

WHAT'S WRONG WITH SILICON DIODE NOISE GENERATORS?

by Pitt W. Arnold, WØIPE

The article of W6HPH published in Sept. VHFER deals at some length with the problems he has had with his noise generator, mostly with respect to the poor VSWR of his device. I believe there is a simple reason for his problem, this being the simple fact that his diode is forward biased as indicated in his schematic, and further illustrated by the VSWR curve he includes. A silicon diode noise generator should be reverse biased to obtain noise power output, this back biasing also providing fairly high resistances even at diode currents causing high noise output.

A diagram of a silicon diode noise generator which I have used successfully for several years is shown in Figure 1. Figure 2 shows the VSWR performance of the unit at 432 Mc., and Figure 3 is a graph of diode back-resistance as a function of diode current. It is easy to see that at a maximum current of 4.7 ma. the resistance is almost 500 ohms, this value of resistance hardly affecting the input impedance of the device at all. The VSWR is not perfect, the value of 1.2 probably caused by the reactance of the 51 ohm resistor and that reactance introduced by the diode and connecting leads. The dip in the VSWR curve at about 1.25 ma. diode current is undoubtedly caused by the changing reactance of the diode.

This unit furnishes up to 15 db. of excess noise and has been calibrated against a vacuum tube diode noise generator in the bands through 432 Mc. The calibration seems reasonably constant, but the device is used mostly for comparison, not for absolue noise figure measurement. What's wrong with silicon diode noise generators? Nothing!

COMMENT BY W6HPH: WØIPE certainly has the right answer. The bad results I was getting was due to a reversed diode. It will generate noise in either direction but impedance variations are much less if it is reverse biased. Any noise generator with a VSWR curve as good as Fig. 2 should be usable on any but the most regenerative r.f. stage which rules out paramps, of course. The moral of the story is: make sure your diode is in the right way--i.e. back biased.

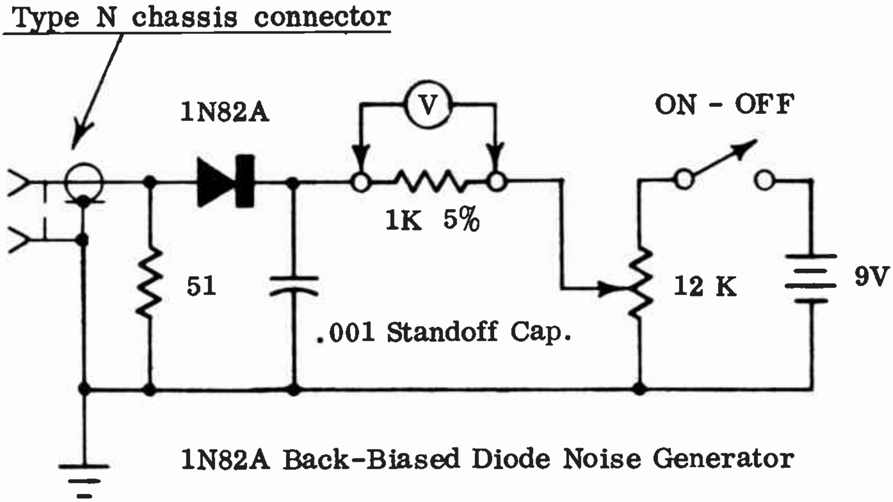
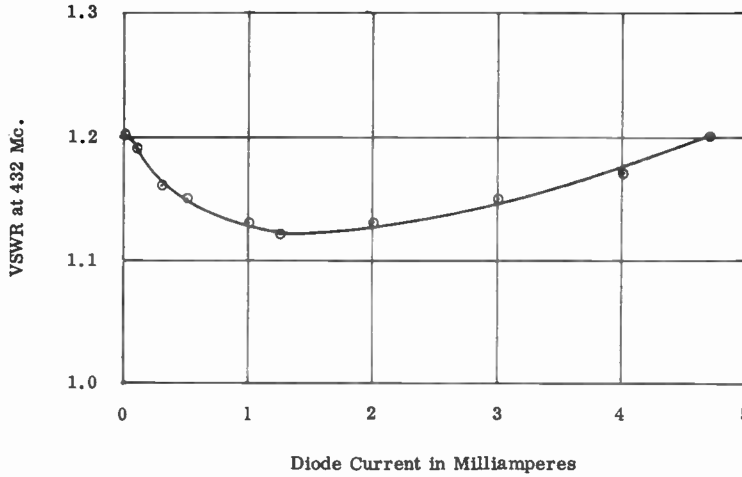
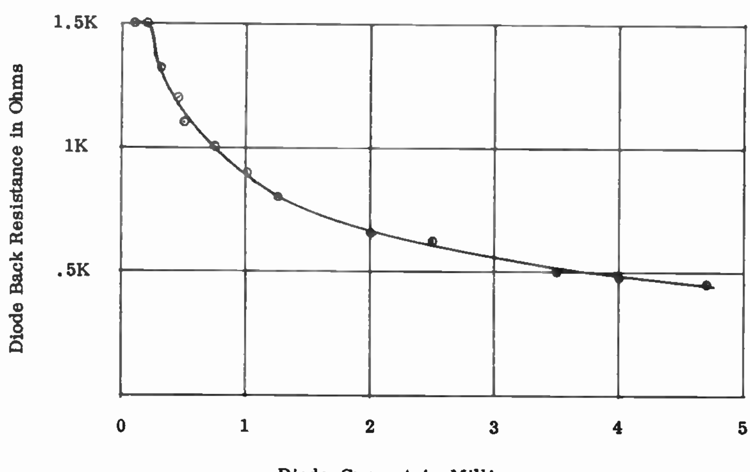


Figure 1



VSWR as a Function of Diode Current

Figure 2



Diode Resistance as a Function of Diode Current

Figure 3

DO YOU NEED A PREAMPLIFIER?

Many hams ordering our converters order a preamplifier at the same time. They must figure a preamplifier is needed to get the ultimate out of a converter. This is not so with anything we are currently building. A preamplifier can complicate matters--by giving you additional gain that makes the system unstable. However, if you have a poor or questionable converter and you build or buy a preamplifier you KNOW is good, you'll come out ahead. Sometimes the communications receiver used behind a converter is so sick that the converter doesn't have enough gain to override the receiver's noise. Then a preamp would help even tho the noise figure is no better than that of the converter. Just because you have a receiver with a "prestige" name, don't assume it is up to snuff on 28 Mc. Many aren't.

SOLID STATE 432 MC. CONVERTER

by R. L. Measures, K6OKC*

The local oscillator in most 432 Mc. converters leaves much to be desired. Overall efficiency is low. Power consumption is at least several watts. Only a few milliwatts of injection is the end result. Often other frequencies are present in the output. Starting with too low a crystal frequency and multiplying many times is the reason. Considering the present state of the art, I can see room for improvement; and that is the reason for this article.

An ideal local osc. for a 432 Mc. to 28-30 Mc. converter should be at 403.7 Mc. This will allow tuning down several hundred k.c. below 432 Mc. In the converter to be described, 432 is at 28.3. The upper limit would then be 433.7 Mc. (30 Mc.). Obtaining direct crystal oscillation at this frequency is impossible. Choosing the highest practical crystal frequency and multiplying from there to reach 403 Mc. seems reasonable.

Crystal-controlled 7th overtone transistor oscillators are capable of fair power output up to 140 Mc. A logical place to start would be 134 Mc. The final frequency could be obtained by a varactor/tripler.

CIRCUIT DESCRIPTION:

The oscillator runs at 134.567 Mc. The crystal is a 19.22 Mc. cut and oscillates in 7th overtone. The frequency stability is excellent--heat not being a problem. A constant voltage source is a prerequisite for this condition. The transistor is a 2N2369. It is a vhf powerhouse in a TO-18 package. So much injection was obtained with this device that the principle problem was reducing the injection to a usable level.

The 134 Mc. energy drives a Philco (now obsolete) or Sprague MADT germanium transistor. These transistors make excellent varactors. Philco is now manufacturing varactors only. The transistors are no longer being produced. Do not attempt using a typical "varactor" such as a 1N82A. They are very poor by comparison and cost very little less than the real thing. I use a 2N2398 in my converters. Its E-B junction suffered an overdose of 432 Mc. R.F. Any MADT Ge type would work as well. Most are priced well below the 2N2398.

The 403.7 Mc. energy generated in the varactor circuit is refined by the resonant circuit L4/C2. Pure, stable energy at 403.7 Mc. is the result. In doing so the power consumption was only 90 mw.

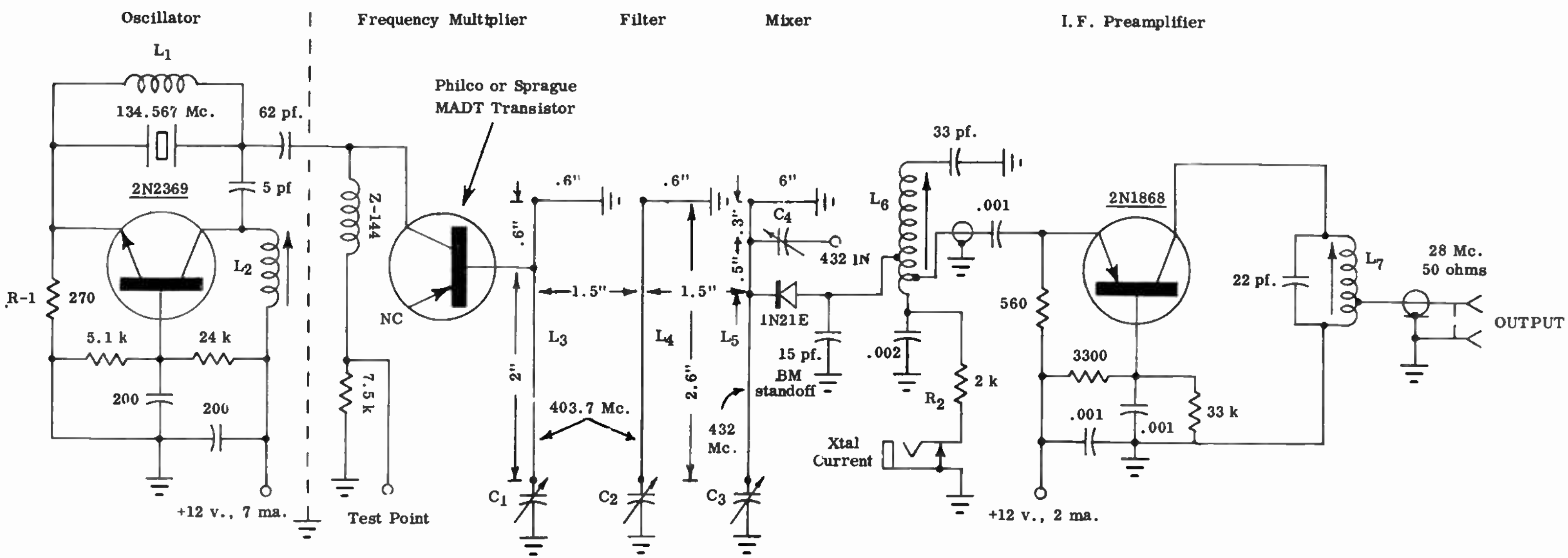
The mixer appears to be very simple. Don't be deceived. The performance is substantially the same as circuitry that is much harder to construct and occupies a great deal more space---half-wave aperture-coupled trough lines being a prime example.

The 432 Mc. signal, either barefoot or from the transistor preamplifier(s) enters the mixer line through a matching device, C4. The L.O. energy is coupled by the close proximity of L4. The resultant signal(s) in the 28/30 Mc. range produced by the mixer are allowed to pass on to L6 by the 15 pf button mica capacitor. The uhf signals are effectively bypassed. To assure no degradation of the 28/30 Mc. signal(s), approximately 22 db of amplification is furnished by a 2N1868 or 2N1745 MADT transistor. The resultant output level is such that even a poor receiver will perform adequately for the tunable I.F. The I.F. preamplifier may be eliminated if you plan on two transistor amplifier stages of R.F. pre-amplification at 432 Mc.

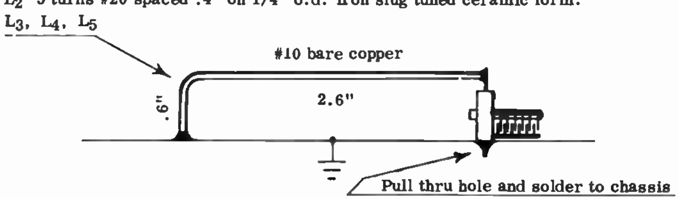
*1121 Glenwood, Oxnard, Calif.

K6OKC

432 Mc. to 28.3 Mc. Converter



L_1 6 turns #22 air wound, spaced .3", 1/4" i.d.
L_2 5 turns #20 spaced .4" on 1/4" o.d. iron slug tuned ceramic form.



L_6 14 turns #22 like L_2. Taps at 2T and 5T.
L_7 15 turns #26 3/16" form similar to L_2. Tap at 2 T.

Xtal = See text

C_1, C_2, C_3 Johnson type "U" 189-1
C_4 Johnson type "U" 189-3

All resistors are 1/2 watt composition types. In some cases, series or parallel combinations of standard values may be needed to obtain the approximate odd values used in the oscillator circuit. Z-144 is an Ohmite R.F. choke. A handwound air core equivalent can be used as a substitute. L2 tunes about 134 Mc.

Refer to Photo on Back Cover

CONSTRUCTION NOTES:

The oscillator crystal is available from International Crystal Co. It is a type FX-1, .01%, and the frequency is 57.678 Mc., 3rd overtone. The fundamental frequency is roughly 19.22 Mc. It is used on its 7th overtone. You may, if you so desire, order a 7th overtone crystal---or at least that is what the frequency shown will be. The cost is over twice as much and it does the same job. Count your pennies and take your pick. Current cost of the third overtone unit is $4.40, postpaid. Do not order a FA type crystal. The "A" indicates amateur use---the temperature tolerance is 5 times worse.

The 2N2369 currently lists for $2.40, a real bargain.

The crystal holder is made from thin-wall brass tubing. Several slots should be made to assure a firm grip on the crystal. The brass tubing and the razor saw are available in your local hobby shop.

The 4" x 6" plate, on which the converter is built, can be of any solderable material. Brass, copper, stainless steel, copper-clad epoxy board, etc. Gold plating is desirable from a weathering viewpoint. Electrically, it won't make any difference.

This converter and its companion two-stage 432 Mc. transistor amplifier have been in service at K6OKC for some time. It has been hauled to an assortment of distant mountain tops. It has been dropped and has suffered other abuses. It continues to operate perfectly. This is not too surprising, however, as there isn't too much to go wrong in the first place. Such reliability is something of a comfort at 8800 feet elevation and 60 hard miles to the nearest store.

ADJUSTMENT:

1. Peak all slug-tuned coils to their design frequencies with a dip meter. Connect a ten meter receiver to the output jack.

2. Connect a high-resistance voltmeter to the Test Point. Connect a 1 Ma. meter thru the crystal current jack.

3. Through a 25 Ma. meter, apply + 12 volts to the converter.

4. Adjust L2 for maximum voltage at the test point. 2 to 4 volts is typical.

5. Adjust C1/C2 for maximum crystal current.

6. Apply a moderate 432 Mc. signal to the input. Peak the 28 Mc. signal with C3, C4, L6, L7. Readjust C1 and C2 for optimum injection.

Adjustment Notes: After mounting in a chassis, some retuning of the UHF lines will be necessary. Holes should be cut in the bottom and sides of the chassis base to allow this operation.

In the likely event that too much or too little injection is obtained, R1 and R2 may be adjusted accordingly. The more "R" the less injection. 150 to 500 microamperes of crystal current is acceptable.

Typical power consumption is 7 to 8 Ma. at 12 volts.

OPEN BANDS

by Marilyn Wiseman, K8ALO

EDITOR'S NOTE: We are getting quite a few kicks on the quality of band openings being listed. Originally we kept reports down to 250 miles on two meters. This brought a few squawks from the low-power gang. Some hams object saying that the distance limit should be raised. On 432 we have been listing about anything that comes in. The purpose is to encourage 432 activity and to let you know who has equipment so you can sked. I see no point now in keeping the 50 Mc. reports because on true openings it makes little difference how good your equipment is or how good an operator you are. Scatter is another thing. Open Bands reports let you compare your equipment, your skill and your DX with that of others. Propagation varies tremendously with different areas--we know, so such things can be taken into consideration in reporting. By reporting the unusual and the difficult, the column can be kept interesting. Send your reports to Marilyn, not to VHFER. K7AAD

News is certainly sparse this month. Don't know what happened to the OMs who told me about the great 2-meter opening Sept. 11-12. Reports were that seven different call areas were heard or worked through the midwest and eastern sections. I missed this one as usual, being on my way to the Findley Hamfest. I can't guarantee a good column without reports, so please send them in. My address: Box 103 Petersburg, Ohio 44454.

50 Mc.

Sept. 6 K7ICW (Nev.) wrkd K7BBO (Wash.) c.w. 0830. K6MLA wrkd K6GJD SSB 1015.
Sept. 11 K7ICW wrkd K7BBO, WA6HXW, W6VOD/6, W6PUZ/6 on c.w., and WB6GKK, WA6ZJN s.s.b.. 0820-0934.
Sept. 12 K7ICW wrkd WØEYE (Colo.), K7BBO (Wash.), W6GDO, WA6HYX, W6NLZ 0712-0912. WØEYE (Colo.) wrkd WB6KAP on scatter 2215.
Sept. 18 K7ICW (Nev.) wrkd W6GDO (Sacramento) SSB, K7BBO (Wash.) c.w. 0844-0855.
Sept. 19 K6MLA wrkd WA6HWX SSB 0925. K7ICW wrkd WØEYE (Colo.) hrd W7CNK.

Editor's note: The above were primarily scatter type contacts and not band openings. These contacts of 600 to 1000 miles occur every weekend morning from southern Calif. to northern Wash. and points in between plus the Nev. and Colorado. This is brute force communication with high power and reasonably good antennas.

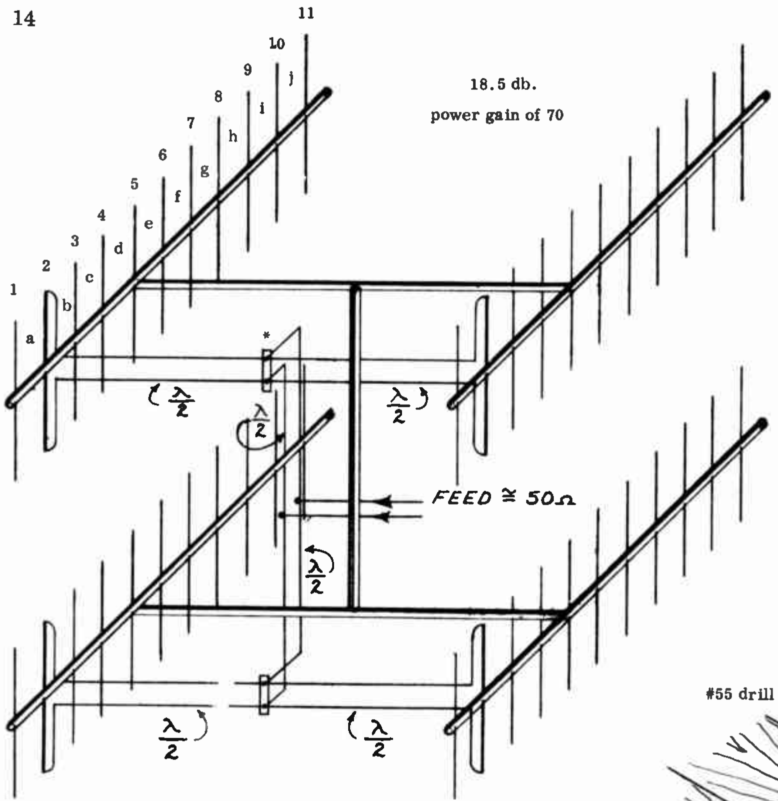
144 Mc.

Sept. 11 K8BHH (Alliance, Ohio) wrkd VE3ESE, VE3BYS (Ont.), W9TWU/9, W9BRN (Ind.), K1YRT/1 (Vt), W1LUA/1 (Conn.), K9VEY (Ill.) 1503-2003. Dan reported all signals 5/9 plus. K7ICW (Nev.) wrkd K7RKH/7 at Castle Cliff, Utah, K7NII (Scottsdale, Ariz.), W6VOD/6 (Calif.) 1605-2230.
Sept. 12 K7ICW wrkd W6DQJ, W6NLZ, K6HAA, W6YVO 1944-2008.
Sept. 26 K7ICW wrkd W6DNG, W6DQJ, W6YVO, K6TSK, all over the mountains. 0810.
Oct. 2 W3ZWZ (Pittsburgh, Pa.) wrkd W4NJE (Tenn.) 400 mi. NBFM 2045.

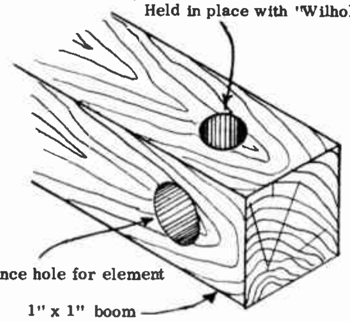
220 Mc.

Sept. 12 K7ICW (Nev) wrkd K7RKH/7 (Castle Cliffs, Utah) 98 mi. A3 & c.w. 1135.

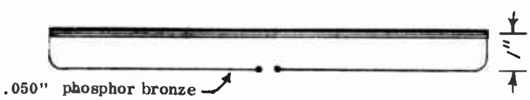
432 Mc. 11 Element Yagi
K6OKC



1. Boom material must NOT be metal. 1" x 1" Douglas fir preferred.
2. Elements are 3/16" aluminum welding rod, (Heliarc type.)
3. Measured gain of quad stack over reference dipole 18.5 db. with approximately 1 wavelength spacing.
4. Quad stacks are spaced 1 wavelength each direction.



ELEMENT MOUNTING

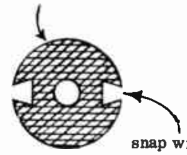


8 1/2:1 impedance dipole

Feed lines are #10 copper spaced 3/4" to 1", hand drawn to straighten wires.

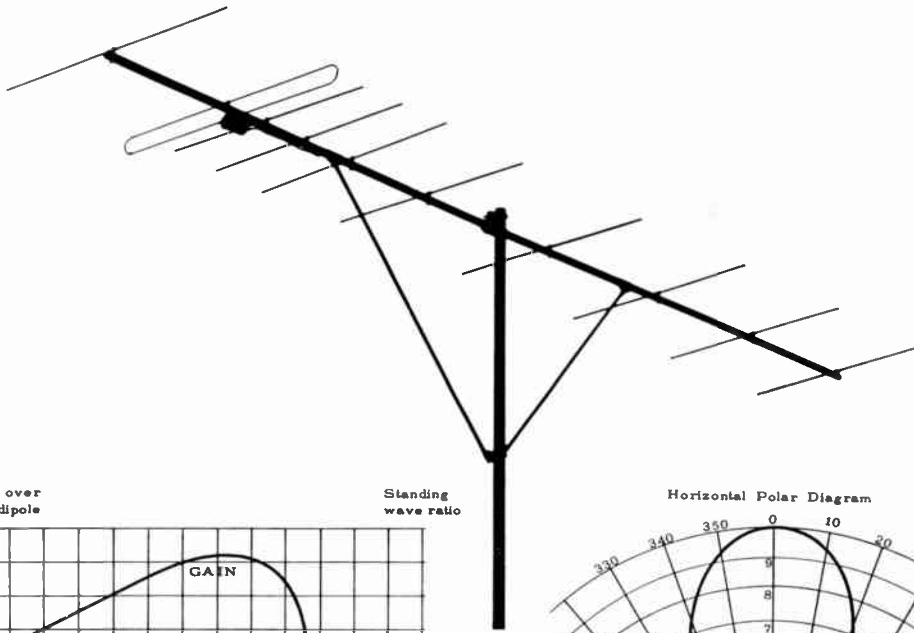
Element Dimensions and Spacings (inches)			
1	13.47	a	4.5
2	12.75	b	5.0
3	12.10	c	7.0
4	11.72	d	8.0
5	11.84	e	8.0
6	11.97	f	9.5
7	11.84	g	9.5
8	11.72	h	9.5
9	11.60	i	9.5
10	11.60	j	9.5
11	11.47		

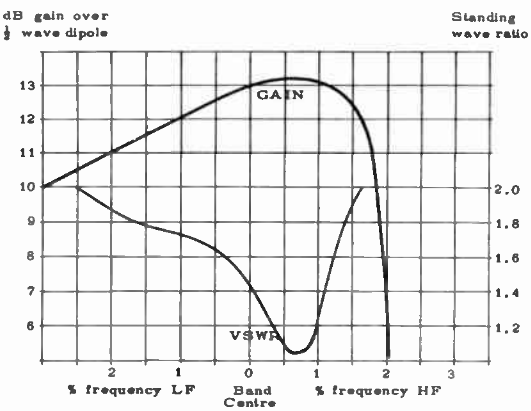
* Teflon insulator

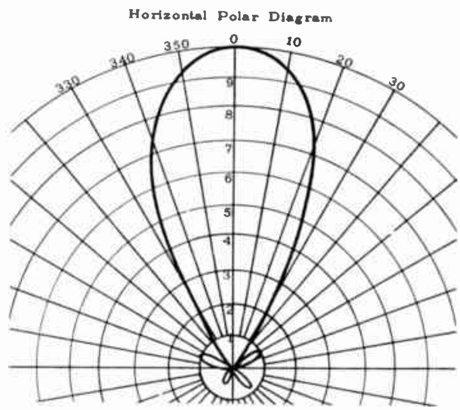


Make from bar stock

SKYBEAM



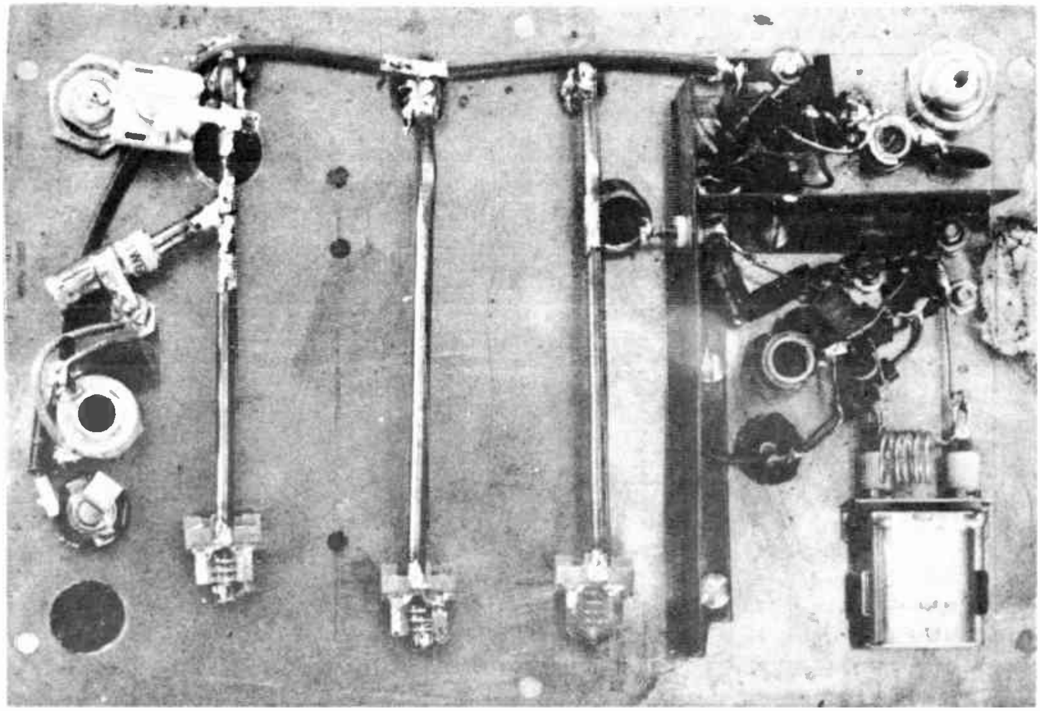




A PROVEN PERFORMER, this two meter SKYBEAM by J Beam Aerials, Ltd. of England. 13 db. gain over a dipole at 146 Mc., 15 db. over an isotropic radiator. Ruggedly built. Boom, elements and support rods of aluminum, 3 brackets of steel (plated). Available for feed with twin lead or coax. See the review in the May VHFER.

Write for literature and prices on this and other J Beams.

Gain, Inc. 27 E. 112th Place Chicago 28, Illinois



Continued from page 11

PROBLEMS WITH 4CX300 TUBES

Information we have received from pretty competent sources indicates you should avoid use of the 4CX300 at 432 Mc. Input characteristics are poor for this frequency. The 4X150 and 4X250 series tubes are working well.

Published by Parks Electronics Lab.
Route 2, Box 35
Beaverton, Oregon

WM. MANDALE 4-66 (8)
251 DELSALB PIKE
KING OF PRUSSIA, PA.

Return Requested

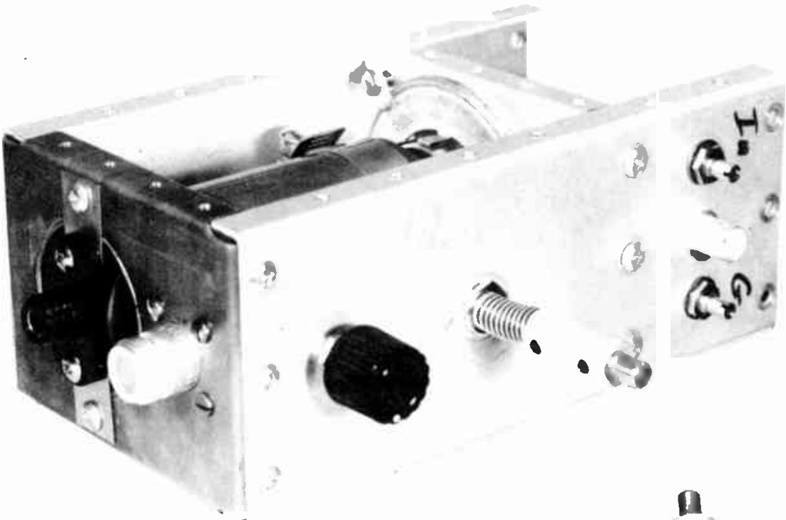
VHFER

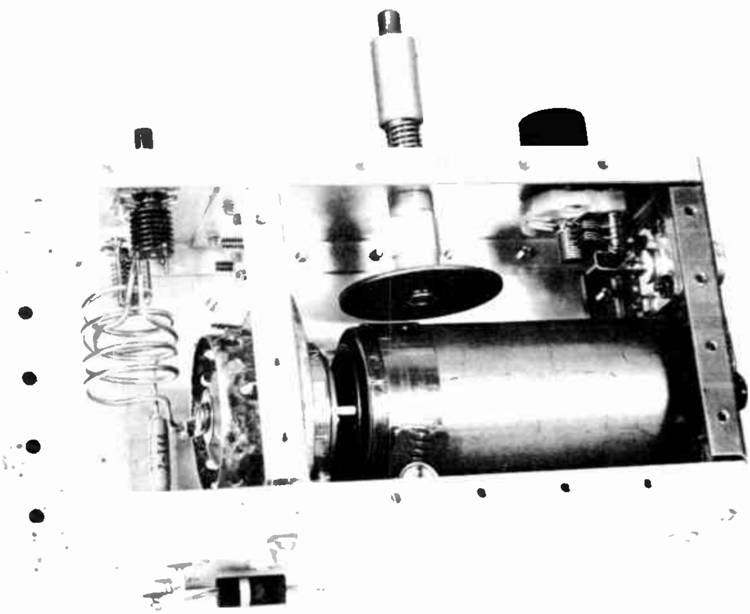
LEARN BY DOING

50 MC. AND UP

Volume 3, No. 9

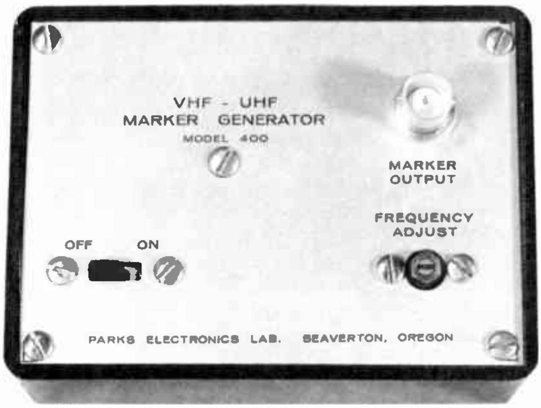
September, 1965





A TRIPLER FOR 432 MC.

NEW PRODUCT



Here's the marker generator described in the May VHFER. We got requests from hams who wanted to buy it so we decided to make it. Price is $25, postpaid. Gives markers every 1 Mc. thru and beyond 1296 Mc. Adjust against WWV.

Nuvistor

CONVERTER

$54.95 postpaid

- Noise Figure less than 3 d.b. over full 4 Mc. Bandwidth.
- Any I.F. from 7 to 50 Mc.

PARKS ELECTRONICS LABORATORY
ROUTE 2, BOX 35 • BEAVERTON, OREGON

VHFER magazine is published monthly by Parks Electronics Lab., Rt 2, Box 35, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions $2 per year, others $3 per year. Second class postage paid at Beaverton, Oregon

A TRIPLER FOR 432 MC.

by Deane Kidd, W7TYR

This article describes a tripler from 144 Mc. to 432 Mc., using a 4X150A tetrode. The target was a transmitter with 40-50 watts of output. This power level is high enough for local contacts and is also enought to drive a kilowatt final. The choice of a 4X150A was made because this tube type is relatively plentiful in the local MARS program. The cost of good air system sockets for these tubes is balanced against the new cost for the 5894 twin tetrode. The forced air cooling needed for this tripler is also needed for the higher power final which will be described shortly that uses two 4X250Bs.

The circuit for the tripler is quite simple. However, as with all higher frequency transmitters, the mechanics of constructing a proper size cavity and line requires some tools. In the next VHFER a kit of the necessary metalwork all done will be offered for sale. For those of you with adequate facilites the major parts are shown in enough detail to permit you to make a reasonable duplicate. The top and bottom are flat pieces of aluminum with identical holes. The two side pieces are identical in size with similar mounting holes. The end with the high-voltage connector is made of brass so the brass quarter-wave line can be soldered to it. The plate line is a 3 3/4" section of brass tube with a 1 3/4" o.d. A one-inch length of 2" aluminum tube is used for the air duct input. The flexible hose used with it is available at any auto supply house (defroster hose.) The plate of the tube is insulated from the line (d.c.) by teflon tape which will be furnished with the kit or will be made available by itself.

TUNE UP. Let me caution you, from personal experience, to use screen and bias supplies as shown. I made the mistake of using regulated supplies that were handy and got into all kinds of trouble. If you do use a regulated screen or bias supply, make sure there is a resistive load on it that draws 20 ma. or so. The screen can draw positive or negative current and completely upset the operation of a conventional regulated supply using a series or "pass" tube. The current through the VR-105 in the grid circuit should be about 5 ma. with no control grid drive. Choose "R" accordingly, taking into account the negative voltage you have available and that grid current will increase the current through the VR. The external supply need only supply a "keep alive" current to keep the tube fired.

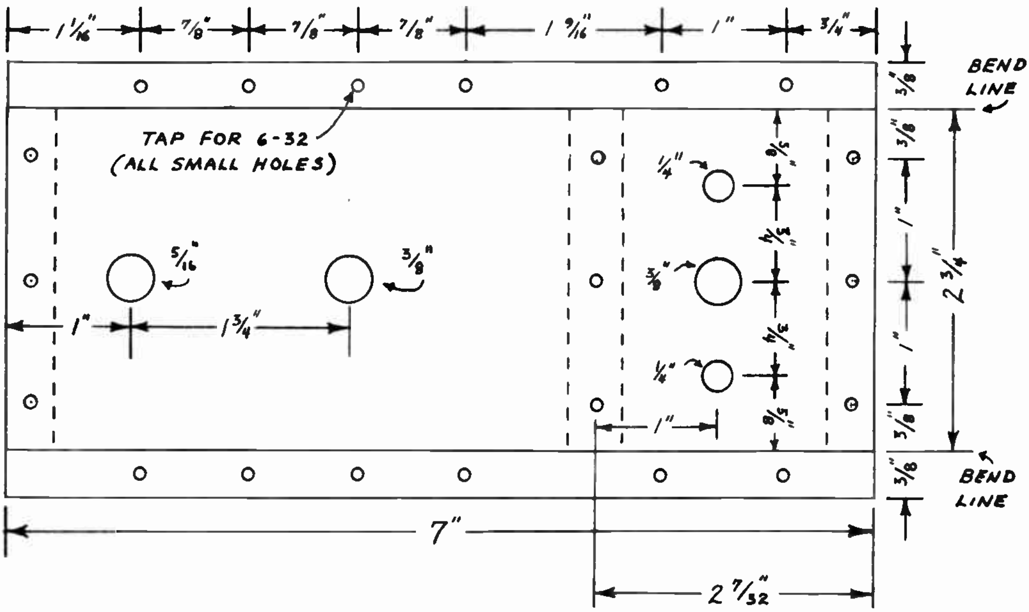
The current through the screen VR tubes should be not less than 5 to 10 ma. at any time and up to 40 ma. with no load. 10 ma. during normal operation is safe. If the tubes extinguish during operation, they aren't regulating and you should lower "R."

Adjust the two condensers in the grid circuit for maximum grid current as measured by the voltage drop across the 10 K resistor or by means of a milliameter in series with the resistor. Make any adjustments to coil or capacitor sizes necessary to do this. A grid dip meter will help. Capacitors in the grid circuitry are 10 to 15 mmf. each. The other critical area in this tripler is the output link. NEGATIVE screen current indicates the output circuit is overcoupled to the plate tank. After a dozen trials at decreasing the length and width of the output link I got to the version pictured on the front page.

