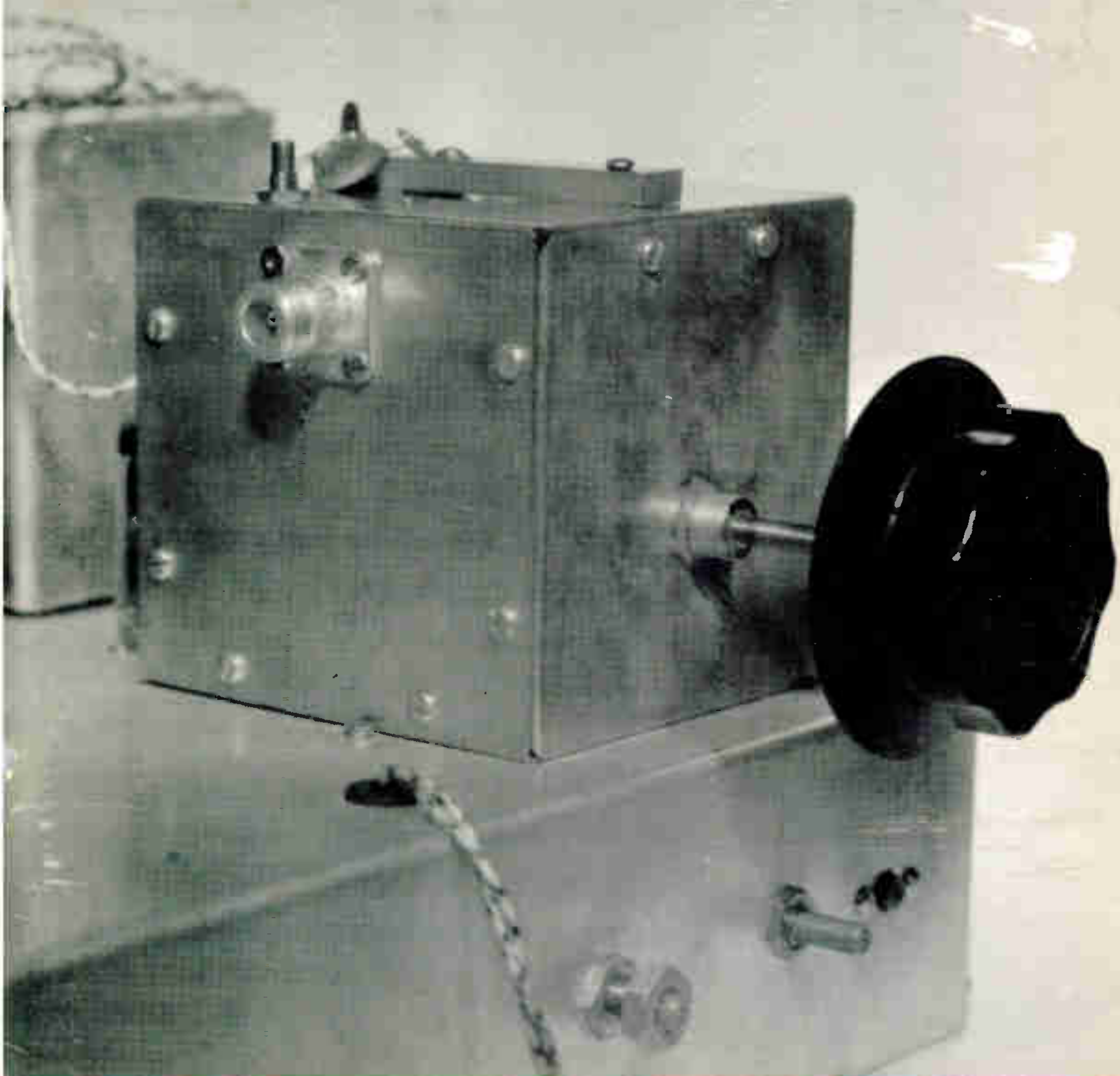
JANUARY 1963
40 Cents

VHF HORIZONS

420 POWER LIMIT OFF! page 40

432 WITH HAMMER AND VISE page 8



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VHF HORIZONS

OUR COVER

To celebrate the opening of high power on 420, we present this month K6HCP's feature on how to get on "432 With Hammer and Vise." The photo shows the finished final; the article is on page 8. Photo by WA6FCH.

CONTENTS

VOLUME 2 — NUMBER 1
JANUARY, 1963

Features

Departments

ADVERTISING—VHF Horizons magazine accepts commercial display advertising from bonafide manufacturers, and distributors of electronic equipment and associated apparatus. Advertising rate card and coverage data available upon proper request.

CIRCULATION—VHF Horizons magazine is circulated through the mails and sold over the counter at leading electronic parts wholesale houses throughout the United States and Canada. Approximately 25,000 active amateur radio operators have VHF/UHF interests, and this is their publication!

SUBSCRIPTION—Subscription rate in the United States, $4.00 per year, $7.00 two years. Airmail subscription available at $7.00 per year. Subscription in Canada, Central America $5.00 per year. Subscription elsewhere $5.50 per year.

SCATTER

. . . de K5JKX

ABOUT MOBILE RELAY STATIONS

Ever hear of a mobile relay station?

If your QTH happens to be anywhere on the West Coast, odds are you have. Anywhere else, you may or may not have.

Briefly, a mobile relay station is a station (usually on a hilltop or high tower) set up for the specific purpose of relaying low-power mobile transmissions on into areas which the mobile itself can't reach, and also relaying the reply back to the mobile.

They're common practice in a number of commercil two-way services; among us hams, their widespread use appears to be confined principally to 6-land.

A recent telephone conversation with W6NAS, Don Bybee, of Fresno, brought out the fact that ham mobile relay stations—like phone patches—are only legal by a hair's breadth.

It seems that Part 12 of the FCC Rules and Regulations, which governs all ham operation, does not mention them at all. By current *interpretation* (and rules-by-interpretation often differ depending on the district in which you happen to be located) they are considered to be remote-controlled ham stations—and as such are legally usable *only* by the person to whom they are licensed.

In other words, a mobile relay station which is open to use by the general ham population is outside the present rules.

In at least one area, the FCC man in charge okays mobile relays, *provided* they are keyed on and off by a specific code so that only the licensee (and any friends to whom he confides the code) can use the relay!

Don felt—and so do we—that mobile relays can be of great value if they are open to all licensed users. He wrote to the FCC to find out more about the situation.

He was, in turn, advised that the FCC was not aware that any problem existed and that, now that he had pointed out its existence, the Commission was looking into the matter with an eye to rules changes. Presumably, the changes would be to liberalize such operation.

We here in Oklahoma City stewed about it for a while, and then we drew up our own petition for rule making. By the time you read this, it will have been filed with the Commission. Since they are already looking into the matter, we hope for some early action. At any rate, we'll keep you fully informed.

As a start, here's the full text of our petition as filed with the Commission:

PETITION FOR RULE MAKING

The undersigned respectfully request that Sections 12.5 and 12.64 of the Commission's Rules and Regulations be amended to provide for the establishment of Amateur Mobile Relay Stations and to provide specific requirements to govern the operation of such stations. Petitioners propose the addition of another definition immediately following the present Section 12.5 as follows:

12.5*A* *Amateur Mobile Relay Station*

The term "amateur mobile relay station" means an amateur station authorized for the primary purpose of extending communication capabilities of "amateur mobile stations".

Petitioners also propose the addition of two subparagraphs to Section 12.64, as follows:

12.64 (*e*) *Amateur mobile relay stations may be authorized to any holder of a renewable amateur operator's license. Specific showing by the applicant that the public interest will be served by such authorization will be required. None of the remote-control provisions of preceding paragraphs* (*a*), (*b*), *and* (*c*) *shall apply to amateur mobile relay stations. In lieu thereof, the following requirements shall apply*:

1. *An amateur mobile relay station will be authorized to operate within a specific assigned amateur frequency band and may not be operated in other bands without proper modification of the license.*

2. *Each amateur mobile relay station must be so designed and constructed that*

(Turn to page 32)

Improved

Noise Generator

Techniques

Barry Collins, W4TLV

In any discussion of receivers or converters for VHF and UHF, eventually noise figure will be discussed. Sometimes these "discussions" take the form of downright arguments about measurement techniques! In this article, improved techniques and equipment will be described which will enable the VHF devotees to produce more meaningful results.

First, let's talk about noise generator circuits. There are two general types of noise generators in use in most ham shacks today: the temperature limited or saturated diode which uses a vacuum diode, and the silicon crystal generator.

The silicon crystal is fine for quick checks of construction. It will not, however, yield a "number" which can be used to discuss performance of your pet amplified with a friend's pet amplifier.

The temperature limited diode generator uses a tube type diode which is especially designed for noise generation. The current drawn by the diode to produce a given amount of noise can be measured by the current reading converted into a decible reading.

The generator pictured offers nothing radically new in circuitry. It does offer improved layout over previously described noise source. The result is less reactance in its output resistance, consequently less error in noise figure measurement vs. frequency.

The diode chosen is the Sylvania 5722, designed for noise generation service. The 5722 cautions are not observed. The life of the is a relatively short lived tube if certain pretube grows shorter and shorter as the filament voltage is increased beyond about 4.8 volts. Since 28 mA diode current can be made to flow at this filament voltage, for in excess of our noise figure needs, care should be used to make certain that the filament voltage is not allowed to reach 4.8 volts or higher. The maximum "on" period at any voltage should not exceed 5 minutes. If these ratings are followed, the 5722 should last many hundreds of hours.

Construction is simplicity itself. Actually, the only "chassis" absolutely necessary is a 2" x 2" piece of copper laminate, or if you prefer, solid brass or copper.

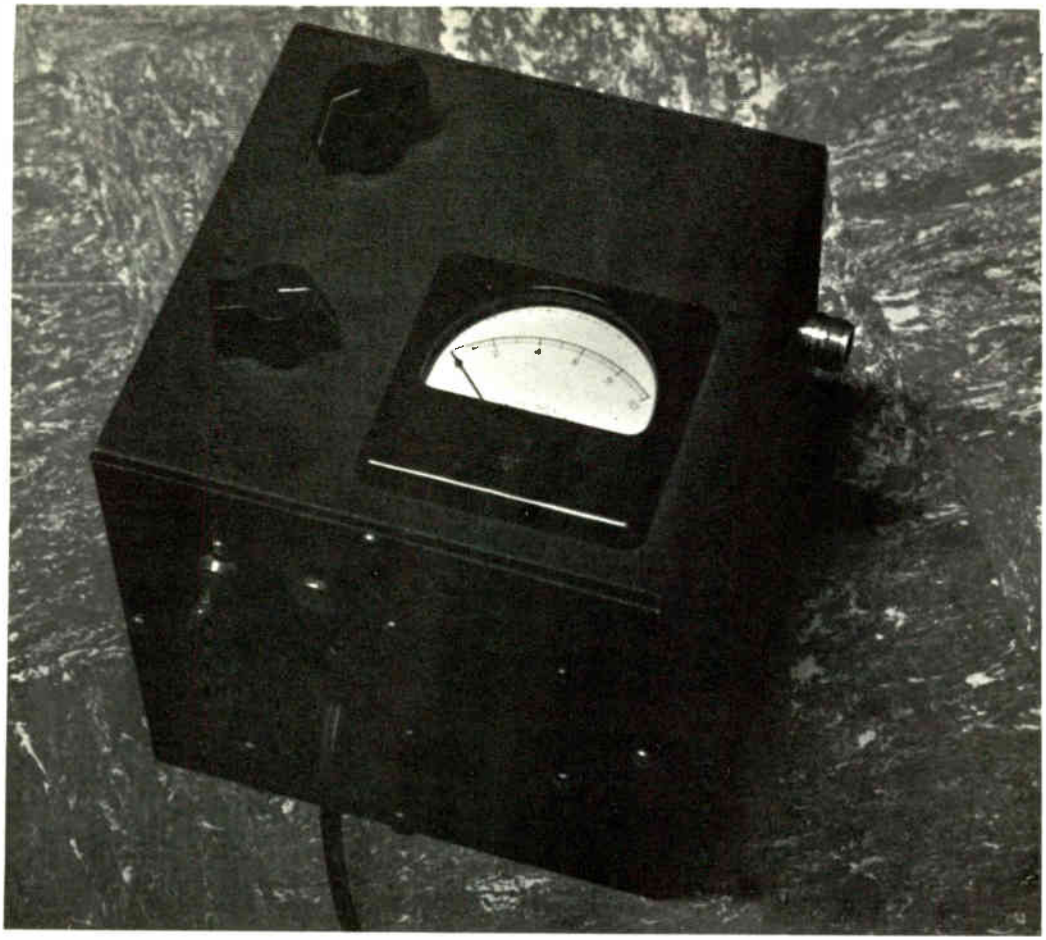
First, the plate is drilled to accomodate the feedthrough bypasses to the filament of the 5722. A slot is cut to allow the output connector, type N or type UHF as you prefer, to be installed. The chassis plate is soldered directly to the output connector.

After the soldering to the connector, install the termination resistor from the center pin of the connector to the chassis plate ground with the shortest leads possible. Some care should be used in selecting the resitor. If 50 ohms is chosen as the output impedence as is usually the case; try several 47 ohm resistors and select the one closest to 50.

If a slotted line or other accurate impedence measuring device is available, it would be very wise to test the terminating resistor at the highest RF frequency on which the generator will be used. (50 Mc is about he upper limit for this configuration.)

A resistor checked in this manner will eliminate any after thoughts about, "now is that thing really 50 ohms? . . ." If RF measurement is impossible, use your ohmeter and a file, if necessary, to get as near 50 ohms as you can. While observing the resistance, carefully file into the center of the resistor. Of course the resistor can only be *raised* above its original value by this method.

The connections to the 5722 pins are made by dismantling a minature socket for connectors. The plate connecter pin of the 5722 is soldered directly to the center pin of the



COMPLETED UNIT is housed in a 6X6X6 chassis box. All controls are on top. Knob in upper left is vernier rheostat; other knob is step control for filament voltage. Power switch is on front and coax connector on side.

output connectors. The filament connections are made by soldering the socket's connections directly to the feedthrough bypass which now serve as a support for the tube and its skeleton socket. Not all of the 7 pins of the 5722 will have connections.

The job of lining up the socket connector pins can be made much easier by slipping the connectors onto the proper pins of any 7 pin miniature tube and soldering with the tube in position. After cooling, the tube can be removed and the 5722 installed, taking care to plug it in correctly.

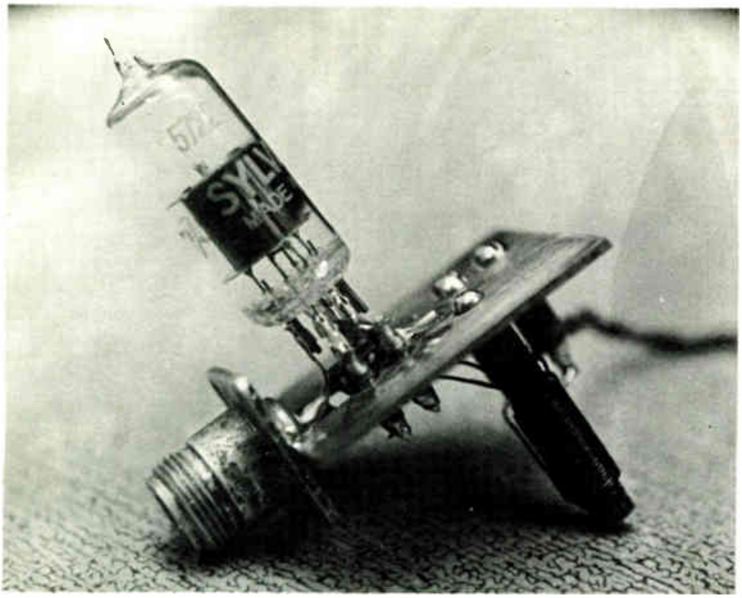
The filament choke is a total of 29 bifilar turns of No. 24 enamel on a ¼" coil form. Winding length is 11/16". The 29 turns occupy 2 layers.

For convenience and protection, the assembly should be mounted in a box of some sort which can also contain the diode current meter and power supply. The meter used to read diode current can be either a 0-5 or 0-10 mA meter. With 5 mA full scale, a noise figure as high as 7 db can be read. With a 10 mA meter, 10 db can be read. For maximum low scale accuracy, the meter can be equipped with a switchable shunt.

A means of varying the filament voltage on the 5722 is required and may consist of a small variable transformer or a 25 watt, 750 ohm variable resistor.

On my generator, two knobs are visable. One is a step control on the filament voltage and the other a vernier rheostat. Whatever method is chosen, a switch should also be included which will turn off the filament voltage without having to disturb the filament voltage adjustment. The filament transformer should be rated at 5 volts, 2 amps. The plate supply is 125 volts at 25 mA.

Several excellent articles have appered which go into detail on noise generator theory. A bibliography is presented at the end of this article for those desiring further



DETAIL VIEW shows 5722 subchassis and construction of "socket" using contacts stripped from miniature socket. Note that all leads are kept as short as possible. This is essential for good performance in the VHF region. Subchassis fastens to case by the mounting holes on the coax connector. Type N was used here but UHF (SO-239) type is also usable if you never plan to use the unit above 54 Mc.

information. This being primarily a "how-to" article, I'll dispense with the mathmatics except for one necessary formula:

Noise figure in db = $10\log_{10}(20 \times IR)$

This formula is important because it tells us that the noise figure of a converter or receiver can be measured in db if we substitute the diode current required to raise the noise output power of the device under test to twice its original value.

The diode current is easily read on the meter in our generator. To get our db reading, it is unnecessary to resort to substituting into the formula each time if a 50 ohm

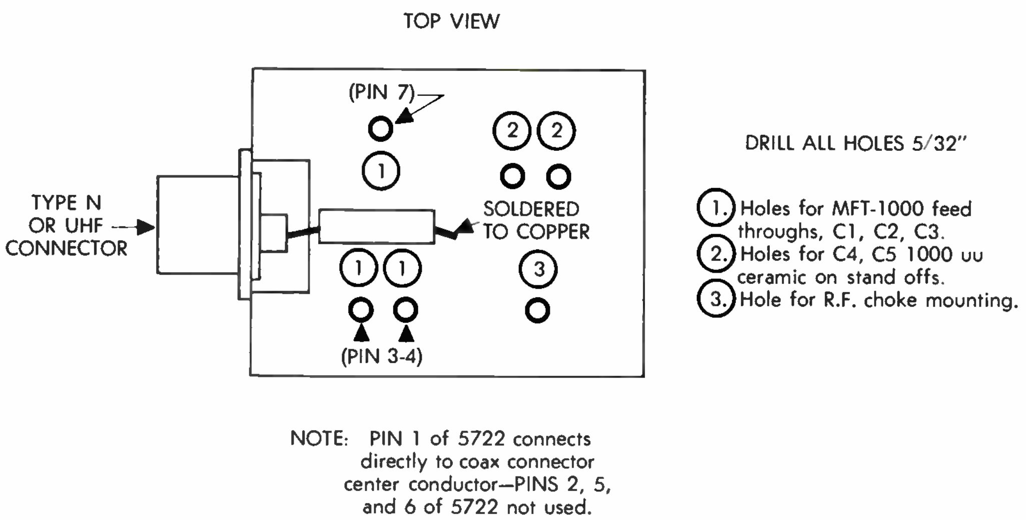


FIGURE 1. Layout drawing showing location of principal parts on subchassis. Subchassis material can be either copper laminate or flashing copper. Rectangular object at center from coax connector to chassis is 50-ohm terminating resistor R4. This view is almost actual size.

terminating resistor is used. The reason for this is apparent if we examine the formula. 20 x IR becomes 20 x 50 x I or 1000 x I. Since I is expressed in milliamperes, 1000 times I gives us a whole number. This number can be read from a standard log table or slide rule.

Example: The meter reads 4 mA. Look up 4 on a log table or slide rule. The answer is approximately .6. This is multiplied by 10 to give a noise figure of 6 db.

The hard part of our problem comes in determining the 3 db increase in output power of the receiver or receiver-converter under test. Common practice is to place an AC voltmeter across the speaker terminals of the receiver and increase the diode current unitl the output voltage has risen to a value of 1.41 times its original value, 1.41 times being equivalent to 3 db. This method may or may not be perfectly accurate. It is *if* the detector is operating as a square-law device and all amplifiers are operating in a linear fashion. In many receivers, this is approximately the case and noise figure measurements taken by this method are close.

An alternate method is used in commercial practice which reduces the possibility of error a bit more. This is the 3 db pad method. The pad is nothing more than a small attenuator with an imuedence of the *if* cable and input impedance of the receiver. With this technique, the coaxial pad is the only additional piece of equipment required

(Turn to page 22)

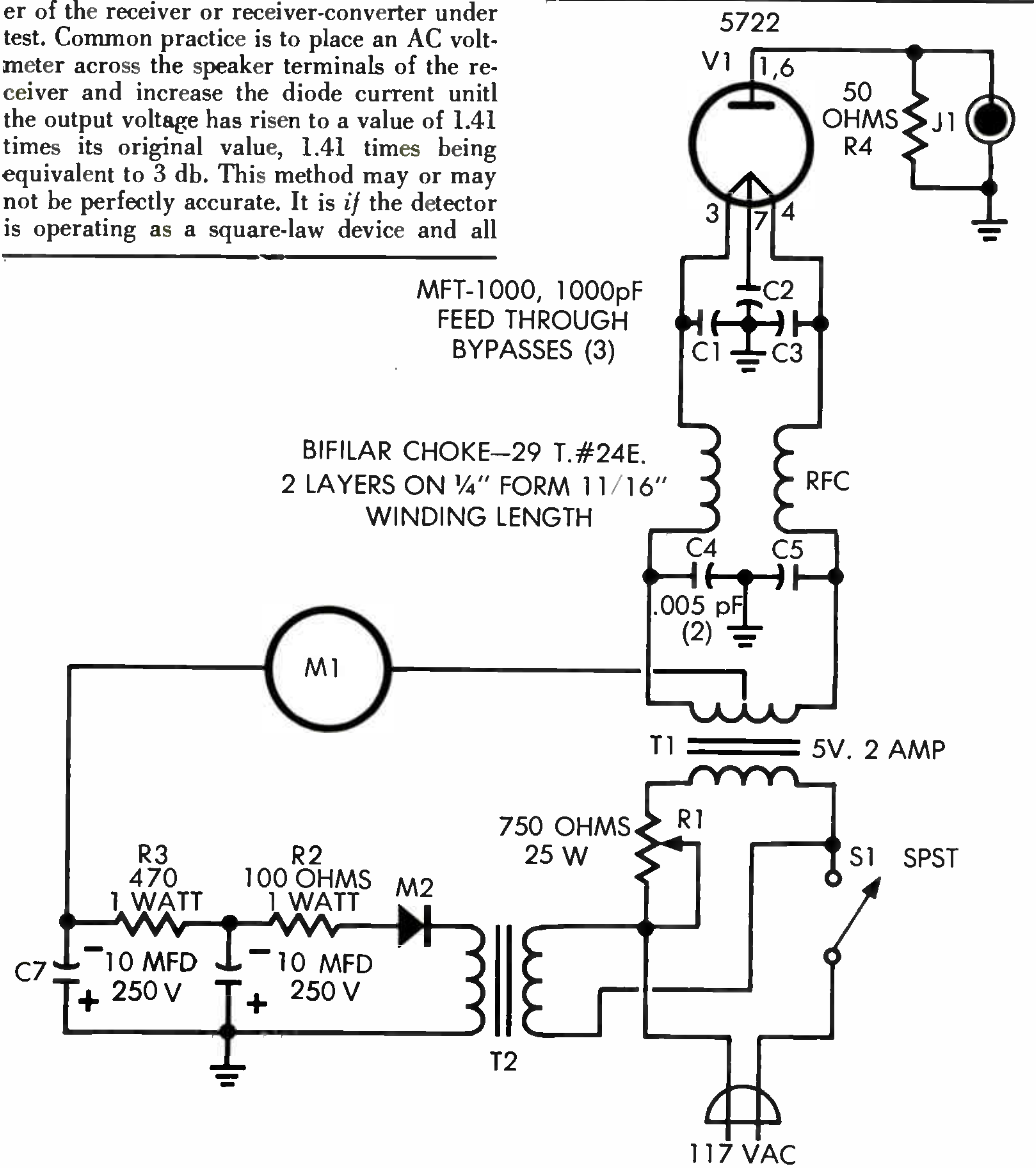


FIGURE 2. Schematic diagram of noise generator. Parts list is on page 27.

432 With Hammer and Vise

Ken Holladay K6HCP

This article deals with the transmitter portion of the 432 Mc station in use at K6HCP. The reason I start here is because the transmitter seems to be the item that scares people the most, and I hope that the following description will remove some of that fear and replace it with the enthusiasm to *build.*

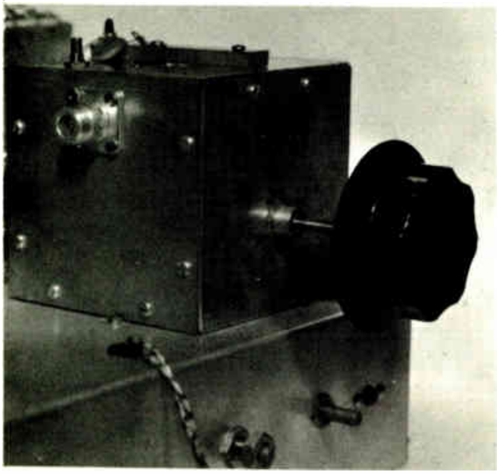
For those who like to "roll your own," 420 Mc is one of the few bands left where there are no "Gooney Birds" or "432-ers." In other words there is very little commercial gear available.

In the future I hope to follow up with articles on a simple but effective converter and an antenna that can be built by anybody. First, I'll see how much Cooper pays.

Now on with the transmitter. In my station I use a 2-meter exciter to drive a 4X250B tripling to 432 Mc. A 4X150 will do quite well also.

EXCITER

The 2-meter portion is not going to be described in detail because schematics and equipment are quite common. I will say I am using a 6360 at 2 meters to obtain about 15 watts of drive. A 2E26 or 832A or anything else will do the job so long as you gan get about 15 watts output, however, I don't think a "Gooney Bird" will supply enough drive unless you add an amplifier.



432 Mc TRANSMITTER unit in place on chassis. Large control is cavity tuning knob. Two shafts visible at front of chassis are grid tuning (left) and grid link coupling (right).

The tripler cavity, Figure 1, was made from 2 pieces of .032 brass sheet, and was designed so that the two parts from a closed box held together by 6.32x¼ sheet metal screws. The plate line was turned on a lathe to open one end to accept the plate of the 4x250 and a piece of 10 mil. Tiflon which is used as the dielectric of the plate coupling capacitor. I am sorry about the need for a lathe, but I have not found a juice can of the right diameter. I am sure that if a lathe is not available, one of the machine shops will turn it for you at a reasonable cost.

The tuning capacitor plate (Figure 2) should be of the dimensions shown, but the threaded rod and the bushing can be of any convenient size or shape. I made the plate from a piece of brass, but a tin can lid could be trimmed to size and should do.

The connection to the plate (Figure 3) is made through a piece of spring bronze and an Ohmite Z-420 RF choke mounted on a piece of insulating material and fastened to the top of the cavity with two No. 6 sheet metal screws. The 2KV capacitor is connected from the B-plus side of the Z-420 to a ground lug mounted under one of the No. 6 screws.

CIRCUIT (FIGURE 4)

The tripler is a standard tetrode amplifier with fixed bias. The grid circuit should be located as close as possible to the tube socket. (Figure 5). Be sure that the bias lead is well bypassed as close to the Z-420 RFC as possible.

The screen is regulated at 200 volts by using two OB2's in series. I found that this was very important in order to obtain maximum tube efficiency. It might be wise to experiment with different screen voltages to find the best operating point in your parti-

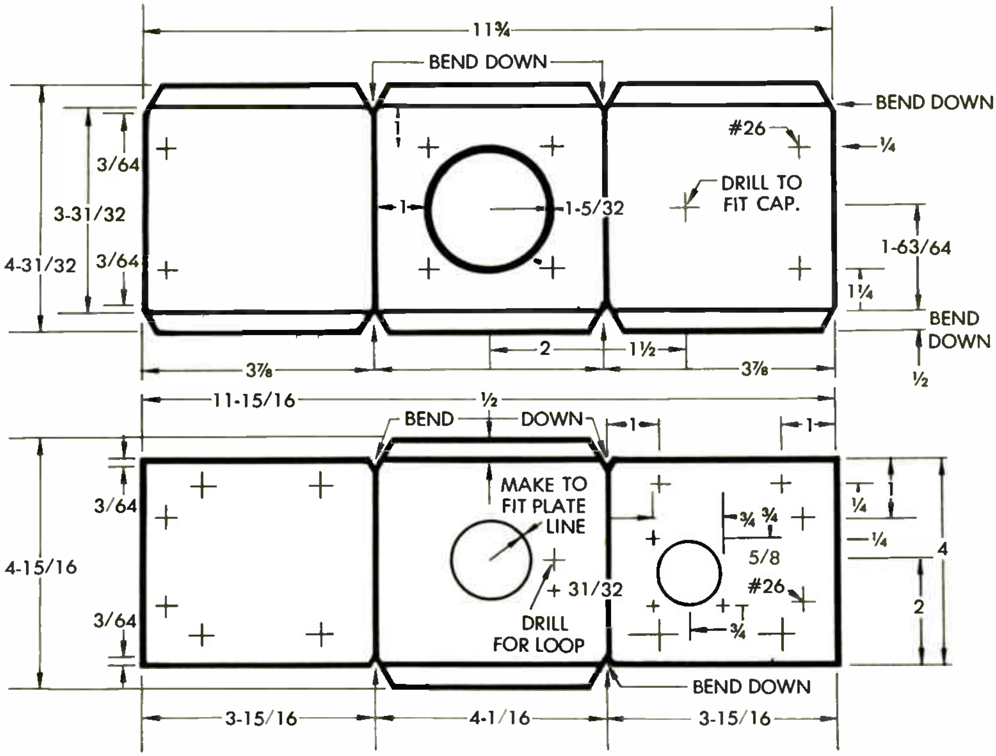


FIGURE 1 (above) and FIGURE 2 (below, left). Dimensions and drilling data for cavity shell and plate line. Material is .032 brass sheet for shell and 1-3/4 O.D. brass tubing for the line.

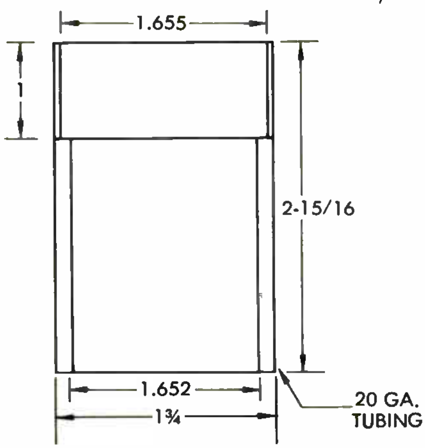
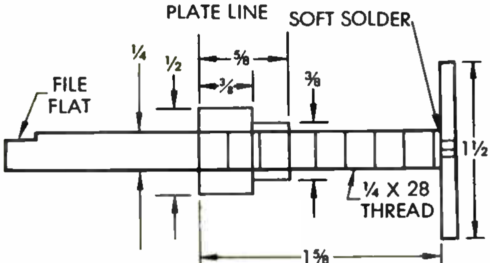


PLATE LINE



TUNING CAPACITOR
(ANYTHING CLOSE WILL DO)
All dimensions in inches.

cular rig, but be sure that you regulate the screen voltage.

The 20 henry choke in series with the screen is necessary to obtain enough modulation. This choke can be as small as 10 H but no smaller, and should be capable of about 80 mA. If you are one of the lucky few that has a modulation transformer with a separate screen winding, put this winding in place of the choke.

The bias supply consists of a filament transformer connected backwards and connected to a fullwave bridge rectifier. This supplies about 230 VDC which is fed to the OA2 to obtain -150 regulated. You do not have to use this system if you don't want to. There are many types of bias supplies, so use one that suits you. The 150V regulated is then connected through R3 to the grid circuit which is designed so that you cannot take the grid more than about 70V negative. This will prevent drawing excessive plate surrent by mistake. R6 should be adjusted to give 6.0 volts on the filament. The RF output is connected to the plate line through the capacitor formed by the 4x250 plate and the plate line separated by a piece of 10 mil. Teflon. The plate tuned with a 1½" disk

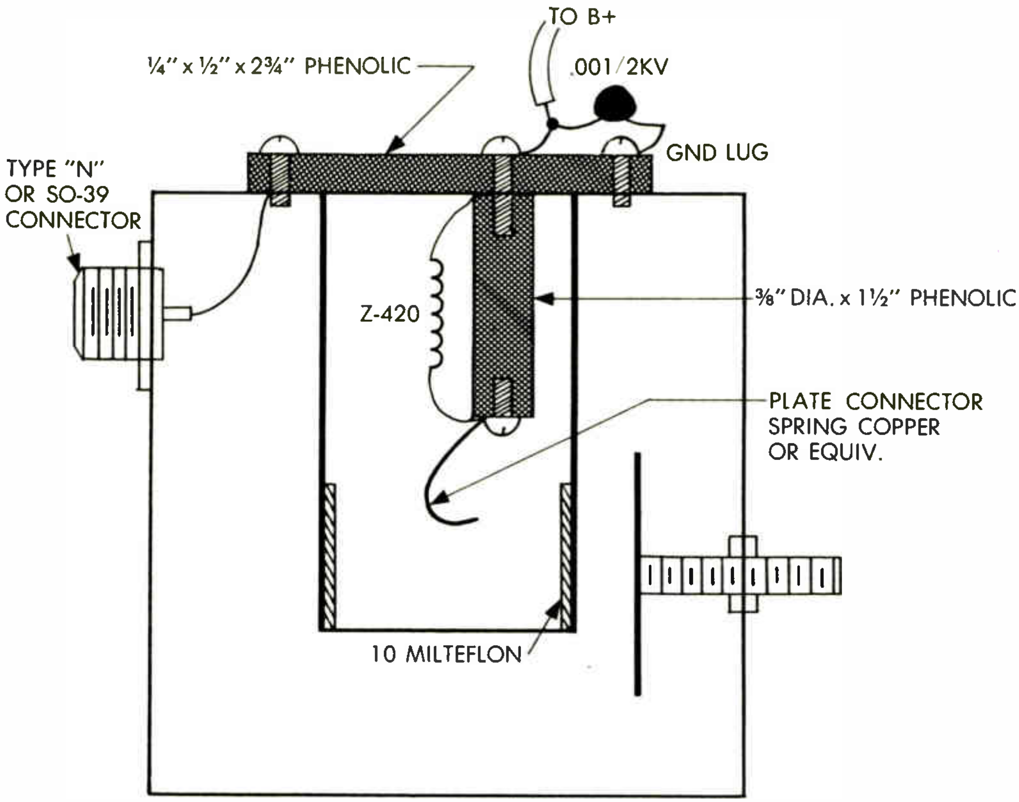
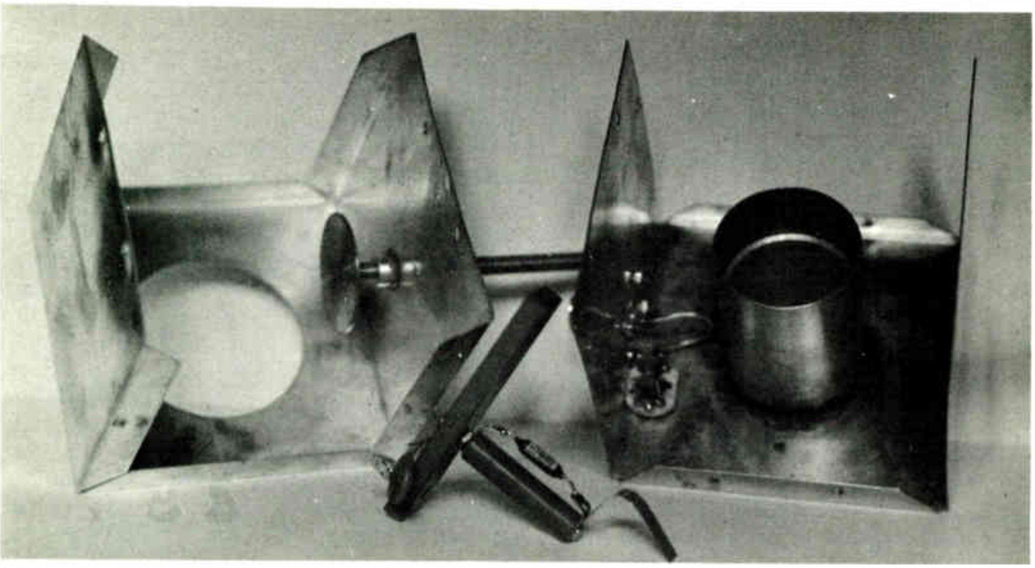


FIGURE 3. Details of assembly. Plate connections for D.C. are shown. Note that photos show a link tuning capacitor; this was found to be unnecessary and is omitted from the schematic and other drawings.



INTERIOR VIEW shows capacitor plate and coupling link details. Assembly of cavity is almost self-explanatory. 6-32 screws in sides of shells secure parts after assembly. Phenolic bar in foreground supports plate-circuit D.C. connecting components. Do not use solid sheet; this would block air flow over the tube and cause failure of the 4X250B.

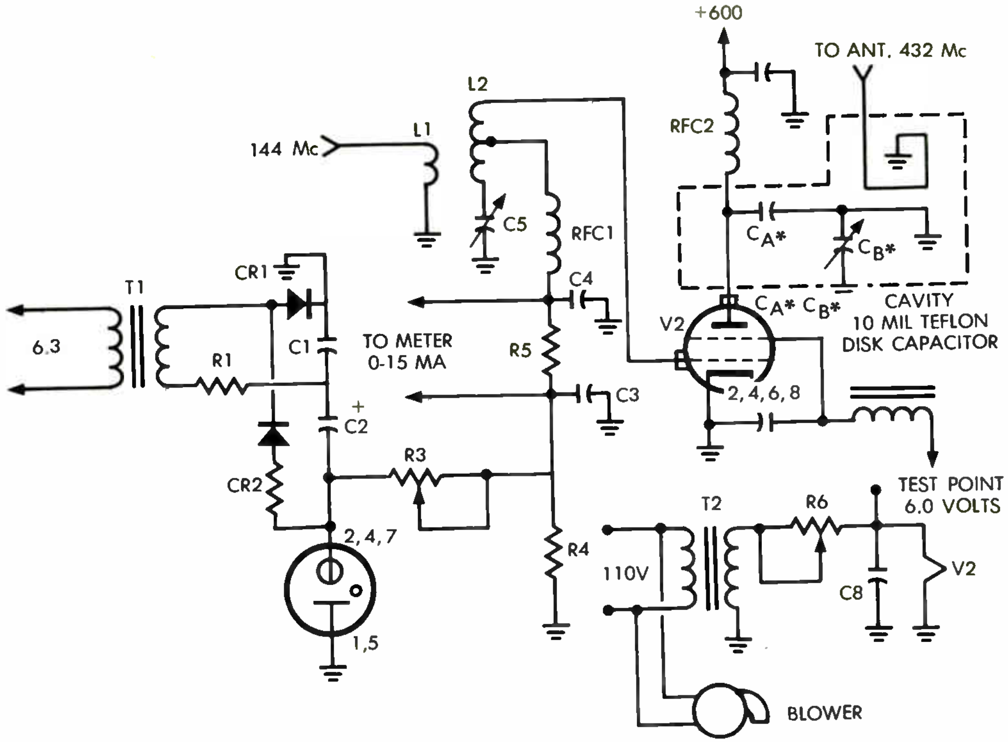


FIGURE 4. Schematic diagram. Parts list is on page 27. See text for screen connection.

mounted on a threaded rod, with a knob on the outside end for ease of adjustment.

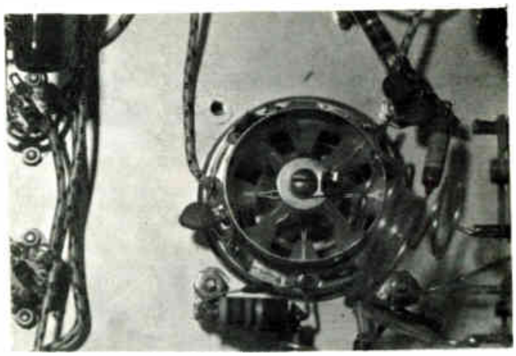
TUNE-UP

Turn on the power and observe that the blower is running. With the high voltage off, check to see that there is about 90V on the grid of the 4x250B. Turn on the high voltage but do not apply the drive. Check to see that you have the proper screen voltage, then adjust the bias to have just zero mA plate current. Do not bias the tube any further into cutoff as the tube efficiency will not be as good. Turn on the drive and tune the plate to resonance, then adjust the grid circuit to about 10 to 15 mA of grid current.

Use an output indicator to adjust the link and plate tuning for maximum output. (This *can* be done by moving the loop from the outside of the cavity.) When the optimum point is wound solder the loose end to the top of the cavity. Although it is not necessary, I found it convenient to mount a miniature 11 pF (mmf) capacitor to the cold end of the link. After you have adjusted the link, the cavity should not require further adjustment if it is always used in the same impedance.

MODULATION

I don't think that the modulator requires a detailed description. Any good modulator will do. I am using a pair of 807's and a BC375 modulation transformer and from "on the air" checks it is modulating the rig quite well.



UNDERSIDE VIEW shows details of grid circuit. Capacitors at right are grid tuning and grid-link coupling controls visible in front-chassis view (page 8). Screen-voltage regulator tubes and bias supply are out of picture at left; wiring at left edge leads to these items.

I have had this rig on the air for several months now and am quite happy with it. I know you will find it a lot of fun on 432 so I hope you will take the time to give 432 a try.

I would like to thank Phil, WA6FCH, for the good job on the pictures.

Never Again!

Jackson L. Cox, WOKMV

To what lengths a VHF man will go to win a contest or make a contact with a new state or set a record is yet unknown. However, I can tell you how far I went, and believe me, never again.

The morning of January sixth dawned dreary and cold. Advance preparations had been completed by the installation three weeks before, of a new Telrex 624 beam, with the help of my long-suffering XYL.

Now that the skyhook was ready, and the G-50 primed and ready to go, I felt this would be the year I would make it three in a row. I hold, proudly, the certificates for the Missouri section for '60 and '61, so I tell the XYL (with tongue in cheek), "if I win this one, never again."

The log, verifier, pencils and pens, scratch paper, cigarettes, matches, sections lists, coffee cup and hot plate, complete with instant coffee, were all laid out with care, knowing that soon 1400 would be here.

At last 1400 arrives and yours truly hits six meters with 50 watts, a six element twirler, and a good voice.

Contacts were goin' like crazy, and I was breaking up every QSO on six meters. I mean, like this was the usual, come contest time, so nobody got mad, I hope. You know, jump in, get a number and report and sign out again. Makes for good log keeping on the other end!

Anyway, after a few of these I notice KOZKC is likewise doing the same thing. He's right on my heels on every contact, and he has the same number of points and everything. Bill's running a G-50 and 8 element Hy-Gain, so we are about evenly matched.

And so the hours go, no skip, just having to rely on local contacts and a little ground wave (In January?).

Long about 2200, we manage to grab Nebraska, and a couple of contacts up that way. Then back to scounging up the locals we haven't worked yet. All this time KOKZC is right on my heels, same number of points, same everything. (Or could it be that I'm right on his heels?)

2330 and the fun starts. Nope, the band didn't open up. The rotator indicator quits. The needle on the meter bangs the stop a couple of times, and slowly dies. Then the beam wouldn't move. Oboy, now what.

A trip outside shows the coax is wound up around the mast. Now what the heck happened.

Grabbing a few wrenches, screwdrivers, and such, I climb the tower and loosen the mast in the rotator and get the coax straight. The temperature is about 25 degrees or less. Forty five feet up it feels *much* less.

With the beam in operation, I manage to make a few more points, without the help of the indicator. Yeah, you guessed it, the beam sticks again. This is about 0100, so I call it a night and get in some sack time.

0700 finds me on the tower, taking the rotator down to try and fix the indicator and see what went wrong with the mechanical stop.

After half an hour of working on the indicator, I give it up as a complete loss. The mechanical stop was worn off on one side, allowing the beam to go past, but it would not come back past the stop. This is what wound up the coax.

Back up the tower with the rotator. By now it is snowing and the wind is blowing hard. Half way up, I drop the rotator on the roof and had to go back down after it. The XYL thinks it was me that hit the roof and comes out prepared to pick up the pieces.

By 0800 I'm back in the shack. Now the beam won't work at all. So, with the XYL at the control box, I goes back up the tower and removes the shorts from the control

(Turn to page 26)

It Pays To Advertise!

Ever stop to think what advertising makes possible? The National Advertising Council has a cute cartoon they managed to get television stations to show late at night after the old movies are over. It goes something like this.

Advertising creates mass demand for a product. Mass demand creates bigger and more efficient factories, which have to grow and improve in order to keep up with the demand. As factories grow and buy the associated equipment they need to grow, allied factories and plants become larger and more efficient. More people are hired and more money is paid for wages. More money paid out for wages means more money in the pockets of the consumer. More money in the pocket of the consumer results in more products being purchased. More products being purchased usually means more expansion money for plants. And part of this expansion money goes for increased advertising. Which creates more demand for more products. And that brings us back to the beginning of our story. Or is it the end?

Advertising also helps media grow. Media, for the unaware, is the term applied to the various outlets for advertising. Magazines, newspapers, radio, television, direct mail, ad infinitum.

When media grows (in our case VHF Horizons) so grows consumer interest. A bigger VHF Horizons means more articles, more news. This in turn means more readers and more reader interest. More readers and more reader interest means better and increased response for the manufacturer-advertiser. Who in turn spends more money advertising because the results he is getting justifies the increased expenditure. And this in turn means a bigger magazine.

Get the picture? Every small cog adds to a big wheel, and the more cogs the bigger the wheel.

Have you done your part this month to bring a few new readers into the fold?

DRP▼ Report for December

From Amateur Radio Station ______________________, QTH ____________

This month we built the following ______________________________

____. And, we improved the

following gear ____

On the air we worked (DX-date, call, time) __________________________

____

____

New VHF calls heard on locally ________________________________

____

Articles we enjoyed in January issue ____________________________

***APPROXIMATELY 5-7,000 SAMPLES OF VHF ARE MAILED OUT MONTHLY. IF THIS IS YOUR FIRST MAIL COPY, YOU MAY CONTINUE RECEIVING VHF BY USING ONE OF THE FORMS BELOW.**

Dear VHF Guys:

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Box 1557
Oklahoma City 1, Oklahoma

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________Attached is my $4. Put me down for **15 issues** of VHF because I am returning this before **December 30th.**

________Attached is my $4. Put me down for **14 issues** of VHF because I am returning this **before January 10.**

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Name ________________________ Call ____________

Address ____

City/Town ____________________ Zone ________ State ____________

Airmail to:
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Sporadic-E

1962 versus 1961
A Comparison

by Bob Grimm, K6RNQ
Western Technical Editor

In tuning across the 50 Mc band, one hears many comments, *i.e.*: "The openings this year were better than last year. There were more openings last year than there were this year, etc."

This is an endless, age-old argument and it becomes particularly heated when there are a couple of good 6 meter Es years in succession. Invariably, during different years, various parts of the country fare better than other parts. While I can't speak for the entire country, I'll try to make a comparison of this year and last year as seen by California 50 Mc operators.

I could quote a lot of figures and make comparisons of one opening vs. another, but this would soon get boring and prove nothing. Let's do it systematically and draw up a chart. This should give quite a clear picture. For the sake of simplicity, we will consider the 50 Mc Es season as starting on May 1st and ending on August 31st.

Due to the characteristics of Sporadic E skip (and also because I'm not infallible) there may be a few openings that I do not have listed in the chart. However, I think the majority of Es openings, and particularly the better ones, are listed. I should make it clear here, that these openings are only ones where the sixth call area is involved.

From the chart it is quite evident that double-hop Es was more predominant in 1961 when there were 18 double hop openings, vs. 13 in 1962. However, the 1962 Es season started earlier in the year than in 1961. There was also quite a bit more double hop Es in May of 1962, as compared to May of 1961. There were very nearly the same number of openings in 1962 as there were in 1961.

So there's the record. Take your pick. Which year do you think was better, 1961 or 1962?

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAY	1962							DE		E	E	DE	DE	DE	DE	DE	E		E													
	1961																DE				E							DE	DE	E	DE	
JUNE	1962													E		E	DE	DE					E	E	E	E	E		E	E	E	
	1961	DE	DE		E	E			E	DE	DE	DE	DE			E		DE		DE	E							DE	E	DE		
JULY	1962	DE			DE	DE						DE		DE				E	E	E												
	1961	DE	E					E							DE	E	DE							E							E	E
AUGUST	1962									E																						
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SPORADIC-E CHART for 1962 vs. 1961. Draw your own conclusions.

E-Skip On Two

How to, Where to, And When

For some years now alert two-meter DX hounds have been aware that Sporadic E skip (the same form of skip that livens up six meters every summer) can occur on *rare* occasions on two meters. Naturally the opportunity to work stations on 144 megacycles over distances comparable to normal single-hop skip on six meters (*i.e.* 800 to 1400 miles) is exciting to all two meter operators, DX fans or not!

Over the past 17 years there have been perhaps 20 instances of DX work on two meters which fell into known Sporadic E patterns. All have occured during the summer months, most in the period mid-June through mid-July. Without chronicaling the actual DX contacts at this time, the results of such a table would show the following patterns:

1) Contacts reported to date rave involved all major geographical areas of the United States except the Pacific northwest.

2) Contacts under discussion here have occured during a period of intense E layer ionization, indicated by a high concentration of concurrent 6-meter DX activity.

3) Contacts reported to date have been, for the most part, a product of late afternoon (local sandard time) openings, with a smattering of such two meter contacts around 0900 LST and 1200-1300 LST. None on record have occured in the mid and late evening period, perhaps the highest time period of normal two-meter activity.

4) The majority of the contacts reported have involved stations in Texas holding down one end of the circuit. Examples are Texas to Southern California, Texas to Ohio and Ontario, Texas to North Carolina, and Texas to Florida. The path from Texas to southern California has been covered on at least three occasions, by far the leading producer of Sporadic-E type DX paths on 144 megacycles.

5) Nearly all, if not all, contacts have been made over paths which were more east-west in nature than north-south. The closest path to a north-south angent was one from Dallas, Texas to Ohio more than 10 years ago.

6) The highest concentration of contacts has occured over pahs in the 1100-1350 mile range. Only two over 1350 miles have been verified. None under 1,000 miles have been validated.

THE THEORY

We once sat in on a discussion attended by a visiting well-known VHF/UHF amateur. He was the subject of one question following another as local VHF'ers paid tribute to the visiting dignitary. The kind gent was tiring and looking for an out for the evening when one lad asked "What do the boys in XXXX think of 'the Theory'?"

"The boys don't think much of the theory," came the reply, "because theories usually explain things that aren't supposed to happen. Hams make them happen . . . and 'the theory' usually goes to pot."

We never did find out what theory the questioner had in mind. None really cared, for the point was well made. VHF/UHF-minded hams have never been particularly curious about theories . . . because theories seldom hold much of a candle to good-old-fashioned stick-to-itiveness. Contacts from California to Hawaii on 144 and 220 megacycles have proven this, as have dozens of other shining examples in the world of the very and ultra highs.

Thus, this business of theoretical considerations, when we are talking about something that has happened and been reported only 20-some times in nearly 17 years of 144 megacycle work in North America, is of little value.

The important consideration here is that it has occured. Now we want to know "how often does it really occur, and how do we make the most of it when it does?"

TIP-OFFS TO 144 MEGACYCLE E SKIP

For the purpose of this discussion, we are going to have to assume that we are talking about sporadic E skip. There will be some who will argue that "theoretically it can't happen." Fine. Let them stay on six meters then while the rest of us pile up the states on two meter "skip!"

Many years ago some well meaning soul suggested that when sporadic E skip got short on six meters, the ionization could be getting intense enough to support E skip on two meters.

As far as he went, his suggestion was fine. But old-timers on six meters took this to mean that they could draw a parallel with ten meters and six meters. For example, many of us listen to ten meters watching for signs of short skip. When we hear E skip on ten meters shorten down to 700 miles or so, we begin to look for six meter stations from the same general direction over paths of 900-1200 miles. Usually it works. However, as figure one shows, it should not work for the same correlation between six and two meters, unless we have truly spectacular conditions existing in the time on six.

Sporadic E ionized clouds are just that. Clouds. They may or may not have their greatest density in the center of the cloud. Where they do have their greatest density is important, because it is their heaviest density portion that will refract two meter signals (*i.e.* skip) if any portion of the cloud will.

Therefore, when you are hearing six meter stations *at* your QTH over a path of 300-500 miles on E skip, the dense part of the cloud is located 150-250 miles from you, or (approximately) half way between your QTH and the short-short skip stations we are hearing on six. There is no question that skip this short on six meters indicates E cloud activity which should be capable of supporting two-meter skip over paths of 1,000-1,350 miles.

BUT—the location of that dense portion of the cloud must be at the mid-point of the 1,000-1,300 mile two meter path, or very close to the mid-point. In other words, as the figure shows, a dense cloud which allows us to hear six meter stations 300-500 miles away is not likely to help us on two meters, unless the cloud is equally dense at a point 500-650 miles away from us (as opposed to 150-250 miles) in the direction of the station or stations we are trying to work on two meters, via skip.

Too many of us, having grown up accustomed to checking ten meter short skip

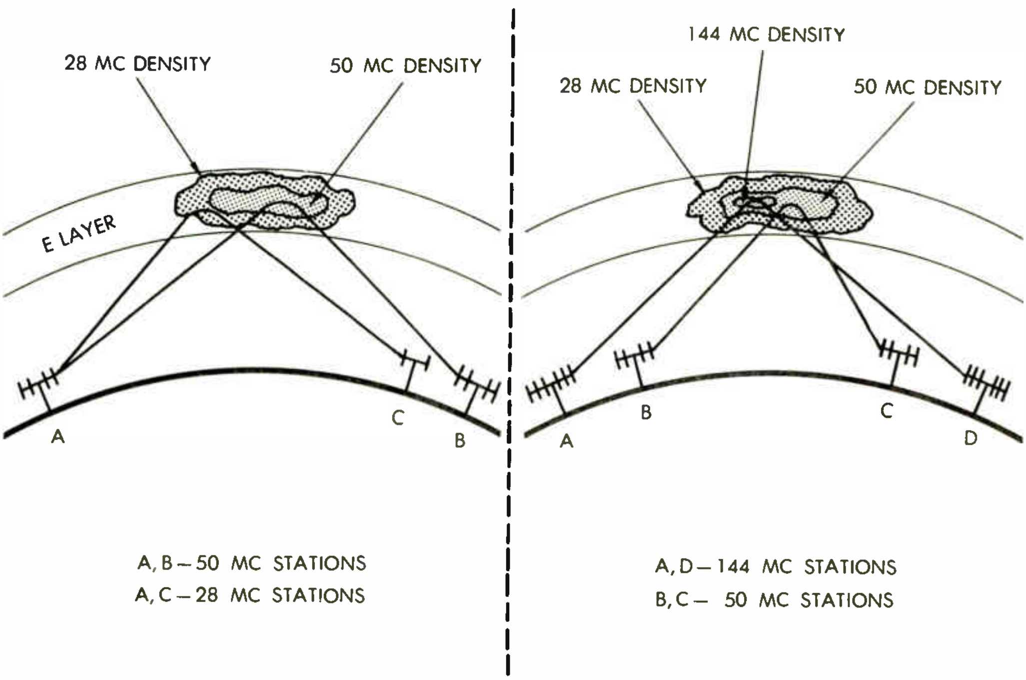

FIGURE 1. Comparison of relationships between 10-meter, 6-meter, and 2-meter skip behavior. See text for full discussion of differences.

for signs of six meter openings, are trying to make the same approach work from six to two.

Here is why it won't.

Sporadic E clouds are by nature seldom very far across. In other words, they seldom cover a very large expanse at one time. They are freaks of nature to begin with.

And, when some portion of that cloud decides (for reasons unknown) to become an even greater freak (by increasing in density), only a small section of the cloud gets into the act.

Interestingly enough, experience has shown that it is usually an edge of the cloud that becomes most saturated with ionization. It were as if a small cancer had decided to form on the edge of the ionized cloud, and it builds and builds (usually very suddenly), apparently sapping the energy away from the rest of the cloud. More scientific types would probably tell you that an ion pile-up attracts more and more ions until the pile-up reaches a critical level and saturates. It rapidly dissipates after reaching the saturation point, which means you will have to act quickly to catch it between the time it reaches a level of ionization sufficent to produce two meter skip, and then begins to break-up Too often, the cloud begins to break-up (reaches saturation) before it attains an ionization level sufficent to support 144 megacycle refraction.

There is *only one* known tip-off to rapidly building intense areas of E cloud ionization. *And that is extremely short skip on six meters.*

We have already ascertained that because the high density spot is small, and, because we want the high density spot *not* to be near us *but* half-way *between* our location and the location of the two meter station(s) we are trying to work, listening for extremely short 6 meter skip at *our* location is fruitless. It is even frustrating.

What we *do* want to listen for is extremely short skip occuring over the mid-point of our magical two meter path. Some practical examples? *OK*. So you live in Connecticut and want to line-up a two meter station in Minnesota, Nebraska, or Iowa. On six meters you do so, arranging that when short skip *on* six meters gets down to a point where stations in Buffalo and Erie *are working* stations in Chicago and Milwaukee, *you* head for two meters, and so does your sked station in Minnesota, Iowa or Nebraska.

Or, you live in Chicago and you are anxious to work a two-meter man in Florida. So after the preliminary arrangements on six meters you note that when stations in St. Louis begin working stations in Tennessee, especially from Nashville to Memphis, you head for two meters.

Now, it is entirely possible that you (in Chicago, or Connecticut) will be out of the six meter skip zone for any 6 meter contacts with your sked stations in Florida or Minnesota (etc.) when skip on six shortens up sufficently to produce the alert. For example, W5SFW in Amarillo, Texas was fortunate enough to work several 144 Mc stations in W8-VE3 land a couple of summers back at a time when he was completely out of the six meter skip activity. None the less, at the same time he was working into these Great Lakes areas (from Amarillo) on two meters, stations on six in Indiana were working into St. Louis, and so on.

More than anything else, this takes careful observing and bird-dogging on six meters. And it takes a little pre-arranging on six (or by whatever other means are at your disposal) with another station who shares your two-meter interest to make it work

It is a sad fact that most two-meter activity is in the mid to late evening hours, a period of time that has yet to produce E skip on 144. It is an equally sad fact that late afternoon on two is the deadest time of the day in most areas and at the same time it is the most apt time to produce two meter E skip, according to records.

It is an enlightening fact that when E skip is "in" on two, it is usually really in. W5SFW, for example, worked his stations in W8-VE3 with a simple dipole hurredly tacked to the ceiling of his home! And one of the stations he contacted was running 12 watts input on two to a ground plane!

Of course E skip on two will be like E skip on six. Sometimes only the high power boys will get through. To date, however, E skip work on two has been characterized by low power stations working low power stations. Probably because they were the only ones on the band when it happened to open.

This is all by way of suggesting that you don't need a 44 element array, 7788 converter and pair of 4X250B's to work E skip on two meters. As a matter of fact, such exotic equipment will probably only pay-off on rare occasions, since our "high-density cloud" is the freak that it is, and

(Turn to page 33)

Public Relations

by Ralph Steinberg, K6GKX
110 Argonne Avenue
Long Beach 3, Calif.

Millions of words are printed yearly, for public relations. Millions of dollars are spent for public relations. But *you*, the radio amateur, can get good results in public relations and the cost is practically nothing.

Public relations is a necessity to amateur radio as it is to big business. Every opportunity to create interest and understanding for the radio amateur must be presented to the public. Good will is the all-important factor. Proper execution and planning are the necessary fundamentals. This is best proven by a recent report of the Public Relations Committee of the ARRL. Chairman D. E. Cartwright, W8UPH, made this statement: "Good public relations for the League for amateur radio are not exactly like a 'push' button on a vending machine where a properly labeled button produces the expected results."

There are many avenues of approach to good public relations. Several tried and successful ideas are available, viz; newspapers, radio (broadcasting stations), television and associating your club or self with worthy causes of civic interest. Newspapers are always cooperative, if the story or news item is of interest to your community, state or nation. Pictures of human interest make an impressive news release. A combination of both enhance the story.

Make a call at your local newspaper and get acquainted with the editor. In large metropolitan papers there are several editors, viz; morning, evening and Sunday. Some newspapers in the metropolitan areas like Cleveland, Los Angeles and Phoenix have ham columns conducted by hams. These columnists invite your material. Harry Tummonds, W8BAH, of the Cleveland Plain Dealer has conducted the column "Ham Antenna" for three years and has done an excellent job of PR. His presentation of the radio amateur is creating better understanding to the public.

More newspapers are recognizing the value of news concerning the radio amateur and are planning such columns. Present this idea to the editor of your local newspaper. He may approve of your suggestion. If he turns you down the first time, don't have faint heart, try again. (It took Harry Tummonds awhile to get the editor sold on his column.) It would be advisable to write up some sample columns to show the editor when you present your sales "pitch". Suggest a "trial run" of several weeks to ascertain reader interest. Newspaper work pays, but it means *work*.

Radio broadcasting and television stations are always ready to assist with public service programs. Should your club or group have an unusual program planned with interest to the general public, contact the public service department of your local radio or TV station. Explain your program with full details. If the program is important to the city, state or nation, they will furnish a remote pick-up at your club rooms or tape the program for a later broadcast.

Recently, KLAC of Los Angeles, broadcast a 55-minute radio program entitled, "Story of the American Ham". This public service feature attracted many thousands of listeners and gave the public a "behind the scenes" conception of the radio amateur.

The broadcast consisted of interviews with a net control of a traffic net with background pickup of the net operation; a DXer and the Southwestern Division ARRL Director, Ray Meyers, W6MLZ. Programs like this are public relations at its best and should be promoted when the opportunity arises.

Radio and television are like newspapers in that the story or news item must be of interest to the community. Clubs or groups programing guests of city, state or national reputation should plan for radio or television coverage. If the program is one in which the public has an interest, invite them to attend. Never miss an opportunity of good will.

Public relations is valuable to the radio amateur in his association with worthy causes of civic interest. Amateur radio can assist in many categories. Mobile units or fixed stations can work as a team on Red Cross, Cancer, Polio or Heart Fund Drives. Assist in getting out the voters on election days by furnishing transportation for the aged and crippled.

There are many more opportunities in which you can offer good public relations. Boys' Clubs need instructors in training youths in electronics. The Microwave Society of Long Beach, Incorporated, of Long Beach, California, has such a program. Your contribution to the youth of your community will be your aid to juvenile decency.

Amateur radio needs continuous public relations. The public should be impressed with the good, and *not* the bad, that the radio amateur has to offer. Worthwhile deeds accomplished by radio amateurs should be brought to the attention of the public through the news media, when they occur. Each month the AREC (Amateur Radio Emergency Corps) of the ARRL reports many exciting and heroic deeds accomplished by radio amateurs. These are the stories which should be used to promote better understanding and good will. Many accomplishments never reach the newspapers because the public relations side of the story is forgotten. Clubs or groups having publicity committees should follow up these incidents in their community to get the public relations credit, due the story. Your ARRL director encourages councils, clubs and even individuals to get any and every worthwhile story to the newspapers or radio.

Public relations is an important part of any group or club and can be the success of any organization. Amateur radio clubs, new or old, should have a permanent public relations committee. It should act on all matters which would benefit both club and community, for good will. This committee can be a combination of your publicity and TVI officers and if you are fortunate to have a newspaper man in your club, add him to the committee. The public relations committee should also work hand in hand with your program committee.

Several times a year, programs should be planned which would interest the general public and they should be invited. There are many subjects for a program in which the public and the radio amateur have common interest. Invitations should also be sent to schools or colleges in your community who teach electronics. The instructors and students are excellent prospects for your club and they will carry your good will message to their homes. This is "grass roots" public relations and should not be overlooked.

Your ARRL Directors and officers continue to emphasize the importance of public relations but you and your club must use your ability to work and perfect methods to increase good will for Amateur Radio.

References:

1. Public Relations Committee Report (ARRL) QST, August 1962, Page 73.

2. Steinberg, Project Boys', QST, July 1962, Page 51.

Public Relations in Action

Oakland Storm Emergency

During the weekend of October 12th and 13th, torrential rains and gale force winds struck Northern California, resulting in a death toll of 38 along with untold injuries.

In the San Francisco Bay Area it started out as a rainstorm on Friday, October 12th. During the late afternoon and early evening hours the storm became more and more ferocious. Sewers and storm drains, normally dry at this time of the year, were soon at full capacity and began to overflow into the streets, causing many roads to become inundated. High winds blew down trees and blocked arterials. The heavy rains kept up overnight, reaching a peak during the early morning hours. Approximately 10 inches of rain fell during this period.

Oakland, with many hills in the city limits, is normally plagued by mudslides during the Winter rain season. But the mudslides triggered by such a large amount of rainfall during such a short period were beyond description. Cars were buried, houses slid

(Turn to page 26)

The Cascode Circuit

A VHF STAFF REPORT

For many years now, the "cascode" circuit has been one of the favorites of many people for use as the first RF amplifier stage in a VHF receiver.

"The gain of a pentode with the noise of a triode" is the way many folks describe its performance — and performance of this sort is deservedly popular.

But the high reputation of the cascode is now leading to attempts to use it where it was never intended to perform — and the VHF ham who fully understands the operation of this circuit is a rare bird indeed. So "cascode" since it cascaded two triodes to maybe we ought to take a long, detailed look at how it works.

A BIT OF HISTORY

The year 1944 was a long time ago. Nearly 20 years. At that time, the best-performing RF amplifier tube readily available was the 6AK5. It was a pentode, and as such had fairly high noise, but it had lower noise than other pentodes and gain far in excess of that obtainable from 1944-style triodes.

Up to around 40 or 50 Mc, the 6AK5 performed very well indeed. But our engineers and scientists were working with a new device termed RADAR, and this required tubes or circuits capable of extending low-noise performance up to much higher frequencies.

At Massachusetts Institute of Technology, the government established The Radiation Laboraory. The full sory of the Radiation Laboratory accomplishments required 15 large volumes to tell after the shooting stopped — but one of the things they did was to develop a new circuit for a low-noise VHF amplifier.

The man who invented it was a scientist named Wallman, and during the first public years of its existence the circuit was known simply as "The Wallman Circuit." However, Wallman himself preferred to call it the act like a pentode — and when TV makers grabbed it as the answer to their needs the new name became firmly attached.

The original Wallman circuit used two type 6AK5 tubes; the first was connected as a triode, with screen strapped to the plate, while the second operated as a grounded-grid pentode. Later, Wallman reported no increase in gain could be had by using a pentode in the second stage and the circuit was reduced to a pair of triodes.

In 1944, the cascode was the best circuit available for frequencies between 30 and 300 Mc.

Even in 1954, 10 years later, it was still the best circuit available at reasonable cost. The advent of TV made available large numbers of tubes especially designed for cascode service, at moderate cost.

But TV set manufacturers are always looking for ways to cut costs back. By the winter of 1957-58, many of them had abandoned the cascode as unnecessary. Instead, they were using a "neutrode" circuit consisting of a single neutralized triode. Performance was equal or better so far as noise was concerned; the pentode gain was no longer needed, with the advent of low-noise mixers and high-gain *if* strips.

Today, literally dozens of different types of circuits are available. Some use grounded-grid triodes; others are of the "neutrode" variety; the cascode is still with us; and finally, low-noise pentodes (*i.e.*, the 7788) are appearing.

Eighteen years ago, the cascode was *the* answer. Today, it is one of *many* possible answers.

WHY USE IT?

This is not to say that the cascode is obsolete. Far from it. Used properly, it is still a very good circuit for its intended purpose.

What it *is* saying is that use of the cascode circuit with tubes which were especially designed to elimate the need for the cascode is neither good design nor fully practical.

For instance, much time and energy has been expended in trying to use Nuvistors in the cascode configuration. Why? A Nuvistor is designed primarily for use as a "neutrode" amplifier and hooked up this way will outperform almost all conventional cascodes. The same qualities which make this possible

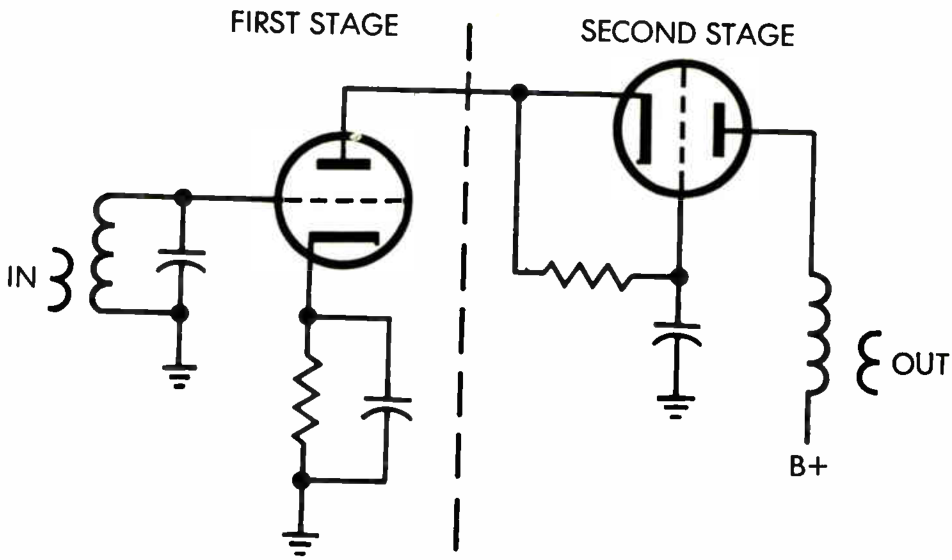

FIGURE 1. Typical basic circuit of cascode ampliifer showing division into "stages" discussed in text. Parts values depend on tubes and frequency. Typical cathode resistor is 68 ohms; bypasses usually .001 mF; second-stage grid resistor usually 470K.

also make it almost impossible to obtain fully satisfactory performance from Nuvistors in cascode.

Or take the 7788. Here is a pentode with lower noise than most triodes. Does it make any sense at all to change it to a triode by strapping grids, then add another tube to get back the gain of a pentode?

To see where the cascode is best used, and why, let's take a detailed look at how it works.

CASCODE CIRCUIT ANALYSIS

Operation of the cascode is best explained by separating it into two stages (one for each tube section) and examining each individually.

The first stage (Figure 1) is a conventional grounded-cathode amplifier. As such, the first thought most people have is that it *should* oscillate wildly since it is an unneutralized triode.

However, feedback theory tells us that, in order for a stage to oscillate, the feedback voltage *must* be greater than the stage losses.

Let's take an arbitrary signal of 1 volt at the grid of the stage. The amplified output voltage at the plate (by standard amplifier theory) will be equal to the tube's amplification factor, times the input voltage, times the ratio of load resistance (in ohms) to the sum of load resistance and plate resistance.

Typical amplification factor of a cascode-designed tube is in the neighborhood of 40. Plate resistance may be in the range of 5,000 ohms or higher. But the load resistance is the input impedance of the second, grounded-grid stage! And this input impedance, like all grounded-grid stages, is very low. Almost always it is lower than 500 ohms, and sometimes as low as 100.

Let's plug these figures in: the equation comes out 40 (amplification factor) times 1 (input votlage) times 500/5500 (ratio of Rl to Rp plus Rl) and this all multiplies out to an output voltage of 2.86 volts.

Now let's look at the feedback path. Feedback in a triode occurs through a built-in capacitive voltage divider made up of the grid-plate capacity and the grid-cathode capacity. Normally the grid-cathode capacity is several times greater than that from grid to plate, so that only a fraction of the output voltage appears at the grid.

Specifically, in a cascode-designed tube, only one-fourth or less of the output voltage appears. Usually, it's much less.

So, going back to our figures, one-fourth of 2.86 volts can appear at the grid when 1 volt is originally fed in. This is a feedback voltage of 0.715 volts, which is less than the original input. Feedback is less than the stage loss, and the circuit cannot oscillate.

Now let's see how we can get the gain of a pentode, after proving that the gain of the first stage is almost always less than 4 and frequently even less than 1.

This *can* be proved mathematically — but it takes many columns of algebra to do it and the result is hardy worth the effort.

The way it works out is this: the gain of two amplifier stages in cascade is equal to the product of the gain of the first stage times the gain of the second.

The gain of the first stage, mathematically, is the standard equation for the gain of a grounded-cathode amplifier. The gain of the second stage, taken the same way, is the equation for the gain of a grounded-grid amplifier.

So the gain of a cascode *must* be equal to the product of these two equations.

And after all the algebra, you come out with a most complex-looking equation (Figure 2). But if (and this is almost always the case) the two tubes are similar in characteristics, and if the plate resistance of the first stage is large compared to the input impedance of the second, this complex-looking equation reduces to a much simpler form: gain is equal to transconductance of the first stage times the load resistance of the second.

And *this* is identical to the equation for the gain of a pentode!

Note that *all* of this theory is based on the idea that the second stage is a true grounded-grid stage. In the modern version of the cascode circuit, this stage is actually at fairly high DC potential but is grounded for RF through a capacitor.

TROUBLES WITH THE CASCODE

If, for any reason, the second-stage grid is *not* completely grounded for the signal, all sorts of troubles can develop.

For one thing, if the grid is not grounded the input impedance of this stage can rise — and as it rises it can cause the first stage to approach the conditions for oscillation.

Before actual oscillation breaks out, regeneration will take place. The effect of regeneration will be to produce a high noise level, counteracting the effects of the stage.

Such an effect has been discovered in at least one commercial version of the cascode circuit. If your cascode amplifier seems to have too much noise, check that second-stage grid!

Some tubes, used in the cascode arrangement, have a strong tendency to overload. Others perform even better in cascode than they do in other circuits. This is one of the reasons we recommend that you use *only* cascode-designed tubes in the cascode circuit.

Several manufacturer's references show the second-stage grid clamped to a definite DC voltage through a divider network (Figure 3). This, with *some* tubes, enhances AVC

$$\text{GAIN}_{\text{CASCODE}} = \frac{\mu_1 \times R_{L_2}}{R_{P_1} + \dfrac{R_{P_2} + R_{L_2}}{\mu_2 + 2}}$$

WHERE μ_1 = FIRST-STAGE AMPLIFICATION FACTOR
R_{P_1} = FIRST-STAGE PLATE RESISTANCE
μ_2 = SECOND-STAGE AMPLIFICATION FACTOR
R_{P_2} = SECOND-STAGE PLATE RESISTANCE
R_{L_2} = SECOND-STAGE LOAD RESISTANCE

FIGURE 2. Accurate equation for gain of a cascode amplifier. Usually, most of this can be eliminated and equation reduces to: gain equals product of first-stage transconductance (in mhos) and second-stage load resistance/impedance (in ohms). Reduced equation is identical to equation for gain of a pentode.

action and makes the stage act like a remote-cutoff tube. With other tubes, it causes the cathode-filament voltage, rating to be exceeded at times and this in urn causes the tube to short out. The only recommendation we can make is to be cautious when trying it!

At one time it was all the rage to cascade two cascodes for extra gain. This is useless. *One* cascode will give you all the performance you can use. A pentode in the next stage of the amplifier will equal the gain and will not be so easy to overload.

Note that we have not mentioned the "neutralizing" adjustment usually found in cascode circuits. At 50 Mc, this adjustment is not needed and is actually a hindrance since it can easily be *mis*adjusted to produce regeneration. At 144 Mc and above, it may or may not be needed. Its purpose is to cancel out whatever feedback remains in the first tube, thus reducing regeneration and resulting noise to the lowest possible level. Its value should be such that it resonates at operating frequency with the grid-plate capacitance of the tube.

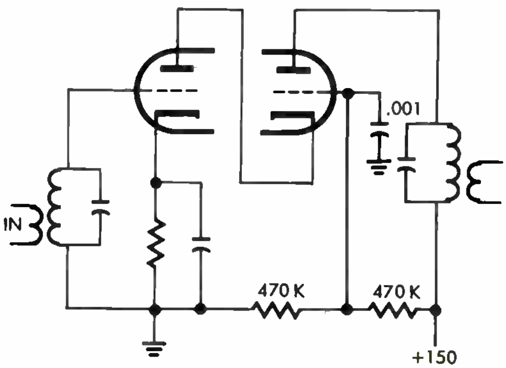

FIGURE 3. Clamped-grid cascode circuit. See text.

Noise Measurement . . . from page 7

and it can be bought, borrowed, or built. The system for measuring with the pad is diagrammed in figure 3.

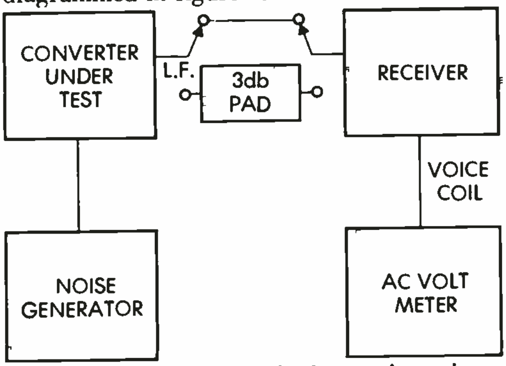

FIGURE 3. 3-db-pad method of measuring noise. Text explains how to use it; this method is far more accurate than usual gain-control calibration technique.

First, a reading is taken from the speaker terminals of the receiver under test with the AVC off, BFO off, ANL off, Audio full on, and RF adjusted to give a suitable meter reading. The meter reading is noted. No controls on the receiver are disturbed. The 3 db pad is inserted in the *if* line from the converter to the receiver. The noise generator filament voltage is switched on and increased until the reference meter yields the same reading. By this method, we have increased the noise power 3 db with a somewhat greater degree of certainty. If the receiver happened to be non-linear, this error has been nullified by bringing the noise into the receiver to ex- the same noise generator into a BC-348.

The 3 db pad method has been tried on all the converters here at W4TLV and compared with the usual 3 db meter increase method. Results are very similar with a 51J-4 receiver. The same converters have been checked with the same noise generator into a BC-348.

The 348 using the 3 db meter increase method will make any converter constructor smile. *All readings are 1 to 1.5 db better than they should be.* The same BC-348 using the 3 db pad method gives figures almost identical to the 51J-4. Apparently, nonlinerity somewhere in the 348 is causing an actual increase of 3 db to appear larger and consequently give optimistic noise figures. From this limited amount of checking, it would appear that the 3 db pad method will give more standard readings with a variety of receivers than the 3 db meter increase method.

To yield maximum accuracy, the noise test should be made a number of times, 15 or 20 not being an unreasonably large amount. Even with the 3 db pad method, the ballistics of the meter still makes it a chore to say exactly when the *same* reading is obtained. When roughly adjusting a new converter, tremendous accurary is not required. But when you've worried the noise down about as far as you can get it, it is comforting if some source of sufficient accurary is available to let you know you are close to the noise figure the "book" says you should get.

It should be mentioned that everybody, including the Bureau of Standards, has trouble with noise figure readings. If we amateurs can get reproduceable results within plus or minus 1 db, we're doing all right. With extreme care, even better readings can be obtained.

There are two important points which have not yet been mentioned, but can play a major part in our success or lack of it. In all the discussion it has been assumed that the image frequency from the converter is sufficiently attenuated to be of no consequence in the noise figure reading. According to available information if the image frequency is attenuated at least 10 db, the effect upon noise figure will be negligible. Any decent amateur converter should be far better than this. Another point worthy of mention is the assumption that the line from the converter to the receiver is "flat". A low VSWR becomes necessary here in order for us to expect the 3 db pad to actually attenuate 3 db.

If abnormally high or low noise figure readings are obtained and the receiver input impedence seems to be the culprit, a small 2 resistor 6 db termination could be used right at the antenna jack to make the run of coax from the converter to the receiver look purely resistive. The 6 db termination can be left in the circuit at all times if the converter possesses sufficient gain.

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VITAL HAPPENINGS & FACTS

OPERATING AND DX NEWS

PRELIMINARY RESULTS— 50 MC SCATTER TESTS

In the November issue of VHF we announced a series of test transmissions from W5KHT on 50.085 megacycles. As this is written the bugs are still being worked out of the new antenna system, which makes these tests seem worthwhile. The antenna system, consisting of 24 elements tuned to 50.1 megacycles, went into actual operation at 8 PM on Sunday, October 28, a week behind schedule. As luck would have it a visitor at the shack the evening the antenna was fired up turned out to be Ed Pick, WφBBM, from up St. Louis way.

Ed's the master of large complex six meter scatter arrays, in our book, and was the author of our 50 megacycle scatter antenna article in the October issue. With Ed watching the S meter and setting the levels we fired up over the 110-mile path to W5-AVV in north central Texas. Another VHF writer, Jim Speck, W5PPE, was operating the W5AVV rig that evening, and between Ed, Jim, and Bob (5KHT) the trio decided the new antenna had the kind of characteristics that made all of the effort worthwhile.

Gain over a six element yagi (on a 24 foot boom) mounted 62 feet above ground varied from no less than 10 db to no more than 15 db, depending on the point in a fade that the switch was made. This, and later tests, indicate that the 24 element array at W5KHT has from 22 to 27 db gain over a tuned reference dipole. VSWR is under 1.3 to 1 at the chosen frequency, 50.100.

The 24-element beam has unusually close spacing, but this will be detailed in a later report. It tilts from horizon (0 degrees) to 90 degrees (straight over head—great for tracking 707's). The tilt is designed to allow us to pick the proper elevation angle for any given scatter or skip path. The 'kinks' in the antenna system to date have all been electrical; all with the tilt array.

None the less the tests began on November 4th, Sunday. First transmission was made on the advanced-notice (November VHF, page 1) 0845-1955 CST period, beaming 120 degrees. This is approximately on Tampa, Florida from Oklahoma City. First report to come in, on the first transmission, came from Jack, K4OCK, Miami. Jack wrote "listened for scatter signal for the first time, Sunday the 4th. Copied 50% of the time with an average signal 1-2 db above the noise. There were a dozen bursts (meteor) with your CQ and call clearly identifiable and with a peak signal of S2. Some bursts would last as long as 3/5 seconds. Also heard you on backscatter, or off the back of the beam, during your 0910-0920 test period (we were beaming WNW or 290 degrees at the time) with call and CQ clearly identified."

Jack is putting a KW on also, CW, and he expects to hold two-way skeds with W5KHT soon.

Other early results indicate the 50 megacycle scatter tests are being well received throughout the country. We'll tell you a secret. Up through mid-November, the tilt on the array was stuck on 8 degrees above the horizon. That makes short range ionospheric scatter (500-900 miles) favored. Long haul tropo (200-500 miles) and long range ionospheric scatter (900 miles up) were at a distinct disadvantage. The power level measured at the phasing harness where the signal split to each of the four antennas in the 24 element array has been 475 watts. Not up to our 750 watts we expected to push up the line.

However, the bugs have now been worked out of the system, and a new schedule is now in effect. The tilt is *now* being varied from transmission to transmission. Individual two-way schedules are also now invited, although we ask that you observe our signal on at least four occasions before requesting a sked, and have at least 400 watts output feeding a 6 element or larger array, mounted well into the clear. We are anxious for schedules during the January

League contest, so keep us in mind for our Oklahoma multiplier!

Sundays

0800-0810 CST	NE	(045 degrees)
0820-0830 CST	ENE	(075 degrees)
0845-0855 CST	ESE	(120 degrees)
0910-0920 CST	WNW	(290 degrees)
0930-0940 CST	WSW	(250 degrees)
1000-1010 CST	W	(270 degrees)

Tuesdays - Thursdays

1900-1910 CST	NE	(045 degrees)
1920-1930 CST	ESE	(120 degrees)

50 Mc news leads off this month. K9DTB, Villa Park, Illinois, is searching for skeds on 50 megacycle SSB or CW to prove the reliability of his system. Phil has SSB on both two and six and hangs out on 50.110 on 6 SSB. The rig on six is a 20A mixing to a 4X150A.

W7UFB is interested in trying his hand at CW scatter schedules from Casper, Wyoming. Bob writes . . . "it is very interesting to sit out here in the center of this expanse of near *un*occupied land wih little or no VHF activity. Especially interesting are comments on the distances reached from relatively small mountains. This, of course, emphatically points out the advantages of a large band occupancy in the 500 mile circle that seems to be the 'with no difficulty' working range.

"Over a period of years I have run numerous tests with W7VTB and W7VDZ in Casper, and K7HKD in Cheyenne, using a 60-watt mobile and a 3 or 5 element wide spaced portable beam (Ed's note: We've all heard you numerous times, Bob, on E-skip during the summer months while you were touring the western expanses). Many of these tests originated from 8,000 to 10,000 foot peaks. Sometimes the results were startling, especially to K7HKD who runs a KW, but more often the successful range was something less than spectacular. Often areas in the clear, with rolling plains country of 400-500 feet relief have netted us rewarding results."

Bob's home station runs 600 watts AM to a 5-element Telrex at 70 feet. The beam feeds a highly modified Tecraft converter and a 75A-3. Bob has intentions to stack a pair of 5's. One of his frequencies is 50.080 megacycles if you would like to give it a try. He's available any evening except Wednesday and Saturday and Sunday mornings.

One of the Columbus, Ohio, gang, K8SCM, John, writes of an extended tropo opening on six that had the boys along the Great Lakes hopping the evening of November 11th and on into the wee hours of the 12th. Among the participants John reports were W3UEJ (Washington, Pa.), K8ZWX (Newark, Ohio), K8CZK (Columbus), W8APD (Columbus), K8VED (Columbus), K8VGL (Convoy, Ohio), K4KFO (Ft. Thomas, Ky.) and K9HMB (Winnetka, Illinois). Everyone worked everyone else including W3UEJ to K9HMB (425 miles) except K4KFO and K9MHB. All operation was on SSB and John—SCM—notes that the exchange was mighty pleasant what with everyone VOX operating. Power levels ranged from SCM's 75 watts and 4 element twirler to UEJ's 2 KW PEP. It all shows to go you what a little suds on SSB and some alert operating will do for an otherwise dull November evening on six.

Some off-season sporadic E openings over the east, midwest and southeast on November 6th, and the weekend of November 16-18 kept many of the boys going, from W8 land south to Miami and the Carolinas west to the Rockies. Most report Saturday the 17th was the big day with the band open early in the morning and then spotty throughout most of the day with the band finally folding around 8 PM CST. Nearly 12 hours of on-and-off-again DX was reported by several of the crew.

Reporter SFW out in Amarillo, Texas, reports the 50 Mc band has been in the doldrums in the Texas panhandle. So he's been putting his efforts into a new sideband station for the coming season. Phil will be dumping near the limit into a 6N2 Thunderbolt before long on 50 SSB. He reports an opening into Mexico City on October 22 when Tad, XE10E popped through. Phil also sat in on the openings into California, Arizona and Nevada back on October 6.

K5CFT in Sunray, Texas, is working on one of the new Heathkit six meter rigs. This will be number 3 on SSB from the Texas panhandle.

Old timer (on six) George, W6OKR, Larkspur, California, (north of San Francisco) is plugging for some scatter boys to give RTTY a chance. George says he'd be willing to get back on Saturday and Sunday mornings if someone with scatter range would give it a try with him. George lost his five element tried-and-true beam which *used* to sit 120 feet above ground in a redwood tree, during the big storm that hit the west coast. George would also like to see the 50 megacycle WAS listings revived here since QST ceased to run them every month. So would we George—even so far as to list all with 45 or more (since anything less than 45 is about 2 months work during recent summers) state workers. What do the rest of the fellows think?

Two new SSB stations are active in Kansas. WAϕCKD is operating from Baxter Springs, and KϕYZZ is active in Prairie Village, Kansas, with 100 watts PEP to an 829B. This should make Kansas SSB contacts somewhat easier when the Es is in.

WϕBCE in Kansas City is putting a 10B and 6146 on SSB. He was expected on around December 1. WϕKMV in K.C. has a new phasing rig in the mill.

WϕEPD in Kansas City reports some E skip into Utah and Nevada during the first part of November and on the 17th Florida and Alabama popped through in the evening.

W5KHT reports Es into Ohio, West Virginia, and Tennessee, on the evening of November 20 between 1930 and 2100 CST. "Signals were very weak, less than 10 db signal to noise in most cases, and suspect that without the 24 element array I wouldn't have heard a thing." Most stations worked commented he was the only station coming through on Es.

Iowa stations are at last being worked in Kansas and central Missouri according to WϕEPD. KϕYYM at Fort Madison, Iowa has been worked by several of the boys.

KϕKZC, also of the Kansas City area, is looking for Oklahoma contacts on six. He's only on AM at present but expects to be sidebanding it soon. KZC was portable 7 in Cheyenne, Wyoming November 22-23.

KϕLSP, Columbus and WϕGIP, Independence, in Kansas have been putting good signals north into northern Kansas and central Missouri of late, reports WϕKMV. KMV also notes he heard what appeared to be a broadcast station harmonic on approximately 49.990 on November 13. The signal had typical skip QSB and lasted 15 minutes, peaking east. Considerable meteor scatter wih bursts lasting up to 45 seconds were also noted on the 12th and 13th.

144 Mc news is all of building and minor meteor showers this month. KϕHLC in Hutchinson, Kansas, reports he has a 4CZ250-B in a coaxial cavity feeding an array of ten element yagis 60 feet above ground. Roy uses a homebrew converter to get his HT-37 up to 144 Mc. He reports on some recent work with the new AMECO Nuvistor two meter converter. "Several of these units ave been thoroughly gone over," he notes, "with lab test gear and the results are just short of fantastic. The noise figure will make you recalibrate the noise generator and *then* you will not believe what you read. I won't quote noise figures, but if one of these units is properly adjusted, it will run rings around the best of the 417A rigs, using premium 417A tubes."

Look for him on SSB or CW on two when the band is hot into Hutchinson and environs, Kansas (environs is just up the road from Hutchinson).

W4HHK, Collierville, Tennessee, reports that the grape vine trough W4HJO (Glendale, Kentucky) has it that Shelby, W4WNH in Elizabethtown, Kentucky worked K7HKD in Wyoming on November 17 via meteor bursts. This year's results via 144 and meteor propagation have been far more productive than past years, according to the best of records. All of which proves you never know until you try.

K4ZAD in Lynchburg, Virginia, completed a tone dialing sysem for his two meter FM link recently and added a 6CW4 preamplifier. He would like to see more information in print on wide band FM activities and techniques.

WA2EMA, who hangs out on 144.004 Mc, continues his skeds with K4IXC down Florida way. Bill is running 1 kilowatt input to a pair of 4X250B's with a 417A converter into a Collins *if* strip. The antenna is a 15 over 15 array at 70 feet. He reports he is busy with a new 104 element array(!) and is looking forward to working with ECHO II. He also plans to get in on the 144 Mc moonbounce experiments as soon as the new array is up and perking.

Shelby, W4WNH, reports on his results with the Giacobinids meteor shower early in October. Those who expected it to peak October 10 were disappointed, says Shelby. He had skeds with K7HKD in Wyoming and K5TQP in New Mexico on this one. Several strong pings were heard on HKD's frequency.

Other schedules held October 20, 21, 22 during the Orionids shower with K7IDD in Utah produced no results. On Sunday morning, 21st, Shelby heard several bursts from a station on 144.061. He suspects this was

(Turn to page 30)

Never . . . page 12

cable. Before coming back down, the XYL tests the thing, and lo and behold, it works, but still no indicator.

Having a brainstorm, I confiscate the XYLs' mirror, which is about three feet long by one and a half feet wide. I put this in the window well and now I have an indicator. Of course, everything is backwards, but it only takes about an hour to get used to pressing the switch one way and seeing the beam go the other.

At 1030 I manage to work Iowa, with KOKZC right behind me. By this time he is six or eight contacts ahead of me and the fight is on to regain the lost points. (Next year I'll use a halo.)

1300 and the voice is getting weak. Sure wish I hadn't sold the tape recorder I used last year with a continous tape to call CQ.

I have managed to catch up to Bill by this time, and now it is every man for himself. We are running neck and neck, same points, same everything.

Just before dark I have to put a light up on the tower so I can see the beam. Also I have to clear the snow off the mirror quite a few times.

Nearing the end, 2330 finds me one contact ahead of Bill. We never did figure out where that extra contact came in, but a check and recheck of the log showed no repeats. There was one moment of heart failure. Bill almost worked a Texan, but he didn't come back. How sad.

The XYL was probably as tired as I was after the contest. What with bringing food, coffee, helping with the rotator, and frequent hollers down the steps to see "how it was going" she should get the certificate. All this help and it still doesn't count as a multiple operator station!

Well, I manage to win it for the third year in a row. Bill had 164 contacts and I had 165 in four sections. Never again. (Until next year.)

Storm . . . page 18

down hills and disappeared, and two small children were even buried alive.

On Saturday morning, October 13th, the low lying areas began to flood quite severely due to the enormous amounts of water flowing down from the hills. This was further complicated by high tides. Many telephone lines were down and over 20,000 telephones were out of service. At 0830 WA6BZA went on standby on the Southern Alameda County Emergency Net frequency. By 0930 the area around WA6BZA's QTH began flooding and he set up a PA system to help direct traffic and evacuees. At 1025 the Southern Alameda County Emergency Net was alerted and called to order by WA6GRO, the NCS. WA6BZA acted as a clearinghouse for emergency traffic coming in from the Oakland Auxiliary Police CD station which was operated by WA6EQP. WA6BZA also relayed traffic to WA6GRO, SACEN NCS and to the Red Cross station, W6OT, operated by the Oakland Radio Club, and to K6DOQ.

CD authorities informed SACEN that Oakland and Montclair were the hardest hit areas. The CD then declared two Jr. high schools, Havenscourt and Frick, as evacuation centers. WA6GRO immediately dispatched two SACEN cars to Havenscourt Jr. High. These cars were on the scene and assisting the evacuation of threatened homes even before the CD and Red Cross arrived.

Using a car and a boat, Jim Carter, K6LWA, singlehandedly evacuated 15 families from a stricken area not far from his home, which was also threatened.

As the seriousness of the situation increased the Oakland City council met and declared Oakland a disaster area. A state of emergency was proclaimed. At 1359 Captain Riddell of the Oakland Auxiliary Police called WA6BZA and informed him that all SACEN members had been deputized by Police Chief Toothman. He also conveyed his and Chief Toothman's thanks to the amateurs for their assistance.

By this time WA6NCD, WA6KOS, WA6LYR and WA6EJA had been dispatched to Havenscourt Jr. High. WA6VXP and WA6JTY were dispatched to Frick Jr. High WA6EJA, a chiropractor, closed his office so as to be able to give his full assistance to the disaster.

At 1541 two cars were dispatched to 66th and Spencer to pick up people from boats. At 1551 more evacuees were brought in by K6LWA. 1600: two cars were dispatched to 77th Ave. and E. 14th Sts. by WA6EQP. At 1635 two boats were dispatched to 76th Ave. and E. 14th Sts. At 1614 an emergency notice had gone out that the Broadway Tunnel was closed due to slides and flooding. Warren Freeway and Mt. Diablo Blvd. were closed for the same reasons with reports of cars trapped in the mudslides. All highways leading into Oakland were impassable and people from the outlying areas were warned to stay away.

A report came in that Cull Canyon Dam was very weak and in danger of bursting. 16 families were evacuated from the danger zone.

McChesney Jr. High was opened as an evacuation center and Oakland Hi was put on standby. WA6VQF and WA6JTY were then dispatched to Oakland Hi.

WA6UJT got stuck in the mud, during rescue operations but was pulled out by WA6VXP.

WA6NCD and WA6LYR were routed around to various schools to help with the evacuation. Several cars were assigned to follow CD trucks around to provide them with emergency radio communications. WA6KOS was very prominent in the disaster and seemed to be everywhere at once, according to Clyde, WA6BZA.

At 1723, Police Chief Toothman proclaimed that all SACEN members who had Red Cross armbands now have full police authority. 1730, a truck arrived at CD operations center with 40 cots and blankets for the evacuees. 1820: WA6GRO turned SACEN NC over to W6OT. 1834 WA6MBT assisted in bringing 5 more evacuees into Frick Jr. High. 1855: K6LWA brought in more evacuees. 1910: a lost family of 5 was located and brought in. 1946: WA6EQP sent out word that all SACEN members would be served hot food and coffee by CD at the operations center. 2300: K6DOQ took over as SACEN NCS and held it until the emergency was declared over at 0500, Sunday, October 14th. K6PKW and K6LYR also stood by all nite. K6ZOA also checked in for a few hours during the night.

Those taking part during the emergency were: WA6BZA, K6LWA, WA6MDI, WA6UJT, WA6LIX, WA6GRO, WA6EJA, WA6KOS, W6OTV, WA6VQF, WA6NCD, K6PKW, WA6EQP, WA6VXP, K6DOQ, WA6JTY, WA6GPB, WA6YLR, K6ZOA and W6OT.

Our hats off to all for a job well done!

Parts Lists

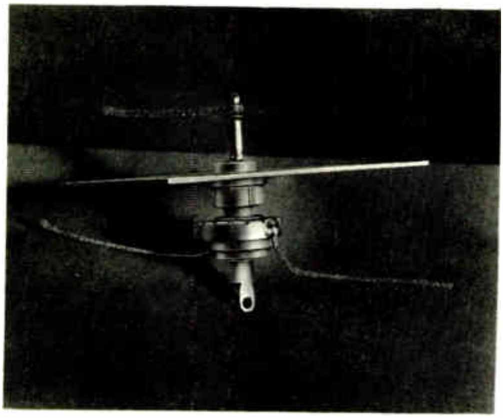
NOISE GENERATOR (Page 4)

C1 thru C3 .001 mF bypass capacitors, feed-thru (Centralab MFT-1000)
C4, C5 .001 mF standoff ceramic capacitors (Erie 325-102)
C6, C7 10 mF, 250WVDC electrolytic
R1 750 ohm 25 watt rheostat (see text)
R2 100 ohms 1 watt
R3 470 ohms 1 watt
R4 50 ohms noninductive (see text)
T1 115VAC to 5VAC C.T. filament transformer, 2 amps
T2 small 1:1 isolation transformer
RFC1 29 turns No. 24 enamel bifilar wound in 2 layers on ¼-inch form, 11/16-inch winding length
M1 0-5 or 0-10 mA meter (see text)
M2 100-mA silicon rectifier
J1 Coaxial fitting to suit your needs
V1 Sylvania type 5722
S1 SPST toggle switch

432 Mc TRANSMITTER (Page 8)

C1, C2 40 mF, 250 WVDC electrolytic
C3, C4, C7, C8 .001 mF disc ceramic
C5 25 pF variable
C6 .001 mF 2KV ceramic buffer
R1 50 ohms 1 watt
R2 3.3K ohms 4 watts
R3 10K 2 watts, variable
R4 25K 4 watts
R5 100 ohms ½ watt
R6 2 ohms 10 watts variable
V1 OA2
V2 4X150A
T1 115VAC to 6.3VAC fil. xfmr, 1 amp.
T2 same as T1 except 4 amps.
L1 2 turns No. 16 tinned, in center of L2
L2 4 turns No. 16, 5/8-inch diameter
L3 20 H, 80 mA filter choke
RFC1, RFC2 Ohmite Z-420 or J. W. Miller RFC-420
CR1, CR2 400 PIV silicon diodes, any type

VHF Showcase



SOCKETS FOR GL-6299

If you've been planning to build a low noise converter around the fantastic new G-E type GL-6299 ceramic planar triode but have been stymied for lack of a socket, *Community Engineering Corp.*, 234 East College Avenue, State College, Pa., has good news for you.

They have come out with not one but two sockets designed especially for the 6299. One, the GG-9, is for grounded-grid service up to 1200 Mc. The other, for grounded-cathode service, is model CM-9.

Both sockets feature heavy silverplating over machined brass contact assemblies, and air-insulation throughout. Chassis mounting is in an 0.312 inch hole.

Write the manufacturer for prices and full data.

NEW TECHNICAL BOOKLIST

A 40-page catalog listing more than 200 currently available books published by *Howard W. Sams & Co., Inc.* is available from Sams.

Subjects range from TV, radio, and audio through ham radio to computers and other advanced circuitry. A 2-page Subject Index allows quick location of the fields which interest you.

To get your free copy, write to Technical Book Divisions, Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis 6, Ind.

"DARK-HEATER" VERSION OF THE 6146

A "dark-heater" version of the 6146, a first of its kind, has been announced by the *RCA Electron Tube Division*, Harrison, N. J.

Designated as type RCA-8032, the new tube has operating characteristics similar to the 6146. Filament voltage is 13.5, either AC or DC. The heater is designed especially for mobile use.

RCA engineers say the "dark-heater" design offers a number of advantages, including longer tube life and reduced heater-cathode leakage.

For a technical bulletin on the 8032, write Commercial Engineering, RCA Electron Tube Division, Harrison, N. J. Tell them we sent you.

CONVERTERS FOR SIX AND TWO

A pair of converters featuring 6 and 2 meter coverage (one band per converter) with 7-Mc output has been announced by *Lafayette Radio*, 111 Jericho Turnpike, Syosset, Long Island, N. Y.

Both units claim better than 1 microvolt sensitivity. The 50-Mc unit, model HE-56, is rated at 0.6 microvolt at 50 Mc and 0.8 microvolt at 54 Mc. The 144-Mc converter, HE-71, has 0.2 microvolt sensitivity at 144 Mc and 0.7 microvolt at 148.

Both units include inbuilt power supplies. Price of the HE-56 is $29.95 and the HE-71 is $31.95. For complete specifications, write Stan Isaacs at Lafayette.

COMING IN FEBRUARY'S VHF . . .

- **A TRULY LOW-NOISE 432 MC CONVERTER**

  You can build this four-tube converter in one evening and have the hottest thing going on 432. Uses a pair of RCA's new 8058 grounded-grid Nuvistors.

- **QSO SHOWBOAT**

  Ever wonder what the VHF bands were like way back when? Staff Historian W5CA/W7ZC tells about it. We've come a long way technically in 22 years—and lost a lot in other areas.

- **PUTING THE AM-33/ART ON SIX AND TWO**

  This unit is around in considerable quantity. Avid homebrewer K5ZND tells how he made his turn out 500 watts of RF on Six and a little less on Two.

- **EVALUATING THE R-449 RECEIVER**

  Research Consultant W6NLZ takes a detailed look at this surplus unit. Recommendations, and how to use them.

- **PLUS ALL THE USUAL DEPARTMENTS . . .**

  Staff report, Construction Box, Showcase, DX and Operating News, VHF-TVI, Lab Report. All these, and many more features too good to talk about now, will be in the February VHF!

HAVE YOU SUBSCRIBED YET? DO IT NOW!

DEAR VHF:

Below are a few of the VHF-UHF operators active in my area. I am anxious to have VHF's files top the 31,000 mark of known VHF-UHF'ers in the United States and Canada. Please see that the following receive a copy of VHF as a sample soon.

NOTE—Mail this to VHF, P. O. Box 1557, Oklahoma City 1, Oklahoma. We'll do the rest!)

REACTANCE SLIDE RULE AGAIN

The famed Shure Reactance Slide Rule—more than 300,000 have been distributed since 1943—is once again available from *Shure Brothers, Inc.*, 222 Hartrey Avenue, Evanston, Illinois.

The rule solves problems involving resonant frequency, capacitive reactance, inductive reactance, coil Q, and dissipation factor, over the frequency range from 5 CPS to 10 kMc.

Price of the rule is $1, complete with detailed instructions and sample problems. Write Sales Department, at Shure, and tell them where you saw this.

SAFE INSULATION STRIPPER

A wire-stripper which removes formvar, teflon, nylon, and almost any other type of insulation from wires quickly and safely—without any chance of nicking the wire—has been announced by *Sentry Electronics, Inc.*, 707 S. Okfuskee, Wewoka 1, Okla.

The new stripper looks something like a soldering gun; it contains a patented heat tip which melts the insulation off and at the same time anneals the wire to make it stronger at the eventual joint. Price of the hand model, type W-1, is $11.95 postpaid. A bench model, W-2, is available for $19.95. Full specifications and data are available from sales manager Ed Neugass. Tell him we sent you.

TEFLON TERMINAL

A new "Press-Fit" terminal providing connections for three leads has been announced by *Sealectro Corporation*, 139 Hoyt Street, Mamaroneck, N. Y.

Designed for use in metal chassis from .040 to .060 inch thick, the new ST-4500 standoff insulator extends .293 inch above the Teflon body. Installation is permanent.

For full data, write the manufacturer.

WϕAZT. During the same time period he heard snatches of signal on 144.151. W5FYZ in Minden, Louisiana is suspected as being the culprit. From 0630-0700 EST Shelby heard someone on 144.185 calling WϕEYE. Possibly backscatter, says Shelby. He caught several pings on the frequency of WϕJAS. On the 22nd he heard pings and bursts from WϕEYE up until around 0630 EST.

Shelby is interested in getting some New England stations to sked him for future showers. Anyone up there want to work Kentucky?

K5CYK in Amarillo is on two now with 400 watts. Anyone interested in working John? (Point over towards Oak City now and then John . . . we'd like to give it a try!)

WA2ONO reports WA2PZE is working on a 4 bay Helix for a try at trans-oceanic moonbounce on 144. Pete also reports good tropo down the coast to Virginia and associated states October 8-20. And, in closing, he notes that WA2LJT was fortunate enough to snag Illinois on 144 during that period.

W5KHT and W5HCX worked some tropo DX, as did a number of others, during the period October 8-9-10. The evening of October 8th Russ and Coop worked Paul W4HHK, two way two meter SSB for Paul's first SSB DX. He had just finished his new two meter SSB rig, which he sets down on 144.200. On the 9th Mississippi (Rex-5RCI), Kansas, Louisiana, Missouri, Texas and others were worked. The W5KHT two-meter frequency (SSB or CW) is approximately 144.104. Power is 1 KW SSB to either a 16 element colinear 70 feet or a 38 element Telrex Spiral-Ray yagi, 60 feet.

K9DTB in Villa Park, Illinois is on SSB on two with around 150 watts. He hangs out on 145.030 and has a sked with Bob, K9EID, from 1015-1100 CST on Sunday. USB.

220 and up

No news of 220 this month; 432 seems to be hogging the limelight. Another report from W5AJG in Dallas tells us that he has been running daily skeds on 432 plus just enough to get out from under QRM (gads! These Texans!) with K5JHG at Atlanta, Texas. Leroy also reports that he, JHG, and a couple of others in the Dallas area are using ARC-27 RF decks as transmitters and drivers for higher-power rigs (when they're legal). "A 522 or ARC5 with about 5 to 7 watts will drive one of these gadgets and bring it out to about 20 watts output," reports Leroy.

On the upper region, Leroy also reports that W5HTZ, Merlin, from Wewoka, Okla., has succeeded in putting his UPX-4 on the air on 1296! So far as we have been able to learn, this is one of the first if not *the* first to be successfully used. Merlin is running 600 watts to his. W4HHK advises that he has heard that a W6 has been running a UPX-4 with 1000 watts in and 300 out. For the uninitiated, the UPX-4 is a "ring amplifier" using six 2C39A's in a single cavity; it's about the only hope of high power on 1296 without a klystron.

Leroy sent along Merlin's full modification data; it's too long for this issue but will be published in these pages next month.

VHF ASSUMES 'TECHNICIAN' MAILING LIST

Effective with this issue of VHF Horizons, Horizons Publications, Inc. has assumed responsibility for mailing the portion of any uncompleted subscriptions to the monthly magazine "The Technician" to the "Technician" subscribers.

In as much as the subscription rate of the "Technician" was $2.00 per year, and VHF Horizons is $4.00 per year, all "Technician" subscribers will receive 1 copy (issue) of VHF for every remaining two issues of their "Technician" subscription.

Present subscribers to VHF who were also "Technician" subscribers will receive an extension on their VHF subscription.

Horizons agreed to take over the mailing list of the "Technician" in November when that publication ceased printing. There was no exchange of funds from the "Technician" to Horizons. The action by Horizons was prompted by an appeal from the Editor and Publisher of "Technician".

Horizons Publications, Inc.

VHF Lab Reports

THE PARKS ELECTRONICS SIX METER CONVERTER

Last month VHF's research staff ran through the merits of the *Parks Electronics Laboratory* (Route 2, Box 35, Beaverton, Oregon) two-meter converter. We found the unit to be an exceptional buy at $54.95 and were quick to pass this information along to the VHF gang who we feel are equally quick to snap up a product that does everything the manufacturer claims, especially when the claims leave very little to be desired!

The six-meter unit is equally impressive. One of the most impressive items about the six meter unit is its price tag: $34.50 with crystal. And power supply. And 6U8A. And 6CW4. With everything you need but the antenna and receiver!

We first saw the Model 50-1 Nuvistor converter that Loren Parks (K7AAD) has, out in Portland at the ARRL National meet. We spent a few hours listening to the meteor burst signals from W6NLZ and others that Sunday morning at Loren's QTH as he demonstrated how the unit performed. We were suitably impressed and asked him to let us borrow one to play with.

The Parks 50-1 is built with the same impeccable care used in the Model 144-1. The anodized aluminum top-plate has the same printed lettering and the case is the same molded plastic, although the unit is smaller than the two meter job. Power supply is included as an integral part of the unit.

The front end is a 6CW4 operating as a neutralized triode. This gives you a noise figure in the vicinity of 2.5 db (ours was closer to 2 db). Next stop for the 50 megacycle signal is the pentode half of the 6U8A which serves as the mixer. The triode section operates as an oscillator. Our unit has a 43 megacycle crystal which netted us an *if* range of 7-11 megacycles.

Input is 50 ohms through a standard UHF type connector, or (your choice) type N or BNC.

Each individual converter is adjusted for lowest noise figure and each unit's noise figure is actually measured. With the 6CW4 you can be sure that the noise figure will be well below your antenna noise.

Operationally, the 50-1 is a joy to work with. We spent considerable time comparing it with a Filter King converter (ala W6BAZ) which *used* to be the standard of comparison for the DX gang in the west. We found that the noise generated by the 50-1 was some 24 db lower(!) than the noise generated by the Filter King. Keep in mind this is *amplified* noise. The actual improvement in signal plus noise to noise from the 50-1 to the Filter King was 3 db, or 1/2 S unit. On weak marginal signals, that 3 db can be a bushel.

Our testing location for six meters is not quiet by any means. At best we experience 12 db of antenna noise at 50 megacycles. None the less we found that although the 50-1 does *not* have the extra-ordinary gain of say the Filter King unit, it has *more* than adequate gain to overcome the conversion loss in the converter itself. And since the real proof of the pudding must be the actual signal to noise ratio of the signal, regardless of its strength, we found the 3 db advantage of the Parks unit to be very exciting.

Inter-connected into the 24 element monster array at W5KHT the Parks 50-1 was compared using an instantaneous switching circuit with the Filter King. Any evening we can sit on 50.110 or 50.115 and leave the beam on the Ohio-Michigan area listening to scatter bursts from the SSB boys. Since this type of tom-foolery is marginal at best the 50-1 got a real workout. The 3 db aforementioned advantage amounted to around 40% greater burst copy time (*i.e.*, a 10-second burst on the Filter King would last an additional 4 seconds on the 50-1) for the 50-1.

Needless to say because the converter has lower overall gain it is not nearly as prone to overload from strong locals. The absence

(Turn to page 33)

Scatter . . . continued from page 3

control of its operation will be restricted to properly licensed amateur operators, and satisfactory proof of such design must be shown in the application for authorization. Essential design factors must include the following:

a. If operation below 50 Mc/S is desired, the mobile relay station shall be so designed and installed that it normally will be activated only by means of a coded signal or signals or such other means as will effectively prevent its activation by undesired signals.

b. If operation is to be confined to the region above 50 Mc/S, the mobile relay station shall be so designed that it is normally capable of activation only by signals received on frequencies above 50 Mc/S.

c. Each amateur mobile relay station shall be so designed and installed that it will be deactivated automatically when its associated receivers are not receiving a signal on the frequency or frequencies which normally activate it.

d. Each amateur mobile relay station shall be so designed and installed that it may be deactivated by remote control either wired or radio) in case of emergency.

e. Facilities must be included in each amateur mobile relay station to provide logging of all mobile stations using the relay facility. Information required in this log shall be confined to the call letters of the stations involved, and the times of beginning and end of such use. Automatic recording facilities which simultaneously record the time and the messages handled by the amateur mobile relay station shall be considered sufficient to meet this requirement.

(f) Application for an amateur mobile relay station shall be made on FCC Form 610-A; engineering data sufficient to show that the requirements of the preceding paragraph will be met shall be included with the application. A satisfactory showing of control of the specific premises upon which the amateur mobile relay station will be located is required; the engineering data required by subparagraph 12.64 (e) shall be deemed a showing of amateur control of the station itself.

In support whereof, the following is respectfully submitted:

1. One of the most important means by which the Amateur radio service contributes to the public interest is by providing emergency communications facilities in time of disaster. Because of the nature of most disasters, the majority of these emergency communications are provided by amateur mobile stations. However, because of power limitations °inherent in most automobile electrical systems, and also because of inefficient antenna systems imposed by mobile physical requirements, the reliable communications range of amateur mobile stations is usually limited. Authorization of amateur mobile relay stations can substantially increase this reliable range because the relay station can employ higher power and more efficient antennas, thereby adding to the effectiveness of emergency communications.

2. The use of mobile relay stations for this same purpose in other radio services is recognized, as for instance in Section 11.7 of the Commission's Rules and Regulations or in Section 16.355 of the Rules and Regulations.

3. Availability of amateur mobile relay stations for general use by all amateurs licensed to operate on any particular frequency band will enhance the attractiveness of mobile operation, thus providing increased interest and activity in mobile operation and thereby providing an expanded pool of available amateur mobile stations in case of any emergency. This also will be in the public interest.

4. Such "amateur mobile relay stations" have been licensed by the Commission in the past, in specific instances, under the somewhat restrictive existing remote-control provisions of Section 12.64 (b). These stations, particularly in the Los Angeles, Calif., area, have proven extremely beneficial to the public interest during brush-fire emergencies by providing extended-range communications. The major purpose of this petition is to formalize the definition of this type of station, and to establish standards which will allow the use of such stations by all amateurs who are able to communicate with them.

5. For these reasons petitioners believe that the public interest will best be served by amending Sections 12.5 and 12.64 to establish Amateur Mobile Relay Stations and to provide specific requirements governing their operation.

What do you think? —K5JKX

Putting the MAR on 432

E-Skip on 2 . . . p. 16

E-Skip on 2 . . . p. 16

since when it is in, it is in! And there is no stopping it.

What *is* needed to work E skip on two meters? An interest in doing so, first of all. This past summer, 1962, for example probably produced at least three occasions from your location to locations 1,000-1,300 miles distant when two meters was open (briefly-*i.e.* 5 minutes to 30 minutes) on E skip. The fact that you were on six meters at the time did you little good.

Next summer, and the summer after (ad infinitum) should be every bit as good. The proof of the pudding will be how much time you put into a little (very little since not much is really required) preliminary planning (*i.e.* plotting paths, determing the ordinates of "tip-off" six-meter short skip, and lining up one or more two meter stations at the other end) in the months ahead.

Too often we hear stations on six suggesting "let's switch to two meters" in the early weeks of the six-meter season. Remember when such two-meter contacts have taken place in the past, and remember that being at the right place at the right time is much more important than anything else. And, if your first round of calls don't produce results, stick to it until all signs of the superdense cloud and extra short skip on six have disappeared. That high density portion of the cloud is going to be short lived at best, and past experience has shown that it can and does develop in a matter of seconds, and without warning.

Lastly, look for W5KHT on 144.120. We'll be in there when ever things look good on six!

by John Chambers, W6NLZ/A6NLZ
c/o VHF Horizons

Putting a MAR on 432 Mc involves, simply, stripping the whole works and salvaging the two rectangular silver-plated boxes which are the final tripler and power amplifier.

Those aren't just good . . . they're perfect!

With these, you'll have a real machine. Outputs of 30 watts are realized readily on 432 Mc.

Converting the tripler box into 144-432 takes approximately 10 minutes: First remove the variable capacitor from the cathode end (where the coil is located) and throw it away. The cathode circuit will now tune to 144 Mc by varying C-177 (save the shaft). Remove the rotor by loosening the set-screws.

Now, with a pair of long-uose pliers, reach in the hole where the rotor of the plate tuning capacitor meshes and pull out and discard the stator plates. The rotor will now tune to 432 by the minute capacity left (note: you may have to adjust trimmer C-112 slightly).

That completes the tripler changes. Just apply 45 volts bias, 6.3 volts filament, 700 VDC to the plate, and 15 watts of 144-Mc drive.

Converting the final straight-thru amplifier is similar. Remove and discard the cathode tuning capacitor. Tune the cathode circuit to 432 Mc with C-118. Convert the plate circuit exactly as described for the tripler and use the same voltages.

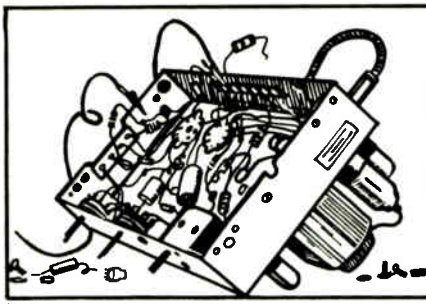
For AM, to get 100 percent modulation, modulate both the tripler and final simultaneously.

Lab Report . . . from page 31

of cross modulation was a particular joy to behold.

However, in all fairness it must be reported that because the 50-1 has a relatively low unit gain we were forced to clean up the inter-connecting coaxial patch cords from our converter to our NC-303. Our 40 meter *if* range produced feedthrough, which was not apparent with the Filter King because the greater noise amplification with the Filter King managed to cover up the 40 meter feedthrough!

At $34.50 this converter looks like a $100 job and performs as well as anything we have had in the shack. It is exceedingly well built and should make a good companion converter to the 144-1 for any serious VHF fan. We only hope that Loren (K7AAD) doesn't go broke turning out such quality gear for so little money!



THE CONSTRUCTION BOX

SPLICING TINSEL CORDS

A simple solution for repairing broken tinsel cord such as that used in headphone cords, mike cables, and telephone has been in use here for some time.

First, make a crimp connector by wrapping many turns of no. 28 to 34 *tinned* wire around the two tinsel wires to be spliced. Solder the tinned wire to make a cylinder. Then crimp it over the ribbon wire to make a solid connection. Insulate it with tape.

—K3BNV

MEASURING FEEDLINE LOSS

The loss in the coax feedline to your antenna array, of great importance to a VHF/UHF operator, may be measured very simply as follows. Make a shorting plug to fit the antenna end of your feedline (I use an SO-239) by cutting a one-inch square of copper flashing with a small hole in the center to go on the back of the connector and solder. Climb your tower and disconnect the coax. Insert the shorting plug. (Use aluminum foil for solder-lug type connections, wrapped around the shield and center conductor to make a complete, enclosed short circuit.)

Then come back down and pipe a *small* amount of RF (on operating frequency) through an SWR bridge into the line. Only enough to give a full-scale reading on the meter in the forward position is required. Note the percentage power reflected by the short (usual values range from 30 to 70 percent depending on the line and the frequency). The square root of this percentage is the efficiency of the feedline. To find loss in db use the formula: Loss — 5 times the log of the ratio (power into line/power reflected), or loss — 5 times the log of the ratio (100/percentage of reflected power).

Many SWR bridges are calibrated in reflected voltage rather than power. In this case, the percentage voltage reflected is immediately your feedline efficiency, and the formula for db loss becomes: Loss — 10 times log ratio (100/percentage voltage reflected).

—W5PPE

WANTED: MORE TIPS

This is your corner, to pass on those little tips, ideas, etc., which you've come across in the course of your VHF operation. We provide the space—you provide the material.

Send 'em in any way you like (K3BNV's tip came in on a DRP card!) but let's have them thick and fast. Sorry, we can't acknowledge them—but the extension of the sub will be effective with the issue in which your tip is published. Fair 'nuff?

—K5JKX

Letters

Dear VHF:

First, read the fifth paragraph of your November editorial. I just did and, brother, did you ever hit a raw nerve! I am enclosing verifax copies of FCC Docket 11157 "Notice of Proposed Rule Making" and "Report and Order." Please read them carefully. (Ed. note: the documents relate to the opening of 6 Meters to Technicians; they show the petition was filed by W5FXN and Tom Walker.) OK, so my nerve tingles because I was W5FXN at that time. Maybe it tingles a bit because I can't "get the whole message" from your ediorial. Do I detect a hint that the relative low 50 Mc and 144 Mc frequencies have tainted the Tech ticket? Not so, gentlemen, the foot is in the other shoe! Sure the Technician Class license is a steppingstone—League and FCC be hanged! I'm GLAD. The thousands of Novice to Tech to Generals have, in most cases, enjoyed some exposure to VHF. From them we have "captured" hundreds of serious VHF operators and countless occasional VHF ops. Let us continue to encourage "stepping stones," especially when our stone is so attractive to the imagination of the serious minded regardless of eventual license status. To those Generals or Extra's that would look down on the "lowly" Tech, we need only to say: look NOT at my license but, AT my accomplishments!

73
James M. Price, WA9ESM
ex-W5FXN, W8FXP, W2PVM, WA4DGI
Globe-RME Communications
General Sales Manager

Jim—

Gad—we did goof in crediting the initiative for getting Techs on Six to the wrong quarter! Our most sincere apologies; we're happy to set the record straight. We do hope that the editorial contained no hint that the 6-and-2-meer privileges have "tainted" the ticket because that's sure not what we meant. The comment about being "officially second-class" was intended as a slur on the restriction on 145 Mc, not as a slur on the license! It appears that we both agree that accomplishments don't look at the license class of the accomplisher—even if we can't agree with you that the Tech ticket is a true stepping stone (we feel that it's worthy of being an end in itself, unless you feel a real need for LF liaison work)!

Dear VHF—

Think you have a good thing here. I hope to be able to submit comments and reports to add to interest of other subscribers in promoting VHF.

Good luck
Bert Ingalls, K7DTH
312 N.E. 81st
Seattle, Wash.

Bert—

Thanks for the comments. VHF comments and reports can be sent via any means (radiogram, wire, postcard, telephone) just so long as they get here. We're especially eager for news from your corner of the woods, as well as from 1 and 2 land. Any reporters down East?

Dear VHF:

I have always felt that 6 meters is NOT VHF. Please note that in all other publications 6 meter nonsense takes up about 80% of available space. I know that this is economically very sound since there are few who go 432 and above, but still I feel that 6 meters has no business in a magazine devoted to high frequency topics. This is 1962, not 1932, and six meters is no trick at all.

73
Raymond De Vos, W2TAM
140 Summit Avenue
West Trenton, N. J.

Ray—

Before you're deluged with angry letters disagreeing with you, we hasten to point out that our most recent survey showed 83.3 percent of our readers operate on the 50-Mc band. But lest anyone get the idea that we're for-six-only, we add rapidly that 83.3 percent operate on 144 also! (Not the same 83.3 percent in all cases; some of the gang, like yourself, omit 6.) An astounding 27 percent operate 220! Higher bands showed smaller but highly active occupancy. Since so many of us do operate on Six, we'll continue to feature it quite a bit—but other times you may be pressed to find a 50-Mc-only article in an issue!

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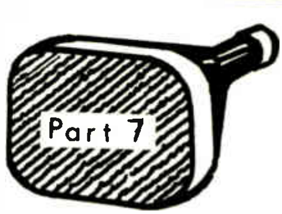


by Robert Grimm, K6RNQ
VHF Western Technical Editor

AN UNDERSTANDING OF HARMONICS

Generally, when we think of harmonics, we think of TVI. While this is partially true, we must remember that harmonics play an essential part in the operation of a vast majority of VHF transmitters.

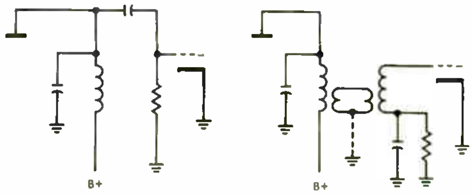
The most common use of harmonics are in the frequency multiplier stages. Why? Well, most VHF transmitters utilize either 8 Mc crystals or 8 Mc VFO's. To multiply this 8 Mc signal to the VHF region usually entails the use of a number of doubler and/or tripler stages.

Now, for a frequnecy multiplier stage to operate efficiently it must operate with high grid drive and high bias. This condition is conducive to high harmonic content in the plate circuit of the multiplier stage. The The greatest output will naturally be at the frequency to which the plate tank circuit is tuned. Unfortunately, due to the operating conditions, a fair amount of signal will also be generated at other multiples of the drive signal than the desired one.

This little problem is one of the unfortunate "tragedies of life." It can be alleviated, to a certain extent, by operating the frequency multipliers at as low a level as possible, consistent with reasonable efficiency. Traps, tuned to the frequency of unwanted troublesome harmonics may then be installed in the plate circuit of the frequency multipliers.

There is a method of getting around the problems of frequency multipliers. That is to use the heterodyne method, and "beat" the signal up to the desired frequency. This way is not foolproof either, as the other stages may also generate some harmonics, but more on this later.

Now, there is no such thing as a transmitter that does not generate some harmonics. A "clean" transmitter will still generate some harmonics. It is only their level that has been reduced. If, however, the level of an unwanted harmonic is reduced to a point where it is no longer troublesome, then we have accomplished our purpose.



HARMONIC CONTROL is best achieved by link-coupling between multiplier stages. Top-coupling (as at left) allows unwanted harmonics as well as the desired one to get through to the next stage. Link coupling (right) transfers only the desired harmonic at enough strength to drive the following amplifier. Grounding the link (doted line) helps prevent higher harmonics from getting through.

Efficient operation of class "C" amplifiers is always accompanied by some harmonic generation. Therefore, it is desirable to operate a class "C" amplifier stage with as low grid drive as is consistent with reasonable efficiency. It is a good idea to bear in mind that the drive signal at the grid of an amplifier stage contains not only the desired frequency, but harmonics of it as well.

The generation of harmonics in a "straight-through" power amplifier can be reduced a certain extent by running the amplifier as a "linear amplifier." *I.E.*: Class "A", "AB1", "AB2", or "B". The output of such a stage will have a very low harmonic content, providing that it is operating "truly linear." However, as such things go, "nothing in life is free," and the price one pays is—reduced efficiency.

While we are on the subject of harmonics, it might be well to mention harmonic traps, stubs and low pass filters. None of the aforementioned devices will actually "eliminate" a harmonic. They only attenuate, or reduce the level, of the harmonic. The big advantage here is that a well designed trap or low pass filter can reduce the level of an unwanted harmonic sufficiently so that it is no longer troublesome.

Harmonics, therefore, like many other things, are neither good or bad, but a little bit of both.

Letters

Dear VHF:

Here are some more ideas in regards to NBFM and TVI. It was found that it's the TVI complaint—not TVI—that gives the ham trouble. NBFM tends to reduce if not eliminate, TVI complaints. My own findings back up those statements. Here are the reasons: 1) Modulation bars and audio rectification are eliminated—TV owner doesn't know you are transmitting. 2) Both AM and FM carriers will overload the TV, however when this happens the AM station's audio will blast through, but not a peep is heard from the NBFM station—TV owner merely scratches his head. 3) Cross modulation from the TV seemed to be distorted and unreadable—TV owner may have a few suspicions, but may not be entirely sure that it is that ham next door. Trouble No. 3 appeared only a couple of times in my tests

For well over a year I have had no TVI complaints. Not even a peep or nasty glare. In the past I had 104 TVI complaints. None of these were caused by any faults in the transmitter. Again—my 6-meter transmitter is clean.

Believe it or not I'm no "pusher" for NBFM. I merely wished to add more factual information. For those who feel that NBFM may solve their problems, then for Heaven's sake, please also use a simple speech-clipper; but that's another story.

73
John P. Skubick, K8ANG
1033 Meadowbrook, S. E.
Warren, Ohio

Dear VHF:

I wish you all success but I won't subscribe. I shall provide the type of journal I am looking for. It is your continue to pick it up at the radio store though, in the hope that you will reach a balance in your articles and sounding-board and you use your prerogative to promote VHF SSB, the 50 Mc band and DXing, all worthy endeavors. Except I, an average VHFer, gave six meters back to the neighbors and their TV sets four years ago; nor, do I wish to give up my rag-chewing for expensive (you have to receive as well as transmit) SSB which many of my friends are not set up for, and neither can I afford kilowatts. Then what, you may ask, am I looking for in a VHF magazine?

I am looking for information and construction articles that apply to more than one band and more than one mode of transmission. Why does your article on pi-net nomographs give data for 50 Mc only? I would like to see articles on other bands (besides antennas which you have covered thoroughly) and answers to your own questions (How do you feed a 1296 Mc antenna without hard-to-get coax or a machine shop to build wave guide?). I'll keep looking if you keep publishing.

73
Norm Weinress, WA6TOZ, ex-K9GBJ
1652 S. Colby Avenue
Los Angeles, Calif.

Norm—

Sounds as if you might like the super-selective VHF receiver we have in the mill (total cost about $75) or the all-band (6 through 432) exciter under construction by K5JKX. They'll be along sometime in the next few months. The pi-net article covered 50 Mc only, simply because the nomos could be drawn as they were for ONLY one frequency and more people use pi-nets on Six than anywhere else (to convert to 144, multiply all values of C and L by 50/144). You keep looking, we'll keep publishing—and before long we'll bet you we get together!

Dear VHF:

I'd like to get all back issues available. With the references to what has gone past such as the VHF TVI articles and the 7788 converter, I fear I've missed out on a lot of goodies.

73
R. L. "Dick" Tester, W6YVD
641 East I Street
Ontario, Calif.

Dick—

Several of the back issues are already out of print. However, we're sending you what's available as you request. Other subscribers can still get the ones they missed (maybe, if any are left) for the original news-stand price, 40 cents a copy, plus 5 cents each for handling and postage. If you want 'em, hurry, because almost all are running very short by now and they won't be reprinted.

Scanning the literature

CURRENT MAGAZINES

Solid State 1296 Mc Converter. John Specialny, Jr., W3HIX. 73, November, 1962, page 6.

This 3½-page article tells you how to build a converter for 1296 Mc which is all solid-state; no tubes are employed anywhere in the device!

The secret is the Philco 2N1742 MADT transistor (the author is a Philco applications man); six of them are used in the oscillator-multiplier chain and the 30-Mc *if* strip which is an integral part of the converter. The mixer is a 1N263 diode.

Full data for Chinese-copying is included, as well as enough on the theory to make it easy for you to pick up any part of the unit to put into your own designs.

Recommendation: try it, if you just want to be different. But whether or not you do it this way, get on 1296!

In the same 73:

Deluxe Your Transceiver, K6UGT. Some goodies for the HE-35A and like varmints. Instructions for adding an illuminated meter, a xmtr tuning control, a spotting switch, a phone jack, and bandspread for the receiver. Good data. 4½ pages.

The Continental Six, W1PYM. Product report on the new 6M SSB up-converter. 1¼ pages.

73 *Tests The Gonset Communicator IV-220*. Product report on this unit. 2⅜ pages.

In the November QST:

Low-Noise Transistor Preamplifier for 50 *or* 144 *Mc*., D. Meyer. How to build your own Irving Preverter using the 2N2398. Very detailed data. 3 pages.

Amateur TV—The Easy Way, W1CUT. RF deck, etc., for a 420-450 Mc ATV transmitter. Only fly in the soup: "first you get a camera" for $495, then go from there. Very good for those of us who can afford half a kilobuck for one-way video! 9¼ pages.

T. D. Superregen, W5EIM. Hiding in the "Technical Correspondence" section is this first real ham use of the tunnel diode—a 435-Mc receiver! 3/4 page.

Miniature 6-Meter Transmitter, W8BEB. Similarly hiding in "Hints and Kinks" is a 5-transistor "wrist-radio" for 50 Mc with less than 2-ounce weight. 1 page.

In the November CQ (Received November 27):

The Standing Wavemeter, W6HPH. How to build a "slotted-line" for 300-ohm twin-lead. Can double as Lecher wires for frequency measurement. 3 pages.

A Transistorized Preamp for 420 *Mc*., W2VCG. A one-transistor preamp built around the T2028. Claims noise figure of 4.5 db. 1½ pages.

CQ Reviews The Heath HW-20 "Pawnee," W6TNS. Product report on one of the most popular 2-meter rigs around. 3 pages.

How to Measure Antenna Gain, W6HPH. Just what the title indicates; includes details on escaping the influences of reflections, etc. Good. 3 pages.

VHF (column), W6TNS. Construction data for a silicon diode noise generator (similar to Jones handbook unit) and using the T-23/ARC-5 as a 2M SSB mixer. 3 pages.

The SB-62, K9EID. Construction details on a 6-and-2-meter SSB mixer, starting with 14-Mc SSB. 2½ pages.

Introduction to V.H.F., K3HNP. Quick introduction to the differences between VHF and lower bands. 2 pages.

Results of the July 1962 *VHF Amateur VHF Contest.* K1UGZ/1 was high scorer multiband; W8HBI/8 topped the list on 6 and WA2FVR came in high on 2. 2 pages.

Portable 6 *Meter Antenna*, K3HNP. How to build a folded dipole. ½ page.

VHF SSB (column), K9EID. Introducing a new column and telling of directory plans. 1½ pages.

UHF (column), K2UYH. Brief report on activity above 220 Mc in the Northeast. 1 page.

DX Report (column), K2ZSQ. Roundup of reports covering activity on 6 and 2. Division by call areas appears good. Noticeably absent: W4HHK, W6NLZ, W5AJG, etc. 2½ pages.

Putting the FMTU-30D on Two, W5VLE. Step-by-step data for getting on FM with a surplus (not war, civilian) Motorola unit. Good data. 3¼ pages.

(*EDITOR'S NOTE: It is not normally our policy to review regular columns in this department. However, since the November CQ marked the marriage of CQ and the old VHF Amateur, we felt a review of the columns in this issue alone would be of interest to those of our readers who have not seen the issue. In subsequent months, this department will confine itself to reviews of feature articles.*)

Letter

Dear VHF:

Many new hams can back up what I say; since the first day you get your license a tremendous amount of advertising pours in. I was looking for a magazine to subscribe to that was run by hams for hams and then yours came in. This magazine is much better than others that have poured in. It's concise and it's for hams. That is why of all the magazine subscription ads I received, yours is the only one I subscribed to. I hope you keep up the great work that I have already noted.

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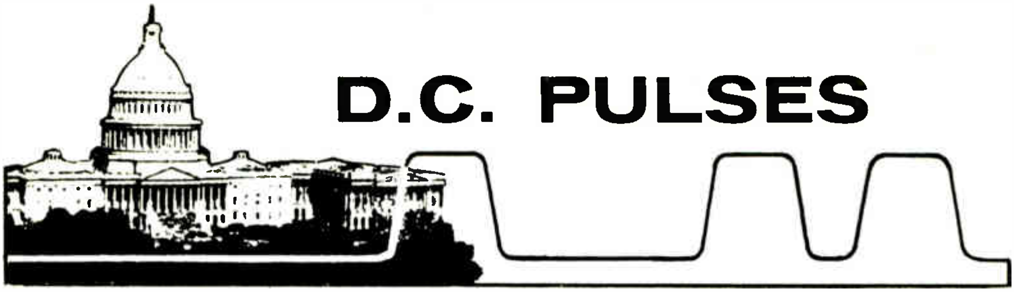
D.C. PULSES



The power limit on 420 is off.

Following up on an earlier, League-requested action, the FCC has amended the amateur rules to permit use of "maximum" (1,000-watt) input power in the 420-450 Mc band, except in the states of Florida and Arizona, and portions, of Texas, New Mexico, California, and Nevada.

In the excepted regions, the 50-watt limit still applies. In general, the regions where power remains limited are areas within 200 miles of rocket and missile test ranges; reason for the limitation is apparently the possibility of ham interference with telemetry channels near 420 Mc.

In the rule changes, provisions were included to allow individual amateurs located within the still-restricted zones to use full-kilowatt power, provided the ham is able to satisfy military authorities that his equipment is so designed and so operated that no possibility of interference exists.

In a separate action, the Commission invited comments on a Notice of Proposed Rule Making which looks toward amending Part 12 of the rules to provide that, during a period of continuous amateur mobile operation, only the dates and times of commencing and terminating such operation need be entered in the log.

> ### *LEONIDS REPORT*
>
> The Leonids meteor shower paid off with two new states on 144 for Ken Erickson, W7JRG. Ken reports he worked WϕLFE in Missouri for No. 16 and W7LHL in Washington for No. 17. He heard K9UIF S2 and K9AAJ S3 but never got past complete calls. No results on skeds with W8KAY and W9CUX. "This isn't much compared to others," wrote Ken from his Billings, Montana, QTH, "but it's pretty hard to work 2 meters any other way out here!"

The ARRL has petitioned for relaxation of the present requirement for logging the specific time of each transmission. In addition, a Texas ham has petitioned to relax the logging requirement entirely from mobile units operating above 50 Mc.

The comment invitation was announced November 21. No deadline was set.

Earlier developments during the month included two petitions for rule-making filed by a Bedford, Mass., ham, as well as the VHF petition to authorize "amateur mobile relay stations" and regulate their operation (Scatter, page 3, this issue). Both were by Chester L. Smith, of Bedford, Mass.

The first, FCC file no. RM-378, requests amendment of Section 12.81 of the Rules governing the Amateur Extra Class license to add, as incentive for this class, the possibility of obtaining two-letter calls.

"Holders of Extra Class licenses may, upon proper application," the action would add to the rules, "be assigned call signs consisting of a two-letter prefix, a numeral, and a two-letter suffix."

Smith's second petition, File no. RM-385, proposes an additional class of amateur license which he dubs the "Intermediate Class." This class would require the same written examination as the General Class but would require only 10 WPM code speed. Such licensees would have all authorized privileges in the ham bands above 21 Mc, but would be limited to CW only below 21 Mc. This is, in a way, similar to the old Class B license which became extinct nearly 20 years ago.

The petition is not clear as to whether the "Intermediate Class" examination would be conducted by FCC inspectors as the General Class exam is now given, or by volunteers as is the case with Novice and Technician Classes now.

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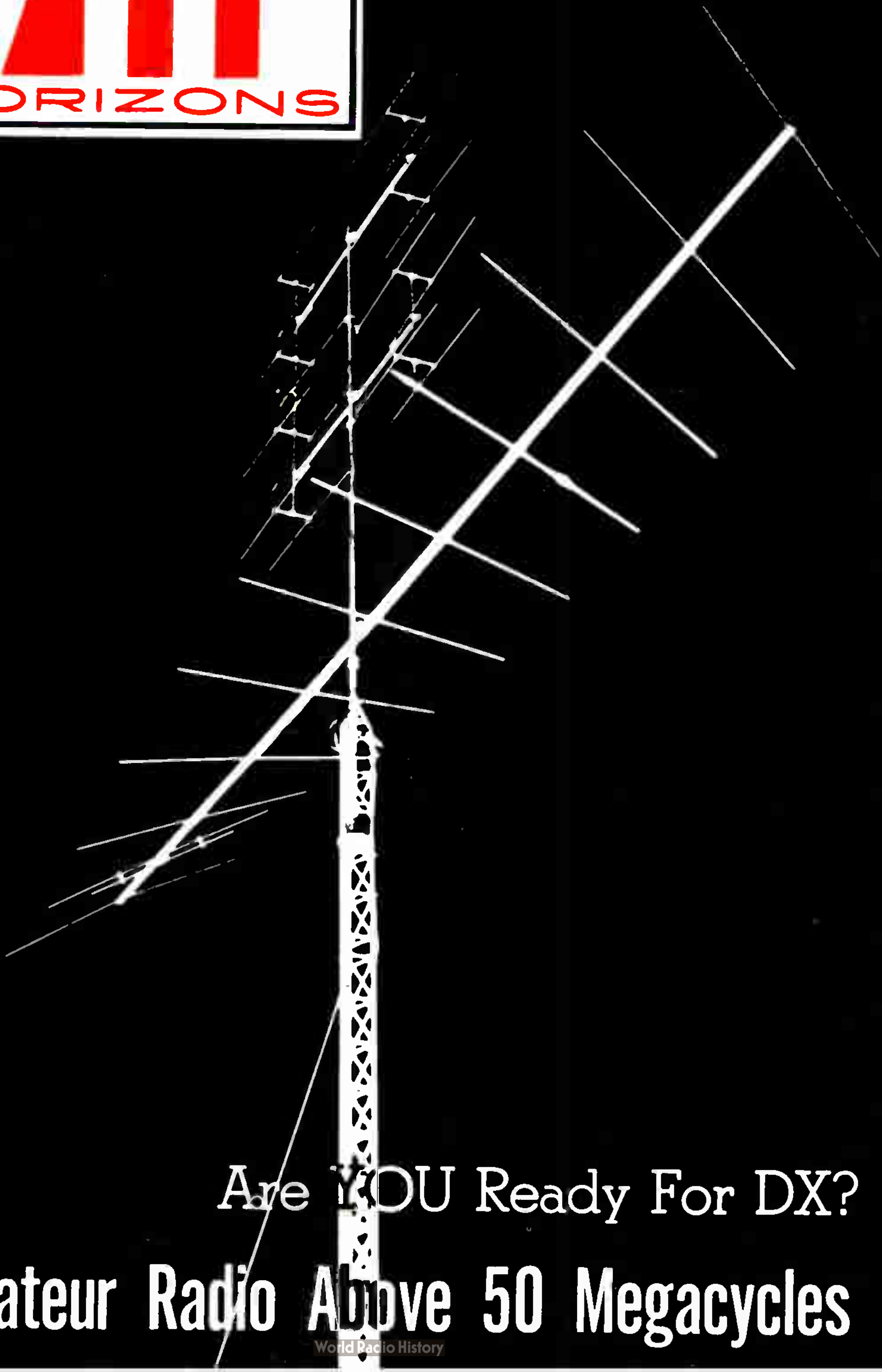

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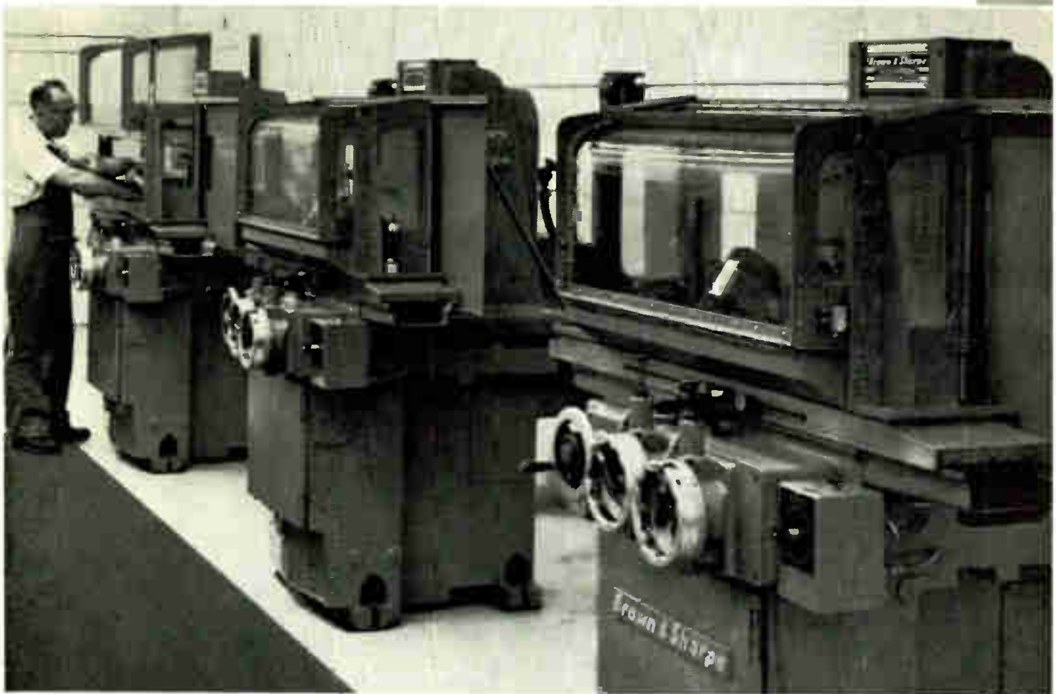

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CONTENTS

VOLUME 2 — NUMBER 4
APRIL, 1963

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Departments

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SCATTER

. . . de K5JKX

ABOUT BOATS AND THEIR ROCKING . . .

'Way back when, I was a newspaper reporter. Five long years I spent grinding out the wrappers for tomorrow's garbage . . . But that's not the point of today's essay.

Thanks to Hollywood and TV, most people tend to have the idea that a reporter is a sort of knight in shining armor, always looking for a crusade and usually finding it. They think he works for a fellow with no hair and a green eyeshade, who picks up a phone and yells "Stop the presses!" at least five times a day.

To be honest, I had a little of this idea too when I first got into the business. I went looking for good crusades—and there are always plenty to be found.

But when I brought them back to the boss, he would always answer with one phrase. It's burned bitterly on my brain. "Don't," he would say with a fatherly-advising expression, "rock the boat."

So maybe it's only natural that when I finally became an editor myself, I should want to rock the boat good and hard at least once. I'm not sorry I did, either, on the subject of class-consciousness among us hams—because it's a subject which has rankled in my heart even longer than the injunction against boat-rocking.

But this particular boat has been shaken long enough for now; my proof for this is the stack of letters which has been building up for some time.

Because he puts it all into easily understood words, I'm turning the rest of this column this month over to R. G. Knowles, W8JND, an IBM engineer in Gahanna, Ohio. This is the last word you'll see in these columns for a spell on this subject—unless the boat needs rocking again.

And while you read OM Knowles' letter, keep this Biblical injunction in mind: "He that hath ears to hear, let him hear."

Dear VHF Horizons,

A number of years ago, a local hub-bub arose, when a small group of hams moved from ten meters to two meters. Our reason for this move was two-fold: first, to provide more reliable communications for a local Civil Defense effort and secondly, to explore a relatively new band.

The original ten meter group, (78 active members in all, of which over 30 were mobiles!) was organized primarily as a Civil Defense effort, so when eight or ten of us went to two meters, a large and immediate "class distinction" movement took over, and some nasty thoughts and words were carelessly flung between both groups.

Finally Civil Defense activities collapsed on both bands! First one, then the other, gave in to petty segregation to the extent that it annihilated, in time, all local Civil Defense activities carried on by amateurs.

Then, as now, I tried to make myself heard above the din of childish name-calling, but succeeded only in distributing the brashness of an over-eager sixteen-year-old with an ax to grind.

Today, nine years later, I see approximately the same type of rift appearing in the ranks of amateurs on a national scale. Having seen this sordid segregation on a local level, and what it did to a few dozen darn good friends, I am now equipped with the experience needed to know that today, on a national level, both sides of this General vs. Technician feud are at fault (in varying degrees) as were both sides of this 10/2 thing here in my home-town.

I am not yelling my fool head off today, as I did nearly ten years ago. I am trying to point out several very important facts however: that we are Hams, first and foremost, Technicians and Generals alike. We have in the past years been responsible for large amounts of "State of the Art" advancement. Now, on the very threshold of the most recent, and perhaps the most important of all modes of communication: VHF/UHF and above, petty grievances and jealousies are at best, slowing progress.

In my ham shack, framed and hanging on the wall, is the following:

(Turn to page 40)

More Mobile Relay

Our proposal to authorize "mobile relay stations" in the amateur service and to establish regulations to govern them seems to have ignited localized but intense interest—both for and against the idea!

The situation seems to boil down to this —those amateurs who have successfully negotiated the present somewhat rocky path to legal repeater operation tend to feel that existing regulations are satisfactory. However, hams who are still battling the red tape tend to support our ideas.

Several of those who have written us to comment have important points to make; most of this report will be devoted to their comments. For a start, since discussion with him started the whole idea, let's turn the floor over to Don Bybee, W6NAS:

"I think this proposal will limit too much amateur repeater operation. It really isn't too much different from the existing rules. We need changes in the rules to permit repeater operation with no announcement of call signs from the repeater but using saying 'thru W6—' by the mobiles sufficient. Then, no logs necessary except for keeping track of when the actual repeater is turned on and ready to be used. We have to make any rule changes **simple** and **flexible.**"

Don also found fault with some specific wording, which he feared might be used to eliminate use of the repeaters by fixed stations. Other wording, he felt might be read to eliminate cross-band operation.

Sharing Don's fears about the wording "MOBILE" relay station was Frank Greene, K5IQL, well-known New Mexico VHF op.

"We did not feel any need for revision or clarification," Frank wrote (he holds WA5DMQ, a mountain-top repeater on Capitan Peak, N.M.).

"The first question arises, why do you call them **mobile** relay stations? In the West, the vantage position of a mountain-top repeater makes possible communication between fixed stations over otherwise impossible paths. The fact that a mobile station, or any station that can hit the frequency, is likewise extended is only a secondary factor. However, our rules of operation dictate that stations in QSO shall 'drag their feet' for mobiles."

Still in the West, Northe Osbrink, WA6-ZEM, wrote to mention a problem with the K6RTU Los Angeles repeater: "I feel that it provides a very important service," Northe wrote. "However, there is one fact that I find rather irritating and inconvenient about its operation. When the repeater is on, it repeats signals from 50.55 Mc to about 51.1 Mc. The operation is not scheduled, and it may go on at any hour. When it is on, it makes use of the 50.55 frequency (the national calling and distress frequency on 6 meters) for its original purpose nearly impossible. The situation could easily be remedied by changing the frequency of operation, and it would then leave 50.55 clear for emergency."

One group agreeing with us that present rules were in need of clarification was the Northwest Amateur Radio Communications System, Inc., a Washington State society. Secretary Barbara Ashley, W7GJL, wrote that the group "has been interested in repeaters for several years and are currently engaged in getting one in operation to cover the Western Washington State area.

"As the current rules and regulations are most ambiguous," Barbara continued, "we heartily support your petition for rule changes concerning Amateur Radio Relay Stations."

Also in agreement with our effort was Robert E. Raper, W4DXC, 6-meter FM liason station for Virginia. Bob wrote, "I want to offer any help I can in the crusade to amend the FCC rules and regulations to allow such operation."

He enclosed a block diagram (Figure 1) of the layout of his legal repeater/remote-control base. "This system has been licensed and in operation since May 4, 1961, under Section 12.64," Bob wrote. "To be completely legal is quite a task, as mentioned in gives full break-in by the controlling station for identification or information.

"It also goes without saying that the controlling station can shut down the repeater at any time, if unauthorized use or abuse of the operating rules dictates.

"The conventional rig must be modified to some extent. A 3-stage coaxial filter and a Nuvistor pre-amp are installed at the receiver input. A modified squelch relay keys the transmitter. Audio in the transmitter incorporates compression and limiting to prevent loud stations overmodulating.

"At the control point, we have a crystal-controlled monitor receiver, with squelch-operated (vox-operated) recorder for logging. Also, there is a transmitter on the repeater frequency for normal use of the translator. A tape loop connected to the 220-Mc transmitter provides hi-speed MCW for identification, much like the "beep" on the telephone circuits.

"Users are instructed to use their calls in a normal way, and to add the time of day at beginning and end of a QSO.

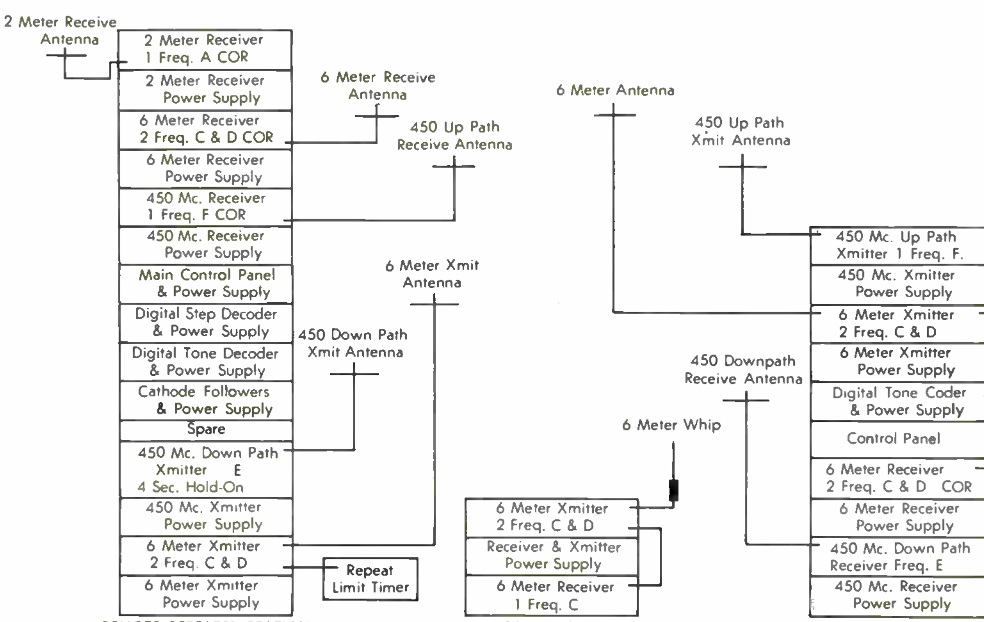
"Our choices of frequencies for the translator were 145.020 Mc for receiving and your article. This system here in Richmond gets very little use by other stations as a mobile repeater; your changes would sure ease the situation."

What does one of these stations encompass? The block diagram of W4DXC's remote-control arrangement shows one approach; Frank Greene's letter describes another in detail:

"The repeater (translator) station consists of a transmitter which is keyed by a receiver. For obvious reasons, the two frequencies are widely separated.

"The simplest rig—such as we started with—is a straight AM repeater, using a modified SCR-522.

"AC power is turned on remotely (in a manner which must be okayed by FCC) by a channel in the 220 Mc band. Full use of a tone generator and decoder permits further flexibility such as switching crystals, etc. Receiver also has a carrier-operated relay. The 220-Mc transmitter at the control point has conventional audio, in addition to the tone generator. Thus the control station can take over the audio of the two-meter transmitter without any carrier heterodyne. This



REPEATER STATION block diagram shows complexity of one legal repeater unit. This is the equipment in use at W4DXC, Richmond, Va., to relay 6-meter signals. Control frequencies are in the 420-Mc band.

146.980 for transmitting. This, of course, makes it possible for Novices and Techs to use it. We know of one unit which uses frequencies outside the Novice band, reportedly finding the operational problems much less acute. However, we feel that our rules will not be abused by those in this area.

"As far as the FCC is concerned, their rules covering the use of one's station by another licensed ham are valid in this case. If you wish to let another ham use your station, so long as the frequency and power are authorized in his own license, you may do so. However, the responsibility of keeping such operation within legal limits is yours.

"Getting back to the technical side, the ultimate—which we hope to have before long—is the linear translator. It will repeat anything it hears: AM, FM, PM, SSB, and whatnot. No detection takes place anywhere, excepting as a side issue for AGC purposes. The incoming signal is converted down to a lower frequency for selectivity and then heterodyned back up to the outgoing frequency.

"Since a complete diagram of the station, showing means used to control the translator, must now be included in the operation, the FCC has the power to approve or deny. (It now takes more than three months for such approval.)

"The 220-Mc control transmitter is fairly simple. It uses a 6252, modulated by an 815. Squirts in excess of 20 watts into the antenna. It uses the same power supply as the ARC-4 monitor station."

So that's the situation until now.

No action has been taken on our petition so far as we know. Repeaters are legal now, but are somewhat difficult to get going.

"This is a field where we shall never see a large number of such installations," wrote Frank Greene, and we must agree with him. "The installation of good equipment is expensive, and requires no little technical know-how."

But such installations can and have put in good service, extending communications range for both mobile and fixed stations. We still feel they should be more widely known, and more easily licensed. We welcome any additional opinions.

THE ARIZONA REPEATER

We promised, last month, that this month's cover feature would be a complete description of the Pinal Repeater covering southern Arizona on two meters.

But just at presstime, we received the following communique from Turk Smith, W7FRR, who was writing the article for us:

"Hold the phone.

"Half the gang here have the flu, and the one guy who can do the block diagrams has been put on night work at Motorola.

"The article will be along just as soon as I can get the gang together for it—but as it stands now, I can't promise to meet your deadline.

"73, Turk, W7FRR."

So that's why it's not here; maybe next month, if we're all lucky. It's gonna be worth waiting for!

