March 1975
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CQ

What's Behind the OTP'S Illegal Grab for 220 MHz?

See page... 24

The Radio Amateur's Journal
08240

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SB-104 SSB transceiver— a new standard for the industry

A revolutionary "new generation" transceiver. It's completely solid-state and totally broadbanded to eliminate preselector tuning. And the output can be instantly switched from 100 watts to 1 watt. The true digital readout offers resolution down to 100 Hz and outstanding tuning accuracy. Receiver intermodulation distortion has been minimized and there are very few active devices ahead of the highly selective crystal filter. Adjacent channel overload is negligible, yet sensitivity is better than 1 μV (.6 μV typical) and front-end overload is dramatically reduced. The "104" is 12 VDC-powered for mobility and the optional HP-1144 fixed station supply fits inside the SB-604 speaker cabinet. An optional noise blanker can be installed in the "104" and an optional 400 Hz crystal filter improves CW selectivity.

Kit SB-104, 31 lbs., mailable **669.95***
Kit SBA-104-3, 400 Hz CW crystal filter, 1 lb., mailable **34.95***
Kit SBA-104-1, Noise blanker, 1 lb., mailable **24.95***
Kit SBA-104-2, Mobile mount, 6 lbs., mailable **34.95***
Kit HP-1144, Fixed station power supply, 28 lbs., mailable **89.95***

SB-230 — the lowest-cost conduction-cooled linear around

The SB-104's "silent partner." 1200 watts PEP or 1000 watts CW from less than 100 watts drive. It's rated at 400 watts input for slow-scan TV and RTTY. The high-efficiency Eimac 8873 triode is double-shielded to reduce stray RF and a massive heat sink replaces noisy fans and blowers. The "230" assembles in just 15 to 20 hours with no alignment.

Kit SB-230, 40 lbs., mailable **319.95***

SB-634 station console combines 5 convenient accessories

The "634" performs 5 important functions — a 10-minute digital ID timer with visual or visual and audible indicators an RF wattmeter that reads 0-200 or 0-2000 watts with ±10% accuracy, an SWR bridge, a hybrid phone patch that can be used manually or with VOX control, and a 24-hour digital clock that runs independently of all other functions. It's a must for every well equipped station.

Kit SB-634, 14 lbs., mailable **179.95***

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Highly visible 1½ x 2" CRT detects problems that can reduce the effectiveness of your signal — nonlinearity, insufficient or excessive drive, poor carrier or sideband suppression, regeneration, parasitics and CW key clicks. It monitors SSB, CW and AM signals from 80 to 6 meters. Push-pull drive for keystone free trace; automatic sync sweep generator with 3 ranges from 10 Hz to 10 kHz. Can be used as an ordinary oscilloscope from 10 Hz to 50 kHz.

Kit SB-614, 17 lbs., mailable **139.95***

SB-644 remote VFO

Designed exclusively for the SB-104. It provides split transmit and receive control and you aren't frequency-limited in any way — transmit at one end of the band, receive at the other. The "644" even has two crystal positions for fixed-frequency control. The "644" has a linear dial, but the exact frequency is displayed on the "104's" digital readout. The display automatically changes when switching from transmit to receive.

Kit SB-644, 10 lbs., mailable **119.95***

SB-604 station speaker — response-tailored to SSB

Designed to match the SB-104 in styling and performance. The "604" uses a 5x7", 3.2-ohm speaker. And there's room inside for the HP-1144 power supply. With connector cable and plug.

Kit SB-604, 8 lbs., mailable **29.95***

DESIGN NOTES

Mike Elliott
Sr. Design Engineer

Digital frequency readout

Two major problems face the engineer designing a digital readout transceiver like the SB-104. The fe a S th o th pl m w to pr er to Th pr Th mi BF ra ± the VF mi rep

To digitally count and display the operating frequency, then, the BFO frequency must be subtracted from the premix frequency.

$$f_{operating} = f_{premix} - f_{BFO}.$$

The SB-104 uses a string of programmable decade counters. These devices are quite versatile, since they can be set to start counting from any number. If programmed to start counting at a number below zero, they count up through zero and continue, so that the end result is a form of digital subtraction. Obviously, then, if the counter string is programmed to start below zero by an amount equal to the BFO frequency, counting the premix frequency will result in direct readout of the oper- ured by V. The nce all cheme, e LSB, e pro- ven by curacy served lection cy dis- n is a similar calcu- ility in ct sun- himum range ateurs,

With the HAL RVD-1005, what you see is what you get.

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The HAL DKB-2010 dual mode keyboard is another example. It allows you to transmit TTY or Morse—TTY at all standard data rates, and CW between 8 and 60 WPM. You also get complete alphanumeric and punctuation keys, plus 10 other function keys, a "DE—call letters" key and a "QUICK BROWN FOX..." diagnostic key. In both modes you have a three character buffer for bursting ahead (larger buffers optional); and in the CW mode you can adjust the dot-to-space ratio (weight) to your liking.

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RVD-1005 Video Unit: $575. RVD-2110 Monitor TV: $150. DKB-2010 TTY/CW Keyboard: $425.
All prices include USA shipping. Add $10 each for air shipment. Illinois residents add 5% sales tax. C

MARCH, 1975 VOL. 31, NO. 3

CQ The Radio Amateur's Journal

FEATURES

DEPARTMENTS

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ZERO BIAS

The mail has begun to pour in. It didn't take long for amateurs to react to Docket 20282. Unfortunately, we think, because the majority of the early comments are based on misinformation, coming either from believing what they hear on the air or from too hasty reading of available published material.

A number of early letters voice dissatisfaction with having to sit for additional examinations in order to maintain existing privileges. That's not exactly what FCC has proposed, however. In fact even the Commission admits that their policy on how existing licensees will be treated is not yet firmed up. It appears, though, that the holder of a current license will be allowed to operate as though he had been issued the equivalent new license or licenses, and upon renewal of his current license, appropriate Series A and Series B licenses will be issued without further examination.

Where some of our correspondence seems to be on the mark is on the subject of current conditionally issued licenses. Docket 20282 proposes that in most cases these licenses be non-renewable at the conclusion of their present license period, and that holders of these licenses be required to be re-examined at a Commission examining point.

As documentation for the validity of its proposal, FCC states "...it would not be unreason - able to expect a conditionally licensed amateur to travel to one of the many Commission examining points sometime within the five year period." Commission sources indicate that only about half of the conditionally issued licensees called for re-examination show up, and of those who do show up, only about half pass the examination.

We have no argument with the Commission's figures, but they don't give a complete picture. Let us suppose for a moment that large numbers of Commission-examined licensees were selected at random for re-examination at an authorized examining point. (Remember that the number of examining points is shrinking with each passing year, and the days on which amateur examinations are given has dwindled sharply. In New York City 15 years ago, amateur exams were given five days a week. Now they're given on only one day a week.) Given the large number of inactive hams in our ranks and the cost and difficulty of appearing for an examination, what percentage of Commission-examined amateurs would become no-shows? We suspect a large percentage. And among those who did show up, what percentage would fail to pass? Probably a fairly high percentage here too, simply because of the increased difficulty of the present examinations and the possible lack of active involvement in the technical aspects of the hobby for any number of reasons.

No, we don't think that holders of Conditionally issued licensees should be singled out for special unfavorable treatment, provided thay still meet the criteria upon which the Conditional license was first issued; that is, they reside more than 150 miles from an FCC examining point, or are physically disabled making an appearance at an examining point impractical or impossible.

We have the gut feeling that holders of conditionally issued licenses giving General or higher privileges are often more active and make better and more regular use of the amateur bands than Commission examined licensees. If our feeling is correct then penalizing this large group could do significant harm to the amateur service.

Unquestionably there are numerous cases where a Conditional licensee no longer meets the criteria for the Conditional license. The serviceman returns home, the distant small-town resident moves to the city, and sometimes the disabled person recovers his mobility. In such cases, it seems entirely fair that the Conditional licensee be required to stand for examination at a Commission examination point. A reasonable grace period of 2 years or before the expiration of the Conditional license whichever is greater, seems appropriate.

Summing up, it is our feeling that holders of conditionally issued licenses should be granted full renewable license privileges provided they still meet the criteria upon which their license was first issued. In the event they no longer meet the criteria, we propose that they required to be re-examined within a reasonable period of time after their status has changed.