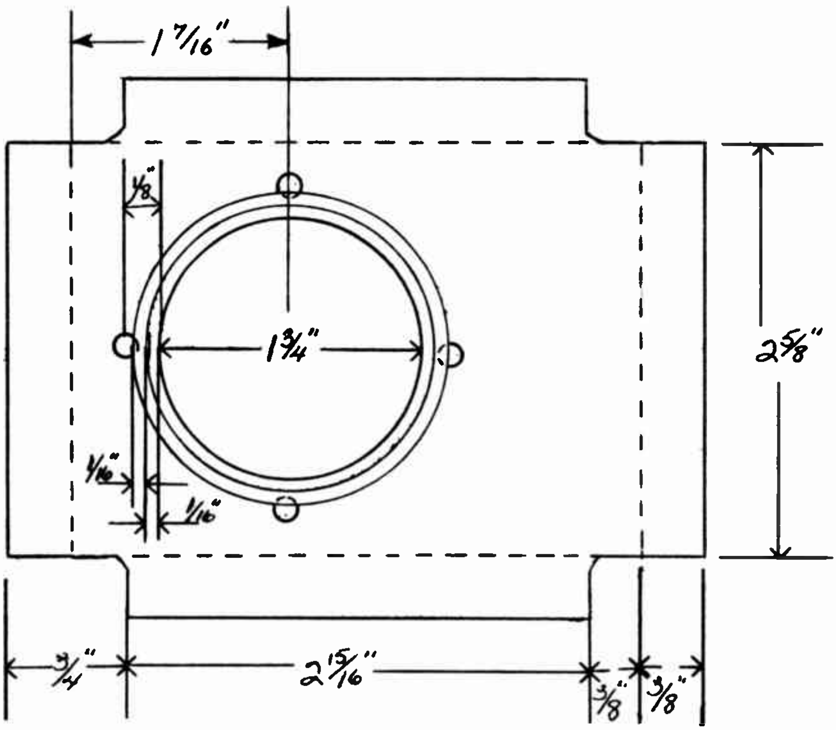
FINAL STATISTICS

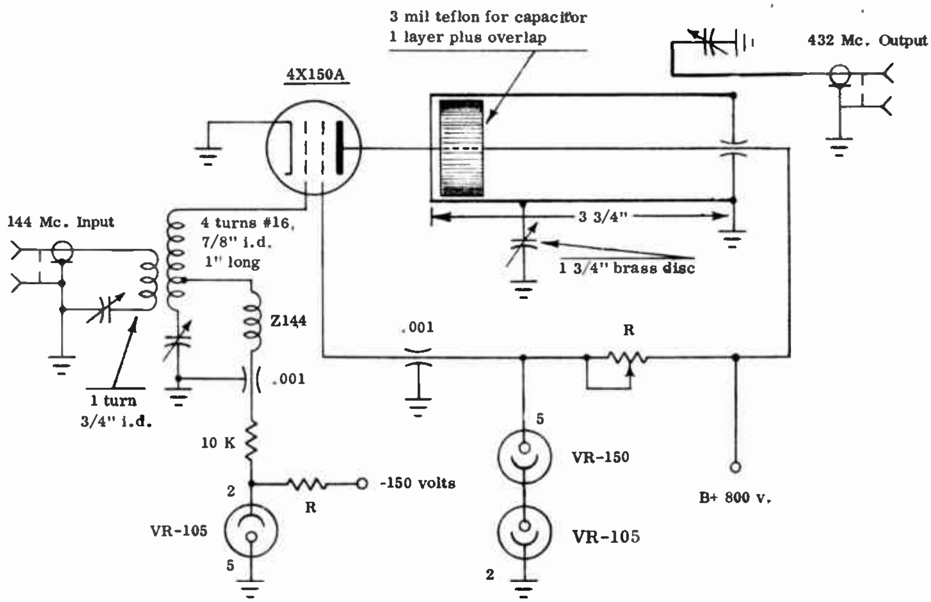
Plate voltage	800 volts
Plate current	250 ma.
Screen voltage	250 v.
Screen current	7 ma.
Grid current	12 ma.
Power output	56 watts

Power output was measured with a Sierra Model 164 Wattmeter with a 200 to 1000 Mc. head. The dummy load was 500 feet of RG 58/U coaxial cable.



Front view of the tripler. Dotted lines show fitting of other metal sections and do not indicate bends. Back panel is same dimension. Since terminal placement is not critical, no drawing was made.





OPEN BANDS

by Marilyn Wiseman, K8ALO

Lots of openings, wow! Received plenty of reports, so won't take up much gab space. Thanks to all who sent in reports. Looking forward to your reports for next month's column. My address: Box 103, Petersburg, Ohio 44454.

50 Mc.

AUG. 1 K7ICW (Nev.) worked WØEYE (Colo), K3MXW (Pa.), Calif. Hrd W8EPO (Ohio), K3KEO (Del.), WAØATY (Iowa), W1ITS (Mass.) 0730-1701.

3 W7VDZ, W7VTB (Wyo) wrkd K6GJD 1832. K7ICW (Nev.) wrkd w5LKL (Tex), hrd WØEYE in Colo., WA5FJN (Texas) 1832-1858.

7 K5JFW (Tex) wrkd WB6JSI 1355. K7ICW wrkd WA5ICH, K5PNC (Tex) hrd Calif. 0807-1528.

8 K7ICW wrkd W7CNK (Wash.), WØEYE (Colo.) 0730-0900.

14 K7ICW (Nev.) wrkd K5OOJ WA5IYX (Tex) 1728-1737.

15 K7ICW (Nev.) wrkd WØEYE (Colo.), K7BBO (Wash.), WA6FQB/5 (Ark), WA6RGH/5 (Okla.) WA4LTS (S.C.), WA4HAV (N.C.), W5LUJ, WA5CZM, W5SFW (Tex.), & Calif stations.0730-1120.

23 W5TKT (Okla) wrkd W5RLM (Tex) 2030. Both stations heard by K7ICW

SEPT.11 WA2CJK/2 (N.Y.) wrkd W1UGO/1 (Me) and Ohio. Reported by K2ODL.

144 Mc.

AUG. 1 K7ICW (Nev.) wrkd many calif. stations 0811-0828.

7 W8WEN (Ohio) wrkd K4TXD (Ky) 2332. K7ICW wrkd W6NLZ (L.A.) 0706.

8 W2DFV (N.J.) wrkd WA1DPP (Mass) 213 mi, K1ABR (R.I.) 205 Mi. DFV used a Two'er. 0105.

9 W8WEN (Ohio) wrkd W4EXS (Ky).

10 W1AZK (N.H.) wrkd W4AWS (Fla.) W8WEN (Ohio) wrkd K9OYD (Ind.)

11 K8PBA (Mich) wrkd W8FYX (Mich) 310 mi, WA2RDE (N.Y.) 250 mi, WØMQS (Iowa) 460 mi. K2RTH (N.Y.) wrkd W4WNH (Ky). K1UGQ (Me) wrkd W4WNH (Ky.). W8WEN (Ohio) wrkd W3GKP (Md.), W9AAG (Ill), KØMQS (Iowa), K1PXE (Conn) 2140-2350. K7ICW (Nev.) wrkd K5TQP (N.M.) during meteor showers (0603-0620.

12 K1MTJ (Me) wrkd W4WNH (Ky). K1UGQ (Me) wrkd W8PT (Mich.) , K4IXC, Fla. K1OYB (Me) wrkd W4MNT (Fla.) K1ABR (RI)wrkd WØCUC (S.D.), WØPHD (Minn.). K8ZES (Ohio) wrkd VE3CRU (Toronto) 275 mi. 0019. K7ICW wrkd WØEYE, K5TQP on meteor showers 0600.

13 K8ZES (Ohio) wrkd K9ZUF (Ill.) 280 Mi., WA9KPD (Wis.) 310 mi. 0008-0025. W8WEN (Ohio) wrkd W9MAL (Ill). K7ICW wrkd WØEYE (Colo) 0724.

Cont'd. on Page 6

14 WA2JMN (N.Y.) wrkd VE2BMQ, VE2BTZ, VE2TO 0032-0115. K7ICW (Nev.) wrkd WØENC (S.D.) 0500. W8WEN (Ohio) wrkd VE2ALE 2200.

10-14 Perseids Meteor Showers. K6HMS (Calif.) wrkd K5WXZ (Tex), hrd long bursts on K5TQP (N.M.) W7UAB (Ore.), a few pings on WØENC (S.D.). Skip says these showers were better than those of the past few years but best years were 1957-58.

15 K9RVG (Ill.) wrkd WØDQY (Mo.) 300 mi., K8PBA (Mich.) 400 mi., WA2RDE (N.Y.) 680 mi, K8EJU (Ohio) 300 mi. W2DFV (N.J.) wrkd W4JFU (Va.) 271 mi, 0013. W8WEN (Ohio) wrkd W3LML (Del), W1AZK (N.H.), 2221-2255. K7ICW (Nev) wrkd W6VOD/6 S-4 peaks 1132. K8PBA Mich. wrkd WA2RDE (N.Y.) 250 mi., W9OEQ (Ill) 250 Mi., WØDQY (Mo) 450 mi.

19 K8PBA (Mich) wrkd WA4ELH (Ky) 250 mi.

22 K8PBA (Mich) wrkd WA2RDE (N.Y.) 250 mi. K7ICW (Nev.) wrkd many Calif. stations 0800.

23 W8WEN (Ohio) wrkd K3LML (Del), W4EXS (Va), K4TXD (Ky), W1AZK (N. H.) 2142-2321.

24 W8WEN (Ohio) wrkd K3OBU(Del) 2300.

29 K8PBA (Mich) wrkd WØDQY (Mo.) 450 mi, WA2RDE (N.Y.) 250 mi.

SEPT. 5 WA8IAU (Ohio) wrkd K9WHF (Inc) 280 mi. K8ZES (Ohio) wrkd W9OTE, WA9HQQ (Ill.) 270 mi. 2100-2123. K8PBA (Mich) wrkd WØDQY (Mo) 450 mi, WA2RDE (N.Y.) 250 mi.

SEPT. 6 W9DID (ILL) wrkd 21 Ohio stations, K8TIF, WA8KBJ, WN8OKA (Mich), K9IOM (Ind), K3EXU, K3BBO (Pa.), W4YXT, WA4ELH (Ky), VE3BVC (Ont.) K2MNB (N.Y.) 0130-2200. WA8IAU (Ohio) wrkd WAØIRF (Iowa) 500 mi, K9VRL (Ill) 420 mi, K9VEY, WN9PHV, K9TLK, WA9FUO, W9YOI (Ill)360 mi. (1033-2038). K8ZES (Ohio) wrkd 12 Ill stations, WØTAF (Mo.) 425 mi, WAØCER (Iowa) 400 mi, WØRWC (Iowa) 400 mi, 7 Wis. stations with WN9OFF (Wisc.) running a Two'er, WA9MZP mobile in Wisc. That's right, mobile! 0732-1940.

7 K8ZES (Ohio) wrkd WA2LTM (N.J.) 432 mi, K3OBU (Del) 375 mi, K3JPB (Pa.) 400 mi. 2150. K8PBA (Mich) wrkd K3OBU (Del) . This is PBA's 24th state on 2 meters.

11 WA2CJK/2 N.Y. wrkd WØBFB (Iowa) over 700 mi, W8PT (Mich) and Ind 2000-2300. K8ZES (Ohio) wrkd K9MZZ (Ill) 350 mi, WAØJMC (Mo.) 625 mi, WAØHMZ (Kan) 675 mi, KØVBZ (Kan) 685 mi., K9HEU (Ill) 350 mi., W9OTE (Ill.) 270 mi., K9VEY(Ill) 290 mi. 0052-1029

220 Mc.

SEPT. 12 WA2CJK/2 (N.Y.) heard K1UGO/1 (Me) 290 mi, W1AZK (N.H.) 220 mi. 0000-0200.

432 Mc.

AUG. 7 K3EAV (pa.) wrkd W2CCY (N.Y.) 130 mi.

11 K8ZES (Ohio) wrkd K8OXZ (Ohio) 75 mi. 0100

13 K3EAV (Pa.) wrkd W2MDE (N.Y.) 185 mi.

14 K7ICW (Nev.) hrd K7RKH/7 (Ariz) 37 mi 2002.

18 K3EAV (Pa.) wrkd W2MDE (N.Y.) 185 mi, K2GUN (N.Y.0 140 mi.

20 K3EAV (Pa.) wrkd W3SDZ 85 mi, W3mmv 30 mi.

29 K6OKC wrkd WA6SSU 157 mi, accomplished with 1/2 watt on SSU's end. A-3 emission. K6OKC/6 reports working 31 stations in 7 sections during June VHF contest. K3EAV (pa.) wrkd W3RUE at 170 mi, W3SDZ 85 mi, W3MMV 30 mi.

Sept. 3 K3EAV (Pa.) wrkd W2DWJ 130 mi.

5 W8YIO (Mich) wrkd K9AAJ (Ill) 430 mi.

6 K8ZES (Ohio) wrkd W9BRN (Ind), W8PT (Mich) 200 mi. 2203-2224.

7 K8ZES (Ohio) wrkd W8YIO (Ind) 110 mi, W8EDS (Ohio) 100 mi, W8DQU (Ohio) 75 mi. 1938-2059 W8YIO (Mich) wrkd W3MMV York Pa. 405 mi. On 9/11 he wrkd W2MDE (N.Y.) 562 mi., and on Sept. 11 K2CBA in N.Y. at 530 mi. He runs 200 w. out to 48 el. colinear at 70 ft.

F.M. FOR 6, 2, AND 432 MC.

432 MOONBOUNCE TEST RESULTS
by Loren Parks, K7AAD

The 150-foot dish at Stanford was in operation Sept. 25 as announced in the August VHFER. The test terminated prematurely because of other demands for the dish, but in spite of this and some other problems I think you'll agree that the results were remarkably good. Hams in attendance were WA6QQI, W6GDO, WB6FSC/6, K6HCP, WA6MGZ and W6GXN. Here is the log as forwarded to me by Hank Olson, W6GXN.

LOG OF WA6LET Sept. 25, 1964
Freq. 432.000 1,000 watts input

			Sent	Received
0739	K2MWA/2	432.009		5-6-9
0747	W9HGE	432.013	5-6-9	
0801	W3SDZ	432.014	5-4-9	4-4-9
0809	W9HGE	432.013	5-6-9	3-4-9
0815	W2CCY	431.995	3-3-9	3-2-9
0832	G3LTF	432.036	3-3-9	5-4-9
0843	W9GAB		3-3-9	
0850	K2MWA/2	432.009	4-4-9	4-4-9
0855	W1BU	432.010		
0900	K2CBA	432.020	5-4-9	4-1-9
0914	HB9RG	432.000	2-1-9	
0931	W1BU	432.001	3-2-9	
1025	K2IYC/2	432.009	2-2-9	3-3-9
1054	W2FZY/2	432.009	5-5-9	5-7-9
1059	W2IMU/2	432.009	5-6-9	5-5-9
1118	W1ZIG	432.000	4-3-9	4-6-9
1129	W1HIV	432.001	4-3-9	4-4-9
1210	W9HGE	432.013	4-4-9	

The contact with G3LTF makes a new E-M-E distance record on 432 I believe. I don't know how much power was used on that end. Maybe England isn't permitted a kilowatt. Probably most of the rest were running a full gallon. K2MWA/2 and some of the others used the Bell Labs. dish. W3SDZ's 24' dish is pictured in a recent QST. The dish at W1BU is 30'. Wish we knew what equipment the others were using. If anyone used Yagis or colinears successfully I wish they would report it to me as it would give encouragement to others.

At any rate, if you listened and heard nothing your equipment is sick or your aim is bad. The Stanford dish had steering problems at first, being 1 degree off the moon. It wasn't corrected until about 1730 GMT which was too late for Europe. There were some other mysteries too. Scientific explanations given were tropo-refraction, servo error, program error and gremlins. The truth is that no one knows yet. You can see from the reports that signals could have been down another 10 db and contacts still made in several instances. So there is hope for the non-dish type antennas. I think we need to know how much the noise should rise when you point your antenna at the sun if it has a given amount of gain. I will try to pry this information out of some knowledgeable ham so you can have your gear adequately tested for proper operation before the next attempt, whenever it may be. End.

WHY SILICON DIODE NOISE GENERATORS ARE NO DARNED GOOD

by Frederick W. Brown, W6HPH*

This article is going to step on some toes, for which I apologize in advance. But in the interest of technical progress I believe the shortcomings of crystal diode noise generators should be publicly exposed.

Figure 1 is a typical noise generator circuit of the type frequently described in amateur publications. The "experts" tell us that a receiver adjusted for best noise figure with this type of generator will be capable of optimum performance when used with a matched transmission line. They usually specify a value of R equal to the line impedance, let's say the standard value of 50 ohms. What they don't tell you is that when d.c. flows through the crystal, _its_ impedance is also about 50 ohms. So we have 50 in parallel with 50, or 25 ohms---a 2 to 1 mismatch. Now a converter optimized with a 25 ohm noise generator will have best noise figure for a 25-ohm source, but certainly not for 50 ohms. Furthermore, if you use a quarter wavelength of 50-ohm line to connect to the converter input, the 25 ohms will be transformed to 100 ohms, and you'll be optimizing for that impedance. In fact, depending on the length of line, the converter will see 25 or 100 ohms resistance or some intermediate value in series with a reactance.

Now, off hand, you might think that an easy cure for this problem is to simply use a large value resistor for R or even an r.f. choke. The generator will then be approximately matched to 50 ohms when the switch is closed, but when the generator is turned off to take a reference reading the output impedance will soar to a high value. Will this make a difference when measuring noise figure?

Unfortunately, the answer is that it will. The trouble is you're changing the source impedance at the same time you're changing noise output. Not only does noise figure depend on source impedance, if the r.f. stage is slightly regenerative (or even _de_generative), but the _gain_ will depend on input loading. This, of course, will make noise figure measurements from a variable impedance generator completely meaningless. The measured noise figure can be fantastically high or fantastically low, depending on adjustments.

This fact was dramatically demonstrated recently when I tried a silicon diode noise generator on my slightly regenerative 432 Mc. Nuvistor r.f. stage. I connected the generator to the Nuvistor converter through a short length of 50-ohm coax and adjusted the receiver gain to a reference level on the noise output meter. When I turned the noise generator on to adjust for a 3 d.b. increase in noise, the output meter actually went down! This would indicate I have a _negative_ n.f., whatever that means.

Out of curiosity I plotted the noise generatorSWR vs. diode current at 432 Mc. The result is shown in Fig. 2. The value used for R was 220 ohms, which makes the circuit a good match to 50 ohms for high values of diode current.

Probably the reason all these years have gone by with no one measuring the mismatch of these things is that they aren't easy to measure. You can't use an ordinary reflectometer because the power level required will run the diode current up to a high value, possibly even burning it out. To measure mismatch without rectifying any signal requires that measurements be made at very low level --- below a microwatt of r.f. power.

*Pine Cove, Idyllwild, Calif.

Recently I got hold of a beautiful slotted line (good old MARS) that is very adaptable to low level work. By connecting a sensitive 432 Mc. receiver to the sliding probe in place of the usual crystal detector it is possible to work in the nanowatt region. Fig. 3 shows the measurement set-up used to determine Fig. 2.

In general there are three things that can be done either separately or in combination to reduce impedance variations to the point where the noise generator will be usable on most receivers. Of course, any noise generator with a changing impedance, even though very slight, will be useless on negative-conductance amplifiers such as tunnel diodes or paramps which are extremely sensitive to input impedance variations.

Three partial remedies are:

1. If a value of about 75 ohms is used for R, the SWR will be below 2 to 1 with the switch in either position although there will still be a substantial variation between on and off.

2. If a resistor is placed across the switch so that about 0.2 ma crystal current is flowing in the off position, the impedance variation between off and on will be relatively small. The optimum value for R will then be about 200 ohms.

3. A 50-ohm pad can be used between the noise generator and receiver to wipe out impedance variations. A high value of attenuation will more perfectly equalize the impedance changes but will also require more diode current to make the noise generator "hearable." Remember, the crystal only takes so much d.c. before it burns out.

Noise generators have other weaknesses. For one thing, since they generate noise on all frequencies, noise can be transferred through the receiver on its image frequency. This makes a receiver with poor image rejection look better than it really is.

Noise generators have other weaknesses. For one thing, since they generate noise on all frequencies, noise can be transferred through the receiver on its image frequency. This makes a receiver or converter with poor image rejection look better than it really is. For this and other reasons I prefer to tune up receivers with a weak signal source such as the one described by K6HMS in the July VHFER. (Ed. note: For relative measurements and tune up, a weak signal source is very good. However, for quantitative measurements at VHF and above the noise generator is used. Precautions are taken to make certain that the contribution of signal (noise) at the image frequency is negligible. A relatively high I.F. (5 to 10% of the signal frequency) is used to reduce image response and r.f. tuned circuits are designed to have sharp skirts at the edge of the required pass band.)

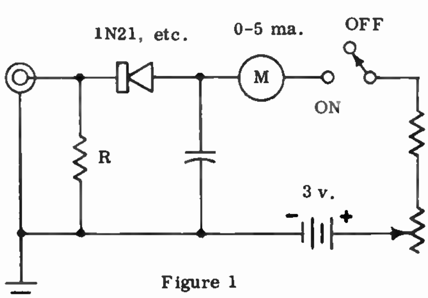


Figure 1

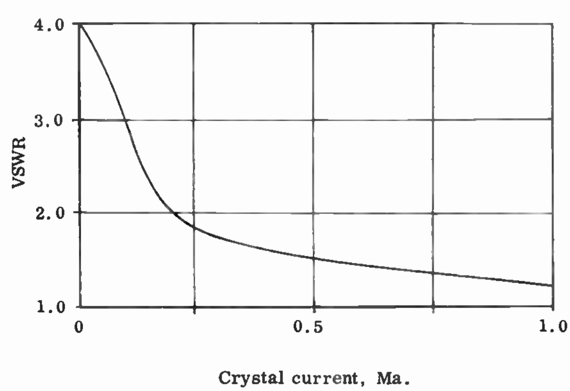


Figure 2.

VSWR vs. crystal current for the typical noise generator of Fig. 1 with R=220 ohms.

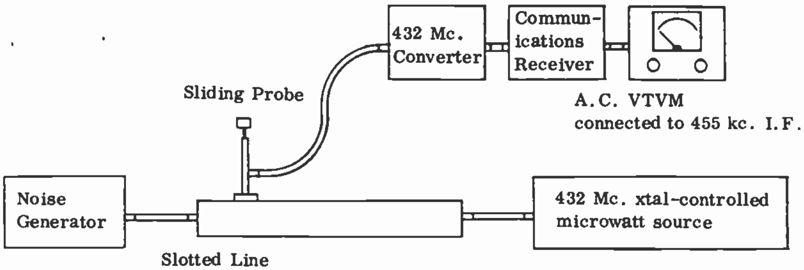


Figure 3

Measurement set-up used to derive Fig. 2

VHF ANTENNA HANDBOOK, by Jim Kyle, K5JKX. If you hadn't noticed, antenna information is hard to come by. Jim has collected data from numerous technical sources and compiled it nicely in this inexpensive book. If you're interested in antennas, this is a very useful book that can save you lots of time and money. Published by 73 Magazine, Peterborough, New Hampshire.

ANTENNA-MOUNTED PREAMPLIFIERS

If your 2 meter or 432 antenna is high in the sky, you have feedline loss. With RG 8/U cable at 2 meters, you are throwing away half the received signal in 120 feet of line. Of course you are also throwing away 1/2 of your transmitter power. Pole-mounted preamps are not hard to build--or buy. One way to work it that saves all the received signal is to mount the preamp. in a box right under the beam. Put your coax relay there too. Run RG 58/U from the preamp. down to your converter. Its loss is high but the preamp. has so much gain there is no problem. Remember that the "sensitivity" of the receiving system is determined at the front end in a decently operating system. Gain after that is just to let you hear the signal, for the most part. It has little function in pulling the signal out of the noise. Where you don't want loss is ahead of the preamp. At 432 Mc. an antenna-mounted preamp. is going to make a more noticeable difference, because economical cable is very lossy. A power resistor or a light bulb constantly energized will keep moisture out of the box. Always leave a little hole in the bottom of the box or you'll have condensation problems. Temperature may affect the performance of transistor preamps. so take that into consideration. I don't believe tubes have a problem.

HENRY'S PREAMP.

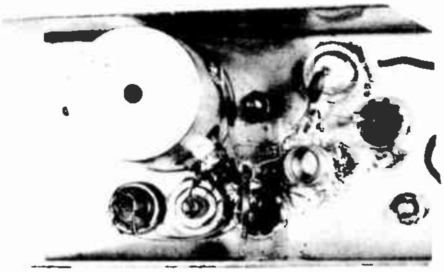
by K7AAD

As you have probably gathered by now, there are several views as to which way 432 pre-amps should be made and what transistors should be used. I believe they're all pretty good, and the performance obtained depends on who is building them, the transistors he selects (not just type), and what he has available to adjust and test with. This one is by Henry Cross, W1OOP. It uses an RCA 2N3478 in the grounded-emitter configuration. This preamp with the cavity measures the same as ours (as near as we can tell), but ours doesn't have a cavity. So it is doing an excellent job. Now in Henry's words--

"As far as input circuits go, I am completely opposed to ANY sort of untuned input. On the Pack (Pack Monadnock Mt.) we share the top of the mountain with the CAA which is on 225-400 among other frequencies. At home, it's channels 2,4,5,7, 10 & 12 plus 4 FM stations which are significantly strong. IF we put a big fat cavity ahead of the pre-amp there is not only the chance of making the input reactance the right value but there is a bit of selectivity to be gained. With a good cavity having an unloaded Q of 4000 (not hard to do) and loaded to a small insertion loss (as for instance 1/4 db) it would be 4 Mc. wide. Our (Sam's) old paramp cavities have about that performance if they are well made. The loop length plus coupling line length is best an even half wave (including corrections) so that the cavity tunes the transistor input. Even a loaded Q of 20 will give 23 db attenuation of a Channel 12 or 13 TV station."

Some of the details of construction on Henry's preamp. are kind of hard to give. As you can see, he builds for performance--no sockets, fancy layout. You don't need to have the special cavity but something similar, about 1" in diameter. You can make it. This one has a flat disc at the top of the center conductor. The lid gradually screws down toward it, making the lid one part of the variable capacitor. No socket is used for the transistor. Keep components and lead lengths very close in the base and emitter circuits. Capacitor values are probably not critical except of course the collector tuning. All are button bypasses except the one from the cavity which happens to be a tubular ceramic to fit this particular cavity. A shield strap is placed between the exposed base and collector circuits. Connectors are BNC types. I wouldn't use the standard UHF or SO-239 because their impedance characteristics are poor at 432. Type N is OK but inconvenient because of the cable size and the problem of getting things mounted close together.

Henry states that this preamp. does 2.5 ma. noise current on an HP 343A when it is tuned for best performance with his antenna and 2.2 ma when tuned for best performance on the 343A. This is approximately a 3.5 db noise figure. Keep in mind that this is the measurement obtained when it is used in front of a 5.5 db. converter. If you use it in front of a 10 db one you won't get that, for stage gain is only about 9 db. A crummy converter needs more than 1 stage of transistor gain. When you cascade stages you may have instability problems and have to use special techniques to stabilize the system. This is no fault of this or any other preamp. but is a matter of shielding and the coupling between stages. Another point is that this is a SELECTED 2N3478. They won't all do this well. End.



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TYPE "N" CONNECTORS FOR RG 17A/U

by Jim Geddes, K7ZIR*

This article describes a method for putting UG 58/BU type N bulkhead connectors on the end of RG 17 cable, for both economy and convenience.

The flange on the type N connector that is normally used to fasten it to a panel should be removed by cutting it off with a hacksaw and then filing it round or turning it off on a lathe. See Fig. 1.

The end of the coax should be prepared in the following manner:

1. Remove 1" of the outer plastic covering (Fig. 2).

2. Fold the exposed shield braid back out of the way. Cut 3/8" of dielectric off the exposed end (Fig. 3.) Then carefully remove 1/2" more dielectric. Do this with care as this 1/2" long piece will be re-used to maintain the characteristic impedance of the line near the fitting junction. The piece should be split as in Fig. 4.

3. File the end of the center conductor of the cable flat and drill a 1/8" hole in the exact center, about 1/4" deep. Do this very carefully as the center conductor is only 3/16" in diameter.

4. Tin the hole in the center conductor of the coax. A 100-watt iron will be needed. Insert the center conductor of the prepared connector in the hole and solder. (Fig. 6)

5. Put the 1/2" long pieces of dielectric back around the center conductor of the coax between the connector and the undisturbed dielectric, trimming as necessary for a good fit.

6. Fold the braid back down over the replaced dielectric and the connector tightly and solder to the connector. A piece of #20 or #22 bare wire will be useful to hold the braid on the connector while trimming and soldering

7. Trim the braid so it is 1/2" from the front of the connector. Then trim and file the excess solder from the joint and connector. Wrap with good black tape and the job is done.

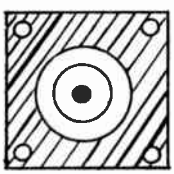
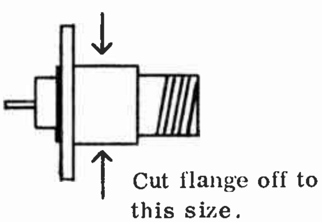


Figure 1.



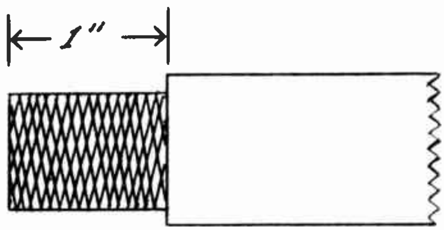


Figure 2.

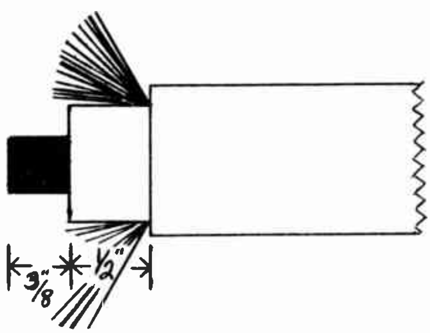


Figure 3.

*5955 S.W. 179th Beaverton, Ore. 97005

Figure 4.

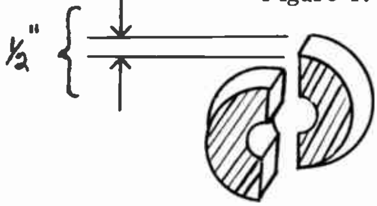


Figure 5.

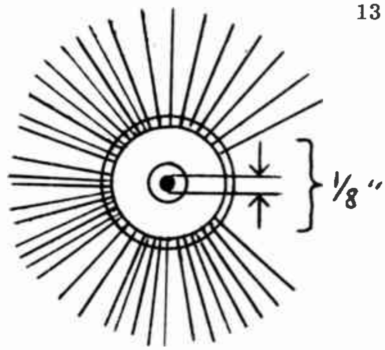


Figure 6.

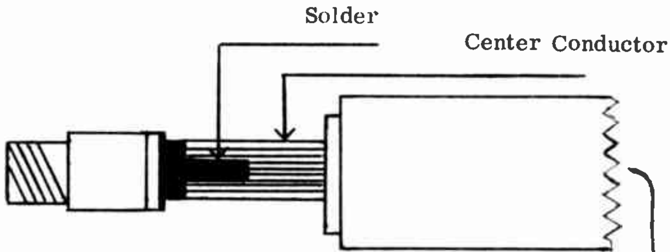


Figure 7.

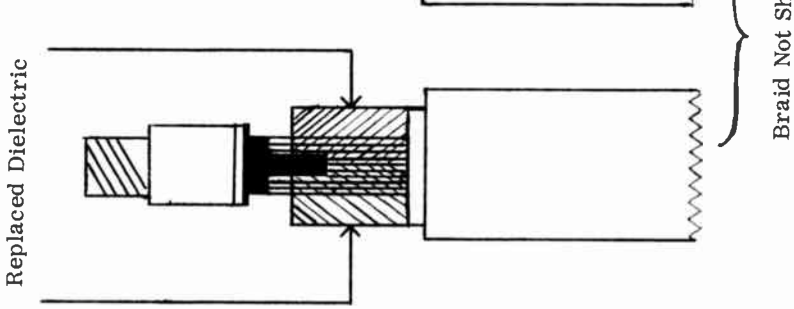
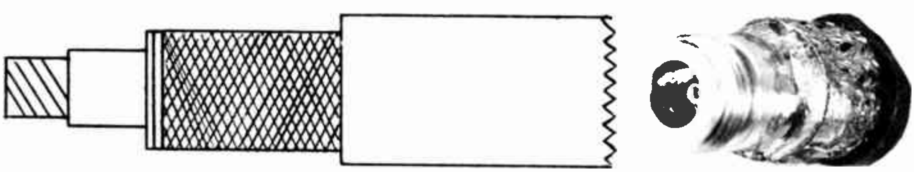
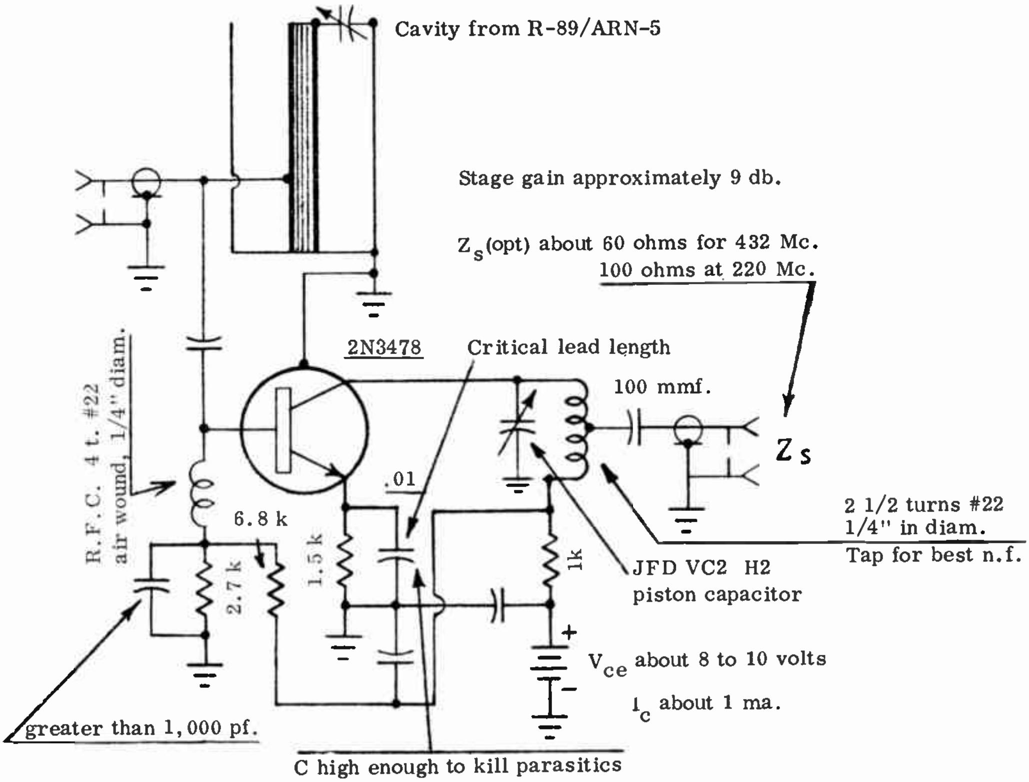


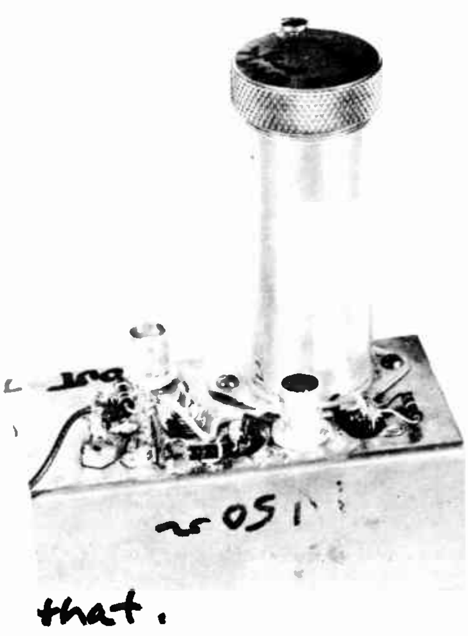
Figure 8.



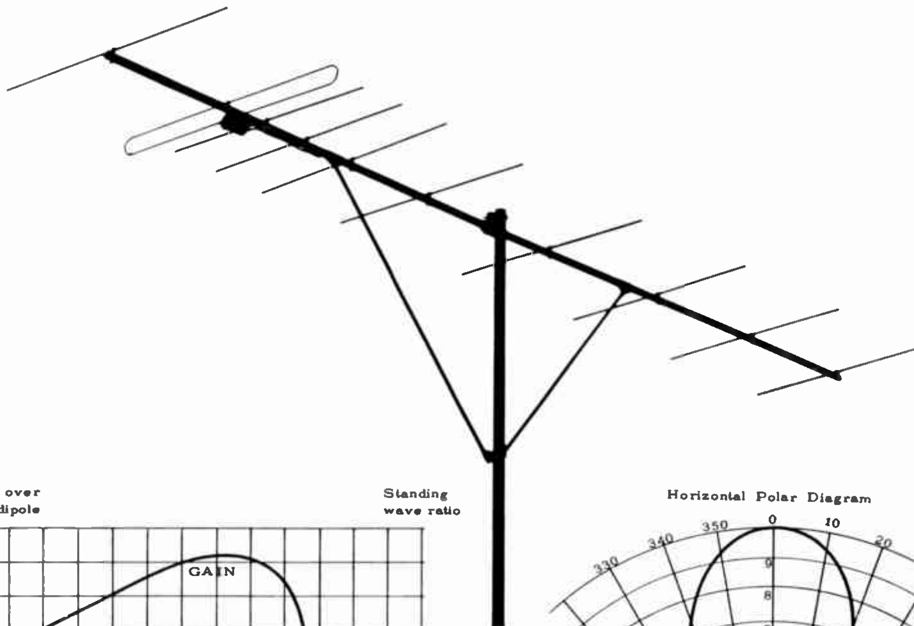
GRIPE DEPARTMENT

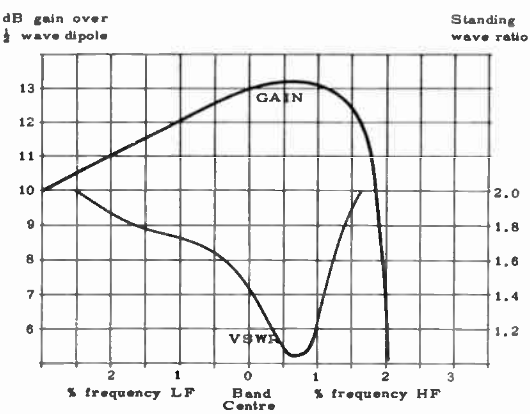
"Rusty" Holshouserof Salisbury, No. Carolina writes "Why report routine 2 meter and 432 contacts as openings. Any well-equipped 2 meter station can work 400 miles 365 days a year, 24 hours a day. I run skeds with W8SKJ at 330 miles that are always 100% copy. Can work W8KAY at 400 miles and K8AXU at 350 miles anytime. This just isn't an opening in the true sense of the word." Well, he's a better man than I am. I think the flatlanders have it a lot easier than those of us on the west coast. I suppose it is only just that there be some compensation for the constant threat of floods, tornados, blizzards, heat and humidity. Seriously though, Rusty is right. We've heard this song before. Those of you who can't cut it have problems. And it isn't because you don't have a K.W. Your problems are primarily your antenna, your converter and your operating practices. LP

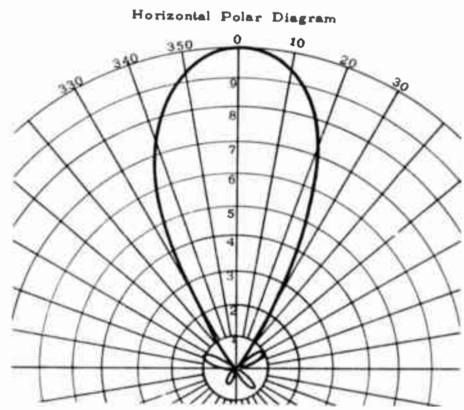

Cavity from R-89/ARN-5
Stage gain approximately 9 db.
Zs(opt) about 60 ohms for 432 Mc.
100 ohms at 220 Mc.
2N3478
Critical lead length
100 mmf.
Zs
R.F.C. 4 t. #22 air wound, 1/4" diam.
6.8 k
.01
2.7 k
1.5 k
1k
2 1/2 turns #22
1/4" in diam.
Tap for best n.f.
JFD VC2 H2
piston capacitor
Vce about 8 to 10 volts
Ic about 1 ma.
greater than 1,000 pf.
C high enough to kill parasitics



SKYBEAM







A PROVEN PERFORMER, this two meter SKYBEAM by J Beam Aerials, Ltd. of England. 13 db. gain over a dipole at 146 Mc., 15 db. over an isotropic radiator. Ruggedly built. Boom, elements and support rods of aluminum, 3 brackets of steel (plated). Available for feed with twin lead or coax. See the review in the May VHFER.

