FM

volume 2, number 10

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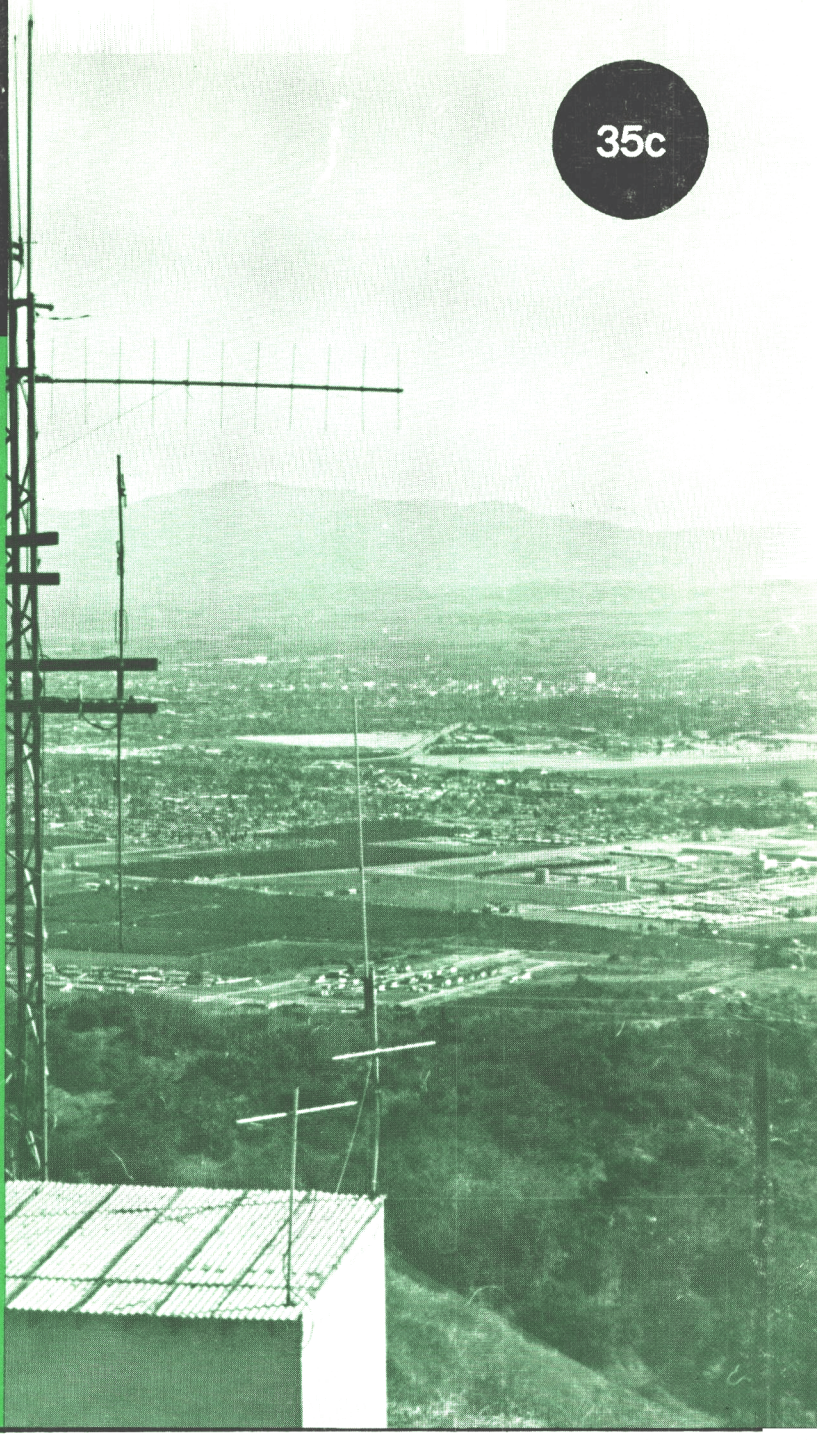
IN
THIS ISSUE

MORSE CODE
AC FOR H23
NARROW BANDING



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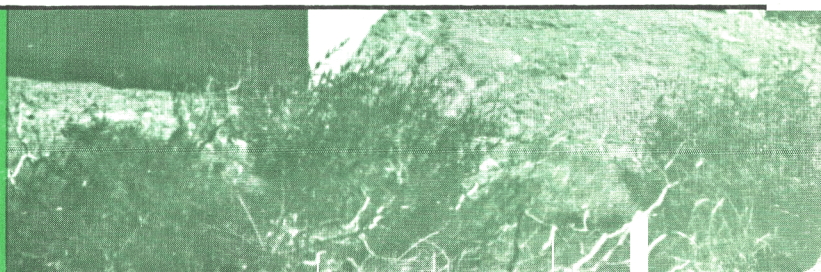
THE K6MVH REPEATER SITE

NOVEMBER 1968



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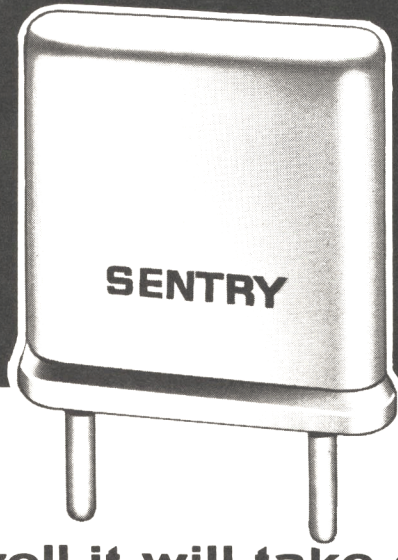

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PUBLISHER
M. Van Den Branden
WA8UTB

EDITOR
K. Sessions, Jr.
K6MVH

STAFF

Technical Consultant
Don Milbury, W6YAN

Cartoonist
Bill Ridenour, W3HI

Canadian Liason
Paul Hudson, VE3CWA

Circulation Manager
Glenn Pohl, K8IYZ

ADMINISTRATIVE OFFICE
P.O. BOX 5203
Grosse Pointe, Michigan
48236
Phone (313) 886-4115

ADVERTISING OFFICE
4861 Ramona Place
Ontario, California
91762
Phone (714) 599-2010

EDITORIAL OFFICE
1 Radio Ranch
San Dimas (8) California
91773

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THE CODE:

A STEP BACKWARD?

Have you ever stopped to consider the antiquity of the amateur radio licensing requirements with respect to Morse code knowledge and speed? The technology of radio has advanced to the point where communication by individually transmitted characters is as outmoded in our world as the horse and buggy is to transportation — perhaps even more so. The amateur's code proficiency requirement as a prerequisite to the privilege of experimenting and communicating on noncommercial bands is as nonsensical as requiring a potential driver to be a skilled horseman.

Without delving too deeply into this analogy, let us state that there are many who could point out advantages of horse-and-buggy proficiency (e.g., horses go places where cars can't), but these advantages are so remote as to be almost nonexistent.

Cw allows a maximum of groundwave "range" coverage and consumes little spectrum, but the time required to convey a given sentence reduces its efficiency.. AM consumes a broad spectrum, but a given message can be sent at a considerably reduced time when compared with cw. FM consumes a broad spectrum which is compensated for by the resulting signal-to-noise ratio; its range is heightened by its insensitivity to noise. When compared with cw, its very slight range disadvantage is more than compensated for by the amount of information that can be processed in a given time frame.

The relative disadvantages, advantages, and general characteristics of all amateur modes of operation actually can be reduced to mathematical equations for objective comparison. If relative numerical values are assigned for range, information per minute, spectrum consumption, and noise immunity, and all values were multiplied, cw would always come out lowest in the tabulation.