Reader comments related to the proposed power changes have been largely ho-hum, Generals feeling that a restriction to 500 watts p.e.p. output would not affect most of their operating and Advanced and Extra licensees not exactly thrilled at the prospect of being able to legally run 2000 watts p.e.p. output. The prospect of a 250 watt input power limit for the Novice also generates only slight enthusiasam.

It is our feeling that the Commission is barking up the wrong tree with its proposed changes in power limitations. The present power limitations cannot be demonstrated to be a cause for concern

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among either amateurs or Commission personel. Few amateurs, if any, have actively campaigned for power increases, and if any change has been discussed actively among concerned amateurs it's been the idea of lowering power limits. We don't support either course of action.

The prospect of exchanging one set of unenforced (or should it be unenforcable?) power regulations for another set which are even more complex seems unwarranted. A problem of some significance in US amateur radio is that of super power–powers ranging from 4 to 25 or more kilowatts input. Too many amateurs active in DXing and contests contend that only by joining the super power ranks can they compete effectively with others running super power. What effect would a 2kw p.e.p. output limit have on this situation? None whatsoever. FCC is currently unable to properly enforce the existing 1-kw-d.c./2-kw p.e.p. input limit. They would be no more capable of enforcing a higher limit.

Take the case of the General class operator who now enjoys the privilege of running 1 kw d.c./2 kw p.e.p. input. If he is among the substantial number of Generals having a kw linear amplifier on his operating desk, how realistic is it to expect him to not use it when conditions demand, particularly when he knows full well that the FCC machinery to catch him in the act is non-existant. One effect, then, of a 500 watt p.e.p. output limit for General class operators would be to establish conditions which would encourage the violation of the law by a normally law-abiding amateur. That's bad. A rule, in order to be effective, must be realistic.

For different reasons, we oppose the raising of Novice power limits to 250 watts input. The beauty of a Novice power limit of 75 watts is that it's cheap. Using relatively low cost components individuals and manufacturers have been able to build inexpensive transmitters at or near the 75 watt power limit. The 250 watt level, however begins to move into a significantly higher price range and that will have the effect of excluding from amateur radio still more people, at a time when the Commission is attempting to increase the number of amateurs. Certainly there is no requirement for a manufacturer to abandon his cheaper lower powered equipment–what little is still being offered–but most likely that's just what will happen. We realize that many well-heeled Novices are already on the air with sophisticated, high-priced commercial equipment capable of meeting the proposed 250 watt limit, but that's part of the picture that wouldn't change anyway. What would change is the number of inexpensive, yet fully competitive alternatives available to the Novice. It's not the way to encourage large numbers of new amateurs.

All told, we feel that the existing power limitations more satisfactorily meet the needs of amateur radio now, and in the forseeable future, than those proposed in Docket 20282.

73, Dick, K2MGA

Announcements

Skokie, Illinois

The National Amateur Radio Education Net will be holding an unusual contest. Send SASE to WA9MZS, 8041 N. Hamlin, Skokie, Illinois for details. Zip code, 60076.

Hancock, Michigan

The Copper Country Radio Amateur Association will have their annual Ham Radio Auction on Saturday, March 15, 1975, in Hancock Michigan. For more information, contact: Janet Ahlquist, Box 221 Chassell, MI 49916.

Midland, Texas

On March 23rd, 1975, the Midland Amateur Radio Club will hold a St. Patricks Day Swapfest. It will be in the Midland County Exhibit building 2 miles east of Midland on U.S. 90. For more information contact: WA5POK, P.O. Box 2491, Midland TX 79701.

Englewood, New Jersey

An R.L. Drake Transceiver, Model TR-4 was stolen from an Army MARS Station. Serial no. 29782. Please advise all of your branch stores in the area of this number. If this transceiver is offered for sale, please contact: Det. LT. W. Jacobs, Englewood, New Jersey Police Dept. (201)568-2700 or Federal Bureau of Investigation, Newark, NJ (201)622-5613.

Paterson, New Jersey

The Knight Radiers VHF Club will hold their auction and flea market Sunday, March 23, 1975 at the YWCA, of Paterson, 185 Carol Street, Pater son, New Jersey. Free Admission, and parking. Reserve in advance by writing to: Knight Raiders VHF Club, Inc., K2DEL, P.O. Box 1054, Passaic NJ 07055.

Charlotte, North Carolina

On March 23rd, 1975, the Metrolina Hamfest will be held at the Carolina Trade Mart at the corner of Stonewall and College Street. There will be prizes and flea markets. For more information: Contact: The Mecklenburg Amateur Radio Society, Inc., 2425 Park Road, Rm. 023, Charlotte NC, 28203.

Natchez, Mississippi

The Old Natchez Amateur Radio Club is sponsoring it's third Hamfest on April 13, 1975, in Natchez Mississippi. For more information con - tact K5OCM, Old Natchez Amateur Radio Club, P.O. Box 299, Natchez, Mississippi 39120.

Johnson City, New York

The Sixteenth Annual Hamfest, sponsored by the Southern Tier Amateur Radio Clubs will be April 19, 1975, at St. Johns Ukranian Hall, Johnson City, New York. For tickets and further information, write to: STARC, P.O. Box 11, Endicott, NY 13760.

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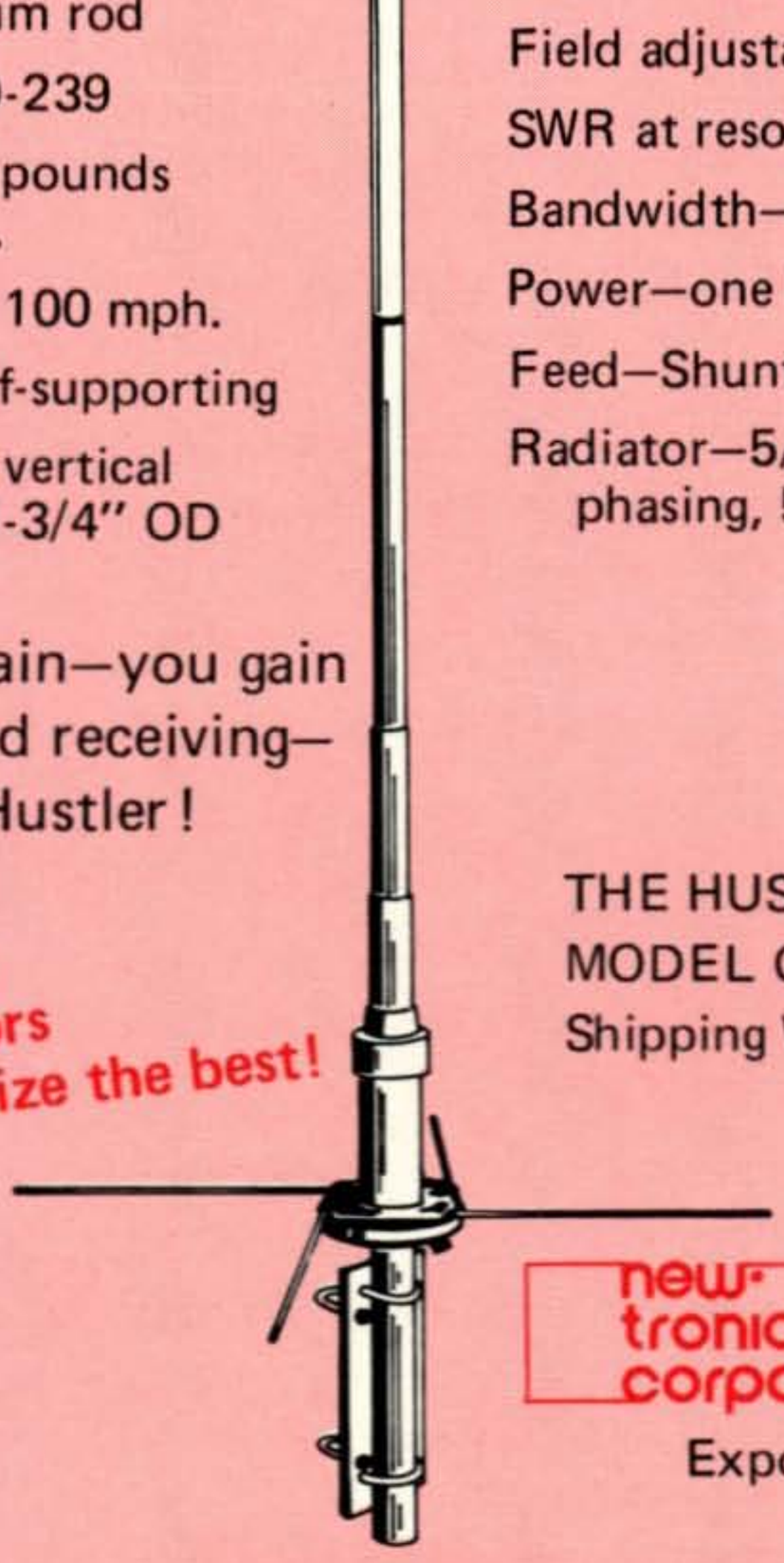