—K5JKX

6-Element Skeleton Slot

by Frank Griffin, WB6AOW
Silverstrand, Santa Cruz Island, California

After building two of these, I decided to write them up. I find this antenna does a very good job in its operation and with the average amount of "junk" and tools one can be built for next to nothing.

THE FRAME

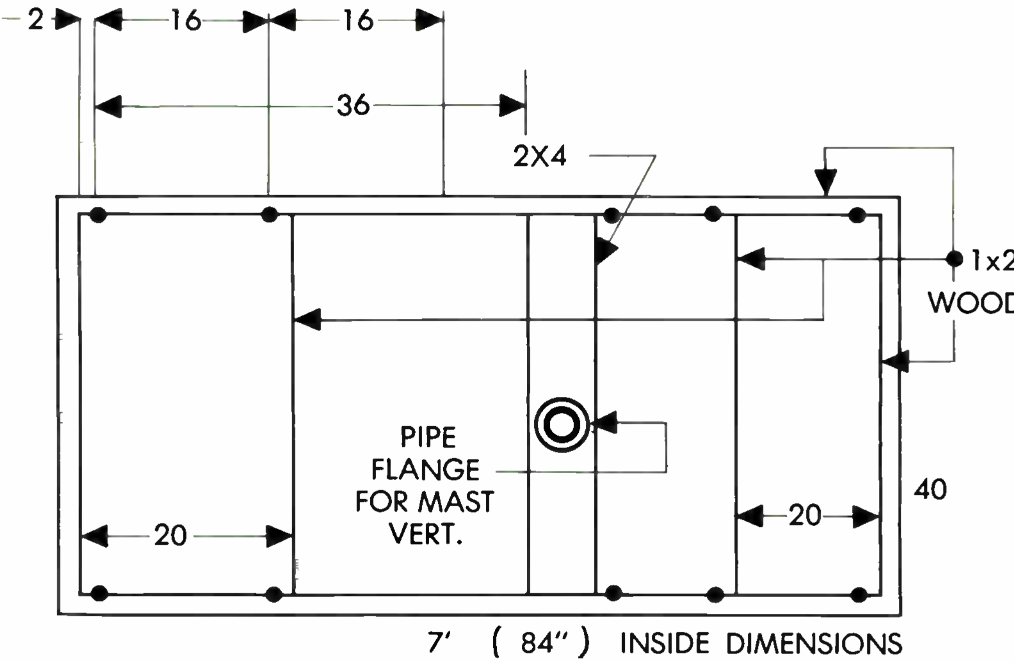
The frame consists of 1 x 2 light lumber with a 2 x 4 as the cross boom. The dimensions are shown in Figure 1.

ELEMENT SPACING

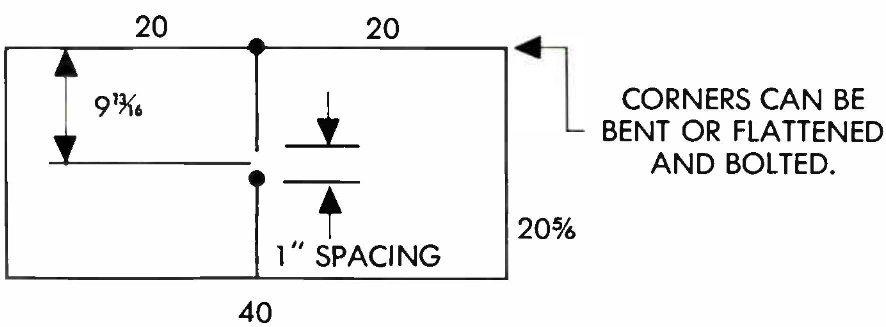
Starting from the end closest to the 2 x 4 (it's offset for balance) measure in 2 inches and make a mark. Then make 5 marks, each spaced 16 inches, for each element (.2 wavelength spacing). Mount the driven element at the second mark and the other elements on the other marks. These can be mounted with a screw and nut, or small nails. Ending up you should have two rows of elements 40 inches apart and spaced 16 inches. (See last month's VHF for a picture of the antenna—in the Gain, Inc., ad.)

A standard 300 ohm to 50 ohm balun is used and can be made from 50 ohm coax. A length of 27½ inches was used.

The second contact with this antenna produced San Diego on a "Twoer," with a S-9 report. So improve that signal and start hearing and getting out.



THE DRIVEN ELEMENT:



The elements:

Reflector	2 each 40"
1st Director	2 each 36½"
2nd Director	2 each 36¼"
3rd Director	2 each 36"
4th Director	2 each 35¾"

All elements made from Conical TV antenna or similar stock

CONSTRUCTION OF SLOT antenna is shown in these views. Mounting technique indicated is for use in vertically polarized areas; rotate 90 degrees for horizontal polarization.

E-Skip on 2 Second Verse

"The opportunity to work stations on 144 megacycles over distances of 800 to 1400 miles is exciting to all two-meter operators, DX fans or not!"

Those words, from the opening paragraph of our January feature concerning "E-Skip on Two," have proved to be our understatement of the year. If our mailbag is any indication, two-meter ops the nation over are going to be looking for skip openings this summer like never before.

And along with all the expressed interest in possible schedules, a batch of additional data has poured in—data which proves that it has happened before, and which offers some new ideas about finding the skip when it's in.

What about this thing called skip? First, let's make it completely clear that we are talking only about E-layer ionospheric skip, such as that known as "Sporadic-E" on 50 Mc. Let's see what the old standby, the ARRL handbook, has to say about the frequency limit for Sporadic-E:

"The upper limit of frequency for sporadic-E skip is not positively known," reads the 1962 edition, "but scattered instances of 144-Mc propagation over distances in excess of 1,000 miles indicate that E-layer reflection, possibly aided by tropospheric effects, may be responsible."

If you've ever worked skip on Six, you know what it sounds like. Starting with a quiet band, you find (usually but not always) a sudden buildup of antenna noise, and then almost instantly there are DX stations all over the band. As the session opens, and as it goes out, signal levels fluctuate rapidly. When the signal is there, it usually pegs your S-meter, but it is also subject to rapid fades on the order of 60 db or more which may chop it into a garbled mess.

The session usually ends as suddenly as it starts. Often you will find in the middle of a QSO the fellow on the other end just isn't there any more!

Keeping this in mind, let's take a look at an excerpt from the log of W8KAY, Art Paradis, of Akron, Ohio. Two-meter ops the country over know Art as one of the true experimenters and top operators on the band. Here's the data he sent:

"Time, 1805. Routine check of 50 Mc conditions. Noted usual sigs from Texas-Oklahoma area, also a few Louisiana sigs; some working Indiana stations, others working W1, W2, W3. Heard one W1. Sigs from W5 very strong, E layer must be pretty dense. No short skip signals heard to West or Southwest. Fired up with a CQ tape on 144.300, calling 2 of 3 minutes at a time with short listening periods.

"1837. W5LUU 144.171, calling me, A3, S9 plus with some QSB. Shifted from A1 here to phase modulation. Signed after solid 8-minute contact. No other sigs heard. Back to the CQ tape.

"1900. Contacted W5VWU, Albuquerque, N.M., on landline. His 144 gear not in operating condition but said he would alert K5TQP.

"1930. Still hearing W5LUU. Running CQ tape here.

"1940. Raised W5BEB, Hamilton, Texas, 144.126 SSB. Shifted to phase modulation here. Did not hear him again. His sigs S9 plus.

"1958. Strong A3 on 144.058 . . . 'W5-M--'. Back to CQ tape here.

"2012. Raised W5MJD 144.043, Amarillo. S9 plus, almost no QSB. Appears he was sig heard on .058 at 1958. Said he alerted W5SFW. Did not hear Phil on 144, tho heard him earlier on 50 Mc.

"2135. WØIC's XYL on landline, says Claude hearing and working Es stations.

"2149. KØAYK, 144.090, A3, peaking S8 with bad QSB, calling K9IUF. AYK running 10 watts. No other Colorado stations heard.

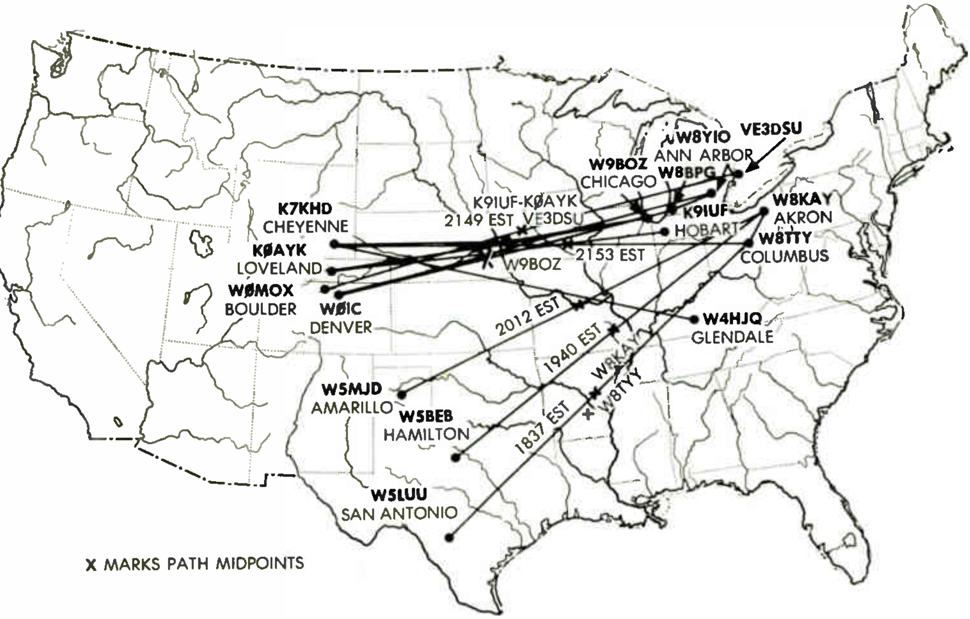
"2258. Signal on .053 to SW, weak, with severe QSB; unable to identify.

"2315. 50 Mc all but folded completely. End of hunt for Es on 144."

How would you have liked to have been in that session?

The date was 10 July 1961. All times given are in Eastern Standard. And that's not all the story.

The full roundup furnished by Art shows that he worked W5LUU, W5BEB, and W5-



OPENING OF JULY 10, 1961 showing straight-line paths and path midpoints of 2-meter contacts. Note that E-cloud apparently became dense enough to support 144-Mc signal about 1837 EST, over east central Arkansas, and then moved north by northwest at about 180 miles an hour. Unusual feature of opening was its duration—from 1837 EST until after 2200 EST! Both 1962 reported openings apparently also involved clouds over east-central Arkansas.

MJD, in the time between 1837 and 2012. An hour and a half later, at approximately 2149, he heard KØAYK at Loveland, Colo., calling K9IUF.

Art was not the only one enjoying the session. W8YIO, Ann Arbor, Mich., worked WØIC, WØMOX, and KØAYK but heard no other DX signals.

W8BPG, in New Buffalo, Mich., worked K7HKD in Wyoming.

W8TYY, Columbus, Ohio, worked W5-LUU, K7HKD, and as Art reports "perhaps some of the other DX stations."

Western N.Y. stations K2LVR and K2-KVN worked W5LUU but apparently did not hear any other DX.

VE3DSU, near Detroit, worked WØIC. VE3CIK, also near Detroit, heard and worked some of the DX but details were unknown to Art.

K2IEJ, on Long Island, said he may have heard WØMOX and WØIC but was not sure because of severe local QRM. W2AZL had the same report.

W4HJQ, Glendale, Ky., worked South Dakota and heard K7KHD.

W9BOZ, Chicago, heard the three Colorado stations.

And finally, K9IUF, Hobart, Indiana, near Chicago, reported working KØAYK (the call heard by Art earlier).

Now let's look at the report of this fray which appeared in QST (page 64, September, 1961, issue). "A cold front approaching from Canada and extending east from Wyoming toward the Lake Michigan area could possibly account for the WØ, W7 to W8, W9 opening. The Texas to Lake Erie opening had no weather indications . . ."

The accompanying map shows the paths covered by the QSO's reported by Art. The signals sound more like Es than tropo, in that no intermediate points were heard and even the 10-watt signal of KØAYK approached S9 in level; however, the lengthy duration of the opening makes it also appear possible (though not probable) that tropo helped some.

The answers might possibly lie in what K2TKN calls "a bank shot." Bill has found that frequently in attempting Aurora contacts he has best results pointing away from the curtain; his explanation is that tropo going away may be guiding his signal around to a better part of the Aurora, or, in other words (his), "I make a bank shot." Perhaps tropo conditions provided the same "bank shot" at an E-cloud, allowing it to be observed far longer than one would expect.

How did conditions correlate elsewhere during this opening?

The QST reports showed aurora present on the night of July 10, 1961, from WA2-HFI to the Gulf area. Julian, W4YRM, in Madison, Tenn., reported working Pennsylvania, N.J., Texas, Colorado, Nebraska, Mass., Conn., N.Y., and Virginia by Es on Six between July 8 and 17 but gave no specific dates. K9PNP, in Indiana, reported a Six-meter opening on July 10 from his location to W2 and W3, plus Florida. That's all we could locate.

Art's report makes one conclusion which differs drastically from our recommendation in the January article:

"Recapping," Art wrote, "despite frequent checks of 50 Mc, no really short skip sigs were heard. Think this should be stressed. Think conditions on 144 are suitable for Es contacts more often than generally believed."

That same QST issue which carried Art's report originally also reported another possible Two-meter skip contact, between W1-AJR and K9AAJ of Quincy, Ill.

Andy heard Michigan stations working into West Virginia, and Indiana stations working Pennsylvania, on 50 Mc at 2400 GMT on June 19, 1961, and began calling CQ on 144. Ten minutes later he made the contact; the QSO lasted about three minutes.

On this one, the tipoff was the hearing of 50-Mc short skip at the other end. Andy did not hear the short skip himself.

The tipoff for Art, on the other hand, was the extreme strength of signals from W5 land. (The Louisiana stations he heard calling Indiana on Six were not really short skip, but short enough to justify checkout.)

Incidentally, check those times of day again. Art's opening began shortly before sunset, local time, and extended until 11 p.m. Andy's occured at about the same time of day—near sunset.

Let's come closer to the present. Like last July 21. The time, 2030 to 2034 Central Standard time—just after sunset in northern Texas.

Our report comes from K5MBV and W5AJG; according to Ken, "Several of us mistook it for IF feedthrough. The entire two meter band was filled with strong QSBing signals from W3 and W4 stations, all the way to above 146 Mc." Ken noticed it first when a beat appeared on a near-local station he was working; the beat was a W3!

The following weekend, Leroy held a net check on the reported opening; six stations, scattered across northern Texas, reported hearing the strange doings.

Oddly enough, we have never received a report on this one from the other end. Will the W3 and W4 operators on the band the night of July 21 please check their memories and their logs?

And then, of course, there's our own experience in last June's VHF contest. You'll remember that one. Six was wide open to everywhere from the central states, and at one time we could count six separate stations coming in on Channel 6 of our TV monitor. And at 1855 Eastern Standard time—again, just at sunset—K4IXC, John, in Melbourne, Fla., "heard a phone signal which I identified as W5THT." This was the night of June 9. The misidentified (no W5THT is listed in the callbook) station was calling a W7 portable 5.

At 1755 Central Standard time, Russ Miller, operating W5KHT during the contest, called and worked W7JCU/5 in Oklahoma City. We had been, for much of the afternoon, attempting to raise someone to attempt two-meter E-skip, without luck.

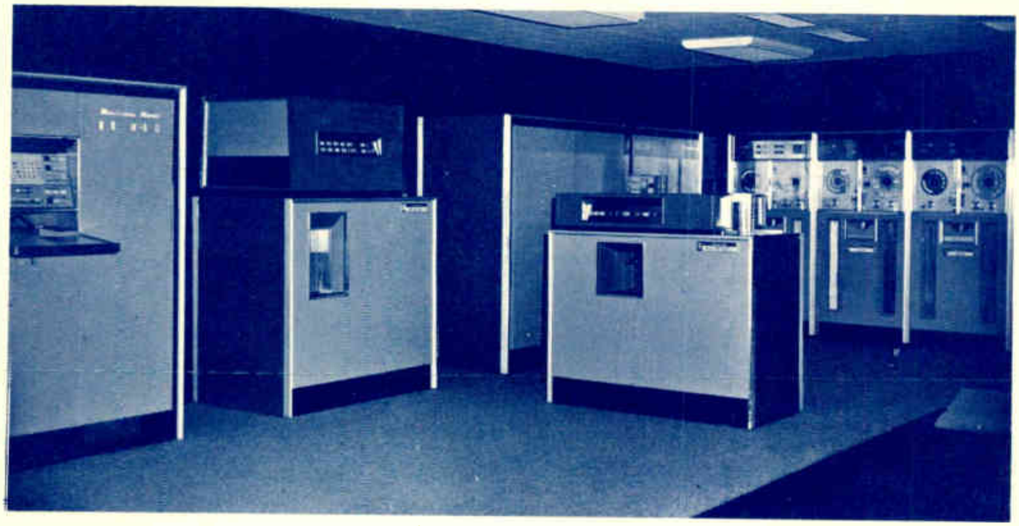
These are not all the recorded instances by any means. W5SFW has worked several two-meter DX stations on what appears to be skip. So have several other people.

But these we cite have all happened in the past two years; in the 17 years of looking, only some 20 previous instances had been reported.

And besides their recency, these all have something else in common—they happened near sunset local time!

We—all of us—still have much to learn about this phenomenen. The interest is there —your mail has proved it. We're interested too. What will we discover this spring?

About Univac . . .



One nice thing about modern technology, it never ceases to have side benefits to mankind. Take our (Horizons Publications) new UNIVAC installation. For all of our four monthly books plus our two semi-annuals and our annual, we now handle all subscriptions, billings, accounting and store re-sale copy orders using a UNIVAC system. Where one girl previously needed a day to process 300 subscription orders, we now do it in a fraction of an hour.

But about the side benefits: VHF Associate Editor Russ Miller (W5HCX) has been spending some time with our UNIVAC engineer of late discussing how UNIVAC might be utilized to study VHF propagation. Russ felt that if he could card-index a large enough cross section of VHF DX reports, he could let the machine tell us what patterns, if any, VHF DX took. A few weeks ago he brought us the results of his thinking. If VHF readers would contribute detailed DX data, he would spend time programming UNIVAC to see what we could learn about VHF DX. Maybe even predict it with a measure of accuracy. Now of course we haven't invested in UNIVAC equipment for this purpose. But Russ wants to tackle the project on his own on weekends in true ham pioneering spirit. So we say OK.

The last page of this heavy card insert contains a special reporting form for the four week period March 15-April 15. VHF readers who wish to contribute to W5HCX's project can start the ball rolling by completing the card as the month wears on and return it to Russ' attention. We'll have more detailed reporting forms for all UNIVAC Propagation Reporters in the months ahead, but this card will give Russ what he needs to get the project started. Even if you have no DX to report, file the card anyhow noting that you heard no DX, and indicating that you wish to become a regular U.P. (UNIVAC Propagation) Reporter. Russ will do the rest!

W5KHT

NEW SUBSCRIBER INSTRUCTIONS

Use top form (FORM A) to subscribe to VHF Horizons yourself. Use middle form (FORM B) to have a friend subscribe. Use bottom form to send us the call letters of VHF stations you hear on the air in your area. We'll send them a sample copy of VHF Horizons in hopes that they too will subscribe!

FORM A FORM A FORM A

___ Enclosed is my check/money order for $4. Enter my 15-month subscription to VHF Horizons starting with the next issue to be mailed.

NAME ______________________ Call __________

Address ______________________________

Town/City ______________ Zone ______ State __________

Airmail to: VHF Horizons
P.O. Box 1557
Oklahoma City 1, Oklahoma

FORM B FORM B FORM B

___ My VHF buddy has twisted my arm until I can bear the pain no longer. Enter my 15-month subscription to VHF Horizons in return for my $4.00 enclosed. Start me soonest.

NAME ______________________ Call __________

Address ______________________________

Town/City ______________ Zone ______ State __________

Airmail to: VHF Horizons
P.O. Box 1557
Oklahoma City 1, Oklahoma

FORM C FORM C FORM C

Here are some of the VHF-UHF'ers active in this area. See that they receive a sample copy of VHF Horizons with mucho speed.

Airmail to: VHF New Calls
P.O. Box 1557
Oklahoma City 1, Oklahoma

A NFM Adapter

by Jim Speck, W5PPE
1609 Glenbrook Terrace
Oklahoma City, Okla.

As a beginning step in a program of on-the-air weak signal checks of NFM vs. Sideband being undertaken at this station, in response to the recent articles in VHF, this adapter was designed to allow the station receiver to receive simultaneously SSB and NFM with no switching or modification to the receiver required.

The adapter plugs into the Q-Multiplier socket on the rear of the Drake 2B, and consists of one 455 Kc IF amplifier, a limiter, diode discriminator, and one stage of headset audio. The effect is to have two receivers, the 455 Kc FM "receiver" and the 455 Kc superhetrodyne "receiver" following the same tunable "converter," (the VHF converter and the Drake front end).

This means the tunable passband and product or diode detector in the Drake has no effect on the NFM reception, and may be set up as desired, namely zero beat with the (suppressed) carrier of the SSB or FM signal. Listening to NFM reception with phones over one ear, and the speaker turned up, the other station may switch back and forth between the two modes, and A-B checks can easily be made.

This unit will be available on loan to Drake 2B owners within SSB range of Oklahoma City who will report signal comparisons of scheduled six-meter beacon broadcasts of W5PPE, first SSB and NFM of comparable power level. Similar units may be constructed by those not wanting to wait on their chance at the unit, or for independent experimentation.

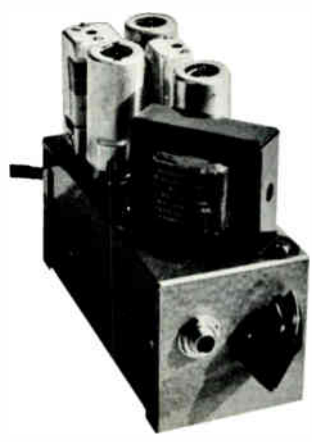
Of course, this adapter will give broadcast quality reception of other NFM signals such as from the Elmac AF67-68 series transmitters. All parts are readily available standard components, and the unit may be duplicated in three or four evenings.

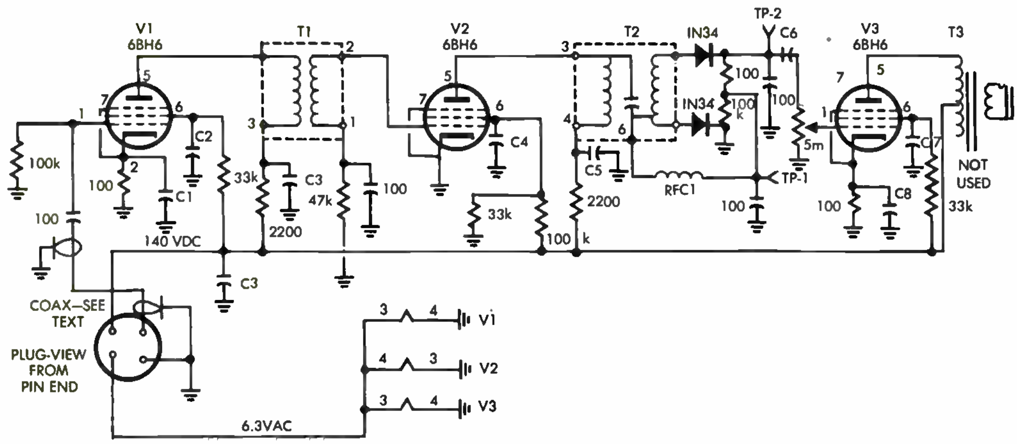
While the parts layout and wiring is not critical, hole layout is shown in Figure 1 for those who wish to duplicate this unit. The chassis is a 2¼ x 2¼ x 5 in. LMB utility box, which is just adequate. The Q-Multiplier plug is a Cinch-Jones 5AB2 battery plug. The 455 Kc signal is brought in with coax cable, which should be short, since its capacitance detunes the Drake's AM/SSB stages. The coax used in this unit was Amphenol Subminax 75 ohm, but RG-58 or 59 is also suitable although larger.

The detuning referred to above is bad enough to require retuning of the Drake T-2 IF can, if use on the Low-Frequency bands is desired. However, most VHF converters have plenty of gain to render this unnecessary for the purpose of these tests. If for a permanent installation, it is recommended this transformer be adjusted to compensate for the added capacitance.

After checking the wiring for errors, the unit may be plugged in and the receiver warmed up. Test equipment required for alignment is a DC VTVM (preferable to a 20,000 ohm-per-volt meter which can be used although it loads the circuit) and a source of unmodulated carrier (such as the crystal calibrator, your VFO, or crystal oscillator).

Tune up Procedure: A. Tune in the test signal and zero beat with the BFO and product detector on, listening on the loudspeaker. B. Connect the VTVM to TP-1 (I used a lug on the terminal strip for the TP), and adjust the slugs in T-1 for maxi-



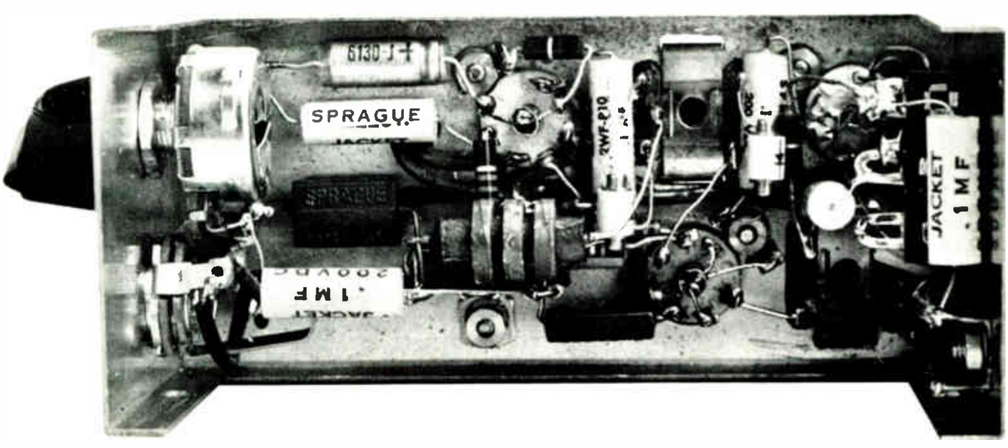


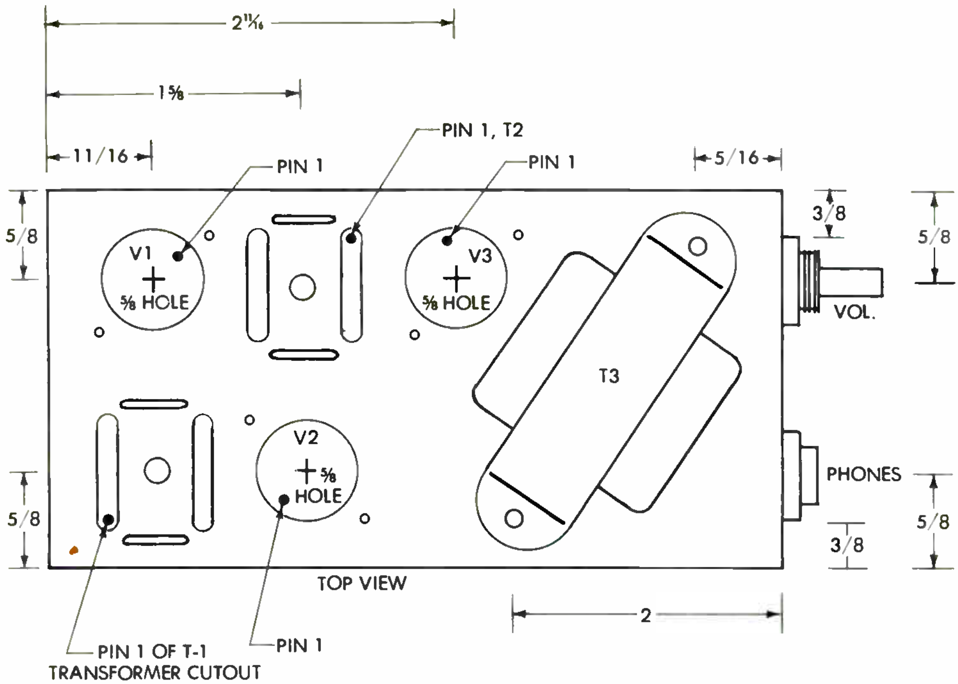
SCHEMATIC DIAGRAM OF NFM ADAPTER shows all wiring. Power is taken from Drake receiver. Nothing is particularly critical. Unless otherwise specified capacitance values without decimal point are in pF (micromicrofarads) and those with decimal point are in microfarads. Resistance values are in ohms; unspecified resistors are ½-watt composition units.

mum voltage, using an insulated tool. C. Next connect the probe to TP-2 and adjust the top slug in T-2 for zero D.C. voltage. D. Then vary the main tuning control of the Drake and note the frequency change to give a peak positive (one way from zero beat) and a peak negative (other way) voltage indications. If the bottom slug is properly positioned, the frequency deviation up and down will be the same for the peak readings on the VTVM, and the voltages at the peaks will also be the same, although one is negative and one positive. If this is not the case, change the setting of the bottom slug a little and begin again with step C above. A little juggling may be required, but it quickly comes in.

The peak separation, with the IF shaping given before the discriminator, is about 12 Kc with a linear response of about plus-or-minus 4.5 Kc. This is just a little more broad than optimum for a 3 Kc deviation, but the performance should not be degraded to any great extent.

On tuning the band with this adapter, you will discover it has a broad response to a signal, very noticeable in comparison to the 3.6 Kc position of the Drake's AM section. Also, some response to AM signals can be heard, except when tuned exactly on the signal (unless of course there is some incidental FM on the signal which is illegal on Six) although the gain control on the adapter must be well advanced to hear it. This has resulted in an unexpected bonus of being able to work local (AM) nets listening over the phones and not having to touch the dial!





PARTS LAYOUT for NFM adapter is shown in this drawing. See text for full details.

PARTS LIST

C1 0.1 mf 50V disc capacitor
C-2 thru C-7 0.1 mf 200V capacitors (Sprague 2WF-P10)
C8 5 to 10 mf 10V electrolytic
RFC1 10 mh ferrite-core RF choke (Miller 6306)
T1 455 Kc input transformer (Miller 12C1)
T2 455 Kc discriminator transformer (Miller 12C45)
T3 18K C.T. to 600-ohm 2-watt output transformer (Triad A-53X)
All 100-pf capacitors are silver mica.

Letters

Dear VHF:

I have a problem and perhaps you can give me a solution or tell me who might. I have converted an FMT-50D Motorola "coffin box" to 6 meters and AM with a transistorized modulator, but not only get AM but also FM. Everyone has to tune to the side of my carrier to copy the audio and thus the carrier goes down. If one tries to copy the audio at the center, it is distorted and bassy. I tried bypassing the modulator tubes, but the drive dropped to almost nothing. Thanks for any suggestions.

73,
Richard Jacobs, WA0AIY
1015 Glenside Place
University City 30, Mo.

Richard—

Haven't run into this problem here in the office; maybe some of the readers will have some answers for you. How about it, gang?

Dear VHF:

The following may suggest some stimulating thoughts on polarization during skip conditions within the VHF spectrum:

If the reflecting matter is off a considerable distance, either to the left or right, as opposed to the shortest path, horizontally polarized signals would then appear to be in a simulated vertical plane upon arrival at the other end of the circuit.

I have taken the liberty of presenting the above theory hoping it will be of interest to you and your readers.

Yours truly,
A. W. Poze, K6LEK

OM—

Thanks for the thought. Any of the slipstick crowd want to discuss it at length for us?

Dear VHF:

While I'm not a darn bit interested in VHF anymore, I take your magazine. I want to congratulate you on the fine circuit drawings in the January issue. I have been trying for years to get the magazines to print heavy line drawings so that we blind old timers can see them without going for our specs. Keep it up and don't let anyone talk you out of it even if you need more advertising space. Best of luck to your magazine.

73,
Ed Marriner, W6BLZ
528 Colima Street
La Jolla, Calif.

Ed—

We'll try! Wish you would reconsider all these megacycles we have up here—we'd like to have some of your fine copy in our pages!

Dear VHF:

Could you tell me where and at what price I can get a AM-33/ART transmitter as you had the dope on in the February issue?

I want to thank you for the fine way you are publishing your magazine. It is the best and I am sure glad I subscribed for it. If I had to take only one it would be VHF.

73,
Glen H. Adams, K0USB
118 South Main
Independence, Mo.

Glen—

Sorry we don't have (yet) a list of surplus houses handling the AM-33/ART. Maybe some of the gang can help us out along these lines; we'd like to know the name and address of every surplus house in the country so next time we have a "goodie" conversion article we can check and find out who has it. Listening, gang?

VHF Showcase

NOISE-CANCELLING MIKE

Noise-cancelling microphones can provide highly intelligible radio transmission from crowded, noisy locations, according to **Shure Brothers, Inc.**, 222 Hartrey Avenue, Evanston, Ill.

Shure reports side-by-side comparison tests of their 440SL standard mike and their model 488 noise-cancelling unit at ham stations set up in public fairs at Chicago. First tryout was at W9TEM, operated by Chicago Radio Council, Inc., during the International Trade Fair. Another, also at W9TEM, was at the National Electronics Conference.

Transmissions over the 488 could be copied easily even when a person standing near the operator could not hear his voice, Shure reported.

For full data on the 488 and other noise-cancelling units in the Shure line, write the manufacturer.

RECTIFIER REPLACEMENTS

They're not new, but many of us possibly haven't realized that silicon-diode units to replace vacuum rectifiers have come down to reasonable prices.

Sarkes-Tarzian Inc., Bloomington, Indiana, reminded us here at VHF of this by pointing out that their S-5251 unit, which replaces the 5U4, 5AU4, 5AW4, 5AZ4, 5T4, 5V4, 5W4, 5Y3, and 5Z4 tubes, sells for less than $7 net.

Their bulletin on "Tube Replacement Silicon Rectifiers" lists a number of other such units too—including one, the S-5344, which replaces an 872A! It's more expensive, though.

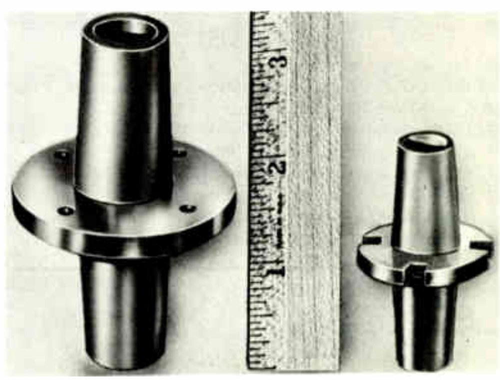
To get a copy, write to S-T and tell them we sent you.

A BRACE OF BOOKS

Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis 6, Indiana, the book-publishing people, have announced three new titles which should be of interest to VHF/UHF minded hams.

They are "ABC's of Lasers & Masers," by Allan Lytel; "Handbook of Ham Radio Circuits," by David E. Hicks, W9CGA; and the fourth edition of Sams' "Transistor Substitution Handbook."

We'll be reviewing all three in the coming months, undoubtedly. In the meantime, if you'd like to know more about them, drop a note to Mal Parks at Sams and tell him we suggested it.



25-KILOVOLT CONNECTOR

A high-voltage connector insulated for 25,000 volts and capable of handling up to 20 amps has been announced by **Kalpa Scientific Laboratories, Inc.**, Dept. VHF, P.O. Box 172, Flemington, N.J.

Made of modified diallyl phthalate for superior arc resistance and low power factor, the connector is said to be easily mated with a standard banana jack for quick disconnect or with a 10-32 machine bolt for permanent service. They're available in 10 colors.

For more information write the manufacturer.

SSB TRANSCEIVER

Leo has done it again! Leo Meyerson, that is, at **World Radio Laboratories,** Council Bluffs, Iowa. He's come out with a SSB transceiver, the "Galaxy 300."

Though it's designed to cover only 80, 40, and 20 meters it should be a natural mate for the VHF "Transceiverter" described last September. WRL says it's the most economical (under $300) SSB transceiver on the market, and we won't argue (or agree either if some other transceiver maker is listening—we're just telling you what he told us).

For complete specifications on the 20-tube unit, drop Leo a line.

COOLING FAN BULLETIN

A new 4-page technical bulletin containing complete specifications on the super-silent Whisper Fan for cooling electronic equipment has been released by **Rotron Mfg. Co., Inc.,** Woodstock, N.Y.

The bulletin contains performance curves, application and mounting information, dimension drawings, and OEM selling prices.

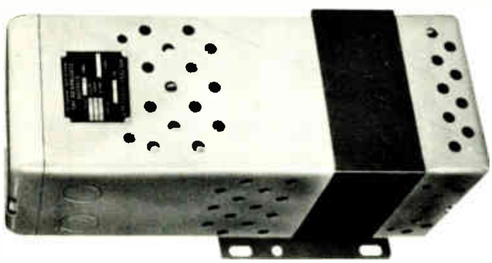
Write to Rotron and ask them for technical bulletin No. E-2801

MIDGET INDICATOR BULB

An indicator bulb so tiny that it would take a hundred of them to cover a penny has been introduced by **Aristo-Craft Distinctive Miniatures,** 314 Fifth Avenue, New York 1, N.Y.

Less than 1/16-inch in diameter and only 3/16-inch long, the tiny bulb is available in various voltage ratings. Suggested uses are as indicators, tuning pointers, etc. Price is said to be exceptionally low.

For full data and specifications, drop a note to Mr. M. Hubert. Aristo-Craft caters to hobbyists as well as engineers.



POWER REGULATION DEVICES

An extensive line of power regulation devices, to be marketed under the name "Powerguard," is being developed by **Stancor Electronics, Inc.,** 3501 Addison Street, Chicago 18, Ill.

First such units will be automatic line voltage stabilizers, holding line voltage variations within 1 percent for 15-percent variations on the input side.

The units will be available in 30, 60, 250, 500, 1000, and 3000 VA ratings. They will be stocked by Authorized Stancor Industrial Distributors.

For additional data, write to Mr. Roy Horstmann, industrial sales manager, at Stancor. Tell him we sent you.

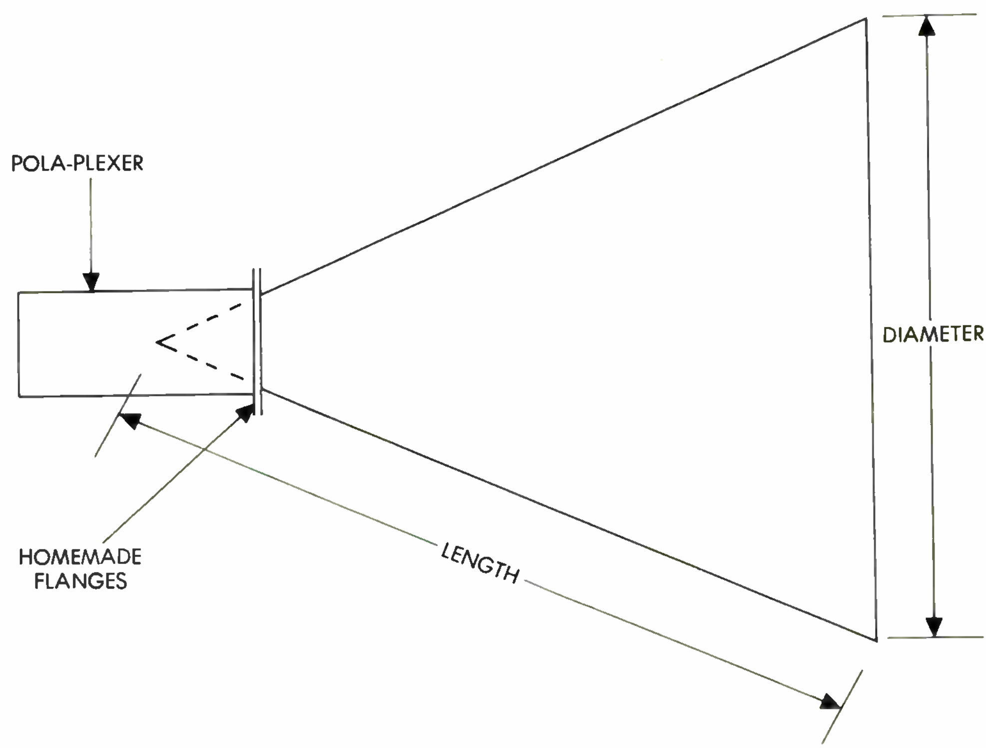
3300 Mc Conical Horn

The conical horn can be constructed by anyone with a large piece of metal (even galvanized iron), a good pair of tin snips and a hot soldering torch. To many, the conical horn looks like an overgrown funnel. It requires no focusing and if long enough will produce an excellent antenna pattern.

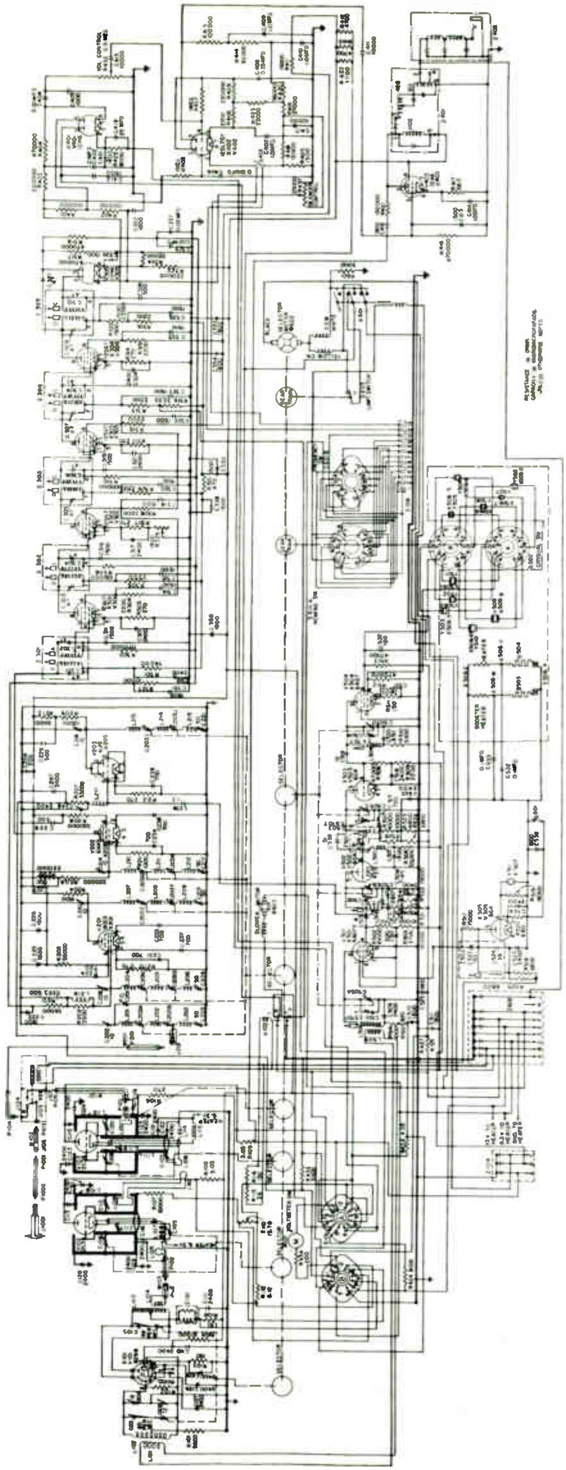
The basic disadvantage of the conical horn is that the length becomes very large when a large aperture of high gain is desired. For an optimum gain conical horn (a conical horn with a maximum gain for a minimum length) the length is related to the mouth diameter thusly: LENGTH = DIAMETER SQUARED / 3 x WAVELENGTH.

One can see, by running the equations through the mathematical mill, that a 12-inch diameter 3300 Mc conical horn should have a length of 13 inches and will yield about 18 db gain over an isotropic radiator. If the diameter is doubled, the length must be quadrupled and the gain will be increased by 6 db; i.e. 24 inch diameter, 54 inch length, 24 db gain and so on. It is obvious from these examples that the length becomes large as the gain is increased, but if the length for a given diameter is decreased, the horn efficiency decreases, and the side-lobe structure becomes larger.

However, this antenna is the easiest type for the home constructionist to fabricate and is recommended if a parabolic reflector is not available. The technique is identical to the construction of an ordinary funnel, with the small opening designed to fit the feed system.



CONICAL HORN FOR 3.3 GC looks like this when seen from the side. See text for details of size; refer to October, 1962 issue of VHF for details of Pola-Plexer feed arrangement.



SURPLUS SCHEMATIC of the month from **W6NLZ/A6NLZ** is this one of the MAR unit. John promises more in the months ahead; sorry we have no additional data on the unit but John has described two separate conversions of it in past issues.

An Unusual 6-Meter Preamp

by Joseph Marshall, WA4EPY
Ozone, Tenn.

Most hams working the 6-meter band use amateur band or general coverage receivers. Those which do not cover the 6 meter band are preceded by converters. There are several amateur receivers which do cover the 6 meter band barefoot. However, most have a relatively poor noise figure on 6 and therefore the sensitivity is considerably below the optimum. The simplest way to improve 6 meter sensitivity of these receivers is with a preamplifier with a good noise figure. In this way the sensitivity can be made as good or better than that of receivers with converters ahead of them.

However, the increased ham population on 6, especially in the metropolitan areas, and the rapidly growing trend to higher powered transmitters, has raised some very serious problems with "overload" or "Cross-modulation" of receivers when they are preceded by preamplifiers. The usual preamplifier using a triode in a neutrode or cascode arrangement is so prone to overload that the added sensitivity is often useless when a nearby 6-meter station comes on the air.

The overload or cross-modulation is the result of two factors. First, the added gain of the preamplifier pushes a much larger signal into the input of the receiver and thus may overload it. Secondly, and more often, the overload occurs in the preamp itself because most preamps use sharp cut-off triodes which are easily overloaded and when overloaded turn into detectors or mixers.

High sensitivity and a fine noise figure are obviously not very useful if they cannot be realized a high percentage of the time. Therefore, the objective in a preamplifier must be a combination of high sensitivity plus high immunity to cross-modulation and overload. The preamplifier described here provides sensitivity which is only about 1 db poorer than that of an ideal receiver on 6, has very high immunity to overload and cross-modulation, and, as a bonus, is considerably less critical to put together and much more stable than the typical neutrode or cascode.

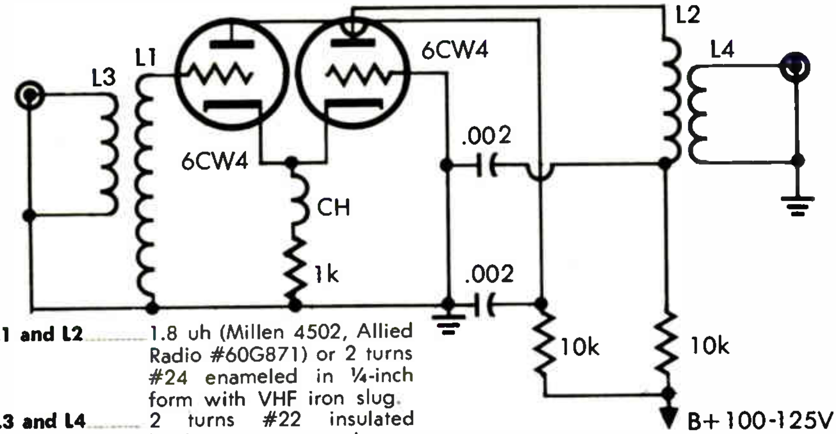
THE CIRCUIT

The cathode-coupled RF amplifier of Figure 1 has received very little attention. There is only one commercial application to my knowledge — in the Dynatuner. In the standard texts and handbooks it is dismissed with a once over lightly comment which stresses that the noise figure and gain are both poorer than that of the same tube as a grounded-cathode amplifier. This criticism is valid but exaggerated. The **theoretical** noise figure is poorer but the **practical** noise figure is not much poorer.

The first section, being a cathode follower has no gain and indeed a small loss. The second section is grounded-grid and ordinarily one cannot expect as much gain from a grounded-grid as from a grounded-cathode stage. However, as in the case of the cascode, there are features in this configuration which are not obvious at first sight and which result in a better noise figure and more gain than most people believe.

The cathode follower input tube, while it has no gain, does have a very high input resistance. If a tube with a high input admittance is used the result is extremely light loading of the input tuned circuit and therefore a much higher effective Q and higher transformer ratio. As a result, a given signal delivered to the antenna has a much higher value at the grid of the cathode follower than it has at the grid of either a grounded-cathode or grounded-grid amplifier.

In practice, within the 30 to 100 Mc range, this may amount to a 10 db improvement in Signal-to-Noise ratio. This helps to make up for the lack of gain, and while the grounded-grid section sees more noise that it would connected directly to the antenna it also sees a higher signal. It also develops more gain than when fed by an antenna directly, because the cathode load provides a better impedance match. As a



L1 and L2 1.8 uh (Millen 4502, Allied Radio #60G871) or 2 turns #24 enameled in ¼-inch form with VHF iron slug.
L3 and L4 2 turns #22 insulated hook-up wire wound over L1 and L2.
CH 1.8 or 2.2 uh choke (allied Radio #57G865) or 20 turns #24 enameled on 1-W resistor
J1, J2 BNC or 83 type chassis connectors, or phono jacks.

FIGURE 1

result the overall gain can be 20 to 26 db in a wide band amplifier which is quite comparable to the gain of a neutrode triode and quite sufficient to bring the sensitivity to ½ microvolt or better, providing the noise figure is good enough.

The need for very low noise figures on 6 meters is greatly exaggerated. In a very quiet location, where there is little or no man-made noise, and using directive beams with gains of 10 db or more, the cosmic noise level at its lowest amounts to an equivalent noise figure of 6 db. Calculations, which we will not go into here, will show that a receiver noise figure equal to the noise figure of the cosmic noise at a given frequency results in overall sensitivity only some 2.7 db poorer than that of a perfect receiver; and a noise figure one-half that of the cosmic noise yields a sensitivity only 1 db poorer than that of the perfect receiver.

It may have been difficult to achieve noise figures in the 3 to 6 db region two or three years ago with a cathode-coupled amplifier, but it is no trick today. It is quite possible, for example, by using a pair of 6CW4 Nuvistors to achieve a noise figure of less than 3 db in a cathode-coupled amplifier. The difference in performance between such an amplifier and the optimum neutrode with a possible 1 db noise figure, is completely indistinguishable since the difference in actual sensitivity will be a small fraction of 1 db, when the two are used with an actual antenna in space picking up cosmic noise.

Furthermore, the cathode-coupled amplifier has two big virtues which provide sizeable bonuses. First it is the most uncritical and stable of all RF amplifiers, not excepting the grounded grid. So far as the tubes are concerned the isolation between input and output is complete. There is no capacitance between input and output except that contributed by the wiring. The only possible source of coupling between input and output is through the input and output tanks. If this is minimized by proper placement of the two coils, the circuit will be stable and oscillation or regeneration cannot occur. This is another reason why in practice the cathode-coupled amplifier has a noise figure little if any inferior to that of a neutrode or cascode. A neutrode or cascode which is regenerative will have a poor noise figure — and very few high gain preamplifiers are carefully enough neutralized to prevent regeneration throughout the operating range.

But for our particular purpose, the great advantage of the configuration is its high immunity to overload. It is virtually impossible to overload it with anything short of a signal of several volts.

This does not mean that complete freedom from overload and cross-modulation will be achieved. The receiver itself can still be overloaded and, indeed, the additional gain of the preamp makes this more likely. But in general the overall immunity to overload is almost entirely a factor of the receiver characteristics. In other words, the cathode-coupled preamp will give additional sensitivity without making the receiving setup significantly worse from the point of view of overload than it is when running barefoot. More than this no preamp can do, and very few can do it as well as the cathode-coupled preamp.

PRACTICAL MODEL

The diagram of Figure 1 shows a prototype of a practical preamp for 6 meters using a pair of 6CW4s. The gain is about 26 db for a 2 Mc bandwidth and about 20 db for a 4 Mc bandwidth. The noise figure can be adjusted to less than 3 db if a noise generator is available and will not be much worse than 4 db if the preamp is peaked on cosmic noise. Ahead of an SP600 receiver, it is possible to work a 10 microvolt signal within 25 Kc of a 100 millivolt signal, and a 1 microvolt signal within about 200 Kc. There are no spurious responses. The effect of the interfering signal is to reduce the receiver gain as it comes close to the receiver band-pass. It would be possible to work duplex with separate receiving and transmitting antennas and a separation of about 200 Kc, assuming the receiver and preamp are both well-shielded and there isn't too much stray RF in the shack.

Although the suggested layout is logical it can be varied without too much risk of trouble. Here, for example, a shield is used between the two sockets to isolate the input and output coils. The shield could possibly be dispensed with if the coils were mounted at right angles to each other. On the other hand, the shield provides a very convenient central wiring distribution and grounding point.

The two sockets are mounted close together and oriented so that the grid of the first tube will be close to the input coil and the plate of the second close to the output coil. The common heater and cathode connections are made through very short lengths of insulated wire passing through small holes in the shield. All bypass grounds are made to one point — the anchor point of the terminal strip on the shield. The terminal strip is grounded to the shield by soldering to the shield, rather than with a bolt and nut. The grounded grid and heater terminals are grounded right at the socket terminals.

I have found the phenolic base Printed Circuit board with copper foil on both sides a very convenient chassis for VHF work. It is easily drilled and grounds can be soldered directly to the foil with a small soldering iron or gun. Only one precaution is necessary. The two copper sides must be joined together somewhere, otherwise the chassis would be a large capacitor and instead of a direct connection between top and bottom we would have a capacitative one.

Here they are bonded together at the sockets, which are soldered to the upper foil at the mounting lugs, and to the bottom foil at the metal rim of the socket. The bolts fastening the input and output coax connectors also bond the two foils together.

No attempt was made to insure minimum losses. The coils were wound on forms with high frequency slugs and relatively small wire. Larger coils with larger diameter wire would undoubtedly be more efficient though the difference might not be very noticeable. The standard commercial coils listed offer the simplest means of obtaining the tanks; but if you have a grid-dip meter you can wind any coils that will resonate within the 50-Mc band with the tube capacitance. The best procedure is to wire the other components into the circuit before dipping the coils. Then dip the coils with the tubes in the sockets. It is best to trim the coils so that they will resonate in the middle of the band with the slugs about half way in. The hot-tube capacitance will be slightly different from the cold-tube, and if you do not leave yourself some tolerance you may find that one coil or the other resonates outside the band and maximum gain cannot be achieved.

Adjustment is simple. Peak the antenna coil at about 50.5 and the output coil at about 51.5 for a 2 Mc bandpass; or 51 and 52.5 for a 4 Mc bandpass. The light loading of the input coil will be very evident when doing this because the resonant peak will be quite sharp. A signal generator feeding a very low level signal is best for this but peaking for maximum noise when the receiver is tuned to these frequencies will do.

The coupling of the link on the antenna coil is very important. When it is placed over the grid coil do not twist it so tightly that it cannot be moved. The simplest way to change coupling is simply to move the coil up and down the grid coil. The best way to do this is with a noise generator for the best noise figure. However, if you adjust it so that the antenna noise is loudest, or a very weak signal is most readable, you will be close to optimum. In the prototype a position almost exactly in the middle of the coil turned out the best noise figure—2.7 db.

The preamp will require 100 to 125 volts at around 15 Ma maximum. This can be stolen from an appropriate point in the receiver, if it has no accessory socket. If the available voltage is higher than 125 volts a series resistor should be added to reduce it to between 100 and 125. The optimum voltage appears to be about 80 V at the plates of the Nuvistors.

Although the cost of two Nuvistors is obviously greater than the cost of one, there is a saving in other parts and the total cost will be little more than that of a neutrode type preamp and less than that of a cascode. The sensitivity will be fully as good and the immunity to overload nearly complete.

The problem of overload in converters can be treated similarly. A converter using a cathode-coupled RF stage into a cathode-coupled mixer would have much higher immunity to overload than the usual neutrode RF and triode mixer configuration. The noise figure would probably not be quite as good as that of the preamp feeding an RF stage because the mixer would make a noise contribution, but it can probably be held down to 6 db. This will still yield pretty close to the optimum sensitivity possible on 6, and less than 2 db poorer than that of the best possible practical converter.

The configuration can be used on 2 meters although the noise figure with Nuvistors will not be nearly as good. A pair of 417As, however, would yield results at least as good as those in a two-stage grounded-grid arrangement.

The arrangement can be useful in a booster on the FM band for one or two stations within a couple of megacycles of each other in locations where proximity to a powerful local FM station causes troubles with ordinary boosters. A cathode coupled booster covering the entire 20 Mc would be difficult to achieve because of the high Q of the input coil and the gain would be very small, unless the two tanks were tunable and could be peaked for any station in the band.

A frame-grid double triode, like the 6DJ8, will provide performance quite close to that with two Nuvistors.

But for 6 meters, the cathode-coupled configuration provides just about the optimum combination of noise figure, sensitivity and freedom from overload and cross modulation that the state of the art permits today at any reasonable price.

Another SSB Mixer

By Ken Holladay K6HCP
1109 Norval Way
San Jose, Calif.

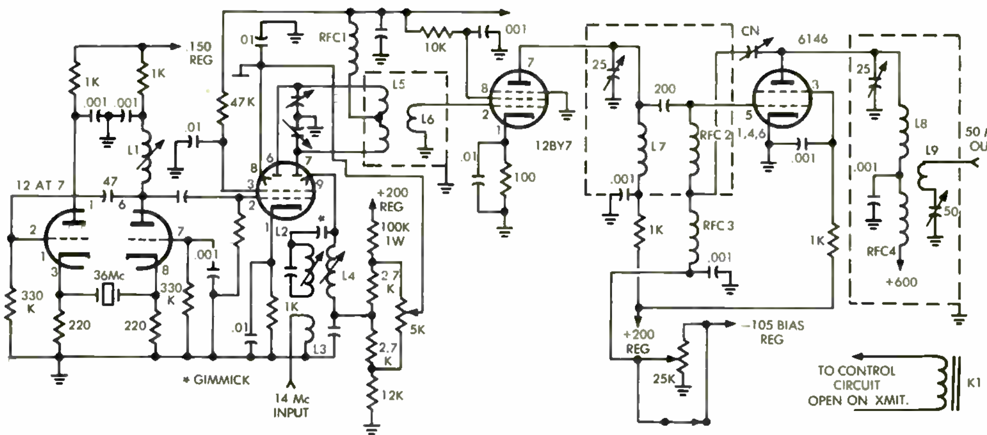
I am going to describe a more complex mixer than has been presented before for getting on 6 meter SSB. The reason for the complexity is that it is not a "power mixer." It is a true low-level, low-third-order-distortion, and low-frequency-drift mixer.

After being on 6 meters for 3 years with a 6360 power mixer and listening to the new SSB signals that appeared on the band from time to time, it became evident that a more sophisticated mixer was necessary to minimize drift and distortion, so I set out to build a good SSB mixer.

First the problem of drift in the 36 Mc crystal oscillator seemed easy enough to solve by using a Butler oscillator. It requires low crystal current, thereby cutting down crystal heating. The crystal and the plate tuning are isolated so changes in output tuning do not pull the frequency. This circuit also works well with overtone crystals.

Next came the problem of the mixer. After scrounging through the tube manuals, it was decided that the RCA 7360 beam deflection tube was the best bet. First it is a tube designed to be used as a mixer; it requires low drive, isolates SSB input from the crystal oscillator (no pulling with modulation), provides cancellation of the 36 Mc signal (a cause of T.V.I. 36—36—72) (72—14—86) (72—14—58) and gives low third order distortion.

The only drawback with the 7360 is the output voltage which is not high enough to drive a power amplifier. After some con-



SSB MIXER SCHEMATIC shows wiring of unit. Unless otherwise specified capacitance values without decimal point are in pF (same as micromicrofarads) and those with decimal point are in microfarads. Resistance values are in ohms; unspecified resistors are ½-watt composition units.

sultation with Jay, K6HUM, who was building a similar system, a 12BY7 in class A was put in to act as a voltage amplifier.

Finally a 6146 power amplifier was added. This provides enough signal to use on the air directly or to drive a high power grid driven linear.

Circuit Description

Butler Oscillator: The Butler uses a 12AT7. One half of this is used as a cathode follower driving through the crystal to the other half of the tube which is run grounded grid. The G. G. plate which is tuned to the crystal frequency supplies the oscillator output and regenerative feedback to the grid of the cathode follower and presto, it oscillates! The output is also taken from this plate.

The only adjustments are the values of the cathode resistors. These should be reduced to a point where the oscillator has a minimum output but still oscillates satisfactorily and will start all the time. The values shown should be all righ for most oscillators.

7360 Mixer: The oscillator is coupled to the first grid of the mixer. The SSB is coupled through a bandpass transformer to one deflection plate. The deflection plates are also connected to a DC network which is used to balance the plate currents for best oscillator-frequency rejection in the plate circuit.

The plate circuit is connected in push-pull, with the output taken from the center of the plate coil.

12BY7 Amplifier: This stage is driven from the 7360 plate circuit through a two turn untuned link. The output is capacity coupled to the grid of the 6146.

6146 Amplifier: The grid circuit is a Z-50 with the neutralization stub taken from the cold end. A small RF choke was put after the Z-50 to develop enough RF for neutralization. This is then decoupled and goes to a bias supply. The screens are run at —200 volts regulated. The regulation is a must.

Miscellaneous Things: Shielding is necessary around the final, as well as 12BY7 plate and 6146 grid circuits and the 7360 plate and the 12BH7 grid. The gain through the 12BY7 is so high that any little RF signal in the proper phase will make the mixer oscillate.

You will note in the pictures that I did not fully enclose the grid circuit of the 6146 or the 7360 plate circuit. The reason is that when I laid out the mixer it was not known that such extensive shielding would be necessary so I had to put it in place after assembly.

In the picture you will also note there is a copper strap on the 6146 tube socket. This was put on in an attempt to stabilize the mixer but the problem was solved with the addition of the shielding.

The pictures also show the neutralizing stub closely coupled to the plate circuit. This is because there is very little RF at the cold end of the Z-50 in the grid circuit. A smaller stub or a variable capacitor could be used if the grid circuit were changed.

The small butterfly in the 7360 plate circuit is inconvenient to use but it was the only butterfly I had when I built the mixer.

In the original layout I had lots of room and things were not so crowded, but with the addition of the 12BY7 and the shielding things got a little messy. The pictures do not show much detail but they do give the basic layout and show my mistakes which you should be able to benefit from and you should come up with a good clean layout.

The small relay in the bias circuit of the 6146 is to bias the tube completely off during receiving since the gain of the system is so high that mixer noise gets into the receiver. This relay can be anything that is compatible with your own system.

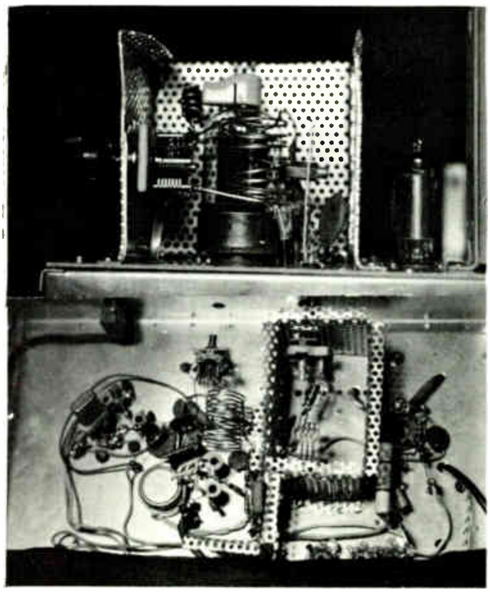
Adjustment

Turn on the filaments and check to see that there is at least —50 volts bias on the 6146. Turn on the B-plus to all stages except the plate and screen of the 6146.

Using a grid dip meter, adjust the 36 Mc oscillator for maximum output. If it does not oscillate, increase the value of the two cathode resistors.

Next, look for a 36 Mc signal at the plate of the 7360. Adjust this for a minimum with the deflection plate balance control.

Apply a 14 Mc signal to the bandpass transformer. (This does not have to be very big. I am driving the mixer to full output with a C. E. 10B swamped with 22 ohms). Adjust the transformer for maximum signal.



Later the coils can be stagger tuned so you can VFO around without retuning these stages.

Tune the 7360 plate and 12BY7 for maximum signal.

Now, with the G.D.O., adjust the neutralization stub for minimum, signal at the 6146 plate circuit.

Turn off the drive and apply B-plus to the 6146 plate and screen. Adjust the 6146 bias to get 23mA plate current.

Turn the drive back on and adjust the plate and the loading condensers for maximum output. If you bowed toward Mecca and had your fingers crossed, you're now on the air.

It is interesting to note the very low driving power required. It makes this unit a natural to use with any very low power 14 Mc SSB generator, either tube or transistor type.

Be careful not to overdrive the unit. This can be seen when the output stops increasing with an increase in drive and the

Well, that's it. I hope the mixer works as well for you as it has for me. It's a good low power rig as well as a driver. It appears to be free from TVI without the use of a filter.

I would like to thank Jay, K6HUM, for the help with the voltage amplifier, and Phil, WA6FCH, for the pictures and all the on-the-air checks.

COIL DATA

L1	15 turns No. 22 on ¼-inch dia. form
L2	30 turns No. 26 on ¼-inch dia. form
L3	3 turns No. 26 at cold end of L2
L4	30 turns No. 26 on ¼-inch dia. form
L5	10 turns No. 16, ¾-inch diameter
L6	2 turns No. 16, ¾-inch diameter
L7	3 turns No. 16, ¾-inch diameter
L8	3 turns No. 16, 1 inch diameter
L9	3 turns No. 16, 1 inch diameter, at cold end of L8
RFC1	National molded choke, 6.8 microhenries
RFC2	Ohmite Z-50
RFC3	Same as RFC1
RFC4	Ohmite Z-50

MIXER DETAILS are shown in the photos at left. Upper photo shows top-chassis wiring of 6146 output stage. Lower photo shows under-chassis arrangement. Shielding doesn't look so neat but works well and is inexpensive.

Vital Happenings & Facts

OPERATING AND DX NEWS

WATCH THE BAND!

That time of year is rapidly approaching again. DX season.

Is there a six, two, 220, or 432 heart so heavy that a bit of summertime DX will not lift its heavy burden? We think not.

We are reminded of the many openings, especially in the south and mid-west, that go practically unnoticed on two meters and above. Down in the south and throughout the mid-west DX types are forever reminding us to have the gang tune the band(s) more often. We have a letter on our desk at this moment from a W5 in the deep south who bemoans the apparent backwardness (as he puts it) of the WØ stations in Iowa on two meters.

Seems this W5 type spent a frustrating several hours one evening last summer listening to an Iowa two meter net in which 50% of the Iowa stations were solid copy, with the 522's and ground planes or dipoles. Of course he didn't have the particular crystal to get him on net frequency (he has since gone VFO on two!), so he did his best to attract their attention (or anyone's attention) down the band several hundred kc's!

He still needs Iowa for two meter WAS.

All of which boils down to a little diligence on the part of more of us to give the band an adequate tune whenever we hear the semi-local stations running even an S unit above normal. It's surprising what old man weather will stir up for us if we would only look around to see what is taking place. Too often we get inclined to tune with the RF gain turned way down so the local block buster signals won't wrap the cans around our noggin. Only to miss the real choice DX signals that are riding over the noise one to several S units.

With all of the new interest in six and two sideband, and the usual beam raising parties that dot the land in April, there is no good reason why we shouldn't add a few new states in the next 8 weeks.

If we would all only tune a little more before calling CQ, and then tune the band with everything cranked wide open before we shut down for the night.

DX NEWS

The DRP program is in full, full swing. It looks like we may make WAS-DRP one of these fine months soon. This month we have DRP reports from 30 states and all Call-Areas on hand as we deadline our report, and dozens more coming in daily. Don't forget to send yours along this month!

144 Mc activity was highlighted by the League's SS contest. K1WHS/K1WHT, Westport, Connecticut reports working W3KKM, W3KMN, W1-KSI/1, K3KMV, K3GAS, W1VNH (Mass.) and W3TBH during the contest. The same station added a super stability VFO for two and an audio filter with 100 cycle selectivity for DX work.

K1QIC in Maine added a 144 quad antenna, re-worked the two meter rig, modulator and VFO, but reports no DX heard or worked.

W1AHE in Stow, Massachusetts, reports working 6 New England sections during the SS with just 18 watts. 5 other sections were heard on the 24 element beam, 417A converter into his Skysweep converter, but not worked.

WA2ONO, East Meadow, New York reports good activity during the SS and notes copying a VE3 and K8 station while the festivities were on. The VE3 was S3 in bursts while the K8 was a steady S4. Sideband in the area is congregating on 144.-100. W2GMT is now on, using NBFM.

W2EIC/2 in Manhasset, L.I. reports working 532 stations in the SS using six and two meters. A 144 Mc Linear was recently completed.

K3OQP, Uniontown, Pennsylvania is building up a pair of 4X150's for 144 and reports a long string of new calls heard on the air in his locale.

K4YZE votes for more and better articles on converting surplus gear for VHF-UHF, and notes he finished up a tank-air two meter balun for his Marietta, Georgia station. K4YBL, Fort Lauderdale, Florida has a VHF panadapter about ready to go. He's in the process in getting going on VHF SSB.

W4HHY, Nashville, Tennessee is working on a 2-meter SSB mixer. He wonders where he can find an AM-33/ART unit such as was described in the February issue of VHF.

W4BUZ, writing in the North Carolina Ragchewer, notes on the subject of crystal control on VHF, "If you are crystal controlled and happen to get tromped by a VFO, as I did, there is no support for a gripe because we don't own frequencies of our own. Personally, I use 10 surplus crystals which cost me $6.50 and if you don't think I can change 'em fast, just watch! And, I may have clobbered you with my VFO, too, but like the others, I moved off frequency when the contact was over. In the recent SS contest it was necessary to call a station on the frequency used by the station last worked in order to get him, which is DC band practice. Calling him a megacycle away was wasted effort until everyone else had worked him. The big secret is in 'Who acquires the station's attention first.' Avoid pile ups. If you don't get him the first or second try, don't waste 30 minutes beating your brains out. He wants your contact as badly as you want his and will count just as much after the smoke clears. Don't be a one crystal operator, and most of all, avoid 145.350. W4VHH was heard in Greensboro on this spot miserably clobbered by 5 stations he, of course, couldn't hear. And, don't be guilty of a ragchew between 145.0 and 145.4 or you are a meanie even if you are within your rights in the eyes of many."

W5BEP, Longview, Texas has completed a heterodyne converter for 144 Mc SSB, and has the 500 watt final working well. W5-IQE is reportedly getting on 144 Mc SSB with a T-23 converter and 829-B final.

W5WAX, Muskogee, Oklahoma reports adding AMECO converters for two and six as well as converting a Heath Seneca to plate modulation. Stations in Kansas, Oklahoma, Missouri and North Texas were worked during the SS.

Rex, W5RCI, Marks, Mississippi reports finishing up the 144 Mc SSB exciter, and work progressing on the 4X250 final. Rex is also adding RTTY to his two meter installation.

VHF'ers in the California area are planning a real get together at the Fresno Hamfest-Pacific Division Convention combination. Gib, W6BJI, and Alan, W6FZA, are working up a super program. The convention is scheduled for May 18 at the Towne and Country Inn. The Fresno Amateur Radio Club is in charge of the event and it is always one of the best in the west. You can get full data from the F.A.R.C. at P.O. Box 783 in Fresno.

WB6AOW has completed a conversion making a 4X150 surplus rig into a Linear for 144 Mc. He has also been working through the S.F. Bay Area MARS repeater as well as into stations in Bakersfield, Santa Maria and Brackenridge.

WA6OPG, North Sacramento reports running a 417A converter on two, with a Heath Seneca transmitter. The antenna is a 24 foot long 13 element yagi.

W6ILL is new on two with a 75 watt rig and an FCV-2 converter from International Crystal Mfg. Company. He's in Los Angeles.

WA6YOB, San Rafael, California notes conversion of a Link 2240 unit from mobile to AC operation, to be used through the FM repeater now operating on two in the San Francisco Bay Area.

WA6TBL, Campbell, added RTTY gear during this past month.

WA6USW reports installing a Heath Pawnee for two meter mobile operation and a 16 element beam for base. He's in Santa Ana.

WA6SSK, Los Angeles, has finished up a 8 by 16 foot shack for a good winter-time project, and is now working on some high power for VHF.

K6SWO, Daly City, California put up a Slot Antenna and slotted feed line for two.

K6VCO, Riverside, installed a 5 element beam, Nuvistor converter and 2E26 transmitter on two.

W7KRW (ex WØITO) is working to get back on the air in Mesa, Arizona. He plans a complete VHF installation.

WØVKH is another slant 7 operator. He's active from Reno, Nevada in case you run across his call.

K8ANG, Warren, Ohio reports he made his FCV-2 converter overload resistant. Is that the same as overload proof, OM? If so, lots of us would like to hear how you did it!

WA8DZP, Detroit, Michigan reports working W8TWK/9 in Illinois at 2210 EST on February 3.

W9JFP, Milwaukee, reports working K8ZES in Gallion, Ohio on January 5 during the contest. Amazing what an extra bit of activity will do for dead band conditions, isn't it Vic!

WØWYX, 11,500 feet above sea level on Squaw Mountain near Idaho Springs, Colorado reports he has trouble keeping any decent sized arrays in the air. Wouldn't think you would need but a piece of wet string from that QTH OM. He has a four element circular quad on two meters with 100 watts of RF. Should be a good candidate for some real DX.

WAØASA, Wichita, Kansas has completed a 4X250B final and reports working W5PZ in Ponca City during the VHF SS.

WAØDZH, Marion, Iowa reports two meter activity low but he is hoping for some Aurora soon.

KØJQV, Wichita, Kansas reports working a slug of 5 area stations during the VHF SS including VHF's W5HCX and VHF author W5ORH (The Little Feller, November 1962 issue). Both W5HCX and W5ORH were on SSB.

WØLFE, Bowling Green, Missouri reports adding a P and H 2-150 transmitting converter and a Parks two meter converter during January, and notes ". . . like 'em both." Lots of the two meter gang are adding these items to their shacks; VHF recommends both very highly. Ed also reports coming close to a contact with K7-HKD on meteors during January, as well as near misses with WØEYE and WØIUF, both Colorado.

VP7CX

San Salvador, Bahamas

Radio________ Confirming QSO ________ at ________ GMT

UR SIG R ____ S ____ T ____

Rig Here

Gonset G-77A Collins 75A2

Johnson 6N2 Pierson KE-93

PSE QSL TNX ·73·

Harold R. Lund
RCA San Salvador AAFB
P.O. Box 4187
Patrick AFB Fla., U.S.A.

DESSELER PRINTING 1800 N. 30TH STREET MILWAUKEE 8, WIS.

DRP FROM VP7CX

The auroral display the night of February 9 in the northeast produced a phenominal Es session for Harold R. Lund, VP7CX, located at San Salvador, the Bahamas, on February 10.

Starting at 2243 GMT on the 10th and running through 0153 GMT on the 11th., VP 7CX worked 80 W1, W2, W3, W4 stations, plus VHF staffer W5SFW. Harold also writes "I have just received permission to operate two meters this past week and have gear for two." With his signal on six meters, we can expect tremendous things from Harold this spring and summer on 144.

Harold reports working K4TJA at 2007 GMT on January 5 during the contest, and K5MOH, K4KIF, K4-GGU 0228-0248 GMT on January 13. He notes having worked all W1, 2, 3, 4 and 8 states, still needs W6, WØ and New Mexico and Oklahoma for W5.

QSL's go via W9ZDI, and S.A.S.E. are appreciated.

50 Mc News

continues to roll ahead. There were few signs of DX on six during January except for a brief session as the month closed, although February got off to a good E-skip start.

Bob, K8IFL, reports on the address of the newest DX enthusiast outside the USA on six. VP7CX can be reached at (direct) Harold R. Lund, RCA, Pan American World Airways, Inc., San Salvador, P.O. Box 4187, Patrick Air Force Base, Florida. Wow—some address! No wonder he's letting a W9 handle his QSL chores! At last word VP7CX had worked 30 states and all call-areas except W6 and Ø. He's worked more than 500 stations to date from the Bahamas and has worked as far west as K7ALE in Tucson. He is using a 6N2 and a 6N2 converter ala Johnson, with a Finco 6N2 beam. He has also worked KP4 and a YV3 station. QSL's go via W9ZDI, who is also handling his 15 meter QSL's. He can be found on 15 most days, and plans to be on two meters this spring. He also intends to be active on six and two through the summer period, so there is still hope if you haven't yet worked him. Oh yes, his home call is W8LIM and he's from Ironwood, Michigan.

K9DNW/7 is now slant in Libya, North Africa. Wrong part of the sun spot cycle for F2 so here's hoping he makes it back there in say four years.

WA2ADZ asks if we are kidding when we ask for DX reports on the DRP card. Nope OM, not kidding. Some of the gang worked DX as you will shortly see.

In Coming Months . . .

We'll be having the best VHF/UHF articles you've seen for a spell. For example, the following are among the features now scheduled for our May issue (off the presses April 20). Naturally, last-minute developments may make it necessary to replace one or two of these with even more timely material — but if so you can be sure they will be appearing in the coming months.

✔ **Little Joe**

Staff Historian A. David Middelton, W5CA/W7ZC, tells another incident from the days of W2OEN. This is a short but moving story of how one ham, not blessed with capital, managed to stay on the air. If you enjoyed "QSO SHOWBOAT," you'll not want to miss this item.

✔ **Coaxial Cavity Design**

Dr. Wally Lamb, W0PHD, has put together the first practical article we've ever seen on designing your own coaxial cavity to fit your own requirements. They work and they work well. Read how to do it.

✔ **50 Watts on Six — Simply**

Advanced VHF enthusiasts won't like this one at all — it's a simple, direct, efficient 50-watt 50-Mc rig built around a couple of 6CL6's and a 6146. The newcomers to our bands, though, will find it an excellent way to graduate from the transceiver class. K8YZP is the author.

This isn't the whole list by any means. The usual departments will be around, DX and operating news should be even more informative in May as the E-skip season gets into better swing, and we have a few items in the fire we don't want to talk about yet. Don't take a chance on missing this edition of VHF. Subscribe yesterday!

PLACE
STAMP
HERE

AIRMAIL TO: VHF Horizons DRP
P. O. Box 1557
Oklahoma City 1, Oklahoma

UNIVAC PROPAGATION REPORT FORM

Your Location (City and State) ____________________ Call __________

Geographic Coordinates (to nearest second) Longitude ____________________

Latitude __________ Bands covered ____6____2____220____432 Time in ____ST

Date/Time		Station		Location	Leave Blank	Sig Rpt	Type Fading	Antenna Heading
Start	End	Wked	Hrd					

Airmail completed report for period March 15-April 15 to

UNIVAC Propagation Project, Box 1557, Oklahoma City 1, Oklahoma

DRP REPORT FOR MARCH

From Amateur Radio Station ____________________ **QTH** __________

This month we built the following ____________________

____________________. And, we improved the following

gear ____________________

On the air DX highlights ____________________

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Articles we enjoyed in April issue ____________________

WA2DEW/KV4CQ is planning another trip from Bloomfield, N.J. down to St. Thomas in the Virgin Islands. Now that sounds like a good DX-pedition. We'll all be watching for him to show up on six.

WB2CGY, Franklin Lakes, N.J. put a Knight T-150 on six meters recently and wants to know what we think of the Lafayette HE-45 B. It works OM.

K3KEL modified a Clegg 99'er for CW operation. How did you do it OM? He reports heavy wind and ice damaged his antenna system in Montoursville, Pa., so DX has been nil cause he didn't have the where-with-all to hear it !

W4CAH, Charlotte, N.C. reports adding a modulator to his 6N2. One more 100 watt AM signal on the low end this summer.

K5CFT, Sunray, Texas has finished building up the Heath HX-20 for 20 watts of six meter SSB. Now he joins Phil, W5-SFW in representing the panhandle on 50 SSB. Speaking of Phil, he passes along the May 11-12 Hamfest date in Amarillo. It would be worth going just to meet **Slew Foot Willie.**

W5KHT, Oklahoma City, found six open to W4 and 3 on 1/28, W6 on 1/29, W6 again on 1/30 and W6, 7 plus W5 backscatter on 2/1 when a log book page was filled with contacts. The band opened to W6 on the morning of February 10 and to W4 on the evening of the 10th. Who says February is no good for E skip!

W5BCS/5, Midwest City, Okla., found 50 Mc open to Nevada and K7ICW on February 16. At the same time, W5BIC in North Texas was working 6's in the L.A. area.

W6BUR, San Francisco, reports a nice rise in 50 Mc SSB activity in the San Francisco Bay Area. George writes "I've been on with my 10A since Ed Tilton's article back in 1957. For a long time it was only W6JKN and myself, then K6UZK, K6KFF and Red and I. Now the really active ones are K6QXY, K6YIL and K6HCP, who work scatter. I've counted 23 different Bay Area SSB stations now and they keep coming on."

WA6YOB in San Rafael reports working K7ONL, K7OWI, K7QXA, K7UKI/m, K7URG, WA5DHF, W4FLX (double hop Es into Florida), K5FGI, K5EBZ and WA6LGV (near the Mexican Border on short-short Es) from 2310 GMT on January 29th through 0205 GMT on the 30th for a nice winter time session.

WA6KHN, San Diego has built up a new 50 meg converter to seek out the rare DX stations this summer.

WA6SUL, San Fernando reports on the opening of January 29th noting Texas, Colorado and then Washington popped through at his QTH. The opening began at 1530 PST and ending up at 1730 PST. He reports seeing TV DX signals from the same three states as well as a Spanish speaking station on channel 3. He lives under the guns of the L.A. low band TV stations on 2, 4 and 5 so sticks to channel 3 for tipping him off to six meter band openings.

W7VHS, P.O. Box 84, Pinedale, Wyoming is looking for skeds on six meters. This should bring you a sack of mail OM!

W7CZG is a new op on six in Wyoming. He's running 3 watts but has an FB signal, according to W7VHS.

K7ICW reports the opening on Feb. 1, from 1900-2045 MST, from his Las Vegas location to Oklahoma, Arkansas, and N. Mex. Al noted that the New Mexico stations heard were working into Texas and Arizona, with W5TMQ working both ways at once! A possible 2-meter cloud missed?

W7HTW is set up for bear on six with a new 2E26 rig modulated with a pair of 6V6's in Class B. The entire rig is on a single chassis. A Nuvistor converter does the receiving. He's in Phoenix, Arizona.

K7JUE, Tempe, Arizona reports adding a Tapetone SB-50 unit and then working (on 50 SSB) K6HUM and K6HCP at 0152 GMT on January 30th. JUE had one of the outstanding SSB signals heard in W5 land February 1 during the Es opening. He says he's running a pair of 826's in the final. Must of had 10 KV on the plates from the sound of the signal!

W7CJN, Butte, Montana has added a 6DS4 grounded grid converter for six but reports no signs of DX signals to try the unit out. Just wait OM . . . almost here!

WA8ASQ, Taylor, Michigan has a B & W 5100-51SB rig running straight through on six meter SSB. Sounds like a good conversion OM . . . how about the details?

W8TZZ, Monroe, Michigan reports an Auroral-Es opening on January 12 when he snagged VE4TL and VE4FO from 0237 to 0255 EST. He notes "did not hear anyone else work them!" No wonder at 3 A.M. in the morning. Some guys never go to bed!

W8JND, Columbus, Ohio has a 6146 rig perking and has added a 6CB6 pre-amp ahead of his HQ-170 receiver, reporting much improved HQ-170 reception.

K9POX, Chicago added a transistor pre-amp for six meter FM work, and reports it is working FB.

K9FKA goes back into December (1962 we assume) to report K5BTC worked from his Lincolnwood, Illinois QTH 1715 CST on the 27th.

K9DTB, Villa Park, Illinois took his 4X150 off six and is working on a 3-400Z to drive with his P and H 6-150. He reports a slug of 2, 3, 8 and 9 area stations worked on skip and tropo during December.

K7RIA/KØCER will be back active under his zero area call from Sioux Falls, S.D. soon. Bill will have his 5 element array and Ranger 2 working and desires skeds within range of Sioux Falls. He can be reached by writing in care of the KELO-TV studios there.

WAØBFF, Cedar Rapids, Iowa reports an auroral opening on January 29th (that's when the 5-6-7 area stations were working Es, OM) with W8, 9 and Ø area stations heard. No QSO's however. He recently completed a 6146 rig for six.

VE8BY, Pete, up in Yellowknife, NWT, tells us of an auroral-Es opening he sat in on January 31 0250-0410 GMT. Worked were VE4MA, VE6IP, VE6OH, VE4HW, VE4FO. Heard was WØEUQ. Oh yes, Pete has a new "local" station. VE8EW is now on 50 Mc. He's a little over 600 miles west of VE8BY.

220 Mc and up

Most reports center around 432 converter building. K1RTS, Waterbury, Connecticut reports acquiring an ARR-2 to put on 220.

WA2ONO is talking of being active on 220 Mc by QSO-party time.

K3LSB, Pottstown, Pennsylvania wants to see some simple superregen gear in VHF for 220 and 420. Who wants to write it?

K3KEL, Montoursville, Pa. has about completed a 432 Mc converter using a 6CW4 ground grid stage in RF. Why not the 8058 OM, and go all the way?

W4TLC, Taylors, S.C. has likewise about finished up a 432 converter. As has W4-CAH, Charlotte, N.C. His is a 6CW4 into 1N82A mixer, 12AT7 and 6AJ5 oscillator-multiplier.

W5BEP, Longview, Texas is searching for some 432 Mc SSB information. So is VHF. How about it some of you Bay Area, California geniuses?

Rex, W5RCI, has 500 watts on 432.045 now, loading into his 64 element array. Someone should hear you Rex.

WA6GYD, Palo Alto, finished up his 432 tripler and modulator-driver for this band.

W6IEY, La Mesa, finished his tripler for 432 and installed a 15 element yagi antenna. He also added 4 elements to his 220 array making 13 total. His 432 rig ends up in a surplus TDZ cavity. Tell us about it OM.

K7ICW and K6IBY made the grade on their 220 Mc effort from Las Vegas to Costa Mesa, Calif., the night of February 7. The skeds continue every Tuesday and Thursday night on 221.5 Mc from 1930 to 2000 PST. K7ICW transmits first 2½ minutes. Listeners are welcome.

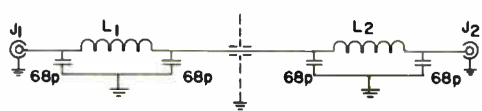
K7KDU, Seattle, Washington built up a 1296 cavity wavemeter and a 10 turn Helix antenna.

WA9FTN, Milwaukee, Wisconsin converted an APX-6 and wants to know where one can find a UPX-4 'cheap.' Most of us would be willing to pay good money just to get one OM!

Vic, W9JFP, also Milwaukee, reports he is silverplating his 54 element yagi on 432 (you're a lovable nut, Vic) and hopes to have it in operation 130 feet in the air by the time this is in print. (Hint to WA9-FTN: Some cloudy night, steal over to Vic's and scrape the silver plating from his 432 yagi. Collect it carefully and turn it in for cash. Use the cash to buy the UPX-4.)

WAØDZH, Marion, Iowa wants to put his state on the air on 432. He's finished up his 432 converter, using a 416B into a 6CW4 GG stage. He is multiplying up from 144 with a 3CX100A5 to 432. He and Vic ought to get together on ¾ meters this summer with little trouble.

Silver plated elements . . . phewww!



J1,J2-COAXIAL CONNECTORS

L1,L2 - 4 TURNS, 14 SOLID COPPER, 1/2"DIAM., 3/4"LONG

HOMEBREW TVI FILTER designed by K6RNQ for 50-Mc use. J1 and J2 are coaxial connectors; dotted line indicates internal shield. Filter must be fully shielded to be effective; SWR on 50-ohm line must also be low for filter to operate properly.

VHF-TVI

Part 9
by K6RNQ

Many VHF'ers are using surplus crystals of the 6, 8 or 9 Mc variety in their rigs (or a VFO operating on one of these frequencies), and in some cases even 12 Mc crystals are used. Harmonics of these crystal frequencies can, in many cases, be an unsuspected cause of TVI. This is particularly true in fringe or semi-fringe areas.

To aid you in quickly determining if one of these harmonics may be the cause of a particular case of TVI we have drawn up the following chart. It lists crystal frequencies, the order of harmonic and the TV channel in which the harmonic will fall.

BAND	XTAL FREQ.	HARMONIC	TV CHANNEL
50	8334-8571	7th	2
50	8572-9000	7th	3
50	8334-9000	8th	4
50	8444-9000	9th	5
50	6250-6666	9th	2
50	6667-6750	9th	3
50	12,500-13,200	5th	3
50	13,200-13,500	5th	4
50	12,666-13,500	6th	5
50	12,500-12,571	7th	6
144	8000-8222	7th	2
144	8000-8222	8th	3
144	6000-6166	9th	2
144	9000-9250	6th	2
144	9000-9250	7th	3
144	9000-9111	9th	5
144	12,000-12,332	5th	3
144	12,000-12,332	7th	6
220	8148-8133	7th	2
220	8148-8250	8th	3
220	8251-8333	8th	4
432	Will generally parallel 144 Mc as the same basic crystals are used.		

Any of these harmonic frequencies may be greatly attenuated by the simple expedient of installing a series-tuned trap, resonant at the frequency of the offending harmonic, in the plate circuit of the oscillator tube.

No harmonics higher than the 9th order were listed as higher order harmonics rarely cause trouble.

A point of interest to 50 Mc operators: A lot more channel No. 2 TVI is caused by the 7th harmonic of 8 Mc crystals than is generally realized. This is due to the fact that most 50 Mc tank circuits will pass some energy at 56 Mc.

TVI can also be caused by a frequency multiplier operating on a frequency in a TV channel.

LETTERS

Dear Bob:

"I wonder if you could tell me who makes HiPass filters and where I can buy one?"

Thanks,
R. S.
Ohio

High Pass filters are manufactured by: Drake, Bud, Ameco and Amphenol among others. They are readily obtainable from Allied Radio, 100 N. Western Ave., Chicago 80, Ill.

Dear Bob:

"Just one simple question. Why does TVI happen?" . . .

J. J.
New York

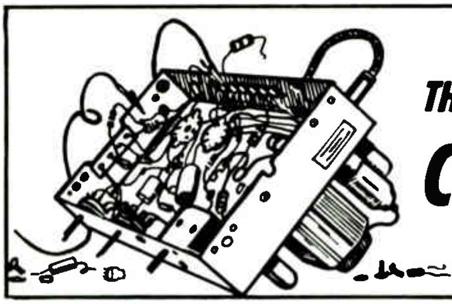
But what a question! Let's say TVI occurs due to: proximity effect between the transmitter and the TV set, poor design on the part of some TV sets, harmonics, poor design on the part of some transmitters, improper operation of a transmitter and just plain "bad luck."

Robert:

"A friend of mine uses vertical polarization and doesn't have any TVI. . . . Do you think it would help me get rid of my TVI if I went vertical?" . . .

Sincerely,
G. S.
Calif.

TV uses horizontal polarization, so if you cross polarize, i.e.: use vertical polarization, your field strength at a horizontally polarized TV antenna would be reduced by a factor of 20 db, or so. Naturally this may help eliminate a lot of your TVI.



THE CONSTRUCTION BOX

Crystal Etching Fluid

A solution for etching FT-243 crystals to move them off the crowded spots is available in the grocery stores locally. Called "Whink" and billed as a rust stain remover, it contains weak hydroflouric acid and will raise crystal frequencies. We have also seen one other rust stain remover under another name—look for the brown plastic bottle. Up to about 100 Kc at the fundamental frequency, for 8-Mc rocks, the results are very good; above that, unpredictable. Care should be observed in handling the solution, and of course, scrupulous cleanliness when handling the crystals and holders. Use tweezers as much as possible and wash crystals thoroughly after etching.

—W4VRV

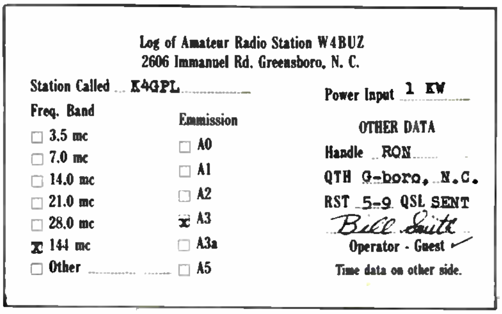
Matching Coax to Collinear

This is how I matched 50-ohm RG-8/U to a 16-element co-linear beam. First I tried a coax balun but the SWR was high. Then I tried a ¼-wave piece of 300-ohm line, still high SWR. Then it struck me why not parallel two pieces of 300-ohm line and vary the spacing to get a good match. I found out that about ¼ inch spacing worked real well. Changing the spacing makes a big change in SWR, so I used Lucite blocks for spacers tied with plastic tape. One end of this assembly was connected to the phasing line and the other to a coax balun.

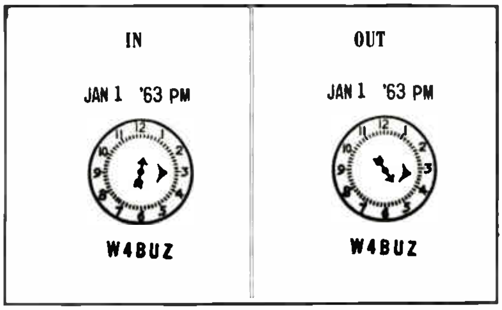
—W6DEE

Logging Made Easy

Now you can keep 50, 144, 220, 432, etc. logging in separate files or file by call letter for quick reference with this original unique method utilizing a Dorson Jr. time stamp and custom card system. The card illustrated is self explanatory in that you check off most operating constants, enter power and call of station worked plus other data desired. No need to look at the clock after setting the date time stamp before operating. Just stamp time in and out on back of card. This really helps in fast pace SSB, too.



FRONT VIEW of W4BUZ log card.



REAR VIEW shows time stamp.

For full rule compliance, the first card in the file must be prepared special giving name, address, town, and state with the statement that unless otherwise specified, all transmissions are by you, the licensee, and that time data is in EST or what have you. Then sign the card. If you test or call CQ, draw one line through station and enter CQ or TEST after called, etc. If a friend ham operates your station, he must sign his name and period of control of apparatus. If a friend speaks over the mike, or a phone patch is run, the name of the person speaking over your station must be entered. My cards are 3x5" and in pads of 100. It's worth the cost!

The time date stamp can be ordered from any office supply house.

—W4BUZ

Improving Twoer Selectivity

A substantial improvement in the selectivity of the Heath "Twoer" may be obtained by changing resistor R10 from 10 megohms to anything over 27 megohms. This modification takes but a few moments to perform and does not cause any loss in sensitivity.

—WA6OUJ

No Cost Oscillator

A major stumbling block to anyone interested in a cheap homebrew SSB mixer is the injection oscillator. In many cases, the receiving converter has a low drive level, highly stable crystal oscillator, on the proper frequency, just begging to be robbed of a little signal. At K5EVI, a one-turn link was wound around the oscillator coil, and presto—6 Meter SSB! In some cases, it may be necessary to throw in a buffer stage, to up the signal level for the SSB mixer. No problems with birdies have been experienced and the converter's sensitivity has not been in the least impaired.

—K5EVI

Power Supply Test Load

Often the need arises to check the characteristics of a power supply under load. Most of us do not have access to several handsful of power resistors. A simple solution (no pun intended) is to use a saltwater solution as the load. Use a plastic container or earthenware crock. The power to be dissipated will determine the size, but a 10 to 12 inch diameter works nicely for power up to 1 KW. Fill the container with tap water and immerse the tips of fine wires from the power source on opposite sides of the container. Apply power and take voltage and current readings (BE CAREFUL—avoid contact with the water load and be sure your hands are dry!). If current is too high the tap water must be replaced with distilled water; if not enough current flows turn off power, add some salt, stir, and try again. I have used this technique successfully to check supplies up to 5 KV at 1 amp.

—K6YWE

Do-It-Yourself 4X150 Sockets

by Frank Griffin, WB6AOW
Box 633
Port Hueneme, California

Want to put those 4X150's to work for you but don't want to spend those hard earned dollars for a socket? Well read on.

As many of you have noticed, the basic socket is the old eight-pin "loctal," so here's your start. However, choose a ceramic "loctal" socket, forget that mud base stuff.

Next is the screen connection; here is where some work is involved, but it is more than rewarding for the time spent. Actually, this connection forms the RF screen-bypass capacitor as well as making contact to the 4X150 screen.

You'll need some thin brass or copper (like shim stock), teflon or mica insulating material, some finger stock, and four 6/32 x 3/8 bolts and nuts. The finger stock can be purchased or you can do as I did, bust it loose from an old RF cover from a discarded surplus transmitter by punching out the rivets.

The shim stock is cut into two pieces 2 inches square and a hole cut in each piece for the tube to pass through. The holes should be 1½ inches in diameter. Next, cut two pieces of mica or teflon into 2 inch squares and cut one center hole 1-9/16 inches in diameter and one center hole 1-1/8 inches in diameter. This can be done with sharp scissors or your drafting compass. The pen compass works best as a double edge razor blade can be broken off to a sharp tapering edge, tightened up in the pen and secured with scotch tape. (This will also be useful for other holes in non-metal material.)

Now take one of the metal pieces and lay out four corner holes, each ¼ of an inch in from the flat side of the "square" (see diagram). After laying out the holes, stack all the pieces like playing cards and center punch the stack. This assures that all corner holes will be in line.

Take the "finger" stock, cut off eight of the "fingers" and tin, with solder, the bottom side of each. Lay out the other metal square with eight "spokes" for the "fingers." Tin these areas also.

Now the fun starts. Measure the spring distance of the fingers and set two on the tinned square 180 degrees apart so that they will make solid contact with the screen of the 4X150. Without too much jarring put your iron on the "fingers" and sweat them into position. Check for solid contact, alignment and solid soldering and then put the remainder of the "fingers" on. Your socket is now ready to assemble.

Take the square without the fingers and use it to drill and punch the chassis where you want the 4X150. Be sure all burrs and metal surplus are removed from the chassis as these burrs can puncture your insulator and short out the capacitor!

Mount the "loctal" socket with flathead screws as the chassis should be flat to accept the first insulator.

From the bottom of the chassis inside insert two of the 6/32 screws in opposite corners and start stacking the squares in this order:

1. one insulator
2. finger contact section
3. other insulator
4. other metal square

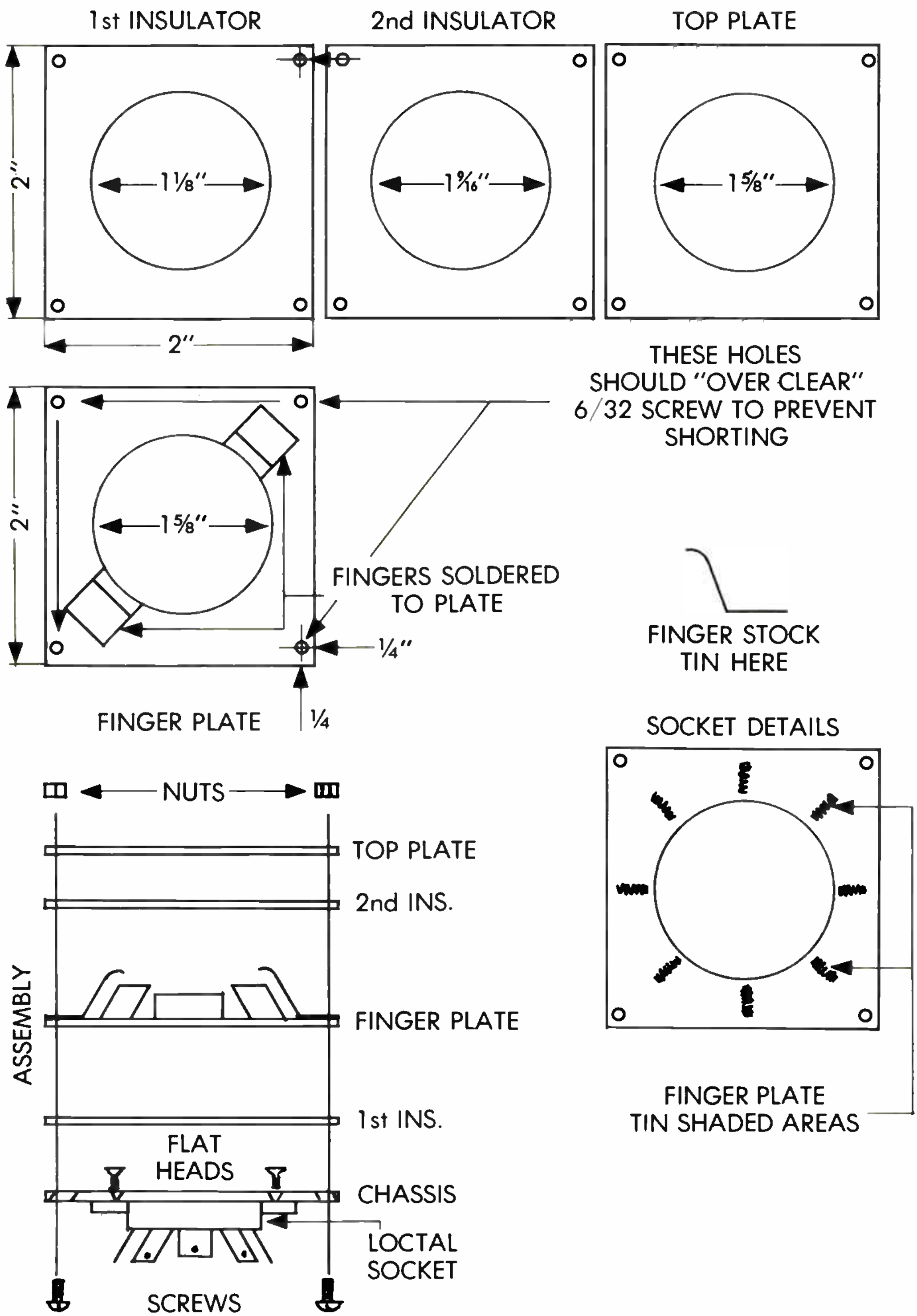
Drop on the nuts and slightly tighten. Then put the other screws in and after aligning all the sections, tighten up.

At this point, as if I had to tell you, put in the 4X150 and see what a fine job you have done!

For the plate connector, use some of your shim stock to make a band to go around the head-fins ring of the tube. Leave about ½ of an inch extra so after the ring diameter has been determined the stock can be bent outward and secured with a nut and bolt. The addition of a solder lug here makes a good connector and the plate "lead" can be soldered right in.

So, that's your socket; it works for me and it will work for you. Use a little care, be sure to remove all of those burrs, and you can use all those 4X150's you have.

Just one parting thought—have you ever looked at the 4X150 specs as a modulator? I have, and these little block busters may be my next modulator project.



COMPONENT DETAILS show particulars of bypass construction for do-it-yourself 4X150 sockets. See text for details.

Scanning the literature

CURRENT MAGAZINES

Pulse: A Practical Technique for Amateur Microwave Work. Robert F. Guba, W1-QMN, and John T. Zimmer, W2BVU. QST, February, 1963, page 23.

February is a hard month to pick the top-interest VHF/UHF article from the literature; this 4½-page essay—the first installment of a series—won out primarily because it offers some practical, you-can-do-it-too approaches to a way of utilizing that microwave space languishing above 1300 Mc!

This first installment shows a block-diagram description of the equipment now in use by the two authors, and offers enough data to fire the imagination of almost anyone interested in the UHF-and-above region.

For instance, would you like to have your own radar, capable of spotting objects up to 30 miles away? The system described in this article can be used as one—in fact, that's the simplest way to tune it up!

Actual construction data is promised for the remainder of the series. We hope it won't require too much in the way of machine tools to duplicate the equipment—and we're looking forward to reading it.

Recommendation—need we make one? Read it, by all means!

IN THE SAME QST:

An Interlaced Quad Array for 50 and 144 Mc, K8WYU. How to build and feed a 2-band cubical quad at VHF. Detailed data for duplicating the unit; mechanically it appears to be a good one too (the first K5JKX quad blew apart in a light breeze!). Excellent article. 3 pages.

Double - Conversion V.H.F. Converter with a Single Oscillator, W1EYM. How to have both low images and a low tunable IF. The idea isn't completely new, but it's a good one. 1½ pages.

The Oscar III V.H.F. Translator Satellite, W6SAI. Description of philosophy and development problems connected with the next Oscar. Must reading if you intend to try to work Oscar III. 2-2/3 pages.

IN THE FEBRUARY 73:

6M SSB, W2NSD. General discussion of pros and cons of 50-Mc SSB, with history of the band thrown in. Roundup of commercial SSB gear included too. 3 pages.

432 Mc Gallon, K2TKN. Complete how-to-do-it on building a 432 KW around an RCA 7650 (if you can get hold of a 7650). Excellent material; wish we had had it instead. 4¼ pages.

Mountain-Topping for Blood, K1CLL. How to work 200-mile DX on 2 meters with the aid of a good mountain. But what if you live on the prairies? 3 pages.

Ultra-Stable Xtal Oscillator, K2TKN. Schematic of primary frequency control for 1296 Mc moonbounce project. ½ page.

Station Time Panel, Ives. Not exactly VHF, but this device gives your station clock 1/20 second accuracy at all times with an automatic WWV-synchronizing circuit.

A Precision Frequency Standard, W4-WKM. How to use components of the AN/SRT-14 to build a frequency standard giving you top accuracy at 10-Kc intervals. 4 pages.

IN THE FEBRUARY CQ:

The Overtone-Harmonic Crystal Oscillator, W6AJF. A new oscillator circuit from Frank Jones, which can give output on 130 Mc in one stage using inexpensive crystals. Also has data on a 2-meter converter using the circuit. 4¼ pages.

A "G-Line" for U.H.F., W6HPH. Report of experiments with surface-conduction line. Losses were high at 432 but on 1296 measured loss in a 150-foot run was just 1 db. Who needs waveguide? Most interesting. 2 pages.

V.H.F. Transistor Bargains, W6TNS. Listing of V.H.F. transistors available for $4.95 or less. 1¼ pages.

The Amazing Skeleton Slot, K2ZSQ. General description of this unusual antenna. 1 page.

Twelve Hour VHF Contest. Announcement of a contest. It's already over as you read this. 2 pages.

The Care and Feeding of TV Rotators, W3JJY. What's in a TV rotor and how it works. 1 page.

New Linear, WB2AAI. Product report on e.c.i.'s 6-meter linear (6146 final). 1 page.

Getting Along with the Indians, K3HNP. How to cure TVI. 2 pages.

Letters

Dear VHF:

Congratulations on your editorial in the February issue! It is really a mature approach to a subject that many treat with ill-considered emotions.

The RM-389 proposal is interesting but extreme. If all present technician class privileges were retained but new licenses and renewal licenses issued only by FCC-administered examinations, the class of license would become respected. Perhaps, though, the theory should be that of the Extra Class instead of that of the General Class, as most holders of Technician class licenses believe themselves to be the only technical-minded personnel of amateur radio!

73,
Carl Drumeller, W5EHC

Carl—

We might go along with your thought if, at the same time, all General, Advanced, and Extra Class licensees were required to pass re-examination on the code-speed requirements at every renewal. But thanks anyway for the compliment. We appreciate it.

Dear VHF:

Retain your excellent format of VHF articles and I'll remain a fan of yours. How about some articles about VHF FM? I'm working in 2-meter FM (mobile and fixed) and I'd like some info.

Best of luck and 73,
Alan Christian, WA6YOB

Alan—

We'd love to run such articles if someone would send us some. How about it, authors?

A Brief History of Ham Radio Since 1945

by Jim Kyle, K5JKX
Managing Editor, VHF Horizons

For nearly 12 years, the structure of the ham radio licensing system has undergone almost no change; many of today's licensees (who weren't around 12 years ago) are not aware that things were ever different than they are today!

The present system is a far cry, though, from "the old days" of hamming. This drastic difference is probably part of the reason for the current situation and so-called "discrimination" among hams who hold different classes of license.

Arguing no point, attempting to prove nothing, let's go back and look at the history behind us all as hams. Possibly if we all know a little more about what has gone before, we can better handle the inevitable problems coming tomorrow.

For an arbitrary starting point, let's take December, 1941. In these days immediately prior to World War Two, ham radio in the U.S. was divided into three license classes; all of which were allowed at least some type of operation on all amateur bands.

Most privileged class was that known as "Class A." A Class A licensee enjoyed all amateur privileges; these included the use of phone on 75 and 20 meters, CW on 80, 40, and 20, and either phone or CW on 160, 10, 5, 2½, and on the higher bands.

In order to obtain a Class A license, one had to serve an apprenticeship in the Class B or Class C ranks. Before taking the exam for Class A, a ham was required to hold a B or C ticket for 12 months, and he had to show proof of using this ticket (such as a logbook).

Class B and C licensees were more restricted in their operation: CW on any ham band, but phone activities restricted to 160 and the bands above 28 Mc.

Code-speed requirements were the same for all three classes—10 words a minute.

The only difference between the Class B and the Class C licenses lay in the examination techniques; Class B was taken in person, from an F.C.C. examiner, while Class C was given by a volunteer.

To be eligible for a Class C license, one had to live more than 125 miles from a quarterly examination point; in the event a ham had a Class C and moved into a Class B area, he was required to appear at the next examination to take the Class B test!

That was the situation in the first week of December, 1941. Then, immediately following Pearl Harbor, the F.C.C. issued a series of orders which effectively put ham radio out of business for the duration. Operator licenses were still granted, but no new station licenses were authorized.

The war came to an end in August, 1945. On November 15 of that year seven bands were returned to the hams: 10, 5 (56-60 Mc), 2 (the new 144-148 Mc region, replacing 112-116 Mc), and four microwave bands above 2 kMc.

As a point of interest, one of the first postwar QSO's took place at 7:46 p.m. on that same day, between W2LGF/2 and W6BMS/2, on the 5300-Mc band! They operated duplex, using 2K43 klystrons at each end with 30-inch reflectors, and covered a 5-mile range. One was on 5280 Mc, the other on 5390.

In January, 1946, on the 16th, another FCC order released the 420-430 and 1215-1295 Mc bands for ham use, and six weeks later on March 1 the five-meter band from 56 to 60 Mc was killed and the new 6-meter band from 50 to 54 was substituted for it.

Though the exact limits of the bands above 50 Mc have undergone a little editing since (the 220-Mc band was, at first, from 235 to 240 Mc, for instance) the basic pattern of our UHF bands was essentially complete as of March 1, 1946.

But not so the license structure and status of the users of these (and the lower) bands. The old Class A-Class B-Class C license system, set up in the early '30s, had survived the war, but a number of suggestions for change were bandied about for several years.

On April 21, 1949, the FCC dropped a "bombshell" into ham ranks by releasing docket 9295, a notice of proposed rule-making.

This notice included, among other items, provision for abolishment (over a 3-year period) of the Class A license and the substitution instead of a higher grade (Extra Class), requiring 20 WPM code speed and a 2-year apprenticeship instead of only one. This was not new—an "Amateur Extra First" ticket existed as far back as 1929—but the toughness of the examination had caused it to be withdrawn.

It also introduced the concept of a beginner's, or Novice, license with extra-simple examinations in both code and theory, and the experimenter's or Technician's license restricted to UHF activity.

Since the new Extra Class, Novice, and Technician classes proposed in docket 9295 bore descriptive titles, the Commission also believed it should discard the old letter designations for the other three classes; so Class A became the Advanced Class, Class B was called General, and Class C became Conditional.

The FCC proposal aroused a storm of comment. For a time it appeared that the ARRL might be split by internal pressures, and two rival organizations appeared on the scene only to collapse almost immediately.

Most bitterly opposed of the F.C.C. ideas was the abolition of the Class A license. Many hams appeared to feel that the Class A license was satisfactory as a top-grade ticket, and wanted it continued. They did **not** want it up-graded into a tougher examination.

On November 16, 1949, some seven months after the original proposal, the F.C.C. issued an **amended** version for comment. Major changes were to allow Class A licenses to be renewed indefinitely, although no more new ones would be issued, and to change the frequencies assigned to the Novices.

(Original FCC planning had been for Novices to get 50 kc on 80 CW, another 50 kc on 20 CW, 500 kc on 10 CW, and 2 megacycles on two-meter phone or CW.)

The amended version retained the 50-kc assignment on 80 and the two-meter assignment, but quietly dropped the idea of any Novice operation on 20 and moved the Novice 10-meter assignment over to the newly-opened 11-meter band, from 26.96 to 27.23 Mc.

Over numerous ham objections to the still-remaining provision to discontinue new Class A grants and require Extra Class instead—one of the hams objecting was an FCC commissioner who issued a dissenting statement—the Commission on January 31, 1951, issued the order placing the amended proposal in effect as of March 1 of that year.

Novice and Technician class licenses were to become available on July 1. Class A licenses were to be discontinued (so far as issuance of new ones was concerned) on December 31, 1952.

At first, Technician and General class requirements were almost identical. Both were taken before FCC examiners, and both required the same theory test. The only difference was in the code speed. At a considerably later date, the Technician license was switched over to the by-mail-only category in an effort to reduce administrative load for the Commission.

The next major development came on May 1, 1952, when the 15-Meter band was established. At first, this band was a CW-only band (like 40 meters at the time) and as such, open to Extra Class, Advanced, General, and Conditional licensees alike.

But a bare six months later, on December 23, 1952, the FCC issued a pair of semi-surprise orders which shook ham radio to its core—and the shock is still echoing.

Although both orders were issued the same day, one took effect two days before the other: the concluding action of docket no. 10173, which removed all operating restrictions from General and Conditional class licensees, effective February 18, 1953.

This allowed **any** ham operator **except** a Novice or a Technician to operate anywhere in the ham bands; at a single stroke, **all "privilege" incentive to advance beyond the level set by the old Class B license (originally the apprentice class!) was removed.** To this day it has not been restored.

The other order was the closing action of docket no. 10073, and established a **phone** subband on 40 meters. Like those on 75 and 20, it was open to everyone except Novices and Technicians. Novices got a break too; a 40-meter subband was set aside from 7175 to 7200 kc for their use.

Just over a month later, on March 28, 1953, the 15-meter band was subdivided for phone and Novice segments also. This gain in privileges cost the Novices their 11-meter segment.

That FCC action marked the last major change in the structure of ham radio regulations, although a number of minor changes have occurred since. The 40-meter Novice segment was expanded from 25 to 50 kc; Technicians (originally restricted to the region above 220 Mc) came to six and later to part of two; the 20-meter phone subband was expanded 50 kc upward to reach to the top of the band; 11 meters was taken away in 1958 and transferred to the Citizens Radio Service; and not long afterward CW segments were established on 50 and 144 Mc. The UHF bands have undergone considerable shuffling—particularly the one around 3500 Mc. Power limits were removed on 420. But the basic structure has not been changed.

At the outset of this article, we promised to argue no point and attempt to prove nothing.

In concluding, having kept our promise, we feel compelled to bring to your attention the editorial appearing on page 9 of the February, 1963, issue of QST.

If you've already read it, go back and read it again—referring all the while to this brief history of ham radio since 1945. If you haven't yet read the QST item, by all means do so.

And then, form an opinion—for yourself!

Scatter. . .from page 5

"I believe in the United States of America as a government of the people, by the people, for the people, whose just powers are derived from the consent of the governed; a democracy in a Republic; a sovereign nation of many sovereign states; a perfect union, one and inseparable, established upon those principles of Freedom, Equality, Justice and Humanity for which American patriots sacrificed their lives and fortunes.

"I therefore believe it is my duty to my country to love it, support its Constitution, to obey its laws, to respect its flag, and to defend it against all enemies."

Change just a few words in "The American's Creed" above, and it would possibly read: "The Amateur's Creed":

"I believe in the brotherhood of amateur radio, as an organization of hams, for the hams, whose enjoyment is derived from participation in any and all activities pertaining to amateur radio.

"Let it be that this brotherhood be a perfect union, one and inseparable, established upon those principles of freedom, equality, justice, and humanity for which amateurs have given unselfishly of their time and energies."

I therefore believe . . .

Is not the foregoing 'creed,' in its basic form, really the standard which we as Americans, and we as hams, should strive to equal?

I am not throwing stones at either the Generals or the Technicians in writing this. I am merely asking for more cooperation from both. Let's get our heads together, Technicians and Generals, and completely erase this rift by concentrating on amateur radio. From this point on, I prefer to hear not another word about this, a condition that shouldn't even exist.

Congratulations to you, VHF Horizons, for expounding some good old fashioned Americanism!

I am certain that all who read between your covers applaud this fact, as well as your excellent efforts to further amateur radio on 50 megacycles and up.

Richard G. Knowles
W8JND

What do you think?

—K5JKX

Letters

Dear VHF:

Saw your December issue and liked it. Here's my subscription. One comment: How about some information about other places than W5-land?

I enjoyed the 2-meter linear the best of any article I saw. "Twoer" conversion was very good also.

73
K1YLU

OM—

We're getting around; last month we had D.R.P. reports from every call area. Maybe next month we will make a "WAS" via the D.R.P. cards—and this is one of the biggest sources of news. Send yours in today!

Dear VHF:

I like your magazine. Keep up the good work! Continue with more construction articles and features. Keep away from the gossip-column type of magazine. Also try not to feature the same people in your operating and DX news column such as W5KHT. Let someone else share the limelight.

Conspicuous by its absence is the lack of news, articles, and research consultants from the northeast.

I have a 416B preamp in the works for 144 Mc and 420 Mc. In the process I acquired quite a few 416B's and if anyone is interested in them they may be had for $2 or $3. I limit the number per person to 4; I assure you I am making no profit.

Will also consider swaps such as HV xfmr, 700-watt mod xfmr, 7½-volt 30-amp xfmr, etc.

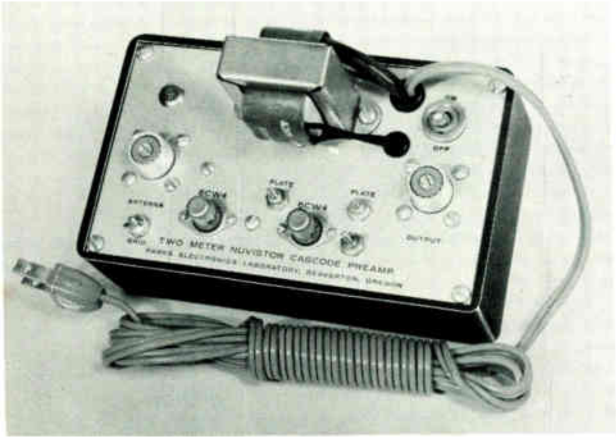
I would like to find others in a 50-mile radius interested in makng a group effort wth moonbounce.

73,
Ron McCloud
P.O. Box 149
Hinsdale, Mass.

Ron—

Thanks for the comments. We're wide open for contributions from 1-land—as well as from anywhere else. Also have room for a few well-qualified research consultants. How copy, W1OOP?

FOR 2 METER DX



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23,890 readers* can't be wrong! Direct your inquiries to Publisher Bob Cooper, W5KHT, at P.O. Box 1557, Oklahoma City 1, Oklahoma, or phone CEntral 2-1108 for the story.

*February, 1963 issue

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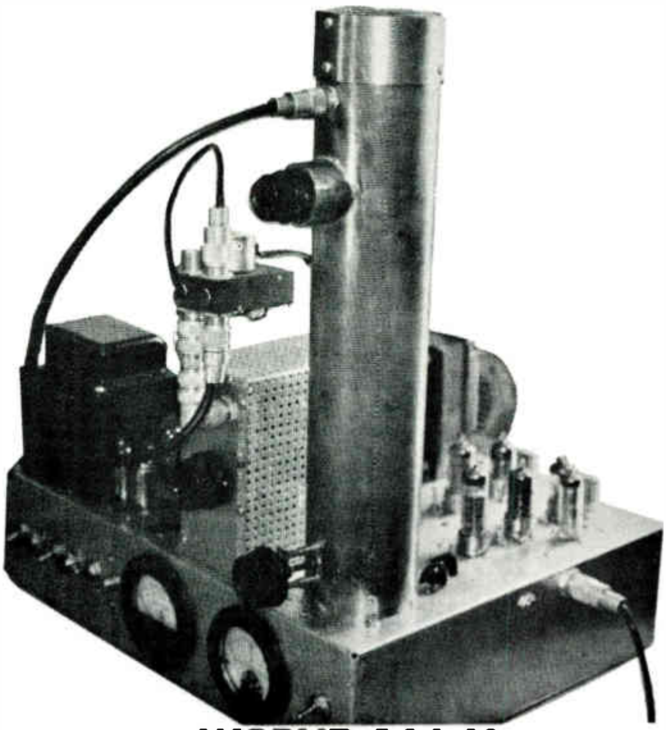

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Coaxial Tank — described in May VHF Horizons

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- Effective noise limiter.

The THOR 6 is of two unit construction with attractively styled receiver and transmitter rf section mounted in one cabinet for convenient desk top operation. The power supply/modulator section is mounted in a second cabinet for remote location. A ten foot interconnecting cable is provided.

Amateur net price for AC operation $349.95. 12V DC Mod./Pwr. Sup. $100.

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VOLUME 2 — NUMBER 6
JULY, 1963

VHF HORIZONS

CONTENTS THIS ISSUE

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From the Publisher's Shack

We've had a few letters of late about the apparent changes in the VHF Horizons operating structure and the appearance of the book.

So I thought a brief comment or two might not be out of order.

In terms of subscribers, VHF is a howling success. Lots of fellows, it seems, have been searching for a VHF only publication. And, I think we've proven that there is a fairly good storehouse of VHF-UHF news just sitting around to be printed. Most of it is first-time in print material, and very informative.

But magazines cost money. A lot of money. How much money is of little importance, except to note that it costs more to put this one out, even on a shoestring budget, than it is taking in.

This kind of situation can exist only so long. Last month we trimmed 8 pages out and cut the staff. **Now we are breaking even.** Which is all we intended to do in the first place. VHF Horizons has cost me more sweat, blood and tears than any magazine Horizons has ever put out. We still put out magazines for CB, closed circuit television, two-way public safety communications and so on. They all carry their own weight. I knew, down deep, that VHF wouldn't carry its' own weight. But I have been an ardent VHF-UHF'er from the day I first became a ham, and I also knew that my kind of amateur radio just wasn't getting its fair share in existing books.

No fault of the existing books. This is simply an age of specialization, and VHF-UHF is highly specialized. It takes one to talk to one, as it were.

So I stuck my own neck out with my stockholders and said we'll print this magazine, or I'll be more that a little hard to get along with. They retaliated with "go ahead and print it, but if it doesn't at least break even, **we'll be very hard to get along with.**"

And they have been.

So here is how things stand. I'll keep VHF going forever, now that it is a proven reader success, even if it comes out of my very own pocket, which it may. I'm a nut that way.

But I'll need the help of each and every one of you 23,000 readers, and especially the help of those fellows who haven't found it in their hearts to subscribe yet. It is subscriptions which have and will keep a journal of this stature going for VHF-UHF'ers. And this means beating the bushes on the air, and in person, each of you, for every subscription we can find.

At the present reduced overhead break even point we don't have a budget for attending ham conventions and whooping it up on behalf of VHF, and we don't have a budget for elaborate advertising promotions.

We have a budget, limited, to put out and mail a magazine. Naturally advertising does and will help. But it offsets less than 20% of the overhead presently. Any additional advertising will, I am sure, be taken as an endorsement of our product, and more important, an endorsement of VHF-UHF amateur radio in general. It seems quite reasonable to us that some of the bigger names in amateur radio manufacturing should have some sort of stake in the future of VHF-UHF. And our rates are so unbelievably low that even a full year's support with full pages every month amounts to less than $1,400 for the year. And we know that they will be buying a whole lot more good will and sales value than that!

So there you have it. I want to state in clear, pear-shaped tones that we are not in any stretch of the imagination going to cease publishing VHF, even though there have been rumors to the contrary.

Period.

I'm simply asking for your support of this medium of expression in amateur radio, if you feel that VHF Horizons has a place in your hobby and your life.

That's not too much to ask, or is it?

W5KHT

FOR THE 1215 Mc BUFF

L BAND COAXIAL WAVEMETER

K7KDU
2800 N.E. 55th
Seattle 5, Washington

Most hams who are using APX-6 type equipment on the 1215 Mc. band are likely to become a bit shifty eyed when you ask them what their frequency is. "Around 1220 mc. I think," is about as close as you'll pin them down, with an occasional "I dunno" denoting the more honest types.

Since I am allergic to Federal Investigation it became obvious when 1215 Mc was undertaken as a joint project of K7KDU-W7QID that Steve and I would have to figure out some way of measuring our frequency.

The first attempt was a set of close spaced Lecher Lines like those in the Books. The results were just about what we expected from previous experience. Sharp nulls were very difficult to find because of radiation from the lines, body and hand capacity effects, oscillator pulling because of the tight coupling required, reflections from walls, etc.

It is possible to obtain accurate frequency measurements in the L band through use of Lecher Lines if you are very careful and very patient. Here however, something better was needed. Most of our operation is portable, a fact of life that we Western Mountain boys learn to appreciate more and more as operations go higher and higher in frequency. Lecher Lines are not really designed for portable operation. A cavity or coaxial type of wavemeter was indicated and after several attempts were made, we came up with a good one.

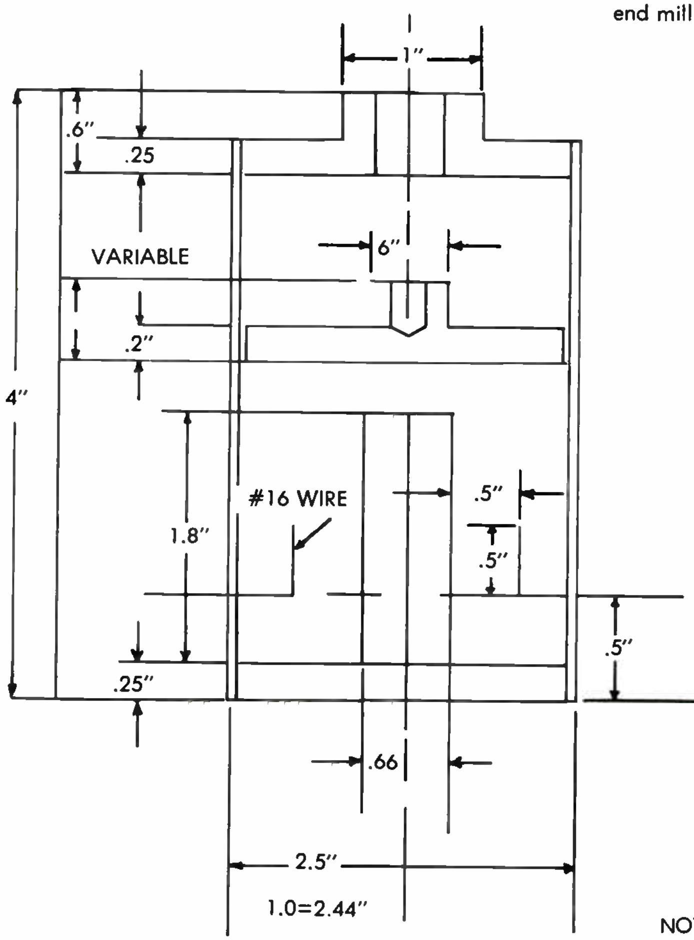
A few notes of caution are in order at this point. This wavemeter was constructed as a frequency standard and as such, great care must be exercised in its construction. If haphazard construction is practiced, the results can hardly be expected to be very precise. With this in mind, it is imperative that access to a lathe be obtained.

Physically, the wavemeter consists of a capacity loaded ¼ wave coaxial tank, with the loading capacitor driven by a micrometer from with the frequency is read. Both input and output coupling fittings are included and the wavemeter may be used as a transmission or absorbtion type with equally good results.

Initial calibration of the K7KDU-W7-QID unit was with the Lecher Lines, and upon laboratory calibration, the original calibration was found to be accurate within 4 Mc. Further checks showed that the unit has a VSWR of less than 2:1 across the entire L band when used as a transmission type wavemeter terminated with 50 ohms. Loss through the filter is on the order of 1 to 2 db. depending on frequency. Frequency accuracy and resetability was less than plus-minus 1% when Fo is approached from the high frequency side on all readings.

The method used for input and output coupling is by no means the ultimate. Originally, further experiments with different coupling methods were planned. These plans have been dropped, in view of the excellent results already obtained.

Little difficulty should be encountered in the construction once you have obtained all the parts. The tuning capacitor is actually a false top for the cavity but does not contact the cavity walls. An earlier model had a contacting plunger and was very noisy The false top or capacitor late is built in such a fashion that it is firmly attached to the driven post of a 1" travel micrometer. This must be very accurately fitted. The



.5" Hole—Use spot facer or end mill with pilot.

Drill 0.235" hole .3" deep and blind.

Starret #263 1" travel mike.

Coupling probe detail #16 wire

Drill 3/8" hole for UG 109 4/U BNC coax receptacle.

NOTE: Mike mounts in .5" hole in top of cavity. Flange is equipped with two 6/32 set screws 90° opposed.

False top fastens to mike piston in same manner.

Top is fastened by three 4/40 machine screws 120° intervals. Bottom is soldered on.

hole into which the micrometer post fits should be nearly a press fit with the mic. post and must be exactly perpendicular to the inside face of the capacity plate. The actual top of the cavity must also be exactly perpendicular to the cavity walls and the hole in this plate that the micrometer is seated in must be exactly perpendicular to the plate. If all this seems a bit difficult, let me point out that a good lathe operator will have no difficulty in squaring all these things to a fantastic degree. The reason for the precision is to avoid the false or multiple resonances one gets if the capacitor plate is slightly "out of plumb" and therefore wobbles slightly in its travel. One of our first units had this trouble and we had three distinct resonances in a single turn of the micrometer. Confusing to say the least.

The cavity top which holds the micrometer is held in place by three 4-40 machine screws around its edge and a few more screws won't hurt a thing. Our cavity is machined for a near press fit, making extra screws unnecessary.

The cavity bottom with the center post is soldered in place. Soft solder, good flux and a torch make a neat job here. In our unit, the center post was removable for experimental purposes, by removing two screws. Once the exact size needed for the center post was established, this post was mounted with its screws and soldered in place.

UG-1094 BNC fittings are used for input and output fittings. These are soldered to the outside of the cavity in such a way that the teflon insulation around the center conductor is just flush with the inside cavity wall. If desired, the hole in the cavity wall could be threaded to take the shank of the fitting. However, we just soldered the nuts supplied with the fittings to the outside of the cavity, centered over the hole in the wall, and screwed the fitting into the nut until it was flush, as mentioned above. Another nut on the shank of the fitting was used as a jam nut to hold the fitting until coupling systems were tried and the one used was settled upon. Then the whole mess was carefully soldered in place. A note here is in order. Do not attempt to use other than Teflon insulated jacks here if you plan on doing any soldering. Poly melts! Type N fittings could also be used but do not use the garden variety UHF fittings unless you are willing to put up with the SWR etc., that these things cause at 1215 Mc.

To use the Wavemeter after calibration it may be inserted in the line from the transmitter to the antenna and resonance indication taken from a field strength meter at the antenna. A better way is to isolate the unit with a sampling probe made from a type N Tee fitting. The Tee is modified by removing the male branch of the fitting with a jewelers saw and carefully soldering in a BNC fitting like those used on the cavity. No actual contact is made from the center conductor of the Tee to the center conductor of the BNC fitting. Two such units made here with a spacing of about 1/16 inch between the center conductor of the BNC and the Tee section, show -20 and -22 db coupling. This affords plenty of isolation from the coaxial line actually carrying power from transmitter to load and still provides enough RF for the Wavemeter to allow an indication of resonance, when used with an APX-6 transmitter. The RF detector is just a 50 ohm resistor mounted in one end of a BNC Tee connector with a 1N25 etc. diode in a BNC fitting hooked to the other end of the Tee in series with a line to a microammeter or VTVM. Just tune the cavity for maximum indication on the meter with the transmitter loaded into the antenna, or dummy load, and read the frequency from the micrometer.

The actual calibration is a matter of choice. If you or a friend works in a lab, permission might be obtained to run some calibration on your own unit. Lacking that, the Lecher Lines will do OK, provided care is taken to avoid errors introduced by the factors previously mentioned.

You will need a variable frequency source for the L band (such as the L.O. in your APX-6) and your Lecher Lines. Couple the oscillator through your modified Tee to the Lecher Lines, set the oscillator on some frequency, measure this Frequency with your Lecher Line setup and peak your cavity wavemeter. Then record the Micrometer reading on a chart opposite the correct

Frequency. The chart and your Cavity Wavemeter are considerably more portable than those Lecher Lines and you'll probably have a lot of calls from the local 1215 Mc Ops to "Drop over and bring your wavemeter."

Much credit is due Steve, W7QID, whose professional lathework and careful attention to detail, made this Wavemeter and another one just completed for the 10 KMc band, practical and worthwhile additions to our ever growing "junkpile" of UHF gadgets.

YOU NEED ONE TO ALIGN VIDEO AMPS

A TRANSISTOR SQUARE WAVE GENERATOR

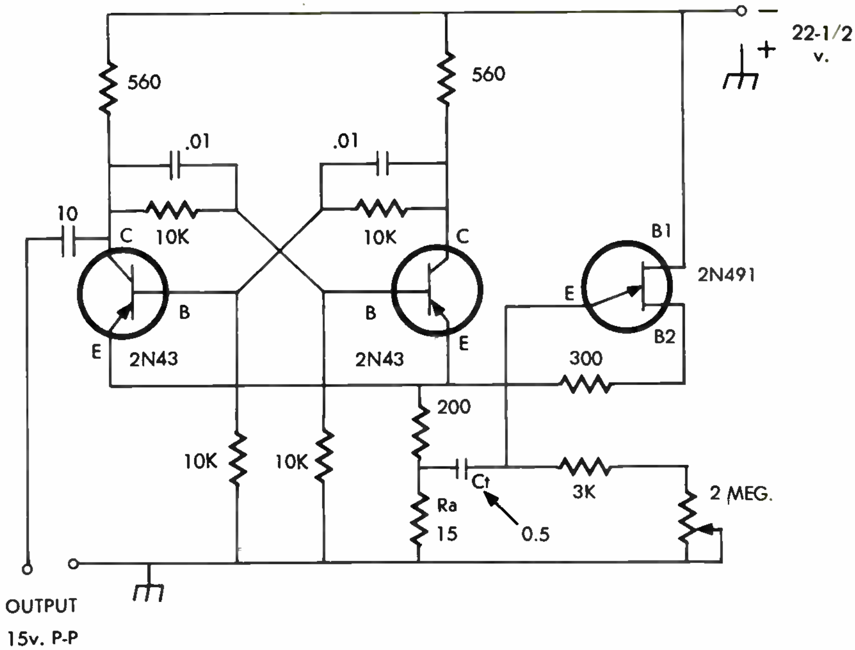
By W4HHK — A4HHK
℅ VHF Horizons

A square wave generator can be a very useful tool in the radio shack. It may be used to check the response of audio and video amplifiers, for the generation of timing signals, and for pulse work. The unit described generates symmetrical, square wave pulses, and is adjustable from 1 cps to 500 cps. It is built around a G.E. unijunction transistor, the heart of the unit, and employs a total of three transistors. It was constructed as a companion unit to the VHF transistor oscillator described in the May issue of VHF Horizons. As such, it functions as a pulser. The result is a pulsed signal at 144 and 432 mc instead of a cw one. This permit observing the relative amplitude of received signal and noise on an oscilloscope.

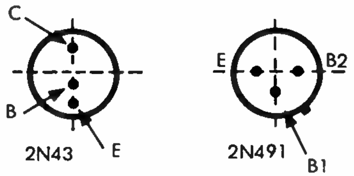
Circuit layout and lead dress are not critical. Parts may be arranged on a circuit board in the same manner as the schematic diagram. The generator could be housed in a Minibox of the same size as the VHF oscillator unit (2-1/4 x 2-1/4 x 5 in.) for the sake of uniformity. Such an enclosure would not accommodate a battery of sufficient capacity, however, as the circuit requires a total of 30 ma at 22½ volts. At this supply voltage, the pulse amplitude is approximately 15 volts (peak-to-peak).

The 2N491 unijunction transistor has electrical characteristics that are quite different from those of the conventional two-junction transistors. Also, it is somewhat expensive (price tag — $8.40), but this is offset by the fact that it greatly simplifies circuits such as sawtooth generators, pulse generators, trigger circuits, and etc. It has a highly stable negative resistance characteristic. The 2N491 seems hardly enough. The writer inadvertently cross-connected its base-two in the breadboard lash-up with no apparent ill effect, but this practice is not recommended. Luckily, the wiring error resulted only in failure of the 2N491 to trigger the flip-flop circuit, although it did generate weak sawtooth waves. When the circuit connections were corrected, the unit began functioning properly.

The output of the square wave generator is connected to the 2N2398 output stage of the VHF oscillator through a 10 mfd. coupling condenser. Also, the two circuit board grounds should be connected. Insufficient coupling capacity will result in distortion of the pulses. In the VHF oscillator unit the -22½ v. lead connecting to the 5.1 k resistor feeding the 2N2398 collector circuit is broken, and the pulses from the square wave generator are fed through the 5.1 k resistor. Increasing the capacity of Ct will decrease the frequency of the pulses. Frequencies up to 100 kc may be generated by proper choice of Ct and Ra and suitable flip-flop design. The 2N384 oscillator runs continuously from its own 22½ v. battery



BASE DIAGRAMS



NOTES:
All capacitors in mfd. and rated at min. of 25 vdc.
All resistors in ohms, ½ watt.
2N43 is PNP type. 2N525 may be substituted for 2N43, but base diagram is different.

when the output stage is pulsed. A separate battery or power supply powers the square wave generator.

References:
G.E. Transistor Manual, Fifth Edition
Pulsed, Crystal-Controlled Signal Generator, A. McFarland, QST, March, 1961.
Selected Semiconductor Circuits Handbook, MIL-HDBK-215.

Letters

Editor:

Appreciate your recent card advising the new late production date for VHF. I like your magazine so far, but cannot say I appreciate the late mailing date summer or otherwise. I'd like to get both my monthly publications, QST and VHF the first week of the month.

W0BAG

OM:

We changed the mailing date to give better service. With the June issue, we should have achieved this mecca.

Dear VHF:

Well, I finally finished persuing your latest issue and decided to drop you a line. I'm not an exclusive VHF'er, nor do I subsist on HF activity. Your magazine is pretty good, especially the technical articles. However, 40 cents is rather steep. Any chance of getting back issues?

Martin J. Feeney, Jr.
K1OYB
Portland, Maine

Martin:

40 cents may be steep. But its exactly what it costs us to put the book out. We're out of all back issues but April, 1963 (our pressman forgot to stop at 24,500 copies). However, we plan to run a "Best of VHF" annual late this summer which will sell for about two bucks, and contain the original scripts of the most highly rated articles to appear in VHF in the past year. We're open to comments from readers who would like to have such a handbook.

Editor

PROGRESSIVE 5894 TRANSMITTER

FRANK L. GRIFFIN,
WB6AOW

Some months ago, I wrote your Editor, and told him I had completed a 5894 RF unit for Two Meters. In his reply he stated that he was interested and to write it up. Well, before I got around to writing up the unit I traded it off. This left me with any working details, as I build from impulse, not schematics, so there was nothing from which to work.

Now, many months later, and after much thinking I am fulfilling the promise.

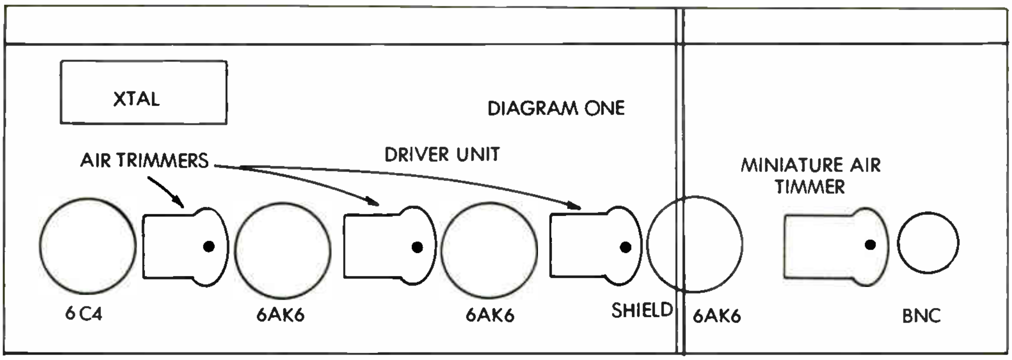
At the time of the original construction I spent quite a few dollars and a good many hours in completing the RF unit. Having a chance to reminisce about the original unit, I came to several conclusions that would not be accepted by the average constructor. The first being the material cost. Each week during construction the major portion of my allowance went into parts without any RF coming out. If it had not been for other projects to fill my time and the desire to complete the unit it would have given up before completion. Secondly, some of the circuitry was tricky and could cause problems. The other reasons were minor, but had a factor in the redesign of the presented unit.

The redesign and packaging was brought about through the need of a bench driver test transmitter. It seemed I was constantly disconnecting the driver from my operating rig. What I needed was low drive for tubes like 6360's etc., and higher drive for 4X150's etc.

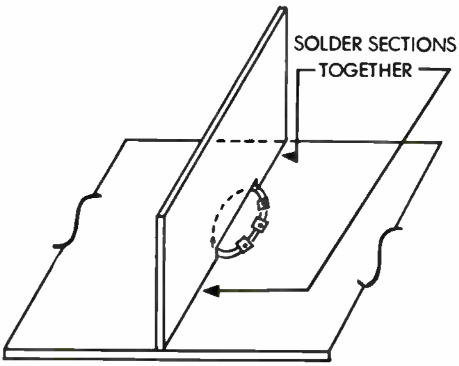
CIRCUIT DISCRIPTION

The complete transmitter uses six tubes, these are: a 6C4 oscillator, a 6AK4 tripler, a 6AK6 doubler, a 6AK6 144 mc amplifier, a 6360 intermediate power amplifier and a 5894 final amplifier.

The oscillator is an oscillator/tripler type, using 8 mc crystals and a capacity voltage divider to give that needed kick to make most 8 mc "rocks" take off on third



overtone. This is a good circuit, most of my 8 mc crystals oscillate in it. Remember however, this is a multiplier circuit and that the output is a third overtone, not a third harmonic. Due to the cut of the crystal, the holder, the holder plates and the crystal manufacturer, each crystal will have a different frequency output. Because of these factors all crystals will vary several kilocycles from their indicated frequency, so do not use your band edge "rocks" until you monitor the final output or you could be outside the band. The multiplier stages are straight forward with no trick circuits and the amplifier stages, also straight-forward, require no neutralization. Although no neutralization is needed, care must be taken to shield the doubler from the first amplifier to prevent 144 mc oscillation. This was done by shielding all the small tubes, 6C4 to 6AK6 amp., and running a shield across the bottom side of the 6AK6 amplifier socket. Since the driver unit runs at 250 volts, or less, the heat from the tubes, while shielded causes no problem. Self-oscillation at 144 mc can also be experienced in the 6360 stage if a shield is not used across this tube socket. In the 5894 stage no problems exist as the grid is below, and the plate circuit above the chassis. The manufacturer, Amperex, states both tubes, the 6360 and the 5894, are internally neutralized and I have found this to be so. But do not push your luck with careless wiring and poor parts layout, as some interesting self-oscillation problems could exist. My "bread board" layout showed this to me.



SOCKET SHIELD DETAIL
FOR 6AK6 AMP & 6360 IPA

DIAGRAM TWO

GENERAL CONSTRUCTION

All of the parts but one, except sockets, came from the junk box and parts on hand (I have a 20 year collection). As for parts, the only unusual ones will be a 5894 socket, a split tank capacitor for the 5894, miniature butterflies and BNC connectors.

The chassis for all units; driver, I.P.A. and final, is sheet copper. Copper was used, as solder can be applied. This makes possible the direct grounding of socket lugs and ground connections, also the application of the needed shields can made by direct soldering with a husky iron.

Before the driver unit was assembled on the copper plate, it was "breadboarded" on an aluminum plate. It was on this plate each of the stages was worked out. It is recommended that after the parts are mounted and filaments wired, each stage be wired and tested, from the oscillator on, to prevent any "built in" trouble that could occure. In this way you know that the finished stage is operating and supplying drive to the next stage. I bring this out, as if trouble develops in testing, and it could, you know the stage in which it exists. Anyway, test data and chassis layout will be given in detail with each unit.

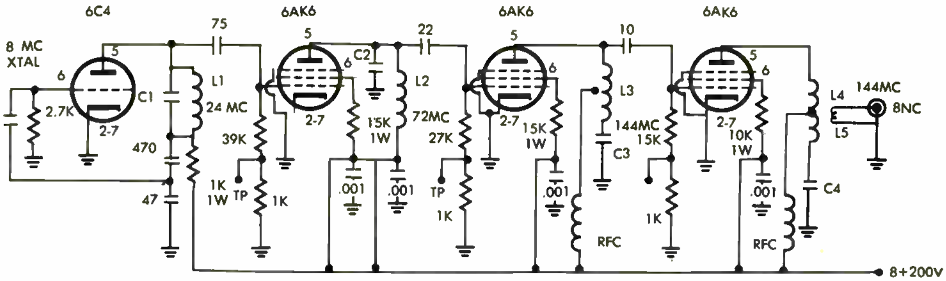
THE DRIVER UNIT

As mentioned earlier, the system was mounted on copper plates and was to be used as a bench test rf source. The driver unit and also the 6360 I.P.A. were then mounted on an inverted 3x17x4 aluminum chassis. No attempt was made to add a front panel.

The driver unit is built on a 4x12 copper plate with the sockets, air trimmers and BNC connector mounted inline on the plate centerline. Since parts will vary, exact layout is not shown, but a general idea is given by diagram one.

The socket shield for 6AK6 and the 6360 is shown in this diagram. Although copper was used, aluminum can be used by bending a lip on the shield and mounting with nuts, bolts and star lock washers, between the shield and chassis, for good positive grounding.

Again I call out stage by stage wiring and testing to eliminate possible construction error. The Driver data shows the stage



L1 15T No. 18 Enam. 5/8"d. Tight Wound on 5/8" Lucite Form
L2 5T No. 16 1/2"d. Spaced 5/8"
L3 5T No. 14 1/2"d. Spaced 9/16"
L4 6T No. 14 1/2"d. Spaced 3/8" per Section, Center Separation 3/8" for Ls
L5 2T No. 16 1/2"d. Spaced to Fit in L4

C1 8 Plate Air Trimmer
C2 5 Plate Air Trimmer
C3 5 Plate Air Trimmer
C4 15 Plate Miniature Trimmer

RFC Z-144 or RFC-144

All .001 Caps. Feedthru Type

drive readings, and from this you can check your progress.

When the 6AK6 amplifier is ready for testing, a 47 pilot bulb makes a good dummy load. It will glow to a brilliance that will hurt the eyes when the 6AK6 is properly tuned. Leave the test meter in the 6AK6 amplifier grid position and remove the crystal. The dummy load should go out and grid current drop to zero. When this happens you know the shielding from the tube and socket shields is effective and no coupling from the preceeding stage is taking place.

THE 6360 INTERMEDIATE POWER AMPLIFIER

I hate to say this, but, there will probably be some of you who will not be interested in the Driver unit as you are running "Twoers." The Twoers makes an excellent driver unit and will drive a 6360 nicely. No attempt was made to make the 6360 IPA a "linear" but it can be used as a modulated final on a "Twoer" or similar equipment.

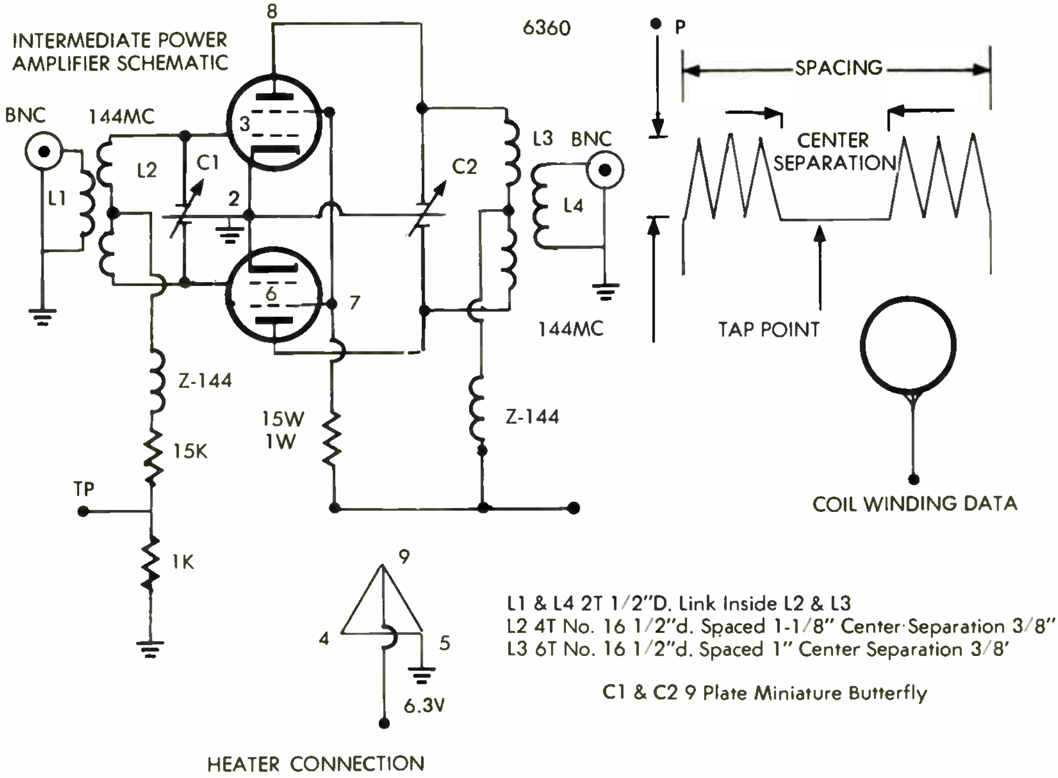
The IPA was built on a 4x5 copper plate and mounted, in line with the driver. It was coupled with a short coax jumper. The IPA data shows the drive needed, and it is recommended that at least 3 ma of drive be at the 6360 grids before B+ is applied to the plates and screens. For those of you who want to stop here, a 100 ma meter can be wired in the plate circuit for plate tuning. At resonance, under load, the plate current will be around 60 ma. at 250 volts.

Care should be taken in this stage to shield the tube socket as feed through signal from grid can cause self oscillation. Here too, the check of removing the crystal and reading the grid current, as well as loss of load, will show proper shielding.

THE 5894 FINAL

The final was built on a 4x6 copper plate and mounted on a 3x6x4 chassis. It was built with parts on hand. A longer plate should have been used as the chassis had to extend to receive the plate tank and pickup link. Although, mechanically, the layout leaves much to be desired the circuit operates smoothly.

The first attempt at the grid circuit design was to tune the input to the 5894. With the components on hand a suitable tuned



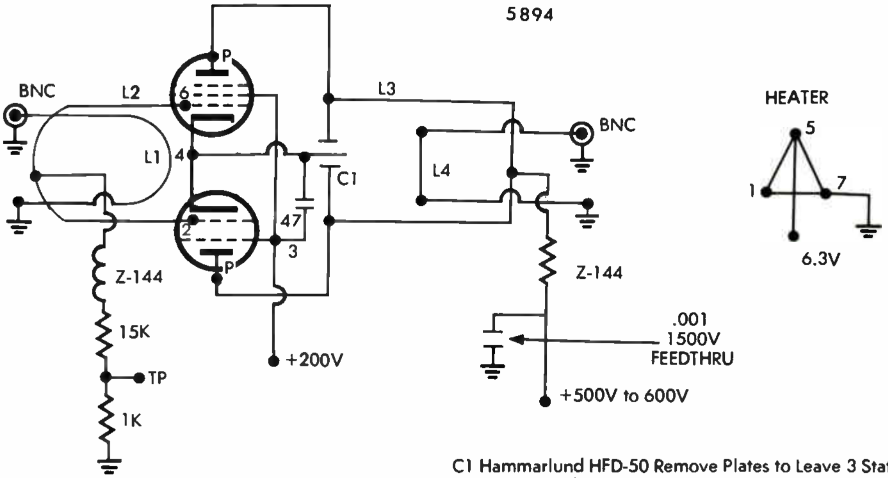
could not be favorably worked out, so the input circuit was left "fixed tuned." This was done by cutting a "hairpin" tank until it resonated with the tube capacity at 146 megacycles. The tank, being too long for the chassis, was bent 90 degrees at the midpoint and hung down into the chassis. At the midpoint, two bent ceramic insulators were mounted to add rigidity. Since the "U" portion of the tank hung down the input link was mounted perpendicular to the chassis late from the BNC connector and a ground lug spaced the width of the grid tank. This mounting allowed me to "swing" the input link for proper coupling from the 6360. This will also allow coupling variation if linear operation is anticipated.

Two sources of drive were used to check the grid circuit. These were the aforementioned driver and IPA and my Communicator IV, both of which use a 6360. The Communicator was used at I do not have band extreme crystals and the VFO capabilities into Communicator could be used to check the tank range. More than adequate drive was obtained throughout the entire band.

The plate tank was made from a Hammarlund HFD-50 with three stator and two rotor plates left in each section and a piece of number 10 copper wire bent into a flat "U". The "U" was cut until 146 megacycles resonance was reached at mid capacitor range. This was done by checking with a grid dipper. The pickup link, also of the configuration, was mounted the same way as the grid links. In this manner of mounting it could also be swung for coupling.

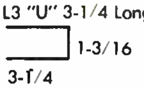
In establishing the grid drive to meet the tube requirements, several grid resistors were used. A value of 15K gave the best ratio of current to voltage for the 5894 grids. Screen voltage was taken from a separate 200 volt source so no screen resistor is shown. Again the approximate drive shown in the data should be obtained before B+ is applied to the tube.

The dummy load used, an RF Wattmeter, would not accept a fully coupled load so the data shown is far from full output. A hundred watt bulb, used also as a dummy load, showed almost full brilliance, so quite a bit more output can be expected under full load.



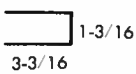
C1 Hammarlund HFD-50 Remove Plates to Leave 3 Stator & 2 Rotor each section

L3 "U" 3-1/4 Long, 1-3/16 Wide



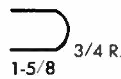
No. 10 Wire

L4 "U" Pickup Link, 3-3/16 Long, 1-3/16 Wide



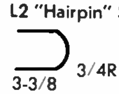
No. 14 Wire

L1 "Hairpin" 1-5/8 long, 1-1/2 Dia.



No. 16 Wire

L2 "Hairpin" 3-3/8 Long, 1-1/2 Dia.



No. 16 Wire

DIAGRAM FIVE

MODULATION

The driver unit was Heising modulated for reference only. This was done by running the B+ through the output transformer of a small broadcast receiver and connected to the 6AK6 amplifier. A station was selected and the level set for the proper modulation. Good quality was obtained from a 12SQ7 and a 50L6.

Several 6360's have been used at the Santa Cruz Island QTH. These were modulated with a pair of 6V6's into a TCS modulation transformer. Repeats were always good on modulation with these transmitters and this modulator. However, any good ten watt modulator will do the job. The modulated signals is coupled to the plate and screen, through its dropping resistor, in this

6360 DATA

DRIVE 4.4 MA No Load (B+ OFF ON PLATE & SCREEN)
3.2 MA Loaded

SCREEN—Dropped thru 15K Resistor

PLATE +250 V +300V (Loaded To Termaline Wattmeter)

OUTPUT 8 Watts 12.5 Watts

DRIVER DATA	**+200 Volts**	**+250 Volts**
drive to tripler	1.5 ma	2.1 ma
drive to doubler	1.0 ma	1.3 ma
drive to amplifier	2.0 ma	2.1 ma
Power out amplifier (RF to Termaline Wattmeter)	1.25 Watts	2.5 Watts
Total current drawn (all driver tubes)	98 ma	125 ma

5894 DATA

DRIVE 9 MA B+ OFF PLATE & SCREEN
7 MA B+ ON

SCREEN +200V

PLATE +500V at 162 MA
*(Loose Coupled to Termaline RF Wattmeter)

INPUT 81 Watts

OUTPUT 45 Watts

*Wattmeter has 50 watt range, this accounts for loose coupling. Higher output can be had with tighter coupling.

configuration.