Radio is representative of modern man. The conventions of yesterday should be the curiosities of today. Communication by code is a tradition; there is little room for tradition in a field as rapidly advancing as radio. But most importantly, there should be no room allowed for tradition where it hinders progress! And code proficiency as a license requirement does indeed hinder progress.

The FCC has set aside portions of the amateur spectrum for the exclusive use of cw. Will portions be set aside for AM, FM, SSB, RTTY, or ATV? None will deny the inefficiency of cw when compared with more modern forms of communication. In a given time period, will cw allow conveyance of as much air traffic as any other mode? Is the range of cw truthfully better (to a significant and measurable

degree) than SSB or FM? The answer, in both cases, is an unqualified "no" — yet the brass pounders command a large share of exclusive spectrum.

Have you never wondered why? Why is code proficiency a prime license requirement when its use is a backward step in an otherwise awesomely modern technology? Why are spectrum slices reserved for cw when, for the sake of communication efficiency, cw should be discouraged? Members of the ARRL staff have attempted to answer these questions for amateurs in the past. But their arguments have never been more than cursorily convincing:

1. The code requirement is a means of restricting the flow of non-serious amateurs to our ranks.

2. The requirement for code proficiency allows newcomers a taste of our "amateur" heritage.

3. Since code may be learned by anyone, it gives all prospective amateurs an equal opportunity to compete for exclusive amateur privileges.

There may be other reasons offered, but doubtless they would hold no more water than these. Take item 1, for instance: a stiffer technical exam would accomplish the same purpose and would result in a stronger likelihood of the amateur radio world participating in state-of-the-art advances. Item 2: Radio — even amateur radio — should be treated as more of a science than an art. The "heritage" angle could be as effectively exploited with a knowledge of radio history as with code proficiency. Skill in the form of manual dexterity is certainly no substitute for technological know-how. Item 3: The very sad truth is that code proficiency may not be acquired by "anyone"; some are more adept than others. And the result is a test that may discriminate against those best-suited for amateur privileges.

The reason cw has been so solid a requirement over the years is probably because the ARRL policymakers are oldtimers. In their day, the ability to send and receive Morse code was the criterion of a man's status as amateur. This was rightfully so when vice president Soupy Graves was a youngster; if an amateur couldn't copy code, he couldn't communicate by wireless.

Today, the emphasis should be shifting to technical ability and theoretical knowledge — but it isn't. And it won't, either, unless a powerful and influential voice is brought before the Commission in favor of such an emphasis shift. The ARRL has such a voice, but the traditions and mores of yesterday are so well entrenched that only a complete staff renovation could change its policy.

Another voice could probably be raised loud enough. But it would require the combined active support of every serious amateur radio operator, and mustering such support would prove a formidable task indeed.

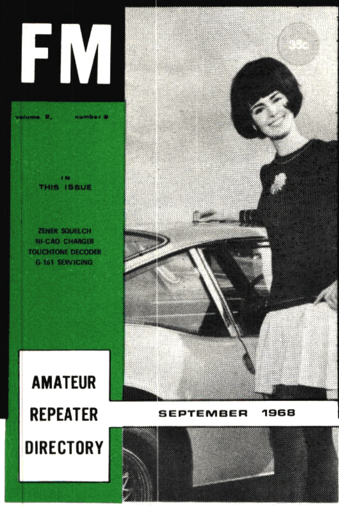
In the light of recent technological advances, it would be extremely difficult for any group or individual to make a pat case for code as a license requirement. The time is ripe for the code proficiency requirement to be dropped altogether. As it happens, the United States is allegedly bound by an archaic rule to an international agreement that code will be a requirement for certain high frequencies. No such agreement governs the VHF licensing, however. The international agreement, if it exists, should be re-examined and updated at the earliest opportunity. The outmoded domestic prerequisites should be changed now!

What is involved in recommending an FCC rule change? A formal petition must be drafted and placed on the docket before the Commission. The Commission then reviews the proposition, ostensibly by studying the various aspects for merit and overall impact. The decision, made by an internal subcommittee referendum, is then documented and published for distribution.

Very significant and noteworthy is the fact that the Commission's views on a docketed proposal are published along with the decision. Examination of previous submittals tends to show that the FCC evaluators give careful and thoughtful consideration to each suggested change, and their documented views reflect wisdom of judgment, freedom of thought, and reasonableness of attitude. For these reasons it would seem the Commission would now be particularly open-minded with respect to the evaluation of proposals that represent a radical departure from established tradition. It is my belief that the FCC will not necessarily favor the ARRL in a policy decision of this nature, and its representatives will listen attentively to sound arguments from any source.

In view of these and other considerations, the FM Magazine intends to submit a petition to the FCC, in the interest of all amateur radio licensees, to the effect that the Morse code requirements be dispensed with as a major prerequisite to licensing in the VHF spectra (technician class).

Your voice is important to us. Maybe you've read editorials in the past and have vowed to yourself to write in to support or deride the views — only to let the idea die before you took pen in hand. DON'T LET IT HAPPEN NOW! We at FM MUST know how you feel about this proposal.



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TWO-FREQ AND SIMULTANEOUS MONITORING with the GE 4ER6

by **Bill Harris K9FOV**

Probably the most common set of GE two-piece gear on the amateur FM scene consists of the Pre-Progress transmitter in the ludicrous green case, series 4ET5 or 4ET6 (30 watt and 50 watt, respectively) and the 4ER6 (series A through F) receiver. Many of these units were used in systems that use semiduplex or "three-way" frequency setups. That is, the mobile transmitters are capable of two-frequency operation for either calling the base station or other cars in the system at will, while all the mobile receivers monitor the base frequency only. Most police and utility company radio systems are set up in this fashion, so radio sets that come out of such systems usually have a two-channel transmitter and a single-channel receiver. This may be fine for localized repeater use or simplex use (simply ignore the second crystal socket and leave the switch on the control head permanently in the correct position), but many hams will want to be able to duplex between two adjacent channels, and for this the receiver will have to be selectable between two crystal-controlled channels along with the transmitter.

The first thing that comes to mind is that the transmitter crystals are switched by means of a relay. Why, therefore, can't the receiver crystals be switched in the same manner? Well, a few of the ER6 receivers did indeed have a relay selecting between a pair of crystals. However, the relay was a special low-capacity type and was mounted in such a manner that lead inductance and capacitance were kept to a bare minimum. In addition, the author has not seen any receivers of this type above 43 MHz using the relay. This method of switching was tried in an older 4RMV35 receiver using 47 MHz crystals, and, true to form, it was impossible to get both crystals to exhibit uniform activity, even by trying several types of relays, different hookups, and swapping crystals between sockets. This helped foster the notion that relay switching of receiver crystals in the 6-meter receiver was impractical. With that in mind, I cleaned up the mess in the octal-tube receiver and focused my rheumy eyes on a 4ER6B2 with intentions of dual-frequing it. I came up with the following procedure.

Remove the oscillator compartment cover and peer in. You should have a ready-made hole for another crystal socket right beside the existing one. Fill it with another ceramic socket. There are two small holes about 1/4 inch apart directly behind the oscillator meter jack. Imagine another hole, in line with these two but an additional 1/4 inch nearer the high-IF amplifier tube, and punch at that point for a 7-pin miniature socket. Drill the saddle holes so that pin 1 points toward the corner of the chassis. When mounting the socket, put a ground lug under the mounting nut nearest pins 3 and 4.