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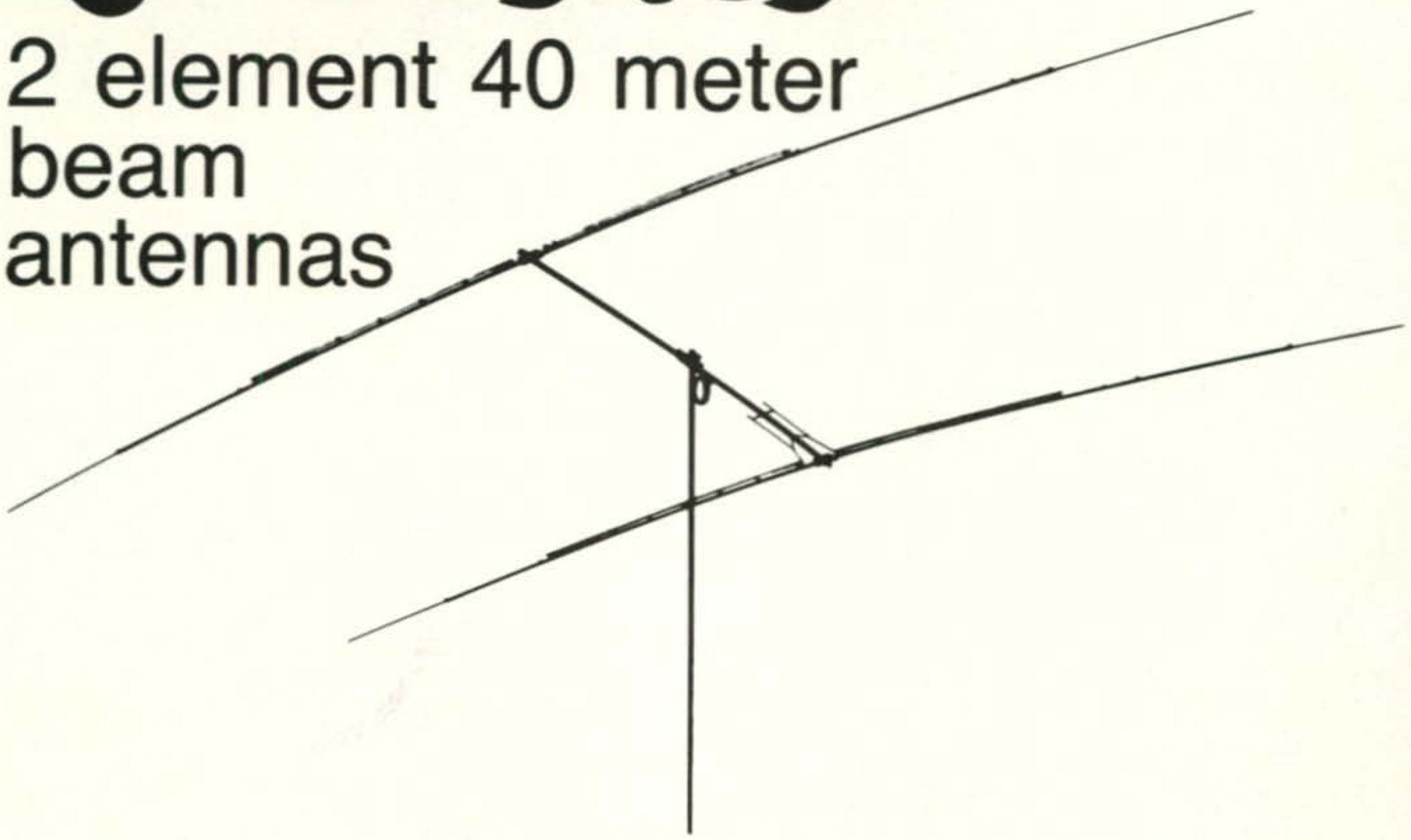

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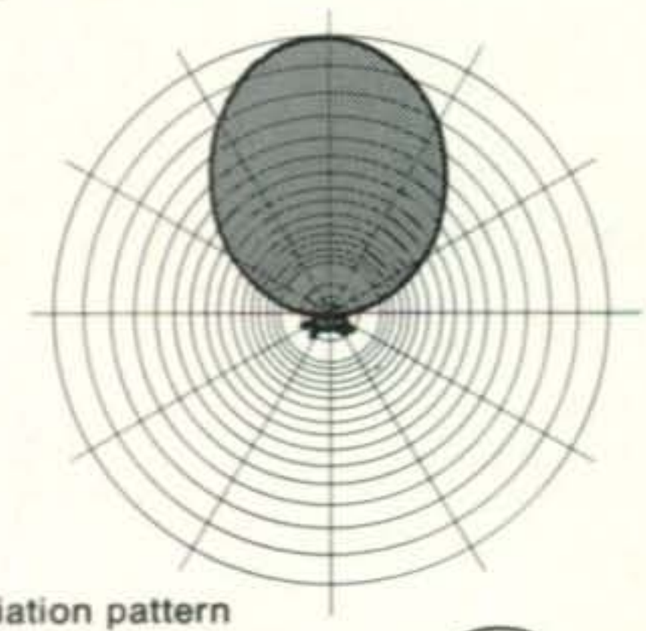

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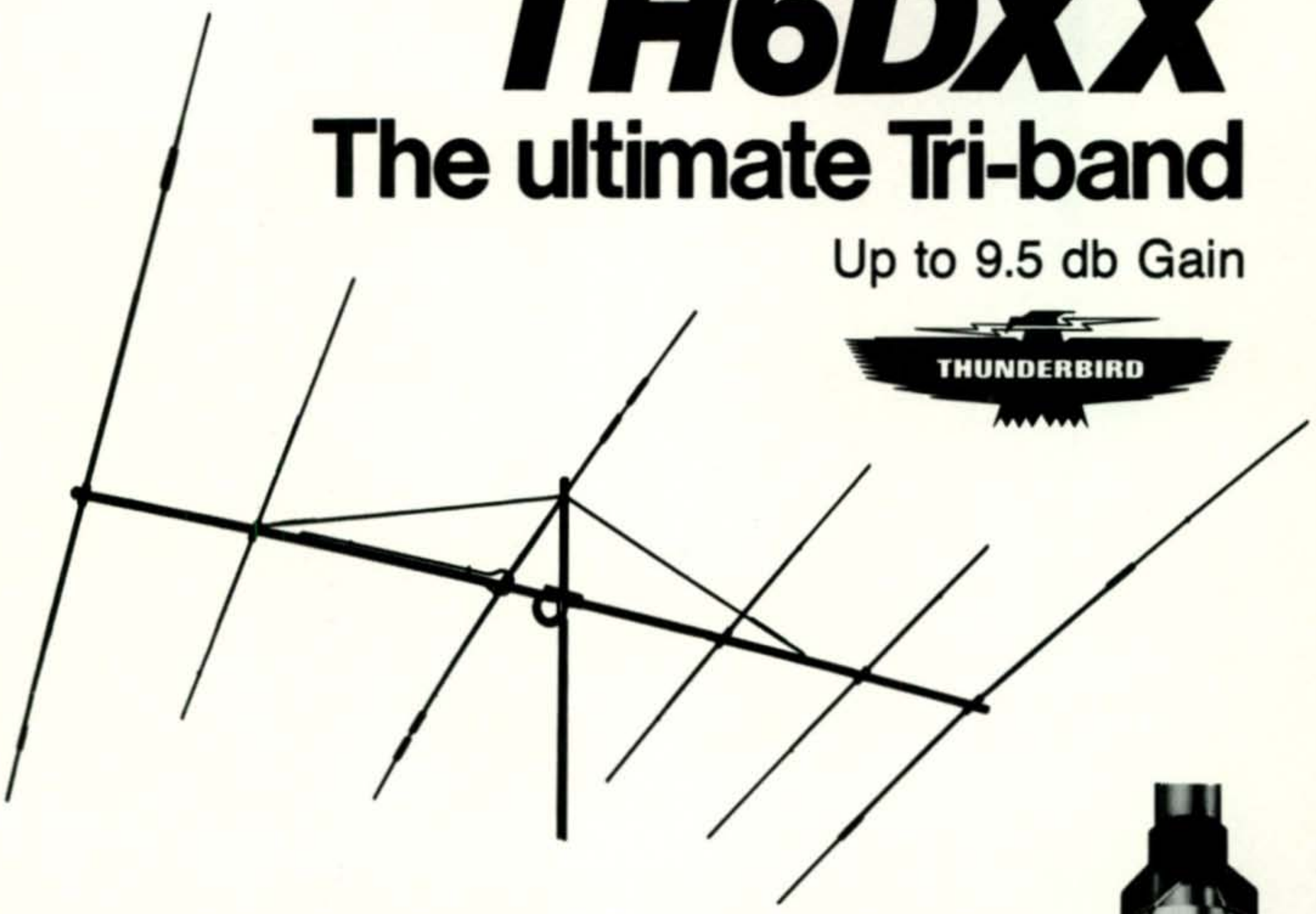