The first 5894 rig was modulated with a pair of 6146's into a TCZ/ART-13 modulation transformer. Because this rig was traded before it went into operation, "on the air" reports were never received, but the local tests sounded very good. Anyway the presence or absence of modulation will be the builders choice. I have mentioned the various methods I have used to give you a point from which you can start thinking.

CONCLUSION

This article is presented to start you, carry you on or help you "beef up" your present, 2 meter RF capabilities. The circuits have been worked out and double checked to prevent any miscalculation. Electrically, I believe they are sound and fewer as I believe the builder will want to inject his personality into the layout and packaging. Keep in mind to follow good VHF wiring procedure, clean layout of components, short solid ground connections and testing of each completed stage, and you'll come out a winner!

—WB6AOW—

Letters

Dear Editor:

You said in April VHF that others might be interested in what I did to my International Crystal FCV-2 converter. To me, overload PROOF and overload RESISTANT are a matter of definition. Overload proof is what the Clegg Interceptor receiver is. However, my FCV-2 is only overload resistant, i.e., no cross modulation is evident; a Johnson 6N2 running 100 watts, beam-to-beam, separated 160 feet, is virtually un-noticed plus/minus 45 kcs. Good enough?

John P. Skubick, K8ANG
Warren, Ohio

John:

OK — that's good enough for us. Draft up an article and we'll print it pronto. International might even be persuaded to incorporate the changes into their production line FCV-2's.

Editor

Dear Editor:

We have been browsing through the February issue of VHF Horizons which was forwarded here to Inchon, Korea, and must comment on the insert between pages 12 and 13 in this issue. This is not the first time the "great prophet from the east" has goofed. In last December's issue of his magazine he made the brash statement that he had "the most elaborate VHF installation in New Hampshire" — or words to that affect. We challenged him on that and received a polite reply that he guessed "he had spoken out of turn." Hi! Would appreciate a few words in your June issue to the effect that we will be back in operation at the home QTH June 1st and looking for M/S skeds on 144, especially from Minnesota and points west.

73,
Don — W1AZK

Don:

Consider the word spread.

Editor

Dear Editor:

I have finally decided that your magazine was due for a few comments from my neck of the woods — so here goes. I would first like to mention that I enjoy your magazine very much and have subscribed to it, I feel that it is put together in a very good manner, and my only real complaint is there isn't enough in it to satisfy my taste for VHF operating and experimentation.

David Heifetz, K1PDA
Manchester, N.H.

Dave:

For the record, the size of the book is directly proportional to income. Income is directly proportional to number of subscribers plus number of advertisers. We'll add pages when there's money enough to do it! In the mean time, we have to be very selective when wading through the pile of manuscripts received every week.

Editor

Editor:

The article in April VHF Horizons on E-skip on 2 prompts me to file my observations of July 10, 1961 (the date in question). I was operating W0AXU, Cedar Rapids, Iowa at that time. At 2122 CST I heard W0IC calling CQ and he came back to my call (S9 plus) and then faded out. At 2146 W0IC was worked again and I was on phone. In between, W0AYK in Loveland, Colorado was heard. W9AAB worked K7-HKD at about 2146. W0IC was in for over 30 minutes here. A check on six meters showed Colorado to be coming in, nothing else that I could tell. W0IC must have worked several W8's and VE3's at least. The W0IC to Cedar Rapids path is only 720 miles and to work this distance on Es requires a critical frequency of 50 mc! I conclude, however, that the opening must have been Es, and my QSO with W0IC must be about the shortest Es ever observed on 2 meters. The cloud must have been small as the stations to the west of me in Iowa and Nebraska didn't hear a thing, which adds up to Es evidence.

Dick Fenwick, W5KTR

Dick:

We've all been assuming straight-line propogation in this case, which possibly wasn't true. Did you get a true beam heading on W0IC and W0AYK during your listening period? Perhaps the cloud was off-path to the south and tilted.

Editor

Sir Editor:

Received your latest edition and found it quite sterling. Just what the VHF doctor ordered, to be sure. Several of the boys down here have seen it and will be subscribing directly. We had to give up our six meter band for TV, finally, so everyone is going on 1296. I'm chattering 60 airline miles here in New South Wales nightly now on 1296. Some of the boys are going on mountain tops and it's great sport.

VK2ZCF, Croydon, N.S.W.
Australia

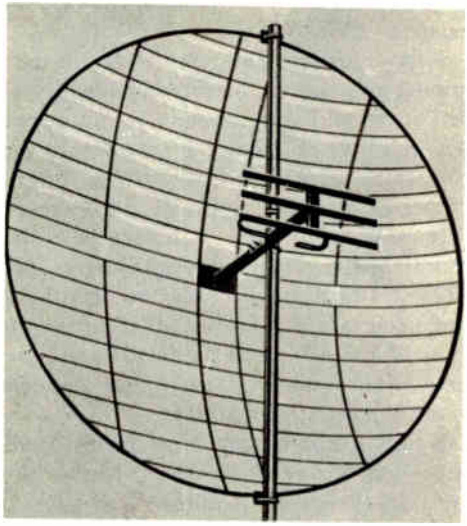
CHEAP GAIN ANTENNA FOR 'L' BAND

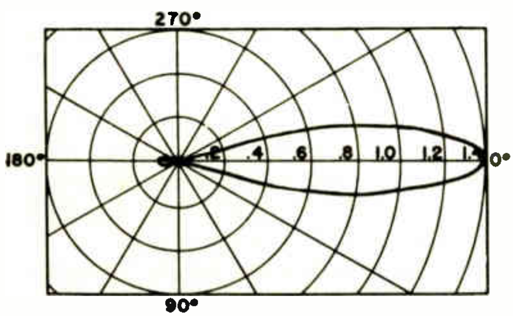
FOUR FOOT DISH FOR 1296 Mc

John T. Chambers — W6NLZ/A6NLZ
℅ VHF Horizons

Most of the 1296 gang sooner or later want to try a parabolic reflector. Until now surplus military reflectors and a few home brew models have dominated the band. The main disadvantage to the military dishes has been their extreme bulk. Most of them look like they were built for a battleship—and they probably were!

Recently a commercial manufacturer* of almost all kinds of antennas brought out a parabolic reflector antenna for the UHF TV trade: Four feet in diameter; very light, but sturdy construction — and a net price under $20.00. As it comes, TACO's model 3050 UHF Parabolic must be modified to work on 1296. The feed elements are too long, and the mesh in the reflector too far apart. Conversion to 1296 is simple since the hot dipped galvanized of the reflector assembly is easy to solder to. Merely double up (add another set of horizontal wires) the mesh curved to match the shape of the dish. Soldering the new bars in place is simplified by tying them in place with No. 30 tinned wire before soldering.





HORIZONTAL RADIATION PATTERN

Before modification, the front to back ratio of the antenna was 5 DB. As 1296 Mc is well above the maximum design frequency of channel 83. After modification of the reflector (doubling reflector bars), the front to back ratio rose to almost 20 DB or very adequate.

Modification of the feed (blue anodized aluminum) was as follows: The driver (where the feed line attaches) was shortened to 4½ inches by cutting, re-bending, and drilling new holes to attach the feed line with. The three bar illuminator reflector was cut off to a total length of 7 inches. How much gain now? Just a fraction over 20 DB.

*TACO (Technical Appliance Corporation, Sherburne, New York)

VHF EXPEDITION

- CIRCA 1941 -

by A. David Middleton, W5CA/W7ZC
Staff Historian, VHF Horizons

Thousands of QSO's have been added to my logs since that summer day in 1941, but none of them are more vivid in my memory than the one in which the entire future of a new ham operator possibly hung in the balance.

I have just reviewed my 1941 log books hoping to uncover the call and identity of a certain Brooklyn ham, but I found no written notation of anything that would identify this particular QSO from those so numerous in those happy VHF days just before WW2. W2OEN, at Kilocycle Hilltop, Middletown, New Jersey worked a lot of W2s and many in Brooklyn so alas the call and name are not known. But the implications of the QSO and its details are clear. I have often wondered what ever happened to my contact after that day.

It was a hot muggy New Jersey Sunday afternoon. There was a decent breeze blowing thru the shack's windows and I was debating whether to get on the air or not. I sat idly tuning the dial on my "French 75-acorn-regen" and wondered if a QSO with Nature out on the hill under an apple tree with a tall glass of cool lemonade, might not be better than an on-the-air QSO inside. Radio won out, however, and I listened across the 112 MC band. There were the usual Sunday squeals of the mobileers chasing each other up and down the bands with their transceivers — the ones with the "19 type" tube in them and the "J" antennas! General activity was pretty low as most guys were outside on a day like this.

I strolled out onto the hill and up to the base of my tall mast. I swung the capstan bar around so that the 15-element beam was aimed up the coast of Long Island Sound. Some maritime-mobile might be on or perhaps some vacationers on the shore.

A CQ brought a reply from a station out on the tip of the Island. Not a bad haul for 112 MC. But like me the fellow was only half-interested and the QSO died on the vine.

When I signed off and stood by on the band I heard a signal frantically calling W2OOEN. (Let's assign him the call of W2XYZ). The signal was weak, wobbling all over the band and hardly understandable. But the urgency of the call was not to be mistaken! This guy was really trying to raise me.

Finally, he wound up his almost interminable call and stood by. I caught his call and his location—"W2XYZ—Brooklyn."

I replied and acknowledged his call and gave him the usual report. You know, the kind when the guy is a poor operator and his signal is even worse! Non-committal—and sort of "so what."

There was a long pause. Then the carrier came on and in the far distance and off mike, I heard a voice say—"you **see—it does work!**". Then the voice picked up and W2XYZ continued in a boyish tone, eager and excited and somewhat scared. It was obvious that this guy was NOT a highly skilled VHF man. Finally he steadied himself and gave me the usual report that I had heard so often W2OEN was booming in Brooklyn. But, the operator asked me to repeat my location. He gave me his name—"Joe".

I went back to Joe and told him I was on a high hill overlooking the New York area and that I was near famous Telegraph Hill, Northwest of Red Bank. I added "Why the interest in where I am?"

The next remark was a stopper! A man's voice boomed out of my speaker saying, "How do I know you are near Red Bank.

That is a long way from here!" The voice was almost dubious.

Here was a queer situation. No one had ever questioned the authenticity of my QTH and it seemed rather strange. After all—how does one prove over the air just where he is operating?

There was confusion at W2XYZ and then Joe came back on the mike and startled me by saying. "My father does not believe that you are operating in Middletown. You are too loud!"

I had been accused of being "too loud" before, but no one ever questioned my locale. I snapped back at Joe and demanded to know what difference did it make anyway, and anyway what did his father have to do with our QSO!

Joe came back and what he told me was a real kicker. His simple poignant story has stuck in my memory. Here it is, without embellishment.

Joe was a teenager. He lived in a poor section of Brooklyn and attended high-school. He had some ham friends who were as unskilled and as embryonic as he. He had studied; taken the ham license examination passed and had received his call. He was not interested in CW and so he chose the easiest band on which to operate voice—112 MC.

Money was scarce in the family home of Joe. He had to work hard and scrape together a lot of bucks before he could bring home equipment for a 112 MC. He chose widely-used Abbott DK-2 transceiver. This was a battery-operated unit, one that was thoroughly distasteful to the more serious class of VHF amateur. The DK2 had a notoriously bad signal but it was cheap and, under good conditions could get out—but it was hard to copy and tough on batteries! It had a simple circuit and was—what was considered a minimal station in 1941.

Joe had gotten his equipment but he was faced with that perennial problem—that old devil—Antenna! The best he could get up was a double dipole fed with twisted pair—the old green and yellow lamp drop cord which was the fore-runner of the coax and Twin-lead so widely used today. However, the old "twisted pair" had high losses at 112 MC, so Joe did not get much into or out of his antenna! The dipole was up somewhat on the apartment building, Joe was a bit vague just where.

W2XYZ made a few contacts all locals! To Joe, local meant just that — stations only a few blocks away and usually with the group that had introduced him to ham radio. Many stations ignored the DK2's when possible. Joe's pals could not work out well either.

Then came one eventful day when Joe heard W2OEN blasting in from Middletown. Here was DX! Now if he could only work that station! He tried hard but W2OEN did not reply to his frantic calls. He wore down a set of batteries. These had to be replaced by more scraping of hard-to-get dollars.

Joe could hear other "outside stations" at times but they would not answer him. He knew that if he could only work W2OEN he would break the jinx and blast thru the barrier to the realm of VHF DX. Joe had made some exaggerated claims and statements to his parents and they expected some results from all the expense and much shouting into the carbon mike! Not to mention the squeals and whistles given out by the DK2 receiver section!

Then Joe had a happy inspiration! He knew that 112 MC would work out much better if the antenna was out in the open where there were fewer buildings and wires to shield these feeble warbling signals from the DK2. Right that moment Joe conceived the idea of VHF DXPEDITION although he had never heard the word as it was not in common usage until after the War.

Joe's family possessed no car or access to one. So he and "Father" lugged the DK2, a batch of heavy dry cell A and B batteries, plus some sort of antenna lashup out into one of Brooklyn's many public parks. There on a park bench, W2XYZ was set up. Joe had heard W2OEN regularly on Sunday afternoon so the expedition was mounted for that period.

What was the results of all this effort? The primary purpose was to work W2OEN and that was accomplished. A two-way QSO with an "outside" station proved that the much maligned, expensive (to Joe) unit could work all the way across the Bay into New Jersey a spot that was considered to be a "foreign land" to many Brooklynites.

I talked like a Dutch uncle to Joe's dad, and as clearly and accurately as possible, I tried to convey to him the fact that W2OEN was where I said it was. I gave him the geographical facts of my location and described what I could see. The fact that I could see the gas tank at Coney seemed to carry more weight than anything else I could bring out.

Eventually I sent a QSL to Joe, but never received a reply. I suppose that QSLs and their stamps were not included in Joe's budget. So to this day I do not know what happened to Joe and his VHF work as I never heard W2XYZ again.

However, I'd like to know. So—Joe, if by chance you read this article, and if you are a VHFer today you will—please identify yourself, and I'll pass the word along to the VHF gang.

What do you think, OM? Is "little Joe," W2XYZ still on the air? I like to think so!

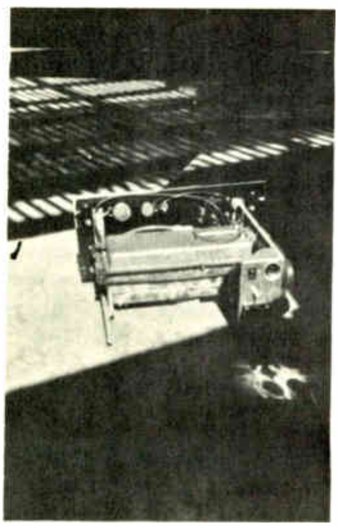
STILL A GOOD WAY . . .

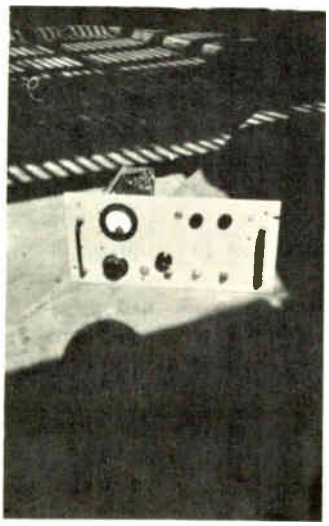
TDZ TRIPLER TO 432

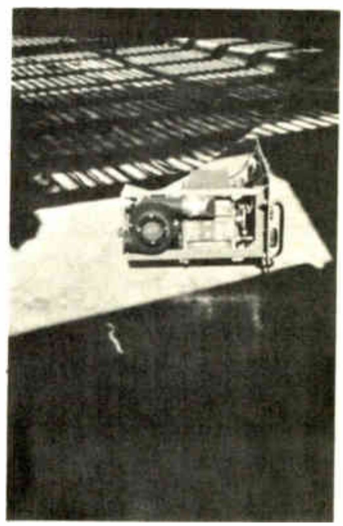
Louis R. "Dick" Bailey
W6IEY/A6IEY
6273 De Camp Dr.
La Mesa, Calif.

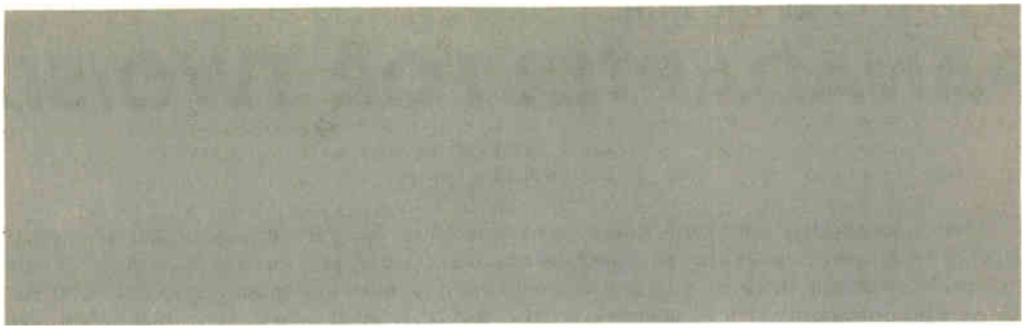
There is nothing new in this method of getting on 432 mcs. W6MMU published the circuit in the December 31, 1959 issue of "Western Radio Amateur" and it was repeated in the "VHF Amateur" at a later date. However, I believe that the way it is mounted is neatly done and may give someone the urge to get on 432 mcs very easily. The only requirement is a little drive (modulated) at 144 mcs. A Communicator or an SCR 522/as used here will supply this.

The tripler unit that I acquired at one of the local surplus emporiums did not have the original blower attached and I used a 28 volt surplus dual outlet blower on hand to supply the needed air. The extra outlet will be used to supply air to the amplifier unit when completed. A 28 volt DC supply was incorporated to run the blower and an external antenna relay.









The input tuning condenser is tuned with a reduction knob from a BC375 tuning unit on an extended shaft. The chain drive for the plate line is the original with an added chain drive to offset the knob away from the input condenser shaft. Some gear ratio was added here to provide smoother tuning. The Meter is for plate current at 60 mils with 750 volts on the plate. A filament transformer with a variable resistor in the low voltage side is used to give six volts at the 2C39 filaments.

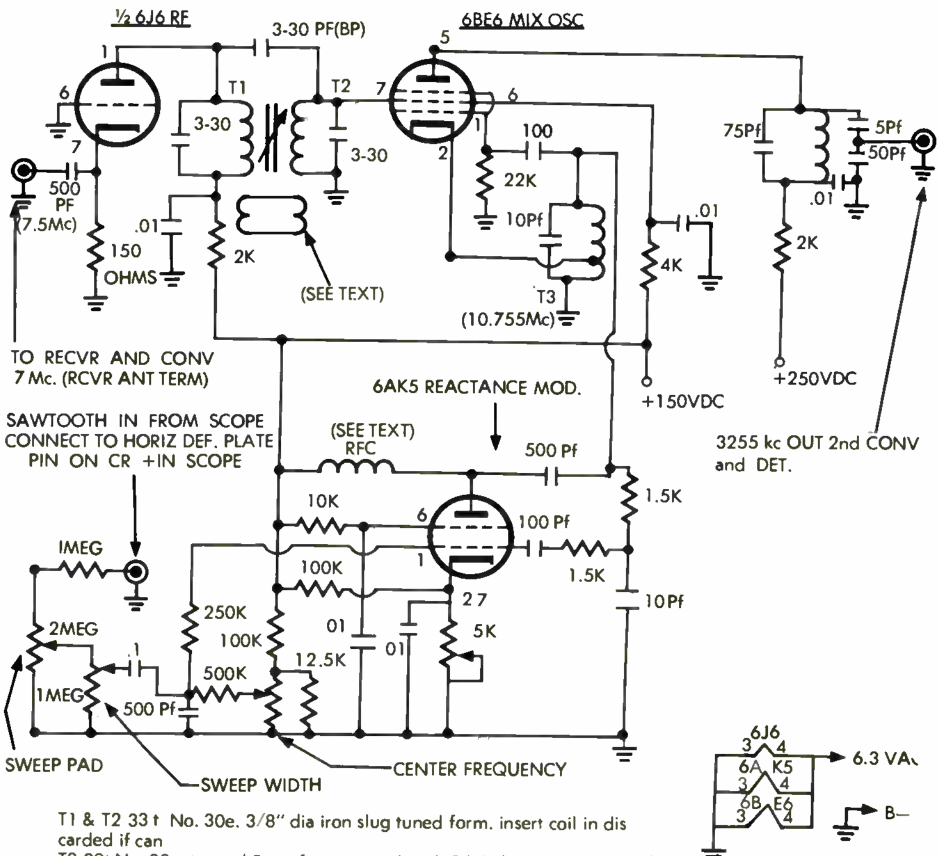
This unit is excellent for local work, however, for DX type phone work not enough "Lumps" on the carrier are produced to give good modulation percentage. Best DX with this unit so far has been 120 miles on check-ins to the MARS 432 R & D Net with WA6HIT.

THE BETTER TO SEE YOU WITH

PANADAPTER FOR TWO/SIX

JOHN A. FREDRICKS K7GGJ
314 South 13th Avenue
Yakima, Washington

There are many amateurs today who operate with the advantage of panoramic reception. Just ask them, if you are one of those who does not have a panadapter, what you are missing. They will tell you they couldn't operate without the thing! The idea for the panadapter described here is far from new but, here is the advantage: This particular panadapter will "see" more of the band in question (about ± 450 to 500 Kc) and this is in itself is a real advantage. Imagine yourself "seeing" approximately 1 Mc of the band without turning the dial on your reciver!



T1 & T2 33 t No. 30e. 3/8" dia iron slug tuned form. insert coil in dis carded if can
T3 29t No. 30e. tapped 5t up from ground end. 3/8" dia. iron slug tuned form. Insert in discarded if can.
T4 45t No. 30e. 3/8" dia. iron slug tuned from. Insert in discarded if can.
All resistors 1/2 watt.

FIGURE 1

CONSTRUCTION

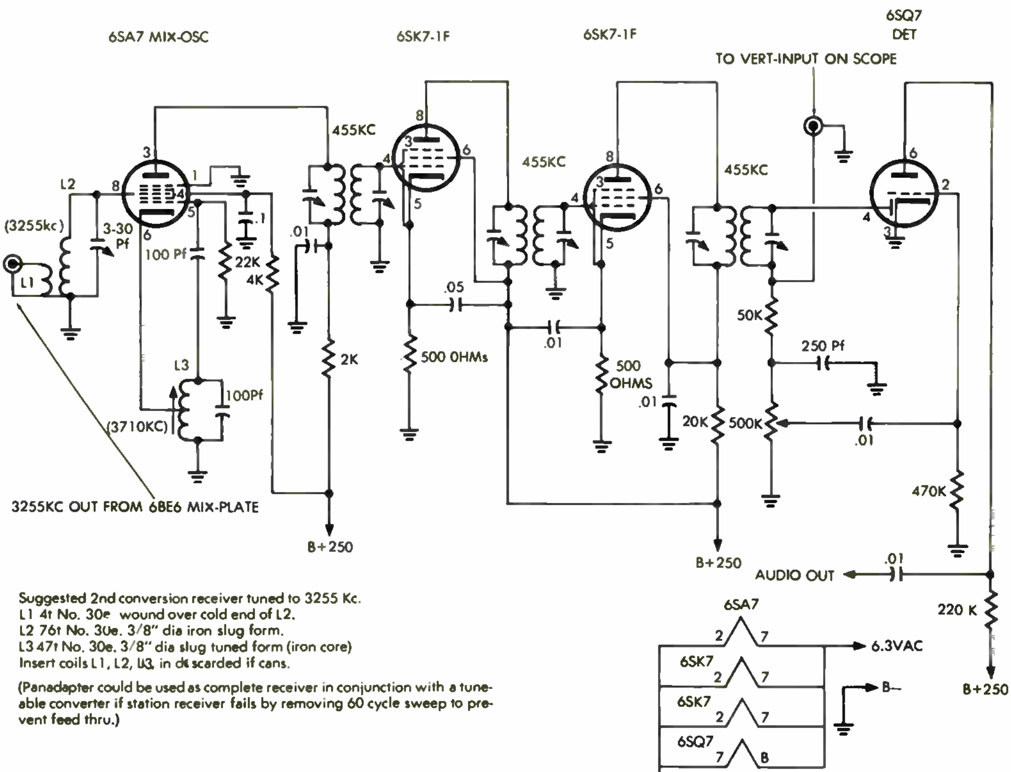
My unit was built on two separate chassis one measuring 2"x5"x8' for the panadapter proper and one measuring 3¼"x2"-8" for the 2nd conversion receiver. The construction of the panadapter is not at all difficult if you keep one thing in mind: Make sure to keep all leads as short and direct as possible! Looking at Fig. 1 you will notice that between T1 & T2 there is a link coil coupling the two windings. This is made up of 4t of No. 30e. close wound on the cold end of both coils and connected with a short piece of 75 ohm twinlead.

You will also notice the RFC in the B+ line to the plate of the 6AK5 reactance modulator. This choke is made up of one section of a 2.5 mH RF choke.

In my unit I was quite liberal with the use of terminal strips as I found it necessary to maintain mechanical rigidity, a factor very important to proper operation. It also is advisable to use mica capacitors in both the 6BE6 converter stage and the 6AK5 reactance modulator stage, in order to maintain maximum stability. Other than the aforementioned points, I don't think any thing else need be said about the converter — reactance modulator unit is it is quite straight-forward in construction.

Now let's go on to Fig 2. The first thing we might say is "what is all that old junk doing in there?" Well, its just what I happened to have on hand at the time that I built the unit. This does not mean that the builder has to use such outdated tubes at all.

Looking again at Fig. 2, the receiver is a bit unorthodox, and some trouble was experienced with the first model, but, after adding Bridge neutralization to the i.f. stages all was well and trouble free operation has been the order of the day ever since. As I stated earlier, I can see no reason at all for not modernizing the receiver with up-to-date tubes but this is up to the reader.



Suggested 2nd conversion receiver tuned to 3255 Kc.
L1 4t No. 30e wound over cold end of L2.
L2 76t No. 30e. 3/8" dia iron slug form.
L3 47t No. 30e. 3/8" dia slug tuned form (iron core)
Insert coils L1, L2, L3, in discarded if cans.

(Panadapter could be used as complete receiver in conjunction with a tuneable converter if station receiver fails by removing 60 cycle sweep to prevent feed thru.)

FIGURE 2

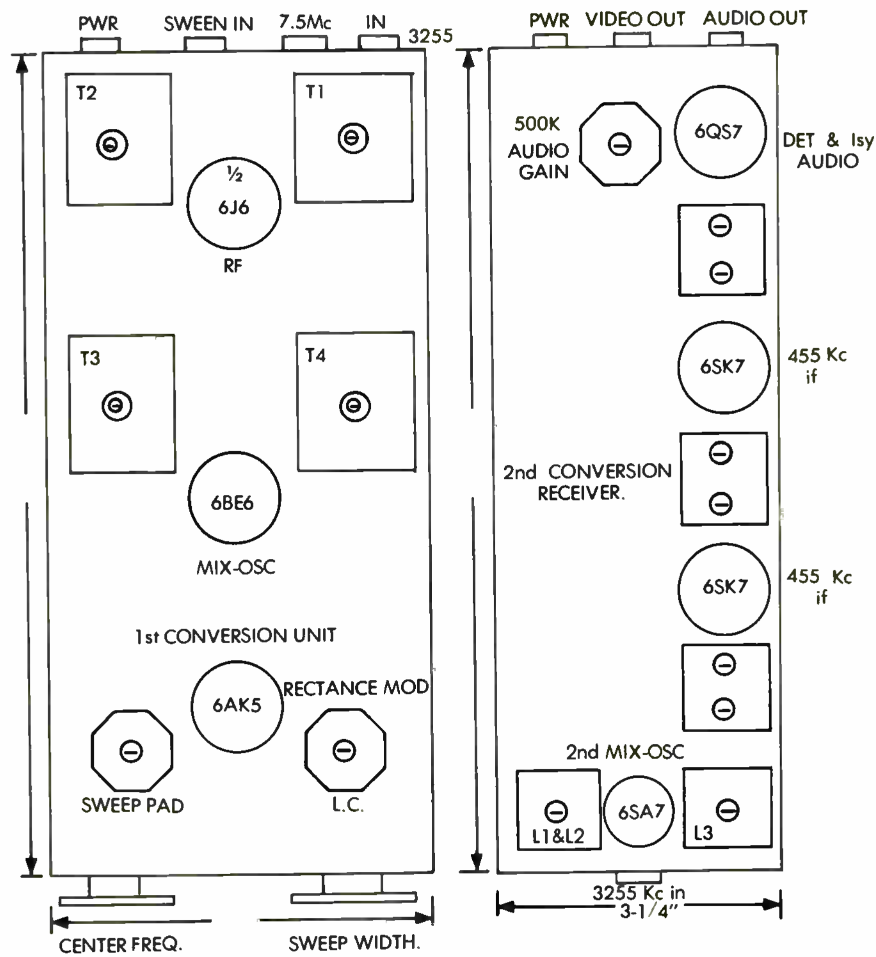
SAWTOOTH VOLTAGE FOR THE REACTANCE MODULATOR

Sawtooth voltage for the reactance modulator was, in my case, taken directly off the horizontal deflection plate pin of the crt in the scope itself, although in some cases it may be necessary to take the sawtooth voltage off the sweep oscillator within the scope.

ADJUSTMENT

The first step in adjustment is to connect the sweep voltage out of the scope to the input of the reactance modulator and the output of the panadapter (2nd Det) to the vertical input terminals of the scope. All connections between the panadapter receiver and the scope were made with shielded microphone cable, as the use of coax seemed a bit unnecessary. Next connect the appropriate voltage to the panadapter receiver. At this point I might mention that any small regulated power supply capable of + 250 and + 150 VDC at 120 to 130 mA and 6.3 VAC at 4 amps will suffice.After the aforementioned voltages have been applied to the panadapter receiver, turn the scope on

CHASSIS LAYOUT OF PANADAPTER
(general layout)



All connectors shown are standard mic connectors, coax connectors could be substituted.

FIGURE 3

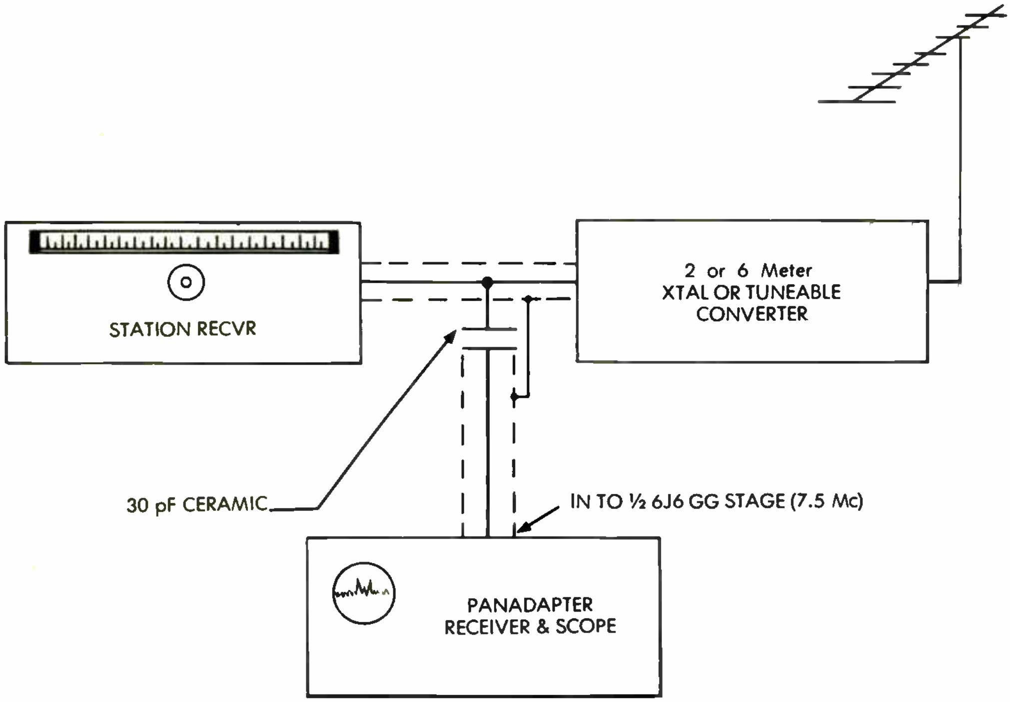


FIGURE 4

and allow both to warm up. At this point a 7.5 Mc signal should be fed to the panadapter input (gg ½ 6J6) with all potentimeters set at half-mast. Then slowly tuning T3's iron core, a pip should appear on the screen of the crt. After centering the nip on the crt screen (7.5 Mc) tune T4 of the 6BE6 mixer plate & L2, of the 2nd conversion receiver for maximum height with the vertical gain control in the scope about ¾ open. I would also like to point out that I had already tuned up the 2nd conversion receiver to approximately 3255 Kc beforehand. Although this may not be entirely necessary, I felt that it would surely speed things up. Now with the pip centered on the crt screen tune T1 & T2 for maximum height and maximum frequency response over the range of 7 to 8 Mc. There should be very little deterioration of the pip over this range. The amount of the spectrum seen will also be determined by the setting of the Sweep Pad, & Sweep width potentimeters. As can be seen from above, the tune-up procedure is really quite conventional and I don't think any real trouble should be had if directions are followed carefully.

PUTTING IT INTO USE:

The panadapter should be connected between the converter and the receiver as shown in Figure 4.

CONVERSION AND TUNE-UP CHART
1st conversion
mix — 7.5 Mc.
osc — 10.755 Mc.
mix out — 3255 Kc.
2nd conversion
mix — 3255 Kc
osc — 3710 Kc.
out — 455 Kc.
detector — 455 Kc.
Band-pass
T1 & T2
Peak slug on low side of 7.5 Mc (hi sig)
Peak 3-30 pF (B.P.) on high side of 7.5 Mc (low sig)
Scope set for 60 cycle sweep rate.

Although this panadapter was designed around a tunable converter such as the RME VHF-126, performance leaves little to be desired when in use with crystal controlled converters. The only drawback is the fact that the pips will not move across the screen as they will with a tunable converter but the scope screen can be readly calibrated to show the frequency on which the pip is appearing. At K7GGJ this particular panadapter has been in use with crystal controlled converters on both two and six meters and the performance has been very satisfactory. Also let me say this: although coil specifications are given for 7.5 Mc, if your converter has an i.f. of 14 — 18 Mc or any of the other popular i.f. oututs, the first conversion stage (6BE6) could be made to operate in conjunction with the 2nd conversion receiver at these frequencies without any difficulty, with the help of a grid-dipper.

Well that wraps it up, good luck with the panadapter. Once you have built it you won't operate without it!

GOOD TO KNOW

VSWR vs COAXIAL TANK LOADING

Here is an interesting exercise for those VHF'ers using converted surplus units which feature coaxial cavity amplifiers, or those who have built up their own coaxial cavity amplifiers for 144, 220 or 432 megacycles.

In a staff report appearing in our October, 1962 issue, we reported on the design characteristics of a pi-network and the usefulness of this circuit at VHF frequencies.

Recognizing that a pi-network is essentially "a cheater device" for making our final think our feedline is flat, and thereby bringing our VSWR down to a reasonable value for loading of the final (as far as the final is concerned, from a load standpoint), we decided to purposely mis-tune a coaxial tank amplifier using a 4CX250B on 220.050 megacycles, and then try to load it into a 32 element colinear array which we had also purposely mis-tuned.

Our goal was to plot the affects of VSWR, on loading of a coaxial tank circuit, versus the VSWR present on the line at the transmitter.

The meter used to measure the VSWR was a calibrated MC Jones (now **Microwave Devices, Bristol, Connecticut)** 120 watt unit. It has a four function switch for forward power, back (reverse) power, calibrate (through a pot) and actual VSWR.

With the final mistuned (through the cavity plunger), but the antenna properly matched to provide a VSWR of 1.0 to 1,

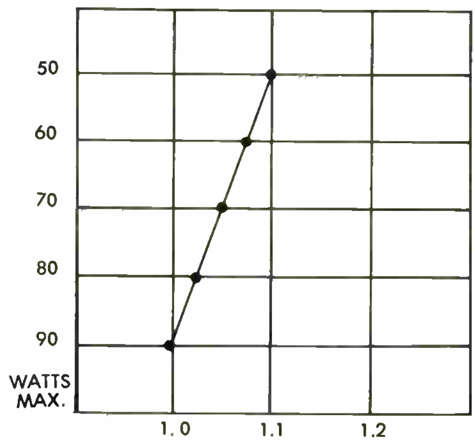
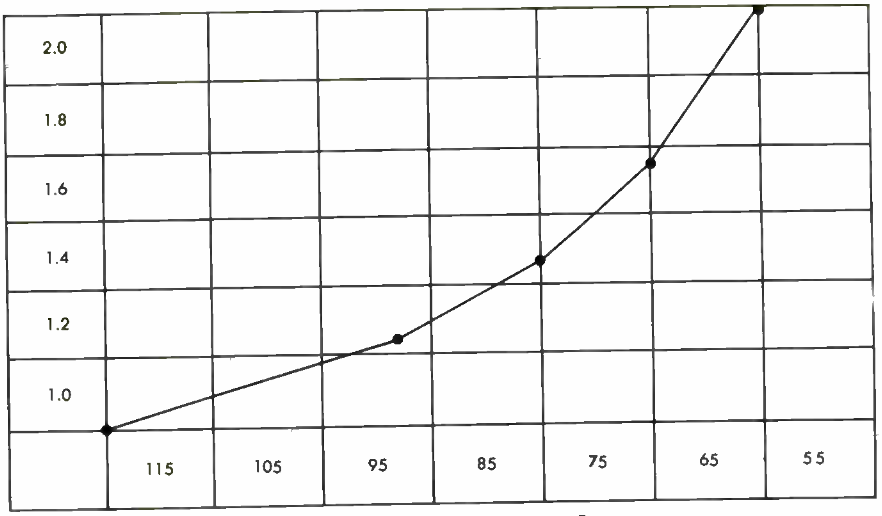


chart number one shows the result. Keeping in mind that the antenna, when properly matched, and the coaxial tank, when properly tuned, will provide 115 watts into the line at 220.050 mc/s, the slight reactance affect of the mis-tuned cavity on the VSWR is plotted in chart number one.

Of perhaps greater interest is chart number two. Here the antenna was mis-tuned to the extent of producing a VSWR of 2.0 to 1, not really very high by modern tolerances. And yet note that with a VSWR of 2.0 to 1, the **miximum** loading we could manage through the final was 65 watts.

In other words, with a VSWR of only 2.0 to 1, the final would only load to 65 watts forward power (and 12 watts of reflected power). That's a 43% reduction in transmitter output!



MC JONES 120 WATT CALIBRATED METER

Retune the matching bars on the colinear, bringing the VSWR down to 1.6 to 1, and the final coaxial tank loading increased to 85 watts forward power.

Bring it down further to 1.2 to 1 (which is a point where most of us are inclined to leave well enough alone) and the final loading increases to 98 watts forward power.

Now make it match perfectly, which is no real effort with a matching stub set such is provided with Cushcraft's colinear antennas, 1.0 to 1 and the final loading jumps up to 115 watts.

With no detectable power beihg returned.

How important is a flat line when you are using a coaxial tank circuit final amplifier? We think we know. What about you?

HAMFESTS:

Watertown, Alberta, Canada — July 20, 21 — Glacier, Watertown Hamfest. $3.00 pre-registration by July 10. Contact Clif Cartwright, VE6AGM, Box 941, Lethbridge, Alberta.

CORRECTION

Dear Editor:

It was a big surprise to find my piece on the 6M pre-amp in the April issue. This is just about the shortest period between submission and publication in my experience. There are two errors in the parts list. One mine, and one the typesetters, to wit:

(1) The coils are Miller, not Millen 1. to 1.6 uH. The Allied Number is correct.

(2) It is 20 turns of number 24, not two turns. This one should have been pretty obvious to most readers.

I can testify to the effective coverage you have in circulation, having received many comments over the air since the magazine arrived.

Joe Marshall
Ozone, Tenn.

Joe:

Corrections noted. Several of the gang also brought the 24 turns versus 2 turns to our attention.

Editor

Editor:

Your's truly owned one of the AM-33-RT amplifiers for more than a year, and had consigned it to a dark closet. Your recent article concerning the conversion of this unit brought it back to mind and out of the closet. After some time spent in conversion, the rig is now ready to go. I am running 435 watts input to the converted unit and getting 300 watts output on peaks. See you on six SSB, upper, lower and crossways this summer!

Glenn, W4MMP

Note:

Glenn had two pages of details on how he "modified" the conversion article ran in VHF. If there's enough interest we'll get Glenn to make it up in article style. Or have you had enough on the AM-33-RT?

Editor

Vital Happenings & Facts

OPERATING AND DX NEWS

WHAT DO WE HAVE TO SAY?

Remember of two articles on Sporadic E skip and two meters? One ran last fall under our own pen, another ran in conjunction with W8KAY who provided the raw data we worked from.

We added in such reports as our being heard during the June 1962 contest (VHF QSO PARTY) by K41XC in Melbourne, Florida, and we promised to be on the air if it happened again this year.

At press time it has happened twice. We were there both times. **Where were you?**

JUNE 2

Six has been open most of the afternoon. Around 1900 we started hearing a brace of signals from western Tennessee here in Oklahoma City, and soon found central Arkansas stations coming through. We promptly went to two meters. The time was about 1915 CST, or 2015 EST. We apparently were too early.

For K4IXC, Melborne, Florida writes ". . . Remember sometime ago I wrote and told you that I had heard your two meter signals (June QSO Party, 1962) here in Melbourne? Well, it has happened again. Only this time I heard W9UNN/Ø, Wichita, Kansas. The time was 2227 EST (2127 CST) and his frequency was just near mine of 144. 091. I heard a carrier start to build out of the noise, and when it got up there I switched off the BFO and heard W9UNN/Ø calling CQ Two Meter Phone. He built to well over S9 and lasted until he was about to sign, then faded down and out. This signal was also heard by W4-MNT, Orlando, and W4VTJ Lantana. We all called but he was gone."

Let's check the W5KHT log for that approximate period. When I switched to two meters at 1915 CST (2015 EST) I immediately heard a station I Read as W8WAQ, rag chewing on about 144.105. He was in with a carrier (only read his phone at the beginning) from 1915 or so through 2005 CST. I also heard fading Es type carriers at 144.175, 144.090 and 144.015, between 1930 and 1955 CST.

I got Russ, W5HCX, on calling CQ with his KW on 144.205 and 40 element array from 1930 to 2000. He heard nothing.

We both shut down by 2105 CST, before K4IXV heard the signal on W9UNN/Ø.

What was six doing at this time? By 1945 CST the Arkansas short skip stations were gone, but they were replaced with some tremendously strong (and deep fading) signals from South Carolina, Georgia.

They lasted until around 2200 CST (2300 EST).

JUNE 9

This was a week later, the Sunday of the contest. We found six shortening up to Little Rock, Arkansas; Louisiana; Mississippi (all 300 to 500 miles) around 0820 CST. We immediately fired up on 144.140 (our contest frequency) as well as calling a QST-QST on 50 megacycles alerting the gang that two meters was possibly open between the midwest and Georgia — the Carolinas and Florida.

Several of the 4's apparently went to two meters. We heard two carriers come up and go down, and then at 0850 CST CO2DL, Arnaldo Coro, gave us a call on six meters to report he was copying our two meter signal in Havana. Arnaldo is a dyed in the wool VHF enthusiast and while he has no two meter transmitting gear, he does have a complete receiving lash-up from six meters up through all of the TV channels, FM band, aircraft band, two meters, and into the TV channels again, in fact all the way to UHF TV (he's copied several stateside UHF television stations in Havana.) He gave us a run down on what we are saying and we had a cross band of sorts between two and six for a few minutes, the best we could through separate operating positions for six and two that were separated by 12 feet. Then we bid him good bye and quickly announced two was for sure open, and where the devil were the 4's!

We finally gave up two meters around 0915 CST.

Oh, yes, Arnaldo reported he heard two other two meter phone signals, some one was giving us QRM on 144.140. Who ever it was was counting 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and then back down to 1 again. Guess you'll listen next time you spend a few minutes tuning your two meter rig, hey OM?

In spite of all of this encouragement, we are far from happy. There is simply not yet enough interest in two meter Es to make it work. Next year we will have a 500 watt CW keyer beacon running whenever we hear a remote sign of six meter DX. And you'd better be listening and ready to transmit back to us!

SIX METER NEWS

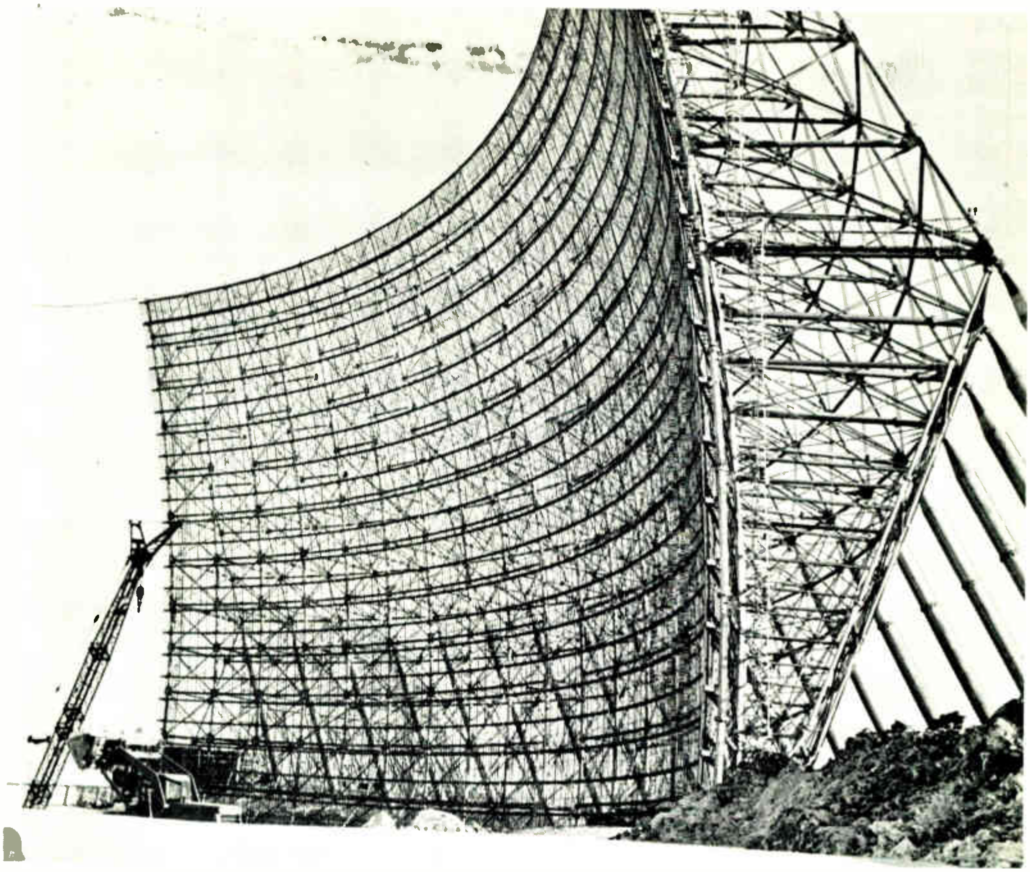
Some of this will (unfortunately) be a little out of date when you receive and read this. However, on the chance some of the dates will be extended, we pass it along.

VP7CX, Harold of Bahamas fame, was to have operated on 50.040 as HI8XHL in the Dominican Republic from June 22 to July 2. This is his vacation. He asked that everyone keep QSO's to a bare minimum, i.e., RST, location and confirmation of contact, so as to allow him to work as many as possible.

Harold also has been active promoting more six meter activity in the Caribbean. He sent a complete six meter station down to VP2SY, on 50.060, on June 3. This would have been active by mid June, although we have no reports at press time.

VP5BB, Barbados, is on 50.130 most of the time, when he is on. He has Lafayette's HE-45 so can move (VFO) if he thinks the going is too rough. Why isn't he in the foreign phone band?

VP9WB is on with a similar Lafayette product. Also on six meters in Bermuda is



RUMOR has it Sam and the gang at W1BU have something cooking in the tropo scatter department for 432. A wandering sole who admits he was lost and says he wouldn't know a Massachusett's swamp from a Louisiana mud hole claims he snapped this snapshot someplace in the northeast. We take no credit for this news scoop. We leave that to Sam and QST.

K4PGL/VP9, who was worked on double Es by W5SFW on June 2.

KV4CQ will not be active from Virgin Isles until after mid August. Too bad. He's a W2 who vacations down there, east of Puerto Rico.

Speaking of east of Puerto Rico, FG7XT, Guadalupe, was worked by W5KHT from Oklahoma on June 1. He has Clegg gear (Zeus and Interceptor) and operates just outside US band (50.096) most of the time. His signal has a little instability, probably due to the line voltage regulation problem down there.

FP8CA and FP8CB were supposed to have been active from St. Pierre on six and two during the contest. Clegg gear. No reports on this one, did they make it?

CO2DL, Arnaldo, is pretty active on six. His name is Arnaldo Coro, Havana is his QTH. If you are interested in Es and propagation topics, call him and spend 90 minutes rag chewing with him like we did June 2. A most interesting chap who notes "we now use Russian or Chinese People's Republic tubes and components in all of our gear since we can't get American parts any more."

Rumor has it a TI2R? has been active. XE10E in Mexico City was supposed to know his call and frequency, but Ted said he had no such knowledge when we worked him on June 9.

Two KP4's were supposed to have worked YV5's in Venezuela on June 1. We know nothing definite about this.

VP4ZN was heard being worked by two K6 stations on June 1, on CW (!).

VP7CX was to be on two meters during

the June contest. His frequency was to be 144.450. CW. Anyone work him?

KB6CL/H6, is supposed to be on 50.102 with a gallon on SSB at 2200 CST nightly, according to 5WSFW. No reports on KH6 contacts so far this year, nor any reports on any KL7 activity.

VP7CX heard a Seattle station on SSB on May 31. Who was the 7 station that missed a Bahamas contact?

Contest Report

We should really wait until next month since we haven't had time to gather ade-fared best on E skip apparently were the fellows in W4 and W8 land. Sunday was a real bang up day until mid-afternoon.

Here at W5KHT, we held down the fort with W5ORH, K2JWE/5 and myself, W5KHT. W5HCX, Russ, was in Seattle attending a television conference for one of the books he edits.

We pulled a sneak test by running two rigs on six meters simultaneously.

One was the KW on the low end, AM, CW, or SSB, the other was a 100 watter on AM which stayed above 50.3. This gave us a chance to work an extra hundred plus contacts above 50.300, and it worked so well (after we engineered out the cross modulation and overload) that we plan to really do it up right with kw's on both ends of the band next year, unless the League decides this is not a kosher way to do things. As far as we could determine, there is nothing preventing two rigs per band at this time, in the rules. Makes life mighty interesting for the logging man, I can tell you that!

We ran closed loop television between the two operating positions and the logging desk, and the logger (and record keeper) had to keep up with two operators.

He had a return audio loop to advise either of the operators when the station being called or about to be heard had already been worked. It worked fine.

The band conditions were not as good as 1962. We managed to work 512 contacts in 54 sections, for a total score of 27,650. But wait until next year! We have some real plans for 6,2,220,432 1296. Watch out you eastern multi-op stations. W5KHT is about to strike!

SSB Picture

Last month we promised a run down on six meter SSB conditions. We have an announcement from the East Coast VHF Single Sideband Association. At their quarterly Dinner Meeting, their outgoing President John Super, K2ZBX, presented the group with a large and attractive trophy, which is in turn to be given (awarded) to the first amateur to work all states in the continental 48 on VHF SSB. This means the first fellow to make the grade on six meter SSB is going to receive a most well deserved trophy for his feat. This now puts real emphasis into what all of us sidebanders have been working for!

The custodian for the trophy is Abe Cutler, WA2ONB. This is the first such trophy to be offered, as an award for VHF sideband work, and we feel it will be both an extreme honor privilege to earn same. The East Coast VHF gang is to be congratulated for their efforts in this area.

Oh yes, the East Coast sideband gang meets on 50.108 Sundays at 1100 hours EDT (this summer).

Now to those rare states on sideband.

Still no word on Maine, Vermont, New Hampshire, Connecticut sideband activity. Guess there is none. Arkansas is also apparently a void. (See list of states in June VHF) North Dakota ditto.

In Utah, we have definite conformation that no one is active. **Sorry Charlie.**

In Nevada, you can get K7ICW in Las Vegas to go SSB if you get ahold of him (name is Al) on CW (or phone, although he preferes CW) first. We did it early in June one night (June 2nd). Also about to get active on six meter SSB from Nevada are K7HRW and K17LB in Reno who are working together on companion mixer units. K7HRW will be on with a full gallon.

Oregon? K7IMH was worked by the Horizons gang on SSB on June 9th during the contest. He's good for a QSL too.

Idaho? Apparently no one there, yet, since W7UBI left last year.

The rest of the states are reported to be represented by varying amounts of activity, although we personally have quite a few left to work, especially in the Nebraska-Wisconsin-South Dakota area.

It appears that we have never had SSB activity on six from the states of Maine, Vermont, Arkansas, Utah or North Dakota. Anyone know any different? It will help us plan how hard we have to work to beat someone else to the East Coast VHF gang trophy.

General News

We'll dispense with the band by land listings this issue for two reasons. I'm writing this just hours before I personally head on a ten day trip into the west coast, and it's still four hours before the VHF contest folds up. Time being of the essence, we want to hit the highlights the hardest and leave the details to the other magazines.

W7GJL, Barbara Ashley, Secretary of the **Northwest Amateur Radio Communications System, Inc.** of Washington state advises they are opposed to Wayne Green's (73 magazine) proposal to take the upper IMC of six meters (in particular) in favor of amateur television. The Washington group says they feel that the number of people who would utilize restricted bandwidth amateur television on six is small when compared to the number of people now using the upper megacycle for FM work.

They would like to see other groups voice their opinions to the FCC.

K1AGG, Phoenix, is another fellow hot for two meter DX work, especially Es. He has a habit of operating on 144.025 plus or minus a little bit and is apparently well enough equipped to make the grade when the band is hot. He tunes the lower 100 kc on two meters.

WA4ISG advises that if you worked VP9WB, he should get his QSL's in care of KØORH.

VE3BRI, Woodstock, Ontario has two 13 element yagis put together for 432 megacycles. Watch for him. The beams are silver plated ala that nut W9JFP (hi-Vic).

Dozens of stations report dobule hop Es during the month. We would like to acknowledge all of them here, but simply don't have the space. Your material will be fed into Univac gents, and it all helps.

K6QKL/KH6 advises he is monitoring 50.110 upper sideband 24 hours a day from Honolulu. He heard South American signals

LAST YEAR IN PORTLAND at the ARRL National, we caught this young lad (I believe from Seattle) with his complete walking-portable six meter station. A Sixer, voice operated mike (through a headset) or the more conventional hand held mike, halo, and 12 volt battery. Straps on the back on the rig allowed him to haul its 40 pounds around the convention floor. Ah to be young again!

at 2210 GMT on May 13. He believes the reception was due to ionized trail sleft by a Pacific Missile Range launch.

WA6HIT/AD6HIT reports a 432 megacycle MARS net in the Los Angeles area. It's Sixth Army MARS, every Saturday morning at 1600 GMT, and Sunday mornings at 1500 GMT. They have 20 members and average 10 check ins per session. 1296 operation is contemplated. Sounds unique.

Ralph Metro, WA2SVD asks for any information on the R-449 receiver, as discussed in a past issue of VHF. Can anyone help, with where to get such an animal?

OK2-4511, Josef Menda, Olsany, Ruda nad Moravou, Czechoslovakia writes he enjoys very much VHF Horizons but is having trouble getting the necessary financial exchanges worked out to get his sub current.

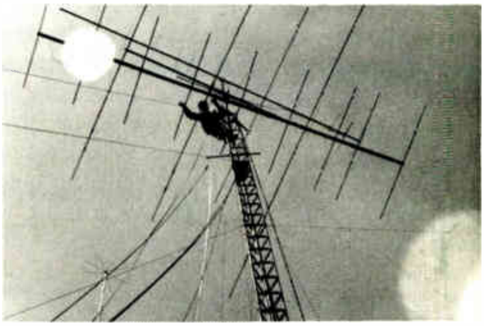
SORRY to have missed attending the Fresno VHF Whing-Ding in May. This shows two of the principal participants in a past such meet; Alan, W6FZA, leaves the rostrum while wildly enthusistic crowd (including Gib, W6BJI, standing) applaud his efforts. Both Alan and Gib are VHF staff members.

Anyone want to see a worthy European receive VHF monthly? $5.00 per year foreign.

K5DRF reports he worked XE1CT in Mexico City, on 50.125, with 3 watts input on May 31. Who says you need power!

K7DTS, Napavine, Washington reports FM DX on 53.29 megacycles when he heard W7FXJ/6 in Bakersfield, California for 3½ hours on May 9.

W6GDO, Rio Linda, California reports on attending the VHF hamfest in Fresno on May 18, with 53 VHF'ers present. Those who appeared included K7AAD, Loren Parks of Electronics, who spoke on VHF converter design. 18 of the 53 there indicated VHF-UHF current activity, in this fashion: 6 on 6 SSB; 18 on 2 SSB; 12 on 220; 5 on 432; 7 on 1296! W6DNG played his moonbounce tapes (wow!) and K6UQH and VHF Staffer W6BJI talked on Paramps.



BILL KAMP, WA9DML, perches 100 feet up on the tower at W9JFP. Bottom to top, 9 elements on 50 mc/s, test beam for 432 (15 elements on 14 foot boom), TH-4 Tri-bander, 15 element two meter array. The big 432 antenna broke in two on the way up. Vic has nothing but troubles and money.

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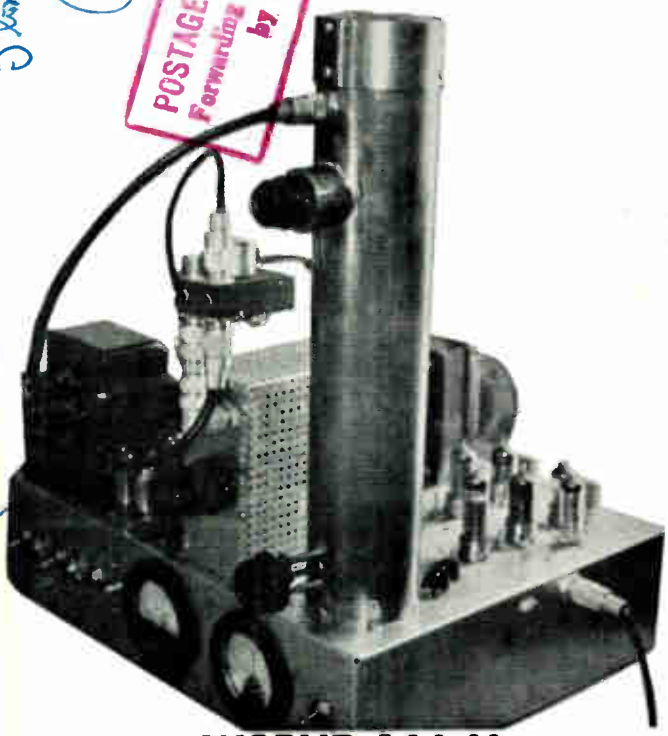

W0PHD 144 Mc
Coaxial Tank — described in May VHF Horizons

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VOLUME 2 — NUMBER 6
JULY, 1963

VHF HORIZONS

CONTENTS THIS ISSUE

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From the Publisher's Shack

We've had a few letters of late about the apparent changes in the VHF Horizons operating structure and the appearance of the book.

So I thought a brief comment or two might not be out of order.

In terms of subscribers, VHF is a howling success. Lots of fellows, it seems, have been searching for a VHF only publication. And, I think we've proven that there is a fairly good storehouse of VHF-UHF news just sitting around to be printed. Most of it is first-time in print material, and very informative.

But magazines cost money. A lot of money. How much money is of little importance, except to note that it costs more to put this one out, even on a shoestring budget, than it is taking in.

This kind of situation can exist only so long. Last month we trimmed 8 pages out and cut the staff. Now we are breaking even. Which is all we intended to do in the first place. VHF Horizons has cost me more sweat, blood and tears than any magazine Horizons has ever put out. We still put out magazines for CB, closed circuit television, two-way public safety communications and so on. They all carry their own weight. I knew, down deep, that VHF wouldn't carry its' own weight. But I have been an ardent VHF-UHF'er from the day I first became a ham, and I also knew that my kind of amateur radio just wasn't getting its fair share in existing books.

No fault of the existing books. This is simply an age of specialization, and VHF-UHF is highly specialized. It takes one to talk to one, as it were.

So I stuck my own neck out with my stockholders and said we'll print this magazine, or I'll be more that a little hard to get along with. They retaliated with "go ahead and print it, but if it doesn't at least break even, we'll be very hard to get along with."

And they have been.

So here is how things stand. I'll keep VHF going forever, now that it is a proven reader success, even if it comes out of my very own pocket, which it may. I'm a nut that way.

But I'll need the help of each and every one of you 23,000 readers, and especially the help of those fellows who haven't found it in their hearts to subscribe yet. It is subscriptions which have and will keep a journal of this stature going for VHF-UHF'ers. And this means beating the bushes on the air, and in person, each of you, for every subscription we can find.

At the present reduced overhead break even point we don't have a budget for attending ham conventions and whooping it up on behalf of VHF, and we don't have a budget for elaborate advertising promotions.

We have a budget, limited, to put out and mail a magazine. Naturally advertising does and will help. But it offsets less than 20% of the overhead presently. Any additional advertising will, I am sure, be taken as an endorsement of our product, and more important, an endorsement of VHF-UHF amateur radio in general. It seems quite reasonable to us that some of the bigger names in amateur radio manufacturing should have some sort of stake in the future of VHF-UHF. And our rates are so unbelievably low that even a full year's support with full pages every month amounts to less than $1,400 for the year. And we know that they will be buying a whole lot more good will and sales value than that!

So there you have it. I want to state in clear, pear-shaped tones that we are not in any stretch of the imagination going to cease publishing VHF, even though there have been rumors to the contrary.

Period.

I'm simply asking for your support of this medium of expression in amateur radio, if you feel that VHF Horizons has a place in your hobby and your life.

That's not too much to ask, or is it?

W5KHT

FOR THE 1215 Mc BUFF

L BAND COAXIAL WAVEMETER

K7KDU
2800 N.E. 55th
Seattle 5, Washington

Most hams who are using APX-6 type equipment on the 1215 Mc. band are likely to become a bit shifty eyed when you ask them what their frequency is. "Around 1220 mc. I think," is about as close as you'll pin them down, with an occasional "I dunno" denoting the more honest types.

Since I am allergic to Federal Investigation it became obvious when 1215 Mc was undertaken as a joint project of K7KDU-W7QID that Steve and I would have to figure out some way of measuring our frequency.

The first attempt was a set of close spaced Lecher Lines like those in the Books. The results were just about what we expected from previous experience. Sharp nulls were very difficult to find because of radiation from the lines, body and hand capacity effects, oscillator pulling because of the tight coupling required, reflections from walls, etc.

It is possible to obtain accurate frequency measurements in the L band through use of Lecher Lines if you are very careful and very patient. Here however, something better was needed. Most of our operation is portable, a fact of life that we Western Mountain boys learn to appreciate more and more as operations go higher and higher in frequency. Lecher Lines are not really designed for portable operation. A cavity or coaxial type of wavemeter was indicated and after several attempts were made, we came up with a good one.

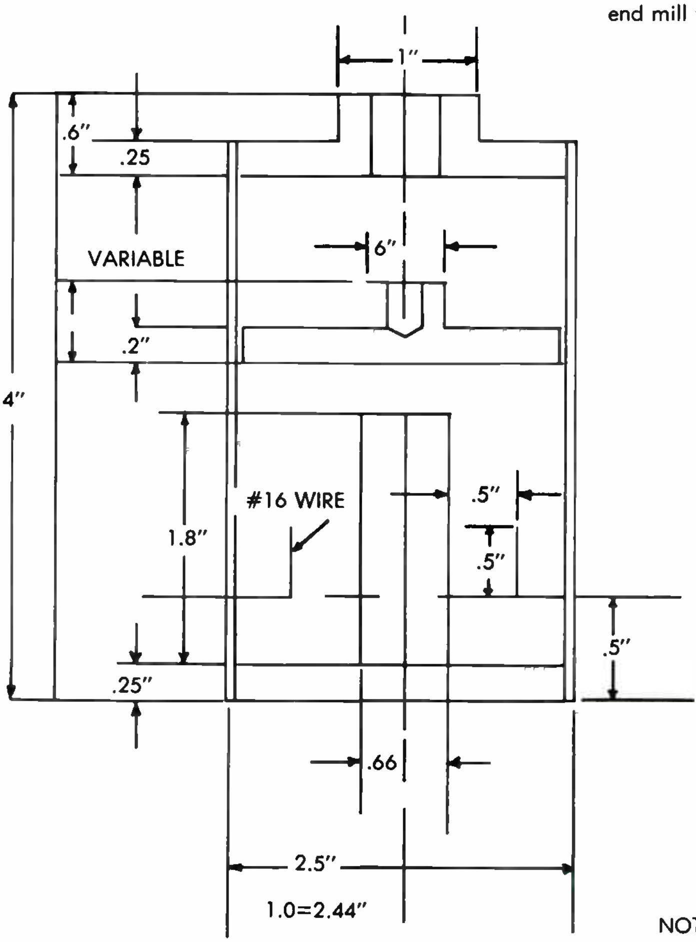
A few notes of caution are in order at this point. This wavemeter was constructed as a frequency standard and as such, great care must be exercised in its construction. If haphazard construction is practiced, the results can hardly be expected to be very precise. With this in mind, it is imperative that access to a lathe be obtained.

Physically, the wavemeter consists of a capacity loaded ¼ wave coaxial tank, with the loading capacitor driven by a micrometer from with the frequency is read. Both input and output coupling fittings are included and the wavemeter may be used as a transmission or absorbtion type with equally good results.

Initial calibration of the K7KDU-W7-QID unit was with the Lecher Lines, and upon laboratory calibration, the original calibration was found to be accurate within 4 Mc. Further checks showed that the unit has a VSWR of less than 2:1 across the entire L band when used as a transmission type wavemeter terminated with 50 ohms. Loss through the filter is on the order of 1 to 2 db. depending on frequency. Frequency accuracy and resetability was less than plus-minus 1% when Fo is approached from the high frequency side on all readings.

The method used for input and output coupling is by no means the ultimate. Originally, further experiments with different coupling methods were planned. These plans have been dropped, in view of the excellent results already obtained.

Little difficulty should be encountered in the construction once you have obtained all the parts. The tuning capacitor is actually a false top for the cavity but does not contact the cavity walls. An earlier model had a contacting plunger and was very noisy The false top or capacitor late is built in such a fashion that it is firmly attached to the driven post of a 1" travel micrometer. This must be very accurately fitted. The



.5" Hole—Use spot facer or end mill with pilot.

Drill 0.235" hole .3" deep and blind.

Starret #263 1" travel mike.

Coupling probe detail #16 wire

Drill 3/8" hole for UG 109 4/U BNC coax receptacle.

NOTE: Mike mounts in .5" hole in top of cavity. Flange is equipped with two 6/32 set screws 90° opposed.

False top fastens to mike piston in same manner.

Top is fastened by three 4/40 machine screws 120° intervals. Bottom is soldered on.

hole into which the micrometer post fits should be nearly a press fit with the mic. post and must be exactly perpendicular to the inside face of the capacity plate. The actual top of the cavity must also be exactly perpendicular to the cavity walls and the hole in this plate that the micrometer is seated in must be exactly perpendicular to the plate. If all this seems a bit difficult, let me point out that a good lathe operator will have no difficulty in squaring all these things to a fantastic degree. The reason for the precision is to avoid the false or multiple resonances one gets if the capacitor plate is slightly "out of plumb" and therefore wobbles slightly in its travel. One of our first units had this trouble and we had three distinct resonances in a single turn of the micrometer. Confusing to say the least.

The cavity top which holds the micrometer is held in place by three 4-40 machine screws around its edge and a few more screws won't hurt a thing. Our cavity is machined for a near press fit, making extra screws unnecessary.

The cavity bottom with the center post is soldered in place. Soft solder, good flux and a torch make a neat job here. In our unit, the center post was removable for experimental purposes, by removing two screws. Once the exact size needed for the center post was established, this post was mounted with its screws and soldered in place.

UG-1094 BNC fittings are used for input and output fittings. These are soldered to the outside of the cavity in such a way that the teflon insulation around the center conductor is just flush with the inside cavity wall. If desired, the hole in the cavity wall could be threaded to take the shank of the fitting. However, we just soldered the nuts supplied with the fittings to the outside of the cavity, centered over the hole in the wall, and screwed the fitting into the nut until it was flush, as mentioned above. Another nut on the shank of the fitting was used as a jam nut to hold the fitting until coupling systems were tried and the one used was settled upon. Then the whole mess was carefully soldered in place. A note here is in order. Do not attempt to use other than Teflon insulated jacks here if you plan on doing any soldering. Poly melts! Type N fittings could also be used but do not use the garden variety UHF fittings unless you are willing to put up with the SWR etc., that these things cause at 1215 Mc.

To use the Wavemeter after calibration it may be inserted in the line from the transmitter to the antenna and resonance indication taken from a field strength meter at the antenna. A better way is to isolate the unit with a sampling probe made from a type N Tee fitting. The Tee is modified by removing the male branch of the fitting with a jewelers saw and carefully soldering in a BNC fitting like those used on the cavity. No actual contact is made from the center conductor of the Tee to the center conductor of the BNC fitting. Two such units made here with a spacing of about 1/16 inch between the center conductor of the BNC and the Tee section, show -20 and -22 db coupling. This affords plenty of isolation from the coaxial line actually carrying power from transmitter to load and still provides enough RF for the Wavemeter to allow an indication of resonance, when used with an APX-6 transmitter. The RF detector is just a 50 ohm resistor mounted in one end of a BNC Tee connector with a 1N25 etc. diode in a BNC fitting hooked to the other end of the Tee in series with a line to a microammeter or VTVM. Just tune the cavity for maximum indication on the meter with the transmitter loaded into the antenna, or dummy load, and read the frequency from the micrometer.

The actual calibration is a matter of choice. If you or a friend works in a lab, permission might be obtained to run some calibration on your own unit. Lacking that, the Lecher Lines will do OK, provided care is taken to avoid errors introduced by the factors previously mentioned.

You will need a variable frequency source for the L band (such as the L.O. in your APX-6) and your Lecher Lines. Couple the oscillator through your modified Tee to the Lecher Lines, set the oscillator on some frequency, measure this Frequency with your Lecher Line setup and peak your cavity wavemeter. Then record the Micrometer reading on a chart opposite the correct

Frequency. The chart and your Cavity Wavemeter are considerably more portable than those Lecher Lines and you'll probably have a lot of calls from the local 1215 Mc Ops to "Drop over and bring your wavemeter."

Much credit is due Steve, W7QID, whose professional lathework and careful attention to detail, made this Wavemeter and another one just completed for the 10 KMc band, practical and worthwhile additions to our ever growing "junkpile" of UHF gadgets.

YOU NEED ONE TO ALIGN VIDEO AMPS

A TRANSISTOR SQUARE WAVE GENERATOR

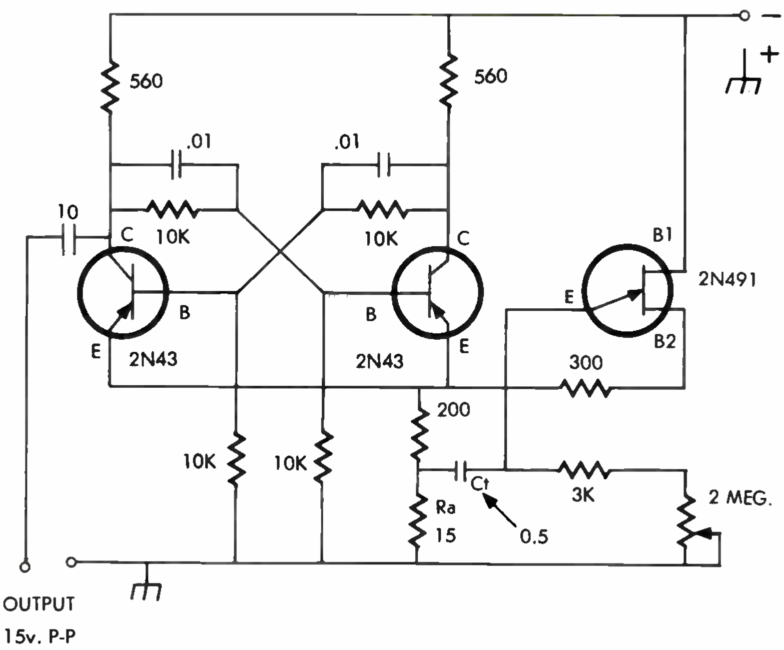
By W4HHK — A4HHK
c/o VHF Horizons

A square wave generator can be a very useful tool in the radio shack. It may be used to check the response of audio and video amplifiers, for the generation of timing signals, and for pulse work. The unit described generates symmetrical, square wave pulses, and is adjustable from 1 cps to 500 cps. It is built around a G.E. unijunction transistor, the heart of the unit, and employs a total of three transistors. It was constructed as a companion unit to the VHF transistor oscillator described in the May issue of VHF Horizons. As such, it functions as a pulser. The result is a pulsed signal at 144 and 432 mc instead of a cw one. This permit observing the relative amplitude of received signal and noise on an oscilloscope.

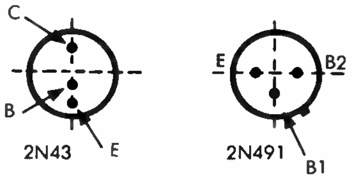
Circuit layout and lead dress are not critical. Parts may be arranged on a circuit board in the same manner as the schematic diagram. The generator could be housed in a Minibox of the same size as the VHF oscillator unit (2-1/4 x 2-1/4 x 5 in.) for the sake of uniformity. Such an enclosure would not accommodate a battery of sufficient capacity, however, as the circuit requires a total of 30 ma at 22½ volts. At this supply voltage, the pulse amplitude is approximately 15 volts (peak-to-peak).

The 2N491 unijunction transistor has electrical characteristics that are quite different from those of the conventional two-junction transistors. Also, it is somewhat expensive (price tag — $8.40), but this is offset by the fact that it greatly simplifies circuits such as sawtooth generators, pulse generators, trigger circuits, and etc. It has a highly stable negative resistance characteristic. The 2N491 seems hardly enough. The writer inadvertently cross-connected its base-two in the breadboard lash-up with no apparent ill effect, but this practice is not recommended. Luckily, the wiring error resulted only in failure of the 2N491 to trigger the flip-flop circuit, although it did generate weak sawtooth waves. When the circuit connections were corrected, the unit began functioning properly.

The output of the square wave generator is connected to the 2N2398 output stage of the VHF oscillator through a 10 mfd. coupling condenser. Also, the two circuit board grounds should be connected. Insufficient coupling capacity will result in distortion of the pulses. In the VHF oscillator unit the -22½ v. lead connecting to the 5.1 k resistor feeding the 2N2398 collector circuit is broken, and the pulses from the square wave generator are fed through the 5.1 k resistor. Increasing the capacity of Ct will decrease the frequency of the pulses. Frequencies up to 100 kc may be generated by proper choice of Ct and Ra and suitable flip-flop design. The 2N384 oscillator runs continuously from its own 22½ v. battery



BASE DIAGRAMS



NOTES:
All capacitors in mfd. and rated at min. of 25 vdc.
All resistors in ohms, ½ watt.
2N43 is PNP type. 2N525 may be substituted for 2N43, but base diagram is different.

when the output stage is pulsed. A separate battery or power supply powers the square wave generator.

References:
G.E. Transistor Manual, Fifth Edition
Pulsed, Crystal-Controlled Signal Generator, A. McFarland, QST, March, 1961.
Selected Semiconductor Circuits Handbook, MIL-HDBK-215.

Letters

Editor:
Appreciate your recent card advising the new late production date for VHF. I like your magazine so far, but cannot say I appreciate the late mailing date summer or otherwise. I'd like to get both my monthly publications, QST and VHF the first week of the month.

W0BAG

OM:
We changed the mailing date to give better service. With the June issue, we should have achieved this mecca.

Dear VHF:
Well, I finally finished persuing your latest issue and decided to drop you a line. I'm not an exclusive VHF'er, nor do I subsist on HF activity. Your magazine is pretty good, especially the technical articles. However, 40 cents is rather steep. Any chance of getting back issues?

Martin J. Feeney, Jr.
K1OYB
Portland, Maine

Martin:
40 cents may be steep. But its exactly what it costs us to put the book out. We're out of all back issues but April, 1963 (our pressman forgot to stop at 24,500 copies). However, we plan to run a "Best of VHF" annual late this summer which will sell for about two bucks, and contain the original scripts of the most highly rated articles to appear in VHF in the past year. We're open to comments from readers who would like to have such a handbook.
Editor

1963			SEPTEMBER			1963
Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

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PROGRESSIVE 5894 TRANSMITTER

FRANK L. GRIFFIN,
WB6AOW

Some months ago, I wrote your Editor, and told him I had completed a 5894 RF unit for Two Meters. In his reply he stated that he was interested and to write it up. Well, before I got around to writing up the unit I traded it off. This left me with any working details, as I build from impulse, not schematics, so there was nothing from which to work.

Now, many months later, and after much thinking I am fulfilling the promise.

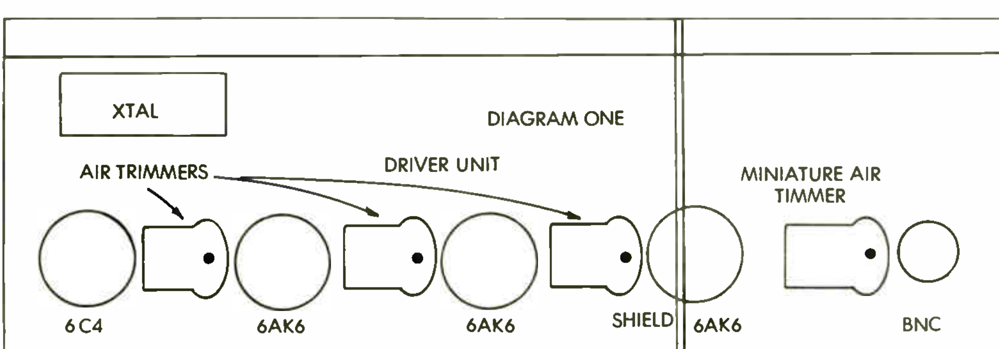
At the time of the original construction I spent quite a few dollars and a good many hours in completing the RF unit. Having a chance to reminisce about the original unit, I came to several conclusions that would not be accepted by the average constructor. The first being the material cost. Each week during construction the major portion of my allowance went into parts without any RF coming out. If it had not been for other projects to fill my time and the desire to complete the unit it would have given up before completion. Secondly, some of the circuitry was tricky and could cause problems. The other reasons were minor, but had a factor in the redesign of the presented unit.

The redesign and packaging was brought about through the need of a bench driver test transmitter. It seemed I was constantly disconnecting the driver from my operating rig. What I needed was low drive for tubes like 6360's etc., and higher drive for 4X150's etc.

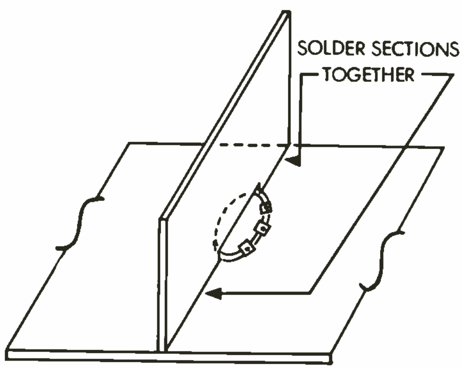
CIRCUIT DISCRIPTION

The complete transmitter uses six tubes, these are: a 6C4 oscillator, a 6AK4 tripler, a 6AK6 doubler, a 6AK6 144 mc amplifier, a 6360 intermediate power amplifier and a 5894 final amplifier.

The oscillator is an oscillator/tripler type, using 8 mc crystals and a capacity voltage divider to give that needed kick to make most 8 mc "rocks" take off on third



overtone. This is a good circuit, most of my 8 mc crystals oscillate in it. Remember however, this is a multiplier circuit and that the output is a third overtone, not a third harmonic. Due to the cut of the crystal, the holder, the holder plates and the crystal manufacturer, each crystal will have a different frequency output. Because of these factors all crystals will vary several kilocycles from their indicated frequency, so do not use your band edge "rocks" until you monitor the final output or you could be outside the band. The multiplier stages are straight forward with no trick circuits and the amplifier stages, also straight-forward, require no neutralization. Although no neutralization is needed, care must be taken to shield the doubler from the first amplifier to prevent 144 mc oscillation. This was done by shielding all the small tubes, 6C4 to 6AK6 amp., and running a shield across the bottom side of the 6AK6 amplifier socket. Since the driver unit runs at 250 volts, or less, the heat from the tubes, while shielded causes no problem. Self-oscillation at 144 mc can also be experienced in the 6360 stage if a shield is not used across this tube socket. In the 5894 stage no problems exist as the grid is below, and the plate circuit above the chassis. The manufacturer, Amperex, states both tubes, the 6360 and the 5894, are internally neutralized and I have found this to be so. But do not push your luck with careless wiring and poor parts layout, as some interesting self-oscillation problems could exist. My "bread board" layout showed this to me.



SOCKET SHIELD DETAIL
FOR 6AK6 AMP & 6360 IPA

DIAGRAM TWO

GENERAL CONSTRUCTION

All of the parts but one, except sockets, came from the junk box and parts on hand (I have a 20 year collection). As for parts, the only unusual ones will be a 5894 socket, a split tank capacitor for the 5894, miniature butterflies and BNC connectors.

The chassis for all units; driver, I.P.A. and final, is sheet copper. Copper was used, as solder can be applied. This makes possible the direct grounding of socket lugs and ground connections, also the application of the needed shields can made by direct soldering with a husky iron.

Before the driver unit was assembled on the copper plate, it was "breadboarded" on an aluminum plate. It was on this plate each of the stages was worked out. It is recommended that after the parts are mounted and filaments wired, each stage be wired and tested, from the oscillator on, to prevent any "built in" trouble that could occure. In this way you know that the finished stage is operating and supplying drive to the next stage. I bring this out, as if trouble develops in testing, and it could, you know the stage in which it exists. Anyway, test data and chassis layout will be given in detail with each unit.

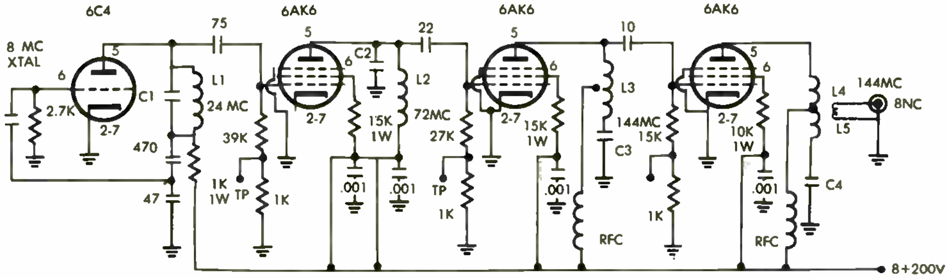
THE DRIVER UNIT

As mentioned earlier, the system was mounted on copper plates and was to be used as a bench test rf source. The driver unit and also the 6360 I.P.A. were then mounted on an inverted 3x17x4 aluminum chassis. No attempt was made to add a front panel.

The driver unit is built on a 4x12 copper plate with the sockets, air trimmers and BNC connector mounted inline on the plate centerline. Since parts will vary, exact layout is not shown, but a general idea is given by diagram one.

The socket shield for 6AK6 and the 6360 is shown in this diagram. Although copper was used, aluminum can be used by bending a lip on the shield and mounting with nuts, bolts and star lock washers, between the shield and chassis, for good positive grounding.

Again I call out stage by stage wiring and testing to eliminate possible construction error. The Driver data shows the stage



L1	15T No. 18 Enam.	5/8"d.	Tight Wound on 5/8" Lucite Form
L2	5T No. 16	1/2"d.	Spaced 5/8"
L3	5T No. 14	1/2"d.	Spaced 9/16"
L4	6T No. 14	1/2"d.	Spaced 3/8" per Section, Center Separation 3/8" for Ls
L5	2T No. 16	1/2"d.	Spaced to Fit in L4

C1 8 Plate Air Trimmer
C2 5 Plate Air Trimmer
C3 5 Plate Air Trimmer
C4 15 Plate Miniature Trimmer

RFC Z-144 or RFC-144

All .001 Caps. Feedthru Type

drive readings, and from this you can check your progress.

When the 6AK6 amplifier is ready for testing, a 47 pilot bulb makes a good dummy load. It will glow to a brilliance that will hurt the eyes when the 6AK6 is properly tuned. Leave the test meter in the 6AK6 amplifier grid position and remove the crystal. The dummy load should go out and grid current drop to zero. When this happens you know the shielding from the tube and socket shields is effective and no coupling from the preceeding stage is taking place.

THE 6360 INTERMEDIATE POWER AMPLIFIER

I hate to say this, but, there will probably be some of you who will not be interested in the Driver unit as you are running "Twoers." The Twoers makes an excellent driver unit and will drive a 6360 nicely. No attempt was made to make the 6360 IPA a "linear" but it can be used as a modulated final on a "Twoer" or similar equipment.

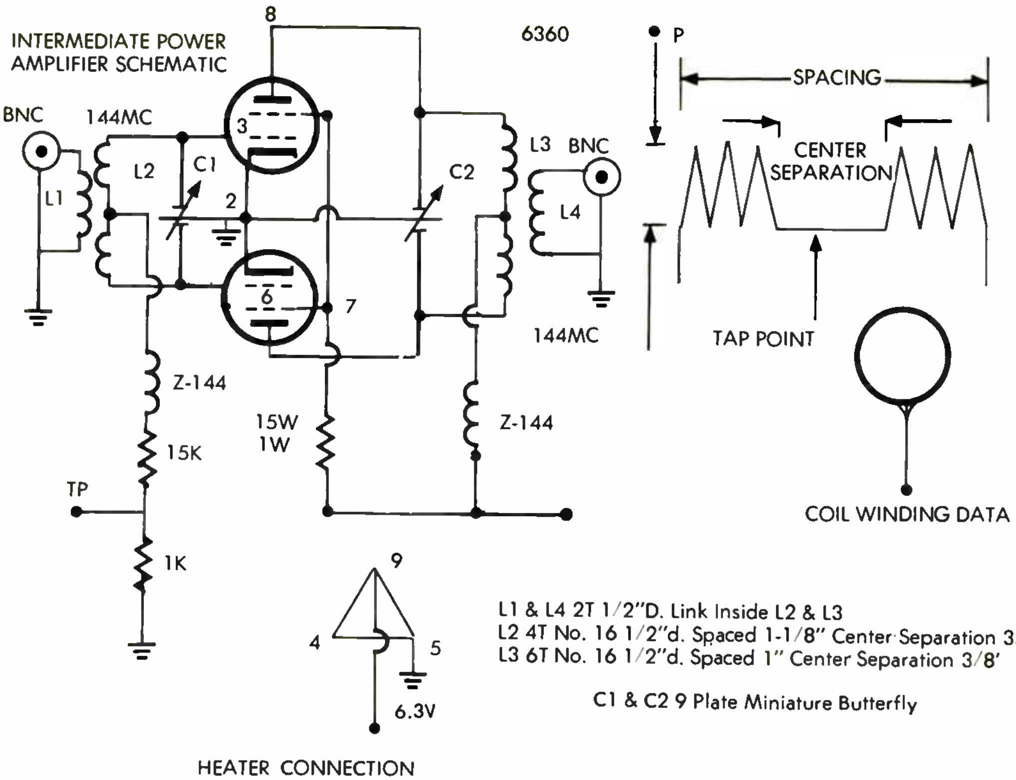
The IPA was built on a 4x5 copper plate and mounted, in line with the driver. It was coupled with a short coax jumper. The IPA data shows the drive needed, and it is recommended that at least 3 ma of drive be at the 6360 grids before B+ is applied to the plates and screens. For those of you who want to stop here, a 100 ma meter can be wired in the plate circuit for plate tuning. At resonance, under load, the plate current will be around 60 ma. at 250 volts.

Care should be taken in this stage to shield the tube socket as feed through signal from grid can cause self oscillation. Here too, the check of removing the crystal and reading the grid current, as well as loss of load, will show proper shielding.

THE 5894 FINAL

The final was built on a 4x6 copper plate and mounted on a 3x6x4 chassis. It was built with parts on hand. A longer plate should have been used as the chassis had to extend to receive the plate tank and pickup link. Although, mechanically, the layout leaves much to be desired the circuit operates smoothly.

The first attempt at the grid circuit design was to tune the input to the 5894. With the components on hand a suitable tuned



L1 & L4 2T 1/2"D. Link Inside L2 & L3
L2 4T No. 16 1/2"d. Spaced 1-1/8" Center Separation 3/8"
L3 6T No. 16 1/2"d. Spaced 1" Center Separation 3/8'

C1 & C2 9 Plate Miniature Butterfly

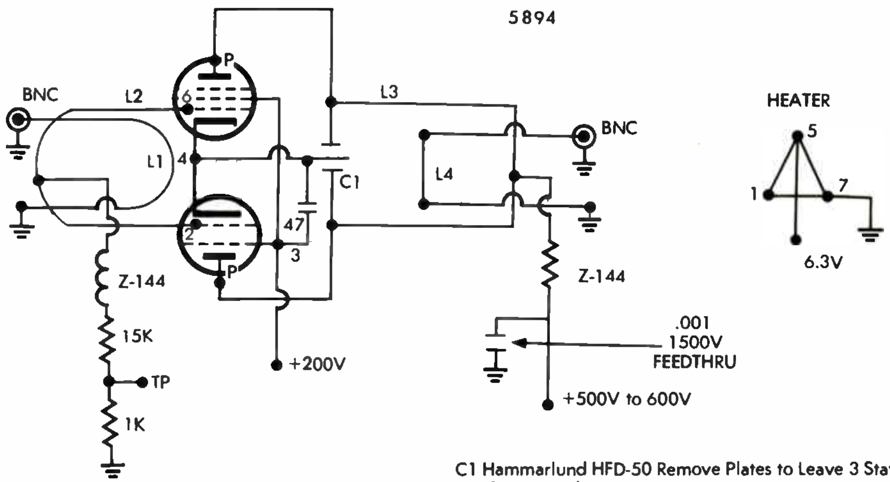
could not be favorably worked out, so the input circuit was left "fixed tuned." This was done by cutting a "hairpin" tank until it resonated with the tube capacity at 146 megacycles. The tank, being too long for the chassis, was bent 90 degrees at the midpoint and hung down into the chassis. At the midpoint, two bent ceramic insulators were mounted to add rigidity. Since the "U" portion of the tank hung down the input link was mounted perpendicular to the chassis late from the BNC connector and a ground lug spaced the width of the grid tank. This mounting allowed me to "swing" the input link for proper coupling from the 6360. This will also allow coupling variation if linear operation is anticipated.

Two sources of drive were used to check the grid circuit. These were the aforementioned driver and IPA and my Communicator IV, both of which use a 6360. The Communicator was used at I do not have band extreme crystals and the VFO capabilities into Communicator could be used to check the tank range. More than adequate drive was obtained throughout the entire band.

The plate tank was made from a Hammarlund HFD-50 with three stator and two rotor plates left in each section and a piece of number 10 copper wire bent into a flat "U". The "U" was cut until 146 megacycles resonance was reached at mid capacitor range. This was done by checking with a grid dipper. The pickup link, also of the configuration, was mounted the same way as the grid links. In this manner of mounting it could also be swung for coupling.

In establishing the grid drive to meet the tube requirements, several grid resistors were used. A value of 15K gave the best ratio of current to voltage for the 5894 grids. Screen voltage was taken from a separate 200 volt source so no screen resistor is shown. Again the approximate drive shown in the data should be obtained before B+ is applied to the tube.

The dummy load used, an RF Wattmeter, would not accept a fully coupled load so the data shown is far from full output. A hundred watt bulb, used also as a dummy load, showed almost full brilliance, so quite a bit more output can be expected under full load.



C1 Hammarlund HFD-50 Remove Plates to Leave 3 Stator & 2 Rotor each section

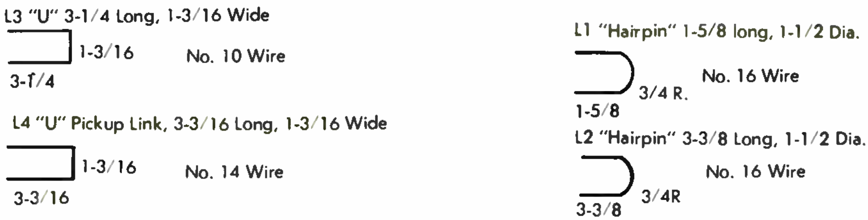


DIAGRAM FIVE

MODULATION

The driver unit was Heising modulated for reference only. This was done by running the B+ through the output transformer of a small broadcast receiver and connected to the 6AK6 amplifier. A station was selected and the level set for the proper modulation. Good quality was obtained from a 12SQ7 and a 50L6.

Several 6360's have been used at the Santa Cruz Island QTH. These were modulated with a pair of 6V6's into a TCS modulation transformer. Repeats were always good on modulation with these transmitters and this modulator. However, any good ten watt modulator will do the job. The modulated signals is coupled to the plate and screen, through its dropping resistor, in this

6360 DATA

DRIVE 4.4 MA No Load (B+ OFF ON PLATE & SCREEN)
3.2 MA Loaded

SCREEN—Dropped thru 15K Resistor

PLATE +250 V +300V (Loaded To Termaline Wattmeter)

OUTPUT 8 Watts 12.5 Watts

DRIVER DATA	**+200 Volts**	**+250 Volts**
drive to tripler	1.5 ma	2.1 ma
drive to doubler	1.0 ma	1.3 ma
drive to amplifier	2.0 ma	2.1 ma
Power out amplifier (RF to Termaline Wattmeter)	1.25 Watts	2.5 Watts
Total current drawn (all driver tubes)	98 ma	125 ma

5894 DATA

DRIVE 9 MA B+ OFF PLATE & SCREEN
7 MA B+ ON

SCREEN +200V

PLATE +500V at 162 MA
*(Loose Coupled to Termaline RF Wattmeter)

INPUT 81 Watts

OUTPUT 45 Watts

*Wattmeter has 50 watt range, this accounts for loose coupling. Higher output can be had with tighter coupling.

configuration.

The first 5894 rig was modulated with a pair of 6146's into a TCZ/ART-13 modulation transformer. Because this rig was traded before it went into operation, "on the air" reports were never received, but the local tests sounded very good. Anyway the presence or absence of modulation will be the builders choice. I have mentioned the various methods I have used to give you a point from which you can start thinking.

CONCLUSION

This article is presented to start you, carry you on or help you "beef up" your present, 2 meter RF capabilities. The circuits have been worked out and double checked to prevent any miscalculation. Electrically, I believe they are sound and fewer as I believe the builder will want to inject his personality into the layout and packaging. Keep in mind to follow good VHF wiring procedure, clean layout of components, short solid ground connections and testing of each completed stage, and you'll come out a winner!

—WB6AOW—

Letters

Dear Editor:

You said in April VHF that others might be interested in what I did to my International Crystal FCV-2 converter. To me, overload PROOF and overload RESISTANT are a matter of definition. Overload proof is what the Clegg Interceptor receiver is. However, my FCV-2 is only overload resistant, i.e., no cross modulation is evident; a Johnson 6N2 running 100 watts, beam-to-beam, separated 160 feet, is virtually un-noticed plus/minus 45 kcs. Good enough?

John P. Skubick, K8ANG
Warren, Ohio

John:

OK — that's good enough for us. Draft up an article and we'll print it pronto. International might even be persuaded to incorporate the changes into their production line FCV-2's.

Editor

Dear Editor:

We have been browsing through the February issue of VHF Horizons which was forwarded here to Inchon, Korea, and must comment on the insert between pages 12 and 13 in this issue. This is not the first time the "great prophet from the east" has goofed. In last December's issue of his magazine he made the brash statement that he had "the most elaborate VHF installation in New Hampshire" — or words to that affect. We challenged him on that and received a polite reply that he guessed "he had spoken out of turn." Hi! Would appreciate a few words in your June issue to the effect that we will be back in operation at the home QTH June 1st and looking for M/S skeds on 144, especially from Minnesota and points west.

73,
Don — W1AZK

Don:

Consider the word spread.

Editor

Dear Editor:

I have finally decided that your magazine was due for a few comments from my neck of the woods — so here goes. I would first like to mention that I enjoy your magazine very much and have subscribed to it, I feel that it is put together in a very good manner, and my only real complaint is there isn't enough in it to satisfy my taste for VHF operating and experimentation.

David Heifetz, K1PDA
Manchester, N.H.

Dave:

For the record, the size of the book is directly proportional to income. Income is directly proportional to number of subscribers plus number of advertisers. We'll add pages when there's money enough to do it! In the mean time, we have to be very selective when wading through the pile of manuscripts received every week.

Editor

Editor:

The article in April VHF Horizons on E-skip on 2 prompts me to file my observations of July 10, 1961 (the date in question). I was operating W0AXU, Cedar Rapids, Iowa at that time. At 2122 CST I heard W0IC calling CQ and he came back to my call (S9 plus) and then faded out. At 2146 W0IC was worked again and I was on phone. In between, W0AYK in Loveland, Colorado was heard. W9AAB worked K7-HKD at about 2146. W0IC was in for over 30 minutes here. A check on six meters showed Colorado to be coming in, nothing else that I could tell. W0IC must have worked several W8's and VE3's at least. The W0IC to Cedar Rapids path is only 720 miles and to work this distance on Es requires a critical frequency of 50 mc! I conclude, however, that the opening must have been Es, and my QSO with W0IC must be about the shortest Es ever observed on 2 meters. The cloud must have been small as the stations to the west of me in Iowa and Nebraska didn't hear a thing, which adds up to Es evidence.

Dick Fenwick, W5KTR

Dick:

We've all been assuming straight-line propogation in this case, which possibly wasn't true. Did you get a true beam heading on W0IC and W0AYK during your listening period? Perhaps the cloud was off-path to the south and tilted.

Editor

Sir Editor:

Received your latest edition and found it quite sterling. Just what the VHF doctor ordered, to be sure. Several of the boys down here have seen it and will be subscribing directly. We had to give up our six meter band for TV, finally, so everyone is going on 1296. I'm chattering 60 airline miles here in New South Wales nightly now on 1296. Some of the boys are going on mountain tops and it's great sport.

VK2ZCF, Croydon, N.S.W.
Australia

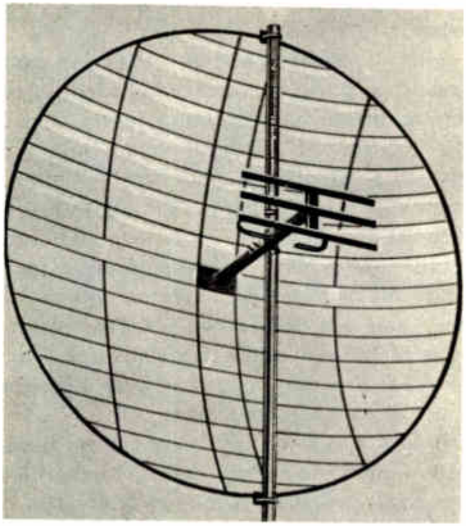
CHEAP GAIN ANTENNA FOR 'L' BAND

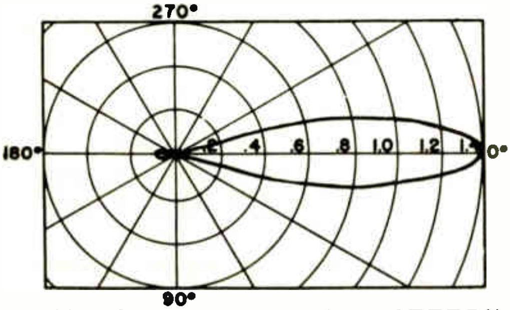
FOUR FOOT DISH FOR 1296 Mc

John T. Chambers — W6NLZ/A6NLZ
% VHF Horizons

Most of the 1296 gang sooner or later want to try a parabolic reflector. Until now surplus military reflectors and a few home brew models have dominated the band. The main disadvantage to the military dishes has been their extreme bulk. Most of them look like they were built for a battleship— and they probably were!

Recently a commercial manufacturer* of almost all kinds of antennas brought out a parabolic reflector antenna for the UHF TV trade: Four feet in diameter; very light, but sturdy construction — and a net price under $20.00. As it comes, TACO's model 3050 UHF Parabolic must be modified to work on 1296. The feed elements are too long, and the mesh in the reflector too far apart. Conversion to 1296 is simple since the hot dipped galvanized of the reflector assembly is easy to solder to. Merely double up (add another set of horizontal wires) the mesh curved to match the shape of the dish. Soldering the new bars in place is simplified by tying them in place with No. 30 tinned wire before soldering.





HORIZONTAL RADIATION PATTERN

Before modification, the front to back ratio of the antenna was 5 DB. As 1296 Mc is well above the maximum design frequency of channel 83. After modification of the reflector (doubling reflector bars), the front to back ratio rose to almost 20 DB or very adequate.

Modification of the feed (blue anodized aluminum) was as follows: The driver (where the feed line attaches) was shortened to 4½ inches by cutting, re-bending, and drilling new holes to attach the feed line with. The three bar illuminator reflector was cut off to a total length of 7 inches. How much gain now? Just a fraction over 20 DB.

*TACO (Technical Appliance Corporation, Sherburne, New York)

NOSTALGIA CORNER

VHF EXPEDITION

- CIRCA 1941 -

by A. David Middleton, W5CA/W7ZC
Staff Historian, VHF Horizons

Thousands of QSO's have been added to my logs since that summer day in 1941, but none of them are more vivid in my memory than the one in which the entire future of a new ham operator possibly hung in the balance.

I have just reviewed my 1941 log books hoping to uncover the call and identity of a certain Brooklyn ham, but I found no written notation of anything that would identify this particular QSO from those so numerous in those happy VHF days just before WW2. W2OEN, at Kilocycle Hilltop, Middletown, New Jersey worked a lot of W2s and many in Brooklyn so alas the call and name are not known. But the implications of the QSO and its details are clear. I have often wondered what ever happened to my contact after that day.

It was a hot muggy New Jersey Sunday afternoon. There was a decent breeze blowing thru the shack's windows and I was debating whether to get on the air or not. I sat idly tuning the dial on my "French 75-acorn-regen" and wondered if a QSO with Nature out on the hill under an apple tree with a tall glass of cool lemonade, might not be better than an on-the-air QSO inside. Radio won out, however, and I listened across the 112 MC band. There were the usual Sunday squeals of the mobileers chasing each other up and down the bands with their transceivers — the ones with the "19 type" tube in them and the "J" antennas! General activity was pretty low as most guys were outside on a day like this.

I strolled out onto the hill and up to the base of my tall mast. I swung the capstan bar around so that the 15-element beam was aimed up the coast of Long Island Sound. Some maritime-mobile might be on or perhaps some vacationers on the shore.

A CQ brought a reply from a station out on the tip of the Island. Not a bad haul for 112 MC. But like me the fellow was only half-interested and the QSO died on the vine.

When I signed off and stood by on the band I heard a signal frantically calling W2OEN. (Let's assign him the call of W2XYZ). The signal was weak, wobbling all over the band and hardly understandable. But the urgency of the call was not to be mistaken! This guy was really trying to raise me.

Finally, he wound up his almost interminable call and stood by. I caught his call and his location—"W2XYZ—Brooklyn."

I replied and acknowledged his call and gave him the usual report. You know, the kind when the guy is a poor operator and his signal is even worse! Non-committal—and sort of "so what."

There was a long pause. Then the carrier came on and in the far distance and off mike, I heard a voice say—**"you see—it does work!"**. Then the voice picked up and W2XYZ continued in a boyish tone, eager and excited and somewhat scared. It was obvious that this guy was NOT a highly skilled VHF man. Finally he steadied himself and gave me the usual report that I had heard so often W2OEN was booming in Brooklyn. But, the operator asked me to repeat my location. He gave me his name—"Joe".

I went back to Joe and told him I was on a high hill overlooking the New York area and that I was near famous Telegraph Hill, Northwest of Red Bank. I added "Why the interest in where I am?"

The next remark was a stopper! A man's voice boomed out of my speaker saying, "How do I know you are near Red Bank.

That is a long way from here!" The voice was almost dubious.

Here was a queer situation. No one had ever questioned the authenticity of my QTH and it seemed rather strange. After all—how does one prove over the air just where he is operating?

There was confusion at W2XYZ and then Joe came back on the mike and startled me by saying. "My father does not believe that you are operating in Middletown. You are too loud!"

I had been accused of being "too loud" before, but no one ever questioned my locale. I snapped back at Joe and demanded to know what difference did it make anyway, and anyway what did his father have to do with our QSO!

Joe came back and what he told me was a real kicker. His simple poignant story has stuck in my memory. Here it is, without embellishment.

Joe was a teenager. He lived in a poor section of Brooklyn and attended high-school. He had some ham friends who were as unskilled and as embryonic as he. He had studied; taken the ham license examination passed and had received his call. He was not interested in CW and so he chose the easiest band on which to operate voice —112 MC.

Money was scarce in the family home of Joe. He had to work hard and scrape together a lot of bucks before he could bring home equipment for a 112 MC. He chose widely-used Abbott DK-2 transceiver. This was a battery-operated unit, one that was thoroughly distasteful to the more serious class of VHF amateur. The DK2 had a notoriously bad signal but it was cheap and, under good conditions could get out —but it was hard to copy and tough on batteries! It had a simple circuit and was—what was considered a minimal station in 1941.

Joe had gotten his equipment but he was faced with that perennial problem—that old devil—Antenna! The best he could get up was a double dipole fed with twisted pair—the old green and yellow lamp drop cord which was the fore-runner of the coax and Twin-lead so widely used today. However, the old "twisted pair" had high losses at 112 MC, so Joe did not get much into or out of his antenna! The dipole was up somewhat on the apartment building, Joe was a bit vague just where.

W2XYZ made a few contacts all locals! To Joe, local meant just that — stations only a few blocks away and usually with the group that had introduced him to ham radio. Many stations ignored the DK2's when possible. Joe's pals could not work out well either.

Then came one eventful day when Joe heard W20EN blasting in from Middletown. Here was DX! Now if he could only work that station! He tried hard but W20EN did not reply to his frantic calls. He wore down a set of batteries. These had to be replaced by more scraping of hard-to-get dollars.

Joe could hear other "outside stations" at times but they would not answer him. He knew that if he could only work W20EN he would break the jinx and blast thru the barrier to the realm of VHF DX. Joe had made some exaggerated claims and statements to his parents and they expected some results from all the expense and much shouting into the carbon mike! Not to mention the squeals and whistles given out by the DK2 receiver section!

Then Joe had a happy inspiration! He knew that 112 MC would work out much better if the antenna was out in the open where there were fewer buildings and wires to shield these feeble warbling signals from the DK2. Right that moment Joe conceived the idea of VHF DXPEDITION although he had never heard the word as it was not in common usage until after the War.

Joe's family possessed no car or access to one. So he and "Father" lugged the DK2, a batch of heavy dry cell A and B batteries, plus some sort of antenna lashup out into one of Brooklyn's many public parks. There on a park bench, W2XYZ was set up. Joe had heard W20EN regularly on Sunday afternoon so the expedition was mounted for that period.

What was the results of all this effort? The primary purpose was to work W20EN and that was accomplished. A two-way QSO with an "outside" station proved that the much maligned, expensive (to Joe) unit could work all the way across the Bay into New Jersey a spot that was considered to be a "foreign land" to many Brooklynites.

I talked like a Dutch uncle to Joe's dad, and as clearly and accurately as possible, I tried to convey to him the fact that W2OEN was where I said it was. I gave him the geographical facts of my location and described what I could see. The fact that I could see the gas tank at Coney seemed to carry more weight than anything else I could bring out.

Eventually I sent a QSL to Joe, but never received a reply. I suppose that QSLs and their stamps were not included in Joe's budget. So to this day I do not know what happened to Joe and his VHF work as I never heard W2XYZ again.

However, I'd like to know. So—Joe, if by chance you read this article, and if you are a VHFer today you will—please identify yourself, and I'll pass the word along to the VHF gang.

What do you think, OM? Is "little Joe," W2XYZ still on the air? I like to think so!

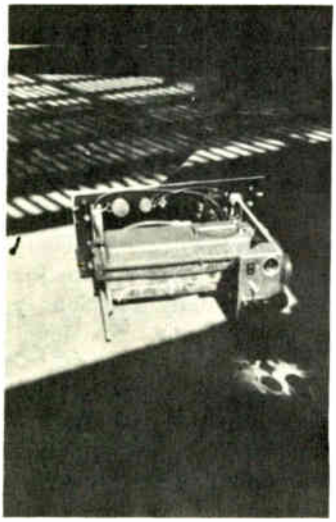
STILL A GOOD WAY . . .

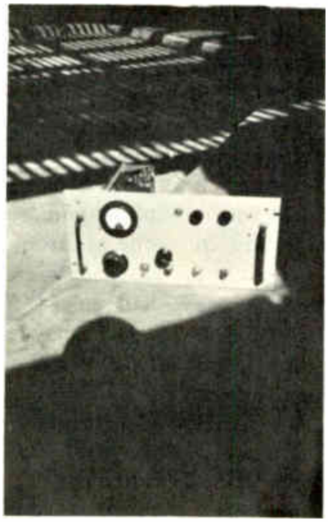
TDZ TRIPLER TO 432

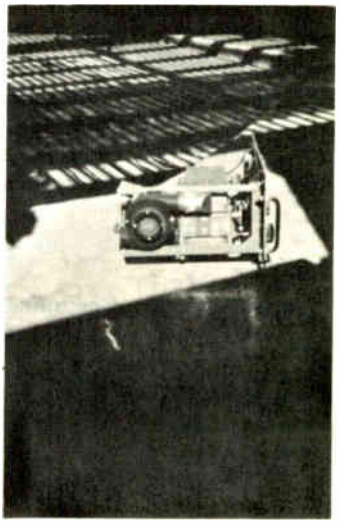
Louis R. "Dick" Bailey
W6IEY/A6IEY
6273 De Camp Dr.
La Mesa, Calif.

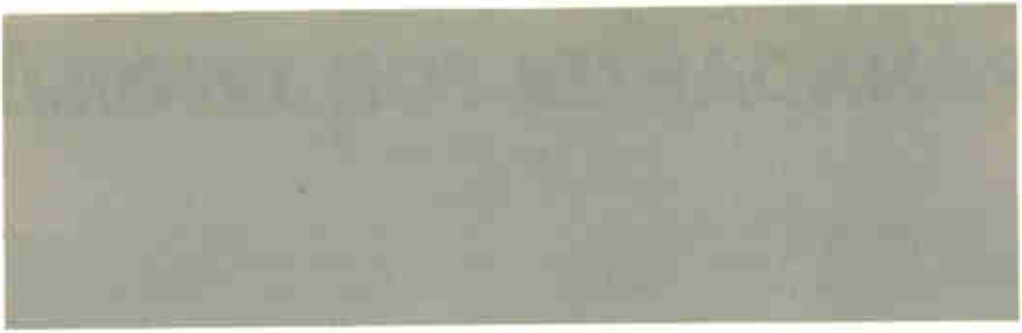
There is nothing new in this method of getting on 432 mcs. W6MMU published the circuit in the December 31, 1959 issue of "Western Radio Amateur" and it was repeated in the "VHF Amateur" at a later date. However, I believe that the way it is mounted is neatly done and may give someone the urge to get on 432 mcs very easily. The only requirement is a little drive (modulated) at 144 mcs. A Communicator or an SCR 522/as used here will supply this.

The tripler unit that I acquired at one of the local surplus emporiums did not have the original blower attached and I used a 28 volt surplus dual outlet blower on hand to supply the needed air. The extra outlet will be used to supply air to the amplifier unit when completed. A 28 volt DC supply was incorporated to run the blower and an external antenna relay.









The input tuning condenser is tuned with a reduction knob from a BC375 tuning unit on an extended shaft. The chain drive for the plate line is the original with an added chain drive to offset the knob away from the input condenser shaft. Some gear ratio was added here to provide smoother tuning. The Meter is for plate current at 60 mils with 750 volts on the plate. A filament transformer with a variable resistor in the low voltage side is used to give six volts at the 2C39 filaments.

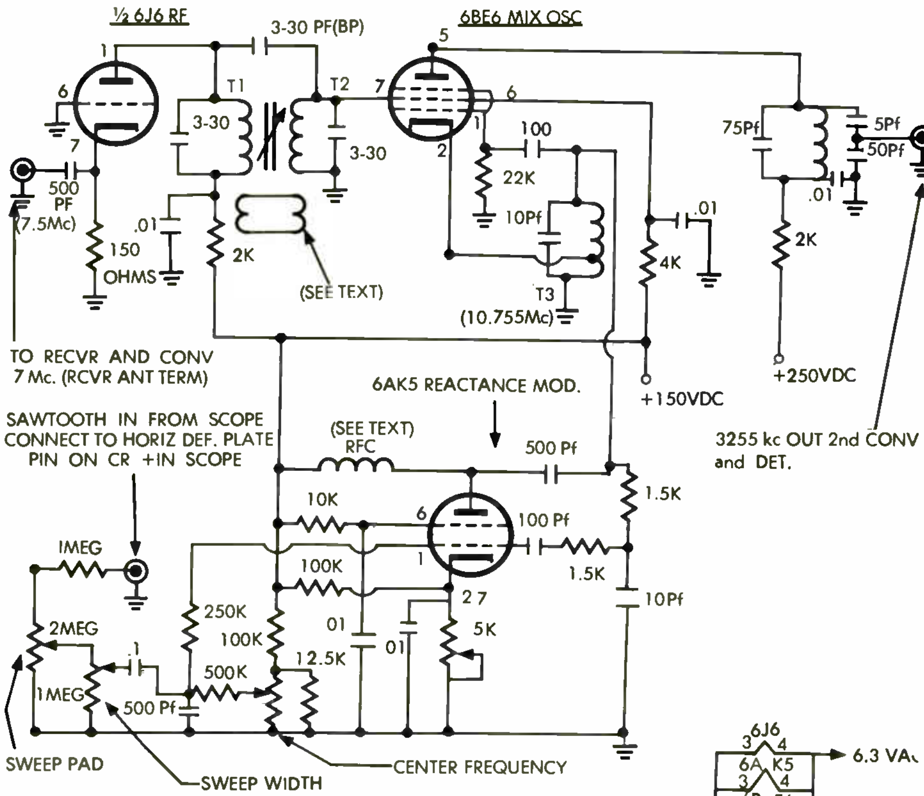
This unit is excellent for local work, however, for DX type phone work not enough "Lumps" on the carrier are produced to give good modulation percentage. Best DX with this unit so far has been 120 miles on check-ins to the MARS 432 R & D Net with WA6HIT.

THE BETTER TO SEE YOU WITH

PANADAPTER FOR TWO/SIX

JOHN A. FREDRICKS K7GGJ
314 South 13th Avenue
Yakima, Washington

There are many amateurs today who operate with the advantage of panoramic reception. Just ask them, if you are one of those who does not have a panadapter, what you are missing. They will tell you they couldn't operate without the thing! The idea for the panadapter described here is far from new but, here is the advantage: This particular panadapter will "see" more of the band in question (about ± 450 to 500 Kc) and this is in itself is a real advantage. Imagine yourself "seeing" approximately 1 Mc of the band without turning the dial on your reciver!



T1 & T2 33t No. 30e. 3/8" dia iron slug tuned form. insert coil in discarded if can
T3 29t No. 30e. tapped 5t up from ground end. 3/8" dia. iron slug tuned form. Insert in discarded if can.
T4 45t No. 30e. 3/8" dia. iron slug tuned from. Insert in discarded if can.
All resistors 1/2 watt.

FIGURE 1

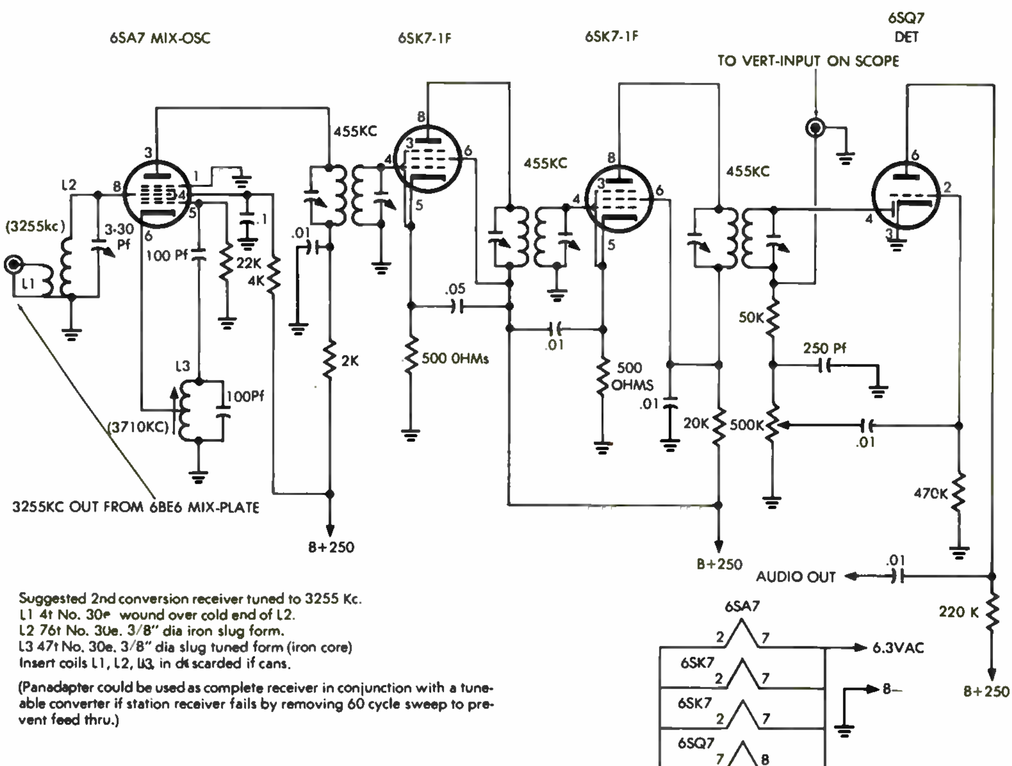
CONSTRUCTION

My unit was built on two separate chassis one measuring 2"x5"x8' for the panadapter proper and one measuring 3¼"x2"-8" for the 2nd conversion receiver. The construction of the panadapter is not at all difficult if you keep one thing in mind: Make sure to keep all leads as short and direct as possible! Looking at Fig. 1 you will notice that between T1 & T2 there is a link coil coupling the two windings. This is made up of 4t of No. 30e. close wound on the cold end of both coils and connected with a short piece of 75 ohm twinlead.

You will also notice the RFC in the B+ line to the plate of the 6AK5 reactance modulator. This choke is made up of one section of a 2.5 mH RF choke.

In my unit I was quite liberal with the use of terminal strips as I found it necessary to maintain mechanical rigidity, a factor very important to proper operation. It also is advisable to use mica capacitors in both the 6BE6 converter stage and the 6AK5 reactance modulator stage, in order to maintain maximum stability. Other than the aforementioned points, I don't think any thing else need be said about the converter — reactance modulator unit is it is quite straight-forward in construction.

Now let's go on to Fig 2. The first thing we might say is "what is all that old junk doing in there?" Well, its just what I happened to have on hand at the time that I built the unit. This does not mean that the builder has to use such outdated tubes at all. Looking again at Fig. 2, the receiver is a bit unorthodox, and some trouble was experienced with the first model, but, after adding Bridge neutralization to the i.f. stages all was well and trouble free operation has been the order of the day ever since. As I stated earlier, I can see no reason at all for not modernizing the receiver with up-to-date tubes but this is up to the reader.



Suggested 2nd conversion receiver tuned to 3255 Kc.
L1 4t No. 30e wound over cold end of L2.
L2 76t No. 30e. 3/8" dia iron slug form.
L3 47t No. 30e. 3/8" dia slug tuned form (iron core)
Insert coils L1, L2, L3, in discarded if cans.

(Panadapter could be used as complete receiver in conjunction with a tuneable converter if station receiver fails by removing 60 cycle sweep to prevent feed thru.)

FIGURE 2

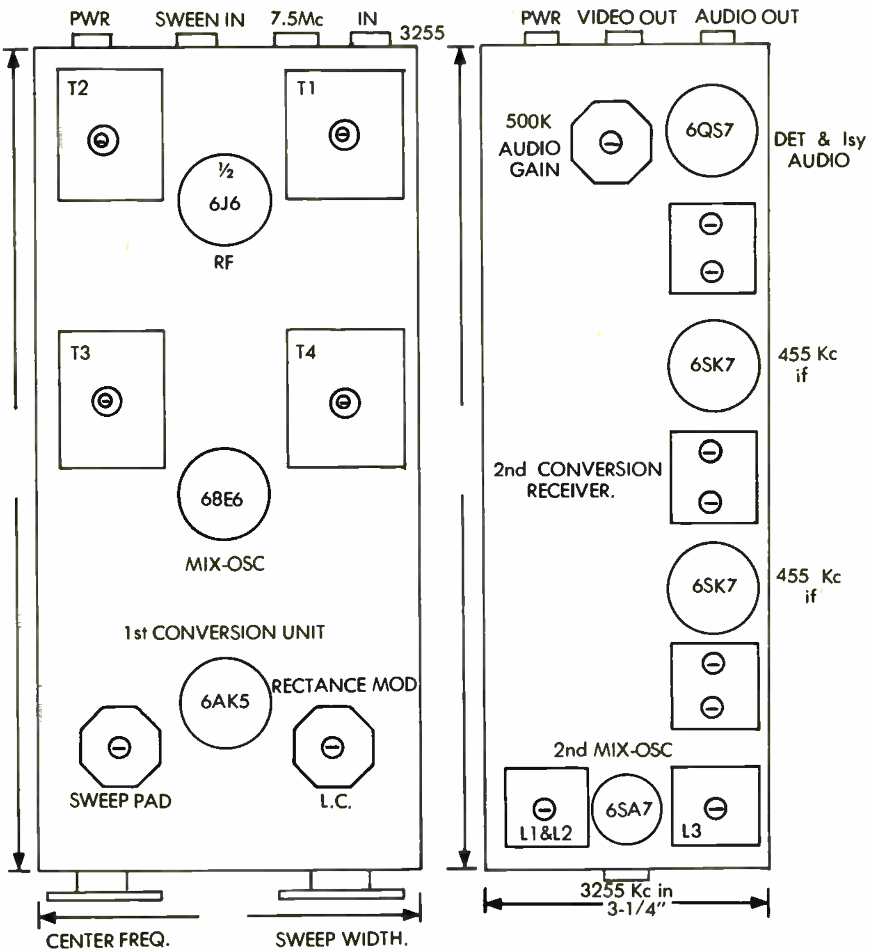
SAWTOOTH VOLTAGE FOR THE REACTANCE MODULATOR

Sawtooth voltage for the reactance modulator was, in my case, taken directly off the horizontal deflection plate pin of the crt in the scope itself, although in some cases it may be necessary to take the sawtooth voltage off the sweep oscillator within the scope.

ADJUSTMENT

The first step in adjustment is to connect the sweep voltage out of the scope to the input of the reactance modulator and the output of the panadapter (2nd Det) to the vertical input terminals of the scope. All connections between the panadapter receiver and the scope were made with shielded microphone cable, as the use of coax seemed a bit unnecessary. Next connect the appropriate voltage to the panadapter receiver. At this point I might mention that any small regulated power supply capable of + 250 and + 150 VDC at 120 to 130 mA and 6.3 VAC at 4 amps will suffice. After the aforementioned voltages have been applied to the panadapter receiver, turn the scope on

CHASSIS LAYOUT OF PANADAPTER
(general layout)



All connectors shown are standard mic connectors, coax connectors could be substituted.

FIGURE 3

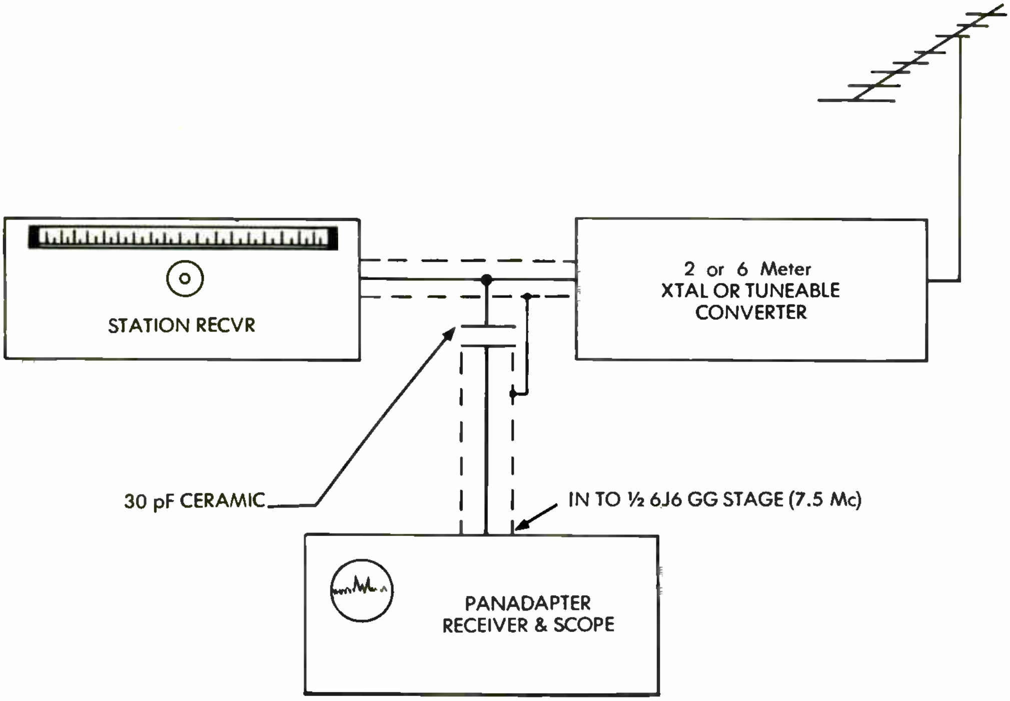


FIGURE 4

and allow both to warm up. At this point a 7.5 Mc signal should be fed to the panadapter input (gg ½ 6J6) with all potentimeters set at half-mast. Then slowly tuning T3's iron core, a pip should appear on the screen of the crt. After centering the nip on the crt screen (7.5 Mc) tune T4 of the 6BE6 mixer plate & L2, of the 2nd conversion receiver for maximum height with the vertical gain control in the scope about ¾ open. I would also like to point out that I had already tuned up the 2nd conversion receiver to approximately 3255 Kc beforehand. Although this may not be entirely necessary, I felt that it would surely speed things up. Now with the pip centered on the crt screen tune T1 & T2 for maximum height and maximum frequency response over the range of 7 to 8 Mc. There should be very little deterioration of the pip over this range. The amount of the spectrum seen will also be determined by the setting of the Sweep Pad, & Sweep width potentimeters. As can be seen from above, the tune-up procedure is really quite conventional and I don't think any real trouble should be had if directions are followed carefully.

PUTTING IT INTO USE:

The panadapter should be connected between the converter and the receiver as shown in Figure 4.

CONVERSION AND TUNE-UP CHART
1st conversion
mix — 7.5 Mc.
osc — 10.755 Mc.
mix out — 3255 Kc.
2nd conversion
mix — 3255 Kc
osc — 3710 Kc.
out — 455 Kc.
detector — 455 Kc.
Band-pass
T1 & T2
Peak slug on low side of 7.5 Mc (hi sig)
Peak 3-30 pF (B.P.) on high side of 7.5 Mc (low sig)
Scope set for 60 cycle sweep rate.

Although this panadapter was designed around a tunable converter such as the RME VHF-126, performance leaves little to be desired when in use with crystal controlled converters. The only drawback is the fact that the pips will not move across the screen as they will with a tunable converter but the scope screen can be readly calibrated to show the frequency on which the pip is appearing. At K7GGJ this particular panadapter has been in use with crystal controlled converters on both two and six meters and the performance has been very satisfactory. Also let me say this: although coil specifications are given for 7.5 Mc, if your converter has an i.f. of 14 — 18 Mc or any of the other popular i.f. oututs, the first conversion stage (6BE6) could be made to operate in conjunction with the 2nd conversion receiver at these frequencies without any difficulty, with the help of a grid-dipper.

Well that wraps it up, good luck with the panadapter. Once you have built it you won't operate without it!

GOOD TO KNOW

VSWR vs COAXIAL TANK LOADING

Here is an interesting exercise for those VHF'ers using converted surplus units which feature coaxial cavity amplifiers, or those who have built up their own coaxial cavity amplifiers for 144, 220 or 432 megacycles.

In a staff report appearing in our October, 1962 issue, we reported on the design characteristics of a pi-network and the usefulness of this circuit at VHF frequencies.

Recognizing that a pi-network is essentially "a cheater device" for making our final think our feedline is flat, and thereby bringing our VSWR down to a reasonable value for loading of the final (as far as the final is concerned, from a load standpoint), we decided to purposely mis-tune a coaxial tank amplifier using a 4CX250B on 220.050 megacycles, and then try to load it into a 32 element colinear array which we had also purposely mis-tuned.

Our goal was to plot the affects of VSWR, on loading of a coaxial tank circuit, versus the VSWR present on the line at the transmitter.

The meter used to measure the VSWR was a calibrated MC Jones (now Microwave Devices, Bristol, Connecticut) 120 watt unit. It has a four function switch for forward power, back (reverse) power, calibrate (through a pot) and actual VSWR.

With the final mistuned (through the cavity plunger), but the antenna properly matched to provide a VSWR of 1.0 to 1,

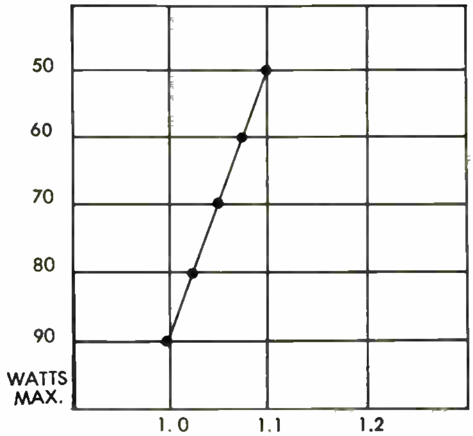


chart number one shows the result. Keeping in mind that the antenna, when properly matched, and the coaxial tank, when properly tuned, will provide 115 watts into the line at 220.050 mc/s, the slight reactance affect of the mis-tuned cavity on the VSWR is plotted in chart number one.

Of perhaps greater interest is chart number two. Here the antenna was mis-tuned to the extent of producing a VSWR of 2.0 to 1, not really very high by modern tolerances. And yet note that with a VSWR of 2.0 to 1, the miximum loading we could manage through the final was 65 watts.

In other words, with a VSWR of only 2.0 to 1, the final would only load to 65 watts forward power (and 12 watts of reflected power). That's a 43% reduction in transmitter output!

PREVIEW - AUGUST VHF HORIZONS

- VHF SIDEBAND SPECIAL —
  * Complete Design for 220 Mc SSB by W4LIP
  * Stable Mixer Circuit for 50 and 144 Mc SSB, by W4LIP
- Planar Triodes at UHF, by W6SAI and W6UOV
- Part One —
  * Taking 'Amateur' Out of Ham TV, by W5HCX
- VHF Crystal Calibrator for DX, by K8AXU
- 50 Mc F2 DX-Pedition Locales, by W5KHT

PLUS — Several Additional Features
(11 in all)

Place
Stamp
Here

VHF Horizons D.R.P.
P.O. Box 1557
Oklahoma City 1, Oklahoma

UNIVAC PROPAGATION REPORT FORM

Your Location (City and State) ________________ Call ________

Geographic Coordinates (to nearest second) Longitude ________________

Latitude ________ Bands covered ____ 6 ____ 2 ____ 220 ____ 432 Time in ____ ST

Date/Time		Station		Location	Leave Blank	Sig Rpt	Type Fading	Antenna Heading
Start	End	Wked	Hrd					

Airmail completed report for period July 15

UNIVAC Propagation Project, Box 1557, Oklahoma City 1, Oklahoma

DRP REPORT

From Amateur Radio Station ________________ **QTH** ________

This month we built the following ________________

________________ And, we improved the following

gear ________________

On the air DX highlights ________________

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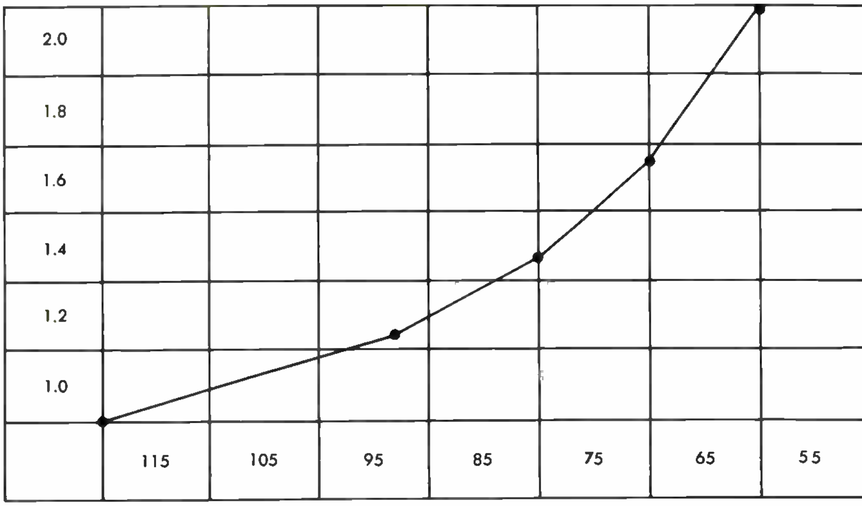
Articles we enjoyed in July issue ________________



MC JONES 120 WATT CALIBRATED METER

Retune the matching bars on the colinear, bringing the VSWR down to 1.6 to 1, and the final coaxial tank loading increased to 85 watts forward power.

Bring it down further to 1.2 to 1 (which is a point where most of us are inclined to leave well enough alone) and the final loading increases to 98 watts forward power.

Now make it match perfectly, which is no real effort with a matching stub set such is provided with Cushcraft's colinear antennas, 1.0 to 1 and the final loading jumps up to 115 watts.

With no detectable power being returned.

How important is a flat line when you are using a coaxial tank circuit final amplifier? We think we know. What about you?

HAMFESTS:

Watertown, Alberta, Canada — July 20, 21 — Glacier, Watertown Hamfest. $3.00 pre-registration by July 10. Contact Clif Cartwright, VE6AGM, Box 941, Lethbridge, Alberta.

CORRECTION

Dear Editor:

It was a big surprise to find my piece on the 6M pre-amp in the April issue. This is just about the shortest period between submission and publication in my experience. There are two errors in the parts list. One mine, and one the typesetters, to wit:

(1) The coils are Miller, not Millen 1. to 1.6 uH. The Allied Number is correct.

(2) It is 20 turns of number 24, not two turns. This one should have been pretty obvious to most readers.

I can testify to the effective coverage you have in circulation, having received many comments over the air since the magazine arrived.

Joe Marshall
Ozone, Tenn.

Joe:

Corrections noted. Several of the gang also brought the 24 turns versus 2 turns to our attention.

Editor

Editor:

Your's truly owned one of the AM-33-RT amplifiers for more than a year, and had consigned it to a dark closet. Your recent article concerning the conversion of this unit brought it back to mind and out of the closet. After some time spent in conversion, the rig is now ready to go. I am running 435 watts input to the converted unit and getting 300 watts output on peaks. See you on six SSB, upper, lower and crossways this summer!

Glenn, W4MMP

Note:

Glenn had two pages of details on how he "modified" the conversion article ran in VHF. If there's enough interest we'll get Glenn to make it up in article style. Or have you had enough on the AM-33-RT?

Editor

Vital Happenings & Facts

OPERATING AND DX NEWS

WHAT DO WE HAVE TO SAY?

Remember of two articles on Sporadic E skip and two meters? One ran last fall under our own pen, another ran in conjunction with W8KAY who provided the raw data we worked from.

We added in such reports as our being heard during the June 1962 contest (VHF QSO PARTY) by K41XC in Melbourne, Florida, and we promised to be on the air if it happened again this year.

At press time it has happened twice. We were there both times. Where were you?

JUNE 2

Six has been open most of the afternoon. Around 1900 we started hearing a brace of signals from western Tennessee here in Oklahoma City, and soon found central Arkansas stations coming through. We promptly went to two meters. The time was about 1915 CST, or 2015 EST. We apparently were too early.

For K4IXC, Melborne, Florida writes ". . . Remember sometime ago I wrote and told you that I had heard your two meter signals (June QSO Party, 1962) here in Melbourne? Well, it has happened again. Only this time I heard W9UNN/Ø, Wichita, Kansas. The time was 2227 EST (2127 CST) and his frequency was just near mine of 144. 091. I heard a carrier start to build out of the noise, and when it got up there I switched off the BFO and heard W9UNN/Ø calling CQ Two Meter Phone. He built to well over S9 and lasted until he was about to sign, then faded down and out. This signal was also heard by W4-MNT, Orlando, and W4VTJ Lantana. We all called but he was gone."

Let's check the W5KHT log for that approximate period. When I switched to two meters at 1915 CST (2015 EST) I immediately heard a station **I Read** as W8WAQ, rag chewing on about 144.105. He was in with a carrier (only read his phone at the beginning) from 1915 or so through 2005 CST. I also heard fading Es type carriers at 144.175, 144.090 and 144.015, between 1930 and 1955 CST.

I got Russ, W5HCX, on calling CQ with his KW on 144.205 and 40 element array from 1930 to 2000. He heard nothing.

We both shut down by 2105 CST, before K4IXV heard the signal on W9UNN/Ø.

What was six doing at this time? By 1945 CST the Arkansas short skip stations were gone, but they were replaced with some tremendously strong (and deep fading) signals from South Carolina, Georgia.

They lasted until around 2200 CST (2300 EST).

JUNE 9

This was a week later, the Sunday of the contest. We found six shortening up to Little Rock, Arkansas; Louisiana; Mississippi (all 300 to 500 miles) around 0820 CST. We immediately fired up on 144.140 (our contest frequency) as well as calling a QST-QST on 50 megacycles alerting the gang that two meters was possibly open between the midwest and Georgia — the Carolinas and Florida.

Several of the 4's apparently went to two meters. We heard two carriers come up and go down, and then at 0850 CST CO2DL, Arnaldo Coro, gave us a call on six meters to report he was copying our two meter signal in Havana. Arnaldo is a dyed in the wool VHF enthusiast and while he has no two meter transmitting gear, he does have a complete receiving lash-up from six meters up through all of the TV channels, FM band, aircraft band, two meters, and into the TV channels again, in fact all the way to UHF TV (he's copied several stateside UHF television stations in Havana.) He gave us a run down on what we are saying and we had a cross band of sorts between two and six for a few minutes, the best we could through separate operating positions for six and two that were separated by 12 feet. Then we bid him good bye and quickly announced two was for sure open, and where the devil were the 4's!

We finally gave up two meters around 0915 CST.

Oh, yes, Arnaldo reported he heard two other two meter phone signals, some one was giving us QRM on 144.140. Who ever it was was counting 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and then back down to 1 again. Guess you'll listen next time you spend a few minutes tuning your two meter rig, hey OM?

In spite of all of this encouragement, we are far from happy. There is simply not yet enough interest in two meter Es to make it work. Next year we will have a 500 watt CW keyer beacon running whenever we hear a remote sign of six meter DX. And you'd better be listening and ready to transmit back to us!

SIX METER NEWS

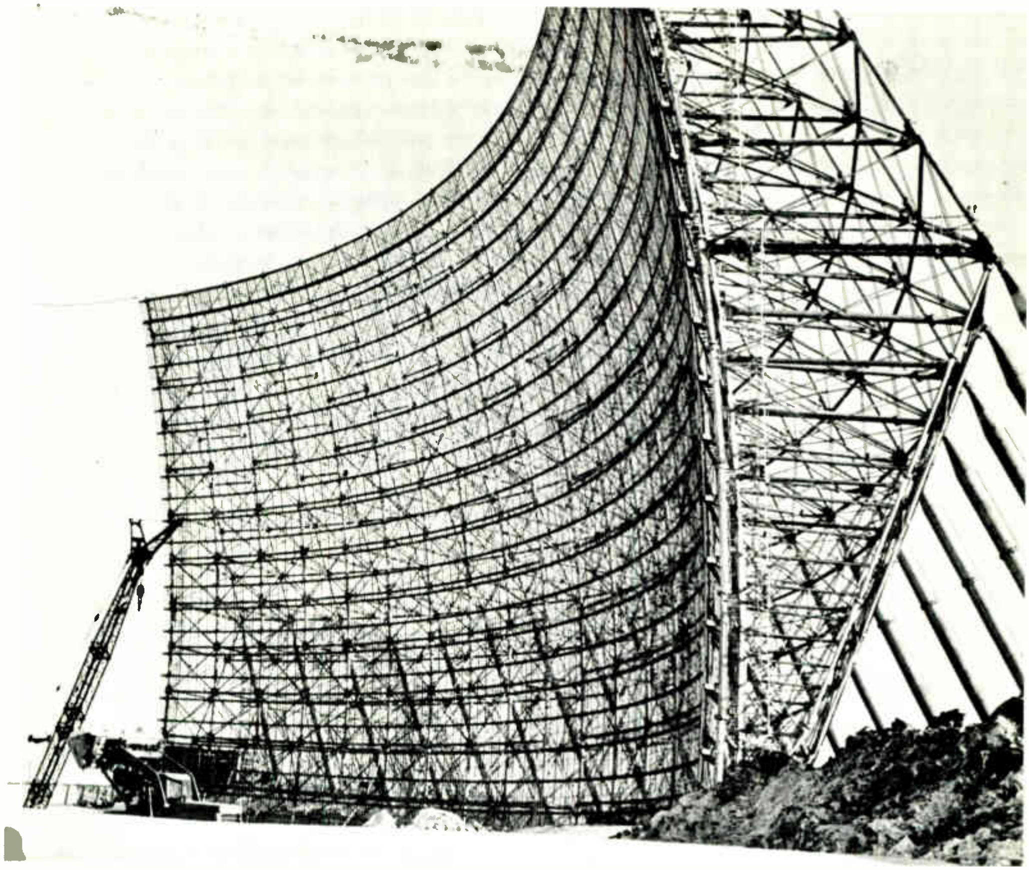
Some of this will (unfortunately) be a little out of date when you receive and read this. However, on the chance some of the dates will be extended, we pass it along.

VP7CX, Harold of Bahamas fame, was to have operated on 50.040 as HI8XHL in the Dominican Republic from June 22 to July 2. This is his vacation. He asked that everyone keep QSO's to a bare minimum, i.e., RST, location and confirmation of contact, so as to allow him to work as many as possible.

Harold also has been active promoting more six meter activity in the Caribbean. He sent a complete six meter station down to VP2SY, on 50.060, on June 3. This would have been active by mid June, although we have no reports at press time.

VP5BB, Barbados, is on 50.130 most of the time, when he is on. He has Lafayette's HE-45 so can move (VFO) if he thinks the going is too rough. Why isn't he in the foreign phone band?

VP9WB is on with a similar Lafayette product. Also on six meters in Bermuda is



RUMOR has it Sam and the gang at W1BU have something cooking in the tropo scatter department for 432. A wandering sole who admits he was lost and says he wouldn't know a Massachusett's swamp from a Louisiana mud hole claims he snapped this snapshot someplace in the northeast. We take no credit for this news scoop. We leave that to Sam and QST.

K4PGL/VP9, who was worked on double Es by W5SFW on June 2.

KV4CQ will not be active from Virgin Isles until after mid August. Too bad. He's a W2 who vacations down there, east of Puerto Rico.

Speaking of east of Puerto Rico, FG7XT, Guadalupe, was worked by W5KHT from Oklahoma on June 1. He has Clegg gear (Zeus and Interceptor) and operates just outside US band (50.096) most of the time. His signal has a little instability, probably due to the line voltage regulation problem down there.

FP8CA and FP8CB were supposed to have been active from St. Pierre on six and two during the contest. Clegg gear. No reports on this one, did they make it?

CO2DL, Arnaldo, is pretty active on six. His name is Arnaldo Coro, Havana is his QTH. If you are interested in Es and propagation topics, call him and spend 90 minutes rag chewing with him like we did June 2. A most interesting chap who notes "we now use Russian or Chinese People's Republic tubes and components in all of our gear since we can't get American parts any more."

Rumor has it a TI2R? has been active. XE10E in Mexico City was supposed to know his call and frequency, but Ted said he had no such knowledge when we worked him on June 9.

Two KP4's were supposed to have worked YV5's in Venezuela on June 1. We know nothing definite about this.

VP4ZN was heard being worked by two K6 stations on June 1, on CW (!).

VP7CX was to be on two meters during

the June contest. His frequency was to be 144.450. CW. Anyone work him?

KB6CL/H6, is supposed to be on 50.102 with a gallon on SSB at 2200 CST nightly, according to 5WSFW. No reports on KH6 contacts so far this year, nor any reports on any KL7 activity.

VP7CX heard a Seattle station on SSB on May 31. Who was the 7 station that missed a Bahamas contact?

Contest Report

We should really wait until next month since we haven't had time to gather adefared best on E skip apparently were the fellows in W4 and W8 land. Sunday was a real bang up day until mid-afternoon.

Here at W5KHT, we held down the fort with W5ORH, K2JWE/5 and myself, W5KHT. W5HCX, Russ, was in Seattle attending a television conference for one of the books he edits.

We pulled a sneak test by running two rigs on six meters simultaneously.

One was the KW on the low end, AM, CW, or SSB, the other was a 100 watter on AM which stayed above 50.3. This gave us a chance to work an extra hundred plus contacts above 50.300, and it worked so well (after we engineered out the cross modulation and overload) that we plan to really do it up right with kw's on both ends of the band next year, unless the League decides this is not a kosher way to do things. As far as we could determine, there is nothing preventing two rigs per band at this time, in the rules. Makes life mighty interesting for the logging man, I can tell you that!

We ran closed loop television between the two operating positions and the logging desk, and the logger (and record keeper) had to keep up with two operators.

He had a return audio loop to advise either of the operators when the station being called or about to be heard had already been worked. It worked fine.

The band conditions were not as good as 1962. We managed to work 512 contacts in 54 sections, for a total score of 27,650. But wait until next year! We have some real plans for 6,2,220,432 1296. Watch out you eastern multi-op stations. W5KHT is about to strike!

SSB Picture

Last month we promised a run down on six meter SSB conditions. We have an announcement from the East Coast VHF Single Sideband Association. At their quarterly Dinner Meeting, their outgoing President John Super, K2ZBX, presented the group with a large and attractive trophy, which is in turn to be given (awarded) to the first amateur to work all states in the continental 48 on VHF SSB. This means the first fellow to make the grade on six meter SSB is going to receive a most well deserved trophy for his feat. This now puts real emphasis into what all of us sidebanders have been working for!

The custodian for the trophy is Abe Cutler, WA2ONB. This is the first such trophy to be offered, as an award for VHF sideband work, and we feel it will be both an extreme honor privilege to earn same. The East Coast VHF gang is to be congratulated for their efforts in this area.

Oh yes, the East Coast sideband gang meets on 50.108 Sundays at 1100 hours EDT (this summer).

Now to those rare states on sideband.

Still no word on Maine, Vermont, New Hampshire, Connecticut sideband activity. Guess there is none. Arkansas is also apparently a void. (See list of states in June VHF) North Dakota ditto.

In Utah, we have definite conformation that no one is active. **Sorry Charlie.**

In Nevada, you **can** get K7ICW in Las Vegas to go SSB if you get ahold of him (name is Al) on CW (or phone, although he preferes CW) first. We did it early in June one night (June 2nd). Also about to get active on six meter SSB from Nevada are K7HRW and K17LB in Reno who are working together on companion mixer units. K7HRW will be on with a full gallon.

Oregon? K7IMH was worked by the Horizons gang on SSB on June 9th during the contest. He's good for a QSL too.

Idaho? Apparently no one there, yet, since W7UBI left last year.

The rest of the states are reported to be represented by varying amounts of activity, although we personally have quite a few left to work, especially in the Nebraska-Wisconsin-South Dakota area.

It appears that we have never had SSB activity on six from the states of Maine, Vermont, Arkansas, Utah or North Dakota. Anyone know any different? It will help us plan how hard we have to work to beat someone else to the East Coast VHF gang trophy.

General News

We'll dispense with the band by land listings this issue for two reasons. I'm writing this just hours before I personally head on a ten day trip into the west coast, and it's still four hours before the VHF contest folds up. Time being of the essence, we want to hit the highlights the hardest and leave the details to the other magazines.

W7GJL, Barbara Ashley, Secretary of the **Northwest Amateur Radio Communications** System, Inc. of Washington state advises they are opposed to Wayne Green's (73 magazine) proposal to take the upper IMC of six meters (in particular) in favor of amateur television. The Washington group says they feel that the number of people who would utilize restricted bandwidth amatuer television on six is small when compared to the number of people now using the upper megacycle for FM work.

They would like to see other groups voice their opinions to the FCC.

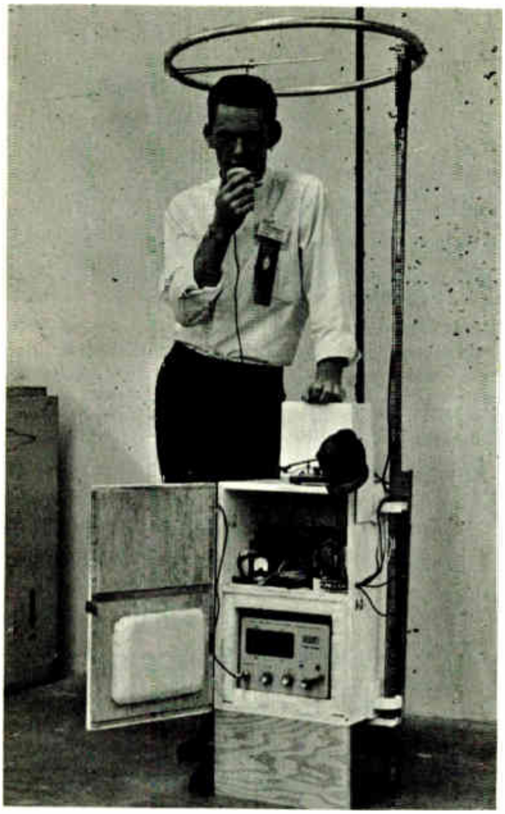
K1AGG, Phoenix, is another fellow hot for two meter DX work, especially Es. He has a habit of operating on 144.025 plus or minus a little bit and is apparently well enough equipped to make the grade when the band is hot. He tunes the lower 100 kc on two meters.

WA4ISG advises that if you worked VP9WB, he should get his QSL's in care of KØORH.

VE3BRI, Woodstock, Ontario has two 13 element yagis put together for 432 megacycles. Watch for him. The beams are silver plated ala that nut W9JFP (hi-Vic).

Dozens of stations report dobule hop Es during the month. We would like to acknowledge all of them here, but simply don't have the space. Your material will be fed into Univac gents, and it all helps.

K6QKL/KH6 advises he is monitoring 50.110 upper sideband 24 hours a day from Honolulu. He heard South American signals



LAST YEAR IN PORTLAND at the ARRL National, we caught this young lad (I believe from Seattle) with his complete walking-portable six meter station. A Sixer, voice operated mike (through a headset) or the more conventional hand held mike, halo, and 12 volt battery. Straps on the back on the rig allowed him to haul its 40 pounds around the convention floor. Ah to be young again!

at 2210 GMT on May 13. He believes the reception was due to ionized trail sleft by a Pacific Missile Range launch.

WA6HIT/AD6HIT reports a 432 megacycle MARS net in the Los Angeles area. It's Sixth Army MARS, every Saturday morning at 1600 GMT, and Sunday mornings at 1500 GMT. They have 20 members and average 10 check ins per session. 1296 operation is contemplated. Sounds unique.

Ralph Metro, WA2SVD asks for any information on the R-449 receiver, as discussed in a past issue of VHF. Can anyone help, with where to get such an animal?

OK2-4511, Josef Menda, Olsany, Ruda nad Moravou, Czechoslovakia writes he enjoys very much VHF Horizons but is having trouble getting the necessary financial exchanges worked out to get his sub current.

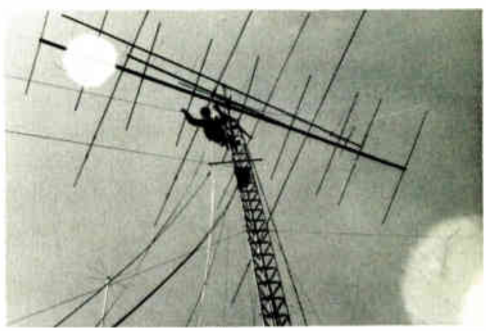
SORRY to have missed attending the Fresno VHF Whing-Ding in May. This shows two of the principal participants in a past such meet; Alan, W6FZA, leaves the rostrum while wildly enthusistic crowd (including Gib, W6BJI, standing) applaud his efforts. Both Alan and Gib are VHF staff members.

Anyone want to see a worthy European receive VHF monthly? $5.00 per year foreign.

K5DRF reports he worked XE1CT in Mexico City, on 50.125, with 3 watts input on May 31. Who says you need power!

K7DTS, Napavine, Washington reports FM DX on 53.29 megacycles when he heard W7FXJ/6 in Bakersfield, California for 3½ hours on May 9.

W6GDO, Rio Linda, California reports on attending the VHF hamfest in Fresno on May 18, with 53 VHF'ers present. Those who appeared included K7AAD, Loren Parks of Electronics, who spoke on VHF converter design. 18 of the 53 there indicated VHF-UHF current activity, in this fashion: 6 on 6 SSB; 18 on 2 SSB; 12 on 220; 5 on 432; 7 on 1296! W6DNG played his moonbounce tapes (wow!) and K6UQH and VHF Staffer W6BJI talked on Par-amps.



BILL KAMP, WA9DML, perches 100 feet up on the tower at W9JFP. Bottom to top, 9 elements on 50 mc/s, test beam for 432 (15 elements on 14 foot boom), TH-4 Tri-bander, 15 element two meter array. The big 432 antenna broke in two on the way up. Vic has nothing but troubles and money.

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VHF HORIZONS

OCTOBER 1962
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Amateur Radio Above 50 Megacycles

From the Publisher's Shack

A TRIBUTE TO AN ERA

By now many will have learned that the original nationwide VHF newsheet for the amateur (VHF Amateur) is no more.

It is with a great deal of sadness that we mark its passing. Young Editor-Publisher Bob Brown (K2ZSQ) is personally known to many of you through on-the-air contact and his frequent appearances at amateur radio conventions and gatherings, especially along the east coast. For nearly five years Brown filled a void . . . a very deep void. He cranked out monthly issues of VHF Amateur keeping so many of us informed of what each other was doing during a period when the current mushrooming interest in VHF/UHF was only in its infancy. Often without adequate finances, Bob plugged along convinced that he was doing a job that needed doing and apparently certain that someday his *efforts* would be recognized.

Well . . . *they were.* Cowan Publishing Company (the publishers of *CQ*) acquired the rights to *VHF Amateur* in the first days of August. At this writing the future of this institution in amateur VHF/UHF radio is unknown, although it is understood that *VHF Amateur* will become a section or department in *CQ*.

While this will certainly contribute considerably to the *professionalism* of *VHF Amateur* (as a department in *CQ*), we never felt that lack of professionalism hampered the future of "the early day VHF man's publication."