Remove the oscillator grid metering jack. Set aside both it and the 22K meter shunt resistor connected between it and ground. Connect the loose end of the 220K grid resistor to the grounded side of the original crystal socket. Find a small slug-tuned coil form that will fit in the hole vacated by the meter jack. (The store-bought ceramic type such as the Cambridge Thermionic CSTC will fit directly, or if you rob an old 1/4-inch fiber form out of a junked TV IF strip like I did, the hole will have to be filed out a few caliber.) Wind on five or six turns of No. 20 or 22 enameled wire and put an 18 or 22 pF NPO ceramic or silver mica across it. Stick it in the hole and wire one end to pin 1 of the new socket. Run the other end of the winding directly over to the B+ end of the existing oscillator coil. (Even though this lead is quite long, there seemed no need to bypass it at the coil.)

Connect a 1500 pF 10% disc capacitor between pin 7 of the new socket and pin 3 of the 12AT7 (first mixer). (This is also a long reach; use spaghetti on the leads of the cap.) Connect one end of a 270-ohm 1/2-watt resistor to pin 7 of the new socket and run the other lead of this resistor to the ground lug. Feed the leads of a 270K 1/2-watt resistor through the lugs of the new crystal socket and connect one to pin 6 and the other to the ground lug. This completes the RF wiring; all that remains is to connect the heater and cathode circuits.

This is the point at which to decide how we are going to switch between channels. On most of the Pre-Prog units there were just enough wires in the control cables to go around. However, some have a high-impedance volume control on the chassis instead of at the head, and this leaves an additional lead unused in the cable. In these units, also, a red wire was reserved for two-frequency operation, and this should give you a pair of unused wires. In this case, you can wire the oscillator cathodes to ground through the switch, Motorola style, by removing the cathode resistor of each oscillator, bypassing it with a 0.01 Discap, and sending it up to the head to be grounded by the switch. This provides a "1 - 2 - BOTH" operation with the use of the proper switch.

Let's say you have the older unit that has a high-impedance control at the head. In that case, all the wires are used up and no two-frequency lead is provided. Chin up - there's still hope! You can disconnect the capacitor coupling the output of the discriminator to the control socket connection that goes to the top of the volume pot, and reconnect it to the socket lug that comes back from the rotor of the pot. This effectively converts the volume control from a series to a shunt type and you should not notice any difference in its operation. It works fine for Comco, I might add. They wire theirs that way.

In the head, clip the wire off the top of the volume pot and wire it to the two-frequency switch. Back in the receiver, run a lead from the reclaimed lug on the control receptacle to the oscillator compartment.

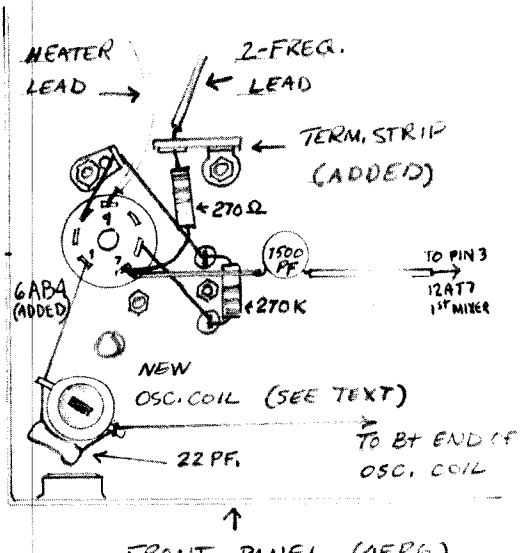
Now, HOW are we going to electrically select the oscillator tube we wish to use? If we have come back with two wires, as in the later receiver, we either connect the cathodes to the leads, instead of to the chassis, and select ground with the switch in the head (changed to a DPDT), or even select which heater to turn on, if the 11-second delay would not be objectionable. This could be done with either the hot or cold side of the heaters. But if we have the set with only one wire coming back, we will have to do something a little different. Either use a small relay to select cathodes or filaments, or allow the original oscillator to run all the time and turn the new oscillator on and off by means of operating the cathode or filament through the single lead. This has the disadvantage of not being able to mute the calling channel while receiving on the secondary one, but in areas of light activity this might not be too objectionable. In addition, I have found that the GE receiver exhibits an almost imperceptible loss in sensitivity while simultaneously monitoring two channels (I used a Measurements 560 generator for these deter-

minations), so loss of sensitivity should not be of concern in this case.

As for hooking up the heaters, we will assume the reader attempting this modification has done a conversion or two and knows how to handle 6/12 strings. The 6AB4 tube draws 150 mA at 6.3V and can be seriesed with either a 39-ohm 2W resistor or a #47 bulb for 12, or tied in parallel with the other tubes for 6.

The missing meter jack may cause feelings of insecurity in case of a breakdown in the field, but is not necessary once the oscillators are initially set up on frequency. Use a VTVM on the 50-volt negative range and meter the respective crystal while tuning the coil for a peak. Then back the slug off to 90% of that reading on the slow side. If the new coil does not tune to the crystal frequency, check all the connections at the 6AB4 socket and take a dipper to the coil to see where it tunes IN THE CIRCUIT, WITH THE TUBE IN ITS SOCKET but the power off. Modify the coil if necessary to achieve oscillation.

If you have trouble with the modification, drop me a letter and I'll try to help.



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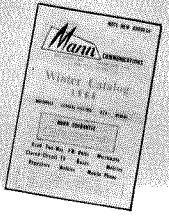

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THE WICHITA REPEATER AND CIVIL DEFENSE

By Bob Nordstrom KØIFJ

It was September 3, 1965 and Wichita was covered with cloudy, balmy skies. There were no severe weather conditions reported to be in the area. Then out of a reasonably settled sky at approximately 8:30 p.m., Wichita's first major tornado dipped and spread its violence in the area of 13th and Woodlawn. On hearing of the possible disaster in the area, two units of the then Wichita Radio Emergency Net (known by its acronym WREN) proceeded to the area. I arrived on the scene and stopped at 11th and Woodlawn to make contact with other WREN operators or the net control station. Operating on the RACES frequency of 29.520 MHz, I was unable to locate any station to take traffic. Not one of the 20 members was on. Later, I found there were two stations standing by on 10 meters, but they were on 28.80 MHz, not 29.52 MHz. Meanwhile, Bill (WAØHVZ) was in the area operating two meters AM on 145.35 MHz and trying to find stations to take traffic from the core area. Finally, Bill was able to contact a security officer at one of the local hospitals. At last, one station was taking and fanning out the information from the scene.

It was at this point that several of us sat back and took a long look at our CD communications system for Sedgwick County. We decided that our system must be improved. The WREN had been in operation for several years on the RACES frequency and had approximately 10 mobiles and as many base stations that were active. Of these active stations, all were excellent operators, hams who had made several tornado runs, storm watches, and other activities all over Sedgwick County. The biggest problem we encountered was the fact that we were using 10 meters, which in storm conditions is typically very difficult to monitor. During the storm, it proved virtually impossible for the net control station to make intelligible copy of a mobile unit stationed to give a closeup view of the conditions. From the NCS a two-meter AM link communicated to the weather bureau. Thus it was necessary for the NCS to repeat all the information both to and from the weather bureau. This not only took extra time, but it increased the probability of error.

It was further noted that during storm watch conditions, there were few stations monitoring due to the difficulty in receiving. We were supposed to be crystal-controlled, but only about half of the stations actually were. All of us were using tunable receivers--and it was not uncommon to find one, two, or three stations off the actual net frequency. This made it necessary for the NCS to tune around for his stations and many times he would miss all or part of the comments of the addressed station.

The overall picture looked very grim, and we felt that it was time to do something. But what? To make things even worse, the NCS suddenly left town, leaving the net without a control operator. Not wanting the system to fall by the wayside until something else could be put to use, I fell heir to the job of NCS.