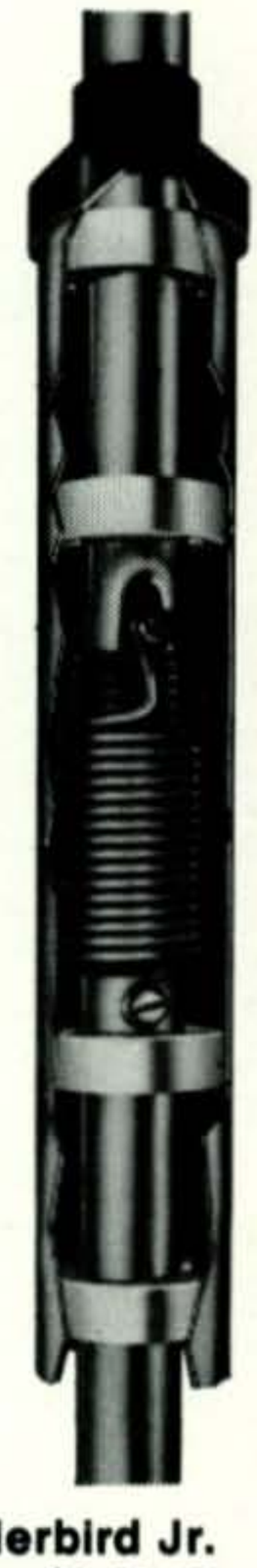

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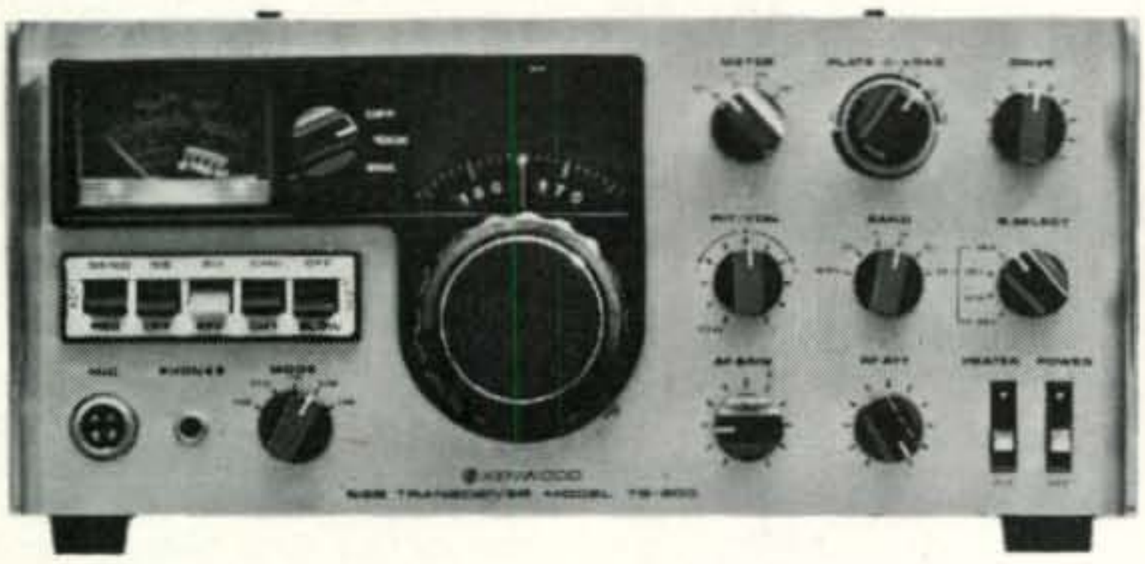

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A Breakthrough In Simplifying Ionospheric Propagation Forecasts

BY GEORGE JACOBS,* W3ASK AND THEODORE J. COHEN,† W4UMF

It is with considerable pride that CQ *reports that WWV propagation forecasts made fourteen minutes past each hour now contain updated measurements of* solar flux *and* geomagnetic activity. *Inclusion of this data seems to have resulted from reader response to Theodore Cohen's [W4UMF] article "Short-Term Predictions for Ionospheric Propagation", which appeared in the September, 1974, issue of* CQ. *In the following article, Ted teams up with* CQ's *Propagation Editor W3ASK to describe how this new data can be applied to the* Propagation Charts *which appear monthly in* CQ. *This marriage between short-term forecasts and long-term predictions results in a relatively easy do-it-yourself method for forecasting day-to-day conditions on any path in the h.f. amateur bands.* —K2MGA

A RECENT article[1] on short-term ionospheric forecasting demonstrated how daily observed values of *solar flux* and *geomagnetic activity* can be used to forecast day-to-day changes in h.f. propagation conditions with a relatively high degree of accuracy. At the time the article was written, however, current data for these variables were not available on a real-time basis to radio amateurs or to other users of the h.f. bands. Readers were urged to write the National Bureau of Standards, and to request that *timely* data on solar flux and geomagnetic activity be included in the regular WWV propagation forecasts made *fourteen minutes* past each hour on 2.5, 10, 15, 20, and 25 MHz.

Apparently in response to reader requests, WWV has now added current readings of solar flux and geomagnetic activity to its forecasts. Updated as often as every three hours, this now provides users of the h.f. spectrum with additional information for making more meaningful forecasts of day-to-day conditions.

In the article on short-term predictions,[1] values of solar flux and geomagnetic activity were related to signal variations observed on several geographically different DX paths on the 14 MHz amateur band. The method described, however, can be applied to determine conditions on any path, and on any h.f. band. The following article shows how to apply this method using the Propagation Charts which appear monthly in *CQ* as a convenient source of expected signal strength for a desired path on a particular band. It also shows how this signal strength data can be related to the updated values of solar flux and geomagnetic activity as broadcast by WWV, so that day-to-day variations in signal strength and conditions can be determined for up to almost a month in advance.

Solar Flux

High frequency radio signals can travel great distances because there exists in the earth's atmosphere an "electrified" region, called the *ionosphere,* which bends or reflects signals over hundreds and thousands of miles.[2]

The ionosphere is formed primarily by ultraviolet radiation received from the sun. The stronger the radiation, the "stronger" the ionosphere; the weaker the radiation, the "weaker" the ionosphere. The stronger the ionosphere, the better are h.f. propagation conditions.

Solar flux is a measure of the level of radiation from the sun, and consequently, is an indication of the general state of the ionosphere.

The solar flux is monitored at numerous observatories throughout the world. For example, the values of solar flux broadcast by WWV are determined by an observatory at Ottawa, Canada, and are measured at a frequency of 2,800 MHz (10.7 cm wavelength).

Because solar flux is a measure of solar activity, a relationship exists between it and the daily sunspot number *(R),* which is also an index of solar activity. During the present period of low solar activity, this relationship is given approximately as follows:

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† 8603 Conover Place, Alexandria, Virginia 22308.

[1] "Short-Term Predictions for Ionospheric Propagation," Cohen, T. J., *CQ,* Sept. 1974, p. 27.