Write for literature and prices on this and other J Beams.

Gain, Inc. 27 E. 112th Place Chicago 28, Illinois

SURPLUS

BIRD Model 80-M Coaxial Load Resistor 5 watts continuous duty. VSWR 1.1 max DC to 1,000 Mc. 1.2 max 1,000 to 4,000 Mc. "N" connector. Reg. $25, now $12.50. New.

STODDART coaxial attenuators, used, "N" fittings. 3 db, $6. 1, 8 or 30 db. $5 each. 2 w.

CONNECTORS: BNC small flange, used 50¢. BNC large flange, new, $1.10, BNC elbow, used, $1. BNC thru chassis, used, $1.25. N to BNC adapter, used, $1. UHF male to N female (UG-83 B/U) new, $2. N to N, used, $1. All clean stock, guaranteed. Prices on all the above are postpaid BUT your minimum order must be $5 because of processing costs. You may add small items to your converter order, as the TOTAL will exceed $5.

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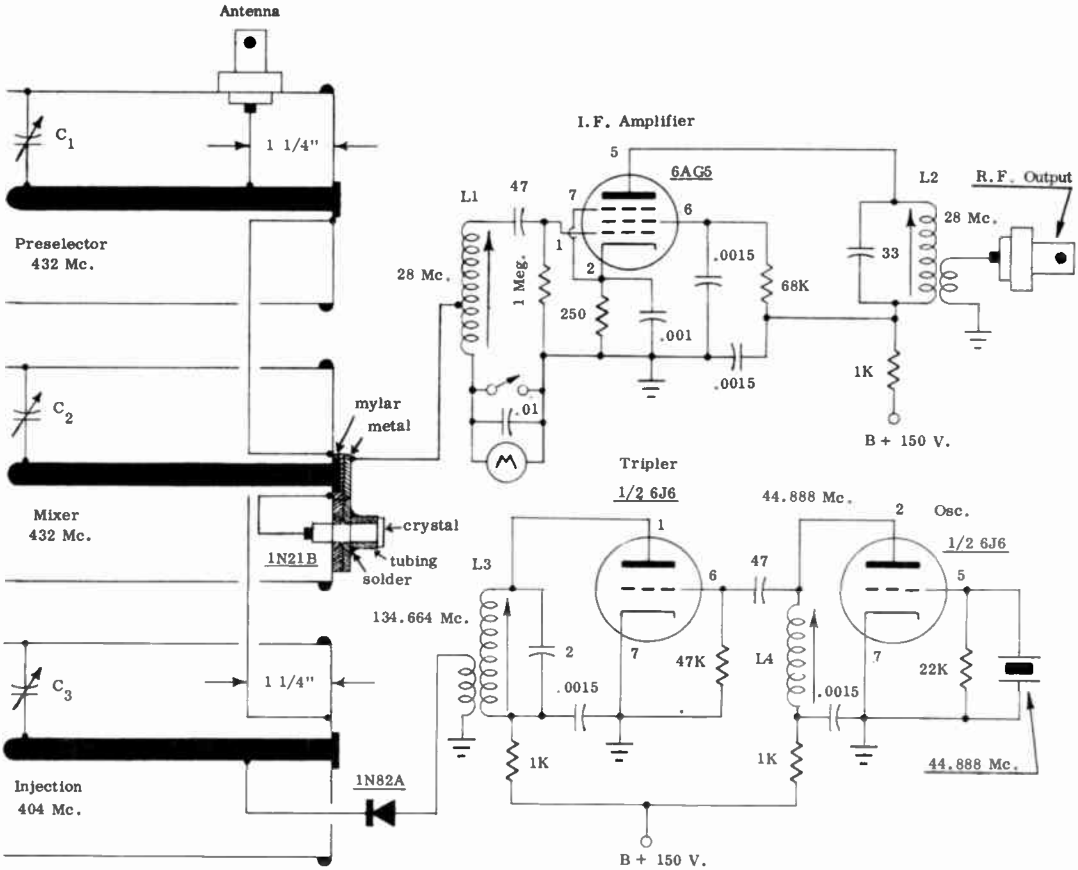
VHFER

50 MC. AND UP

LEARN BY DOING

Volume 3, No. 6 June 1965



All tin cans 3 7/8" long, 2 1/8" in diameter.

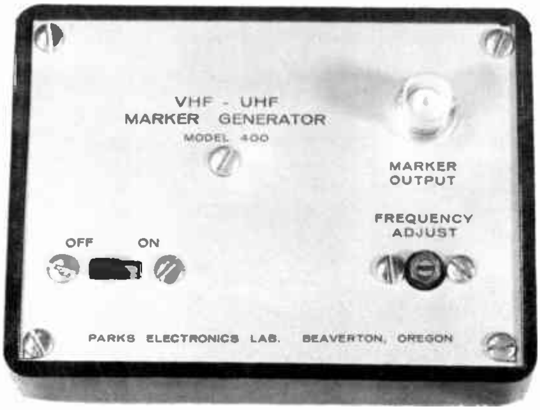
Center conductor 3/16" diameter

Coil data for 432 Mc. Tin Can Converter

L_1	28 Mc. 3/16" diameter, slug tuned. 25 turns #24 tapped 8 turns from cold end.
L_2	28 Mc. 3/16" diameter, slug tuned. 14 turns # 20. Link 2 turns on cold end. #18 hook-up wire.
L_3	134.6 Mc. 3/16" diameter, slug tuned. 5 turns #18. Link 2 turns on cold end. #1 8 hook-up wire.
L_4	48.88 Mc. 3/16" diameter, slug tuned. 16 turns #22
C_1-C_2-C_3	Piston capacitors. Approximately .5 to 10 mmf.

TIN CAN CONVERTER FOR 432

TWO NEW PRODUCTS



Here's the marker generator described in May, VHFER. We got requests from hams who wanted to buy it so we decided to make it. Price is $25, postpaid. Delivery after July 15. Gives markers every 1 Mc. thru and beyond 1296 Mc. Adjust against WWV.

This is a modification of our all nuvistor converter for 432. The noise figure is lower, the front end is more tolerant of antenna mismatch, and there is more gain to cover the noise of your receiver. Transistors (underneath) are two 2N3399s as r.f. amplifiers, and a 2N3478 mixer. The two nuvistors are used in a Butler-type oscillator. No internal batteries--all a.c. powered. Guaranteed to please. $54.95 postpaid. Those of you who have our Model 432-1, we can up-date it to make it exactly like the 432-2 including a new panel for $10, postage paid.

parks electronics laboratory route 2, box 35 beaverton, oregon

VHFER magazine is published monthly by Parks Electronics Lab., Rt 2, Box 35, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions $2 per year, others $3 per year. Second class postage paid at Beaverton, Oregon

ODDS & ENDS
K7AAD

The big event for UHF comes off July 3rd and July 24th when KP4BPZ at Arecibo, Puerto Rico will be using the thousand foot hemishperical reflector of the Cornell Univ. Ionospheric Laboratory. On July 3 the test will start with a 2-minute c.w. CQ by KP4BPZ at 1942 GMT, on 432.000 Mc. That's 1242 PDT same date. They prefer that stations calling use 432.01 to 432.1. After initial c.w. contacts, KP4BPZ will shift to lower sideband S.S.B. and attempt 2-way voice work. It is anticipated that 100 watts output on s.s.b. and an antenna gain of 15 d.b. should permit voice work. The same procedure will be followed on July 24. To give everyone a chance it is suggested that contacts be kept as brief as possible. Please report observations to ARRL. The preceeding paraphrased from ARRL bulletin of May 26. Additional information has been scrounged, to wit--polarization will be circular, probably right-hand circular and at any rate probably the same as described in QST about the event last time. Any linear polarization can be used with a loss of 3 d.b. If you have an antenna that works, use it. The big dish gain is 56.25 d.b. at 432 and the path loss is 261 d.b. In trying to confirm a bit of the above I called Sam Harris' residence but found he has moved to Puerto Rico for at least a couple of years. He is on 75 and 20 meters.

Getting power out at 432 with reasonable efficiency apparently is a problem. A kilowatt amplifier described in QST not long ago measured about 20% efficiency. W7UDM's rig measured a little over 50% when fed into 2,000 feet of RG 8/U as a dummy load. His rig has half-wave lines inside a box about 1' square. At present he attributes the higher efficiency to the big box, however there is a question about the output coupling method in the QST final. We'll know the answers probably within a month or so and report. W7UDMs final will be described in VHFER later. The need is for a decent exciter for 432. Several hams at Tektronix are going to pool their efforts to come up with a 432 exciter with reasonable power that isn't hard to build. The idea is to make several and if they all work, to publish a description.

The crying need is for a kit of metalwork for these big rigs and efforts are being put forth in that direction. I absolutely do not have the time to spend on that sort of thing and have to rely on others. K7ZIR has made two very nice KW finals for 2 & is now working on a 4X150 tripler to 432 which we hope to describe and offer you the metalwork at a reasonable price.

Every Calif. VHF get-together in the past has had an informal converter competition for 2 meters. W6NGN brings his weak signal source which is adjustable in output by means of a micrometer-type dial. Several converters are tried and the one which hears the signal with the lowest dial setting wins. This device will be described in the next VHFER.

VHFER articles have been heavy on antennas recently. Keep in mind that antenna articles are no good in the dead of winter. Another reason for harping on antennas is to prepare you for the results of the antenna contest to be held at the ARRL National Convention July 3. It has been "arranged" to enter as many "store-bought" antennas as possible for 432. I'm taking the Gibson yagi I always take for comparisons and the Gain Skybeam for 432. There will also be a new Telrex and Hy-Gain entered which were purchased especially for the contest plus other ones we can scrounge. One big problem in entering commercial antennas is making darned sure the antennas are put together just as the manufacturer says. Also, models change. So to try to minimize any chance of mistake or being unfair and to benefit those of you who cannot attend the contest, K6KV in Santa Barbara and I are footing the bill on the 3 brand new 432 antennas. We've had Telrex, Cushcraft and Hy-Gain at previous contests and results were written up in VHFER last year. I have copies of the results you may have for a self-addressed, stamped envelope. The antennas that always win are the extended-expanded colinears described in the Frank Jones (CQ) Handbook.

Continued on page 12

ANTENNA MEASUREMENTS WITH A MATCHED DETECTOR

by Frederick W. Brown, W6HPH*

What with all the recent attention given to antenna contests, this summer should see a great many such competitions throughout the country. The day may even come when we have call-district-wide and nation-wide finals. Such large scale contests would probably do more to raise the level of the amateur antenna art than all the technical articles written so far.

For the individual participant the main value of the antenna contest lies in revealing just how low his antenna gain really is. The very sick performance of most store-bought antennas usually comes as a shocking surprise to those who take the advertisements literally.

The fine points of making gain measurements by what might be called the "receiver method" have been published in detail, [1,2] and will not be repeated here. Of course, even a "guess" meter can be used to determine relative performance (which antenna is best, 2nd best, etc.). But for absolute gain figures in db. over a dipole, a signal strength meter with an accurately known response characteristic is required. This article will dwell on an alternative to the "receiver method" which might be called the "direct detection method." There are advantages and disadvantages to both techniques.

The advantages of the receiver method might be listed as follows:

1. Only a very weak signal source (microwatts) is required which can be supplied by transistors permitting independence of the power lines at the transmitting end.

2. Since low power is used, there is no need to sign the station call every ten minutes.

3. A greater range is usually possible.

On the other hand, the field strength method has the advantages of:

1. No power required at the receiving site where measurements are made, and no equipment other than a microammeter and matched detector.

2. Although fairly high transmitter power (watts rather than microwatts) is required, the transmitter power output is not as sensitive to line voltage changes as is receiver gain. This is because every stage in the receiver is gain-sensitive to supply voltage changes and the total effect is cumulative. For a transmitter usually only the final is appreciably affected by supply voltage changes since earlier stages are normally running class C.

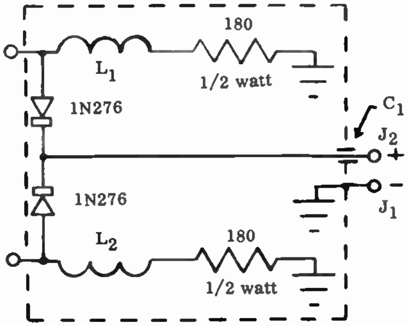
Fig. 1 is the circuit and photograph of a 300-ohm balanced detector which can be connected to a microammeter for measurement of antenna gain. The SWR of this device is less than 2 to 1 at both 144 and 432 Mc. Fig. 2 is a calibration curve which will permit conversion of microammeter readings into db.

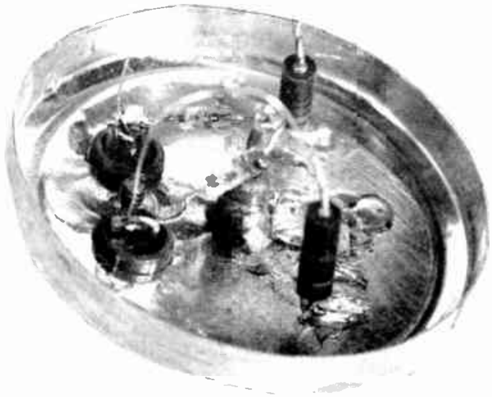
The purpose of the two 180-ohm resistors is to terminate the 300-ohm line. Inductances L_1 and L_2 tune out some of the capacitive reactance introduced by the diodes. Do not use larger wire for these inductances because the inductance will be less and the capacitance greater. The wire should be kept at least 3/8 inch from the walls of the can in all directions. Symmetry should be maintained as much as possible. The diode leads should be short, less than 1/4".

*Pine Cove, Idyllwild, Calif.

[1] Brown, F.W. "How to Measure Antenna Gain" CQ, Nov. 1962
[2] Brown, F.W. "The Antenna Measuring Contest" CQ, Oct. 1964

Fig. 1 Circuit and photograph of the 300-ohm balanced detector. It is built in a 1 7/8" diameter utility parts can. The input connector is a standard FT-243 crystal socket which will accept a Mosley type 301 twinlead plug.





C1 -- .001 mfd. feed-thru bypass

J1, J2 -- phone tip jacks for microammeter

L1, L2, -- 1 1/2 inches #28 tinned copper bent into U shape

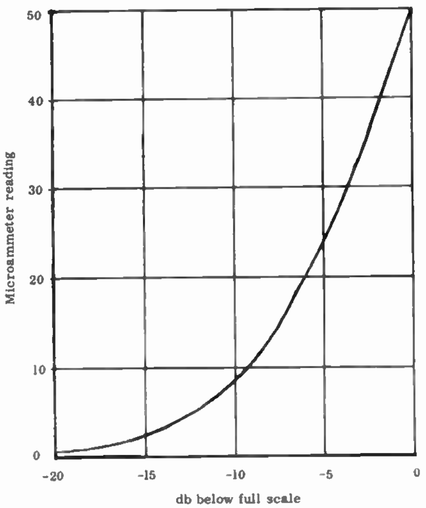
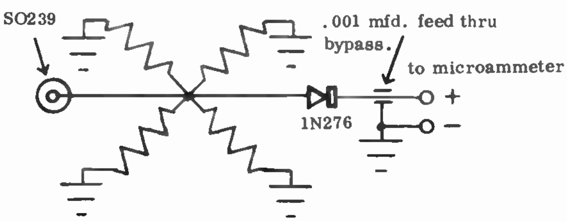


Fig. 2 - Calibration curve for the detector of Fig. 1 or Fig. 3 used in conjunction with a 5000 ohm 50 micro-amp meter.



All resistors 220 ohm, 2 watt composition

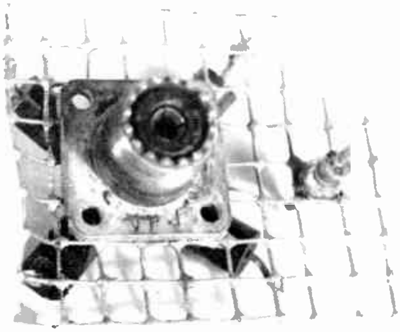


Fig. 3 Combination 50-ohm detector and wattmeter/dummy load for use with coax. Built on a 2" square of hardware cloth.

If you are standardized on coax, a detector of the type shown in Fig. 3 should be of interest. It was originally designed as a combination dummy load and wattmeter and is an excellent match to 50-ohm coax on all bands through 1296 Mc. Fig. 2 also applies to this detector using the same 5,000-ohm, 50 microampere meter.

The gain of your antenna is obtained by noting the difference in microammeter reading when a reference antenna (such as a folded dipole when using twinlead, or the dipole described in April VHFER for coax) is plugged into the detector in place of the antenna under test. The curve of Fig. 2 will then convert the two readings into gain difference in db. Of course, the distance requirement[1] must be met, and the site should be fairly free of reflections.

To make use of Fig. 2 it is necessary that the d.c. resistance of the microammeter be 5,000 ohms. If it is less, the difference can be made up with a series resistor. The calibration curve was made using a Japanese 20,000 ohm per volt multimeter switched to the 50 microamp scale which is also the 1/4 volt scale. The d.c. resistance is therefore 1/4 volt divided by 50 microamps, or 5,000 ohms. Most American-made 50-microamp. meters are about 2,000 ohms in which case a 3,000 ohm series resistor would be required. The d.c. resistance of any microammeter is easily measured by connecting it in series with a resistor and a battery of a few volts. The series resistor is adjusted in value until the meter reads full scale. Then a 10K pot connected as a rheostat (center and one end) is shunted across the meter and adjusted until the meter reads half scale. At that setting of the pot, the resistance between the terminals is equal to the resistance of the meter and is easily measured with an ohmmeter after it is disconnected from the meter. Be sure to use at least 3 volts of battery so the meter is driven from a current source(current through the series resistor doesn't change when you connect the pot.) Alternatively, a voltmeter can be used to measure the voltage across the microammeter when current through it is adjusted for full-scale deflection (with the voltmeter across it) and the resistance of the meter movement calculated by Ohm's Law.

Matched detectors are also very handy for matching the antenna to the transmission line. A match is obtained simply by adjusting the matching device (stub, Q bars, aluminum foil, etc.) for maximum received signal on the microammeter. No distance requirement need be met for matching. In fact, the operation can be carried out indoors. The accuracy of the match will depend on how well the detector is matched to the line (remember it can be improved with pads or long lengths of lossy coaxial line) and on how accurately the matching device is peaked. 1/2 db. error will result in about a 2 to 1 SWR so it is important to peak carefully. Of course, this method will not insure a low SWR if the matching device is incapable of completely matching the antenna, but it will give the lowest possible SWR with any given matching device.

For antenna measurement it will be necessary to have at least a few watts output on 432. With about 400 watts ERP (effective radiated power) obtained from a transmitter with 20 watts output into a 13 db. transmitting antenna, and using a 10 db. gain receiving antenna, we get about 25 microamps at 200 feet. This is more than enough distance for all but the very largest 432 antennas. End.

CORRECTION

There was an error (or two) in the diagram of the Marker Generator in the May issue. I regret it exceedingly, however WA6EWV says the thing works pretty well without the tunnel diode which means the circuit would work to 432 anyway. The 2.2 output cap. should go to the t.d., not the transistor collector. The T.D. symbol may be backwards but the text is right. The t.d. in the photo is not a T.D.-2. There is nothing special about the transistors except that they have good gain at 1 Mc. so if you substitute another PNP be sure its alpha cutoff is well above 1 Mc. We have used Amperex 2N3399s with no problem and a number of other types should work OK.

NOTES ON ANTENNA GAIN

By Bill Roberts, W9HOV

Gain, Inc.

The advent of moonbounce as a reality for the amateur has been brought about largely by improvements in the performance of receivers and antenna systems. The moonbounce path is completely unforgiving in terms of performance. The path is nearly half a million miles and the attenuation at 144 Mc. is very large and approximately constant. The reflection coefficient of the moon is know and unfortunately is not large. There are no shortcuts in obtaining the performance needed. Since the transmitted power is limited to one kilowatt, we cannot just add brute power to accomplish the feat. The best receivers are now quite sensitive and there is not much hope of great improvements in the future. Actually, below 300 Mc. the limit is set by sky noise which is largely of cosmic origin.

The remaining requirement is an adequate antenna which must have a minimum gain of about 20 db. over a dipole. The gain of an antenna usually is an unknown quantity taken on trust from the manufacturer whose selling point is the advertised gain of the antenna. Those with experience are able to form their own conclusions, but most of us have to rely on the published information.

There is a basic rule with antenna gain figures, namely that doubling the size of the antenna will produce a 3 db. increase in gain. The basic rule applies in almost every case. For instance, stacking two identical antennas will increase the gain by 3 db. or doubling the length of the antenna will accomplish about the same thing. Doubling the number of elements will not do this unless the antenna is lengthened accordingly.

The most common antenna is the Yagi and the gain of the Yagi is governed by the physical length rather than the number of elements used. That is a most important fact to remember. A typical example is the 12 db. gain over a dipole that may be obtained from ten elements on a boom of two wavelengths or about 13 1/2 feet on two meters. An antenna of twenty elements could be fashioned on this two-wavelength boom but its gain would not exceed the 12 d.b. obtainable from the 10 wide-spaced elements. This should explode the myth that gain comes from the greater number of elements alone. Bandwidth is made greater with the use of additional elements but the overall gain is limited by the boom.

Simply put, if one antenna gives 13 d.b. gain, it would take two to give 16 db., four to give 19 db., and eight to give 22 db. gain. Realizing that doubling the size of an antenna increases the gain by 3 db., we find the bulk rapidly reaching gigantic dimensions when the antenna is considered for a moonbounce project which necessitates gains exceeding 20 db. For instance, a two meter antenna would require a space at least 20 by 22 by 14 feet to give 21 db. gain, a very formidable piece of machinery.

The next bitter pill to be swallowed is the minimum stacking distance between beams. The aperture of the beam must be considered. Aperture is directly proportional to gain and this may be imagined as an infinite sheet of metal between the transmitter and the receiver with the aperture of the antenna represented by a hole in the sheet. The larger the hole, the greater the gain. If you increase the gain by using two holes, it would not pay to have them overlap. Thus the optimum stacking distance is that which just allows the apertures to touch. In the case of the two-wavelength Yagi it would be about 11 feet between booms. A moonbounce antenna made of nine of these Yagis in three lines of three would be 22 feet square measured between the outside booms.

The gain over a dipole is simply measured by substituting a half-wave dipole for the antenna under test and noticing the difference in signal. Incidentally, having the "other fellow" read the difference on his "S" meter is a poor testing device since the "S" meter calibration may not be what the receiver manufacturer says it is. A much better way is to rely on accurately calibrated attenuators. They avoid the error caused by receiver non-linearity but are not always readily available.

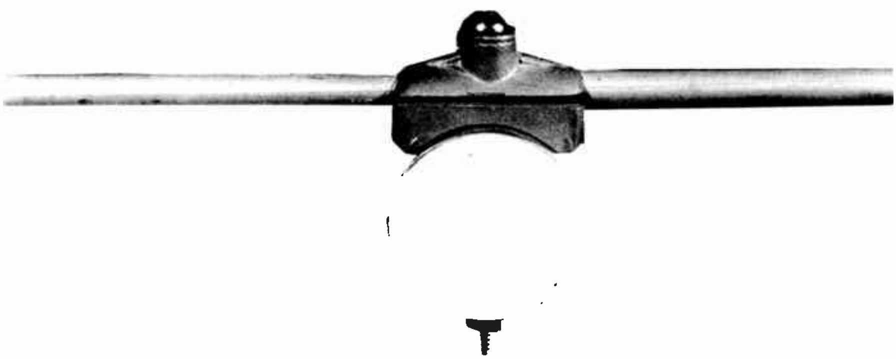
This all may sound simple, but when a number of tests are taken on an individual antenna the results may vary widely. The greatest error results from the fact that the antenna may not be receiving the direct signal alone, but reflected signals from the ground or other reflecting objects. You can see the effects of reflections if you walk around or near the antenna and watch the fluctuations in signal strength.

The amount of room required for an accurate testing range is quite large and tests taken on inadequate ranges often result in very conflicting results. In addition, the site should be as free from reflections as possible. A simple formula for determining the minimum range required is

$$R = \frac{4D^2}{\lambda}$$

where R is the minimum distance between transmitting and receiving antennas, D is the largest dimension of the antenna under test, and λ is the wavelength measured in the same units as R and D.

In conclusion we offer this advice: Be skeptical of gain figures that seem to be rather high. It could be that you are buying something that will not produce the expected results.



A TIN CAN CONVERTER FOR 432 MC

by Louis Hutton, K7YZZ*

432 is the up and coming VHF band in most areas of the country. In many of the larger cities there is 432 activity almost every evening. Band openings on 432 can extend for a thousand miles or more in some areas. There are also a number of 432 repeaters in operation on TV towers and mountain tops. The effect of orbiting and stationary satellites on 432 activities should be tremendous.

Unfortunately, many hams have had trouble building 432 gear. The sheet metal work required may not easily be done in the modest facilities of most ham shacks. Many converters described in ham magazines use high-priced tubes that are hard to tame and hard to handle mechanically. Many hams are still reluctant to use transistors. A project is always easier to get started and completed if all or most of the parts are at hand. The tin can converter was designed for easy, low-cost construction. It should be as easy to get to work as any 432 gear you might build.

The tin can converter as it is described is for local work. With r.f. amplification ahead of it the performance can be improved considerably. You can look at it as half of a high-quality converter, the other half of which can be built later as a separate unit.

The circuit diagram is shown on the front cover of this issue. Only two tubes are used. The 6J6 is a double triode that performs as oscillator and tripler. A 1N82A diode acts as a tripler also, working into the injection frequency coaxial cavity tuned to 404 Mc. The injection coupling to the crystal mixer is made by close-coupling the injection pickup link probe to the top of the crystal mixer link. The 432 Mc. received signal is also coupled into the mixer cavity and the difference frequency is taken from the right end of the crystal to the 6AG5 I.F. amplifier. The purpose of the I.F. amplifier is to assure you of a low-noise stage of amplification before you go into your receiver, as many receiver front ends are not what they should be at 28 Mc. A crystal mixer has a relatively low noise figure but so much signal is lost in the conversion process that you can't utilize its low noise figure unless you follow it with a very low noise I.F. stage or preceed it with a lot of R.F. gain, which may be hard to tame.

The complete converter is shown in Figs. 1 and 2. It uses tin cans as coaxial resonant circuits. In Fig. 1, the can with the BNC connector is the preselector, the center can is the mixer and the other one is the injection cavity. The entire converter is built on a flat piece of aluminum which is fastened into an inverted chassis. Construction is easier on a flat plate and when the plate is fastened to the chassis, the unit is mechanically strong and shielded besides.

CONSTRUCTIONAL DETAILS

The tin cans originally contained fruit juice and should be easily obtained. The center rod of the tin can tuned circuit is soldered to the bottom of the can from the outside. The grounded end of the pickup link is passed through a hole drilled next to the center rod in the bottom and soldered. Insulating sleeving is passed over the links when going from one can to the next to prevent shorts.

The 1N21 crystal mixer output bypass capacitor is formed by a small semicircle of sheet metal (tin can stock or brass) mounted over a sheet of plastic (bread wrapper) on the bottom of the mixer can. The attaching screws are insulated from the metal sheet by shoulder washers. This home-made bypass has extremely low series inductance and effectively grounds 432 and 404 Mc. energy but does not bypass much of the 28 Mc. I.F. energy. Details of the construction of this capacitor are shown in Fig. 3. An octal tube socket pin was used as a clip to connect to the tip of the mixer diode.

* 12235 S.E. 62nd St., Bellevue, Wash. 98004

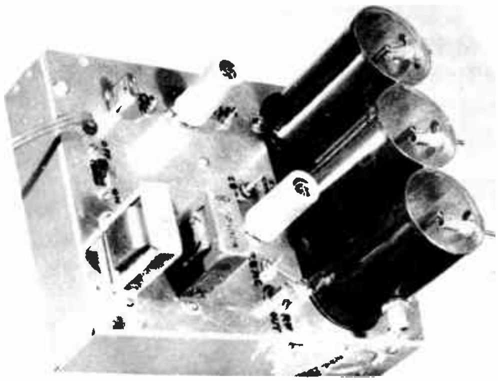
TUNE UP

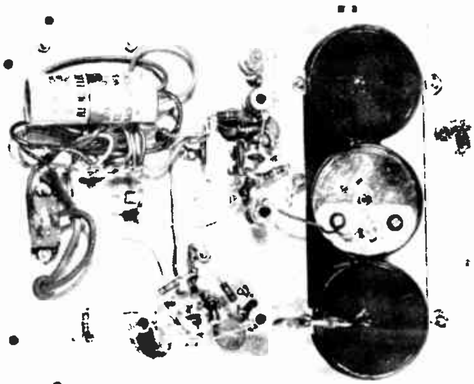
A grid-dipper is used to rough-tune the coils to the proper frequency. With the grid dipper in the "diode" mode of operation, the 6J6 oscillator and tripler are tuned for maximum detected output. There are two ways to tune the injection cavity. One way is to put a low-resistance 1 ma. meter in series with the 1N21 circuit to ground as shown in the diagram. The meter resistance should be not more than 100 ohms (don't measure it with an ohmmeter or you may ruin the meter.) The other way is to put a 100-ohm resistor in place of the meter and measure the voltage across the resistor. Crystal current should run between .2 and 1 ma., so the voltage should be between .02 and .1 volt. The resistor may be left in the circuit or shorted after proper adjustment has been made.

Next, connect the converter I.F. output to a receiver tuned to 28 Mc. and feed a 432 Mc. signal into the converter input. Tune C_1, C_2, L_1 and L_2 for maximum r.f. output as noted on the receiver's "S" meter. It is desirable for the noise output of the converter to cover up the noise of your receiver front end. Test for this by removing the 44.888 Mc. xtal & noting the drop in the noise. It should drop by a noticeable amount. If it doesn't, you have trouble--either in the converter or in your receiver. Reception of automobile ignition on a 432 converter is a favorable sign but does not mean as much as some people think. You will not hear an increase in background noise level when the antenna is connected. You must do the final tune up on an actual weak 432Mc. signal.

ADDING A PREAMPLIFIER

If you wish to add a preamplifier at a later time and want to approach the limit on weak signal reception, it will be necessary for you to use more than one stage of r.f. amplification. At least two stages of transistor amplification will be required. End.





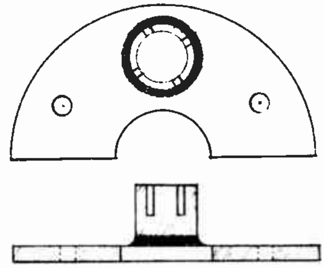


Fig. 3. Details on construction of the crystal mount. The black area around the base of the tubing represents a solder fillet. The drawing is not to scale.

Open Bands

By Marilyn Wiseman, K8ALO

Since this column is fairly new I imagine it will take time to catch on. I've received very little mail from readers and the few I did hear from are in the eastern states. In order to make the column more interesting I need reports from other parts of the country. I'm sure in time you would all be bored reading the same calls over and over again. If no reports are sent to me I surely can't report them. Reporting is really quite simple. All letters received will be acknowledged.

The following information is required: Call, date, time, city, state, freq. and approximate number of miles worked. it would be appreciated if you reported all times in 2400 hour time. Of course don't forget your own call so I'll know who worked who-Hi! The column is strictly for band openings at 50 Mc. and up so please don't send other types of info. for publication.

50 Mc:

May 10 W8PHJ (White Lake, Mich) worked K6VIH (Huntington Beach, Calif.) 2600 miles and KØSGX (Denver) Time 1010-1345
May 11 K1WYS/4 (Orlando, Fla.) heard K1ZGH (Scituate, Mass.)
May 12 K1WYS/4 heard K1MRI (Ridgefield, Conn), K1TZC (Whitman, Mass.)
May 18 K1WYS/4 heard W1KKB (N.H.)
May 23 WA8GBZ (Struthers, Ohio) wrkd WA6LJB, WA6SQT, K6MEF 2800 mi. 1245-1335
May 29 K1WYS/4 (Fla.) hrd W1JAE (Mass), W1KKB (N.H.), K2YWG (Hazlet, N.J.)
June 5 WA8GUP (Poland, Ohio) wrkd VP7DD (Bahama, Islands) at 1620, WA8BGZ (Ohio) worked K4RZB/4 (Athens, Ga.) at 0955.
June 18 WA8BGZ (Ohio) worked VP7NX (Bahama Islands) at 0910.

144 Mc:

May 2 K3GGZ (Enon Valley, Pa.) worked K8TCA (Horton, Mich), K8DBA (Monroe, Mich) 175 miles. Time 0810-0930
May 5 K3GGZ (Pa.) wrkd K2KGN (Bemus Point, N.Y.) 180 mi. at 2116.
May 9 W8PHJ (White Lake Mich.) worked WA9DOT (Grafton, Wisc.) 230 Mi. at 2040, K3GGZ (Pa.) worked WA8LBE (Detroit) 175 mi., VE3EXY (Blenheim, Ont.) 170 mi. 1003.
May 11 W8AXR (Calcutta, Ohio) hrd WØBRI (St. Louis) and WAØBMI (Des Moines.)
May 14 K3GGZ (Enon Valley, Pa.) worked W8QLO (Lavonia, Mich), K8YZK (Flatrock, Mich.)
May 16 K3GGZ (Pa.) worked K8PEJ (Troy, Mich.), W8QLO (Mich.), K8DBA (Mich.) all 175 m
May 19 K8ALO (Ohio) hrd W8AXN (Bangor, Mich.) 350 mi. at 2135, K3GGZ (Pa.) worked K2KGN (Bemus Point, N.Y.) 180 mi., WA8KBJ (Royal Oak, Mich.) 175 mi. 1850-2108
May 23 VE3EYX (Blenheim, Ont.) heard W4ZX (Fla.) on CW at 2000.

Please send ur DX reports to Marilyn Wiseman, K8ALO Box 103 Petersburg, Ohio

I mentioned last issue we were trying to correlate information and measurements on 432 receiving equipment with fellows on the east coast, namely W1FZJ and W1OOP. Pat, Sam's son, said our preamp. is in Puerto Rico where they have some pretty fancy test equipment and that it measured 4.75 d.b. Sam said it was better than any tube preamp he had ever measured. I asked if they were going to use it on the dish and the answer was probably not, they'll use the parametric amplifier. Henry Cross, W1OOP, has been running tests on the preamp. against his preamp. with a 2N3478. According to his measurements the 2N3478 (selected) runs a db. and a half or so better. The "or so" is for my poor memory. Hank believes in a tuned circuit at the input since he experiences TV interference without it . He uses a cavity ahead of his preamp. He lives very close to TV stations. We hope to get his 2N3478 preamp here to test using our equipment. If we also find it does a better job we'll switch provided there isn't too much trouble selecting 2N3478s. (we'd rather switch than fight) The 2N3399s are consistently good. With respect to the burnout problem with transistors, W7UDM used the preamp. in moonbounce tests on 432 with his KW at about 50% efficiency and a Dow Key relay with contacts that short the receiver input when transmitting. There was no transistor damage. No one has reported to us that they've burned out any transistors with r.f. I suspect part of the burnout problem is also the configuration that is used. We use grounded base in the preamp. and the new converter. The circuit for the preamp. was written up in VHFER (July, 64.) There are few if any copies here. For those of you who like to build your own, our experience has been that there was far less development time on that preamp. than on anything we've manufactured. No super-design on our part, the 2N3399s just work well.

Better get your home station in shape if you want to be in on things that may come off this fall or winter. See that you have a good 2 meter antenna you can control in azimuth and elevation and a high-powered rig to drive it. Circular polarization may help and the Gain Moonbouncer is probably a good antenna. You'd better also be sure you have a good 432 antenna and a low-noise receiver behind it. Have it so you are set to transmit on 144 and listen on 432. Oscar is part of it but by no means all of it. More later.

"IT CAN'T BE DONE"

By Bill Graham, VE4GI*

Last August after missing a contact with XE1OE I spent two weeks building and moved up to the 1200 watt range (ssb.) Since the band had closed down in the meantime, I began to think about ionospheric scatter. I worked WØHAN but I had done that before so I wrote to W1HDQ (I still need Conn. for WAS) to arrange for four scatter skeds on Saturday morning.