Bob Brown had many of the advantages that we have attempted to build into *VHF Horizons*. Bob was aware that VHF/UHF news is by its very nature a timely item. He recognized that the 45-57 day lead time (*i.e.* the period of time between the day that a magazine stops accepting editorial copy and the date the magazine actually came out) inherent with other amateur magazines was not materially contributing to the "operating state-of-the-art" in VHF and UHF.

So he set out to tackle this in the same way we did, later, here at *VHF*. Simply arrange your production and delivery schedules so that your printer can accept copy up to a matter of days (two weeks at the most) before the magazine hits the mails.

Now, with *VHF Amateur* absorbed by *CQ*, it loses what many felt was its primary appeal . . *i.e.* news while it was still news. For this we are deeply sorry and not a little concerned on behalf of the entire VHF/UHF fraternity, which we feel by now we have gained the right to speak for.

Somewhere out there are 2,500 or so subscribers to *VHF Amateur*. They probably feel a little left out right about now. Some probably also subscribe to *CQ*. While we feel certain that Cowan Publishing Company will work out the problems involved with changing over or extending their present subscriptions (to *CQ*), we wonder if this is enough?

If you are one of these 2,500 *VHF Amateur* readers, and you *do* feel a little left out in the cold (of old news), we would like to offer to you a six months subscription to *VHF Horizons*, at a token charge of $1.00. Please recognize that we do not have access to the subcription records of *VHF Amateur*. Therefore we must trust in the integrity of the amateur radio operator to represent to *VHF Horizons* his existing subscription in a truthful way.

Our reason for doing such a thing is simple enough. We feel that you subscribed to *VHF Amateur* for the same reason we did. To obtain news of VHF/UHF, exclusively. We don't want you to ever develop the feeling that you can no longer have this kind of service delivered to your doorstep monthly.

By offering you a six month carry-over subscription with *VHF Horizons*, for the token fee of $1.00, *we will see that you* keep in contact with the world of the very highs and ultra highs, during a period of time when 50 megacycles and up needs everyone of its newly found supporters.

OK . . . so the line starts at the right. Just drop a short note to *VHF Horizons* at P. O. Box 1557, Oklahoma City 1, Oklahoma with the information that you were a subscriber to *VHF Amateur* when the sale took place. Enclose your dollar, and we are in business!

VHF HORIZONS

VOLUME 1 — NUMBER 4
OCTOBER 1962

CONTENTS

Features

Departments

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OUR COVER

What can you say about a plain type layout? Design by K5QGO, to set off this special antenna issue—that's all. Inside, you find a separate antenna article for every VHF band in anything like wide use (except 432, and it's covered thoroughly in two of the other articles). Send us some pictures of your own antenna installation—you might find one on the cover of next year's Antenna Special.

ADVERTISING—VHF Horizons magazine accepts commercial display advertising from bonafide manufacturers, and distributors of electronic equipment and associated apparatus. Advertising rate card and coverage data available upon proper request.

CIRCULATION—VHF Horizons magazine is circulated through the mails and sold over the counter at leading electronic parts wholesale houses throughout the United States and Canada. Approximately 25,000 active amateur radio operators have VHF/UHF interests, and this is their publication!

SUBSCRIPTION—Subscription rate in the United States, $4.00 per year, $7.00 two years. Airmail subscription available at $7.00 per year. Subscription in Canada, Central America $5.00 per year. Subscription elsewhere $5.50 per year.

SCATTER

. . . de K5JKX

CONVENTIONEERING . . .

One thing about summertime and being a ham magazine editor — you'll get your fill of both conventions and hamfests!

I just got back from the West Gulf division convention at Corpus Christi and already I'm trying to get the work ahead enough to make it to Syracuse for the big VHF bash. And if you think (like several people I know) that this is simple, then you should try filling 40 pages every month with interesting and informative articles.

Don't get me wrong. I'm not complaining in the least. These things are fun — but at the same time they make life a bit more complicated than it is already.

Like for instance the trip to Corpus. That one was the weekend of August 3-5. Our deadline to the printer for the September issue was August 6. It doesn't take higher math to figure out that the magazine either had to be put together early, or late — but not on time in either case.

But even with that deadline hanging overhead, Corpus was fun. Had a long visit with Bill Ashby, K2TKN. One of the most immediate results appears further on in this issue — his article on 1296 Mc antennas. Other things are in the mill, if Bill or I either one can ever scrape up enough time to do them.

And at this point, an aside to those of us who work only 50 Mc and scornfully refer to the 75-thru-10 regions as "DC bands": it comes as a bit of a shock to talk with people who work almost exclusively *above* 432 Mc. To them, 6 and 2 are DC bands!

Bill wasn't the only interesting VHFer at Corpus. I talked quite a bit with George Munsch, of San Antonio, about wide-band FM work on 6 and 2.

One thing many people don't realize about FM. When proper receivers are used, FM has approximately the same advantage over SSB that SSB has over AM! The only thing wrong with FM is that too many people try to receive it by "slope detection", and the results are definitely not as good as AM.

Anyhow, George and a bunch of other people scattered across the country are working with converted commercial two-way gear, mostly on 52.525 Mc although other channels are also in use. If anyone is interested, we can twist some arms for some articles on how and why you can get into this bunch.

And there were dozens of other people who stopped by the booth to pass the time of day. All in all, much fun.

We did find that large numbers of hams still hadn't heard of us, and others confused us with other publications.

So here's one place every reader can help VHF. Get on the air and tell people about us. Tell them to drop us a note for a free sample copy if you like — or just send us the calls and we'll do the rest. This way, maybe more people at the next convention will know who we are.

OUR DEPARTMENTS . . .

The eagle-eyed reader will notice a drastic absence of our usual departments in this issue. Specifically, among the missing are the VHF Showcase, D. C. Pulses, and Scanning the Literature.

However, a glance at the "Features" listing on the opposite page will rapidly explain why. With so much solid data on antennas for all our bands, something *had* to give — and the departments went for this issue only.

They'll all be back next month. If you've been following "Scanning the Literature" to keep up with all the other publications, don't worry about missing out on a month. Our new schedule put us at deadline before two of the three other major ham magazines came out anyway — so next month we'll be scanning the September issues.

Incidentally, I'd like to know what you think of our departments — *all* of them. Do you like them, or would you prefer that we use more of the space for technical material? After all, this is *your* magazine — and if you'll just tell me what you want, I'll do my best to give it to you.

What do you think? **—K5JKX**

50 Mc

Designed and built by Edwin A. Pick, W0BBM
RR 3, Box 377
Imperial, Missouri

This photo story is aimed not so much at the 50 Mc enthusiast who is looking for a complete *nut and bolt* how-to-do-it story, as it is aimed at the 6-meter man who is looking for new ideas, or new uses for old ones.

The antennas (notice we are plural now) shown in these photos have been erected and put into the air over the W0BBM QTH during the past several years. The object of each of the arrays was extended ground wave, long haul weak signal skip, and scatter.

Over the period that each antenna was in use, careful observations were made to the effectiveness of each design. *Some* of these observations are included in this report. More will be made available at a later date as the totals are tallied.

Having read that long-haul scatter signals become pretty beat up, in respect to polarization of the original signal, during the scattering mechanism, we decided to experiment with various forms of stacking, and polarization switching.

Anyone who has worked a summer of E skip has probably had the opportunity to observe that under some very special conditions stations "on the other end of the line" (ie. 700-1500 miles distant) running low power into ground plane antennas, often times will compare very favorably with their higher power bretheren with much larger yagi arrays.

When working into an area that has both vertical and horizontal polarized stations in quantity (*ie.* Los Angeles basin and vicinity) it is often surprising to hear the top signal on the band announcing "I'm running a four element yagi and a G-50. *The beam is vertical.*" You are receiving on a horizontal antenna.

Too often we tend to chalk this up to a number of rationalizations such as (A) No one with comparable power and a horizontal antenna is active at the particular moment; (B) skip is so good that anyone with a 6J6 and clip lead would be S9; (C) skip is so spotty that this vertical fellow just happens to be in the right spot.

On the other hand, vertically polarized stations often find they are receiving better signals on skip from horizontally polarized skip stations than their horizontal brothers.

All of which leads those of us with a flair for imagination "could it be possible that the E skip mechanism actually twists the signal?'

Believe it or not, this is not a new thought. However, to the best of my knowledge, it has never been officially explored on a concentrated effort over a summer of E skip. It is hoped that this article, and others to follow over the winter ahead, will send enough 50 megacycle men to the aluminum piles to erect a number of switchable dual polarization beams for the 1963 E skip season.

But it was not E skip that first attracted me to the dual polarization antenna. It was, as noted earlier, scatter.

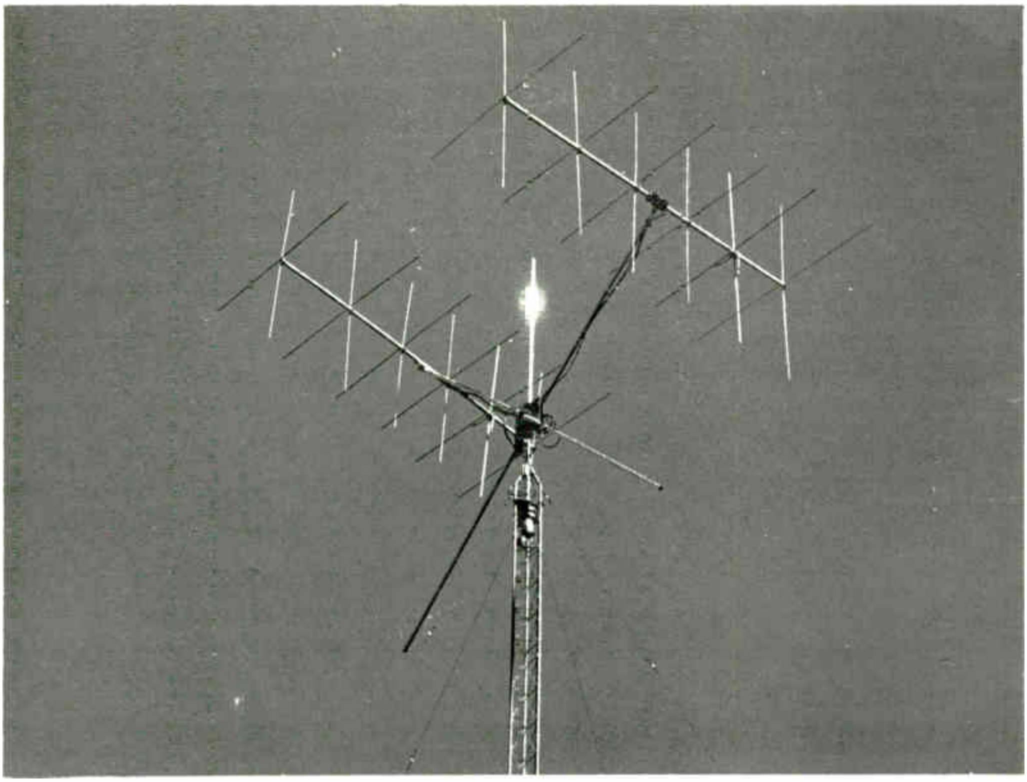
The scatter mechanism is one which displaces small globs of semi-ionized molecular concentrations in either the D or E layers of the ionosphere, or in the atmosphere itself, in the case of tropo scattering. There has been some evidence advanced that the semi-ionized globs are twisting (*ie.* rotating in a spiral) at an irregular rate as they fly through the layers involved. It is these globs, which, when excited by meteorites and ionospheric winds, cause momentary refraction (or reflection) of your 50 megacycle signal. In its most basic approach, ionospheric scatter is exceedingly short-lived E skip, occuring at a height just slightly lower in the E layer than normal E skip occurs.

Some have suggested that the twisting and spiraling of the semi-ionized globs which cause scatter to occur also twist the plane of the signal as the signal reflects from (or reflects in) the glob it passes into and through.

It is on this basis that we attempted the design of an array which would give us the following options at the throw of a switch:

(A) Horizontal only
(B) Vertical only
(C) Clockwise circular
(D) Counter clockwise circular

As far as this array went, it did just that. However no attempt was made to sample via any automatic means the relative signal levels on each of the four choices of polari-



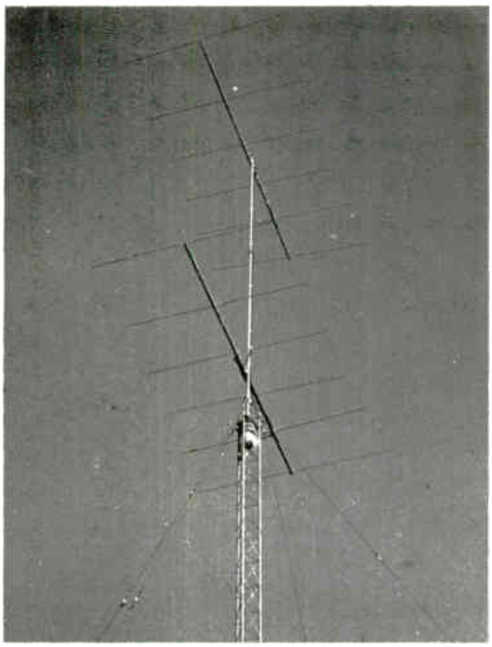
Diversity 12 by 12 array at W0BBM, Imperial, Missouri. Boom lengths—15 feet, spreaders 20 feet long. Antenna height 70 feet above ground. A late winter storm brought this one down with 4 inches of ice loaded on the cross members.

zation, thereby choosing the particular polarization which was producing the greatest signal level at any given instant.

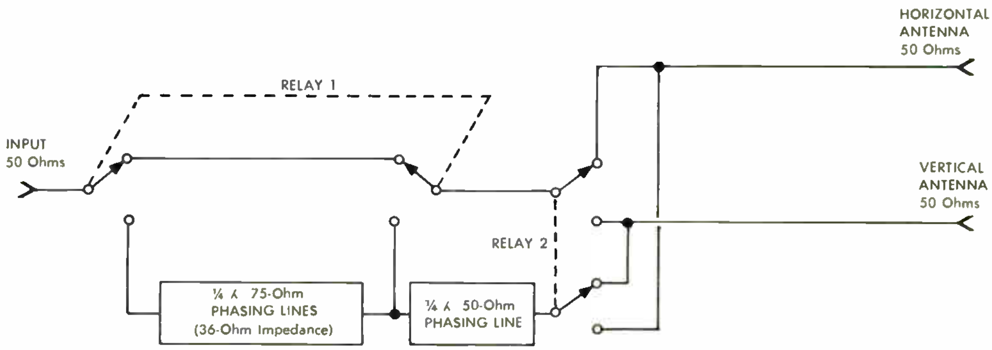
Diagram one shows the very simple means employed to select any one of the four polarization modes. The principal means of phase change was the use of ¼ wavelength coaxial delay lines, which by simple addition and subtraction to the basic phase of the input signal (left hand side of diagram 1) resulted in any of the four choices of polarization desired.

Notice in diagram 1 that we are maintaining a 50 ohm output in either vertical, or horizontal, or circular polarized arrays. Keep in mind, when duplicating any part of the switchable feed system, that the ¼ wavelength phasing transformers must have the velocity factor of the coax you choose to use calculated into the actual phasing line length. Note also that both 75 ohm and 50 ohm coaxial cables are employed in the phasing array.

Diagram two offers two possibilities for phasing together together either 2 or 4 fifty



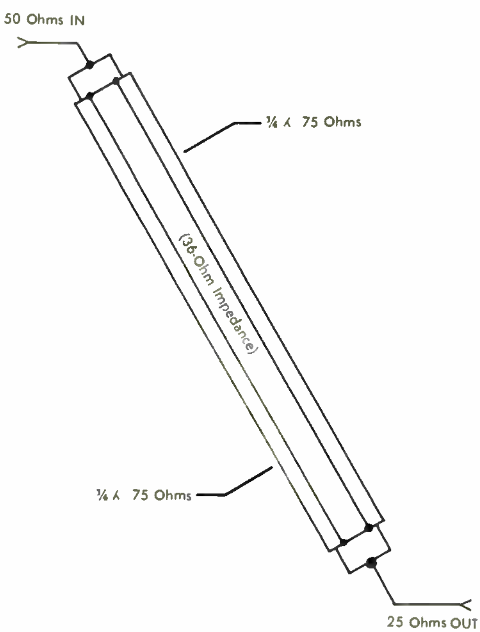
Horizontal 6 over 6 shown here produced a 48-state WAS in 5 months in the 1961 E skip summer season. Boom's 15 feet long, vertical spacing 18 feet. Top antenna 80 feet above ground.



POLARIZATION CHOICES

RELAY 1	RELAY 2	
	NORMAL	ENERGIZED
NORMAL	HORIZONTAL (Only)	CLOCKWISE CIRCULAR
ENERGIZED	VERTICAL (Only)	COUNTERCLOCKWISE CIRCULAR

Diagram 1



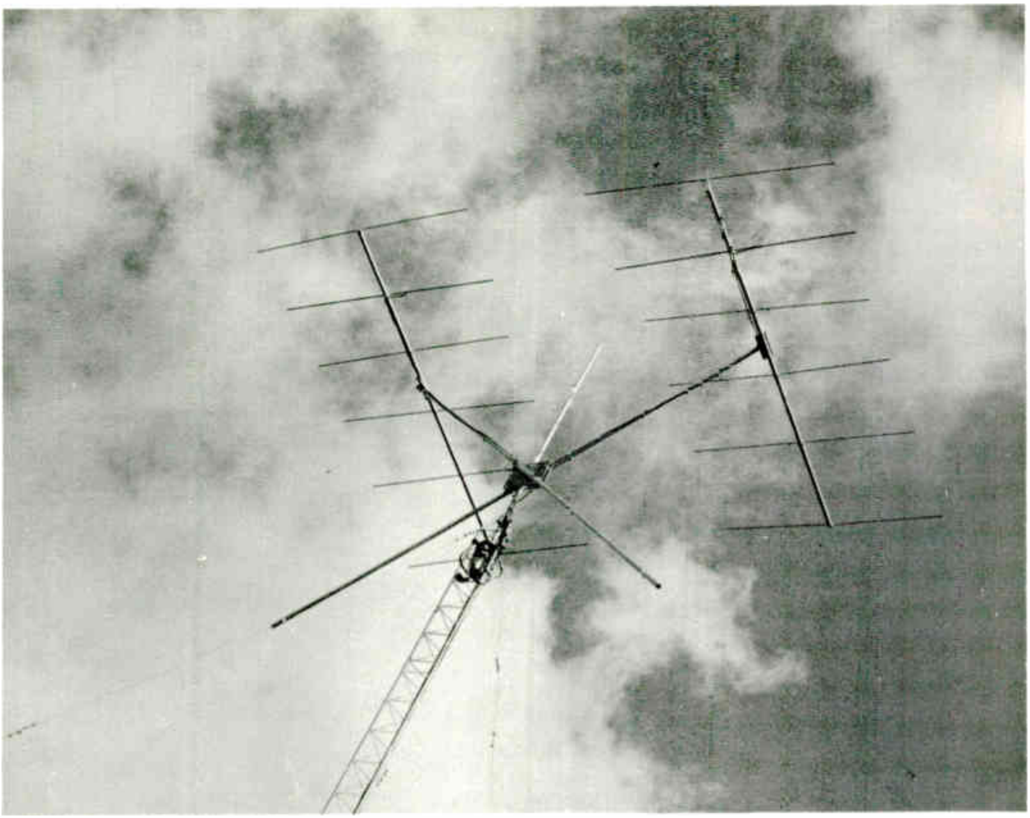
1. Stubs can be made up with connectors, or soldered and taped, with coax connectors only at input and output.
2. Parallel 75-ohm ¼-wave lines are used to match two 50-ohm antennas to one 50-ohm line.
3. Parallel 50-ohm ¼-wave lines may be used to match 4 50-ohm antennas to one 50-ohm line.

Diagram 2

(50) ohm yagi antennas into a single array These methods are, of course, good whether you are stacking horizontal and vertical yagis on the same boom, as was done in photo 1 with the 24 element (12 vertical and 12 horizontal) dual diversity array or if you are simply stacking 2 or 4 yagis in the vertical plane (photo 2) or horizontal plane (photo 3.).

SELECTIVE SAMPLING

With an antenna such as is shown in photo one (24 elements) you have the makings for a polarization diversity array which offers selectable polarization, depending on the signal level present in any one of the four polarizations (*ie.* horizontal, vertical, clockwise circular, counter-clockwise circular) at any given instant. With a single feedline to the receiver (converter) this limits you to manual selective-sampling. In other words, you rotate your relay changeover switch in the shack listening for audible changes in the signal level you are working with, picking the polarization position which produces the best signal to noise ratio.



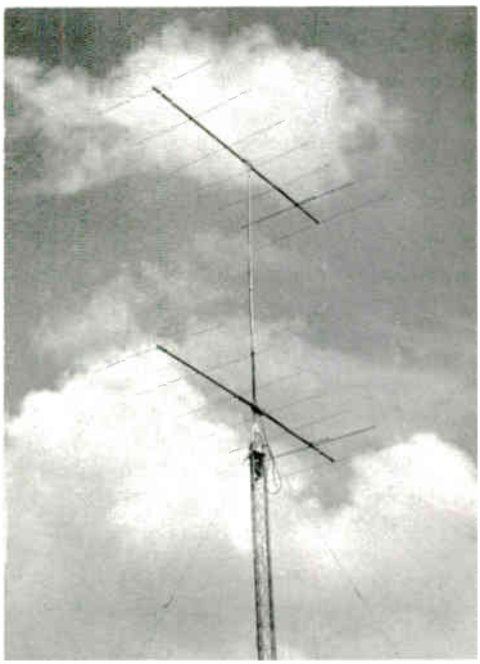
Horizontally stacked 6 by 6. Boom lengths 15 feet, spreader lengths 20 feet, antenna height 70 feet. This array suffered on low angle long haul paths (tropo scatter).

PERFORMANCE

The array shown in photo 1, with two booms, each of which had a six element vertical and six element horizontal antenna mounted thereon, was a real winner on short-haul scatter (high angle work) and E skip. However it was not as good as the stacked 6-6 or 7-7 for low angle work. It is felt that this antenna (the 24 element dual array) would have performed well on low angle scatter also, had we been able to add an additional 24 element array on the bottom of the spreaders, identical to the top mounted array. However the ice of a late winter storm beat us to it this spring and the entire array, coated with ice as big around as your wrist, came shattering to the ground!

It is hoped that many serious minded 50 megacycle amateurs will give consideration to this basic design in the winter months ahead with an eye toward real evaluation of the four modes of polarization over paths likely to produce shifting polarizations due to irregularities in the troposphere or ionosphere.

W0BBM



Vertically stacked 7 over 7 presently in use at W0BBM, pending completion of a more elaborate dual diversity array. Boom lengths 20 feet, vertical spacing 18 feet. Top antenna 80 feet above ground.

144Mc

usually long piece of conduit used for the boom material. If you cannot obtain a piece this long, have a short piece arc-welded to a standard 10' length.

by Russ Miller, W5HCX
Associate Editor
VHF Horizons

The construction techniques of building a colinear usually presents problems to most amateurs who attempt to build this antenna type.

Seemingly, the antenna appears difficult to construct when it really isn't. In fact, its odd size plus the mechanical problems has in reality scared off a lot of erstwhile builders. Don't let it scare you.

A colinear array, particularly at 2 meters and up, will give you a healthy amount of gain, has a good capture area, is not specifically a narrow band device and can be used over a wider range of frequencies than the Yagi without introducing a serious VSWR. Also, the radiation pattern of the array is naturally broad and eliminates the need for precise aiming.

Building a colinear can be approached in a number of ways. Of first interest is mechanical strength to keep storms from damaging the array. Weight is also a consideration since too heavy an array makes its mounting difficult. A colinear need not be heavy. Size is important because the physical area of the array determines its performance.

The best all-around size at 2 meters is the 16-element array. The array described here is a simplification of the usual construction process. The antenna is constructed from aluminum tubing and steel conduit, the latter used for the boom and the cross-arms. Lashing it together consists of arc welding the cross-arms at their mid-point to the boom as shown in Figure 1. The letter "W" indicates the weld point in the illustration. The next item is the insulator support plates which, by the way, are designated as 'mending plates, 1" x 6" with 10/32 countersunk holes' and are available from local hardware stores or suppliers. These are also made of steel and can be arc welded to the ends of the cross-arms. Why weld the steel parts together? Rigidity is one reason, and the other is cost. It is cheaper than using numerous U-bolts and clamps.

Figure 2 gives all the necessary dimensions. One thing you may notice is the un-

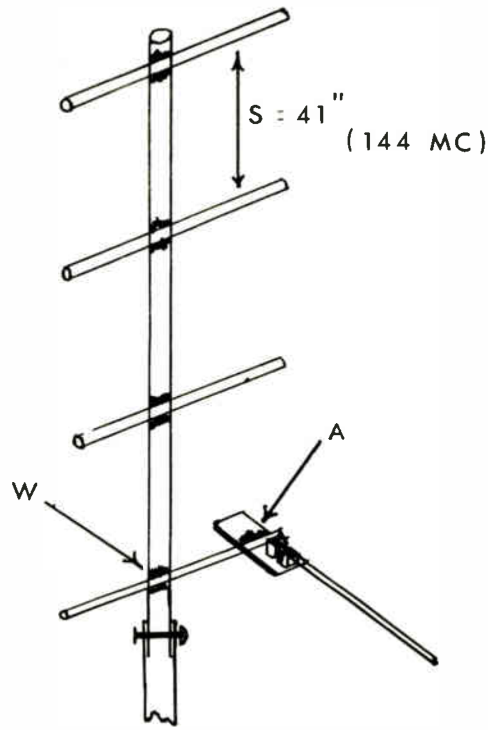


Figure 1

The insulators used with this array should be ceramic, although glazed steatite will do. The insulators should be approximately 1" square by 1¼" high with 10/32 threaded holes in each end. The elements are held fast to the insulators with standard ½" fuse clips. See Figure 3 for details. The fuse clips are available from a number of sources through the surplus stores have the best selection. Holding the elements in the fuse clips can best be done by drilling a hole through the fuse clips and the elements and securing the assembly with 6/32 bolts and nuts. This will also give you a place to fasten a phasing harness.

Feeding the colinear is like most all other arrays; it *must* be matched to the feed line. The actual impedance of this array at the feed point does not approach any figure that can be easily matched. If a ½ wave balun is usd with 72 ohm transmission line, an approximate match will be obtained. However, if you want to lower the standing wave ratio to better that 2/1, a ¼ wave matching stub

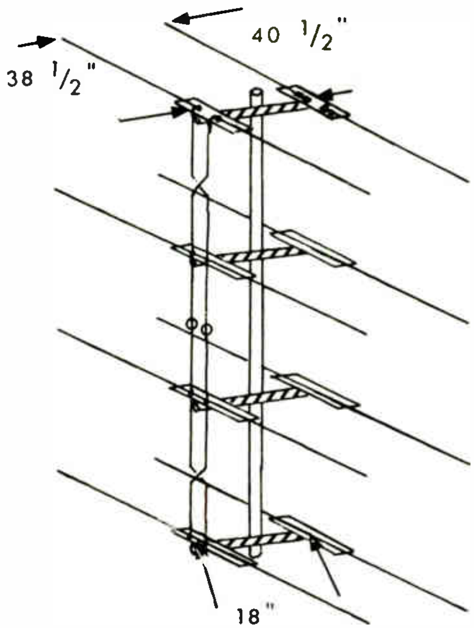


Figure 2

will have to be used. The ¼ wave matching stub is adjusted by moving the transmission line point of connection up or down until minimum SWR is reached.

Slight adjustment of both the transmission line connection and the shorting bar then should be made to reduce the SWR to as close to 1/1 as possible. Incidently, since the array is a balanced device and the transmission line is not, a balun will have to be used at the transmission line connection to the ¼ wave matching stub.

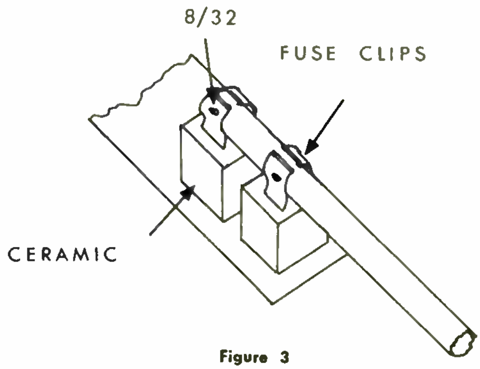


Figure 3

Letters

Dear VHF:
Received the complimentary copy of VHF yesterday and after having ingested its contents wish to apply for future as per enclosed subscription form. To me it appears that you are off to a good start with a long needed tool for the serious VHFer and with the staff you have listed on page two, this effort should be very successful.

Judging from the W4IKK/W4HHK article, you may have lost contact with Bill. He is now associated with AEDC at Tullahoma, Tenn. At last accounting, he was running six watter on 50 Mc rather sporadically due to work and study.

C. A. Waterhouse, W4INM
700 Marlboro Avenue
Chattanooga 11, Tenn.

OM—
Thanks for the note on Bill's location; the first time ye ed worked him, he was running 5 watts on a mountaintop during a tropo opening—so we'll be looking for his mighty 6-watt signal again!

Dear VHF:
First I would like to say your new magazine looks real good. I already know of 10 subscribers locally. The next thing I would like to know is what are you doing to your modulation on W5KHT SSB rig. During the VHF contest it sure sounded good. If there is anything I can do to help the magazine let me know.

73
Ken Halladay, K6HCP
San Jose, Calif.

Ken—
The W5KHT modulation secret is nothing more than Art Collins KWM-2. They don't come any better! You, and others, can help by simply spreading the word about VHF. We'll gladly mail a sample copy to anyone requesting same . . . provided they haven't received a free one previously. Pass that word around!

Dear VHF:
Thank you for the complimentary copy of your new VHF Horizons magazine. Frankly, I compared it (August issue) with the 3 ham journals I now subscribe to and came to the following conclusion of preference; in this order: 1—QST, 2—73, 3—CQ, 4—VHF Horizons. I also had access to two other ham journals, VHF Amateur and Western Radio Amateur, both of which I would cast below your magazine.

Try me again in the future; possibly by then you may have achieved the key to a superior journal at which time I'll buy.

73's
Vin Salemme, K6VUB
Livermore, Calif.

Dear VHF:
After devouring the meaty information in every page, I just had to collar myself and forward the enclosed subscription. I am interested in NFM at present and would like to round up other enthusiasts thru your columns. Most of my NFM operation is on 6 meters.

73
August Oechsli, K2PQY
Massapequa, L. I., N. Y.

August—
Stand by for a deluge of letters from NFM enthusiasts. How about it, gang?

Dear VHF:
Congratulations on the fine publication which covers most interesting topics. Finally the Technicians have been recognized as a powerful group who have no beef with anyone. The need for such a magazine has been filled.

Best wishes
Daniel R. West, K6DRX
Menlo Park, Calif.

Dan—
Thanks for the comments but we must set one thing straight: VHF is published for the technician, not for the Technician. We all feel that high technical interest is the lifeblood of VHF ham radio — but when it comes to the class-consciousness which a few hams of all license classes try to foster, we draw the line. To us, a ham is a ham is a ham — and if he's interested in VHF work, we're all for him no matter what the "class" of his license!

220 Mc

by Robert Grimm, K6RNQ
Western Technical Editor
VHF Horizons

After loading the 220-Mc rig up to a kilowatt one cool summer evening and burning up the transmission line to the 13-element long yagi in the process, the author made the marvelous deduction that he might have an SWR problem. This is later confirmed by a check which showed SWR of 10 to 1.

Now very few hams have the patience and/or equipment to properly tune a very long yagi for optimum forward gain, this being no simple task. At this point it was decided that a simpler antenna of equivalent characteristics would be highly desirable.

A quick check with George (let George do it? No.) W6OKR, in Larkspur, gleaned us some data on a very interesting little 6-element yagi.

One of these little gems was put together quite easily using ¼-inch aluminum tubing, which was readily available at the local surplus outlet. A quick trip to the neighborhood hardware store netted us some nice ¾-inch aluminum tubing for the boom. After some fast calculations and a little work with the drill and hacksaw, there was a 6-element yagi.

It was tried out and the results were so gratifying that I decided to put up a small array using four of these little gems in a quad stack. This quad-stacked array turned out so nicely that this article was the results!

Gain figures are not too easy to determine accurately at this frequency; I'll just say it outperforms the old long beast—and has no problem either!

The stack spacing is 0.85 wavelength vertically and 1 wavelength horizontally. All elements were cut from 1/4-inch aluminum tubing and the booms (as mentioned before) are 3/4-inch aluminum. The elements were force-fitted through 1/4-inch holes in the boom and then the edges of the boom were punched down with a center-punch to lock the elements securely in place without any hardware.

One of the first things you will probably notice is the rather peculiar staggered length of the directors; this results in slightly more gain than would be attainable with tapered directors and is not a typographical error.

The element lengths and spacing distances are shown in Figure 1. Design center frequency is 221 Mc.

The phasing lines were made from 1/2-wavelength sections of transmission line. We used Gonset Silver U line but almost any type of balanced transmission line could be used.

The folded-dipole section of the driven element is made from No. 18 enameled copper wire spaced 3/4 inch from the driven element. Ceramic standoff insulators were used to support the dipole at the feed points. About the easiest method of attaching the dipole to the driven element is to flatten the outer half-inch of the ends of the driven element and drill a hole 1/4 inch in, for a 6-32 bolt. The No. 18 wire can then be fastened either by wrapping it under the bolt or by use of soldering lugs. Be careful to scrape the insulation from the wire to get a good electrical contact.

The front-to-back ratio of the array is approximately 18 db while VSWR at center frequency measures 1.2 to 1. The pattern is needle-sharp in the forward direction, with deep nulls so you can drop out QRM (!). Feedline of 300-ohm or 450-ohm open type is suggested.

Balun Lengths

Many antenna-matching systems use the familiar half-wave balun. But to be a half-wave long, which is necessary for the balun to work right, the physical length must be reduced according to the "velocity factor" of the cable.

So long as everyone used ordinary coax (RG-58, RG-8, etc.), all "velocity factor" figures were the same and you could trust published balun data. However, the new low-loss foam-type coax has a *different* velocity factor — and this may be why your balun doesn't seem to work quite right.

The following table gives balun length, in inches, for the most popular bands for both old and new types of coax.

Freq. (in Mc)	Ordinary Coax	Foam-Type Coax
50.3	77½	91½
52.0	75	88
144	27	32
146	26⅝	31½
221	17⅝	20¾
432	9	10⅝

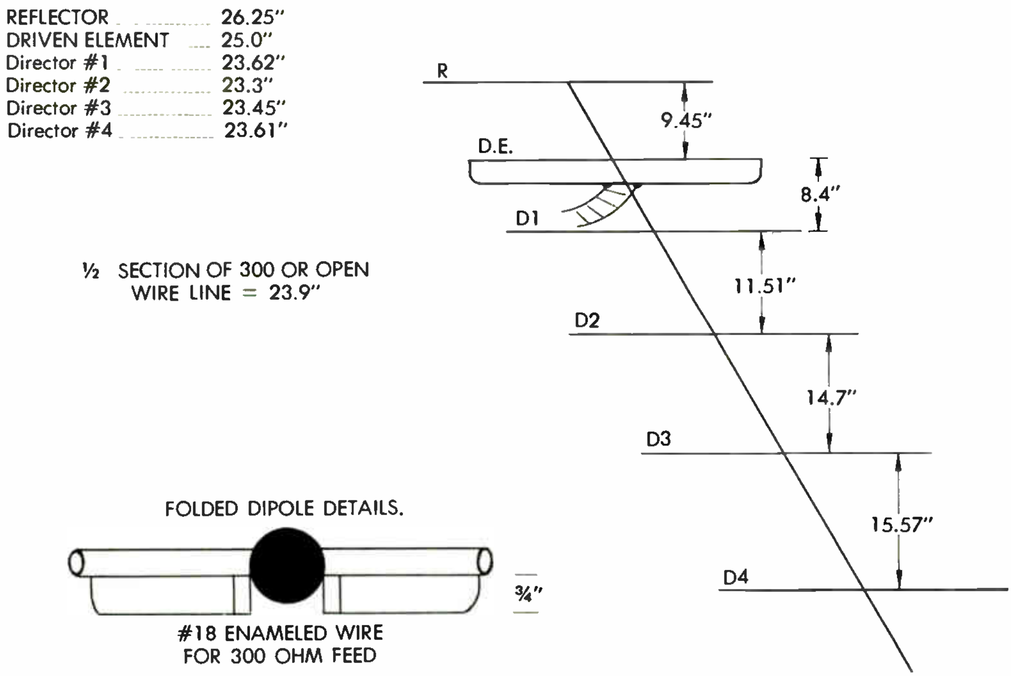


Figure 1. Element Length and Spacing Details

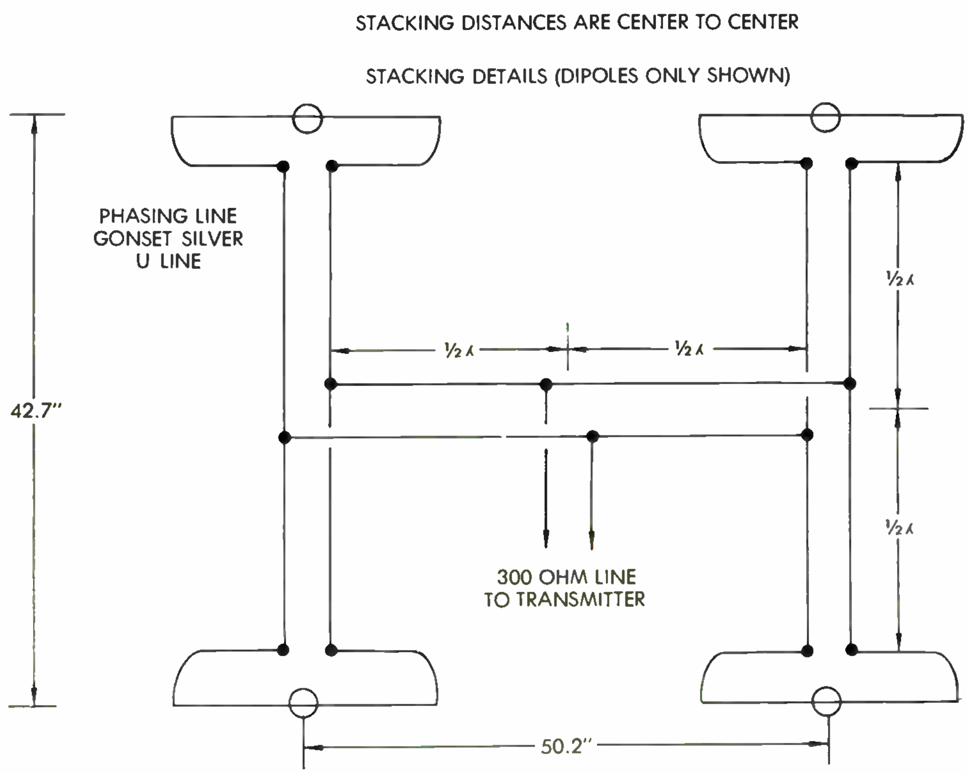


Figure 2. Phasing Harness Construction and Stacking

Antenna Construction

by Paul M. Wilson, W4HHK/A4HHK
Southern Technical Editor
VHF Horizons

During the past fourteen years of VHF operation, the writer has built and used a number of antennas on the 50, 144, 220, and 420 Mc bands. Some were mechanically sound and worked well electrically, while others ended up in the antenna graveyard on the back side of the lot.

Experience has shown that certain construction techniques are reliable. It is the purpose of this article to pass on some tips and recommendations that have been employed successfully at this station. They are not to be taken as the "only way to skin the cat", but tried and proven construction employed personally.

All-metal construction is a must. Wooden frames and supports are difficult to build to close tolerance and cannot be maintained in this condition because of the effects of time and weather. In addition, all-metal construction is safer from the standpoint of grounding for lightning protection.

Metal parts such as U-bolts, brackets, screws, bolts, etc., should be sprayed generously with a clear plastic spray such as Krylon or painted with metal primer paint. The latter is available in spray cans, also, for small jobs as well as in larger quantities, and comes in a choice of two colors, red or green.

Construction using tubular booms and framework offers minimum wind resistance, but it can result in other problems. Mounting several elements in line along a tubular boom requires great care in construction. The use of V-blocks for holding the boom while drilling the element mountings holes does *not* insure that all of the elements will be precisely in line when the job is finished. For the amateur who is not a machinist one solution to the problem is the employment of square boom stock.

A drill press is a must, in any event, if one is to drill holes "straight through" the boom and to the size producing a tight fit that requires the elements be forced through by tapping gently on one end with a wooden hammer. With the element centered in the boom, a pilot hole is drilled through the boom and one wall of the element tubing. A sheet metal screw is then run through the boom wall and element wall. The tip of the screw does not penetrate the opposite wall of the element tubing, but approaches it. The head of the screw should be sprayed or painted to prevent rusting.

There are other methods for mounting elements such as cast aluminum brackets (for tubular booms) and soldering techniques. The brackets are well suited for 50 Mc antenna construction. On 432 Mc where elements lengths and diameter are small, copper tubing or pipe booms and hard drawn copper wire elements can be assembled by drilling and soldering.

A rule of thumb in determining the boom size and element diameter (where square boom stock is used) is to make the dimension of the square tubing twice the element diameter. For example, ¼ inch diameter elements, suitable on 432 Mc, would mount with ½ by½ inch square boom.

On 144 Mc a 32 element collinear-broadside array has been in use continuously for the past nine years at this station that employs 1 x 1 inch square booms and ½ inch diameter elements. To date all elements are still intact, and in line, despite severe windstorms encountered during the annual tornado season.

One half inch diameter elements have been used successfully in six meter arrays. They have held up well, but do have a slight amount of droop, and perhaps five-eights inch or three-quarters inch diameter elements would be desired.

Element diameter is not critical (electrically) in collinear-broadside arrays, but is extremely critical in yagi construction, especially on 144 Mc and higher.

The addresses of firms in your city handling aluminum stock may be found in the

yellow pages of the telephone directory, or write to: Dick's, 61 Cherry Ave., Tiffin, Ohio, for his list of tubing, angle, channel, and sheet aluminum for amateur construction.

One weak point in any array is the connection of the phasing line or feed line to the element. If possible, solder lugs should be avoided. They have a habit of flexing and eventually fatiguing . . . breaking loose.

One solution is to use No. 12 or No. 14 solid copper wire for the phasing lines. At the point of connection, the end of the wire is scraped clean and formed into an eye. A machine screw with flat washer under the head is run through the formed eye and then the hole in the elment wall. On the inside of the element an internal washer and nut complete the connection. The final step is to spray with clear Krylon or paint with metal primer.

On 432 Mc where the element diameter may be one-quarter inch, the end of the element may be flattened for a distance of about one-quarter inch, and the hole drilled through both walls. The flattening should start gradually to avoid cracking the aluminum. A vise is used for this job.

If solder lugs *must* be used, secure extra heavy ones, or double up on two normal-thickness lugs. The element ends should be corked or sealed to cut down on wind noise (neighbors dislike antennas that whistle) and keep out rain. During winter weather water trapped inside an element may freeze and burst the tubing.

Another problem is the support of phasing lines. They must be supported frequently or they will sway and flop when the weather is windy. Excessive movement will lead to the breaking of solder lug connections and/or polystyrene insulators.

On 50 Mcs and 144 Mcs phasing lines made of No. 12 solid copper spaced one inch, center to center, have held up well where properly supported. Kilowatt type 300 ohm tubular line may be used for phasing sections, but it, too, must be supported adequately or conductor fatigue will occur at the connection point. In addition, the "uphill" end should be sealed (with poly rod and dope or poly material) to keep out water and the "down-hill" end left open to allow the tubing to "breath". Otherwise, moisture will build up inside.

The same practice must be followed where this type of line is used for the feedline. should be formed on the outside with a small Where the line enters the house a "drip loop" opening cut in the underside to permit collected moisture to drain out. Care should be used to avoid cutting the conductors when doing this.

Some amateurs have had mysterious results where tubular line was used and moisture could build up. The strength of local signals would vary considerably from time to time. Some of the inexpensive TV type hardware is well suited for phasing line support . . . but not all. The type affording minimum capacity to ground is desired. Care must be taken to preserve line balance to the metal frame and mast. These stand-offs tend to rust easily, so should be sprayed with clear Krylon or painted.

A phasing line trick worth remembering is that the line repeats the load impedance every half wave. Because of this, the exact impedance of the line is not critical if line length is a multiple of a half wave.

This characteristic may be used to good advantage at times. The writer's six meter beam has a 200 ohm feed point. A half wave section of phasing line (no. 12 spaced one inch) carries this 200 ohm load down the mast to a conveniently mounted balun. The balun, made of RG-8U coax, transforms the balanced 200 ohm load to an unbalanced 50 ohm value. RG-8U is run from this point to the shack. A bracket supports a small plate for mounting the SO-239 connectors to which the phasing line, feedline and balun section connect. The connectors of the coax line and balun section are taped with poly tape and sprayed with Krylon after being screwed up tightly. The use of connectors to head up the ends of the coax makes it easy to connect or disconnect and facilitates weather-proofing.

The length of the half wave section of coax for the balun may be safely determined by formula for 50 Mcs work (66% of 114 inches); for 144 Mcs and higher, it is recommended the length be checked with a calibrated grid-dip meter with the coax fittings (plugs) on the cable. The line should be an electrical half wave for the middle of the band in question or the frequency of operation, depending on the amount of frequency changing employed.

(Turn to page 37)

1296 Mc

by Bill Ashby, K2TKN
Box 97
Pluckemin, New Jersey

Everyone who has managed to get a watt or two of power above 1000 Mc forgets all about making contacts for a long time. The possibilities for antenna design are countless and very intriguing. The fact that high-power, narrow beam-width antennas can be built with a few scraps of wire and a soldering iron, with plenty of space in the average room to make all kinds of experiments, is too interesting to pass by. Simple test equipment is not hard to build, accurate enough to show relative gains of various combinations, but exact values in actual db are very difficult to come by.

Ten years of work by numerous amateurs have produced the following deductions about antennas for 1296 Mc and up:

1) Yagi types will work, but are very difficult to put on frequency. Attempts to scale down dimensions from lower frequencies do not normally produce good results.

2) Driven arrays of dipoles, so-called co-linears, etc., are easily built, matched, and capable of medium gains (approximately 18 db) before multiple-matching problems catch up. Frank Jones, W6AJF, in his VHF handbook, has excellent designs to start with.

3) Rhombics, V-beams, and other long-wire arrays can be made to work, but directivity and gain leave much to be desired.

4) Helical antennas are excellent, easy to build and match. An informative article recently appeared in QST. The predicted reduction in gain when working with a linear antenna does not show up in practice.

5) Above 1000 Mc, passive reflector antenna arrays really start to work. A 90-degree square corner, 12 inches on a side, with a "bow-tie" driven element, cannot fail to give 10 db gain. Careful adjustment of the driven element, feed and matching, plus postion in relation to the reflector, will produce 13 to 14 db gain. Stacking four of these wide by four high is practical and will produce gains in excess of 28 db.

Like all multiple-feed arrays, the major problem is getting exactly the same amount of power, in exactly the same phase, to each driven element. For gains in excess of 30 db, the only practical method known is to use a horn or circular parabola.

High-gain horns are not efficent from the size or weight aspect, but small horns make excellent feeds for parabolas. The feed problem eliminates the possibility of using a cylindrical parabola, but parabolas of revolution are easier to build anyway. Excellent reflectors have been made by amateurs using plywood, aluminum, or steel, up to 26 feet in diameter.

The curve necessary for the ribs of the framework is easy to derive, without any complex mathematics — all that is needed is a steel wire or measuring tape and a square. Decide what will be your focal length. This is the distance your feed will be in front of the dish. 50 percent of the desired diameter works out very well in practice (this is known as a 0.5 F/D parabola).

Lay out this line full scale on a fairly flat surface, such as your basement (or garage) floor. Mark the focal point "A" and the other end "B". Lay out another line absolutely perpindicular to A-B and inter-

EDITOR'S NOTE: We went all-out to be sure you had good information on 1296-and-up antennas in this issue. We contacted everyone we knew of working in this region and solicited contributions. By press-time, it was obvious that we were getting snowed under. Because it offers a number of new and intriguing ideas, we're featuring this month Bill Ashby's collection of tips. Next month, we'll hear from the West Coast as W6MMU, Don Goshay, presents his ideas ,including another, different dish feed system) and K6GKX, Ralph Steinberg, of the Microwave Society of Long Beach, tells how to build a colinear dipole array for 1296 in a matter of minutes. If you get infected by the bug and decide to forsake such "DC bands" as 6 and 2 in favor of the exciting region above 1000 Mc, let us know. And we'd like to see some snapshots of any dishes built as a result of these articles — who knows, that might make for a couple of interesting pages some time next spring!

—K5JKX

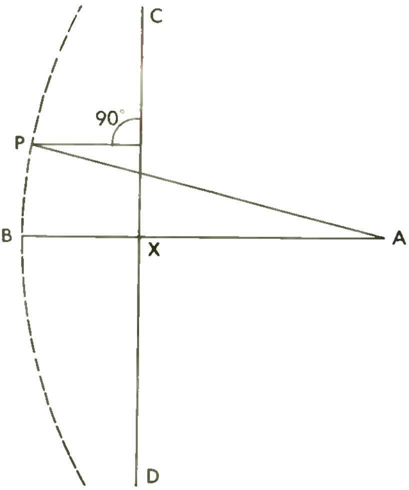


Figure 1

secting it at about 1/3 of the way from B to A. Mark the intersect point "X" and the ends of the second line "C" and "D". C-D should be a little longer than the desired diameter of the dish.

Drive a nail at point A, and attach one end of the steel tape. Then stretch the tape to point B and back to point X. Mark the tape well here, for this distance (A to B to X) now is our standard length. Using the square to always keep the tape perpindicular to line C-D, move the marked point of the tape from X out toward C or D. The point where the tape folds ("P" in Figure 1) to go back to point A is always a point on the actual curve of the parabola.

The focal length is fixed, but any diameter can be had by drawing a line parallel to C-D that intersects the parabolic curve at the desired diameter.

As you can see, any energy leaving the focal point A that reflects from the parabola will be in exactly the same phase as any other. You have ray-traced your design full scale, and it always works. A plywood template is drawn, and the rest is easy.

I have used yagis, square corners, dipoles with reflectors, slot, and horn feeds for various dishes; all with success of some sort. However, a horn antenna, designed so that the 3-db points of its pattern fall just outside the edges of the dish, always gives maximum gain. My 0.5 F/D 20-foot diameter dish with a good horn feed (9 inch square opening) allows the feed to be as much as 12 inches off the true feed point before any gain decrease is noticed.

(Turn to page 23)

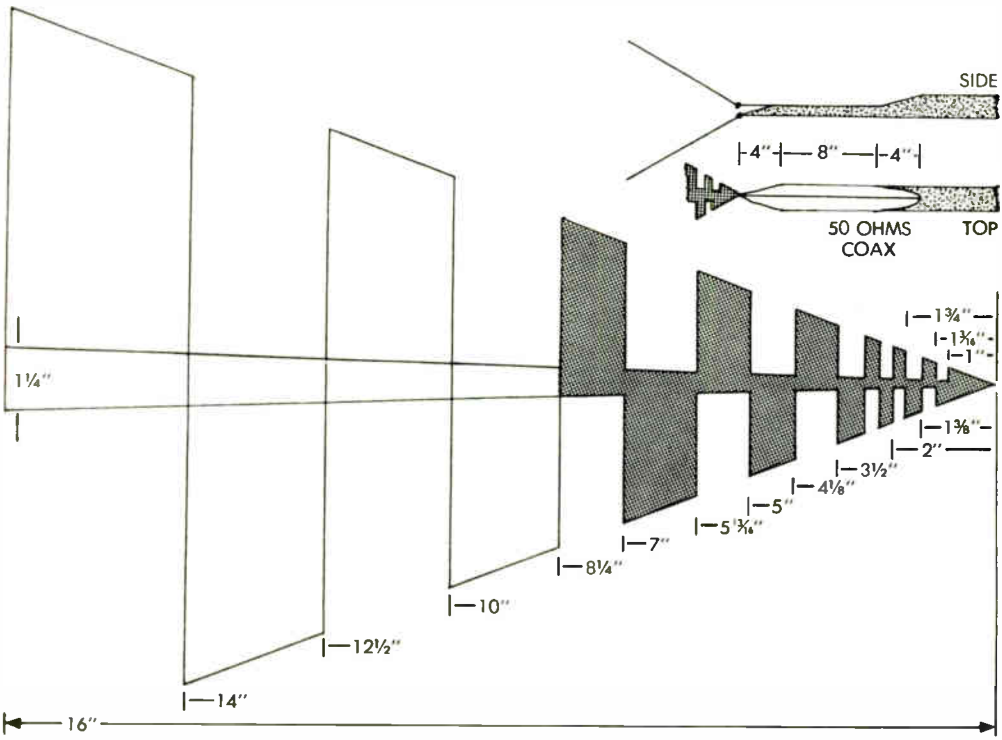


Figure 2. Log-Periodic Feed for 400-2500 Mc

3300 Mc (and up)

by George F. Tillitson, K6MBL
462 East Grove Street
Pomona, Calif.
(holder of one end, 3300-Mc record)

This article, although directed toward the 3300 megacycle band, is applicable to the 2400, 5700 and 10,000 megacycle bands as well. It is written not as a construction article, but as a guide to present and future microwave enthusiasts in their antenna selection and design.

At 3300 megacycles, the 9 centimeter wavelength is small enough to make almost any type of antenna possible. The problem is to select the most practical type for amateur use on 3300 Mc.

Since most 3300 Mc amateur operation is performed with microwave power output in the 100 milliwatt region, a high gain antenna system is necessary. Low power operation allows pola-plexing or simultanous transmission and reception using transmitting and receiving antenna polarizations at right-angles to each other. The pola-plexer provides a waveguide feed system for the antenna. (More on this later).

The parabolic reflector and the conical horn appear to be the most practical antenna types for use on the 3300 Mc band. Both types are broad band antennas, require a minimum of elements to adjust and will support a dual polarization type communicatons system.

The parabolic reflector, or "dish", will produce a directional beam, following the laws of optional reflection. It is a type of mirror having a focal point located along the center axis (Figure 1). When a source of microwave energy is situated at the focal point, illuminating the parabolic reflector, the energy will be reflected in such a way that it travels outward and parallel to the axis of the reflector. The reflector size determines the forward gain of the parabolic reflector.

In other words, the larger the diameter of reflector, the greater will be the forward gain and the smaller will be the beamwidth. For example: an 18 inch diameter parabola at 3300 Mc will provide 21 db gain over an isotropic radiator, with a beamwidth of approximately 14 degrees. An 8-foot diameter reflector at the same frequency will provide a 36 db gain and a 2.5 degree beamwidth.

Before you run down to the local surplus emporium and purchase that eight or ten foot radar antenna, consider the problems involved with the larger size reflectors. Besides having high gain capabilities, they also have

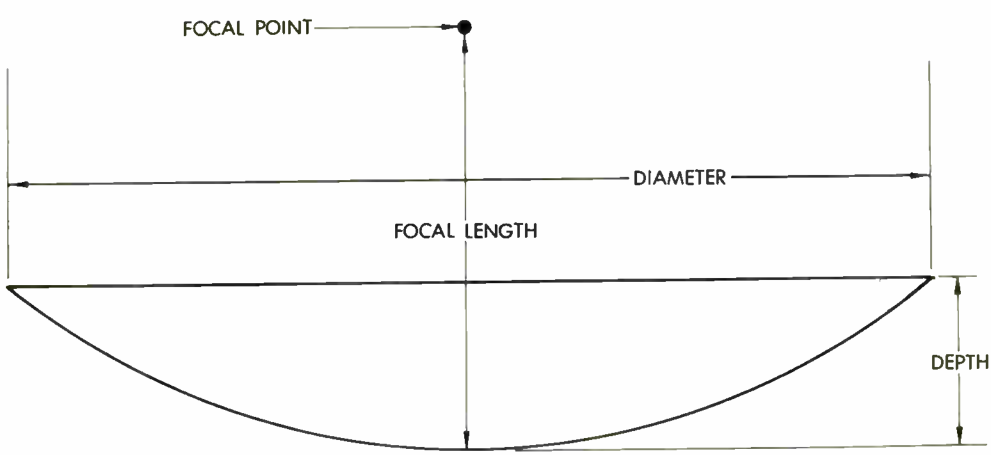


Figure 1. Parabolic Reflector

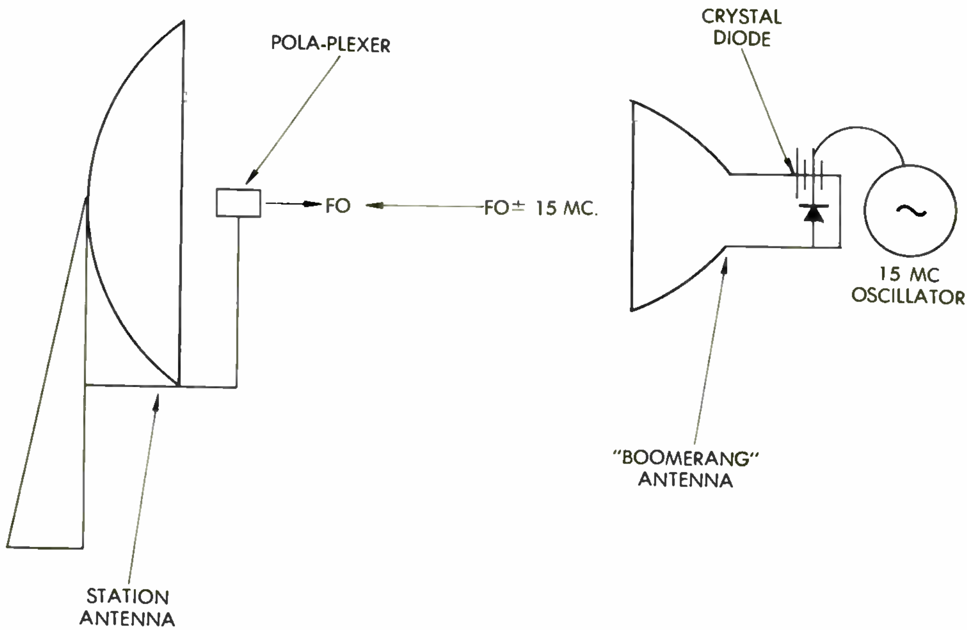


Figure 2. Boomerang Focus System

greater weight and wind resistance. A solid eight foot parabolic reflector can place over 1000 pounds of torque on your rotating system in a 70 mph wind. A four footer can produce 260 pounds of torque under the same conditions. A perforated reflector will decrease the wind resistance, but will limit the reflector's efficiency at higher frequencies.

I have found that a four-foot reflector is about the largest that one man can handle easily. I have mine mounted on a sturdy surplus light tripod capable of being operated as a "mountain-top" portable unit or placed on my garage top for fixed operation. The method of mounting the reflector will be left up to the ingenuity of the individual, as each reflector presents a different mounting problem.

The feed system for the parabolic reflector must be placed precisley at the focal point for maximum forward gain and minimum sidelobe structure. A simple equation that can be applied to the reflector to find the approximate focal point is: FOCAL LENGTH = DIAMETER SQUARED / 16 x DEPTH. The feed can be placed at this point and experimentally adjusted for optimum performance.

Several methods can be used to optimize the focal point, but I believe the best is W6IFE's "boomerang" system. This consists of a transistorized crystal controlled oscillator modulating a microwave crystal diode placed at the feed point of a remote antenna (Figure 2). The transistorized oscillator operates at ½ the communications *if* frequency, 30/2 Mc or 15 Mc in our case. The transmitting klystron radiates from the feed to be adjusted, toward the "boomerang" antenna. The CW signal, intercepted by the "boomerang" antenna, is AM modulated at a 15 Mc rate by the crystal diode. Thus, a signal containing the original carrier and two 15 Mc sidebands (which are 30 Mc apart) is reradiated back to the station antenna.

The receiver mixer detects the 30 Mc difference signal and passes it to the 30 Mc *if* amplifier and signal strength meter.

Since the detected signal is twice the "boomerang" oscillator frequency and the amplitude is proportional to both radiated power and receiver sensitivity, we have a

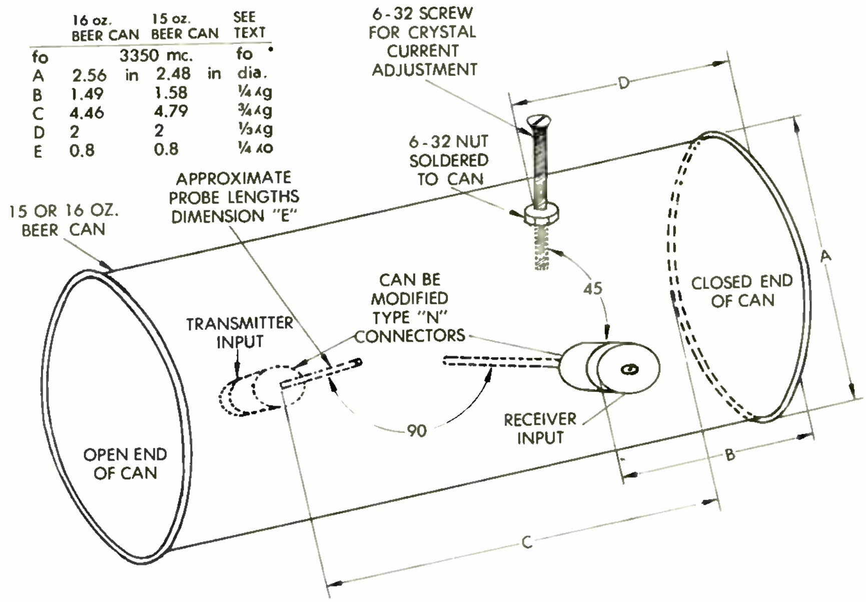


Figure 3. Polaplexer Construction Details

stable *if* signal that will indicate maximum signal strength when the feed is optimumly placed at the reflector's focal point.

When performing the above focal adjustment, the distance between the station antenna and the "boomerang" antenna, in feet, should be greater than 1.41 x 10^{-5} x frequency in Mc x reflector diameter in inches squared. For example: the minimum distance between the "boomerang" antenna and a four foot parabolic reflector at 3300 Mc should be 107.2 feet.

Dimensions for use of common 15 or 16 oz. beer cans for basic pola-plexer construction are included in Figure 3. For those energetic souls wishing to compute their own dimensions for this band or others, the procedure is as follows: Select a waveguide whose diameter in inches falls between 6917 / fo and 9035 /fo, where fo is the operating frequency in Mc, preferably closer but not equal to the later equation. This will assure that the TE11 circular wavequide mode will dominate and no spurious waveguide modes will exist. Then compute the waveguide cutoff frequency (fc) by equating fc = 6917 /dw, where dw is the waveguide diameter in inches. Now compute the guide wavelength, $\lambda g = 11803 \; / \; fo \times 1\text{-}(fc/fo)^2$. λg is the guide wavelength in inches. Now apply λg to the third column in the dimension table in Figure 3.

The use of type "N" connectors terminating the probes is not the only way to couple energy in or out of the pola-plexer. A 726A klystron, for example, can be mounted directly on the pola-plexer (see QST, Dec. 1957, June 1958 and Aug 1960) with an extended klystron probe directly exciting the waveguide. The receiving probe can be replaced by a mixer assembly within the pola-plexer. Many other modifications can be made to the basic pola-plexer dependent upon the availability of components and the cleverness of the individual.

Since it is necessary that the transmitter look at the other fellow's receiver, it is suggested that the transmitted signal polarization be 45 degrees to the right of vertical looking in the direction of transmission. This will eliminate the classic argument about who is to transmit horizontally and who vertically with the pola-plexing system. Also when you complete your 3300 Mc station, you can more easily communicate with me.

This should serve to acquaint you with some of the antenna techniques used on 3300 Mc and other microwave bands. If there is sufficient interest in these antennas or in the crystal controlled klystron "ROCK-LOC" systm in use by members of the San Bernardino Microwave Society, more can be published by prodding the editor of *VHF Horizons* via Uncle Sam's Postal Service.

Antenna Height

By Alan T. Margot, W6FZA
Communications Engineering Co.
167 Leggett Drive
Porterville, Calif.

Did you ever wonder why, on six meter E openings, the follows with the high antennas sometimes beat out those with the low ones, and sometimes vice-versa?

Did you ever wonder why some stations who do quite well on sporadic E take a back seat on tropospheric work?

I used to wonder too, and would set my mind at ease by muttering phrases like "ground reflections" and that old favorite "angle of radiation" and the like.

Recent efforts in the line of ionospheric scattering, however, drove me to the point where I felt that maybe these vague things could be put to use in actual communication instead of just as excuses for strange behavior of signals. A check of the available information on the subject in the ham magazines and technical periodicals yielded practically nothing.

Maybe everybody knew about those things so no articles were necessary. Everybody but me, that is. After a few well-guarded statements and questions I found, with relief, that we were all in the dark when it came to actual facts and figures concerning these matters.

Some plowing through the old textbooks revealed that the signal coming from an antenna operating in the general vicinity of the ground is the sum of the direct signal, and the one reflected from the ground. The reflected signal is slightly delayed due to the extra distance traveled. At certain angles from the horizon these two signals arrive in such a time-phase relationship as to add and double the field strength, and at other angles they can cancel completely. Doubling the field strength is a power gain of 4, or 6 db.

Determination of these angles, assuming good ground reflection, is pure geometry. A typical pattern for a horizontal dipole operating 4 half waves (39.4 feet on 50 mc.) over smooth earth is shown in Figure 1.

But, you say, "I don't use a horizontal dipole, I use a four element yagi". The vertical pattern in this case would be the product of the solid line and the free space pattern of the four element beam.

The result is to increase the size of the lower radiations, or lobes, and decrease the size of the higher ones. It does not, however, change the angles of the nulls and maximums at all. They are determined by the height of above ground alone.

Multiplying the solid dipole pattern of Figure 1 by the handbook pattern of a four element yagi yields the dashed pattern. Actually, the ground reflections will be something less than complete, except possibly over salt water, so full cancellation and 6 db reinforcement will not be achieved.

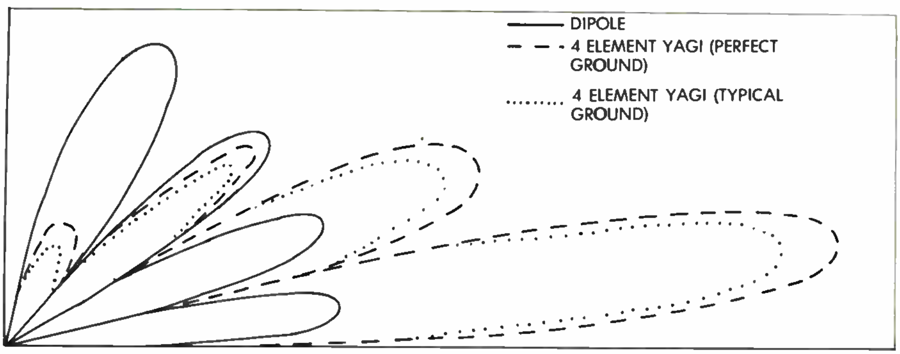


Figure 1. Dipole Reflection Angles

The ground reflections vary with type of earth and moisture content, but they are considerable even over the worst types of earth. Imperfect ground reflections might change the pattern further to look like the dotted lines of Figure 1. Pronounced maximums and minimums do exist, and if we understand what they do to us we can use them to advantage.

Since 50 Mc signals are reflected back to earth by the E layer of the ionosphere like a billiard shot, for every angle there is a corresponding distance where the signal returns.

Transferring these vertical patterns into actual earth distances requires slightly more complicated geometry because of the curvature of the earth. At this point, two variables are introduced: the effect of refraction, and the variable height of the reflecting layer.

The bending effect of normal atmosphere is known, and the upper and lower limits of the E layer are known, so two sets of calculations yield the chart of Figure 2.

The first figure in each spot is for a minimum layer height of 70 miles, and the second is for a minimum height of 50 miles. Because of the variable height of the E layer, there is no point in trying to improve the accuracy of this information. The chart does show some interesting things, however.

The chart also shows that we are donating a lot of power to space. Except in the higher antennas, only the first lobe is useful in VHF work. With horizontal antennas there is always one lobe for every halfwave of antenna height. This means that the fellow with the 70 ft. antenna (on 50 mc.) is shooting six useless lobes into the sky. The more directive the antenna, the more juice in the first lobe, hence the trend toward bigger antennas.

Note that there are a few cases that seem to contradict the old idea of getting the antenna up as high as possible. For example, from Figure 2, at 700 miles a 40 ft. antenna could quite possibly outperform any other up to 100 ft. Generally, it appears that the lower antennas can hold their own against the higher ones in average sporadic E situations.

Figure 3 is a similar chart for ionospheric scattering, based on an average scattering height of 50 miles. This height and the corresponding distances are for the center of the scattering region (36-60 miles). The scattered signal differs from the E reflected

FIGURE 2 PERFORMANCE OF 50 MC. ANTENNAS AT VARIOUS SPORADIC E DISTANCES E LAYER HEIGHT — 70-50 MILES

Ant. Ht. Halfwaves	Ant. Ht. Feet	−3db	0db	+3db	+6db First max	First Null	+6db Second max
2	16.68	1150- 920	1020- 780	830- 630	500-350	———	———
3	29.52	1260-1040	1160- 940	1040- 800	650-550	———	———
4	39.36	1330-1100	1240-1020	1120- 900	850-625	500-350	———
5	49.2	1350-1120	1280-1070	1190- 960	910-700	600-430	———
6	59.04	1390-1170	1340-1120	1240-1020	1010-800	700-500	500-350
7	68.88	1400-1180	1360-1120	1280-1050	1080-850	780-580	580-420
8	78.72	1420-1200	1370-1150	1300-1070	1130-900	850-625	640-450
9	88.56	1450-1220	1390-1170	1330-1100	1160-930	880-670	750-550
10	98.4	1500-1250	1480-1220	1360-1100	1180-950	925-725	820-650

FIGURE 3 PERFORMANCE OF 50 MC. ANTENNAS AT VARIOUS IONOSPHERIC SCATTER DISTANCES CENTER OF SCATTERING — 50 MILES

Ant. Ht. Halfwaves	Ant. Ht. Feet	0db	+3db	+6db First Max	First Null	For 6db angle Distance to Ground Reflection
4	39.36	920 mi.	850 mi.	590 mi.		320 feet
5	49.20	1000	920	700		495
6	59.04	1060	970	760		715
7	68.88	1080	1010	820		980
8	78.72	1100	1025	850	590 mi.	1270
9	88.56	1125	1040	900	625	1600
10	98.40	1150	1075	920	675	2000

one in that fragments of it arrive from all parts of the scattering region, while the E reflected signal usually arrives from one particular height in the E region.

Figure 4 is a plot of db antenna gain (relative to free space) against the very low angles from the horizon, for several common antenna heights. Sporadic E distances range from around 750 miles for 30° to about 1400 for 0.5°.

Of particular concern to the operator interested in long haul Es and tropospheric work is the performance of antennas in the 0.25° to 0.5° region. Energy radiated at these extremely low angles is bent to travel horizontally by refraction. The results of these curves are dramatic and obvious, and can be generalized by saying that you gain approximately 6 db in a horizontal direction every time you double the antenna height.

The man with the 100 ft. tower is almost 15 db better off shooting horizontally than the one with the same antenna just off the roof. No wonder the high antennas work all the groundwave DX! And this advantage continues up to over 32 halfwaves high (300 feet at 50 Mc) if we neglect the effects of line losses.

These advantages would not be wholly realized if (1) you were shooting over hills nearby, (2) there were abnormal bending conditions, or (3) the path were line of sight. Bear in mind that the ground reflections that form the 0.5° radiation angle occur about 115 times the tower height away from the antenna!

There are other important reasons for getting the antenna up in the air. Useful energy is absorbed from low antennas by surrounding objects. Gain antennas depend on phase relationships of the currents in the various elements, and reflections from nearby objects can induce currents which upset these relationships. A perfectly good antenna can give a queer pattern when mounted too low. These factors are difficult to analyze quantitatively, but antenna handbooks always suggest that antennas be mounted "free and clear" of surrounding objects.

The information in this article just scratches the surface of this interesting subject. If any reader desires more information, or solution of a particular problem please communicate with me. If you hear me on six and my signal is weak, it's probably one of those darn nulls again!

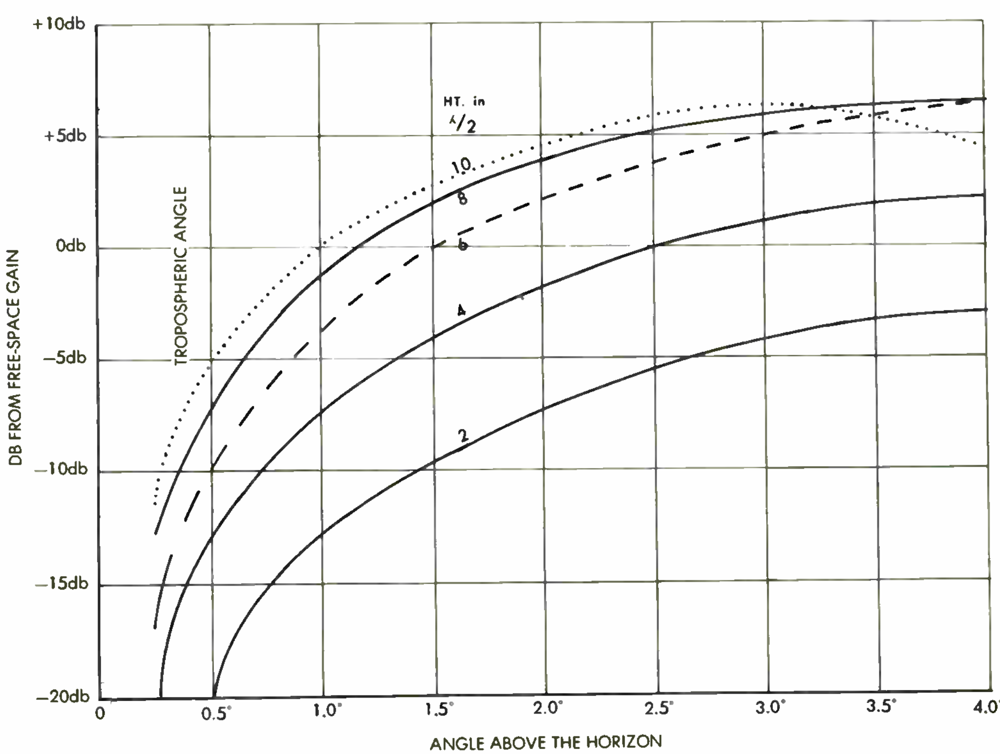


Figure 4. Antenna Gain at Common Heights

Salvaging Old TV Rotors

Every VHF antenna in practical use must have some means for rotating it — and it's here that many constructors run into a big problem.

If you're willing to go out and spend a hundred dollars or more, there's no problem at all. The CDR HAM-M model, a couple of Telrex jobs, and one made by Johnson all serve admirably in the upper price brackets.

Less expensively, a number of TV rotors which will handle medium-size 6-meter beams, fairly large 2-meter arrays, and all but the most gigantic of antennas for higher bands can be bought for between $15 and $50.

However, that's still a good-sized chunk of cabbage for those of us who must cut our hamming budget as thin as a Harvey House ham sandwich!

Fortunately, there *is* a source of supply of rotors for $5 or so if you just take a little extra time and trouble.

This source is born in the fact that most home TV-pole installations are not the best, from a mechanical-engineering standpoint. Comes a good-sized wind, and down falls the pole.

When this happens, the antenna ends up as a tangled mass of tubing — and the insurance adjustor comes in and writes the whole set-up off as junk.

Usually, in such an event, the rotor survives the fall. But knowledgable TV repairmen snaffle off the good rotor-control head pairs which show up by this route. The ones left for us hams usually consist of only a rotor mechanism, sans control head or instructions.

Most people pass these by — and when they do, they pass up a bargain. Because almost all TV rotors operate in much the same manner, and it should take you no longer than 15 minutes to put any rotor back in service (less time if you have a control head, even if it doesn't match the rotor you have).

Virtually all TV rotors operate on 24 volts AC, using the split-phase principle to give you direction control. This means that a simple control head consisting only of a 24-volt transformer, a DPDT-center off or a DP3T switch, and a big capacitor will work with any of them.

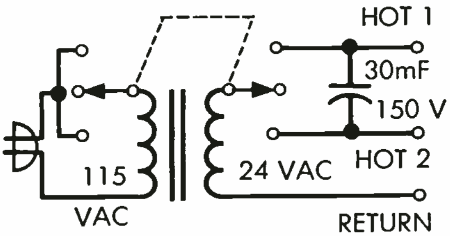


Figure 1

Note that the control head (schematically shown in Figure 1) has only three output wires. Most rotors have from 4 to 8 wires in the control cable. The other wires are for position indication — and that's something this salvage control unit won't help with.

Most practical approach to the problem of position indication is to use a synchro (generally termed Selsyn, though this is a trademarked trade name) system to drive a pointer at the control location.

To determine which three of the wires coming from the rotator you should connect to, take your trusty ohmmeter in hand and measure the resistance between pairs of wires.

Eventually you should come up with three wires, two of which show a low (20 to 200 ohms) resistance from each of them to the third wire, with just twice that resistance reading between the two themselves.

These two wires are the two motor "hot" windings, while the third wire is the "common" motor return. The two wires connect to the two ends of the capacitor, while the third wire connects to the remaining terminal on the control head. If you find the rotor turns the wrong way when you operate it, reverse the connections of the ""hot" wires and it will reverse. —K5JKX

1296 Mc . . . from p. 15

Recently, the log-periodic type of drive has been tried with excellent results. The log-periodic antenna by itself is not much for the amateur, but placing it in front of a square-corner or a good parabola produces a *fantastic* array. The six-foot dish pictured with the log drive stays within 30 to 80 ohms and holds a good pattern from 400 Mc through 2500 Mc!

All forms of dipole antennas are based on electrical length of something, but a log-periodic antenna is based on proportion and angles, not finite lengths. Theory is non-existent in practical form, but certain kinds of log-periodic antennas are capable of uniform patterns and impedances over 100-to-1 frequency ranges. 10-to-1 is easy! They can be fed with open-wire or by use of a common form of balue from coax. See Figures 2 and 3 for one very crude version; this is the broadest-band antenna with gain that it has ever been my pleasure to work with. Log-periodic antennas can be readily scaled up or down in frequency, and of course the parabola works from audio frequencies up . . .

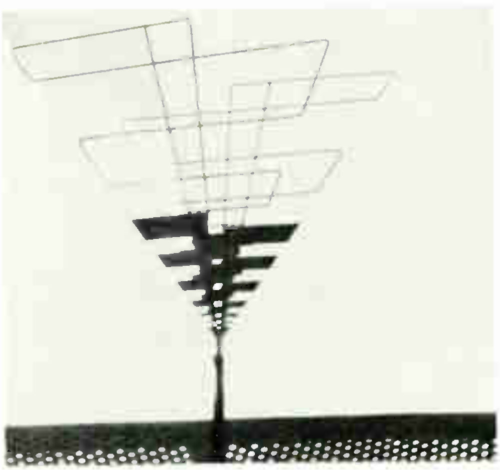


Figure 3

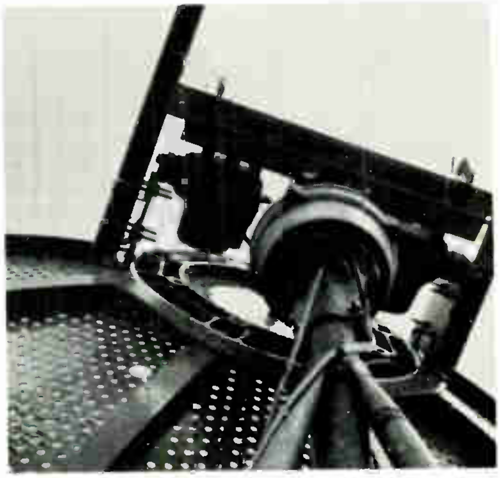


Figure 4. Dual Rotor Arrangement

Figure 5. Dish is Parked Straight Up

The other photos are of the alt-az mounting using one good rotor and two TV types sawed off and mounted by angle brackets on top of the first. This makes a rugged, easy mount that will handle a counterbalanced six-foot dish with ease. By parking the dish straight up when not in use, no wind problem is encountered, even at 70 feet!

Any high-gain antenna with less than 10-degree beam width should have electrical elevation built into the mounting. Plus or minus 10 degrees of tilt, controllable from the operating position, makes a world of difference on local contacts, and if you are going to do that, make it from minus 10 to plus 90 degrees while you are at it. If any moon work is contemplated, start by building a good Polar mount. Failure to believe this has cost me three years of hard work — I believe it now! Without a motor-driven, accurate Polar mount, you are just wasting everyone's time and effort.

This could go on and on, but once you get interested you will find a great deal has been written about antennas. The VHF handbooks detail the common types and periodicals leak out info on the exotic ones. All are of interest when you reside above 1000 Mc.

—K2TKN

VITAL HAPPENINGS & FACTS

OPERATING AND DX NEWS

HEARD IN FLORIDA

Remember the VHF contest sponsored by the League back in June? Were you on six meters around 1800 CST (1900 EST)? Perhaps you heard W5KHT announcing (in a somewhat quivering voice) "QST-QST to any two-meter equipped stations . . . it appears that two meters is open in Florida and the Carolinas from Oklahoma. We are tuning 144 to 145 megacycles at this time at W5KHT. Anyone want to try it?"

The 50 Mc operator was 5KHT, Coop. An old hand at sporadic E propagation, Bob detected what he thought sounded like skip sufficently short on 50 megacycles to support a 144 megacycle path of around 1,000 to 1,200 miles in a line to Florida and the Carolinas.

Russ, W5HCX, had the contest rig on two meters at the time, calling CQ. The peak in Es ionization on six meters lasted approximately 30 minutes, from 1745-1815, according to the contest log. On 50 megacycles we were working Arkansas and southern Missouri at the time (300-400 miles) with outstanding signals. We heard stations in Tennessee working stations in Florida and the Carolinas.

No station answered our calls on 50 megacycles (skip was apparently so short as to shut us out of Florida and the Carolinas) and Russ, W5HCX, was having nil luck on 144. At 1755 CST he called and worked W7JCU/5 portable in Oklahoma City.

And we forget about the incident because there had been many-many other "it looks good for 144 megacycles Es occasions" in the past, which did not pan out.

Recently we received a letter from John, K4IXC, of Melbourne, Florida. Melbourne is on the eastern coast of Florida, approximately 90 miles south of Jacksonville.

It began "Dear Bob — On June 9 (at) about 1855 EST on 144.208 Mc I heard a phone signal which I identified as W5THT. Not finding this call in any callbook, I assumed I had made a mistake. He gave his QTH as Oklahoma City, and was calling a W7—/5. I was so surprised I didn't make a note of the W7 call. Recently in talking to WA4DRJ your call was mentioned in connection with VHF Horizons. I then remembered this incident and realized I could have heard W5KHT, and mistaken the call. If it was you, I know you will be interested in this report. The signal was about S-1 when I first heard it, building up to S-9 and then fading down and out. I heard your call 2 or 3 times in the space of about two minutes and had time to set my VFO on your frequency and call between your breaks. I used both phone and CW. No luck. That is my story. Could it have been you?"
Sob.

It could have been W5KHT. It seems rather likely it was. Our operating frequency was 144.208 megacycles (on the nose no less — you must have *some* VFO calibration, John!) throughout the contest.

How did we miss K4IXC? For one thing, we were not listening on our own frequency, nor were we VFO.

John's 100 watts on phone might not have made the grade but his 800 watts CW surely would have. Operator Russ (HCX) says he promises, on a stack of 7788's, to *always* check his own frequency in the future when E skip on 144 megacycles seems possible! That takes care of next time. But who will ever forget how we missed Florida on E skip *the first time?*

As with any event of this type, there is at least one lesson to be learned. Many 144 Mc men expected E skip on two meters this summer. It looked like "the year" for it to happen. To the best of our knowledge, this report is the only one for the season that even smells of E skip. But we know, from our logbook of the past summer, that even from our own limited baliwick, we heard five different occasions when E skip got down to the 350-500 mile range on 50 Mc. Any textbook will tell you that assuming a

normal E cloud formation, this is sufficent intensity to support a 1,100 mile 144 Mc path.

So where was everyone who operates 144 this summer? Sleeping, we suspect. Or tied up on six meters. Whatever the case, VHF hopes to explore this subject in considerable detail in the winter ahead. Maybe next summer more of us will be aware of what it takes to work E skip on two meters. Even the best of us need a state or two in the 1,000 to 1,400 mile range.

50 Mc foreign leads off this month. September - October is traditionally the period of the year when we are led to expect at least a few openings into the far-north land. VE8BY (50.040) has been known to come through in southern Canada and the northern States. Now we have detailed word from Jack Reich, KL7-AUV, concerning operation of not one, but two stations in the Artic Circle. KL7FLC can be found on 50.045 megacycles. FLC is located on Arlis 2, at a position 81 degrees north, 163 degrees east. This was his location in mid-August, and it is assumed that with winter coming on, he won't have moved much in the interim. This is roughly 1500 miles from Anchorage, according to KL5AUV.

The operator's name is Bob, and he has been on the air and running a keyer since May. Also on from the Artic Circle is KL7-FLB, operated by Bob Mellen. This is Fletcher Ice Island, known as T-3. The KL7-FLB frequencies are 50.040 and 50.112. Those wanting to write to Bob can direct their mail to "Artic Research Laboratory, Pt. Barrow, Alaska," All of KL7FLB's contacts have been from 0400-0800 GMT to date. KL7AUV advises that he himself is operating his code wheel on 50.084, 200 watts CW. Regular schedules are maintained 0400-0435 GMT for VE8BY, KL7FLB, KL7FLC, KL7AUG and KL7AJ. AUG and AJ are located in Ketchikan and both have recently been helping a great number of W7, W0 and W6 stations to Alaska. Just in case you hear the KL7AUV code wheel on 50.084, Jack's telephone is FA-2-2950 in the Anchorage exchange. It can be direct dialed from most of the 48.

KL7FLB has been working KL7AUV, KL7ECT (Ft. Greenly) with KL7FLC also getting into the act.

From way down south, VHF'er XE1CZ writes "I have been working 50 Mc for 5 months now and have made contact with about 350 different stations. This includes LU, CE, CO, K-W's, KP4's, XE. I have confirmed 25 states and worked 30 to date. I'm the only station working VHF in Puebla, which is located 80 miles SE of Mexico City. Altitude above sea level is 7,200 feet. I also work 2 meters (9 element yagi and a pair of 6146's) and 432 megacycles (10 element beam, crystal converter). My six meter rig runs 50 watts to a 6146, and my antenna is a homebrew two element quad."

50 mc SSB enjoyed a heyday during the Perseids shower (reported in considerable detail for the two meter buffs, elsewhere in this issue). WOPFP took the occasion to catch W5KHT on forward scatter (or meteor scatter) over the 590 mile Ames-to-Oklahoma City path. After exchanging the usual formalities on both August 11 and 12, the two agreed to have at it 0730 CST on 50.110 Saturday mornings in the future.

K4VZU, Alton Morgan, sets us straight on who is operating 50 Mc SSB from Alabama. Al writes "W4JMS, K4UTH, K4LSK, W4CIN, W4ZQM and K4MBM are active currently, "as is he, K4VZU. Take W7UBI off of your active list for SSB. Those that have Keith's Idaho SB card for 50 Mc can count their blessings because it may be awhile before we get anyone to replace him going. Keith became W7UBI/0 in Warrensburg, Missouri in August, where he will be for at least 18 months. No SSB activity is planned however, because the 4-400A power supply was left behind in Idaho. Come on, Keith, don't let a little thing like that stop you!

W7ZQX continues his SSB scatter schedules with the California crew on weekend mornings. George represents the sum total of SSB stations known to be active from the state of Washington. Maybe some of the gang will take heed of last month's issue of VHF and get abuilding during the winter months ahead.

50 mc fone has a strange spell over it. The shock resulting from a sudden drop off in E skip openings has caused a numbness to set in and everyone frozen at the mike! Few still realize that off-season E openings are frequent visitors throughout the country, especially on east west paths south of a line from Norfolk, Virginia west to San Francisco. Watch

those early evening periods. They can be real producers of DX!

K1PDA, Manchester, N. H. found six open from 2310 to 0200 on the 14th-15th of August. The opening was to the west for Dave, with VE4MA, Winnipeg, Manitoba worked. Dave heard K9SSU working VE2-MJ and worked W3BWU and K3ADZ in Western Pennsylvania on short skip. Also heard were many stations in Minnesota and 4, 8 and 9 land. The Manchester lad has 29 states and 1 Province worked. He is looking for 3 of the zero states, all of the 7's, California, the 5's and Maryland and Deleware. Seems that a lot of the western boys should need New Hampshire too, Dave. Just announce where you are when the band opens out that way, and stand back. Gravity should take care of the rest!

144 mc news this month falls in the Perseids department, and the report of E skip reception, both covered elsewhere in this issue. In other than meteor burst land, tropo bending continues to make news, with the likelihood that much more ground wave news will be made as this is read.

K4IXC, Melbourne, Florida has a pair of 4X250B's coasting at 800 watts on two meter CW, crystal on 144.090, or vfo as the need arises. The antenna is a 30 foot long yagi on a crank-up tower which can climb to 100 feet! The converter is a 417A mounted at the top of the tower, with only the *if* output signal coming down the cable to the 75A1 receiver in the shack (Now there's a good idea!). John reports regular schedules with W8QOH/MM who plys between New Orleans and Fall River, Mass., around the cape of Florida and on up the eastern seaboard. Schedule times at 0655 and 2100 EST on CW. Results to date show all-overwater path to 460 miles is no difficulty. IXC has worked QOH/MM several times out to 550 miles in the Gulf, and in the Atlantic, off Cape Hatteras. The skeds run from 20 minutes to a half hour. With W8QOH/MM off the coast this fall, during the annual fall inversion season, a number of interesting contacts are bound to result. His frequency is 144.078. When QOH is out of tropo range for K41XC, the pair continue skeds using meteor burst techniques, 15 seconds on and 15 seconds off. K4IXC is very interested in setting up skeds for the coming fall showers. Those interested can contact him at Rt. 2, Box 684-P, Melbourne, Florida.

Several Florida VHF'ers report the passing of W4DPD of Lake Wales, Florida. The central Florida gang feels this loss as the passing of a friend liked by all, and an avid VHF'er from years ago.

Southern Technical Editor Paul Wilson, W4HHK, noted a new two meter SSB station now active near Huntsville, Alabama. K4ZQM is running a 20A exciter into a home-brew converter ending up with a 4X150 final on 144.102 megacycles. Look for him.

Barry, W4TLV, also reports from Alabama that the night of August 10th was a hot one for the gang in his area. The band was open on tropo into Wisconsin, Michigan, Illinois, Indiana, Kentucky, and Ohio. A 432 megacycle try with W8PT in Detroit proved no good. This was the first north-south opening ir. some time, according to Barry.

220 mc activity is apparently poor only outside of the larger centers of population. W2SEU reports considerable activity in the New Jersey-New York area. Fred reports W2IQR, W2AOC, W2WOF, W2HVL, W2NTY, WA2IFP, K2IQR, K2-IPC, K2DZM, K2AXO, W1NOC, W1MFT, W1AJR, W3CGV, K3IUV and W2SEU active. Fred is currently stationed in Massachusetts but as he notes (as of August 8) "just 317 days until I am out . . . and then watch out!" For the time being his 100 watts into a 22 element beam 55 feet up loads up on 221,400 Mc only on weekends.

W9OVL reports 220 activity is not exactly missing in Chicago. Some 50 stations are active according to Ben, with most of the activity concentrated around 2000-2100 EST Mondays, Wednesdays and Fridays. Ben runs 20 watts for local contacts and 150 watts for DX. He has worked as far west as Omaha during tropo openings, and suggests that those stations outside centers of activity run at least 60-70 watts into a decent beam to be heard.

REPORTING TO VHF

A change in printing dates and deadlines resulted in this column being shorter this month than usual. Dozens of good reports arrived after our *new* deadline, the 23rd of the month. Drop us a note with news of operating and DX in your area. We would all like to see your contributions monthly!

Perseids Report

Although results varied from area to area, most Perseids meteor shower reporters would agree that this year's event was good drill for all involved. A number of 144 megacycle DX enthusiasts added new states and all had an opportunity to put new equipment through its paces.

Comments from actual 144 Mc participants varied from Ernie Brown's (W5FYZ) "This seems to have been the best Perseids shower for the past three years . . ." to W6WSQ's "In general a very poor shower."

The table accompanying this report breaks down some of the results reported up to press time by shower dates and time of contacts. In this case, times are in CST since the majority of path-midpoints were over the Central Time zone.

Our table indicates that things just didn't start happening until the 11th this year. The vast majority of contacts reported occured beween 0200 and 0700 CST, although one occured as late as 1020 CST (W6WSQ to K7IDD on the 12th). Several stations reported hearing strong bursts from other stations, on schedule, in the 2000-0000 CST time period (W5JWL heard bursts from W1JDF, etc.) but bursts were apparently too far between during the evening hours to make a QSO work.

Pure north-south path QSO's and reports of bursts heard concentrate in the 2300-0200 CST time segment. More slanted paths, *i.e.* SE to NW, SW to NE, etc., occured in the 0200-0600 CST time segment for the most part. Due east-west paths varied from W6WSQ to K5TQP in the 0200-0300 CST segment on the 12th to W4VHH-W5FYZ in the 0500-0600 CST segment on the 12th and W4WNH-W0EYE in the 0500-0600 CST time segment on the 13th.

The table does not tell the entire story however. As with any super-human effort (and any participant in the wee-hour Perseids will tell you it is just that), it is the minor things which really make the story complete. They seldom seem minor when they are occuring!

W5FYZ (Minden, Louisiana) reports "copied W5JWL skedding K5TQP, New Mexico with both stations heard well. K5TQP had several 20-second bursts. Also copied W5KXD, Dallas, skedding W2AZL, New Jersey. Both stations copied including several 5-second burst from W2AZL making identification easy. While working K2LMG I was worried with Perseids QRM! Carl, W2AZL was on 144.013 and Dave (LMG) on 144.014. On a ping or short burst I would hear K2LMG first followed after about a second with a burst or ping from W2AZL. On sustained bursts they were both in there banging away and QRMing each other. I use a 2.4 kc bandpass in receiver in MS, so could hear them both throughout schedule. W7JRG surprised us all with the consistent signal he put into this area. Good, solid QSOs were the order of the day with extra 73s gms and sks thrown in for good measure." The W5FYZ 144 Mc total is now 33 states, 9 call areas and VE3. Ernie guesses he will have to wait for Echo A12 to work W6, his 10th continental call area.

W6WSQ, West Covina, California felt there was a definite peak on the 12th (our table would seem to verify this) with a slight drop off on the 13th. The NE-SW paths were particularly poor, according to our West Covina reporter. Don also copied a 90-second burst (!) at 0758 on the 12th from K7IDD during the Utah station's tune-up, seconds before the sked began. The 90-second burst was strength 6.

W4WNH, Elizabethtown, Kentucky found the 1962 Perseids a trial by tribulations! Shelby had one equipment problem after another including a broken quarter-wave matching transformer on his 32-element array, and a snapped feedline (one after the other). This didn't keep him from putting in one of the star performances however. Shelby was running his 5-year-old 829-B loafing along as usual at 400 watts input (that's what he said!), the aforementioned 32-element array and a 6CW4 pre-amp into a crystal-controlled converter and 75A3 with audio filter.

He notes (on his contact with W0EYE, Boulder) "On the 13th it was all over (successfully) at 0651 EST. Five pings, 6 short

1962 PERSEIDS METEOR SHOWER RESULTS

Time—CST	August 10	August 11	August 12	August 13	August 14
2300-2400		W4WNH hrd WA4DRJ			
0000-0100			W76H6 hrd W6YX W6WSQ hrd W7MAH		
0100-0200			W4WNH hrd K4IXC	W4WNH wked K4IXC W4WNH hrd K7HKD	
0200-0300	W5JWL hrd W7FGG		W5JWL hrd W7LEE W6WSQ wked K5TQ? W3TDF hrd W5PZ	W5JWL hrd W7LEE	
0300-0400	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ W7JRG wked W5RCI	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ
0400-0500			W5JWL hrd K7IDD W5FYZ wked W7JRG	W5YZ wked K8AXU	
0500-0600	W4WNH hrd W7JRG	W7JRG wked W5RCI	W4WNH hrd K7HKD W5FYZ wked W4VHH	W4WNH wked WOEYE	
0600-0700		W5FYZ wked K2LMG	W4WNH hrd WOEYE	W5JWL wked K5TQP W2AZL wked W5KXD	
0700-0800	WZAZL hrd W5KXD	WZAZL hrd W5KXD	W2AZL hrd W5KXD	W5JWL hrd WA2EMA	
Miscellaneous			W5JWL hrd WIJDE. 2000-2100; W6WSQ wked K7IDD 0900-1020		

bursts and 3 slightly longer ones; the best being long enough for an exchange at 0650:30. My third QSO with Colorado, all MS."

Shelby's QSO with K4IXC was detailed this way. "Not having previously known about his operation, he was called via land-line on the 11th and skeds set up for the rest of the shower. On 12 August during his sked with K9UIF (0100-0200) he had some extremely strong bursts. I waited. Came 0200 EST and my sked, he all but vanished. There were plenty of pings and even a few short bursts. But they were SO weak! But it took only 31½ minutes on 13 August, with several bursts, to set things up, concluding at 0231, almost exactly like the W0EYE contact. This was a new state for each of us."

Shelby never heard W7JRG during their sked, but the Billings station was heard "on the 11th during most of two 30-second calling periods when he was skedding W5-RCI. This was the longest burst heard . . ." during the Perseids. K7HKD (Wyoming) was the most consistent station heard in Kentucky by Shelby, although no good bursts were copied. Plenty of pings though, whenever K7HKD was transmitting, or so it seemed.

W2AZL, Plainfield, N. J. kept at it with W5KXD, Dallas, starting with schedules at 0700 CST on the 10th and running the same time period through the 13th when they switched to 0200 CST. The 13th schedule ran from 0200 CST through 0643 CST when long bursts exchanged all of the required information. W2AZL also maintained skeds with W0QDH (Kansas) and W0EMS (Nebraska) and W0IUF (Colorado). Results were nil.

W3TDF maintained his schedules with W5PZ, Oklahoma. Starting on the 10th the sked ran through the 14th. Pings were heard on the 10th and 11th, while a complete ident was copied at 0218 and 0253 on the 12th. The 13th was nil, and W3TDF assumes the Oklahoma station did not make the sked. On the 14th several pings were copied, and a complete ident at 0256 CST.

Schedules between W3TDF and W5KXD led TDF to wonder if KXD's 144.140 frequency might not have been closer to 144.-137. TDF heard W2AZL calling W5KXD on the 13th, apparently during his sked period with the Dallas station. This was during the extended period of the 13th when 2AZL and 5KXD were running most of the night up to 0643 CST. W3TDF's schedule with W0QDH proved fruitless.

W5JWL had skeds with W7FGG in Arizona 0230 to 0300 CST on the 10th, and the Arizona station was copied very well in Gurdon, Arkansas, according to Jay. How-

ever W7FGG had to break off skeds abruptly at 0300 because of illness. W7LEE, in his new location above Parker, Arizona was a near-miss for W5JWL. Jay reports "heard lots from Parker but just couldn't get the final "R" through. Signals were quite strong peaking S5-S6 with bursts to 20 seconds or so." W5JWL's sked with W6WSQ resulted in a few pings 0330-0430 over the 10th to 14th period. "Apparently this is stretching distance some . . . and 16 db gain antenna on this end needs some improvement" noted Jay. W5JWL also notes "Sked with WA2-EMA 0700-0730, almost had QSO on the 13th but had to rush off to work and was unable to continue. Another 5-10 minutes and we should have made it. Signals peak S4."

Jay had W4WNH type troubles too. A tuning capacitor went up in smoke (strange, isn't it, how this always seems to happen during a maximum effort period?) and took a 4X250B, or a bad 4X250B took a capacitor. Jay also had antenna rotator trouble which gave false bearings. But, as he notes, "Outside of this, some arc-over in the HV supply and a little line noise, everything went smoothly!"

W7LHL had a single sked with W0ENE, August 10-13, from 0100-0200 CST. Ernie didn't hear anything from the Omaha station. Ernie did copy a 20 second burst from W6YX (Stanford, California operated by Vic, W7QDJ) when YX was running a CQ wheel on a W7RT sked.

W5RCI's contact with W7JRG resulted in the 38th two-meter state for the Marks, Mississippi two-meter pioneer.

W7JRG put his brand new W0MOX design two-meter final to work for the first time this year. In addition to working W5-FYZ, W5RCI and W0BFB (Iowa), Ken heard W0EYE on August 9, 10 and 13 (". . . should have worked him," noted Ken). Skeds with W8KAY, VE3DIR and W4WNH produced no pings or signals. W7-JRG has 15 states now on 144.

W4HJQ, Kentucky, was kept out of the shower by feedline problems.

144 Megacycle Operating Frequencies

WA4DRJ	Florida	144.008
K4IXC	Florida	.089
K7HKD	Wyoming	.124
W7JRG	Montana	.008
W0EYE	Colorado	.048

(Courtesy W4WNH)

Meteor Scatter

by Raymond P. Bilger, W3TDF
Harthorne Avenue
Langhorne, Pa.

Although I haven't participated much in Meteor Scatter work, I have been observant of the operations of others. The more I hear, the more convinced I am that many are wasting their time. There is a very dire need for a standard practice. The following views may put Meteor Scatter propogation into the scientific class, but then we wouldn't be on the VHF bands if we weren't more scientifically inclined than the average ham.

The ARRL has, through Ed Tilton and his column, expressed the opinion that the absolute minimum requirements for a contact are, (1) positive identification, (2) swapping of signal reports and (3) the Roger. The positive identification, in this humble one's opinion, is that you must hear the other station call you and sign his own call. The signal report needs no explanation for normal purposes, nor does the Roger, except that the Roger should not be sent until all the necessary information constituting a contact has been received. For Meteor Scatter work these requirements still hold true but can be accomplished in an absolute minimum time if both stations agree upon and use a common system.

Many stations have been observed sending S1 and S2 to indicate that they have received pings or a short burst. This is an unnecessary and fruitless waste of time. If, for instance, you are sending a complete set of call letters (those of both stations) and 10 reports of S1's. The fellow on the other end has heard nothing but a couple of pings up to now and then receives an 8 second burst of S1's. In those 8 seconds he could have received a complete set of call letters! Yet, since he received only a batch of S1's, it means nothing more to him than the fact that you have received several isolated pings from him. (Assuming that you are using transmission speeds of 25 to 30 WPM, it takes only 5 seconds to send a set of call letters broken by 'de'.)

Assuming that the signal report should never be sent until positive identification is established, which after all is only ethical, the receiving station, having received an 8 second burst containing a complete set of call letters can now begin sending a signal report (a true signal report), interspersed with the call letters. On the other hand, since he only received a batch of S1's, he has no way of knowing who sent them or to whom they were being directed. Result—one good burst wasted!

Another fact which I would like to bring to light is the assumption of at least one MS enthusiast. It was his thought that an S2 should be sent indicating a short overdense burst was received, but not necessarily containing any positive identification. (It could have been 8 seconds of S1's). However, if later in the schedule he receives a full set of call letters and S2's he enters in his log an S2 as his signal report. He has sent an S2 to indicate reception of a burst but containing no valuable information, yet on receiving that same S2 he considers it as a signal report. How can a signal report and some other explanation be tacked onto a single symbol?

One system which has been endorsed is sending a Roger to indicate you have received a full set of call letters. Then, and only after both stations have received and rogered for the calls, they begin to send signal reports, which also must be rogered separately. Then comes the ultimate of confusion, 'The Roger of the Roger.' This sort of thing can go on forever!

The prize that most of us look and hope for is a burst of 20 seconds plus, starting between 5 and 10 seconds before the end of station A's transmisison. If station A has been sending calls only, then station B will have received a full set of call letters and will then send one complete set of call letters, one signal report and BK. Station A then comes back with a Roger, one signal report and BK. Then station B comes back with a Roger and you've got it made. If the burst lasts any longer you can try to get through other information.

Assuming that both operators are using 25 to 30 WPM and can work fast break-in the burst must last 12 to 13 seconds after the change of transmission, *i.e.* after the start of station B's transmission in the

case above. This cuts the absolute minimum length of the overdense burst to 17 to 18 seconds for a completed QSO. This is exactly how W4LTU and I made our contact during the Geminids shower on Dec. 14th, 1956. The total burst was 27 seconds long and started about 10 seconds before the end of Walt's transmission. I even got a '73 es Tnx' through before the burst died.

We all want to work more states and the fellow that comes up with 40 on 2 meters first is going to be one proud peacock. I doubt very much if it will be a coastal station, unless we get one of the rare gems that gave that deserving fellow, Tommy, KH6UK and W6NLZ the record. If we intend to use MS propagation (if it can be termed propagation), we must make use of every burst that is long enough to contain any information at all. Therefore we must agree upon and very diligently use a system which is designed for 'getting the mostest from the leastest.'

The greatest asset to anyone using MS is the automatic keyer. I use a 6AQ5 clamp tube to control the driver screen. The driver has no bias other than that developed across the grid resistor. The 6AQ5 is biased beyond cutoff and a plate relay in the plate of a 6AC7 (any reasonable tube can be substituted) shorts the bias out on the 6AQ5, through a resistor arrangement so the actual bias supply is not shorted out. The 6AC7 and 6AQ5 use separate supplies so that the 6AC7, which is also biased to cutoff, can be keyed without having the driver screen voltage on the key. The 6AC7 bias is applied in a special circuit in which there is also a tone rectifier. I use a tape recorder with a loop of tape for auto-keying, feeding the output through a small output transformer into the one rectifier. The key is left in the circuit at all times and all that is necessary to change from auto-keying to hand keying is to cut the volume on the recorder, or stop it. As a matter of information I use a second tape recorder for complete recording of all schedules.

Regardless of the system used for auto-keying, it should be set up so that the hand key may be used in place of the auto-keying on a split second's notice. Suppose, like myself, you leave the auto-keyer running continuously and merely turn the rig on and off at the appropriate times. Then at the very end of the other station's transmission you get a ping. This could be the beginning of an extended burst. Therefore you go back on manual and give one complete call and a BK. If the other station doesn't break-in within 3 or 4 seconds then you go back on automatic. As pointed out before, you must make use of every available opportunity to get through information and take advantage of every overdense burst that may come along.

My proposed system is quite simple once you get on to it, but requires that you be on your toes to transmit only that which is necessary at each and every stage of the game. First you transmit full sets of calls over and over, (ie. W4LTU de W3TDF W4LTU de W3TDF etc.), on each transmission. Then, and only after you receive a full set of call letters from the other station do you include a signal report. The signal report will be taken up later. When you do begin to include the signal report it should be thus, W4LTU de W3TDF S3 S3 W4LTU etc. This sending of the signal report is your information to the other station that you have received his full set of call letters. When received by him, it tells him he need not send the calls anymore and can send the signal report and a Roger, thus R S3 R S3

When you receive	You send	Sig Rpt	Meaning
Nothing or incomplete calls	Calls only	S1	Up to 5 Sec.
Complete calls	Calls & Sig Rpt	S2	6 to 10 Sec.
Calls & sig Rpt.	Sig Rpt & Roger	S3	11 to 15 Sec.
Sig Rpt & Roger	R's continuous	S4	16 to 20 Sec.
2 or more R's	Nothing	S5	over 20 Sec.

etc. Therefore, you send complete calls only, until you receive full calls. You send signal report until you receive a signal report and then and only then do you send Rogers. Keep in mind, of course, that you continue sending the signal report until you receive a Roger. If while you are still sending only calls you receive calls and a signal report, you then send only signal report and Rogers. If while you are sending calls and signal report, (which will be only after you have received full calls), you receive a signal report and a Roger, you then send a series of Rogers and nothing else. When you receive 2 Rogers in succession you quit. You've got it made! For this to be absolutely conclusive you must be sure not to send more than one R at a time when you still haven't received a Roger. which of course necessitates that you be sending a signal report along with the Roger.

The signal report can be any arbitrary report, but a system is likewise here suggested. S1 is for a signal burst of not more than 5 seconds, or more than one burst of less than 5 seconds each sufficient to get the full set of calls through. (Again — No signal report is sent until the full set of calls have been received.) S2 for a burst of up to 10 seconds (during which full calls have been received). S3 for a burst of up to 15 seconds, etc. Therefore an S5 would be the highest report you would give indicating a burst of 21 or more seconds. If the burst lasts more than 25 seconds you will probably be using break-in anyway, so you still use S5, or possibly there will be opportunity for use of the complete RST system.

It should be evident from the above that you will never have need to send all 3 items of information together, because if you are in a position to send a Roger, it can only be after you have received a signal report which in itself is indication that your complete set of calls were received at the other end making it unnecessary to send them with the Roger.

The signal report you send will be based on the length of the burst in which you received the complete set of calls, and will not change unless you again receive another full set of calls on a longer burst which still doesn't include a signal report. This is possible because if he is still sending calls without signal reports, it is only because he has not received a signal report from you.

A simple chart is given here which can be cut out or reproduced and displayed at the operating position. Keep in mind three simple rules. Don't send unnecessary information. Don't send more than one Roger in succession until you have received all the information you require. Always be ready to switch to break-in, should the need arise.

As can be evidenced from the chart you can have four separate auto-keying sequences set up ahead of time and will have no need for the hand key unless a chance at break-in avails itself. The one containing solid R's can be used for all MS skeds of course.

SSB for Two

part two

by Russ Miller, W5HCX
Associate Editor
VHF Horizons

The most important step in putting a SSB signal 'on-the-air' is the application of audio to whatever form of balanced modulator we're using. At this point no item should be slighted in order to come up with adequate unwanted sideband suppression and clean audio. The "SSB Rig on Two" is no exception.

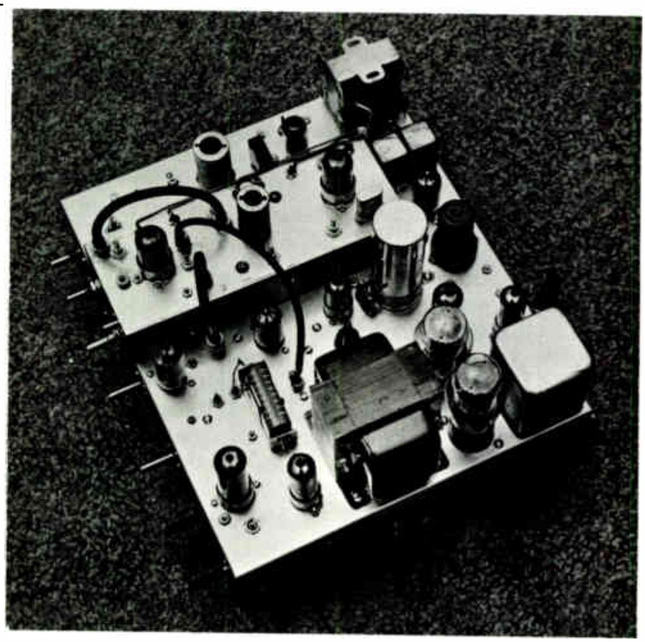
Power supplies are also an important consideration. Important, primarily because if they are not adequately regulated where specified, the result will be a wobbling signal with big chunks of distortion riding on it.

There are many, many ways of cutting corners when building any rig and some are very useful but don't try to cut too many corners. One of the easiest things an amateur can do is to substitute some different tubes than those specified. This idea will probably occur when considering the linear RF amplifiers used in the SSB on Two rig. Don't be tempted. The tubes selected will do the job and last for a long period of time before they start to fall on their nose. Also, if the 5763 is inter-changed with something else, the AM quality will suffer and the RF distortion will go up when the rig is operated in the AM mode. Incidently, the original article last month mentioned using a 12BY7A instead of a 5763. Reason for the change was based on seeking improvement of the AM signal. The 5763 did provide that improvement.

AUDIO SECTION

The 1st audio stage in the rig uses a 12AT7, witth both halves operating as straight voltage amplifiers. The second half of the 12AT7, 1st audio stage, is fed to the AM-SSB selector switch. At this point the audio output is fed to either the grid of the 6AQ5 modulator or to the audio phasing network depending on which function is selected.

Selecting SSB connects a small transformer in parallel with the load resistor of



Top-side view of SSB unit. 6360 RF amplifier occupies lower corner of chassis. Battery shown in photo is bias source for the 6360. Average life of battery is two years. Feed-thru capacitor located slightly to the left of the bias battery feed-thru capacitor is meter connection to RF diode. Co-ax plug and jack immediately above feed-thru are used for coupling 2nd mixer output to the RF amplifier input. 16.5 Mc signal is coupled to the sub-chassis by co-ax line shown adjacent to the battery and power transformer. Nylon jack shown on top, front part of sub-chassis, is TP-2.

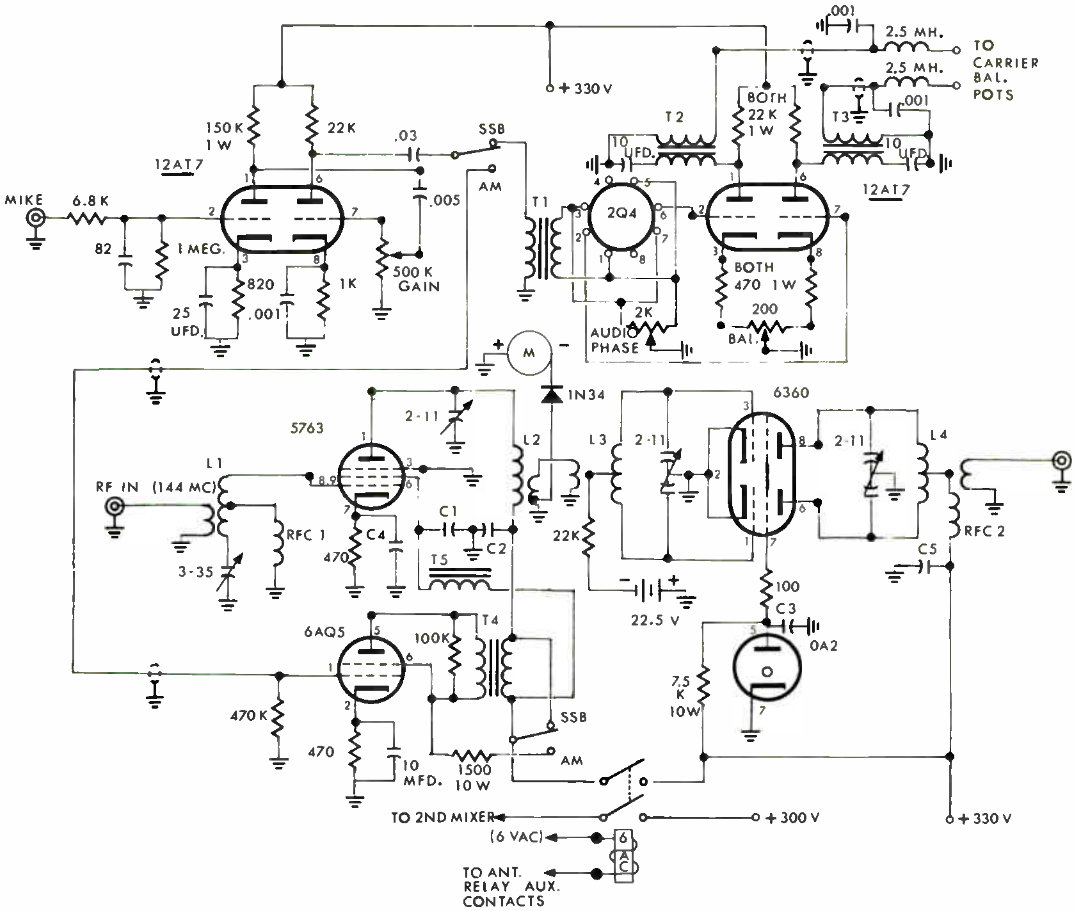


Figure 1. Audio and RF Circuitry, Schematic

the 12AT7. This transformer feeds a B & W 2Q4 audio phase shift network which in turn feeds another 12AT7 audio stage. This 2nd 12AT7 stage is also a straight voltage amplifier. A pair of 20,000 ohm to 600 ohm transformer (W2EWL type) are used as the plate loads for the 12AT7, 2nd audio stage. From here the audio goes through a pair of 2.5 mH RF chokes to the balanced modulators.

AM is a horse of a different color. Back at the 1st audio amplifier stage, 2nd triode section, we feed the audio to the grid of a 6AQ5 through our selector switch. The 6AQ5, operated Class A, is the sole modulator stage. It will provide more than enough audio to modulate the 5763 Class A linear. It might be well to mention at this point that this method of AM is not normally used but it does the job with only a small sacrifice in modulation percentage. I know some amateurs may worry about linearity, varying load conditions, etc. Once again, the rig won't sound like a broadcast station but it will sound clean and do the job.

Gaining a few additional percent improvement in modulation percentage at the expense of a big modulator and the necessity of operating some form of amplifier Class C just isn't worth the cost. There is one thing which is in your favor as far as the modulated stage is concerned, it is highly inefficient. But, it doesn't have to have much output to comfortably drive the following 6360 Class AB1 amplifier.

When considering the microphone types to be used with the SSB on Two rig, don't use a mike with a particularly flat response curve. The high end of the audio spectrum and its rich overtones are best done without. Besides the audio phase shift network is not particularly designed for the range past 3000 cps or below 300 cps. If operation with a carbon mike is desired, ground the grid of the 1st triode section and connect the mike in series with the cathode.

RF AMPLIFIERS

The only tubes used in the RF amplifer section are the 5763 and 6360. The 6360 is

operated as a conventional Class AB1 linear with both its input and output circuits coupled fairly tight to the driving source and load. This is necessary to realize a 2.5 Mc bandpass which is about as much as can be expected without overcoupling and thereby enhancing unwanted harmonics. By properly adjusting this stage, a 3 Mc slice of the 2 meter band can be easily covered in practice.

Like all RF amplifiers, care must be taken to isolate the input and output circuits of the 5763 and the 6360. The only necessary item in either stage is the 100 ohm resistor in series with the 6360 screen grid lead. This resistor should be mounted as close to the socket connection as physical size will allow and also the opposite end should be as close to the .001 stud-mounted capacitor as possible.

If the schematic and the above suggestions are followed, both stages will be stable enough to eliminate the need for neutralization.

The only tuning that is necessary in the RF amplifiers is the grid and plate tuning of the 5763. The 6360 is adjusted only during the initial tune-up of the rig. The absence of any metering in the 6360 stage may lead to some question. The high-power linear that this exciter drives has an RF voltmeter circuit built in to indicate its output. This is used for initial tune-up of the exciter and since the 6360 is fixed-tuned eliminates further need for metering. If bare-foot operation is desired, a 1N34 diode used with a milliameter will suffice to tune up the 6360 stage although some means of monitoring its output is desired. Since the 5763 stage is tuned, a metering provision is necessary. In this case, a 1N82 was tapped up 1/4" from the ground connection provided for the coupling links between the 5763 plate and 6360 grid tanks. The diode (1N82) is then connected to a 500 pfd. feed-thru capacitor. The other end of the feed-thru capacitor is connected to a 0-1 mA. meter.

POWER SUPPLIES

Two power supplies are used for the rig. One supply provides a regulated 210 & 105 VDC and unregulated 250 VDC. This small supply is incorporated on the exciter chassis. It supplies all the stages except for the audio sections and RF linears. The second supply is external and supplies a regulated 300 VDC for the screens of a KW, 4CX250B linear, and an unregulated 350 VDC for the audio sections and low level RF linears. This 350

VDC source is also fed to a 150 VDC regulator on the exciter chassis to provide a regulated voltage for the 6360 screens.

CONTROL CIRCUITS

The actual controls circuits are confined to a single relay. One set of contacts removes the voltage from the 6X8 2nd mixer and the other set of contacts removes the voltage from the 5763. All the oscillator circuits are allowed to operate at all times for maximum stability. There are no birdies in the receiving combination used for the check out of the oscillators, with the oscillators running. However, since the checks were made with a converter using a 30-35 Mc IF this might not be true for those receiving set-ups using a different IF.

Anyways, this problem can be approached a number of ways if you are troubled with annoying birdies from the exciter. One means would be to install another relay to cut off whichever oscillator is interfering. If the birdie is in a portion of the band that is not used, you might just leave it alone. The only other alternative would be to select crystal frequencies that would place the birdies out of the band. If you do have to key one of the oscillator stages, don't be too concerned. In our particular case the International FA series crystals that were used proved extremely stable.

If you are wondering how the control relay is keyed, an extra set of contacts on the external antenna relay does this for us.

LAYOUT

Starting with the audio stages, these were constructed across the back of the chassis. The 2Q4 audio phase shift network is located in the far rear-center of the exciter chassis. To the left is the 12AT7 2nd audio stage. The 6AQ5 is to the right of the 2Q4 and adjacent to the modulation transformer. Directly in front of the modulation transformer is the 210 VDC supply regulators with the 12AT7 1st audio adjacent to the left-hand regulator tube.

The RF amplifiers are located on the front of the chassis and occupy the right hand side. The 150 VDC screen regulator for the 6360 is located behind and to the right of the 6360. A small battery can also be seen on top of the chassis, near the 6360. This is the bias source for the 6360.

The 5763 tuning controls are mounted on either side of the respective tube socket and in a line with the other controls. Since space was needed for the control relay and other components, the audio gain control/on-off switch and the AM-SSB switch were mounted on an aluminum 'L' bracket on the bottom rear of the chassis. This works out very well by eliminating unnecessary long leads between the controls and switches and the audio section.

The audio phasing pot and 2nd audio stage balance pot are mounted across the rear side of the chassis. Also, the AC leads, external power jack, and the microphone jack are located here. Placement of these various parts is not critical although it would be best to keep the audio pots as close to their respective stages as possible.

ADJUSTMENT

RF from the 2nd mixer should be applied to the 5763 and this stage along with the 6360 should be adjusted for maximum output, (full carrier insertion). Next, set the AM-SSB switch for SSB. Apply a 1000 cps audio tone to the grid of the 2nd triode section. With an oscilloscope connected alternately to pins 2 and 7 of the 2nd 12AT7 audio amplifier, adjust the audio phasing pot for a 90 degree phase relationship between these two points. Next, adjust the audio balance pot for equal amplitude output fro this same stage. If an oscilloscope is not available, a suitable receiver may be used for the same purpose. In this case adjust pots for maximum suppression of the unwanted sideband.

After these adjustments have been made, the rig is ready to be put on the air. The only thing that remains is to adjust the mike gain control for the best levels, depending upon which mode of modulation is selected. The RF voltmeter in the exciter RF section will provide a means to monitor the output and assure that either the correct amount of carrier is inserted when operating AM or that the mike gain is set properly when operating SSB.

When using SSB, don't crank the audio up any farther than necessary. If you choose to drive a high-power linear, adjust the audio so you obtain sufficient drive and no more.

When operating AM, you may insert full carrier with one of the carrier balanace pots. There is more than enough audio available to modulate the 5763 so be careful not to turn up the mike gain to the point where distortion is present. The exciter will probably have to be cranked down by adjustment of the carrier balance pots to keep from overdriving a high-power linear amplifier, and consequently, so will the audio gain.

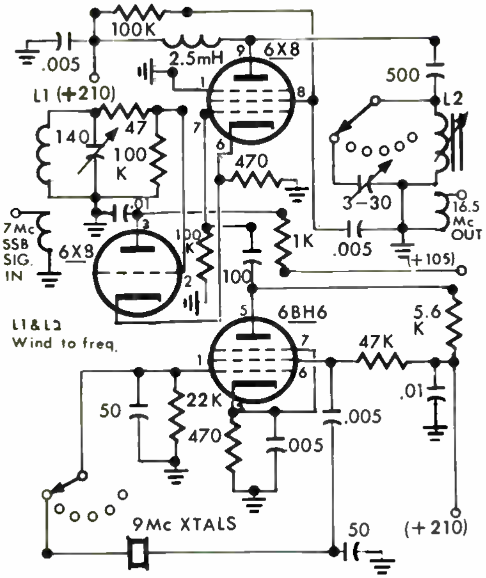


Figure 2. 16.5 Mc Mixer (see part 1)

Operation of the SSB for Two rig is self-explanatory. Changing from AM to SSB or vice-versa, or changing frequencies, is quick and easy. The results you obtain with the rig will be astounding if you have never operated VHF SSB. Better still, tie on a good sized linear. This topic leaves lots of room for thought. Next months issue will contain a full KW linear that can be over-driven by the SSB for Two exciter yet for its power feature occupies a space 12" x 7" x 6". W5HCX

Dear VHF:

Best of luck in your new venture. I particularly appreciated your features by John Chambers and the staff report on "Pi in the Sky". The pi net article was a very clear treatment of common pi net problems.

73
Carl Ebhardt, W4HJZ
22 Rowan Street
Raleigh, N. C.

Carl—

John has quite a bit more to say — and our staff report people are nosing around some more interesting problem areas.

Dear VHF:

I am not at present a VHF bug but the magazine looks so good I had to subscribe (I hope the rest of the issues are just as good). This magazine may make a VHF bug out of me yet!

Edward Nester
2184 Light Street
Bronx 66, N. Y.

Ed—

Welcome aboard — you'll find a lot of fun above 50 Mc! And you can count on the future issues being at least as good as those so far — we're going to try to make them even better.

Construction . . . from p. 13

A good open-wire line can be constructed using No. 12 solid copper wire and 5/16 inch or 3/8 inch diameter polystyrene rod. These sizes afford more strength than 1/4 inch diameter rod. The line is fabricated by stretching two lengths of No. 12 wire tightly between two points in the workshop, making certain they are the proper distance apart (one inch center to center is suitable for 50 and 144 mcs) and parallel the entire length. The wires should be touching the floor.

Polystyrene spacers one and one-half inches long (for one inch spaced line) are cut from stock and placed under the tightly stretched wires every six inches. Make certain the spacers are at right angles to the wires. The tip of a hot soldering iron is pressed downward against the wire, and to one side of the polystyrene rod, forcing the wire into the rod. Remove the iron when the wire is completely covered over by the softened polystyrene, taking care not to move the rod or wire until after the polystyrene has hardened. Then perform the same operation on the other end of the spacer. Do not allow the iron tip to touch the polystyrene rod!

A TV type standoff insulator intended for supporting small, tubular 300 ohm line may be used to support open-wire line. At the point of support, the polystyrene spacer should be made longer than normal so that a standoff support may be used at each end rather than one at the middle. This gives better support and minimizes capacity, and possible unbalance, to ground.

Amateurs living in coastal areas or windy locations may find other precautions are necessary. Only a few phases of antenna construction have been covered. Doubtless you have some tricks of your own that make for a better antenna installation. In general, taking a little extra care in the construcion of your VHF antenna and feedline . . . using a little more than the bare minimum . . . protecting against corrosion and moisture . . . will pay off many times. An array that is dependable and does not require frequent repairs is far more useful than a larger one that is out of service much of the time.

For additional information on VHF antennas and construction you are referred to: The A.R.R.L. Antenna Book, The VHF Handbook by Orr and Johnson, and VHF For The Radio Amateur by Frank C. Jones.

T
VHF
I

by Robert Grimm, K6RNQ
VHF Western Technicol Editor

While we are not faced with "odd-ball" cases of TVI everyday, these can be a real headache to track down when they do occur. Some of them can be so far fetched as to make your head spin.

A classic example of this type of TVI oddity was experienced by W6BAZ of Santa Rosa, California a few years ago. Paul had received a report from a TV service organization that he was clobbering Channel No. 5 on a TV set. This TV set happened to be located about 40 miles away from W6BAZ's QTH. To make things even more interesting, there happened to be a 4,000 foot high mountain in between him and the TV set. (Mt. Saint Helena).

Paul dutifully checked his transmitter, but was unable to detect any spurious signals or harmonics that could be causing the trouble. He then communicated with the TV service company that was responsible for maintaining the TV set, and, by working together, they were able to find the cause of the difficulty. What was it? Just an oscillaing mixer tube in the TV set's tuner. Fortunately, it was correctable by replacing the mixer tube. Granted, this was a very unusual case of TVI. The kind of thing you might run into only once in a lifetime. But it's a prime example of the many "oddball" types of interference that do occur. These are the things that make many hams permaturely gray!

Not quite so unusual was a situation I experiencd a few months ago. Some people from down the street called and informed me they were receiving interference on Channel No. 2 and they thought it might be caused by me. (In fact they were pretty doggone sure it was).

Not being on the air at the time, I knew it couldn't be me. But being a good neighbor, I took a stroll over to their house to see what the trouble might be. Sure enough, there was a big black herringbone pattern wandering up and down the screen. It was doing a thorough job of obliterating Channel No. 2 although the other channels were not affected.

Playing a hunch, I turned off the TV viewing lamp that was setting on top of the set. The interference immediately disappeared. Turning the light back on caused the interference to reappear.

The interference was eliminated by the simple expedient of replacing the bulb in the lamp. Why was the bulb radiating this signal?. Don't ask me! I had run into this situation several times in the past, when I was doing TV service work. It could always be remedied by replacing the bulb. (Provided, of course, that it was being caused by the bulb).

While we are in the light bulb department, a real hash generator is the old carbon arc bulb. These things are a holdover from the twenties and are occasionally found in porch lights on older houses. The hash they generate is not far removed from what you would expect from a spark-gap transmitter and they louse things up just about as well, too! They should be replaced with modern bulbs.

Getting back to the TV viewing lamp: An important thing to remember is to *not* rub it into the people who complained. They are going to be very embarrassed when they find out they were the cause of their own TVI and had blamed it on you.

They will want to make up for having wronged you and, if handled properly, can become neighborhood boosters for you. Be sure to tell them that "this is just one of those things that happen and don't feel bad about it."

"SINGING BATHTUBS"

You have probably heard of incidents where people have heard music insuing from their dental fillings, from pipes in the basement or coming out of their bathtub. These are not "Old Wives Tales". They really do happen. These incidents generally occur in the immediate vicinity of high powered AM broadcast stations.

While it isn't likely that your neighbors will copy you loud and clear on their dentures, the causes of these strange phenomena are closely related to the causes of many unusual types of TVI, *i.e.*: rectification. This can be caused by a rusty joint in a waterline, two pipes of dissimilar metal resting against each other, loose or corroded connections in the TV antenna system, on telephone lines (call the telephone company if you think a corroded joint in their lines is causing the trouble — never touch the telephone lines yourself!), or a loose or corroded connection *in your antenna system!*

If you stop and think about it, there is really no great mystery why corroded or rusty connections cause TVI. Another name for rust is oxidation. An oxide can be a very good rectifier; you've undoubtedly heard of copper oxide rectifiers.

Well, when this recitifier detects your signal many harmonics are generated and if one of these harmonies happens to fall into a TV channel . . . TVI!

If your neighborhood is like most American neighborhoods, you probably have your local HiFi addict who manages to pick you up on his TV set, hifi amplifier, tape recorder and radio, what with his audio leads strung all over the house. (These leads sometimes make such excellent 50 Mc antennae, that I've often considered discarding my beam and using them.)

It's amazing how much signal these audio leads pick up and pipe directly into the TV receiver and audio amplifiers. About the only way to handle these types of cases is to temporarily disconnect the leads and demonstrate how much interference they are picking up. If he refuses to shorten the leads or to cooperate in the usual methods of curing audio rectification (as discussed in a preceeding chapter) his refusal should be communicated to the local field engineer's office of the FCC.

Obviously, if he won't coooperate, there is nothing you can do for him. Actually, the vast majority of people are quite co-operative in these cases; the above was mentioned only so that you will know what to do when you run into someone who refuses to cooperate in having the TVI cleared up.

Next month we will discuss the proper methods of shielding and cleaning up your transmitter. 'Til then, lots of luck on your WAC (worked all channels).

CLASSIFIED

Commercial classified advertising space is available at 25 cents per word, per month. Minimum number of words per advertisement, 10. Classified advertising submitted by individual hams which in the opinion of VHF Horizons is non-commercial in nature, 10 cents per word, no minimum. Full remittance must accompany all orders; closing date for each issue is the 5th of the preceding month. Copy must reach Oklahoma City by that time.

LIKE NEW SX-101A, $295. K9IEB, 31 Ridge Avenue, Evanston, Illinois.

HEATH SHAWNEE 6 mtr. transceiver in top shape with Ameco preamp, $225. Write: K9YCA, 107 N. 26th, South Bend, Indiana.

WANTED: tropo skeds with Kansas on 50 Mc. Saturday evenings or early Sunday mornings. CW or SSB, 50.012 and 50.112; CW, 144.012. Have kilowatt, suitable antenna, passable receiving set-up . . . will listen for you. W5KHT, P. O. Box 1557, Oklahoma City 1, Okla.

SURPLUS goodies stacking up on you? Send us an ad on them and watch them go. One fellow got cleaned out on 832A's—by a retail house yet! What have you got to sell?

VHF Lab Reports

A 38 element yagi antenna on any band below 144 megacycles would be a physical impossibility. On two meters it just barely gets inside the realm of credibility.

Telrex Labs, Inc., Asbury Park, N. J. has such an antenna. And just to make the array even more fascinating, they have allowed someone to talk them into twisting it from length to length (43 feet from tip to tip) in a not so common Spiral-Ray fashion.

The end result is a two meter yagi that demands the very best patience and equipment the typical two meter enthusiast can muster, if the array is to perform properly. However, if you are as much an engineer as you think you are, assembly, erection and tuning of this monster should occupy no more than a typical sun-up Saturday to sundown Sunday weekend. It did us.

Everything comes from the packing carton. In abundant handfuls, we might add. The 43-foot boom is broken down into three sections of tubing. Starting from the rear, the reflector, driven element and first 8 directors mount on a single piece of 2 inch OD tubing. Next in line, the middle piece. It holds the next 19 directors. Last in line, the final boom section. It suspends directors numbered 28 to 36.

Like all good Telrex beams, this antenna is rugged and well designed. The fact that all of the 80 odd holes line up is a tribute to somebody at Telrex. We can't imagine any amateur tackling the project with a hand drill and vise.

As it arrives, the beam is tuned for 144.5 megacycles. As Telrex notes, you can move it up a megacycle at a time by whacking 1/4 inch off the overall length of each element (they vary from 42 inches long for the reflector to 30 inches long for the 36th director). From a practical standjoint, we would have liked Telrex to start off with the antenna resonant at 144.000 megacycles and then let us whack off the 1/4 inch pieces. We feel that those characters who are going to invest in this antenna are going to be DX nuts concentrating on the low edge of the band.

Once assembled (a project roughly equivalent to building the Empire State Building from an erector set) the antenna really begins to impress you. For example you try to lift it, by firmly grasping the boom in the middle and giving a heave-ho. If you have recently devoured a bowl of Wheaties the antenna slowly rises from the saw-horses you assembled it on, "twangs" on each end and then goes into wild oscillations from its 30 inch director, to the other end and its 42 inch reflector. You move quickly to get it above your head because the spiral elements are dancing dangerously close to your windpipe, and you never were much of a CW man.

Finished with the erection and mounting you dash to the receiver and listen for the S9 signals you expect to hear from KH6UK. The band is quiet. You casually observe the beam is pointed to the northwest — a direction in which you have not heard a 144 megacycle station in the past six months. Bringing the big array around to the northeast you find a number of carriers in the lower megacycle running 6-15 db above the noise on your 7788 converter. All W0's.

Advice? Comments? Keep this yagi mounted on a tower all by itself. Other antennas within 43 feet of it on the same tower throw it into *pattern fits*. It is even advisable to break up the antenna horizon around your QTH by keeping other antennas at least 1/2 boom length out of its plane (*i.e.* none between 39 feet above ground and 81 feet above ground) This is not an antenna for the casual operator. It is for the dead serious two meter addict who wants his cake, and wishes to eat it too. The 2MSR-3843 is truly a two-beam spotlight . . . one in the vertical plane and one in the horiznotal.. And dead in the center of the "spot" is two meter DX. Lots of it.

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OCTOBER 1962
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From the Publisher's Shack

A TRIBUTE TO AN ERA

By now many will have learned that the original nationwide VHF newsheet for the amateur (VHF Amateur) is no more.

It is with a great deal of sadness that we mark its passing. Young Editor-Publisher Bob Brown (K2ZSQ) is personally known to many of you through on-the-air contact and his frequent appearances at amateur radio conventions and gatherings, especially along the east coast. For nearly five years Brown filled a void . . . a very deep void. He cranked out monthly issues of VHF Amateur keeping so many of us informed of what each other was doing during a period when the current mushrooming interest in VHF/UHF was only in its infancy. Often without adequate finances, Bob plugged along convinced that he was doing a job that needed doing and apparently certain that someday his *efforts* would be recognized.

Well . . . *they were.* Cowan Publishing Company (the publishers of *CQ*) acquired the rights to *VHF Amateur* in the first days of August. At this writing the future of this institution in amateur VHF/UHF radio is unknown, although it is understood that *VHF Amateur* will become a section or department in *CQ*.

While this will certainly contribute considerably to the *professionalism* of *VHF Amateur* (as a department in *CQ*), we never felt that lack of professionalism hampered the future of "the early day VHF man's publication."

Bob Brown had many of the advantages that we have attempted to build into *VHF Horizons*. Bob was aware that VHF/UHF news is by its very nature a timely item. He recognized that the 45-57 day lead time (*i.e.* the period of time between the day that a magazine stops accepting editorial copy and the date the magazine actually came out) inherent with other amateur magazines was not materially contributing to the "operating state-of-the-art" in VHF and UHF.

So he set out to tackle this in the same way we did, later, here at *VHF*. Simply arrange your production and delivery schedules so that your printer can accept copy up to a matter of days (two weeks at the most) before the magazine hits the mails.

Now, with *VHF Amateur* absorbed by *CQ*, it loses what many felt was its primary appeal . . *i.e.* news while it was still news. For this we are deeply sorry and not a little concerned on behalf of the entire VHF/UHF fraternity, which we feel by now we have gained the right to speak for.

Somewhere out there are 2,500 or so subscribers to *VHF Amateur*. They probably feel a little left out right about now. Some probably also subscribe to *CQ*. While we feel certain that Cowan Publishing Company will work out the problems involved with changing over or extending their present subscriptions (to *CQ*), we wonder if this is enough?

If you are one of these 2,500 *VHF Amateur* readers, and you *do* feel a little left out in the cold (of old news), we would like to offer to you a six months subscription to *VHF Horizons*, at a token charge of $1.00. Please recognize that we do not have access to the subcription records of *VHF Amateur*. Therefore we must trust in the integrity of the amateur radio operator to represent to *VHF Horizons* his existing subscription in a truthful way.

Our reason for doing such a thing is simple enough. We feel that you subscribed to *VHF Amateur* for the same reason we did. To obtain news of VHF/UHF, exclusively. We don't want you to ever develop the feeling that you can no longer have this kind of service delivered to your doorstep monthly.

By offering you a six month carry-over subscription with *VHF Horizons*, for the token fee of $1.00, *we will see that you* keep in contact with the world of the very highs and ultra highs, during a period of time when 50 megacycles and up needs everyone of its newly found supporters.

OK . . . so the line starts at the right. Just drop a short note to *VHF Horizons* at P. O. Box 1557, Oklahoma City 1, Oklahoma with the information that you were a subscriber to *VHF Amateur* when the sale took place. Enclose your dollar, and we are in business!

VHF HORIZONS

VOLUME 1 — NUMBER 4
OCTOBER 1962

CONTENTS

Features

Departments

OUR COVER

What can you say about a plain type layout? Design by K5QGO, to set off this special antenna issue—that's all. Inside, you find a separate antenna article for every VHF band in anything like wide use (except 432, and it's covered thoroughly in two of the other articles). Send us some pictures of your own antenna installation—you might find one on the cover of next year's Antenna Special.

ADVERTISING—VHF Horizons magazine accepts commercial display advertising from bonafide manufacturers, and distributors of electronic equipment and associated apparatus. Advertising rate card and coverage data available upon proper request.

CIRCULATION—VHF Horizons magazine is circulated through the mails and sold over the counter at leading electronic parts wholesale houses throughout the United States and Canada. Approximately 25,000 active amateur radio operators have VHF/UHF interests, and this is their publication!

SUBSCRIPTION—Subscription rate in the United States, $4.00 per year, $7.00 two years. Airmail subscription available at $7.00 per year. Subscription in Canada, Central America $5.00 per year. Subscription elsewhere $5.50 per year.

SCATTER

... de K5JKX

CONVENTIONEERING . . .

One thing about summertime and being a ham magazine editor — you'll get your fill of both conventions and hamfests!

I just got back from the West Gulf division convention at Corpus Christi and already I'm trying to get the work ahead enough to make it to Syracuse for the big VHF bash. And if you think (like several people I know) that this is simple, then you should try filling 40 pages every month with interesting and informative articles.

Don't get me wrong. I'm not complaining in the least. These things are fun — but at the same time they make life a bit more complicated than it is already.

Like for instance the trip to Corpus. That one was the weekend of August 3-5. Our deadline to the printer for the September issue was August 6. It doesn't take higher math to figure out that the magazine either had to be put together early, or late — but not on time in either case.

But even with that deadline hanging overhead, Corpus was fun. Had a long visit with Bill Ashby, K2TKN. One of the most immediate results appears further on in this issue — his article on 1296 Mc antennas. Other things are in the mill, if Bill or I either one can ever scrape up enough time to do them.

And at this point, an aside to those of us who work only 50 Mc and scornfully refer to the 75-thru-10 regions as "DC bands": it comes as a bit of a shock to talk with people who work almost exclusively *above* 432 Mc. To them, 6 and 2 are DC bands!

Bill wasn't the only interesting VHFer at Corpus. I talked quite a bit with George Munsch, of San Antonio, about wide-band FM work on 6 and 2.

One thing many people don't realize about FM. When proper receivers are used, FM has approximately the same advantage over SSB that SSB has over AM! The only thing wrong with FM is that too many people try to receive it by "slope detection", and the results are definitely not as good as AM.

Anyhow, George and a bunch of other people scattered across the country are working with converted commercial two-way gear, mostly on 52.525 Mc although other channels are also in use. If anyone is interested, we can twist some arms for some articles on how and why you can get into this bunch.

And there were dozens of other people who stopped by the booth to pass the time of day. All in all, much fun.

We did find that large numbers of hams still hadn't heard of us, and others confused us with other publications.

So here's one place every reader can help VHF. Get on the air and tell people about us. Tell them to drop us a note for a free sample copy if you like — or just send us the calls and we'll do the rest. This way, maybe more people at the next convention will know who we are.

OUR DEPARTMENTS . . .

The eagle-eyed reader will notice a drastic absence of our usual departments in this issue. Specifically, among the missing are the VHF Showcase, D. C. Pulses, and Scanning the Literature.

However, a glance at the "Features" listing on the opposite page will rapidly explain why. With so much solid data on antennas for all our bands, something *had* to give — and the departments went for this issue only.

They'll all be back next month. If you've been following "Scanning the Literature" to keep up with all the other publications, don't worry about missing out on a month. Our new schedule put us at deadline before two of the three other major ham magazines came out anyway — so next month we'll be scanning the September issues.

Incidentally, I'd like to know what you think of our departments — *all* of them. Do you like them, or would you prefer that we use more of the space for technical material? After all, this is *your* magazine — and if you'll just tell me what you want, I'll do my best to give it to you.

What do you think? **—K5JKX**

50 Mc

Designed and built by Edwin A. Pick, W0BBM
RR 3, Box 377
Imperial, Missouri

This photo story is aimed not so much at the 50 Mc enthusiast who is looking for a complete *nut and bolt* how-to-do-it story, as it is aimed at the 6-meter man who is looking for new ideas, or new uses for old ones.

The antennas (notice we are plural now) shown in these photos have been erected and put into the air over the W0BBM QTH during the past several years. The object of each of the arrays was extended ground wave, long haul weak signal skip, and scatter.

Over the period that each antenna was in use, careful observations were made to the effectiveness of each design. *Some* of these observations are included in this report. More will be made available at a later date as the totals are tallied.

Having read that long-haul scatter signals become pretty beat up, in respect to polarization of the original signal, during the scattering mechanism, we decided to experiment with various forms of stacking, and polarization switching.

Anyone who has worked a summer of E skip has probably had the opportunity to observe that under some very special conditions stations "on the other end of the line" (ie. 700-1500 miles distant) running low power into ground plane antennas, often times will compare very favorably with their higher power bretheren with much larger yagi arrays.

When working into an area that has both vertical and horizontal polarized stations in quantity (*ie.* Los Angeles basin and vicinity) it is often surprising to hear the top signal on the band announcing "I'm running a four element yagi and a G-50. *The beam is vertical.*" You are receiving on a horizontal antenna.

Too often we tend to chalk this up to a number of rationalizations such as (A) No one with comparable power and a horizontal antenna is active at the particular moment; (B) skip is so good that anyone with a 6J6 and clip lead would be S9; (C) skip is so spotty that this vertical fellow just happens to be in the right spot.

On the other hand, vertically polarized stations often find they are receiving better signals on skip from horizontally polarized skip stations than their horizontal brothers.

All of which leads those of us with a flair for imagination "could it be possible that the E skip mechanism actually twists the signal?'

Believe it or not, this is not a new thought. However, to the best of my knowledge, it has never been officially explored on a concentrated effort over a summer of E skip. It is hoped that this article, and others to follow over the winter ahead, will send enough 50 megacycle men to the aluminum piles to erect a number of switchable dual polarization beams for the 1963 E skip season.

But it was not E skip that first attracted me to the dual polarization antenna. It was, as noted earlier, scatter.

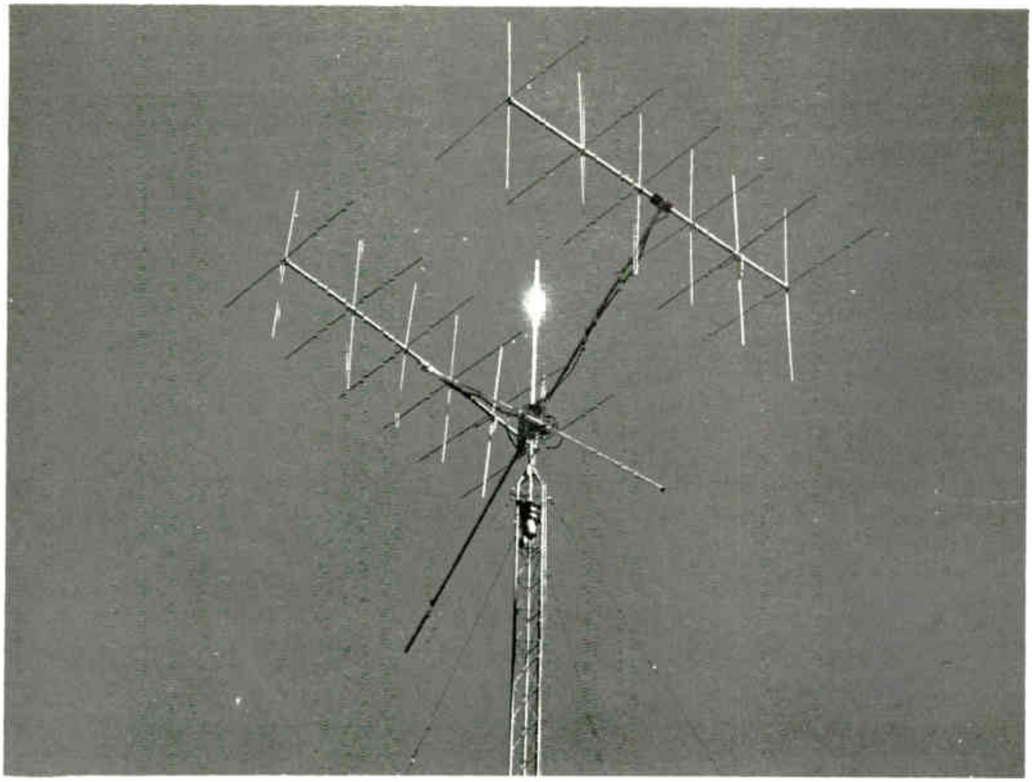
The scatter mechanism is one which displaces small globs of semi-ionized molecular concentrations in either the D or E layers of the ionosphere, or in the atmosphere itself, in the case of tropo scattering. There has been some evidence advanced that the semi-ionized globs are twisting (*ie.* rotating in a spiral) at an irregular rate as they fly through the layers involved. It is these globs, which, when excited by meteorites and ionospheric winds, cause momentary refraction (or reflection) of your 50 megacycle signal. In its most basic approach, ionospheric scatter is exceedingly short-lived E skip, occuring at a height just slightly lower in the E layer than normal E skip occurs.

Some have suggested that the twisting and spiraling of the semi-ionized globs which cause scatter to occur also twist the plane of the signal as the signal reflects from (or reflects in) the glob it passes into and through.

It is on this basis that we attempted the design of an array which would give us the following options at the throw of a switch:

(A) Horizontal only
(B) Vertical only
(C) Clockwise circular
(D) Counter clockwise circular

As far as this array went, it did just that. However no attempt was made to sample via any automatic means the relative signal levels on each of the four choices of polari-



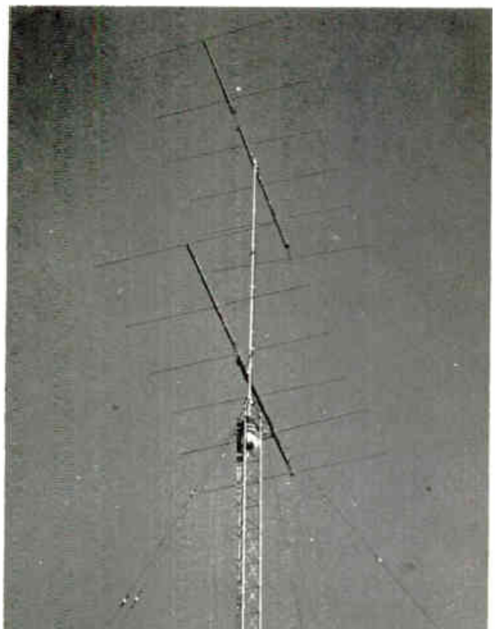
Diversity 12 by 12 array at WO[redacted], Imperial, Missouri. Boom lengths—15 feet, spreaders 20 feet long. Antenna height 70 feet above ground. A late winter storm brought this one down with 4 inches of ice loaded on the cross members.

zation, thereby choosing the particular polarization which was producing the greatest signal level at any given instant.

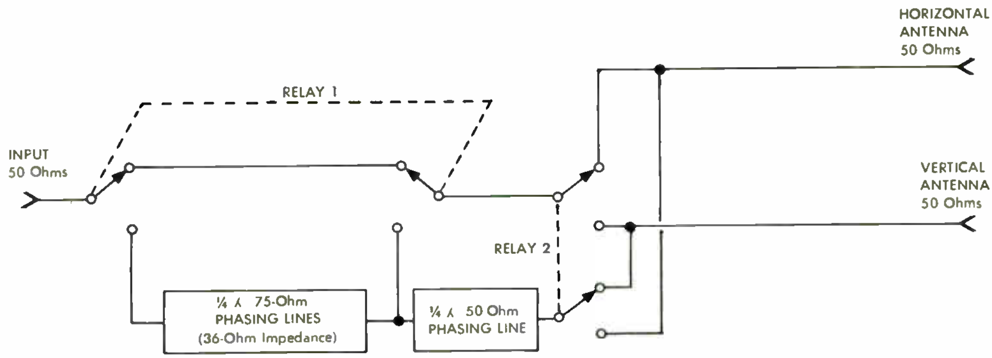
Diagram one shows the very simple means employed to select any one of the four polarization modes. The principal means of phase change was the use of ¼ wavelength coaxial delay lines, which by simple addition and subtraction to the basic phase of the input signal (left hand side of diagram 1) resulted in any of the four choices of polarization desired.

Notice in diagram 1 that we are maintaining a 50 ohm output in either vertical, or horizontal, or circular polarized arrays. Keep in mind, when duplicating any part of the switchable feed system, that the ¼ wavelength phasing transformers must have the velocity factor of the coax you choose to use calculated into the actual phasing line length. Note also that both 75 ohm and 50 ohm coaxial cables are employed in the phasing array.

Diagram two offers two possibilities for phasing together together either 2 or 4 fifty



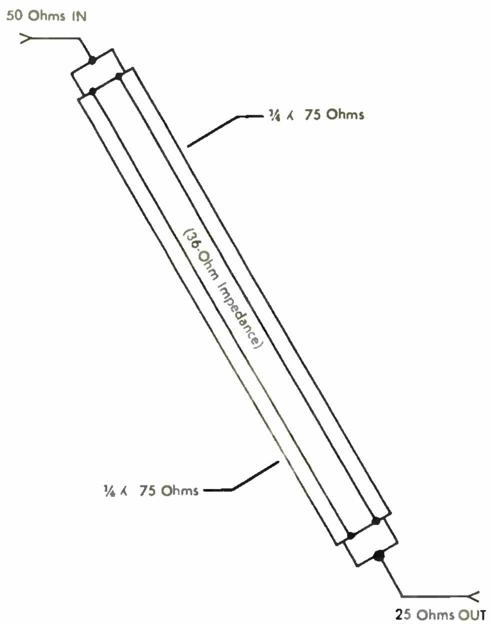
Horizontal 6 over 6 shown here produced a 48-state WAS in 5 months in the 1961 E skip summer season. Boom's 15 feet long, vertical spacing 18 feet. Top antenna 80 feet above ground.



POLARIZATION CHOICES

RELAY 1	RELAY 2	
	NORMAL	ENERGIZED
NORMAL	HORIZONTAL (Only)	CLOCKWISE CIRCULAR
ENERGIZED	VERTICAL (Only)	COUNTERCLOCKWISE CIRCULAR

Diagram 1



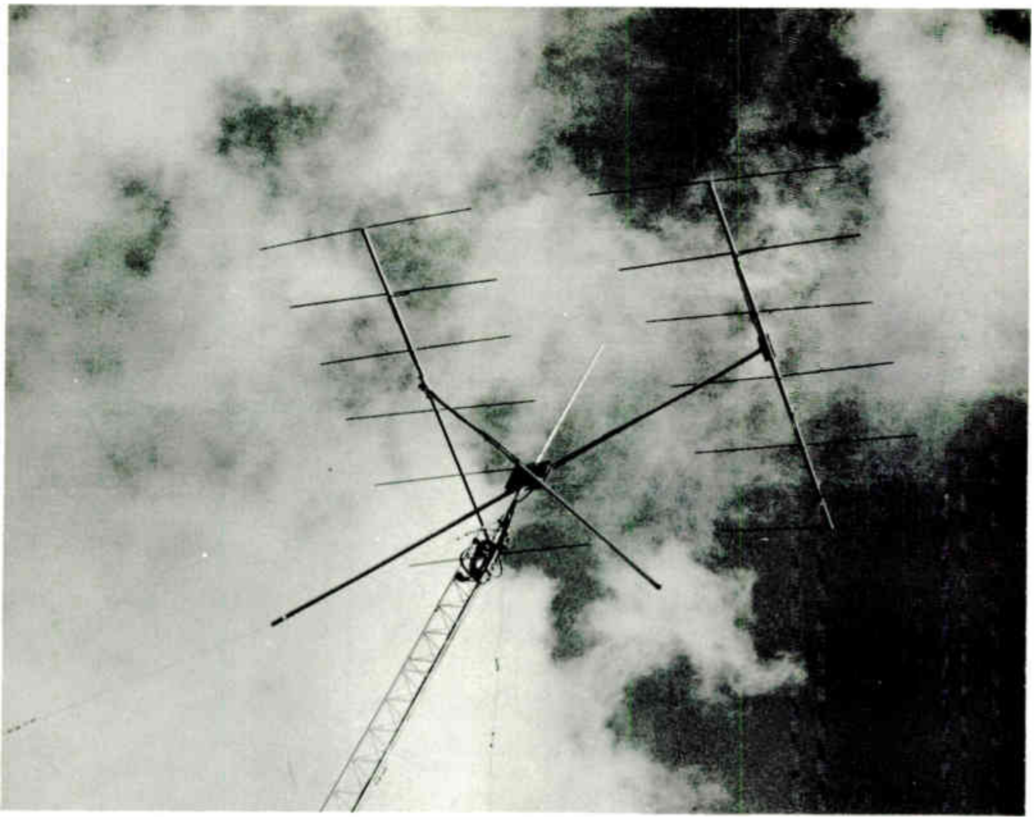
1. Stubs can be made up with connectors, or soldered and taped, with coax connectors only at input and output.
2. Parallel 75-ohm ¼-wave lines are used to match two 50-ohm antennas to one 50-ohm line.
3. Parallel 50-ohm ¼-wave lines may be used to match 4 50-ohm antennas to one 50-ohm line.