[2] "Short Wave Radio and the Ionosphere," Jacobs, G. and Leinwoll, S., *CQ,* Nov. 1969, p. 16.

$$\text{Solar Flux} = 72 + 0.6\,R$$

Use of solar flux as a measure of *daily* solar activity is now preferred to the use of the daily sunspot count because solar flux has been found to be more direct and objective. It is also much more sensitive to change than is the daily sunspot count and is more readily available for public dissemination.

During the present period of low solar activity, which is likely to last for at least the next two years,[3] daily solar flux levels will generally range between 72 and 90, and may occasionally exceed 100.

Geomagnetic Activity

While ultraviolet radiation from the sun produces the ionosphere, another type of solar radiation also affects h.f. propagation. Called *solar particle radiation,* it causes the ionosphere, and hence, h.f. signals, to weaken or disappear entirely. It is also responsible for flutter and other types of fading as well as for increased noise levels. Since solar particle radiation also affects the earth's magnetic field, its level can be determined from certain measurements of this field's activity.

The activity of the earth's magnetic field is monitored by a large number of observatories throughout the world. The results are reported using two different, but related, indices: A_p and K.

The world-wide, or planetary A index (A_p) is the daily average of geomagnetic activity as measured at all participating observatories. Since it takes at least one full day to determine A_p, it is not a real-time index. Daily values of A_p are reported the *following* day on solar-geomagnetic broadcasts given eighteen minutes past each hour on WWV and forty-five minutes past each hour on WWVH.

Recently WWV began broadcasting real-time three-hourly K figures of geomagnetic activity from the Fredericksburg, Virginia observatory on its propagation forecasts *fourteen* minutes past each hour. The K and A_p indices are related approximately as follows:

K	0	1	2	3	4	5	6	7	8	9
A_p	0	4	7	15	27	48	80	140	240	400

The K index varies over a scale of 0 to 9. The higher the value, the greater the influx of solar particles, which in turn causes weaker signals, and increased fading and noise.

Although there are exceptions, a K index of 2 or less generally indicates a low level of particle radiation and little effect upon the ionosphere. A reading greater than 4 usually indicates active or storm conditions, and poorer h.f. propagation. Readings of 3 and 4 generally indicate an unstable or unsettled condition.

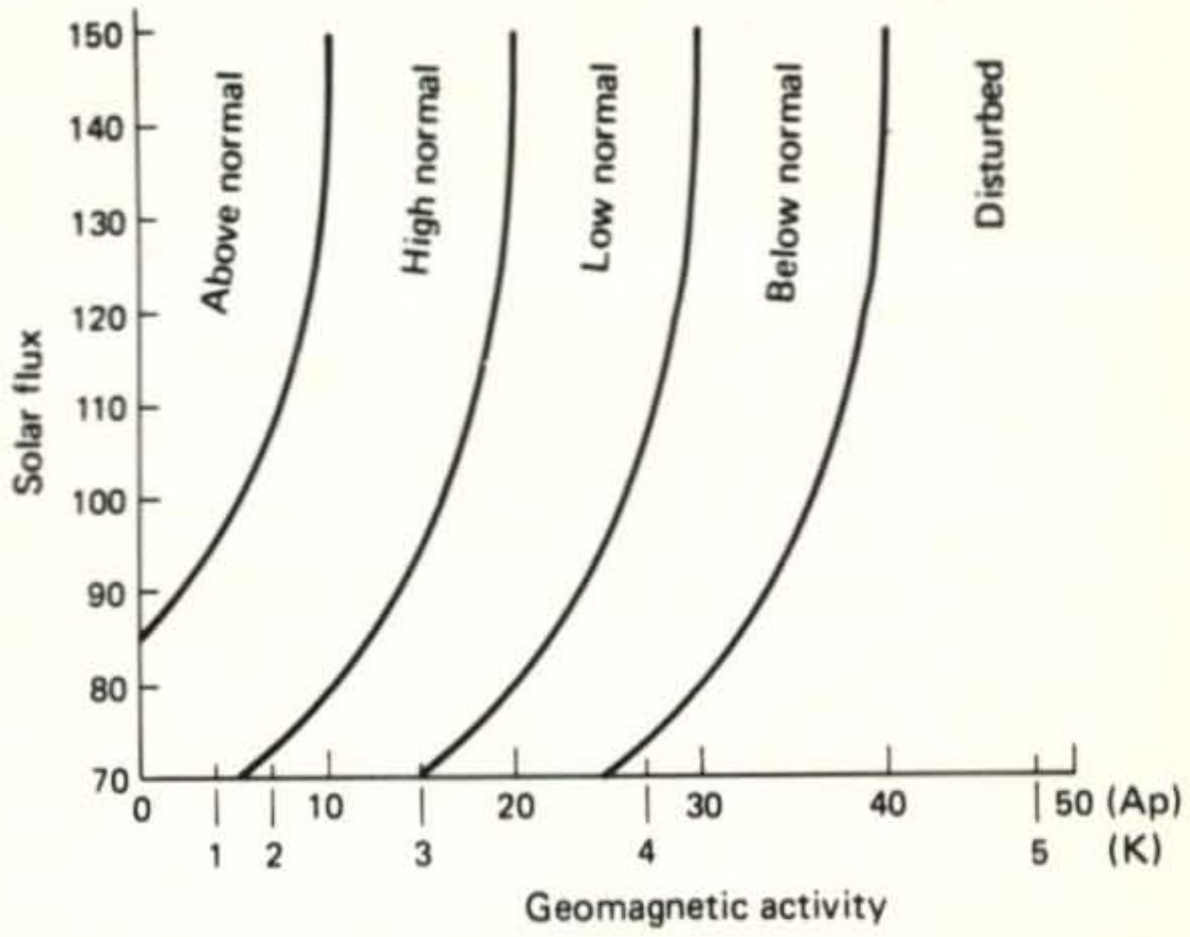


Fig. 1—Intersection of given values of solar flux and geo-magnetic activity determine expected h.f. ionospheric propagation conditions. (Example: S.f. —80, Ap —25; expect Below Normal conditions.)

Short-Term Forecasting

Solar flux indicates the degree of ionization in the earth's atmosphere, and either the A_p or the K index measures the activity of the earth's magnetic field, or radio storminess. Both taken together give a relatively accurate picture of overall ionospheric propagation conditions.

With few exceptions, the *higher* the value of solar flux and the *lower* the level of magnetic activity, the *better* will be ionospheric propagation conditions on the h.f. bands. Conversely, the *lower* the solar flux and the *higher* the magnetic activity, the *poorer* will be conditions.

Figure 1 graphically shows the relationship between solar flux, geomagnetic activity, and general h.f. propagation conditions expressed subjectively as Above Normal, High Normal, Low Normal, Below Normal, and Disturbed. Geomagnetic activity is shown both in A_p and K units.

Figure 1 is derived from data reported daily during 1974,[4] and fits 90% of the cases observed. It can be used during the present period of low solar activity, which is expected to last for at least the next two years.

As an example of how to use fig. 1, assume that the latest WWV propagation broadcast reports a solar flux of 80 and a K index of 2. The intersection of these two values falls within the area defined as High Normal. While this result by itself is not related directly to any particular path or band, it does suggest that it should be worthwhile to get on the air. On the other hand, if a solar flux of 73 is reported along with a K index of 5, the Disturbed conditions might justify watching television or going to the movies rather than wasting time

[3]"Sunspot Cycle, Analysis and Prediction," Cohen, T. J. and Lintz, P. R., *CQ,* March 1974, p. 24.

[4]"Solar-Geophysical Data," published monthly, U.S. Dept. of Commerce, Boulder, Colorado 80302.

Signal Strength (r)	Symbol	Signal Quality
$r > S9 + 30$ db	A	Excellent opening, exceptionally strong, steady signals
$S9 < r \leqq S9 + 30$ db	B	Good opening, moderately strong signals with little fading or noise
$S3 < r \leqq S9$	C	Fair opening, signals between moderately strong and weak, with some fading and noise
$S1 < r \leqq S3$	D	Poor opening, signals weak with considerable fading and noise
—	E	No opening expected

Table 1—Signal quality (A to E) defined in terms of expected signal levels. Based on a transmitter effective radiated power of 1 kw p.e.p., and a typical radio amateur receiving installation using a directional antenna.

on bands where there may be few if any signals.