At this time, further studies were initiated to improve the communications system. We found that Don Chase (WØDKU) and others were involved in a construction project which incorporated techniques completely foreign to most of us -- something called a two-meter FM repeater. Most of us were completely unaware of the existence, the benefits, and the versatility of repeater operation. In talking with Don and the

other hams, we became aware of the possibilities of its use for Wichita and Sedgwick County civil defense operations. We were, of course, aware that the police, sheriff, and other municipal governments used this type of system.

Even so, it took a considerable amount of selling on the part of Don and the others involved in building the repeater to convince even a minority of us that this was the system we needed. When our built-in "resistance to change" abated, we were to learn that, with a two-meter FM repeater system, all stations would not only be crystal-controlled on transmit, but also crystal-controlled on receive; there would be no way to miss any transmissions from any unit. The lightning and corona would not have any serious effect on the signals and the coverage would be increased considerably. The main problem as we could see it was the availability of equipment.

Once the repeater was in operation, with only a handful of operators, the real test came to light: selling civil defense officials and the radio officer. This took about two months to accomplish. The selling job was done so completely that the civil defense officials purchased a station to be installed near the radar room at the weather bureau. In the months to follow, they provided maintenance funds for the repeater and obtained a backup repeater should the main repeater fail (which, by the way, has happened only four times in the past two years).

The proper authorities, having agreed to the change from 10 meters to the new two-meter FM repeater system, called a general meeting for the first of February 1966. At this meeting, which included all WREN operators and interested persons, we advised that as of March 1966 the frequency of 29.52 MHz would no longer be used and that the new frequencies would be 146.34 and 146.94 FM. Additionally, we would now be known as the Wichita-Sedgwick County Civil Defense RACES Net. We would, however, continue for the month of February to operate on ten meters while also holding net on two meters FM. Unfortunately, the proposed change was not put to a vote of the general membership and, as a consequence, we lost a few good, tried and proved operators. We ended up with only those who were really willing to put forth the extra effort --but then these are the ones you want.

The following RACES procedure was given to all members to be used for all net operations.

I. Net meets every Sunday at 1830 CST (except holidays)

   A. Rollcall is taken, using full amateur calls.

   B. Announcements are made to the members by the NCS.

   C. Every station is given an opportunity to talk.

   D. All stations use only suffix letters of calls after check-in.

   E. Sign out, using full amateur calls.

II. Storm alert operations

   A. All stations are to monitor the frequency at first notice of storm conditions, thus being ready to be activated if needed.

   B. When net is activated, the rollcall is taken using the complete amateur calls of all stations.

   C. After the rollcall, only the suffix letters are to be used. Any station breaking silence must use the wording "This is --- ."

   D. NCS will make a radio check with any mobile not heard from for more than 10 minutes.

   E. This will be a quiet net. All traffic is directed only to the NCS. (The single exception is the weather bureau, whose representatives may direct a call to any mobile station at any time.)

F. All mobiles are authorized to use blue flashing lights on the front left, red flashing lights on the rear.

G. The NCS will stay on the air until all mobile units return to their homes.

The Wichita Sedgwick-County Civil Defense RACES net was now in operation, with only five mobiles and five base stations. We continued to operate through the summer of 1966 gaining new members. By September 1966 we had 15 mobiles and base units. The summer had gone by quickly with no tornados (though several watch conditions)--but never lacking for operators.

By this time we had also established communications with several of the surrounding communities. The Butler County CD communications system had been operating on two meters FM for several years, but without the use of a repeater. With the advent of the Wichita repeater, the Butler County base station at El Dorado was quick to install an additional rig for repeater operation, thereby becoming part of our organization and giving them direct communications with the Wichita weather bureau.

The addition of their mobile units greatly increased the number of available operators in central Kansas. We then began adding stations in the surrounding areas, such as Newton, Pratt, Canton, Hesston, and Hutchinson -- all with the capability of using the Wichita repeater at any hour of the day or night, regardless of conditions. The main advantage for the surrounding areas is that they now are able to receive directly from the weather bureau all bulletins or data prior to their being put on the weather wire.

Many of the smaller towns do not have any means of communication with the weather bureau other than by telephone. Now, even though they do not have a ham in the area, then can and do monitor the repeater during weather alerts. Having this type of broad-range communications, we have been able to assist a much larger area than merely our own county. This works to our advantage in yet another way: Several of the mobile operators in the surrounding counties have pledged themselves to aid us, as we have pledged to aid them in case of an emergency. For example, should there be a disaster in Butler County, the Wichita mobiles could move into the area and assist them directly through their own base station via the Wichita repeater.

With a well functioning radio system, we had the responsibility of keeping the members active and interested. We meet every Sunday evening using the RACES procedure and take every opportunity to put the operators out in the field for any type of public service. One of the first such field trials was in October 1966 when we were asked by the Sedgwick County sheriff to assist on Halloween with "Spook Patrol." This has, of course, been done by many a ham in the past but is fast being taken over by the CB'ers. Our operation so impressed the sheriff that this has become an annual event with us.

Interestingly, and much to the surprise of the sheriff, our units were able to communicate in many areas the sheriff's couldn't. It was with no problems the next year that we set up NCS directly in the dispatch shack at the sheriff's office.

Our net has been available for lost aircraft search, drownings, and many other emergency situations. On one occasion, our units were the first to arrive on the scene of a fatal plane crash and helped direct the rescue squads into the area. This experience proves extremely valuable: The more practice we have, the more proficient we become. After spending weeks of training and making several watches that turned out to be just heavy thunderstorms, our organization had yet to have an actual storm emergency arise.

It was not until May 1967 that we had our first "hit." We were on alert and had mobiles in the troubled area watching for possible tornados. Then one of our mobiles, Jim (KØICU) was stationed in

(Continued on Page 29)

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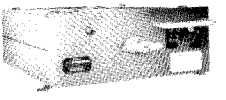

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Number 6 on information card

Complete Narrowbanding of the GE Pre-Prog

by
Jim Lev K6DGX

Serious FM operators are constantly refining and improving their equipment; witness the incredible multihop repeaters of the east coast and the many fine remote bases scattered throughout the west. Consider the heavy demand for articles on Touchtone control, T-power supplies, transistorized accessories, soup-up info, etc. Never before in the history of FM amateur radio have so many been doing so much. Who knows, if present trends continue, it just may be that Motorola and General Electric might come knocking on our doors (hat in hand) for new ideas and techniques! Some might question my definition of the word "improve"; to them I offer the following: "The amateur is constantly in the forefront of technical progress. His incessant curiosity, his eagerness to try anything new, are two reasons." The foregoing is a direct quote from the Radio Amateur's Handbook.

Narrowband operation on 450 MHz is something new; only recently the big names in two-way radio introduced new narrowband 450 MHz equipment, and across the country dozens of service shops are working to meet FCC narrowband deadlines. This article should be of special interest to those in the profession who desire to retain the venerable GE Pre-Progress MC306 receiver in repeater service. Commercials are narrowbanding out of sheer necessity and not for many of the reasons that we would undertake such a step. To them it is a business; to us it is a hobby that we love.

There are advantages and disadvantages to be considered when thinking of a switch to narrowband; I will cover some of them here. The GE MASTR Line 450 MHz receiver is a fine piece of engineering that is available either wideband or narrowband; interestingly enough (and despite identical front ends), GE claims a 20 dB quieting sensitivity of 0.65 μV for the wideband version and 0.40 μV for the narrowband one; it is doubtful that this 4 dB difference can be attributed to narrowbanding, but I have noted an increase of approximately 2 dB in quieting sensitivity on many of the 100 or so Pre-Progress Line receivers that I have narrowed. So, as a result of narrowbanding, you may gain a few dB; this is nothing to scoff at as decibels are increasingly hard to come by as your repeater system approaches the "ultimate."