Diagram 2

(50) ohm yagi antennas into a single array These methods are, of course, good whether you are stacking horizontal and vertical yagis on the same boom, as was done in photo 1 with the 24 element (12 vertical and 12 horizontal) dual diversity array or if you are simply stacking 2 or 4 yagis in the vertical plane (photo 2) or horizontal plane (photo 3.).

SELECTIVE SAMPLING

With an antenna such as is shown in photo one (24 elements) you have the makings for a polarization diversity array which offers selectable polarization, depending on the signal level present in any one of the four polarizations (*ie.* horizontal, vertical, clockwise circular, counter-clockwise circular) at any given instant. With a single feedline to the receiver (converter) this limits you to manual selective-sampling. In other words, you rotate your relay changeover switch in the shack listening for audible changes in the signal level you are working with, picking the polarization position which produces the best signal to noise ratio.



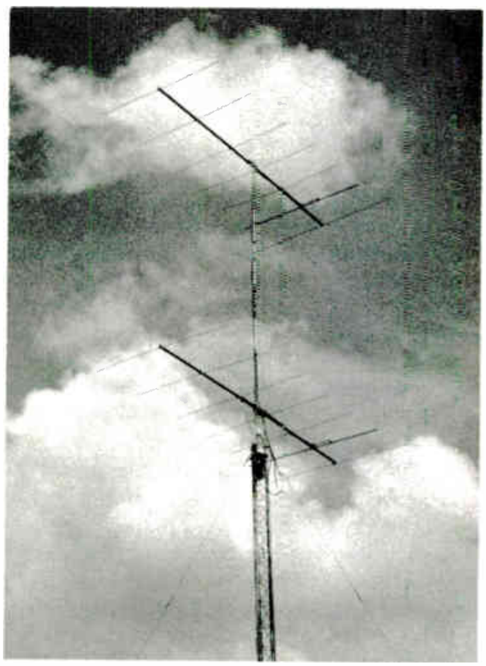
Horizontally stacked 6 by 6. Boom lengths 15 feet, spreader lengths 20 feet, antenna height 70 feet. This array suffered on low angle long haul paths (tropo scatter).

PERFORMANCE

The array shown in photo 1, with two booms, each of which had a six element vertical and six element horizontal antenna mounted thereon, was a real winner on short-haul scatter (high angle work) and E skip. However it was not as good as the stacked 6-6 or 7-7 for low angle work. It is felt that this antenna (the 24 element dual array) would have performed well on low angle scatter also, had we been able to add an additional 24 element array on the bottom of the spreaders, identical to the top mounted array. However the ice of a late winter storm beat us to it this spring and the entire array, coated with ice as big around as your wrist, came shattering to the ground!

It is hoped that many serious minded 50 megacycle amateurs will give consideration to this basic design in the winter months ahead with an eye toward real evaluation of the four modes of polarization over paths likely to produce shifting polarizations due to irregularities in the troposphere or ionosphere.

W0BBM



Vertically stacked 7 over 7 presently in use at W0BBM, pending completion of a more elaborate dual diversity array. Boom lengths 20 feet, vertical spacing 18 feet. Top antenna 80 feet above ground.

144Mc

by Russ Miller, W5HCX
Associate Editor
VHF Horizons

The construction techniques of building a colincar usually presents problems to most amateurs who attempt to build this antenna type.

Seemingly, the antenna appears difficult to construct when it really isn't. In fact, its odd size plus the mechanical problems has in reality scared off a lot of erstwhile builders. Don't let it scare you.

A colinear array, particularly at 2 meters and up, will give you a healthy amount of gain, has a good capture area, is not specifically a narrow band device and can be used over a wider range of frequencies than the Yagi without introducing a serious VSWR. Also, the radiation pattern of the array is naturally broad and eliminates the need for precise aiming.

Building a colinear can be approached in a number of ways. Of first interest is mechanical strength to keep storms from damaging the array. Weight is also a consideration since too heavy an array makes its mounting difficult. A colinear need not be heavy. Size is important because the physical area of the array determines its performance.

The best all-around size at 2 meters is the 16-element array. The array described here is a simplification of the usual construction process. The antenna is constructed from aluminum tubing and steel conduit, the latter used for the boom and the cross-arms. Lashing it together consists of arc welding the cross-arms at their mid-point to the boom as shown in Figure 1. The letter "W" indicates the weld point in the illustration. The next item is the insulator support plates which, by the way, are designated as 'mending plates, 1" x 6" with 10/32 countersunk holes' and are available from local hardware stores or suppliers. These are also made of steel and can be arc welded to the ends of the cross-arms. Why weld the steel parts together? Rigidity is one reason, and the other is cost. It is cheaper than using numerous U-bolts and clamps.

Figure 2 gives all the necessary dimensions. One thing you may notice is the unusually long piece of conduit used for the boom material. If you cannot obtain a piece this long, have a short piece arc-welded to a standard 10' length.

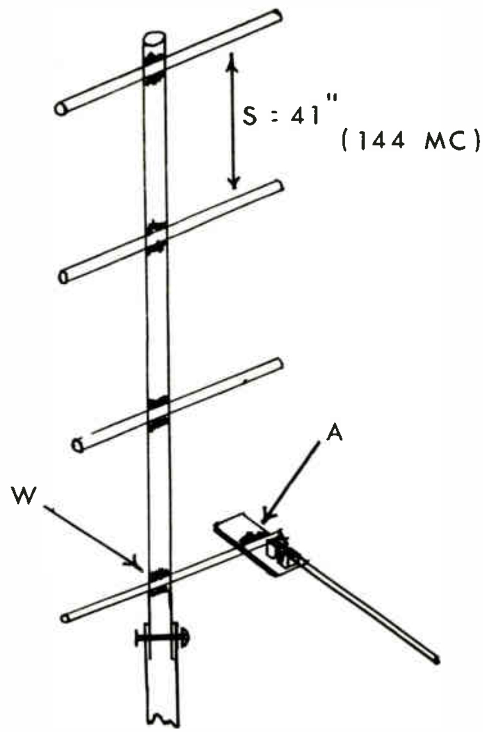


Figure 1

The insulators used with this array should be ceramic, although glazed steatite will do. The insulators should be approximately 1" square by 1¼" high with 10/32 threaded holes in each end. The elements are held fast to the insulators with standard ½" fuse clips. See Figure 3 for details. The fuse clips are available from a number of sources through the surplus stores have the best selection. Holding the elements in the fuse clips can best be done by drilling a hole through the fuse clips and the elements and securing the assembly with 6/32 bolts and nuts. This will also give you a place to fasten a phasing harness.

Feeding the colinear is like most all other arrays; it *must* be matched to the feed line. The actual impedance of this array at the feed point does not approach any figure that can be easily matched. If a ½ wave balun is usd with 72 ohm transmission line, an approximate match will be obtained. However, if you want to lower the standing wave ratio to better that 2/1, a ¼ wave matching stub

will have to be used. The ¼ wave matching stub is adjusted by moving the transmission line point of connection up or down until minimum SWR is reached.

Slight adjustment of both the transmission line connection and the shorting bar then should be made to reduce the SWR to as close to 1/1 as possible. Incidently, since the array is a balanced device and the transmission line is not, a balun will have to be used at the transmission line connection to the ¼ wave matching stub.

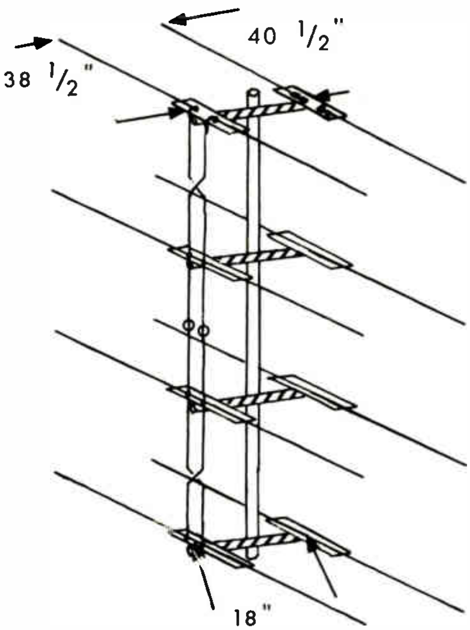


Figure 2

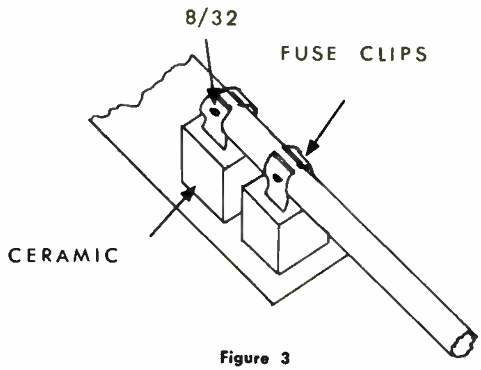


Figure 3

Letters

Dear VHF:
Received the complimentary copy of VHF yesterday and after having ingested its contents wish to apply for future as per enclosed subscription form. To me it appears that you are off to a good start with a long needed tool for the serious VHFer and with the staff you have listed on page two, this effort should be very successful.

Judging from the W4IKK/W4HHK article, you may have lost contact with Bill. He is now associated with AEDC at Tullahoma, Tenn. At last accounting, he was running six watter on 50 Mc rather sporadically due to work and study.

C. A. Waterhouse, W4INM
700 Marlboro Avenue
Chattanooga 11, Tenn.

OM—
Thanks for the note on Bill's location; the first time ye ed worked him, he was running 5 watts on a mountaintop during a tropo opening—so we'll be looking for his mighty 6-watt signal again!

Dear VHF:
First I would like to say your new magazine looks real good. I already know of 10 subscribers locally. The next thing I would like to know is what are you doing to your modulation on W5KHT SSB rig. During the VHF contest it sure sounded good. If there is anything I can do to help the magazine let me know.

73
Ken Halladay, K6HCP
San Jose, Calif.

Ken—
The W5KHT modulation secret is nothing more than Art Collins KWM-2. They don't come any better! You, and others, can help by simply spreading the word about VHF. We'll gladly mail a sample copy to anyone requesting same . . . provided they haven't received a free one previously. Pass that word around!

Dear VHF:
Thank you for the complimentary copy of your new VHF Horizons magazine. Frankly, I compared it (August issue) with the 3 ham journals I now subscribe to and came to the following conclusion of preference; in this order: 1—QST, 2—73, 3—CQ, 4—VHF Horizons. I also had access to two other ham journals, VHF Amateur and Western Radio Amateur, both of which I would cast below your magazine.

Try me again in the future; possibly by then you may have achieved the key to a superior journal at which time I'll buy.

73's
Vin Salemme, K6VUB
Livermore, Calif.

Dear VHF:
After devouring the meaty information in every page, I just had to collar myself and forward the enclosed subscription. I am interested in NFM at present and would like to round up other enthusiasts thru your columns. Most of my NFM operation is on 6 meters.

73
August Oechsli, K2PQY
Massapequa, L. I., N. Y.

August—
Stand by for a deluge of letters from NFM enthusiasts. How about it, gang?

Dear VHF:
Congratulations on the fine publication which covers most interesting topics. Finally the Technicians have been recognized as a powerful group who have no beef with anyone. The need for such a magazine has been filled.

Best wishes
Daniel R. West, K6DRX
Menlo Park, Calif.

Dan—
Thanks for the comments but we must set one thing straight: VHF is published for the technician, not for the Technician. We all feel that high technical interest is the lifeblood of VHF ham radio — but when it comes to the class-consciousness which a few hams of all license classes try to foster, we draw the line. To us, a ham is a ham is a ham — and if he's interested in VHF work, we're all for him no matter what the '''class'' of his license!

220 Mc

by **Robert Grimm, K6RNQ**
Western Technical Editor
VHF Horizons

After loading the 220-Mc rig up to a kilowatt one cool summer evening and burning up the transmission line to the 13-element long yagi in the process, the author made the marvelous deduction that he might have an SWR problem. This is later confirmed by a check which showed SWR of 10 to 1.

Now very few hams have the patience and/or equipment to properly tune a very long yagi for optimum forward gain, this being no simple task. At this point it was decided that a simpler antenna of equivalent characteristics would be highly desirable.

A quick check with George (let George do it? No.) W6OKR, in Larkspur, gleaned us some data on a very interesting little 6-element yagi.

One of these little gems was put together quite easily using ¼-inch aluminum tubing, which was readily available at the local surplus outlet. A quick trip to the neighborhood hardware store netted us some nice ¾-inch aluminum tubing for the boom. After some fast calculations and a little work with the drill and hacksaw, there was a 6-element yagi.

It was tried out and the results were so gratifying that I decided to put up a small array using four of these little gems in a quad stack. This quad-stacked array turned out so nicely that this article was the results!

Gain figures are not too easy to determine accurately at this frequency; I'll just say it outperforms the old long beast—and has no problem either!

The stack spacing is 0.85 wavelength vertically and 1 wavelength horizontally. All elements were cut from 1/4-inch aluminum tubing and the booms (as mentioned before) are 3/4-inch aluminum. The elements were force-fitted through 1/4-inch holes in the boom and then the edges of the boom were punched down with a center-punch to lock the elements securely in place without any hardware.

One of the first things you will probably notice is the rather peculiar staggered length of the directors; this results in slightly more gain than would be attainable with tapered directors and is not a typographical error.

The element lengths and spacing distances are shown in Figure 1. Design center frequency is 221 Mc.

The phasing lines were made from 1/2-wavelength sections of transmission line. We used Gonset Silver U line but almost any type of balanced transmission line could be used.

The folded-dipole section of the driven element is made from No. 18 enameled copper wire spaced 3/4 inch from the driven element. Ceramic standoff insulators were used to support the dipole at the feed points. About the easiest method of attaching the dipole to the driven element is to flatten the outer half-inch of the ends of the driven element and drill a hole 1/4 inch in, for a 6-32 bolt. The No. 18 wire can then be fastened either by wrapping it under the bolt or by use of soldering lugs. Be careful to scrape the insulation from the wire to get a good electrical contact.

The front-to-back ratio of the array is approximately 18 db while VSWR at center frequency measures 1.2 to 1. The pattern is needle-sharp in the forward direction, with deep nulls so you can drop out QRM (!). Feedline of 300-ohm or 450-ohm open type is suggested.

Balun Lengths

Many antenna-matching systems use the familiar half-wave balun. But to be a half-wave long, which is necessary for the balun to work right, the physical length must be reduced according to the "velocity factor" of the cable.

So long as everyone used ordinary coax (RG-58, RG-8, etc.), all "velocity factor" figures were the same and you could trust published balun data. However, the new low-loss foam-type coax has a *different* velocity factor — and this may be why your balun doesn't seem to work quite right.

The following table gives balun length, in inches, for the most popular bands for both old and new types of coax.

Freq. (in Mc)	Ordinary Coax	Foam-Type Coax
50.3	77½	91½
52.0	75	88
144	27	32
146	26⅝	31½
221	17⅝	20¾
432	9	10⅝

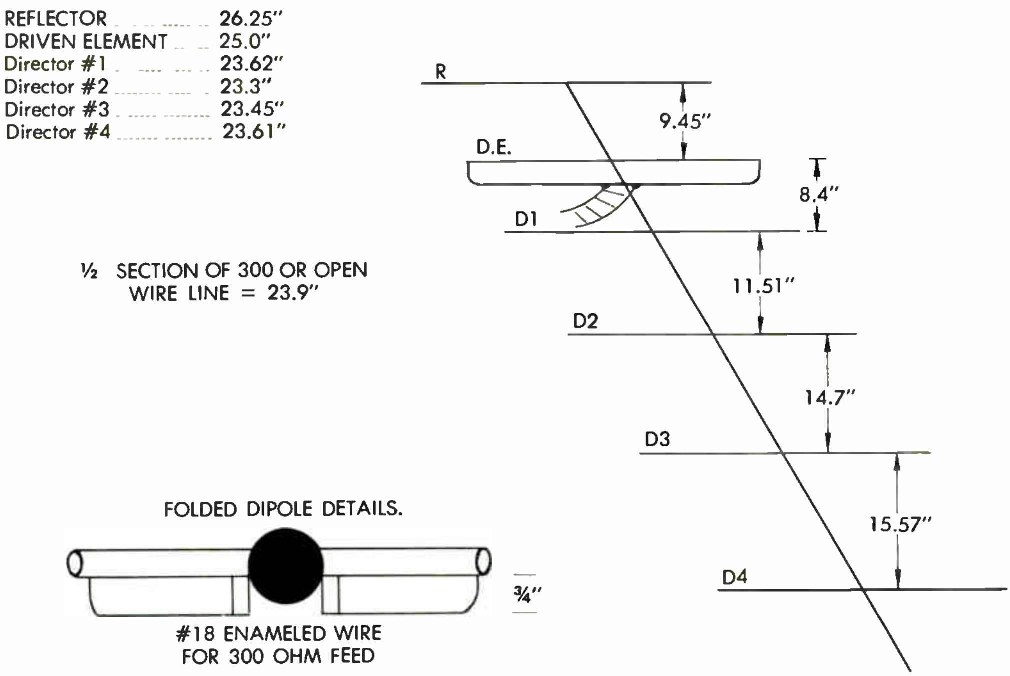


Figure 1. Element Length and Spacing Details

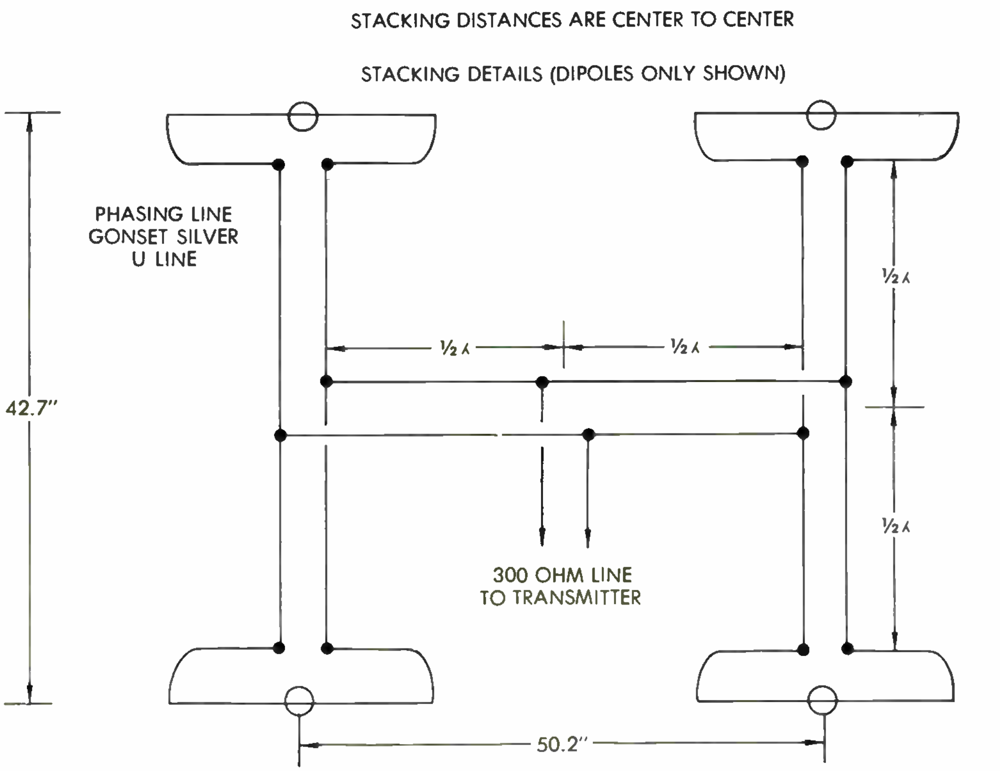


Figure 2. Phasing Harness Construction and Stacking

Antenna Construction

by **Paul M. Wilson, W4HHK/A4HHK**
Southern Technical Editor
VHF Horizons

During the past fourteen years of VHF operation, the writer has built and used a number of antennas on the 50, 144, 220, and 420 Mc bands. Some were mechanically sound and worked well electrically, while others ended up in the antenna graveyard on the back side of the lot.

Experience has shown that certain construction techniques are reliable. It is the purpose of this article to pass on some tips and recommendations that have been employed successfully at this station. They are not to be taken as the "only way to skin the cat", but tried and proven construction employed personally.

All-metal construction is a must. Wooden frames and supports are difficult to build to close tolerance and cannot be maintained in this condition because of the effects of time and weather. In addition, all-metal construction is safer from the standpoint of grounding for lightning protection.

Metal parts such as U-bolts, brackets, screws, bolts, etc., should be sprayed generously with a clear plastic spray such as Krylon or painted with metal primer paint. The latter is available in spray cans, also, for small jobs as well as in larger quantities, and comes in a choice of two colors, red or green.

Construction using tubular booms and framework offers minimum wind resistance, but it can result in other problems. Mounting several elements in line along a tubular boom requires great care in construction. The use of V-blocks for holding the boom while drilling the element mountings holes does *not* insure that all of the elements will be precisely in line when the job is finished. For the amateur who is not a machinist one solution to the problem is the employment of square boom stock.

A drill press is a must, in any event, if one is to drill holes "straight through" the boom and to the size producing a tight fit that requires the elements be forced through by tapping gently on one end with a wooden hammer. With the element centered in the boom, a pilot hole is drilled through the boom and one wall of the element tubing. A sheet metal screw is then run through the boom wall and element wall. The tip of the screw does not penetrate the opposite wall of the element tubing, but approaches it. The head of the screw should be sprayed or painted to prevent rusting.

There are other methods for mounting elements such as cast aluminum brackets (for tubular booms) and soldering techniques. The brackets are well suited for 50 Mc antenna construction. On 432 Mc where elements lengths and diameter are small, copper tubing or pipe booms and hard drawn copper wire elements can be assembled by drilling and soldering.

A rule of thumb in determining the boom size and element diameter (where square boom stock is used) is to make the dimension of the square tubing twice the element diameter. For example, ¼ inch diameter elements. suitable on 432 Mc, would mount with ½ by½ inch square boom.

On 144 Mc a 32 element collinear-broadside array has been in use continuously for the past nine years at this station that employs 1 x 1 inch square booms and ½ inch diameter elements. To date all elements are still intact, and in line, despite severe windstorms encountered during the annual tornado season.

One half inch diameter elements have been used successfully in six meter arrays. They have held up well, but do have a slight amount of droop, and perhaps five-eighths inch or three-quarters inch diameter elements would be desired.

Element diameter is not critical (electrically) in collinear-broadside arrays, but is extremely critical in yagi construction, especially on 144 Mc and higher.

The addresses of firms in your city handling aluminum stock may be found in the

yellow pages of the telephone directory, or write to: Dick's, 61 Cherry Ave., Tiffin, Ohio, for his list of tubing, angle, channel, and sheet aluminum for amateur construction.

One weak point in any array is the connection of the phasing line or feed line to the element. If possible, solder lugs should be avoided. They have a habit of flexing and eventually fatiguing . . . breaking loose.

One solution is to use No. 12 or No. 14 solid copper wire for the phasing lines. At the point of connection, the end of the wire is scraped clean and formed into an eye. A machine screw with flat washer under the head is run through the formed eye and then the hole in the elment wall. On the inside of the element an internal washer and nut complete the connection. The final step is to spray with clear Krylon or paint with metal primer.

On 432 Mc where the element diameter may be one-quarter inch, the end of the element may be flattened for a distance of about one-quarter inch, and the hole drilled through both walls. The flattening should start gradually to avoid cracking the aluminum. A vise is used for this job.

If solder lugs *must* be used, secure extra heavy ones, or double up on two normal-thickness lugs. The element ends should be corked or sealed to cut down on wind noise (neighbors dislike antennas that whistle) and keep out rain. During winter weather water trapped inside an element may freeze and burst the tubing.

Another problem is the support of phasing lines. They must be supported frequently or they will sway and flop when the weather is windy. Excessive movement will lead to the breaking of solder lug connections and/or polystyrene insulators.

On 50 Mcs and 144 Mcs phasing lines made of No. 12 solid copper spaced one inch, center to center, have held up well where properly supported. Kilowatt type 300 ohm tubular line may be used for phasing sections, but it, too, must be supported adequately or conductor fatigue will occur at the connection point. In addition, the "up-hill" end should be sealed (with poly rod and dope or poly material) to keep out water and the "down-hill" end left open to allow the tubing to "breath". Otherwise, moisture will build up inside.

The same practice must be followed where this type of line is used for the feedline. should be formed on the outside with a small Where the line enters the house a "drip loop" opening cut in the underside to permit collected moisture to drain out. Care should be used to avoid cutting the conductors when doing this.

Some amateurs have had mysterious results where tubular line was used and moisture could build up. The strength of local signals would vary considerably from time to time. Some of the inexpensive TV type hardware is well suited for phasing line support . . . but not all. The type affording minimum capacity to ground is desired. Care must be taken to preserve line balance to the metal frame and mast. These stand-offs tend to rust easily, so should be sprayed with clear Krylon or painted.

A phasing line trick worth remembering is that the line repeats the load impedance every half wave. Because of this, the exact impedance of the line is not critical if line length is a multiple of a half wave.

This characteristic may be used to good advantage at times. The writer's six meter beam has a 200 ohm feed point. A half wave section of phasing line (no. 12 spaced one inch) carries this 200 ohm load down the mast to a conveniently mounted balun. The balun, made of RG-8U coax, transforms the balanced 200 ohm load to an unbalanced 50 ohm value. RG-8U is run from this point to the shack. A bracket supports a small plate for mounting the SO-239 connectors to which the phasing line, feedline and balun section connect. The connectors of the coax line and balun section are taped with poly tape and sprayed with Krylon after being screwed up tightly. The use of connectors to head up the ends of the coax makes it easy to connect or disconnect and facilitates weatherproofing.

The length of the half wave section of coax for the balun may be safely determined by formula for 50 Mcs work (66% of 114 inches); for 144 Mcs and higher, it is recommended the length be checked with a calibrated grid-dip meter with the coax fittings (plugs) on the cable. The line should be an electrical half wave for the middle of the band in question or the frequency of operation, depending on the amount of frequency changing employed.

(Turn to page 37)

1296 Mc

by **Bill Ashby, K2TKN**
Box 97
Pluckemin, New Jersey

Everyone who has managed to get a watt or two of power above 1000 Mc forgets all about making contacts for a long time. The possibilities for antenna design are countless and very intriguing. The fact that high-power, narrow beam-width antennas can be built with a few scraps of wire and a soldering iron, with plenty of space in the average room to make all kinds of experiments, is too interesting to pass by. Simple test equipment is not hard to build, accurate enough to show relative gains of various combinations, but exact values in actual db are very difficult to come by.

Ten years of work by numerous amateurs have produced the following deductions about antennas for 1296 Mc and up:

1) Yagi types will work, but are very difficult to put on frequency. Attempts to scale down dimensions from lower frequencies do not normally produce good results.

2) Driven arrays of dipoles, so-called co-linears, etc., are easily built, matched, and capable of medium gains (approximately 18 db) before multiple-matching problems catch up. Frank Jones, W6AJF, in his VHF handbook, has excellent designs to start with.

3) Rhombics, V-beams, and other long-wire arrays can be made to work, but directivity and gain leave much to be desired.

4) Helical antennas are excellent, easy to build and match. An informative article recently appeared in QST. The predicted reduction in gain when working with a linear antenna does not show up in practice.

5) Above 1000 Mc, passive reflector antenna arrays really start to work. A 90-degree square corner, 12 inches on a side, with a "bow-tie" driven element, cannot fail to give 10 db gain. Careful adjustment of the driven element, feed and matching, plus postion in relation to the reflector, will produce 13 to 14 db gain. Stacking four of these wide by four high is practical and will produce gains in excess of 28 db.

Like all multiple-feed arrays, the major problem is getting exactly the same amount of power, in exactly the same phase, to each driven element. For gains in excess of 30 db, the only practical method known is to use a horn or circular parabola.

High-gain horns are not efficent from the size or weight aspect, but small horns make excellent feeds for parabolas. The feed problem eliminates the possibility of using a cylindrical parabola, but parabolas of revolution are easier to build anyway. Excellent reflectors have been made by amateurs using plywood, aluminum, or steel, up to 26 feet in diameter.

The curve necessary for the ribs of the framework is easy to derive, without any complex mathematics — all that is needed is a steel wire or measuring tape and a square. Decide what will be your focal length. This is the distance your feed will be in front of the dish. 50 percent of the desired diameter works out very well in practice (this is known as a 0.5 F/D parabola).

Lay out this line full scale on a fairly flat surface, such as your basement (or garage) floor. Mark the focal point "A" and the other end "B". Lay out another line absolutely perpindicular to A-B and inter-

EDITOR'S NOTE: We went all-out to be sure you had good information on 1296-and-up antennas in this issue. We contacted everyone we knew of working in this region and solicited contributions. By press-time, it was obvious that we were getting snowed under. Because it offers a number of new and intriguing ideas, we're featuring this month Bill Ashby's collection of tips. Next month, we'll hear from the West Coast as W6MMU, Don Goshay, presents his ideas ,including another, different dish feed system) and K6GKX, Ralph Steinberg, of the Microwave Society of Long Beach, tells how to build a colinear dipole array for 1296 in a matter of minutes. If you get infected by the bug and decide to forsake such "DC bands" as 6 and 2 in favor of the exciting region above 1000 Mc, let us know. And we'd like to see some snapshots of any dishes built as a result of these articles — who knows, that might make for a couple of interesting pages some time next spring!

—K5JKX

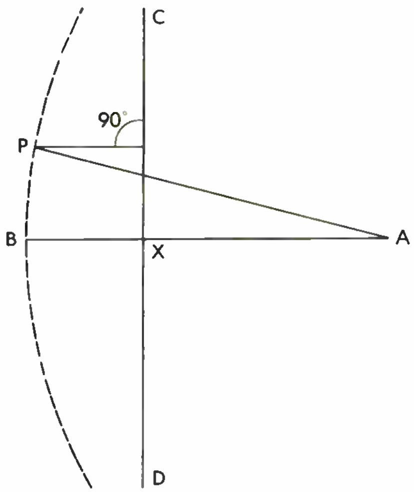


Figure 1

secting it at about 1/3 of the way from B to A. Mark the intersect point "X" and the ends of the second line "C" and "D". C-D should be a little longer than the desired diameter of the dish.

Drive a nail at point A, and attach one end of the steel tape. Then stretch the tape to point B and back to point X. Mark the tape well here, for this distance (A to B to X) now is our standard length. Using the square to always keep the tape perpindicular to line C-D, move the marked point of the tape from X out toward C or D. The point where the tape folds ("P" in Figure 1) to go back to point A is always a point on the actual curve of the parabola.

The focal length is fixed, but any diameter can be had by drawing a line parallel to C-D that intersects the parabolic curve at the desired diameter.

As you can see, any energy leaving the focal point A that reflects from the parabola will be in exactly the same phase as any other. You have ray-traced your design full scale, and it always works. A plywood template is drawn, and the rest is easy.

I have used yagis, square corners, dipoles with reflectors, slot, and horn feeds for various dishes; all with success of some sort. However, a horn antenna, designed so that the 3-db points of its pattern fall just outside the edges of the dish, always gives maximum gain. My 0.5 F/D 20-foot diameter dish with a good horn feed (9 inch square opening) allows the feed to be as much as 12 inches off the true feed point before any gain decrease is noticed.

(Turn to page 23)

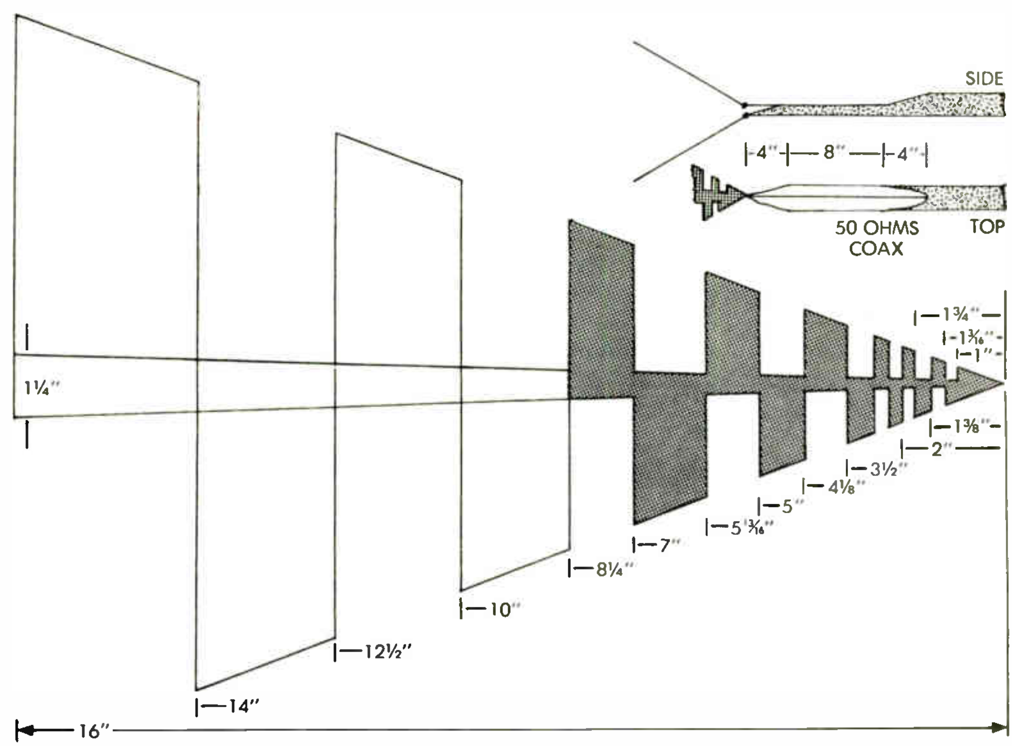


Figure 2. Log-Periodic Feed for 400-2500 Mc

3300 Mc (and up)

by George F. Tillitson, K6MBL
462 East Grove Street
Pomona, Calif.
(holder of one end, 3300-Mc record)

This article, although directed toward the 3300 megacycle band, is applicable to the 2400, 5700 and 10,000 megacycle bands as well. It is written not as a construction article, but as a guide to present and future microwave enthusiasts in their antenna selection and design.

At 3300 megacycles, the 9 centimeter wavelength is small enough to make almost any type of antenna possible. The problem is to select the most practical type for amateur use on 3300 Mc.

Since most 3300 Mc amateur operation is performed with microwave power output in the 100 milliwatt region, a high gain antenna system is necessary. Low power operation allows pola-plexing or simultanous transmission and reception using transmitting and receiving antenna polarizations at right-angles to each other. The pola-plexer provides a waveguide feed system for the antenna. (More on this later).

The parabolic reflector and the conical horn appear to be the most practical antenna types for use on the 3300 Mc band. Both types are broad band antennas, require a minimum of elements to adjust and will support a dual polarization type communicatons system.

The parabolic reflector, or "dish", will produce a directional beam, following the laws of optional reflection. It is a type of mirror having a focal point located along the center axis (Figure 1). When a source of microwave energy is situated at the focal point, illuminating the parabolic reflector, the energy will be reflected in such a way that it travels outward and parallel to the axis of the reflector. The reflector size determines the forward gain of the parabolic reflector.

In other words, the larger the diameter of reflector, the greater will be the forward gain and the smaller will be the beamwidth. For example: an 18 inch diameter parabola at 3300 Mc will provide 21 db gain over an isotropic radiator, with a beamwidth of approximately 14 degrees. An 8-foot diameter reflector at the same frequency will provide a 36 db gain and a 2.5 degree beamwidth.

Before you run down to the local surplus emporium and purchase that eight or ten foot radar antenna, consider the problems involved with the larger size reflectors. Besides having high gain capabilities, they also have

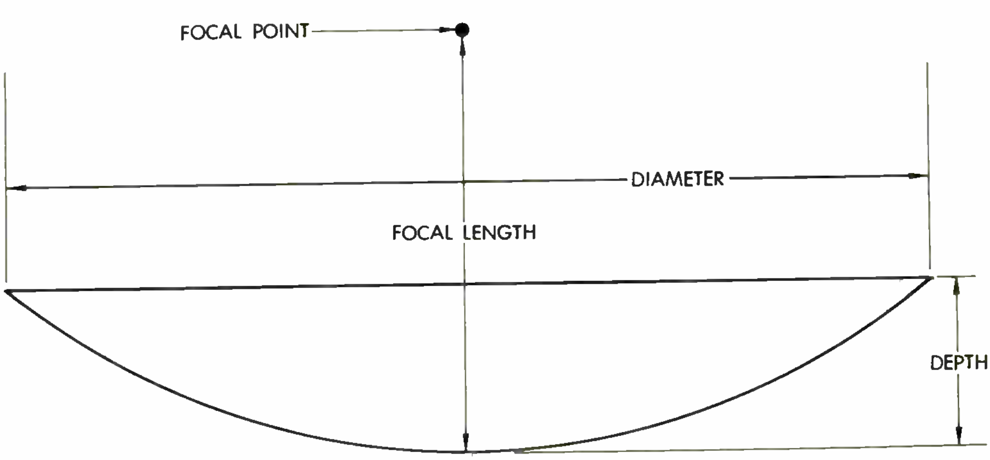


Figure 1. Parabolic Reflector

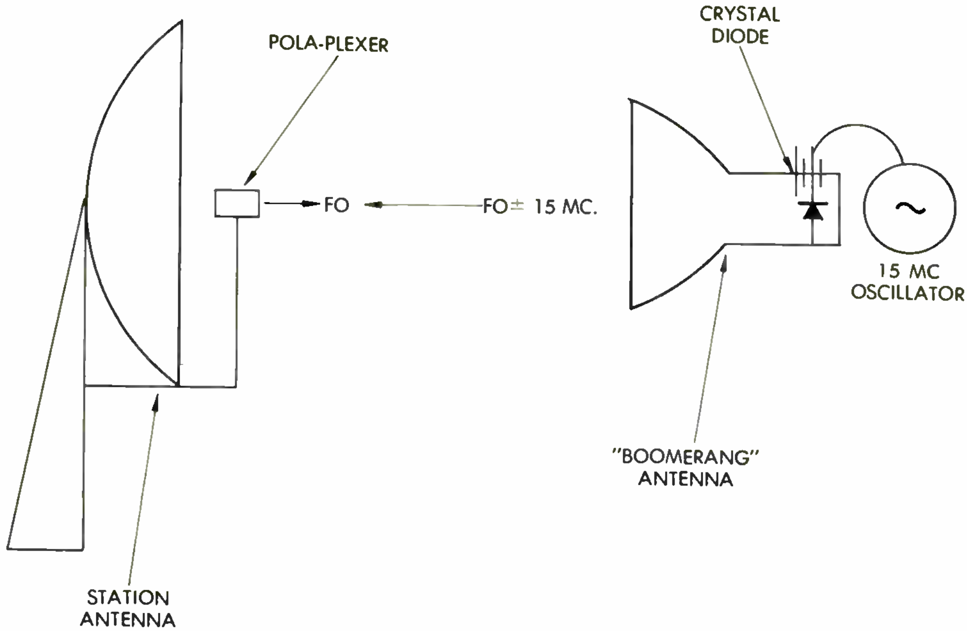


Figure 2. Boomerang Focus System

greater weight and wind resistance. A solid eight foot parabolic reflector can place over 1000 pounds of torque on your rotating system in a 70 mph wind. A four footer can produce 260 pounds of torque under the same conditions. A perforated reflector will decrease the wind resistance, but will limit the reflector's efficiency at higher frequencies.

I have found that a four-foot reflector is about the largest that one man can handle easily. I have mine mounted on a sturdy surplus light tripod capable of being operated as a "mountain-top" portable unit or placed on my garage top for fixed operation. The method of mounting the reflector will be left up to the ingenuity of the individual, as each reflector presents a different mounting problem.

The feed system for the parabolic reflector must be placed precisley at the focal point for maximum forward gain and minimum sidelobe structure. A simple equation that can be applied to the reflector to find the approximate focal point is: FOCAL LENGTH = DIAMETER SQUARED / 16 x DEPTH. The feed can be placed at this point and experimentally adjusted for optimum performance.

Several methods can be used to optimize the focal point, but I believe the best is W6IFE's "boomerang" system. This consists of a transistorized crystal controlled oscillator modulating a microwave crystal diode placed at the feed point of a remote antenna (Figure 2). The transistorized oscillator operates at ½ the communications *if* frequency, 30/2 Mc or 15 Mc in our case. The transmitting klystron radiates from the feed to be adjusted, toward the "boomerang" antenna. The CW signal, intercepted by the "boomerang" antenna, is AM modulated at a 15 Mc rate by the crystal diode. Thus, a signal containing the original carrier and two 15 Mc sidebands (which are 30 Mc apart) is reradiated back to the station antenna.

The receiver mixer detects the 30 Mc difference signal and passes it to the 30 Mc *if* amplifier and signal strength meter.

Since the detected signal is twice the "boomerang" oscillator frequency and the amplitude is proportional to both radiated power and receiver sensitivity, we have a

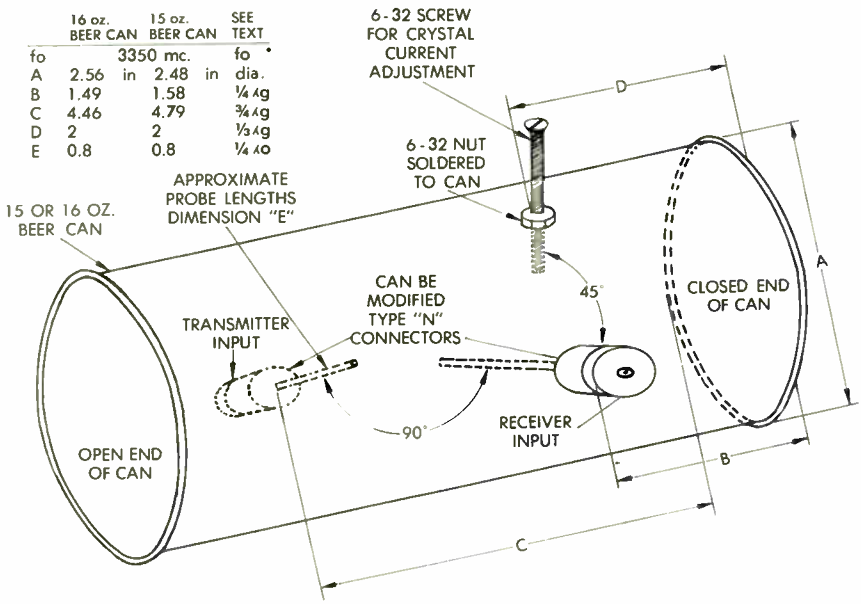


Figure 3. Polaplexer Construction Details

stable *if* signal that will indicate maximum signal strength when the feed is optimumly placed at the reflector's focal point.

When performing the above focal adjustment, the distance between the station antenna and the "boomerang" antenna, in feet, should be greater than $1.41 \times 10^{-5} \times$ frequency in Mc x reflector diameter in inches squared. For example: the minimum distance between the "boomerang" antenna and a four foot parabolic reflector at 3300 Mc should be 107.2 feet.

Dimensions for use of common 15 or 16 oz. beer cans for basic pola-plexer construction are included in Figure 3. For those energetic souls wishing to compute their own dimensions for this band or others, the procedure is as follows: Select a waveguide whose diameter in inches falls between 6917 / fo and 9035 /fo, where fo is the operating frequency in Mc, preferably closer but not equal to the later equation. This will assure that the TE11 circular wavequide mode will dominate and no spurious waveguide modes will exist. Then compute the waveguide cut-off frequency (fc) by equating $fc = 6917 / dw$, where dw is the waveguide diameter in inches. Now compute the guide wavelength, $\lambda g = 11803 \; / \; fo \times 1 \cdot (fc/fo)^2$. λg is the guide wavelength in inches. Now apply λg to the third column in the dimension table in Figure 3.

The use of type "N" connectors terminating the probes is not the only way to couple energy in or out of the pola-plexer. A 726A klystron, for example, can be mounted directly on the pola-plexer (see QST, Dec. 1957, June 1958 and Aug 1960) with an extended klystron probe directly exciting the waveguide. The receiving probe can be replaced by a mixer assembly within the pola-plexer. Many other modifications can be made to the basic pola-plexer dependent upon the availability of components and the cleverness of the individual.

Since it is necessary that the transmitter look at the other fellow's receiver, it is suggested that the transmitted signal polarization be 45 degrees to the right of vertical looking in the direction of transmission. This will eliminate the classic argument about who is to transmit horizontally and who vertically with the pola-plexing system. Also when you complete your 3300 Mc station, you can more easily communicate with me.

This should serve to acquaint you with some of the antenna techniques used on 3300 Mc and other microwave bands. If there is sufficient interest in these antennas or in the crystal controlled klystron "ROCK-LOC" systm in use by members of the San Bernardino Microwave Society, more can be published by prodding the editor of *VHF Horizons* via Uncle Sam's Postal Service.

Antenna Height

By Alan T. Margot, W6FZA
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Porterville, Calif.

Did you ever wonder why, on six meter E openings, the follows with the high antennas sometimes beat out those with the low ones, and sometimes vice-versa?

Did you ever wonder why some stations who do quite well on sporadic E take a back seat on tropospheric work?

I used to wonder too, and would set my mind at ease by muttering phrases like "ground reflections" and that old favorite "angle of radiation" and the like.

Recent efforts in the line of ionospheric scattering, however, drove me to the point where I felt that maybe these vague things could be put to use in actual communication instead of just as excuses for strange behavior of signals. A check of the available information on the subject in the ham magazines and technical periodicals yielded practically nothing.

Maybe everybody knew about those things so no articles were necessary. Everybody but me, that is. After a few well-guarded statements and questions I found, with relief, that we were all in the dark when it came to actual facts and figures concerning these matters.

Some plowing through the old textbooks revealed that the signal coming from an antenna operating in the general vicinity of the ground is the sum of the direct signal, and the one reflected from the ground. The reflected signal is slightly delayed due to the extra distance traveled. At certain angles from the horizon these two signals arrive in such a time-phase relationship as to add and double the field strength, and at other angles they can cancel completely. Doubling the field strength is a power gain of 4, or 6 db.

Determination of these angles, assuming good ground reflection, is pure geometry. A typical pattern for a horizontal dipole operating 4 half waves (39.4 feet on 50 mc.) over smooth earth is shown in Figure 1.

But, you say, "I don't use a horizontal dipole, I use a four element yagi". The vertical pattern in this case would be the product of the solid line and the free space pattern of the four element beam.

The result is to increase the size of the lower radiations, or lobes, and decrease the size of the higher ones. It does not, however, change the angles of the nulls and maximums at all. They are determined by the height of above ground alone.

Multiplying the solid dipole pattern of Figure 1 by the handbook pattern of a four element yagi yields the dashed pattern. Actually, the ground reflections will be something less than complete, except possibly over salt water, so full cancellation and 6 db reinforcement will not be achieved.

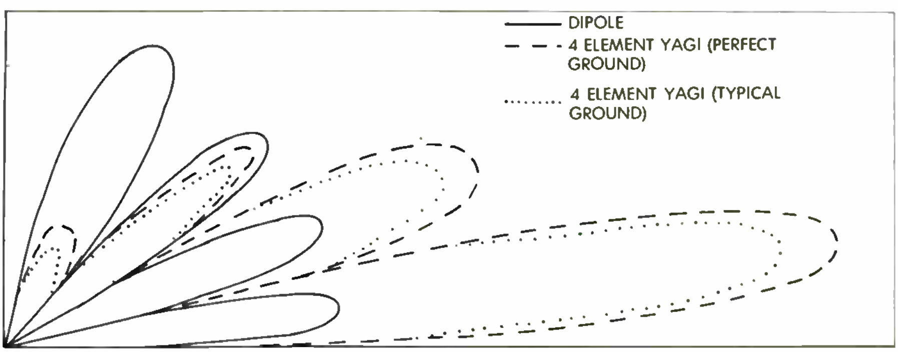


Figure 1. Dipole Reflection Angles

The ground reflections vary with type of earth and moisture content, but they are considerable even over the worst types of earth. Imperfect ground reflections might change the pattern further to look like the dotted lines of Figure 1. Pronounced maximums and minimums do exist, and if we understand what they do to us we can use them to advantage.

Since 50 Mc signals are reflected back to earth by the E layer of the ionosphere like a billiard shot, for every angle there is a corresponding distance where the signal returns.

Transferring these vertical patterns into actual earth distances requires slightly more complicated geometry because of the curvature of the earth. At this point, two variables are introduced: the effect of refraction, and the variable height of the reflecting layer.

The bending effect of normal atmosphere is known, and the upper and lower limits of the E layer are known, so two sets of calculations yield the chart of Figure 2.

The first figure in each spot is for a minimum layer height of 70 miles, and the second is for a minimum height of 50 miles. Because of the variable height of the E layer, there is no point in trying to improve the accuracy of this information. The chart does show some interesting things, however.

The chart also shows that we are donating a lot of power to space. Except in the higher antennas, only the first lobe is useful in VHF work. With horizontal antennas there is always one lobe for every halfwave of antenna height. This means that the fellow with the 70 ft. antenna (on 50 mc.) is shooting six useless lobes into the sky. The more directive the antenna, the more juice in the first lobe, hence the trend toward bigger antennas.

Note that there are a few cases that seem to contradict the old idea of getting the antenna up as high as possible. For example, from Figure 2, at 700 miles a 40 ft. antenna could quite possibly outperform any other up to 100 ft. Generally, it appears that the lower antennas can hold their own against the higher ones in average sporadic E situations.

Figure 3 is a similar chart for ionospheric scattering, based on an average scattering height of 50 miles. This height and the corresponding distances are for the center of the scattering region (36-60 miles). The scattered signal differs from the E reflected

FIGURE 2 PERFORMANCE OF 50 MC. ANTENNAS AT VARIOUS SPORADIC E DISTANCES E LAYER HEIGHT — 70-50 MILES

Ant. Ht. Halfwaves	Ant. Ht. Feet	−3db	0db	+3db	+6db First max	First Null	+6db Second max
2	16.68	1150- 920	1020- 780	830- 630	500-350	———	———
3	29.52	1260-1040	1160- 940	1040- 800	650-550	———	———
4	39.36	1330-1100	1240-1020	1120- 900	850-625	500-350	———
5	49.2	1350-1120	1280-1070	1190- 960	910-700	600-430	———
6	59.04	1390-1170	1340-1120	1240-1020	1010-800	700-500	500-350
7	68.88	1400-1180	1360-1120	1280-1050	1080-850	780-580	580-420
8	78.72	1420-1200	1370-1150	1300-1070	1130-900	850-625	640-450
9	88.56	1450-1220	1390-1170	1330-1100	1160-930	880-670	750-550
10	98.4	1500-1250	1480-1220	1360-1100	1180-950	925-725	820-650

FIGURE 3 PERFORMANCE OF 50 MC. ANTENNAS AT VARIOUS IONOSPHERIC SCATTER DISTANCES CENTER OF SCATTERING — 50 MILES

Ant. Ht. Halfwaves	Ant. Ht. Feet	Odb	+3db	+6db First Max	First Null	For 6db angle Distance to Ground Reflection
4	39.36	920 mi.	850 mi.	590 mi.		320 feet
5	49.20	1000	920	700		495
6	59.04	1060	970	760		715
7	68.88	1080	1010	820		980
8	78.72	1100	1025	850	590 mi.	1270
9	88.56	1125	1040	900	625	1600
10	98.40	1150	1075	920	675	2000

one in that fragments of it arrive from all parts of the scattering region, while the E reflected signal usually arrives from one particular height in the E region.

Figure 4 is a plot of db antenna gain (relative to free space) against the very low angles from the horizon, for several common antenna heights. Sporadic E distances range from around 750 miles for 30° to about 1400 for 0.5°.

Of particular concern to the operator interested in long haul Es and tropospheric work is the performance of antennas in the 0.25° to 0.5° region. Energy radiated at these extremely low angles is bent to travel horizontally by refraction. The results of these curves are dramatic and obvious, and can be generalized by saying that you gain approximately 6 db in a horizontal direction every time you double the antenna height.

The man with the 100 ft. tower is almost 15 db better off shooting horizontally than the one with the same antenna just off the roof. No wonder the high antennas work all the groundwave DX! And this advantage continues up to over 32 halfwaves high (300 feet at 50 Mc) if we neglect the effects of line losses.

These advantages would not be wholly realized if (1) you were shooting over hills nearby, (2) there were abnormal bending conditions, or (3) the path were line of sight. Bear in mind that the ground reflections that form the 0.5° radiation angle occur about 115 times the tower height away from the antenna!

There are other important reasons for getting the antenna up in the air. Useful energy is absorbed from low antennas by surrounding objects. Gain antennas depend on phase relationships of the currents in the various elements, and reflections from nearby objects can induce currents which upset these relationships. A perfectly good antenna can give a queer pattern when mounted too low. These factors are difficult to analyze quantitatively, but antenna handbooks always suggest that antennas be mounted "free and clear" of surrounding objects.

The information in this article just scratches the surface of this interesting subject. If any reader desires more information, or solution of a particular problem please communicate with me. If you hear me on six and my signal is weak, it's probably one of those darn nulls again!

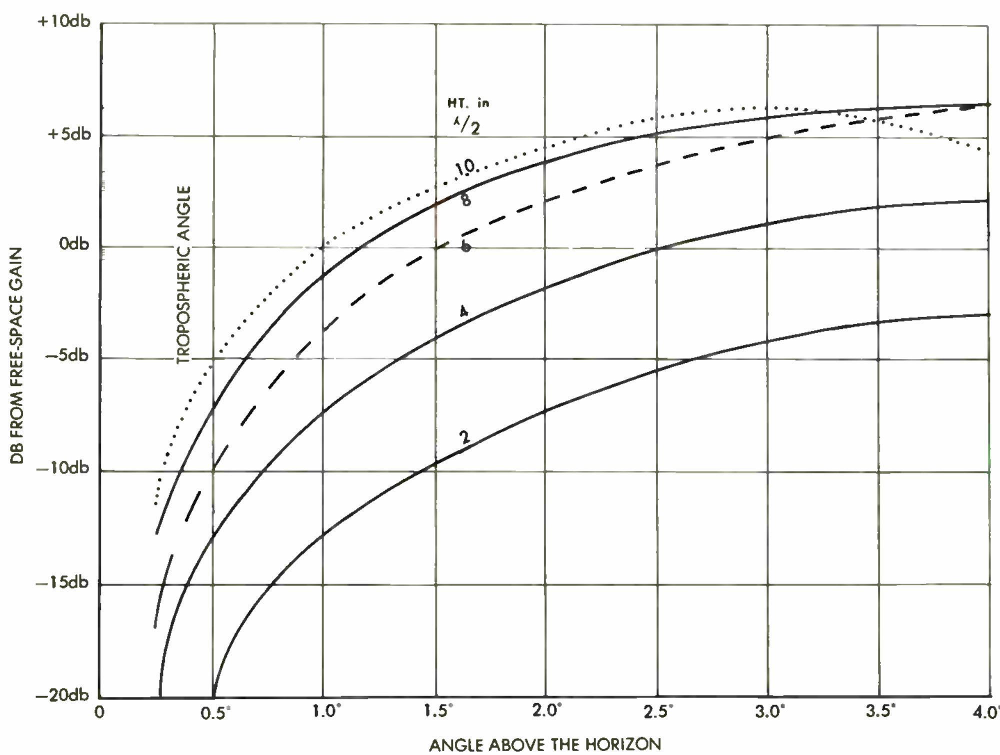


Figure 4. Antenna Gain at Common Heights

Salvaging Old TV Rotors

Every VHF antenna in practical use must have some means for rotating it — and it's here that many constructors run into a big problem.

If you're willing to go out and spend a hundred dollars or more, there's no problem at all. The CDR HAM-M model, a couple of Telrex jobs, and one made by Johnson all serve admirably in the upper price brackets.

Less expensively, a number of TV rotors which will handle medium-size 6-meter beams, fairly large 2-meter arrays, and all but the most gigantic of antennas for higher bands can be bought for between $15 and $50.

However, that's still a good-sized chunk of cabbage for those of us who must cut our hamming budget as thin as a Harvey House ham sandwich!

Fortunately, there *is* a source of supply of rotors for $5 or so if you just take a little extra time and trouble.

This source is born in the fact that most home TV-pole installations are not the best, from a mechanical-engineering standpoint. Comes a good-sized wind, and down falls the pole.

When this happens, the antenna ends up as a tangled mass of tubing — and the insurance adjustor comes in and writes the whole set-up off as junk.

Usually, in such an event, the rotor survives the fall. But knowledgable TV repairmen snaffle off the good rotor-control head pairs which show up by this route. The ones left for us hams usually consist of only a rotor mechanism, sans control head or instructions.

Most people pass these by — and when they do, they pass up a bargain. Because almost all TV rotors operate in much the same manner, and it should take you no longer than 15 minutes to put any rotor back in service (less time if you have a control head, even if it doesn't match the rotor you have).

Virtually all TV rotors operate on 24 volts AC, using the split-phase principle to give you direction control. This means that a simple control head consisting only of a 24-volt transformer, a DPDT-center off or a DP3T switch, and a big capacitor will work with any of them.

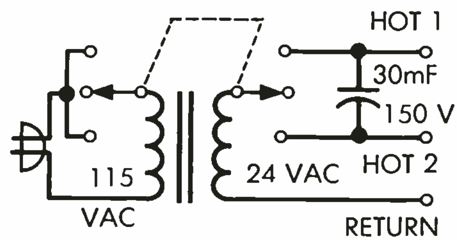


Figure 1

Note that the control head (schematically shown in Figure 1) has only three output wires. Most rotors have from 4 to 8 wires in the control cable. The other wires are for position indication — and that's something this salvage control unit won't help with.

Most practical approach to the problem of position indication is to use a synchro (generally termed Selsyn, though this is a trademarked trade name) system to drive a pointer at the control location.

To determine which three of the wires coming from the rotator you should connect to, take your trusty ohmmeter in hand and measure the resistance between pairs of wires.

Eventually you should come up with three wires, two of which show a low (20 to 200 ohms) resistance from each of them to the third wire, with just twice that resistance reading between the two themselves.

These two wires are the two motor "hot" windings, while the third wire is the "common" motor return. The two wires connect to the two ends of the capacitor, while the third wire connects to the remaining terminal on the control head. If you find the rotor turns the wrong way when you operate it, reverse the connections of the "hot" wires and it will reverse. —K5JKX

1296 Mc . . . from p. 15

Recently, the log-periodic type of drive has been tried with excellent results. The log-periodic antenna by itself is not much for the amateur, but placing it in front of a square-corner or a good parabola produces a *fantastic* array. The six-foot dish pictured with the log drive stays within 30 to 80 ohms and holds a good pattern from 400 Mc through 2500 Mc!

All forms of dipole antennas are based on electrical length of something, but a log-periodic antenna is based on proportion and angles, not finite lengths. Theory is non-existent in practical form, but certain kinds of log-periodic antennas are capable of uniform patterns and impedances over 100-to-1 frequency ranges. 10-to-1 is easy! They can be fed with open-wire or by use of a common form of balue from coax. See Figures 2 and 3 for one very crude version; this is the broadest-band antenna with gain that it has ever been my pleasure to work with. Log-periodic antennas can be readily scaled up or down in frequency, and of course the parabola works from audio frequencies up . . .

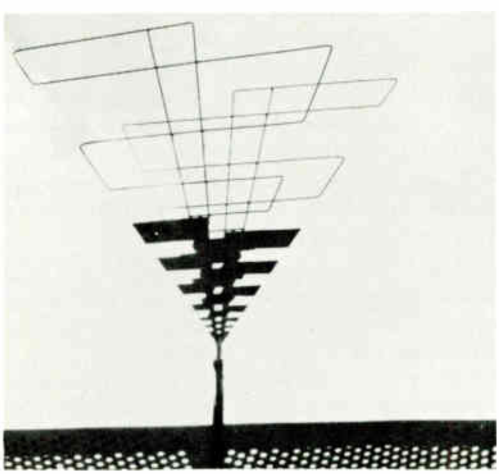


Figure 3

The other photos are of the alt-az mounting using one good rotor and two TV types sawed off and mounted by angle brackets on top of the first. This makes a rugged, easy mount that will handle a counter-balanced six-foot dish with ease. By parking the dish straight up when not in use, no wind problem is encountered, even at 70 feet!

Any high-gain antenna with less than 10-degree beam width should have electrical elevation built into the mounting. Plus or

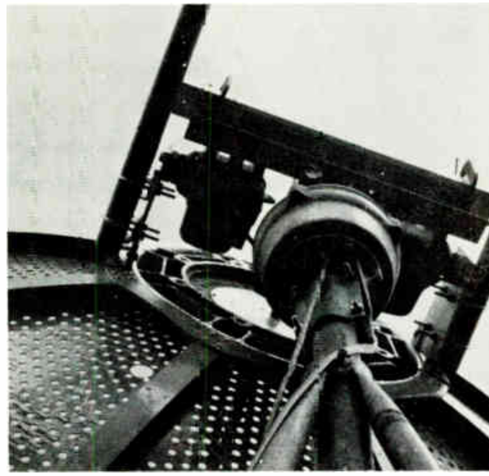


Figure 4. Dual Rotor Arrangement

Figure 5. Dish is Parked Straight Up

minus 10 degrees of tilt, controllable from the operating position, makes a world of difference on local contacts, and if you are going to do that, make it from minus 10 to plus 90 degrees while you are at it. If any moon work is contemplated, start by building a good Polar mount. Failure to believe this has cost me three years of hard work — I believe it now! Without a motor-driven, accurate Polar mount, you are just wasting everyone's time and effort.

This could go on and on, but once you get interested you will find a great deal has been written about antennas. The VHF handbooks detail the common types and periodicals leak out info on the exotic ones. All are of interest when you reside above 1000 Mc. —K2TKN

VITAL HAPPENINGS & FACTS

OPERATING AND DX NEWS

HEARD IN FLORIDA

Remember the VHF contest sponsored by the League back in June? Were you on six meters around 1800 CST (1900 EST)? Perhaps you heard W5KHT announcing (in a somewhat quivering voice) "QST-QST to any two-meter equipped stations . . . it appears that two meters is open in Florida and the Carolinas from Oklahoma. We are tuning 144 to 145 megacycles at this time at W5KHT. Anyone want to try it?"

The 50 Mc operator was 5KHT, Coop. An old hand at sporadic E propagation, Bob detected what he thought sounded like skip sufficently short on 50 megacycles to support a 144 megacycle path of around 1,000 to 1,200 miles in a line to Florida and the Carolinas.

Russ, W5HCX, had the contest rig on two meters at the time, calling CQ. The peak in Es ionization on six meters lasted approximately 30 minutes, from 1745-1815, according to the contest log. On 50 megacycles we were working Arkansas and southern Missouri at the time (300-400 miles) with outstanding signals. We heard stations in Tennessee working stations in Florida and the Carolinas.

No station answered our calls on 50 megacycles (skip was apparently so short as to shut us out of Florida and the Carolinas) and Russ, W5HCX, was having nil luck on 144. At 1755 CST he called and worked W7JCU/5 portable in Oklahoma City.

And we forget about the incident because there had been many-many other "it looks good for 144 megacycles Es occasions" in the past, which did not pan out.

Recently we received a letter from John, K4IXC, of Melbourne, Florida. Melbourne is on the eastern coast of Florida, approximately 90 miles south of Jacksonville.

It began "Dear Bob — On June 9 (at) about 1855 EST on 144.208 Mc I heard a phone signal which I identified as W5THT. Not finding this call in any callbook, I assumed I had made a mistake. He gave his QTH as Oklahoma City, and was calling a W7—/5. I was so surprised I didn't make a note of the W7 call. Recently in talking to WA4DRJ your call was mentioned in connection with VHF Horizons. I then remembered this incident and realized I could have heard W5KHT, and mistaken the call. If it was you, I know you will be interested in this report. The signal was about S-1 when I first heard it, building up to S-9 and then fading down and out. I heard your call 2 or 3 times in the space of about two minutes and had time to set my VFO on your frequency and call between your breaks. I used both phone and CW. No luck. That is my story. Could it have been you?"
Sob.

It could have been W5KHT. It seems rather likely it was. Our operating frequency was 144.208 megacycles (on the nose no less — you must have *some* VFO calibration, John!) throughout the contest.

How did we miss K4IXC? For one thing, we were not listening on our own frequency, nor were we VFO.

John's 100 watts on phone might not have made the grade but his 800 watts CW surely would have. Operator Russ (HCX) says he promises, on a stack of 7788's, to *always* check his own frequency in the future when E skip on 144 megacycles seems possible! That takes care of next time. But who will ever forget how we missed Florida on E skip *the first time?*

As with any event of this type, there is at least one lesson to be learned. Many 144 Mc men expected E skip on two meters this summer. It looked like "the year" for it to happen. To the best of our knowledge, this report is the only one for the season that even smells of E skip. But we know, from our logbook of the past summer, that even from our own limited baliwick, we heard five different occasions when E skip got down to the 350-500 mile range on 50 Mc. Any textbook will tell you that assuming a

normal E cloud formation, this is sufficent intensity to support a 1,100 mile 144 Mc path.

So where was everyone who operates 144 this summer? Sleeping, we suspect. Or tied up on six meters. Whatever the case, VHF hopes to explore this subject in considerable detail in the winter ahead. Maybe next summer more of us will be aware of what it takes to work E skip on two meters. Even the best of us need a state or two in the 1,000 to 1,400 mile range.

50 Mc foreign leads off this month. September - October is traditionally the period of the year when we are led to expect at least a few openings into the far-north land. VE8BY (50.040) has been known to come through in southern Canada and the northern States. Now we have detailed word from Jack Reich, KL7-AUV, concerning operation of not one, but two stations in the Artic Circle. KL7FLC can be found on 50.045 megacycles. FLC is located on Arlis 2, at a position 81 degrees north, 163 degrees east. This was his location in mid-August, and it is assumed that with winter coming on, he won't have moved much in the interim. This is roughtly 1500 miles from Anchorage, according to KL5AUV.

The operator's name is Bob, and he has been on the air and running a keyer since May. Also on from the Artic Circle is KL7-FLB, operated by Bob Mellen. This is Fletcher Ice Island, known as T-3. The KL7-FLB frequencies are 50.040 and 50.112. Those wanting to write to Bob can direct their mail to "Artic Research Laboratory, Pt. Barrow, Alaska," All of KL7FLB's contacts have been from 0400-0800 GMT to date. KL7AUV advises that he himself is operating his code wheel on 50.084, 200 watts CW. Regular schedules are maintained 0400-0435 GMT for VE8BY, KL7FLB, KL7FLC, KL7AUG and KL7AJ. AUG and AJ are located in Ketchikan and both have recently been helping a great number of W7, W0 and W6 stations to Alaska. Just in case you hear the KL7AUV code wheel on 50.084, Jack's telephone is FA-2-2950 in the Anchorage exchange. It can be direct dialed from most of the 48.

KL7FLB has been working KL7AUV, KL7ECT (Ft. Greenly) with KL7FLC also getting into the act.

From way down south, VHF'er XE1CZ writes "I have been working 50 Mc for 5 months now and have made contact with about 350 different stations. This includes LU, CE, CO, K-W's, KP4's, XE. I have confirmed 25 states and worked 30 to date. I'm the only station working VHF in Puebla, which is located 80 miles SE of Mexico City. Altitude above sea level is 7,200 feet. I also work 2 meters (9 element yagi and a pair of 6146's) and 432 megacycles (10 element beam, crystal converter). My six meter rig runs 50 watts to a 6146, and my antenna is a homebrew two element quad."

50 mc SSB enjoyed a heyday during the Perseids shower (reported in considerable detail for the two meter buffs, elsewhere in this issue). WOPFP took the occasion to catch W5KHT on forward scatter (or meteor scatter) over the 590 mile Ames-to-Oklahoma City path. After exchanging the usual formalities on both August 11 and 12, the two agreed to have at it 0730 CST on 50.110 Saturday mornings in the future.

K4VZU, Alton Morgan, sets us straight on who is operating 50 Mc SSB from Alabama. Al writes "W4JMS, K4UTH, K4LSK, W4CIN, W4ZQM and K4MBM are active currently, "as is he, K4VZU. Take W7UBI off of your active list for SSB. Those that have Keith's Idaho SB card for 50 Mc can count their blessings because it may be awhile before we get anyone to replace him going. Keith became W7UBI/0 in Warrensburg, Missouri in August, where he will be for at least 18 months. No SSB activity is planned however, because the 4-400A power supply was left behind in Idaho. Come on, Keith, don't let a little thing like that stop you!

W7ZQX continues his SSB scatter schedules with the California crew on weekend mornings. George represents the sum total of SSB stations known to be active from the state of Washington. Maybe some of the gang will take heed of last month's issue of VHF and get abuilding during the winter months ahead.

50 mc fone has a strange spell over it. The shock resulting from a sudden drop off in E skip openings has caused a numbness to set in and everyone frozen at the mike! Few still realize that off-season E openings are frequent visitors throughout the country, especially on east west paths south of a line from Norfolk, Virginia west to San Francisco. Watch

those early evening periods. They can be real producers of DX!

K1PDA, Manchester, N. H. found six open from 2310 to 0200 on the 14th-15th of August. The opening was to the west for Dave, with VE4MA, Winnipeg, Manitoba worked. Dave heard K9SSU working VE2-MJ and worked W3BWU and K3ADZ in Western Pennsylvania on short skip. Also heard were many stations in Minnesota and 4, 8 and 9 land. The Manchester lad has 29 states and 1 Province worked. He is looking for 3 of the zero states, all of the 7's, California, the 5's and Maryland and Deleware. Seems that a lot of the western boys should need New Hampshire too, Dave. Just announce where you are when the band opens out that way, and stand back. Gravity should take care of the rest!

144 mc news this month falls in the Perseids department, and the report of E skip reception, both covered elsewhere in this issue. In other than meteor burst land, tropo bending continues to make news, with the likelihood that much more ground wave news will be made as this is read.

K4IXC, Melbourne, Florida has a pair of 4X250B's coasting at 800 watts on two meter CW, crystal on 144.090, or vfo as the need arises. The antenna is a 30 foot long yagi on a crank-up tower which can climb to 100 feet! The converter is a 417A mounted at the top of the tower, with only the *if* output signal coming down the cable to the 75A1 receiver in the shack (Now there's a good idea!). John reports regular schedules with W8QOH/MM who plys between New Orleans and Fall River, Mass., around the cape of Florida and on up the eastern seaboard. Schedule times at 0655 and 2100 EST on CW. Results to date show all-overwater path to 460 miles is no difficulty. IXC has worked QOH/MM several times out to 550 miles in the Gulf, and in the Atlantic, off Cape Hatteras. The skeds run from 20 minutes to a half hour. With W8QOH/MM off the coast this fall, during the annual fall inversion season, a number of interesting contacts are bound to result. His frequency is 144.078. When QOH is out of tropo range for K41XC, the pair continue skeds using meteor burst techniques, 15 seconds on and 15 seconds off. K4IXC is very interested in setting up skeds for the coming fall showers. Those interested can contact him at Rt. 2, Box 684-P, Melbourne, Florida.

Several Florida VHF'ers report the passing of W4DPD of Lake Wales, Florida. The central Florida gang feels this loss as the passing of a friend liked by all, and an avid VHF'er from years ago.

Southern Technical Editor Paul Wilson, W4HHK, noted a new two meter SSB station now active near Huntsville, Alabama. K4ZQM is running a 20A exciter into a home-brew converter ending up with a 4X150 final on 144.102 megacycles. Look for him.

Barry, W4TLV, also reports from Alabama that the night of August 10th was a hot one for the gang in his area. The band was open on tropo into Wisconsin, Michigan, Illinois, Indiana, Kentucky, and Ohio. A 432 megacycle try with W8PT in Detroit proved no good. This was the first north-south opening ir. some time, according to Barry.

220 mc activity is apparently poor only outside of the larger centers of population. W2SEU reports considerable activity in the New Jersey-New York area. Fred reports W2IQR, W2AOC, W2WOF, W2HVL, W2NTY, WA2IFP, K2IQR, K2-IPC, K2DZM, K2AXO, W1NOC, W1MFT, W1AJR, W3CGV, K3IUV and W2SEU active. Fred is currently stationed in Massachusetts but as he notes (as of August 8) "just 317 days until I am out . . . and then watch out!" For the time being his 100 watts into a 22 element beam 55 feet up loads up on 221,400 Mc only on weekends.

W9OVL reports 220 activity is not exactly missing in Chicago. Some 50 stations are active according to Ben, with most of the activity concentrated around 2000-2100 EST Mondays, Wednesdays and Fridays. Ben runs 20 watts for local contacts and 150 watts for DX. He has worked as far west as Omaha during tropo openings, and suggests that those stations outside centers of activity run at least 60-70 watts into a decent beam to be heard.

REPORTING TO VHF

A change in printing dates and deadlines resulted in this column being shorter this month than usual. Dozens of good reports arrived after our *new* deadline, the 23rd of the month. Drop us a note with news of operating and DX in your area. We would all like to see your contributions monthly!

Perseids Report

Although results varied from area to area, most Perseids meteor shower reporters would agree that this year's event was good drill for all involved. A number of 144 megacycle DX enthusiasts added new states and all had an opportunity to put new equipment through its paces.

Comments from actual 144 Mc participants varied from Ernie Brown's (W5FYZ) "This seems to have been the best Perseids shower for the past three years . . ." to W6WSQ's "In general a very poor shower."

The table accompanying this report breaks down some of the results reported up to press time by shower dates and time of contacts. In this case, times are in CST since the majority of path-midpoints were over the Central Time zone.

Our table indicates that things just didn't start happening until the 11th this year. The vast majority of contacts reported occured beween 0200 and 0700 CST, although one occured as late as 1020 CST (W6WSQ to K7IDD on the 12th). Several stations reported hearing strong bursts from other stations, on schedule, in the 2000-0000 CST time period (W5JWL heard bursts from W1JDF, etc.) but bursts were apparently too far between during the evening hours to make a QSO work.

Pure north-south path QSO's and reports of bursts heard concentrate in the 2300-0200 CST time segment. More slanted paths, *i.e.* SE to NW, SW to NE, etc., occured in the 0200-0600 CST time segment for the most part. Due east-west paths varied from W6WSQ to K5TQP in the 0200-0300 CST segment on the 12th to W4VHH-W5FYZ in the 0500-0600 CST segment on the 12th and W4WNH-W0EYE in the 0500-0600 CST time segment on the 13th.

The table does not tell the entire story however. As with any super-human effort (and any participant in the wee-hour Perseids will tell you it is just that), it is the minor things which really make the story complete. They seldom seem minor when they are occuring!

W5FYZ (Minden, Louisiana) reports "copied W5JWL skedding K5TQP, New Mexico with both stations heard well. K5-TQP had several 20-second bursts. Also copied W5KXD, Dallas, skedding W2AZL, New Jersey. Both stations copied including several 5-second burst from W2AZL making identification easy. While working K2LMG I was worried with Perseids QRM! Carl, W2AZL was on 144.013 and Dave (LMG) on 144.014. On a ping or short burst I would hear K2LMG first followed after about a second with a burst or ping from W2AZL. On sustained bursts they were both in there banging away and QRMing each other. I use a 2.4 kc bandpass in receiver in MS, so could hear them both throughout schedule. W7JRG surprised us all with the consistent signal he put into this area. Good, solid QSOs were the order of the day with extra 73s gms and sks thrown in for good measure." The W5FYZ 144 Mc total is now 33 states, 9 call areas and VE3. Ernie guesses he will have to wait for Echo A12 to work W6, his 10th continental call area.

W6WSQ, West Covina, California felt there was a definite peak on the 12th (our table would seem to verify this) with a slight drop off on the 13th. The NE-SW paths were particularly poor, according to our West Covina reporter. Don also copied a 90-second burst (!) at 0758 on the 12th from K7IDD during the Utah station's tune-up, seconds before the sked began. The 90-second burst was strength 6.

W4WNH, Elizabethtown, Kentucky found the 1962 Perseids a trial by tribulations! Shelby had one equipment problem after another including a broken quarter-wave matching transformer on his 32-element array, and a snapped feedline (one after the other). This didn't keep him from putting in one of the star performances however. Shelby was running his 5-year-old 829-B loafing along as usual at 400 watts input (that's what he said!), the aforementioned 32-element array and a 6CW4 pre-amp into a crystal-controlled converter and 75A3 with audio filter.

He notes (on his contact with W0EYE, Boulder) "On the 13th it was all over (successfully) at 0651 EST. Five pings, 6 short

1962 PERSEIDS METEOR SHOWER RESULTS

Time—CST	August 10	August 11	August 12	August 13	August 14
2300-2400		W4WNH hrd WA4DRJ			
0000-0100			W76H6 hrd W6YX W6WSQ hrd W7MAH		
0100-0200			W4WNH hrd K4IXC	W4WNH wked K4IXC W4WNH hrd K7HKD	
0200-0300	W5JWL hrd W7FGG		W5JWL hrd W7LEE W6WSQ wked K5TQ? W3TDF hrd W5PZ	W5JWL hrd W7LEE	
0300-0400	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ W7JRG wked W5RCI	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ
0400-0500			W5JWL hrd K7IDD W5FYZ wked W7JRG	W5YZ wked K8AXU	
0500-0600	W4WNH hrd W7JRG	W7JRG wked W5RCI	W4WNH hrd K7HKD W5FYZ wked W4VHH	W4WNH wked WOEYE	
0600-0700		W5FYZ wked K2LMG	W4WNH hrd WOEYE	W5JWL wked K5TQP W2AZL wked W5KXD	
0700-0800	WZAZL hrd W5KXD	WZAZL hrd W5KXD	W2AZL hrd W5KXD	W5JWL hrd WA2EMA	
Miscellaneous			W5JWL hrd WIJDE, 2000-2100; W6WSQ wked K7IDD 0900-1020		

bursts and 3 slightly longer ones; the best being long enough for an exchange at 0650:30. My third QSO with Colorado, all MS."

Shelby's QSO with K4IXC was detailed this way. "Not having previously known about his operation, he was called via land-line on the 11th and skeds set up for the rest of the shower. On 12 August during his sked with K9UIF (0100-0200) he had some extremely strong bursts. I waited. Came 0200 EST and my sked, he all but vanished. There were plenty of pings and even a few short bursts. But they were SO weak! But it took only 31½ minutes on 13 August, with several bursts, to set things up, concluding at 0231, almost exactly like the W0EYE contact. This was a new state for each of us."

Shelby never heard W7JRG during their sked, but the Billings station was heard "on the 11th during most of two 30-second calling periods when he was skedding W5-RCI. This was the longest burst heard . . ." during the Perseids. K7HKD (Wyoming) was the most consistent station heard in Kentucky by Shelby, although no good bursts were copied. Plenty of pings though, whenever K7HKD was transmitting, or so it seemed.

W2AZL, Plainfield, N. J. kept at it with W5KXD, Dallas, starting with schedules at 0700 CST on the 10th and running the same time period through the 13th when they switched to 0200 CST. The 13th schedule ran from 0200 CST through 0643 CST when long bursts exchanged all of the required information. W2AZL also maintained skeds with W0QDH (Kansas) and W0EMS (Nebraska) and W0IUF (Colorado). Results were nil.

W3TDF maintained his schedules with W5PZ, Oklahoma. Starting on the 10th the sked ran through the 14th. Pings were heard on the 10th and 11th, while a complete ident was copied at 0218 and 0253 on the 12th. The 13th was nil, and W3TDF assumes the Oklahoma station did not make the sked. On the 14th several pings were copied, and a complete ident at 0256 CST.

Schedules between W3TDF and W5KXD led TDF to wonder if KXD's 144.140 frequency might not have been closer to 144.-137. TDF heard W2AZL calling W5KXD on the 13th, apparently during his sked period with the Dallas station. This was during the extended period of the 13th when 2AZL and 5KXD were running most of the night up to 0643 CST. W3TDF's schedule with W0QDH proved fruitless.

W5JWL had skeds with W7FGG in Arizona 0230 to 0300 CST on the 10th, and the Arizona station was copied very well in Gurdon, Arkansas, according to Jay. How-

ever W7FGG had to break off skeds abruptly at 0300 because of illness. W7LEE, in his new location above Parker, Arizona was a near-miss for W5JWL. Jay reports "heard lots from Parker but just couldn't get the final "R" through. Signals were quite strong peaking S5-S6 with bursts to 20 seconds or so." W5JWL's sked with W6WSQ resulted in a few pings 0330-0430 over the 10th to 14th period. "Apparently this is stretching distance some . . . and 16 db gain antenna on this end needs some improvement" noted Jay. W5JWL also notes "Sked with WA2-EMA 0700-0730, almost had QSO on the 13th but had to rush off to work and was unable to continue. Another 5-10 minutes and we should have made it. Signals peak S4."

Jay had W4WNH type troubles too. A tuning capacitor went up in smoke (strange, isn't it, how this always seems to happen during a maximum effort period?) and took a 4X250B, or a bad 4X250B took a capacitor. Jay also had antenna rotator trouble which gave false bearings. But, as he notes, "Outside of this, some arc-over in the HV supply and a little line noise, everything went smoothly!"

W7LHL had a single sked with W0ENE, August 10-13, from 0100-0200 CST. Ernie didn't hear anything from the Omaha station. Ernie did copy a 20 second burst from W6YX (Stanford, California operated by Vic, W7QDJ) when YX was running a CQ wheel on a W7RT sked.

W5RCI's contact with W7JRG resulted in the 38th two-meter state for the Marks, Mississippi two-meter pioneer.

W7JRG put his brand new W0MOX design two-meter final to work for the first time this year. In addition to working W5-FYZ, W5RCI and W0BFB (Iowa), Ken heard W0EYE on August 9, 10 and 13 (". . . should have worked him," noted Ken). Skeds with W8KAY, VE3DIR and W4WNH produced no pings or signals. W7-JRG has 15 states now on 144.

W4HJQ, Kentucky, was kept out of the shower by feedline problems.

144 Megacycle Operating Frequencies

WA4DRJ	Florida	144.008
K4IXC	Florida	.089
K7HKD	Wyoming	.124
W7JRG	Montana	.008
W0EYE	Colorado	.048

(Courtesy W4WNH)

Meteor Scatter

by Raymond P. Bilger, W3TDF
Harthorne Avenue
Langhorne, Pa.

Although I haven't participated much in Meteor Scatter work, I have been observant of the operations of others. The more I hear, the more convinced I am that many are wasting their time. There is a very dire need for a standard practice. The following views may put Meteor Scatter propogation into the scientific class, but then we wouldn't be on the VHF bands if we weren't more scientifically inclined than the average ham.

The ARRL has, through Ed Tilton and his column, expressed the opinion that the absolute minimum requirements for a contact are, (1) positive identification, (2) swapping of signal reports and (3) the Roger. The positive identification, in this humble one's opinion, is that you must hear the other station call you and sign his own call. The signal report needs no explanation for normal purposes, nor does the Roger, except that the Roger should not be sent until all the necessary information constituting a contact has been received. For Meteor Scatter work these requirements still hold true but can be accomplished in an absolute minimum time if both stations agree upon and use a common system.

Many stations have been observed sending S1 and S2 to indicate that they have received pings or a short burst. This is an unnecessary and fruitless waste of time. If, for instance, you are sending a complete set of call letters (those of both stations) and 10 reports of S1's. The fellow on the other end has heard nothing but a couple of pings up to now and then receives an 8 second burst of S1's. In those 8 seconds he could have received a complete set of call letters! Yet, since he received only a batch of S1's, it means nothing more to him than the fact that you have received several isolated pings from him. (Assuming that you are using transmission speeds of 25 to 30 WPM, it takes only 5 seconds to send a set of call letters broken by 'de'.)

Assuming that the signal report should never be sent until positive identification is established, which after all is only ethical, the receiving station, having received an 8 second burst containing a complete set of call letters can now begin sending a signal report (a true signal report), interspersed with the call letters. On the other hand, since he only received a batch of S1's, he has no way of knowing who sent them or to whom they were being directed. Result—one good burst wasted!

Another fact which I would like to bring to light is the assumption of at least one MS enthusiast. It was his thought that an S2 should be sent indicating a short overdense burst was received, but not necessarily containing any positive identification. (It could have been 8 seconds of S1's). However, if later in the schedule he receives a full set of call letters and S2's he enters in his log an S2 as his signal report. He has sent an S2 to indicate reception of a burst but containing no valuable information, yet on receiving that same S2 he considers it as a signal report. How can a signal report and some other explanation be tacked onto a single symbol?

One system which has been endorsed is sending a Roger to indicate you have received a full set of call letters. Then, and only after both stations have received and rogered for the calls, they begin to send signal reports, which also must be rogered separately. Then comes the ultimate of confusion, 'The Roger of the Roger.' This sort of thing can go on forever!

The prize that most of us look and hope for is a burst of 20 seconds plus, starting between 5 and 10 seconds before the end of station A's transmisison. If station A has been sending calls only, then station B will have received a full set of call letters and will then send one complete set of call letters, one signal report and BK. Station A then comes back with a Roger, one signal report and BK. Then station B comes back with a Roger and you've got it made. If the burst lasts any longer you can try to get through other information.

Assuming that both operators are using 25 to 30 WPM and can work fast break-in the burst must last 12 to 13 seconds after the change of transmission, *i.e.* after the start of station B's transmission in the

case above. This cuts the absolute minimum length of the overdense burst to 17 to 18 seconds for a completed QSO. This is exactly how W4LTU and I made our contact during the Geminids shower on Dec. 14th, 1956. The total burst was 27 seconds long and started about 10 seconds before the end of Walt's transmission. I even got a '73 es Tnx' through before the burst died.

We all want to work more states and the fellow that comes up with 40 on 2 meters first is going to be one proud peacock. I doubt very much if it will be a coastal station, unless we get one of the rare gems that gave that deserving fellow, Tommy, KH6UK and W6NLZ the record. If we intend to use MS propagation (if it can be termed propagation), we must make use of every burst that is long enough to contain any information at all. Therefore we must agree upon and very diligently use a system which is designed for 'getting the mostest from the leastest.'

The greatest asset to anyone using MS is the automatic keyer. I use a 6AQ5 clamp tube to control the driver screen. The driver has no bias other than that developed across the grid resistor. The 6AQ5 is biased beyond cutoff and a plate relay in the plate of a 6AC7 (any reasonable tube can be substituted) shorts the bias out on the 6AQ5, through a resistor arrangement so the actual bias supply is not shorted out. The 6AC7 and 6AQ5 use separate supplies so that the 6AC7, which is also biased to cutoff, can be keyed without having the driver screen voltage on the key. The 6AC7 bias is applied in a special circuit in which there is also a tone rectifier. I use a tape recorder with a loop of tape for auto-keying, feeding the output through a small output transformer into the one rectifier. The key is left in the circuit at all times and all that is necessary to change from auto-keying to hand keying is to cut the volume on the recorder, or stop it. As a matter of information I use a second tape recorder for complete recording of all schedules.

Regardless of the system used for auto-keying, it should be set up so that the hand key may be used in place of the auto-keying on a split second's notice. Suppose, like myself, you leave the auto-keyer running continuously and merely turn the rig on and off at the appropriate times. Then at the very end of the other station's transmission you get a ping. This could be the beginning of an extended burst. Therefore you go back on manual and give one complete call and a BK. If the other station doesn't break-in within 3 or 4 seconds then you go back on automatic. As pointed out before, you must make use of every available opportunity to get through information and take advantage of every overdense burst that may come along.

My proposed system is quite simple once you get on to it, but requires that you be on your toes to transmit only that which is necessary at each and every stage of the game. First you transmit full sets of calls over and over, (ie. W4LTU de W3TDF W4-LTU de W3TDF etc.), on each transmission. Then, and only after you receive a full set of call letters from the other station do you include a signal report. The signal report will be taken up later. When you do begin to include the signal report it should be thus, W4LTU de W3TDF S3 S3 W4LTU etc. This sending of the signal report is your information to the other station that you have received his full set of call letters. When received by him, it tells him he need not send the calls anymore and can send the signal report and a Roger, thus R S3 R S3

When you receive	You send	Sig Rpt	Meaning
Nothing or incomplete calls	Calls only	S1	Up to 5 Sec.
Complete calls	Calls & Sig Rpt	S2	6 to 10 Sec.
Calls & sig Rpt.	Sig Rpt & Roger	S3	11 to 15 Sec.
Sig Rpt & Roger	R's continuous	S4	16 to 20 Sec.
2 or more R's	Nothing	S5	over 20 Sec.

etc. Therefore, you send complete calls only, until you receive full calls. You send signal report until you receive a signal report and then and only then do you send Rogers. Keep in mind, of course, that you continue sending the signal report until you receive a Roger. If while you are still sending only calls you receive calls and a signal report, you then send only signal report and Rogers. If while you are sending calls and signal report, (which will be only after you have received full calls), you receive a signal report and a Roger, you then send a series of Rogers and nothing else. When you receive 2 Rogers in succession you quit. You've got it made! For this to be absolutely conclusive you must be sure not to send more than one R at a time when you still haven't received a Roger. which of course necessitates that you be sending a signal report along with the Roger.

The signal report can be any arbitrary report, but a system is likewise here suggested. S1 is for a signal burst of not more than 5 seconds, or more than one burst of less than 5 seconds each sufficient to get the full set of calls through. (Again — No signal report is sent until the full set of calls have been received.) S2 for a burst of up to 10 seconds (during which full calls have been received). S3 for a burst of up to 15 seconds, etc. Therefore an S5 would be the highest report you would give indicating a burst of 21 or more seconds. If the burst lasts more than 25 seconds you will probably be using break-in anyway, so you still use S5, or possibly there will be opportunity for use of the complete RST system.

It should be evident from the above that you will never have need to send all 3 items of information together, because if you are in a position to send a Roger, it can only be after you have received a signal report which in itself is indication that your complete set of calls were received at the other end making it unnecessary to send them with the Roger.

The signal report you send will be based on the length of the burst in which you received the complete set of calls, and will not change unless you again receive another full set of calls on a longer burst which still doesn't include a signal report. This is possible because if he is still sending calls without signal reports, it is only because he has not received a signal report from you.

A simple chart is given here which can be cut out or reproduced and displayed at the operating position. Keep in mind three simple rules. Don't send unnecessary information. Don't send more than one Roger in succession until you have received all the information you require. Always be ready to switch to break-in, should the need arise.

As can be evidenced from the chart you can have four separate auto-keying sequences set up ahead of time and will have no need for the hand key unless a chance at break-in avails itself. The one containing solid R's can be used for all MS skeds of course.

SSB for Two

part two

by Russ Miller, W5HCX
Associate Editor
VHF Horizons

The most important step in putting a SSB signal 'on-the-air' is the application of audio to whatever form of balanced modulator we're using. At this point no item should be slighted in order to come up with adequate unwanted sideband suppression and clean audio. The "SSB Rig on Two" is no exception.

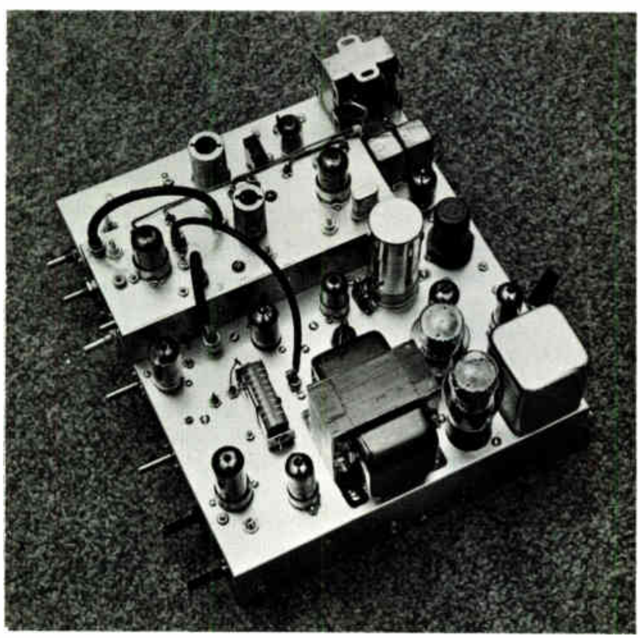
Power supplies are also an important consideration. Important, primarily because if they are not adequately regulated where specified, the result will be a wobbling signal with big chunks of distortion riding on it.

There are many, many ways of cutting corners when building any rig and some are very useful but don't try to cut too many corners. One of the easiest things an amateur can do is to substitute some different tubes than those specified. This idea will probably occur when considering the linear RF amplifiers used in the SSB on Two rig. Don't be tempted. The tubes selected will do the job and last for a long period of time before they start to fall on their nose. Also, if the 5763 is inter-changed with something else, the AM quality will suffer and the RF distortion will go up when the rig is operated in the AM mode. Incidently, the original article last month mentioned using a 12BY7A instead of a 5763. Reason for the change was based on seeking improvement of the AM signal. The 5763 did provide that improvement.

AUDIO SECTION

The 1st audio stage in the rig uses a 12AT7, witth both halves operating as straight voltage amplifiers. The second half of the 12AT7, 1st audio stage, is fed to the AM-SSB selector switch. At this point the audio output is fed to either the grid of the 6AQ5 modulator or to the audio phasing network depending on which function is selected.

Selecting SSB connects a small transformer in parallel with the load resistor of



Top-side view of SSB unit. 6360 RF amplifier occupies lower corner of chassis. Battery shown in photo is bias source for the 6360. Average life of battery is two years. Feed-thru capacitor located slightly to the left of the bias battery feed-thru capacitor is meter connection to RF diode. Co-ax plug and jack immediately above feed-thru are used for coupling 2nd mixer output to the RF amplifier input. 16.5 Mc signal is coupled to the sub-chassis by co-ax line shown adjacent to the battery and power transformer. Nylon jack shown on top, front part of subchassis, is TP-2.

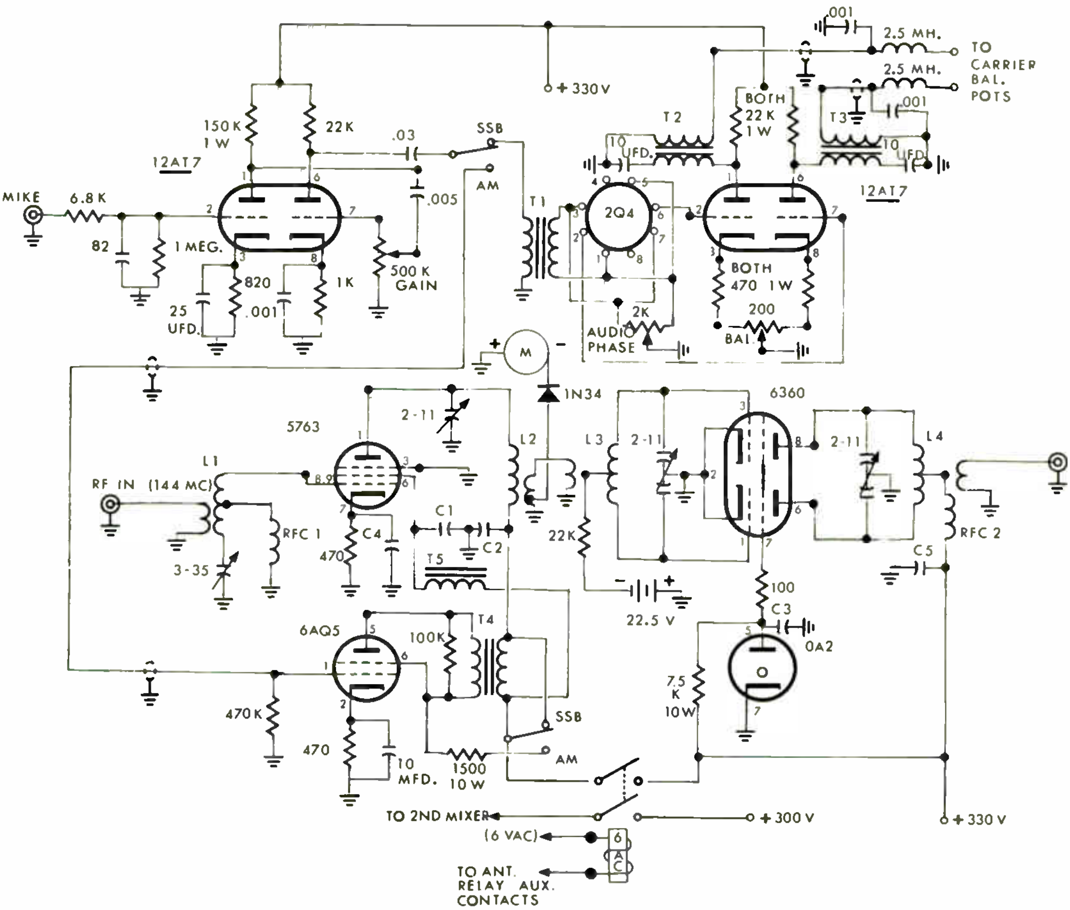


Figure 1. Audio and RF Circuitry, Schematic

the 12AT7. This transformer feeds a B & W 2Q4 audio phase shift network which in turn feeds another 12AT7 audio stage. This 2nd 12AT7 stage is also a straight voltage amplifier. A pair of 20,000 ohm to 600 ohm transformer (W2EWL type) are used as the plate loads for the 12AT7, 2nd audio stage. From here the audio goes through a pair of 2.5 mH RF chokes to the balanced modulators.

AM is a horse of a different color. Back at the 1st audio amplifier stage, 2nd triode section, we feed the audio to the grid of a 6AQ5 through our selector switch. The 6AQ5, operated Class A, is the sole modulator stage. It will provide more than enough audio to modulate the 5763 Class A linear. It might be well to mention at this point that this method of AM is not normally used but it does the job with only a small sacrifice in modulation percentage. I know some amateurs may worry about linearity, varying load conditions, etc. Once again, the rig won't sound like a broadcast station but it will sound clean and do the job.

Gaining a few additional percent improvement in modulation percentage at the expense of a big modulator and the necessity of operating some form of amplifier Class C just isn't worth the cost. There is one thing which is in your favor as far as the modulated stage is concerned, it is highly inefficient. But, it doesn't have to have much output to comfortably drive the following 6360 Class AB1 amplifier.

When considering the microphone types to be used with the SSB on Two rig, don't use a mike with a particularly flat response curve. The high end of the audio spectrum and its rich overtones are best done without. Besides the audio phase shift network is not particularly designed for the range past 3000 cps or below 300 cps. If operation with a carbon mike is desired, ground the grid of the 1st triode section and connect the mike in series with the cathode.

RF AMPLIFIERS

The only tubes used in the RF amplifer section are the 5763 and 6360. The 6360 is

operated as a conventional Class AB1 linear with both its input and output circuits coupled fairly tight to the driving source and load. This is necessary to realize a 2.5 Mc bandpass which is about as much as can be expected without overcoupling and thereby enhancing unwanted harmonics. By properly adjusting this stage, a 3 Mc slice of the 2 meter band can be easily covered in practice.

Like all RF amplifiers, care must be taken to isolate the input and output circuits of the 5763 and the 6360. The only necessary item in either stage is the 100 ohm resistor in series with the 6360 screen grid lead. This resistor should be mounted as close to the socket connection as physical size will allow and also the opposite end should be as close to the .001 stud-mounted capacitor as possible.

If the schematic and the above suggestions are followed, both stages will be stable enough to eliminate the need for neutralization.

The only tuning that is necessary in the RF amplifiers is the grid and plate tuning of the 5763. The 6360 is adjusted only during the initial tune-up of the rig. The absence of any metering in the 6360 stage may lead to some question. The high-power linear that this exciter drives has an RF voltmeter circuit built in to indicate its output. This is used for initial tune-up of the exciter and since the 6360 is fixed-tuned eliminates further need for metering. If bare-foot operation is desired, a 1N34 diode used with a milliameter will suffice to tune up the 6360 stage although some means of monitoring its output is desired. Since the 5763 stage is tuned, a metering provision is necessary. In this case, a 1N82 was tapped up 1/4" from the ground connection provided for the coupling links between the 5763 plate and 6360 grid tanks. The diode (1N82) is then connected to a 500 pfd. feed-thru capacitor. The other end of the feed-thru capacitor is connected to a 0-1 mA. meter.

POWER SUPPLIES

Two power supplies are used for the rig. One supply provides a regulated 210 & 105 VDC and unregulated 250 VDC. This small supply is incorporated on the exciter chassis. It supplies all the stages except for the audio sections and RF linears. The second supply is external and supplies a regulated 300 VDC for the screens of a KW, 4CX250B linear, and an unregulated 350 VDC for the audio sections and low level RF linears. This 350

VDC source is also fed to a 150 VDC regulator on the exciter chassis to provide a regulated voltage for the 6360 screens.

CONTROL CIRCUITS

The actual controls circuits are confined to a single relay. One set of contacts removes the voltage from the 6X8 2nd mixer and the other set of contacts removes the voltage from the 5763. All the oscillator circuits are allowed to operate at all times for maximum stability. There are no birdies in the receiving combination used for the check out of the oscillators, with the oscillators running. However, since the checks were made with a converter using a 30-35 Mc IF this might not be true for those receiving set-ups using a different IF.

Anyways, this problem can be approached a number of ways if you are troubled with annoying birdies from the exciter. One means would be to install another relay to cut off whichever oscillator is interfering. If the birdie is in a portion of the band that is not used, you might just leave it alone. The only other alternative would be to select crystal frequencies that would place the birdies out of the band. If you do have to key one of the oscillator stages, don't be too concerned. In our particular case the International FA series crystals that were used proved extremely stable.

If you are wondering how the control relay is keyed, an extra set of contacts on the external antenna relay does this for us.

LAYOUT

Starting with the audio stages, these were constructed across the back of the chassis. The 2Q4 audio phase shift network is located in the far rear-center of the exciter chassis. To the left is the 12AT7 2nd audio stage. The 6AQ5 is to the right of the 2Q4 and adjacent to the modulation transformer. Directly in front of the modulation transformer is the 210 VDC supply regulators with the 12AT7 1st audio adjacent to the left-hand regulator tube.

The RF amplifiers are located on the front of the chassis and occupy the right hand side. The 150 VDC screen regulator for the 6360 is located behind and to the right of the 6360. A small battery can also be seen on top of the chassis, near the 6360. This is the bias source for the 6360.

The 5763 tuning controls are mounted on either side of the respective tube socket and in a line with the other controls. Since space was needed for the control relay and other components, the audio gain control/on-off switch and the AM-SSB switch were mounted on an aluminum 'L' bracket on the bottom rear of the chassis. This works out very well by eliminating unnecessary long leads between the controls and switches and the audio section.

The audio phasing pot and 2nd audio stage balance pot are mounted across the rear side of the chassis. Also, the AC leads, external power jack, and the microphone jack are located here. Placement of these various parts is not critical although it would be best to keep the audio pots as close to their respective stages as possible.

ADJUSTMENT

RF from the 2nd mixer should be applied to the 5763 and this stage along with the 6360 should be adjusted for maximum output, (full carrier insertion). Next, set the AM-SSB switch for SSB. Apply a 1000 cps audio tone to the grid of the 2nd triode section. With an oscilloscope connected alternately to pins 2 and 7 of the 2nd 12AT7 audio amplifier, adjust the audio phasing pot for a 90 degree phase relationship between these two points. Next, adjust the audio balance pot for equal amplitude output fro this same stage. If an oscilloscope is not available, a suitable receiver may be used for the same purpose. In this case adjust pots for maximum suppression of the unwanted sideband.

After these adjustments have been made, the rig is ready to be put on the air. The only thing that remains is to adjust the mike gain control for the best levels, depending upon which mode of modulation is selected. The RF voltmeter in the exciter RF section will provide a means to monitor the output and assure that either the correct amount of carrier is inserted when operating AM or that the mike gain is set properly when operating SSB.

When using SSB, don't crank the audio up any farther than necessary. If you choose to drive a high-power linear, adjust the audio so you obtain sufficient drive and no more.

When operating AM, you may insert full carrier with one of the carrier balanace pots. There is more than enough audio available to modulate the 5763 so be careful not to turn up the mike gain to the point where distortion is present. The exciter will probably have to be cranked down by adjustment of the carrier balance pots to keep from overdriving a high-power linear amplifier, and consequently, so will the audio gain.

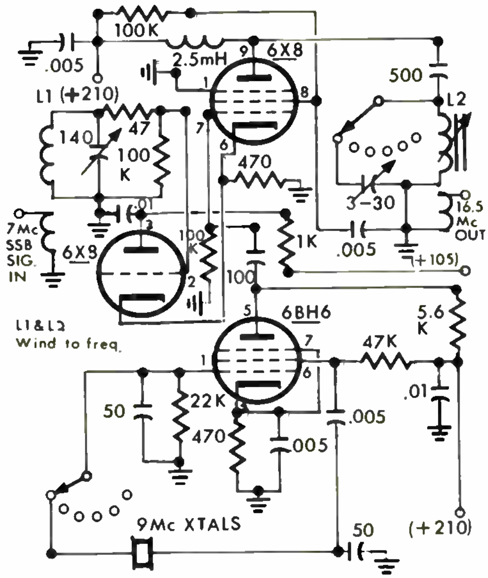


Figure 2. 16.5 Mc Mixer (see part 1)

Operation of the SSB for Two rig is self-explanatory. Changing from AM to SSB or vice-versa, or changing frequencies, is quick and easy. The results you obtain with the rig will be astounding if you have never operated VHF SSB. Better still, tie on a good sized linear. This topic leaves lots of room for thought. Next months issue will contain a full KW linear that can be over-driven by the SSB for Two exciter yet for its power feature occupies a space 12" x 7" x 6". W5HCX

Dear VHF:
Best of luck in your new venture. I particularly appreciated your features by John Chambers and the staff report on "Pi in the Sky". The pi net article was a very clear treatment of common pi net problems.

73
Carl Ebhardt, W4HJZ
22 Rowan Street
Raleigh, N. C.

Carl—
John has quite a bit more to say — and our staff report people are nosing around some more interesting problem areas.

Dear VHF:
I am not at present a VHF bug but the magazine looks so good I had to subscribe (I hope the rest of the issues are just as good). This magazine may make a VHF bug out of me yet!

Edward Nester
2184 Light Street
Bronx 66, N. Y.

Ed—
Welcome aboard — you'll find a lot of fun above 50 Mc! And you can count on the future issues being at least as good as those so far — we're going to try to make them even better.

Construction . . . from p. 13

A good open-wire line can be constructed using No. 12 solid copper wire and 5/16 inch or 3/8 inch diameter polystyrene rod. These sizes afford more strength than 1/4 inch diameter rod. The line is fabricated by stretching two lengths of No. 12 wire tightly between two points in the workshop, making certain they are the proper distance apart (one inch center to center is suitable for 50 and 144 mcs) and parallel the entire length. The wires should be touching the floor.

Polystyrene spacers one and one-half inches long (for one inch spaced line) are cut from stock and placed under the tightly stretched wires every six inches. Make certain the spacers are at right angles to the wires. The tip of a hot soldering iron is pressed downward against the wire, and to one side of the polystyrene rod, forcing the wire into the rod. Remove the iron when the wire is completely covered over by the softened polystyrene, taking care not to move the rod or wire until after the polystyrene has hardened. Then perform the same operation on the other end of the spacer. Do not allow the iron tip to touch the polystyrene rod!

A TV type standoff insulator intended for supporting small, tubular 300 ohm line may be used to support open-wire line. At the point of support, the polystyrene spacer should be made longer than normal so that a standoff support may be used at each end rather than one at the middle. This gives better support and minimizes capacity, and possible unbalance, to ground.

Amateurs living in coastal areas or windy locations may find other precautions are necessary. Only a few phases of antenna construction have been covered. Doubtless you have some tricks of your own that make for a better antenna installation. In general, taking a little extra care in the construcion of your VHF antenna and feedline . . . using a little more than the bare minimum . . . protecting against corrosion and moisture . . . will pay off many times. An array that is dependable and does not require frequent repairs is far more useful than a larger one that is out of service much of the time.

For additional information on VHF antennas and construction you are referred to: The A.R.R.L. Antenna Book, The VHF Handbook by Orr and Johnson, and VHF For The Radio Amateur by Frank C. Jones.

T
VHF
I

by Robert Grimm, K6RNQ
VHF Western Technical Editor

While we are not faced with "odd-ball" cases of TVI everyday, these can be a real headache to track down when they do occur. Some of them can be so far fetched as to make your head spin.

A classic example of this type of TVI oddity was experienced by W6BAZ of Santa Rosa, California a few years ago. Paul had received a report from a TV service organization that he was clobbering Channel No. 5 on a TV set. This TV set happened to be located about 40 miles away from W6BAZ's QTH. To make things even more interesting, there happened to be a 4,000 foot high mountain in between him and the TV set. (Mt. Saint Helena).

Paul dutifully checked his transmitter, but was unable to detect any spurious signals or harmonics that could be causing the trouble. He then communicated with the TV service company that was responsible for maintaining the TV set, and, by working together, they were able to find the cause of the difficulty. What was it? Just an oscillaing mixer tube in the TV set's tuner. Fortunately, it was correctable by replacing the mixer tube. Granted, this was a very unusual case of TVI. The kind of thing you might run into only once in a lifetime. But it's a prime example of the many "oddball" types of interference that do occur. These are the things that make many hams permaturely gray!

Not quite so unusual was a situation I experiencd a few months ago. Some people from down the street called and informed me they were receiving interference on Channel No. 2 and they thought it might be caused by me. (In fact they were pretty doggone sure it was).

Not being on the air at the time, I knew it couldn't be me. But being a good neighbor, I took a stroll over to their house to see what the trouble might be. Sure enough, there was a big black herringbone pattern wandering up and down the screen. It was doing a thorough job of obliterating Channel No. 2 although the other channels were not affected.

Playing a hunch, I turned off the TV viewing lamp that was setting on top of the set. The interference immediately disappeared. Turning the light back on caused the interference to reappear.

The interference was eliminated by the simple expedient of replacing the bulb in the lamp. Why was the bulb radiating this signal?. Don't ask me! I had run into this situation several times in the past, when I was doing TV service work. It could always be remedied by replacing the bulb. (Provided, of course, that it was being caused by the bulb).

While we are in the light bulb department, a real hash generator is the old carbon arc bulb. These things are a holdover from the twenties and are occasionally found in porch lights on older houses. The hash they generate is not far removed from what you would expect from a spark-gap transmitter and they louse things up just about as well, too! They should be replaced with modern bulbs.

Getting back to the TV viewing lamp: An important thing to remember is to *not* rub it into the people who complained. They are going to be very embarrassed when they find out they were the cause of their own TVI and had blamed it on you.

They will want to make up for having wronged you and, if handled properly, can become neighborhood boosters for you. Be sure to tell them that "this is just one of those things that happen and don't feel bad about it."

"SINGING BATHTUBS"

You have probably heard of incidents where people have heard music insuing from their dental fillings, from pipes in the basement or coming out of their bathtub. These are not "Old Wives Tales". They really do happen. These incidents generally occur in the immediate vicinity of high powered AM broadcast stations.

While it isn't likely that your neighbors will copy you loud and clear on their dentures, the causes of these strange phenomena are closely related to the causes of many unusual types of TVI, *i.e.*: rectification. This can be caused by a rusty joint in a waterline, two pipes of dissimilar metal resting against each other, loose or corroded connections in the TV antenna system, on telephone lines (call the telephone company if you think a corroded joint in their lines is causing the trouble — never touch the telephone lines yourself!), or a loose or corroded connection *in your antenna system!*

If you stop and think about it, there is really no great mystery why corroded or rusty connections cause TVI. Another name for rust is oxidation. An oxide can be a very good rectifier; you've undoubtedly heard of copper oxide rectifiers.

Well, when this recitifier detects your signal many harmonics are generated and if one of these harmonics happens to fall into a TV channel . . . TVI!

If your neighborhood is like most American neighborhoods, you probably have your local HiFi addict who manages to pick you up on his TV set, hifi amplifier, tape recorder and radio, what with his audio leads strung all over the house. (These leads sometimes make such excellent 50 Mc antennae, that I've often considered discarding my beam and using them.)

It's amazing how much signal these audio leads pick up and pipe directly into the TV receiver and audio amplifiers. About the only way to handle these types of cases is to temporarily disconnect the leads and demonstrate how much interference they are picking up. If he refuses to shorten the leads or to cooperate in the usual methods of curing audio rectification (as discussed in a preceeding chapter) his refusal should be communicated to the local field engineer's office of the FCC.

Obviously, if he won't coooperate, there is nothing you can do for him. Actually, the vast majority of people are quite co-operative in these cases; the above was mentioned only so that you will know what to do when you run into someone who refuses to cooperate in having the TVI cleared up.

Next month we will discuss the proper methods of shielding and cleaning up your transmitter. 'Til then, lots of luck on your WAC (worked all channels).

CLASSIFIED

Commercial classified advertising space is available at 25 cents per word, per month. Minimum number of words per advertisement, 10. Classified advertising submitted by individual hams which in the opinion of VHF Horizons is non-commercial in nature, 10 cents per word, no minimum. Full remittance must accompany all orders; closing date for each issue is the 5th of the preceding month. Copy must reach Oklahoma City by that time.

LIKE NEW SX-101A, $295. K9IEB, 31 Ridge Avenue, Evanston, Illinois.

HEATH SHAWNEE 6 mtr. transceiver in top shape with Ameco preamp, $225. Write: K9YCA, 107 N. 26th, South Bend, Indiana.

WANTED: tropo skeds with Kansas on 50 Mc. Saturday evenings or early Sunday mornings. CW or SSB, 50.012 and 50.112; CW, 144.012. Have kilowatt, suitable antenna, passable receiving set-up . . . will listen for you. W5KHT, P. O. Box 1557, Oklahoma City 1, Okla.

SURPLUS goodies stacking up on you? Send us an ad on them and watch them go. One fellow got cleaned out on 832A's—by a retail house yet! What have you got to sell?

VHF Lab Reports

A 38 element yagi antenna on any band below 144 megacycles would be a physical impossibility. On two meters it just barely gets inside the realm of credibility.

Telrex Labs, Inc., Asbury Park, N. J. has such an antenna. And just to make the array even more fascinating, they have allowed someone to talk them into twisting it from length to length (43 feet from tip to tip) in a not so common Spiral-Ray fashion.

The end result is a two meter yagi that demands the very best patience and equipment the typical two meter enthusiast can muster, if the array is to perform properly. However, if you are as much an engineer as you think you are, assembly, erection and tuning of this monster should occupy no more than a typical sun-up Saturday to sundown Sunday weekend. It did us.

Everything comes from the packing carton. In abundant handfuls, we might add. The 43-foot boom is broken down into three sections of tubing. Starting from the rear, the reflector, driven element and first 8 directors mount on a single piece of 2 inch OD tubing. Next in line, the middle piece. It holds the next 19 directors. Last in line, the final boom section. It suspends directors numbered 28 to 36.

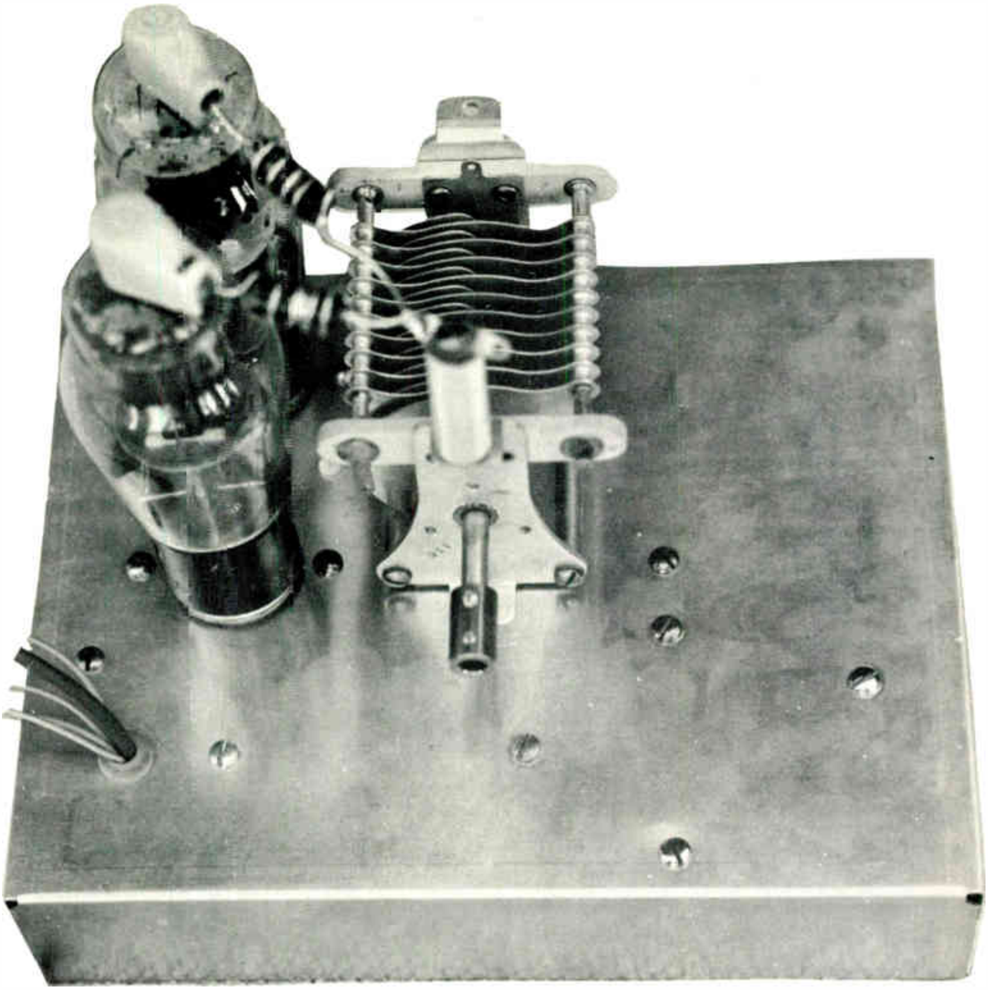
Like all good Telrex beams, this antenna is rugged and well designed. The fact that all of the 80 odd holes line up is a tribute to somebody at Telrex. We can't imagine any amateur tackling the project with a hand drill and vise.

As it arrives, the beam is tuned for 144.5 megacycles. As Telrex notes, you can move it up a megacycle at a time by whacking 1/4 inch off the overall length of each element (they vary from 42 inches long for the reflector to 30 inches long for the 36th director). From a practical standjoint, we would have liked Telrex to start off with the antenna resonant at 144.000 megacycles and then let us whack off the 1/4 inch pieces. We feel that those characters who are going to invest in this antenna are going to be DX nuts concentrating on the low edge of the band.

Once assembled (a project roughly equivalent to building the Empire State Building from an erector set) the antenna really begins to impress you. For example you try to lift it, by firmly grasping the boom in the middle and giving a heave-ho. If you have recently devoured a bowl of Wheaties the antenna slowly rises from the saw-horses you assembled it on, "twangs" on each end and then goes into wild oscillations from its 30 inch director, to the other end and its 42 inch reflector. You move quickly to get it above your head because the spiral elements are dancing dangerously close to your windpipe, and you never were much of a CW man.

Finished with the erection and mounting you dash to the receiver and listen for the S9 signals you expect to hear from KH6UK. The band is quiet. You casually observe the beam is pointed to the northwest — a direction in which you have not heard a 144 megacycle station in the past six months. Bringing the big array around to the northeast you find a number of carriers in the lower megacycle running 6-15 db above the noise on your 7788 converter. All W0's.

Advice? Comments? Keep this yagi mounted on a tower all by itself. Other antennas within 43 feet of it on the same tower throw it into *pattern fits.* It is even advisable to break up the antenna horizon around your QTH by keeping other antennas at least 1/2 boom length out of its plane (*i.e.* none between 39 feet above ground and 81 feet above ground) This is not an antenna for the casual operator. It is for the dead serious two meter addict who wants his cake, and wishes to eat it too. The 2MSR-3843 is truly a two-beam spotlight . . . one in the vertical plane and one in the horiznotal.. And dead in the center of the "spot" is two meter DX. Lots of it.



What is it ?

Yeah — what is this gadget? At this point, it could be almost anything. So to end the suspense, we'll tell you. This is the "Lazy Linear" which will be one of our November features, as seen in an early stage of construction. Using a couple of vintage 807's and a handful of other parts from the junk box, this device is designed to boost the output power of the popular Heath Sixer to more-respectable levels. We've measured better than 20 watts from a Sixer-linear combination here — and the same amplifier, driven with a fleapower SSB exciter, gives more than 100 watts! This is just one of the many features coming your way in November and following issues of VHF — one of the five

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From the Publisher's Shack

A TRIBUTE TO AN ERA

By now many will have learned that the original nationwide VHF newsheet for the amateur (VHF Amateur) is no more.

It is with a great deal of sadness that we mark its passing. Young Editor-Publisher Bob Brown (K2ZSQ) is personally known to many of you through on-the-air contact and his frequent appearances at amateur radio conventions and gatherings, especially along the east coast. For nearly five years Brown filled a void . . . a very deep void. He cranked out monthly issues of VHF Amateur keeping so many of us informed of what each other was doing during a period when the current mushrooming interest in VHF/UHF was only in its infancy. Often without adequate finances, Bob plugged along convinced that he was doing a job that needed doing and apparently certain that someday his *efforts* would be recognized.

Well . . . *they were.* Cowan Publishing Company (the publishers of *CQ*) acquired the rights to *VHF Amateur* in the first days of August. At this writing the future of this institution in amateur VHF/UHF radio is unknown, although it is understood that *VHF Amateur* will become a section or department in *CQ*.

While this will certainly contribute considerably to the *professionalism* of *VHF Amateur* (as a department in *CQ*), we never felt that lack of professionalism hampered the future of "the early day VHF man's publication."

Bob Brown had many of the advantages that we have attempted to build into *VHF Horizons*. Bob was aware that VHF/UHF news is by its very nature a timely item. He recognized that the 45-57 day lead time (*i.e.* the period of time between the day that a magazine stops accepting editorial copy and the date the magazine actually came out) inherent with other amateur magazines was not materially contributing to the "operating state-of-the-art" in VHF and UHF.

So he set out to tackle this in the same way we did, later, here at *VHF*. Simply arrange your production and delivery schedules so that your printer can accept copy up to a matter of days (two weeks at the most) before the magazine hits the mails.

Now, with *VHF Amateur* absorbed by *CQ*, it loses what many felt was its primary appeal . . *i.e.* news while it was still news. For this we are deeply sorry and not a little concerned on behalf of the entire VHF/UHF fraternity, which we feel by now we have gained the right to speak for.

Somewhere out there are 2,500 or so subscribers to *VHF Amateur.* They probably feel a little left out right about now. Some probably also subscribe to *CQ*. While we feel certain that Cowan Publishing Company will work out the problems involved with changing over or extending their present subscriptions (to *CQ*), we wonder if this is enough?

If you are one of these 2,500 *VHF Amateur* readers, and you *do* feel a little left out in the cold (of old news), we would like to offer to you a six months subscription to *VHF Horizons*, at a token charge of $1.00. Please recognize that we do not have access to the subcription records of *VHF Amateur.* Therefore we must trust in the integrity of the amateur radio operator to represent to *VHF Horizons* his existing subscription in a truthful way.

Our reason for doing such a thing is simple enough. We feel that you subscribed to *VHF Amateur* for the same reason we did. To obtain news of VHF/UHF, exclusively. We don't want you to ever develop the feeling that you can no longer have this kind of service delivered to your doorstep monthly.

By offering you a six month carry-over subscription with *VHF Horizons,* for the token fee of $1.00, *we will see that you* keep in contact with the world of the very highs and ultra highs, during a period of time when 50 megacycles and up needs everyone of its newly found supporters.

OK . . . so the line starts at the right. Just drop a short note to *VHF Horizons* at P. O. Box 1557, Oklahoma City 1, Oklahoma with the information that you were a subscriber to *VHF Amateur* when the sale took place. Enclose your dollar, and we are in business!

VOLUME 1 — NUMBER 4
OCTOBER 1962

VHF HORIZONS

CONTENTS

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OUR COVER

What can you say about a plain type layout? Design by K5QGO, to set off this special antenna issue—that's all. Inside, you find a separate antenna article for every VHF band in anything like wide use (except 432, and it's covered thoroughly in two of the other articles). Send us some pictures of your own antenna installation—you might find one on the cover of next year's Antenna Special.

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SCATTER

... de K5JKX

CONVENTIONEERING . . .

One thing about summertime and being a ham magazine editor — you'll get your fill of both conventions and hamfests!

I just got back from the West Gulf division convention at Corpus Christi and already I'm trying to get the work ahead enough to make it to Syracuse for the big VHF bash. And if you think (like several people I know) that this is simple, then you should try filling 40 pages every month with interesting and informative articles.

Don't get me wrong. I'm not complaining in the least. These things are fun — but at the same time they make life a bit more complicated than it is already.

Like for instance the trip to Corpus. That one was the weekend of August 3-5. Our deadline to the printer for the September issue was August 6. It doesn't take higher math to figure out that the magazine either had to be put together early, or late — but not on time in either case.

But even with that deadline hanging overhead, Corpus was fun. Had a long visit with Bill Ashby, K2TKN. One of the most immediate results appears further on in this issue — his article on 1296 Mc antennas. Other things are in the mill, if Bill or I either one can ever scrape up enough time to do them.

And at this point, an aside to those of us who work only 50 Mc and scornfully refer to the 75-thru-10 regions as "DC bands": it comes as a bit of a shock to talk with people who work almost exclusively *above* 432 Mc. To them, 6 and 2 are DC bands!

Bill wasn't the only interesting VHFer at Corpus. I talked quite a bit with George Munsch, of San Antonio, about wide-band FM work on 6 and 2.

One thing many people don't realize about FM. When proper receivers are used, FM has approximately the same advantage over SSB that SSB has over AM! The only thing wrong with FM is that too many people try to receive it by "slope detection", and the results are definitely not as good as AM.

Anyhow, George and a bunch of other people scattered across the country are working with converted commercial two-way gear, mostly on 52.525 Mc although other channels are also in use. If anyone is interested, we can twist some arms for some articles on how and why you can get into this bunch.

And there were dozens of other people who stopped by the booth to pass the time of day. All in all, much fun.

We did find that large numbers of hams still hadn't heard of us, and others confused us with other publications.

So here's one place every reader can help VHF. Get on the air and tell people about us. Tell them to drop us a note for a free sample copy if you like — or just send us the calls and we'll do the rest. This way, maybe more people at the next convention will know who we are.

OUR DEPARTMENTS . . .

The eagle-eyed reader will notice a drastic absence of our usual departments in this issue. Specifically, among the missing are the VHF Showcase, D. C. Pulses, and Scanning the Literature.

However, a glance at the "Features" listing on the opposite page will rapidly explain why. With so much solid data on antennas for all our bands, something *had* to give — and the departments went for this issue only.

They'll all be back next month. If you've been following "Scanning the Literature" to keep up with all the other publications, don't worry about missing out on a month. Our new schedule put us at deadline before two of the three other major ham magazines came out anyway — so next month we'll be scanning the September issues.

Incidentally, I'd like to know what you think of our departments — *all* of them. Do you like them, or would you prefer that we use more of the space for technical material? After all, this is *your* magazine — and if you'll just tell me what you want, I'll do my best to give it to you.

What do you think? **—K5JKX**

50 Mc

Designed and built by Edwin A. Pick, W0BBM
RR 3, Box 377
Imperial, Missouri

This photo story is aimed not so much at the 50 Mc enthusiast who is looking for a complete *nut and bolt* how-to-do-it story, as it is aimed at the 6-meter man who is looking for new ideas, or new uses for old ones.

The antennas (notice we are plural now) shown in these photos have been erected and put into the air over the W0BBM QTH during the past several years. The object of each of the arrays was extended ground wave, long haul weak signal skip, and scatter.

Over the period that each antenna was in use, careful observations were made to the effectiveness of each design. *Some* of these observations are included in this report. More will be made available at a later date as the totals are tallied.

Having read that long-haul scatter signals become pretty beat up, in respect to polarization of the original signal, during the scattering mechanism, we decided to experiment with various forms of stacking, and polarization switching.

Anyone who has worked a summer of E skip has probably had the opportunity to observe that under some very special conditions stations "on the other end of the line" (ie. 700-1500 miles distant) running low power into ground plane antennas, often times will compare very favorably with their higher power bretheren with much larger yagi arrays.

When working into an area that has both vertical and horizontal polarized stations in quantity (*ie.* Los Angeles basin and vicinity) it is often surprising to hear the top signal on the band announcing "I'm running a four element yagi and a G-50. *The beam is vertical.*" You are receiving on a horizontal antenna.

Too often we tend to chalk this up to a number of rationalizations such as (A) No one with comparable power and a horizontal antenna is active at the particular moment; (B) skip is so good that anyone with a 6J6 and clip lead would be S9; (C) skip is so spotty that this vertical fellow just happens to be in the right spot.

On the other hand, vertically polarized stations often find they are receiving better signals on skip from horizontally polarized skip stations than their horizontal brothers.

All of which leads those of us with a flair for imagination "could it be possible that the E skip mechanism actually twists the signal?'

Believe it or not, this is not a new thought. However, to the best of my knowledge, it has never been officially explored on a concentrated effort over a summer of E skip. It is hoped that this article, and others to follow over the winter ahead, will send enough 50 megacycle men to the aluminum piles to erect a number of switchable dual polarization beams for the 1963 E skip season.

But it was not E skip that first attracted me to the dual polarization antenna. It was, as noted earlier, scatter.

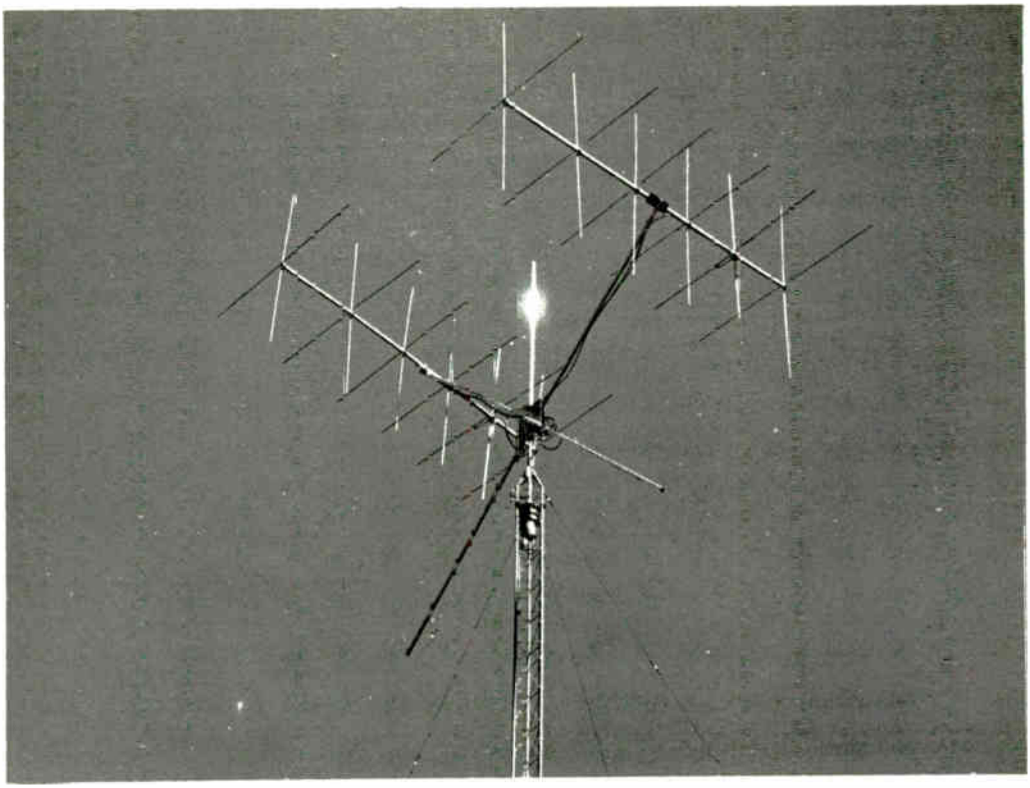
The scatter mechanism is one which displaces small globs of semi-ionized molecular concentrations in either the D or E layers of the ionosphere, or in the atmosphere itself, in the case of tropo scattering. There has been some evidence advanced that the semi-ionized globs are twisting (*ie.* rotating in a spiral) at an irregular rate as they fly through the layers involved. It is these globs, which, when excited by meteorites and ionospheric winds, cause momentary refraction (or reflection) of your 50 megacycle signal. In its most basic approach, ionospheric scatter is exceedingly short-lived E skip, occuring at a height just slightly lower in the E layer than normal E skip occurs.

Some have suggested that the twisting and spiraling of the semi-ionized globs which cause scatter to occur also twist the plane of the signal as the signal reflects from (or reflects in) the glob it passes into and through.

It is on this basis that we attempted the design of an array which would give us the following options at the throw of a switch:

(A) Horizontal only
(B) Vertical only
(C) Clockwise circular
(D) Counter clockwise circular

As far as this array went, it did just that. However no attempt was made to sample via any automatic means the relative signal levels on each of the four choices of polari-



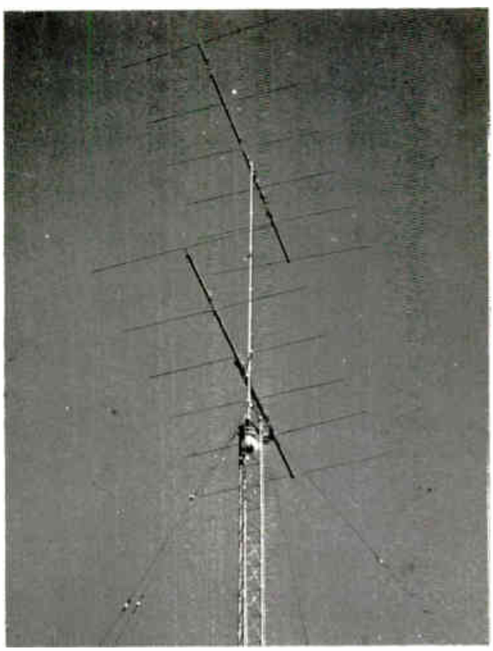
Diversity 12 by 12 array at WO[illegible]M, Imperial, Missouri. Boom lengths—15 feet, spreaders 20 feet long. Antenna height 70 feet above ground. A late winter storm brought this one down with 4 inches of ice loaded on the cross members.

zation, thereby choosing the particular polarization which was producing the greatest signal level at any given instant.

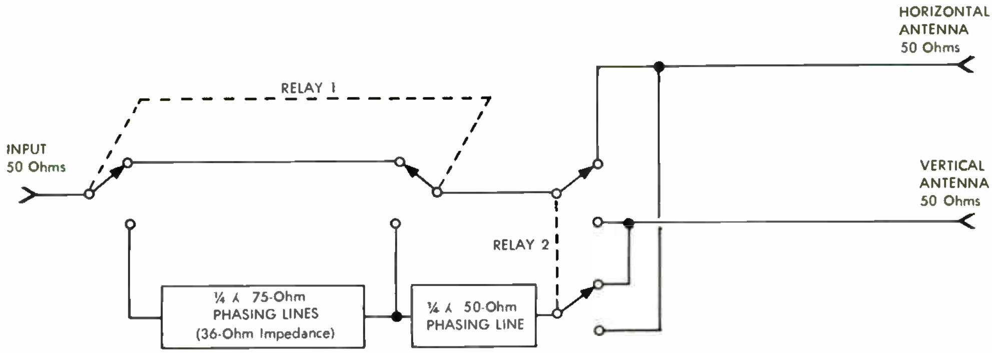
Diagram one shows the very simple means employed to select any one of the four polarization modes. The principal means of phase change was the use of ¼ wavelength coaxial delay lines, which by simple addition and subtraction to the basic phase of the input signal (left hand side of diagram 1) resulted in any of the four choices of polarization desired.

Notice in diagram 1 that we are maintaining a 50 ohm output in either vertical, or horizontal, or circular polarized arrays. Keep in mind, when duplicating any part of the switchable feed system, that the ¼ wavelength phasing transformers must have the velocity factor of the coax you choose to use calculated into the actual phasing line length. Note also that both 75 ohm and 50 ohm coaxial cables are employed in the phasing array.

Diagram two offers two possibilities for phasing together together either 2 or 4 fifty



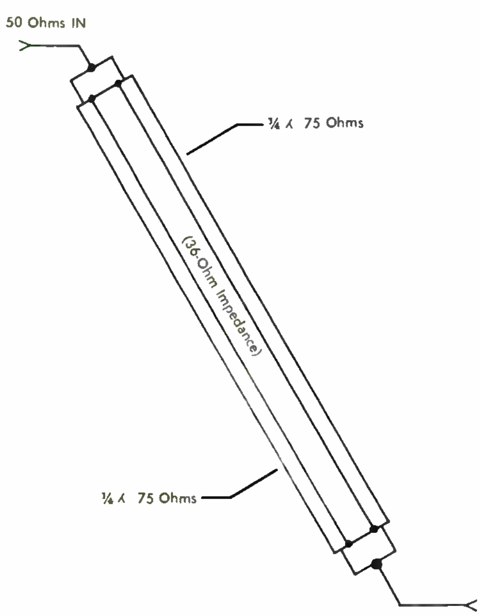
Horizontal 6 over 6 shown here produced a 48-state WAS in 5 months in the 1961 E skip summer season. Boom's 15 feet long, vertical spacing 18 feet. Top antenna 80 feet above ground.



POLARIZATION CHOICES

RELAY 1	RELAY 2	
	NORMAL	ENERGIZED
NORMAL	HORIZONTAL (Only)	CLOCKWISE CIRCULAR
ENERGIZED	VERTICAL (Only)	COUNTERCLOCKWISE CIRCULAR

Diagram 1



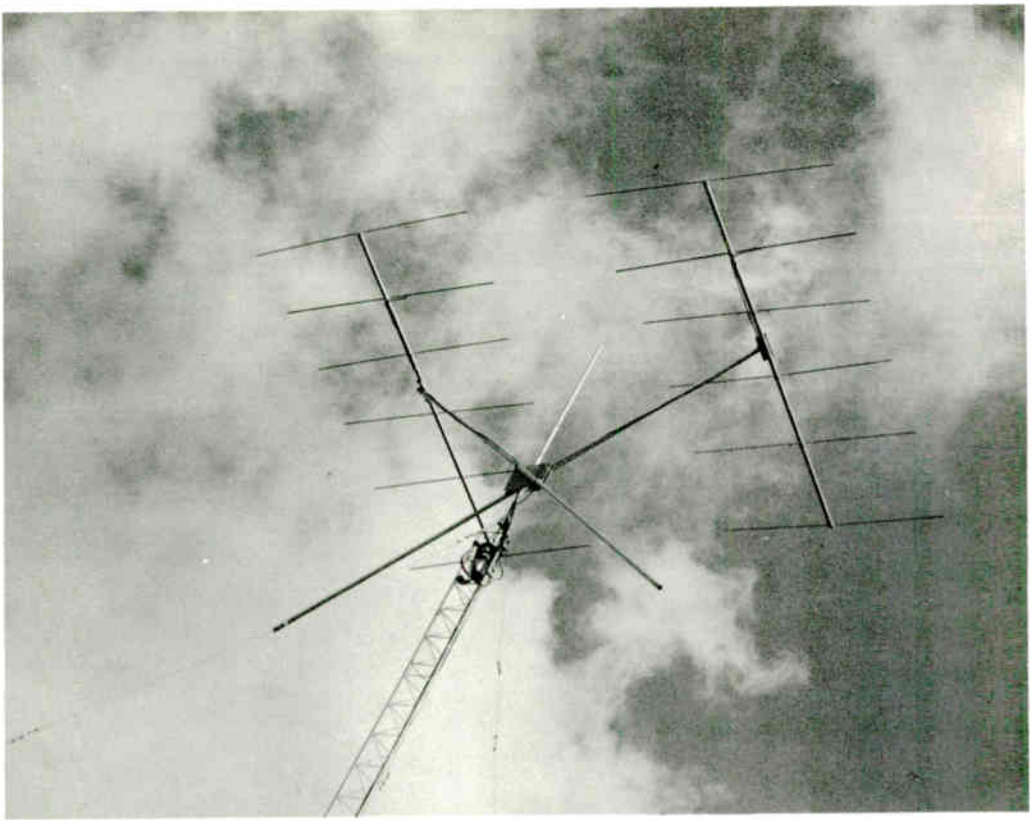
1. Stubs can be made up with connectors, or soldered and taped, with coax connectors only at input and output.
2. Parallel 75-ohm ¼-wave lines are used to match two 50-ohm antennas to one 50-ohm line.
3. Parallel 50-ohm ¼-wave lines may be used to match 4 50-ohm antennas to one 50-ohm line.

Diagram 2

(50) ohm yagi antennas into a single array These methods are, of course, good whether you are stacking horizontal and vertical yagis on the same boom, as was done in photo 1 with the 24 element (12 vertical and 12 horizontal) dual diversity array or if you are simply stacking 2 or 4 yagis in the vertical plane (photo 2) or horizontal plane (photo 3.).

SELECTIVE SAMPLING

With an antenna such as is shown in photo one (24 elements) you have the makings for a polarization diversity array which offers selectable polarization, depending on the signal level present in any one of the four polarizations (*ie.* horizontal, vertical, clockwise circular, counter-clockwise circular) at any given instant. With a single feedline to the receiver (converter) this limits you to manual selective-sampling. In other words, you rotate your relay changeover switch in the shack listening for audible changes in the signal level you are working with, picking the polarization position which produces the best signal to noise ratio.



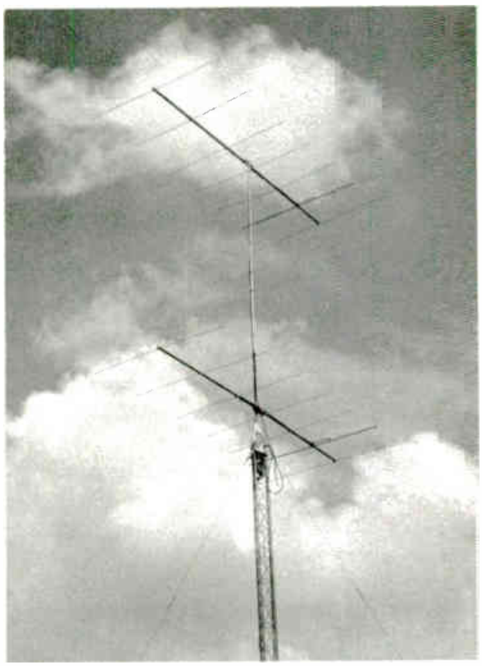
Horizontally stacked 6 by 6. Boom lengths 15 feet, spreader lengths 20 feet, antenna height 70 feet. This array suffered on low angle long haul paths (tropo scatter).

PERFORMANCE

The array shown in photo 1, with two booms, each of which had a six element vertical and six element horizontal antenna mounted thereon, was a real winner on short-haul scatter (high angle work) and E skip. However it was not as good as the stacked 6-6 or 7-7 for low angle work. It is felt that this antenna (the 24 element dual array) would have performed well on low angle scatter also, had we been able to add an additional 24 element array on the bottom of the spreaders, identical to the top mounted array. However the ice of a late winter storm beat us to it this spring and the entire array, coated with ice as big around as your wrist, came shattering to the ground!

It is hoped that many serious minded 50 megacycle amateurs will give consideration to this basic design in the winter months ahead with an eye toward real evaluation of the four modes of polarization over paths likely to produce shifting polarizations due to irregularities in the troposphere or ionosphere.

W0BBM



Vertically stacked 7 over 7 presently in use at W0BBM, pending completion of a more elaborate dual diversity array. Boom lengths 20 feet, vertical spacing 18 feet. Top antenna 80 feet above ground.

144Mc

by Russ Miller, W5HCX
Associate Editor
VHF Horizons

The construction techniques of building a colinear usually presents problems to most amateurs who attempt to build this antenna type.

Seemingly, the antenna appears difficult to construct when it really isn't. In fact, its odd size plus the mechanical problems has in reality scared off a lot of erstwhile builders. Don't let it scare you.

A colinear array, particularly at 2 meters and up, will give you a healthy amount of gain, has a good capture area, is not specifically a narrow band device and can be used over a wider range of frequencies than the Yagi without introducing a serious VSWR. Also, the radiation pattern of the array is naturally broad and eliminates the need for precise aiming.

Building a colinear can be approached in a number of ways. Of first interest is mechanical strength to keep storms from damaging the array. Weight is also a consideration since too heavy an array makes its mounting difficult. A colinear need not be heavy. Size is important because the physical area of the array determines its performance.

The best all-around size at 2 meters is the 16-element array. The array described here is a simplification of the usual construction process. The antenna is constructed from aluminum tubing and steel conduit, the latter used for the boom and the cross-arms. Lashing it together consists of arc welding the cross-arms at their mid-point to the boom as shown in Figure 1. The letter "W" indicates the weld point in the illustration. The next item is the insulator support plates which, by the way, are designated as 'mending plates, 1" x 6" with 10/32 countersunk holes' and are available from local hardware stores or suppliers. These are also made of steel and can be arc welded to the ends of the cross-arms. Why weld the steel parts together? Rigidity is one reason, and the other is cost. It is cheaper than using numerous U-bolts and clamps.

Figure 2 gives all the necessary dimensions. One thing you may notice is the unusually long piece of conduit used for the boom material. If you cannot obtain a piece this long, have a short piece arc-welded to a standard 10' length.

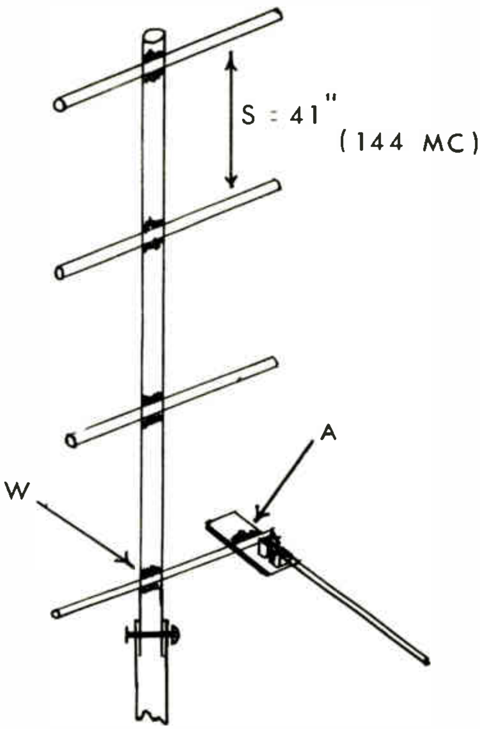


Figure 1

The insulators used with this array should be ceramic, although glazed steatite will do. The insulators should be approximately 1" square by 1¼" high with 10/32 threaded holes in each end. The elements are held fast to the insulators with standard ½" fuse clips. See Figure 3 for details. The fuse clips are available from a number of sources through the surplus stores have the best selection. Holding the elements in the fuse clips can best be done by drilling a hole through the fuse clips and the elements and securing the assembly with 6/32 bolts and nuts. This will also give you a place to fasten a phasing harness.

Feeding the colinear is like most all other arrays; it *must* be matched to the feed line. The actual impedance of this array at the feed point does not approach any figure that can be easily matched. If a ½ wave balun is usd with 72 ohm transmission line, an approximate match will be obtained. However, if you want to lower the standing wave ratio to better that 2/1, a ¼ wave matching stub

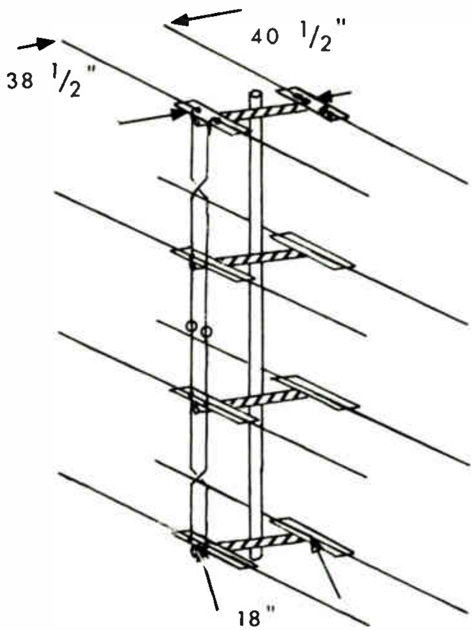


Figure 2

will have to be used. The ¼ wave matching stub is adjusted by moving the transmission line point of connection up or down until minimum SWR is reached.

Slight adjustment of both the transmission line connection and the shorting bar then should be made to reduce the SWR to as close to 1/1 as possible. Incidently, since the array is a balanced device and the transmission line is not, a balun will have to be used at the transmission line connection to the ¼ wave matching stub.

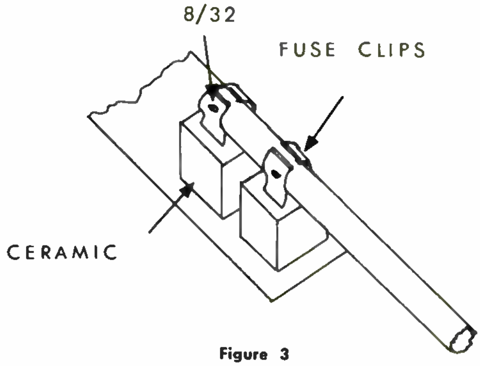


Figure 3

Letters

Dear VHF:
Received the complimentary copy of VHF yesterday and after having ingested its contents wish to apply for future as per enclosed subscription form. To me it appears that you are off to a good start with a long needed tool for the serious VHFer and with the staff you have listed on page two, this effort should be very successful.
Judging from the W4IKK/W4HHK article, you may have lost contact with Bill. He is now associated with AEDC at Tullahoma, Tenn. At last accounting, he was running six watter on 50 Mc rather sporadically due to work and study.

C. A. Waterhouse, W4INM
700 Marlboro Avenue
Chattanooga 11, Tenn.

OM—
Thanks for the note on Bill's location; the first time ye ed worked him, he was running 5 watts on a mountaintop during a tropo opening—so we'll be looking for his mighty 6-watt signal again!

Dear VHF:
First I would like to say your new magazine looks real good. I already know of 10 subscribers locally. The next thing I would like to know is what are you doing to your modulation on W5KHT SSB rig. During the VHF contest it sure sounded good. If there is anything I can do to help the magazine let me know.

73
Ken Halladay, K6HCP
San Jose, Calif.

Ken—
The W5KHT modulation secret is nothing more than Art Collins KWM-2. They don't come any better! You, and others, can help by simply spreading the word about VHF. We'll gladly mail a sample copy to anyone requesting same . . . provided they haven't received a free one previously. Pass that word around!

Dear VHF:
Thank you for the complimentary copy of your new VHF Horizons magazine. Frankly, I compared it (August issue) with the 3 ham journals I now subscribe to and came to the following conclusion of preference; in this order: 1—QST, 2—73, 3—CQ, 4—VHF Horizons. I also had access to two other ham journals, VHF Amateur and Western Radio Amateur, both of which I would cast below your magazine.
Try me again in the future; possibly by then you may have achieved the key to a superior journal at which time I'll buy.

73's
Vin Salemme, K6VUB
Livermore, Calif.

Dear VHF:
After devouring the meaty information in every page, I just had to collar myself and forward the enclosed subscription. I am interested in NFM at present and would like to round up other enthusiasts thru your columns. Most of my NFM operation is on 6 meters.

73
August Oechsli, K2PQY
Massapequa, L. I., N. Y.

August—
Stand by for a deluge of letters from NFM enthusiasts. How about it, gang?

Dear VHF:
Congratulations on the fine publication which covers most interesting topics. Finally the Technicians have been recognized as a powerful group who have no beef with anyone. The need for such a magazine has been filled.

Best wishes
Daniel R. West, K6DRX
Menlo Park, Calif.

Dan—
Thanks for the comments but we must set one thing straight: VHF is published for the technician, not for the Technician. We all feel that high technical interest is the lifeblood of VHF ham radio — but when it comes to the class-consciousness which a few hams of all license classes try to foster, we draw the line. To us, a ham is a ham is a ham — and if he's interested in VHF work, we're all for him no matter what the "'class" of his license!

220 Mc

by **Robert Grimm, K6RNQ**
Western Technical Editor
VHF Horizons

After loading the 220-Mc rig up to a kilowatt one cool summer evening and burning up the transmission line to the 13-element long yagi in the process, the author made the marvelous deduction that he might have an SWR problem. This is later confirmed by a check which showed SWR of 10 to 1.

Now very few hams have the patience and/or equipment to properly tune a very long yagi for optimum forward gain, this being no simple task. At this point it was decided that a simpler antenna of equivalent characteristics would be highly desirable.

A quick check with George (let George do it? No.) W6OKR, in Larkspur, gleaned us some data on a very interesting little 6-element yagi.

One of these little gems was put together quite easily using ¼-inch aluminum tubing, which was readily available at the local surplus outlet. A quick trip to the neighborhood hardware store netted us some nice ¾-inch aluminum tubing for the boom. After some fast calculations and a little work with the drill and hacksaw, there was a 6-element yagi.

It was tried out and the results were so gratifying that I decided to put up a small array using four of these little gems in a quad stack. This quad-stacked array turned out so nicely that this article was the results!

Gain figures are not too easy to determine accurately at this frequency; I'll just say it outperforms the old long beast—and has no problem either!

The stack spacing is 0.85 wavelength vertically and 1 wavelength horizontally. All elements were cut from 1/4-inch aluminum tubing and the booms (as mentioned before) are 3/4-inch aluminum. The elements were force-fitted through 1/4-inch holes in the boom and then the edges of the boom were punched down with a center-punch to lock the elements securely in place without any hardware.

One of the first things you will probably notice is the rather peculiar staggered length of the directors; this results in slightly more gain than would be attainable with tapered directors and is not a typographical error.

The element lengths and spacing distances are shown in Figure 1. Design center frequency is 221 Mc.

The phasing lines were made from 1/2-wavelength sections of transmission line. We used Gonset Silver U line but almost any type of balanced transmission line could be used.

The folded-dipole section of the driven element is made from No. 18 enameled copper wire spaced 3/4 inch from the driven element. Ceramic standoff insulators were used to support the dipole at the feed points. About the easiest method of attaching the dipole to the driven element is to flatten the outer half-inch of the ends of the driven element and drill a hole 1/4 inch in, for a 6-32 bolt. The No. 18 wire can then be fastened either by wrapping it under the bolt or by use of soldering lugs. Be careful to scrape the insulation from the wire to get a good electrical contact.

The front-to-back ratio of the array is approximately 18 db while VSWR at center frequency measures 1.2 to 1. The pattern is needle-sharp in the forward direction, with deep nulls so you can drop out QRM (!). Feedline of 300-ohm or 450-ohm open type is suggested.

Balun Lengths

Many antenna-matching systems use the familiar half-wave balun. But to be a half-wave long, which is necessary for the balun to work right, the physical length must be reduced according to the "velocity factor" of the cable.

So long as everyone used ordinary coax (RG-58, RG-8, etc.), all "velocity factor" figures were the same and you could trust published balun data. However, the new low-loss foam-type coax has a *different* velocity factor — and this may be why your balun doesn't seem to work quite right.

The following table gives balun length, in inches, for the most popular bands for both old and new types of coax.