Marriage With Long-Term Predictions

While a general overview of h.f. propagation conditions obtained from fig. 1 can be very useful on a day-to-day basis, short-term forecasts are of considerably greater value when they can be related directly to particular paths on specific bands.

In his original article,[1] Cohen related short-term forecasts to signal variation on several circuits for which he kept careful signal records for as long as three years. It is now possible to make short-term forecasts *without* the need for going through such a time consuming operation by using *CQ*'s Propagation Charts.

High frequency propagation predictions for DX from the three main geographical areas of the continental USA (eastern, central and western) to more than a dozen different geographical areas throughout the world, appear every other month in *CQ*'s Propagation column.[5] The DX predictions, it should be noted, cover a two-month period. During alternate months, similar predictions are made for short-skip openings up to a distance of 2300 miles, and for openings from the continental USA to Hawaii and Alaska.

While the explanation which follows uses the DX predictions as an example, the same method will apply to the short-skip predictions as well.

With respect to these predictions, a number between 1 and 4, appearing in ( ), follows the times given in the DX Propagation Charts for each band opening on a particular circuit. This is called the *propagation index*, and it indicates the number of days during the month that openings are likely to occur:

(4) Openings likely to occur on more than 22 days during month
(3) Openings likely to occur between 14 and 22 days during month
(2) Openings likely to occur between 7 and 13 days during month
(1) Openings likely to occur on less than 7 days during month

While the propagation index indicates the likely number of days the opening should take place, it does not give the actual dates. A marriage between these predictions and the short-term forecast discussed previously *will permit the actual dates to be determined*. First, however, we will need the information given in Tables I and II.

Table I relates ranges of expected signal strength with the *signal quality* ratings (A through E) used in the *CQ* predictions. Table II, on the other hand, ties together *signal quality* ratings (A through E) and the *propagation index* (1 to 4), with the categories of general conditions used in fig. 1 for short-term forecasts.

With fig. 1, and Tables I and II, it is now possible to relate the short-term forecasts to the long-range predictions, and to forecast likely conditions and expected levels of signal strength for any h.f. band, at any time, and for any path.

As an example, suppose you live in the eastern third of the USA and you have a schedule to keep on 20 meters with a station in western Europe between 3 and 4 P.M. EST. The DX Propagation Chart shows a propagation index of (2) for this path at the schedule time. The last WWV propagation broadcast before the schedule, at 2:14 P.M. reports a solar flux of 87 and a *K* index of 3. Entering fig. 1, these values are found to intersect in the Low Normal range.

Next, using Table II, determine the expected signal quality at the intersection of the propagation index (2) and Low Normal conditions. You find it to be *D*. A check of Table I for the definition of *D* indicates that you can expect a poor opening with weak signals and with considerable fading and noise. If reference power levels are being used, you can expect the signal strength of the scheduled station to be somewhere between S-1 and S-3.

In the same example, had the solar flux been 78 and the *K* index 2, the resulting signal quality rating would have been a *C*, with a much better chance for a fair opening and stronger signals.

Here's another example, this one showing how expected signal quality can vary on two different paths under the same category of ionospheric conditions. The DX Propagation Charts show that between 8 and 10 P.M. PST, the 20 meter band is expected to open from the western states to the South Pacific with a propagation index of (4), and to South Asia with an index of (1). Let's assume that at 7:14 P.M. WWV reported a solar flux of 82 and a *K* index of 2. From fig. 1, these two values

[5]Latest DX Propagation Charts for Feb. 15 to Apr. 15, 1975 appear in the Feb. 1975 issue of *CQ*, p. 53.

fall in the area defined as High Normal. Table II shows that for High Normal conditions and a propagation index of (4), the signal quality expected on the path to the South Pacific is *B*, while for the path to South Asia where the propagation index is (1), the resulting signal quality is expected to be *D*. Figure 2 translates these into an expected S-9 to 30 db-over-9 signal from the South Pacific and an S-1 to S-3 signal from South Asia.

In sum, fig. 1 and Tables I and II permit the solar flux and geomagnetic activity levels broadcast by WWV to be related directly to path openings as they appear in the monthly *CQ* Propagation Charts.

27/28-Day Cycle

The sun makes one complete rotation on its axis in slightly over 27 days. There is a very good chance, therefore, that if a group of sunspots is in a position to affect the earth's magnetic field and ionosphere today, it will be back in the same relative position about 27 days from now. Thus, ionospheric propagation conditions should recur every 27 days or so. During periods of high solar activity, when spots appear at higher latitudes on the sun's surface, the recurrence period is closer to 27 days. During periods of low solar activity, such as at present, when the spots appear close to the sun's equator, the recurrence period is closer to 28 days. Though the recurrence of similar ionospheric propagation conditions every 27 to 28 days is not always observed (old sunspots can disappear and new ones form during a solar rotation), it does occur a very high percentage of the time. This is particularly true during periods of low solar activity when the same sunspot configuration may appear over a half dozen or more consecutive rotations of the sun.

	Propagation Index			
Expected Conditions	(4)	(3)	(2)	(1)
Above Normal	A	A	B	C
High Normal	B	B	C	D
Low Normal	B	C	D	E
Below Normal	C	D	E	E
Disturbed	D-E	E	E	E

Table 2—Expected signal quality (A to E) as a function of propagation index (1 to 4) and expected conditions. Example: A path opening with a predicted propagation index of (3) is expected to have a signal quality of C during Low Normal conditions. (See fig. 2 for reference power level).

To see how a radio amateur can make his own 28-day advance forecasts, consider the following example. Suppose that on March 2nd, WWV reported at eighteen minutes past each hour (forty-five minutes past the hour on WWVH) that on March 1st, the solar flux was 76 and the A_p index was 20. Reference to fig. 1 shows that under these circumstances, conditions on the h.f. bands should have been Below Normal. Using arithmetic or by counting days on a calendar, add 28 days to March 1st. This comes out to be March 29th, and you can expect conditions to be Below Normal on this date as well.

If you keep a daily log of the solar flux and values of A_p broadcast by WWV, you will be able to predict day-by-day conditions up to 28 days in advance. It won't always work out correctly, but you may score as high as 90% correct during the remaining two years or so of low solar activity.

An example of this recurrence tendency for geomagnetic conditions is shown in fig. 2. Here the planetary magnetic index A_p is plotted daily for the last five months of 1974. While behavior of the earth's magnetic field is fairly erratic on a day-to-day basis, the recurrence of high and low periods on a 27-day period stands out clearly.

[*Continued on page 63*]