A local ham, who is considered by all to be my superior, told me that ionospheric scatter was impossible at amateur power levels so I wasn't surprised that I didn't hear a ping nor did Ed. Later a 250 mile tropo path proved impossible although I heard signals. So the big rig spent an idle winter. Recently I was persuaded to try again. My first sked on 50 Mc. was with WØPFP (600 miles)and it produced a contact with lots of signal to spare on ssb. I was very pleasantly surprised at this and arranged for two more skeds for the next Sunday. WØPFP was a little weaker, although there was plenty of signal. But K9HMB (750 miles) was about 80% readable and an easy contact. I'm looking for more scatter skeds on 6 and crying over a wasted winter. I have sworn that never again will I listen to a person who says "It can't be done."

*1743 Grant Ave., Winnipeg 9, Manitoba

VIDICON OPTICAL FOCUS & LIGHT LEVEL REQUIREMENTS

By Alfred Denson *

Two of the most frequent questions asked about the use of vidicon tubes in CCTV applications are the mechanical lens mounting requirements and the light level essential for proper operation. As normally constructed in the usual 1 inch vidicon of the general 6198 type and their equivalents, the arrangements of the photo-pickup tube (vidicon) in the camera is such that for all standard lenses, the image IN AIR would have to be formed at 0.690 inches behind the front surface of the camera front plate. The recess in the front plate mounting is normally made to accommodate a standard 16 mm C mount designed so that the FRONT of the C mount is flush with the camera front plate surface.

Any special lens mount should be designed so that when the lens is in position, the image in air will be formed 690 mils behind the front surface camera front plate.

The image plane of the vidicon is on the rear surface of the glass window, which is 87 mils thick (average.) When the vidicon is in place, the presence of the glass window moves the actual image plane back by approximately 29 mils due to the index of refraction of the glass. window. Operating image plane is 719 mils behind the camera front, on the average. The correct position of the vidicon is obtained by measuring 719 - 87 or 632 mils from the front surface of the camera C mount to the front surface of the vidicon's glass face. When the lens is at infinite focus, the optical image on the vidicon will be in focus with this arrangement.

The preceding shows why an 8 mm type of lens in a standard D mount has too short a focal plane to properly fucus the image without moving the lens too close to the vidicon face, which, of course, gives a "looking thru a stove-pipe" effect. It also is sometimes useful where fast speed lenses of longer than normal focal length are required that it becomes desirable to use conventional 35 mm camera lenses with an adapter in place of the 16 mm movie camera types. For example, a 400 mm focal length lens of the 35 mm camera type would be available at a reasonable cost for use with an adapter to the usual 16 mm C mount whereas the same focal length in the 16 mm size would be prohibitive in cost, slower in speed and next to impossible to obtain.

The required light level for the vidicon is normally 0.3 to 0.6 lumens square feet of illumination on the cathode for a noise free picture. A useful formula for computation of this quantity is:

$$I_K = I_s/8\ (f/-)^2$$

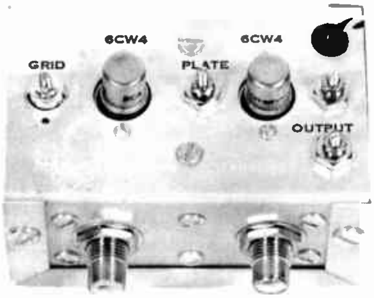
Example: $I_s = 320$, $(f/-) = f/4.5$, $I_K = 320/\ 8 \times (4.5)^2 = 2$ ft. candles

Where I_s is the measured scene brightness in ft. candles and $(f/-)^2$ is the square of the f/ number of the lens. I_K is in this case more than ample and the target of the vidicon could be operated at a lower than normal value. When the light level is low, the target needs to be advanced. Some high output vidicons will give a picture at 10 times lower light levels; i.e. at 0.03 to 0.06 ft. candles on the cathode.

Usually, however, electric focus may be found to be not quite as good in the higher output tubes, as with the human eye which accommodates itself to low light levels at the expense of resolution. In general, a rough rule of thumb would be that after the initial camera setup has been made, if you open the iris to the point at which the image (FLARES) then stop your lens iris down by one F stop and then readjust your beam target and focus controls, the best image for that particular set of conditions will be obtained.

*Longview Street, Rockville, Conn.

2 METER
NUVISTOR CASCODE
PREAMPLIFIER



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NOISE FIGURE: 3 DB. GAIN: 20 DB.

FIXED STATION:

The amount of improvement you get in reception depends on how poor your present receiving set-up is and how much outside noise you have. Almost all converters will be improved somewhat, but not all will be improved significantly. No other pre-amplifier (except a parametric) will give a noticeably better signal-to-noise ratio than this one. Most improvement in performance will be noticed when this preamplifier is used ahead of military receivers, transceivers such as the Heath Two'er, Gonset Communicator, Poly-Comm., etc. The RME VHF-152 will be helped by this preamplifier as will other communications receivers and converters using non-nuvistor tubes.

MOBILE:

Many FM mobile receivers have an input sensitivity of 1 microvolt for 20 db. of quieting. This preamplifier used ahead of such a receiver brings the sensitivity to .2 microvolt for 20 d.b. quieting. This is equivalent to increasing the other fellow's transmitting power by 14 db. or approximately 25 times. It really makes a difference. It also permits the performance of the receiver to deteriorate considerably without noticeable effect because the low noise and high gain of this preamplifier compensates for deterioration in the rest of the receiver. The nuvistor maintains low noise figure much, much longer than other premium or standard tubes. This preamplifier fits in the Motorola 5V, 30D and most other FM mobile receivers. Special bracket and instructions for the Motorola 5V available at $1 extra.

POWER REQUIRED:

6.3 v. at 260 ma. or 12.6 v. at 130 ma. (easily changed internally.) 150 volts d.c. minimum at 15 ma. Higher voltage may be used with additional series dropping resistor.

CONNECTORS:

Phono (recommended for most mobiles and transceivers), UHF (SO-239), or BNC.

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METEOR SCATTER SKEDS WANTED

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Want meteor and tropo scatter skeds on 2 meters. Bill Smith, KØCER 1301 Churchill Ave., Sioux Falls, South Dakota 57103.

Want meteor scatter skeds on 144 Mc. with Louisian, Arkansas, Texas, Oklahoma, Kansas, Nebraska and No. Dakota, both for major and minor showers. Don Learned, W1AZK, Bear Hill Road, North Chichester, N.H.

Others always looking for meteor skeds, WØEYE, Box 563, Boulder, Colo., W6DNG, 4608 La Cara, Long Beach 15, Calif. WA6QQI, 925 Redwood Ave. Sunnyvale, Calif.

50 Mc. Want skeds with KH6 land. 50 Mc. SSB or CW. Have 600 W. & 6 el. Telrex at 40 ft. W5SFW, Rt. 3 Box 219A, Amarillo, Texas 79107

If you have the power and the antenna to do the job, send a listing of your equipment and your desires for contacts and we'll try to find someone to oblige you. K7AAD

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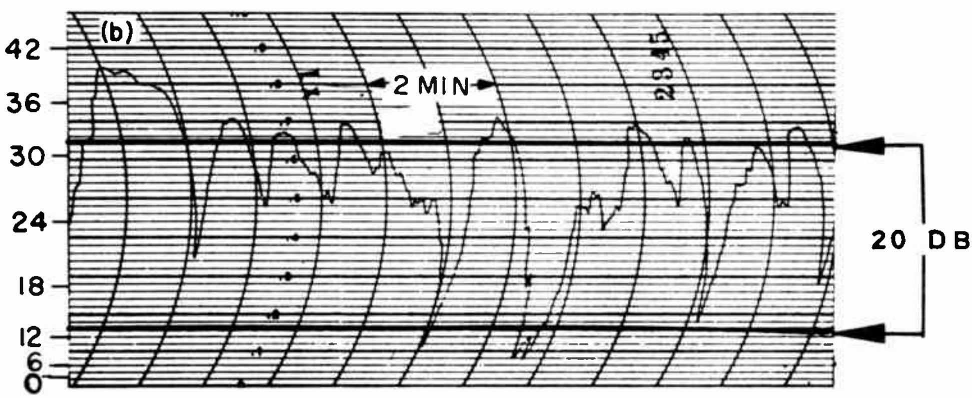
Volume 3, No. 8 — August, 1965

400 MC. TROPOSPHERIC SCATTER FADING



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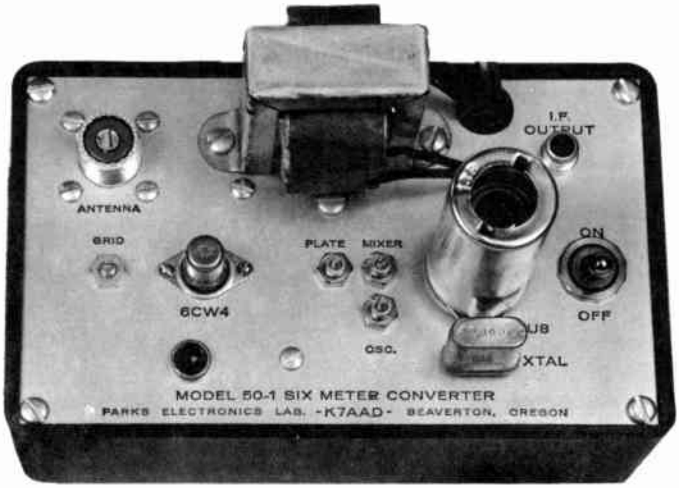

This is the first amateur product we ever made. Hundreds are in use. Noise figure of 2.5 d.b. or less with plenty of gain to override the noise of your communications receiver. Choose your I.F.: 7, 10, 14, 22, 26, 27, 28 or 30.5 megacycles. Choice of UHF (shown) or BNC input connector, phono or BNC output connector. Bandwidth about 1.5 Mc. Neutralized triode front end (6CW4), 6U8 mixer-osc. Self-contained power supply. Send check or money order to Parks Electronics Lab., Rt. 2, Beaverton, Oregon. Add 35¢ for Special Handling (same speed as first class letter.)

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LETS TALK ABOUT MOONBOUNCE
by Loren Parks, K7AAD

From the mail I get and what I hear on our 75 meter VHF net it is pretty evident that interest in moonbounce is snowballing. Of course not a large number of hams have the inclination, space and ability to go this route. But those hams who do will get full co-operation here. We aren't oriented toward gooney box operation. I would like to be able to give you a listing of all stations who have heard their own echos via the moon, but I only know of 6 or 7. I'm sure there are many more. If I had such a listing I wud publish it so everyone would know who has what and they could get together for skeds. If you have such information, whether you did the m.b. or not, please send it in and I will badger the proper person for information on equipment and frequencies plus any other secrets he may have to ferret out signals from white noise. Here are a few calls of successful stations. 2 meters: W6DNG, OH1NL, UA1DZ (Russia), KP4BPZ. 432: KP4BPZ, W1BU, W3SDZ, WA6LET, KH6UK. 1296: W1BU and the Eimac group. Surely there are many more. Who are they? If you know some, please write.

It has been against VHFER policy to put in stuff about who is building what because a high percentage of those projects never get beyond the talking stage. I will make an exception here to show you how many hams are sporting dishes in their back yards and getting ready for moonbounce. Here are some I know of: W6NLZ (15 ft parabola), K6KV (15 ft parabola), Herb Gordon in Harvard, Mass. with a 24 ft. parabola going up (I think the size is right), W4HHK with a 15 ft? parabola (see recent QST cover), WØIKQ (15 ft), W1BU (30 ft parabola) and K7AAD with a 40 ft. orange peel.

How do you get a dish? Most are bought at junk yards or from surplus houses, maybe thru MARS. Sometimes the dish is cheap but carting it is very expensive. Sam Harris' 30 ft parabola came from a junk yard for $200. A friend of his ran across it and told him about it. What a bargain that was. Some hams make their own dishes. Perhaps we can get more info. on techniques. A back issue of 6 up showed how to do it but we don't have any copies of that issue. You sure don't have to have a dish to do moonbounce. Most moonbouncers have used Yagis or colinears. But you have to know what you're doing. Count me among those scared silly of the phasing problems on a big array at 432, or even two meters. I can figure it like anyone else but the mechanics and electronics of proving proper phasing experimentally is another matter. That's why I jumped at the chance to use the big orange peel. I have almost 6 acres. The orange peel is bright orange. My neighbors are not happy. Neither is my wife.

MOONBOUNCE TESTS COMING UP

Moonbounce tests will begin at 1430 GMT and last thru 2400 GMT utilizing the 150 ft. dish of Stanford University operating under the call WA6LET. Frequency will be 432.000. They will use right-hand circular polarization. A 1 d.b. noise figure parametric amplifier will be used for receiving. One goal is to work VK3ATN in Australia, but they will of course also work anyone else they can hear. It is estimated that only a few stations will have sufficient power and antenna to make the grade. Date is Sept. 25. If you wish to write about skeds you may contact Ken Holladay, K6HCP, 7733 Rainbow Drive, San Jose, Calif. Send self-addressed, stamped envelope.

VHFER magazine is published monthly by Parks Electronics Lab., Rt. 2, Box 35, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions, $2 per year. Others, $3 per year. Second class postage paid at Beaverton, Oregon.

A HIGH-SENSITIVITY VHF FIELD STRENGTH METER

by Rod Rigg, W6YGZ*

A good field strength meter is a very handy instrument for tuning transmitters and antennas. Simple field strength meters that use just a diode, meter and a dipole have their place, but a higher sensitivity unit certainly has more applications. Now that good transistors and diodes are available for under a dollar, a complete high-sensitivity field strength meter can be built for just a few dollars including the price of the meter.

The unit to be described is very simple and easy to adjust. It consists of a tuned circuit, a diode rectifier and a silicon transistor amplifier driving a 0-1 ma. meter. Almost any germanium diode and NPN silicon transistor will do the job. While a germanium transistor could be used, it won't have the temperature stability and leakage characteristics of the silicon unit. If you use a PNP transistor you will have to reverse the polarity of the diode, battery and the meter. The circuit is shown in Fig. 1 below.

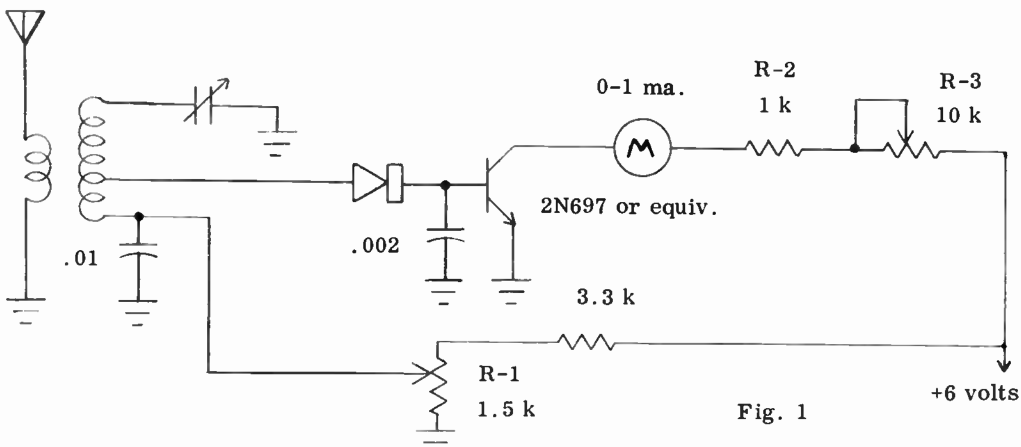


Fig. 1

The tuned circuit you use will of course depend on the band you want to use. A grid dip meter can be used to set up the range of frequencies to be tuned. You may connect the diode to the top of the coil if you want broader tuning, but sharper tuning can be achieved with very little apparent loss of signal by tapping down on the coil for the diode take-off point. If the diode is connected backward it will reverse bias the base of the transistor by applying a negative voltage to the base when signal is applied. This will cut off or reduce current flow through the transistor and the meter with signal.

R1 is adjusted only once in a great while so it can be left inside the case. Initial adjustment simply involves turning R1 until the meter reads about .05 to .1 ma. with no r.f. signal applied. R2 is a current-limiting resistor for protection. R3 is a sensitivity control of sorts. Minimum resistance will produce maximum sensitivity. If you adjust the pot (R3) so that no more than 1 ma. flows with maximum signal it can be left in this position for most applications. Increasing the resistance of R3 more will decrease the sensitivity and will also reduce the maximum reading of the meter.

The transistor used here was an RCA 2N697 and it turned out to be very stable. The current price on the 697 is about 81¢ and it has a gain-bandwidth product of 100. Watch the insulation because the case of the 2N697 is connected to the collector for cooling purposes.

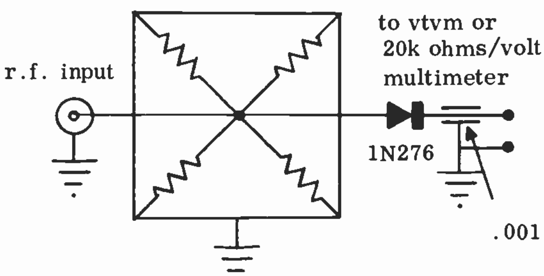
*1305 Occidental, Stockton, Calif.

A HOMEMADE R.F. WATTMETER

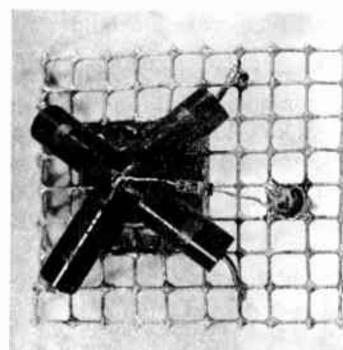
by Frederick W. Brown, W6HPH *

This is a little gadget that I've found to be darn near indispensable for experimental work on low-power transmitters and exciters. It doesn't measure r.f. power with 1% precision, but it certainly is a vast improvement over the light bulb method. If built and used carefully the accuracy is comparable to the lower-priced (less than $200) laboratory type instruments, most of which work on the same principle.

Essentially this wattmeter is simply a dummy load and diode rectifier which permits measurement of r.f. voltage across the load with a d.c. voltmeter. Application of the E^2/R power relation gives the r.f. power being dissipated in the load. The configuration of four 220-ohm, 2 watt resistors is an excellent match to 50-ohm coax on all bands through 1296 Mc. The resistors will dissipate 8 watts continuously and up to 20 watts for brief periods.



all resistors 220 ohm, 2 watt composition



If the detector responded to peak voltage and had a rectification efficiency of 100%, the E^2/R formula would have to be multiplied by 1/2 since the formula assumes r.m.s. voltage. For a 50-ohm load the formula would then be $P=.01\ E^2$ watts, E being the voltmeter reading. If the rectification efficiency were 70.7% the meter would read r.m.s. voltage directly and the formula would be $P=.02\ E^2$ watts. The actual measured rectification efficiency lies between 70 and 100 percent, and the best formula for amateur bands below 300 Mc. turns out to be Power in Watts = $.013\ E^2$.

There are two limitations to this type of instrument that should be kept in mind. One is the fact that for voltages below 1/4 volt (which is less than a milliwatt of power) the detector will begin to get square law and readings will be low. The useful range of the instrument is therefore about a milliwatt to 8 watts continuous or 20 watts briefly.

The other thing to remember is that this is a peak-reading device that effectively adds voltages instead of powers. If more than one frequency is present the reading will be way high. So make sure your exciter has no parasitics or harmonics in the output. It is very easy to measure more than 100% efficiency with varactor multipliers unless you are very careful to suppress completely the wrong harmonics.

Construction is simple and self-evident from the photograph and diagram. The device is also useful as a matched detector for antenna measurements (see June VHFER.) End.

*Pine Cove, Idyllwild, Calif.

SPACE DIVERSITY FOR IMPROVED RECEPTION

by John Chambers, W6NLZ*

A definition of the term "diversity" is the use of more than one receiver or antenna, or the combination thereof, in a manner to minimize the undesirable effects of fading of radio communications. The use of space diversity is far from new. In the 1937 copy of Terman's Radio Engineering, on page 587, there is a discourse on the advantages of diversity reception. It gives references to the Proceedings of the IRE, Volume 19, dated April 1931, where Mr. H.H. Beverage and Mr. H.O. Peterson describe the receiving systems of RCA communications for radio telegraphy.

Why diversity? In the main, it goes back to the nature of signals which we are trying to receive. They fade. And worse than that, they fade just when you are trying to hear what the other fellow is saying. True, many of the normal ionospherically propagated signals (h.f. bands 3-30 Mc.) are pretty good, but when trying to work either tropospheric or ionospheric scatter or just weak distant stations, about the time the other fellow is giving you your report, out he goes. Worse than that, you give him a good report and the next transmission you can't hear him. Refer now to Figure 1. It shows a typical

Refer now to Figure 1 on the front cover of this issue. It shows a typical tropospheric scatter signal and its fading characteristics. Note the extreme depth of the fades. It would take a lot of brute force to fill those holes. Now it is easy to see that if you establish contact during apperiod of high signal strength and give the other fellow a good signal report, he will assume copy is good. Then if, on the next transmission, his signal goes into one of the deep nulls and you can hardly tell he's there, let alone copy him, you have just classified yourself in his mind as an exaggerator. Besides, if you can't carry out a reasonable exchange of intelligence, what is the use of it?

Now, what is the mechanism of this fading? Nearly all of the weak signals amateurs receive are signals from many sources. That is, the signal that originated from, say, India on 20 meters has taken several ionospheric bounces to get here; usually not in a clean and clear-cut three or four bounces, but a mixture of two or more paths along, and sometimes completely around the earth's surface. This energy arrives at the receiving antenna in varying phase and amplitude relationships. If it is exactly in phase, the signal is good. It peaks up. If the energy is out of phase (and this often happens), and the two sources are exactly 180 degrees out of phase and are of almost equal amplitude, the signal is gone and it stays gone while this relationship exists, often as long as several seconds. Interestingly enough, if two receivers a few wavelengths or so apart are tuned to the same signal, the fading characteristic of Signal A and Signal B will be different. Space diversity systems are and have been commonly employed for h.f. commercial radio communications for a very long time. Amateurs in general do not have sufficient real estate for a practical space diversity antenna setup for the h.f. bands. This is a good place to point out that cross polarization diversity works very well on h.f. with almost no physical spacing, but has very limited application to UHF and VHF circuits with the exception of sporadic "E", meteor scatter and "F" layer reflection, when we get it.

A few words are in order about polarization diversity on VHF and UHF. It is used very extensively in commercial circuits. It normally consists of two sets of antennas at each end of the circuit, usually one set horizontal and one set vertical. They are not cross-polarized as would be commonly employed on h.f., but horizontal to horizontal and vertical to vertical. The cross-polarization content is very small, but interestingly enough the fading characteristics are substantially different as compared between the horizontal and the vertical. By splitting the transmitter output power between the horizontal and the vertical, the equipment at the transmitted end is relatively simple. The receiving end requires two antennas and either antenna switching or two receivers. Normally on

2228 Via La Brea, Palos Verdes Estates, Calif.

scatter circuits quadruple diversity (both polarization and frequency diversity) are employed to yield a remarkable degree of consistency. Figure 2 shows the typical improvement that can be expected from properly used quadruple diversity.

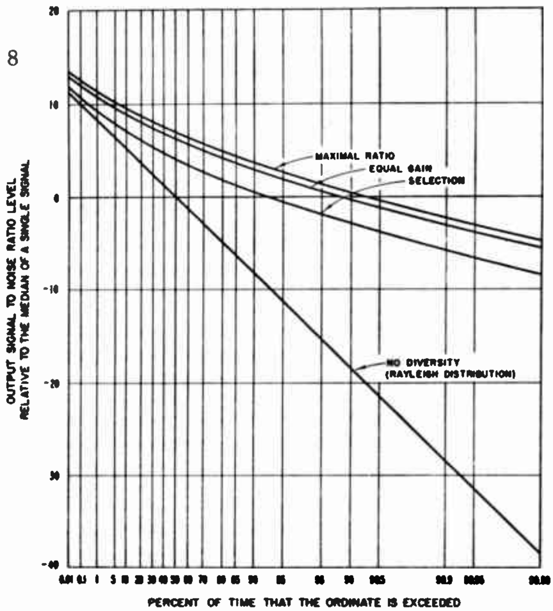
But the subject at hand is space diversity and particularly its application to ionospheric and tropospheric scatter circuits. As these modes of communication are only effective in the VHF-UHF region, and particularly those frequencies above 30 Mc., the requirements of great physical spacing are materially more appropriate; that is, 4 to 10 wavelengths at 20 meters is a minimum of 240 ft. and a maximum of 660 ft. This is a bit impractical, but at 2 meters the distance is 1/10 that at 20 meters. The dimensions are substantially appropriate for amateur-size real estate.

The mechanism of fading on h.f. is very much the same phenomenon that happens on VHF and UHF. It is pretty well conceded that most over-the-horizon signals beyond the diffraction zone on UHF and VHF are mainly the result of scattering of waves from "scatters." The exact nature of these scatters is subject to some dispute, but the results are not. It is clear that most of them come from a multitude of weak returns, as though patches and areas of reflective material were being shaken and varied by the hands of the Almighty. If these energy parts add up in phase, the signal is loud. If out of phase, the signal will fade to nothing at times. A phenomenon that is remarkably similar is star scintillation or "twinkling." The results at the receiving end are very much the same as a very poor h.f. signal with one exception, and that is that there is very little polarization rotation. If a signal starts horizontally polarized, almost all of it ends up at the receiving antenna horizontally polarized.

Signals arriving into a receiving area from a typical scatter signal vary slightly in phase, amplitude and heading. However, if one examines the nature of the phase/amplitude variations along the path "normal" to the direction of arrival up to a distance of 40 wavelengths, a correlation of .5 is still present. Unfortunately the IRE Dictionary of Electronic Terms does not include the term "correlation," but it essentially means the degree of similarity between two signals. A correlation of .5 would mean half of all energy received would be similar in phase and in amplitude and the other half would not. When measurements are made across the path, at 90 degrees to the direction of arrival, a correlation of .5 is measured at only 3.5 wavelengths. This would suggest a curious long, thin shape to the coherency of arriving energy. It does say clearly that an array more than 4 wavelengths across will not yield its full free space gain in scatter circuits.

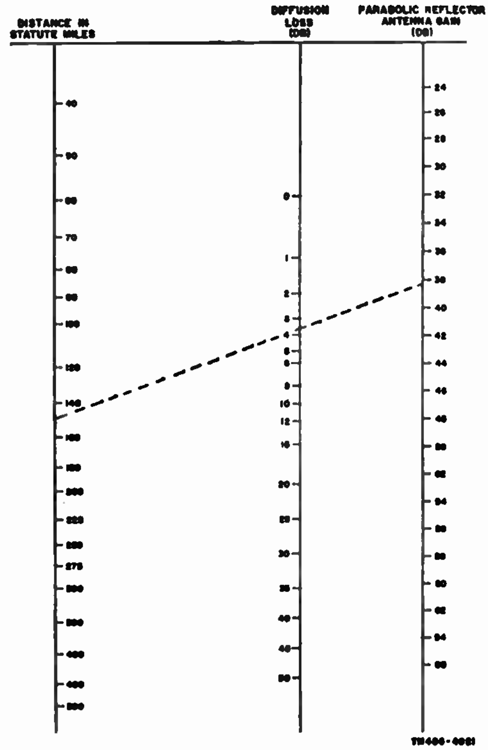
Figure 3 shows the "gain loss" which can be expected at various distances and conditions from this very effect. But this very effect is what makes diversity work. Moving away with a second antenna, you get a different fading pattern.

There has been a great deal of comprehensive data collected regarding the nature of fading signals. See Figure 4. This shows a typical distribution of fading, comparing various types of combining when used with dual diversity, interestingly enough. Note that the upfades are rather limited in amplitude, while the downfades are almost bottomless. Also shown is the improvement attainable from dual diversity. Note that it's good for almost 3 d.b. on an average (that is, 50% of all time) and on poor signal conditions you will lose less than 8.5 d.b. below the average signal for 99% of all time. Three different types of diversity combiners are shown---the maximum ratio, equal gain and selection. The maximum ratio combiner uses the best features of both the equal gain and the selection combiner. The term selection is another name for switching. For amateur purposes I suggest the experimenter start with the swithing type for simplicity's sake. Combiners



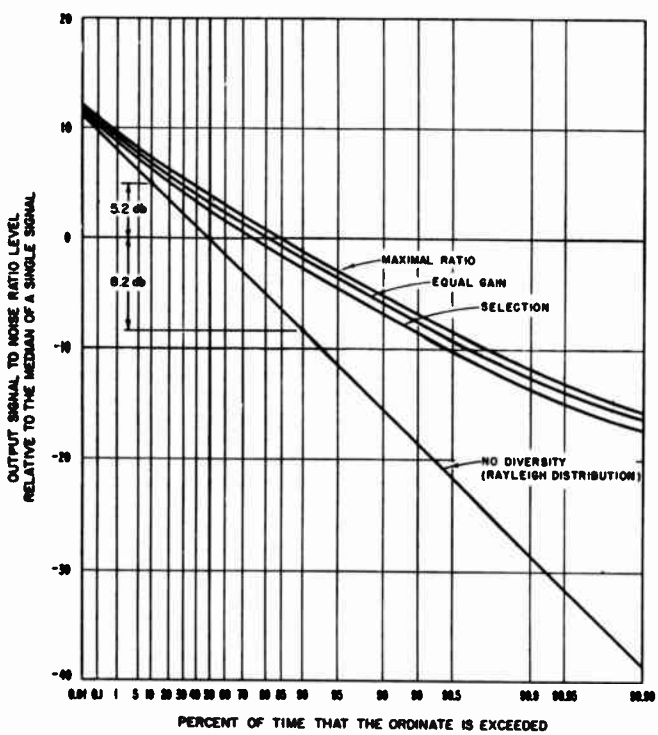
Comparison of the Time Distribution of Three Types of Combiners Using Quadruple Diversity

Figure 2



Nomogram for Estimating Diffusion Loss

Figure 3



Comparison of the Time Distribution of Three Types of Combiners Using Dual Diversity

Figure 4

that will work on C.W. and S.S.B. signals without the human servo or without loss are very complex. The "human servo" diversity selector needs to be no more complex than your listening to the signal on, say, Antenna "B" and turning a transfer switch to Antenna "A" when the signal quality becomes poor, or vice versa.

Now many people have considered the theoretical wonders of diversity and pondered the complex circuits for combiners and other ingenious mechanisms of automation of the diversity combining procedure and, like myself, decided it was too much work and not worth it. However, about three years ago I conducted an extensive series of antenna on-the-air performance checks and the setup was roughly as follows: two different arrays were aligned on a heading roughly 13 degrees West to North and side by side and spaced 12 ft. The antennas under test on the two-meter band were a vast assortment of almost any antennas I could borrow, but mostly were variations of colinear arrays up to 24 elements and Yagis up to 13 elements. A coaxial toggle switch was used to select Antenna A or Antenna B in on-the-air checks. At first, the test antenna and the reference antenna were relocated back and forth to establish that neither the location for Antenna A nor Antenna B had any inherent advantage over the other. The reference antenna was a twin 11-element Cushcraft. Probably the most interesting finding from this family of comparisons was not the fact that some of the best-advertised antennas yielded the poorest results, but the amazing effects of how well space diversity at even so small a distance as 12 ft. actually works. It became necessary to switch back and forth and back and forth to establish a statistical pattern of how the test antenna compared to the reference antenna. What rapidly became significant is that in the vast majority of times, if the signal faded down to an unreadable point on the reference antenna, it would be good, in fact at times very good, on the test antenna and vice versa. The human servo mechanism ending up with the thumb on the switch handle was functioning as a backyard diversity combiner. A more recent variation of this experiment has been the performance of a six element Telrex Yagi roughly 1 ft. above the roof line and 55 ft. below a 13 element four wavelength Yagi. On my Friday night schedules toward the San Francisco Bay area, it has been immensely interesting to observe the number of times that the six-element Yagi substantially on the roof will out-perform the big antenna some 64 ft. in the air. Be assured that if they are compared on a statistical basis, the big antenna runs about 12 d.b. better, both because of more basic gain and greater height than the small antenna. But the diversity effect in hole filling by the low antenna is almost irreplaceable. This is particularly true with a signal such as received from WA6RTM at San Miguel, a distance of 220 miles. Leon's signal usually runs from S-6 to S-9, however repeated fades will take him below intelligibility. Only on rare occasions will the signal have faded down on both antennas at the same time. This, of course, speaks for the desirability of triple diversity, an experiment which I have yet to try but one for which there is great promise. Of course, for optimum performance an optimum antenna should be used for both members of a diversity system. But even a mediocre antenna and a switch can add immensely to the performance of a non-optical system.

Now I would like to refer back to Figure 2. Characteristics like this could come from a system using two different spaced antennas and both horizontal and vertical polarization at the same time. It is a bit complex, but not out of the grasp of an ambitious experimenter. Note that 90% of the time the signal variation would be less than 10 d.b. rather than the 25 d.b. which normally wipes us out at just the wrong time. End.

OPEN BANDS

by Marilyn Wiseman, K8ALO

There have been band openings with very few around to work them (including me). This being the time of year for vacations, high temperatures, humidity, long grass, back-yard barbecues and antenna remodeling, a good many amateurs are staying out of their shacks. Of course there are lots of band openings yet to come so don't give up. If some calls do not appear, I might have received them too late for publication. Loren is trying to set up a publication date so your magazine will reach you earlier in the month than it has in the past. In order to help him achieve this, I'm requesting that all reports be sent to me no later than the 15th of the month. Persons requesting skeds should send their information directly to VHFER and not to me. Looking forward to your reports. Box 103, Petersburg, Ohio 44454.

<u>50 Mc</u>.

July 2-9 W4IMX Nashville wrkd Fla., Texas, Minn, Pa. Conn., Del., Mich., Ohio, N.Y., Winnipeg and heard Ascension Island.

July 20 WA8GBZ (Ohio) wrkd WA4UWW in Fla. at 0850.

July 22 VE6OH at Lethbridge, Alberta wrkd VP7DD in the Bahamas 2600 mi 1026

July 26 WA8GBZ in Ohio wrkd VP7NA in the Bahamas 2600 mi. 1026.

Aug. 1 K1VFX in Stratford, Conn. wrkd K8TCA in Royal Oak, Mich, WA8EJP in Ashtabula, Ohio, K9SRS in Milwaukee and hrd Fla., Ky, Tenn, Ill., Neb. Ark., Mo., Kans., Ind., Bahamas 1840-1940. WA8GBZ in Ohio wrkd WA4NHR in Fla., WA1CZB, WA1EIH, W1ADY, VE1UW 1300 2120.

Aug. 2 WA8GBZ in Ohio wrkd K4TBG in Fla., CO5CN in Cuba 1155-1810.

Aug. 4 WA8GBZ wrkd WA5NHR, WA4IPP (Ala.) 1145-1155.

<u>144 Mc</u>.

July 3 W3RUE Pittsburgh wrkd K4QIF in Salisbury, N.C.

July 12 KØGEY in Iowa wrkd K9UIF (Indiana) 270 mi, K9OYD (Gary, Ind.) 260 mi. and K9RVG Chicago 0039-0150.

July 13 VE3DSU London, Ont. wrkd WØIDY in Cedar Rapids, Iowa, W5JWL (Gurdon, Ark.) .0015-0115. KØGEY (Iowa) wrkd K9RVG (Chicago) 0036. WA8IKN (Ohio) wrkd WA9GWC (Decatur, Ill) 275 mi. 2256.

July 19 KØGEY mobile (Iowa) was heard by W9WCD Dekalb, Ill. 18 watts mobile.

July 21 KØGEY Iowa wrkd K9JAM in Chicago 0030.

July 22 KØGEY wrkd WØPHD in Warren, Minn. 515 mi., K9KYZ Middletown, Ill Hrd WØRWG La Plata, Mo. VE3DSU wrkd W4WNH in Elizabeth, Ky, W4TKH, Lexington, Ky. c.w. 0030-0110.

July 30 W3RUE (Pa.) wrkd K4QIF (N.C.)

Aug. 4 W3RUE wrkd K4MHS in Salisbury, N.C.

Aug. 7 W3RUE wrkd K4QIF (N.C.)

Aug. 8 K9JAM (Chicago) wrkd KØEMO (Hiawatha, Iowa), WØMQS (Cedar Rapids, Iowa) and KØGEY at Calmar, Iowa.

Aug. 10 VE3DSU (Ont.) wrkd W4ZCM (Bondville, Ky) 0030.

Aug. 12 K9JAM (Chicago) wrkd K2GUG (Lancaster, N.Y.), K8AXU (Marietta, Ohio), K9TFC/8 (Bellefountain, Ohio), WA8IDU (Ohio) wrkd K9ZNK, K9RMJ (La Porte, Ind, W4ZCW (Ky.), VE3BVK (St. Thomas, Ont.) hrd W2AZL (Plainfield N.J.) and W9ZIH (Ill.)

Aug. 14 K3GGZ (Pa.) wrkd VE3FJJ (Pickton, Ont.) 300 mi. VE3DSU (Ont.) wrkd W4ZCW (Ky.) 0200. WA8IDU (Ohio) wrkd W4ZCW (Ky.) & hrd VE2CFO.

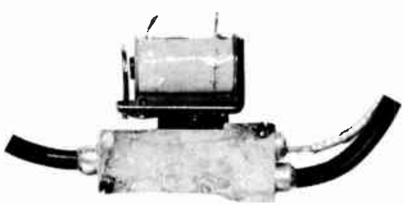
Aug. 15 K3GGZ (Pa.) wrkd VE3ETO (Mountain, Ont.) 400 mi.