Another point: What about lessened interference from adjacent-channel operations? If you are now being bothered by your neighbor, tightening up your receivers can help a lot; also, if you are plagued with intermod, narrowbanding could be your answer. Furthermore, if you now live in a congested

450 MHz area (like Los Angeles) and use two channels side by side, how would you like a "free" third channel right in the middle? In the Los Angeles area and probably elsewhere in the country, 450 MHz activity has increased to a point where virtually every 50 kHz channel between 440 and 450 MHz is in use. Are you naive enough to believe that your rival across town or your buddy down the street is going to be dissuaded from building his own remote simply because all the channels are in use? Hah! Would you have been? You know where he is going to put it, don't you? Probably right between you and what's his name! If your receivers are broad you can say goodbye to the good old days of a clear channel. Commercials are narrowbanding because of congestions, and we amateurs may eventually be forced to do so for the same reasons.

Besides all this, aren't you curious to see if you can do it? If for no other reason, wouldn't you be proud to number your remote among the pioneers across the country?

On the negative side of the ledger, let's consider the following: frequency drift up, down, and around cannot be tolerated; your equipment will have to hold 0.0005% frequency stability. The Pre-Prog MC306 and the Motorola T-44 transmitters are rated for this; however, junkbox ovens and surplus crystals are out; save them for AM use or whatnot. You will have to use the finest crystals available (International or Sentry) and topgrade ovens. (This poses no problem for most of us, as serious FM'ers have always used the best.) Gone will be the days of setting deviation by haphazard rule of thumb; the level will be ± 5 kHz--period. You will have to make, scrounge, or buy deviation-measuring equipment because you can no longer use your dev pot for a mike gain control! Seriously though, aren't we truthfully a lot better off without these "disadvantages"?

This is a conversion article for complete narrowbanding of the very popular GE Pre-Prog Line MC306. Although the MC306 receiver differs considerably from its Motorola T-44 counterpart, enterprising T-44 owners may use the same general procedure. Unfortunately, the Motorola owner's conversion cost begins at $20, as he must buy a new Permakay filter; GE owners merely modify and realign the existing six-coil 290 kHz i-f can.

The entire conversion is not difficult, but I strongly suggest that it not be attempted by inexperienced technicians! I-f and discriminator alignment is a serious business and you can make or break a receiver in this one area. You will need a BC-221 or LM-type frequency meter and some type of output attenuation box as well as ordinary shop equipment. Naturally, you should have complete MC306 schematics. In addition to these, you will need a Progress Line manual that gives alignment instructions for the six-coil 290 kHz i-f can used in narrowband 150 MHz receivers.

The conversion may be broken down into four main steps. First, modifying the transmitter modulator and post-limiter filter. Second, increasing the receiver frequency stability to 0.0005%. Third, modifying the receiver audio and squelch circuits. And fourth, narrowbanding the six-coil low i-f can. Wherever possible, I will use GE component identification such as "C301," etc.; where necessary, I will refer to schematics shown in this article.

TRANSMITTER NARROWBANDING

Step 1. Remove C103 (0.02 μF) and replace with 0.005 disk.

Step 2. Remove C117 (4700 pF) and replace with 3300 pF.

Step 3. Remove R119 (56K) and in its place install the circuit shown in figure 1.

Upon completion of the foregoing, it is only necessary to reset your mod pot to ± 5 kHz. Incidentally, the part values given are those specified by GE. Also,

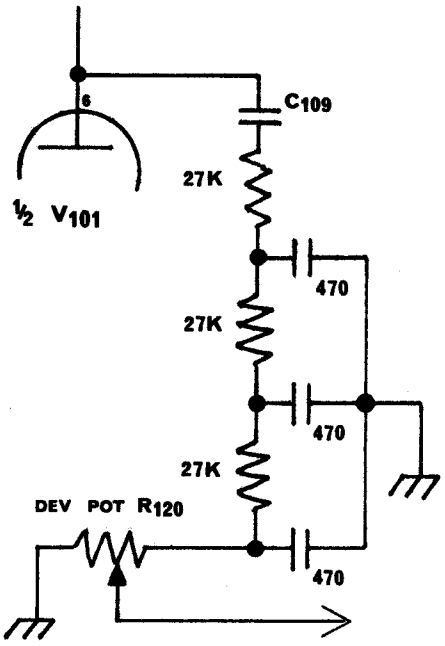


FIGURE 1

your mod circuit is now identical with the later-model GE Progress Line 450 MHz units.

RECEIVER NARROWBANDING

Improving Frequency Stability to 0.0005%

If you have already replaced the original AFC-type first oscillator platter with a Progress Line heated-oven circuit, you may skip this section. If not, convert the original circuit to the Progress Line oscillators as shown in the schematic of figure 2. Sketch A of figure 2 shows the original oscillator circuit of the Pre-Prog; the modification is shown in sketch B. The sequence is as follows:

Step 1. Remove the AFC-type first oscillator platter and rewire in accordance with sketch B, figure 2.

Step 2. Mount an oven socket on the adjacent blank plate and connect its heater to the 6- or 12-volt bus.

Step 3. Remove the following miscellaneous components:

S301
R354
C373
C387
R6
R323
Black shielded AFC feed cable

Your old AFC-type oscillator crystal cannot be used in this Progress Line circuit; it will be necessary to order a new International or Sentry crystal. When ordering the new crystal, specify the following information:

- Receive frequency
- Crystal frequency

$$f_{xtal} = \left(\frac{f_{rcvr-48}}{36}\right)$$

- GE 4ER26 Progress Line oscillator circuit
- 85°C crystal oven
- F605 holder
- Non-AFC use

Make doubly sure you have a good crystal oven. If you have doubts, check the oven. (Ed. Note: See "Checking Crystal Ovens," J. Lev K6DGX, FM Magazine, May 1968.)

Receiver Audio and Squelch Modifications

By narrowbanding your system and running ± 5 kHz deviation, you will suffer a serious loss of receiver audio; in addition, due to a lower level of noise into the squelch circuit, it may fail to squelch the receiver. By following the detail procedure shown here you will eliminate these undesirable effects. Your receiver's final audio output power will be equal to or greater than what you had before.

Step 1. Remove R353 (100K) and replace with 470K.

Step 2. Remove R352 (100K).

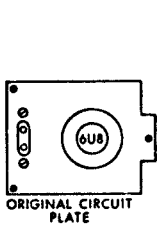
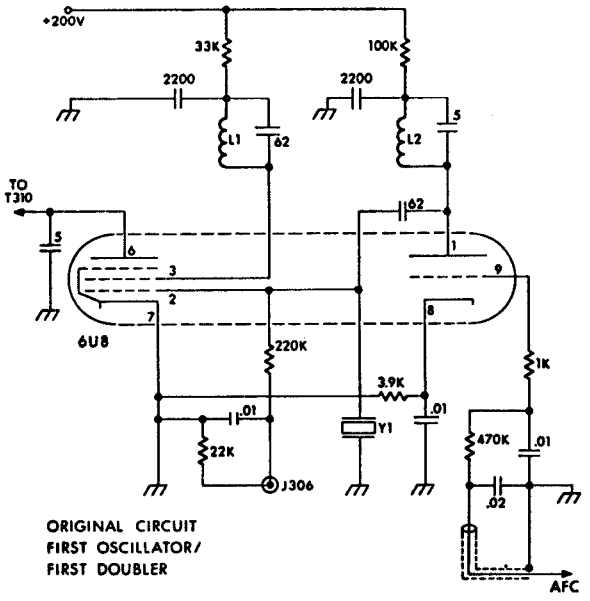


FIGURE 2
sketch
A



Step 3. Remove C347 (1500 pF).