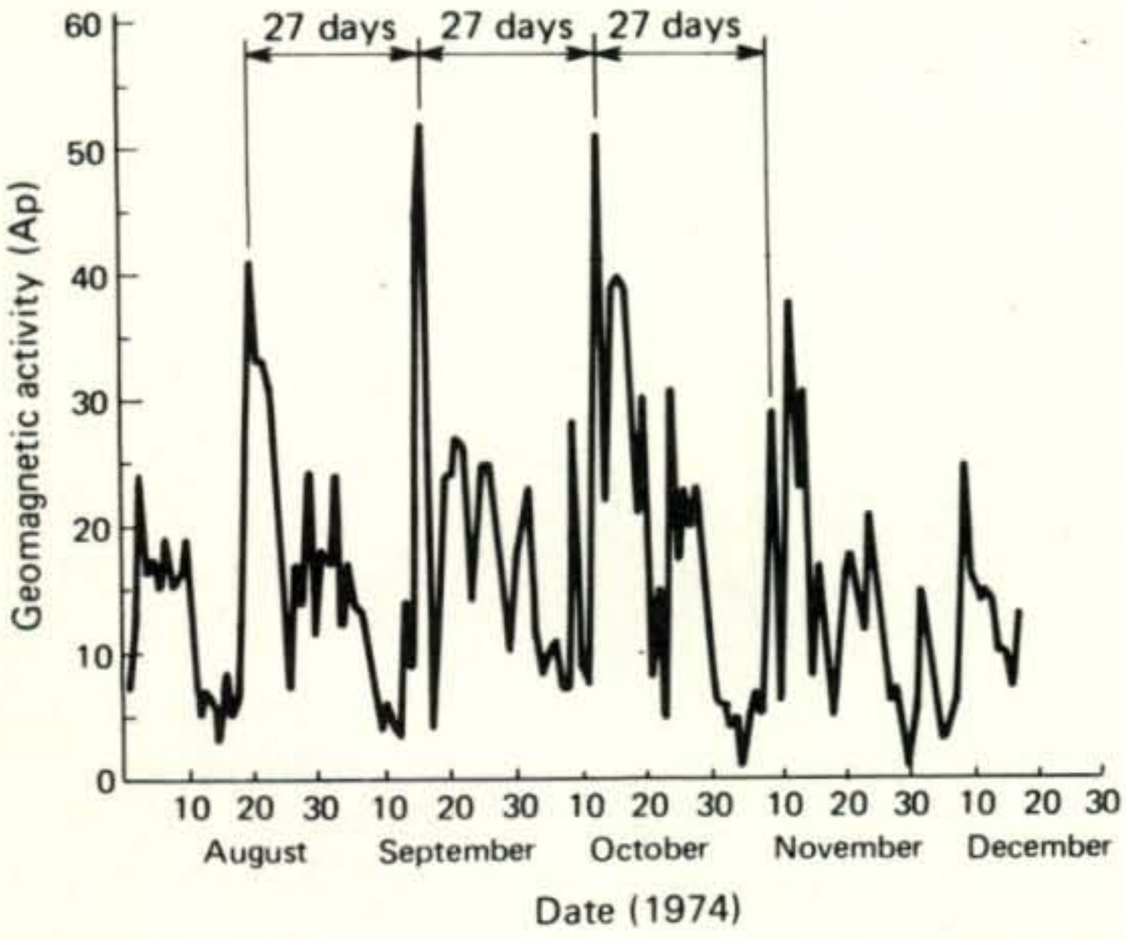


Fig. 2—Geomagnetic activity (Ap index) as a function of time (Aug. 1 through Dec. 17, 1974). Note approximate 27-day recurrence tendency of values.

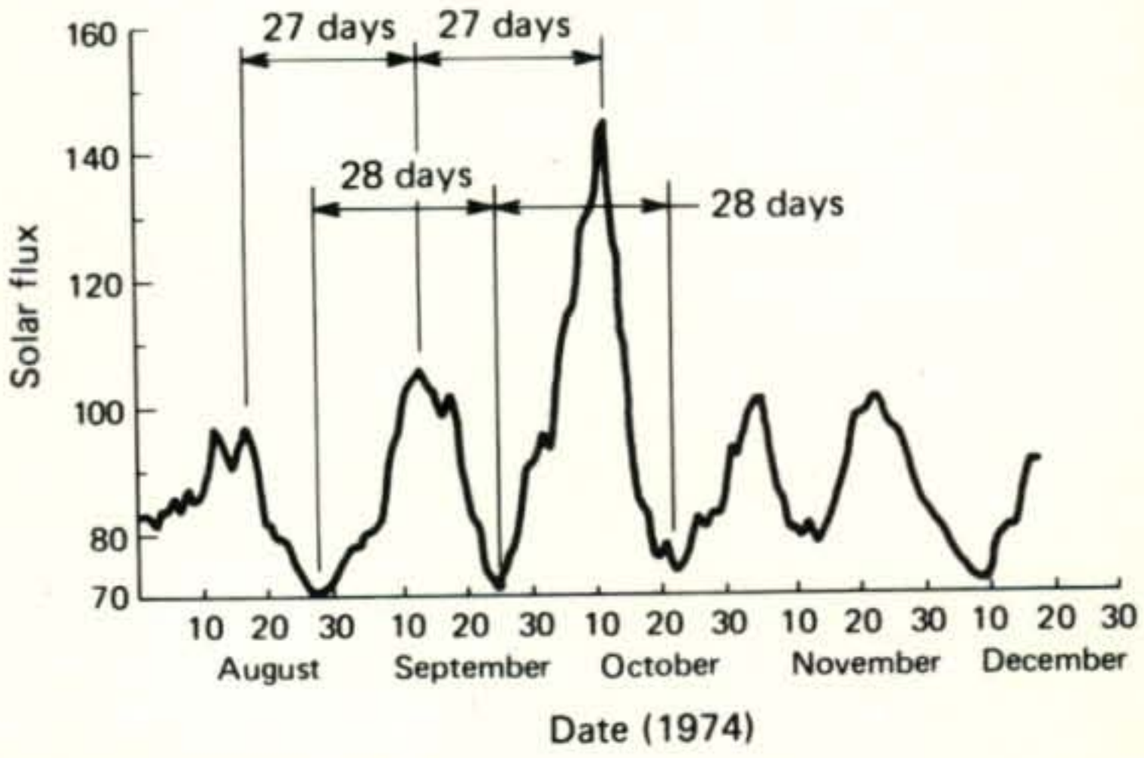


Fig. 3—Solar flux as a function of time (Aug. 1 through Dec. 17 1974). Note tendency towards approximate 28-day recurrence.

antennas

BY WILLIAM I. ORR,* W6SAI

"What's a KLM?" asked Pendergast.

"What's a *what?*" I replied evasively.

"A KLM. It's a new, super, *super* antenna. I heard one on 20 meters a few days ago in a pile-up. *Man!* What a signal. What do you know about it?"

"You must be a mind reader," I replied. "How would you like to have a sneak preview of my March *CQ* Antenna Column? It has a discussion of the KLM antenna prepared by Mike Stall, K6MYC, one of the best antenna designers I know of."

I searched through the desk drawer and brought out a typewritten manuscript. "Here's what Mike has to say about the KLM. Why don't you read it, while I take a quick look-see over 20 meters and see what's going on." I turned toward the operating table as Pendergast settled down in his chair and began to read.

The KLM Antenna

The KLM antenna is an adaptation of the popular Yagi array to obtain better bandwidth performance while retaining the high forward gain and good front-to-back ratio of the Yagi.

In general, the Yagi provides the greatest gain per unit size of any of the popular amateur arrays, but as the gain increases with the number of elements, the more restricted will be the bandwidth of this type of antenna. A high gain Yagi for operation on the 2 meter band, for example, will only provide good performance over a portion of the band. Even at 20 meters, it is not easy to obtain a good match, and good front-to-back ratio, for both the c.w. and phone parts of the band.

The restricted bandwidth of a radiator may be improved by applying the *equiangular principle* to the antenna design. That is, if the shape of the antenna can be specified entirely by angles, antenna performance would be independent of frequency.

A frequency independent antenna, of which the *log periodic array* is an example, is a structure that exhibits the same performance at different frequencies by virtue of the fact that the antenna is self-scaling and has no dimensions that are frequency sensitive. A simple frequency independent antenna described by angles is shown in fig. 1. Practical structures are limited in size and thus limit the frequency independent characteristic. To be truly independent, a spiral antenna of this type would have to start at an infinitely small point and expand to infinity. Practically, the antenna has a feed point at the center and has outer limits. As a result, the antenna has frequency limits defined by the physical, not the electrical, limitations.

A modified, frequency independent antenna is shown in fig. 2. This is a planar structure, with the design repeated *periodically* with respect to the *logarithm* of the frequency. It is known as a *log periodic antenna*. A simpler form of log periodic antenna is shown in fig. 3, wherein the toothed structure is replaced with simple, dipole elements. This is known as a *log periodic dipole* array, and is a popular configuration for television receiving antennas. Radiation is directed toward the apex when used for transmitting, and versions of these antennas are used by amateurs on the v.h.f. bands.

The antenna has frequency limits that are defined as the frequencies at which the outer elements of the array are about one-half wavelength long.