432 Mc.

May 22	W3RUE (Pittsburgh, Pa.) reports first Pittsburgh-Canada QSO.with VE3AIB.
May 24	W3RUE (Pa.) wrkd K2ACQ (Lockport, N.Y.) for first Pittsburgh-NyY. QSO. This is the 9th state on 432 for W3RUE.
June 9	W8FWF (Garden City, Mich.) wrkd W9ZIH (Hickory Hills, Ill) 220 mi, W8PT Benton Harbor, Mich at 135 mi. 2058-2200.
July 3	W3RUE (Pa.) hrd KP4BPZ from 1545-1730. Ted said peaks were S2.
July 5	VE3DSU (London, Ont.) wrkd W9ZIH (Ill.) WA9HUV (Elmhurst, Ill.) hrd Mich. & Ohio. VE3AIB and VE3BQN both wrkd W9ZIH, WA9HUV also. W8FWF (Mich) wrkd VE3DSU (Ont.), WA9HUV 2040-2300.
July 7	W8FWF wrkd VE3AIB (Ont.) 220 miles 0010.
July 11	VE3EMT wrkd W9ZIH, WA9HUV. VE3DSU hrd W9ZIH.
July 12	VE3DSU (Ont) wrkd K2ACQ (Lockport, N.Y.) and hrd W9GAB, W9ZIH, WØRPY, W8FWF (Mich) wrkd WØIDY (Cedar Rapids) 450 mi., WA9HUV 2200 2224. George (W8FWF) runs 20 watts output.
July 24	W3RUE (Pa.) hrd KP4BPZ 0715-1005 S4 peaks. Ted also reports working W8YIO, VE3AIB, VE3BQN, K2ACQ about 2 times a week now.

EFFECTS OF TOO MUCH R.F. ON TRANSISTORS
by K7AAD

We have had only one transistor converter returned for service because of r.f. damage to the transistors. Damage was not at all like we had expected so I thought you might be interested. We found that a signal would still go through the converter and it wasn't too bad. The tuning was off a bit and we re-peaked the r.f. coils. At first we thought the converter had just been diddled with, but on checking the noise figure we found it was way high. It turned out that both r.f. transistors had been damaged--not just the input one. When both were replaced, everything tuned up as it should and made specifications. I have seen and heard of stations using transistor preamps at 432 which did not use shorting type relays. But they were usually very expensive military types. The point I'm trying to make is that just because you can still hear signals on 432 thru a transistor input, don't assume your input transistor isn't damaged.



Coaxial relay for antenna switching of 150 watts maximum R.F. power up to 470 Mc. when inserted in a properly terminated 50-ohm line. For 12 v. mobile equipment, operation over temperature of -30 to +85 degrees centigrade. Contacts, SPDT. VSWR 1.25:1 max. from 0-470 Mc. Crosstalk: 40 db min. 0-470 Mc. Contact springs: silver-plated beryllium copper, positively staked to prevent loosening or turning. Coil: 12 volts d.c. 3 50-ohm cables come out of unit. Ant. cable about 2" long, others about 15" long. No coax fittings on relay. $2 each, postpaid. Sid, K8ZES, 660 Willowcrest, Galion, Ohio 44833

MIDWEST 432 ACTIVITY
by Ken Bell, W9OKB

The summer season has found several stations in Chicagoland running 500 watts or more to large new colinear antennas. W9ZIH is running 1 KW while W9OKB and WA9HUV are at the 500 watt level. SSB has resulted in an increase in phone contacts for WA9HUV and W9OKB with good results into Toledo, Ohio (250 plus miles) and Cedar Rapids, Iowa, over 200 miles from the Chicago area.

Colinear antennas of 64 elements or more seem to be necessary for reliable contacts of 200 miles or more, however, not always required at both ends of a path. W8RQI in Toledo is using 96 elements, 80 watts input with a 4X150 and works reliably into Chicago under normal band conditions. W8YIO in Manchester, Mich. (near Ann Arbor) is working into Chicago regularly especially since an increase in power at his station to the 1/2 k.w. area.

W8PT near Benton Harbor, Mich. works regularly into Chicago and Toledo, being situated between the two cities. Jack reportely is moving to North Carolina and active 432 men will miss his dependable signal from Michigan. Jack reports a better than ever signal-to-noise ratio with his new transistor preamp.

Out in Freeport, Ill. (90 mi. west of Chicago) W9NKT is working WØIDY in Cedar Rapids, Iowa and of course into the Chicago area. WA9NKT also is using a transistor preamp. as is WØIDY.

Up in Milwaukee (90 mi. north of Chicago) W9BTI is still putting out a strong signal with his 4X150 mounted at the antenna. He is keeping skeds with W8PT, W9NKT and most Chicago area stations.

Band openings during August permitted W9GAB and W9ZIH to work into W2 land (400 plus miles). A previous opening allowed WA9HUV to contact a couple of VE3s. WØCTM in Minneapolis is keeping skeds with W9OKB and WA9HUV in an attempt to make the 300 mi. plus path. No luck so far.

Lots of interest in transistor preamps with WØIDY, W9OKB, W9NKT and W8PT using them. Seems like everyone has to experience r.f. burnout of the front end before installing sequential relays or some form of protection. WA9HUV uses an all nuvistor receiving set up with noise figure around 3.5 db. (??? editor) Lack of activity to the south of Chicago is disappointing. Everyone is anxious to see stations on in Missouri or Kentucky. Several hundred watts, a 64 element colinear and a low noise figure preamp should put them into the Chicago or Toledo areas. End.

BACK ISSUES OF 6 UP

We have bundled up 12 back issues of 6 up and offer them to you for $2 postpaid. magazines are free, but you have to help me pay the $46 freight bill for 14 cartons from New Hampshire to Oregon. When the bundles of 12 are gone we will offer smaller bundles or probably any four issues of what we have for a buck--but not yet. Old VHFERS are about impossible to come by. We have some Feb., March, June & July. Some of the early material missed by about a thousand of you will be re-done in future issues, especially constructional articles. We cannot answer your individual inquiries on back issues. The paper load is awful and I'm way behind in the part of the business I eat from. VHFER accounts for over half our mail.

K7RKH will be operating portable from Brianhead peak at 11,315 ft. elevation in Cedar Breaks National Monument, Southwestern Utah during the Sept. 11-12 VHF QSO Party. Bands 50 thru 420 Mc. will be used. 50.0-50.2 and 144.0-144.1 will be used for general tuning during non-schedule periods. Us of 220 or 420 band will be by sked only.

With a few exceptions all schedules will be arranged by radio, using 3810 or 7210 Kc., 75 meters in the evening and early morning, 40 meters in the late morning till sundown. It is expected that the HF bands will be monitored on the hour. It is hoped that those equipped to receive K7RKH will help others and assist as necessary so that all might benefit in this effort. de K7ICW.

The Tektronix A.R.C., K7AUO/7, will again be on 8,000 ft. Paulina Peak near Bend, Oregon during the entire contest. They will have low power (75 watts) on 50 Mc. but kilowatts on 144, 220 and 432. 3810 and 7210 k.c. will be monitored almost continuously for liason purposes. Skeds may also be arranged by letter. Write Gene Single, c/o Tektronix, Box 500, Beaverton, Ore. 97005. Home fone is Area 503 644 0807.

Another Tektronix group will be on Simcoe peak in south central Washington. Call will be K7CCW/7. They will be on 50 thru 432 with moderate power. Good shots in all directions except west, however they think they can work into Seattle. They will attempt to ride piggyback on K7AUO/7 contacts.

SKEDS WANTED

Random tropo and meteor scatter skeds wanted. Also skeds for the Orionids (October), Leonids (November) and Geminids (December) on two meters. Bill Smith, KØCER, 1301 Churchill Ave. Sioux Falls, South Dakota, 57103.

Want meteor scatter skeds. Victor Frank, WB6KAP (W7QDJ), 12450 Skyline Blvd., Woodside, Calif.

I don't know if these fellows want skeds but might be worth a try to some of you. Doug. Allen, K1UGQ reports working W4WNH, K4IXC and W8PT during Perseids. Hrd but did not work K4SJF, W4HHK, K9AAJ and W5RCI. K1UGQ does want skeds for two and operates from Biddeford Pool, Maine (no other address needed) until mid-September, then to home QTH. Has gear on 50, 144 and 220 (abt 150 watts and brand X converters.)

Wanted: 144 Mc. meteor and non-meteor DX skeds. Must know your frequency to within 1/2 kc. Location is ten miles north of Sacramento. Jay O'Brien, W6GDO. 6606 fifth street, Rio Linda, Calif. 95673.

Some other calls that are heard during meteor showers are K5TQP (New Mexico), K7ICW (Nevada), WØEYE (Colorado), WØENC (S. Dakota) and W7LHL (Wash.)

SUGGESTION FOR M.S. ADDICTS: If you have successfully worked meteor scatter, we should have a record here of your equipment and power level. Periodically then we could put all these calls and addresses in very fine print to get people together for skeds in the areas they want. In other words, a directory just like I hope to do for moon bounce. LP

Want tropo skeds on two meters. Have 250 W. A.M. and 500 W. CW. Ant is 15 element at 49 ft. Richard Flaskerud KØGEY RFD #1 Calmar, Iowa.

WEST COAST VHF REPORT
by Al Olcott, K7ICW

K9UIF reports that his is equipped for EME work on 144 Mc. with 88 elements. His 41 states worked on this band prove that not all his DX is due to a fortuitous QTH. If anyone in Nevada, Utah, Ariz., Idaho and points west wants 2 meter sked he is ready, willing and able. He is in Indiana, 40 mi. SE of Chicago.

Glenn L. Smith, WØDQY in St. Louis is interested in 145 Mc. SSB skeds, especially to the west. He has 27 states on this band. Says he will work cross frequency to 144 Mc. from 145.07. His transmitter is 1 KW, ant. is four 8-element Yagis, tiltable, fed with Andrews Heliax. Rcvr is Collins 51S1 with nuvistor converter. You can write Glen at 9658 Lilly Jean Dr., St. Louis or call 314 428-9741.

Fred Fish, K5TQP reports that he has repeated at least 4 times a QSO with K5WXZ in Garland, Texas. This is a distance of 570 miles airline from his QTH in Albuquerque, New Mexico. Freq. is 144 Mc., c.w. That particular path is not know for regular tropo openings.

On Aug. 6 the 2 meter band opened wide between Sacramento and Los Angeles From 9:30 to 10:40 signals between W6GDO and W6NLZ were S-9 on SSB. Nobody else in Los Angeles could be gotten going. Unfortunately W6GDO's 432 gear was temporarily out of service or they would have tried. WA6RLW in Exeter could not hear NLZ during this time though he usually can. Path length for the opening was about 400 miles.

K7ZIR in Aloha, Ore. (near Portland) worked into Vancouver, B.C. on two.

WØENC, Bob Eide, in Rapid City, S.Dakota has been working KØCER in Sioux Falls S.D. at 325 miles on Tues and Fri nites. Bob reports hearing him nearly every sked on 2 meter c.w. but SSB is very poor. Bob has some quantity of RG-17/U coax available for those in need. Write for shipping costs, etc.

WA5HAO at the tip of Louisiana, way out in the Gulf of Mexico, (what a beautiful noise-free QTH) says he has been hearing the Gulf Coast states of Texas, La., Miss., Ala., and Fla. on a pre-war 144 Mc. super-regen. Imagine what he could do with a gud rcvr.

Scotchkote by 3-M, also called Proseal in another brand, is that terrific stuff that you can put on coax connectors with a stick or paint brush. It does not harm the connectors or the coax and seals the joint from the weather. You can see through it and it can be cut off easily with a knife.

I have reports that J.J. Glass and Candee Electronics in the L.A. area are loaded with dish antennas including a 40-foot monster with polar mount in one case. Prices not known.

CALL FOR ARTICLES

We are in need of articles, especially constructional type. Don't get the idea that because we manufacture converters we wouldn't accept converter or preamp. articles. We do insist they be put in proper perspective. 432 and 1296 transmitter articles are very much needed and other articles above the idiot level. If you have something in mind, write in and get an opinion here before you go to the work of writing. A line drawing or two or a photograph dresses up an article. How about it?

SURPLUS

BIRD Model 80-M Coaxial Load Resistor 5 watts continuous duty. VSWR 1.1 max DC to 1,000 Mc. 1.2 max 1,000 to 4,000 Mc. "N" connector. Reg. $25, now $12.50. New.

STODDART coaxial attenuators, used, "N" fittings. 3 db, $6. 1, 8 or 30 db. $5 each. 2 w.

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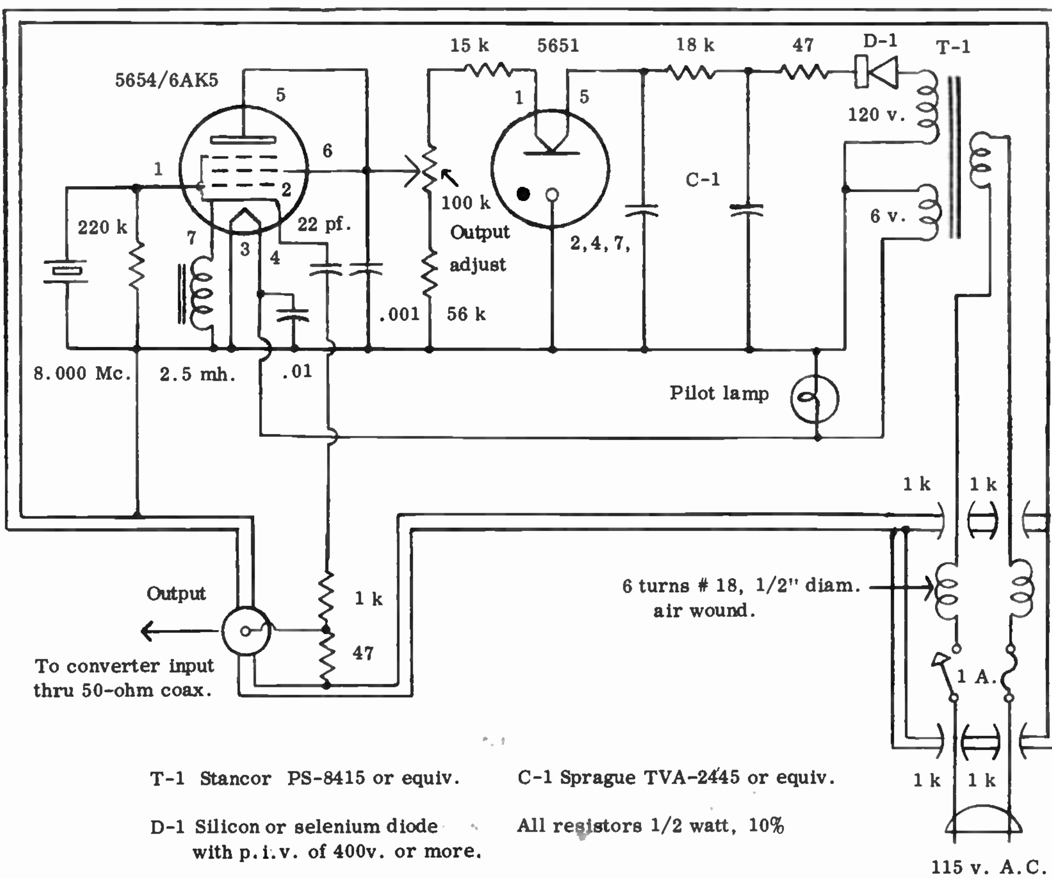
VHFER

LEARN BY DOING

50 MC. AND UP

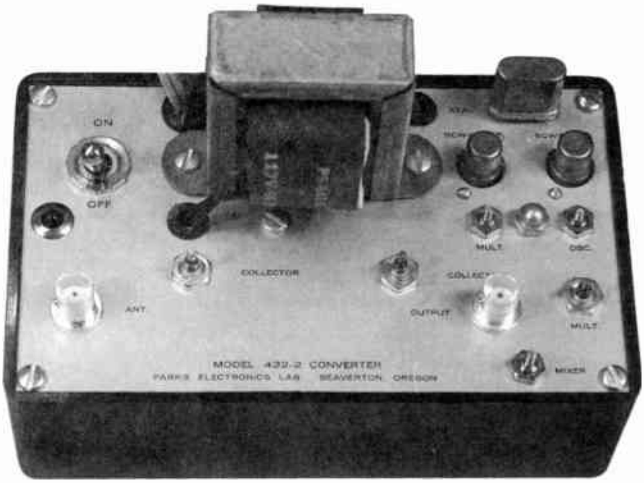
Volume 3, No. 7 July, 1965



144 MC. WEAK SIGNAL SOURCE

TWO NEW PRODUCTS

Here's the marker generator described in the May VHFER. We got requests from hams who wanted to buy it so we decided to make it. Price is $25, postpaid. Gives markers every 1 Mc. thru and beyond 1296 Mc. Adjust against WWV. Delivery late August.



This is a modification of our all nuvistor converter for 432. The noise figure is lower, the front end is more tolerant of antenna mismatch, and there is more gain to cover the noise of your receiver. Transistors (underneath) are two 2N3399s as r.f. amplifiers, and a 2N3478 mixer. The two nuvistors are used in a Butler-type oscillator. No internal batteries--all a.c. powered. Guaranteed to please. $54.95 postpaid. Those of you who have our Model 432-1, we can up-date it to make it exactly like the 432-2 including a new panel for $10, postage paid.

parks electronics laboratory   route 2, box 35   beaverton, oregon

VHFER magazine is published monthly by Parks Electronics Lab., Rt 2, Box 35, Beaverton, Ore. 97005. Subscription rates: U.S. & possessions $2 per year, others $3 per year. Second class postage paid at Beaverton, Oregon

ODDS & ENDS
by K7AAD

July has been a month of very heavy VHF activity on the west coast, starting with the A.R.R.L. National Convention in San Jose June 3 and ending with the very successful moonbounce work on 432 Mc. July 24. While building stuff is fun, there comes a time to evaluate what you have. This issue has quite a bit of that sort of thing in it. As an example, if you listened for the KP4BPZ moonbounce signals and couldn't copy it close to 100% (both CW and s.s.b.), you have a very sick receiving set up. The W7UAB-W7UDM team tried using a dipole for a receiving antenna and found they could copy BPZ moonbounce signals on both s.s.b. and CW. They used a Parks preamp. (432-2P)

Apparently KP4BPZ had transmitter trouble on July 3 because everyone I've heard from reported a.c. on the CW note and the speech was plenty readable but kind of garbled. On the 24th, however, everything was cleaned up.

In the last VHFER I referred to a KW 432 amplifier described in QST as measuring 20% efficiency. This information came to me on a 75 meter VHF net. I found out later that I hadn't gotten all the information, due to QRM and QRN. This final wasn't being driven into grid current, so the comparison with W7UDM's final efficiency of 50% in Class C was completely invalid. I should have checked that. My apologies to all of you whom I might have misled.

The metalwork for the 432 tripler I mentioned last time is going along well. The tripler measures about 30% efficiency. Using a 4X150 (pushing it hard) the output on 432 is about 120 watts with 1600 volts at 230 ma. in. It requires about 10 watts of drive at 144. Several of these triplers are being made up in different versions to be tried out by various hams before being described in VHFER. A metalwork kit will be offered.

We have W1OOP's preamp. for 432 here using the selected RCA 2N3478 with a cavity input and it works darned well. His preamp. with the cavity performs the same as our production preamps without a cavity on our test equipment. Hank says the insertion loss of this cavity is less than 1/2 d.b. which is a small price to pay for the added selectivity it gives. I believe this selectivity is important where TV signals are extremely strong and mixing occurs in the transistors. We have had only two reports of this with about 75 preamps in service. One was from Hank and the other from a ham in Arlington, Va. Maybe others have had a problem and have gone to cavities. Apparently tho a very small percentage of hams have run into this. This sort of thing is more common with transistors than with tubes. That figures. You never get something for nothing.

The Amperex 1N4885/H4A power varactor can handle 40 watts of input on 144 with about 22 watts out on 432, according to the manufacturer's data sheets. Over 50% efficiency is pretty good. K7CCW has one built that we are testing. Varactor triplers are sure the easy way to get on 432, fone or CW. If you modulate the 144 drive the 432 doesn't sound too sharp at high modulation levels but it is readable. We'll be making them when we can get around to it. See W1OOP's article in Oct. 62 QST.

All of you who sent in $3 for a 2-year subscription to VHFER are only getting a year and a half. The ad in 73 was in error because the rate changed the first of the year and we didn't notify the 73 staff. Advertisers don't foot the bill in this mag., readers do most of it. I hope you think you're getting your money's worth. About three kilobucks has gone into new equipment to put out this mag. in the last 3 months. Bear with us.

VHFER now caters to the intermediate and advanced VHF ham. We feel the beginner is adequately cared for by others. We want to help up-grade VHF amateur radio.

MOON BOUNCE REPORT
by Tom Curran, W7UAB

The signals on 432 from KP4BPZ on July 3 were good though somewhat unclear from a.c. on the carrier which affected the c.w. tone and the sideband quality. W7CNK in Seattle reported that signals were so strong he could copy the c.w. while climbing the dish outside the shack. Lucky used the 15 foot parabolic dish at the U. of Wash. antenna range. The feed was a vertical dipole tuned for 450 Mc. He placed his Parks transistor preamp at the dish and ran 100 feet of RG 58/U to the converter in the shack. He also used the "swampgator" and a Drake 2B. Reported signal strength was from 5-7 to 5-9. In 2 1/2 hours of copy (which he taped) he did not miss a word on either c.w. or SSB. There was some fading, some problem getting the dish to track. He states that the SSB had a hollow sound, something like aurora--but that he could hear Sam's beard rubbing against the mike. He believes they also heard W1BU but were not sure. No other SSB was heard.

On July 24, WA6LET at Stanford was the first station worked. Members of the UHF Radio Society (W6GD) and the Stanford Research Institute Club operated the 150' dish. Power into the dish was 300 watts from an overworked 4CX250B. Receiver was a Parks 432-2 converter---no preamp---into a 75A3. Report received was 5-6. A tape recording received from WA6LET had portions of their 20 minute contact with K2MWA/2. Signals ran about 10 db above the noise. KP4BPZ was about 45 db above the noise. They also had their own echoes on the tape which they measured at 3 db above the noise. The sideband echoes were quite Q5. They had a partial contact with DJØLO.

K7ZIR in Aloha, Ore. used 4 Gibson yagis in a quad spaced 5' apart (see photo) on a home-made polar mount operated just as shown--on the ground and right through the power line. Measured power at the antenna was 270 watts. He gave BPZ a 5-6-9 and received 5-5-9. He used a Parks 432-2 converter. Jim noticed that when the sun came up his background noise came up noticeably. Moonbounce started at 4 a.m. in Oregon.

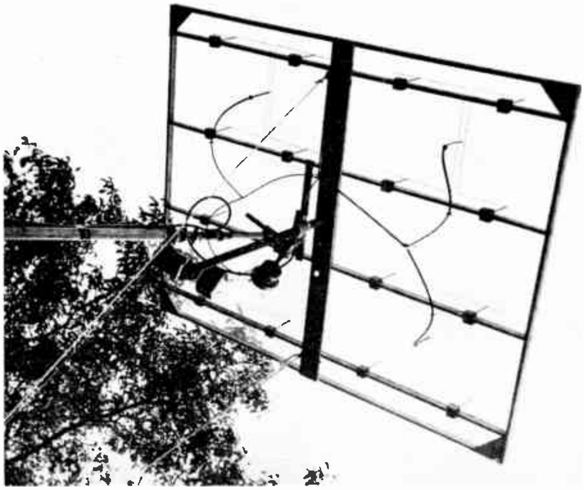
The station with which I was associated was W7UDM/7. We used an antenna with 16 driven dipoles and a screen reflector. Basic design was from the Frank Jones Handbook. The center of the antenna was about 10' high. (see photo). The polar mount was constructed of pipe fittings. We used a Parks transistor preamp into a home-made nuvistor converter to a 75S-1. Signal report received was 5-5-9, given was 5-6-9. At times the Moonbounce Filter described in the March VHFER was used. It improved the signal to noise ratio considerably tho it wasn't necessary. Pointing of the antenna didn't seem to be very critical.

WB6FSC/6 in Mountain View, Calif. worked BPZ and got a 5-6-9. He runs 1 KW input, 600 watts output to a cavity amplifier built by WA6BAN. The receiver was a paramp. built by K6IMZ with noise figure on the order of half a db., then into an 8058 converter (8 db n.f.) and a Drake R4 (400 cycle bandwidth). The antenna was a 64-element extended-expanded colinear (32 driven elements.) Chuck reports that he heard K2MWA/2 working WA6LET but the K2 was right at the noise level. He thinks a good c.w. operator could have copied them. He comments that KP4BPZ should have given the freq. of each station he worked so others could listen for them. It happened that the K2 was right on WA6LET's frequency. Had it not been for that he probably wouldn't have found them. He says" I am almost positive this station was the best, short of a larger antenna, that could be achieved." Sounds like they're way out in front, anyway.

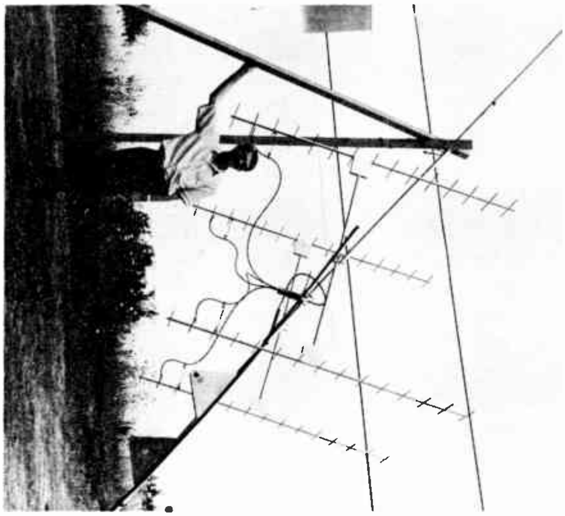
*7965 S.W. 87th. Portland, Ore.

Some of the signal reports given by KP4BPZ are as follows:

WA6LET	5-6	KØDLK	3-4-9
W3FCZ	5-6-9	K7MMT	5-4-9
DJ4AU	4-4	W1TQZ	3-4-9
WB6FSC	5-6-9	K2CBA	5-6-9
G3CCH	4-3-9	W7UDM/7	5-4-9
SM7OSC	3-3-9	W7PUA/2	4-4-9
W6YK	5-6-9	K6JLZ	4-4-9
DJØLO	4-5	K3HOC	4-4-9
K3LPF	5-7	W5LUU	4-4-9
K7ZIR	5-5-9		



16 driven dipoles in front of a screen reflector at W7UDM/7.



K7ZIR and his quad of Gibson yagis on a home-made polar mount.

METEOR SCATTER SKEDS WANTED

NOTE: There are restrictions on listings in this column. You must have a few hundred watts power, a good converter and antenna and you must list the equipment you have. The column is meant to bring together serious meteor scatter enthusiasts,

Want meteor and tropo scatter skeds on 2 meters. Bill Smith, KØCER 1301 Churchill Ave., Sious Falls, South Dakota 57103.

Want meteor scatter skeds on 144 Mc. with Louisiana, Arkansas, Texas, Oklahoma, Kansas, Nebraska and North Dakota, both for major and minor showers. Don Learned, W1AZK, Bear Hill Road, North Chichester, New Hampshire.

Want 2 meter meteor scatter skeds. Victor Frank, WB6KAP (W7QDJ) 12450 Skyline Blvd. Woodside, Calif. , Don Hilliard, WØEYE Box 563, Boulder, Colo., Bill Conkel, W6DNG 4608 La Cara, Long Beach 15, Calif.

NEED FOR CAVITY FILTERS

Many hams have TV garbage in the receiver that could be eliminated with a good cavity filter. The selectivity of very low noise converters or preamps is not the best--they are adjusted to do the best job on extremely weak signals. However, the addition of a cavity filter, in spite of a small insertion loss, can improve reception and may not make a noticeable difference in weak signal reception. Try it on two meters if you have a problem. Construction cost is on the order of $5. One was described in Feb. 65 VHFER. Others are in the new A.R.R.L. VHF handbook.

TIN CAN SOLDERING PROBLEMS

One of the problems reported to K6HCP after his fb article on beer can baluns in QST was that in some areas of the country the cans are made of aluminum. I've heard this about some of the juice cans too, so before you get all set to go on any construction project, better check and see that you have a can you can solder to.

WHAT I.F. FOR YOUR CONVERTER?

There are several criteria for choosing an I.F. range. Many times you have to compromise--especially with "ham bands only" receivers. If you're working very weak signals you need a very slow tuning rate. On an N.C. 300 and similar receivers, the 7 or 14 Mc. i.f. uses more revolutions of the dial to cover a given number of kilocycles. 14 Mc. is a good compromise, but you can only tune a few hundred k.c. of the band. Another advantage of a low i.f. is that the receiver will probably be more stable. If you use an i.f. that is too low, you may get into image problems. 7 Mc. is a low practical limit for two meters. At 220 and 432 a higher i.f. is preferred---a compromise on some receivers between tuning rate and image noise rejection. With receivers such as the Drake, tuning rate is the same on all bands, so the image is the only consideration. If you want to cover the whole band, then you have to forget about tuning rate. Don't expect to hold a weak c.w. signal on a sharp filter tho. Tuning gets extremely difficult, to say nothing of the receiver's local oscillator drift or jumping around.

NOTES ON CONVERTING MOTOROLA FM RADIOS

By Jim McMechan,* WØPFP

There are a lot of old Motorola FM radios of the 30 D transmitter and FMAR 13 V receiver types available to amateurs now at very reasonable prices. These notes are to enable the conversion of this equipment to the 6 meter amateur band. In central Iowa we are using 52.525 Mc. and 52.640 Mc. This requires the use of the following crystal frequencies:

Frequency	Receiver Crystal	Transmitter Crystal
52.525 Mc.	8037.5 Kc.	1641.40625 Kc.
52.640 Mc.	8056.67 Kc.	1645.00000 Kc.

Most of the units we have obtained cam equipped with the K8102, two-frequency adapter for the transmitter. If you do not have one, it may be easily made using a Mini-box. In any case, each crystal socket needs to have a trimmer capacitor in parallel with it. I normally use Erie type 557 8-50 pf. trimmers as they are quite small and have an adequate range. These trimmers allow each transmitter to be tuned to frequency.

Conversion of the transmitter is reasonably simple. Transformer T1 is modified by removing 20 turns. In some cases the oscillator does not always start under load if this is done, so a better modification is to rewind T1 with 44 turns in each half of the winding using the original wire. In the case of T2, merely remove 8 1/2 feet (that's right, feet, not turns.) T3 in our units required removing 8 turns from each coil. T4 requires the removal of 4 rotor and 4 stator plates from each capacitor as well as the removal of 3 turns from each coil. Move the bottom coil up so the two coils are separated by 1/4 inch. These modified coils should have 12 turns. T5 also requires removal of 4 rotor and 4 stator plates from each capacitor and 1 turn from each end of the coil leaving 3 turns tapped 1 turn from the top of the coil.

The final tank coil is 4 turns of the original coil. There may be several capacitors in parallel with the loading capacitor, so remove all these but the tubular ceramic which in most units is brownish-black in color and 75 pf. in value. These capacitors are to adjust the loading to the middle of the variable loading capacitor range.

Tune up is much easier if an absorption wavemeter is used to insure that each transformer is on the proper frequency. These frequencies are:

T-1 and T-2	1640 Kc.
T-3	6.5 Mc.
T-4	26 Mc.
T-5 and Final	52 Mc.

Since the Motorola units were made in 3 frequency range groups, any unit may have different transformers than we found. However, the instructions given show the number of turns in the modified transformers as needed for 50 Mc. operation.

In order to obtain more drive for the 807, the quadrupler screen voltages may be raised. This is done by changing the two 150 K, 1 Watt resistors on the resistor board at the end of the chassis to 68 K, 2 W. If you are going to use the two-frequency adaptor, be sure there is a 5 pf. capacitor from grid to plate of the 7C7 oscillator stage. Also some units do not have an 18 K, 1/2 W resistor from grid to ground on each of the 7A8 modulator tubes. If you cannot find these resistors, add them (unless your unit uses the speech clipper which is a board mounted vertically over the mike transformer.) Finally, on the numbered terminal strip behind the front chassis edge, check the value of the resistor between terminals #19 and #20. This is the mike dropping resistor and should be 470 ohms for 6 volts, 1K for 12 volts and 820 ohms for 12 volts when using the speech clipper.

Typical meter readings obtained from a properly operating unit with a 2K, 50 microampere meter are given in the following table:

Meter Switch Position	Meter Reading
1 Oscillator bias	-30
2 1st Quadrupler grid	-18
3 2nd Quadrupler grid	-27
4 Doubler grid	-20
5 Final grid	-20
PA Final cathode current	Depends on loading
Mod Modulator Bias	-22

The receiver changes are easier, so if you have gotten this far you are about done. The first problem is to determine which of the several models of this receiver you have. Most of our receivers have small coils in shields about one inch square which are marked T810, T811 and T812. The IF transformers in this receiver are of the same type. The 1st IF is 4.3 Mc and the 2nd IF is 1.7 Mc. The second type receiver has large RF transformers which look like the coils in the transmitter, but with the small 2nd IF transformers. The RF coils are marked T811 and T812. This receiver has an APC trimmer for the antenna coil tuning. The intermediate frequencies are the same as for the first receiver. There is also a third receiver which has the large transmitter-size coils for both RF and IF coils. This receiver has a 4.3 Mc. 1st IF and a 455 Kc. 2nd IF. Finally, the fourth type is the precision selectivity receiver which has three of the small-sized transformers between the RF amplifier and mixer and 2.7 Mc. 1st IF and a 2.0 Mc 2nd IF. These receiver transformers are marked T820, T821, T822 and T823. The following modifications have been made on the first three receivers mentioned but do not apply to the precision selectivity model nor do the crystal frequencies given earlier apply to this model.

The receiver with the small RF transformers will be described first. Turns are to be removed from T810, T811 and T812 and it is suggested that they be removed from the top of the coil form to allow the greatest tuning range. On T810 leave 7 1/2 turns, on T811 leave 7 turns in each coil and for T812 leave 7 turns on each coil. This completes the modification of the receiver. Plug in the new high-frequency local oscillator crystal (8 Mc) and retune the receiver.

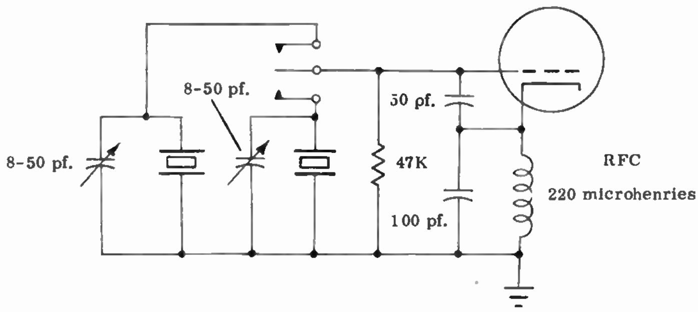
The receivers having the large size RF transformers require the removal of 3 turns from the antenna coil, leaving 7 turns. On T812 remove 2 turns leaving 4 turns. The oscillator coil T811 may have several windings. Be careful to disturb only the winding tuned by the variable capacitor and remove 3 turns leaving 5 turns.

The meter switch positions are listed below to make the tune-up easier. Use a 2K, 50 microampere meter.

Meter Switch Position	
1. 1st Low Frequency IF grid	4. Discriminator Balance
2. 1st Limiter grid	5. Discriminator Primary
3. 2nd Limiter grid	

If it is desired to use the receiver on two frequencies, several changes are necessary. In the transmitter add a lead from pin 5 of the octal plug to pin 2 of the 6 prong socket. The Motorola cables have this lead run to the receiver. This will allow both the transmitter and receiver frequency change relays to operate together. In the receiver add a DPDT relay of appropriate coil voltage with one lead of the coil to ground and the other coil lead to pin 2 of the 6 prong plug. Wire the relay contacts to a double crystal socket which has an 8-50 pf. trimmer in parallel with each crystal socket. The common contact of the relay goes to the oscillator grid. When changing the receiver to 2-frequency operation it is advisable to.

change the high-frequency oscillator to a Colpitts circuit in place of the Tri-tet circuit normally found in the receiver. The sketch below shows the circuit we used here.

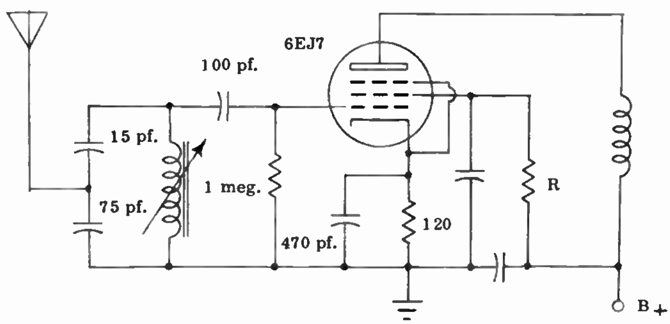


The major job left is optional but well worth the effort. WØLRY suggested changing the first RF amplifier to a 6EJ7. Except for the change in the socket this is not too difficult. Position the grid pin close to the input coil. In the mobile receivers with the small RF transformers, use the original cathode resistor and change the screen resistor to a 1K, 1W. If the grid resistor is 3.3 Meg. or 4.7 Meg., replace it with a 1 Meg. resistor. Since the 6EJ7 filament requires 300 ma., the 12 volt mobile receiver requires a 42 ohm 2 W resistor to balance the filament current. Usually this may be added in parallel with the 7C5 filament but it would be wise to check the filament wiring to be sure. Since the 6EJ7 pin connections are somewhat difficult to find, here they are:

1-cathode. 2-grid 1. 3-cathode. 4-heater. 5-heater. 6-internal shield (do not use.) 7-plate. 8-screen. 9-suppressor grid (tie to cathode at socket.)

In the large-sized transformer receiver it may be necessary to remove the APC trimmer and associated coil if trouble is experienced with oscillation. Replace it with a shielded 1/4" coil as shown below:

Adjust the number of turns in this new coil, starting with about 7 turns spaced 1/2 inch, for resonance with the capacitor values given. Notice that these capacitors form an R-9er type input circuit. Screen voltage on the 6EJ7 should be about 180 volts and the screen resistor (R) is selected to give this voltage in normal operation.



NOTE: Reprints of this article singly or in quantity are available for a stamped, self-addressed envelope to the publisher.

*Route 3, Ames, Iowa 50012

Open Bands

By Marilyn Wiseman, K8ALO

Reports are coming in fairly well, although nothing farther west than Illinois. The bands seem to be in good shape. Reports are starting to come in on 220 and 432. I would like to thank everyone who has sent reports to me. If I answered all the letters I'd certainly have a good case of writer's cramp-hi. So let's keep those reports coming in and I'll report as many as possible. My address: Box 103, Petersburg, Ohio.