Step 4. Remove C349 (47 pF) and replace with 470 pF.

Step 5. Connect free end of R360 (220K) to pin 1 of 6AL5 (V313).

Step 6. Remove R361 (100K) and replace with jumper.

Step 7. Remove C357 (1500 pF).

Step 8. Remove R381 (10K) and replace with jumper.

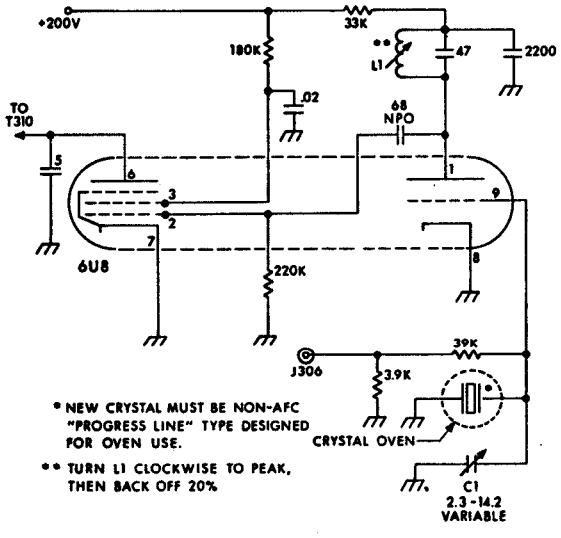
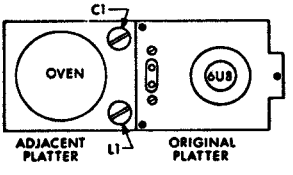


FIGURE 2
sketch
B



Step 9. Remove C358 (1000 pF) and replace with 0.01 (400V).

Step 10. Add 2500 pF (400V) from pin 1 of 12AX7 (V316) to ground.

Step 11. Replace C361 (4700 pF) with a new component of same value.

Step 12. Remove C359 (0.02 μF).

Step 13. Remove R376 (270Ω, 1W) and replace it with 270Ω, 2W.

Step 14. Remove C362 (25μF, 25V) and replace with a new component of same value.

Step 15. Remove C360 (5 μF) and replace with a new component of same value.

Step 16. Remove R369 (1 meg) and replace with 10 meg.

Step 17. Remove R382 (100K) and replace with 1 meg.

Narrowbanding Low I-F

GE engineers were incredibly farsighted in the design of the Pre-Prog receiver; the six-coil 290 kHz i-f can (T303) is the same unit that is used on later Progress Line units; thus, it is ready-made for narrowband conversion. Either remove T303 and replace it with a new "factory" narrowband one or follow standard GE procedure in narrowing the original. To modify the original, proceed as follows.

Step 1. Remove T303.

Step 2. Carefully remove the three covers shielding the six i-f coils.

Step 3. Clip C3 (7.25 pF) loose from L2.

Step 4. Very carefully remove coil assembly L2 and reinstall it in the adjacent "N" hole. Reverse the assembly so that the center hole is again over the test point; be careful not to change the position of the coil slug.

Step 5. Very carefully remove coil assembly L3 and reinstall in same manner as L2.

Step 6. Remove C3 (7.25 pF).

Step 7. Remove C6 (6.0 pF) and install it in place of C3.

Step 8. Very carefully remove coil assembly L5 and reinstall in same manner as L2.

Step 9. Install a 2.0 pF capacitor in place of C6.

Step 10. Replace the three shield covers.

Step 11. Use an ohmmeter to check the center test points on L2 through L5 to ground for possible shorts due to coil handling and coupling capacitor replacement. Normal resistance is a few hundred ohms.

Step 12. Reinstall i-f can T303.

I will not give complete alignment data for T303 here; you should have this information available in a Progress Line 150 MHz narrowband manual. I will, however, give the general procedure to be followed. The first step in the alignment procedure is to check the discriminator transformer (T305). To do this, proceed as follows:

Step 1. Monitor the discriminator test point J310 with an ac VTVM on a low dc scale.

Step 2. Connect an accurate 290 kHz generator through a 0.01 capacitor to pin 1 of 6BH6 V310. Saturate the limiters.

Step 3. Adjust the top slug of T305 for zero at J310.

Step 4. Shift the generator frequency exactly 5 kHz upwards in frequency and carefully note the resultant reading at J310.

Step 5. Shift the generator frequency exactly 5 kHz downwards from the 290 kHz center and carefully note the resultant reading at J310.

Step 6. Subtract the two voltage readings obtained in steps 4 and 5 from one another. If they differ by over 0.1 volt, the dis-

criminator primary should be realigned; if the two readings are essentially the same, stop here and go to the six-coil i-f (T303).

Step 7. If the discriminator primary must be realigned, carefully adjust the bottom slug of T305 a fraction of a turn in one direction and then repeat steps 2 through 6. Continue shifting the bottom slug of T305 in small increments one way or another until the readings at J310 are essentially equal at 5 kHz above and 5 kHz below the center frequency.

To properly align the six-coil 290 kHz i-f can, connect your generator through a 0.01 capacitor to pin 1 of 12AT7 (V308). Monitor the discriminator test point (J310) with a VTVM or VOM. Monitor the limiter test point (J309) with a VTVM only. Adjust your generator for exactly 290 kHz. If your discriminator alignment was correct, you should read dead zero at J310. You are now set to follow the GE resistor loading method of alignment. (Ed. Note: See "The Fine Art of Receiver Alignment," Donald L. Milbury W6YAN, FM Magazine, March 1968.)

Your output attenuator will be invaluable as you adjust coils L1 - L6. Simply keep increasing the attenuation as the limiter reading rises during alignment. The foregoing procedure may sound somewhat hairy, but after your first one you should be able to go through the necessary alignment in a few minutes! Be patient the first time as you get your feet wet.

Commercial shops should carefully note the following. As of the date of publication of this article, the GE MC306 or 4ES14A1 is still scheduled to lose "type acceptance" before long. Although the transmitter postlimiter modifications specified herein transform the unit into a true narrowband transmitter, there is no indication at this time that the FCC will "buy" this and permit the unit to retain type approval.

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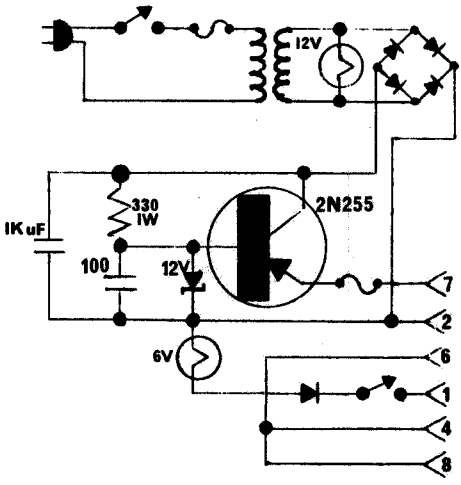
An AC Supply for the Motorola H23 Handie-Talkie

BY RICHARD THOMAS, W8VJC

The Motorola H23BAM Handie-Talkie, with the all-transistor receiver, comes with an 8-pin Jones plug installed so the unit may be operated from an external 6- or 12-volt battery supply. Provisions are built in to trickle-charge the internal Ni-Cad 6-volt battery at a 70 mA rate while the H23 is being used on on external 12-volt battery. With proper connections to the external power supply plug, a regulated 12-volt dc power supply will operate the transceiver and charge the Ni-Cad battery from the 117-volt ac line, allowing you to use the Handie-Talkie around the ham shack and still keep the battery charged for portable operation.