Freq. (in Mc)	Ordinary Coax	Foam-Type Coax
50.3	77½	91½
52.0	75	88
144	27	32
146	26⅝	31½
221	17⅝	20¾
432	9	10⅝

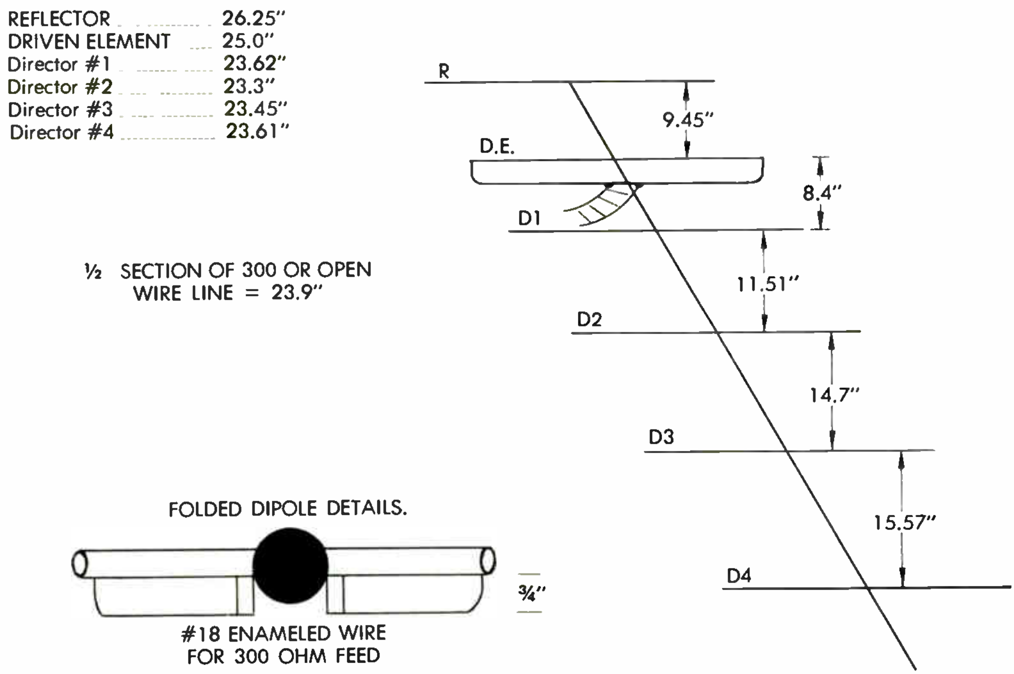


Figure 1. Element Length and Spacing Details

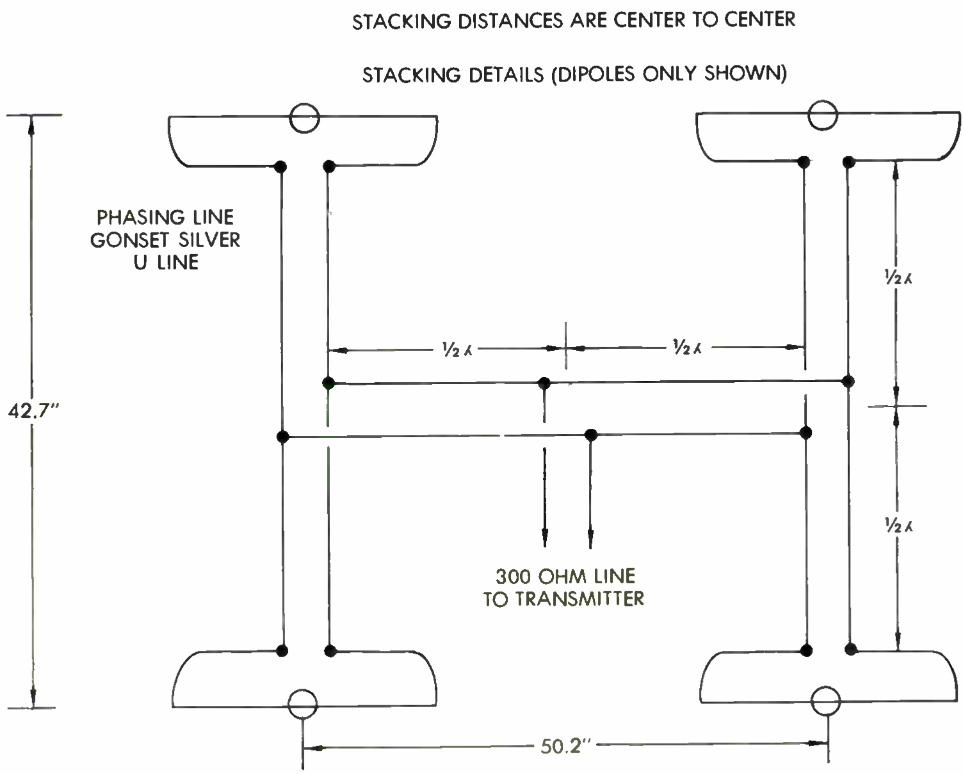


Figure 2. Phasing Harness Construction and Stacking

Antenna Construction

by **Paul M. Wilson, W4HHK/A4HHK**
Southern Technical Editor
VHF Horizons

During the past fourteen years of VHF operation, the writer has built and used a number of antennas on the 50, 144, 220, and 420 Mc bands. Some were mechanically sound and worked well electrically, while others ended up in the antenna graveyard on the back side of the lot.

Experience has shown that certain construction techniques are reliable. It is the purpose of this article to pass on some tips and recommendations that have been employed successfully at this station. They are not to be taken as the "only way to skin the cat", but tried and proven construction employed personally.

All-metal construction is a must. Wooden frames and supports are difficult to build to close tolerance and cannot be maintained in this condition because of the effects of time and weather. In addition, all-metal construction is safer from the standpoint of grounding for lightning protection.

Metal parts such as U-bolts, brackets, screws, bolts, etc., should be sprayed generously with a clear plastic spray such as Krylon or painted with metal primer paint. The latter is available in spray cans, also, for small jobs as well as in larger quantities, and comes in a choice of two colors, red or green.

Construction using tubular booms and framework offers minimum wind resistance, but it can result in other problems. Mounting several elements in line along a tubular boom requires great care in construction. The use of V-blocks for holding the boom while drilling the element mountings holes does *not* insure that all of the elements will be precisely in line when the job is finished. For the amateur who is not a machinist one solution to the problem is the employment of square boom stock.

A drill press is a must, in any event, if one is to drill holes "straight through" the boom and to the size producing a tight fit that requires the elements be forced through by tapping gently on one end with a wooden hammer. With the element centered in the boom, a pilot hole is drilled through the boom and one wall of the element tubing. A sheet metal screw is then run through the boom wall and element wall. The tip of the screw does not penetrate the opposite wall of the element tubing, but approaches it. The head of the screw should be sprayed or painted to prevent rusting.

There are other methods for mounting elements such as cast aluminum brackets (for tubular booms) and soldering techniques. The brackets are well suited for 50 Mc antenna construction. On 432 Mc where elements lengths and diameter are small, copper tubing or pipe booms and hard drawn copper wire elements can be assembled by drilling and soldering.

A rule of thumb in determining the boom size and element diameter (where square boom stock is used) is to make the dimension of the square tubing twice the element diameter. For example, ¼ inch diameter elements, suitable on 432 Mc, would mount with ½ by ½ inch square boom.

On 144 Mc a 32 element collinear-broadside array has been in use continuously for the past nine years at this station that employs 1 x 1 inch square booms and ½ inch diameter elements. To date all elements are still intact, and in line, despite severe windstorms encountered during the annual tornado season.

One half inch diameter elements have been used successfully in six meter arrays. They have held up well, but do have a slight amount of droop, and perhaps five-eights inch or three-quarters inch diameter elements would be desired.

Element diameter is not critical (electrically) in collinear-broadside arrays, but is extremely critical in yagi construction, especially on 144 Mc and higher.

The addresses of firms in your city handling aluminum stock may be found in the

yellow pages of the telephone directory, or write to: Dick's, 61 Cherry Ave., Tiffin, Ohio, for his list of tubing, angle, channel, and sheet aluminum for amateur construction.

One weak point in any array is the connection of the phasing line or feed line to the element. If possible, solder lugs should be avoided. They have a habit of flexing and eventually fatiguing . . . breaking loose.

One solution is to use No. 12 or No. 14 solid copper wire for the phasing lines. At the point of connection, the end of the wire is scraped clean and formed into an eye. A machine screw with flat washer under the head is run through the formed eye and then the hole in the elment wall. On the inside of the element an internal washer and nut complete the connection. The final step is to spray with clear Krylon or paint with metal primer.

On 432 Mc where the element diameter may be one-quarter inch, the end of the element may be flattened for a distance of about one-quarter inch, and the hole drilled through both walls. The flattening should start gradually to avoid cracking the aluminum. A vise is used for this job.

If solder lugs *must* be used, secure extra heavy ones, or double up on two normal-thickness lugs. The element ends should be corked or sealed to cut down on wind noise (neighbors dislike antennas that whistle) and keep out rain. During winter weather water trapped inside an element may freeze and burst the tubing.

Another problem is the support of phasing lines. They must be supported frequently or they will sway and flop when the weather is windy. Excessive movement will lead to the breaking of solder lug connections and/or polystyrene insulators.

On 50 Mcs and 144 Mcs phasing lines made of No. 12 solid copper spaced one inch, center to center, have held up well where properly supported. Kilowatt type 300 ohm tubular line may be used for phasing sections, but it, too, must be supported adequately or conductor fatigue will occur at the connection point. In addition, the "up-hill" end should be sealed (with poly rod and dope or poly material) to keep out water and the "down-hill" end left open to allow the tubing to "breath". Otherwise, moisture will build up inside.

The same practice must be followed where this type of line is used for the feedline. should be formed on the outside with a small Where the line enters the house a "drip loop" opening cut in the underside to permit collected moisture to drain out. Care should be used to avoid cutting the conductors when doing this.

Some amateurs have had mysterious results where tubular line was used and moisture could build up. The strength of local signals would vary considerably from time to time. Some of the inexpensive TV type hardware is well suited for phasing line support . . . but not all. The type affording minimum capacity to ground is desired. Care must be taken to preserve line balance to the metal frame and mast. These stand-offs tend to rust easily, so should be sprayed with clear Krylon or painted.

A phasing line trick worth remembering is that the line repeats the load impedance every half wave. Because of this, the exact impedance of the line is not critical if line length is a multiple of a half wave.

This characteristic may be used to good advantage at times. The writer's six meter beam has a 200 ohm feed point. A half wave section of phasing line (no. 12 spaced one inch) carries this 200 ohm load down the mast to a conveniently mounted balun. The balun, made of RG-8U coax, transforms the balanced 200 ohm load to an unbalanced 50 ohm value. RG-8U is run from this point to the shack. A bracket supports a small plate for mounting the SO-239 connectors to which the phasing line, feedline and balun section connect. The connectors of the coax line and balun section are taped with poly tape and sprayed with Krylon after being screwed up tightly. The use of connectors to head up the ends of the coax makes it easy to connect or disconnect and facilitates weather-proofing.

The length of the half wave section of coax for the balun may be safely determined by formula for 50 Mcs work (66% of 114 inches); for 144 Mcs and higher, it is recommended the length be checked with a calibrated grid-dip meter with the coax fittings (plugs) on the cable. The line should be an electrical half wave for the middle of the band in question or the frequency of operation, depending on the amount of frequency changing employed.

(Turn to page 37)

1296 Mc

by Bill Ashby, K2TKN
Box 97
Pluckemin, New Jersey

Everyone who has managed to get a watt or two of power above 1000 Mc forgets all about making contacts for a long time. The possibilities for antenna design are countless and very intriguing. The fact that high-power, narrow beam-width antennas can be built with a few scraps of wire and a soldering iron, with plenty of space in the average room to make all kinds of experiments, is too interesting to pass by. Simple test equipment is not hard to build, accurate enough to show relative gains of various combinations, but exact values in actual db are very difficult to come by.

Ten years of work by numerous amateurs have produced the following deductions about antennas for 1296 Mc and up:

1) Yagi types will work, but are very difficult to put on frequency. Attempts to scale down dimensions from lower frequencies do not normally produce good results.

2) Driven arrays of dipoles, so-called co-linears, etc., are easily built, matched, and capable of medium gains (approximately 18 db) before multiple-matching problems catch up. Frank Jones, W6AJF, in his VHF handbook, has excellent designs to start with.

3) Rhombics, V-beams, and other long-wire arrays can be made to work, but directivity and gain leave much to be desired.

4) Helical antennas are excellent, easy to build and match. An informative article recently appeared in QST. The predicted reduction in gain when working with a linear antenna does not show up in practice.

5) Above 1000 Mc, passive reflector antenna arrays really start to work. A 90-degree square corner, 12 inches on a side, with a "bow-tie" driven element, cannot fail to give 10 db gain. Careful adjustment of the driven element, feed and matching, plus postion in relation to the reflector, will produce 13 to 14 db gain. Stacking four of these wide by four high is practical and will produce gains in excess of 28 db.

Like all multiple-feed arrays, the major problem is getting exactly the same amount of power, in exactly the same phase, to each driven element. For gains in excess of 30 db, the only practical method known is to use a horn or circular parabola.

High-gain horns are not efficent from the size or weight aspect, but small horns make excellent feeds for parabolas. The feed problem eliminates the possibility of using a cylindrical parabola, but parabolas of revolution are easier to build anyway. Excellent reflectors have been made by amateurs using plywood, aluminum, or steel, up to 26 feet in diameter.

The curve necessary for the ribs of the framework is easy to derive, without any complex mathematics — all that is needed is a steel wire or measuring tape and a square. Decide what will be your focal length. This is the distance your feed will be in front of the dish. 50 percent of the desired diameter works out very well in practice (this is known as a 0.5 F/D parabola).

Lay out this line full scale on a fairly flat surface, such as your basement (or garage) floor. Mark the focal point "A" and the other end "B". Lay out another line absolutely perpindicular to A-B and inter-

EDITOR'S NOTE: We went all-out to be sure you had good information on 1296-and-up antennas in this issue. We contacted everyone we knew of working in this region and solicited contributions. By press-time, it was obvious that we were getting snowed under. Because it offers a number of new and intriguing ideas, we're featuring this month Bill Ashby's collection of tips. Next month, we'll hear from the West Coast as W6MMU, Don Goshay, presents his ideas ,including another, different dish feed system) and K6GKX, Ralph Steinberg, of the Micro-wave Society of Long Beach, tells how to build a colinear dipole array for 1296 in a matter of minutes. If you get infected by the bug and decide to forsake such "DC bands" as 6 and 2 in favor of the exciting region above 1000 Mc, let us know. And we'd like to see some snap-shots of any dishes built as a result of these articles — who knows, that might make for a couple of interesting pages some time next spring!

—K5JKX

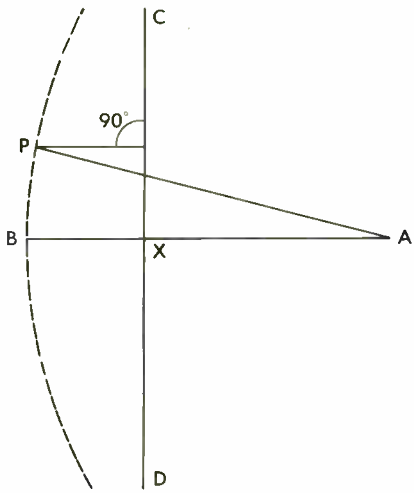


Figure 1

secting it at about 1/3 of the way from B to A. Mark the intersect point "X" and the ends of the second line "C" and "D". C-D should be a little longer than the desired diameter of the dish.

Drive a nail at point A, and attach one end of the steel tape. Then stretch the tape to point B and back to point X. Mark the tape well here, for this distance (A to B to X) now is our standard length. Using the square to always keep the tape perpendicular to line C-D, move the marked point of the tape from X out toward C or D. The point where the tape folds ("P" in Figure 1) to go back to point A is always a point on the actual curve of the parabola.

The focal length is fixed, but any diameter can be had by drawing a line parallel to C-D that intersects the parabolic curve at the desired diameter.

As you can see, any energy leaving the focal point A that reflects from the parabola will be in exactly the same phase as any other. You have ray-traced your design full scale, and it always works. A plywood template is drawn, and the rest is easy.

I have used yagis, square corners, dipoles with reflectors, slot, and horn feeds for various dishes; all with success of some sort. However, a horn antenna, designed so that the 3-db points of its pattern fall just outside the edges of the dish, always gives maximum gain. My 0.5 F/D 20-foot diameter dish with a good horn feed (9 inch square opening) allows the feed to be as much as 12 inches off the true feed point before any gain decrease is noticed.

(Turn to page 23)

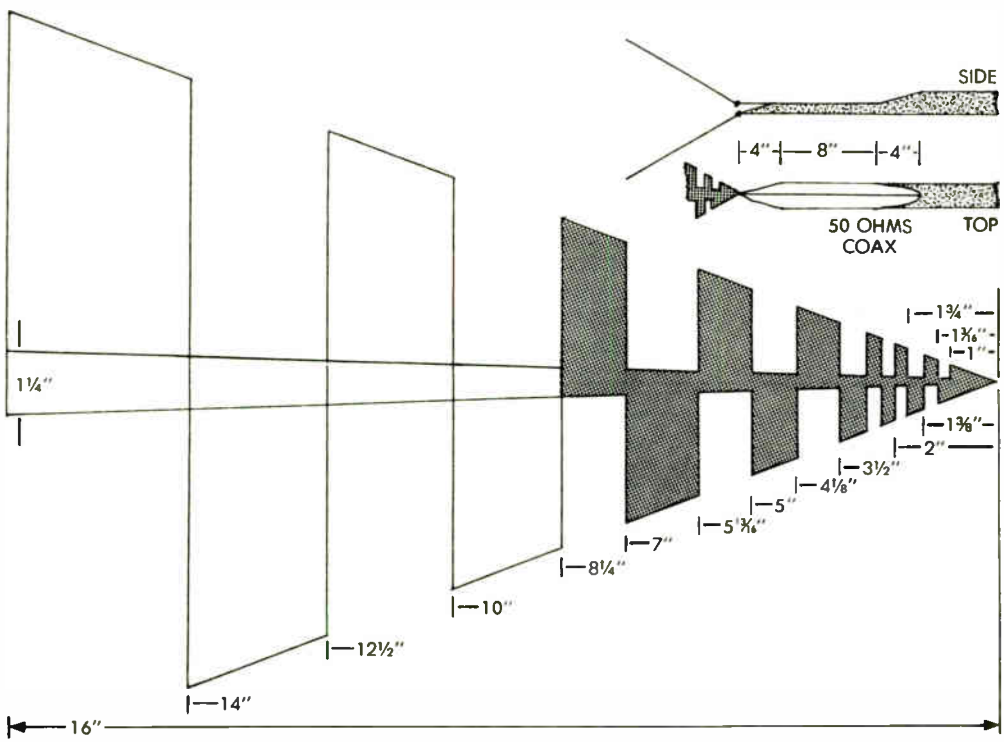


Figure 2. Log-Periodic Feed for 400-2500 Mc

3300 Mc (and up)

by George F. Tillitson, K6MBL
462 East Grove Street
Pomona, Calif.
(holder of one end, 3300-Mc record)

This article, although directed toward the 3300 megacycle band, is applicable to the 2400, 5700 and 10,000 megacycle bands as well. It is written not as a construction article, but as a guide to present and future microwave enthusiasts in their antenna selection and design.

At 3300 megacycles, the 9 centimeter wavelength is small enough to make almost any type of antenna possible. The problem is to select the most practical type for amateur use on 3300 Mc.

Since most 3300 Mc amateur operation is performed with microwave power output in the 100 milliwatt region, a high gain antenna system is necessary. Low power operation allows pola-plexing or simultanous transmission and reception using transmitting and receiving antenna polarizations at right-angles to each other. The pola-plexer provides a waveguide feed system for the antenna. (More on this later).

The parabolic reflector and the conical horn appear to be the most practical antenna types for use on the 3300 Mc band. Both types are broad band antennas, require a minimum of elements to adjust and will support a dual polarization type communicatons system.

The parabolic reflector, or "dish", will produce a directional beam, following the laws of optional reflection. It is a type of mirror having a focal point located along the center axis (Figure 1). When a source of microwave energy is situated at the focal point, illuminating the parabolic reflector, the energy will be reflected in such a way that it travels outward and parallel to the axis of the reflector. The reflector size determines the forward gain of the parabolic reflector.

In other words, the larger the diameter of reflector, the greater will be the forward gain and the smaller will be the beamwidth. For example: an 18 inch diameter parabola at 3300 Mc will provide 21 db gain over an isotropic radiator, with a beamwidth of approximately 14 degrees. An 8-foot diameter reflector at the same frequency will provide a 36 db gain and a 2.5 degree beamwidth.

Before you run down to the local surplus emporium and purchase that eight or ten foot radar antenna, consider the problems involved with the larger size reflectors. Besides having high gain capabilities, they also have

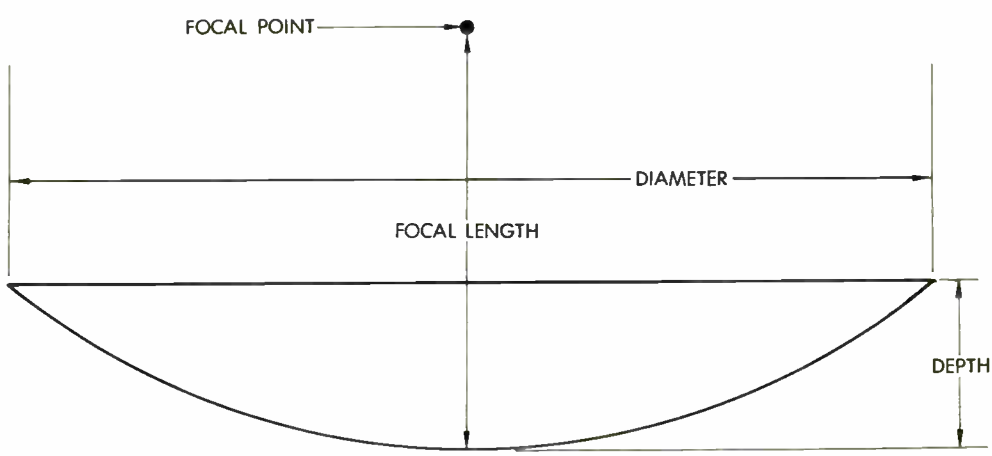


Figure 1. Parabolic Reflector

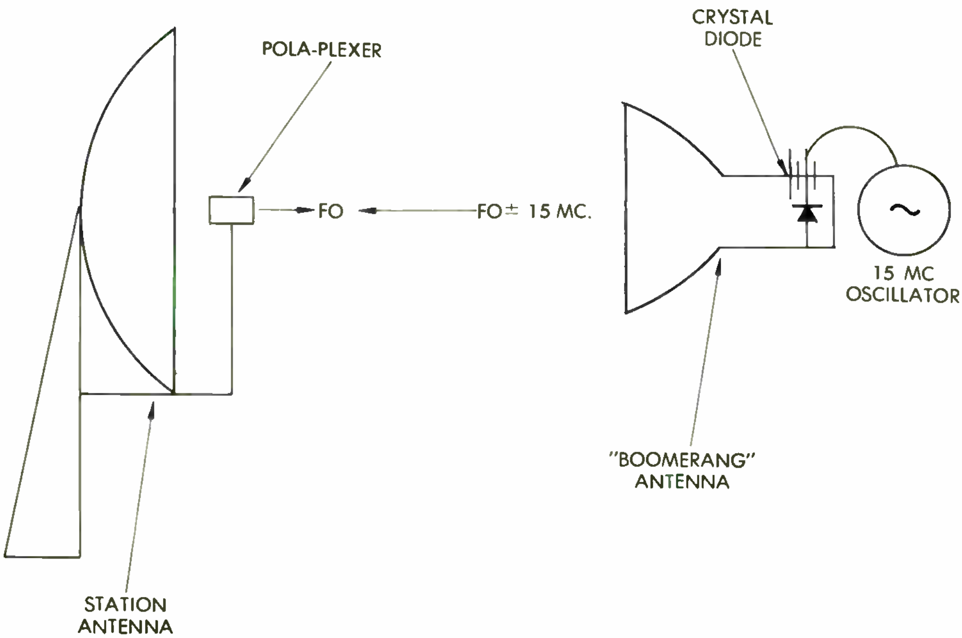


Figure 2. Boomerang Focus System

greater weight and wind resistance. A solid eight foot parabolic reflector can place over 1000 pounds of torque on your rotating system in a 70 mph wind. A four footer can produce 260 pounds of torque under the same conditions. A perforated reflector will decrease the wind resistance, but will limit the reflector's efficiency at higher frequencies.

I have found that a four-foot reflector is about the largest that one man can handle easily. I have mine mounted on a sturdy surplus light tripod capable of being operated as a "mountain-top" portable unit or placed on my garage top for fixed operation. The method of mounting the reflector will be left up to the ingenuity of the individual, as each reflector presents a different mounting problem.

The feed system for the parabolic reflector must be placed precisley at the focal point for maximum forward gain and minimum sidelobe structure. A simple equation that can be applied to the reflector to find the approximate focal point is: FOCAL LENGTH = DIAMETER SQUARED / 16 x DEPTH. The feed can be placed at this point and experimentally adjusted for optimum performance.

Several methods can be used to optimize the focal point, but I believe the best is W6IFE's "boomerang" system. This consists of a transistorized crystal controlled oscillator modulating a microwave crystal diode placed at the feed point of a remote antenna (Figure 2). The transistorized oscillator operates at ½ the communications *if* frequency, 30/2 Mc or 15 Mc in our case. The transmitting klystron radiates from the feed to be adjusted, toward the "boomerang" antenna. The CW signal, intercepted by the "boomerang" antenna, is AM modulated at a 15 Mc rate by the crystal diode. Thus, a signal containing the original carrier and two 15 Mc sidebands (which are 30 Mc apart) is reradiated back to the station antenna.

The receiver mixer detects the 30 Mc difference signal and passes it to the 30 Mc *if* amplifier and signal strength meter.

Since the detected signal is twice the "boomerang" oscillator frequency and the amplitude is proportional to both radiated power and receiver sensitivity, we have a

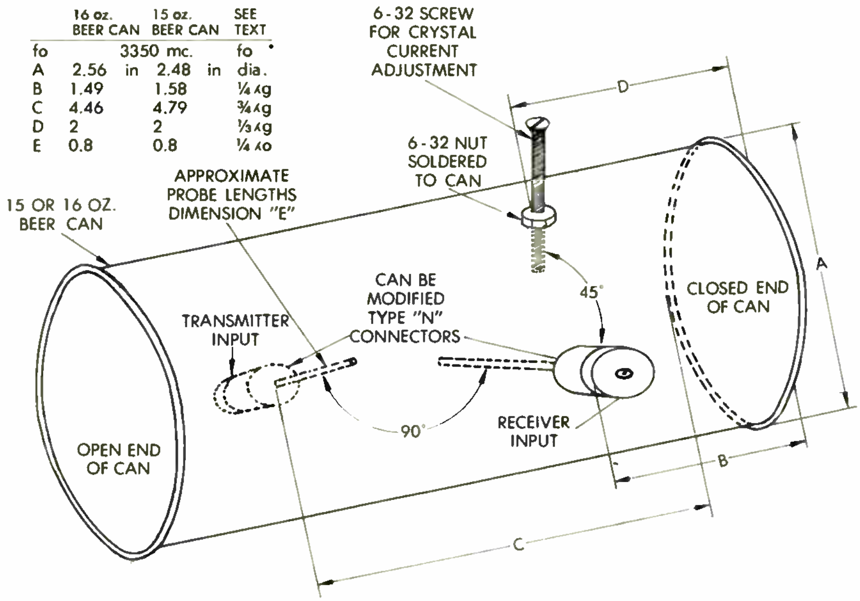


Figure 3. Polaplexer Construction Details

stable *if* signal that will indicate maximum signal strength when the feed is optimumly placed at the reflector's focal point.

When performing the above focal adjustment, the distance between the station antenna and the "boomerang" antenna, in feet, should be greater than 1.41 x 10^{-5} x frequency in Mc x reflector diameter in inches squared. For example: the minimum distance between the "boomerang" antenna and a four foot parabolic reflector at 3300 Mc should be 107.2 feet.

Dimensions for use of common 15 or 16 oz. beer cans for basic pola-plexer construction are included in Figure 3. For those energetic souls wishing to compute their own dimensions for this band or others, the procedure is as follows: Select a waveguide whose diameter in inches falls between 6917 / fo and 9035 /fo, where fo is the operating frequency in Mc, preferably closer but not equal to the later equation. This will assure that the TE11 circular wavequide mode will dominate and no spurious waveguide modes will exist. Then compute the waveguide cutoff frequency (fc) by equating fc = 6917 /dw, where dw is the waveguide diameter in inches. Now compute the guide wavelength, $\lambda g = 11803 \ / \ fo \times 1\text{-}(fc/fo)^2$. λg is the guide wavelength in inches. Now apply λg to the third column in the dimension table in Figure 3.

The use of type "N" connectors terminating the probes is not the only way to couple energy in or out of the pola-plexer. A 726A klystron, for example, can be mounted directly on the pola-plexer (see QST, Dec. 1957, June 1958 and Aug 1960) with an extended klystron probe directly exciting the waveguide. The receiving probe can be replaced by a mixer assembly within the pola-plexer. Many other modifications can be made to the basic pola-plexer dependent upon the availability of components and the cleverness of the individual.

Since it is necessary that the transmitter look at the other fellow's receiver, it is suggested that the transmitted signal polarization be 45 degrees to the right of vertical looking in the direction of transmission. This will eliminate the classic argument about who is to transmit horizontally and who vertically with the pola-plexing system. Also when you complete your 3300 Mc station, you can more easily communicate with me.

This should serve to acquaint you with some of the antenna techniques used on 3300 Mc and other microwave bands. If there is sufficient interest in these antennas or in the crystal controlled klystron "ROCK-LOC" systm in use by members of the San Bernardino Microwave Society, more can be published by prodding the editor of *VHF Horizons* via Uncle Sam's Postal Service.

Antenna Height

By Alan T. Margot, W6FZA
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Did you ever wonder why, on six meter E openings, the follows with the high antennas sometimes beat out those with the low ones, and sometimes vice-versa?

Did you ever wonder why some stations who do quite well on sporadic E take a back seat on tropospheric work?

I used to wonder too, and would set my mind at ease by muttering phrases like "ground reflections" and that old favorite "angle of radiation" and the like.

Recent efforts in the line of ionospheric scattering, however, drove me to the point where I felt that maybe these vague things could be put to use in actual communication instead of just as excuses for strange behavior of signals. A check of the available information on the subject in the ham magazines and technical periodicals yielded practically nothing.

Maybe everybody knew about those things so no articles were necessary. Everybody but me, that is. After a few well-guarded statements and questions I found, with relief, that we were all in the dark when it came to actual facts and figures concerning these matters.

Some plowing through the old textbooks revealed that the signal coming from an antenna operating in the general vicinity of the ground is the sum of the direct signal, and the one reflected from the ground. The reflected signal is slightly delayed due to the extra distance traveled. At certain angles from the horizon these two signals arrive in such a time-phase relationship as to add and double the field strength, and at other angles they can cancel completely. Doubling the field strength is a power gain of 4, or 6 db.

Determination of these angles, assuming good ground reflection, is pure geometry. A typical pattern for a horizontal dipole operating 4 half waves (39.4 feet on 50 mc.) over smooth earth is shown in Figure 1.

But, you say, "I don't use a horizontal dipole, I use a four element yagi". The vertical pattern in this case would be the product of the solid line and the free space pattern of the four element beam.

The result is to increase the size of the lower radiations, or lobes, and decrease the size of the higher ones. It does not, however, change the angles of the nulls and maximums at all. They are determined by the height of above ground alone.

Multiplying the solid dipole pattern of Figure 1 by the handbook pattern of a four element yagi yields the dashed pattern. Actually, the ground reflections will be something less than complete, except possibly over salt water, so full cancellation and 6 db reinforcement will not be achieved.

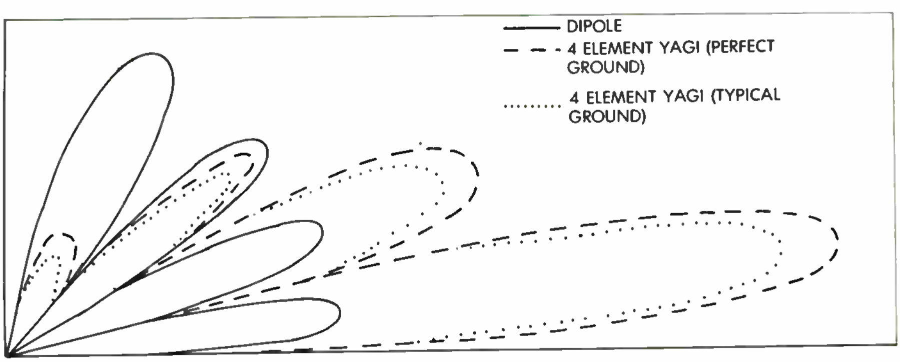


Figure 1. Dipole Reflection Angles

The ground reflections vary with type of earth and moisture content, but they are considerable even over the worst types of earth. Imperfect ground reflections might change the pattern further to look like the dotted lines of Figure 1. Pronounced maximums and minimums do exist, and if we understand what they do to us we can use them to advantage.

Since 50 Mc signals are reflected back to earth by the E layer of the ionosphere like a billiard shot, for every angle there is a corresponding distance where the signal returns.

Transferring these vertical patterns into actual earth distances requires slightly more complicated geometry because of the curvature of the earth. At this point, two variables are introduced: the effect of refraction, and the variable height of the reflecting layer.

The bending effect of normal atmosphere is known, and the upper and lower limits of the E layer are known, so two sets of calculations yield the chart of Figure 2.

The first figure in each spot is for a minimum layer height of 70 miles, and the second is for a minimum height of 50 miles. Because of the variable height of the E layer, there is no point in trying to improve the accuracy of this information. The chart does show some interesting things, however.

The chart also shows that we are donating a lot of power to space. Except in the higher antennas, only the first lobe is useful in VHF work. With horizontal antennas there is always one lobe for every halfwave of antenna height. This means that the fellow with the 70 ft. antenna (on 50 mc.) is shooting six useless lobes into the sky. The more directive the antenna, the more juice in the first lobe, hence the trend toward bigger antennas.

Note that there are a few cases that seem to contradict the old idea of getting the antenna up as high as possible. For example, from Figure 2, at 700 miles a 40 ft. antenna could quite possibly outperform any other up to 100 ft. Generally, it appears that the lower antennas can hold their own against the higher ones in average sporadic E situations.

Figure 3 is a similar chart for ionospheric scattering, based on an average scattering height of 50 miles. This height and the corresponding distances are for the center of the scattering region (36-60 miles). The scattered signal differs from the E reflected

FIGURE 2 PERFORMANCE OF 50 MC. ANTENNAS AT VARIOUS SPORADIC E DISTANCES E LAYER HEIGHT — 70-50 MILES

Ant. Ht. Halfwaves	Ant. Ht. Feet	−3db	0db	+3db	+6db First max	First Null	+6db Second max
2	16.68	1150- 920	1020- 780	830- 630	500-350	——	——
3	29.52	1260-1040	1160- 940	1040- 800	650-550	——	——
4	39.36	1330-1100	1240-1020	1120- 900	850-625	500-350	——
5	49.2	1350-1120	1280-1070	1190- 960	910-700	600-430	——
6	59.04	1390-1170	1340-1120	1240-1020	1010-800	700-500	500-350
7	68.88	1400-1180	1360-1120	1280-1050	1080-850	780-580	580-420
8	78.72	1420-1200	1370-1150	1300-1070	1130-900	850-625	640-450
9	88.56	1450-1220	1390-1170	1330-1100	1160-930	880-670	750-550
10	98.4	1500-1250	1480-1220	1360-1100	1180-950	925-725	820-650

FIGURE 3 PERFORMANCE OF 50 MC. ANTENNAS AT VARIOUS IONOSPHERIC SCATTER DISTANCES CENTER OF SCATTERING — 50 MILES

Ant. Ht. Halfwaves	Ant. Ht. Feet	Odb	+ 3db	+6db First Max	First Null	For 6db angle Distance to Ground Reflection
4	39.36	920 mi.	850 mi.	590 mi.		320 feet
5	49.20	1000	920	700		495
6	59.04	1060	970	760		715
7	68.88	1080	1010	820		980
8	78.72	1100	1025	850	590 mi.	1270
9	88.56	1125	1040	900	625	1600
10	98.40	1150	1075	920	675	2000

one in that fragments of it arrive from all parts of the scattering region, while the E reflected signal usually arrives from one particular height in the E region.

Figure 4 is a plot of db antenna gain (relative to free space) against the very low angles from the horizon, for several common antenna heights. Sporadic E distances range from around 750 miles for 30° to about 1400 for 0.5°.

Of particular concern to the operator interested in long haul Es and tropospheric work is the performance of antennas in the 0.25° to 0.5° region. Energy radiated at these extremely low angles is bent to travel horizontally by refraction. The results of these curves are dramatic and obvious, and can be generalized by saying that you gain approximately 6 db in a horizontal direction every time you double the antenna height.

The man with the 100 ft. tower is almost 15 db better off shooting horizontally than the one with the same antenna just off the roof. No wonder the high antennas work all the groundwave DX! And this advantage continues up to over 32 halfwaves high (300 feet at 50 Mc) if we neglect the effects of line losses.

These advantages would not be wholly realized if (1) you were shooting over hills nearby, (2) there were abnormal bending conditions, or (3) the path were line of sight. Bear in mind that the ground reflections that form the 0.5° radiation angle occur about 115 times the tower height away from the antenna!

There are other important reasons for getting the antenna up in the air. Useful energy is absorbed from low antennas by surrounding objects. Gain antennas depend on phase relationships of the currents in the various elements, and reflections from nearby objects can induce currents which upset these relationships. A perfectly good antenna can give a queer pattern when mounted too low. These factors are difficult to analyze quantitatively, but antenna handbooks always suggest that antennas be mounted "free and clear" of surrounding objects.

The information in this article just scratches the surface of this interesting subject. If any reader desires more information, or solution of a particular problem please communicate with me. If you hear me on six and my signal is weak, it's probably one of those darn nulls again!

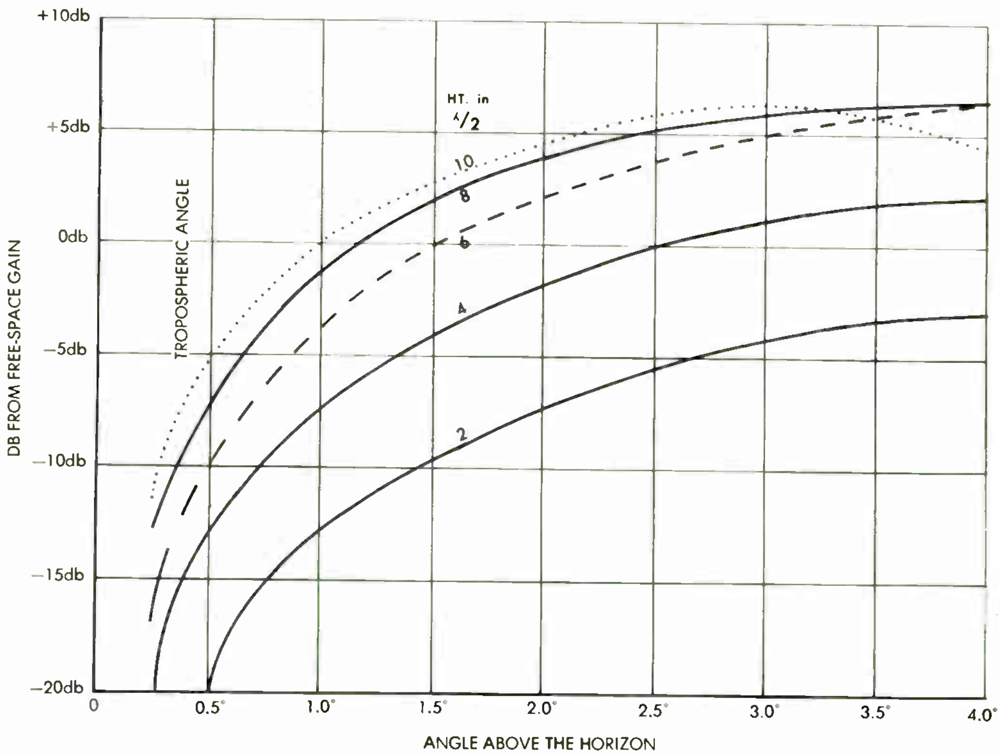


Figure 4. Antenna Gain at Common Heights

Salvaging Old TV Rotors

Every VHF antenna in practical use must have some means for rotating it — and it's here that many constructors run into a big problem.

If you're willing to go out and spend a hundred dollars or more, there's no problem at all. The CDR HAM-M model, a couple of Telrex jobs, and one made by Johnson all serve admirably in the upper price brackets.

Less expensively, a number of TV rotors which will handle medium-size 6-meter beams, fairly large 2-meter arrays, and all but the most gigantic of antennas for higher bands can be bought for between $15 and $50.

However, that's still a good-sized chunk of cabbage for those of us who must cut our hamming budget as thin as a Harvey House ham sandwich!

Fortunately, there *is* a source of supply of rotors for $5 or so if you just take a little extra time and trouble.

This source is born in the fact that most home TV-pole installations are not the best, from a mechanical-engineering standpoint. Comes a good-sized wind, and down falls the pole.

When this happens, the antenna ends up as a tangled mass of tubing — and the insurance adjustor comes in and writes the whole set-up off as junk.

Usually, in such an event, the rotor survives the fall. But knowledgable TV repairmen snaffle off the good rotor-control head pairs which show up by this route. The ones left for us hams usually consist of only a rotor mechanism, sans control head or instructions.

Most people pass these by — and when they do, they pass up a bargain. Because almost all TV rotors operate in much the same manner, and it should take you no longer than 15 minutes to put any rotor back in service (less time if you have a control head, even if it doesn't match the rotor you have).

Virtually all TV rotors operate on 24 volts AC, using the split-phase principle to give you direction control. This means that a simple control head consisting only of a 24-volt transformer, a DPDT-center off or a DP3T switch, and a big capacitor will work with any of them.

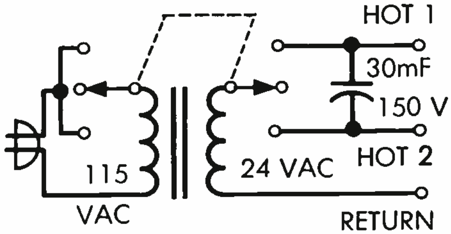


Figure 1

Note that the control head (schematically shown in Figure 1) has only three output wires. Most rotors have from 4 to 8 wires in the control cable. The other wires are for position indication — and that's something this salvage control unit won't help with.

Most practical approach to the problem of position indication is to use a synchro (generally termed Selsyn, though this is a trademarked trade name) system to drive a pointer at the control location.

To determine which three of the wires coming from the rotator you should connect to, take your trusty ohmmeter in hand and measure the resistance between pairs of wires.

Eventually you should come up with three wires, two of which show a low (20 to 200 ohms) resistance from each of them to the third wire, with just twice that resistance reading between the two themselves.

These two wires are the two motor "hot" windings, while the third wire is the "common" motor return. The two wires connect to the two ends of the capacitor, while the third wire connects to the remaining terminal on the control head. If you find the rotor turns the wrong way when you operate it, reverse the connections of the "hot" wires and it will reverse. —K5JKX

1296 Mc . . . from p. 15

Recently, the log-periodic type of drive has been tried with excellent results. The log-periodic antenna by itself is not much for the amateur, but placing it in front of a square-corner or a good parabola produces a *fantastic* array. The six-foot dish pictured with the log drive stays within 30 to 80 ohms and holds a good pattern from 400 Mc through 2500 Mc!

All forms of dipole antennas are based on electrical length of something, but a log-periodic antenna is based on proportion and angles, not finite lengths. Theory is non-existent in practical form, but certain kinds of log-periodic antennas are capable of uniform patterns and impedances over 100-to-1 frequency ranges. 10-to-1 is easy! They can be fed with open-wire or by use of a common form of balue from coax. See Figures 2 and 3 for one very crude version; this is the broadest-band antenna with gain that it has ever been my pleasure to work with. Log-periodic antennas can be readily scaled up or down in frequency, and of course the parabola works from audio frequencies up . . .

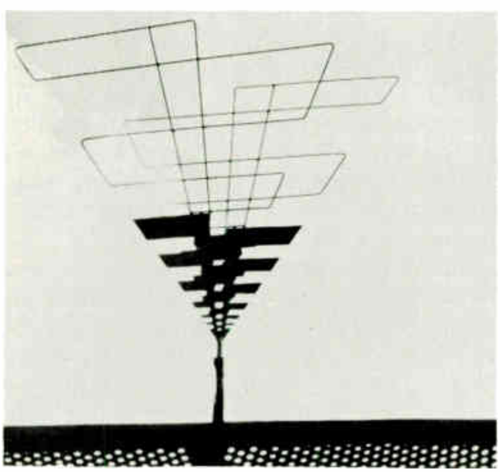


Figure 3

The other photos are of the alt-az mounting using one good rotor and two TV types sawed off and mounted by angle brackets on top of the first. This makes a rugged, easy mount that will handle a counter-balanced six-foot dish with ease. By parking the dish straight up when not in use, no wind problem is encountered, even at 70 feet!

Any high-gain antenna with less than 10-degree beam width should have electrical elevation built into the mounting. Plus or minus 10 degrees of tilt, controllable from the operating position, makes a world of difference on local contacts, and if you are going to do that, make it from minus 10 to plus 90 degrees while you are at it. If any moon work is contemplated, start by building a good Polar mount. Failure to believe this has cost me three years of hard work — I believe it now! Without a motor-driven, accurate Polar mount, you are just wasting everyone's time and effort.

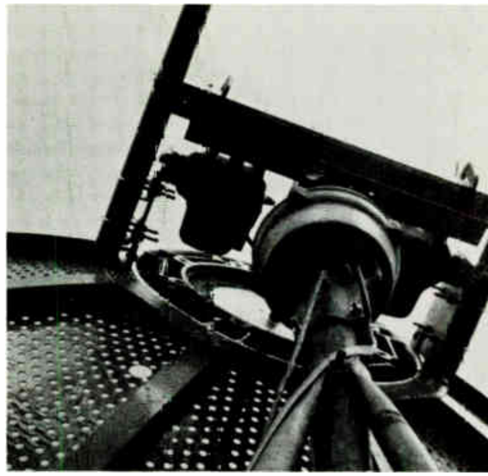


Figure 4. Dual Rotor Arrangement

Figure 5. Dish is Parked Straight Up

This could go on and on, but once you get interested you will find a great deal has been written about antennas. The VHF handbooks detail the common types and periodicals leak out info on the exotic ones. All are of interest when you reside above 1000 Mc. —K2TKN

VITAL HAPPENINGS & FACTS

OPERATING AND DX NEWS

HEARD IN FLORIDA

Remember the VHF contest sponsored by the League back in June? Were you on six meters around 1800 CST (1900 EST)? Perhaps you heard W5KHT announcing (in a somewhat quivering voice) "QST-QST to any two-meter equipped stations . . . it appears that two meters is open in Florida and the Carolinas from Oklahoma. We are tuning 144 to 145 megacycles at this time at W5KHT. Anyone want to try it?"

The 50 Mc operator was 5KHT, Coop. An old hand at sporadic E propagation, Bob detected what he thought sounded like skip sufficently short on 50 megacycles to support a 144 megacycle path of around 1,000 to 1,200 miles in a line to Florida and the Carolinas.

Russ, W5HCX, had the contest rig on two meters at the time, calling CQ. The peak in Es ionization on six meters lasted approximately 30 minutes, from 1745-1815, according to the contest log. On 50 megacycles we were working Arkansas and southern Missouri at the time (300-400 miles) with outstanding signals. We heard stations in Tennessee working stations in Florida and the Carolinas.

No station answered our calls on 50 megacycles (skip was apparently so short as to shut us out of Florida and the Carolinas) and Russ, W5HCX, was having nil luck on 144. At 1755 CST he called and worked W7JCU/5 portable in Oklahoma City.

And we forget about the incident because there had been many-many other "it looks good for 144 megacycles Es occasions" in the past, which did not pan out.

Recently we received a letter from John, K4IXC, of Melbourne, Florida. Melbourne is on the eastern coast of Florida, approximately 90 miles south of Jacksonville.

It began "Dear Bob — On June 9 (at) about 1855 EST on 144.208 Mc I heard a phone signal which I identified as W5THT. Not finding this call in any callbook, I assumed I had made a mistake. He gave his QTH as Oklahoma City, and was calling a W7—/5. I was so surprised I didn't make a note of the W7 call. Recently in talking to WA4DRJ your call was mentioned in connection with VHF Horizons. I then remembered this incident and realized I could have heard W5KHT, and mistaken the call. If it was you, I know you will be interested in this report. The signal was about S-1 when I first heard it, building up to S-9 and then fading down and out. I heard your call 2 or 3 times in the space of about two minutes and had time to set my VFO on your frequency and call between your breaks. I used both phone and CW. No luck. That is my story. Could it have been you?"
Sob.

It could have been W5KHT. It seems rather likely it was. Our operating frequency was 144.208 megacycles (on the nose no less — you must have *some* VFO calibration, John!) throughout the contest.

How did we miss K4IXC? For one thing, we were not listening on our own frequency, nor were we VFO.

John's 100 watts on phone might not have made the grade but his 800 watts CW surely would have. Operator Russ (HCX) says he promises, on a stack of 7788's, to *always* check his own frequency in the future when E skip on 144 megacycles seems possible! That takes care of next time. But who will ever forget how we missed Florida on E skip *the first time?*

As with any event of this type, there is at least one lesson to be learned. Many 144 Mc men expected E skip on two meters this summer. It looked like "the year" for it to happen. To the best of our knowledge, this report is the only one for the season that even smells of E skip. But we know, from our logbook of the past summer, that even from our own limited baliwick, we heard five different occasions when E skip got down to the 350-500 mile range on 50 Mc. Any textbook will tell you that assuming a

normal E cloud formation, this is sufficent intensity to support a 1,100 mile 144 Mc path.

So where was everyone who operates 144 this summer? Sleeping, we suspect. Or tied up on six meters. Whatever the case, VHF hopes to explore this subject in considerable detail in the winter ahead. Maybe next summer more of us will be aware of what it takes to work E skip on two meters. Even the best of us need a state or two in the 1,000 to 1,400 mile range.

50 Mc foreign leads off this month. September - October is traditionally the period of the year when we are led to expect at least a few openings into the far-north land. VE8BY (50.040) has been known to come through in southern Canada and the northern States. Now we have detailed word from Jack Reich, KL7-AUV, concerning operation of not one, but two stations in the Artic Circle. KL7FLC can be found on 50.045 megacycles. FLC is located on Arlis 2, at a position 81 degrees north, 163 degrees east. This was his location in mid-August, and it is assumed that with winter coming on, he won't have moved much in the interim. This is roughtly 1500 miles from Anchorage, according to KL5AUV.

The operator's name is Bob, and he has been on the air and running a keyer since May. Also on from the Artic Circle is KL7-FLB, operated by Bob Mellen. This is Fletcher Ice Island, known as T-3. The KL7-FLB frequencies are 50.040 and 50.112. Those wanting to write to Bob can direct their mail to "Artic Research Laboratory, Pt. Barrow, Alaska," All of KL7FLB's contacts have been from 0400-0800 GMT to date. KL7AUV advises that he himself is operating his code wheel on 50.084, 200 watts CW. Regular schedules are maintained 0400-0435 GMT for VE8BY, KL7FLB, KL7FLC, KL7AUG and KL7AJ. AUG and AJ are located in Ketchikan and both have recently been helping a great number of W7, W0 and W6 stations to Alaska. Just in case you hear the KL7AUV code wheel on 50.084, Jack's telephone is FA-2-2950 in the Anchorage exchange. It can be direct dialed from most of the 48.

KL7FLB has been working KL7AUV, KL7ECT (Ft. Greenly) with KL7FLC also getting into the act.

From way down south, VHF'er XE1CZ writes "I have been working 50 Mc for 5 months now and have made contact with about 350 different stations. This includes LU, CE, CO, K-W's, KP4's, XE. I have confirmed 25 states and worked 30 to date. I'm the only station working VHF in Puebla, which is located 80 miles SE of Mexico City. Altitude above sea level is 7,200 feet. I also work 2 meters (9 element yagi and a pair of 6146's) and 432 megacycles (10 element beam, crystal converter). My six meter rig runs 50 watts to a 6146, and my antenna is a homebrew two element quad."

50 mc SSB enjoyed a heyday during the Perseids shower (reported in considerable detail for the two meter buffs, elsewhere in this issue). WOPFP took the occasion to catch W5KHT on forward scatter (or meteor scatter) over the 590 mile Ames-to-Oklahoma City path. After exchanging the usual formalities on both August 11 and 12, the two agreed to have at it 0730 CST on 50.110 Saturday mornings in the future.

K4VZU, Alton Morgan, sets us straight on who is operating 50 Mc SSB from Alabama. Al writes "W4JMS, K4UTH, K4LSK, W4CIN, W4ZQM and K4MBM are active currently, "as is he, K4VZU. Take W7UBI off of your active list for SSB. Those that have Keith's Idaho SB card for 50 Mc can count their blessings because it may be awhile before we get anyone to replace him going. Keith became W7UBI/0 in Warrensburg, Missouri in August, where he will be for at least 18 months. No SSB activity is planned however, because the 4-400A power supply was left behind in Idaho. Come on, Keith, don't let a little thing like that stop you!

W7ZQX continues his SSB scatter schedules with the California crew on weekend mornings. George represents the sum total of SSB stations known to be active from the state of Washington. Maybe some of the gang will take heed of last month's issue of VHF and get abuilding during the winter months ahead.

50 mc fone has a strange spell over it. The shock resulting from a sudden drop off in E skip openings has caused a numbness to set in and everyone frozen at the mike! Few still realize that off-season E openings are frequent visitors throughout the country, especially on east west paths south of a line from Norfolk, Virginia west to San Francisco. Watch

those early evening periods. They can be real producers of DX!

K1PDA, Manchester, N. H. found six open from 2310 to 0200 on the 14th-15th of August. The opening was to the west for Dave, with VE4MA, Winnipeg, Manitoba worked. Dave heard K9SSU working VE2-MJ and worked W3BWU and K3ADZ in Western Pennsylvania on short skip. Also heard were many stations in Minnesota and 4, 8 and 9 land. The Manchester lad has 29 states and 1 Province worked. He is looking for 3 of the zero states, all of the 7's, California, the 5's and Maryland and Deleware. Seems that a lot of the western boys should need New Hampshire too, Dave. Just announce where you are when the band opens out that way, and stand back. Gravity should take care of the rest!

144 mc news this month falls in the Perseids department, and the report of E skip reception, both covered elsewhere in this issue. In other than meteor burst land, tropo bending continues to make news, with the likelihood that much more ground wave news will be made as this is read.

K4IXC, Melbourne, Florida has a pair of 4X250B's coasting at 800 watts on two meter CW, crystal on 144.090, or vfo as the need arises. The antenna is a 30 foot long yagi on a crank-up tower which can climb to 100 feet! The converter is a 417A mounted at the top of the tower, with only the *if* output signal coming down the cable to the 75A1 receiver in the shack (Now there's a good idea!). John reports regular schedules with W8QOH/MM who plys between New Orleans and Fall River, Mass., around the cape of Florida and on up the eastern seaboard. Schedule times at 0655 and 2100 EST on CW. Results to date show all-overwater path to 460 miles is no difficulty. IXC has worked QOH/MM several times out to 550 miles in the Gulf, and in the Atlantic, off Cape Hatteras. The skeds run from 20 minutes to a half hour. With W8QOH/MM off the coast this fall, during the annual fall inversion season, a number of interesting contacts are bound to result. His frequency is 144.078. When QOH is out of tropo range for K41XC, the pair continue skeds using meteor burst techniques, 15 seconds on and 15 seconds off. K4IXC is very interested in setting up skeds for the coming fall showers. Those interested can contact him at Rt. 2, Box 684-P, Melbourne, Florida.

Several Florida VHF'ers report the passing of W4DPD of Lake Wales, Florida. The central Florida gang feels this loss as the passing of a friend liked by all, and an avid VHF'er from years ago.

Southern Technical Editor Paul Wilson, W4HHK, noted a new two meter SSB station now active near Huntsville, Alabama. K4ZQM is running a 20A exciter into a home-brew converter ending up with a 4X150 final on 144.102 megacycles. Look for him.

Barry, W4TLV, also reports from Alabama that the night of August 10th was a hot one for the gang in his area. The band was open on tropo into Wisconsin, Michigan, Illinois, Indiana, Kentucky, and Ohio. A 432 megacycle try with W8PT in Detroit proved no good. This was the first north-south opening in some time, according to Barry.

220 mc activity is apparently poor only outside of the larger centers of population. W2SEU reports considerable activity in the New Jersey-New York area. Fred reports W2IQR, W2AOC, W2WOF, W2HVL, W2NTY, WA2IFP, K2IQR, K2-IPC, K2DZM, K2AXO, W1NOC, W1MFT, W1AJR, W3CGV, K3IUV and W2SEU active. Fred is currently stationed in Massachusetts but as he notes (as of August 8) "just 317 days until I am out . . . and then watch out!" For the time being his 100 watts into a 22 element beam 55 feet up loads up on 221,400 Mc only on weekends.

W9OVL reports 220 activity is not exactly missing in Chicago. Some 50 stations are active according to Ben, with most of the activity concentrated around 2000-2100 EST Mondays, Wednesdays and Fridays. Ben runs 20 watts for local contacts and 150 watts for DX. He has worked as far west as Omaha during tropo openings, and suggests that those stations outside centers of activity run at least 60-70 watts into a decent beam to be heard.

REPORTING TO VHF

A change in printing dates and deadlines resulted in this column being shorter this month than usual. Dozens of good reports arrived after our *new* deadline, the 23rd of the month. Drop us a note with news of operating and DX in your area. We would all like to see your contributions monthly!

Perseids Report

Although results varied from area to area, most Perseids meteor shower reporters would agree that this year's event was good drill for all involved. A number of 144 megacycle DX enthusiasts added new states and all had an opportunity to put new equipment through its paces.

Comments from actual 144 Mc participants varied from Ernie Brown's (W5FYZ) "This seems to have been the best Perseids shower for the past three years . . ." to W6WSQ's "In general a very poor shower."

The table accompanying this report breaks down some of the results reported up to press time by shower dates and time of contacts. In this case, times are in CST since the majority of path-midpoints were over the Central Time zone.

Our table indicates that things just didn't start happening until the 11th this year. The vast majority of contacts reported occured beween 0200 and 0700 CST, although one occured as late as 1020 CST (W6WSQ to K7IDD on the 12th). Several stations reported hearing strong bursts from other stations, on schedule, in the 2000-0000 CST time period (W5JWL heard bursts from W1JDF, etc.) but bursts were apparently too far between during the evening hours to make a QSO work.

Pure north-south path QSO's and reports of bursts heard concentrate in the 2300-0200 CST time segment. More slanted paths, *i.e.* SE to NW, SW to NE, etc., occured in the 0200-0600 CST time segment for the most part. Due east-west paths varied from W6WSQ to K5TQP in the 0200-0300 CST segment on the 12th to W4VHH-W5FYZ in the 0500-0600 CST segment on the 12th and W4WNH-W0EYE in the 0500-0600 CST time segment on the 13th.

The table does not tell the entire story however. As with any super-human effort (and any participant in the wee-hour Perseids will tell you it is just that), it is the minor things which really make the story complete. They seldom seem minor when they are occuring!

W5FYZ (Minden, Louisiana) reports "copied W5JWL skedding K5TQP, New Mexico with both stations heard well. K5-TQP had several 20-second bursts. Also copied W5KXD, Dallas, skedding W2AZL, New Jersey. Both stations copied including several 5-second burst from W2AZL making identification easy. While working K2LMG I was worried with Perseids QRM! Carl, W2AZL was on 144.013 and Dave (LMG) on 144.014. On a ping or short burst I would hear K2LMG first followed after about a second with a burst or ping from W2AZL. On sustained bursts they were both in there banging away and QRMing each other. I use a 2.4 kc bandpass in receiver in MS, so could hear them both throughout schedule. W7JRG surprised us all with the consistent signal he put into this area. Good, solid QSOs were the order of the day with extra 73s gms and sks thrown in for good measure." The W5FYZ 144 Mc total is now 33 states, 9 call areas and VE3. Ernie guesses he will have to wait for Echo A12 to work W6, his 10th continental call area.

W6WSQ, West Covina, California felt there was a definite peak on the 12th (our table would seem to verify this) with a slight drop off on the 13th. The NE-SW paths were particularly poor, according to our West Covina reporter. Don also copied a 90-second burst (!) at 0758 on the 12th from K7IDD during the Utah station's tune-up, seconds before the sked began. The 90-second burst was strength 6.

W4WNH, Elizabethtown, Kentucky found the 1962 Perseids a trial by tribulations! Shelby had one equipment problem after another including a broken quarter-wave matching transformer on his 32-element array, and a snapped feedline (one after the other). This didn't keep him from putting in one of the star performances however. Shelby was running his 5-year-old 829-B loafing along as usual at 400 watts input (that's what he said!), the aforementioned 32-element array and a 6CW4 pre-amp into a crystal-controlled converter and 75A3 with audio filter.

He notes (on his contact with W0EYE, Boulder) "On the 13th it was all over (successfully) at 0651 EST. Five pings, 6 short

1962 PERSEIDS METEOR SHOWER RESULTS

Time—CST	August 10	August 11	August 12	August 13	August 14
2300-2400		W4WNH hrd WA4DRJ			
0000-0100			W76H6 hrd W6YX W6WSQ hrd W7MAH		
0100-0200			W4WNH hrd K4IXC	W4WNH wked K4IXC W4WNH hrd K7HKD	
0200-0300	W5JWL hrd W7FGG		W5JWL hrd W7LEE W6WSQ wked K5TQP W3TDF hrd W5PZ	W5JWL hrd W7LEE	
0300-0400	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ W7JRG wked W5RCI	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ
0400-0500			W5JWL hrd K7IDD W5FYZ wked W7JRG	W5YZ wked K8AXU	
0500-0600	W4WNH hrd W7JRG	W7JRG wked W5RCI	W4WNH hrd K7HKD W5FYZ wked W4VHH	W4WNH wked WOEYE	
0600-0700		W5FYZ wked K2LMG	W4WNH hrd WOEYE	W5JWL wked K5TQP W2AZL wked W5KXD	
0700-0800	WZAZL hrd W5KXD	WZAZL hrd W5KXD	W2AZL hrd W5KXD	W5JWL hrd WA2EMA	
Miscellaneous			W5JWL hrd W1JDE, 2000-2100; W6WSQ wked K7IDD 0900-1020		

bursts and 3 slightly longer ones; the best being long enough for an exchange at 0650:30. My third QSO with Colorado, all MS."

Shelby's QSO with K4IXC was detailed this way. "Not having previously known about his operation, he was called via land-line on the 11th and skeds set up for the rest of the shower. On 12 August during his sked with K9UIF (0100-0200) he had some extremely strong bursts. I waited. Came 0200 EST and my sked, he all but vanished. There were plenty of pings and even a few short bursts. But they were SO weak! But it took only 31½ minutes on 13 August, with several bursts, to set things up, concluding at 0231, almost exactly like the W0EYE contact. This was a new state for each of us."

Shelby never heard W7JRG during their sked, but the Billings station was heard "on the 11th during most of two 30-second calling periods when he was skedding W5-RCI. This was the longest burst heard . . ." during the Perseids. K7HKD (Wyoming) was the most consistent station heard in Kentucky by Shelby, although no good bursts were copied. Plenty of pings though, whenever K7HKD was transmitting, or so it seemed.

W2AZL, Plainfield, N. J. kept at it with W5KXD, Dallas, starting with schedules at 0700 CST on the 10th and running the same time period through the 13th when they switched to 0200 CST. The 13th schedule ran from 0200 CST through 0643 CST when long bursts exchanged all of the required information. W2AZL also maintained skeds with W0QDH (Kansas) and W0EMS (Nebraska) and W0IUF (Colorado). Results were nil.

W3TDF maintained his schedules with W5PZ, Oklahoma. Starting on the 10th the sked ran through the 14th. Pings were heard on the 10th and 11th, while a complete ident was copied at 0218 and 0253 on the 12th. The 13th was nil, and W3TDF assumes the Oklahoma station did not make the sked. On the 14th several pings were copied, and a complete ident at 0256 CST.

Schedules between W3TDF and W5KXD led TDF to wonder if KXD's 144.140 frequency might not have been closer to 144.-137. TDF heard W2AZL calling W5KXD on the 13th, apparently during his sked period with the Dallas station. This was during the extended period of the 13th when 2AZL and 5KXD were running most of the night up to 0643 CST. W3TDF's schedule with W0QDH proved fruitless.

W5JWL had skeds with W7FGG in Arizona 0230 to 0300 CST on the 10th, and the Arizona station was copied very well in Gurdon, Arkansas, according to Jay. How-

ever W7FGG had to break off skeds abruptly at 0300 because of illness. W7LEE, in his new location above Parker, Arizona was a near-miss for W5JWL. Jay reports "heard lots from Parker but just couldn't get the final "R" through. Signals were quite strong peaking S5-S6 with bursts to 20 seconds or so." W5JWL's sked with W6WSQ resulted in a few pings 0330-0430 over the 10th to 14th period. "Apparently this is stretching distance some . . . and 16 db gain antenna on this end needs some improvement" noted Jay. W5JWL also notes "Sked with WA2-EMA 0700-0730, almost had QSO on the 13th but had to rush off to work and was unable to continue. Another 5-10 minutes and we should have made it. Signals peak S4."

Jay had W4WNH type troubles too. A tuning capacitor went up in smoke (strange, isn't it, how this always seems to happen during a maximum effort period?) and took a 4X250B, or a bad 4X250B took a capacitor. Jay also had antenna rotator trouble which gave false bearings. But, as he notes, "Outside of this, some arc-over in the HV supply and a little line noise, everything went smoothly!"

W7LHL had a single sked with W0ENE, August 10-13, from 0100-0200 CST. Ernie didn't hear anything from the Omaha station. Ernie did copy a 20 second burst from W6YX (Stanford, California operated by Vic, W7QDJ) when YX was running a CQ wheel on a W7RT sked.

W5RCI's contact with W7JRG resulted in the 38th two-meter state for the Marks, Mississippi two-meter pioneer.

W7JRG put his brand new W0MOX design two-meter final to work for the first time this year. In addition to working W5-FYZ, W5RCI and W0BFB (Iowa), Ken heard W0EYE on August 9, 10 and 13 (". . . should have worked him," noted Ken). Skeds with W8KAY, VE3DIR and W4WNH produced no pings or signals. W7-JRG has 15 states now on 144.

W4HJQ, Kentucky, was kept out of the shower by feedline problems.

144 Megacycle Operating Frequencies

WA4DRJ	Florida	144.008
K4IXC	Florida	.089
K7HKD	Wyoming	.124
W7JRG	Montana	.008
W0EYE	Colorado	.048

(Courtesy W4WNH)

World Radio History

Meteor Scatter

by Raymond P. Bilger, W3TDF
Harthorne Avenue
Langhorne, Pa.

Although I haven't participated much in Meteor Scatter work, I have been observant of the operations of others. The more I hear, the more convinced I am that many are wasting their time. There is a very dire need for a standard practice. The following views may put Meteor Scatter propogation into the scientific class, but then we wouldn't be on the VHF bands if we weren't more scientifically inclined than the average ham.

The ARRL has, through Ed Tilton and his column, expressed the opinion that the absolute minimum requirements for a contact are, (1) positive identification, (2) swapping of signal reports and (3) the Roger. The positive identification, in this humble one's opinion, is that you must hear the other station call you and sign his own call. The signal report needs no explanation for normal purposes, nor does the Roger, except that the Roger should not be sent until all the necessary information constituting a contact has been received. For Meteor Scatter work these requirements still hold true but can be accomplished in an absolute minimum time if both stations agree upon and use a common system.

Many stations have been observed sending S1 and S2 to indicate that they have received pings or a short burst. This is an unnecessary and fruitless waste of time. If, for instance, you are sending a complete set of call letters (those of both stations) and 10 reports of S1's. The fellow on the other end has heard nothing but a couple of pings up to now and then receives an 8 second burst of S1's. In those 8 seconds he could have received a complete set of call letters! Yet, since he received only a batch of S1's, it means nothing more to him than the fact that you have received several isolated pings from him. (Assuming that you are using transmission speeds of 25 to 30 WPM, it takes only 5 seconds to send a set of call letters broken by 'de'.)

Assuming that the signal report should never be sent until positive identification is established, which after all is only ethical, the receiving station, having received an 8 second burst containing a complete set of call letters can now begin sending a signal report (a true signal report), interspersed with the call letters. On the other hand, since he only received a batch of S1's, he has no way of knowing who sent them or to whom they were being directed. Result—one good burst wasted!

Another fact which I would like to bring to light is the assumption of at least one MS enthusiast. It was his thought that an S2 should be sent indicating a short overdense burst was received, but not necessarily containing any positive identification. (It could have been 8 seconds of S1's). However, if later in the schedule he receives a full set of call letters and S2's he enters in his log an S2 as his signal report. He has sent an S2 to indicate reception of a burst but containing no valuable information, yet on receiving that same S2 he considers it as a signal report. How can a signal report and some other explanation be tacked onto a single symbol?

One system which has been endorsed is sending a Roger to indicate you have received a full set of call letters. Then, and only after both stations have received and rogered for the calls, they begin to send signal reports, which also must be rogered separately. Then comes the ultimate of confusion, 'The Roger of the Roger.' This sort of thing can go on forever!

The prize that most of us look and hope for is a burst of 20 seconds plus, starting between 5 and 10 seconds before the end of station A's transmisison. If station A has been sending calls only, then station B will have received a full set of call letters and will then send one complete set of call letters, one signal report and BK. Station A then comes back with a Roger, one signal report and BK. Then station B comes back with a Roger and you've got it made. If the burst lasts any longer you can try to get through other information.

Assuming that both operators are using 25 to 30 WPM and can work fast break-in the burst must last 12 to 13 seconds after the change of transmission, *i.e.* after the start of station B's transmission in the

case above. This cuts the absolute minimum length of the overdense burst to 17 to 18 seconds for a completed QSO. This is exactly how W4LTU and I made our contact during the Geminids shower on Dec. 14th, 1956. The total burst was 27 seconds long and started about 10 seconds before the end of Walt's transmission. I even got a '73 es Tnx' through before the burst died.

We all want to work more states and the fellow that comes up with 40 on 2 meters first is going to be one proud peacock. I doubt very much if it will be a coastal station, unless we get one of the rare gems that gave that deserving fellow, Tommy, KH6UK and W6NLZ the record. If we intend to use MS propagation (if it can be termed propagation), we must make use of every burst that is long enough to contain any information at all. Therefore we must agree upon and very diligently use a system which is designed for 'getting the mostest from the leastest.'

The greatest asset to anyone using MS is the automatic keyer. I use a 6AQ5 clamp tube to control the driver screen. The driver has no bias other than that developed across the grid resistor. The 6AQ5 is biased beyond cutoff and a plate relay in the plate of a 6AC7 (any reasonable tube can be substituted) shorts the bias out on the 6AQ5, through a resistor arrangement so the actual bias supply is not shorted out. The 6AC7 and 6AQ5 use separate supplies so that the 6AC7, which is also biased to cutoff, can be keyed without having the driver screen voltage on the key. The 6AC7 bias is applied in a special circuit in which there is also a tone rectifier. I use a tape recorder with a loop of tape for auto-keying, feeding the output through a small output transformer into the one rectifier. The key is left in the circuit at all times and all that is necessary to change from auto-keying to hand keying is to cut the volume on the recorder, or stop it. As a matter of information I use a second tape recorder for complete recording of all schedules.

Regardless of the system used for auto-keying, it should be set up so that the hand key may be used in place of the auto-keying on a split second's notice. Suppose, like myself, you leave the auto-keyer running continuously and merely turn the rig on and off at the appropriate times. Then at the very end of the other station's transmission you get a ping. This could be the beginning of an extended burst. Therefore you go back on manual and give one complete call and a BK. If the other station doesn't break-in within 3 or 4 seconds then you go back on automatic. As pointed out before, you must make use of every available opportunity to get through information and take advantage of every overdense burst that may come along.

My proposed system is quite simple once you get on to it, but requires that you be on your toes to transmit only that which is necessary at each and every stage of the game. First you transmit full sets of calls over and over, (ie. W4LTU de W3TDF W4-LTU de W3TDF etc.), on each transmission. Then, and only after you receive a full set of call letters from the other station do you include a signal report. The signal report will be taken up later. When you do begin to include the signal report it should be thus, W4LTU de W3TDF S3 S3 W4LTU etc. This sending of the signal report is your information to the other station that you have received his full set of call letters. When received by him, it tells him he need not send the calls anymore and can send the signal report and a Roger, thus R S3 R S3

When you receive	You send	Sig Rpt	Meaning
Nothing or incomplete calls	Calls only	S1	Up to 5 Sec.
Complete calls	Calls & Sig Rpt	S2	6 to 10 Sec.
Calls & sig Rpt.	Sig Rpt & Roger	S3	11 to 15 Sec.
Sig Rpt & Roger	R's continuous	S4	16 to 20 Sec.
2 or more R's	Nothing	S5	over 20 Sec.

etc. Therefore, you send complete calls only, until you receive full calls. You send signal report until you receive a signal report and then and only then do you send Rogers. Keep in mind, of course, that you continue sending the signal report until you receive a Roger. If while you are still sending only calls you receive calls and a signal report, you then send only signal report and Rogers. If while you are sending calls and signal report, (which will be only after you have received full calls), you receive a signal report and a Roger, you then send a series of Rogers and nothing else. When you receive 2 Rogers in succession you quit. You've got it made! For this to be absolutely conclusive you must be sure not to send more than one R at a time when you still haven't received a Roger. which of course necessitates that you be sending a signal report along with the Roger.

The signal report can be any arbitrary report, but a system is likewise here suggested. S1 is for a signal burst of not more than 5 seconds, or more than one burst of less than 5 seconds each sufficient to get the full set of calls through. (Again — No signal report is sent until the full set of calls have been received.) S2 for a burst of up to 10 seconds (during which full calls have been received). S3 for a burst of up to 15 seconds, etc. Therefore an S5 would be the highest report you would give indicating a burst of 21 or more seconds. If the burst lasts more than 25 seconds you will probably be using break-in anyway, so you still use S5, or possibly there will be opportunity for use of the complete RST system.

It should be evident from the above that you will never have need to send all 3 items of information together, because if you are in a position to send a Roger, it can only be after you have received a signal report which in itself is indication that your complete set of calls were received at the other end making it unnecessary to send them with the Roger.

The signal report you send will be based on the length of the burst in which you received the complete set of calls, and will not change unless you again receive another full set of calls on a longer burst which still doesn't include a signal report. This is possible because if he is still sending calls without signal reports, it is only because he has not received a signal report from you.

A simple chart is given here which can be cut out or reproduced and displayed at the operating position. Keep in mind three simple rules. Don't send unnecessary information. Don't send more than one Roger in succession until you have received all the information you require. Always be ready to switch to break-in, should the need arise.

As can be evidenced from the chart you can have four separate auto-keying sequences set up ahead of time and will have no need for the hand key unless a chance at break-in avails itself. The one containing solid R's can be used for all MS skeds of course.

SSB for Two

part two

by Russ Miller, W5HCX
Associate Editor
VHF Horizons

The most important step in putting a SSB signal 'on-the-air' is the application of audio to whatever form of balanced modulator we're using. At this point no item should be slighted in order to come up with adequate unwanted sideband suppression and clean audio. The "SSB Rig on Two" is no exception.

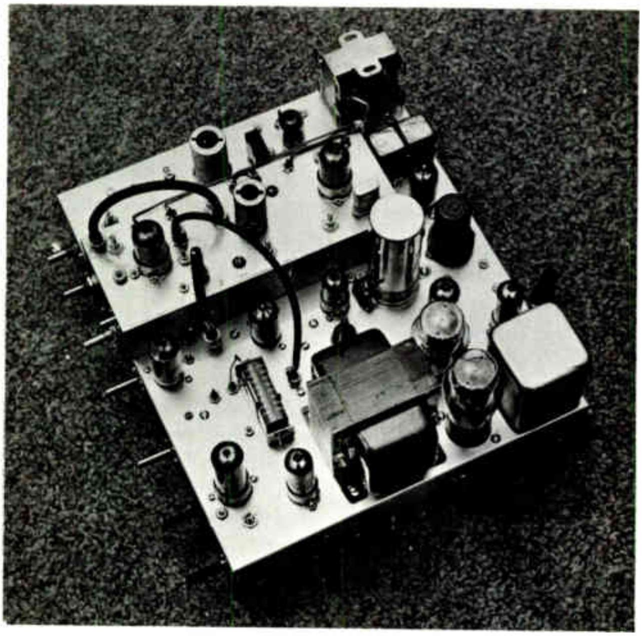
Power supplies are also an important consideration. Important, primarily because if they are not adequately regulated where specified, the result will be a wobbling signal with big chunks of distortion riding on it.

There are many, many ways of cutting corners when building any rig and some are very useful but don't try to cut too many corners. One of the easiest things an amateur can do is to substitute some different tubes than those specified. This idea will probably occur when considering the linear RF amplifiers used in the SSB on Two rig. Don't be tempted. The tubes selected will do the job and last for a long period of time before they start to fall on their nose. Also, if the 5763 is inter-changed with something else, the AM quality will suffer and the RF distortion will go up when the rig is operated in the AM mode. Incidently, the original article last month mentioned using a 12BY7A instead of a 5763. Reason for the change was based on seeking improvement of the AM signal. The 5763 did provide that improvement.

AUDIO SECTION

The 1st audio stage in the rig uses a 12AT7, witth both halves operating as straight voltage amplifiers. The second half of the 12AT7, 1st audio stage, is fed to the AM-SSB selector switch. At this point the audio output is fed to either the grid of the 6AQ5 modulator or to the audio phasing network depending on which function is selected.

Selecting SSB connects a small transformer in parallel with the load resistor of



Top-side view of SSB unit. 6360 RF amplifier occupies lower corner of chassis. Battery shown in photo is bias source for the 6360. Average life of battery is two years. Feed-thru capacitor located slightly to the left of the bias battery feed-thru capacitor is meter connection to RF diode. Co-ax plug and jack immediately above feed-thru are used for coupling 2nd mixer output to the RF amplifier input. 16.5 Mc signal is coupled to the sub-chassis by co-ax line shown adjacent to the battery and power transformer. Nylon jack shown on top, front part of sub-chassis, is TP-2.

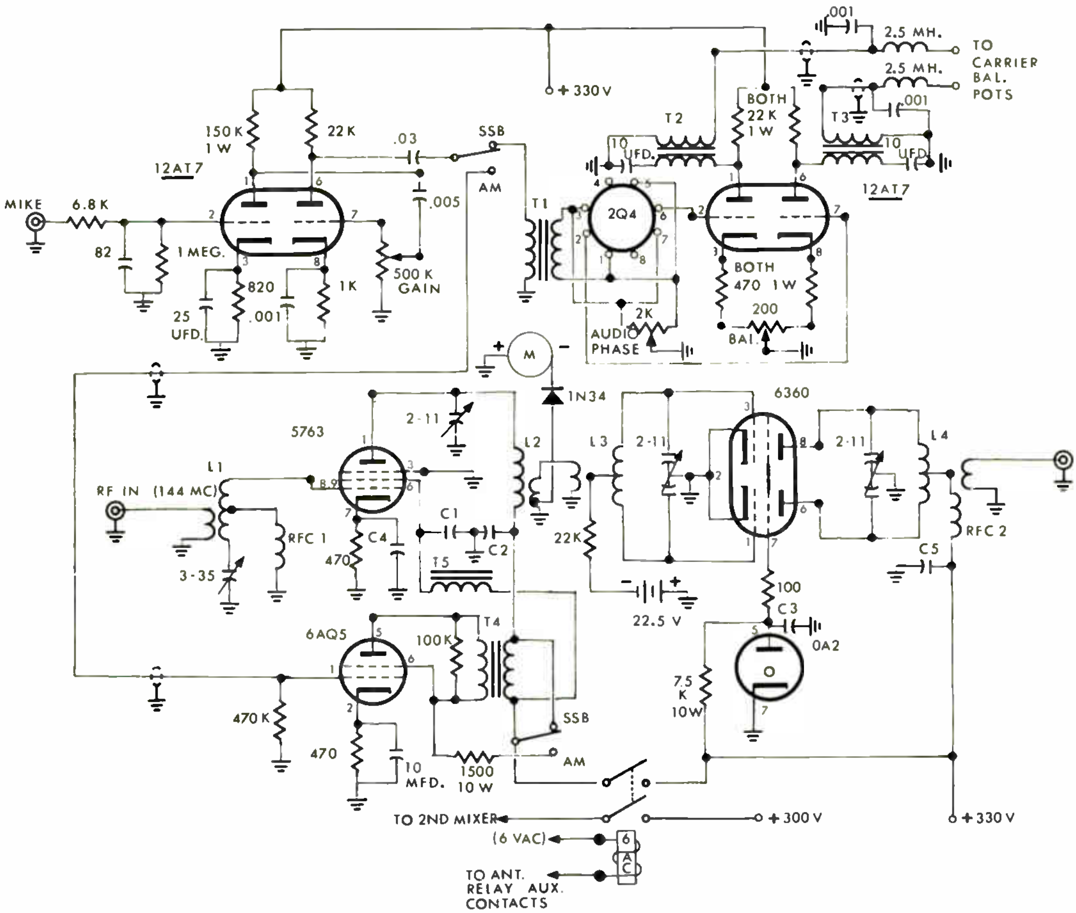


Figure 1. Audio and RF Circuitry, Schematic

the 12AT7. This transformer feeds a B & W 2Q4 audio phase shift network which in turn feeds another 12AT7 audio stage. This 2nd 12AT7 stage is also a straight voltage amplifier. A pair of 20,000 ohm to 600 ohm transformer (W2EWL type) are used as the plate loads for the 12AT7, 2nd audio stage. From here the audio goes through a pair of 2.5 mH RF chokes to the balanced modulators.

AM is a horse of a different color. Back at the 1st audio amplifier stage, 2nd triode section, we feed the audio to the grid of a 6AQ5 through our selector switch. The 6AQ5, operated Class A, is the sole modulator stage. It will provide more than enough audio to modulate the 5763 Class A linear. It might be well to mention at this point that this method of AM is not normally used but it does the job with only a small sacrifice in modulation percentage. I know some amateurs may worry about linearity, varying load conditions, etc. Once again, the rig won't sound like a broadcast station but it will sound clean and do the job.

Gaining a few additional percent improvement in modulation percentage at the expense of a big modulator and the necessity of operating some form of amplifier Class C just isn't worth the cost. There is one thing which is in your favor as far as the modulated stage is concerned, it is highly inefficient. But, it doesn't have to have much output to comfortably drive the following 6360 Class AB1 amplifier.

When considering the microphone types to be used with the SSB on Two rig, don't use a mike with a particularly flat response curve. The high end of the audio spectrum and its rich overtones are best done without. Besides the audio phase shift network is not particularly designed for the range past 3000 cps or below 300 cps. If operation with a carbon mike is desired, ground the grid of the 1st triode section and connect the mike in series with the cathode.

RF AMPLIFIERS

The only tubes used in the RF amplifier section are the 5763 and 6360. The 6360 is

operated as a conventional Class AB1 linear with both its input and output circuits coupled fairly tight to the driving source and load. This is necessary to realize a 2.5 Mc bandpass which is about as much as can be expected without overcoupling and thereby enhancing unwanted harmonics. By properly adjusting this stage, a 3 Mc slice of the 2 meter band can be easily covered in practice.

Like all RF amplifiers, care must be taken to isolate the input and output circuits of the 5763 and the 6360. The only necessary item in either stage is the 100 ohm resistor in series with the 6360 screen grid lead. This resistor should be mounted as close to the socket connection as physical size will allow and also the opposite end should be as close to the .001 stud-mounted capacitor as possible.

If the schematic and the above suggestions are followed, both stages will be stable enough to eliminate the need for neutralization.

The only tuning that is necessary in the RF amplifiers is the grid and plate tuning of the 5763. The 6360 is adjusted only during the initial tune-up of the rig. The absence of any metering in the 6360 stage may lead to some question. The high-power linear that this exciter drives has an RF voltmeter circuit built in to indicate its output. This is used for initial tune-up of the exciter and since the 6360 is fixed-tuned eliminates further need for metering. If bare-foot operation is desired, a 1N34 diode used with a milliameter will suffice to tune up the 6360 stage although some means of monitoring its output is desired. Since the 5763 stage is tuned, a metering provision is necessary. In this case, a 1N82 was tapped up 1/4" from the ground connection provided for the coupling links between the 5763 plate and 6360 grid tanks. The diode (1N82) is then connected to a 500 pfd. feed-thru capacitor. The other end of the feed-thru capacitor is connected to a 0-1 mA. meter.

POWER SUPPLIES

Two power supplies are used for the rig. One supply provides a regulated 210 & 105 VDC and unregulated 250 VDC. This small supply is incorporated on the exciter chassis. It supplies all the stages except for the audio sections and RF linears. The second supply is external and supplies a regulated 300 VDC for the screens of a KW, 4CX250B linear, and an unregulated 350 VDC for the audio sections and low level RF linears. This 350

VDC source is also fed to a 150 VDC regulator on the exciter chassis to provide a regulated voltage for the 6360 screens.

CONTROL CIRCUITS

The actual controls circuits are confined to a single relay. One set of contacts removes the voltage from the 6X8 2nd mixer and the other set of contacts removes the voltage from the 5763. All the oscillator circuits are allowed to operate at all times for maximum stability. There are no birdies in the receiving combination used for the check out of the oscillators, with the oscillators running. However, since the checks were made with a converter using a 30-35 Mc IF this might not be true for those receiving set-ups using a different IF.

Anyways, this problem can be approached a number of ways if you are troubled with annoying birdies from the exciter. One means would be to install another relay to cut off whichever oscillator is interfering. If the birdie is in a portion of the band that is not used, you might just leave it alone. The only other alternative would be to select crystal frequencies that would place the birdies out of the band. If you do have to key one of the oscillator stages, don't be too concerned. In our particular case the International FA series crystals that were used proved extremely stable.

If you are wondering how the control relay is keyed, an extra set of contacts on the external antenna relay does this for us.

LAYOUT

Starting with the audio stages, these were constructed across the back of the chassis. The 2Q4 audio phase shift network is located in the far rear-center of the exciter chassis. To the left is the 12AT7 2nd audio stage. The 6AQ5 is to the right of the 2Q4 and adjacent to the modulation transformer. Directly in front of the modulation transformer is the 210 VDC supply regulators with the 12AT7 1st audio adjacent to the left-hand regulator tube.

The RF amplifiers are located on the front of the chassis and occupy the right hand side. The 150 VDC screen regulator for the 6360 is located behind and to the right of the 6360. A small battery can also be seen on top of the chassis, near the 6360. This is the bias source for the 6360.

The 5763 tuning controls are mounted on either side of the respective tube socket and in a line with the other controls. Since space was needed for the control relay and other components, the audio gain control/on-off switch and the AM-SSB switch were mounted on an aluminum 'L' bracket on the bottom rear of the chassis. This works out very well by eliminating unnecessary long leads between the controls and switches and the audio section.

The audio phasing pot and 2nd audio stage balance pot are mounted across the rear side of the chassis. Also, the AC leads, external power jack, and the microphone jack are located here. Placement of these various parts is not critical although it would be best to keep the audio pots as close to their respective stages as possible.

ADJUSTMENT

RF from the 2nd mixer should be applied to the 5763 and this stage along with the 6360 should be adjusted for maximum output, (full carrier insertion). Next, set the AM-SSB switch for SSB. Apply a 1000 cps audio tone to the grid of the 2nd triode section. With an oscilloscope connected alternately to pins 2 and 7 of the 2nd 12AT7 audio amplifier, adjust the audio phasing pot for a 90 degree phase relationship between these two points. Next, adjust the audio balance pot for equal amplitude output fro this same stage. If an oscilloscope is not available, a suitable receiver may be used for the same purpose. In this case adjust pots for maximum suppression of the unwanted sideband.

After these adjustments have been made, the rig is ready to be put on the air. The only thing that remains is to adjust the mike gain control for the best levels, depending upon which mode of modulation is selected. The RF voltmeter in the exciter RF section will provide a means to monitor the output and assure that either the correct amount of carrier is inserted when operating AM or that the mike gain is set properly when operating SSB.

When using SSB, don't crank the audio up any farther than necessary. If you choose to drive a high-power linear, adjust the audio so you obtain sufficient drive and no more.

When operating AM, you may insert full carrier with one of the carrier balanace pots. There is more than enough audio available to modulate the 5763 so be careful not to turn up the mike gain to the point where distortion is present. The exciter will probably have to be cranked down by adjustment of the carrier balance pots to keep from overdriving a high-power linear amplifier, and consequently, so will the audio gain.

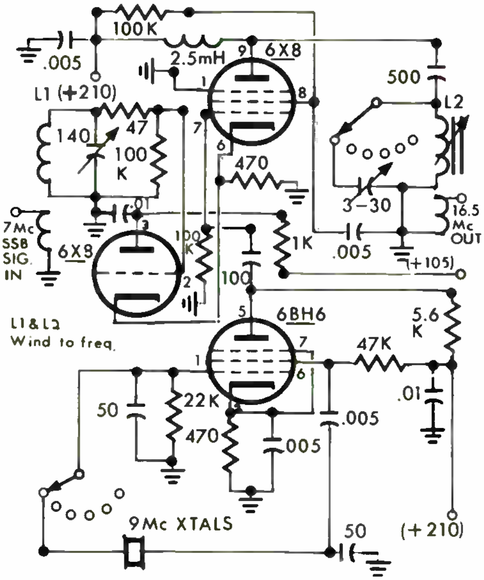


Figure 2. 16.5 Mc Mixer (see part 1)

Operation of the SSB for Two rig is self-explanatory. Changing from AM to SSB or vice-versa, or changing frequencies, is quick and easy. The results you obtain with the rig will be astounding if you have never operated VHF SSB. Better still, tie on a good sized linear. This topic leaves lots of room for thought. Next months issue will contain a full KW linear that can be over-driven by the SSB for Two exciter yet for its power feature occupies a space 12" x 7" x 6". W5HCX

Dear VHF:
Best of luck in your new venture. I particularly appreciated your features by John Chambers and the staff report on "Pi in the Sky". The pi net article was a very clear treatment of common pi net problems.

73
Carl Ebhardt, W4HJZ
22 Rowan Street
Raleigh, N. C.

Carl—
John has quite a bit more to say — and our staff report people are nosing around some more interesting problem areas.

Dear VHF:
I am not at present a VHF bug but the magazine looks so good I had to subscribe (I hope the rest of the issues are just as good). This magazine may make a VHF bug out of me yet!

Edward Nester
2184 Light Street
Bronx 66, N. Y.

Ed—
Welcome aboard — you'll find a lot of fun above 50 Mc! And you can count on the future issues being at least as good as those so far — we're going to try to make them even better.

Construction . . . from p. 13

A good open-wire line can be constructed using No. 12 solid copper wire and 5/16 inch or 3/8 inch diameter polystyrene rod. These sizes afford more strength than 1/4 inch diameter rod. The line is fabricated by stretching two lengths of No. 12 wire tightly between two points in the workshop, making certain they are the proper distance apart (one inch center to center is suitable for 50 and 144 mcs) and parallel the entire length. The wires should be touching the floor.

Polystyrene spacers one and one-half inches long (for one inch spaced line) are cut from stock and placed under the tightly stretched wires every six inches. Make certain the spacers are at right angles to the wires. The tip of a hot soldering iron is pressed downward against the wire, and to one side of the polystyrene rod, forcing the wire into the rod. Remove the iron when the wire is completely covered over by the softened polystyrene, taking care not to move the rod or wire until after the polystyrene has hardened. Then perform the same operation on the other end of the spacer. Do not allow the iron tip to touch the polystyrene rod!

A TV type standoff insulator intended for supporting small, tubular 300 ohm line may be used to support open-wire line. At the point of support, the polystyrene spacer should be made longer than normal so that a standoff support may be used at each end rather than one at the middle. This gives better support and minimizes capacity, and possible unbalance, to ground.

Amateurs living in coastal areas or windy locations may find other precautions are necessary. Only a few phases of antenna construction have been covered. Doubtless you have some tricks of your own that make for a better antenna installation. In general, taking a little extra care in the construcion of your VHF antenna and feedline . . . using a little more than the bare minimum . . . protecting against corrosion and moisture . . . will pay off many times. An array that is dependable and does not require frequent repairs is far more useful than a larger one that is out of service much of the time.

For additional information on VHF antennas and construction you are referred to: The A.R.R.L. Antenna Book, The VHF Handbook by Orr and Johnson, and VHF For The Radio Amateur by Frank C. Jones.

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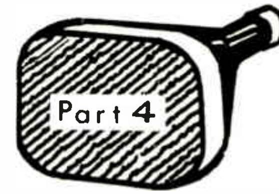

by Robert Grimm, K6RNQ
VHF Western Technical Editor

While we are not faced with "odd-ball" cases of TVI everyday, these can be a real headache to track down when they do occur. Some of them can be so far fetched as to make your head spin.

A classic example of this type of TVI oddity was experienced by W6BAZ of Santa Rosa, California a few years ago. Paul had received a report from a TV service organization that he was clobbering Channel No. 5 on a TV set. This TV set happened to be located about 40 miles away from W6BAZ's QTH. To make things even more interesting, there happened to be a 4,000 foot high mountain in between him and the TV set. (Mt. Saint Helena).

Paul dutifully checked his transmitter, but was unable to detect any spurious signals or harmonics that could be causing the trouble. He then communicated with the TV service company that was responsible for maintaining the TV set, and, by working together, they were able to find the cause of the difficulty. What was it? Just an oscillaing mixer tube in the TV set's tuner. Fortunately, it was correctable by replacing the mixer tube. Granted, this was a very unusual case of TVI. The kind of thing you might run into only once in a lifetime. But it's a prime example of the many "oddball" types of interference that do occur. These are the things that make many hams permaturely gray!

Not quite so unusual was a situation I experiencd a few months ago. Some people from down the street called and informed me they were receiving interference on Channel No. 2 and they thought it might be caused by me. (In fact they were pretty doggone sure it was).

Not being on the air at the time, I knew it couldn't be me. But being a good neighbor, I took a stroll over to their house to see what the trouble might be. Sure enough, there was a big black herringbone pattern wandering up and down the screen. It was doing a thorough job of obliterating Channel No. 2 although the other channels were not affected.

Playing a hunch, I turned off the TV viewing lamp that was setting on top of the set. The interference immediately disappeared. Turning the light back on caused the interference to reappear.

The interference was eliminated by the simple expedient of replacing the bulb in the lamp. Why was the bulb radiating this signal?. Don't ask me! I had run into this situation several times in the past, when I was doing TV service work. It could always be remedied by replacing the bulb. (Provided, of course, that it was being caused by the bulb).

While we are in the light bulb department, a real hash generator is the old carbon arc bulb. These things are a holdover from the twenties and are occasionally found in porch lights on older houses. The hash they generate is not far removed from what you would expect from a spark-gap transmitter and they louse things up just about as well, too! They should be replaced with modern bulbs.

Getting back to the TV viewing lamp: An important thing to remember is to *not* rub it into the people who complained. They are going to be very embarrassed when they find out they were the cause of their own TVI and had blamed it on you.

They will want to make up for having wronged you and, if handled properly, can become neighborhood boosters for you. Be sure to tell them that "this is just one of those things that happen and don't feel bad about it."

"SINGING BATHTUBS"

You have probably heard of incidents where people have heard music insuing from their dental fillings, from pipes in the basement or coming out of their bathtub. These are not "Old Wives Tales". They really do happen. These incidents generally occur in the immediate vicinity of high powered AM broadcast stations.

While it isn't likely that your neighbors will copy you loud and clear on their dentures, the causes of these strange phenomena are closely related to the causes of many unusual types of TVI, *i.e.*: rectification. This can be caused by a rusty joint in a waterline, two pipes of dissimilar metal resting against each other, loose or corroded connections in the TV antenna system, on telephone lines (call the telephone company if you think a corroded joint in their lines is causing the trouble — never touch the telephone lines yourself!), or a loose or corroded connection *in your antenna system!*

If you stop and think about it, there is really no great mystery why corroded or rusty connections cause TVI. Another name for rust is oxidation. An oxide can be a very good rectifier; you've undoubtedly heard of copper oxide rectifiers.

Well, when this recitifier detects your signal many harmonics are generated and if one of these harmonies happens to fall into a TV channel . . . TVI!

If your neighborhood is like most American neighborhoods, you probably have your local HiFi addict who manages to pick you up on his TV set, hifi amplifier, tape recorder and radio, what with his audio leads strung all over the house. (These leads sometimes make such excellent 50 Mc antennae, that I've often considered discarding my beam and using them.)

It's amazing how much signal these audio leads pick up and pipe directly into the TV receiver and audio amplifiers. About the only way to handle these types of cases is to temporarily disconnect the leads and demonstrate how much interference they are picking up. If he refuses to shorten the leads or to cooperate in the usual methods of curing audio rectification (as discussed in a preceding chapter) his refusal should be communicated to the local field engineer's office of the FCC.

Obviously, if he won't coooperate, there is nothing you can do for him. Actually, the vast majority of people are quite co-operative in these cases; the above was mentioned only so that you will know what to do when you run into someone who refuses to cooperate in having the TVI cleared up.

Next month we will discuss the proper methods of shielding and cleaning up your transmitter. 'Til then, lots of luck on your WAC (worked all channels).

CLASSIFIED

Commercial classified advertising space is available at 25 cents per word, per month. Minimum number of words per advertisement, 10. Classified advertising submitted by individual hams which in the opinion of VHF Horizons is non-commercial in nature, 10 cents per word, no minimum. Full remittance must accompany all orders; closing date for each issue is the 5th of the preceding month. Copy must reach Oklahoma City by that time.

LIKE NEW SX-101A, $295. K9IEB, 31 Ridge Avenue, Evanston, Illinois.

HEATH SHAWNEE 6 mtr. transceiver in top shape with Ameco preamp, $225. Write: K9YCA, 107 N. 26th, South Bend, Indiana.

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SURPLUS goodies stacking up on you? Send us an ad on them and watch them go. One fellow got cleaned out on 832A's—by a retail house yet! What have you got to sell?

VHF Lab Reports

A 38 element yagi antenna on any band below 144 megacycles would be a physical impossibility. On two meters it just barely gets inside the realm of credibility.

Telrex Labs, Inc., Asbury Park, N. J. has such an antenna. And just to make the array even more fascinating, they have allowed someone to talk them into twisting it from length to length (43 feet from tip to tip) in a not so common Spiral-Ray fashion.

The end result is a two meter yagi that demands the very best patience and equipment the typical two meter enthusiast can muster, if the array is to perform properly. However, if you are as much an engineer as you think you are, assembly, erection and tuning of this monster should occupy no more than a typical sun-up Saturday to sundown Sunday weekend. It did us.

Everything comes from the packing carton. In abundant handfuls, we might add. The 43-foot boom is broken down into three sections of tubing. Starting from the rear, the reflector, driven element and first 8 directors mount on a single piece of 2 inch OD tubing. Next in line, the middle piece. It holds the next 19 directors. Last in line, the final boom section. It suspends directors numbered 28 to 36.

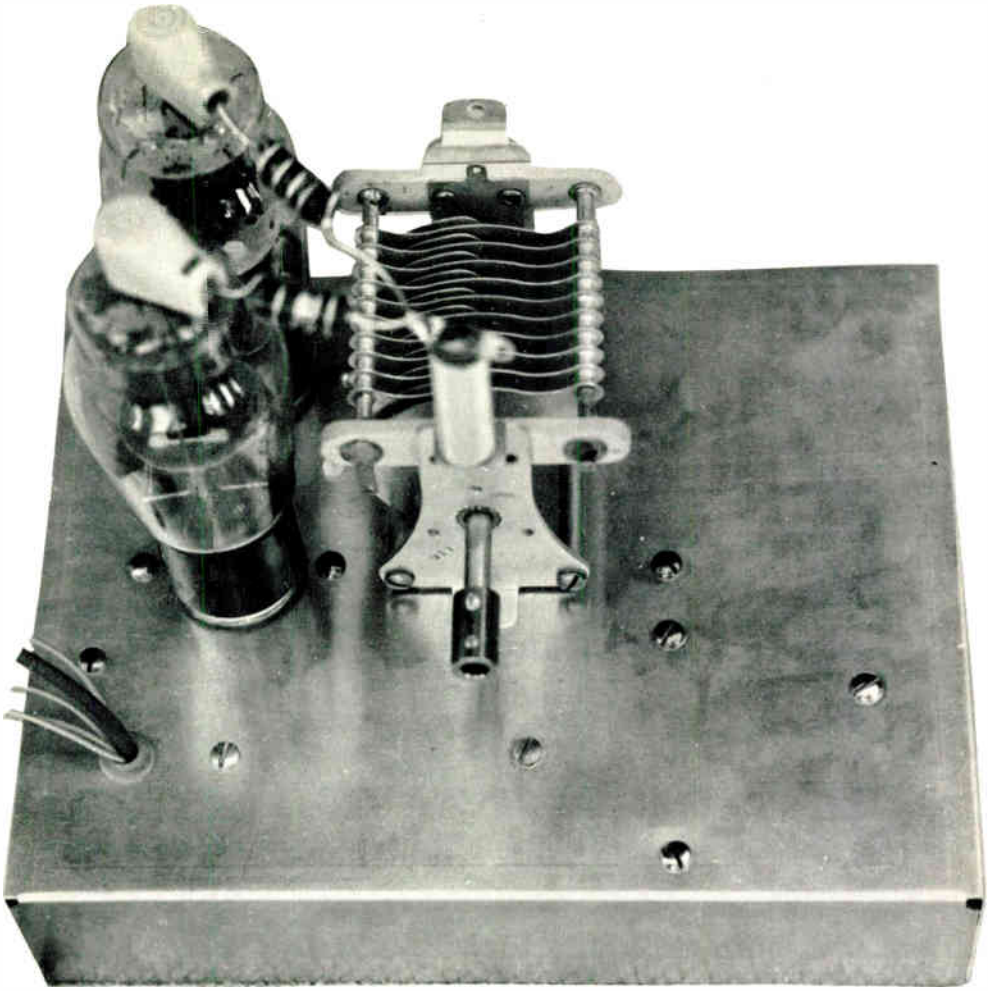
Like all good Telrex beams, this antenna is rugged and well designed. The fact that all of the 80 odd holes line up is a tribute to somebody at Telrex. We can't imagine any amateur tackling the project with a hand drill and vise.

As it arrives, the beam is tuned for 144.5 megacycles. As Telrex notes, you can move it up a megacycle at a time by whacking 1/4 inch off the overall length of each element (they vary from 42 inches long for the reflector to 30 inches long for the 36th director). From a practical standjoint, we would have liked Telrex to start off with the antenna resonant at 144.000 megacycles and then let us whack off the 1/4 inch pieces. We feel that those characters who are going to invest in this antenna are going to be DX nuts concentrating on the low edge of the band.

Once assembled (a project roughly equivalent to building the Empire State Building from an erector set) the antenna really begins to impress you. For example you try to lift it, by firmly grasping the boom in the middle and giving a heave-ho. If you have recently devoured a bowl of Wheaties the antenna slowly rises from the saw-horses you assembled it on, "twangs" on each end and then goes into wild oscillations from its 30 inch director, to the other end and its 42 inch reflector. You move quickly to get it above your head because the spiral elements are dancing dangerously close to your windpipe, and you never were much of a CW man.

Finished with the erection and mounting you dash to the receiver and listen for the S9 signals you expect to hear from KH6UK. The band is quiet. You casually observe the beam is pointed to the northwest — a direction in which you have not heard a 144 megacycle station in the past six months. Bringing the big array around to the northeast you find a number of carriers in the lower megacycle running 6-15 db above the noise on your 7788 converter. All W0's.

Advice? Comments? Keep this yagi mounted on a tower all by itself. Other antennas within 43 feet of it on the same tower throw it into *pattern fits*. It is even advisable to break up the antenna horizon around your QTH by keeping other antennas at least 1/2 boom length out of its plane (*i.e.* none between 39 feet above ground and 81 feet above ground) This is not an antenna for the casual operator. It is for the dead serious two meter addict who wants his cake, and wishes to eat it too. The 2MSR-3843 is truly a two-beam spotlight . . . one in the vertical plane and one in the horiznotal.. And dead in the center of the "spot" is two meter DX. Lots of it.



What is it ?

Yeah — what is this gadget? At this point, it could be almost anything. So to end the suspense, we'll tell you. This is the "Lazy Linear" which will be one of our November features, as seen in an early stage of construction. Using a couple of vintage 807's and a handful of other parts from the junk box, this device is designed to boost the output power of the popular Heath Sixer to more-respectable levels. We've measured better than 20 watts from a Sixer-linear combination here — and the same amplifier, driven with a fleapower SSB exciter, gives more than 100 watts! This is just one of the many features coming your way in November and following issues of VHF — one of the five

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Really Low Noise ... page 4

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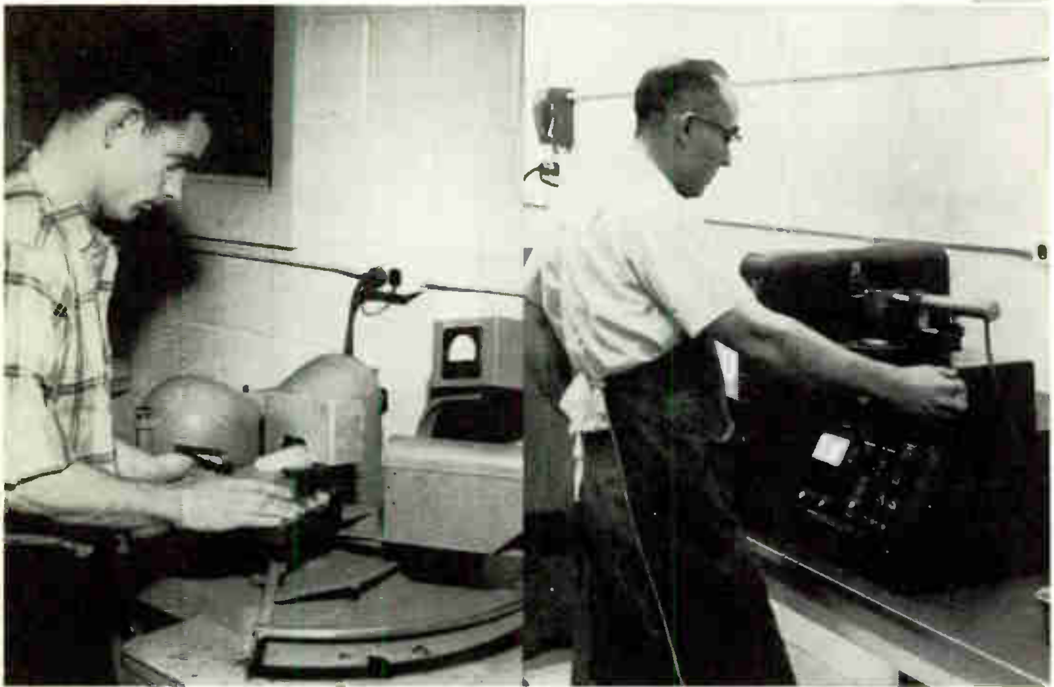

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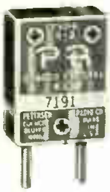

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VOLUME 2 — NUMBER 2
FEBRUARY, 1963

VHF HORIZONS

CONTENTS

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OUR COVER

The odd-looking object on our cover this month is the top of the box in which RCA ships developmental-type Nuvistors; a few months ago it arrived in our office with several 8058's inside. We promptly put them to work.

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SCATTER

. . . de K5JKX

ABOUT TYPE AND ITS LOOKS

Those of you who have suffered with us from the start know that we've had more than our share of typos, etc. Well, we've changed printers and the troubles should be about over. Why? The foreman at the new printer is K5SAM, that's why!

At the same time, we're considering another change — to a different-looking type than we have used in the past. Only trouble is we can't make up our minds which is best, so we want your help. This issue contains the four front runners. You tell us (via DRP or postcard) which you like best. The type on this page is **Garamond**; that on pages 4, 5, 6, 7, 22, 23, 24, 26, and 27 is **Estienne**; that on 8, 9, 10, 12, 29, 30, 31, 32, and 33 is **Century**; and pages 14 through 21 are in **Bodoni**. Which do you like?

ABOUT CANCELLATIONS AND CARDS

Several times a week, letters cross my desk which start out: "Dear VHF Gang — I like your magazine so well that I am cancelling my subscriptions to all other ham publications . . ."

Naturally, this makes me more than a little bit happy. But it also makes me a bit **unhappy** as well at the thought that the writers may mean they are quitting the ARRL! (At least, that's what cancelling QST implies to me.)

We've said it before and we'll say it again from time to time: the League is not perfect. But on the other hand, who is? I am reminded of an ancient and somewhat apocryphical story about a cowpoke back in the wild days of the West:

Seems he was busily engaged in a poker game when his buddy sidled up to him and whispered in his ear, "Don't you know that game is crooked?"

To which our hero replied, after calling the dealer and raising five, "Sure—but it's the only game in town!"

This is not meant to imply in any way that we feel the League is crooked. It's not. We know many of the HQ gang and several directors personally. A finer bunch of fellows we've never met. They're trying hard, and doing their best, to represent ham radio. All ham radio, not any one minority segment.

But the fact remains it is the only game in town. What's more, there's no room for another one.

The major function of the ARRL is to serve as a unified spokesman for ham radio before the world, and especially before governmental groups which regulate radio.

Two such organizations competing with each other could never hope to succeed. For success in such an effort, we hams must speak with a single voice. And the League is that voice. Like it or not, those are the facts of life.

If you don't like something the League happens to be doing, then the best thing for you to do it to sound off about it in a constructive way. Tell your ARRL director about it. Tell him what you don't like and why. If enough directors hear the same complaints often enough, things will change.

If you've ever studied the workings of the League, you know it is run on a democratic basis. The whole cornerstone of this country is the idea that the majority of the public, if they are well-informed, will invariably make the right decision. That's just as true in ham radio as it is in national politics.

So if you don't like the ARRL, but **do** like ham radio, why then you'd better join the League and work like a beaver to get enough guys to agree with you to change what you think is wrong. If you're right, you'll win out, never fear.

And if you can't bring yourself to do that, then the next best thing to do is just to keep quiet and let those of us who **are** willing to work for what we believe in do what we can.

One thing for sure — attempts to undercut or discredit the League do nothing but hurt those who try it. The ARRL has been

(Turn to page 28)

How to Have Really Low Noise on 432 Mc

By JIM KYLE, K5JKX
Managing Editor: VHF

The UHF operator who wants really low noise receivers for 432 Mc and higher bands has (until recently) faced a complex problem.

In essence, it's this: readily available front-end tubes just don't have the low-noise characteristics needed. Those that do, for the most part, have other failings that prevent their use above about 300 Mc.

For instance, the 7788 tends to fold up and die because of cathode lead inductance just above 300 Mc. The 6CW4/6DS4 series of Nuvistors behave about the same.

And the choice, for 432, has been between three approaches: the 6AM4 UHF TV triode, the 416B, and a paramp. Each has had its disadvantages.

The 6AM4, for instance, can't give you a noise figure much better than 10 db. The 416B is capable of better performance but is hard to obtain and is also short-lived. The paramp gives outstanding performance but is somewhat tricky to adjust and to keep in adjustment.

However, the situation has now changed for the better. RCA has come up with a new Nuvistor — the type 8058 — which overcomes the failings of the earlier models for UHF use and which allows a simple tube-type 432 converter to compete with paramps.

The converter described here uses two of these new tubes in an adaptation of the rig described in the current ARRL handbook. The result is outstanding on-the-air performance, with noise characteristics more like what you would expect on 50 Mc than on 432!

It was born during a discussion with Bill Ashby, K2TKN, during the 1962 Syracuse Roundup. Bill mentioned that he had built a converter using two 8058's feeding a crystal mixer which he said "performed like a paramp." That was all it took.

As soon as a couple of 8058's could be located (they're so new nobody had them but RCA; we understand the cost is about $13 each but they're well worth it), this rig was put together.

The oscillator gave us some trouble, but after the shorted section of coax was located and removed everything perked nicely. On-the-air 432 Mc signals are scarce around this region, so a signal generator was used to compare the 8058 converter with a fully aligned and well-operating Centimeg unit.

The Centimeg cranked about 10 to 15 db of noise into the *if* receiver; the test signal from the generator produced a 60-over-9 signal. Since the noise made the S-meter read between 7 and 8, this means the signal itself was about 69 "db" over the noise.

The 8058 unit put no noticeable extra noise in (just enough to tell it was working). The test signal read about 20-over-9. This meant the signal was some 74 "db" over the noise — a clear 5 db improvement *provided* that the "db" of the S-meter used for the measurement are true db. Probably they are not.

According to RCA, this tube shows only 5 db noise figure at 1,000 megacycles in a test circuit; at 500 Mc this drops off quite a bit.

After the measurements, on-the-air tests confirmed the improvement in performance. It should do the same for you.

CONSTRUCTION

If you're used to building UHF equipment, this converter will be duck soup for you. No parts layout was included with the article because nothing seems to be quite that critical; the photos show general placement of parts and, if you keep signal leads short, this should be enough.

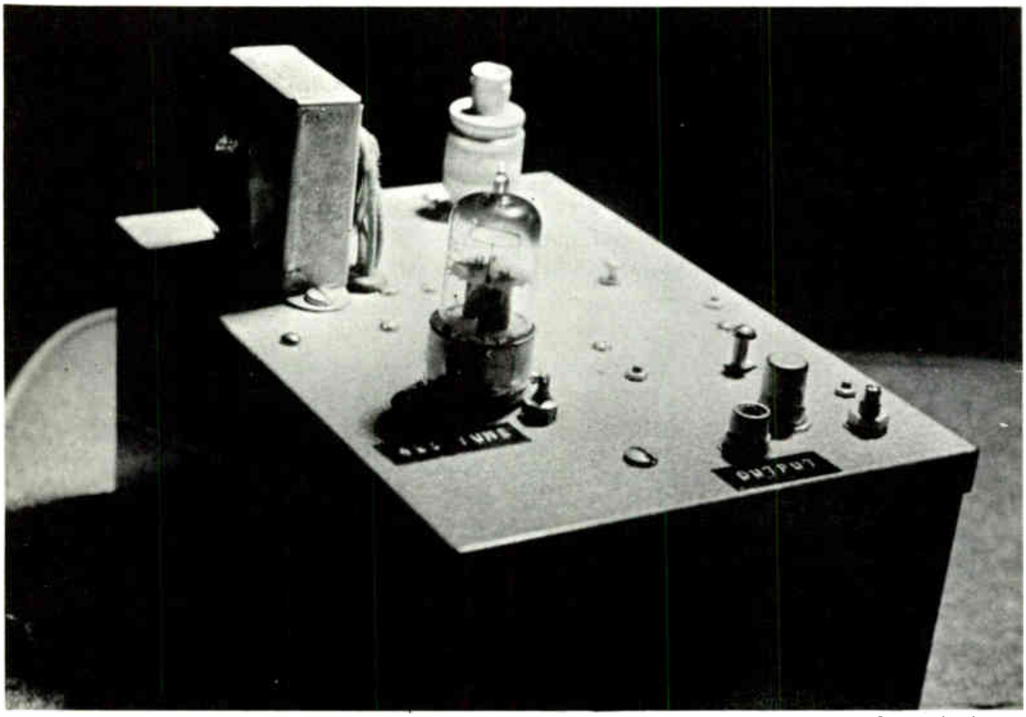
The converter consists of two grounded-grid amplifiers using the 8058 in each, a triode mixer using a 6DS4, and an oscillator-multiplier chain using a single 12AT7 and one semiconductor diode.

Signal feeds directly from the input jack (through a 50-pF disc ceramic capacitor) to the cathode of the first 8058. The plate circuit of this stage (consisting of a half turn of No. 12 bus wire 5/8 inch in diameter, tuned with a 4-pF piston trimmer) is tapped 1/3 of the way from the cold end. This tap feeds the second 8058 in the same way; the second stage is a Chinese copy of the first.

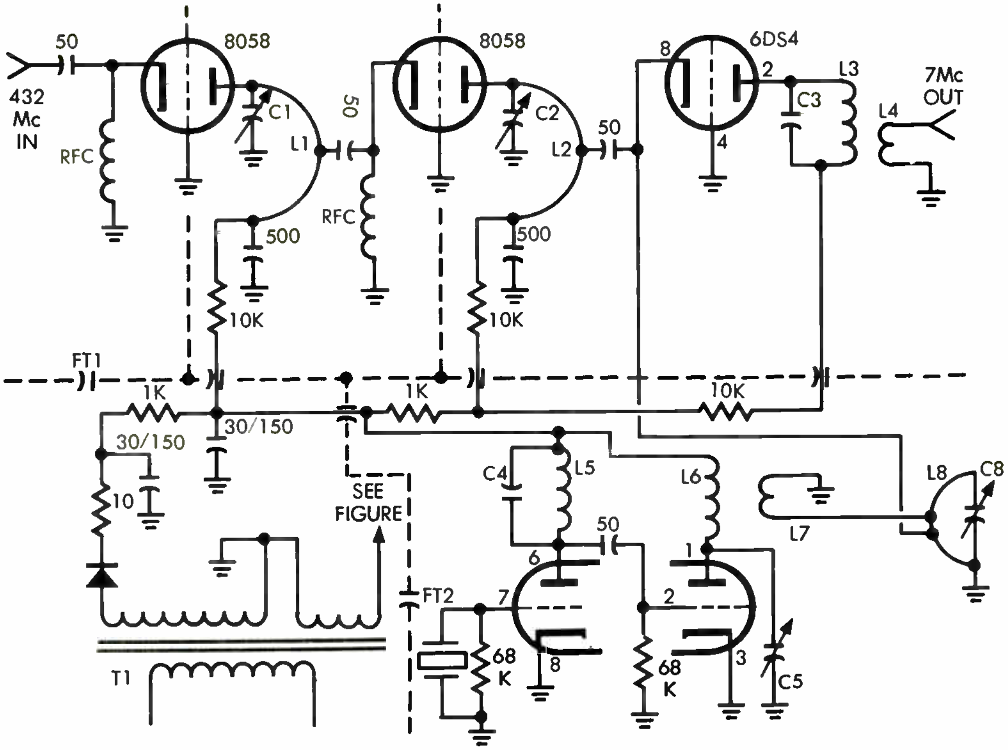
Signal from the second stage feeds to the mixer in the same way; however, the mixer cathode returns through the final multiplier tank rather than through an RF choke.

The oscillator is a conventional overtone circuit operating at 47.222 Mc. This is then tripled to 141.666 Mc in the second half of the 12AT7. A link over the 141 Mc tank coil connects to the 1N82 diode multiplier and taps onto the 425-Mc final multiplier tank. I actually used a special computer diode I had on hand instead of the 1N82, but almost any diode will work (even a 1N34 — I tried it) so try all you have and use the one which gives you the best output.

The crystal I used came from Texas Crystals and was actually calibrated down to the last cycle. Naturally, this calibration holds true only in one specific circuit and you will probably find yourself several



EXTERNAL VIEW shows very little of circuit exposed outside of 5 by 7 by 3 inch chassis box. 12AT7 tube in center foreground is oscillator; 6DS4 Nuvistor is mixer. Odd looking item at rear is BNC adapter on Type N antenna input jack. Since photo was made, small transformer has been replaced with slightly larger one. RF amplifier stages are beneath chassis.



SCHEMATIC DIAGRAM shows all wiring except heater circuits. In grounded-grid amplifier at this frequency, heater circuit is important. It is shown in separate drawing. RF chokes are made by winding ½-watt composition resistor full of No. 26 enamel wire (about 9 inches of wire will do the job).

dozen cycles off at 425 Mc. Once you have the receiver calibration error in mind, though, this should make no difference.

The 425-Mc injection frequency was chosen to allow 7-Mc output. This is really too low an *if* for use at 432 Mc; 14 or even 28 Mc would be better but I wanted to use it with a special 7-Mc tunable *if* strip already in the shack. For other output frequencies, change the crystal frequency, multiplier coils, and output coil accordingly.

SPECIAL NOTES

This converter uses a multiplicity of RF chokes. J. W. Miller type RFC-420 or Ohmite Z-420 units will work nicely — but the ones used in the original unit consisted of 1/2-watt resistors (27K or higher) wound full of No. 26 formvar-insulated magnet wire. About 9 inches of wire per choke does it. Since so many chokes are used, this cuts the cost considerably.

One of the major factors in the ease of construction and use of the unit, too, is the liberal use of bypass capacitors. All these are the low-inductance stud-mounted variety, such as the Sprague BH-140 or the surplus variety (surplus ones were used here). Any capacitance value larger than about 500 pF is all right. These bypasses provide complete grounding for the UHF energy and at the same time act as tie points for the power connections.

Just to make things simple, a power supply was included in the converter. This supply provides 150 volts DC; it is a standard half-wave circuit using a silicon rectifier. The transformer in the photos is a Stancor type PS8415; this one is rated at only 15 MA and since the converter draws about 50 MA, the voltage at the tube plates was only about 35 during operation. When a type PA8421 (also from Stancor) was substituted, voltages came up to normal.

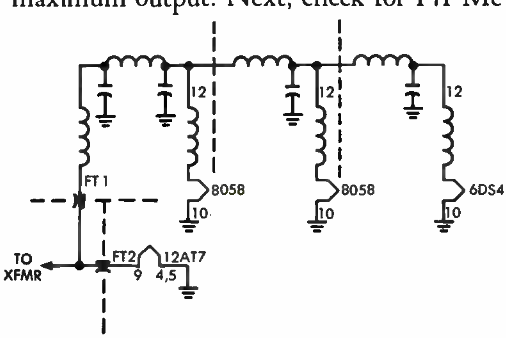
A special note about the 8058 socket and its mounting: This tube is designed for grounded-grid use and the grid connects to the metal shell. For this reason, the shield plates separating the stages (see photo) should be of some solderable material. We used perforated sheet brass since a good supply of this stock was on hand; copper sheet would be equally satisfactory if you can find any. The hole for the socket is cut and filed to the standard shape for Nuvistor sockets (a standard Nuvistor type socket is used) but after putting the socket in the hole and bending back the ears, bond it to the shield all the way around with solder. This assures a good ground and will prevent any chance of oscillation.

The particular type of box used was chosen because one end can be removed and all wiring done more or less in the open. Then buttoning everything back tight prevents any *if* leakthrough.

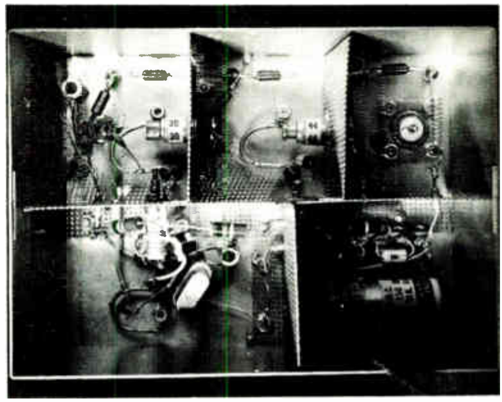
ADJUSTMENT AND ALIGNMENT

After everything is wired in and you have double-checked for wiring errors, plug in all tubes and turn on the power. Measure DC output voltage of the power supply; it should be approximately 150. Voltages at the Nuvistor plates should be in the region around 70 volts; if less, they are drawing too much current.

Using a grid-dipper or a receiver which will tune the frequency, check for 47-Mc output from the oscillator. Tune L5 for maximum output. Next, check for 141 Mc



HEATER CIRCUIT shows liberal use of RF chokes and bypass capacitors. Bypasses are stud-mounting type such as Sprague BH-140 or surplus 500-pF units.



INTERNAL LAYOUT is shown in this photo. Parts placement does not appear to be critical so long as leads are kept short. U-shaped loops of wire at top are tank coils. Power supply wiring is conventional.

at L6. Adjust for maximum. C5 helps in this adjustment.

Now (unless you have a 432-Mc grid-dipper) provide an 8-Mc or 144-Mc test signal. Search the region around 7 Mc with the *if* receiver for your test signal (ours first appeared at 7.5 Mc due to a small error in the 8-Mc oscillator, which was then multiplied 54 times!)

When you find the test signal, tune C8 for maximum. Peak up L3, then C2 and C1 in order.

The converter is now working, but you can still improve it some. Try moving the taps on L8, one at a time, to get more signal output (ours was right the first time by pure accident, but small differences in construction can make a big difference in the tap point). The taps on L1 and L2, likewise, can be touched up. A noise generator is most helpful here.

PARTS LIST AND COIL DATA

L1, L2, L8 — ½ turn No. 12 bus wire, ⅝ inch diameter, ¾ inch long.

L3 — 28 turns, No. 26 Formvar on National XR-50 form.

L4 — four-turn link, No. 26, at cold end of L3.

L5 — 14 turns No. 28 on Miller 4300 form (¼ inch dia. iron-slug tuned)

(Turn to page 33)

6-Meter Meteor

DSB for 50 Mc - (Mostly) Factory-Wired!

There's no question that sideband is the coming thing on the VHF bands, just as it has taken over much of the phone operation in the HF range.

VHF'ers, more than most, appreciate the special advantages of sideband operation. When all your power is **talkpower**, you can get phone efficiency which approaches CW in its range capabilities! Math experts have calculated that SSB has a 9-db advantage over ordinary AM; in practice, VHF'ers have found as much as 25 db advantage.

But with all its advantages, sideband **does** have one major disadvantage. It's expensive, compared to any of the other modes.

It doesn't have to be. The Little Feller (in the November, 1962, issue) can be built for as little cash as a comparable AM rig. But if you're not a confirmed homebrewer from way back, you'll find it a bit heavy on the pocketbook region to go out and buy your way to VHF sideband.

That is, you will if you insist on **single** sideband. **Double** sideband, which has most of the advantages except savings of spectrum space, comes considerably cheaper.

For instance, WRL has a rig on the market (they call it the Meteor SB-175) which delivers a hefty punch of DSB signal — and sells for less than $100, factory wired!

Unfortunately for the VHF'er, the SB-175 covers only the HF bands, 80 through 10. However, it's only a one-evening job to convert it to 50 Mc operation. The result: a factory-wired unit (with your modification) delivering 70 watts PEP output to the antenna.

This 70 watts, bye the bye, is measured RF power. DC input at this level is just under 140 watts. The efficiency is only 50 percent — but at 50 Mc, 50 percent is more than fair performance.

In addition to the DSB features, you also have an AM rig and a CW rig all in the same package. Modes are selected by a front-panel switch. Output in the CW mode is 35 watts, since one of the final tubes operates only in the DSB mode. AM output is lower — 10½ watts — but is still good, considering that a confirmed sidebander will use AM only to explain to new contacts how sideband works.

Interested? Let's proceed.

The first step, naturally, is to check out your SB-175 to make sure it is operating properly in its original condition. If your license won't permit phone operation on 40 meters, test into a light-bulb dummy load — but test!

When you're satisfied that all is working well, take out the wire-cutters and soldering iron and dive into the wiring. CAUTION. Be sure the power supply is unplugged. We'll be working in the high-voltage area much of the time.

First step is to remove the bandswitch and all associated wiring. Remove the lower-frequency coil from the oscillator completely, and take eight turns off the lower end of the higher-frequency coil.

The next step is in the multiplier (5763) screen region, where the bandswitch selected different screen resistors. Jumper the connections, as shown in the revised schematic.

While you're in the multiplier stage, remove the RF choke (RFC2) from the plate. Prepare a new plate coil by winding 10 turns of No. 26 enamel on a Miller type 4400 coil form (3/8-inch iron-slug tuned). However, installation of this coil must await the next step, which is rather drastic.

This drastic step is to remove all wiring in the final grid circuit. Take the grid tuning capacitor off the top of the chassis, remove the grid coils, and take out all function-switch connections to the grids (leave the switch wiring itself alone — we'll use some of it later).

With the grid circuit stripped, you'll notice the two holes in the chassis through which the leads to the grid tuning capacitor ran. Remove the grommet from the front hole; it's in just the right place for mounting the new multiplier plate coil. Install and connect the plate coil.

At this stage, the final-amplifier circuit should be completely free of components connected to pin 5 of either tube. Wind a new grid coil of No. 20 tinned bus wire; 4½ turns each side of center (9 turns total) on a 3/8-inch form worked here. Connect the two free ends of the coil to the two grid pins. Connect a 27K ½-watt resistor from the center-tap of the coil to the old R11 (a 1K resistor to ground, located on the tie strip beneath the bandswitch). Also connect a 25 pF ceramic capacitor from each grid pin to ground.

At this point, dip out the grid coil with a GDO. It should resonate between 50 and 51 Mc. Exact frequency is unimportant, since the tuning of the higher-Q multiplier plate coil will control the circuit.

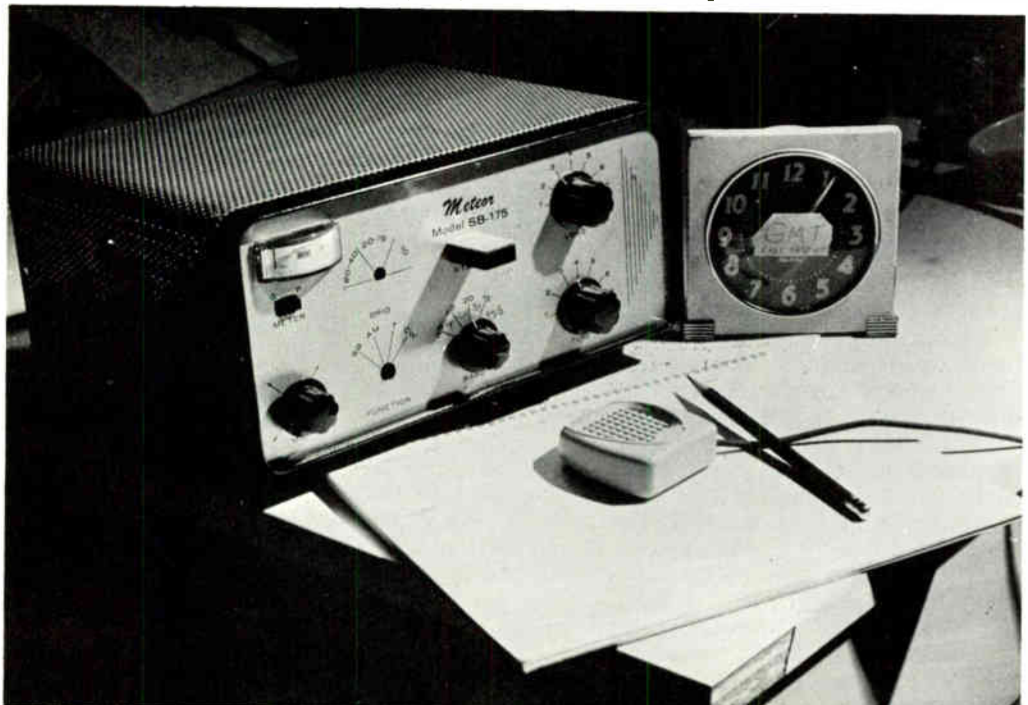
Using No. 22 insulated hookup wire, wind a 1-turn link in the center of the grid coil. Twist the wire to form a twisted pair and wind a single-turn link around the cold end of the multiplier plate coil.

The next thing to do is modify the plate circuit.

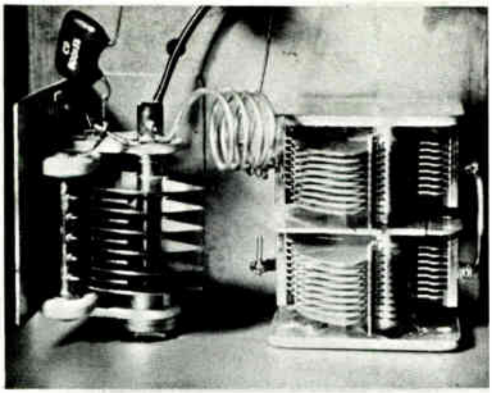
Start by removing both the TUNE and LOAD capacitors. Remove also the existing pi-net coil. The old LOAD capacitor can be added to the junkbox. The old TUNE capacitor should be mounted in its place.

NOTE: For simplicity, we did not remove the old TUNE capacitor. Instead, we left it in place and put our new TUNE capacitor, a 25 pF Hammarlund variable, where the LOAD capacitor has been located.

Wind a new coil of 4 turns of No. 12 tinned wire on a 1-inch diameter form and connect it from the stator of the new TUNE capacitor to the stator of the LOAD capacitor. Run a lead from



SET UP AND READY TO GO, the 6-meter Meteor shows remarkably little external change. In the one we converted, the function switch was moved to the old bandswitch position in an effort to retain the original circuit as much as possible. In the final conversion, though, moving the switch turned out to be unnecessary. Your unit should look like this except that the vacent hole will be in the center instead of at the left side.



NEW PI-NET TANK details are shown in this view. Old TUNE capacitor was retained as loading capacitor; old LOAD capacitor was replaced with Hammarlund 25-pF tuning capacitor. New coil was wound from material in original coil.

the LOAD capacitor stator to the coax at the rear of the chassis.

Now comes the surprising part. Remove both parasitic suppressors and replace them with No. 12 wire leads from the plate caps to the junction point. By converting to a single-band rig and eliminating the originally long grid leads, we have also eliminated the parasitic problem.

Now, only one step remains before you can start your on-the-air adjustments. We must make provisions to kill one final-amp tube in the AM and CW modes.

Fortunately, the wiring originally provided on the mode switch to transfer one grid from the parallel to the push-pull connection is ideal for our purpose.

Locate the wafer which contains this wiring (it's the rear one; this set of contacts can be identified by the in-and-out pattern of jumpers). Remove the striped wire from pin 7 of the 6DQ6 nearest the front panel and reroute this wire to the switch terminal which formerly went to the grid of V4. Connect the switch terminal which formerly went to the "uncluttered" end of the final grid tank to pin 7. This will make the filament circuit complete in the SB position and will remove one 6DQ6 in all other modes.

If you want to use the rig on 12 volts, a resistor of the proper value and wattage to duplicate a 6DQ6 filament must be connected from the other switch terminals (the strapped ones) to ground to replace the 6DQ6 filament in the non-SB modes. Since we intended to use the rig only at a fixed location, we omitted this resistor.

ADJUSTMENT

Adjustments pretty well follow the Meteor instruction manual; set the mode switch to T (for tune) and the meter switch to G. Tune the oscillator plate coil and the multiplier plate coil for maximum indicated grid current. This is easier if both are dipped to approximate frequency before you start.

Next place the switch in AM position and connect to a dummy load. Set the LOAD capacitor to maximum and the meter switch to P. Apply power and dip with the TUNE capacitor. Tuning and loading are the same as with any pi-net unit.

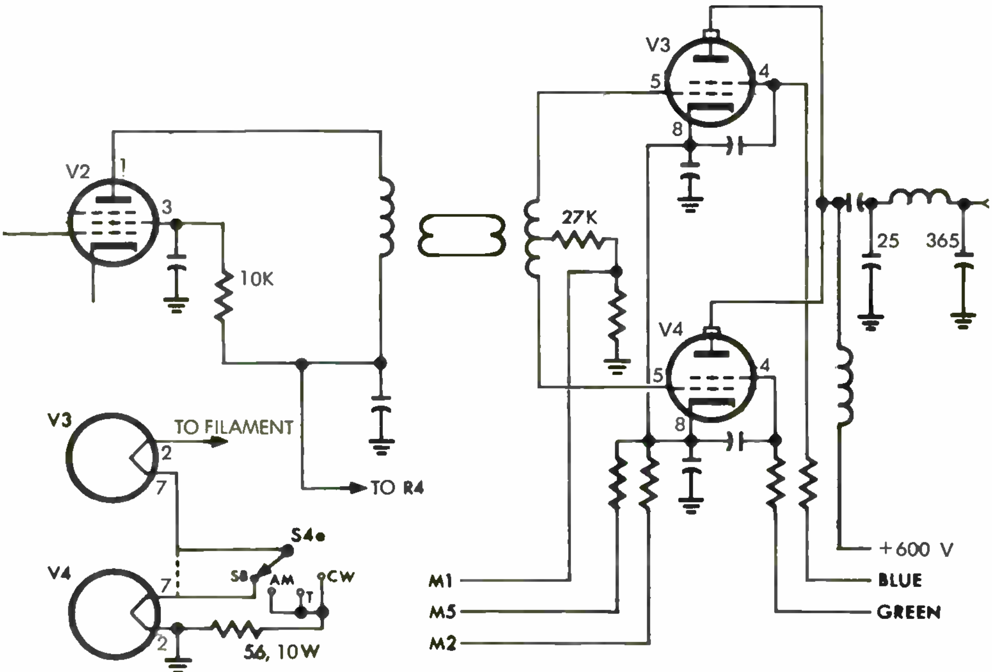
However, since only one 6DQ6 is in use, you won't be able to load up to the red marks indicated on the meter. About halfway to these positions is correct for AM and CW.

CW tuneup is the same as AM except that since screen voltage is a bit higher, it's easy to get color in the tube plate if it is operated off-tune. Best way to tune up here is to first tune on AM and then touch it up a bit after switching to CW.

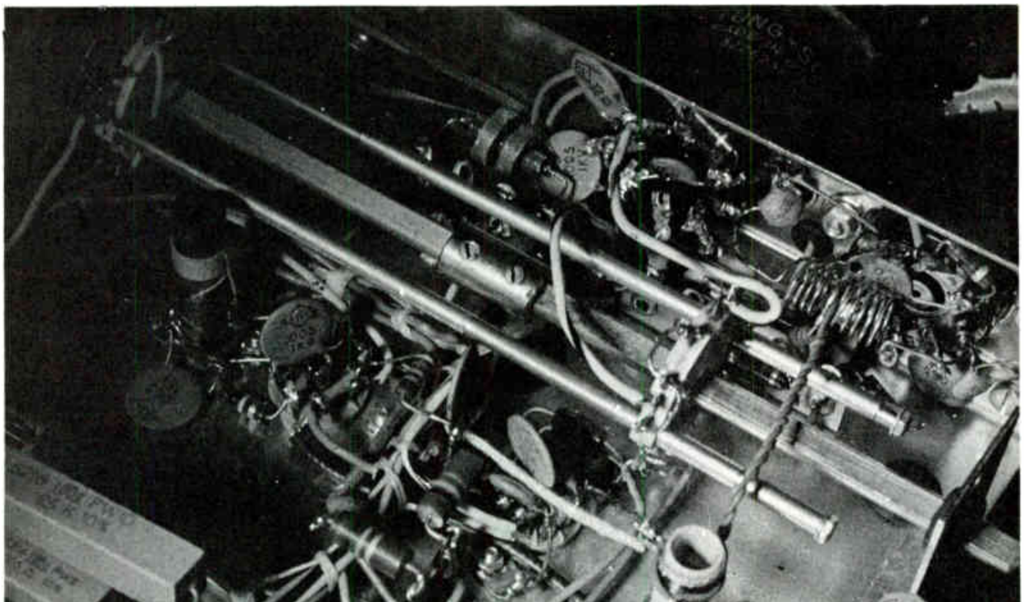
For SB, tune in the AM position and then leave the tuning controls alone. Advance the mike gain until the meter just touches the red SB block on voice peaks. On-the-air reports from qualified operators provide the best check of sideband modulation quality.

ADDENDA

This just about wraps up the conversion except for one final note. Discussions are under way with WRL Manufacturing, makers of the Meteor, looking toward their production of either an adapter kit or a replacement front panel to help you make this conversion and retain a "factory" look. Exact contents of the kit, as well as price, have not yet been announced. If you're interested, drop a line to Ed Shulman, chief engineer, WRL Manufacturing, Council Bluffs, Iowa — he'll have the latest poop on it!



REVISED SCHEMATIC shows circuit changes involved. Unlabeled parts are original factory-circuit items; labelled parts are those changed or added. Unless otherwise noted, capitance values without decimal point are in picofarads (mmf) and those with decimal point are in microfarads. Resistance values are in ohms and all resistors are ½-watt.



UNDERSIDE CHANGES are spotlighted in this view. Most major change is in the region from multiplier plate (center of photo) to final grids (upper right). Added coil is shown clearly, as is new final grid coil. Note connection of wires to back wafer of function switch. Striped wire is original lead to 6DQ6 heater while the the other wire runs to the heater pin. In SB position, this circuit is completed; in all other positions it is open. Function switch position will not be as shown here in your unit; rear wafer will be just to right and behind 25K 10W resistor at left of photo. This will simplify grid-coil installation.

The AM-33/ART for Six and Two

by **WILLIE MAYES, K5ZND**
3509 Woodside Drive
Midwest City, Oklahoma

Here is my version of the AM-33/ART power amplifier. It works swell for me; total cost for 500 watts plus some was about $5 plus a cleaner junk box!

The original AM-33/ART was a noise pulse amplifier designed to convert a 60-watt signal to an output of 250 watts.

The amplifier originally operated with negative 2000 volts on the grids, and the plates grounded through an RF choke (or in other words, a positive-ground supply system).

To convert the amplifier to one tuning both the 6 and 2 meter bands is extremely easy. Input to the converted rig will range from 600 to 850 watts in a package that measures only 10 by 9 by 9 inches including the tube blower fan! I have converted two of these units with no difficulties.

THE CONVERSION

Start by getting rid of the 400-cycle power supply. Saw off the chassis a half inch behind the amplifier itself.

Next, modify the input circuit by lifting the grounded end of the link coupling and insert a 50 pF variable capacitor in series between the link and ground. This makes easier the job of input tuning.

Leave the grid circuit intact (it will reach the 2-meter band with a little straining although it was rated only to 100 Mc). Bring the center-tap of the RF choke to a terminal for grid bias voltage. Bias requirement will be approximately minus 110 volts, to run a no-signal plate current of 40 to 50 MA.

Next, the filament wiring was modified slightly, by lifting the grounded side and wiring the filaments in parallel. If you have a 10-volt transformer in your junk box instead of the 5-volt unit I had, leave them in series.

Modification of the plate circuit consisted of removing the original antenna link winding in the plug-in coil, and winding a new link from two turns of wire with good high-voltage insulation. I stripped the shield from a piece of RG-58 coax and used the center conductor. Next, lift the grounded end of the link (at the socket pin) and insert a 100 pF series capacitor to ground.

To complete the conversion, lift the center tap of the plate coil socket from ground and insert an RF choke. I wound the choke from 40 turns of No. 28 enamel wire on a 5/16-inch diameter standoff. Bypass both ends of this choke to ground with 500 pF TV doorknob type capacitors.

High-voltage requirement is 2000 volts, more or less. Check manufacturer's ratings for various operating conditions for the 4E27's.

One final caution — don't forget to ground the tube-socket subchassis. It originally floated 2000 volts negative to ground. I used several 1/4-inch wide copper straps to bond it to the main chassis.

That's it; have fun, and I'll see you on six!

—K5ZND

SCHEMATIC DIAGRAM (opposite page) shows circuit of amplifier after modification. Unlabeled components are those of original circuit. Electrical changes are minor although physical changes are not if full conversion is made. Not shown on schematic is blower wiring; if operation at full power is anticipated blower motor should be wired to 24 VAC to provide proper cooling of 4E27's.

Around and around we go . . .

Some months ago we inaugurated a program in this publication whereby we asked our readers to contribute the call letters of amateurs they heard on the air, on 6 meters and up, in their locales. This program was designed to do one thing . . . build up a file in our offices of active VHF/UHF stations.

In early December this file was approaching the 31,000 mark. In six short months, our readers have contributed the call letters of 31,000 amateur operators on six and up! We think this is something short of amazing. WHY?

Amazing because that's a lot of contributing by our readers! And amazing because there were some of us who listened to the great prophet from the east when he warned "there are fewer than 3,000 VHF addicts who will subscribe to a VHF magazine."

Fortunately not many of **you** heard his crystal gazing comments!

Now that our press run is up to 24,000 this month we are beginning our **'Second Time Around'** for some of the 31,000 VHF active hams in our files. This means that in the 4th, 5th and 6th call districts this month we are mailing out sample copies of **VHF Horizons** to VHF OP's who have not yet subscribed. Naturally we hope that by this second barrage of literature you will be ready to succumb to our terrible high pressure sales techniques!

On the subject of high pressure sales techniques, a number of the gang asked how we did with our full page advertisement in the October issue of QST. Inquiries were very good, but not as good as we expected, frankly. The ad was hastily prepared (excuses!) and should we ever do it again, it won't be done the same way. We did pick up approximately **50** new newsstand dealers (i.e. amateur suppliers who carry magazines, too) and we impressed approximately **45** VMF minded hams outside the USA and Canada sufficiently to get their subscriptions.

We may be advertising in QST again come later this spring. They, at least, don't seem concerned about our ability to stay in business.

Subscribe? No time like the present. There is **no** better way to stay current with the wonderful expanding world of communications above 50 megacycles.

(TURN CARD OVER FOR SUBSCRIPTION BLANK)

DRP Report for January

(BY AIRMAIL)

From Amateur Radio Station ______________________, QTH ______________

This month we built the following ________________________________

______________________________________. And, we improved the

following gear ____

On the air we worked (DX-date, call, time) ____________________________

____

____

New VHF calls heard on locally ______________________________________

Articles we enjoyed in February issue__________________________________

Type we preferred ____

WE SEND YOU A FREE SAMPLE COPY OF VHF HORIZONS

FOR ONE REASON

(We want you to subscribe)

Won't You — please?

DEAR VHF GUYS:

__________Attached is $4.. I am standing over the head of one of **our** non-supporters with an 807, while he fills this out. He is the kind that is slow to act and needs persuasion. I hope you can read his name and address. He doesn't write so well either. Give him 15 issues of **our** magazine.

His Name____

His Call____

His Address______________________________________

His Town____________________ His Zone____ State____________

He is sending this to:

VHF HORIZONS

P. O. Box 1557

Oklahoma City 1, Oklahoma

(TEAR OUT—AIRMAIL)

DEAR VHF GUYS:

__________Attached is $4. of my hard earned money. I don't part with this kind of loot lightly, and I expect you to deliver the goods for the next 15 months. **I am mailing this prior to February 1 to take advantage of an extra 3 issues.**

__________I goofed I didn't mail in my sub before February 1st. My $4. is attached. **Give me 15 issues anyhow.**

Name____

Call____

Address____

City/Town____________________ Zone____ State____________

Place

Stamp

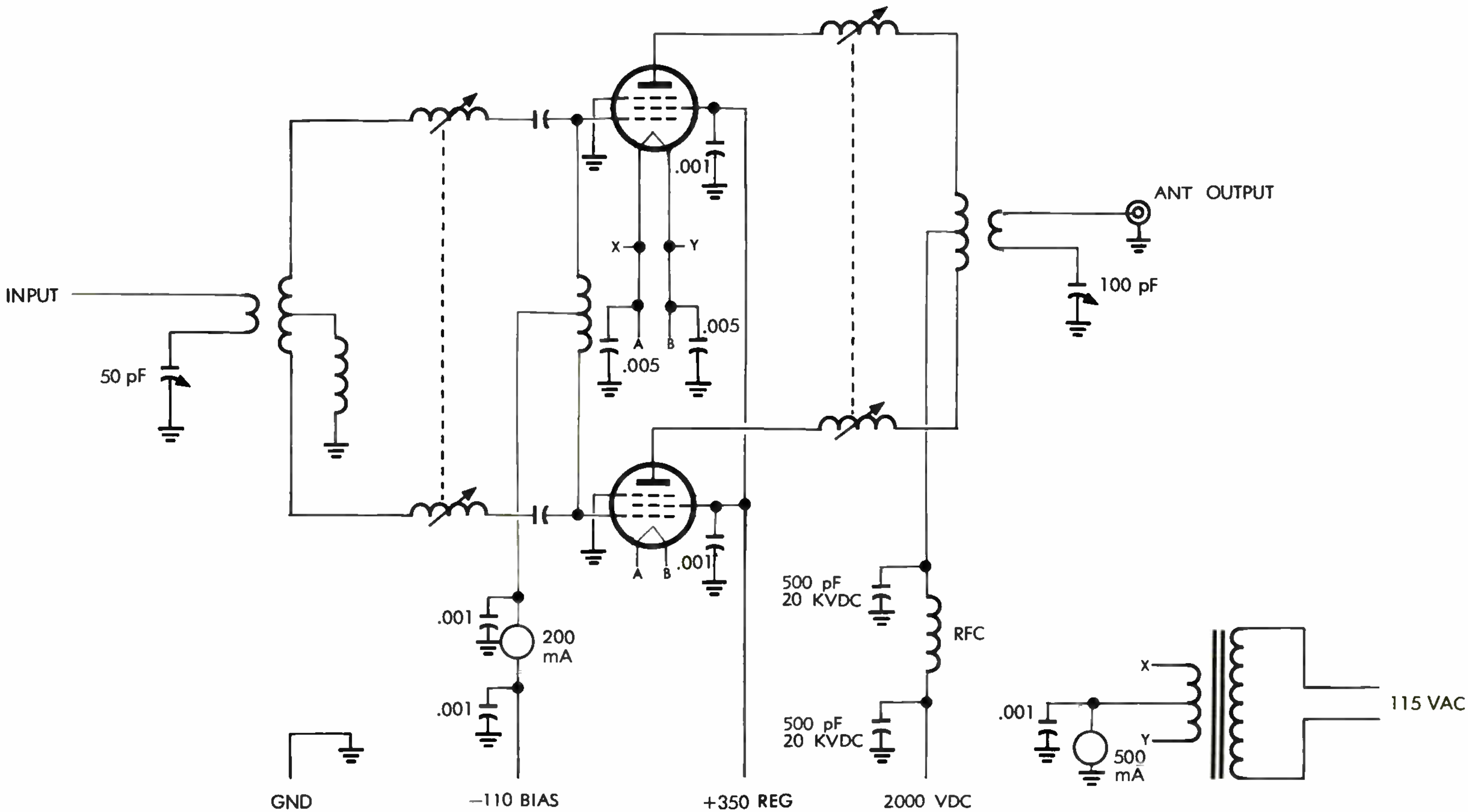
Here

Airmail to:

VHF Horizons—DRP Program

Box 1557

Oklahoma City 1, Oklahoma


INPUT
50 pF
.001
.005
.005
A
B
X
Y
A
B
.001
ANT OUTPUT
100 pF
.001
200
mA
.001
500 pF
20 KVDC
RFC
500 pF
20 KVDC
X
Y
.001
500
mA
115 VAC
GND
−110 BIAS
+350 REG
2000 VDC

Utility 8-Megacycle Oscilator-Buffer

by Paul M. Wilson, W4HHK/A4HHK
Southern Technical Editor
VHF Horizons

The unit described is an eight megacycle crystal oscillator/buffer for use with a VHF transmitter. It has good stability and the frequency may be varied over a small range by adjusting an air dielectric variable capacitor. These features simplify generating a specific VHF frequency and maintaining it.

No claims are made for originality. The oscillator circuit was recommended by International Crystal Mfg. Co. of Oklahoma City, Oklahoma, for use with an 8.0 Mc crystal calibrated for a 32-pf load. The cathode follower/buffer circuit was borrowed from the ARRL Handbook (ref. page 148 of the 1962 edition). It is used by the writer to drive a 5763 tripler stage in a 144 Mc transmitter.

When multiplying 18x (from 8.0 Mc) to reach 144 Mc or 54x for 432 Mc work, the slightest drift at the crystal frequency becomes a sizeable amount. For example, a drift of only 55 CPS at 8.0 Mc would result in a Kc change at two meters. This may not sound like much, but when received on a selective system it can be very annoying. Good stability is not achieved by using any old crystal and circuit. It is obtained by employing high quality components, regulated voltages, and stabilization of temperature.

The crystal oscillator should be used only for frequency generation . . . not power. In the circuit persented, the oscillator is run at very low power level and a cathode follower and buffer used for isolation and developing of drive power. The unit in use at this station also employes a large oven and separate power supply to reduce and regulate ambient temperature.

In the oscillator portion of the circuit, the 12 and 75 pF condensers should be of the zero temperature coefficient type or silvered mica ones as a substitute. The condenser shunting L1 should be a silvered mica. The 1 millihenry choke is a National R-50. The coupling condenser between L1 and pin 6 of the 6C4 should be a silvered mica or mica as should the 12 pF across L3. All by-pass condensers are disc ceramics. The 3-35 pF air trimmer used was a Hammarlund HF-35. A small knob on the shaft makes frequency adjustment easy. At two meters the frequency range is about 25 Kc.

A crystal calibrated for 8,000 Kc with a 32 pF load may be adjusted to produce any two meter frequency in the range from approximately 143.985 to 144.010 Mc. This includes the MARS frequency 143.990 Mc and the first ten Kc of the amateur band. The adjustable range at 50 Mc would be about 8 Kc.

Although a copper shield was used to isolate the input and output of the 5763 buffer, and other stabilizing techniques employed, this stage had to be tamed by loading L2 with a 3.9 K resistor and L3 with a 22 K one. The oscillator and cathode-follower should run continuously for maximum stability.

Good shielding and filtering of leads leaving the oscillator compartment will eliminate or reduce to a negligible amount the oscillator signal present when receiving. The 5763 stage receives plate and screen voltage only when the transmitter is in transmit condition. The oscillator might be used to drive a low power multiplier stage direct, but power output from it is small.

COIL DATA

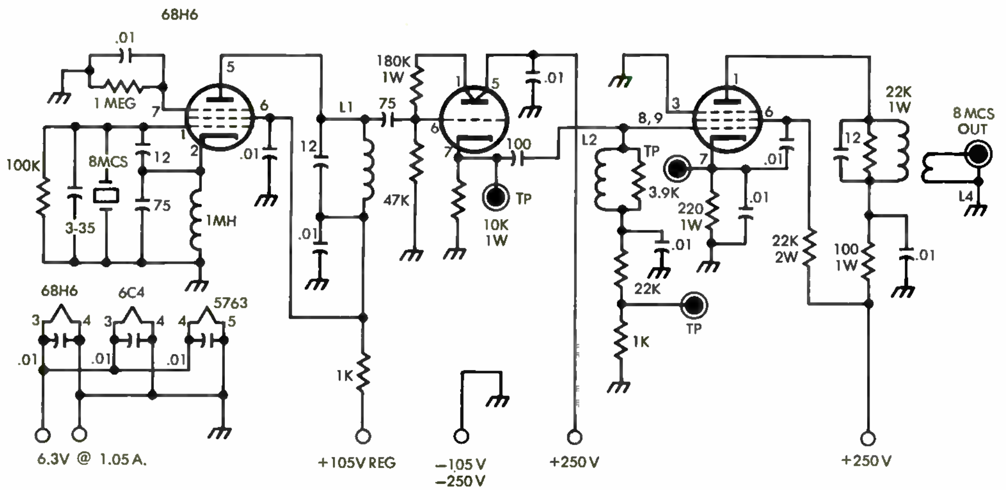
L1—National XR-50 form, 43 turns close wound, No. 28 enamel wire.

L2—National XR-50 form, 36 turns close wound, No. 28 enamel wire.

L3—National XR-50 form, 50 turns close wound, No. 28 enamel wire.

L4—Output link made of two turns of small plastic overed wire wound over the coil end of L3 and cemented in place.

Note: Unless specified otherwise, capacitances are mmf, decimal capacitances are in mfd,



8-MEGACYCLE OSCILLATOR-BUFFER SCHEMATIC diagram shows all wiring details. Power requirements are small.

69-cent Heat Chimneys

by Don Goshay, W6MMU
8352 Westlawn Avenue
Los Angeles 45, Calif.

In order to provide proper cooling for the base seals of 4-125A, 4-250A, and similar tubes, the pressurized chassis principle is frequently employed. This system involves making the space below the chassis surface airtight and forcing air into the confined area by an internal or external blower.

Since the only means for the cooling air to escape from the pressurized subchassis is through the ventilated tube socket and tube base, effective cooling is provided to the filament, screen, and grid seals. However, after cooling these seals, the air escapes in such a manner as to provide little, if any, cooling to the plate seal at the top of the glass envelope.

Frequently, a heat-dissipating plate connector is the only avenue of heat transfer (other than by direct radiation from the anode itself) available for heat generated by plate and seal dissipation. The later dissipation is often quite high when operating above 100 Mc.

If additional envelope cooling is needed, a second blower or fan can be placed above the chassis to circulate air around the envelope and plate seal. However, it is simpler to install a chimney around the tube which will divert the air leaving the base ventilating holes in such a fashion as to cause it to flow around the glass envelope and, to some extent, around the plate connector.