50 Mc.

June 10 K1MAI (Conn.) wrkd KP4AST, KP4BPJ (Puerto Rico) 1835-1846.
June 19 WA8FTA (Mich.) wrkd WB6PBU, W6NLZ, K6IBY 1124-1557
June 20 K1MAI (Conn) wrkd WA4SDX (Fla.) KP4BCS. VP7NS, XE1CT 1856-1956.
June 22 WA8GBZ (Ohio) wrkd ZD8LR (Ascension Island), K7VTM (Wyo.) 1555.
July 1 WA8GEG (Ohio) wrkd YV5AGM (Venezuela), KP4AST
July 2 K1MRI (Conn.) wrkd VP7NA 2046
July 5 WA8GBZ (Ohio) wrkd KP4BCS 1935. WA8GEG (Ohio) wrkd WA4WVY (Fla.)
July 7 WA8GEG (Ohio) wrked KØBGF (Iowa), W1FLD (Mass.), K1QQH (Mass.)
July 10 WA8GEG (Ohio) wrkd WA5LBO (Texas)
July 13 K1MRI (Conn.) wrkd VE4MB, VE4YW. VE4JC (Manitoba) W7VTB (Wyo.), K7BHF (Utah) 2001-2225. Also hrd stations at British Guiana and Ascension Isl.

144 Mc. (reports are limited to abt. 250 mi. or more)

June 12 K8ZES (Galion, Ohio) reports working 84 contacts & 8 sections during contest. Conditions good to west. southwest.
June 26 K9JAM (Chicago) wrkd VE3EYX (Blenheim, Ont.) 295 mi, W8ANZ/8 (Plymouth. Ohio) 265 mi, W8EST/8 (North Branch, Mich.) 250 mi., W8IAD/8 (Deckerville, Mich.) 280 mi. 0024-0538.
July 2 K9JAM (Ill.) wrkd W8SDJ (Milford, Ohio) 260 mi. 0216.
July 5 WA8KBJ. WA8KOS (brothers) in Royal Oak, Mich. wrkd K9LMR (Wheeling, Ill.) 250 mi, K9WFA (aurora. Ill) 280 mi., K9HMB (Deerfield, Ill.) 250 mi, WA9BMU (streamwood, Ill.) 280 mi 2107-2255 ssb. WA8IAU (Chesterland, Ohio) wrkd W9YOI (Mundelein, Ill) 350 Mi., K9HMB at 350 Mi., K9YGZ (New Berlin, Wisc.) 410 mi. 2158-2218.
July 6 K3GGZ (Enon Valley. Pa.) wrkd K9YGZ (New Berlin, Wisc.) 440 mi. Hrd W9YOI. WA8IDU (Canton, Ohio) wrkd K9YGZ (Wisc.) 440 mi., W9YOI 400 mi. 0035. WA8IAU (Ohio) worked WA8LLY (Mich.) 280 mi. 2035. WA8KBJ-WA8KOS wrkd K9RVG Chicago 250 mi. ssb.
July 12 WA8KBJ, WA8KOS, W8AOE, WA8DOJ (all Royal Oak, Mich. wrkd WØDQY (St. Louis, Mo.) 500 mi. 2252 SSB. WA8IDU (Ohio) hrd KØIOD (St. Clair, Mo.) and WA4ELH (Fort Thomas, Kentucky).
July 13 WA8KBJ, W8WZB (lnear Detroit) wrkd WA9FVR (Greenwood, Ind.) 280 mi. 2330. WA8IDU (Ohio) wrkd K9KEM (Georgetown, Ill.) 384 mi., K9SBQ (Jerseyville, Ill.), 538 miles, W9JMF (Taylorville, Ill.) 500 mi., K9CHV (Marion, Ind.) 290 mi. 2330.
July 14 WA8KBJ (Mich) wrkd WN8OUB (Cincinnati) 245 Mi. .0018
July 16 K3HHC (Beaver Falls, Pa.) hrd K9KEM, K9SBP, W9CHV, WA9WAG, W9JMF, VE3BVK.
July 17 WA3BRA (Balt.. Md.) wrkd K1TPK (Portsmouth, R.I.) 310 mi. .0042.

220 Mc.

June 1-6 K8ZES (Galion, Ohio) reports skeds with W8DQU (Bedford, Ohio) 75 mi. Sid used 25 watts of FM with some difficulty. W8CSW (Powell, Ohio) and W8DQU (Bedford, Ohio) 125 mi. have nightly skeds. K8ZES also reports that W9HLY in Decatur, Ind. had good signals on June 1.
June 7 K8ZES running 100 watts a.m. wrkd W8DQU 75 mi. Good reports. Skeds maintained from June 8 thru 23rd.

432 Mc.

June 4 K8ZES (Galion, Ohio) worked W8UCT, W8FWF (both near Detroit) 110 mi.

144 MC. WEAK SIGNAL SOURCE

by "Skip" Freely, K6HMS*

The adjustment of VHF converters and preamplifiers for best signal-to-noise ratio can be a difficult job without some type of test equipment. What most hams do is adjust for maximum "S" meter reading on a received signal, and this method leaves much to be desired. It is primarily a gain adjustment. What they should do is tune for best signal to noise ratio by adjusting for maximum signal over background noise on a weak signal. While this method is a lot better than nothing it has several shortcomings, some of which are:

1. You often have no control over the time when the station you're adjusting to is on the air or how strong he is.

2. Variations in propagation make all but short-term observations highly questionable.

3. You can't compare your converter's performance before and after major alterations in its design such as use of different tubes. different L/C ratios, voltages, currents, etc.

4. It is difficult or practically impossible to compare your converter with converters of a number of other hams. Such comparisons often show serious shortcomings in performance.

Of course the noise generator is the instrument used to get a measurement of the noise figure---the meaning of which is widely understood. For those of you without the funds or knowledge needed to make valid noise figure measurements, the weak-signal source to be described is very inexpensive, easy to build and very, very useful. Even if you do have a noise generator the weak-signal source is a good device to use in conjunction with the noise generator. The weak signal produced is not quantitative, but it is quite reproducible from day to day or month to month and is very controllable in its amplitude. My two-meter version of this instrument, originally designed by Mel Baer (W6WSQ), is shown in the photograph of Fig. 1.

What is inside is shown in the diagram on the front cover of this issue. It is a one-tube crystal oscillator operating at 8 Mc., a small power supply and a voltage-regulator tube. Most parts can come from the junk box. The crystal can be any frequency that has a harmonic at the frequency you want to "peak" your converter.

DESCRIPTION OF OPERATION

The 6AK5 or 5654 operates as a triode oscillator at 8 Mc. since the plate and screen are connected together and there are no tuned circuits. R.F. output is taken from the cathode. The amplitude of the oscillations varies with the plate voltage, which is controlled by the Output Adjust control (Sensitivity in the photo). Plate voltage is derived from a voltage divider across a gas-tube regulator (5651) which regulates the supply voltage to about 85 volts. The power supply is a simple half-wave rectifier into a two-section RC filter. The current drain is so small a choke is not needed.

Since the signal is generated at a low frequency (8 Mc.) and all frequency multiplication is done in the oscillator. the output at 144 Mc. is quite weak. This is due to the inefficient harmonic-generator action of the oscillator. The coupling for the output is well-isolated from the oscillator and it does not affect the stability of the signal.

Several variations of the circuit may be tried. A tuned circuit for 144 Mc. may be included in the cathode circuit or a germanium diode may be used. Both these devices would enhance the desired high-order harmonics. The Output Adjust pot could be a ten turn device with a counter dial for logging purposes. I used an Allen-Bradley precision

*187 E. 22nd St., Costa Mesa, Calif.

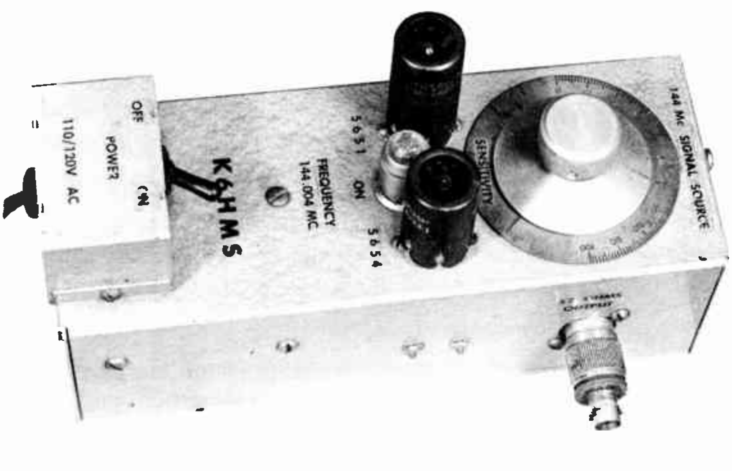
type with a 0-100 logging scale. CAUTION: For meaningful comparisons it is important to use the same output cable. For that reason I have an 18" cable terminated in a BNC plug and use adapters to other connector types.

To use this instrument, connect its output to the input of the converter being tested, turn the Output Adjust control fully clockwise and locate the signal on the receiver. Then reduce the output until the signal is just barely discernible in the noise. The reading of the scale at this point should be recorded for future comparisons---either with the same converter or with others.

This unit has one particular attribute that is quite valuable. Most signal generators available to hams are not usable as test instruments to generate very weak signals. The reason is that the attenuators in them are poor, there is leakage of the signal outside the cabinet or the frequency stability is not good. The effect of R.F. leakage in a signal generator makes poor converters look good because even though the attenuator scale shows the signal output is extremely low, signal leaking thru the attenuator or by other paths may be fairly high. In this instrument the oscillator output is reduced by means of the Output Adjust control so any leakage through the box is being reduced in the same proportion as the signal. In most commercial generators the oscillator continues to run at full output. For this application--one frequency and one mode (c.w.)--this weak signal source is far superior to some rather expensive commercial instruments. For most good converters or receivers, a signal of .1 microvolt is a big signal, and most signal generators leak a tenth of a microvolt. From that level on down, this device takes over.

Frequency stability of the signal source is very important when testing signals down in the noise. This unit is very stable for any setting of the Output Adjust control, but frequency does change a bit when this control is changed very much. It will be necessary to retune the receiver slightly to re-peak the signal on a sharp filter when a very weak signal is used.

This weak signal source has been very popular on the West Coast for several years, and many converters have been evaluated with the various units built. If you bring your converter to a west coast convention or technical meeting on VHF, chances are that Ed Tice, W6NGN, will greet you by plugging his weak-signal source into your converter. I hope you'll find your weak signal source as useful as I've found mine. End.



TIN CAN RESONANT CIRCUITS

by Louis Hutton, K7YZZ*

The use of tin cans as resonant coaxial circuits in filters and two-meter converters has been described in recent articles.[1,2] No information could be found as to what size cans would resonate in the various VHF/UHF bands. Six different tin-plated steel cans were acquired and checked for frequency coverage with the results shown in Table 1.

Center conductors of various diameters (1/8 inch to 5/8 inch diameter) were tried with no observable change in characteristics. Piston-type tuning condensers, compression trimmers, and ceramic trimmer condensers were tested as tuning condensers. The piston and compression types were the easiest to use. Precise tuning could not easily be achieved with the ceramic trimmers. They require additional torque, and the thin metal cans and flimsy support of the center rod did not provide enough mechanical stability.

Tapped line and link inputs as shown in Figure 1 were tried with good results. The resonant frequency may be determined by coupling the coil of a grid dipper close to the input link or the open end of the tin-can coaxial circuit.

A 432 Mc. converter has been constructed using tin cans as resonant circuits. It was described in the June issue of VHFER.

TABLE I

CAN SIZE Diameter	Height	DIAMETER OF CENTER CONDUCTOR	TUNING CONDENSER CAPACITY (mmfd.)	FREQUENCY (Megacycles)
2 1/8"	2 7/8"	3/16"	5-25	432
2 3/16"	3 1/2"	3/16"	3-15	432
2 3/16"	3 7/8"	3/16"	3-15	432
2 5/8"	4 7/8"	1/2"	5-25	225
3 3/8"	7"	3/8"	5-25	144
4 1/4"	7"	3/8"	5-25	144

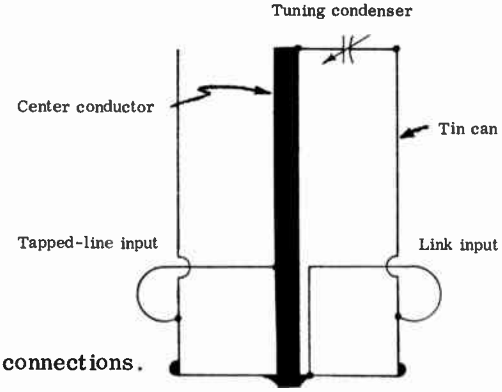


Figure 1.
Tin can input or output connections.

1. Radio Amateur's Handbook, 42nd Edition (1965) Page 55.
2. 73 Magazine, May, 1965 Page 40 2 Meter Beer Can Cavities.

*12235 S.E. 62nd, Bellevue, Wash. 98004

(next page)

DX REPORT
by Lew Munford, W8YIO *

This report came to us with a preamp. returned for service. It had been damaged in shipment so much the piston capacitor was broken, completely detuning the thing. Lew's report on his frustration was so interesting to me I thot you might like to hear it. K7AAD.

On July 13 the band opened up to the south and I worked W5RCI on two meters with good signals both ways, he on SSB and I on CW. I switched over to 432 CW and called him. He rebroadcast my 432 sigs back to me on two meters and we worked duplex for a few minutes. Then he switched over to 432 and called me. Despite the fact that he runs 10 times the power that I do, I could not find any trace of his signal. After 45 minutes trying we finally gave up. Later that nite I got hold of W5JWL in Arkansas on two and asked him to listen for me on 432. He heard me on the first call. Then he switched to 432. Except for one brief instant I heard nothing from him in over two hours of trying. He hrd me for the whole two hours, giving me a 5-5-9 report. Later I was able to work W4TKH in Lexington, Ky. He was using one of your preamps. From this situation and other similar contacts I can only conclude that my receiving setup is far below that of other stations on the band. It has been very discouraging to miss states because of not being able to hear them when they hear me. I only run 25 watts input to a Motorola FM transmitter.

Box 11, Bridgewater, Michigan

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We have all the back issues of 6 up that exist in any quantity. We have packaged up what there is in bundles of 12. You may have all 12, postpaid, for $2. Essentially, the magazines are free. It was the freight shipment here, the postage and the bundling and processing your order that eat up the two bucks. Old VHFERs almost don't exist. Sorry we can't answer your inquiries individually. The paperwork here is terrible.

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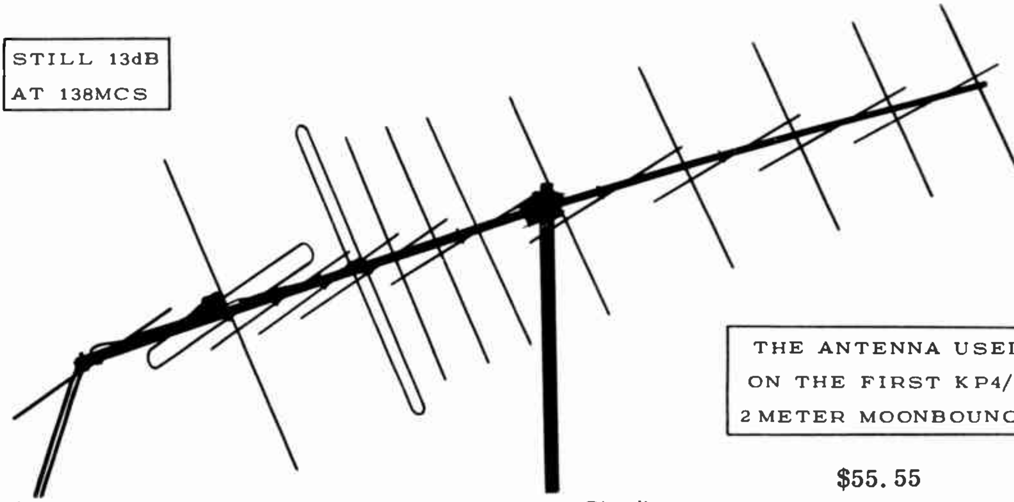

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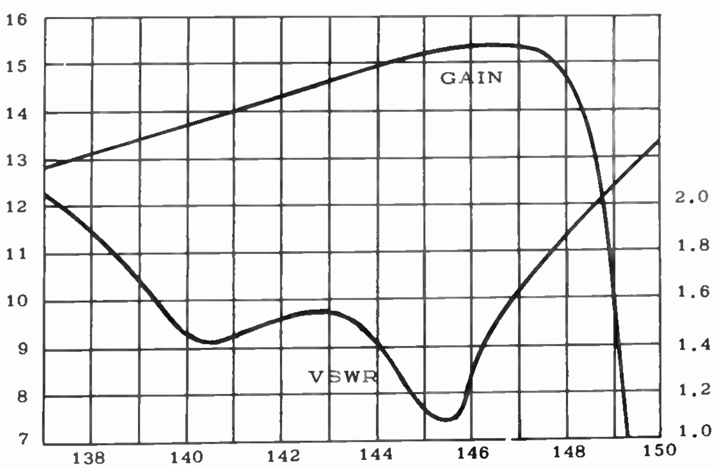

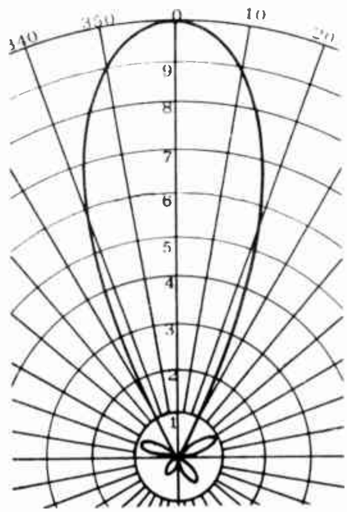

Gain over isotropic..........	15.4dB	Turning Radius....................	104"
Front/back ratio	30dB	Net Weight.......................	13.9lbs
½Power beamwidth	33°	Stacking distance above or alongside...	132"
Boom length...............	194"	Wind area.......................	3.4sq.ft.
Width.....................	41"	Wind load at 100mph..............	83 lbs.

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WEST COAST VHF REPORT
By Al Olcott, K7ICW*

W7HDP at Great Falls, Montana tells me that a 450 Mc. repeater (receiver) near his location has been receiving 15-25 watt mobile stations in Louisiana and Indiana on 450 Mc. starting at 1100 MST.

K6QKL/7 at Tacoma, Wash. says that the 6161 tube which can be obtained for $7.50 will operate full limit on 432 and 1296 Mc. and the socket is even cheaper! (so he says)

A 220 Mc. net using 222.000 Mc. has been operating in the L.A./Orange area on Sun. nites 2000-2230 PDT with K6IBY or K6SQH hosting as net control. The net is expected to get more active in the fall months after vacation time.

W5MJW at El Paso, Texas is interested in 50 Mc. scatter skeds, CW or SSB, 50.010 or 50.110 Mc. Sat & Sun. mornings. "SL" is also interested in 2 meter work but must transmit above 145.000 Mc. Cross frequency work at the low end is OK. W5MJW has heard regular signals from WØEYE (Colorado) and the Tucson area on tropo/m.s., and also Fla. on one occasion.

K6IBY is looking for schedules on 220 Mc., 221.5 Mc. up for long-distance DX including meteor scatter.
K6AZL is operating from Susanville, Calif. with high power on 2 meters (East of the Sierras) and would like skeds. Write Earl C. Jennings, 125 N. Pine St.

50 Mc. opened up here June 13. Stations worked were in Oregon, Wash., VE7, Calif., Iowa, Okla, Ark., Texas, Kansas, Missouri, S. Dakota, Colo., Wyo., N. Dak., Tex., Ill., Minn., Tenn. and South Carolina. On June 19 the band opened to all U.S. call areas plus VE4, VE6, & VE7.

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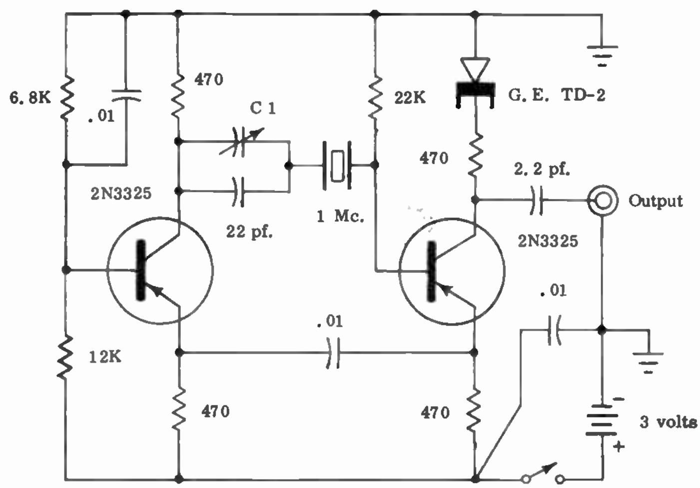
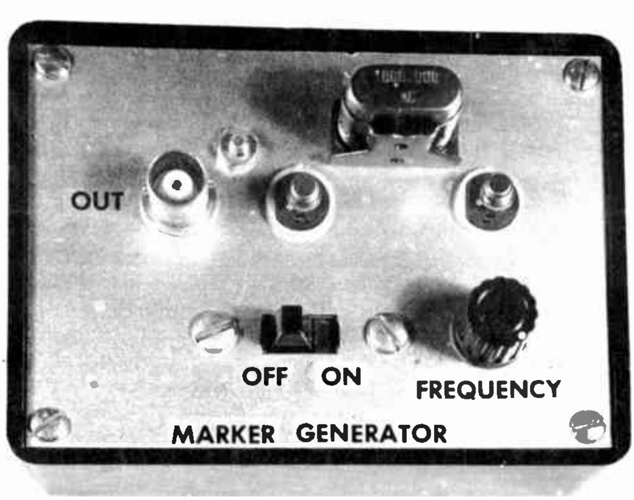
Vol. 3, No. 5 May 1965



C 1 2.7-19.6 pf. Johnson 160-110



VHF-UHF MARKER GENERATOR

A VHF-UHF MARKER GENERATOR
By Mike Metcalf, W7UDM

An accurate receiver calibration is a must for the serious VHF DX man. The 100 kc. crystal calibrator in many receivers is no help at VHF because the crystal in the converter is usually off frequency a bit. Meteor scatter, moonbounce and extremely weak signal detection are next to impossible unless you know just where to listen for the signal. You can't tune around for it at random. Much of this kind of DX work is done near the low edge of the band or very close to 432 Mc. The dial calibration on most recent receivers is accurate enough to let you read frequency to within a kilocycle 20 or 30 kc. up the band once you know where the band edge is.

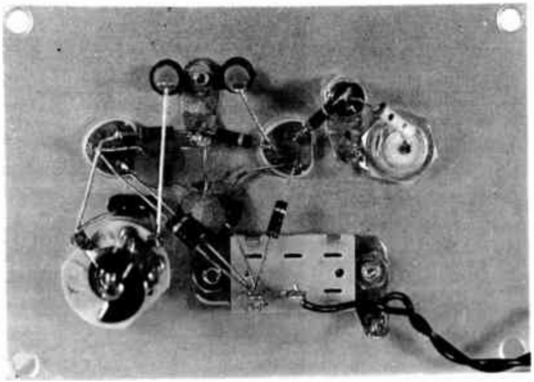
The usual way to spot the band edge is to build a 1 Mc. crystal oscillator and zero beat it with WWV. At the frequencies of 144 Mc. and above it is often difficult to get sufficient harmonic output to accurately mark the band edge. Also, if the receiver I. F. is an even multiple of 1 Mc., the receiver picks up a harmonic of the calibrating oscillator and you get more than one signal at the band edge. With overloading you may get several.

The calibrator to be described has the advantage of very high harmonic output--so much that you can pick up a signal from it without feeding its output directly into the converter. A short piece of solid wire stuck into the output connector will radiate adequately in most cases. Only one signal at every one megacycle interval is the result,

This calibrator uses a multivibrator and a tunnel diode in a switching circuit. Now tunnel diodes may be difficult to work with as oscillators and amplifiers, but as a switch they are simple. And as a switch the tunnel diode is so fast it is very difficult to measure how fast it really is. Switching time of a device like the TD-2 used in this circuit is on the order of a thousandth of a microsecond. A switch that operates in zero time generates an infinite order of harmonics of the switching repetition rate. This is just what we want for a marker generator. By driving the tunnel diode at a 1 Mc. rate there is plenty of marker signal every 1 Mc. from 1 Mc. to well above 1296 Mc. So if you know the location of the band edge on your receiver to within a hundred Kc., this marker generator will let you calibrate every megacycle to an accuracy limited only by your ability to zero the marker generator against WWV.

The circuit diagram is on the front cover of this issue. It has a multivibrator utilizing two high-frequency transistors that includes a crystal in the feedback path. The repetition rate is controlled by the 1 Mc. crystal. The current in the collector of the second transistor varies from zero to about 3 ma. The tunnel diode is in series with this collector so current through the tunnel diode must vary in the same manner. This particular tunnel diode has a peak current of about 2. 2 ma., so when current exceeds that amount it switches from its low-current stable state to the high-current stable state. When the current in the second transistor's collector circuit falls to near zero, the tunnel diode switches back to its low-current state. The operation of a tunnel diode in the switching mode is beyond the scope of this article, but it should be pointed out that you cannot substitute a diode of any other type and get the same effect because a tunnel diode is a negative resistance device and not of the type usually encountered.

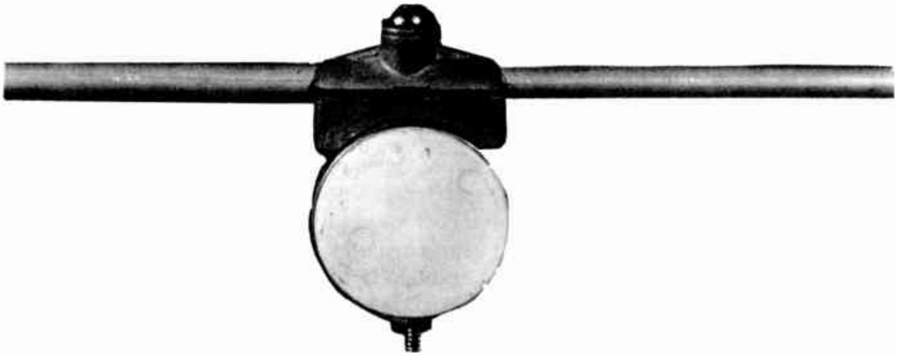
The use of transistors results in a compact and relatively inexpensive unit. The only critical point is the wiring of the tunnel diode. The 470 ohm resistor and 2. 2 pf. capacitor should be wired in first. The tunnel diode must be protected from the heat of the soldering operation. When you solder it in place (use short leads) be sure to clamp the wire next to the device with long-nosed pliers to act as a heat sink. A lead length of 1/2 inch each side of the tunnel diode is acceptable. The outer shell of the tunnel diode should be grounded, preferably near the output connector.



How much capacitance you need in series with the crystal depends on how far off frequency it is in your particular circuit. It may be necessary to change the value of the fixed capacitor so you can zero against WWV with the variable capacitor near the center of its tuning range.

If you have a junk box, construction cost should not exceed $5. 25. The transistors are made by Motorola and cost 90¢ each. The tunnel diode (TD-2 or 1N3714) is made by G. E. and costs $3. 30. Resistors may be 1/2 watt or smaller. Any box or flat piece of metal may be used in the construction. Printed circuit board works well for this sort of thing.

The accuracy of the markers is entirely dependent on the care used to zero WWV. A 10 cycle error at 10 Mc. is an error of 144 cycles at 2 meters and 432 cycles at 432 Mc. In order to zero accurately to WWV you must use a meter. The ear does not respond well to low frequencies. The receiver "S" meter can be used to compare the signal from the calibrator with WWV and permits adjustment to within 1 cps when the tone is off. End.



ANTENNA ELEMENT MOUNTS

VHFER magazine is published monthly by Parks Electronics Laboratory, Route 2, Box 35, Beaverton, Oregon. 97005. Subscription rate is $2 per year U. S., $3. 00 per year foreign. Make checks payable to Parks Electronics Lab., not VHFER magazine.

Application to mail at second class rates is pending at Beaverton, Oregon.

ODDS & ENDS ABOUT 432 MC.
By Loren Parks, K7AAD

The big dish in Arecibo, Puerto Rico (KP4BZ) will be operated on 432 only the 3rd and 4th of July. Operating times will be when the moon is within range of the hemispherical reflector. No more details available yet. Info. from W1HDQ. Of course, July 3 and 4 is during the A. R. R. L. national convention at San Jose and the west coast V. H. F. conference. With all the big 432 antennas that will be present, no doubt something will be set up to listen for moon bounce and hopefully to transmit. Last time I believe the pile up right near 432.000 was pretty bad so it might be a good thing to move off a bit. Remember that with all the gain on that end it doesn't take so much suds on your end. C. W. is probably the mode to be used but in view of some rather good results with fone last time it might be they'll be able to copy a good s. s. b. signal.

Locally, some hams have built a 16 element extended-expanded collinear antenna with a copper screen reflector. Gain measurements were made in the same manner as described in the tests on the Skybeam in this issue. The same reference dipole used at the west coast antenna measuring contests showed the antenna had about 18 d. b. gain. This seems too good to be true and we have been making checks on the dipole and will also make comparisons against the Gibson Yagi which I take to all the contests. At any rate, though gain may not be 18 d. b., the antenna apparently works well and if further tests show it is performing as an antenna of that size should, we will publish constructional details. The extended-expanded collinear was a contribution of the late Oliver Wright, W6GD. This type antenna has always won the contests. Two versions of it are described in the VHF Handbook by Frank Jones (CQ). One was used as a pattern for the antenna made locally. The screen was substituted for reflector elements. The screen reflector probably has too much wind resistance to keep in the air but for moonbounce it seems ideal.

You haven't been seeing much in the way of converter construction articles in VHFER. It isn't that we suppress it, it's just that suitable articles have only recently been submitted. We had plans of presenting a 432 transistor converter article this month, a re-do of an article in the Sixth Army MARS bulletin, but the author decided he wanted it published elsewhere so no article. This seems like an appropriate time to say something about guidance and quality control in VHFER construction articles. A responsibility Fred Brown (W6HPH) and I feel is that it is up to us to see that information presented is reasonably accurate and leads in the direction of up-grading the ham and his station. As a result of the yearly get-togethers the more advanced west-coast hams have to exchange views, measure the performance of receiving equipment on 2 and up, measure antenna gains on 432 & up, we pretty well know what stuff works and how well it works. Though measurements may not be absolute they are certainly useful when a large number of comparisons are made. A year or so ago, the 6CW4 (selected), 416B and Philco 2N2398 all performed essentially the same at 432. Note that the 8058 was not included. How much was the fault of the tube and how much the fault of the builder, we don't know. All we know is that none made a good showing. Now the Amperéx 2N3399 and W6NLZ's planar triode are tied and ahead of the former champs. The planar triode and its associated power supply are so expensive as to be out of the question for most and certainly offer no advantage except perhaps that they will tolerate more r. f. leakage thru the coax relay. The 2N3399 is cheap ($2. 55) and in our experience they all work fine with noise figures by our measurements (which may well be off) of about 4. 5 db. At any rate they're darned good. Now knowing all this, would you solicit or accept articles about HOT converters or preamplifiers using the 416B (which goes sour easily) or the 8058 (which costs $13. 50)? We don't. There is a place for a mediocre converter for 432 that is easily built from readily available, inexpensive components. It has to be stable so it can be used with a good preamp. We have two such articles contributed that will be published shortly.

Last February when I was in Boston, W100P and W1BU told me of their work with selected RCA 2N3478s. We bought some locally, re-worked our preamps to cater to the NPN and results were awful. We got 9 db. noise figures. Maybe we got bad ones or maybe we did something wrong. Not a lot of time was spent on the project. We sent Sam Harris one of our standard preamps to compare with his RCA job to see if it was really a difference in performance or a difference in noise figure measuring techniques. That was in March (Sam hates to write letters) and now he is in Arecibo so we won't know for a while.

At 432, transmission line losses can get pretty bad. Those with permanent towers can sometimes get industrial surplus air line coaxial cable that has extremely low losses at 432. The stuff is rigid and not very suitable for crank-up towers like I have. For those of us who have to live with flexible coax, it would seem very desirable to put the preamp up at the antenna to get another 2 or 3 d.b. of signal. This means special switching, preferably something that also shorts the input of the preamp. while the final is running. We are in correspondence with Dow-Key to see what can be worked out. If we can prove to our own satisfaction that the system is safe for use with transistors we'll let you know about it. Some surplus relays have very good isolation and are quite satisfactory. Transco is one brand that is good. However finding them in any quantity is the problem. The burnout problem has to be solved. Tubes as VHF-UHF front ends have had it.

Open Bands

By Marilyn Wiseman, K8ALO

144 MC.

April 16 WA8KBJ (Royal Oak, Mich.) worked WA8GKK (Port Clinton, Ohio) 100 miles at 2327

April 18 WA8KBJ reports an aurora from 0130 to 0630. Hrd W3LNA, W9PBP, W8GZW, W8KAY, WA9CIY. Wrkd K9SGD (Sparta, Ill.) 470 mi., K9IMX (Bloomington, Ill.) 315 mi., K9HMB (Chicago) 225 mi., VE3EWZ (Toronto) 200 mi., K2LGJ (Buffalo) 215 mi. Time: 0230 to 2355.

April 22 K3GGZ (Enon Valley, Pa.) reports wrking K8IFE (Richmond, Mich.) 200 mi., K8DBA (Monroe, Mich.) 175 mi., WA8KBJ (Royal Oak, Mich) 180 mi., VE3AJU (Bright's Grove, Ont.) 250 mi. Time 2104-2208.

April 23 K3GGZ (Penna.) wrkd VE3FRC (Sarnia, Ont.) 225 mi., VE3BVK (St. Thomas, Ont.) 150 mi., W8JXU (Hazel Park, Mich.) 180 mi., WA8HTL (Detroit, Mich.) and K8DBA (Monroe, Mich), both 175 mi. Time 2321-0050.

April 24 K3GGZ (pa.) wrkd K8PSH (Roseville, Mich.) 185 mi., W8PHJ (White Lake, Mich.) 240 mi. 2137-2256. WA8KBJ (Mich.) wrked K3FOO (Sharon, Pa.) 150 mi., K8RPB (New Cumberland, West Va.) 175 mi. Time 2115 to 2141.

April 29 W3GLC (Beaver, Pa.) wrkd K8TCA (Horton, Mich) 200 mi. at 1930.

May 1 WA8KBJ (Mich.) wrkd K8TVT (Steubenville, Ohio) 300 mi. at 0245.

May 5 K3SBE/3 (Jeanette, Pa.) wrkd VE3EYX (Blenheim, Ont.) 230 mi. at 2226. WA8KBJ (Mich.) wrkd K3PGP (Irwin, Pa.) 215 mi. at 2142.

50 Mc.

May 6 VE4GI wrkd CO2DL. Hrd 30 states in 36 hours.

Send ur dx reports to Box 103, Petersburg, Ohio. Let's keep minimum distance of 250 mi. on 6 & 2 next time. DX in the midwest is much different from northwest and we don't yet know whi distances are exceptional. 432 & up--you be the judge.

K9EID OFF THE AIR TEMPORARILY

The fb station of Bob Heil in Marissa, Ill. is closed down due to a job change and impending matrimony. Bob has joined the Holiday Inn chain & present plans are to have new QTH on top of 33 story Holiday Inn on Lakeshore Drive in Chicago. Should shake things up in Chicago.

MEASUREMENTS ON THE 2 METER TEN ELEMENT "SKYBEAM"
MADE BY "J" BEAM AERIALS, LTD.
By Loren Parks, K7AAD

NOTE: This article is a re-run of one that appeared in VHFER in Sept., 1964. In view of the facts that we have over a thousand more readers and that this is antenna-testing season, it seems appropriate to run it again. This antenna is still by far the best commercial beam I have tested. All elements are "working" elements. I'm well pleased with it and so are a couple of sneaks who copied its dimensions while it was on the ground and I was gone. The beam is distributed in the U.S. by Gain, Inc., one of our advertisers.

In one of my previous VHFER articles I intimated that the claims of some antenna manufacturers were less than hones, by several db. Bill Roberts of Gain, Inc. took it upon himself to prove I was mistaken as far as his line was concerned. He challenged me to measure his Skybeam and I accepted. Later, after I had made a report on it to him, he sent me a very well written booklet put out by J Beam Aerials which showed my measurements were very much in agreement with theirs and that their claims were indeed well-founded. Rather than make this article simply a strong sales pitch for this beam (which I later bought) I would like to go through the measurement method with you and discuss some of the design characteristics of the Skybeam and of Yagi antennas in general. I want to do this because I know full well that the pathway to better dx is more likely to be through the antenna than through improvements on any other part of your equipment, once you have a reasonably good converter, receiver, transmission line and a few hundred watts output power.

Antenna gains are stated as being so many d.b. over a dipole or over an isotropic radiator. An isotropic radiator is a theoretical antenna which puts out radiation equally intense in all directions. Of course a dipole doesn't do that nor does any antenna. But to make an actual gain measurement a reference antenna is used and the dipole is convenient. When you look at antenna specifications be sure you know if gain is specified as being over an isotropic radiator or a reference dipole. An antenna with 10 db. over a dipole has more gain than one 10 d.b. over an isotropic radiator. If the specification says 10 db. over isotropic subtract 2 db. (approximately) from that figure to get the gain over a dipole. I still say that when you read specifications on amateur antennas, be very skeptical of gain claims. Sometimes gains are (mis)calculated and not actually measured. Not all manufacturers of antennas are competent. Not all are truthful.

I measure antenna gain by comparing the relative ability of two antennas, the dipole and the antenna under test, to deliver power to a known load (a 50-ohm 1/2 watt carbon resistor.) The set-up I used to test the Skybeam is illustrated in Fig. 1.