The regulated power supply shown will give close to 12 volts out, with current variable from a trickle charge of 60 mA to full transmit and fast charge of 1.35 amps. Fast charge is available by switching a #44 dial lamp connected through a diode to pin 1 of P201. This adds 230 mA of current to the 70 mA of trickle-charge current built into the Handie-Talkie to make up a total of 300 mA for fast charge. The diode in series with the fast-charge switch is there so that the Ni-Cad battery will not discharge back through the receiver if the power supply is switched off. The #44 lamp acts as a pilot and also as a fuse if the battery is internally shorted or completely discharged.

I mounted all the diodes, capacitors, and small parts on an old piece of printed circuit board. The power transformer, switches, and pilot lamps are on a 3 1/2 x 4 1/2 x 1 inch chassis.



The circuit board is under the chassis. If you keep most of your transmitting times short, the transistor may be mounted on the side of the chassis with a power transistor mounting kit, using the chassis as a heat sink. In the transmitting mode, the 2N255A transistor must dissipate over 6 watts of power and will get warm. If it becomes hot while making many transmissions, you may want to use a commercial power transistor heat sink with a higher-rated PNP power transistor in the power supply.

The Ni-Cad battery supplied in the H23BAM Handie-Talkie is a Motorola NLN 6134A battery rated at 6 volts, 4 amp-hours. A completely discharged Ni-Cad battery (battery voltage below 3 volts) requires 24 hours of fast charge to restore it to full charge. Continuous trickle-charging of a Ni-Cad battery at 50 or 60 mA will not harm the battery. If a fully charged Ni-Cad battery stands idle for 6 weeks, it will discharge to 75% of full charge. The NLN 6134A battery is designed to operate the H23-BAM transceiver for 8 hours with 10% transmitting time on a full charge. After that the battery voltage will have dropped to about 5 volts. Then 8 to 12 hours of fast charging should restore the battery to full charge.

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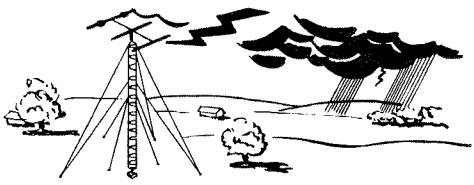
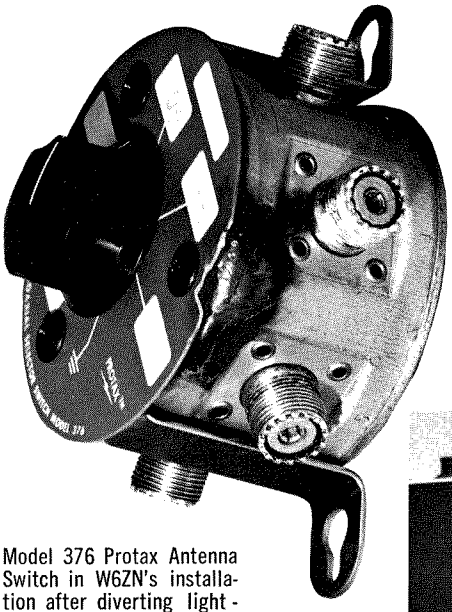
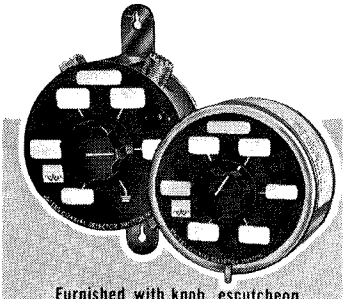




Model 376 Protax Antenna Switch in W6ZN's installation after diverting lightning charge to ground.

PROTAX Switches operate through 150MHz



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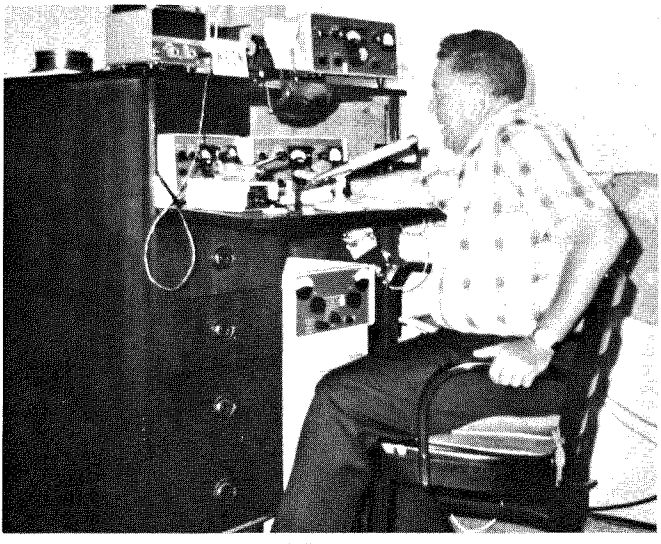

A while back, Walt Henry (**W6ZN**) of Henry Radio Stores was content merely to sell Waters Protax Coaxial Switches with automatic grounding. Today, Walt not only sells them but swears by them. Seems he installed a 376 Protax on his home rig. And the rains came . . . with a lot of lightning! Walt's antenna took a jolt, passed it down the feed line into the Protax. The Protax passed it to ground. Sure, the switch took a licking, but $2300 worth of fine gear didn't. Waters replaced the switch! Free!

Is your rig as well protected?

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southwest Wichita. As Jim was scanning the skies he had his back turned to the southwest. Much to his surprise when he turned around, there, not 500 yards distant, was a tornado coming directly at him. With the hours of training behind him, Jim was able to pick up the mike and say: "This is ICU...I have a tornado on the ground 500 yards southwest heading northeast at about 30 mph."

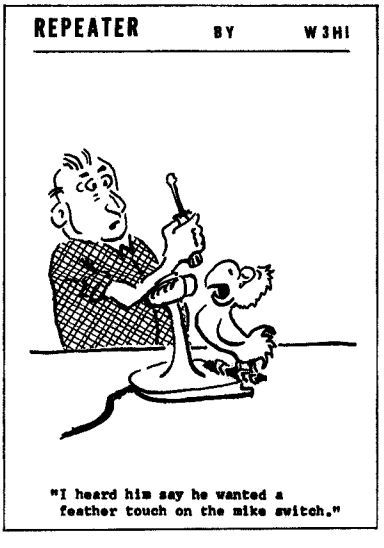
My first comment as NCS was, "Jim, get the heck out of there!" The operators at the weather bureau heard the report and, knowing his location, were able to determine the location of the tornado. In less than 5 seconds the warning sirens had sounded for the city and surrounding area. In the meantime the mobile, which had been located at a four way intersection (always a must), was able to clear the area and reach a safe location. He then repeated his report with additional information. (I must say that as NCS it was a long 30 seconds or so waiting for the mobile to advise that he was safe.)

The system has so proved itself that in the spring of 1968 one of our local TV stations did a 30-minute videotape on what to do during storms and how the city was protected by warnings from the weather bureau. The RACES net was given considerable footage, showing both our operation at the weather bureau and one of the mobiles in the field.

Along the line of emergency use, the repeater is always available for whatever comes. We have on several occasions assisted both private citizens and our own hams who have been involved in auto accidents. Not once has anyone called for help who has not been answered at once, thereby having the proper emergency equipment rolling to his aid in a matter of seconds, as opposed to the possibility of many minutes with a dependence on other means of communications. It has become standard operating procedure for all amateurs using the Wichita repeater to allow immediate break-in of any station. If he just wants to join the group of ragchewers, he so states and is picked up as his turn comes. However, should he have emergency traffic, it can be handled at once. The repeater is monitored at all times and is in operation nearly around the clock. To our knowledge, no transient mobile has ever initiated an unanswered call through the Wichita repeater.