Such a chimney must meet the following requirements:

1) It must reflect as little heat as possible back onto the tube envelope.
2) It must absorb a minimum of heat from the normally red-hot anode.
3) It must be capable of withstanding whatever heat *is* absorbed.

(Turn to page 35)

Using the R-449

by John Chambers, W6NLZ/A6NLZ
VHF Research Consultant
c/o VHF Horizons

When considering the surplus receiver R-449 GRD-5, the tuning range of 120 to 156 Mc quickly catches the eye of the VHF man. This unit was recently added to the surplus market. It is newer surplus than much we have seen since World War II. It has some potential, but also has serious limitations. The unit is less than ten years old, and could have turned out to be a real fine item, but because of a series of factors it is limited.

It was intended for direction finding service, but also is capable of operating as a 9 channel (auto tuned) crystal controlled —plus one tunable channel receiver. Boy! What a deal for a MARS net frequency, a rag chewing net, and a few spot frequencies. To compute the correct crystal for the net frequency you want to hit, the formula is:

$$\frac{\text{Dial frequency in Mc} + 15.09}{3}$$

The crystal holder type is CR-23U. To set up a new crystal channel, the procedure is as follows:

STEP 1. To use crystal extractor remove it from the front panel. First, loosen the knurled locking nut at the large end of the holder; then insert the proper crystal into the forked end of the holder with the two crystal terminals extending away from the tool; then tighten the locking nut. The crystal is now firmly clamped in the fork of the holder.

STEP 2. Tighten the "Autotune Lock".

STEP 3. Turn power "ON-S'BY-OFF" switch to the "S'BY" position.

STEP 4. Open crystal insert door located directly beneath the "R.F. ALIGN" knob; place the left thumb firmly on interlock switch button which appears when crystal insert door is opened; turn "CHANNEL" selector switch until desired channel number appears beneath the crystal socket (seen by looking into the r-f unit casting through the open door in the front panel).

STEP 5. Release thumb from interlock switch to disable Autotune; insert the crystal in the socket directly above the channel number making sure it is firmly seated in the socket.

STEP 6. Close crystal insert door.

STEP 7. Turn "CHANNEL" switch so that channel number corresponding to that set in step 5 appears as the channel selected.

STEP 8. Loosen "AUTOTUNE LOCK". Rotate "OFF-S'BY-ON" switch to "ON".

STEP 9. Turn the "R.F. ALIGN" knob until dial rotation begins.

STEP 10. With the "R.F. ALIGN" knob, set the frequency reading on the dial to *five megacycles below* the r-f frequency for this crystal.

STEP 11. Turn the "R.F. ALIGN" knob very slowly counter-clockwise to increase the frequency and watch meter above "TUNING" until it "kicks in".

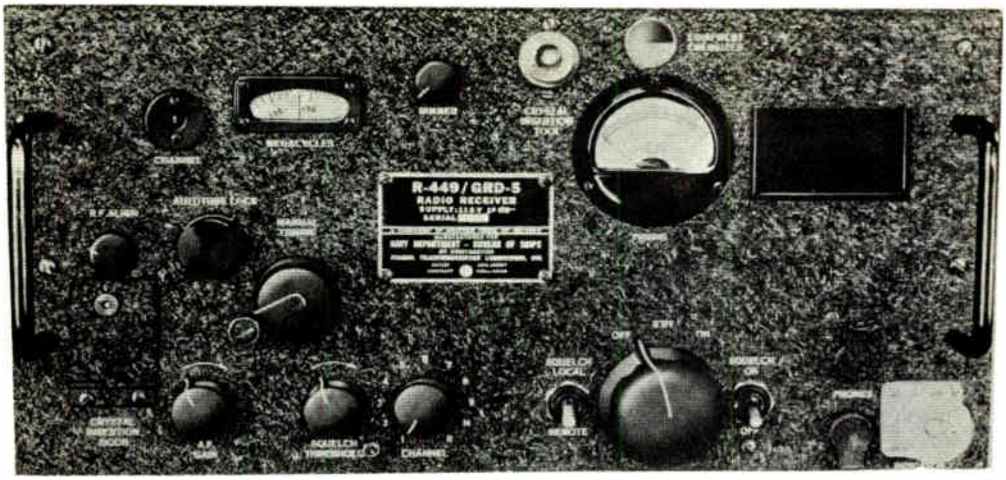
> *NOTE*: In turning the "R.F. ALIGN" knob clockwise from *low* to *high* frequency, the oscillator "TUNING" meter will register a sharp, rapid current increase (called the "kick-in") followed by a gradual decline. From high to low frequency the reverse occurs. In adjusting "R.F. ALIGN", *always* tune from low to high.

STEP 12. Continue to turn the knob very slowly in the high frequency direction until the voltage indicated by the oscillator "TUNING" meter reaches a maximum and is then reduced by one meter scale division below this maximum reading.

STEP 13. Tighten the "AUTOTUNE LOCK".

STEP 14. Turn the "Channel" selector switch to any other channel, then return.

STEP 15. If the oscillator "TUNING" meter reads the same as in step 13, the operation has been performed correctly. If



THIS IS THE R-449 as pictured in the official handbook on the unit. Most units available are in similarly good condition.

not, repeat the operation starting with step 7.

The most important crystal is the one marked "MAN". This is for channel 10—the manual channel. It really isn't a crystal, but a holder with an 81 ohm ½ watt resistor in it. If you can't find an 81 ohm resistor, any value from 47 to 100 ohms appears to work equally well.

The power connects to a receptacle (J107) on the rear of the chassis. You probably won't be able to find a mating plug so just solder the 115 volt line to the two pins (A and B) then plug in the line. Hopefully you will be greeted by a noise that will remind you of the last time you visited a cotton gin. Don't despair: it's just the blower fan designed to keep the cabinet cool. I recommend cutting off the leads to this terrible device — then use a 1-1/8" socket punch to knock a few holes in the cabinet for ventilation. Another thing to cool the beast off: pull out most of the tubes in the indicator part of the circuit. These tubes were intended to work with the direction finding device, and as part of a communications receiver do nothing but heat up the place. To deactivate the direction finding circuit, remove tubes V117, V123, V124, V125, V126, V127, V128, and V129.

Now, more about the set as a receiver: The dial, as shown in the illustration, is calibrated in megacycles and covers well above and below the two meter ham band. It has an S meter calibrated in microamperes, squelch, dimmers for the lamps, good audio, and typical battleship construction. It weighs about 60 pounds and comes with brackets for rack mounting if desired.

Let's consider a few things wrong (later we'll discuss more good points). The sensitivity just isn't so hot. It's rated for 10 microvolts, which is pretty bad by modern standards. It is about on a par with a 522 or a VHF 152, and it is not as good as the old Gonset Communicator 1 by at least 15 db. This means you're not in the DX business at all. However, for talking around town it works.

The *if* amplifier contains 12 tuned circuits (not a compromise).

To get back to the front end: The R.F. assembly is beautiful. A cast honeycomb of aluminum shields all the components of the R.F. and the oscillator chain. It looked so good it was hard to believe it wouldn't work any better than it does. A 6AK5 R.F. stage and 4 tuned circuits are followed by a 6AK5 detector. Despite the excellence of the construction it just isn't much of a performer. It's tempting to consider putting modern tubes in the RF and mixer and seeing if the old girl couldn't be modernized. I haven't tried this yet, and may not for a long time.

Conclusion: It is not a receiver for the fellow out of town; it is a big city receiver for the net man where distances are small and signals are loud. Let us hope a future surplus receiver that looks this good will be a little better performer.

Noise Cancellation

by Ken Durham, K5MBV
3006 Donald Drive
Garland, Texas

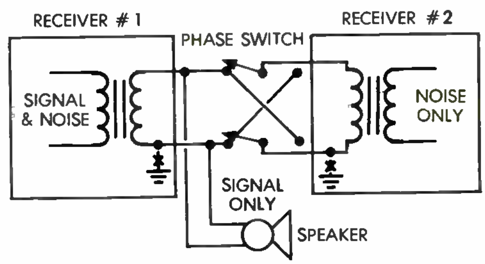
Most VHF operators are interested in signal to noise ratio and the improvement of same, since the ratio is the *only* factor that determines how far we can hear a signal. The method described here to improve the ratio applies to power leaks, ignition noise, and other man-made noises that causes so much trouble for the serious operator.

THEORY OF OPERATION

Two receivers are coupled to a common converter (see Figure 1). One of them is tuned to the desired signal; the other is tuned to an unused portion *of the same band.* When the noise output amplitude from this second receiver is adjusted (by use of receiver gain controls) to be equal to that in the signal channel, the noise will *cancel* if the phasing is correct.

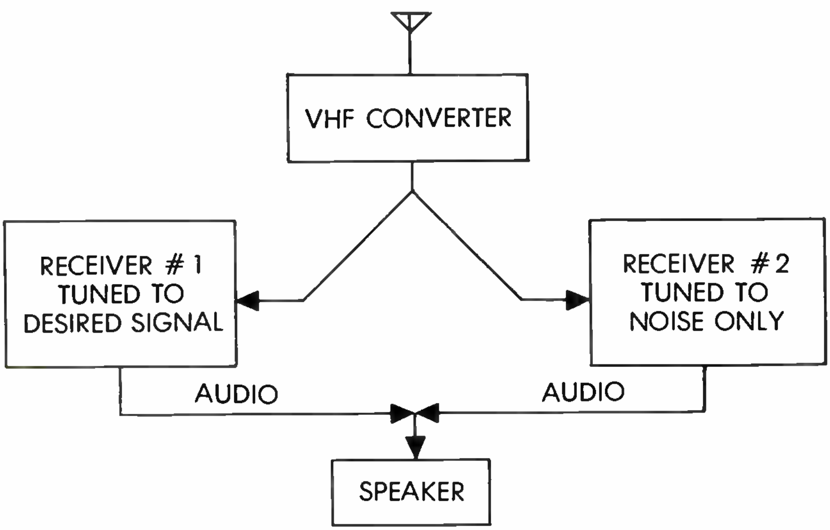
This cancellation will not affect any signal coming from one receiver only It is the same principle used in the hybrid phone patch.

Both receivers should be adjusted for as narrow a bandpass as can be used. Audio, ringing, AVC characteristics, and everything else about the receivers should be similar. This will probably require some modification of one or both receivers, unless you are lucky enough to have two identical, good receivers.



The grounded sides of both receiver output transformers should be lifted from ground (Figure 2) and brought out with the other audio lead so that the proper phase can be selected. Use a DPDT switch as

(Turn to page 37)



QSO Showboat

by A. DAVID MIDDELTON W5CA-W7ZC
ex-W2OEN Staff Historian, VHF Horizons

A fall afternoon is a pleasant time in rural New Jersey. It was Saturday and I had just returned from a walk in the lazy Indian Summer day. I strolled into my ham shack at W2OEN and sat down at the operating table, an apple in one hand and a pencil in the other and began to make notes in my log book. "Saturday, Nov. 1, 1941—2 PM" I wrote. "A2-A3 emission; Power input 10 watts; 2½-meter band; Frequency—113 Mc."

While the filaments were warming I looked around the room and out the windows. This was a rewarding scene, at W2OEN, and a peaceful vista there in Middletown, N. J., in that fall of 1941 just prior to fateful December Seventh.

Looking out the windows in the left wall I could see across the broad rolling acres of the famous Beekman Orchards, where my landlord-neighbor-friend, Mr. Ed Beekman, Sr., raised his premium fruit and produce. A look farther north thru another set of windows revealed the faint line of the Edison Bridge, which at night, was festooned with garlands of lights, jewels on a long necklace that stretched out in the distance. The northeast view from the shack was cut off by a slow rise of the ground but even this view was gratifying for on this knob sat my big V.H.F. beam on its wooden mast.

Before me on the operating table sat my faithful 1934-built c.w. transmitter and my HRO. At just the proper angle for my tuning hand was my red-hot 2½-meter receiver. Lots of long hours and experimentation had gone into this package. Bill Conklin, writing in RADIO, in his v.h.f. column had given this "W2OEN French 75" 2½-meter receiver a lot of publicity.

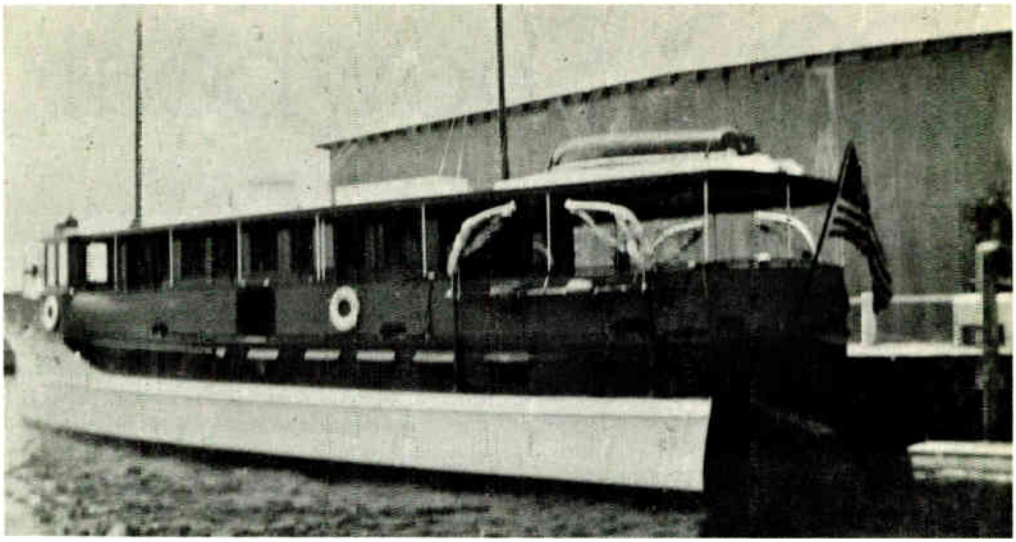
The receiver had a coaxial tank made from a shined-up brass French 75 shell

About the Author - Our 'Newest' Staffer

There was little ham activity in the railroad town of Grafton, W. V., in the pre-war One days, when W7ZC-W5CA became interested in ham radio. He never saw a working rig nor heard a signal for two years—until he moved to Indianapolis in 1919 into a hotbed of ham activity by some of the Greats of those days of roaring SPARK! Licensed in 1921 as 9BJL, David went thru the various stages of hamming and now has his 17th call. He began VHFing in 1931 when Ross Hull and Clark Rodimon made their technical breakthru on 5 meters, and he has been at it ever since.

His amateur radio engineering experience includes tours of duty with Meissner, Stancor, and Guthman Mfg. Companies. Later he put his hamming experience to good use at Fort Monmouth Signal Labs in the Vehicular Radio Section, and with Submarine Signal as a Radar tech-rep. After the war he was Assistant Editor of QST and later Roving Correspondent for CQ Magazine. From 1948 to 1959 he was a Staff research Engineer at Sandia Laboratories, developing sub-miniaturized telemetry gear, and is one of the pioneers in the use of printed circuitry.

David has been a regular contributor to all the ham journals since RADIO NEWS published his first article in 1929, and VHF HORIZONS now presents QSO SHOWBOAT, a narrative bit of nostalgic VHF history—a QSO typical of those which have long made VHF operation one of the more intriguing facets of ham radio.



THE YACHT "SHOWBOAT" at dockside 22 years after the events chronicled in the article. Note size of vessel.

casing, a relic from WW One given me by a friend. This length of tubing, with a center rod, aided by a band-set and a band-spread capacitor, tuned the 2½-meter band and a bit to spare on each end. The Early Warning radar at Twin Lights provided a good marker at about 111 Mc. A small metal panel attached to the end of the 7 X 13-inch chassis held the usual regeneration control and a well-worn but smoothly-operating Marco dial with its slim fiduciary line and the delicately-marked numerals.

The receiver circuit? Simple, OM. As most of the good receivers were in those pre-war years. A 955 "acorn tube" in a ceramic socket, in a super-regenerative circuit as a detector, plus a stage of 6J5 and a 6V6 output, for the audio, comprised the entire receiver. A wireloop at the ground end of the center conductor was adjusted to give the correct antenna coupling. This receiver was stable and, by 1941 standards, selective and easy to control. The "super-regen" action was obtained with about 8 volts on the plate of the 955. This was an excellent receiver. The latest and best of a long series of prototypes.

The transmitter was the RF power section of a Stancor 112T transceiver I had designed at Stancor as a kit. The 112T used the famous Woody Smith transceiver circuit originally described in RADIO. It was an HY75 triode in an ultra-audion circuit. The Heising modulator was a 6V6 with a 6J5 to boost the output from the F2 carbon mike button. Input? about 10 watts; loosely-coupled as it was to make it more stable since it was self-excited. *Output?* who knows! Maybe 3 or 4 watts or even less. An antenna-change-over relay connected the receiver and transmitter to a pair of wires spaced with 2-inch wooden (parrafined) spreaders. The line led to a spot over the window where it passed thru the wall in Pyrex feed-thru tubes. The feed line ran across the yard and up the hill to the base of the mast. I could see the feedline as it laddered its way into the distance where it terminated at the mast.

On top of that mast was W2OEN's pride and joy! A huge 16-element vertically-polarized beam for 2½ meters. This was one of the first and biggest multi-element beams in the East. And, it was a controversial antenna! Who had ever heard of such a thing in those 1941 days. How come it was there on *my* hill?

Along in the summer, John Hollywood, W2AER of Red Bank, an inveterate ham experimenter, had spoken to me something like this. He had built this huge beam in his back yard using a then highly controversial system of four double-extended Zepps, fed in phase, and backed by eight 5/8th wave reflectors. He had no place to properly mount or to try out this array. Would I mind if he brought it out to W2OEN and installed it on my hilltop where I was already putting out a fine loud signal from a dipole and working out fine over the N.Y.-N.J. basin?

Would I mind? My answer is now history! Now the antenna stood there on the hill, thru the kindness of W2AER, plus the good services of Mr. Ed. Beekman who, with the aid of his field crew, his son, and a tractor had put this unwieldy assembly on top of a 30-foot mast. Mr. B. had even rigged a capstan bar so that the beam could be easily turned by hand. On the ground he placed stakes marked with various geographical points so that the beam could be aimed in the right direction without use of map or compass!

Truly, this array was the not-so-secret weapon at W2OEN! The beam gave me the equivalent of a pair of Sioux Indian noses for sniffing out DX. And, when connected to the 10-watter, the beam roared out the voice (or m.c.w.) from W2OEN over the highly active 2½-meter world then existent in the New Jersey-New York basin and up into New England as far as Boston.

A topographical situation that also aided the beam was W2OEN's location (hand-picked) on a hill (yclept "Kilocycle Hilltop" by W2PP) just northeast of the famous Telegraph Hill and northwest of the village of Middletown. Kilocycle Hilltop was the last hill before the land sloped down to the water on South Jersey's north shore. W2OEN had a wide open shot with the beam for about 300 degrees of rotation. Standing at the base of the mast one could see the upper part of the Empire State Building and the gas tank near Coney Island showed up like a big paint can sitting on the hazy distant shore.

Who needed Pack Monadnock? I had it made at W2OEN, right in my own back yard. Picture this layout; a sensitive receiver, an adequate transmitter, lots of gain in a steerable multi-element beam perched on a high hill overlooking the very heart of the country's greatest VHF activity! This was the setup responsible for many amusing and intrguing QSOs in the summer and fall of 1941 including two-way contacts with *seven* states—before WW 2.

I idly tuned the band. There was the usual Saturday afternoon activity. Al, at W2NKO, was yakking away in his typical Brooklynese and with his usual terrific sock. W2GDG was making his amusing sign-off with his gurgling "Two Gallons of Dry Gin." W3HOH was sounding off on some subject dear to his heart up in Bernardsville. Harold, W2DFV, was telling some one about his mobile rig.

There were the usual squealing whistles as the MRT3s and the DK2s fought their peanut-whistle war down in the canyons of New York and over in the Brooklyn area. On a sensitive receiver and a hot antenna these transceiver units were a constant source of annoyance at W2OEN even if they could barely hear each other. But it was VHF *activity* and *that* was good!

I carefully tuned the band, and hearing no CQ I put out a short call and stood by. Listening on my transmitting frequency I heard a feeble voice calling me. I tuned in the signal and made out the call—"this is W2BBI Maritime Mobile."

I replied and established contact but the MM station was so weak that I could scarcely make out his words. I did learn that the station was on a boat, nearing Sandy Hook. After this information was received, I stood by, went up the hill and swung the capstan bar around until the array was aimed directly at the point of Sandy Hook. When I returned to the receiver I was pleased to hear W2BBI/MM much stronger. He was now giving me a good readable signal!

(Turn to page 28)

ANOTHER VIEW OF "SHOWBOAT" pictures the aft deck; also shown is yacht's owner, Mr. Ashton M. Tenney.

Making the UPX-4 Work

by MERLIN BERRIE, W5HTZ/AF5HTZ
Box 1273, Wewoka, Oklahoma

(One of the more-intriguing items of surplus gear for the UHF region is the UPX-4 ring amplifier. This device is not the most common item in the world—and a successfully - converted UPX-4 is even rarer than the original item. So far as we know, W5HTZ / AF5HTZ was the first UHFer to make one work properly on 1296. This is how he did it.)

I replaced the 2C51 with a 6U8 so that I could triple and double from 8 Mc to get to 48 Mc; the circuit for the new oscillator is shown on page 24. I am sure that the 2C51 oscillator would work OK with the right kind of overtone crystal (48 Mc) but I had an 8 Mc International FX-1 I wanted to use.

After getting the crystal oscillator and multiplier working I made the following changes (parts numbers are in the manual and on the schematic, next page):

COIL MODIFICATIONS

L101 — three turns removed. You can do this without taking the coil out.

L110 — three turns removed.

L102 — three turns removed.

L103 — two turns removed, one from each end.

L104 — three turns removed, one and a half from each end.

L105 — two turns removed, one from each end.

OTHER CHANGES

Remove R160, R113, and R159. Change R111 to 15,000 ohms and see that its power rating is large enough to handle the grid current which will be flowing. Connect a 47K resistor in series with Z111. Remove R133.

Modify W106 A and B thusly: Remove the flexible wires from the plate lines to the plate connectors. Connect a 1/4 inch flat strip directly from the plate lines (at the spot where L106 hooks on back side) to the plate connectors. Retune C107, C106, C108, and C109. I found that C112 tuned at minimum capacity so I reduced the minimum capacity by connecting a small 10 pF NPO in series with it. Retune C112.

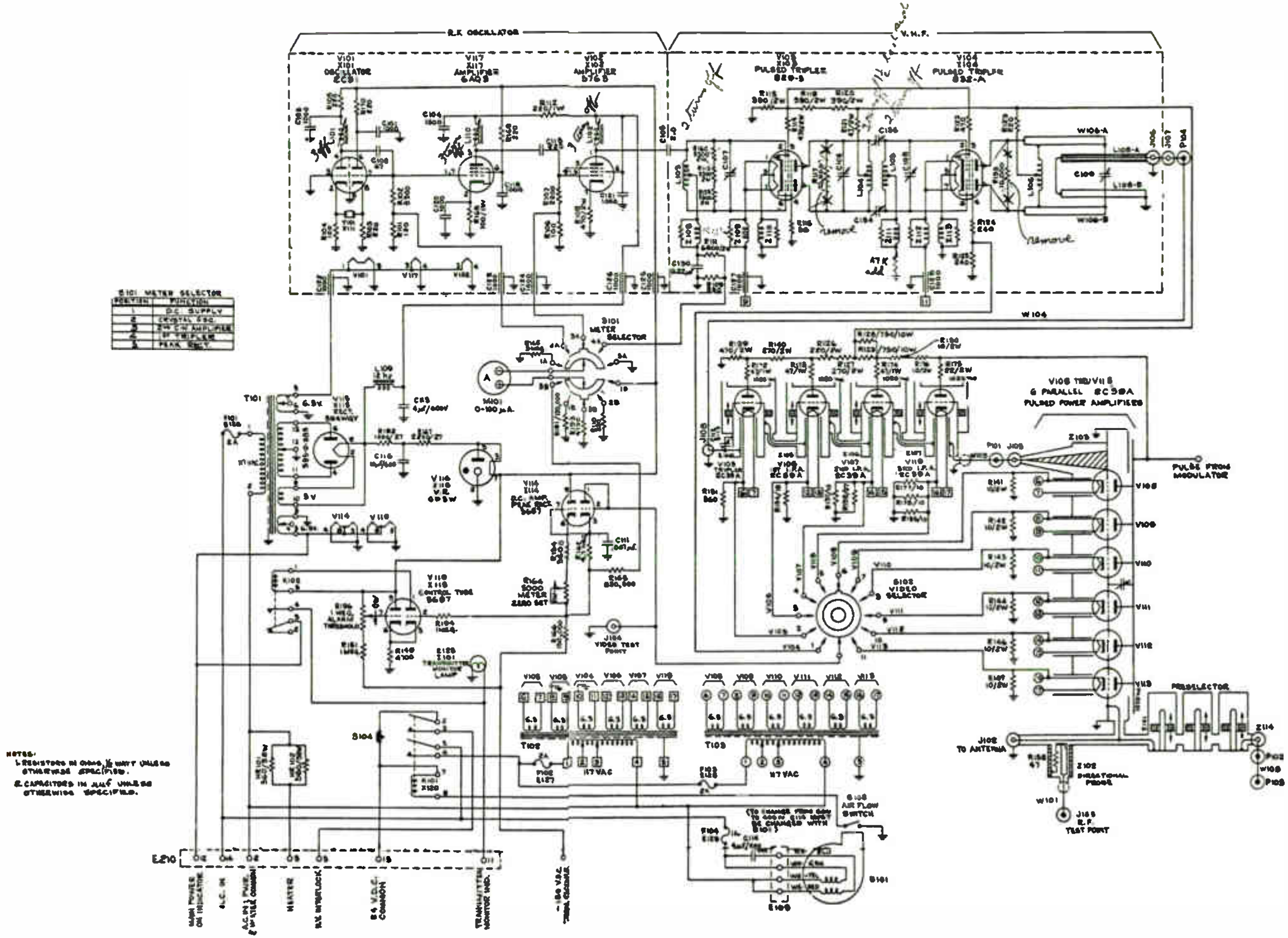
Change the plate and screen voltages thusly:

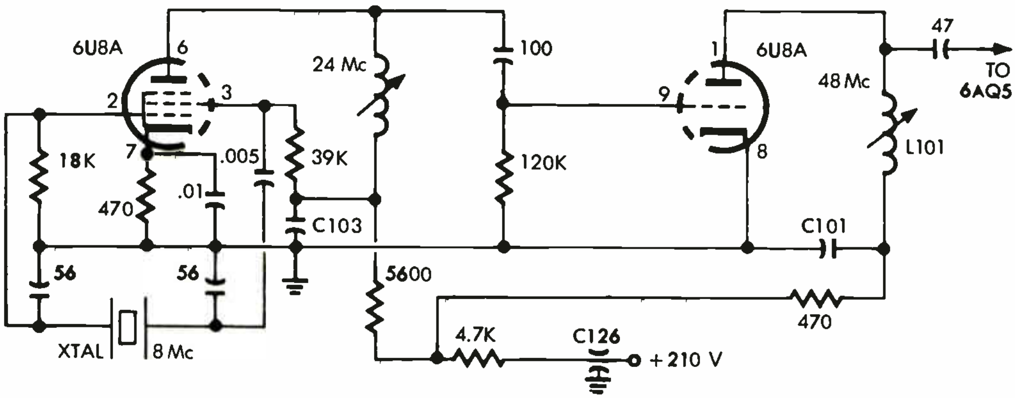
I used R453 wirewound in series with the low-voltage power supply to reduce plate voltage on the 829B to about 350. I used the correct screen resistor for the right screen voltage for the 829B but don't remember the value (I looked in the handbook). This was a 10-watt WW.

In the 832A circuit, I used R441 flat wirewound in series with the low-voltage supply to reduce the plate voltage to about 300. Again, used the handbook value of screen resistor for proper screen voltage.

I changed the 2C39 cathode resistors thusly: I installed wirewound pots and set them for maximum output without exceeding the grid-current ratings. I haven't measured the values.

Other resistor changes made were: R131 changed to 330 ohm, 2 watts with 10 ohm, 2 watt, in series in order to meter by connecting lead to video selector switch S102. R134 changed to 220 ohm, 2 watts, also in series with 10 ohms. R137 and R138


R.F. OSCILLATOR
V.H.F.
PULSED TRIPLER
PULSED TRIPLER
S101 METER SELECTOR
POSITION
FUNCTION
D.C. SUPPLY
CRYSTAL OSC.
6 PARALLEL
PULSED POWER AMPLIFIERS
S102 VIDEO SELECTOR
PULSE FROM MODULATOR
PRESELECTOR
J102 TO ANTENNA
DIRECTIONAL PROBE
R.F. TEST POINT
AIR FLOW SWITCH
117 VAC
HEATER
NOTES:
1. RESISTORS IN OHMS, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. CAPACITORS IN μμF UNLESS OTHERWISE SPECIFIED.



changed to 330 ohms 2 watts in series with 10 ohms. R135, R177, and R178 changed to 390 ohms in series with 10 ohms (single 390-ohm unit). R141, R142, R143, R144, R146, and R147 each replaced with 150 ohm resistors, also in series with 10 ohms, already there.

The 10-ohm resistors are used in order to meter. You may have to experiment a little here to get the meter to read right. When you get it right the top scale of the meter will read in MA.

I cut loose R166 and connected a 33K 1/2-watt resistor between the green wire going to S102 (did go to pin 1 and 2 of 5687 peak rectifier) and the orange and black tracer wire going to S101.

In my case this caused the meter to read approximately correct cathode current in MA when in peak rectifier position. Other wires from S102 were connected to correct 10-ohm resistors in cathodes of 2C39s, where they joined larger cathode resistors.

All 2C39 plates were connected to the low-voltage line except the final and the driver for the final. These two were connected to high voltage, approximately 1,000 volts. I changed these to ceramic tubes. The cathode resistors in the final may have to be adjusted to balance the tubes so they will all draw the same amount of current. Mine read between 100 and 125 MA.

I removed the gang tuning of the 2C39s because tuning was erratic. I tuned each one separately with a screw-and-spring arrangement, and the driver with the panel knob.

Use a dummy or an actual antenna; don't test too much unloaded. I ruined a tube this way (it shorted, grid to plate). This will also take out a meter if you have one in the plate circuit (I did). I also lost a meter to RF even though it was bypassed. I assume there must be a lot of RF in this particular lead. I intend to experiment more here.

I have not used the receiver as I have another converter for 1296. This receiver should work OK as a converter with 30 Mc output. The crystal and multiplier string would have to be changed.

POWER SUPPLY

I removed all 829Bs and associated transformers. Removed plate transformer T407 and replaced it with a 600-0-600 volt high-current job provided by W5HXK. Removed choke L404 and substituted high-current choke, around 700 MA or so. Replaced large filter capacitors with physically smaller ones.

I used the existing bleeders and M401. Used one bleeder on HV and one on LV supply. Take off at center tap of 600-0-600 transformer with a filter choke and capaci tor for the LV supply.

CAVITIES

To raise the frequency of the 2C39 plate cavities, I soldered a piece of 1-7/16 inch ID brass pipe inside the plate cavity. This

(Turn to page 35)

Best Deal on CLEGG—vhf

Florida's BIG 6 and 2 meter signals and fantastic trade in deals come to you from Phil LaMarche, W9DVM/4 manager of our new Orlando Florida Store!

Here is a picture of our man in Florida . . . Phil LaMarche, W9DVM/4. The picture shows Phil with the Clegg "Interceptor" Receiver and the terrific "Zeus" Transmitter . . . at the demonstration desk of Amateur Electronic Supply's new Orlando, Florida store, 23 Azalea Park Shopping Center. Telephone number is 277-8231. Phil is all set up to meet and work with all our Florida ham friends. Come in and personally get acquainted with the big signals that Clegg VHF gear delivers. Phil says, "In addition to the big signal I get from the Zeus Transmitter, I find Clegg gear is remarkably trouble free . . . thanks to the good design and the care they take in production. The only trouble I have with Clegg gear is trying to keep enough of it in stock! If you can't come in, order by mail directly from our Milwaukee store where we're set up to handle all our mail orders and ham correspondence.

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	Amateur Net Price	Payments per month for 1 year	2 years	3 years
Clegg Zeus	$695.00	$63.25	$34.50	$24.91
Clegg Interceptor	473.00	42.83	23.33	17.91
Clegg 99'er Transceiver	159.00	14.11	7.70	5.56
THOR IV, 6 meter, 50 Watt Transceiver Tentative Price	350.00	31.62	17.25	12.45
VENUS, 6 meter, SSB Rig, Tentative Price	425.00	38.50	21.00	15.16

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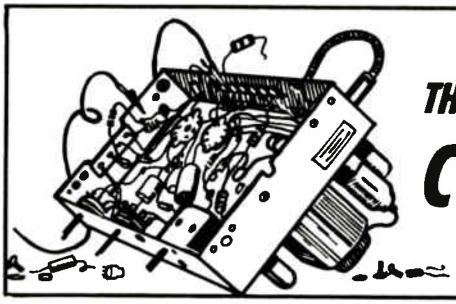


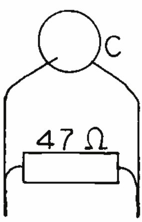
THE CONSTRUCTION BOX

Parasitic Suppressors

Ever had the resistor in one of those standard "5 turns of No. 14 on a 50-ohm resistor" parasitic suppressors burn up? We've lost several here, and three of our friends have had similar trouble.

A rudimentary look at the standard suppressor shows that at VHF, the inductance is such that a very real amount of power will be lost in the resistor.

A suppressor that has been in use here (not original — we saw it somewhere — but it really deserves spreading around) is a capacitor-resistor parallel combination across about an inch of the plate strap lead to the coil. It looks something like this:



As one would expect, the spacing on the strap (since it has low inductance) is not very critical, but the capacitance and *its* lead length are. They form the resonant circuit which the resistor loads. We ran a couple of tests with 47 and 100 pF capacitors:

TOTAL LEAD LENGTH	RESONANT FREQUENCY 100 pF	47 pF
1¾″	68 Mc	——
1½″	——	100 Mc
1¼″	86 Mc	108 Mc
1″	——	120 Mc
¾″	102 Mc	141 Mc
⅝″	115 Mc	155 Mc
½″	138 Mc	170 Mc

One of these (at 135 Mc) is in use here with the homebrew 6146 and the paint has stayed on a 1-watt resistor for 2 months.

This gimmick might also pay off used as a harmonic trap in the plate lead. We haven't had to try it, but it seems reasonable.

—W4VRV

Simple Drill Stop

Have you ever tried to drill a hole in a chassis that already had parts mounted in it? I'll bet you drilled right through some of the parts when the bit broke through. Here's an easy way to save your temper and reduce the load on your pocketbook.

Obtain a length of copper tubing (any other kind will work equally well) that is just a quarter-inch shorter than your bit when it is in the drill. Slip this over the bit. and you have an automatic stop for your drill. This will work on electric and hand drills equally well.

—K9DNW/7

Grid-Dipper Hints

When constructing a grid-dip meter from kit or from scratch, many hams overlook several facts that could cause them much grief when using the meter at VHF.

The most important thing to change in any kit which uses a cheap wafer type socket for the coils is the socket itself. Discard that wafer and replace it with a good phenolic or porcelain socket. At VHF, the cheap sockets are prone to cause double dips and false indications due to high leakage and poor contact.

In some cases, the double dip may still be present although a good socket is used. A cure which works in many cases is to connect an additional pigtail lead from the front of the rotor on the tuning capacitor to ground.

—WA6ZEM

Cutting Air-Wound Coils

Here's an easy way to cut Airdux or B&W miniature coils to size with a minimum of mechanical distortion. Slip the coil over a suitable sized metal rod which is fastened in the bench vise. Grind up a small chisel out of a piece of 3/16 or 1/4 inch tool steel, making the chisel blade slightly less than 1/16 inch wide (if tool steel isn't handy in your shack, use the tang end of a three-cornered file. However, be sure to keep a handle on the file afterward to avoid cutting yourself on the homebrew chisel).

Hold the chisel between thumb and forefinger and place the blade on the coil wire where you want to cut it. Hit chisel with hammer; wire will sever as neatly as if you used sidecutters. Unwind one turn of wire and use sidecutters to clip plastic strips.

—K5KLU

Mounting Power Resistors

A fast and convenient method of mounting power resistors of the hollow Ohmite type, especially for vertical mounting on top of the chassis, is to use Molly Fasteners (trade name) of the appropriate diameter. Collapse or expand the fastener inside the body of the resistor, and presto, one easy hole mounting.

—K5YPH

2C39 Sockets

If you want to make use of your surplus 2C39's and can't find sockets, try using fuse clips mounted on insulator material to accept the tube, and a large size banana plug in the heater "hole."

—WB6AOW

More Tips Wanted

We still need more items for this department. Each one printed gets you a 12-month extension of your present subscription to VHF. Send 'em in however you like, but send them.

Especially needed are *short* items such as many of those appearing this month. They get just as much as the long ones — and most people seem to do the longer ones. But the shorter the item, the more of them we can get in each issue!

QSO Showboat . . . continued from page 21

The QSO progressed. I learned that W2BBI/MM was a battery-powered transceiver aboard the yacht *SHOWBOAT* and that the owner, Mr. Ashton M. Tenney, had brought along a group of friends for a stag cruising party while the yacht was being transferred from her home port of New Rochelle, to Georgetown, Maryland. There the yacht would be berthed during the winter season in the mild waters of the Bay and the yacht's guests would return home by land.

Operator George D. Campbell, W2BBI, told me that a mishap had occurred earlier in the day. The yacht had departed New Rochelle early in the morning. While passing thru Hell Gate in the East River, the yacht struck a submerged log! The blow had damaged both propellers, their shafts and had also harmed the couplings to the twin Diesel engines.

W2BBI said that the yacht's engineer had hove to and made a brief inspection but that it had not revealed the true conditions as the vibration in the propulsion system had worsened. The yacht had proceeded toward the Jersey shore but because the weather was getting heavy in the Atlantic, the party decided to anchor just inside protected Sandy Hook Bay for the night.

By now conditions were excellent for two-way contact as the yacht drew closer to W2OEN. A message was taken to be relayed by telephone to New Rochelle. A standby was made while I ran over to the Beekman Farm, explained the situation and used their telephone to inform the New Rochelle folks that the yacht was safe and where it was headed for the night.

W2BBI suggested that it might be fun to continue the contact as far as possible on the next day (Sunday) and since the yacht would be starting out early in the morning, and going *away* from W2OEN with every turn of her screws, it would be a good test ditions over a path not previously bridged of 2½-meter transmitting and receiving con- by W2OEN. I was glad to have the opportunity to check the performance of the big beam over this terrain and the southerly heading. So we arranged a schedule. I was to pickup W2BBI/MM the next morning while they were anchored in the Bay and we would keep a running QSO as long as possible.

W2BBI signed off and closed down and I resumed my normal operating activities for the evening. No further attempt was made to contact the yacht that night.

An interesting sidelight was the report by W2BBI/MM that he could not hear readable signals from stations other than W2OEN. Altho there were weak stations coming thru, he was unable to raise anyone but me. A strange phenomena but one that was to be fortunate for both W2BBI/MM and the yacht's party. Other stations, sans a powerful beam and a good location were just not able to pick up the weak transceiver signal. Checks later indicated that no one else heard the yacht that afternoon or the next day!

(to be concluded next month)

Scatter . . . continued from page 3

around for quite a while, and has a reputation which speaks for itself. Those who attack it run headlong into this reputation — and the result more often than not is a very sore head. And who likes a sorehead?

Now as I said earlier, the League isn't perfect. I have my own small list of gripes. I'm not going to list them here. I've already told them to Ray Bryan, W5UYQ, the West Gulf vice-director, and I'm satisfied that they are being taken care of (in fact, I found out that at least one ARRL official privately shared some of them). It may take a few months or even a few years, but none of them are really that serious.

Some of the things that made many VHF ops mad appear to be on the way toward being changed — such as official station appointments for Techs. And if you've been reading QST carefully for the past several months, you will have noted a most welcome upsurge in VHF/UHF coverage.

I like this. I'm in favor of ham radio in the VHF/UHF region — and while, as an editor, I'd like to have all the advances appear first in these pages, on the other hand as a ham I'm most happy to see the League taking off in this region too. The more the merrier.

So we come full circle and get back to the original point. Cancel all your other subscriptions if you like, but please don't quit the ARRL. We all need the League — and it needs all of us.

What do you think? **— K5JKX**

COMING NEXT MONTH!

A 432 Kilowatt Without Tools

Through an extraordinary chain of events we have located for you this complete construction article telling how to build a full kilowatt for 432 with no more tools than you'd need to build a similar rig for 6. No lathe, no milling, nothing like that. Just hacksaw, file, hammer, and ordinary hand tools. Yet when you're finished, you'll have a double-cavity rig which can put 500 watts up the feedline.

This is a tried and true design. The prototype has been in commercial service on a neighboring frequency for 14 months, operating 24 hours a day, seven days a week. In that time, only one failure has occurred — and it was due to a blocked air blower.

All tubes used are readily available types (for VHF/UHF people, at least) — 2C39, 4X150, and a pair of 4X250's. If you already have a rig capable of giving you 50 watts out on 432, you need only build the final. This is one cavity with two 4X250's in it. If you have 12 watts on 432 going now, you need only the final and driver (add the 4X150). If you have **nothing** on 432 but have 5 watts or so on 144, build the complete rig. The design is such that you can put it together piecemeal with ease.

The problems of putting two power tubes in one cavity are tremendous — ask anyone who has tried it. That's why we're so excited about this 432 rig; we think you will be too when you read about it.

But it's not the only thing coming in our March issue. It is only one of the many construction, technical, and operating features scheduled. Whatever your interest, whatever your band, don't miss the March issue of VHF Horizons. It'll be the best yet!

DON'T TAKE CHANCES - SUBSCRIBE TODAY!

DEAR VHF:

Below are a few of the VHF/UHF operators active in my area. I am anxious to have VHF's files top the 31,000 mark of known VHF/UHF'ers in the United States and Canada. Please see that the following receive a copy of VHF as a sample soon:

Airmail to

VHF HORIZONS

P. O. Box 1557

Oklahoma City 1, Oklahoma

Vital Happenings & Facts

OPERATING AND DX NEWS

The extraordinary results obtained by two meter meteor scatter (or shower) enthusiasts during the past autumn months is worthy of more than passing interest.

Time was that even the best equipped operators and stations would not venture into the world of two meter meteors except during one the top two or three showers of the year. Usually this meant the Perseids shower in August.

This past fall, however, some of the more enthusiastic of the MS crew (i.e. K7HKD, W4WNH, W8PT, W4TLC, W7JRG, W5PZ and numerous others) have stayed with the pings and pangs straight through. Every minor and even every minor-minor shower has been exploited to some extent. In most cases this fall was the first time these so-called minor showers have really been given the old college try.

The results have been surprising, to say the least. The number of completed two meter QSO's this past fall probably stacks up better than the number of meteor QSO's completed during the August Perseids.

Then again the results may not be so surprising. After all, if we hadn't tried these so-called minor showers in the past, how is it we could stand around with shuffling feet and proclaim "it can't be done!"?

It has been the story of amateur radio from the very beginning that all it usually took for someone to prove that 'it could be done' was for someone to say 'it can't be done.'

Which brings us to 220 meteor scatter. Or 432 moon bounce. Or two meter sporadic E. Or . . , or . . ., or . . . .

Have you tried anything 'impossible' lately?

Leading off the 'what DX' department this month is the news that the 432 Mc power limit has been lifted clear off for most of us (see January issue, VHF Horizons). Now watch those copper strap parasitic suppressors come off the plate current meters!

432 MC will find W8PT active on 432.098 with 500 watts. Jack's Michigan QTH ought to provoke a few of the boys into spinning their beams that way. He skeds K9UIF at 2100 EST these days. Take a listen.

K8AXU, Al, reports he is now spotted on 432.410 from his new 1,000 foot Sisterville, West Virginia QTH. His rig is a 5894 final winding 50 watts and the beam a 13 element yagi. Al reports what may be a new inside continental USA 432 record. He and Rex, W5RCI, worked one another on 144, 220 and 432 one evening in August with signals 10 over on 144, S5 on 220 and S1 on 432 both ways. The distance is 650 miles, and sounds like it should be a new inside continental limits record.

John White, W5UKQ is now /5 in Baton Rouge, temporarily off the air after a move. John, a Research Consultant for VHF, talks of his new 432 rig which will sport a 6181 coaxial tetrode in A1 emission only. With this kind of final, few of us should go begging for Louisiana on 432! He will keep us informed.

Vic, W9JFP, accepted the news that the 432 power limit is off by unveiling a twin lash up he and Dave, K9DOE, in Forest Lake Forest, Illinois are putting together. Vic, in Milwaukee, and Dave will soon be cranking the watts from 4CX100's mounted in coaxial tanks which (along with the 416B converter) will be mounted 130 feet in the air just under the rotor that will twist a 40 foot long 54 element yagi's on 432 Mc! Wow. Shades of Sam Harris. Their frequency (ies) will be 432.025 with beams south at 2200 CST daily.

OK . . . so how about the rest of the 432 crew? Who is doing what to win the race for 432 moon bounce honors?

50 Mc DX was popping through much of November and December. With the exception of the first ten days of December, and a flurry around the last few days, November was as good as December in many southern quarters, to the surprise of all.

From out in La Mesa, California, W6IEY (Dick) reports on Es openings on 1 December (San Antonio, Dallas, El Paso heard or worked), 3 December (Texas area heard again), 11 December band open to Texas panhandle, Colorado, Kansas and 8 land), 14 December (New Mexico and Colorado heard, Oregon and Washington worked), and 16 December (Kansas stations worked in and around San Diego).

W4OAB and W4URS are seeking long ground-wave skeds with Kentucky, Georgia, West Virginia, Tennessee, etc., out 150 miles or more. Both lads are located in Charlotte, North Carolina and would appreciate a note from you if able to accomodate.

From Holbrook, Massachussetts, K1MUC reports on openings down into the Caribbean area on 50 mc. Wayne notes that on November 30th he heard a near-local calling YV1DS at 1600 EST. Later on that same day at 1900 EST K1JMO was able to work VP7CX in the Bahama Islands. VP7CX's frequency was 'just below 50.05' according to Wayne, and he was working W1, 2, 3, 4 and talked of having worked 8 land earlier. On December 4 the band opened from W1 to W4, and again on the 5th 4's rolled in from 1600-2000 EST. On December 6 Wayne heard our friend the unidentified unmodulated carrier on 50.00 megacycles, peaking with a Carribbean origin. (Fidel's playing again.)

Dick Milligan, W5RCK/Ø in Bellevue, Nebraska tells of the activities in his area on six and up. Dick's on six with 20 watts input, using an Ameco converter into an HQ-150 (5 element Hy-Gain up 40 feet). He reports an opening into Florida, Alabama and Mississippi at 1600 CST on 20 December. And, 50.4 megacycles is the monitoring frequency in the Omaha area, in case you are looking for mobile contacts there.

Another portable station, K9DNW/7 in Pinedale, Wyoming is still working on his 2E26 final. With lack of sufficient drive, he's going to a 6CL6 buffer amp. W7VHS is also active in Pinedale using a Knight R-55 and T-60 with a 3 element homebrew beam.

Wanted! Schedules with Kalamazoo, Michigan, says WA9AHZ in Chicago. The Chicago lad wants to phone patch some traffic into the Michigan city. SSB only. Anyone able to help?

Ed Lankford, W4HHY, gives us the dope on VP7CX in the Bahamas. The Bahama lad goes by the moniker of Harold, is located on San Salvador in the Bahamas. Some report he's on 50.240 megacycles, in addition to the 50.049 frequency reported earlier here. He is accepting QSL's in care of a W9???. Anyone know the rest?

Dallas area 50 mc buffs should investigate the 'Cowtown 6 Meter DX Club.' Someone tells us the club has a system of prizes for working DX. This sounds like fun. Jim Palmer, K5TKR, has the story at CR 4-7814, if you are in the Dallas area.

From Seattle, Washington area George Mitchell, W7ZQX advises us of six meter doings from his area. Sporadic E reared its beautiful head with an opening into California between 2100 and 2200 PST on 4 December. George also reports he continues his weekend scatter work with W6FZA and W6NLZ, on CW, with signals running 239 to 449 most mornings. SSB scatter was tried with W6FZA for awhile and continues with good results. New skeds with WØENC in Rapid City, South Dakota are also working out well according to George. Quoting from a letter of 2 December, Bob of Rapid City wrote "Dear George, was just amazed at reception of your SSB signal this AM. Copied calls many times R3 S8 and towards the end it was R3 S5. Didn't hear much CW, one short burst at 1028 when I copied calls . . ."

Note to WØENC: How about a sked with W5KHT. This is a north-south path too!

Back out in California, Denny, K6UMM, in Canoga Park reports on an unusually strong Es opening up into Washington on the 4th. Denny also notes Texas was copied on Es every night for a week from 1 December on, 1700-1800 PST.

Jeff, K5VHU, is on 50 mc teletype keeping skeds with W5EAH, nightly at 2100 CST on 50.45 mc. K5VHU is located in Seminole, Oklahoma and W5EAH is in Cushing, Oklahoma. Any joiners?

Remember W6RLB of Bay Area (California) 50 mc scatter fame? Guy Black is now K1QJT in Belmont, Massachusetts. How times change. Whatcha doing Guy?

K9DTB, Villa Park, Illinois continues his efforts on 50 CW and SSB. He's on 50.110 on SSB and 50.030 on CW. On November 13th he worked two-way SSB K8GND in Michigan, W9CIU in Wisconsin. On November 17th he worked W9HGE Wisconsin. Heard locally on six SSB in Villa Park are K9ZOO, K9HMB, K9VLD, WA9ERC, W9CEV, WA9AHZ, W9BON, K9BBN and K9GIS.

From Oklahoma, W5KHT caught Pappy, W5UB, in San Antonio over a short 400 mile Es path on 1 December at 1900 CST, and worked back-scatter W5SFW from

SCATTER SPECIALIST Ed Pick, W0BBM, shows his newest tilt assembly (made from wreckage of a Rohn foldover tower) during a visit to VHF's home office. Halo proves Ed keeps in touch with VHF operation while traveling; his home location is Imperial, Missouri.

Amarillo at 1944 the same date. Back scatter signals peaked out of the southeast and Phil reported hearing Louisiana and south Texas stations working west to California and east to Florida at the same time. The VP7 was on that evening also, but not heard in the mid-west apparently.

W5KHT also caught K7ICW in Las Vegas on A1 on the 11th and 15th of December, both evenings around 2230 CST.

220 MC news is in bits and pieces this month. K6UMM in Canoga Park is building up gear for this band. Under construction is a Nuvistor converter into an A2 from Collins, a pair of 4X250B's and a set of four 29 element Telrex yagis in a quad for a total of 116 elements! Polarization is horizontal, frequency is 221.4 to 221.6 and skeds are sought east and north.

W4OAB, Brian, North Carolina type, is on 220 with a 6360 rig and Nuvistor converter. The antenna is an 11 element yagi.

Ben Hall, W9OVL, our faithful 220 reporter from up Chicago way tells us four new 220 stations on now in his baliwick. Active new are K9DNG, K9WSZ, K9OOK and W9QDO. K9DNG built up the 220 rig as shown in the VHF Handbook but had no signal at 220! So he pulled out the last three stages and substituted UHF ceramic sockets. Now he has a FB signal.

WØYZV in Omaha heard W9OVL S9 on 220 phone for 30 minutes recently. OVL runs a 10/10 yagi system driven with 125 watts.

Slowly—but surely—1¼ meters is shaping up. Now for some concentrated effort from all hands. How about a series of 220 weekend DX Tests?

K8AXU, A1, sits on 220.105 these days. He runs 120 watts to a homebrew 5894 final with a 10/10 antenna system. He's in Sisterville, West Virginia.

144 MC news is almost exclusively news of meteor scatter schedules and contacts through November and December.

Shelby Ennis, W4WNH, from Louisville, Kentucky reports on the Leonids Meteor Shower November 16 through the 19th.

Out of the shower came a contact with K7HKD in Wyoming. Skeds held with W7LVU, K7IDD and K7HKD on the 16th were without luck. The 17th was a repeat although one weak burst was heard from W4TLC. This is over a 300 mile path that defys tropo activity because of the terrain. Quoting Shelby, (November 17th) "Tuning band, hit signal near .120 about 0706. During next minute received beautiful burst from K7HKD calling VE3DIR. However K7HKD was on 144.119 by my calibration instead of his usual freq of .124. Several more strong pings. Called Harold landline to inform him of his frequency and suddenly heard VE3DIR coming clear thru the telephone. At the end of the calling period could hear K7HKD (on my own receiver) as he went back to Tony. Hope they made it."

W4WNH made it with K7HKD on a sked from 0900 to 0922.

A sked with W4TLC on the 18th produced a single ping with both stations using an Alabama heading. A sked with K1LSY from 0600-0700 on the 18th produced 50 pings and 3 bursts, no QSO.

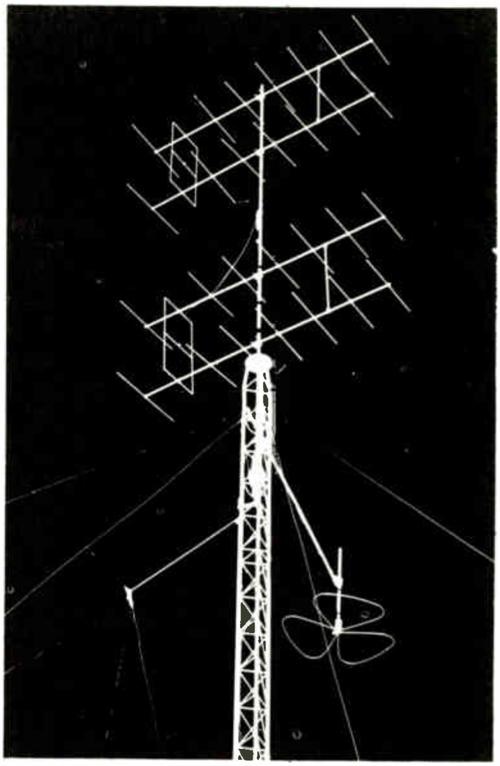
WB6AOW, Santa Cruz Island, California, reports on 144 sideband DX and CW DX. On December 5th a station in Encino was trying to work east into Arizona and the Arizona station's CW signal was heard on the island. Back on November 6th San Francisco Bay Area stations were running S6 on the island. On the 7th W6FZA was heard on SSB from Porterville and San Luis Obispo stations were copied on AM. Sounds as tropo has been breaking along the coast a bit.

K8IFL writes of an award that two meter enthusiasts along the Great Lakes might keep in mind. This is the WUFO-2 Certificate, which you earn by working 5 of the Ironwood, Michigan gang on two meters. Dreamed up by W8LIM, K8IFL is now the custodian of the award. You can look for W9AJU, W9VFO, W9BCY, W9HHJ, W9ERT, K8IFL, K8KYM, K8JWE and WN8EHM for contacts to count towards the certificate.

K1RTS, Waterbury, Connecticut, reports on a November 28th tropo opening over New England. He's looking for two meter CW contacts on Sunday mornings. All directions.

From Bowling Green, Missouri, Ed Porter, WØLFE writes of two meter DX activity in his area. Ed says he spends all of his time on two meters, and hasn't operated six because of being located in a Fringe area for channel 2. Power on two ends up with a 6N2 Thunderbolt driven on either AM or SSB. The SB generator is an HT-37. He also hangs in there on CW on aurora (what's that? Ed). The antenna system at WØLFE is a pair of slots, 8 over 8, 65 feet up. Activity in his area congregates on 144.350 on SSB. K9AAJ, W9KQX, K9-VWX, K9KYZ, W9KZD, W9BGM, K9-VGM are among those active on SSB. A few also work around 145.050 to 144.100. Ed's frequency on aurora or meteor showers (he's been working with W7JRG and K7HKD of late) is 144.246.

W8PT takes us to task for our typographical errors, as well as informing us of



ANTENNA FARM AT NIGHT shows array of arrays at W0LFE, Bowling Green, Missouri. Operator Ed Porter feeds these 2-meter monsters with a Thunderbolt, driven by "either a 6N2, a Communicator 3½, or a HT37 thru a converter." Credit for the unusual shot goes to Joe Bryant, photographer for the Bowling Green Times.

the latest shower results. We've tried every conceivable method of communicating with the type-setter, Jack, and after 7 months have decided that he doesn't speak English. In desperation we have gone to another outfit to set our type. Here's hoping!

On the more serious side, Jack writes ". . . Now for the story of the Geminids meteor shower as seen from the Michigan end. Skeds were set up with K4IXC, WØIUF, K7IDD and VE6HO. Here's how it went: Monday night — called VE6HO, K7IDD and WØIUF on sked. Got one weak ping from WØIUF, nothing from others. QRT at 0300. Tuesday — snow and more snow. Wind 45 mph, with high gusts. Temperature a plus 3, snow 34 inches deep and getting deeper. Gears stripped in rotator, couldn't keep skeds. Wednesday morning — Beam stuck southeast. Worked K4IXC (Florida) on sked even tho beam was 10 degrees off of him. Tried everything to turn beam except to climb tower in zero degree temperatures and high winds. Listened to K4IXC pound in while he kept other skeds. Could have worked him a dozen times . . . what a signal! Thursday—got home from work and looked up at beam. Holy smoley, it's pointing west. Wind? Prayers? Anyway, worked WØIUF in 18 minutes on our 0200 sked. Friday — Weather warm — 22 degrees — climbed tower and loosened bolts, putting beam on VE6HO. Spent most of night listening on his frequency . . . sked ran from 0000 to 0100 and didn't miss a call on my 30 seconds. Heard nothing.

"Sunday — Weather warm — 28 degrees — Folded tower over and replaced rotor which is quite a job, but it got done OK thru the invaluable aid of my wife. So ends the story. How do you suppose the beam got around to the west and right on WØIUF?"

You must live right Jack.

Oh yes, Jack reports an aurora session December 17th from W1, W2, W3, W8, W9 and WØ. Now we know you live right Jack. Sob.

From out in California staffer John Chambers, W6NLZ, reports on a continuing series of two meter schedules and contacts over, around and through the usually impassable terrain features of the California mid-lands.

On November 2 John worked W6GDO in Sacramento on SSB over a little old 360 mile path that defys description. On November 4th, W7JU and K7ICW from Las Vegas were worked on two meters over an equally tough path. W7JU is now on two meters Sunday mornings 0800 PST with very reliable two meter CW signals, says John.

A tropo opening of sorts into central California the evening of the 4th brought in signals from W6GDO, Sacramento, W6NTV, Turlock, W6MSG in Paso Robles. On November 10th John worked W7LEE in Parker, Arizona RST 579 on cw.

Southern staffer John White, W5UKQ, Baton Rouge, Louisiana is putting the finishing touches on his new 'whopper' rig which he says will have loads of stability and suds. Meteor shower frequency will be 144.018 and other DX work will be done around the 144.150 hang out of W5FYZ, W4TLV and others. A new 80 foot tower has been ordered and the old 22 element array will go up on it until a new quad array of yagis from Telrex is installed. John is all enthused over meteor showers since the Perseids and is looking for skeds all over the place. Ok you fellows who need Louisiana on two meter — the line forms to the right.

Remember — fill out and return your DRP cards in this month's issue! Let's have a basket full of information for March.

432 Mc . . . from page 7

L6 — 3⅓ turns No. 20 tinned on Miller 4300.
L7 — 1 turn hookup wire at cold end of L8.
C1, C2 — 4pF piston trimmer (Centralab 829-4).
C3 — 68 pF mica.
C4 — not used in prototype; tunes to XTAL frequency with L5 if necessary.
C5 — 10 pF plastic piston trimmer.
C8 — 6 pF piston trimmer (Centralab 829-6).
FT1, FT2 — 1000 pF feed-thru capacitors Centralab MFT-1000 or similar (6 required).
RFC — see text.
T1 — 125 VAC, 50 MA; 6.3 VAC, 2A (Stancor PA8421).

VHF Showcase

NOISE GENERATOR

With all the emphasis on the use of noise generators, it was a leadpipe cinch that sooner or later someone would come out with one at a reasonable price. Who done it? *Quaker Electronics,* of Mountain Top, Pa., (the crystal people), that's who.

This is a tiny, self-contained unit very similar to the one described in the latest issue of the ARRL Handbook, built around a silicon diode, a battery, and a rheostat. While it will not give you a definite "noise figure" for your receiver, it *will* help you get the best noise figure out of your equipment.

Price of the unit, Quaker advises, is $7.95 postpaid in the U.S.A. For further details, drop them a line and tell them we sent you.

6-METER CONVERTER

A good, low-noise, anti-clobber converter for 50 Mc is always welcome on the market. The latest announcement of such a unit comes from *Amplidyne Laboratories,* 123 Fifth Avenue, Kings Park, N.Y.

Their model C61, available from stock now at a price of $28.50, sports the following specifications: Input, 50 Mc. Output, 14 Mc (other *if's* available at $1 extra charge). Noise figure, 3.5 db maximum (2.5 db typical). Gain, 25 to 40 db, adjustable to receiver needs. Input and output impedances, 50 ohms.

Three tubes are used: a 6CW4 g-g *rf* amp., a 6BK7 mixer-oscillator, and a 6C4 *if* amplifier.

A matching power supply is available for $9.75, and the maker advises that similar units for 144, 220, and 432 are on the way. For additional details, write him and say Ichabod sent you.

SENSITIVE LOW-COST TV CAMERA

A new type of TV camera, inexpensive enough for amateur service yet sensitive enough to compete with Vidicons, has been announced by the *Denson Electronics Corporation,* Longview Street, Rockville, Conn.

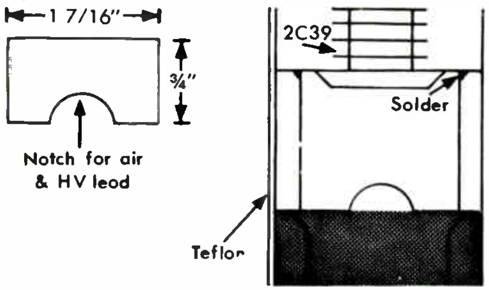
Designated the "Al-Dee," the unit sells for $239.95 complete with lens, F.O.B. Rockville.

Included in this package is a complete TV transmitter. Camera tube is a two-inch electrostatic vidicon of improved design; the lens is a 48mm f/1.9 in standard Leica mount. Output is on any TV channel from 2 to 6 (low-band), at 0.1 volts. Full audio, to be fed by crystal, ceramic, or dynamic mike, is also included.

For complete details and specifications, drop a line to Alfred C. Denson, president of the corporation. He'll be glad to send you the full data.

UPX-4 . . . from page 24

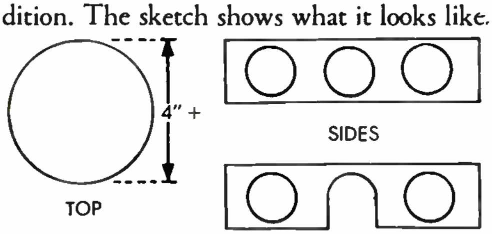
is a size I happened to have handy and no doubt other sizes would work. This will cover about half of each air hole at the top so these holes should be bored out again so plenty of air will go through. Two notches were cut in the sides for the HV connection to come out and for air to go through. The sketch shows more detail.



In my case, the dielectric slug and the pipe just about touch when tuned to 1296. You can judge the length of the slice of pipe by this. Make them long enough to almost touch; it doesn't hurt if they *do* touch because the slug is insulated.

FINAL STAGE CAVITY

Get a piece of 4-inch-plus OD copper pipe and cut off a slice a little less than 3/4 inch long. You can measure the depth of the final plate cavity for the correct width of this slice. This pipe should be the right size to fit tightly in the cavity; I didn't have any, so I made one out of a piece of silver-plated flat brass. I bent it into a tight-fitting circle and soldered the seam. Bore 3/8 inch holes in this slice of pipe to match the air holes inside the cavity. Cut the side out of one hole so the pipe will slide in without disconnecting the output link. I soldered this pipe in but could tell no difference from the unsoldered condition. The sketch shows what it looks like.



There are probably better ways of doing this, but it works. If you make some improvements as you go along let me know.

(P.S. This was originally sent to W5AJG/AF5AJG and later duplicated for use by AF MARS members. That's why the last line, about "improvements." But it still applies. Let us know if you make improvements on this conversion!)

69-cent . . . from page 15

4) It should have low dielectric loss, especially for use above 100 Mc.

Requirements 1 and 2 dictate a transparent substance, since if radiant heat is neither absorbed nor reflected, it must by necessity pass through! The use of glass is thereby indicated.

Since some heat is bound to be absorbed, the use of a temperature-resistant glass such as Pyrex is suggested to fulfill requirement 3. Requirement 4 is fairly well met by Pyrex glass also.

The remaining problem, then, is price and availability of Pyrex glass of the proper size and shape to do the job. Fortunately, chimneys are available at many supermarkets for only 69 cents.

They are sold under the guise of a replacement part for Pyrex coffee percolators The six-cup model fits the 4-125A nicely, while the eight-cup model is ideal for the 4-250A and 4-400 type tubes!

Since using these inexpensive yet effective chimneys, I no longer "suck in" my 4-125A's when running a full KW on 144 Mc AM phone. The addition of the two Pyrex chimneys was the only change made, the sub-chassis blower system being the same as always.

—W6MMU

VHF Lab Reports

Having had considerable experience in the past with Hornet beams and being definitely impressed with the excellent construction of same, in regards to the low frequency versions, imagine the surprise at finding a new line of Hornet antennas for the VHF realm. A quick call to Jack Guest at the Hornet Antenna Products Company verified our findings and a further word of encouragement from Jack prompted us into ordering a complete 40 element 2 meter array.

What Jack had to say about new arrays was enough to convince anyone of their obvious merits. Since Oklahoma is blessed, unhappily so, with some pretty strong spring winds and winter ice (heavily guyed towers fold up down here every year from the effects of the elements) one of the most logical questions we could ask was, "Will they stay up in the Oklahoma weather?" Well, Jack's answer was, "I've got some down here that have already been in 70 plus mph winds and are still standing." Wanting to know more, we asked, "Does this imply that the arrays are constructed of bridge steel?" Jack's answer was a good one but more important, he explained all the mechanics of the new beams which we found all very interesting.

First of all, the new arrays are available in either regular or heavy duty versions and in 5 and 10 element configurations. (We chose the 5 element heavy-duty which was rigid, high strength, 3/16", solid aircraft aluminum elements.) In manufacturing the heavy-duty versions, each element is given a formed, all-weather, plastic extrusion that is shaped in a form which just fits the curvature of the boom. This method really has its advantages especially so since the element is insulated from the boom and eliminates all the electrolysis problems.

The driven element is the most interesting part of the whole beam. It is a "J" matched dipole that is really rugged. The side that is folded back towards the boom has an aluminum sleeve of somewhat different diameter than the driven element itself. The size of this sleeve determines the resultant feed impedance. This makes stacking these arrays quite easy since there is a means by which the feed impedance may be modified. Also, the sleeve is fastened to the smaller part of the element with two Allen Head screws for mechanical strength and good electrical contact. Attaching the feed line is quick and simple with the aid of a husky terminal block that is firmly attached to the boom.

That pretty well describes what we consider as a first-class antenna. But when we saw the 40 element array that Hornet built for us, not enough could be said to express the sheer delight that was experienced. The end result was an array of 8 - 5 element yagis stacked four high by two bays wide. All the matching harness was made of polyfoam coax and was already strapped down to the stacking bars with aluminum Wrap-lock. On top of this, the fittings all had "shrink tubing" over them for complete weather protection. Even the ends of the stacking bars were capped. Since we had requested that the horizontal crossbars be a certain diameter (1-3/8") so a tilt system could be installed, we were a little worried about the strength of this member. Well, the worries ceased upon examination. The crossbar did meet the diameter criteria but to make sure it was strong enough, the Hornet people had put an additional piece of tubing inside and had fastened large sleeves over the outside toward the upright stacking bars. If by now you are thinking that the array is a little heavy, forget about it. Total weight is under 50 pounds. Does it work? Unbelievably so and has already done considerable service at the W5HCX QTH. Truly, the new Hornet arrays are "The beam with a sting."

Noise . . . from page 18

shown, for initial phase selection and also for future demonstration purposes.

When tuning, the noise must be re-nulled with each signal, since signals of different strengths will produce different levels of quieting and will thus require different levels of noise from the cancellation channels.

This balancing procedure might be re- that the signal level would automatically fined by use of a crossover AVC system so determine the gain in *both* receivers. This is an area for future experimenting.

With two average, unmodified receivers the improvement may be up to 6 db. With identical receivers in each channel the improvement theoretically may be much more. Up to 100 percent elimination of man-made noise is possible.

Editor's note: Note carefully that this system does *not* reduce random noise or hiss such as that generated in first-stage RF amplifiers. Such noise has no phase coherence over any bandwidth at all, and so cannot be phased out by cancellation. However, K5-MBV does appear to have hit upon a perfect way to get rid of power leaks and the like. Let us know if you try it.

Scanning the literature

CURRENT MAGAZINES

Three Tubes on Three-Quarter Meters, Fred Brown, W6HPH. CQ, December, 1962, page 48.

About the only state-of-the-art material published during the month of December is this 2½-page description of a mighty midget for 432. Fred is quite an experimenter — some of you may recall his two-tube (plus diode-multiplier) two-meter rig described earlier in the year, also in CQ.

The latest venture is basically that two-tuber for two, with another diode multiplier and a final tube added for 432. All three tubes are 6AK5's; nobody is going to set any power records with this rig but it *does* deliver a quarter watt of output and has received good signal reports at distances up to 100 miles. Part of this is Fred's QTH (ye Ed once worked him with a Two'er at 120 miles!) which is some 6,000 feet up the side of Mt. San Jacinto — but a lot of it is in the rig.

Recommendation: Must reading, especially for those who think 432 Mc requires lots of fancy tubes and expensive metal-work!

In the same CQ:

Packaged Power for Six, W2LCB. How to build a 50-watt 50 Mc transmitter with a 6146. Main feature is the packaging and broad-band setup which eliminates most tuning controls. 6½ pages.

Medium Power on 6 — Economically, WA2NDM. Four-tube, 120-watt, 50-Mc transmitter including VFO. No stability figures given 2⅔ pages.

Eliminate Overload, K3HNP. Construction details on a 6-meter tunable cavity and preamp to clobber clobbering. 2 pages.

APX-6 Radiators, K2UYH. How to build an antenna for 1296 Mc. ½ page.

VHF Balun, WA2NDM. How to make a balum out of TV "elevator coils." ½ page.

In the December QST:

A Low-Noise Preamplifier for 432 Mc., W4TVP. Complete construction details for a 416B preamp for this band. Excellent if you have a 416B. 3½ pages.

A Compact Six-Meter Transmitter, K2-IUV. 100 watts for 50 Mc using an 829B. Size of rig is 3 inches high by 5 inches deep by 12 inches long. Gad! 4½ pages.

September VHF Party Summary. Compare your score with the rest of the country. 5 pages.

In the December 73:

A Stable, Two Meter VFO, W6TKA. One-tube remote-tuned unit with 6-Mc output for ARC-4. Easy to modify for other outputs. Looks good. 2½ pages.

Modifying the Sixer, K4ZQQ. How to boost the power output by 50 percent at the cost of three resistors, a capacitor, and a tube. ½ page.

Modifying the Lafayette HE-45 WA2-INM. Not much to change, but Larry found it. Looks good if you have an HE-45. 1 page.

73 *Tests the Irving Hiverter* 50, Staff. They like it. 1 page.

432 *Mc Antenna Tuner*, W1TQZ. Pictorial of a much-needed item now that power is OK. ½ page.

Coaxial Baluns, WA2INM. How to build them. 1 page.

NEW BOOKS

The Radio Handbook, Sixteenth Edition. Edited by William I. Orr, W6SAI. Published by Editors and Engineers, Limited, Summerland, Calif.

This new, brown-covered edition of the old standby of most homebrew addicts has been around for a month or more but we just got hold of a copy to look at.

Frankly, as VHF'ers we were a bit disappointed. The 15th edition (yellow cover) was crammed full of 6-meter equipment, and with the move to ever-higher frequencies we felt sure this new edition would have the same sort of goodies for 144, 220, 432, etc. It doesn't.

There are a couple of goodies, yes, and the book is well worth its (increased from 15*th* edition) price. But we wish there had been more about UHF.

Most interesting, in our opinion, was the data on strip-line amplifiers for 144 and 220. Though they're included under "Low-Power Transmitters and Exciters" (the only other VHF gear in the chapter is a 6-meter transistorized fone rig), they use 4x250's. Guess anything under 2 KW is

(Turn to page 40)

CLASSIFIED

Commercial classified advertising space is available at 25 cents per word, per month. Minimum number of words per advertisement, 10. Classified advertising submitted by individual hams which in the opinion of VHF Horizons is non-commercial in nature, 10 cents per word, no minimum. Full remittance must accompany all orders; closing date for each issue is the 5th of the preceding month. Copy must reach Oklahoma City by that time.

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TUBES WANTED — all types, highest $ paid. Lou-Tronics, Inc., 131 Lawrence Street, Brooklyn 1, New York.

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WANT SOME 220 GEAR — What have you? Want good quality low noise converter and 25-50 watt plate modulated driver rig with power supply. Have the following to offer in trade. Centimeg 432 converter, brand new with 7-11 i.f., Collins MP-1 mobile power supply for KWM-2, brand new in sealed plastic bag. 38 element Telrex Spiralray yagi for 144. Deluxe voice operated Business Radio Phone Patch ($70.00), brand new. And (as a last resort) money. Write W5KHT in care of VHF Horizons.

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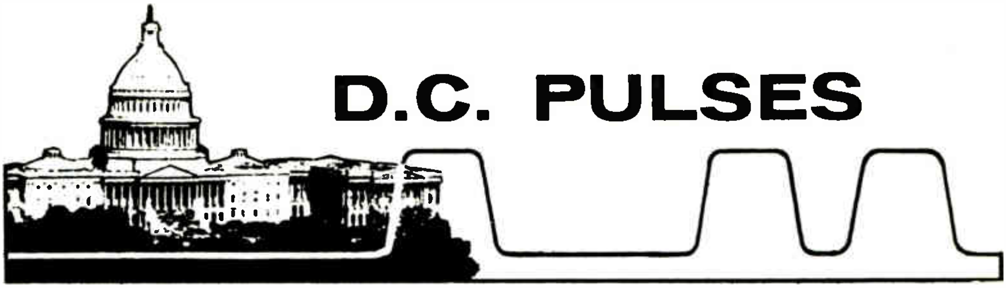
220 MC INFORMATION PLEASE — Call, frequency, equipment, schedules. Postage returned. 73, W9DJ.

D. R. P.

D.C. PULSES



Petitions for rule-making continued to dominate the ham scene in Washington during the normally quiet Holiday season. The two petitions filed both appeared to be of extreme interest to VHF-UHF operators.

Earliest was RM-389 (FCC file number), from Martin K. Barrack, WA2ZKR, of The Bronx, N.Y. His petition requested amendment of present ham rules so as to (1) remove present Novice privileges on two meters, replacing them with a CW assignment from 147.9 to 148 Mc; (2) take away all Technician privileges below 420 Mc; and (3) replace the present method of testing candidates for Technician class licenses with one providing for Extra Class theory and 5 wpm code requirement, to be taken before FCC examiners only.

No indication of any planned immediate action was available from FCC sources. Within the last several months, other petitions aimed at reducing privileges for specific classes of licensees have been rejected with statement that Commission policy is *against* "rollback" of privileges for any class of license.

The other petition was filed in early January by the Institute of Amateur Radio, Peterborough, N.H. It asks amendment of present rules to permit amateur television transmission in the frequency bands 52-54 and 145-9-147.9 Mc. Present rules prohibit TV transmission by hams below 420 Mc.

The IAR petition proposed that the rule amendment include the requirement for restricted-bandpass modulation techniques "subject to the conditions that the bandwidth of emissions shall not exceed a total of one Mc, and that the purity and stability of such emissions shall be maintained in accordance with the requirements of section 12.133."

The petition cited results of "numerous tests conducted by a variety of amateurs" which it said indicate that a standard 262½ line ATV picture can be reduced to as low as 100 lines and still yield an "adequate" picture. With 60-frame-per-second scanning speeds, such a signal would require only 400 Kc of spectrum space

Scanning . . . from page 39

considered "low" power out west, hi!

In the "Receivers and Transceivers" chapter a couple of projects caught our eyes. One was an inexpensive receiver for HF only, with a 3-Kc bandwidth. Looks like a natural for a do-it-yourself *if* tuner. The other was a "Siamese" Nuvistor converter for 6 and 2, using one chassis and power supply.

In the chapter on VHF and UHF antennas, almost no changes were made from the previous edition. The only change we found was the addition of a 13-element 2-meter Yagi (from the Orr and Johnson VHF Handbook).

Theory chapters, of course, remain almost unchanged from edition to edition. After all, the *theory* of radio hasn't been re-written lately.

Conclusion: Must for the library of any serious homebrewer. If you have the 15th, con a buddy into buying this one and share them. Otherwise, buy it yourself.

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CONTENTS

VOLUME 2 — NUMBER 3
MARCH, 1963

Features

Departments

ADVERTISING—VHF Horzons magazine accepts commercial display advertising from bonafide manufacturers and distributors of electronic equipment and associated apparatus. Advertising rate card and coverage data available upon proper request.

CIRCULATION—VHF Horizons magazine is circulated through the mails and sold over the counter at leading electronic parts wholesale houses through out the United States and Canada. 25,000 active amateur radio operators have VHF/UHF interests, and this is their publication!

SUBSCRIPTION—Subscription rate in the United States, $4.00 per year, $7.00 two years. Airmail subscription available at $7.00 per year. Subscription in Canada, Central America $5.00 per year. Subscription elsewhere $5.50 per year.

OUR COVER: All of a sudden silicon diodes are showing up in dozens of types; our cover photo (by K5JKX) shows a few of these. On page 21 Bill McNanny shows how to use them. Have fun!

SCATTER

. . . de K5JKX

ABOUT NEW STAFFERS

If you've been following our masthead on page 2 from the first issue, you've undoubtedly noticed how it's grown.

Our latest addition is W5KTR, Dick Fenwick, of Richardson, Texas. Dick was formerly W7VMP, and is one of the famed Fenwick triplets. Most of us, I am sure, remember Dick for his fine efforts in the meteor scatter realm. He is now with Collins Radio in Texas, and one of his first jobs as a VHF Research Consultant will be a complete head-to-toes checkup on the 62S1.

Dick is a specialist on antennas and propagation, and has a few ideas of his own about antenna design. They should be working out into some practical applications come spring, and you'll be reading about them in these pages.

ABOUT ERRORS, ETC.

Call them typos or what you will, our pages have been plagued with error for a couple of months.

Feedback in this business is sort of slow-acting, so it's taken longer than many of you might have expected, but we have isolated the source of trouble and are correcting it—but in the meantime we have to set the record straight about several of the more serious mistakes that have showed up in the past three or four issues.

And since it was so drastic — it completely negated the purpose of a four-page article! — we might as well start with the note from Barry Collins, W4TLV:

"Would like to point out a rather large error in the Noise Genny article appearing in the January issue. On page 4, right column, fifth paragraph, last sentence."

The sentence in question said, in print, that the noise generator wasn't much good above 50 Mc.

It should have said above 500 Mc.

Barry wrote the article — he should know.

I should have too. But it got by. All of the readers who wrote to complain about "another 6-meter gadget" were unhappy, and I can't blame them.

So take out your January issue right now, turn to page 4, and make the correction. This is a good UHF gadget—don't let my mistake cheat you out of a good project!

In the December issue, another rather large one got by — and this one would have been funny had the possible result not been so tragic.

It's on page 6; this is the schematic for Associate Editor W5HCX's gallon of suds for two.

If you look closely, you'll find that the drawing shows 2000 volts applied to the pi-net and appearing on the antenna terminals, with no voltage applied to the plates. The connection is drawn on the wrong side of the blocking capacitor.

The funny part about it is this: Russ and I both checked that drawing carefully, and found a minor error the first time around. We sent it back and had it re-drawn, then each of us went over it again after correction.

And a possibly fatal flaw got by!

Up at the beginning of this column, I said we had corrected the problem. I ought to amend that: we **think** we have it licked. Please, dear reader, let me know about every typo you find from here on in. Most other books get by without them, and I know we will too. But when you (as I do) read the same copy five times (once in manuscript, once in first proof, once in revised proof, a fourth time on final proof, and the last time on page proof) you get to the point where you see what you think is there rather than what's actually there.

Barry accused me of having blind proofreaders. That's not so, Barry. My vision is 20/400. But with a pair of stronger glasses and a couple more people checking and rechecking, we should surrender our "most errors per page" record soon. Let me know how we're doing; this can be your own personal contribution to a better VHF!

What do you think? **—K5JKX**

A 432 Kw Without Tools

A full kilowatt is now legal for use on the 420-450 Mc band—and most serious UHF addicts are searching for a simple, reliable circuit with which to reach the gallon mark.

Up until about a month ago, we here at VHF were in the same boat. We had heard rumors of a number of 432 kilowatts, but we had seen details of none.

Our in-house efforts were going forward steadily—but the result, it was obvious, was not going to be simple.

For you see, at the frequency and power level involved, such a project more often than not becomes a major problem. Ordinary tank circuits won't do, for instance. A good cavity usually requires some lathe work. Putting two tubes into a single cavity poses its own set of complications, and getting a single tube which will perform efficiently at 432 with 1,000 watts input is a major complication in itself.

That was where we stood a month ago. Then, by purest accident, we ran across an article in a foreign journal describing "A Band IV Beacon Transmitter Designed for Mixed-Path Propagation Studies."

Let's be honest. The first time through the book (Wireless World, December, 1962, issue) we skipped over this article.

But the next time through, a magic phrase leapt off the page and stopped us cold. The phrase? "On a frequency of 431.5 Mc/s."

Quick perusal of the article, written by Mr. H. L. Gibson, of the applications department of the M-O Valve Company, showed that it was providing the answer to our dream. The sketches, drawings, and schematics appearing here show construction details of this transmitter.

According to Mr. Gibson, the original rig has operated as GB3GEC from the M-O factory since January, 1962, on a 24-hour-a-day, 7-day-a-week schedule, as the transmitter end of a propagation study being conducted by the CCIR. During that entire period, only one breakdown has been reported; it was traced to a blocked air filter in the final output stage blower system.

During this time, the unit has been providing 500 watts RF power output (input power was not specified, but is estimated by VHF as 1 kilowatt).

Best of all, no machine tools at all are necessary to duplicate this transmitter. All cavities are box-type, from folded sheet metal, and no precision metalwork is involved.

Interested? Let's take a closer look.

The final output stage uses a pair of 4X250B's in a single box cavity, with the tubes in parallel. Approximately 50 watts of drive are necessary for this stage.

This 50 watts is provided by a 4X150A in a similar box cavity, running at reduced ratings.

Driving the 4X150A is a DT24 disc seal triode, giving 12 watts of power output. No ready U. S. equivalent to this British tube type was locatable; our drawings show a 2C39 in this spot although the 2C39 is a more powerful tube than would be really necessary.

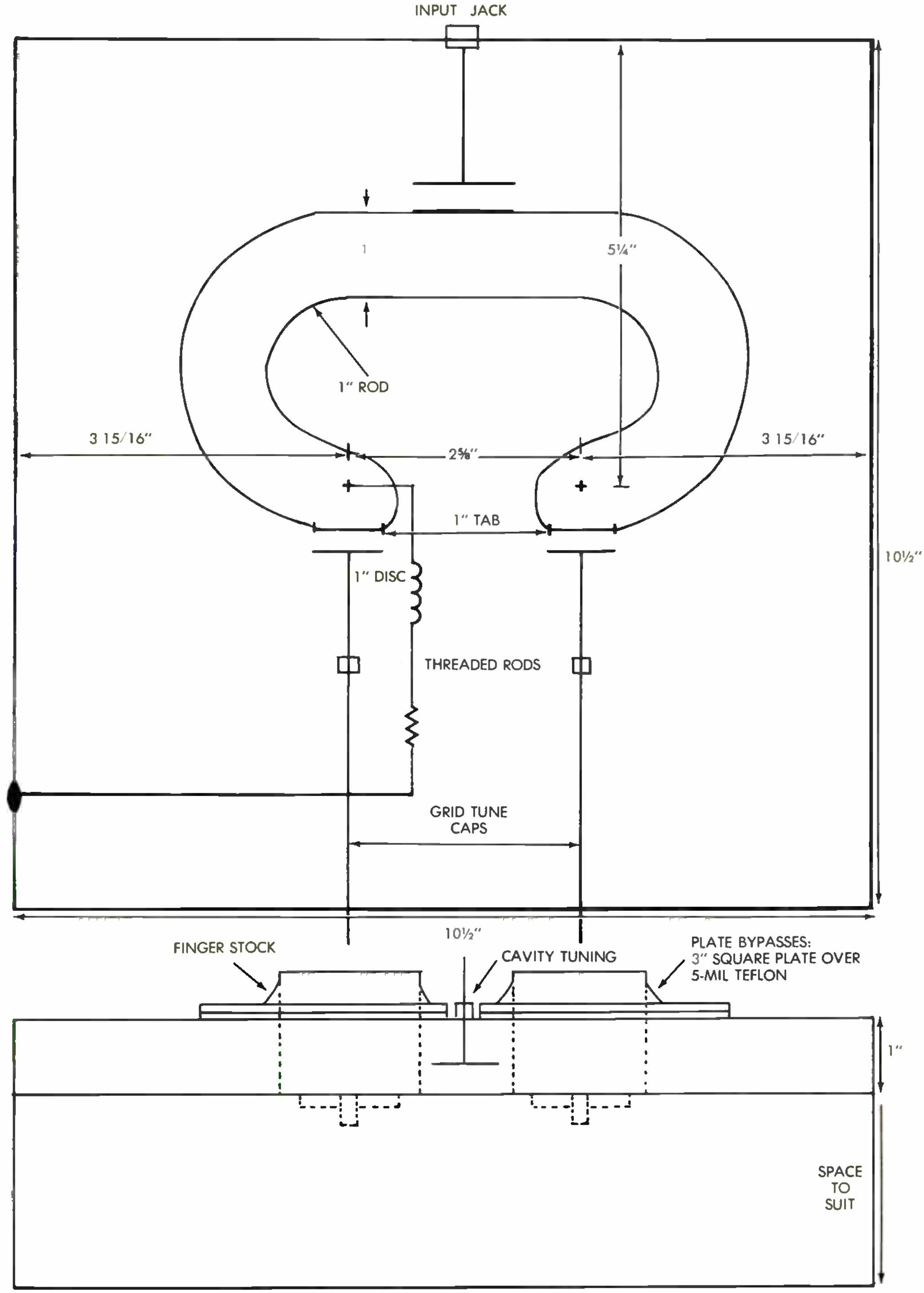
After this quick scan of the various stages of the rig, let's go back and look at the details, starting with the 2C39 stage.

This, as the schematic shows, is a grounded-grid amplifier. It is built on and around two pieces of sheet copper. One, a strip 1¼ inch wide and shaped as shown in the drawing, is bent into a box shape as shown to provide the plate circuit. The other, a flat sheet about four inches square, forms the chassis.

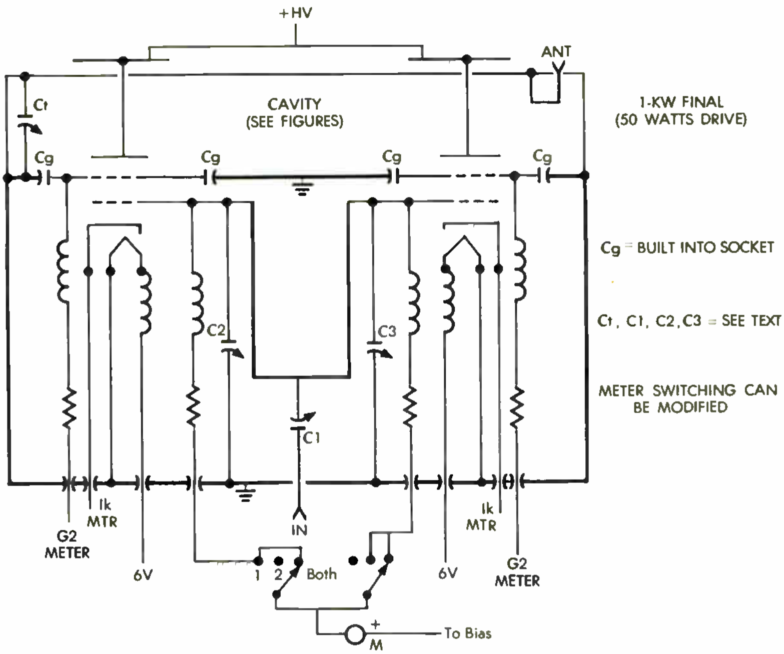
The tube mounts in a ¾-inch hole in the chassis, by the grid ring. The plate circuit is attached as shown in the sketch, with a chunk of 10-mil Teflon between to form a low-inductance bypass capacitor. The cathode is driven directly from the driving source through a series capacitor, and makes its DC return through an Ohmite Z-420 RF choke and an adjustable bias potentiometer. The pot must be set for maximum efficiency without exceeding either grid-current or plate dissipation ratings; this is a trial-and-error business.

Output is coupled from the cold end of the plate circuit by a loop as indicated on the schematic. The loop will probably be about ¾ inch in diameter, with one end grounded.

Both the 4X150A driver and the 4X250B final are constructed similarly; we'll describe



DETAIL DRAWING shows interior of cavity for final; driver cavity is identical except that sides are 13½ inches instead of 10½, only one tube is used (located in exact center), and grid line is straight half-wave affair instead of C-shaped device shown here. Material should be 1/8 or 3/32 sheet copper or brass; lighter stock may not have sufficient rigidity.



SCHEMATIC OF FINAL shows conventional grounded-cathode circuitry. Tubes should be operated at manufacturers' typical ratings; see any transmitting-tube handbook or write the maker of your tubes. Usual ratings are 2000 volts on plates, 250 volts on screens, minus 90 volts on grids, 250 mA plate current, 27 mA grid current, and 25 mA screen current.

the final amplifier and point out the differences (when applicable) for the driver.

The cavity, which determines size of the entire amplifier, is a flat square box. The final cavity is 10½ inches on a side (inside dimensions) and the driver cavity is 13½ inches on each side. These dimensions tune to 440 Mc; the cavities are loaded down to 432 Mc by the disc tuning capacitors shown in the sketches.

For both cavities, distance between top and bottom plates is 1 inch exactly. Airflow sockets for the tube or tubes are mounted on the center-line of the lower plate, in the exact center for the driver and 1-5/16 inch each side of center for the final. Holes large enough to clear the tops of the anodes but not the ceramic chimneys are cut in corresponding positions of the top plate.

The grid circuit of the final is a full-wave line shaped like a "C" as shown in the figure; that of the driver is a straight half-wave line. In each case, the line is made from copper strip one inch wide. Inch-square tabs are bent up as indicated; one at each end of the driver line, and three on the final line.

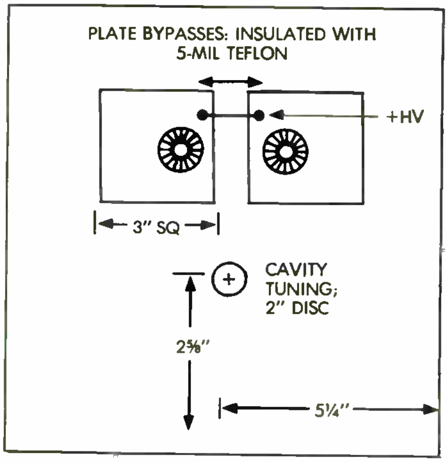
The grid circuits, as well as filament, screen, and cathode wiring, are fully shielded by a metal box formed by continuing the sides of the cavity downward a suitable distance.

In the final, grid tuning capacitors C2 and C3 consist of the inch-square tabs on the line, together with two one-inch discs running on threaded rods a la neutralizing capacitors. The discs are grounded.

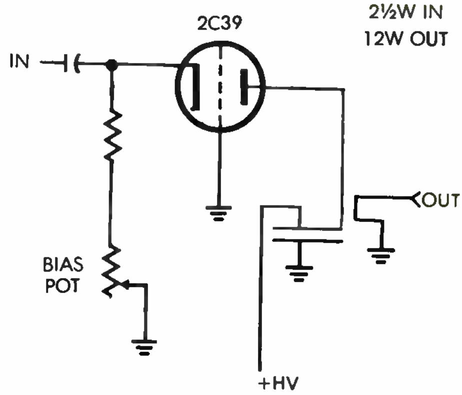
Input capacitor C1 is similar, except that the disc is not grounded. Instead, its rod continues and connects to the center conductor of the INPUT jack. Thus, C1 forms the isolation capacitor for the input circuit.

RF chokes indicated on the schematic can be Z-420's, Miller RFC-420's, or can probably consist of 9 inches of No. 26 wire closewound on high-value (27K or more) ½-watt resistors. Resistors shown should not be necessary with controlled supply voltages; the tubes should be operated at manufacturers' typical recommendations.

About the only thing left unexplained at this point is capacitor Cg on the schematic; this is the bypass built into the air-system socket. Ct, of course, is the cavity tuning capacitor, a 2-inch diameter neutralizing type.



TOP VIEW of final cavity shows construction of HV bypass capacitors and location of tuning capacitor.



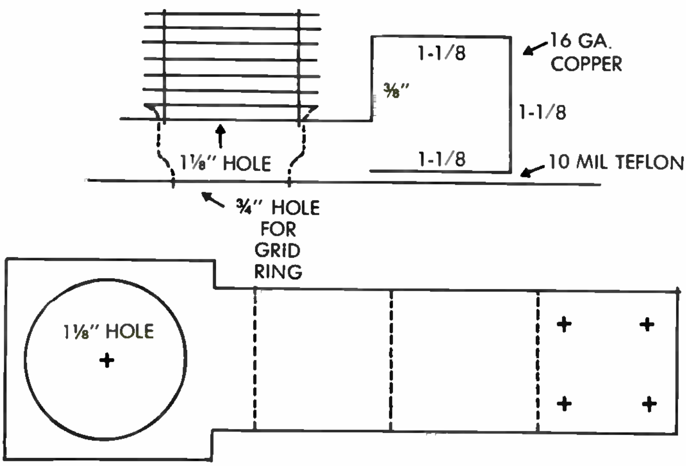
SCHEMATIC OF DRIVER shows simplicity of grounded-grid 2C39 stage. See text for details.

The HV bypass consists of a pair of 3-inch square copper sheets sandwiched to the cavity top plate with a sheet of 5-mil Teflon between. Eimac finger stock or something similar is used on each plate to make good electrical contact with the tube anode. Since these plates will be at approximately 2500 volts in operation, a screen-wire safety enclosure should be arranged to prevent any accidents!

The top view of the final cavity shows location of the tubes and the cavity tuning capacitor, but does not show the output coupling adjustment. This consists of a small loop located exactly opposite the tuning control; a coax connector (Type N) may be used if desired. Coupling is adjusted initially by varying the size and orientation of the loop. Once determined, it should require no further adjustment.

In the original rig, the output loop could be rotated to vary coupling; this complication is probably unnecessary for our purposes.

Just as a teaser, a P.S.: We know of no reason at all why this rig couldn't be used as is, simply by changing the voltages a bit, as a linear. Anybody for SSB on 432?



DRIVER PLATE CIRCUIT consists of sheet-copper stock cut and folded to shape shown here.

Medium Power From the Junkbox

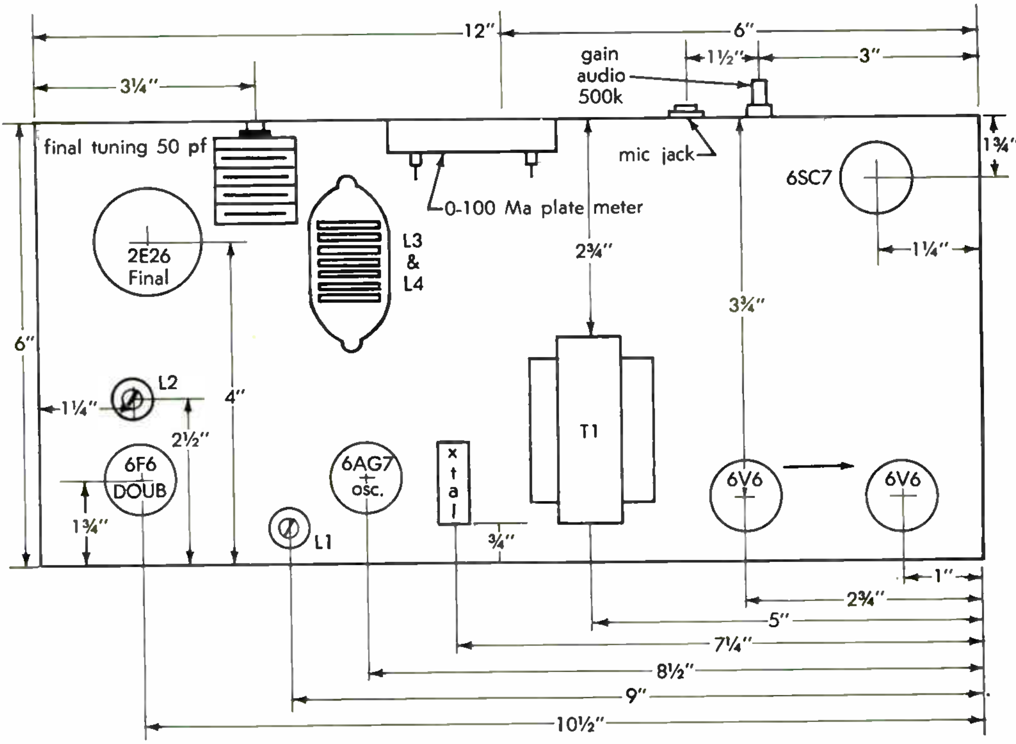
by JOHN A. FREDERICKS, K7GGJ
314 South 13th Avenue
Yakima, Washington

For some time now, I have been concerned about the new amateur who after having been on the air for a while on the DC bands wants to try operating in the VHF regions. This fellow, after looking around at VHF gear on the market today, is probably in a total state of confusion after trying to decide what to invest in. If you are one of these undecided, would be, VHF amateurs, then read on; this is for you, a six-meter rig that can be built from the junk box or that old TV set collecting dust in the basement. What better way to learn VHF than to build your first rig?

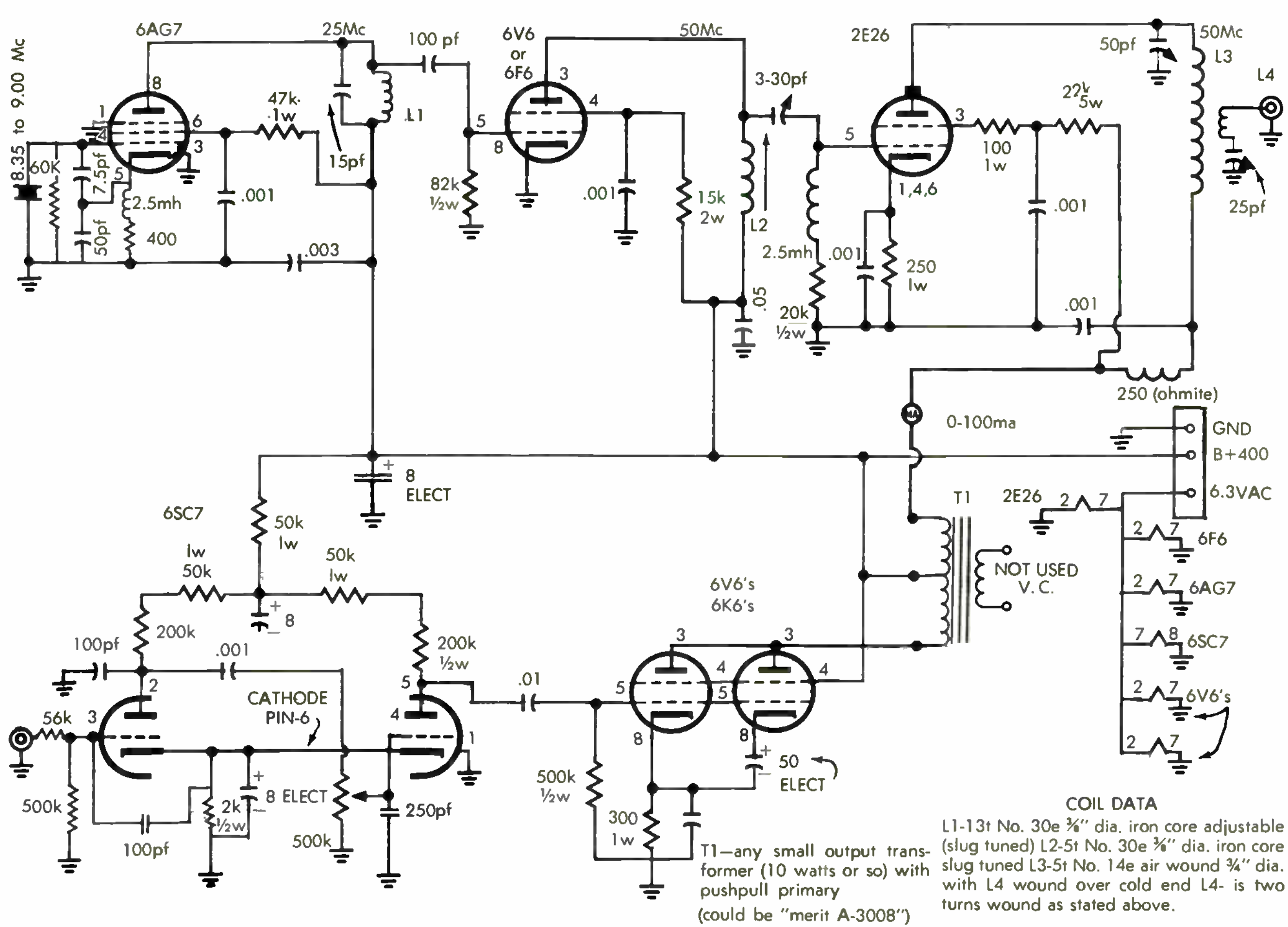
CONSTRUCTION

The rig described herein was built on a 6 x 12 x 2" open end chassis but any chassis of suitable size would suffice. As can be seen by Figure 1, I have employed the old (but good) 6AG7 as the crystal oscillator, in a grid-plate configuration. It employs the plentiful surplus rocks in the 8.35 to 9.00 Mc range for 50 to 54 Mc six-meter operation.

As can be seen in the diagram the crystal frequency is tripled in the osc resulting in 25 Mc output. The 25 Mc drive is then fed to the control grid of the 6F6 doubler which in turn drives the 2E26 final. The 2E26 final is nothing out of the ordinary, except the Sg neutralization resistor R, which must



PARTS LAYOUT of original junkbox rig is shown in this drawing. It is not critical but following it as closely as possible will help avoid neturalization and parasitic problems.



SCHEMATIC DIAGRAM of junkbox rig shows simplicity of construction. Almost all parts can be stripped from salvage TV chassis; very little is critical in this unit. Parts layout is shown in separate drawing. Unless otherwise specified, capacitor values without decimal point are in pF (micromicrofarads) and those with decimal point are in microfarads. Resistors are ½-watt composition units unless otherwise specified.

be a 100 ohm composition type. I also might state at this time that if this is your first VHF rig don't forget to keep all leads in the RF deck as short as possible.

The audio portion of this rig is a little out of the ordinary. As can be seen in Figure 1, the 6SC7 preamp-driver stage is of common design but, the 6V6's in the modulator section are another thing. You will notice the modulation transformer T1 is not really a modulation transformer at all, but, rather an audio output type of the variety used in PA systems and the such. At first glance you may think you see a form of choke-coupled modulation but it is not choke coupled modulation at all, it is just a form of transformer coupled modulation.

TUNE-UP

Tune-up of this rig is very conventional. First apply filament voltage to all tubes and B plus to the oscillator only. On a calibrated receiver, look for the third harmonic of the crystal frequency. When you are sure that the oscillator is putting out, lift the 82 K grid resistor of the 6F6 doubler above ground and insert a 0 - 5 Ma meter in series with the grid resistor to ground. Tune L1 for maximum grid drive (2-3 Ma). Now apply H.V. to the doubler stage and repeat the operation at the grid of the 2E26, tuning L2 for maximum grid drive to the 2E26 (3½-4 Ma).

With the above operations completed, you are ready to go on the air. First apply filament voltage and allow tubes to warm up, then apply H.V. and tune final tank capacitor for the dip and maximum output. This should be about 50 Ma with 400 volts on the plates. Now insert the mike, and make some 50 Mc contacts!

CONCLUSION

Since most of the parts for this rig were scrounged from an old TV set, the power supply was also robbed from the one eyed monster but any supply in the 300-to-400 volt region should do the trick.

How does this rig get out? Well, let me say this: it runs neck and neck with my 829B rig on 50 Mc on every form of propagation except extended ground wave. The modulation? It leaves little to be desired as far as talk-power is concerned!

About Converters

by Jackson L. Cox, WØKMV
Hi-Tronics, 4716 Evanston
Kansas City 33, Mo.

Until recently, the commercial market had not provided the VHF operator with a good VHF receiver. So, lacking this receiver, the VHF'er was forced to use a receiving converter working into a general coverage or ham-bands-only receiver.

As many ops can testify, converters at times leave much to be desired, especially in the area of birdie and image rejection, not to mention such things as gain, signal to noise ratio, cross-modulation and broad band characteristics. It is hoped this article will help clear up some of these problems.

The "noise floor" on any VHF band is that region where atmospheric and man-made noise limit the readability of the weak signal. On six meters, it is relatively easy to reach and go below the noise floor with inexpensive tubes. A noise figure of 3 or 4 db is generally considered adequate on six. There are some locations where a better noise figure MIGHT be used to good advantage, but this is controversial. Some experienced VHF men will say yes, while others will heartily disagree.

On the amateur bands above six meters, tube types and how many to use must be given careful consideration. Some tube types will provide a lot of gain at these frequencies, but due to the internal structure as well as the electrical characteristics, the noise figure will be high.

For these reasons, the tube type should be carefully selected. If you are an avid VHF man, interested in working the "long, weak stuff" you had better forget price and get the best available. With some of the new types coming on the market, even price can be disregarded. For example, the 6CW4 and 6DS4 Nuvistors are capable of delivering a noise figure of 3 db at 144 Mc. if carefully adjusted. Price of these tubes in most areas is under $3. A newer and better tube is the 7788 recently announced by Amperex. According to Amperex and VHF HORIZONS (1) this is the hottest thing to hit the "low noise, low cost" market. Although no actual noise figures have been published for this tube when used in a circuit, it would appear this is the tube to end all tubes. Priced at about $11, this 7788 should be the answer to the small ham fund, high idea VHF operator. Presumably, only a parametric amplifier would be better.

The number of RF stages used should also be carefully considered. The first RF stage must be the one determining the noise figure of the set-up. If more than one RF stage is used, the second tube type can be one of the less expensive ones because, as stated before, the first tube will determine the noise figure. More about gain of these stages later.

Mixers are noisy little devices, but a necessary evil. With careful thought in the design and type of mixer, most of the difficulties of mixers can be overcome.

When considering the mixer type to be used, several things must be borne in mind.

1. The mixer should provide little, if any, gain. Running a mixer at low level will help reduce cross-modulation, as most cross-modulation does take place in the mixer. With the newer tubes used in RF amplifiers, cross-modulation has been reduced so as to be almost non-existent in the tube itself.
2. The local oscillator and the way its signal is injected into the mixer is another important factor. In some circuit designs using Nuvistors as the mixer, cross-modulation can be very bad if the local oscillator is injected at the grid along with the signal from the RF stage. This cross-modulation can be eliminated completely by raising the cathode of the mixer 120 ohms above ground and injecting the local oscillator at the cathode. This requires a little more injection voltage than is necessary at the grid. This can also be applied to other tube types by using the correct cathode biasing resistor. Do not bypass the cathode resistor.
3. The amount of injection voltage at the mixer will have some bearing on the noise figure of the converter as a whole.

There being a large number of mixer circuits available, the designer should not have difficulty selecting one for his particular needs.

Local oscillators can be ticklish problems at times, especially with frequency stability and the harmonics of the oscillator or multiplier stages mixing with local FM and TV stations and causing images to appear in the IF range. It is impossible to design an oscillator that does not have harmonics. There is one circuit (and possibly more) however that is low in harmonic content. This is the transitron circuit. (2)

The transitron oscillator is excellent in the stability department also. If working SSB on VHF is contemplated, the stability of the converter oscillator as well as that of the oscillator and/or oscillators of the IF receiver must be given careful thought. Using the transitron should more than pay off in stability for the extra components required in this circuit.

For maximum stability, any oscillator should be lightly loaded. If more injection voltage is required, this should be obtained through the use of an amplifier. This amplifier will also help increase the stability of the oscillator.

Now comes that subject of gain. It is my contention (I will get some arguments on this statement) that the RF stage or stages should provide only enough gain to:

1. Set the noise figure of the converter. The RF amplifier must provide enough gain to override the mixer noise.
2. Supply enough signal voltage at the output of the mixer to allow the IF receiver to operate at its best signal to noise ratio.
3. Allow the circuitry of the converter to be broadbanded to the extent desired without causing an appreciable drop in the output voltage of the mixer.

A converter should be just what the name implies. Convert one frequency to another, and let the communications receiver used as the tunable IF supply the necessary gain.

When a converter is being used, the receiver should operate no differently than when switching from one band to another. In fact, the converter might be considered as an additional set of coils on the bandswitch. Using a modern receiver, the RF-IF stages will provide more than sufficient gain for proper operation on the VHF bands.

The use of more than one RF stage is something that should be given much thought before installing them. More than one RF stage will provide good image rejection, but will supply the IF receiver with a high noise level if the RF stages are not adjusted properly.

If more than one RF stage is used, they should be adjusted to supply no more gain than a single stage operating normally.

A properly designed and working converter will cause the "S" meter to rise no more than one or two "S" units when it is turned on.

As stated by Russ Miller, W5HCX, in his article on the 7788 two meter converter, (3) and I quote; "Lots of noise is perhaps the best indication of a poor converter or poor alignment technique. The mistaken tendency to use noise as a measure of how hot a converter is prevails to this date. Using this as a yardstick for converter sensitivity will net you lots of local contacts and NO DX. A few quick checks with a weak on-the-air signal will show that the noise can be reduced without significant reduction in signal." Unquote. This is one of the truest statments about converters to be printed in a long time, and you had better believe it!

Receiver "S" meter readings mean nothing if the noise level contributed by the converter is high and is pushing the meter up. How many times have you received a signal report of 20 to 30 db over S9 and later found out (maybe you never did know) that the "S" meter on the other end was already reading S9 from noise contributed by the converter alone? This means you were only S3 to S5 above the noise level on that receiver. Quite a difference, especially if you were checking a new rig or antenna. The only true way to judge a converter is how well the received signal quiets the noise or how good a weak signal can be copied. Owing to the difference in meter readings and the amount of signal required to read a given level from one receiver make to another, and even from one receiver to another of the same make and model, "S" meter readings serve only as a tuning aid or a reference point.

An additional point to remember is that maximum signal strength indication and maximum noise indication do not always occur at the same setting of the IF receiver's antenna trimmer. This condition will exist with some setups, and can be readily seen by peaking the antenna trimmer on noise alone, noting the reading, and then tuning in a signal near the frequency where the trimmer was peaked on noise. After tuning in a signal, repeak the trimmer and then tune off to a clear spot. Many receivers will show a reduction in indicated noise level by as much as one or two "S" units.

All along, the IF receiver has been mentioned, but not much has been said about the IF range to choose. A good rule of thumb is: the IF range should not be less than 5% of the converter frequency to provide good image rejection. 10% to 50% is even more desirable, with anything above 75% starting you back down the other side and approaching the 5% mentioned earlier. Actually, 5% is too close for the best image rejection, as can be seen with a little figuring.

Properly designed converters will show little if no overload in the converter itself. Most overload problems will then take place in the IF receiver. This is caused by too much gain in the converter, supplying the receiver with such a signal level that the receiver's AVC circuitry can't handle it. Also cross-modulation can take place in the IF receiver. This again is caused by too much signal from the converter.

If the converter is supplying an S8 or S9 noise level to the receiver, then an S9 signal appears 54 db over the noise. This is the upper limit of most receivers, and from this point on, the AVC has no further effect on the RF-IF stages of the receiver. Consequently, it overloads or blocks.

Little has been said about alignment of the converter. I will touch on it only lightly here, as an excellent article appeared on page 24 of QST for October, 1958. I strongly recommend this article be read and carefully studied.

Also, the article on page 10 of QST for July, 1953 is highly recommended reading. This article deals with noise generators and their use.

One point in the alignment process to remember is that proper impedance matching between the converter output and receiver input is important. A proper match will provide more and better signal transfer, as well as eliminating the necessity of repeaking the antenna trimmer as excursions are made up and down the band.

REFERENCES:

(1) VHF HORIZONS, August and September, 1962.
(2) September-October, 1962 G-E HAM NEWS and January 1960 QST.
(3) September, 1962 VHF HORIZONS.

Three Cheers for Our Advertisers

(and our readers too!)

The growth of VHF Horizons has been a steady one. We've been told by our readers that this is because this publication is a magazine **for** amateur radio **by** amateur radio licensees.

This is not by accident. When VHF Horizons was originally conceived more than 18 months ago it was to be a magazine that made every possible effort to stay current and up-to-date with the very latest techniques and operating news of the world above 50 megacycles. One of our strong points is the wonderful group of Research Consultants and Editors we have been able to bring into the fold.

It surprised us not a little bit to learn that our early editions were showing up in Research and Development labs being read by non-ham engineers who are individually charged with the development of the newest and most effective communications equipment. It surprised us not a little bit to see our circuits end up in prototype commercial units. After all, hasn't it been said that with the advent of the microwaves the day when the ham would be making significant contributions to the nation's electronics know-how was all over?

It has been said. It is not true. Not even a little bit. Bill Ashby's (K2TKN) Log Periodic microwave antenna, Russ Miller's 7788 converter series and various authors' treatments of sideband at VHF have attracted an uncommon amount of commercial communications designers' interest. And when the engineering departments in the nation's many R and D labs began to use our material it was not too surprising to find their sales departments taking notice of our existence.

The end result? Advertising. Not a lot of it. But a most excellent start. We are happy to see it because it proves that a ham publication that stands on nothing but the tried and true adage that **"we have something new and unique to offer our readers and the communications industry"** has a most excellent chance for survival.

Is communications electronics still dominated by amateur design and development? You bet it is! And every one of us can be proud of the fact that it is!

D.R.P. Report for the Month of February

From Amateur Radio Station .... QTH ....

This month we built the following ....

.... And we improved the following gear ....

On the air we worked (DX— list date, time, call) ....

....

New VHF calls heard on locally ....

....

Articles we enjoyed in March issue ....

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Oklahoma City 1, Oklahoma

More on Meteor Scatter

by Jack T. Woodruff, W8PT
RFD 3, Box 157, Benton Harbor, Mich.

This is written primarily to be of interest to the few of us Meteor Ping Jockeys who take our two-meter meteor scatter work seriously.

Enough attention is not being paid to our angles of radiation. This is usually a factor of the height of the antenna above ground. The only station I know to be doing something about it is K4IXC who can vary his antenna height up to 100 feet above ground and his outstanding signals here in Michigan, shower or no shower, prove that John knows what he is doing.

Another example of this effect is WØIUF who has a fine, high elevation but whose antenna is only 30 feet above ground. His signals during the Geminids were extremely weak here in Michigan and Art, W8KAY, in Ohio only heard a few pings on him. If Tom's antenna was up higher his lowered angle of radiation would have brought his signals in Michigan way up and he probably could have worked W8-KAY with ease.

A table of distances versus height above ground for antennas was given in Walt Bain's (W4LTU) "V.H.F. Meteor Scatter Propagation" in the April, 1957, QST. This article has become the Ping Jockey's Bible. This table, in case you don't have one, reads as follows:

I hope a (another) word to the wise will be sufficient. K4IXC puts some signal into Michigan every time his beam is pointed this way. Not bad for 1100 plus miles on two meters.

Just to be thought-provoking let's discuss antennas in general. Most of us use Yagi arrays because they are the simplest way to get good gain with a minimum of effort. Yet a study shows the main vertical lobes of Yagi antennas are so high that they are just warming the clouds. We are only making use of the minor lobes having lower angles of radiation and trying to build them up with extended lengths, stacking, etc.

This is successful to a degree and makes a good all around antenna, useful for the higher angles required for Aurora work, and fairly satisfactory for tropospheric and meteor scatter work. But a different type of antenna with a lower angle of radiation even though it has less gain should be more effective.

It is the writer's intent to someday try a Sturba Curtain because of its known low angle of radiation. It will be about 24 feet long and rotatable but there is no reason some of our western stations can't try fixed wire arrays of this configuration. For instance, stations in Omaha or Salt Lake City could catch San Francisco off one side and Chicago, Detroit, Cleveland and from New York or even Boston to Philadelphia off the

Height	Wave Angle		Distance
Wavelengths	Feet at 2 meters	Degrees	Miles
1	6.8	14.5	430
2	13.7	7.0	720
3	20.5	4.7	900
4	27.5	3.5	1020
5	34	2.8	1090
6	41	2.4	1130
8	55	1.75	1230
10	68	1.4	1280
12	82	1.2	1310

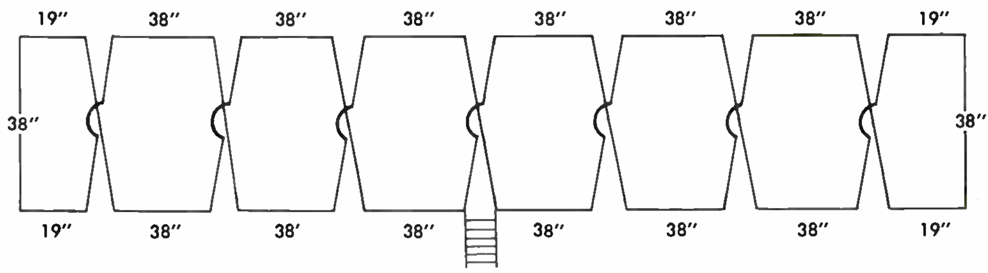
(For 100 Km. Meteor Height)

other side. There is no end to the possibilities. Mine will look something like Figure 1, and will be stretched between two wooden support arms about four feet apart vertically. Then the whole works will be put on a vertical rotating mast out of the top of the tower.

The antenna is bi-directional so some of you may want to add reflectors. I will not attempt to calculate the gain but I expect it will be about 15-17 db. These curtains can be lengthened or stacked as the builder desires. They can be fed thru a stub or used with an antenna tuner. They are not critical as to frequency. The pattern is bi-directional thru the page.

One more thing. You don't need high power to work m/s although it helps. Tests run between New Hampshire (W1AZK) and Michigan when Don was only running 100 watts were quite successful. If you have low power be sure your feed line losses are way down. (It helps on high power, too.) M/S should be workable with as little as 50 watts IN THE ANTENNA.

Code speed: Naturally the faster the better. If you can't send fast with a bug or keyer make an automatic device such as a code wheel or a tape recorder with a keying relay. If your code speed is only 12-15 W.P.M., I'll bet you can recognize your own call at 25 and get his call when you already know what it is. However, I have worked guys on M/S who were only sending 7 or 8 W.P.M. so don't be afraid of it. Write for a sked with those states you need within 1500 miles. It is the usual practice that the Western station takes the first 30 seconds. Use the procedure given by W3TDF in the October 1962 issue of VHF Horizons, set your clock's sweep second hand to WWV or CHU and Let's Go!



STERBA-CURTAIN ARRAY as antcipated for meteor-scatter usage by W8PT. Dimensions are in inches; see text for construction details.

Dinner

The Southern Tier Radio Clubs of Broome County (N.Y.) will hold their 4th Annual Dinner at 7 P.M. on March 30th, 1963, in St. John's Ukranian Hall, Virginia Avenue, Johnson City, N.Y.

Tickets are $3.50 per person, and reservations must be made before March 25th.

There is entertainment scheduled, and prizes galore.

Letters

Dear VHF:

I agree about the class-consciousness business. I think all the classes are going to have to start working together, before someone really gets the frequency grab going again.

Keep up the good work on the magazine.

73
James P. Weiland, K9DNW/7
Box 232
Pinedale, Wyoming

Dear VHF:

If you can find the space, I would like for you to announce the fact that I am in the process of publishing a durable, igh quality VHF Directory, covering an area in a 200 mile radius of Birmingham, Alabama. This includes Memphis, Nashville, Chattanooga, Atlanta, Mobile, Huntsville, Tupelo Mississippi, etc.

I would like all VHF ops in this area to send their names and addresses to me, Wayne Eason, WA4ISG, Editor, 1803 11th Ave., Haleyville, Alabama. We hope to have it ready by the first of May. The cut off date for names appearing in the first issue is the fifteenth of April.

Fraternally yours,
Wayne Eason, WA4ISG

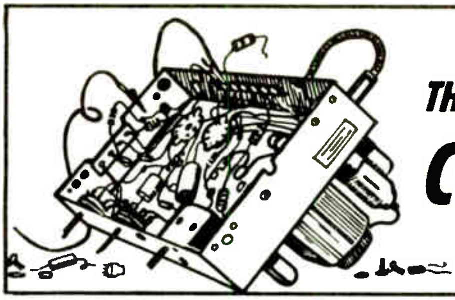
Wayne—
Here's the space. All you need now are the names.

Dear VHF:

Hi to you from W4TKV, W4UII and W4NUT. Keep the good construction articles coming. First thing we ever built from an article that actually worked as built from the printed plans! Have built your D5B rig (Sept. issue) with no problems and have had many FB reports. Congratulations on printing construction articles that work.

73
Capt. George Hunt, W4NUT
Dave Pitkin, W4TKV
D. Hurley, W4UII

Airmail Your D.R.P.!



THE CONSTRUCTION BOX

Quick Octal Plug

One often needs an octal plug when the regular stores are closed. You might be able to take the plug off a regular tube, but then you have the danger of exposed wires. A much safer method is to take a metal receiving tube (often junked by repairmen) and remove the bottom part of it which is the plug. Then break off the sealing tube by striking it sharply with a screwdriver, while holding it away from your face.

Now take a pair of long needlenose pliers and take out the inner parts of the tube. It is then possible to drill a hole in the top of the metal enclosure, make your connections, and fit it all back together, thus forming a perfectly safe, complete, octal plug.

(EDITOR'S NOTE — Another way to do this is to take a burned-out or broken 2E26 or 6146, clean the base, and solder a plate of brass or copper over the top after making your new connections to the pins.)

—WA6KCM

Broadening the 75A4

We all love the selectivity of the Collins 75A4 for ability to separate even those surplus-crystal jams during contests but in everyday operation we're more likely to curse it as we tune hurriedly from station to station.

This modification will give about 30 Kc of bandwidth, with no permanent change to the receiver.

Get a Merit BC-369 455 Kc if transformer or equivalent (one that can be tuned from the top is a must) and a 9-pin socket saver (Model S 3-9, Pomona Electronics). Reverse the center screw of the socket saver. Mount the socket in the center of a 3/16 inch wide metal strip cut and drilled to match the if can screws. Remove the if transformer from the can, heat wax around lower coil, and quickly move it to within 3/16 inch of top coil. Connect red lead to pin 1, blue to 2, green to 7 and black to 6.

Insert this unit in the spare-filter socket of the 75A4, and adjust the trimmers of this if can until the signal through it equals the signal through the 3-Kc filter. Peaking is not the point here, and result will probably be best with slugs nearly all the way out.

To unmodify 75A4, unplug the unit. Total cost, about $4.

—W4BUZ

2-Meter TV Interference

Those 2-meter operators living in an area where TV channels 4 and 5 are in use may experience a rough form of interference peaking at 144.5 Mc. It's caused by intermodulation produced by the two video signals at the grid of the first RF stage. One way to eliminate it is a cavity-type filter between antenna and receiver. Another is a quarter-wave trap stub cut to either 67.25 (channel 4) or 77.25 (channel 5) Mc.

(EDITOR'S NOTE: Channels 4 and 13 cause the same problem at the low end as they are exactly 144 Mc apart; the same cure applies.)

—KØHEI

Quick, Inexpensive Chassis

The next time you need a very inexpensive chassis for a bias supply, converter, etc., try an empty square cigar tin. If you don't partake of stogies yourself, it's no problem to find a friend who does.

To use as a chassis, case, etc., merely remove the paint from the outside with steel wool and a little paint remover.

The cans at K1QIC originally housed El Producto Blunts, but they now provide a compact case for the FCV-2 converter, transmitter shields, and small-parts containers.

—K1QIC

A One-Tube Product Detector

by Harold D. Mohr, K8ZHZ
5670 Taylor Road
Gahanna, Ohio

A product detector is almost a must when receiving VHF SSB signals, because of the hi-gain preamps in most VHF converters. The resulting signal level at the detector is too high for satisfactory results with most diode detectors.

However, those of us with older (or surplus) receivers face a problem in adding a product detector, due to lack of space for the two tubes usually required by conventional circuits.

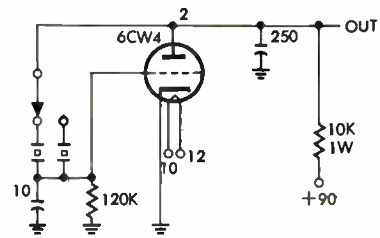
One solution for us was published in the July, 1962, issue of Electronics World, by W2OKO — but it required four Nuvistors and the cost proved a handicap to me at least.

I found another solution — the 6EZ8 triple-triode tube. This 9-pin miniature can fit in almost any small corner; I am using it in a BC-348 with the original BFO. To use it with a BFO-less receiver, build the Nuvistor BFO shown also.

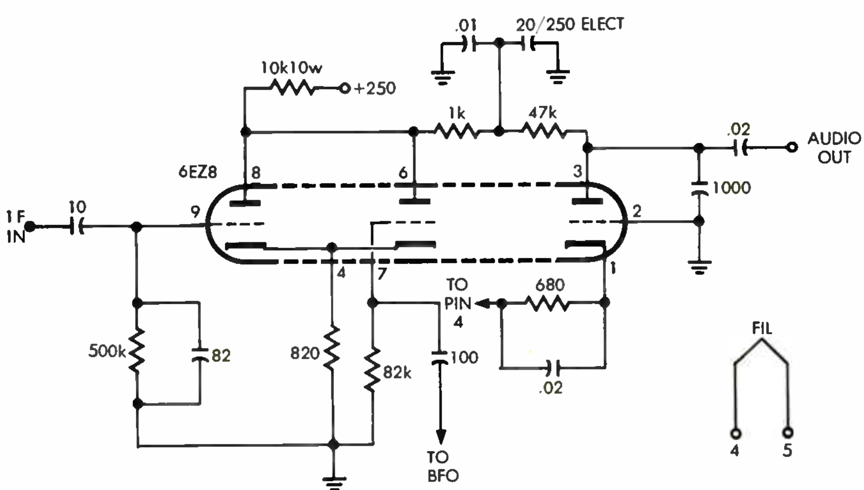
The product detector can fit on a 2 x 3 inch chassis; mount it with short, shielded leads to the if and audio. A DPDT switch can be wired to switch audio and the BFO.

All resistors are ½ watt except the B-plus unit which is 10 watts. This resistor and the 82 pF grid capacitor may have to be changed; the target is about 0.2 to 0.4 volt RF input to the unit with a plate voltage of approximately 150.

The BFO can be even smaller; crystal frequencies should be about 1500 cycles above and below the receiver if. Plate voltage on the 6CW4 should not exceed 90 volts.



BFO SCHEMATIC shows wiring of Nuvistorized BFO, if your receiver's BFO is not satisfactory for SSB operation. This tiny unit can be placed almost anywhere.



PRODUCT DETECTOR SCHEMATIC shows how one tube can perform the functions of three. See text for details concerning B-plus resistor and input grid capacitor.

VHF Showcase

MOBILE AND BASE ANTENNAS

A firm well-known in the commercial-radio antenna field has entered the amateur market with a complete line of 6 and 2 meter whips and ground planes, reasonably priced, and built to perform.

It's The Antenna Specialists Company, 12435 Euclid Avenue, Cleveland 6, Ohio. They've just issued a 12-page catalog of their new ham line. Some typical units included are cowl-mounting 3-db-gain whips for 2 meters; helical-loaded whips for 6 only 37 inches high; a 6-db-gain ground-plane type for Six; and many others too numerous to list here.

For your own copy of their new catalog, which includes a handy element-length chart, drop a note to Bob Beebe. Tell him who sent you.

100-WATT HF/VHF TRANSMITTER KIT

A 100-watt 6-meter transmitter, with coverage also of the HF bands from 80 through 10 at 150 watts input, and priced at less than $120, has been announced by Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.

(They don't really bill it that way, but the 100 watts on 6 is probably more important to the VHF addict than the 150 watts on lower bands.)

The rig is the Knight-Kit T-150, priced at $119.95. In its 28 pounds, it packs full power supply, RF deck, and modulator. VFO control for all bands is another feature.

For full technical details, write J. W. Rubin at Allied. He'll be happy to help you.

STABLE VARIABLE CAPACITOR

A variable capacitor especially designed for UHF VFO circuits, with the emphasis on accuracy, stability, and resettability, has just been announced by Hammarlund Manufacturing Company, 53 West 23rd Street, New York 10, N.Y.

The new unit, designated type VU, features pyrex glass ball bearings. It also has no wiping contacts or uncontrolled masses, thus reducing sources of frequency instability to a minimum.

The new capacitor is available in three basic sizes. Full specifications are available on request; write Frank Lester, W2AMJ, at Hammarlund, and tell him who sent you.

THREE SUPER CONVERTERS FROM TECRAFT

The Equipment Crafters (Tecraft), Box 84, Hackensack, N.J. have announced three new extremely low noise converters for six, two and 220. Kurt Treptau, originator of the now famous T-Craft line of high gain VHF converters, tells us the new units are the Cadillac of VHF converters. For example, each uses two neutrode nuvistor R.F. stages which can be optionally AVC or manually controlled for gain. The mixer stage is a single 6JK8 low noise dual triode for optimum mixer performance, followed by a cathode follower I.F. 144 Mc Noise Figure is 2.1 db with in excess of 30 db gain. You have two up-top crystals for switchable I.F.'s and an attenuator to knock down the converter gain output to the communications' receiver I.F. strip. I. F. outputs run from 6 to 35 megacycles which means you can use the I.F. range in your receiver which gives you best bandspread. Full details are available from Tecraft.

DXpeditions
I Would Like to Take

by Bob Cooper, Jr. W5KHT
Publisher, VHF Horizons

Well, it was just ten years ago this month that I began to take a serious interest in why VHF radio signals acted as they do. First there was my interest in long distance television reception, then my novice ticket and my two meter operation as KN6EDX (from the top of every inaccessible mountain crag in northern California), and then one day in 1954 I managed to get on six meters.

Throughout this period and actually right up into the early '60s I found myself eking out a meager subsistence writing articles for magazines and keeping a regular spot in Radio Electronics magazine filled with TV-FM DX Reports.

During the course of my short but hectic career as a gatherer of reports of strange transmission and reception in the VHF-UHF spectrum I have on occasion sat back and mulled over in my mind the prospect of traveling to some far-off spot to operate as a portable this or that on 6, 2, 220, and 432.

Unlike my fellow HF and LF ham friends in California who forever seemed to be flying off to TG9 or ZC5 I was more interested in locating in a spot which television DX or other forms of VHF DX reports indicated had excellent VHF DX possibilities. You see it takes only a half-way decent television receiver and a fair to middlin' television antenna to spot signs of DX signals. And if you live in an area of the world where there are few if any local television stations, you have it made—so to speak. Anything you see is DX.

Now of course DX is relative. And to my way of thinking an ideal VHF ham-band DX spot should be one that filled the following criteria:

(A) Must be located in some exotic spot not represented by local VHF activity.

(B) Must be fairly accessible (I'm not the rugged type).

(C) Must have adequate substantiation of DX potential back to stateside locations.

Item (C) is the trigger. The spot picked must be one where someone with a fair interest and knowledge of TV DX reception has actually observed over a period of time sufficient TV DX signals from the states to qualify the area for 6 and 2 meter operation.

Needless to say, item (C) eliminated a fair number of otherwise desirable locations. But not all of them.

And, of these that it did eliminate, there are two which intrigue me just enough anyhow that I am not above considering both for VHF DXpedition work during the next sun spot cycle . . . if it proves to be comparable to the recently completed cycle.

Now I'm not one to hog all of the locations to myself. Not by a darn shot. Mainly because if I can get someone else to go there, I can stay home with my kilowatt and 24-element array and work them too!

Thus the ground work is laid for my treatment of 'Three DX Locations for VHF.'

YUCATAN PENINSULA, MEXICO

During the period 1953 through 1958 I had a regular reporter to my Radio-Electronics TV DX column from Merida, Yucatan, Mexico. During the period 1956-58 I had some backup reporting from another lad located in Belize, British Honduras.

Pull out your maps of the Caribbean. Merida is located on the water line of the northern edge of the Yucatan, approximately 725 miles south by SE of Houston. From Brownsville clear on east around and to the southern tip of Florida is an arc that travels over water—all the way—to the states.

The OM reporting from Merida was a ham, an HF type, with an XE3 call. His interest in playing around with television DX stemmed from his livelihood, repairing and installing radios and other audio equipment. He had ordered from Allied Radio a TV chassis and 'deep fringe' all channel antenna, which he located on a 40-foot mast. He was less than 10 miles from the beach.

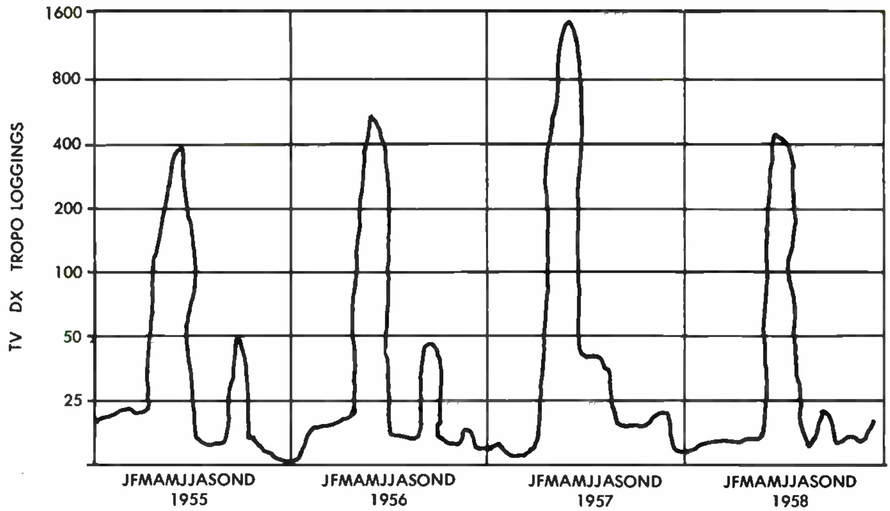


CHART shows incidence of tropo openings from favored DX regions to mid-U.S. during four-year period. Note regular recurring pattern.

The lad down in Belize used to be located (remember they had a bad hurricane down there two years ago) right in the heart of downtown Belize, which if you still have your map handy, is located approximately 220 miles south by SE of Merida, or 930 miles south by southeast from Houston.

On a sporadic basis another XE3 OM in Campeche, Yucatan (approximately 100 miles south by southwest from Merida) also contributed DX reports.

Over the course of the four-year period the trio located in and around the Yucatan Peninsula contributed over 500 observations of long-haul television DX reception ranging from channel 2 to channel 13. The time span gave me an excellent opportunity to evaluate what if any seasonal patterns were involved.

I'm happy to report that there were very definite seasonal variations. Definite enough that I would be more than enthusiastic about scheduling a trip down to the Yucatan Peninsula for any time in April or early May of any year several years in advance.

Here are the tabulations. First we throw out the Sporadic E observations. And we disregard any low-band (channels 2-6) observations which are not concurrent with high band (7-13) observations. We do the latter so as to eliminate anything but the pure tropo (ground wave or ducting) observations. Next we prepare the table shown here which evaluates the extent of the tropo type openings versus the months of the year. Each table is set up this way. For each station identified on tropo bending during a 24 hour period we count one point. For purposes of this chart a 24-hour period begins at 12 midnight CST.

Now let's look at the map. Here we see the paths covered during a seven day period in April (April 20-27) during 1958.

OK . . . so VHF tropo bending signals really get out and travel over the western and central Gulf of Mexico. So what?

Recall if you will some of the DX reports you have read about the tropo work on two meters (144 Mc) from Florida on the East to Texas on the West during the spring period of the year. W4-W5 stations don't need to be reminded, I'm sure!

What VHF'er, especially a two-meter operator, wouldn't give his eye teeth to work an XE3 on the band! And the 500-1,200 mile paths covered by these wandering high band television signals haven't been limited to paths along the Gulf either. Note for example the intrusion inland to Memphis on channel 8, Little Rock on channel 11 or Oklahoma City on channel 9.

Way back when, we spent some time looking at weather maps from the United States Weather Bureau (they publish a very detailed daily map which you can subscribe to) to correlate the weather patterns during the periods of the openings with the DX openings. The correlations were excellent, showing that moist warm fronts (usually moving north slowly from the Gulf) followed by high barometric pressure areas coming off the central Mexico plateau (also moving north by northeast) were producing the standing inversions. As long as the high was centered at any point slightly east of the radio tropo bending path the band was open. Some of the openings lasted for days and one lasted ten days without shutting down day or night!

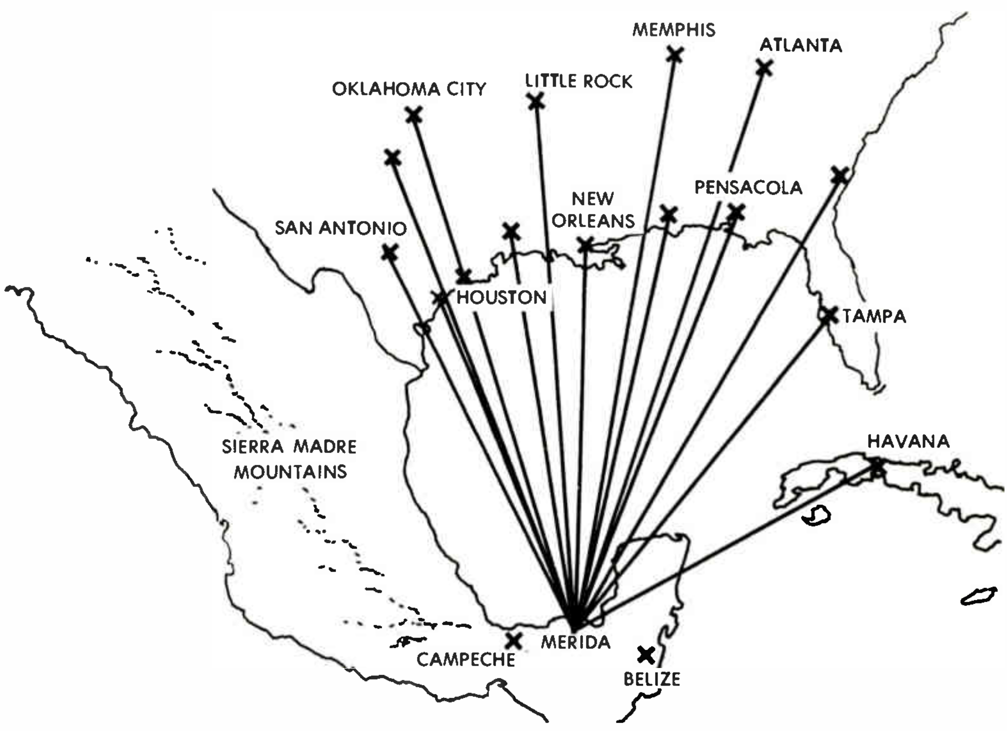
The stronger the high pressure cell, the more pronounced the openings. With more than casual interest we watched for reports from other DX'ers located along the Gulf Coast of the U.S.A. hoping to see what it took in the way of high pressure areas carrying DX on the north-south paths from Merida north to touch off east-west DX from Florida to Texas. We were surprised to observe that less than 10 percent of the high pressure areas that produced north-south DX for Merida observer also produced east-west DX for stateside DX'ers.

One path in particular showed signs of some form of opening almost daily throughout April and May. This was from the Yucatan Peninsula north to the Gulf coast of Texas and southern Louisiana. Almost despite the passing of high or low pressure areas the tropo bending would be in there night after night from sundown on until after midnight. This it appears is due to the cold air flow from Gulf to the Sierra Madre mountain range of Mexico which lies just inland off the Gulf along the entire western edge of the Gulf. As the sun disappears and the earth begins to radiate the day's heat, convection cooling begins. That is, colder (but moister) air from the Gulf sweeps inland while the warmer (but drier) mountain and plateau air runs up and out to sea, in a clockwise flow. This produces a fine temperature inversion which should be at its peak during the period of the year when the sun is most nearly directly overhead in Central Mexico. That happens to be the period from mid-April to mid-May.

So there it is. A built-in DX-producing climate that produces 500-900 mile tropo bending day in and day out for around 5 weeks every spring, which is heightened by the passing of a properly developed high pressure area that extends the tropo bending region inland to the U.S.A. and east into Florida.

Of course without any two-meter activity on the Yucatan Peninsula we can only conjecture where our 6, 2 and up band

(Turn to Page 34)



MAP shows openings reported during four-year period from a single reporting point in Yucatan. Note that openings are not limited to coastal regions but may extend far inland.

Using Silicon Diodes

by Bill McNanny, W3MIQ
P.O. Box 197
Homer City, Pa.

Most of us have learned (the hard way) that silicon diodes have a nasty habit of failing quickly due to overvoltage transients or capacitive inrush currents. Those who have not had this experience will, if a few simple precautions are not taken.

But despite this, silicon diodes are adaptable to our power supplies and will operate for a long time—let's see how!

There are several approaches which may be taken: One method is to shunt the diodes with a resistor and capacitor combination (Figure 1) in the hopes that the capacitor will by-pass the transient voltage developed by current interruption. The resistors in Figure 1 are not needed unless more than one diode is required in series per bridge arm. In this case (Figure 2), the purpose of the resistor is to distribute the normal PRV of the source equally on the diodes in the bridge arm. Silicon diodes have a back resistance on the order of megohms. If, in Figure 2, diodes A and B have back resistances of say 100 and 10 megohms at their rated PRV (incidentally measuring the reverse resistance of a silicon diode with an ohmmeter is a waste of time) then putting a 100 K resistor, of suitable wattage, across each diode makes their effective resistance for all practical purposes 100 K — so the recurrent source PRV now divides equally on diodes A and B.

The capacitors across diodes A and B (Figure 2) serve two purposes in this case. Diodes have what is called "recovery time." This means that when a diode is conducting in the forward direction and the diode stops conducting due to the source voltage passing through zero volts, all diodes in series in any one bridge arm do not begin to block the source voltage at the same time. This is okay since we are usually talking about a 60-cycle source; because recovery time is usually a few microseconds, all diodes in a bridge recover quickly and are able to take their share before any great amount of PRV is applied by the source.

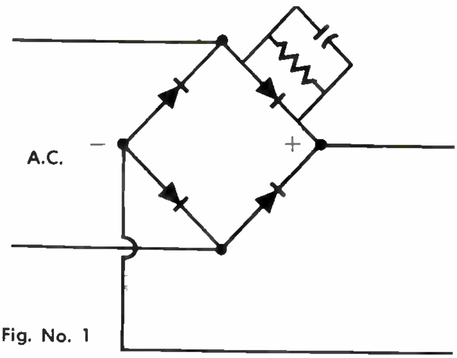


Fig. No. 1

A switching transient, on the other hand, may occur in a few microseconds. Diode A (Figure 2) might say: "I'm ready to block this transient" and diode B might say to diode A: "I'm slower than you are and can't accept my share of this transient voltage just yet." The transient voltage won't wait; so diode A takes the brunt of the transient and might be damaged. (Diodes can't talk really; but they can say "pow" in one microsecond — fast talking.) So since diodes do not recover in the same time we have to help them. Their inherent recovery time cannot be changed; but by placing a capacitor across each diode (0.01 to 0.001 mF) we can cause sufficient delay in the ap-

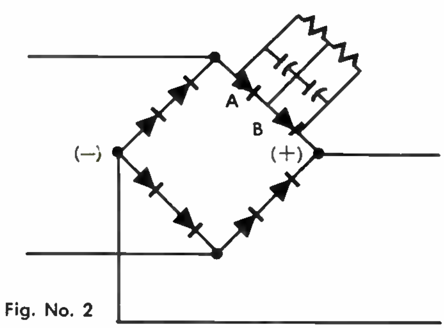


Fig. No. 2

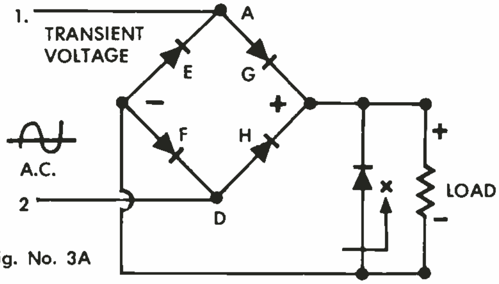


fig. No. 3A

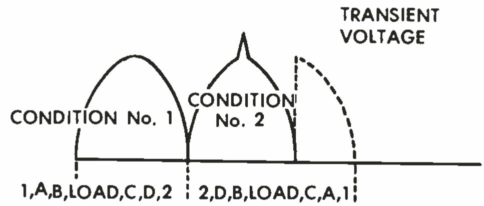


fig. No. 3B

plication of the transient to allow ample time for both diodes A and B to recover.

The other purpose of the shunt capacitors is to by-pass the energy in the transient and dissipate it elsewhere in the circuit.

Now that we have seen the purpose of shunt resistors and capacitors, we might ask, "How do we pick the proper diode PRV?"

It has been a "rule of thumb" to multiply the maximum anticipated recurrent peak of the source voltage by 3 and hope a transient voltage will not exceed that value. For example: If the maximum AC input is 200 volts RMS, the peak will be 200 x 1.414 or 282.8 volts peak. Now multiply 282.8 times 3 and you get 848.4 volts. A 900 PRV silicon diode should be used and in most cases, transients will not exceed the value of the diode.

If 900 PRV diodes are out of the reach of your pocket book, watch the following closely, as I probe the workings of a single-phase bridge in detail and use the inherent voltage transient suppressing ability of selenium to advantage!

In Figure 3A, when point 1 is "going" negative with respect to point 2, "electron" flow will be: 1, A, B, load, C, D, 2 and will produce the voltage across the load as shown in Figure 3B (Condition 1).

When (in Figure 3A) point No. 2 is going negative with respect to point 1, electron flow will be: 2, D, B, load, C, A, 1 and will produce the voltage across the load as shown in Figure 3B (Condition 2).

Now let's see what is common about Condition 1 and Condition 2.

Take condition 1 where the bridge appears "electrically" as in Figure 4. Diodes E & H are conducting, and are essentially short circuits, and diodes F & G are electrically paralleled across the load. On the other half-cycle of conduction (Condition 2), diodes F & G are conducting, and diodes E & H are electrically paralleled across the load. In other words, two diodes on opposite bridge arms are always alternately electrically paralleling the load. So the peak voltage of the source (no matter of what polarity) always "sees" the load paralleled by two diodes. Let's take advantage of this fact!

If a transient appears on the source voltage, say during Condition 2, it will appear across the load. (See Figure 3B, Condition 2.) Don't forget that there are two diodes (E & H) electrically paralleling the load that may be damaged by this transient voltage. So if we can place a voltage transient suppressor across the load, it will always electrically shunt all four diodes in the bridge.

I said earlier that selenium has this transient suppressing ability — so why not use it? Let's let the silicon diodes do the work and selenium do the job of limiting transient voltages.

Suppose we still had the AC input of 200 volts and the load was filtered so that we had for all practical purposes 280 VDC

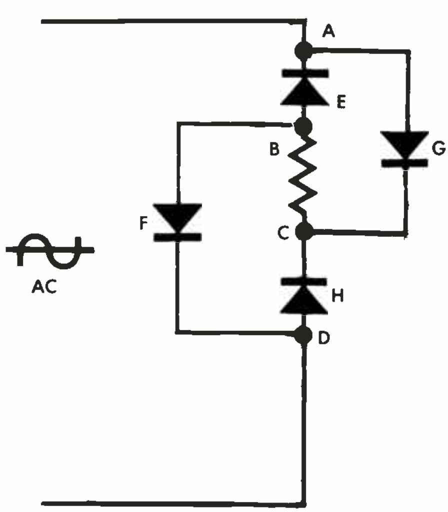


Fig. No: 4

output into a choke input filter, Figure 5 (capacitive input will be less prone to transients because of the capacitor's ability to absorb transient energy). Since the selenium rectifier (x), or other especially designed selenium devices, must be de-rated 20% for DC blocking applications, pick a selenium rectifier (say 1 x 1 inch cell size) that has an RMS rating of 350 V. Derated 20%, it will safely "block" 280 VDC and absorb transient voltages around 500 volts peak. Now, 500-volt diodes can be used instead of the 900-volt diodes mentioned earlier — money saved and much more reliable too than relying entirely on the resistor-capacitor networks of Figures 1 and 2.

Now let's get rid of damaging inrush currents. If a choke input filter is used, there is no problem as the choke will limit the charging current. If a capacitor input filter is used then the peak 1-cycle surge current of the silicon rectifier must be known. Suppose it is 15 amps peak. Then RS (Figure 5) would be: R = 280 volts peak divided by 10 amps peak or 28 ohms (give or take a few ohms — you won't get

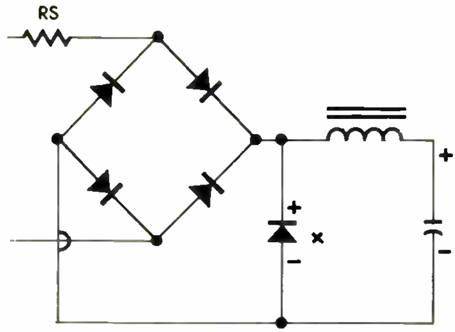


Fig. No. 5

10 amps peak because of transformer secondary impedence, etc.).

Let's use silicon more often, and take advantage of the increased DC output due to better regulation. Remember, full load voltage drop in the preceding circuit will be about 2 volts. What is it for hard-tube rectifiers?

If the preceding discussion is understood and the method of attack and thinking is applied to other basic circuits — success will be yours.

Quadrantids Down Perseids To Go

John P. White, Jr. W5UKQ
635 L.S.U. Ave.
Baton Rouge, Louisiana
Phone: 504-343-4693

Another sleepless session with those blasted little pellets called micro-meteorites has gone by. This operation settled down to a mild 28 WPM calling K4EUS, Sam King in Chester, Va. — oh about 930 miles distant. Some people call meteor scatter routine, but this operator still thinks that if a contact is made it is a miracle.

K4EUS (Sam) and I were at it again, as usual, during the Quadrantids and however as luck is usually with us — we didn't make it again. We haven't made it before so this new and more spectacular failure didn't shake us one itsy bitsy bit.

We did have more pings than ever before. Twice the signals were in for as long as 15 seconds, but they were extremely weak and you had to use your imagination to pull calls through.

Last Perseids gave me the bug when W7FGG came in S-9 for about 25 seconds. Sam was never that strong, even though short pings came in S-4 or better, he did ping many more times. The pings sounded like "Doop," "Ping," and "Tweep." Even a "DoopTweetDoop" came in once or twice. Then at 5:10:40 CST on the 3rd of January the big moment in any ping jockey's life came when calls came through loud and clear from K4EUS for about 15 seconds.

I'll never know if Sam heard me or not via Two Meters that is, cause I didn't receive an "R-S-3" for the remainder of the sked. Short pings were coming in loud, fast and furious, about 4 to 10 per half-minute segment. No more long bursts were heard.

Perseids will be here soon and Sam and I will be at it again, so if any high powered ping jockey would like to work Louisiana or Virginia, just drop us a line. Sam and I will be at it again, 5 A.M., trying to push a signal through. I hope this time we will have better luck and both of us will get a new state.

So Quadrantids Down, Perseids to Go — Perseids is Do or Die!

Letters

Dear VHF:

Received your sample copy today and enjoyed it very much. Enclosed is my check and subscription for your magazine.

I am active on the VHF bands, as well as in the traffic nets of 75 and 80 meters. It is my hope to see more traffic being handled in the VHF bands, as they seem to be almost ideal for the local and short distance handling of traffic with the present changing conditions on the lower bands.

Here in Wisconsin we have only one daily VHF net in operation at this time, but I hope to see more organized soon.

Best of luck with your new magazine, and hope you get plenty of subscribers and advertisers.

Vy 73
Kenneth A. Ebneter, K9GSC
Section Communications Manager
822 Wauona Trail
Portage, Wisconsin

Ken—

Many thanks for the compliments. We find interest springing up all over concerning VHF traffic nets; W5PPE has one going here in Oklahoma City on 50.42, nightly. If the rest of the gang across the nation will send us the poop, we'll run a directory of traffic nets above 50 Mc. Tell us frequency, meeting time (preferably in GMT), and NCS. We'll do the rest. Also of interest would be the local-calling frequencies in use across the country. Oklahoma City is 50.250. What's yours?

Dear VHF:

I hold a Technician license, expires 10-21-64. On this license type squabble, why not like the Commercial? Tie on a rider for code, for general, ham TV, and so forth. Might be easier that way, let 'em go for what they want—

WA5AKD borrowed the magazine (December issue) one night and had a "peanut whistle" nearly ready for airing next evening. I enjoyed the VHF-TVI section very much as also D.C. Pulses. How about a column on clubs—say a club a month. What they stand for, what certificates, what nights, time and frequency, and so forth?

73
Bill Wilson, K5YPH
2703 Bentley Street
Dallas, Texas

Bill—

We're still sifting data on club-column idea. Looks like we might have one yet!

Dear VHF:

Have you ever thought of running a corner showing a complete homebrew station each month with a description of it? Just a thought to help make your magazine a good one; I think it would be interesting. Keep up the good work.

73
Alan R. Northam, WA6TKB
15832 Longwood Drive
Los Gatos, Calif.

Alan—

Fine idea. So where are the photos and descriptions, gang?

Dear VHF:

Your magazine is great! (Yes, I subscribed.) I'd like to say something about Technicians though. I'm a Technician and I have asked a couple of Generals why they dislike Techs. The answer: "I really don't know." If you stop and think a Technician gets the same exam as a General so the only difference is the code and most Techs (at least I do) know the code at 15 wpm. I say if someone wants to limit himself to a certain band or bands that's his privilege as an American. That's the American way. The Generals and Techs who fight back should be ashamed of themselves. I do not take any side but do say that ham, amateur, or whatever you want to call it, radio is such a fine hobby that to see fighting among each other is shameful. P.S. I'm twelve years old.

Yours truly,
George Homme, K1ZBW
48 Poland Street
Webster, Mass.

George—

We only wish that some of our 50-year-old hatemongers who set out to fan this whole squabble could show some of the maturity that your letter does!

Dear VHF:

Keep up good work, your mag receiving good acceptance this area. Don't let those happiness boys discourage you and stockholders. There is a very definite need for a VHF-only type of publication, like the exchange of information and etc. These being short-range bands where ideas cannot be swapped on the air, a good mag with nationwide coverage is the only way it can be done. Your DRP program a **big** step in right direction; hope interest continues. You've got the best chance. If you don't, it's back to waiting for the next spring and E season on 6M to see what's going on. What started out to be a short note sort of got carried away, anyway best of luck. And don't try to sell me subscription—XYL already has one!

73
Bill Bolles, K4RCV
109 S.E. 13th Ave.
Fort Lauderdale, Fla.

Bill—

We won't try to sell you then! Thanks for the kind words; we're not about to get discouraged and so far the stockholders are turning purple but who cares? One of these days we might show a profit—and then they'll all die of sheer shock! But along the way we're all having fun—and what else counts?

Dear VHF:

I am a technician. By F.C.C. definition, by the type of enjoyment I get out of my hamming, and by the nature of my vocation. I have held this class of license for over seven years.