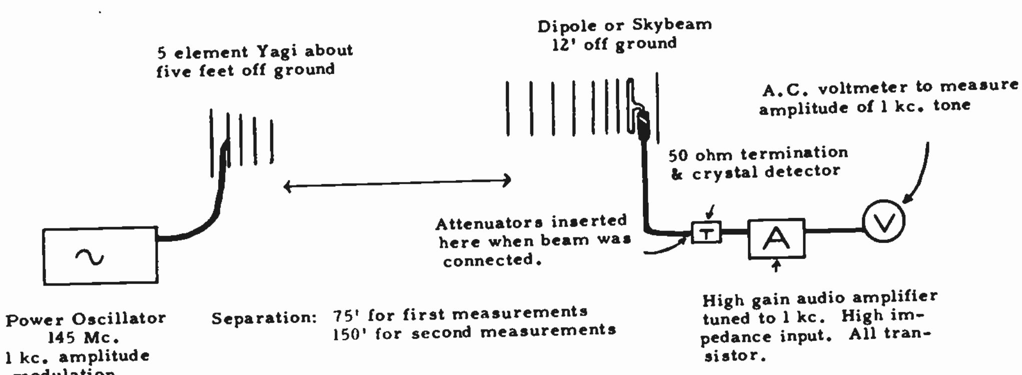


Figure 1

First I raised the dipole to about 12 feet and read the meter on the output of the narrow-band audio amplifier (peaked at 1 kc.) This reading was used as a reference. Then I disconnected the dipole and attached the coax line directly to the balun on the beam so that the coaxial line would be the same length in both measurements. I put up the Skybeam to the same height and of course the meter read off scale. So I inserted coaxial attenuators (shown in Fig. 2) just ahead of my 50-ohm resistive termination and rectifier box until the meter reading was the same as it was with the dipole. To make the meter reading the same as before I had to use 12 db. of attenuation. Therefore the Skybeam was extracting 12 db. more power from the passing wave than the dipole. Only two calibrations are involved in this method--the dipole and the attenuators. The dipole was checked for match and for a symmetrical pattern on an antenna range (April 65 VHFER.) I have a good selection of attenuators and have compared them against each other and believe they are accurate. No matter what may happen to the amplifier with respect to its gain from day to day or week to week, as long as the gain stays constant between comparisons of the dipole and the antenna under test, it does not enter into the measurement at all.

You probably question the accuracy of gain measurements made so close to the ground. There are always problems in making gain measurements unless you're out in free space. The usual problem is ground reflections or reflections from surrounding objects. I was in a large, open field. I had the transmitting antenna fairly close to the ground so that the path to the antennas used to receive would be about the same length whether the wave went directly from the source or was reflected off the ground. This minimizes cancellation or enhancement of the received signal due to interaction of the direct and ground-reflected waves. Also I used a small beam as a source to more or less focus the signal toward the receiving antennas and minimize signal radiated toward the ground.

To test for ground reflections, I moved both the dipole and the beam up and down several feet and sideways too in the test area to note the difference in the received signal. The difference was not appreciable as long as the antenna height remained constant.

Then I moved the entire receiving test set-up another 75 feet away and re-measured, getting the same results for gain. I did not test for side-lobe or front-to-back ratio a second time. Of course I measured 2 or 3 times in each location, never depending on a single reading.

When I measured the first side lobe level, I measured with reference to the forward gain. I got about 16 db. below the main lobe. The back lobe was about 17 db. down from the forward lobe.

From the side lobe level, down 16 db., I guessed that the beam probably had more gain at a higher frequency than the one at which I was measuring, 144 Mc. The reason is that for maximum gain on a Yagi the first side lobes should be about 10 db. down. At lower frequencies side lobes will be lower, at higher frequencies they will be higher and higher until the main lobe splits and the whole pattern breaks up.

Now refer to Fig. 3 which is from the booklet put out by the manufacturer describing the characteristics of this beam. It shows maximum gain to be in the region of 146 to 147.5 Mc., and that gain is down from the peak value by about 3/4 db. at 145 Mc. or about 12.5 db. where I measured 12. I don't consider my measurements accurate to within 1/2 db. and theirs might not be either, but they agree quite closely. I consider their honesty in advertising this amateur beam to be almost beyond belief. Not only is it the best manufactured 2 meter beam I've measured, but it is the best constructed in my opinion. I had been using a 14 foot boom antenna (same as the Skybeam) which is highly advertised as having 15.5 db. gain and on which I measure 9 at the most under the same conditions. The Skybeam I have up now is 3 d.b. better, doubling signal strength in a given direction and doubling received signal power. That's half an S unit. It doesn't sound like much but it's the same effect you would have on a distant receiver if you doubled your transmitter power.

Fig. 2   Fixed attenuators

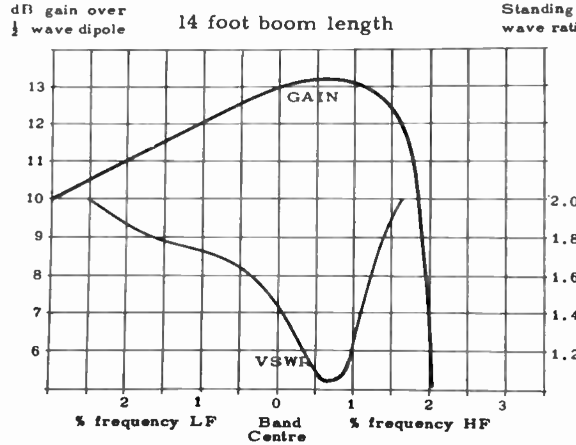


Fig. 3
Ten Element 2 Meter Skybeam

Now there are some things I should clear up so you don't get the wrong impression.

1. There is no collusion between the distributor or manufacturer of the Skybeam and myself. I don't operate that way. I bought the beam and balun after testing it because it was considerably better than what I had been using and was very ruggedly built. I bought the 2B52 balun to go with it and suggest if you buy the beam you do the same.

That combination works, I'm sure. If you use some other combination you may not get the performance I did. For the record, I'd like to say that I do not go along with much of what is written about open wire lines in this and other amateur magazines (in the past.) Moon bounce was done with coax. DXers I know use RG 8/U, RG 17/U or 200-ohm Federal line. I don't know any VHF DXers on the west coast using open wire line and I am acquainted with most of them from Canada to Mexico. Open wire line properly used in some situations is no doubt superior to coax. But at two meters coax will do a better job in the hands of a fool. That's why I use it.

2. If you have an antenna with 9 db. gain and you put up this one as recommended, signals which were marginal with the other beam aren't going to jump out of the speaker at you when you hook up this beam. 3 db. just doesn't make that much difference. It's twice power and worth having, but it takes 6 to 10 db. to make a pronounced difference. To get 6 to 10 db. improvement you have to pick up decibels wherever you can get them. There's no place you can get them any cheaper than in the antenna unless you already have a monster that works. Remember, the 3 db. gain benefits you by essentially doubling the other fellow's power as well as your own.

3. Don't get the idea that because this beam is peaked at about 146 Mc. it won't do an excellent job at 144 or 145. That db. difference is not discernible to your ear or mine.

4. Don't be concerned about the VSWR curve. When I use the balun and my Bird wattmeter at 144.05, reflected "power" indication is practically nothing. Of course, the place to measure is at the antenna, but few do that. Also, reflected "power" is not all lost, and SWR meter readings are not to be trusted without additional tests (changing line length.) The method is described in the Nov. 64 VHFER. At a 1.6:1 VSWR, reflected power is only a little over 5%.

Now I would like to discuss this antenna's design with you and why it works---and why many others don't. First, a Yagi is divided into two basic sections---a launcher and a slow-wave structure. The launcher is the dipole and reflector (or first director) as a rule, but can be a corner reflector antenna, a V antenna or numerous other types used to excite a slow-wave structure which is the string of directors.

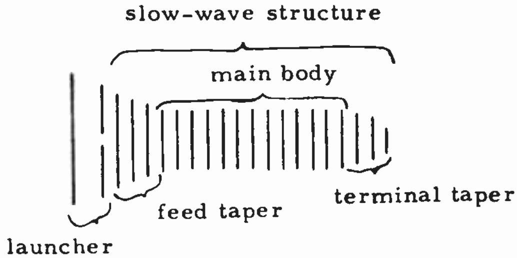


Fig. 4 Parts of a long Yagi with equal element spacing.

Looking at the antenna as a receiver of the passing wave front, the wave is slowed as it enters the front part of the Yagi and travels down to the dipole. The velocity of the wave as it travels along the Yagi is extremely important. The wave arriving from the string of directors must have a certain phase relationship to the wave which arrives directly from free space to show maximum gain. In other words there is a phase shift occurring in the Yagi which is caused primarily by the length of the directors and their spacing. When there is not enough phase shift (phase velocity too fast) the antenna has gain but not the maximum possible. The gain drops very rapidly when there is too much phase shift. Longer directors and closer spacing causes more phase shift or slowing of the traveling wave (if boom length is constant.) Now look again at the chart of Fig. 3 and note how steep the curve is on the high frequency side. This response curve is characteristic of a Yagi type structure. Variations may be caused by different tuning or feeds. A signal at 151 Mc. would be slowed much too much by the Skybeam and therefore the antenna would show little gain there. At 140 Mc. it would still show good gain. This curve and the preceeding discussion are intended to show you why you can't just add more elements to a properly designed Yagi and make it work better. You can only make it worse. If you want to increase the gain of a properly designed Yagi you have to add more to the boom length and readjust everything for optimum phase velocity by changing element lengths, spacing between elements or both.

While phase velocity is extremely important in a Yagi there are other things too. On a Yagi several wavelengths long a high-performance antenna often has 3 parts to its slow-wave structure. The main body, the terminal or end taper and the feed taper, as shown in Fig. 4.

A wave traveling at the speed of light does not couple well into a dipole or dipole reflector combination. If it is slowed down it couples much better. The purpose of the feed taper is to slow the wave considerably for better coupling. You can think of it as a matching network. To slow the wave or "match" it from the main body to the dipole you must put the elements closer together, make them longer or do both. But you still have to keep the total phase shift along the array the same or nearly so. That means increasing the wave velocity somewhere else. The Skybeam has all directors of equal length, so they are spaced more closely near the dipole to slow the wave.

At the far end of the Yagi, in the transmitting case, the wave must suddenly change from the velocity along the directors to free space velocity. It couples to space better when the wave is speeded up, so elements are often shortened near the end or spread farther apart. If the transition is too abrupt, a portion of the transmitted wave is reflected from the end and causes a higher backlobe level

The Skybeam does not have an end taper. It does quite well without it and I suggest you do not try to put one on it for fear you'll foul up the phase velocity. When you're building your own beams you could try the tapers, especially the feed taper. End.

AN AUTOMATIC KEYER FOR METEOR SCATTER

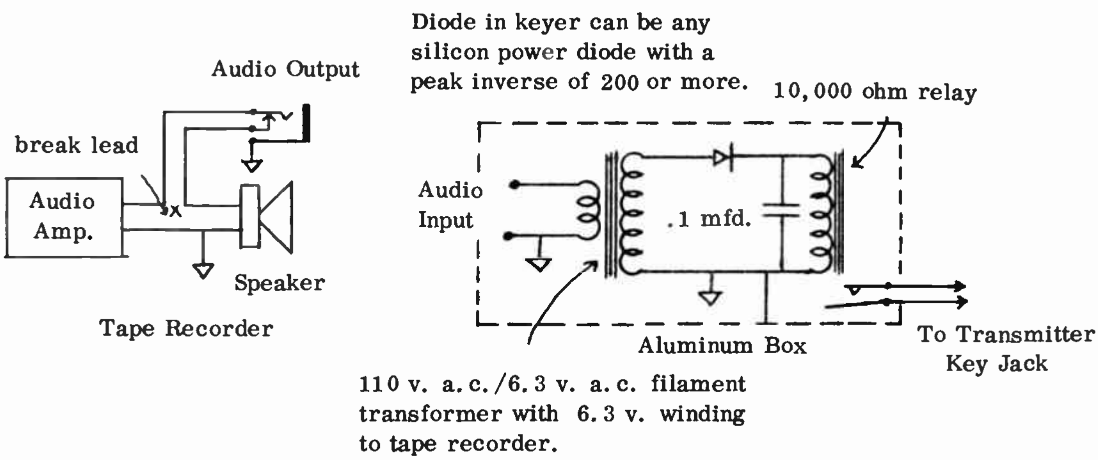
By "Skip" Freely, K6HMS

Have you ever run seven and one-half hours of solid meteor scatter schedules? I have, and this device was built to alleviate such pain.

This simple keyer will find constant use in any hamshack where CW is employed, and particularly on meteor scatter schedules. Since any different number of keying sequences may be used, this device is more practical than a code wheel. Any old tape recorder can be used, and it is very easy to make up endless loops of tape in advance of schedules. Generally, I key an audio oscillator into the tape recorder microphone to make up the tape, then use common "Scotch" tape to splice the ends of the tape together. I added an audio output jack to the recorder, so that when a plug is inserted into the jack the audio is disconnected from the speaker and goes into the keying unit. The keying unit is nothing more than an audio rectifier, simple filter, and sensitive relay. The relay keys the transmitter. Easy, no?

Examples of tapes I have used include "K7AAD de K6HMS", "CQ NW de K6HMS", "VVV QRA de K6HMS", with the message repeating. On meteor scatter I use a 1 RPM synchronous motor which turns on the transmitter for 30 seconds, and off for 30 seconds. Of course this is synchronized with WWV. Any number of schemes may be used, but this one is very successful. The only trouble I've had is with pickup of stray r. f. on the audio leads ahead of the relay. The r. f. is rectified and erratic keying or a hard-keyed condition will exist.

There are many other ways of adapting this to your requirements. I originally packaged the keyer in a little aluminum can, but I built this circuitry into my present exciter. I also suggest a small tape spool be placed on the tape loop to keep a little tension on it and keep the recorder from eating up your loop. The recorder should be standing vertically so that the loop is not rubbing against anything.



METEOR SCATTER SKEDS WANTED

WØEYE Don Hilliard P. O. Box 563 Boulder, Colorado 80301
W6DNG Bill Conkel 4608 La Cara Long Beach 15, Calif.
WA6QQI Doug Beck 925 Redwood Ave. Sunnyvale, Calif.

OBSTACLE GAIN AND THE VHF AMATEUR

By George A. (Al) Olcott, K7ICW
Edited by Fred Brown, W6HPH

What is obstacle gain? It is evident that many VHF/UHF hams are unaware of the importance of obstacle gain, or how to recognize it when it exists. The term applies to mountain obstructed paths and represents the gain in signal strength over what would prevail under normal conditions with no mountain present.

Many VHF hams that I have talked to, especially the group at the West Coast VHF conference last year, seem quite impressed about the tropospheric paths that quite often open up along the California coast and valley areas, but little was mentioned of work being done to areas outside of those with a heavy VHF/UHF population or to the so-called "unworkable" areas over the mountains. In my own situation (Las Vegas, Nevada), stations in the San Joaquin Valley of California are inaccessable to me on VHF except by sky-wave propagation; i.e., skip, backscatter, meteor scatter, ionospheric scatter, etc. But on my regular schedule work to the Los Angeles area I have found several stations that are present all of the time, noise levels permitting. This is clearly in my experience a case of obstacle-diffracted propagation. For example, I have a very good obstacle to W6DQJ and I can work him with only 100 watts on 144 Mc. W6DQJ is also a 432 man and I believe I will be able to work him on 432 when I am set up on that band.

Several outstanding examples of obstacle gain paths come to mind. One is the well-known 2 meter path between Anchorage and Fairbanks, Alaska using Mt. McKinley as the obstacle. Another less-known path is that between Pomona and Mojave, California where a 3300 Mc. 400 milliwatt carrier has been successfully received using the San Gabriel mountains as the diffraction point on this 70-mile path.

Diffraction is a physical phenomenon whereby waves pass over an obstacle and fill in some of the "shadow" area behind it. In the case of VHF/UHF diffraction over mountains, the signal may be enhanced by ground reflection on either or both sides of the mountain. Ground gain is usually associated with Earth-Moon-Earth paths where the area in front of the antenna facing the moon may produce up to 6 d.b. gain both receiving and transmitting. Ground gain may also exist where extraordinary flat surfaces such as dry lake beds exist in front of the antenna.

The best approach for determining your particular obstacle gain paths is to initially maintain a heavy series of schedules to as many stations in as many obstructed directions as possible, preferably on CW. With some stations the obstacle gain path is so strong, even at hundreds of miles, that a residual signal is audible on nearly any beam heading.

In summary, proper recognition of an obstacle gain path may produce results for some stations that other stations in a nearby location may not begin to approach regardless of the apparent location advantage (such as being on a hill) or the equipment used. About the only thing you can do at your location to produce results in some cases is to improve your equipment or wait around for favorable propagation of some other type. Another way might be to find another well-equipped station at the other end of the path which might be more favorably located from an obstacle gain standpoint. End.

VHF QSO PARTY SKEDS WANTED

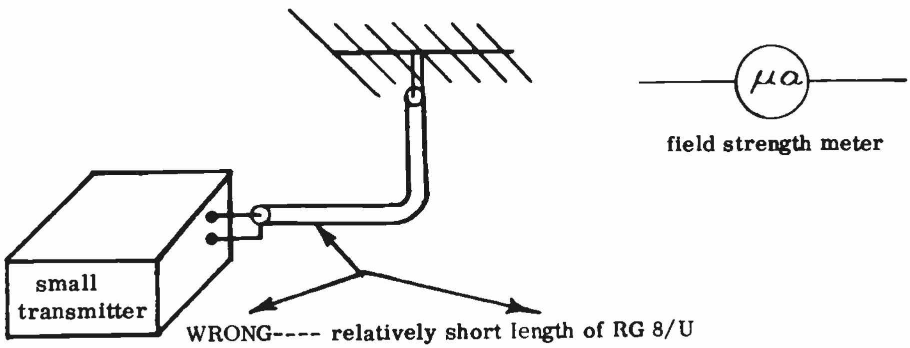
The Tektronix ARC will be on Paulina Peak (8000 ft.) in eastern Oregon during the June party with equipment from 50 thru 432 Mc. They want skeds in British Columbia, Idaho, Nevada, Utah and all of California. Write Gene Single, Tektronix, Box 500, Beaverton, Ore.

The VHF contingent of the Fullerton, Calif. radio club will be operating during the June contest from Diamond Bar Peak in the Orange section. They will be using the call W6ULI/6 on all bands from 50 thru 1296 Mc. High power on all bands except 220, vertical & horiz. polarization, CW and SSB on 50 & 144. Looking for skeds on 50 & 144 tropo scatter. Will have a 16 db. rhombic array on 50 Mc. CW pointed at Denver. Skeds on 432 & 1296 are also badly needed. Please write Bruce Clark, K6JYO, 1019 El Dorado Dr., Fullerton, Calif.

TUNING VHF YAGIS BY THE FIELD STRENGTH METHOD

By Loren Parks, K7AAD

Antenna tuning information is hard to come by. Fred Brown's article in the May, 1963 CQ is the only one I know of. I don't really prefer the field strength method to be described, but it will work OK if you do it right. Its advantage is that it requires a total of one antenna--the one you're tuning. Like most everyone else, I started tuning antennas by field strength and was at that time too dumb to know what I was doing. Later, when I got a power oscillator and started making gain measurements I found out what the problem was. I've never seen this written up before and I offer it as both food for thought and a workable method. I think there are better ways, but this will do you a good job and give you a better antenna than most commercials.



The difference between wrong and right is in the transmission line. The long line of RG 58/U is lossy and at 144 Mc. will have an attenuation of about 10 d. b. This means nine-tenths of the power is absorbed by the line, 10 percent possibly by the antenna. Here is the reason why you need to do this. Every time you move an element near the dipole on a Yagi you change the impedance of the dipole and the load the transmission line sees. If you peak for maximum field strength and use a relatively short, low-loss line, what you are actually doing is adjusting for maximum transfer of power from the transmitter to the antenna. This is NOT what you want to do. What you REALLY want to do is adjust the antenna to deliver maximum field strength when it is driven from a 50 ohm resistive source if you plan to use it with 50-ohm coax. But you do not know the output impedance of your transmitter. So if it isn't 50, and it probably isn't adjusted that way, you are actually using the short transmission line as an impedance transforming device to draw maximum power from the transmitter. As soon as you change line length you're de-tuned---both transmitter AND antenna. If your transmitter output impedance was near 50 ohms when you did your tune up, you are OK. Your reflected power meter can lie to you under certain circumstances (see Nov. 64 VHFER).

Now if you use the lossy line, the transmitter works into a nearly constant load regardless of changes in dipole impedance. It makes no difference what the transmitter output impedance is as far as antenna tuning is concerned. The lossy line looks like a generator with a 50 ohm internal impedance to the antenna (resistive.) This is ideal. So when you tune for maximum field strength at a particular frequency the antenna remains tuned no matter how long or short a line you use thereafter. This is because maximum field strength results when the load (antenna) matches the source impedance (50 ohm line.)

Now just a little bit on construction and techniques. Do NOT use a gamma match if the centers of your elements are grounded to the boom. I have never seen a gamma matched antenna do a decent job made that way. I don't believe it can. Use a symmetrical feed--center fed dipole

(continued on back cover)

OFFICIAL VHF PROGRAM FOR THE 1965 ARRL NATIONAL CONVENTION
San Jose, California

July 3

1 to 2 PM THE WORLD ABOVE 50 MC.--PAST, PRESENT & FUTURE
Highlights and history of amateur VHF activity. What has been accomplished and what to expect in the future.
by Ed Tilton, W1HDQ VHF Editor, QST magazine

2-3 PM MOONBOUNCE
An evaluation of the criteria necessary to calculate system feasibility for this amateur propagation mode. Working systems will be demonstrated with tapes and slides.
by Taylor Howard, W6UGL Research Associate, Stanford Radioscience Lab.

3 to 4 PM YAGI ANTENNAS
Details of the design and development of high gain Yagi antennas by the designer of the spiral Yagi.
by Dr. Donald K. Reynolds, K7DBA Prof. E. E., Univ. of Washington

4-5 PM SPACE DIVERSITY FOR EXTRA DB ON A SCATTER CIRCUIT
An investigation of signal enhancement when using more than one antenna per site during scatter communications.
by John Chambers, W6NLZ R. F. Equipment Dept., Space Technology Lab.

July 4

11-12 AM WEAK SIGNAL DETECTION TECHNIQUES
Various methods of weak signal detection are reviewed and compared with the emphasis on "Fitting the receiver to the expected signal."
by Hank Olson, W6GXN Research Assoc. Stanford Research Institute

1-2 PM ANTENNA MATCHING TECHNIQUES
A discussion and demonstration of practical methods of matching the feedline to the antenna utilizing techniques of the late Oliver Wright, W6GD.
By Bob Melvin, W6VSV President, Melvin Sales, and Jack Trollman, WB6JZY, Sylvania Antenna Engineer.

2-3 PM WHAT CAN BE WORKED ON VHF
A presentation of the various modes and methods for communicating beyond line of sight at VHF, including actual recordings of historic amateur firsts.
by Alan Margot, W6FZA President, Communications Engineering Co.

3-4 PM NOISE FIGURE MEASUREMENT
An analysis and demonstration of low-noise amplifier design and measurement techniques utilizing both amateur and commercial noise-figure-measuring equipment.
by Loren Parks, K7AAD Parks Electronics Lab. & Editor of the VHFER, and Denton E. Nelson, W7UHF, Parks Electronics Lab.

July 5

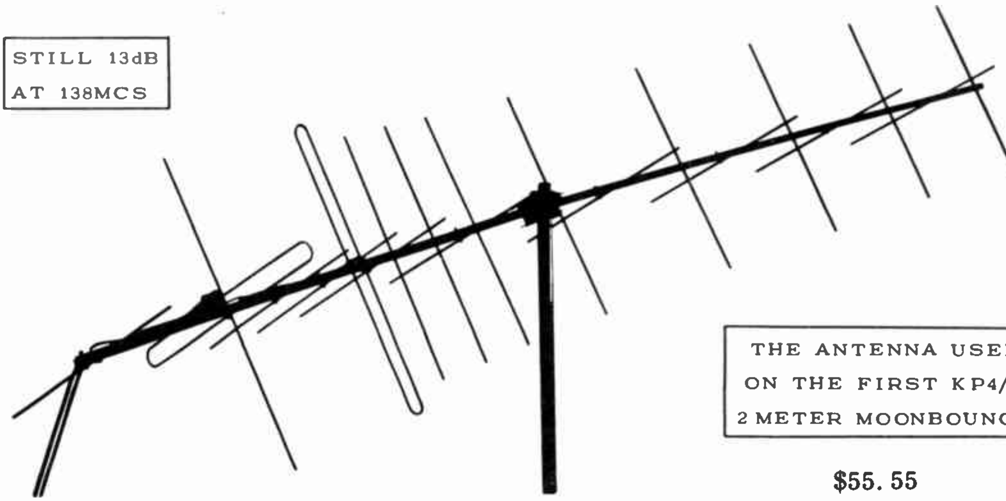
9-12 AM ANNUAL WEST COAST VHF CONFERENCE ANTENNA MEASURING CONTEST
An opportunity for amateurs to measure the actual gain of their favorite 432 or 1296 Mc. antenna using calibrated laboratory equipment. Prizes and trophies will be awarded to the owners of the antennas measuring the highest gain. The antenna must be of such size that it can be supported by one person and have a 50-ohm type N fitting feed point.

THE J BEAM

MOONBOUNCER

SATELLITE TRACKING ANTENNA

STILL 13dB
AT 138MCS



THE ANTENNA USED
ON THE FIRST KP4/G
2 METER MOONBOUNCE

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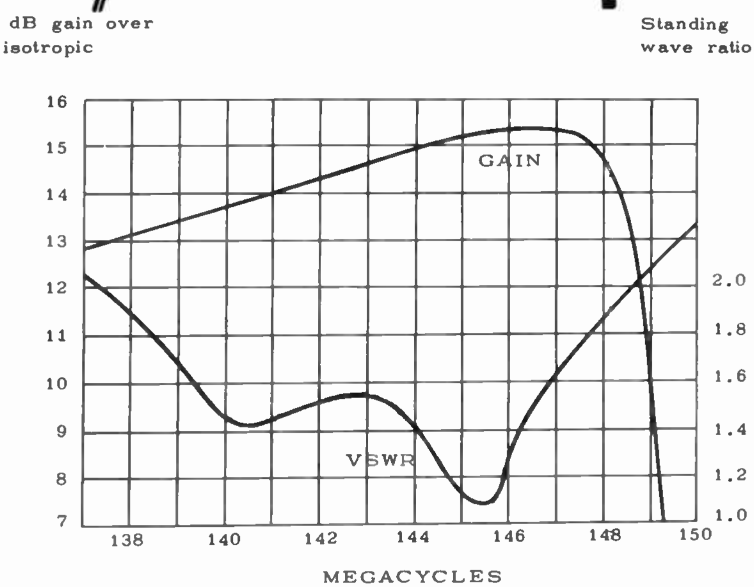

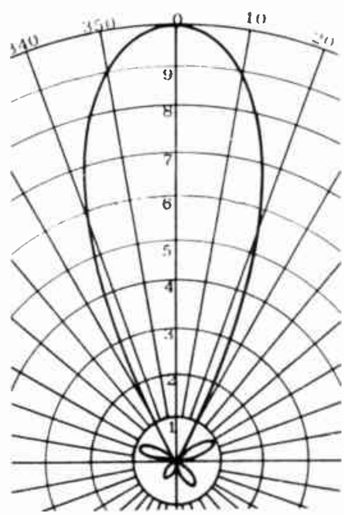

Gain over isotropic.......... 15.4dB
Front/back ratio 30dB
½Power beamwidth .... 33°
Boom length............... 194"
Width..................... 41"

Turning Radius..................... 104"
Net Weight........................ 13.9lbs
Stacking distance above or alongside... 132"
Wind area......................... 3.4sq.ft.
Wind load at 100mph.............. 83 lbs.

Distributed by GAIN, Inc. 27 E. 112th Place Chicago 28, Illinois or folded dipole. Drive a center-fed dipole (which I prefer) with a 1 to 1 balun like that described in the April issue for the reference dipole but do not remove any of the dielect[illegible]. Drive a folded dipole with a 4 to 1 or the 1 to 1 balun and forget about match because that will take care of itself if you tune properly. Take dipole lengths out of the handbook if you wish. When you adjust the first director and the reflector for maximum field strength you are matching the dipole-balun combination to the line as well as adjusting phasing. Start with the first director ahead of the dipole. Leave the reflector off till all directors are tuned. Adjust both its length and spacing for maximum field strength. Experimentally change the length by putting alligator clips on or near the ends. The element mounts we advertise are very, very handy because they can be slid along the boom while you adjust. Then when you're finished you drill the hole, put in the screw and you're done. Otherwise when you drill the boom you have de-tuned somewhat, depending on which band you're on and the width of your boom. Run that first element fairly close to the dipole so it couples well-- like .1 to .15 wavelength. For an antenna with a dipole and a single director, a director that is too short will peak farther away, too long will peak too close. Use the length that gives you maximum field strength and that will occur fairly close but it will not be a permanent setting. Now add a director that is a little shorter. It will peak farther away and you will re-adjust the first director a bit. Add additional directors building up field strength and re-optimize the spacing. If spacing turns out to be more than .2 wavelength lengthen the directors a bit so they will move in closer. When that is all done, bring in the reflector and peak. If you are coupled well to the first director the reflector won't have a lot of effect on forward gain. Some adjust it for best rejection of signals off the back. Re-juggle reflector and first director for maximum. Tie things down and you're done. At 2 meters all this can be done 5 feet off the ground.

Now I did not say this was the way to adjust long, long Yagis. I am referring to Yagis of moderate length, like 4 to 10 elements. I did not say this would give you maximum possible gain. I did say it will give you more gain than most commercial antennas and a very satisfactory antenna. I urge you to use the balanced drive. On an unbalanced antenna you can bring your hand near the element ends and find that one side of the element is "hotter" than the other. On a good antenna you will find that bringing your hand near the ends of the dipole and first director has a strong detuning effect and that the effect is gradually lessened as you move down the beam. On a poorly tuned antenna you will find some elements cold--so much that they can be removed entirely without appreciably affecting the field strength. That's the kind most of you have. End.

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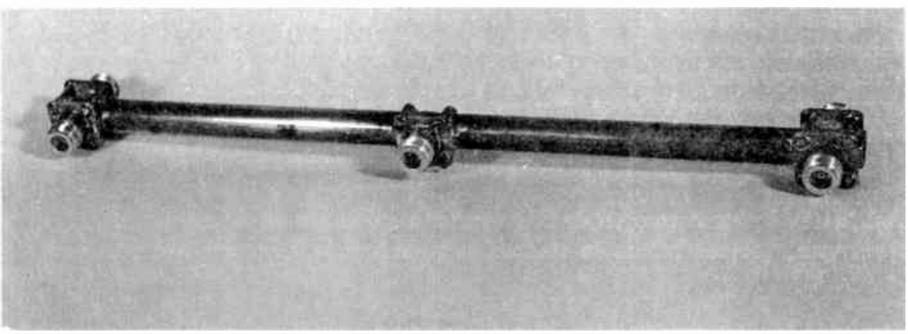
VHFER

LEARN BY DOING

50 MC. AND UP

Volume 5, No. 1 Jan.-Feb. 1967



A POWER DIVIDER FOR AN ARRAY OF YAGIS

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CONVERTER

- Noise Figure less than 3 d.b. over full 4 Mc. Bandwidth.

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Here is the converter that has been accepted by advanced hams all over the U. S. A proven performer for weak-signal work. I.F. ranges available put 144 Mc. at 7, 10, 14, 21, 22, 24, 26, 27, 28, 30.5 or 50 Mc. Choice of connectors: UHF in, phono out (shown) or BNC in and out. Available from stock.

Just think for a moment. How many brands of VHF converters are available today. Really there are only two principal manufacturers--one that sells through dealers and one that doesn't, (that's us). Yet if you look back in the ham magazines you'll see many ads of little companies that have made their little flurry, wild claims, and then laid down and died. Parks converters have been around for quite a few years. You don't stay in business if you don't have something people want. Of course hams talk to each other a lot, and they describe their equipment. A lot of the big DX names have Parks equipment--moonbouncers too. Give a listen on the bands and ask the DX boys about Parks converters. Many of you might think you'd be more likely to buy if we sold the converter as a kit at a lower price. No soap. We don't want our name linked with anything you put together yourself. I couldn't put one of our convverters together and be sure of how it really was working--without test equipment. And 99.999% of you couldn't either. We've made many hundreds of converters and I can tell you for sure a lot of them don't tune up right at first. A little difference in the way a coil is wound can make the difference between making specs and not making specs., and there are a number of other things that happen. If you buy a Parks converter you know you've bought a standard of performance, that it's been aligned and the noise figure checked to prove the converter meets or exceeds the advertised spec. And if you keep your c.p. hands off the slugs it will stay that way for hundreds of listening hours. While tube failure can happen, it is surprisingly rare. The little nuvistor keeps its noise figure well and it tolerates r.f. leakage from your rig. If you're waiting for a transistor converter that works better than ours, you may have a long wait. A db. is about the most you could gain, and you can't hear that. A preamp. could always be added. Parks converters are on the shelf with same-day shipment being the rule. Prices are postpaid, $2.50 more for air mail.

PARKS ELECTRONICS LABORATORY

419 S.W. FIRST AVENUE

BEAVERTON, OREGON 97005

Moonbounce Newsletter

by Victor A. Michael, W3SDZ
Box 345, Milton, Penna.

Close on the heels of my written report of the VK3ATN, K2MWA/2, I received word that K6MYC had finally succeeded in a two-way contact with VK3ATN after several near misses. I have also had the pleasure of hearing the tapes of these contacts, and I must say they are extremely good.

Two meters is again in the news with the two-way contacts between W6DNG and F8DO. While I haven't received any information concerning the equipment set up on either end of this history making effort, I'm sure the complete details will be coming along.

In the last few days, my mail has been filled with requests concerning these two meter efforts. The number one confusion among VHFERs is what band to make a moonbounce effort on. On the one hand, there is the completely logical point of view from the engineering people who will tell you 1296 is the place to go. If I can be illogical for a moment and speak as an amateur, I would say that the work of VK3ATN, W6DNG and K6MYC make an excellent case for the amateur point of view. As I see it, the amateur point of view is different from the engineer's point of view in several respects. When you do something from a professional point of view, you do it with a purpose in mind which should have a reasonable chance for success. As an amateur you are free from this requirement. You can pursue anything you want, for whatever purpose, with no penalty for lack of success. If you had pleasure in this pursuit, that's all that counts! You may even be successful at proving something that no person thought possible! Isn't that what ham radio is all about?

I will leave the two meter story of how to do it to the people who are doing it. The project we are engrossed in at the moment is a large phased array for six meters. The reason we are at work on this project is that VK3ATN would like to make a try on six meters. Since I wrote the last Newsletter, I've learned in more detail the plans on the VK end. Ray is planning a new type of rhombic array for six meters which should produce about 30db of gain. This will mean that the US end of the path should have about 22db antenna gain along with a full KW of transmitter power.

I thought it might be interesting to give you a brief discussion of the system we're working on here. Basically the array will be nine cross-polarized 7 element (14 elements on a boom) yagis on 22 foot booms. Since the spacing between the arrays has to be about 30 feet, obviously it would be difficult to rotate such an array as a single unit. The next best thing one can do is rotate each yagi separately. To do this, I'm placing each yagi on a small polar mount close to the ground. All of the arrays will be placed in line on a north-south line about 240 feet long. Now, this will produce a fan beam array, i.e. the beamwidth in the north-south direction or declination will be very narrow (perhaps as small as a few degrees) while the east-west or hour angle beamwidth will be very broad--over 30 degrees. Now this makes an ideal moonbounce situation, because the declination of the moon changes very slowly over a period of a day (less than a few degrees), but the hour angle changes nearly 15 degrees per hour. Each of the eight polar mounts will be set by moving the mount by hand to a specified position and locking it in place. Since this setting should hold for over an hour at a time, there is no need to put motors on the mounts.

There is a price to pay for this simplification of the mount. With the exception of a few select positions, when the phase centers of the arrays are in a common plane, you have to provide a system for adjusting the phase to each of the arrays to correct for the fact that phase centers don't remain in a common plane. If you don't fully understand this concept, don't be alarmed. Once we complete the array, I will write up the details.

The part of the system we're working on right now is the phasor. Actually we're having reasonably good results using lengths of RG58 A/U coax switched by ceramic wafer switches. While it is "gilding the lily" we are using a coarse and a fine switching arrangement in each phasor. The first switch has 36 degree steps (ten steps) and the second switch has 3.6 degree steps. Initial measurements conducted by W2IMU on a breadboard model look reasonably good on a Vector Voltmeter. The switch introduces about 10 degrees additional phase shift and a VSWR of 1.10 to 1. This all looks very reasonable and can be "lived with" as long as all variations are taken into account.

The phased array is a very reasonable way to go on six and two meters. For the reduction of mechanical complexity, the electrical problems are increased somewhat. The advantage is that the electrical problems can be worked on alone, while moving a structure 100 feet across by 40 feet high is too difficult to think about--even for a group effort. The only other alternative is to build a fixed array, but you then sacrifice a lot of moon time. With most amateur systems, it is an advantage to be able to follow the moon orbit for at least an hour or two per day.