The Wichita repeater has been tower-mounted since Memorial Day 1966. The complete repeater, consisting of a GE Progress Line station in one cabinet, is mounted at the 440-foot level with the antenna at the 450-foot level. Of the four "downs" in the last two years, one was for a fuse, and two were attributable to a malfunctioning identifier. During all of these "downs" the backup repeater was ready for emergencies.

Today, we have many mobile and base stations in Wichita, plus several stations in adjacent areas. In most cases the operators are able to leave their jobs to operate with us during an emergency. We are very proud of our system, but not to the point of ultimate satisfaction. There are plans in the works for linked repeater systems at Canton, Pratt, and Latham, Kansas. These will double and triple the service area of the current system. And who knows--when ours is fully extended, perhaps it will mesh in with the extended systems of other ambitious networks in neighboring states.



"I heard him say he wanted a feather touch on the mike switch."

FM Magazine
WANT ADS--Box 5203
Grosse Pointe, Mich. 48236

FOR SALE... Motorala Permakay Filters #TFN 6013AW Wide Band Filters for Motrac 450 MHZ receivers $4.00 ea. Art Housholder, K9TRG-1774 Farwell, Des Plaines, IL 60018 Phone 827-3433

WANTED... Will pay reasonable amount for manual and schematic for Rayethon Model 21TR-11-A - 6 Volt, DC. Will copy and return. W.J. Hinkle, Box 88 Amsterdam, NY 12010

WANTED...2-Way Technician for Motorola service station in N. W. Ohio. 1st or 2nd phone required. Put your interest in FM to work for you. Contact: McAfee Communications, RT3, Box 245A, Celina OH 45822

WANTED...Touchtone Equipment. Particularly 12 and 16 button Touchtone dials, central office decoder, telephones, etc. Wish to use for remote control, etc. Richard M. Jacobs, WAØAIY; 4941 Tracy Ave. Kansas City, MO 64110- Phone (816) 444-1968

WANTED...P8501 Motorola Test Set state cond., and price. Also Tech Manual or schematic info for Philco Monitor receiver. Type RCM150G. GE Bolin, WA9HNZ; Spencers Court, N. RT 45, Mattoon, IL 61938

WANTED...17 inch Progress line case, 4 freq. deck for low band, Prog Line. Also need 60W Power Supply, and front mount control head. Bob Coburn, WI JJO, RFD 2, Londonderry, NH 03053

FOR SALE OR TRADE...Model 19 Teletype machine with 60 wpm gears, communications type palets and all accessories. Wanted... G.E. Progress Line 2 meter base. Need not be already converted for 2 meters. Contact: Richard Zach WB2AEB, 33 Pike Place, RFD 4 Mahopac, NY 10541

WANTED... Need RCA diagram for power supply and control wiring for 6/12V CMC 1D3. Will swap diagram for AC power supply/multi-freq. deck for ET 8058 which is AC version of this unit. Jim Studer W9RYI, 128 08 S. May Street, Calumet Park, ILL. 60643

TRADE...(2) 4ES1ZC G.E. trans - ceivers with control heads & cables (no mikes or speakers) with Vol 2 pre progress line schematics. Also want 2 meter base 146.34 transmit 146.94 recv. or 6 meter base 52.68 transmit 52.525 recv. Will consider low power on both. Fred Harmon, P.O. Box 203 Owasso, OK 74055.

WANTED... Manual and/or schematic wanted for Raytheon 21TR11A, and Ferris 18B sig. gen. Joel S. Look, W1KCR, Box 25, Claremont, NH 03743

FOR SALE...GE 4ES16 Pre Prog - near new Diano Power & good spare - clean and complete. 12 volt crystaled up for Trans-146.94-146.34 & 146.31; Rec-146.94 & 2 spare pos. First $50. takes it. Wm. A. Sandy, WB 2CTD, RD #1, Box 14-B, Dutch lane, Freehold, NJ 07728

WILL SWAP...Heath SB-300 and SB-401E (110-220 VAC) for Handie-Talkie, late model 150 MHZ or 450 MHZ gear or what have you? Al Klein, 108 Casper St., Valley Stream, N Y 11580 Phone (516) 825-0384

FOR SALE... RCA 250 Watt hi-band CT-6A PR4-125 Final and Power supply $60.00. G.B. Coleman, P.O. Box 7131, Toledo, OH 43615

WANTED...One 60 watt Transistor Power supply for GE Progress, HI Band FMT/C, state condition. WM. Ratliff, North 3rd St., New Freedom, PA 17349

FOR SALE... Collins KWM-1, AC supply, DC supply, and mobile mounts. Like new, best offer over $350.00 incl 3el 15 meter full size beam. Ed Rasmussen W2EJK East Chatham, NY 12060 Phone (518) 365-5303

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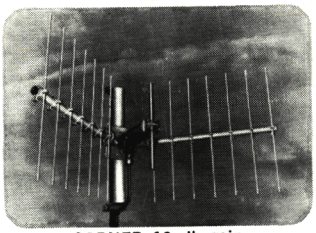
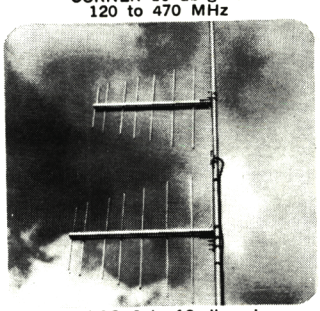
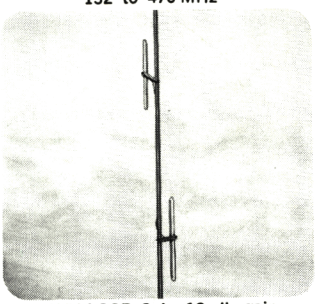


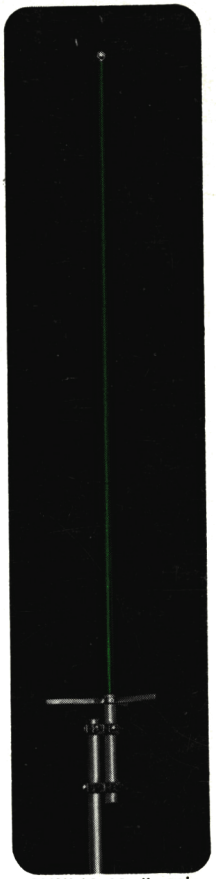
CORNER 10 db gain
120 to 470 MHz



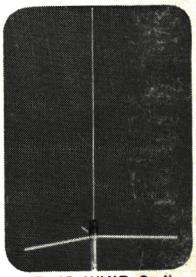
UNI-LOG 6 to 12 db gain
132 to 470 MHz



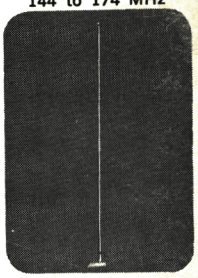
VARI-LOOP 3 to 12 db gain
144 to 470 MHz



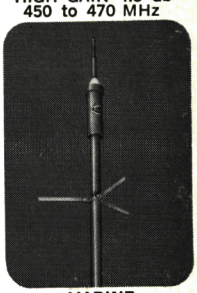
OMNI-10 10 db gain
450 to 960 MHz



LEWIS WHIP 2 db
144 to 174 MHz



HIGH GAIN 4.5 db
450 to 470 MHz



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