The interests I have in communication electronics are strictly V.H.F. and above. I enjoy building, and my attempts at design. All to the end of developing greater efficiency in equipment for these frequencies. I also like the taste of **real** DX offered up here, and a good QSO that I don't have to fight for.

Now that I've established my qualifications, I would like to take issue with a letter appearing in your Dec. letters column.

Mr. Ellis, K4PUD, decries your non-technician attitude. Upon examining the facts, we find neither for, nor against, any class of license. Let's stop a moment and examine some of these facts.

The scope of **VHF**, as stated on its cover, is the same as that defined by the F.C.C. as the Technician license. **VHF** appears to be aimed at technical and operational advances above 50 Mc, where there can be **no** difference between the General and the Technician licensee. We all passed the same theory test. All hams, then, have similar rights in the democracy of V.H.F. The only criterion of judgement up here is **individual ability;** nothing more.

Therefore, my argument with Mr. Ellis, and similarly minded Technicians, is they can and should support **VHF**, along with Generals and anybody else whose interests follow the aims and designs of **VHF**. Regardless of your class of license, if you **qualify** for V.H.F. and up, then **VHF** qualifies for your support.

P.S. If you feel these ideas worth publishing, send a copy of the magazine to K4PUD at my expense.

73
G. A. Mackay, K3QAI
6834 Paschall Ave.
Philadelphia 42, Pa.

OM—

We're glad to oblige but there'll be no charge.

Dear VHF:

Just received your December '62 issue. Enjoyed all of it.

Can we get you to expand the December "staff report" to cover the Pi Net for 2 meters?

One thing which seems to bother me, other than the lack of sufficient "junk-box" parts here at the shack, is the "finite" details on your construction items.

Sincerely
Jim Homan, W0HAN
604B J Street
Grand Forks, N.D.

Jim—

To use the Pi-Net data on two meters, simply divide all the 6-meter values you get for C and L by 2.8. That's all you have to do. Rin and Rout values remain the same, as do the considerations of Q. But when it comes to getting those impractically small values of inductance, you have to use some ingenuity (reference W5HCX's 2-meter final, same issue, where a little over four inches of waveguide turned out to be right). Regarding the "finite" details, we've been trying to squeeze as much data as possible into a given amount of space — and possibly we have on occasion squeezed out some helpful detail. Let us know when we reach the happy medium. Okay?

QSO Showboat

by A. DAVID MIDDELTON W5CA-W7ZC
ex-W2OEN Staff Historian, VHF Horizons

SYNOPSIS

W2OEN, Middletown, New Jersey, operating a sensitive receiver tied to a multi-element rotary beam picks up the signal from a transceiver station, W2BBI/MM operating on the yacht SHOWBOAT off Sandy Hook on Saturday, November 1, 1941. The yacht is in trouble with a defective propulsion system due to a collision with a log. The ship's captain and its owner obviously do not wish to use ship-to-shore radio for assistance. Apparently no one else is hearing the signal from the yacht. W2OEN relays traffic to New Rochelle for the yacht party and agrees to stand by the next day to continue the interesting QSO as the yacht progresses southbound along the Jersey coast. The SHOWBOAT put in to Sandy Hook Bay for the night and W2OEN stands by till Sunday morning.

When schedule time came Sunday morning, I called W2BBI/MM. I picked up their signal but it was weak and almost unreadable. I made out that they had left Sandy Hook Bay and were out on the open Atlantic some miles south of the Hook. I went out and shifted the beam. Once again the signals from the transceiver were plainly heard at W2OEN. George Campbell reported that W2OEN was booming in and he was receiving me perfectly. This was excellent news. Now all depended on how long I would be able to hear W2BBI/MM there on Kilocycle Hilltop.

I was told that Owner Tenney and the yacht's Captain David Thornton had decided to take advantage of the good weather and calm seas and had moved out much earlier than anticipated. Thus at schedule time they were out in the Atlantic and underway for several hours before our mid-morning QSO.

It was now about 10 o'clock. SHOWBOAT was about five miles out off the Jersey shore and Asbury Park. Suddenly, without warning, George announced that a heavy vibration had developed. The yacht's engineer had discovered that the shaft couplings from the Diesels were in bad shape and that their failure could be imminent! Altho not discussed at the time, I wondered why the captain of the yacht did not get on his ship-to-shore radio and report the damage. I said nothing about this as it was none of my business. (Later I learned the *real* reason for their HF radio silence and why they had resorted to VHF ham radio to establish contact with the mainland. I would not have even guessed at their reason!)

W2BBI passed the engineer's report to me. Then he asked if I could ascertain the location of dry-dock facilities along the South Jersey shore where the big yacht could put in for the vitally-needed repairs.

I asked W2BBI to stand by and I went over to Mr. Beekman's for a conference on this new development. I had hardly had time to explain the situation when I learned that the yacht, its owner, and the party were in luck!

I knew that my landlord-neighbor, Mr. Beekman, was a versatile individual and I vaguely recalled that he had previously been a boat owner. But what I did not know was that he was familiar with the dry-dock, shipyard and marine facilities along the shore line. He had first-hand experience as he too had once had a large yacht! But what was even more important at the moment was that Mr. B. was keenly interested in the W2OEN/W2BBI contact and was eager to help get the yacht out of her predicament!

We knew that there was no danger to the personnel aboard *SHOWBOAT* but we knew that the yacht was in serious mechanical trouble and that it would require repairs or the cruise might come to a halt. And, that towing might even be considered!

Mr. Beekman was amazed when I told him the statistics on the yacht. George had told me she was 72 feet long, with an 18-foot beam and a draft of 6 feet. I was told by Mr. Beekman that the yacht's size would make it even more difficult to secure adequate docking facilities and repairmen. This, plus the undeniable fact that it was long past the normal boating season and many yards were closed for the winter. Also, it was Sunday and yards even normally open might be closed. There was no doubt that we might have trouble finding yard facilities and some mention was made of a bonus for having the work done at once. This information was relayed by me to the yacht.

I kept dashing back and forth from W2OEN to the Beekman farmhouse as Mr. B. gt busy with a telephone directory. Soon he had the Long Distance operator hard at wark placing calls. He started with the first boat yard south of Asbury Park and was working his way, by phone, south!

While we still had good voice radio contact, Owner Ashton M. Tenney came on the mike and extended a cordial welcome for my YF and me, plus the Beekmans, to drive down to wherever the yacht would dock for dinner aboard his yacht! I accepted this invitation eagerly as I knew the Beekmans would, like me, be delighted to inspect the *SHOWBOAT* and to meet the party aboard. Another thing—I wanted to meet W2BBI and see his rig!

A couple of hours elapsed and a big toll bill was running up on the Long Distance lines before my landlord came hurrying over to W2OEN with the good news that he had located a suitable dry-dock that would stay open until the disabled yacht could arrive. Work could begin the following morning.

This information was immediately passed along to the ham radio operator on the *SHOWBOAT*. All hands were excited at the news that Johnson's Boatyard in Bayhead, a few miles farther down the intercoastal waterway would welcome the yacht.

By now W2BBI/MM's signals were down into the receiver hiss at W2OEN, big beam and all. I received an "OK" on my report. There were many questions concerning water depths, channel markers and other navigational information regarding the approach from the Atlantic thru Manasquan Inlet. Several repeats were required and finally W2BBI resorted to whistled code in the mike to generate m.c.w. which cut thru the noise better than voice. George Campbell was still reading my voice over W2OEN without difficulty.

I passed along questions to Mr. Beekman who was sitting by me at W2OEN. Again this versatile man amazed me by pulling charts from his pocket and by proceeding to give the yacht's captain just the information he needed, without delay. (Later I learned why the *SHOWBOAT* had no charts of the inland passage waterway. She had not been scheduled for this route and by some quirk of fate, the needed charts had been left behind. Only one stop had been planned, that at Cape May.)

The big yacht continued its slow southbound run along the Jersey coast. The ever-weakening 2½-meter signals became more difficult to copy, with the beam swung in the French 75 receiver at W2OEN.

Suddenly and without warning all indications of W2BBI/MM were gone. I did not believe that it was equipment failure but attributed the lack of signal to the terrain over which we were working.

I continued to make a few voice transmissions then switched to tone-modulated m.c.w. and repeated the last few bits of information and added that we would leave at once for Johnson's Boat Yard where we would expect to find the yacht and its cruise party awaiting our arrival. The over-night stop was to be made at a point some 38 miles by road from W2OEN.

I signed off, and closed down. My wife and I put on our "Sunday best" and hurried over to the Beekman's. We all piled into their Lincoln Zephyr and took off southbound for the "meet" with the *SHOWBOAT* and her party.

It took us over an hour to get down into the Bayhead area and then even more time to locate the boatyard, and the yacht. Evening darkness comes early in November in Jersey. The trouble of locating the yacht in the dark wilds of a boat yard did not dim our enthusiasm nor the glowing welcome extended to us by Owner Tenney as we strode up the gangplank onto the *SHOWBOAT*.

Introductions were made all round and we were escorted into the main saloon. There on a huge table sat the biggest baked ham I have ever seen.

While the chow-hounds (which included most of us) fell to the feast I picked up some scraps of information about the cruise and its party members, not disclosed over the air.

SHOWBOAT's owner, Mr. Ashton M. Tenney, was a vice president of Eastman Chemical Products Inc. (a subsidiary of Eastman Kodak). Among the guests was George R. Campbell, W2BBI. It was he who had done all the skillful operating of the transceiver rig. There was Captain David

Thornton and his brother Jim who served as steward. The engine room was manned by Harry Gibbs. These were professional seamen and well grounded in their jobs and tradition.

The *SHOWBOAT* was a real dreamboat! Formerly owned by the late Jerome Kern the boat had been purchased by Mr. Tenney sans only the immediate personal effects of the famous composer of music all the world knows and loves!

After the tour of the yacht I was eager to inspect the rig that had brought us all together in that pleasant meeting aboard *SHOWBOAT*. Much to my amazement and to the amusement of George Campbell, W2BBI, I was directed to a small black box sitting right there on the dining table. I had been so intent on the food that I had missed seeing the rig.

But there it sat. A six-inch cube of transceiver, with a quarter-wave vertical antenna sticking out the top. There was nothing else except a few batteries and a microphone.

George told me that the unit had originally been built by Walter Stiles, W2MBS. I knew who Stiles was—the recipient, in 1935, of the first William Paley Award for "outstanding amateur achievement." I learned that Owner Tenney usually invited at least one ham aboard on his cruises. Previously the yacht had been provided with 10-meter gear for such use. Following the demise of "ten" due to the war scare, a 2½-meter station had been constructed by W2MBS. This rig used a string of 50L6s in a crystal-controlled VHF layout operating on the yacht's 110-volt DC battery mains. An acorn-tube super-regenerative detector and an audio amplifier had also been designed and built by Stiles.

Trial runs revealed that altho the rig worked out, the drain of the 50L6 rig was too much for the ship's batteries and it was dismantled. However, for this last cruise of the season, Owner Tenney requested Campbell to bring something along to work ham radio from the yacht so W2BBI hastily converted the receiver into a transceiver. Altho this materially reduced the power output, the receiving ability of the station was still adequate. Dry batteries were used on the filaments and the now-lowered plate requirement was obtained from the 110-volt DC supply. Power input to the transceiver on transmit was perhaps less than ONE watt, and the output could not have been more than a few hundred milliwatts. A quarter-wave antenna operating as a groun plane made up the entire antenna systen

I asked Campbell to run thru a play-by play of the QSO, and altho main detail were known, he made it come alive agai in his humorous remarks and asides abou our contact.

W2OEN had been heard at W2BBI/MM thru my final transmission. Checking time against my log, I learned that the yacht' 2½-meter receiver section had done ver well in that department! I had hear W2BBI/MM signals until the *SHOWBOA* passed thru Manasquan Inlet. There a sma range of hills obstructed the propagatio and caused the quick demise of the feebl signal. W2OEN, aided by the big beam, it elevation, and the higher power, had cor tinued to be heard even tho the transceive could not be heard at W2OEN.

After seeing the saloon dining-table loca tion and the general situation, and afte noting the tiny antenna perched on tha black box, I asked Campbell why he ha not taken the transceiver out on deck or o the cabin roof top. His answer was swif and complete. "It was much warmer inside!

That purely physical reason plus the propinquity of a well-stocked table had won out over improvement of radio propagation! Hence, while we at W2OEN were struggling to hear the faint whisper of a voice and a feeble whistled-m.c.w. signal, OM Campbell was right comfortable and cozy—both inside and out!

Of such ephemeral substance is radio contact made and sustained over phenomenal distances and overwhelming obstacles!

Ah! the persistence of the radio ham and especially a VHF'er.

After some prying queries and some rather humorous and evasive replies, we were finally told that the radio silence had been to keep the incident of the submerged log and the subsequent damage and rather embarrassing detour to a dry-dock *off* the ship-to-shore radiotelephone and the ever-alert ears of yacht-buffs and other skippers.

However, this procedure did *not* furnish the desired secrecy. Our VHF contact was not as private as they had assumed, we all learned a few weeks later. The radio-silence merely *delayed* the ribbing by their fellow yachtsmen in New Rochelle and the New York area. For, in spite of the effort made by *SHOWBOAT* to keep her story off the ship-to-shore and out of the ears of the boating public, somehow the story leaked out and was carried by the Newark EVENING NEWS of Nov. 17, 1941 with surprisingly accurate details of the whole episode from beginning to end. Some ham in the Newark area, alert to good publicity for ham radio, plus an ear cocked in the direction of W2OEN, obviously had heard our end of the QSO and pieced it together with possible details learned elsewhere and let the news out to the ham-radio-minded Newark EVENING NEWS.

After several short but happy hours aboard the yacht, the entire Middletown party departed and headed toward W2OEN and home. We were filled with good cheer, wonderful food and the knowledge that once again ham radio had proven its worth in an intriguing two-way contact under unusual and difficult conditions.

Later I learned that the yacht was repaired without undue delay, that she proceeded on to Maryland as planned. Being at work during their resumed cruise I could not maintain contact with the tiny rig on *SHOWBOAT*. But I do believe that had the rig and its tiny antenna been taken OUT on the cabin roof, we could have held QSO for some distance on down the coast. Especially, if George Campbell's whistle had held out!

EPILOGUE

In the fall of 1961 when this article was begun I wrote to W2BBI and found that he was still active in ham radio, mainly on 14-Mc SSB, in Pelham, N. Y. Sadly, I must report that QST for January, 1962, carried the name and call of "George R. Campbell, W2BBI" in "Silent Keys."

Mr. Ashton M. Tenney still owns and sails the *SHOWBOAT*, and kindly furnished the photographs of his yacht for this article, and in a recent letter expressed his keen interest in this memorable and remembered event, and in ham radio.

Walter Stiles, W2MBS at the time of this contact, is now K5ENB at Albuquerque where he is manager of KARA, an ABC affiliate. Walter reported that he is still active on VHF and on SSB on the lower bands.

W2OEN, (now W5CA-W7ZC) is still active on VHF and on SSB on the DC bands, having just completed 43 years activity on the air.

Next Month

✔ MOBILE RELAY

Two separate articles on mobile relay — or mountaintop repeater, if you will — stations head the lineup for the April VHF. One, the cover story, tells in detail about the Pinal repeater in southern Arizona which enables the gang in that region to talk nearly anywhere in the state. The story, by W7FRR, tells not only the technical problems and how they were met but also goes into the human side of the project. The other, a staff article, rounds up views on the VHF mobile relay proposal. Some of you like it, some don't.

✔ ANOTHER 50-Mc SSB MIXER

K6HCP tells about still another mixer; this one's main feature is exceptionally high stability. He's been using it for quite a while and likes it.

✔ E-SKIP ON TWO, Second Verse

Additional data on two-meter E-skip, including a detailed and verified report from W8KAY. Get ready for spring, gang!

✔ MUCH, MUCH MORE too will be in the next issue; this is just to whet your appetite.

Subscribe Now!

DEAR VHF:

Below are a few of the VHF-UHF operators active in my area. I am anxious to have VHF's files top the 31,000 mark of known VHF-UHF'ers in the United States and Canada. Please see that the following receive a copy of VHF as a sample soon.

NOTE—Mail this to VHF, P. O. Box 1557, Oklahoma City 1, Oklahoma.

Vital Happenings & Facts

OPERATING AND DX NEWS

OUR LAB

Ever had a dream? About things you would like to do someday . . . if?

We've had one at HP for sometime. Our dream was to have a separate Research and Development facility where we could breadboard circuits and units, run evaluation environmental tests on various pieces of communication equipment and antennas, and generally 'ham' it up in style. Sort of a super ham shack where everyone would be invited to use our equipment, build and troubleshoot to his heart's content.

On January 15th we opened our Research and Development Lab. Jim Kyle put his hand up first so he was the lucky one chosen to move his office there. The Lab is small, located in a separate building, but with plenty of room to grow. Jim has a private office and the Lab is big enough to allow half a dozen fellows to work at once on the bench equipment.

The Lab is located at 2627 NW 10th in Oklahoma City. It now includes the usual array of test gear for measuring the things you normally measure. We have a DC to 12 KMC digital readout frequency meter in the mill and thanks to a kind assist from Terry Sterman, W9DIA, at Amateur Electronics, Milwaukee, the Lab Standard receiver is an SP-600JX of 1953 vintage. This tunes up to 54 megs, as you probably know, and Stu Meyers, W2GHK, the brand new President of Hammarlund, told us we have made a good decision in this used set for a Lab Standard.

Kyle and Cooper took an afternoon off to move W5KHT's 592 — 3/200A3 six-meter kilowatt down to the Lab (it weighs nearly one ton), and a rack mounted 440 megacycle A5 (video) transmitter from Russ Miller's (W5HCX) garage will provide a video link down to the Horizons main office, some five miles distant.

Don Gwynne, K5EVI, is now employed as a technician at the Lab, under Kyle's guidance, and we are already hard at work doing environmental testing on a number of communications items.

The first antenna tower properly christened the Lab when all 85 feet of it collapsed under a 60 mile breeze (after the antennas on top of the crank-up loaded up with ice) on January 12th. So we're at it again with a 50-foot self-supporting tower this time.

Editor Jim wants to run the 592 kilowatt during the E skip season as an attended beacon on the low end of the CW segment of six.

The 'Horizons Amateur Radio Club' applied for a club call recently and this will be used from the Lab.

In other Horizons' magazines this month we are running a small advertisement asking for inquiries from Technician-Writer type readers who would be interested in joining the Horizons gang.

We're looking for a young fellow, 23-28, with a background in communications systems design, check out and make ready. The fellow we will add to the staff one of these days will be a fair to middlin' winter too.

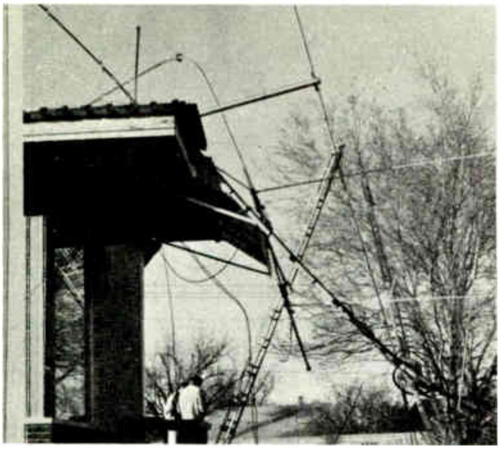
Interested? Drop a note to Jim Kyle.

DX and operating news this month comes from all corners of the states. You'd be surprised how much is going on. We were!

Band by band the activities shape up this way.

50 Mc news comes from W1ELU in Marlboro, Massachusetts, who completed his 300-watt push-pull linear (on SSB) utilizing 826's this past month. Sounds like a good one OM, how about an article? 826's are still easy to come by. From Rhode Island, K1PAM operates 6 looking for CW contacts on 50.04 and 50.022. He's located in East Providence and feeds a five element beam. Anyone want Rhode Island on 50?

K1QIC reports from Maine the following stations are active from that state: K1CXX, K1HAV, K1YSF, W1CFJ, K1-QHE, and K1QIC. Over in Vermont, W1EXZ and K1PQN join in with the Maine gang at 1030 EST on 50.25. K1QIC has a 4X250B SSB rig about ready to go on six. We're waiting Pete!



TANGLED TUBING is all that remains of the 85-foot crank-up at K5JKX/5 after ice storm. Four antennas were lost too.

Watch out for K3ARR, Sunbury, Pennsylvania. This op has a 4-1000A AB2 linear going on six, or at least he will as soon as he gets 5 KV of voltage for it. On December 27th he worked VP7CX in San Salvador, the Bahamas, K1KST, Connecticut, and K7NDU in Arizona. His AM rig is a simple old 4-400A running full bore.

WA4GFW, Alexandria, Virginia, started a sideband rig 'from a back issue of VHF' (we've had a pot of 'em) and would like to see a Superhet receiver for six and two. Anyone have one they're proud of?

Fred Clarke, WA4DGM, located, Nashville, Tennessee, attending school at Drexel in Philadelphia, finished up an 829B rig for six. His next project is the 102 converter from an early issue of VHF. Fred reports K4DNG has built up the SSB rig from the November issue and others are planning the same. DX wise, the band opened to New England on December 15th. K1VCK, K1QAZ, W1MFM and WA2's OLB, OVS, QVD and FMC were worked.

K4JQY, Greenville, South Carolina, finished and air tested his new 175-watt PEP SSB rig for six. He also put up a Telrex 5 element beam to replace his 6 and 2 beam lost during an ice storm (in South Carolina?). K1PBE was worked on meteor scatter during December.

K4LOZ, College Park, Georgia added a 417A front end for six meters. Does it help, OM?

Ed, W4HHY, worked VP7CX on San Salvador at 0132 GMT on November 27th and polished off a Knight-Kit P-2 SWR bridge for antenna checks.

W4ZBS, Arlington, Virginia finished off his 3rd Nuvistor converter for 6 meters (going in business, OM?) and improved the fast-slow AVC on his 75A3. On SSB he heard locals K3UBC, K3HFV, W3DFS, W4DNI, W4VCC and K3PNN.

WA4GMS in Norfolk, Virginia put together a homebrew six-meter converter with a cascode stage up front and a 6U8 mixer, oscillator. On DX he worked WA5EJM, WA4FLJ and many others on December 27th, K5OHP on the 17th and WAØCKX, K9DZY on the 12th of December.

WA4DJF, Pulaski, Tennessee worked K4MGX in Miami on the 4th of December, along with VP7CX, and W3CQH, WA4-EPR on the 5th of December.

W4VRV, Clemson, South Carolina, reports he caught a very rare short-skip opening on December 4 when he heard Washington, D.C. coming through while Connecticut W1's were QRMing W5's from Oklahoma. Arkansas and Delaware were also worked. He finished a 250 watt rig using a pair of 4-65A's, AM and CW so watch for his signal. It shouldn't be hard to spot!

50 Mc stations in the Piedmont area of North Carolina, attention! The six meter daytime monitoring is on 50.25. W4ULE and others monitor it almost constantly so a call should bring results.

From 5 land, Slew Foot Willie, our faithful staff reporter from the Texas Panhandle, notes that W5PVT in Andrews, Texas, worked VP7CX on 50.075 SSB (wow!) on December 1st. This is apparently the farthest west the VP7 has worked. VP7CX reportedly is running 300 watts SSB and the QSL goes to W9ZDI. Phil, W5SFW, reports E skip was active 20 days in December for him (what a DX mecca you have there Phil!), but no openings in January through the 9th. The VHF Airforce Mars boys meet on 49.980 at 1730 CST on Mondays and Thursdays. A new ham on six out that way is WA5AQR, Oscar, in Borger, Texas.

W5JGV says he's installed the 220 volt line into his shack in Metairie, Louisiana, and now he's really loaded for bear with his 4-1000A. He'd like information on frequency shift keying a TBS-50-D. Anyone know how to tame this one?

W5BEP finished up his mixer and 4-125A GG final for 50 Mc SSB during December, and installed a 100 foot tower. On the air he found the band open on December 5th when W4NCV, W4DNK, WA4BDF, W4-

ZBS, K4GCS, K3KED, and W4CPX came through. Daily skeds are carried on with K5VMC/5 and W5ZUA in Shreveport, Louisiana.

K5EVI, Oklahoma City, built up the 102 VHF converter and completed a 14-to-50 Mc mixer for SSB. Welcome to the gang, Don.

W5GKP, New Orleans, Louisiana started a new 6 and 2 meter Thunderbolt Linear type unit (of his own design). On 2-way SSB, he found the band open on December 20th when he worked WØPFP (and many others), on the 21st when he worked K8-PVX, W8HXT, K8DGT, WA8BJZ. On December 27th he worked K4DIG. Most of these openings were in the late afternoon hours.

The Arlington (Texas) Radio Club reports K5TKR came up with 190 contacts during the January League VHF contest, but local activity in Dallas-Fort Worth was not high. Jim, K5TKR, also logged a visit from LU3DCA, Mike during January. How about some photos of the distinguished South American visitor and six meter Op Jim?

From the West Coast, WA6AKM, El Monte, California, reports hearing and working 4, 5, 7 and Ø area stations during the "last week in November and first two weeks of December. The band was dead the last two weeks in December."

WA6NMT completed a six meter converter but reports nothing doing DX wise. He's in Hermosa Beach.

Dick, W6IEL, La Mesa, sent along a nice detailed comparison between his DX work on six in 1961-1962 and the work reported by K6RNQ in the January issue. Notes Dick, "I came to a similar conclusion, both years were pretty much of a toss up. I'm one up on K6RNQ however as I heard him on a short skip opening to the Bay Area on 12 August 1961 but no contact."

A new wideband FM group is set up in the Los Angeles area on 52.525 Mc. All are using late model Motorola FM rigs according to Parks, WA6AKM. Active are W6-KHK, K6GOL, WA6AKM, WA6THL, WA6HSO, WA6ECS, WA6DSO, WA6-LMV, WA6QMD, W6SGD, W6SGJ, K6-DNS, WA6GXJ, WA6BMO, K6DBR, K6PVB and WA6GXJ. Notes Parks, "Range has been found to be roughly double the AM mobile range for similar power levels."

K6RNQ reports that on December 3 the Southern California gang had a good Es opening to the east and northwest, and other Es was noted on December 4th (Tucson, Arizona) and December 7th, when WA6QEJ worked El Paso, Texas on SSB.

K6TMB, Oakland, California reports he's about finished with his 6 meter SSB mixer and has started work on a 4E27A kilowatt final for six. He talked with W6FZA in Porterville via Lee, K6PXT one day in December, for a nice tropo haul across central California.

WA6LBV wonders about a contact with K5EMA who signed as Albuquerque, New Mexico. The QSO took place at 0208 GMT on December 13th. A good opening was in process to New Mexico, Texas, Oregon, Washington and short skip to Northern California at the time.

WA6UOE, Woodland Hills, California completed a 2E26 rig and he converted a MD-7 unit modulating with a pair of 1625's. He's looking for a cheap, simple VFO for six. (Editor's note: Kyle has a superb VFO for six brewing right now. He's trying to make it operate with sufficient stability to work for 50 Mc SSB. Watch for it.)

WA6YOB, San Rafael, installed an 8-element six meter beam and is planning a gallon on SSB by summer. No DX reported.

WA6ZEM completed a field strength meter and coaxial vertical type antenna for six from his Los Angeles QTH.

From the 7th district, WA5BBA reports he has moved from Carlsbad, New Mexico, to Genderson, Nevada, and will be on the air with his T-60 and home brew converter soon, as a Nevada QSO.

K7DTS, Napavine, Washington, completed a 50 Mc converter and transmitter and is now active on the band.

K7EMO reports from Laramie, Wyoming, he completed a Knight Kit T-150 and improved his Nuvistor converter for six. He's getting set for the big DX season ahead.

W7KRW is Ex-WØITO out of Kansas City. He's now in Mesa, Arizona, and is getting squared away after the move to get back on the air.

W8NAF/7 in Scottsdale, Arizona, finished up a 6EZ8-6CL6 50 Mc SSB converter to follow his 10-B. He ends up with a pair of 4X150's, and receives with a new 6CW4-5670 converter into his Drake. He reports K7JUE in Phoenix is about set to go with 50 Mc SSB.

K9DNW/7 in Pinedale, Wyoming rebuilt his 2E26 power supply and is still searching for six meter DX. Aren't we all?

Betty Satta, K8TFL, reports on an election of officers at the **VHF High Banders Club** in and around Marion, Ohio. VHF donated a subscription to the magazine at the group's recent Christmas party. Elected for the new year President Betty, K8TFL, Vice President Floyd, K8QBY, Secretary Maxine WA8ALT, Treasurer John W8-RRB. The group is starting a monthly newspaper with Ben K8BSO as printer and Betty editing. See that we get a copy each month, Betty!

W8MO in Grosse Point, Michigan, built up a six meter transmitter, obtained an AN/SRT14 crystal standard and started assembly on a frequency synthesizer. Tell us about it when it's finished, OM.

WA8ADL, Columbus, Ohio finished up on a new six meter transmitter and on the 20th of December worked WA6CWD and K5PRJ on E skip.

W8HXT, Mansfield, Ohio reports a slug of news from his area. He finished up on his 4CX250's for SSB kilowatt on six driven by a KWM-1 and P and H mixer, and installed a 12 element W8WL beam (what's that, OM?). On DX he reports working Texas, Louisiana, Alabama, Oklahoma, Mississippi, Michigan, Kentucky, Pennsylvania and Ohio. Sounds like fun!

WA9AHZ, Chicago, reports on DX. Worked on December 20th were K3MPZ, W3DEG, and W3BVR. This Op wants skeds with Minnesota, Iowa, Missouri, West Virginia and Tennessee on SSB. Any takers?

K9BEH in Bedford, Indiana had his antenna down while he worked on the tower and antenna system during December (couldn't you pick a better month for antenna work, OM?) so he didn't get in much air time.

WØCES in Omaha, Nebraska, completed a 9 element homebrew yagi for six and added a superhet receiver for his station.

On Six, WØGXJ reports on working W5GXJ (!) in Dallas on December 12th. KØHPQ over in Grimes, Iowa was worked on the 16th.

VHF staffer Jackson L. Cox is busy building his six meter converters (He builds some fine gear) for re-sale. Burstein-Applebee Company is the latest to stock Jack's gear. Jack reports a weak aurora back on November 23 when WWI in Cedar Rapids was heard just below the band edge.

From VE4 land Murray Ronald, VE4RE, reports the Manitoba VHF Society has been formed to further VHF and UHF activity in the VE4 district. The group started off with an even dozen members and hopes to devote group energies to some real VHF-UHF work in 1963. The 50 megacycle net and calling frequency in Winnipeg is 50.-280 and on two meters it's 144.200.

144 Mc news is equally spread about the country this month. Truly, when you have so many fine people reporting, it quickly becomes obvious

40 ELEMENTS ON 2 survived same Oklahoma icestorm which flattened lab tower (see page 30). This is the W5HCX array. Details coming up this spring.

that VHF activity was never higher! Up in Maine, K1QIC notes lots of two meter activity from his home state. Active are K1CXX, VUE, VXK, ROW, VYV, IBY, HAV, VEQ, GVR, QIC, VTZ, OEW, OEX, OVN, MTJ, OMV and W1's CFJ, FTV, EFF, WXR. W1MAS reportedly comes in loud and clear from New Hampshire.

K4KLJ, Washington, North Carolina, reports finishing up a 416B pre-amp for two meters this month. He also worked on an antenna switching panel.

K4SWN, Raeford, has been requested by the Air Force to make a survey of radio operators in the North Carolina area who would be interested in an Air Force MARS 2 meter net on 143.950 Mc. The net would meet twice per week and operate on a point system with equipment available through Air Force MARS channels. This sounds like a good deal fellows. Write to Raeford Everhart, AF4SWN, 1405 S. Main Street, Lexington, North Carolina.

The Piedmont area in North Carolina stands by on 145.350 for two meter calls in case you are mobiling in the area. Most of the fellows run halos and report 30 mile coverage.

W4RMU, Jacksonville, Florida, has moved into his new shop and will be sending CQ NNE each night at 2200 EST on 144.100 plus or minus 2 kc. He is listening for W4FJO in Raleigh, N.C., at 2105 EST. W4FJO is calling towards Florida at 2115 EST on 144.075. W4RMU has a 10 over 10 beam fed with RG-17U.

W4HJQ reports on an Aurora opening on 144, December 17 from 1900-2100 EST when calls in the W8, W9, and W3 area were copied from his Kentucky QTH.

W4LOJ reports his states worked total from Jackson, Tennessee, is now at 19. Jim uses an Ameco Nuvistor converter with a 6N2 transmitter and Finco combination 6 and 2 array 80 feet above ground.

Shelby, W4WNH, Louisville, Kentucky reports he worked a couple of more stations via meteor scatter during the Geminids Shower for two new states!

Worked were W4TLC in South Carolina and K1LSY. Shelby has his auto keyer-station control unit working FB and reports W4HJQ is now building one. Come on Shelby, don't keep us in suspense any longer! Tell us how to build one too! Shelby has 33 state's worked with 8 via meteor scatter now.

W5UKQ, Baton Rouge, Louisiana, finished up a 2 meter SSB hetrodyne unit during December, and managed to copy a few pings from K4EUS in Chester, Virginia (930 miles) during their December 11-14 meteor scatter sked.

WA6NMT, Hermosa Beach, California, is anxious to take advantage of interest stirred up by the 'E Skip On Two Meters' article in our January issue. Gary wants to line out skeds with stations to the north and east for the summer ahead. He's prepared with a 28 element yagi box array at 50 feet and 150 watts CW, 100 A3. His converter is a Nuvistor job. Who wants to try?

WA6TBC, Campbell, California, reports completing a 2 meter Nuvistor converter and a modulator for his two meter rig during December.

W6GDO, Rio Linda, near Sacramento, reports working over his Heath HX-20 to replace his present homebrew SSB exciter for two meters. On December 1 he worked W6NLZ with 5-9 signals both ways for a long north to south ground wave haul. He was also heard in San Diego by K6QVZ. K6LZC in Hawthorne was worked on December 17th. Strange how often the Northern California to Southern California path is broken down these days when only a few years ago it merited a full 'Special Report' in QST. How techniques do advance!

Ernie, W7LHL, Seattle, reports on a new sked he is keeping with VE6HO in Calgary. The two meter sked runs from 2030-2045 PST, with Ernie sending the first 2.5 minutes and then VE6HO sending the next 2.5 minutes, etc. The path is 420 miles long and has yet to be broken down. Ernie's frequency is 144.002 megacycles. Here's hoping.

K7GGJ, Yakima, Washington has a new panadaptor for two meters making visual checking available in his shack for both six and two meters. Sounds like a good article for VHF to us OM.

K7DTS, Napavine, Washington reports working K7SJQ in Portland, Oregon on two at 2115 PST on January 1.

Al, K8AXU, reports he didn't do any good on the December Meteor Showers on two meters, although he had four skeds.

A sked with WØENC in South Dakota in the January shower proved a dud, but a sked with K4IXC, Florida did produce the first West Virginia to Florida QSO on two meters in history. Notes Al, "I got lots of pings on January 1 and 2 but the shower really peaked on the 3rd. In the first half hour we made the QSO, exchanged 73, FB, GM and SK as well as S3 signal reports. The 5 to 7 second bursts were coming fast and heavy."

Al will also be watching for two meter sporadic E this coming summer and operating on 144.124 megacycles.

W8TZZ, Monroe, Michigan, completed a new ten element beam for two meters during December.

K1CRQ/8 reports working W1QAK, W1MEH in Connecticut around 1915 EST on December 17th via Aurora. W1QAK was peaking 57A for a good signal. K1-CRQ/8 is located in Lockbourne, Ohio.

220 Mc

news continues to be on the up and down. W4-RMU is still active with 500 watts from Jacksonville, Florida and is looking for skeds. Write to him at 2442 Pine Estates Road in Jacksonville. He loads into a 13 element yagi on 220.097 Mc.

K8ANG has the right idea but the wrong coax line to support the ideas and results. He loaded his new 2 KW PEP SSB rig into his beam and blew both RG-11 baluns. Now a couple of linear baluns made up from beer cans are being weather tested! How about an article on the baluns OM? He also revamped his 200 Mc paramp (X band pumper) and is really getting set up for DX.

K1CXX is still running his 140 watts on 220 up Maine way.

432 Mc and Higher

revolves around the efforts of many to get some suds on 432. Several are building up the 4X250B final ala the January issue of VHF. John, W5UKQ, in Baton Rouge is working hard on a rig that will run SSB and TV on 432.

K4LOZ, College Park, Georgia has finished up his 1296 parametric amplifier and is now working on his polar mount for the six-foot 1296 dish.

WA6HIA/7 at 16346 NE 11 St., Bellevue, Washington reports lots of experimenting with APX-16 and UPX-7 units in the Seattle area on 1215. He promises to send along some re-designing information for both soon.

Don does report "W7QID and K7KDU have worked 10 to 35 miles mobile over the flatlands across the mountains. They use 36 inch parabolic antennas with Crisco can waveguide feed. They are finishing some capacitance tuned coaxial wavemeters with a micrometer adjustment for frequency calibration. (Tell us more — write us an article — Editor!)

"W7IPJ is still reworking his rig. W7-AGJ has converted a UPX-7 (a non-flying APX-6) but is still working out his antenna problems. K7GIJ and WA6HIA/7 have been working regularly over and around the Seattle Hills, testing a variety of antennas. K7GIJ has a new 30 element, wide spaced 110 inch long yagi with a sheet metal reflector. This works out very well and has a gain of about 20 db. (Anyone who can tune a 30 element yagi at 1215 Mc is a genius — Editor) WA6HIA has tried a variety of corner reflectors and colinear arrays. The 60 degree dipole fed corner is much the easiest to work with."

Up higher, W6IEY has worked over his 10Kmc gear. And WA2UNC in Brooklyn would like more information on 10Kmc gear. Why don't you two fellows get together?

DXpeditions . . . page 20

signals may eventually end up during this season of the year.

It's a weird and wonderful combination of geography (the Gulf, coast, and the mountains butting almost up to the waterline) in this area that makes it all possible.

For my friend the XE3 it makes for a few weeks of interesting television viewing. Now . . . someday when I can get far enough ahead to take two weeks off, I'll give it a try on 6, 2, 220, and 432 as W5-KHT/XE3. Or perhaps you will beat me to it!

(P.S. Where are the other spots I will someday expedition to? The Azores for one. Marshall Islands for another. Both are six meter F2 areas, if and when the MUF starts to approach 50 Mc again. But more about both of these at some other time.)

TVI
VHF

by **Robert Grimm, K6RNQ**
VHF Western Technical Editor

In dealing with the various aspects of TVI I have made very little mention of parasitic oscillations. Parasitics are notorious for causing TVI in low frequency transmitters, however, they are not a primary cause of TVI in VHF rigs.

This is due primarily to lead lengths, which are usually quite short in VHF transmitters. The most common parasitic oscillations encountered in VHF rigs are generally low frequency oscillations and these are, for the most part, caused by RF Chokes resonating with bypass capacitors and forming low frequency resonant tanks. They can be cured by either removing the bypass capacitor, changing the inductance of the RF Choke, or by swamping the choke with a relatively low value resistor.

Before I dig into the mailbag and start answering letters, I want to take this opportunity to thank each and every one of you for your support and letters during the past year and to wish you all, belatedly, a Happy New Year!

And now, on to the letters!

Dear Bob:

"I have had a report that I am coming in on the PA system in the neighborhood church and interfering with services when I operate on two meters" . . . "What should I do about it? . . . Sincerely,

J. S. Illinois"

The trouble sounds like audio rectification, and while the fault probably does not lie with your transmitter you should still make every effort to assist in clearing it up as soon as possible. This is a rather delicate situation and the public image, so to speak, of amateur radio is involved. Needless to say, the congregation is going to take a dim view of you and amateur radio as a whole if you continue to disrupt their services.

Your signal is probably being rectified at the grid of one of the low level audio amplifiers. Standard procedures for the elimination of audio rectification should suffice in this case. These procedures were discussed in the August issue of VHF. They may also be found in the ARRL Handbook.

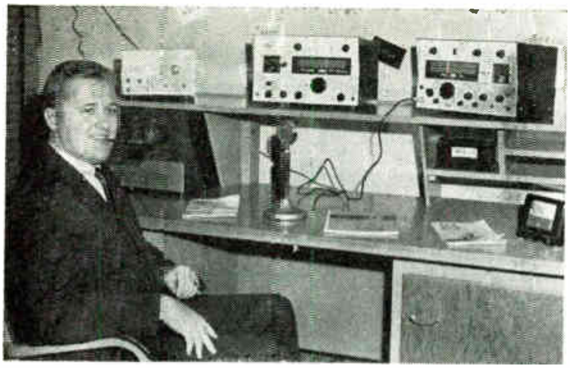
You should work closely with the serviceman or with another ham in getting this situation cleared up if you don't feel capable of doing it yourself.

"Dear Bob:

"I run 20 watts to a homebrew 2E26 rig on 6 meters. The antenna is a 3 element beam up 20 feet high. . . . I'm bothering the TV set of the people down the street when they watch channel 4. . . . One of my locals was telling me something about putting a stub on the TV set. Will this work? . . .

D. M. Calif."

(Turn to Page 39)



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THOR IV, 6 meter, 50 Watt Transceiver Tentative Price	350.00	31.62	17.25	12.45
VENUS, 6 meter, SSB Rig, Tentative Price	425.00	38.50	21.00	15.16

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Scanning the literature

CURRENT MAGAZINES

Using the 4X250B as a Frequency Multiplier to 432 Mc. Ed Tilton, W1HDQ. QST, January, 1963, page 30.

For 2½ pages, Ed describes how he put the "standard" tri-band VHF 4X250 rig first described by W1VLH way back in February '57 to work at the now-legal power levels on 432.

Those who haven't tried it might think that all you have to do is load up to a little more soup — but that's not quite right, and Ed goes into excellent detail telling not only why it's not, but how he solved the problems.

For instance, the plate line which worked nicely at 50 watts had miserable efficiency at two and three times this level. A change in construction technique cured this, but then there was trouble with the tuning capacitor. And so forth.

In the process of explaining all this, Ed tells you what to look out for in adapting your own rig. It's must reading for any ham intending to run a full gallon (or even a couple of hundred watts) on 432.

P.S. — The W1VLH rig modified as described here would be a FB driver for the 432 kw appearing on page 4 of this issue of VHF!

In the same QST:

An All-Nuvistor Converter for 420 Mc., W2VCG. January was a good month for 420-Mc converters using the 8058. This one, another in RCA Ham Tips, and our own circuit (in the February VHF) all appeared about the same time. All work well; build one! 3½ pages.

Frequency Stability of Third-Overtone Crystal Oscillators, W4LNG. Detailed study of stability in a 32.5-Mc overtone oscillator with variations of temperature, voltage, and tuning. Must for rock users. 2 pages.

In the January 73:

Nu 1¼ Meter Converter, WA2INM. A 220-Mc converter using 6CW4's. Looks good and Larry gives plenty of detail for duplicating it. 2¾ pages.

NTSC Signal for Ham TV, K2HQY. Description of standard commercial TV signal so ATV users can be compatible. 5 pages.

73 Tests the WRL Tech-ceiver, Staff. Product test of an inexpensive transceiver for 6. 1½ pages.

In the January CQ:

A Six Meter Double Conversion Converter, CO2LE. Tune 6 with a BC receiver without images; a different approach. 2 pages.

Safari on Six, WA2DEW/KV4CQ. Story of a DXpedition. 2 pages.

Getting Along With the Indians, K3HNP. First of a series on TVI and VHF. 2½ pages.

The "Quickie-Six," WA2VOI. A portable beam for 50 Mc use. 1 page.

Six 'n Stones, WB2AAI/ex-W5KDR. Condemnation of lids on 50 Mc. ½ page.

TVI . . . . from page 36

It sure will. The stub should be of the "open end" type. Cut it from a piece of TV twin lead, 49½ inches long. Connect one end of it across the TV set's antenna terminals, in parallel with the existing TV antenna lead. A photographic demonstration of how to do this was given in the July issue of VHF.

"Bob:

"I'm thinking of buying a commercially built six-meter rig. I want to get something in the 25 to 50 watt category, but I don't want a TVI generator. What do you recommend?

K.V.
Florida"

All of the better quality commercially built rigs are TVI proofed. There are also a number of kits available that have excellent TVI-proofing features.

"Dear Robert:

Does SSB really cause less TVI than AM?

Yours truly,
S.T.
New Jersey"

Looks like you want to start something! The answer to your question is yes, however there are a couple of reasons for this, one being something more than meets the eye. The final amplifier in a SSB rig is a linear and, operated as such, it has a very low harmonic content in its output. Personally, I think another part of the reason is due to the simple fact that people simply can't understand the "Donald Duck" talk.

Airmail Your D.R.P.!

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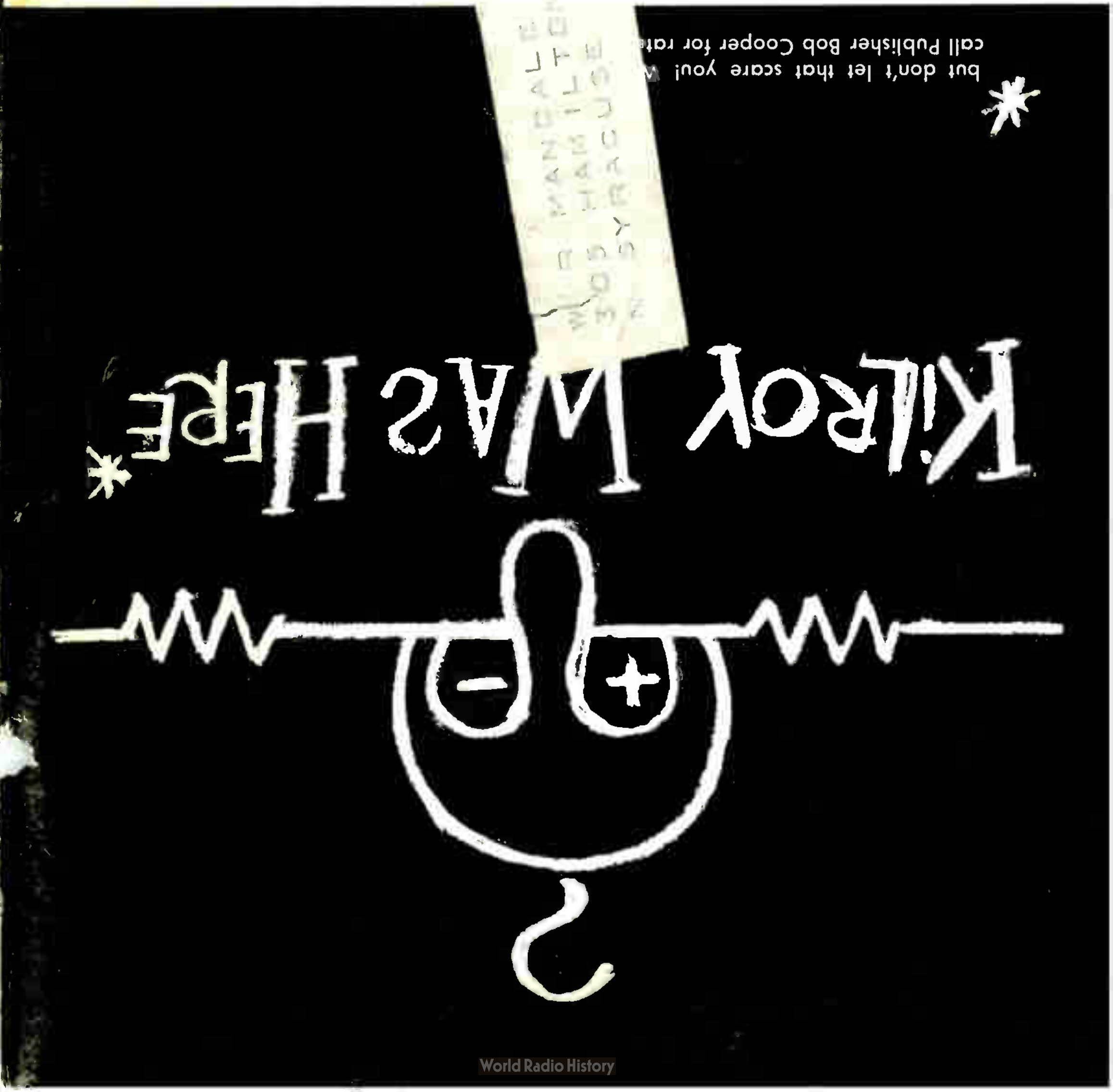

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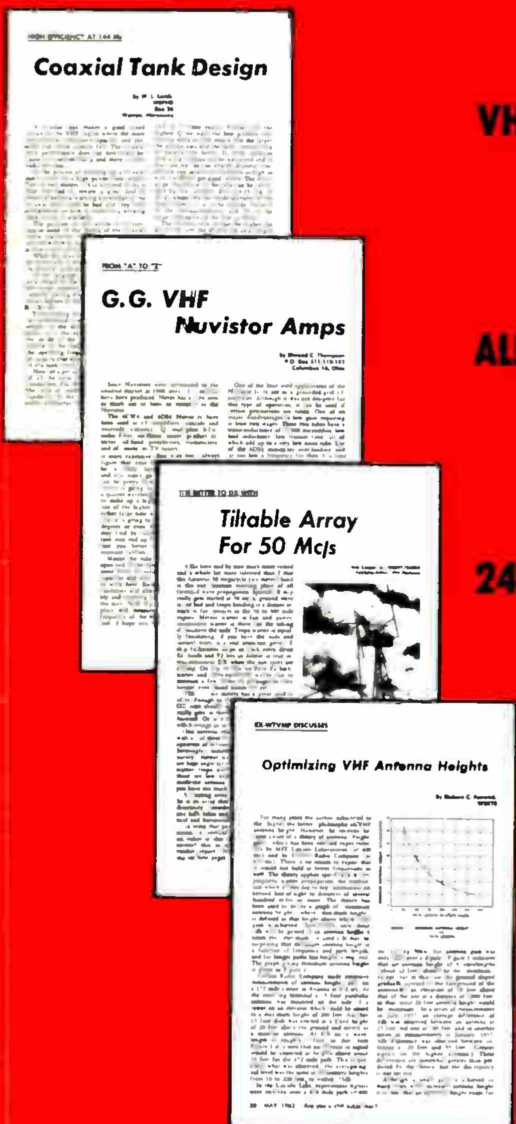

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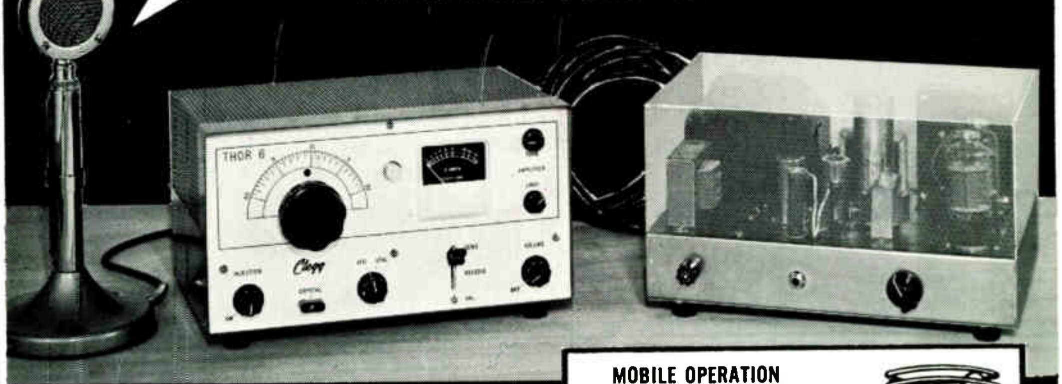

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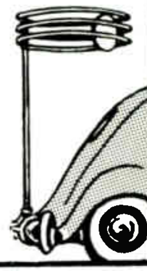

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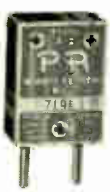

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MAY, 1963

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Coaxial Tank Design

By W. L. Lamb,
W0PHD
Box 26
Warren, Minnesota

A co-axial tank makes a good tuned circuit in the VHF region where the more conventional inductance-capacitor and parallel rod tuned circuits fail. The co-axial tank performance does not deteriorate because it is self-shielding and there is little radiation loss.

In the process of building up a co-axial tank circuit for a high power linear amplifier on two meters, I was suprised to learn that one had to review a great deal of material before a working knowledge of the co-axial tank could be had and very little information on how to construct a working tank circuit is available.

The purpose of this article is to summarize some of the theory of the co-axial tanks, transform it into layman language and show how to utilize this information in a tank circuit of your own design.

What the co-axial tank circuit is going to be electrically is intimately dependent upon its physical construction!

In the language of a mathematician the axial length of the co-axial tank in terms of the surge impedance of the tank and the capacity loading effect is expressed in electrical degrees of length by the formula: $\tan L = Xc/Zo$

Transforming this into a language more can understand it means this: The overall length of the tank circuit is dependent upon: (1.) the ratio of the diameter of the inside of the outer conductor to the outside of the inner conductor (Zo), (2.) the operating frequency, (3.) the amount of capacity that appears across the open end of the tank circuit.

Now let's get down to some details; first of all the ratio of diameters of the two conductors. For the highest Q tank circuit the ratio of inside diameter of the outer conductor to the outside diameter of the inner conductor should be about 4 to 1 (3.6 to 1 to be exact). Further, for the highest Q we want the best possible conducting surfaces, this means that the larger the surface area and the better conductivity of material the better. In some instances such a high Q may not be warranted and in that case we can use smaller diameter conductors and a ratio of diameters as high as 8 to 1 and still get good results. The Zo or surge impedance of the tank can be calculated by the formula: $Zo = 138.15 \log 10 (b/a)$ where b is the inside diameter of the outer conductor, a is the outside diameter of the inner conductor, and Zo is the surge impedance of the line in ohms.

The formula tells us that the higher the Zo of the tank the shorter the axial length will be for any given frequency and capacity loading.

The second factor that effects the overall axial length of the tank is the operating frequency. The higher the operating frequency the shorter the tank for a given surge impedance and loading capacity.

The third factor that effects the overall axial length of the tank is the amount of capacity that APPEARS across the open end of the tank. The greater the capacity the shorter the tank for a given surge impedance and operating frequency.

The capacity that APPEARS across the open end of the tank is all most impossible to calculate, although we can approximate it, and we must account for and take means to compensate for its elusive nature.

The capacity that APPEARS across the open end of the tank is really the summation of all the capacity and inductance effects we introduce into an otherwise pure tank circuit by the installation of tubes, tube sockets, coupling links, heat chimneys, etc. within the structure.

To give you a little better idea of how much this loading capacity effects the over-

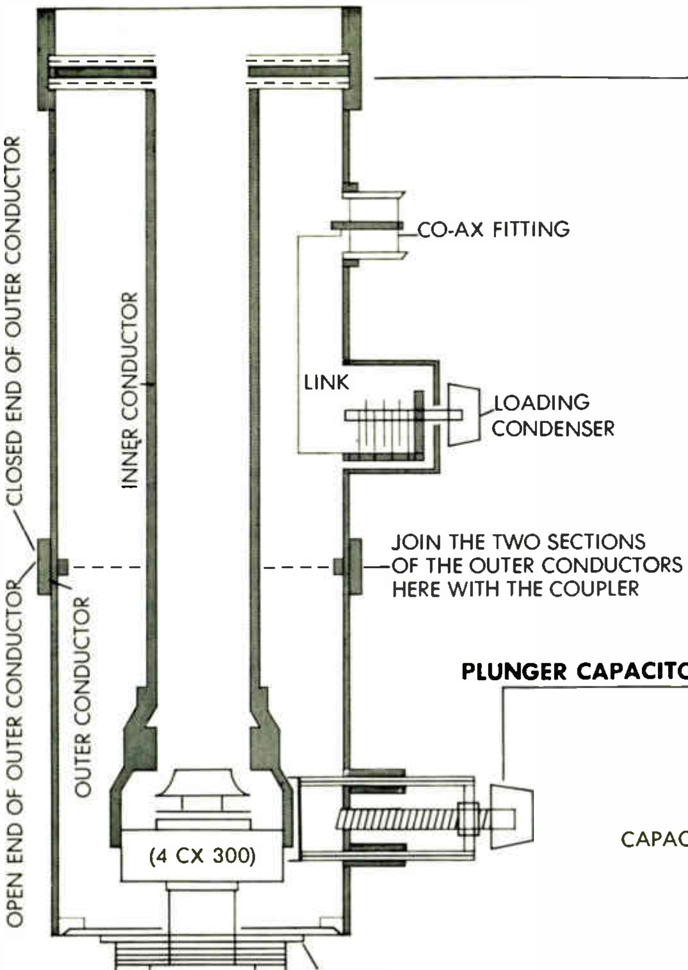


FIGURE 1

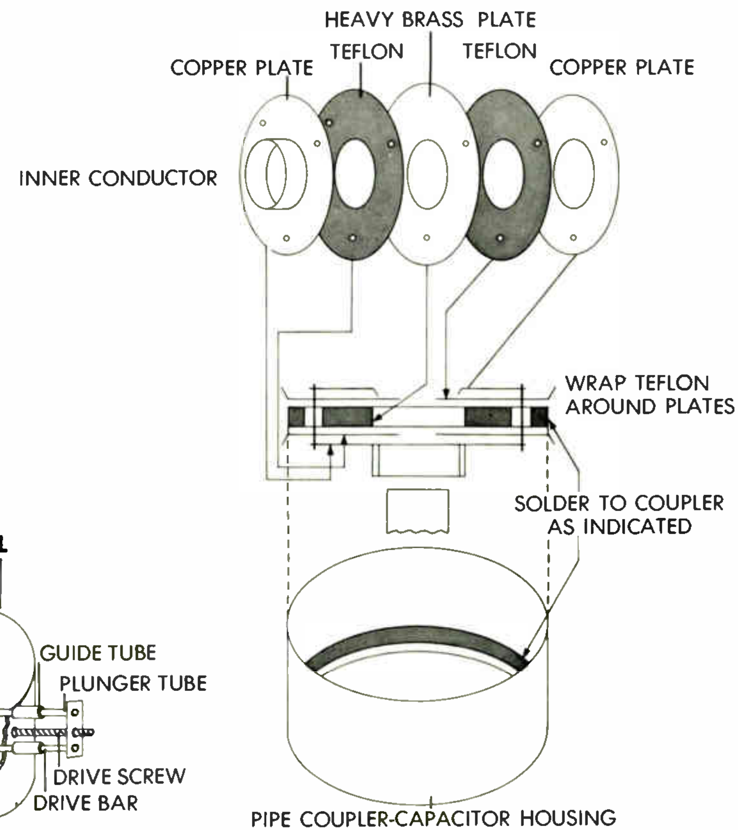


FIGURE 2.

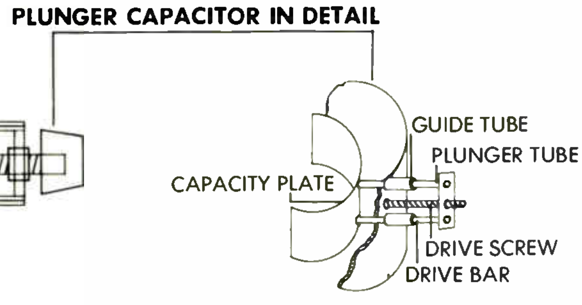


FIGURE 3

all length of the tank circuit let us suppose for example that we build a pure tank to start with, one that has no capacity loading at all. This tank will be just about 90 degrees or a quarter wavelength long at the operating frequency. Now than let us add capacity loading across the open end of the tank so that the capacitive reactance is just equal to the surge impedance of the tank. This new combination will have to be only 45 degrees long or an eight wave length to resonate at the same operating frequency as before.

Now let us tuck this theory into the back of our minds and think a little bit about how to actually make a co-axial tank circuit. We will want to make the tank out of readily available materials that are good electrical conductors. We find that the local plumbing shop is a natural place to shop for our project, for he is sure to have a large assortment of copper pipes, copper couplings and copper reducing couplings.

We must provide some mechanical means of varying the physical length of the tank to compensate for the elusive capacity loading effect. A small variable capacitor is also necessary to permit us to cover a band of operating frequencies.

Energy must be fed into and taken out of the tank circuit by means of links, taps at low impedance and taps at high impedance points as the circuit needs are met.

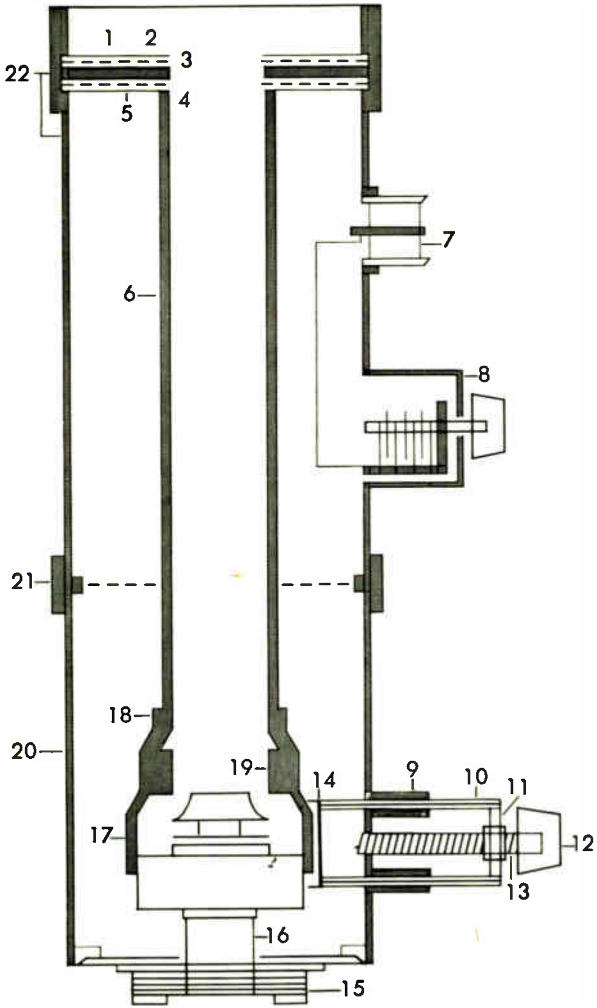
You will please refer to figure 1. This is a sketch of my two meter final tank.

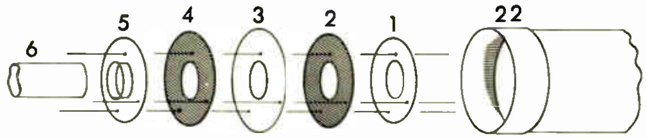
It is made up of three main parts, the inner conductor, the open end of the outer conductor and the closed end of the outer conductor. Contained within the open end of the outer conductor is the variable loading capacitor, the final external anode output tube and tube socket. I decided to use a series feed system for the B plus to the final amplifier. This meant that I had to build a low inductance by-pass condenser to electrically short circuit the RF between the inner and outer conductor at the closed end and still isolate the D.C. that appears on the inner conductor from the outer conductor. It is this RF shorting condenser and the RF output coupling link and condenser that is mounted in the closed end of the tank circuit.

I decided to use the series feed system on this tank circuit because it permitted me to couple the good heat disapating inner conductor directly to the anode of the P.A. with the use of common copper pipe reducer couplers. Also I did not have to concern myself so much with the need for a "super" RF choke as would be necessary in a shunt feed system. This system of feed does call upon the need for a little more mechanical construction. The details of the R.F. shorting condenser are shown in detail in figure two.

This is a good time to reach back into theory and see how our mechanical configuration has goofed up (in a manner of speaking) an otherwise pure tank. Well, for one thing we have placed a tube and its socket right at the open end of the tank. This is going to introduce quite a lot of capacity across the end of the tank, and then of course there is the deliberate addition to the variable loading capacitor. All of these things are going to make the tank circuit shorter than 90 degrees. Now, let's look at the other end of the tank, our R.F. shorting condenser. Ignore it? Nope. We can't, even though it has almost zero capacitive reactance at the operating frequency; why, well it is almost zero but not quite. It does exhibit a little inductance because of the way it is built. Let us look at it this way—we have the inner conductor, the R.F. shorting condenser, the outer conductor and the capacity across the open end of the tank all in one big series loop. Any change in capacity at the cold end of the tank is not going to have much effect upon the capacity loading of the tank directly, but even the slightest change in the capacity across the open end of the tank is going to have a lot of effect upon the final axial length. OK, think about this—the RF shorting capacitor and the fixed and variable capacity at the open end of the tank are really in series. The effect of the RF shorting condenser not being zero reactance is going to make the capacity that appears across the open end of the tank to appear a little smaller than it really is. The result, the axial length of the tank has to be a little longer than you thought. And here is another one, I am using a ceramic heat chimney around the anode of the output tube. The effective capacity at the open end of the tank is going to be increased a little because of the higher dielectric constant of this material at this crucial area, the result the tank has to be a little shorter than without it.

A pipe stretcher is just as hard to find as a wire stretcher . . . and copper pipe





R.F. "shorting" Condensor

code #	discription
1&5	copper discs - 2 plates of the capacitor
2&4	teflon insulation - dielectric material of the capacitor
3	3/16 inch brass plate - the ground plate of the capacitor
6	inner conductor - 3/4" copper water pipe
7	co-ax antenna fitting
8	1 1/2" pipe housing the 50 pfd antenna loading capacitor
9	1/4" i.d. copper guide tubes
10	1/4" o.d. copper plunger rods
11	driving bar for the plunger rods
12	tuning knob
13	driving screw
14	variable loading condensor plate - shaped to conform to anode of tube
15	tube socket
16	external anode tube 4 CX 300A
17	1 1/2" to 1" pipe coupler
18	1" to 3/4" pipe coupler
19	1" coupling pipe - to join the two reducing couplers together
20	lower "open" portion of outside conductor
21	3" pipe coupler
22	closed part of the outer conductor

Plunger type Loading Condensor

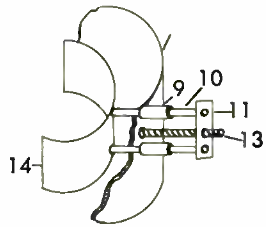


figure 1

TWO METER CO-AX TANK

is more expensive than wire sooo, always figure that your tank circuit is going to be a little longer than you think and you won't go wrong. Off hand, you can be pretty sure that the co-axial tank circuit is going to be somewhat less than a quarter wavelength long. If you are going to make up a high Zo tank operating on one of the higher VHF bands and have a rather large tube with a high output capacity, it is going to be a lot shorter than 90 degrees or even 45 degrees. In fact, you may find by rough calculations that the tank may end up inside the tube, in which case you better start studying up on resonant cavities.

Mount the tube and socket within the open end of the outer conductor along with some form of variable loading or tuning capacitor and your ingenuity can really go to work here. Build up the R.F. shorting condenser and also mount the link assembly and coupling condenser in this end of the tank. Now slip the inner conductor in place and measure the natural resonant frequency of the tank through the output link. I hope you find the tank resonates at too low a frequency for then it is time to get out the pipe cutter and start hacking off a very little at a time until you get the assembly tuned to the frequency range you want. The odds are the tank will be somewhere between 60 and 75 electrical degrees long if you are using one of the modern external anode tubes.

By now I hope that you have got up the courage to tackle a co-axial tank. The little extra effort it takes to build one is worth it!! Don't forget that the same technique can be applied to input tank circuits too. The difference will be in the manner energy is fed into and out of the tank circuit and with a good understanding of the basic theory, I am sure you can anticipate what will happen.

Yes, I have the dimensons written up on the tank circuit shown in figure 1 and will send them to you if you insist, but remember that if you want to duplicate this tank you will have to duplicate everything to the last detail . . . the electrical nature of the tank is intimately dependent upon the physical construction . . .

FROM "A" TO "Z"

G.G. VHF Nuvistor Amps

By Elwood C. Thompson
P.O. Box 511-110-182
Columbus 16, Ohio

Since Nuvistors were introduced to the amateur market in 1960, over 2 1/2 million have been produced. Never has a tube seen as much use or been so versatile as the Nuvistor.

The 6CW4 and 6DS4 Nuvistors have been used as r.f. amplifiers (cascode and neutrode circuits), Q multiplier - b.f.o., audio filter, oscillator, mixer, product detector, all-band preselectors, transmitters, and of course, in TV tuners.

One of the least used applications of the Nuvistor is its use as a grounded-grid r.f. amplifier. Although it was not designed for this type of operation, it can be used if certain precautions are taken. One of its major disadvantages is low gain requiring at least two stages. These two tubes have a transconductance of 12,500 micromhos, low lead inductance, low transist time; all of which add up to a very low noise tube. Use of the 6DS4 minimizes over-loading and cross-modulation due to its cut-off characteristics.

Advantages

Grounded-grid stages (either in a separate preamp or converter front-end) have many advantages over other popular types of VHF circuits. They are less subject to cross-modulation than the cascode, neutrode, or pantode r.f. amplifiers. They also give better noise figure and signal-to-noise ratios than the above mentioned circuits, although the gain is less than the cascode, they approach frame-grid tubes as far as noise figure is concerned. The primary advantage of the grounded-grid amplifier is its stability. A triode can be operated at much higher frequencies without instability in a grounded-grid circuit than in a grounded-cathode circuit having the same voltage gain. Grounded-grid circuits do oscillate, but if careful consideration is given to proper shielding and isolation, this problem can be overcome. A stable amplifier (grounded-grid) with slightly lower gain is more suitable and has a better noise figure than an unstable amplifier neutrode) with higher gain. Nuvistors have a transconductance of approximately 10,000 micromhos in this type of circuit.

Loading and Matching

The noise figure of Nuvistor grounded-grid amplifiers is a function of the source impedance. Any alteration of this source impedance (both resistive and reactive) can make serious changes in the noise figure value. A change of the signal source impedance changes the available gain of the stage. As the resistance increases, the gain decreases and the effect of second stage noise becomes more pronounced. To determine the optimum source resistance for a particular amplifier usually involves a series of noise figure measurements as a function of this resistance, usually 50 to 300 ohms.

When the source impedance and the load impedance do not match the input and output impedances, respectively, of the grounded-grid stage, it is necessary to insert baluns (figure 3) between the source and the stage and between the stage and the load to obtain maximum gain. The equivalent noise resistances of the Nuvistors are in the neighborhood of 200 ohms with grid-leak biasing, and with cathode bias about 250 ohms.

It should be noted that optimum noise figure is not necessarily obtained at the point of optimum gain. The usual procedure is to tune the r.f. circuits for maximum power transfer; to effect a match. Below 500 Mc. the best power match is not the best match for noise figure. With most tubes (Nuvistors included), the best match

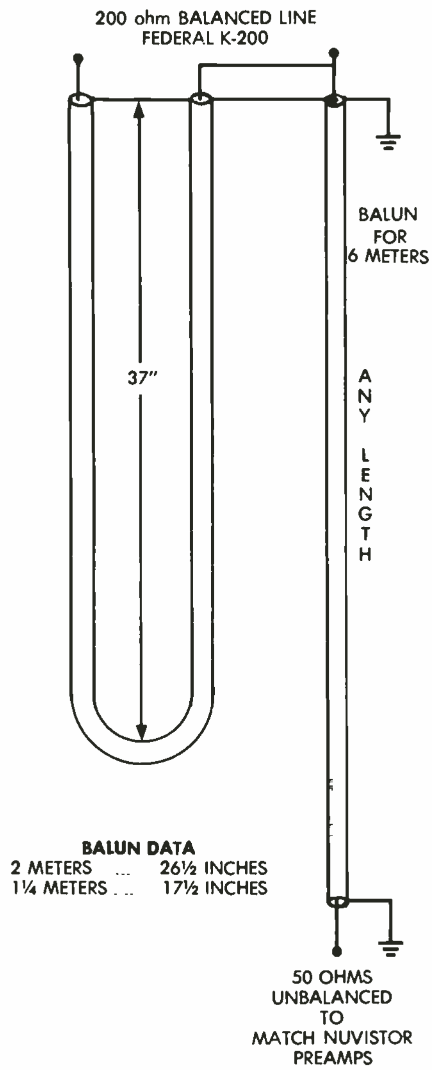


FIGURE 3

occurs when the VSWR is roughly 1.3 or 1.4. The proper match drops the noise figure nearly one db. at 2 meters.

The value of antenna resistance needed to obtain a minimum noise figure decreases with increasing frequency, this is

THIS MAY BE A SAMPLE MAGAZINE

VHF

Rx

BEWARE!

A strange spring-time contagious disease is spreading over the amateur radio fraternity. VHF DX. **There is no cure.** It will cost many a sufferer countless lost hours of sleep.

The first sign of this contagious disease manifests itself as an **itching** dial finger. An itching dial finger that refuses to stay away from the band-spread knob on your receiver! You feel that you have to tune . . . TUNE . . . **TUNE!**

Soon the second stage sets in. You have an irresistable urge to grab the microphone and call "CQ-DX!"

The third and final stage borders on dilerium. You wake up in the middle of the night, a cold sweat crawling down your back. You sniff the air and lunge for the window. A cloud bank to the west . . . clear sky over the rest of the horizon. Moisture in the air! Caught up in a fit of madness you dash for the shack in your PJ's!

DX-DX-DX . . . the band is open! Frantically you turn the dial, spin the rotor and search for your logbook.

As the sun comes up you collapse in a fit of mental exhaustion only to hear the XYL call you for breakfast. Fatigued, all-in, but feeling like a man who has just conquered Mount Everest you stumble to the little woman log-book in hand.

"Look honey — see here. **Two new states on 2 meters!"**

She smiles. "Hurry up and eat your eggs Charlie, you'll be late for work . . ."

AH, YES . . . VHF DX. And what better way to stay up on the very latest DX news throughout the entire six, two, 1¼ and ¾ meter DX sessions ahead than with a regular subscription to VHF Horizons? FILL IN ONE OF THE SUB CARDS BELOW —

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Oklahoma City 1, Oklahoma

where the minimum noise grounded-grid circuit becomes more suitable as a front-end.

With the above parameters in mind we set to work on some preamps. Although a single stage is shown in Figure 1, the advantages of having two stages of amplification really begin to pay off as we go higher in frequency. (Figure 2) This circuit is an offshoot of the popular grounded-grid circuit in the ARRL Handbook. Previous VHF construction experience has shown that at least two stages of r.f. more than offset the added cost and adjustment problems. The cascaded (not cascode) will work up to 220 Mc with lumped constants, but then the circuits give way to coaxial or trough type circuits.

Most preamps or converters with only one r.f. stage (especially at 144 Mc) do not provide enough image rejection. The noise figure can be improved from 1/2 to 1 db. by having the extra stage.

As seen in the formula:

$$NF = \frac{nf2\text{-}1 + NF1}{gl}$$

where:

NF=Overall noise figure
NF1=1st Stage noise figure
NF2=2nd Stage noise figure
gl=1st Stage gain

that as the first stage gain is increased the second stage noise figure is decreased and the overall noise figure is decreased. If this gain is increased too much, the possibility of overload and cross-modulation is increased.

Circuitry

As seen in figure 1, the coil (L1) and capacitor (C1) form an impedance matching circuit. The cathode tap is used to maintain a high "Q" and some selectivity in the input circuit. Link coupled circuits are used between stages. This is a very important feature, making possible a highly desirable flat-topped response curve. Along with providing a good interstage impedance match, this link coupling eliminates taps on the coils, reduces capacitive coupling and spurious responses. A considerable increase in gain can be had if the builder wishes to sacrifice bandwidth, by peaking the stages to cover a 1 Mc segment at the low end of each band. Stability is accomplished by complete grounding of the Nuvistor tube shell and socket. Once the shell is grounded, the tube will give the constructor no trouble. Freedom from possible feedback is had by careful positioning of the slug-tuned coils and phasing of the windings for minimum capacitive coupling. This band-pass coupling permits higher "Q" tuned circuits, resulting in better image rejection and more uniform response across the bands than would be possible with capacitive coupling.

One of the nice features of the two stage circuit is the use of a gain control in the cathode of the second stage. This may or may not be needed, depending on the

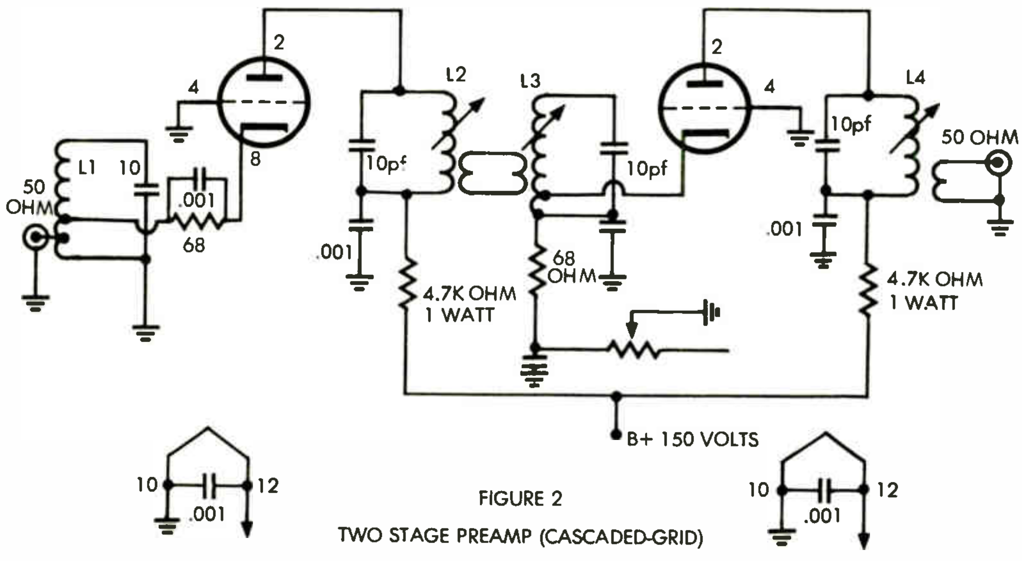


FIGURE 2
TWO STAGE PREAMP (CASCADED-GRID)

actual needs of the constructor. In areas where two and six meter activity is high, it is recommended. The 6DS4, with its semi-remote cutoff characteristics is highly recommended for use in the two stage circuit for 6 meters. At 6 meters the single stage preamp may give all the sensitivity and gain that is needed, but on 2 and 1 1/4 meters, the cascaded stages are used to approach the point where antenna noise is the limiting factor.

Layout

Complete shielding of the input-output circuits is absolutely necessary to obtain trouble-free operation. The preamp or a complete converter may be built into a small chassis box of flashing copper. Soldering of the mounting tabs of the Nuvistor socket to the chassis is a must for stable operation.

The shielding members also must be well soldered to the chassis. As in all circuits at these frequencies, point-to-point wiring is used and no trouble should be encountered in a simple layout for either a preamp or completely Nuvistorized converter. The individual case will dictate the requirements for the actual construction.

COIL TABLE

6 METERS

L1 . . . 10 turns # 28 enamel, 1/4 inch diameter, closewound, cathode tap at 3 turns, antenna tap at 1 1/2 turns from ground end.
L2 . . . same as above (without taps)
L3 . . . 10 turns # 28 enamel (same as above) tap at 3 turns.
L4 . . . same as above
All link windings . . . 2 turns of hookup wire wound at cold end of coils.

2 METERS

L1 . . . 6 turns # 18, 1/4 inch diameter, 5/8 inch long, cathode tap at 4 turns, antenna tap a 2 1/4 turns.
L2 . . . 6 1/2 turns (as above)
L3 . . . 6 turns (same as L1)
L4 . . . 6 1/2 turns (same as L2)
All link windings . . .2 turns of hookup wire wound at cold ends of coils.
capacity across windings: 1-7.5 pf. trimmer; Centralab # 829-7

220 Mc.

L1 . . . 2 1/2 turns # 18 enamel, 1/4 inch diameter, antenna tap at 3/4 turn from ground end.
L2 . . . 3 turns # 18 enamel, 1/4 inch diameter
L3 . . . 3 turns # 18 enamel, 1/4 inch diameter, tap at 1 1/2 turns
L4 . . . 3 turns # 18 enamel, 1/4 inch diameter

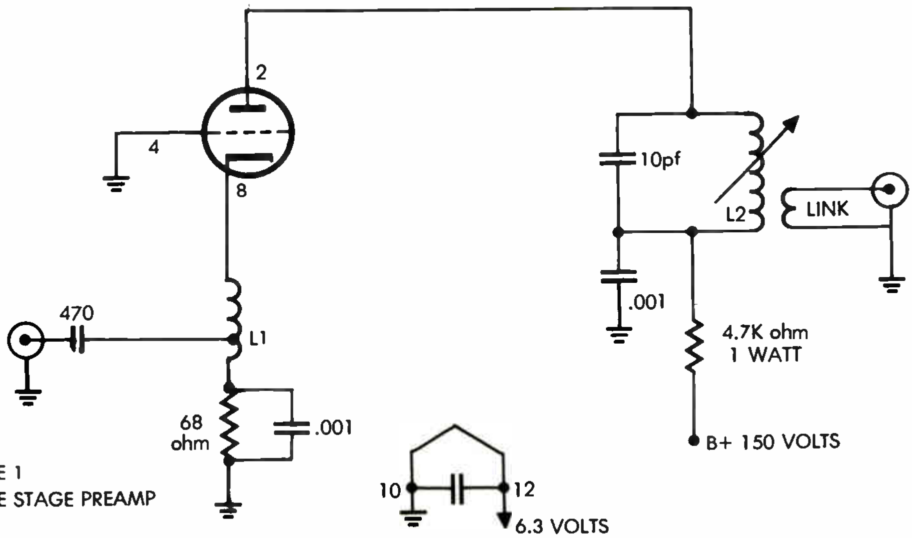


FIGURE 1
SINGLE STAGE PREAMP

Letters

VHF:

We are all very interested in the repeater station articles. Our equipment is a variety of 'surplus' commercial FM gear by GE, RCA, Motorola, etc. My rig is a Motorola 80D with final modified for 6146's. Antenna is double 4 J-Beam 50 feet up, but 160 feet of RG-8/U attenuates the signal some! I have worked Milwaukee, around Chicago, northwest Indiana, Detroit and Fort Wayne, Indiana. About 135-140 miles. My best mobile DX was with K9BHM/M while he was mobile in motion in Gary, Indiana. This was full quieting, 120 miles base to mobile. You fellows have a real good publication, I have enjoyed it from the first issue.

I. DeWitt, K8EMU
Hudsonville, Mich.

THE BETTER TO DX WITH

Tiltable Array For 50 Mc/s

Bob Cooper, Jr., W5KHT/K6EDX
Publisher-Editor, VHF Horizons

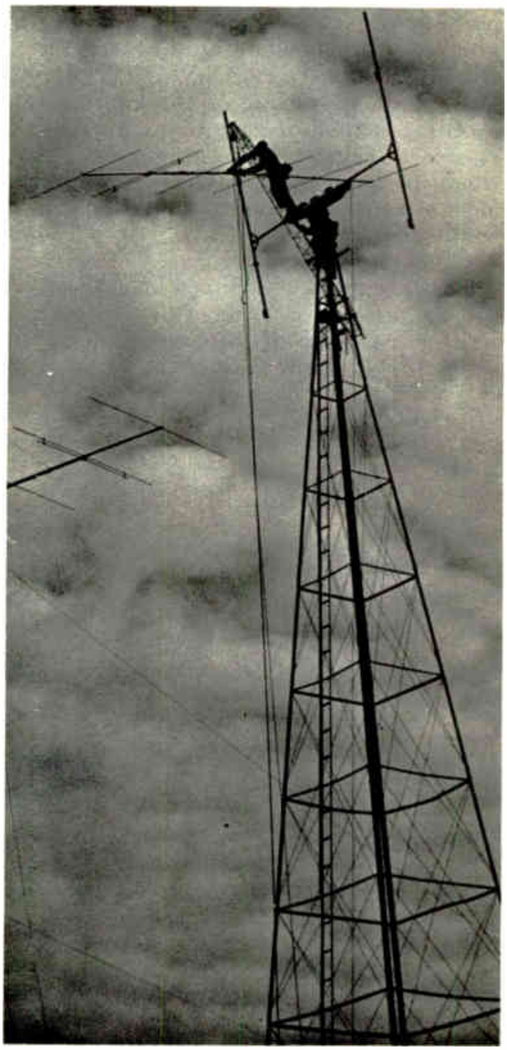
It has been said by men much more versed and a whole lot more talented than I that the Amateur 50 megacycle (six meter) band is the one common meeting place of all forms of wave propogation. Sporadic E skip really gets started at 50 mc/s, ground wave is not bad and tropo bending is a distant attraction for contacts in the 50 to 500 mile region. Meteor scatter is fun and games, ionospheric scatter is there for the taking if you have the suds. Tropo scatter is equally fascinating, if you have the suds and auroral work is a real attention getter. E skip backscatter helps us track extra dense Es clouds and F2 lets us dabble in true inter-continental DX when the sun spots are cycling. On top of this we have F2 backscatter and trans-equatorial scatter not to mention a few forms of propagation they haven't even found names for yet!

YES . . . six meters has a great deal to offer. Enough so that the died in the wool DX nuts should seldom go without if he really gets in there and puts his best foot forward. Or is it his best antenna? All of which brings us to the brink of this report.

One antenna system, capable of dealing with all of these forms of propagation with optimum effectiveness is quite a challenge. Seemingly, something should give. Es, auroral, meteor scatter and even some F2 are high angle activities. Tropo, ionospheric scatter, tropo scatter, F2 backscatter . . . these are low angle items. Some require moderate antenna gain and none hurt if you have too much antenna gain!

A rotating array is an obvious necessity. So is an array that has a high measure of directivity, considerable rejection of side and back lobes and narrow-steep sided vertical and horizontal antenna patterns.

An array that provides switchable polarization, i.e., vertical or horizontal, with gain on either is also to be desired. WØBBM covered this in some detail in his November report (November 1962) appearing in these pages.



80 feet above ground a workman balances on a gin-pole rig (actually the top section of a smaller tower) to tighten clamps on one of the six element arrays as it mounts on the H frame. The single six Telrex is below the 16 element 144 colinear at left.

The 24 element 50 megacycle antenna array at W5KHT has been in service four months or 120 days as this is written. The array consists of four Telrex 6MSR-6 long yagis (six elements each on 24 foot booms) tied together with Telrex phasing harnesses in the manner shown in diagram one.

The center of the array is 80 feet above ground on a hill that rises to 1340 feet msl at the base of the tower.

The tower chosen is the VESTO 77 foot self supporting all steel monster, from VESTO Co. Inc., 20th and Clay Streets, North Kansas City, Missouri. This tower was chosen because it offers excellent support (each leg is sunk six feet under ground with 3 cubic yards of concrete), climbability that even W5KHT dared scamper up, no guying of any kind and an excellent method of mounting a heavy duty rotator (Telrex Model 397-RIS) that would be large enough to take the punishment of an extremely heavy array and spring winds that frequently exceed 110 miles per hour.

The tower was also chosen because it had the appearance of being 'just another oil well' in a portion of the country where oil wells in back yards are not too uncommon (except in mine!-Editor).

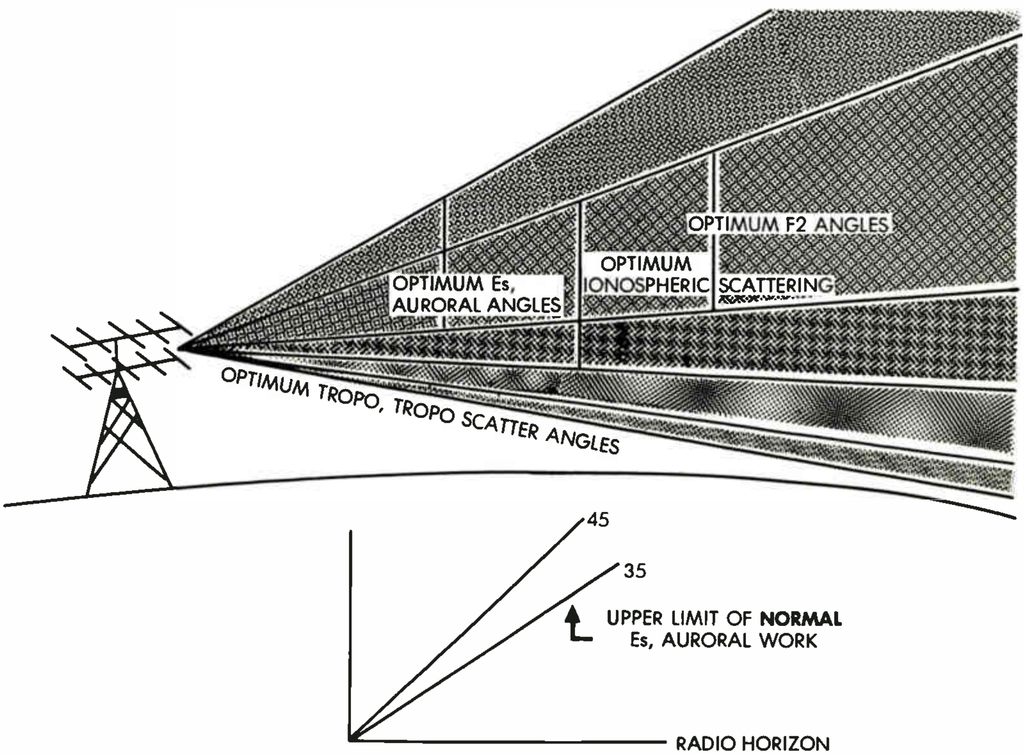
Mage Majors WØOJI, the boss at VESTO, told us we could assemble the tower ourselves in a weekend. This we attempted over 11 weekends throughout the summer of 1962 and then in desperation we found some help from Utility Tower Company, Oklahoma City which promptly had two-three tower climbing daredevils working on it for five straight days before it was completed. Well, I got the holes dug and the bottom section assembled anyhow.

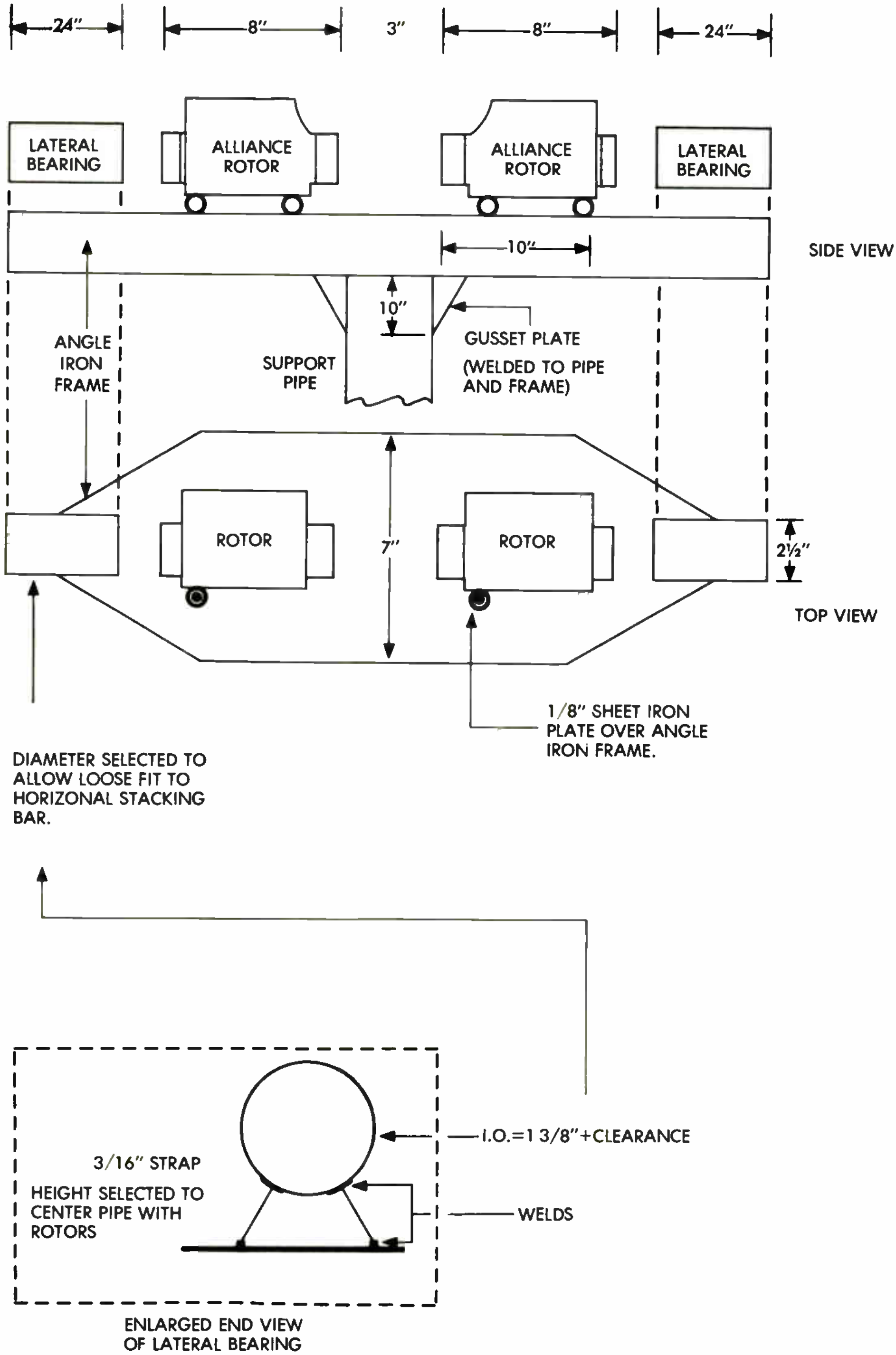
We wanted an array that would produce a pattern no wider than 25 degrees at the half power (6 db) points in the vertical plane and no taller than 20 degrees in the horizontal plane.

Armed with this much information and the characteristics of our individual six element yagi VHF's Russ Miller, W5HCX, went to work with his slide rule, a tall stack of graph paper and the MIT Lab series chapter on antenna phasing solutions.

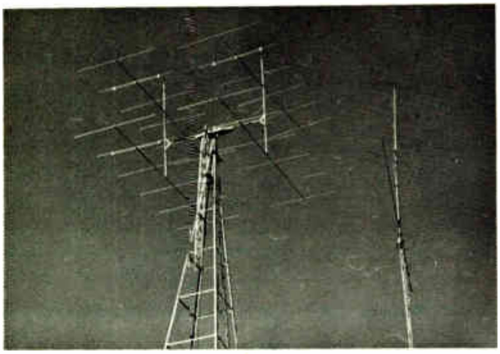
The spacings Russ calculated are shown in diagram one. They will probably look as unusual to you as they did to us at first glance.

"You've made a mistake Russ" we proclaimed. "This looks more like spacing for





TILT MECHANISM FOR 24 ELEMENT 50 MC ARRAY



The full array of four 6 element optimum spaced yagis resting at a 10 degree tilt glistens in the early morning sun at W5KHT. The array is aluminum, the H frame welded steel and the tower a VESTO 77 footer which went together piece by piece!

a two meter array."

Russ was adament and even volunteered to climb the array and respace the antenna if he was wrong. This seemed a reasonable offer so we next approached the problem of how to support the array on top of the tower. My crude drawing of an H frame was quickly discarded after Editor's Kyle and Miller tore it to pieces (verbally) and Miller worked up the specs on a welded construction monster that looked like it would support the Queen Mary. This is shown in diagram two.

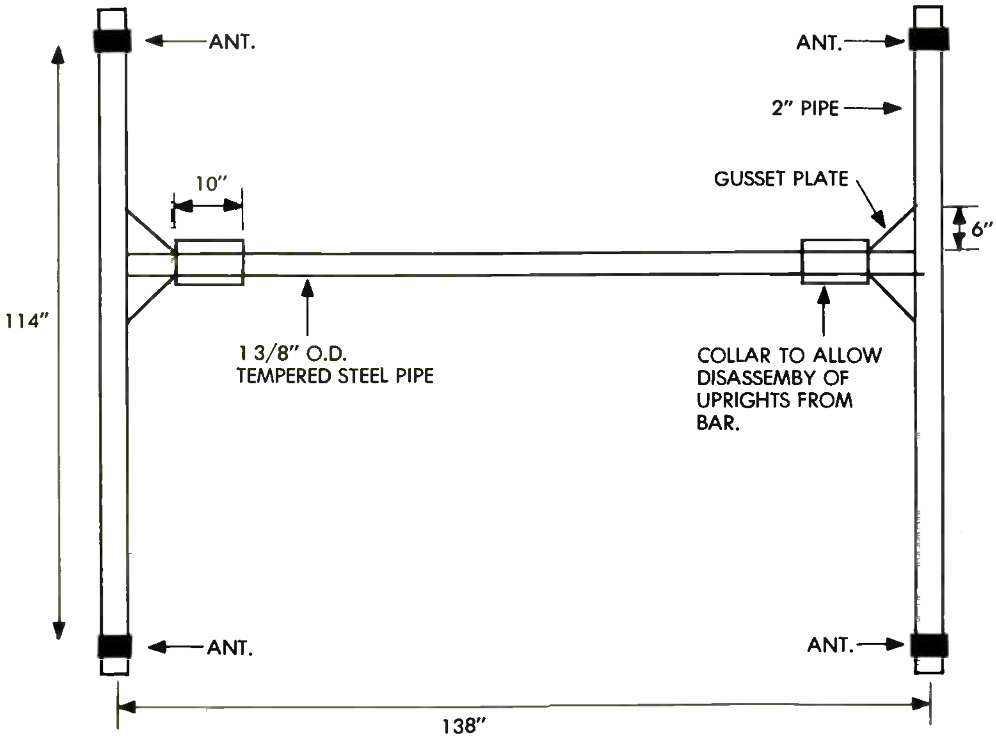
Note in diagram two that we have engineered in a provision for elevation tilt on the antenna.

Elevation tilt on any six or two meter array is desirable to say the least. If you are able to tilt the array up off of the horizon you can track auroral reflections close in short skip on six meters and miscellaneous B-52's as they circle to land at the nearest airbase (this gives the neighbors fits).

You can also explore the unknown world of angular reflection from tropo and ionospheric scatter mechanisms and generally keep your third hand busy with one more switch to play with while you are trying to adjust the receiver, rotate the beam and throw the rig on all at once!

Seriously speaking, the elevation tilt has proved invaluable. On E skip paths worked through the fall and winter season, we could start out an opening with the array pointing even with the horizon and then track the movement of the Es cloud as it switched about. Especially interesting were the contacts that we managed to keep up on

Continued — Page 19



Progressive Thoughts On VHF RTTY

Byron H. Kretzman, W2JTP
431 Woodbury Road
Huntington, N.Y.

For over a decade, following WWII, amateur radioteletype operated, with audio-frequency-shift-keying (a.f.s.k.), on 147.96 mc, a nationally agreed-upon channel, way up on the high end of 2 meters. Radio equipment consisted mostly of war surplus a.m. SCR-522, ARC-5, and ARC-3 equipments. Their crystal controlled receivers eliminated tuning and drift problems. The "squelch" feature of these sets also made possible the completely noiseless monitoring of a channel as their audio amplifiers are completely cut off in the absence of a carrier.

Most of you who have operated other modes as well as RTTY on 2 are painfully aware of the sad history of the ARRL petitioning the FCC for the lower 100 kc of both 6 and 2 meters for exclusive c.w. use; and, its outcome: FCC Docket 12485, effective June 6, 1960, which established a 100 kc c.w. segment at the low end of 6, but which put the c.w. portion of 2 at the high end, 147.9 to 148.0! As the result, the dx-hounds are still using c.w. on the low end of 2, and the c.w. portion at the high end is woefully vacant, except for an occasional weak diathermy harmonic wandering like a lost ghost back and forth across the barren wasteland of 100 kilocycles.

The old "national" 2 meter RTTY frequency of 147.96 is therefore unusable, and as almost three years have gone by since Docket 12485 became effective, it is high time that we established a new "national" frequency for 2.

Considerations in Selecting a Frequency

Now, to select a suitable channel for RTTY there are several factors which should be considered. The first, perhaps, is that in these modern times many f.m. systems, largely for fone, are in use all across the country. Should there be a separate frequency for f.m.? The second consideration is the existance of the RACES segments from 145.17 to 145.71 and 146.79 to 147.33, where 6A2 (a.f.s.k. on a.m.) and 6F2 a.f.s.k. on n.b.f.m.) is permitted but 40F2 is not, although 40F3 (wideband f.m. fone) is. Do we want a "national" RTTY channel in the RACES bands or out of them? Thirdly, any kind of in-band repeater system would require another frequency near the low end. (The New York City metropolitan area used 144.138 with 147.96 before Docket 12485.) Do we need another channel in the low end of 2 meters?

Let us look at conisderation number 1: The old a.m. nets using the SCR-522, etc., and some of the older transceivers are gradually becoming aware of the broadness of their receivers and of their low sensitivity. Problems associated with utilization of some of the newer transceivers are stability and lack of continuous duty capability, and generally, lack of the squelch feature. Those who have changed over to the wide band commercial surplus f.m. sets have been amazed at the increase in performance, such as range, stability, squelch, etc. The FM Net Directory published by K4ZAD shows quite a few f.m. RTTY nets in operation already, such as in Chicago, Detroit, Cleveland, Milwaukee, St. Louis, and Indiana. A definite trend is indicated towards wide band f.m. for this kind of extended local operation. Considering the above trend and all ever-increasing band usage, it appears that RTTY should be concentrated on one channel. If, a.m. is already in widespread use in a particular area, why not continue to use it until availability of f.m. sets in that area makes it possible to economically change over.

Looking at consideration number 2: It has been the writer's personal experience in both the midwest and in the east that the CD radio people, already operating 2 meter fone nets set up for RACES, do not wish to use amateur RTTY, preferring to either do without Teletype for budgetary reasons or to lease machines and landlines from the local telephone company. It also has been noted that CD drill operations, within the RACES segments, pre-empt those frequencies. On the basis of the above observations it seems more practical to select a "national" RTTY frequency outside of RACES segments.

Consideration number 3, the secondary RTTY channel in the low end for in-band repeater usage; is, first of all, not easy to implement. Secondly, it has been the experience of many of the operators of wide band f.m. systems that it is much more practical and easier to repeat from 6 to 2 meters. For example, a high power 2 meter transmitter strategically placed in a high location will cause much less TVI than if it were on 6, and it can be easily triggered by real low power 6 meter signals from each home location. It therefore seems reasonable to suggest that the selection of a secondary 2 meter frequency be done on a local basis, depending upon local requirements, rather than on a national basis.

Suggestion

Consideration of all of the factors detailed above makes it apparent that 146.70 Mc is the logical choice for a "national" RTTY frequency on 2 meters. It is therefore proposed that we obtain comments from Mr. Ed Handy W1BDI, Communication Manager of the ARRL, and leaders in the organized RTTY societies and groups across the nation, such as W2JAV, W3DTH, W4RWM, W5KXD, W6AEE, K6ESZ, W7WWG, W9SPT, WØATM, and WØJHS.

It is further suggested that the above proposal be published in QST and in VHF and RTTY bulletins so that the rank and file of both VHF and RTTY may be made aware.

A Transistorized VHF Oscillator

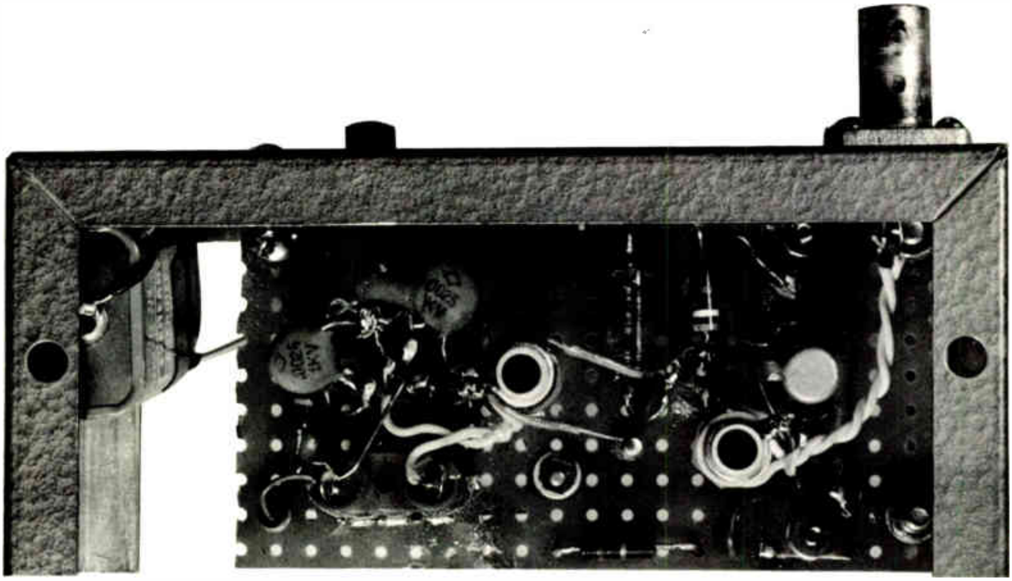
W4HHK/A4HHK
% VHF Horizons

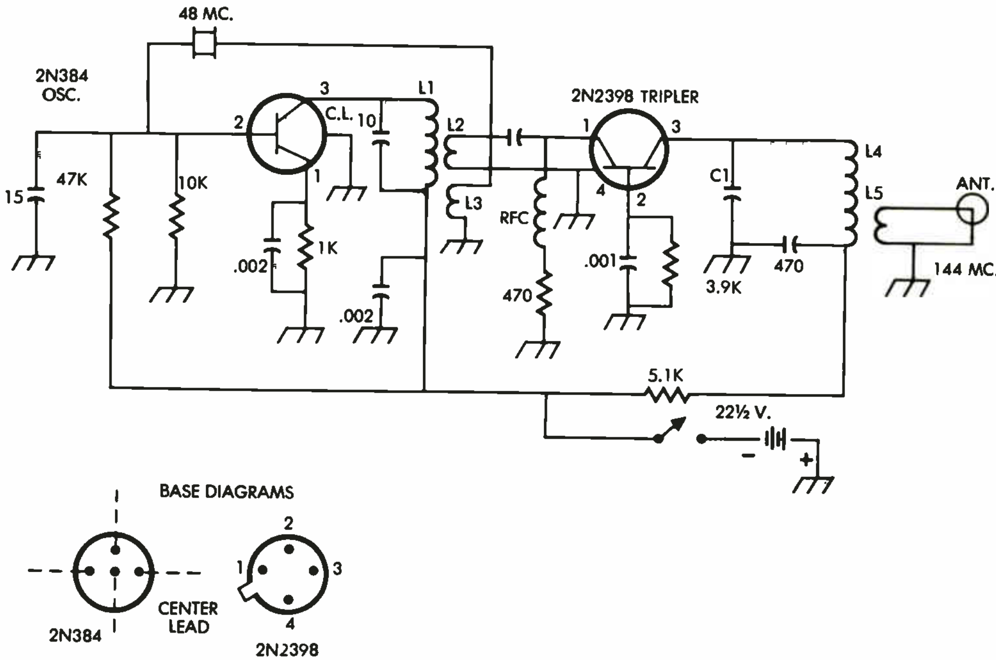
This article describes a transistorized oscillator-tripler for generating marker signals at 144 and 432 mcs. It provides instant r.f.! There is no waiting for a filament to heat up, and no need for an a.c. outlet. This unit combines the advantages of VHF transistors and an overtone crystal to produce stable signals at 144 and 432 mcs with minimum circuitry and battery drain. No attempt was made to miniaturize it. The total weight is eight ounces.

Two transistors are used, both of the P-N-P type. The 48 mc oscillator employs an RCA 2N384 currently selling for $2.06. A Philco 2N2398 is used in the tripler stage that bears a modest price tag of $3.75. The latter is rated as an amplifier up to 800 mcs! The crystal is a third overtone type made by International Crystal Co. Originally, only the oscillator was constructed. A six inch "whip antenna" provided a good signal on 144 mcs at a distance of about two hundred feet, but the 432 mc marker could not be detected (at this range). Also, oscillator frequency was slightly sensitive to proximity of the operator to the antenna. The antenna was coupled to the hot end of the collector tuned circuit, LI, by means of a 3 pf condenser for these tests. Addition of the tripler stage provided the needed isolation of the oscillator from the antenna, and brought the signals up on 144 and 432 mcs.

A 2 1/4 x 2 1/4 x 5 inch Minibox was chosen to house the unit because of its convenient size and shape. A smaller one might have been used, but this one afforded plenty of room for the signal circuits and two batteries (paralleled), if needed, for extended period of operation. A single Eveready No. 412 22 1/2 v battery is normally adequate for the 4.5 ma. required. The plus side of the battery connects to ground and the negative side to the circuits via the off-on switch. Tape was used to cover the negative end to prevent accidental shorting to the case. A small wedge of cardboard holds the battery in place.

Looking at the photograph (approxi-





mately 1 1/2 x actual size), left to right, are the battery, oscillator stage, and tripler stage. A 2 x 3 3/4 inch piece of perforated circuit board was used for mounting all components except the battery, off-on switch, and antenna jack. The circuit board was wired before mounting inside the Mini-box; three 1/2 x 1/2 inch angle brackets being used for the job. It was positioned "on edge" to provide easy access to either side. Sockets were used for connecting the transistors into the circuit in order to avoid soldering. They also facilitate swapping transistors in case of trouble. Proper transistor lead length can be determined by first checking socket depth with a short length of lead size wire. The 2N384 lead length turned out to be about 3/8 in. and the 2N2398 leads approximately 1/4 inch. If in doubt, cut them a little long at first. Care must be exercised when inserting the transistor into its socket to avoid undue bending on the leads and strain on the transistor. If the builder desires to wire in the transistors, lead length should be sufficient to permit the use of a temporary heat sink between the semiconductor and the solder joint. Standard VHF practice of keeping all leads short and direct should be followed. Protect the transistor from heat. It will ruin one in short order.

The 2N384 case is connected to the center lead (see drawing). This socket pin and all oscillator returns to ground, including the feed-back link, were connected to a single ground lug. Pin 4 of the 2N2398 serves to ground its case. The ground side of the link to this stage was connected to this point. A strip of flashing copper 1/2 inch wide was fastened across the end of the circuit board for all tripler stage grounds.

Using a crystal calibrated to oscillate at 48.005 mcs in a recommended tube circuit, a third harmonic frequency of 144.005 mcs was obtained. Adjustment of L1 does have some effect on frequency. Also, substituting different 2N384's will alter it slightly. Improper oscillator tuning may result in spurious, crystal controlled oscillations on frequencies adjacent to the desired one. Oscillator tuning that produces maximum output without generation of these undesired signals should be used. The tripler stage is tuned for maximum output at 144 mcs. This is best done by watching the receiver s-meter, as the one milliwatt (approximately) output is difficult to measure. A six inch length of solid wire inserted into the antenna jack will serve nicely as a 1/4 wave radiator for 432 mcs, and provides plenty of signal at 144 mcs.

Stability is good. For example . . . after checking the frequency alongside the station two-meter receiver at a room temperature of about seventy-five degrees, the unit was taken to the sub-freezing outdoors. A few minutes later the frequency was checked again, and a change of less than one kc. was noted.

The advantages of having a stable VHF signal for antenna and receiver testing and checking are many. The transistor device described will enable the VHF operator to conventiently check the performance of his 144 and 432 mc gear. Prices are lower than ever, and some semiconductors outperform VHF tubes costing much more. Give transistors a try on VHF. You'll find them useful and interesting.

Bibliography:

RCA Transistor Manual, technical series SC-10.

Military Standardization Handbook, Selected Semiconductor Circuits, MIL-HDBK-215. Available from Government Printing Office for $2.25.

"Solid State 1296 Mc. Converter", 73 magazine, November, 1962, page 6.

2N2398 data sheet. Write Philco, Lansdale Division, Lansdale, Pennsylvania.

50 Mc/s Tilt Array — Continued

sideband as much as 45 minutes after the band had dropped out.

On ionospheric and tropo scatter, we found that by raising the tilt angle to 8-12 degrees, were often able to enhance our scatter reception and transmission by as much as 6 db for a given path. This we assume is due to the fact that with a given horizontal setting for the array, the forward ground lobe was not giving us anything like 6 db of phase addition. By varying the trajectory angle we were able to find the elevation where our horizontal lobe went in phase with the scatter signal.

The elevation tilt of the array is handled by two Alliance U-98 television antenna rotors which are mounted on the flat steel bed welded to the top of the vertical rotating column that is in turn connected to the Telrex 397 rotator. The U-98's carry none of the weight of the tilting portion of the array since the weight is properly siphoned off with the twin collar and sleeves made up from 1½ inch I.D. steel thick wall pipe. The simple rod which passes from one side of the array to the other, passes through the collar-support sleeves, through the U-98's and the U-98's are required only for rotating the horizontal pipe.

We did find it necessary to throw away the lightweight brass U bolts supplied with the U-98's and drill the collars on the Aliance products to pass a heavy bolt through the horizontal rotating pipe and the rotator collars. The brass U bolts simply wouldn't take the torque generated by the twisting

PATTERN:

Since the proof of the antenna is its pattern, we've run a number of comparison checks against a single six element array mounted 60 feet above ground and with reliably consistent ground wave signals 60 to 190 miles distant. The average of these checks is shown here:

	Single Six	24 Element Array-0°	24-10°
Front to Back	22. db	22 db	27 db
½ power points	32°	21°	19°
Front to side (90 degrees)	36 db	42 db	45 db
Simultaneous switching on 140 mile signal	20 db s/n	32 db s/n	29 db s/n

Note: we've carefully shied away from making any statements about antenna array gain. This has always been a pretty nebulous thing and what with all the many various local factors that can be introduced into a forward gain computation for an antenna, we would just as soon overlook it.

You can write off a portion of the improvement in signal to noise ratio appearing in the bottom line of the table by noting that the 24 element array is 20 feet or approximately one wavelength higher (above ground) than the single Telrex six.

The real proof of the pudding is the signal the array puts out. To that end we will see you on the air in the coming Es season!

W5KHT

Optimizing VHF Antenna Heights

By Richard C. Fenwick, W5KTR

For many years the author subscribed to the "higher the better" philosophy of VHF antenna height. However, he recently became aware of a theory of antenna "height-gain," which has been verified experimentally by MIT Lincoln Laboratories (at 400 mc) and by Collins Radio Company (at 810 mc). There is no reason to expect that it would not hold at lower frequencies as well. The theory applies specifically to tropospheric scatter propagation, the mechanism which allows day-to-day communication beyond line-of-sight to distances of several hundred miles or more. The theory has been used to derive a graph of "minimum antenna height," where "minimum height" is defined as that height above which little gain is achieved. (Specifically, only about 1db will be gained if an antenna height 4 times the "minimum" is used.) It may be surprising that minimum antenna height is a function of frequency and path length, and for longer paths less height is required. The graph giving minimum antenna height is given as Figure 1.

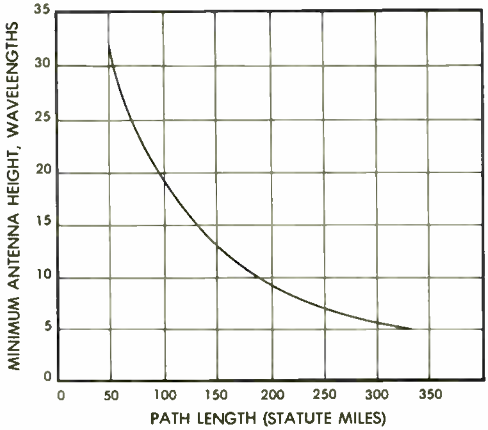


FIGURE 1. MINIMUM ANTENNA HEIGHT VS. PATH LENGTH

Collins Radio Company made extensive measurements of antenna height—gain on a 172 mile circuit in Arizona at 810 mc. At the receiving terminal a 15 foot parabolic antenna was mounted on the side of a tower on an elevator which could be raised to a maximum height of 200 feet. Another 15 foot dish was erected at a fixed height of 20 feet above the ground and served as a monitor antenna. At 810 mc a wavelength is roughly 1 foot, so that from Figure 1 it is seen that no increase in signal would be expected at heights above about 10 feet for the 172 mile path. This is precisely what was observed—the average signal level was the same at all antenna heights from 10 to 200 feet, to within .75db.

In the Lincoln Labs, experiments signals were received over a 618 mile path at 400 mc. (Using 50kw, but antenna gain was only 10db over a dipole.) Figure 1 indicates that an antenna height of 5 wavelengths (about 12 feet) should be the "minmum," except that in this case the ground sloped gradually upward in the foreground of the antenna to an elevation of 10 feet above that of the site at a distance of 1000 feet, so that about 20 feet antenna height would be "minimum." In a series of measurements in July, 1957, an average difference of 2db was observed between an antenna at 25 feet and one at 100 feet, and in another series of measurements in January, 1957, 3db difference was observed between antennas at 20 feet and 55 feet. (Greater signals on the higher antenna.) These differences are somewhat greater than predicted by the theory, but the discrepancy is not serious.

Although a small gain is achieved in many cases with increased antenna height it is clear that an optimum height exists for

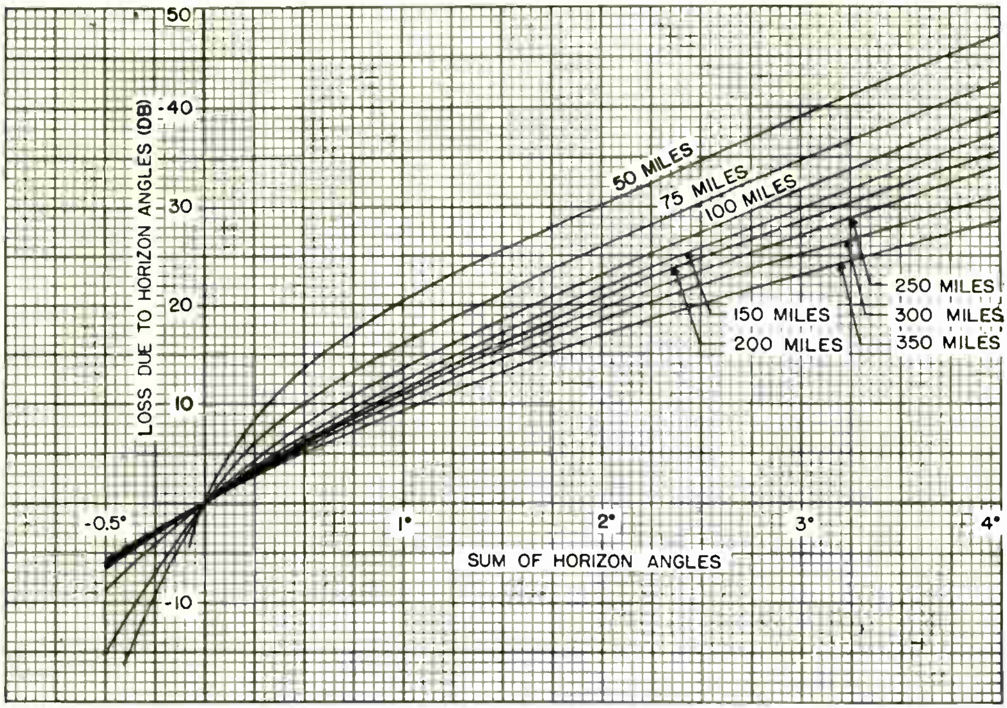


FIGURE 2. LOSS DUE TO ELEVATED HORIZON ANGLES

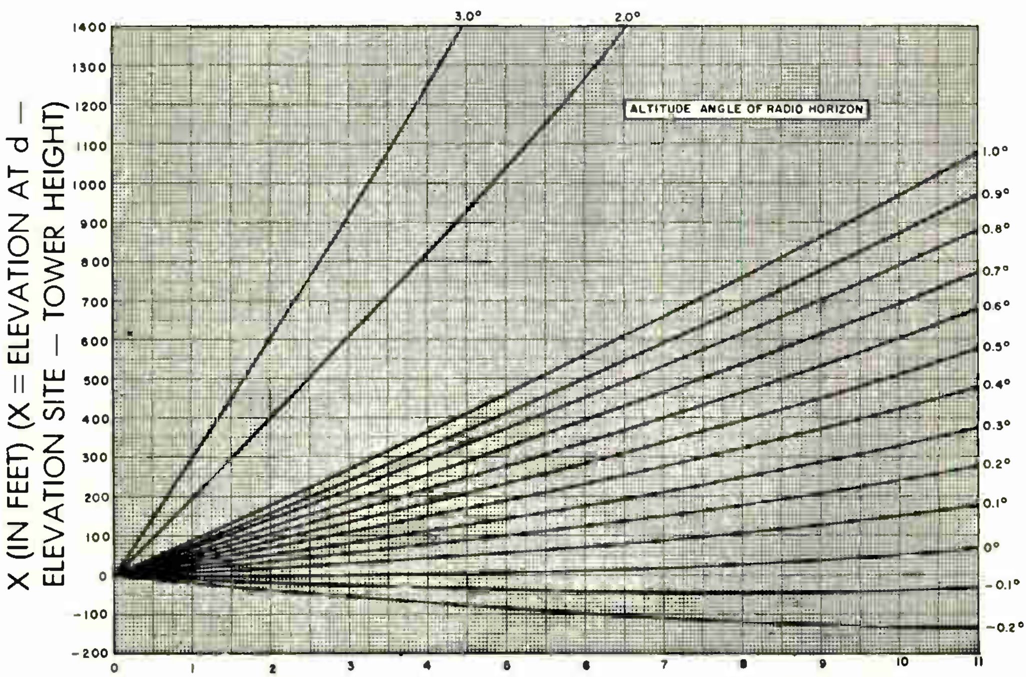
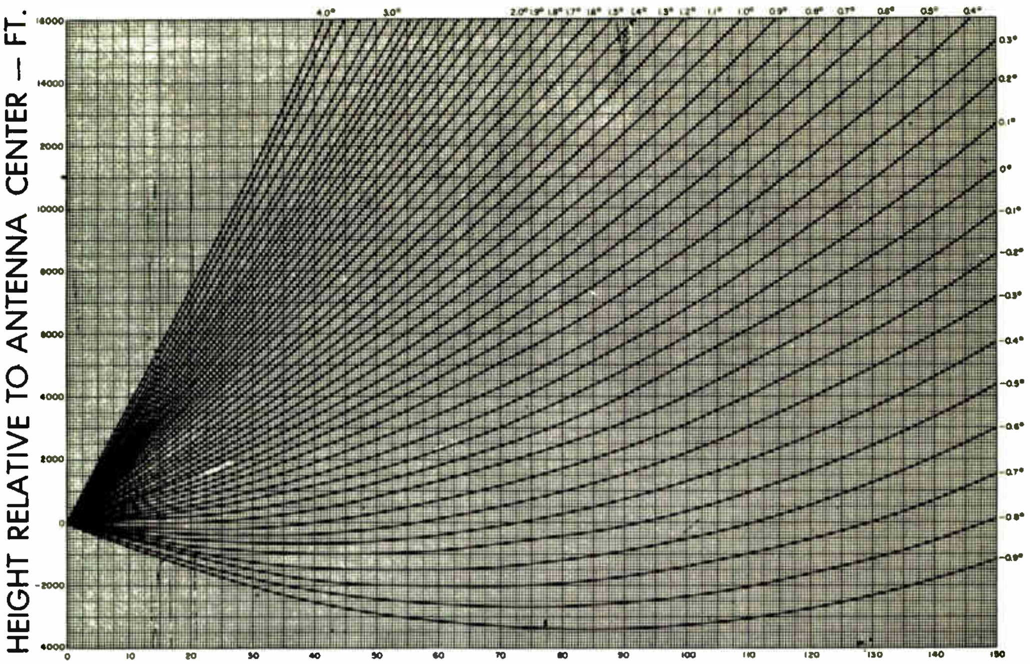


FIGURE 3. HORIZON ANGLE DETERMINATION CURVES FOR SHORT DISTANCES

FIGURE 4.



STATUTE MILES FROM ANTENNA
HORIZON ANGLE DETERMINATION CURVES
FOR LONG DISTANCES

a given band, if economics and transmission line losses are considered. Optimum height will be a function of transmitter power, receiver sensitivity, antenna gain, usual noise levels as well. It is also determined by who you are trying to work. For example, if you want to work mobiles on 2 meters at 100 miles, you will need all the help you can get, so that the full "minimum height" should be used — about 100 feet (about 16 wavelengths, from Figure 1). However, if you are strictly a DX man with 100 watts, a 20db antenna at 50 feet (8 wavelengths) and a good receiver, you can work comparably equipped stations at 200 miles and, as in seen from Figure 1, additional antenna height will give a negligible signal increase beyond 200 miles. Your effort and money will be better spent on a bigger antenna, lower loss transmission line, or a KW than on a higher tower .

All of the foregoing assumes that your antenna is above surrounding trees, buildings, and hills. If this is not the case you may be in trouble. The added loss due to elevated horizons is shown in Figure 2, verified by Collins Radio Co. experiments in the 800 mc region. Your horizon angle can be found from Figure 3 or Figure 4. Note that the loss depends on the sum of your horizon angle and that of the station you are trying to work. As an example, assume that your horizon to the east is determined by a ridge 2 miles away which is 100 feet higher than your antenna. From Figure 3 we see that your horizon angle to the east is .6 degree. Let us further assume that you wish to work a station 200 miles to the east who is more fortunate—his horizon angle in your direction is .1 degree. The sum of horizon angles for this circuit is .7 degree and the loss due to elevated horizons is 8 db, from Figure 2. Note that at 50 miles your signal would be 17 db down from that over smooth earth. If your situation resembles this example, you can use additional antenna height. (You should have played it cool in the first place by building your house on that ridge!)

Airmail Your D.R.P.!

4x150 FOR 144 MC/S

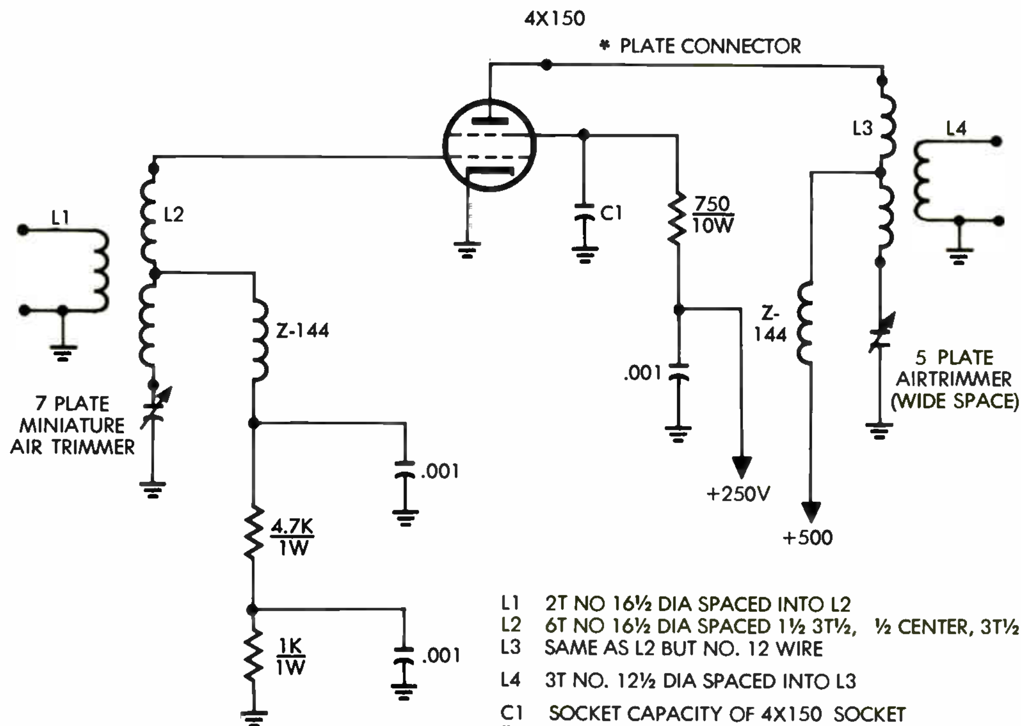
Frank L. Griffin
Box 633
Port Hunene, Cal.

Want a big punch in a small package? Well, this little guy will give it to you!

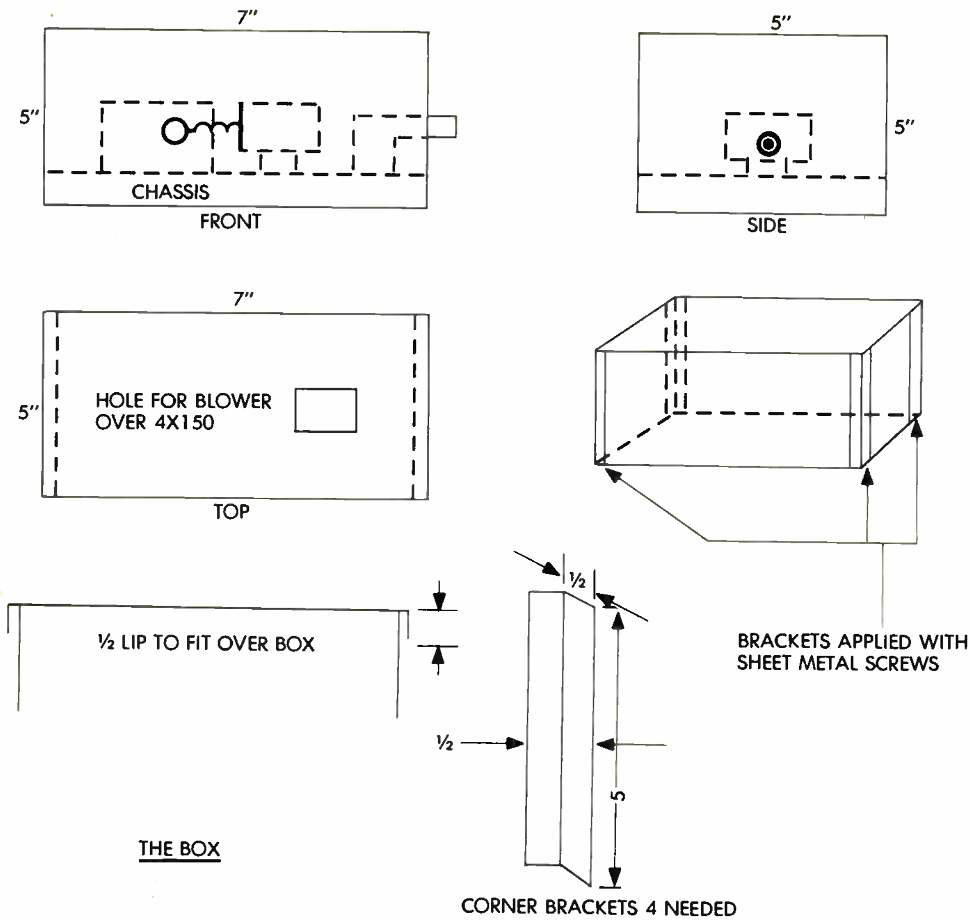
Built on a 5x7 copper plate and mounted on an invester 5x7x2 aluminum chassis in a 5x5x7 aluminum box the RF unit takes up less room than most converters. Copper was used as it can be soldered to, and for that reason only. Aluminum will do just as well. The box was built from scrap aluminum for two reasons: first shielding is necessary and second an air cavity is needed for the 4X150, as forced air should be used to keep the tube from burning up. The RF circuit is a straight forward class "C" amp. and uses "series" appearing tank tuning due to high interelectrode capacities of the 4X150. The screen resistor is strictly for isolation and "formed" a screen lead from the tube socket capacitor to the second by-pass capacitor. All the bypass capacitors are of the 1000 pf type as they make an excellent tie paint as well as having bypass properties. C1 is formed by the tube socket. Details on this home brew socket were given in VHF Horizons for April and the blower can be any small unit capable of moving enough air to cool the 4X150.

Construction

The tube socket was carefully mounted so it would not tear or short the screen insulators and after mounting the socket all



L1 2T NO 16½ DIA SPACED INTO L2
L2 6T NO 16½ DIA SPACED 1½ 3T½, ½ CENTER, 3T½
L3 SAME AS L2 BUT NO. 12 WIRE
L4 3T NO. 12½ DIA SPACED INTO L3
C1 SOCKET CAPACITY OF 4X150 SOCKET
* 4X150 PLATE HEAT RING TAPPED FOR 6/32 AND SOLDER LUG APPLIED WITH 6/32 SCREW



of the cathode leads were "bussed" to ground to reduce any possible RF leakage. The grid tank was layed out and dipped for frequency and then the grid circuitry added. The filament circuit was then fired off and drive applied to check the grid tuning range. Although the "dipper" puts you "in the ballpark" the final test is under load conditions.

From here the screen bypass (.001) was located and the 750-ohm resistor soldered in. To accomodate the plate capacitor a small aluminum plate with an "L" foot was made and bolted to the copper plate, with star lock washers between it and the copper plate, to make a biting ground connection as the mounting plate is a ground return. After mounting the plate capacitor the 4X150 plate heat ring was drilled opposite the key mark for a 6/32 tap hole, the hole tapped and a solder lug and 6/32 screw added. This formed tie points for the plate tank coil. OK, so a plate ring can be used as a connector; but who needs it?? Just more metal to form, and heat!

After mounting the tank coil, it was dipped to check the capacitor range. Also the plate capacitor should be wide spaced if voltage higher than 300 volts is used to eliminate any possible chance of high voltage flash over.

So now the moment of truth!

Testing

Mount the plate on the inverted chassis, secure with masking or Scotch tape to prevent sliding and apply the filament voltage and drive. Check your drive and see that it is somewhere in the vicinity of 20 ma. without screen or plate voltage applied. Now apply the screen voltage, 250 v, and plate voltage of about 300 v. The low plate voltage will let you tune and test

COMING IN THE JUNE VHF HORIZONS

(mailed June 5, 1963)

- **SPECIAL 220 MEGACYCLE ISSUE**

Converting the TRA-19 to 220 Mc, by W6NLZ 100-200 watts on 220 with a very fine piece of surplus gear, uses 4X150 and requires little effort to make go.

20 Watts on 220 — A conventional breadboard rig for this band for those who like to start from scratch.

2 Watts Output on 220, with a very inexpensive tube, the 6CX8. Total of three tubes for 220 megacycle RF. By K6BP.

AND

100 watts on 220 and 432 with the T-217/GR conversion. Amazing two-band final a la W5AJG.

PLUS

CK-5842, Excellent two-meter DX performance

HE-45 Ultimate Conversion, makes this rig a real top performer.

ALERT THE VHF GANG — HAVE THEM SUBSCRIBE TODAY!

for all of these features, and more, plus the latest in summertime DX operating news.

PLACE
STAMP
HERE

AIRMAIL TO: VHF Horizons DRP
P. O. Box 1557
Oklahoma City 1, Oklahoma

DRP REPORT FOR APRIL

From Amateur Radio Station .... **QTH** ....

This month we built the following ....

.... And, we improved the following

gear ....

On the air DX highlights ....

....

....

....

....

....

....

Articles we enjoyed in May issue ....

without a blower and check your circuit for plate resonance. The grid drive should be about 18 ma. now, as no plate load has been applied you are just checking the plate tuning.

Final Test and Loading

After making the primary tests put the chassis in the box, turn on the filaments and the blower, apply drive and then the screen and plate voltages and tune the grid for max current and dip the plate. Now shut off high voltage and connect your dummy load. In my case I used a dummy watt meter but a 25 watt or so resistor can be used in its place. Again turn the high voltage on and tune the plate for a dip. With a fixed antenna pickup link this is all the tuning needed. The same holds true for tuning with an antenna. If desired a tuned antenna pickup link can be used.

Drive to the amp was from a 6360 exciter, with a plate voltage of 300 v and a power output of 8 watts. The grid current should be about 16 ma. and 140 volts. The screen voltage should be about 250 volts and the plate voltage can be from 300 v up to tube maximum. The plate voltage used in this case was 500 v as it is bench power supply maximum. With 500 volts the amp drew 105 ma. loaded and delivered 26 watts to the watt meter.

As mentioned earlier, this unit was used as class C only. But, with correct drive, grid bias and regulated screen voltage, a potent linear could be had. K6TCP who has this unit now, is working toward this use.

WB6AOW

Letters

Dear VHF—

First I want to congratulate you on a magazine strictly for VHF-UHF. Second, I may not always agree with your writers, but in general they contribute to Amateur Radio and I am especially pleased wih K5JKX's Scatier Comments on the ARRL. I am a technician, and sometimes find fault with the ARRL and its policies, but it is a darn good outfit and as you say, the only outfit. Now to the point of this letter. I am interested in seeing a listing of those who operate 220 and 420. Too often we get on the air (I'm about on 432.8) and then try in vain for several weeks or months to find a signal from someone else who is on the air. If you could list those of us who operate, when we operate, and what frequencies we are on, it would help greatly, especially those of us who are spread all across the countryside with out operations.

Dick Hendrix, WA9ESE
Kokoma, Indiana

Dick—

We're willing to list the 220 and 420 gang, but we suspect that not everyone would contribute the necessary information (A), and (B) we all change our operating habits so often that what may have been our normal operating time last week is not this week. Anyhow, welcome to 432.8. You are liable to find the best way to get someone to work you on 3/4 meters is to be on two meters, and change over to the higher band after making contact on 2.

OOPS!

The March issue of VHF Horizons, page 17, contained a press release on the new VHF converters from the Equipment Crafters (Tecraft). We had a few errors (heh-heh), so let's try it all over again.

The **Equipment Crafters (Tecraft), Box 84, South Hackensack, N.J.** has announced three new extremely low noise converters for 6, 2 and 1-¼ meters. Kurt Treptau, originator of the now famous and original high gain converters for VHF, tells us his new units are the Cadillac of the VHF converters.

Some of the many features include a sensitivity of 1/10uV on two meters, to produce a 6 db signal to noise ratio at the i.f. output; 1 uV input will produce 20 db quieting; noise figures 3 db or better; adjustable RF gain to minimize converter overload and cross mod; 4 Mc/s passband, adjusted to 6 db down at 6 Mc/s; .005% crystals for maximum calibration accuracy; extensive shielding throughout; 52 or 72 ohm input; i.f. output attenuator for more reduction of the strong ones; built-in power supply; provision for AGC and provision for remote control relay. The units feature 1-6DS4, 1-6CW4, 1-6JK8, 1-6J6 and 2 silicon diodes. Any i.f. Range is available.

Price is $49.95 for 6, 2 or 1-¼ meter models. Write for full details, naturally.

DRP FROM VP7CX

Harold Lund, VP7CX, San Salvador, Bahamas, reports no DX heard during March, even from his excellent QTH. However on April 19 from 1700 EST through 2100 EST Harold heard and worked W4FBC, K4VGJ (Florida) and he heard W4's working VP5CH, VP5BB and KP4's! Also worked, WA4EFJ, K4-FOW, K4UQM, K4RUF in Georgia and Tennessee.

We'd like information on VP5BB and VP5CH. And don't forget to return by airmail the D.R.P. card in this issue of VHF.

W5KHT

Vital Happenings & Facts

OPERATING AND DX NEWS

PROFESSIONALISM vs. COSTS

Many of us amateurs demand professional equipment, operating techniques and reading material.

In fact most of us expect professional reading material because it is the very lifeblood of the growth of our hobby.

Written by amateurs, to be sure, but prepared by professionals.

This is exactly what we have strived to present in **VHF Horizons.** For 11 issues now.

Many of you recognize this, and not a few have commented on our efforts with some of the nicest comments you could imagine.

Most also recognize that to maintain a professional appearance and appeal, requires a professional pocket book. Like, it takes money.

So, subscriptions bring in money. So does advertising.

And printing, photography, schematics, Univac, billing, editorial, shipping, postage, and a dozen and one other departments cost money. Setting the book into type alone takes over $300.00 each month. That's 75 subscriptions in case you want to look at it that way.

Mailing the book takes nearly $1,000.00. And that equal to 250 subscriptions.

In other words, there's very little that's amateur about a publication that costs upwards of $6,000.00 each month to put out.

Between 25 and 30 cents a copy is how it works out in direct and assignable costs. Indirect corporate overhead works out to another 8-9 cents per month, per issue.

So someplace along the line a corporation president (which is a fancy title hung on the guy who's responsible to two dozen employees and 50 suppliers for their dough!) has to consider what he can do to trim overhead.

At this point we'll assume that the overhead is greater than the income.

Which it is.

Like maybe there's just too much professionalism in the magazine. Like perhaps there is more professionalism than the 20 odd thousand subscribers can afford to support.

So you trim a little here and a little there, fully aware that when you trim, some will take it as a sign of a downward tumble. But you bite your lip and do it anyhow, because you know that if you don't, there may really be a tumble.

We cut back recently. Not because there was a tumble. Because **we didn't want one** to occur. If I'd done the same thing with my two meter final (i.e., cut the input back to 800 watts), you'd call it being cautious to make the old bottles last.

Or to look at it another way, why run the bottles so close to their ratings and endanger the entire final when the other guy is copying me 60 db above the noise.

That's what we've done. Cut our signal back a bit to keep the final bottles in their sockets. So as to not tip the ship.

I'd thought you'd understand. That's what's so great about hams. They always do.

DX AND OPERATING NEWS

Well, DRP grows by leaps and bounds. 31 states this month including all US call areas. Yup, even Alaska and Hawaii. Not bad for the tail end of the winter!

50 Mc doings revolve around a handful of good quality late January and February openings, and the promise of better things to come. With the number of fellows that are talking about SSB rigs conjured up during the winter, there should be a substantial SSB gathering from 50.100 to 50.120 with every band opening.

K1YMQ, Monroe, Connecticut reports the disasterous loss of one shack and all associated equipment back in January (the 6th to be exact). That must have been some VHF contest OM!

K1NKR had a similar experience. He lost his entire VHF antenna array in a winter storm.

WA2KDZ/2, Middle Island, New York reports chatting with Ed Tilton, W1HDQ on 6 meter SSB and notes "this is the first Connecticut 6 meter SSB station heard." Stay on the air Ed, there's a passel of us out west who need your contact. KDZ also reports 1 KW now going to his 4-400A on SSB and a 6 over 6 yagi array 45 feet up. He's looking for scatter skeds.

WA2VOI reports building up the 6 meter converter from the Handbook (1962) injecting at 43 megacycles for a 7-11 i.f. range.

K2HDX, Haddonville, New Jersey notes a new modulator using 1614's for his 6 and 2 meter rig.

K3NOW, Wilkes Barre, Pennsylvania has a new 60 watt 6 meter rig and a 5 element spinner up 45 feet. He's a CW hound and would like schedules with others of similar interest.

W6LAC/3, Emporium, Pennsylvania wonders if anyone has tried a cavity resonator between their rig and halo (mobile). He says it works FB. This OM is setting up a net on 50.4 for McKean, Elm and Cameron counties, Pennsylvania. Check in if you're in the area.

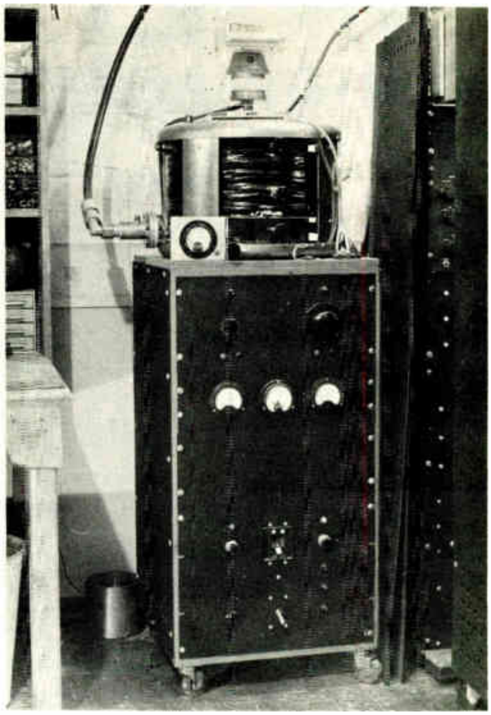
K3LXC, Maryland, built up the Homebrew 102 converter (September, 1962 VHF) and the Peanut Whistle six meter transmitter, also from an earlier edition of VHF.

K3QAI, Philadelphia, Pennsylvania says he improved his 50 megacycle converter problems by reducing the injection voltage on the mixer grid. Sounds reasonable, depending on what the problems were!

K3JML, Nanticoke, Pennsylvania has a new Nuvistor pre-amp on six meters using a pair of the beasts. See this issue of VHF for more on this OM.

W3AED advises he is getting back on 6 and 2 after many years off the bands. He's purchased an RME VHF126 converter and will have a transmitter going soon. He's an old timer from two meter days in Berlin, Maryland.

W3FGU, Brownsville, Pennsylvania has the Knight T-150 going on six and says it works fb. Several have asked why this rig blows final bottles on six OM. Any



W6NLZ's modest 1 KW rig for 1296 mc/s. That's the bias battery at the top, field coil (all 4,000 turns) is rather noticeable. Eimac 3K2500 series operates the modest final. Which surplus yard did you find this in John?

ideas?

WA4DVX, Hampton, Virginia has a new 100 watt final in the mill for 6 and 2.

W4ZBS, Arlington, Virginia built up his own 1 KW dummy load for six and up, similar to the Heath Cantenna, "except a little different". If its a good load on six and 2 OM, we'd like to hear more about it.

K5VHU, Seminole, Oklahoma reports six open to California 13 February at 2230 and again to WA6DBA, W6YDF, WA6SHM, and W7VBO around 1800 CST on February 27.

As reported last month, staffer W5SFW, Amarillo, snagged VP7CX (you lucky dog Phil) February 10 at 1950 CST. Phil also worked XE1P, XE1GE and XE1OE in the same opening, with some W4 and W5 skip stations thrown in for good measure. Phil advises that he's off the last two weeks in June and first of July for his vacation this year. Those of us who have been around a while on six know that when Phil figures his vacation, six will be open daily. Thanks for the advance tip off Phil. Now if only the VHF June contest didn't come so cotton-pickin early this year. . . .

K5ZQX, Port Allen, Louisiana reports working W4LIP on February 10 two-way SSB, 1930 hours CST.

K5DRF, La Marque, Texas reports a new 50 megacycle 6146 rig built up, and he worked WA4KSF, LHK and K4KEX from 1912 to 1950 CST on February 10.

W5BEP, Longview, Texas reports working K7JUE at 2005 CST on SSB February 1. His 3 kv supply for his 50 mc final is now going . . . turn back those RF gains!

WA6RTZ, Simi, California reports using the new DDRR (hula hoop) antenna on 50 megacycles but says he can't talk about it now. We suspect this is the new antenna being introduced by Northrup-Ventura which we saw in Long Beach at the IRE Vehicular show. Right OM?

WA6FJX, Vallejo, California reports K7URG, Tuscon worked February 12 from 2050 to 2115 PST.

W6IEY, La Mesa, California notes six open to W5 land February 13, 20, 25 and 27 and Oregon and Washington on the 13th.

WA6UOE, Woodland Hills found six open to Texas on February 24th. He'll be on CW on 50.052 this summer.

WA6AKM, El Monte has his 4-1000A Class AB1 linear with 5 Kv on it ready to go the first sign of DX on six. You've been a busy boy this winter! He worked W4, 5, 7, 8 and Ø call areas during February. Could be we should all move to southern California!

K7DTS got his 53.29 megacycle FM rig perking during the past report period. He also worked W4EZB mobile 7 who was on Mt. Hebo, Oregon, some 200 miles away, on 53.29 mc on February 26.

W8NAF/7, Scottsdale, Arizona says he's working 20 miles through a mountain with 5 watts on SSB, but his am rig can't be heard. Is that a qualified comparison OM?

K7NVP, Elog, Arizona finished up a 50 mc pre-amp, and worked KØTSD, Denver on February 1, and reports W5's rolling through also.

W7IDI, Seattle found six open to Arizona and California February 13th. He built up the speech compressor in the February QST, and says it works FB.

Mr. SSB powerhouse, K7JUE, Tempe, Arizona advises that he worked WA6GQG, K6SRC, K6BBJ, K6QMD February 1 on skip, along with a slug of 5th district stations, and on the 17th of February caught KØURY.

W9ZIB reports an improved six meter Nuvistor converter and he's added RTTY on six meters. Who's ready for RTTY DX on six this summer? How about some frequencies in use so we can alert all concerned?

K9VCZ reports working K8NYA, 150 miles, on one watt of power. Not bad for ground wave!

WAØGXJ, Cedar Rapids, Iowa has a Gonset even Gonset wouldn't recognize now. He's added a 6CW4 pre-amp, BFO, S meter and product detector.

KØDNW, Boulder, Colorado reports on the February 1 opening to Arizona and Texas plus California with DX signals heard for more than an hour, starting at 1817 MST.

Look for VE4RE on 50 SSB now. He starts at 14 megacycles and gets to six by hetrodyning with a 2E26 in the final.

VE8BY reports six meter auroral-Es on January 31 to VE4MA, VE6IP, VE4JX, VE4HW, and VE4FO. WØEUQ was heard but not worked.

144 MC news pushed all others aside this month with quantity and quality. A few of the fellows report aurora, and some of those near water masses such as the W4-W5 stations report tropo starting to break early in April for the summer season ahead. ZL3AR and ZL3AQ report the status of their two meter activity down under. AR reports he's worked VK on 144 mc with contacts out to 1250 miles. ZL3AR's running a pair of 4CX250's now on two meters. Most of the activity is AM although he reports "the SSB group is growing".

KØCST/KL7, Soldotna, Alaska reports on the two meter activity in his area. Apparently it is just underway and is still in the Heath Twoer and Gonset GC-105 stage. VE6NH/KL7, KL7EAN,KL7WAF, WL7EOU and WL7EJM are active. VE6NH and KL7WAF are working to Mt. Susitna, west of Anchorage, and VE6NH has worked KL7EIS in Fort Richardson. Plans are in the mill for higher power and bigger beams.

VE1CL reports the New Brunswick two meter net meets nightly on 144.4 at 2100 local time (2000 EST). There are 15 active stations in St. Johns, and about 12 in Moncton. 7 more are on Fredericton, and 144.4

is used as the general calling frequency. The Moncton gang has a mountain top repeater going for relaying. Is this the first two meter repeater in Canada?

W1VSM, Waltham, Massachusetts reports on the February 9th aurora with VE3ESE, VE3CVX, W8IFX and W8LCY worked on 144.

WA2RAS, New York City has a homebrew 60 watt rig going on 144. He's building a converter now.

WA2JVO, Westwood, N. J. reports the band open to W1 land and Michigan on February 9.

K4OYT tells of a Nuvistor two meter transmitter with ten watts input to 7587's. Sounds like an excellent article OM. tell us about it!

K4VEJ, Tavares, Florida has incorporated CW and MCW into his 522. That's an excellent start on the DX OM. He's got a Nuvistor converter going too.

WA4AME, Jensen Beach, Florida says he's completed a 416B preamp for two meters.

WA4JOK/W4URJ, Hampton, Virginia, has his PP 4X250B's linear almost finished, and he's working on a 6 and 2 meter SSB exciter with K4UMI.

Barty, W4TLV, has finished up on his 144 mc SSB project using a transitron oscillator, 6360 and 4CX250B's. Says it works great and he has gobs of watts on the Bird 43 thruline. We'll be looking for you Barry.

W4KCQ, Tuscaloosa, Alabama has the 48 foot 21 element Telrex yagi up and working, and he is driving it with the 4CX300A 144 mc amplifier.

K4IXC, Melbourne, Florida tells us about the latest two meter meteor ping work. John worked W8IFX on March 6th with signals peaking S9. He also worked W3SDZ in Milton, Pa. for a new state there on March 11 from 1345 to 1435 EST, with very strong signals both ways. K4IXC's schedule with W4FJ in Richmond always produces signals, he says, and he expects to work Ted soon for Virginia. On March 12th, John received 129 pings (!), calls, etc. from W3SDZ on the 0000 to 0100 sked. The K4IXC frequency is 144.0895.

W5UKQ reports on the March VHF Amateur contest noting he worked 19 contacts, 9 counties and a point total of 5,643. John's our staffer from Baton Rouge.

W5AAJ reports he and W5OOF maintain 146.250 mc RTTY schedules nearly every night out Wagoner, Oklahoma home. They would like to see others join in.

W6GDO, our northern California two meter DXer, notes contacts with K6GVB in Ukiah, K6QJB in Albion and WA6CBQ in Salinas .W6NLZ was worked 8 times on schedule in February.

K6YCX, Pomona, California reports the 5722 Noise Generator works very good. W4TLV should be happy to hear this.

W8KAY, Mr. Two Meters in Akron, Ohio, reports his frequency is still 144.300 with ½ kc at all times. 1 kw is the power to a single 4X500A. A 24 foot 13 element yagi up 72 feet does the signal squirting, from a hilltop location. A 417A converter feeds a pair of 75A4's. Art continues to run nightly skeds with K2IEJ (144.023 and 144.306), Long Island City; W8BKI (144.256), Charleston, West Virginia; and K9IUF (144.185), Hobart, Indiana. Sked times are 2200, 2230 and 2300 EST respectively.

WØDZH, Marion, Iowa reports auroral signals from W8KAY, WØYSJ and W8IFX on two meters February 9th from 1845 to 1915 CST. Other stations were copied from West Virginia, New York and Pennsylvania.

THIS VHF CONVERTER

is engineered to give YOU **complete control** over ALL signals — weak or strong, narrow or broad. This converter is designed to perform as an **integrated part** of your receiver system. **There is no other converter on the market like it today.**

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+ MAXIMUM SENSITIVITY—Lowest practical noise figure (under 3 db) assured by careful selection of premium Nuvistors. Tube compliment — 6DS4, 6CW4, 6JK8, 6J6.

+ FLAT BANDPASS— 4 Mc/s bandpass, flat, with 3 db down 1 megacycle off low and high ends of each band. Bandpass may be operator shifted to peak on a desired portion of the applicable band, thereby increasing skirt selectivity in areas with strong signals adjacent to the amateur band covered.

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+ MAXIMUM GAIN— 1 uV input produces 20 db thermal noise quieting. 1/10 uV input produces 6 db signal to noise ratio. Wide open circuit gain, 30 db.

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WANT 220 432 gear. W9DJ.

SELL BC-640, TDT, FRR-3A, RGCI, Manual FRR-3A. WA6LAI

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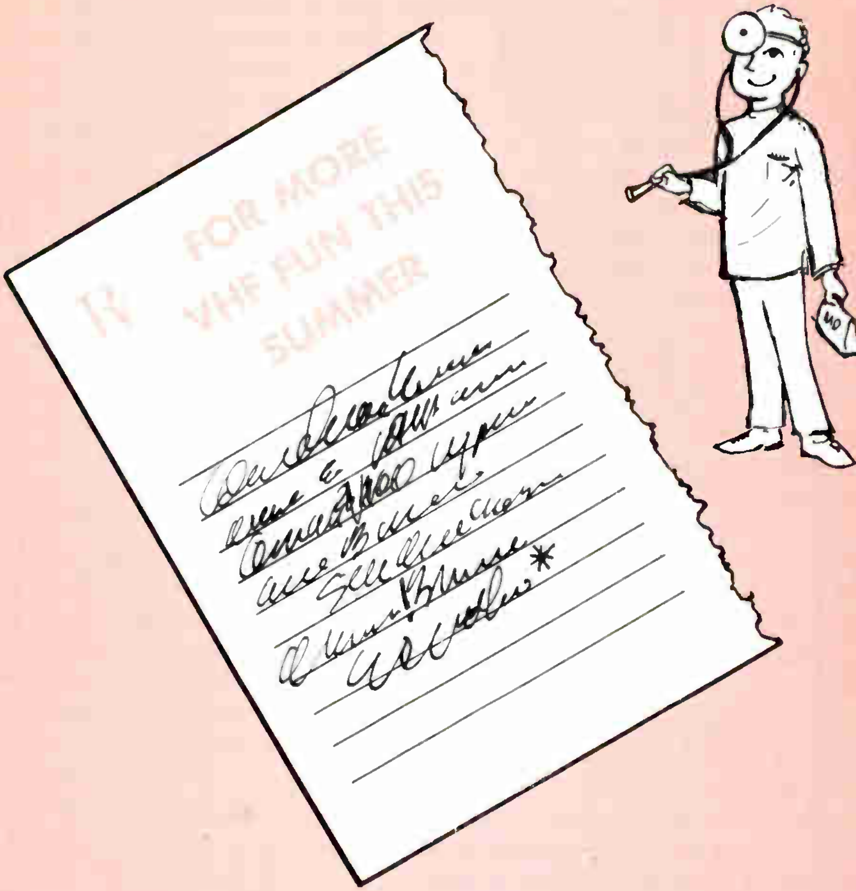

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