The snow is still falling in Pa. as I write this, and the late winter winds that rake this mountain top did a nice job of tearing the counter weight arms off my dish. As you can well imagine, I'm looking for spring as much as any antenna-minded VHFER

LOW IMPEDANCE PARALLEL TRANSMISSION LINES

by Gerald N. Johnson, KØCQA*

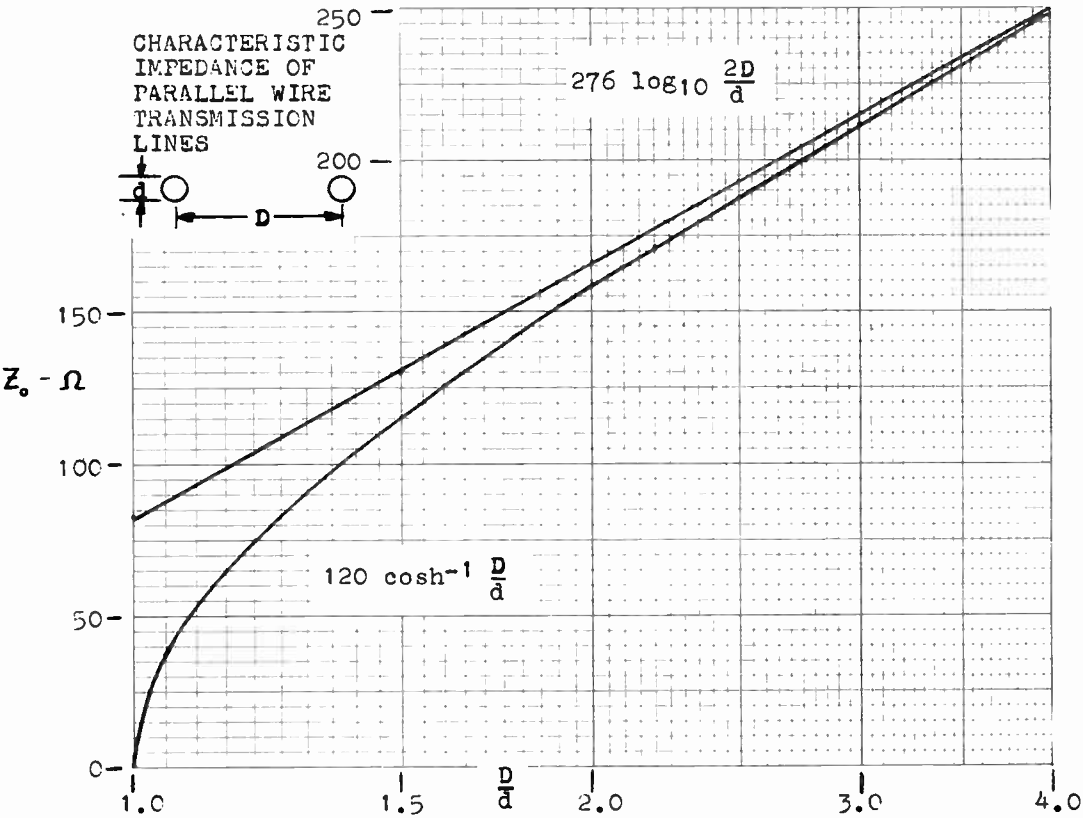
Have you ever tried to match a 100-ohm balanced load to a 50-ohm feed with a quarter-wave open-line Q-section and a 1:1 balun using the handbook formula for characteristic impedance and worked it out--only to find that the center to center spacing was less than the conductor size? The problem is that the commonly used formula has, in fine print, the restriction that the spacing must be very much greater than the conductor size. A few of the better references [1, 2] give a formula without that restriction. It is

$$Z_0 = 120 \text{ arccosh } \frac{D}{d}, \quad D = \text{spacing}, \; d = \text{wire diameter}.$$

Unfortunately in most ham publications the formula looks like hieroglyphics as far as being useful is concerned. The IT&T Handbook, as it is known, not only has tables of cosh x, but also has curves for the characteristic impedance of open wire transmission lines plotted.[3] For Impedance values less than 250 ohms, both curves (the right and the wrong) are plotted in the figure. As larger impedance values are checked, the curves continue to come together. For Z_0= 225 ohms, the error in using the simpler formula is about 1%, but for lower impedances, the error rapidly becomes greater. Note that the simplified formula indicates that the lowest possible impedance for open wire line would be 83.1 ohms but this would be with the two conductors shorted together for their entire length. In the table below are listed the exact D/d ratios for common impedances. These and the curve both assume perfect air insulation with no supports.

Z_o	D/d
0	1.000
25	1.0216
37.5	1.0492
50	1.0882
70.7	1.1784
75	1.2017

Z_o	D/d
100	1.3678
141.4	1.7793
150	1.888
200	2.7672
225	3.350



*221 Abraham Drive, Ames, Iowa 50010

[1]International Telephone and Telegraph Corporation, Reference Data for Radio Engineers, fourth edition, 1956.

[2]Jasik, Antennas, McGraw-Hill Book Company, New York.

[3]IT&T, p. 588.

VHFER magazine is published every other month by Parks Electronics Lab., 419 S.W. First, Beaverton, Ore. 97005. Subscription rates: U. S. & possessions, $1.50 per year, Canada & Mexico, $1.75 per year, others $2 per year. Second class postage paid at Beaverton, Oregon 97005.

PRACTICAL HETERODYNE LOW LEVEL TRANSMITTER MIXERS FOR 432 MHz

by G.A. (Al) Olcott, K7ICW/AA7ICW*
and J. Harness, K7RKH/AA7RKH

One of the big problems on 432 or any other UHF band is to find enough people on the band to make operation worthwhile. In the vast Los Angeles megalopolis there are perhaps 30 people with operating 432 equipment, 15 who use it, and 100 who talk about it. Reports in magazines lead one to believe that there are hundreds of hams on 432 using SSB mixers, and it is a simple matter to build one. When you pin someone down however, the story is much different and very few have working machines.

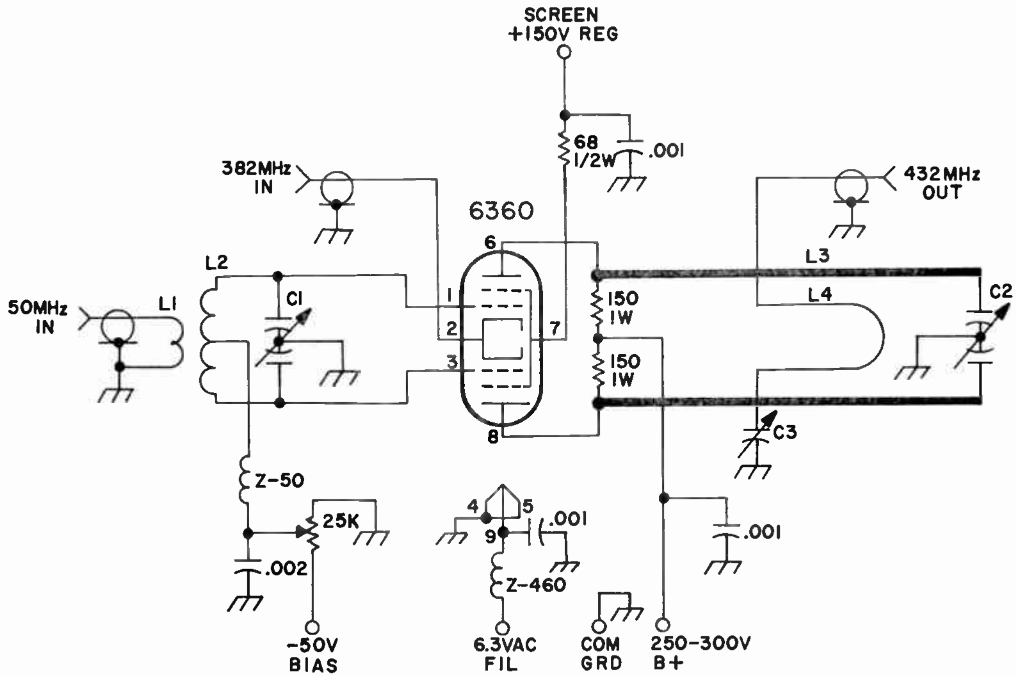
The circuits to be described here are not intended to be a step-by-step construction article and can be made in varying configurations by experienced VHFers. These circuits were developed by K7RKH over the past year, and the results were so favorable they were considered worthy for publication. Very few other designs have appeared in print.

The frequency injection source for both of these models is 382 MHz and the input drive frequency is 50 MHz. Other input frequencies such as 144 and 220 MHz were tried, but the output frequency contained so many undesirable product frequencies that these were abandoned.

The first model built used the 6360 tube. This tube was chosen because it was fairly inexpensive and is rapidly becoming a good surplus and junkbox item. It is recognized that the 6360 is expected to have low efficiency at 432. A similar design for 2 meters might have in the order of 6-8 watts output, but at 432 it is around 1 watt maximum. The output is sufficient to drive such tubes as the 6939, 6252, 5894, 2C39, etc. The 50 MHz driving power required is about 1-1/2 to 2 watts. The 382 MHz injection level is about 1 watt. Referring to the schematic diagram (Fig. 1), the 50 MHz energy is fed into the control grids via link coupling to balanced tank circuit resonant to 50 MHz. The bias, which is adjustable thru a 25K pot, goes to the centertap of the grid tank. The 382 MHz injection is fed into the cathode direct. A filament choke is used to prevent R.F. feedback from the hot cathode feed arrangement. The regulated screen voltage is applied thru a de-coupling resistor with a by-pass capacitor at the feed point. No by-pass or de-coupling capacitor is desired or necessary at the screen itself because the interelectrode capacity is sufficient at this frequency for self de-coupling. The output tank (L3/C2) uses half-wave lines similar to ARRL handbook circuits. The output link is a standard design, although other supposedly more efficient designs were tried. The orientation of the link (L4) is unimportant, but optimum loose coupling is desirable for maximum output. It has been found that the use of flat strap output coupling links at 432 have too low inductance for proper reactive and impedance match and tend to reduce power transfer.

The second model built uses the 6939 tube (see Fig. 2). This design was evolved around a tube that will operate at 432 efficiently. The major drawback is that this

*510 S. Rose St., Las Vegas, Nev. 89106



NOTE– UNLESS OTHERWISE INDICATED ALL CAPACITORS ARE CERAMIC DISC, 500DCWV MINIMUM, VALUE IN UF; RESISTORS ARE CARBON, VALUE IN OHMS, ±10%.

C1 – 8 PF PER SECTION
C2 – 5 PF PER SECTION
C3 – 8 PF
L1 – 2T No. 26 AROUND L2
L2 – 8T No. 26 C.T. 5/8 (1.6 Cm) I.D., 1 WIRE DIA. BETWEEN TURNS
L3 – 4-1/4 (10.3 Cm) LONG No. 12 (2 EA.), SPACED 1/2 (1.2 Cm) APART
L4 – HAIRPIN LOOP 3-1/2 (6.35 Cm) LONG No. 12, 1/2 (1.2 Cm) DIA. ADJ. TO L3

FIGURE 1

tube is not available surplus and costs over $10. The advantages are that this tube has more output power with less drive and injection, less than half that of the 6360. The 382 MHz injection is fed into the cathode thru a tapped inductor resonant between 382 and 432 MHz. This is effectively a tapped R.F. choke and care must be exercised not to resonate this coil at 432 MHz or output instability will result. The tap which is critical, provides an impedance match and expends the R.F. driving power efficiently for proper loading of the cathode. Bias and screen methods are similar to the 6360 model. The bias is set for 35 MA standing current with no drive on both models. It was found that filament de-coupling via a choke in this model was not required.

Details on a 382 MHz injection source are not presented in this article, and construction of one will probably take more time than a mixer. Any stable exciter suitably modified with about 1 watt out should work.

In general, mixers have very poor efficiency. At 432 MHz this is especially true and the use of choice selected hardware such as ceramic tube sockets, good quality resistors and capacitors and constant impedance connectors is a must. The particular units here were constructed on a copper chassis and this is recommended to those inexperienced with working with 432 circuits. Advanced experimenters can construct these mixers on other materials such as aluminum, but the necessary precautions such as short leads, direct ground paths, and proper by-passing/de-coupling is a must. Shielding per se was not a critical factor here as power generation itself was not the desired end product.

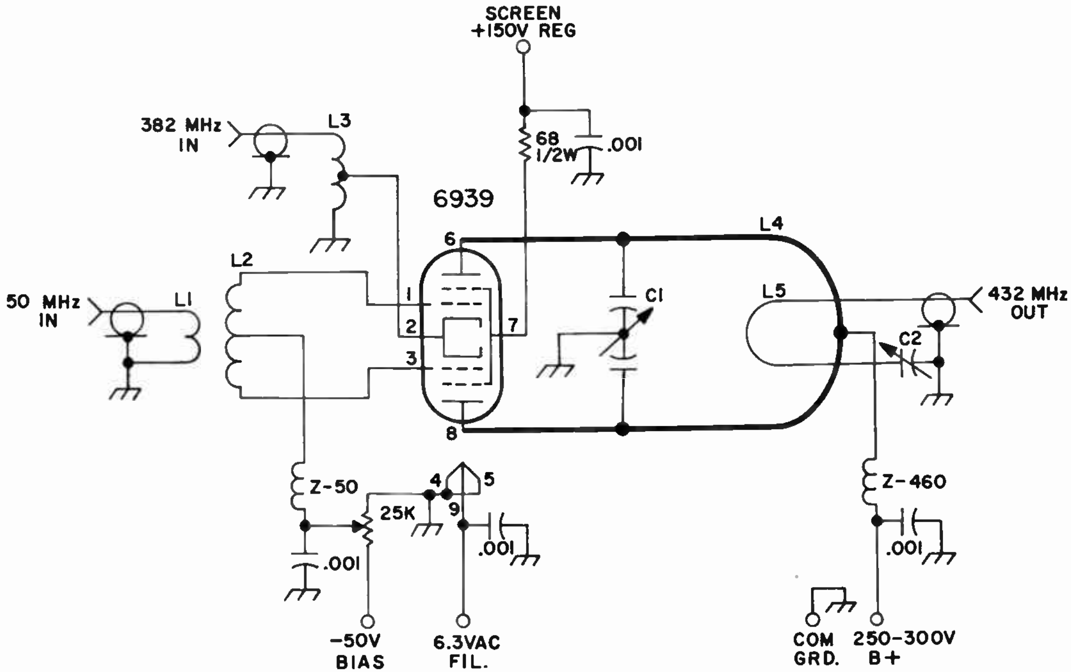
It is always recommended that a filter be used on the output of any mixer should it be used directly on the air. When driving low Q buffer or amplifier stages, some of the spurious energy such as 382 MHz will get thru to the output. Some odd loading effects will occur to broad frequency amplifier stages because the 382 and 432 MHz energy is relatively close together for a UHF circuit. A cavity filter between the mixer and the final amplifier stage is highly recommended. Even an output filter is desirable.

If these mixers are used as a source signal directly for tuning up 432 antennas, the S.W.R. bridge will go crazy and will not give readings truly indicative of tuning or antenna performance.

The driving input frequency, 50 MHz may be almost any mode, CW, A3, SSB, FM, FSK, PM, or what have you, but the modulation/purity index must be clean or the responses, clean or otherwise, will appear in the output.

An operational comparison of the two mixers described would give some surprising results. For instance, the 6360 version sounds better quality-wise when compared to the 6939 model when used with an SSB driver. This is based upon listening to the two versions loaded to the same equipment and antennas and switched back and forth for comparison.

If you have any questions relative to these mixers, write, send details and self-addressed stamped envelope to K7ICW.



NOTE—UNLESS OTHERWISE INDICATED ALL CAPACITORS ARE CERAMIC DISC, 500DCWV MINIMUM, VALUE IN UF; RESISTORS ARE CARBON, VALUE IN OHMS, ±10%.

C1—8PF PER SECTION, LOCATED 15/16 (2.38 Cm) FROM CLOSED END OF L4.
C2—8PF
L1—2T No. 22 AROUND L2.
L2—10T No. 22 3/4 (1.9 Cm) I.D., 1 (2.54 Cm) LONG
L3—2-1/2T No. 18 3/8 (.95Cm) I.D., TAPPED 1-1/4T FROM GRD.
L4—HAIRPIN LOOP 2-1/16 (5.24Cm) LONG No. 12, 1/2 (1.27 Cm) WIDE
L5—HAIRPIN LOOP 3-1/2 (8.89Cm) LONG No. 12, PLACED 1/8 (.32 Cm) AWAY FROM L4

FIGURE 2

A POWER SPLITTER FOR VHF-UHF ANTENNA ARRAYS

by Jim Geddes, K7ZIR*

When more than one load is to be supplied power from a single source some means of dividing the power must be employed. When the load is an amateur antenna array, not only must the power be split but the load presented to the transmission line must be kept at a value that will properly terminate the line. I will describe the method that I used to feed an array of 16 Yagis on 432. The information will also apply to other frequencies since the dimensions are given in parts of a wavelength. The complete power splitter is shown in Fig. 1.

In my array each Yagi has a folded-dipole driven element with an impedance of 200 ohms, balanced. The 200-ohm impedance was reduced to 50 ohms, balanced, by connecting 4 Yagis in parallel with 5/2 wavelength pieces of 300-ohm tubular twinlead (Fig. 2.) By doing this the 200-ohm feed point of the Yagis can be transferred to a place where the other antennas can be paralleled with it. The important thing here is to get all the twin leads the same length and the same side of all the dipoles connected together so all the Yagis will be in phase. Be sure you take into account the propagation factor of the twin lead--the actual length of line will be shorter than 5/2 wavelength in free space. At the point where the lines come together the impedance is 50 ohms, balanced. This point is attached to a 50-ohm "beer can" or coaxial balun to get a 50-ohm unbalanced transformation for attachment to 50-ohm coax line. (Fig. 3.) The construction of coaxial baluns is described in the VHF manual put out by the A.R.R.L.

The other 12 Yagis were connected in 3 groups of 4 each the same way using identical dimensions for the twin lead and the coaxial balun. Each of the four groups of 4 Yagis now has a 50-ohm feed point. These feed points are fed with four pieces of 50-ohm coax of identical length. The length is not important as long as all are the same length. The power splitter feeds each of these lengths of coax (Fig. 4).

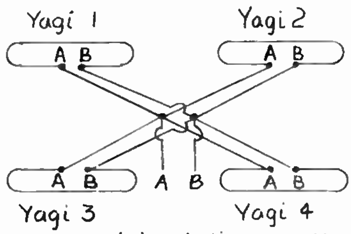
The 4-way power splitter is shown schematically in Fig. 5. The two outputs on the left end are 50 ohms paralleled, making 25 ohms the impedance at that end of the splitter. This is transformed to 100 ohms at the center by the quarter wave 50-ohm section. The same holds true for the right half. When the two halves are paralleled at the center the result is a 50-ohm feed impedance, just right for your long length of coax to the shack.

The power splitter is built using the drawings and these hints:
1. 1/4 wavelength equals 2952 divided by the freq in MHz. Result is in inches. This This is the free-space wavelength and holds for the power splitter and coaxial balun because they have an air dielectric. You must multiply your result by the velocity of propagation of twinlead and also by 2 to arrive at the proper dimension for an electrical half wave of twinlead.
2. The UG58 type N panel connectors have a 3/8" shoulder which fits the 3/8" hole of the outer conductor of the power splitter.
3. The center pin of the UG58 connectors on the ends are filed to a 45 degree angle

*5955 S. W. 179th
Beaverton, Oregon 97005

and the connectors positioned so that the slopes fit together and go through the 1/8" hole in the center conductor of the power splitter. (Fig. 6.)

4. Assembly: Put the center conductor inside the outer conductor. Put a UG58 connector on one side of one end. Put the 1/8" hole in the center conductor over the center pin. Put the other UG 58 on the same end and put the screws in to hold both connectors. Repeat at the other end of the splitter and then do the center. Use a big soldering iron. To make a water-tight seal, the connectors can be soldered to the outer shell and end caps put on. Another cover is required over the access hole to the center connector.



Each twinlead line to the center $\frac{\lambda}{2} \times K$ long

Fig. 2

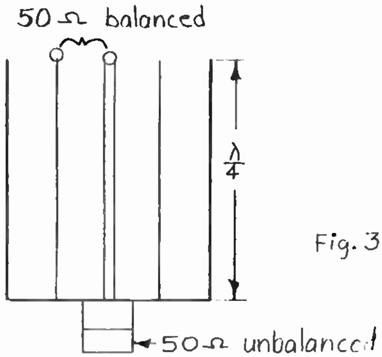


Fig. 3

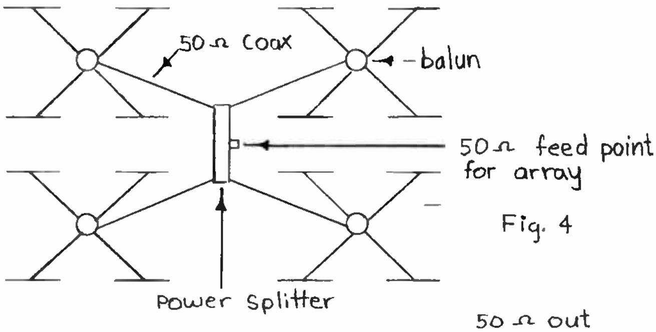
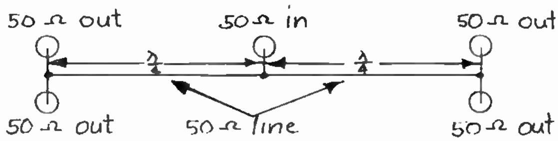


Fig. 4

Fig. 5



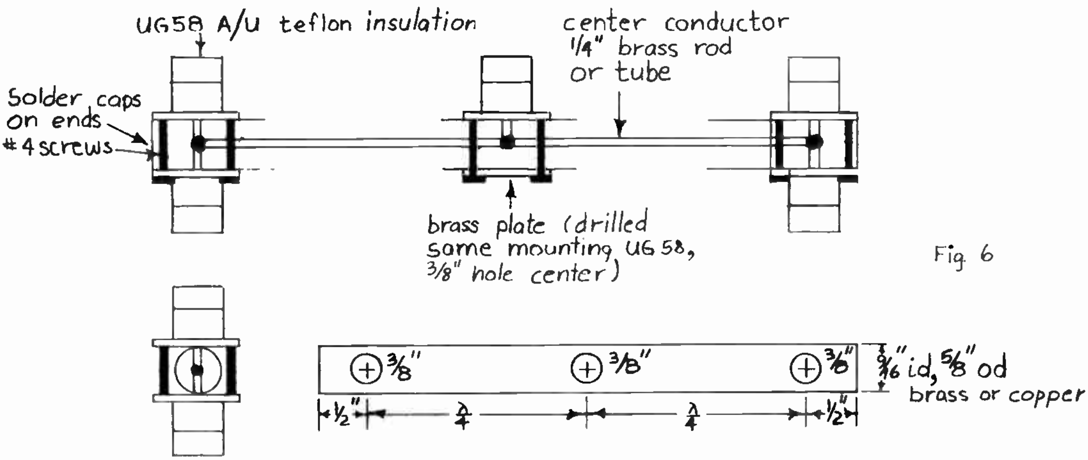
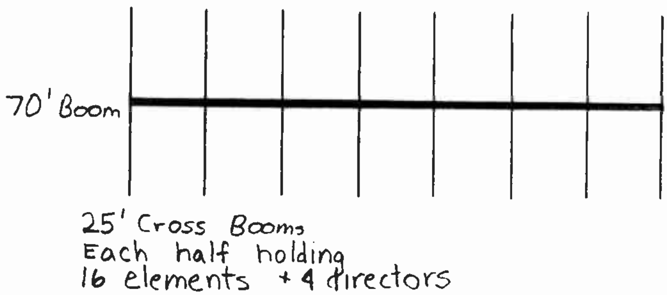


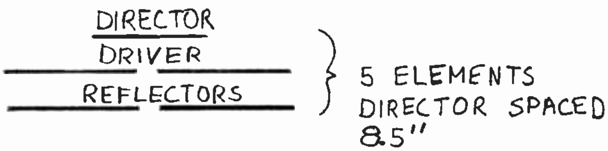
Fig 6

K6MYC-VK3ATN MOONBOUNCE CONTACT
by K7AAD

As you probably know by now, K6MYC (Mike) made a two-way on two meters with VK3ATN in Australia on Dec. 29. It was a monumental effort on both ends of the path. Remember that VK3ATN was limited to 150 watts. His mammoth antenna made it possible. K6MYC's antenna was not exactly small. It was made of 16, 16-element Cushcraft collinears with 64 home-brew half-wave directors added according to the method of Frank Jones. Mike says the barefoot collinear measured 11.7 db. over a dipole and with the addition of the directors he picked up 1.7 to 2 db. The array factor of 12 db. (3 db. increase each time total antenna size is doubled) gives a total gain of a little over 25 db. A diagram of the boom and cross-member layout is given below.

The antenna used 17 quarter-wave sections to keep the line impedance at 300 ohms. The array was fed in the center using a branching feed. Horizontal beamwidth, 5 degrees. Vertical beamwidth, 9 degrees. The array was located on a hillside at Stanford Univ. It was supported by two sets of three 4" x 4" x 8' redwood poles bolted together to form a tripod. The antenna was moveable in elevation from 55 to 90 degrees, azimuth from 253 to 255 degrees. Mike says that judging from the strength of his own echoes an array half that size will work for 2-meter moonbounce.





432 MOONBOUNCE GROUP READY FOR TESTS

A letter from WØWYZ in Denver asks us to help find a 432 m.b. group for them to work with. Ray and Tom, WØIUJ say they're ready. They say they have not yet heard their own echoes but think that they are not more than 3 db from it in normal times. Their rig is a pair of 4CX300As in a KW similar to the W1QWJ rig in Feb. 66 QST. They have a 2N2857 at the antenna followed by a transistor-nuvistor converter in the shack followed by a Drake R-4 and a 100 cps audio filter. They have 8 helices, 4 for receiving, 4 for transmitting. Ray says "antenna gain has been measured at 19-20 db. over isotropic indirectly. We measured two and then hoped for 3 db more." Ray would like to hear from anyone with access to a big dish operating at 432. Write him at 10698 Murray Drive, Denver, Colorado 80233.

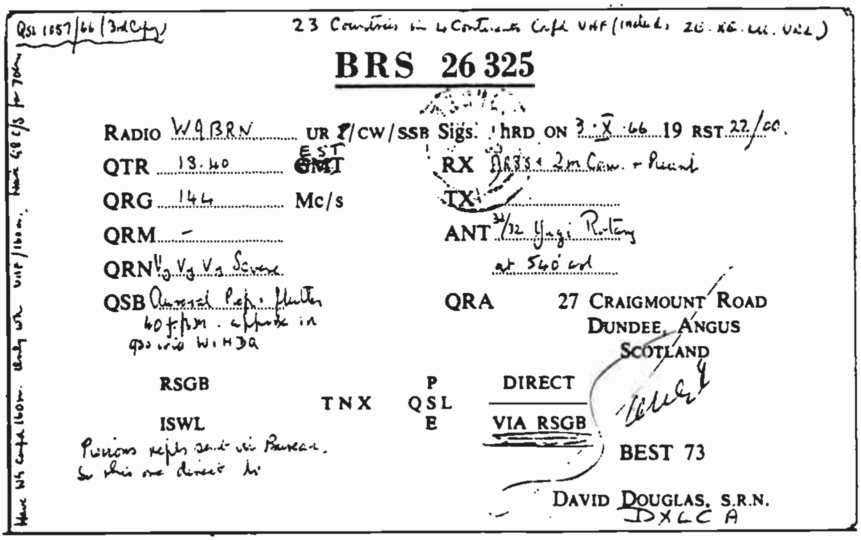
W6DNG-F8DO 2-WAY MOONBOUNCE

On Jan. 27, W6DNG in Long Beach, Calif. and F8DO in Belleville, France made a two-way on 144 Mc. Time was 0600 to 0700 GMT. Bill said that signals were as high as 10 to 12 db. over the noise but mostly in the noise. He told me that they actually made it more than once in their series of skeds but I guess the tape or something was better for proof on the 27th. Bill changed his antenna to a 32 element extended-expanded collinear. It's his 62nd antenna tried for moonbounce. It is all metal and measured 18.3 (his measurement) over a half wave dipole (described in April 65 VHFER I think). VSWR is 1:1 and the antenna was very easy to tune. He says there was no change in the VSWR during elevation so nearby things apparently aren't bothering it. Total weight is 43 lbs. I have a color shot of it but contrast is not very good and doubt if it will print well. Bill said also it doesn't have the gain of his other antenna (8 yagis) but that the other whipped around in the wind so bad it was hard to aim. The collinear is probably the one in Frank Jones VHF Handbook.

AURORA DX

A letter from Dick Stroud, W9BRN says "Thought you would be interested in a SWL report just received from David Douglas, BRS 26325 in Dundee, Angus, Scotland. He reports reception of my 144 Mc. signals during the auroral opening of 10-3-66 while I was in QSO with Ed, W1HDQ at 1840 EST with reception lasting about one minute. He says the signal had auroral properties and fast flutter when received in Scotland. Antenna there is 32 over 32 yagi at 540' elevation.

I have a notation in my log that W1 and W2 signals were peaking exceptionally far east during this particular opening, otherwise everything seemed normal here. A copy of the SWL report is attached." The copy is not too clear and will be even worse when I print it but in view of the unusual nature of this report I thought it would be worthwhile letting you see the copy of the card. ▪ K7AAD



BRS 26 325

RADIO W9BRN UR ~~F~~/CW/SSB Sigs. HRD ON 3·X·66 19 RST 22/00.

QTR 13.40 EST ~~GMT~~ RX

QRG 144 Mc/s TX

QRM –

ANT 32/32 Yagi Rotary

QRN Vy Vy Vy Severe

QSB Auroral Props. flutter 40 p.p.m. approx in QSO with W1HDQ

QRA 27 CRAIGMOUNT ROAD DUNDEE, ANGUS SCOTLAND

RSGB / ISWL

TNX P QSL E — DIRECT / VIA RSGB

BEST 73

DAVID DOUGLAS, S.R.N.

OPEN BANDS

by Marilyn Wiseman, K8ALO

Geminids meteor showers during December reported as poor. Quadrantids showers and auroras in January proved to be great. Plenty of reports, many commenting that auroras seemed to be better than expected. Lots of cold weather throughout the states increased band activity. Plenty of cold weather here, but little snow. Keep those fine reports coming in. See you next issue. My address: Box 103, Petersburg, Ohio 44454

50 MHz Scatter:

Dec. '66	WB6GGK (Calif.) wrkd K7BBO, W7CNK (Wash.), WØEYE (Colo.), W7UFB (Wyo.), WA5CZM/5 (N.M.), K7ICW (Nev.), K6RIL (Calif.), 400 mi. K7BBO (Wash.) wrkd W7UFB, plus 8 Calif. stations.
Jan. ''67	K7BBO (Wash.) wrkd K6RIL, K6IBY, K6JC, W6YKM, W6ABN, WB6GKK, W6NZX, WB6MUI. K7ICW (Nev.) wrkd WØEYE (Colo.), WØJXK/7 (Utah), WA5QHP, K5OOJ, K5YAW/5, WA5FDJ (Tex.), WAØEPZ (Mo.) W6PUZ, K6GJD (Calif.) hrd WA5CZM.

144 MHz.

Dec. '66	K7ICW (Nev.) wrkd 8 Calif. stations during the month.
Jan. '67	K7ICW (Nev.) wrkd many Calif. Stations hrd WØJXK/7, WA6TGH.

144 MHz Meteor Showers:

Dec. 11	K7ICW (Nev.) hrd K7ZIR (Ore.) 800 mi., K7MKW (Idaho) 900 mi.
Dec. 12	K7ICW (Nev.) wrkd K7ZIR (Ore.) 800 mi., hrd K7MKW (Idaho).
Dec. 13	K7BBO (Wash.) wrkd W6IBY (Calif.) hrd WØWYZ bursts. K1ABR (R.I.) hrd W8TIU, WØNXF. WB6GKK (Calif.) wrkd K7BBO (Wash.), K6HCP, WB6JEW, K6RIL, Calif. stations 400-425 mi. K7ICW (Nev.) hrd K7MKW, 900 mi. pings and letters. Al also reports hearing W5ORH (Okla.) wrking W6GDO 450 mi. and W9NIW/5 (Tex.) wrking W6GDO. K2HLA (N.Y.) ran 6 M/S skeds with nil results. Dick says very poor showers for east coast
Dec. 14	K1ABR (R.I.) hrd W8TIU, W5GUE/4. K7BBO (Wash.) wrkd WB6GKK, hrd WA6STS bursts.
Jan. 2	K7ICW (Nev.) wrkd WØLCN (Minn.) 1385 mi. hrd W9NIW/5 (Tex.) wrking W6GDO 500 mi.
Jan. 3	K7BBO (Wash.) hrd W9DID (Ill.) 1 ping, K6RIL a few pings. K1ABR (R.I.) hrd WØNXF.
Jan. 4	K7BBO (Wash.) hrd WØBFB a few pings, K6RIL 6 pings.
Jan. a8	K1ABR (R.I.) wrkd W4LTU (Va.) 450 mi.
Jan . 9	K7ICW (Nev.) hrd W7RQT (Utah) 470 mi.
Jan. 13	K7BBO (Wash.) wrkd K6HAA.
	K2NLA (N.Y.) repeated same skeds as Jan. showers, results nil.
	K1ABR (R.I.) reports keeping daily M/S skeds with K4QIF (N.C.) 650 mi. Dick says good burst every day.
	Special note to scatter boys: K2HLA says K1OYB (Me.) will be back on 144 MHz this summer for good.

144 MHz Aurora:

Nov. 7	W9YYF (ILL.) wrkd VE3EVW (Ont.), K2LGJ (N.Y.), K3JFL, W3BYF, W3MBN, K3HKK (Pa.), WAØFDY, WØLCN (Minn.), WØEMS (Neb.). Jack also wrkd 3 new states W2BU, WA2FGK (N.J.), W8AEC (W.Va.),

W5PZ (Okla.). Jack says 16 states were wrkd in a couple of hrs.

Jan. 7 K2HLA (N.Y.) reports during VHF S.S, good aurora. He wrkd W9UNN (Ill.) 950 mi., W9JGQ (Ill.) 1000 mi. also many 8s and 9s. W7JRG (Mont.) wrkd WØNXF, WØPDJ, KØMQS, WØBFB, WØEYE, WØIC, WØMOX, W7EGN, W7RQT, W7WVE, W7CJB, W7AZU and K7MKW (Idaho), state #26. Hrd K7ZIR.

Jan. 13 K2HLA (N.Y.) wrkd WØJVB (Mo.) state #28, plus many 8s and 9s. Hrd other stations wrking WØCUC (S.D.), WØEOZ (N.D.), hrd W4UHH (S.C.). Dick says at least the hard to work stations are keeping active. W7JRG (Mont.) wrkd W9AAG, K9AAJ, WØENC, WØWYZ, WØEYE, WØIC, WØMOX, hrd K9UIF. K1ABR (R.I.) wrkd W9ZIH (Ill.), W8QOH, W8FSO (Ohio), VE3ASO (Ont.). W9YYF (Ill.) wrkd W2BLV, W2BV (N.J.), K2TXB (N.Y.), W3LHF, W3LNA (Pa.), W8EDU (Ohio), WØEMS (Neb.) Jack also wrkd 3 new states WØCUC (S.D.), WØEKZ (Kan.), WØMOX (Colo.) 1000 mi. Hrd W4NUS (N.C.), W7JRG (Mont.). No luck wrking them. Jack says lots more stations within 400 mi.

432 MHz Aurora:

Jan. 7 W7JRG (Mont.) wrkd WØEYE (Colo.) for first Mont.-Colo. contact.

Jan. 13 W7JRG (Mont.) wrkd WØEYE (Colo.). K2YCO (N.Y.) wrkd W3RUE, K2CBA, K2GRI 2039-2138 EST. Charles says the beam was due north and quite critical. Slanting didn't help. Signals had no tone or buzz but just a hiss like white noise.

Skeds Wanted

W9YYF Jack Spencer, 205 Sherry Lane, Joliet, Ill. 60433, would like M/S or tropo skeds on 144 MHz. Rig 4CX250 B 500 watts, 8/8 J beam AM-CW-SSB

K7BBO Dave Robinson, 1716 S. 8th St., Tacoma, Wash. 98405, wants 144 MHz skeds for April M/S. Dave's freq. 144.086 ± 1 Kc.

K1ABR Dick Bromley, 12 High View Dr., Cranston, R.I. 02920, needs 144 MHz scatter skeds with Ark., La., Tenn., Miss., Ala. Dick also says still no takers on weekend 50 MHz scatter, but still hoping. Rig KW 6 ele wide space beam HQ 180 freq. 50.080 MHz.

K4EJQ J. G."Bunky" Botts, Rt.2, Box 72, Bristol, Tenn. 37620 would like skeds with Minn., Nebr., Kan., Md., Ia. Bunky now has KW to quad array. Freq. 144.026 MHz ± 1 Kc. Bunky wants to know if anyone else than W4HHK Paul and himself work 432-144MHz CW in Tenn.

K7ICW G. A. (Al) Olcott, 510 S. Rose St., Las Vegas, Nev. 89106 wants M/S skeds with Idaho, Wyo., N.Dak., Mo., Ark., La., extreme west Wisc., Tenn., and northern Mich. on 144 MHz.

K2YCO Charles Oneske, 27 Angora Dr., Rochester, N.Y. 14617 would like skeds on 432 MHz. 350-400 mi. range, especially New England states, N.J., Md., etc. Equip. HX30/xmtr conv. PP4CX250 B's 500 watts, 48 L extended expanded plane reflector collinear. Conv. Parks (of course) freq. 432.000 MHz. CW-SSB-AM. Charles has wrkd 6 new states thus far, has kept good skeds with W3RUE, VE2LI, K1JIX on nightly basis.

K2OVS Jay Buscemi, 8 Wexford Court, St. James, N.Y. wants skeds any week-day night 830-930 P.M. EST on 432 MHz. Freq. 432.00 or 431.85 MHz. Rig varactor tripler 20 watts out. H.B. conv. 5 DB NF 13 ele. 190' above sea level. Jay wants to know where all the activity is in the N.Y. Conn. area. Plenty of radar, radio altimeters, etc., but no people. Where are all the W1's, and W2's in this area?

ODDS & ENDS
by K7AAD

The big news since the last issue has been moonbounce, as far as VHFERs are concerned. As for us, the big news was the new regulations on mailing second class matter. It means its about 6 times as hard for us to get VHFER in the mail as before. Our whole filing system has to be re-arranged in the order of your zip codes. No longer are names alphabetical by states. So when you send in your complaints, as many of you so kindly do, please include your zip. Not only do we file differently but we have to examine all the zips and if there are 6 or more to one sectional center (and there are scads of sectional centers) they have to be bundled separately. We used to get away with about 50 bundles but now it will be more like 250. The upshot of all this is that our handling costs are increasing tremendously and at a buck a year we're not about breaking even. The mail volume here is too heavy--new subscriptions, sample issues, what happened to my _____ issue, I paid you $2 last August and I haven't gotten anything yet, etc. So VHFER has a new yearly rate in the U.S., namely $1.50 per year. I realize this is outlandishly high but you can blame it on the Great Society which now makes me pay $1.45/hr for the unskilled high-school help that handles VHFER. Of course all subscriptions paid at the previous rate are still valid at the previous price---a deal is a deal. Apparently a few think they are getting their money's worth as subscriptions still greatly outnumber expires. We will print 2400 this time, up 200 from last issue.

We get requests for odd-ball converters from time to time and normally we just say sorry, no got. But there are some things we do stock and one of them is the converter for the weather satellite at 136 Mc. You might not get your first choice of I. F. but we have it and it works well. Also we have resumed our 220 Mc. converter because the supply we built up about 3 years ago (25 units) has at last been exhausted. A number of our special converters, including the 220, go into commercial and medical telemetry or radio astronomy studies. Special frequencies are a pain and of course don't go at the amateur rate except for the weather satellite converter.

I will be out of the country most of March so no long distance calls please or don't expect a reply to conv. inquiries that require technical advice. Literature is always available.

Published by Parks Electronics Lab.
419 S.W. First
Beaverton, Ore. 97005

WILLIAM R. MANDALE 4-68-1
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