The dipoles are fed at the center from a parallel wire transmission line in such fashion

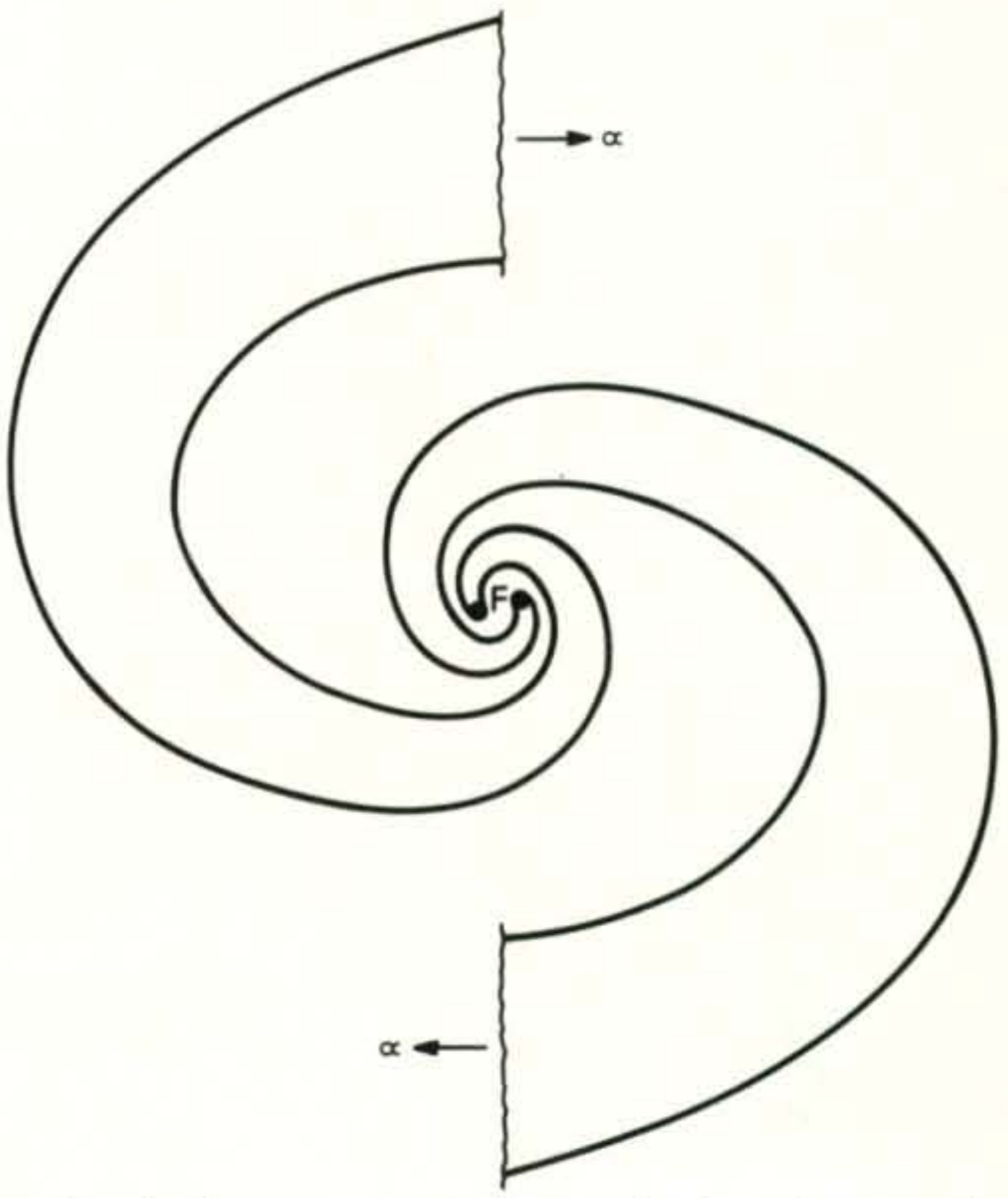


Fig. 1—A frequency independent antenna structure described by angles. The shape of the antenna, when expressed in terms of operating wavelength, is the same for any frequency. The structure is fed at the center point (F) and the arm lengths are infinite. (Illustration courtesy of Editors & Engineers, Ltd.)

*48 Campbell Lane, Menlo Park, CA 94025.

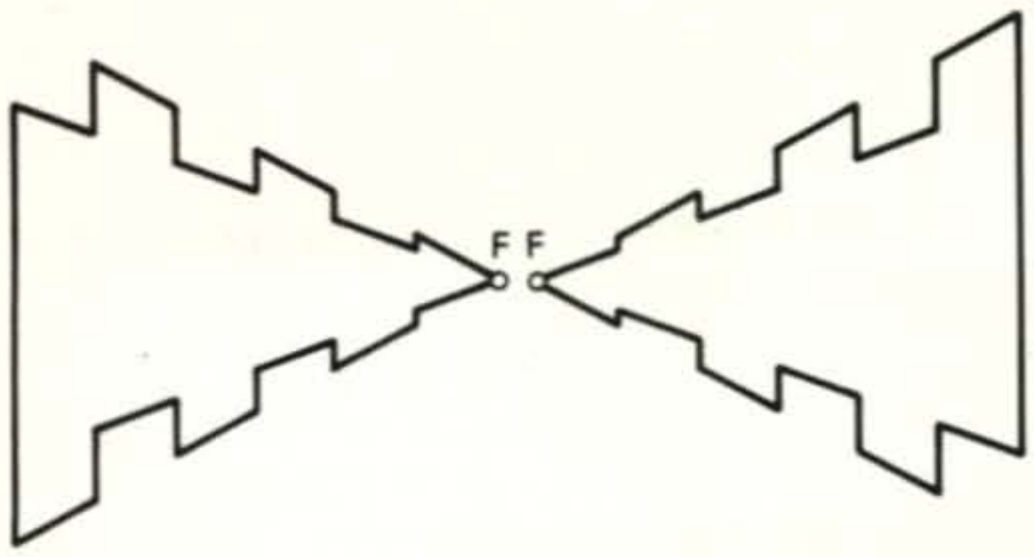


Fig. 2—A planar, pediodic antenna. The toothed structures can be cut from a sheet of aluminum or other conducting material. Feedpoint is F-F. The structures may be folded back upon themselves to form a three dimensional, directional array.

that successive dipoles come out from the line in opposite directions, equivalent to a 180 degree phase shift between elements. A broadband structure is thus formed, with most of the radiation coming from those elements in the vicinity of a half-wavelength long. Gain and bandwidth thus bear a definite relationship to the included angle of the structure, and its length.

The log periodic principle may be applied to the Yagi antenna to expand the bandwidth of this popular antenna. Enough log periodic, driven elements are added to the Yagi beam to provide the desired bandwidth and are fed in the same manner that the log periodic assembly is fed. The number of log periodic elements used depends upon the bandwidth desired.

As a specific example, a 20 meter log periodic Yagi antenna will be discussed.

* * * * *

Pendergast put down the paper and said, "How in the world do you design a 20 meter beam antenna? It's too big to do much experimental work on, and you would need a huge antenna range."

I took off the earphones and replied, "Right. K6MYC developed his 20 meter design by scaling all dimensions down by a factor of ten and making all tests and measurements at 140 MHz. He set his model antenna up one wavelength above ground, or 84 inches. The 20 meter elements were duplicated by using ⅛-inch diameter elements."

"What about the ground plane?" asked Pendergast.

"Mike ended up using natural ground," I replied. At 140 MHz, it compares favorably with 14 MHz. Of course, the comparison is not so true at microwave frequencies.

"I understand one of the local microwave outfits has made a good approximation of actual earth conditions by using a copper ground plane covered with peanut butter for work at 2.5 gHz."

"Peanut butter?," cried Pendergast.

"Yes," I replied. "Peanut butter makes a good approximation of the ground losses for antenna measurements in the microwave region."

Pendergast muttered some uncomplimentary remark under his breath and continued to read the manuscript.

* * * * *

It was soon found out that the tapered elements used at 20 meters could cause significant errors when the elements were scaled up from 140 MHz. The initial design, which used untapered elements, scaled up to a much higher frequency than expected. This was due to element taper on the 20 meter antenna, whereas the 140 MHz model used ⅛-inch diameter elements, butt to tip. This corresponded to 1¼-inch elements at 14 MHz. Using 14 MHz elements that tapered from 1¼-inch at the butt down to ½-inch diameter at the tip required a lengthening of approximately 5 percent to lower the antenna to the desired operating range of 13.9 MHz to 14.4 MHz.

This frequency range for the 20 meter KLM log periodic Yagi was chosen because many amateurs also operate on the MARS frequencies close to 14 MHz. Making a standard Yagi antenna perform optimumly on the MARS frequencies as well as the high frequency end of the 14 MHz band is compromising, if not impossible.

A twin log-driven element system has sufficient bandwidth to cover 500 kHz at 14 MHz and parasitic elements, if properly designed and spaced, respond well when driven over that range. The final antenna design for 20 meter operation provided good gain as low as 13.6 MHz, although the front-to-back ratio and s.w.r. were poor below 13.9 MHz (fig. 4).

* * * * *

"Figure 4! Figure 4! Where is it?" yelled Pendergast.

"You dropped it on the floor," I replied. "Here it is."

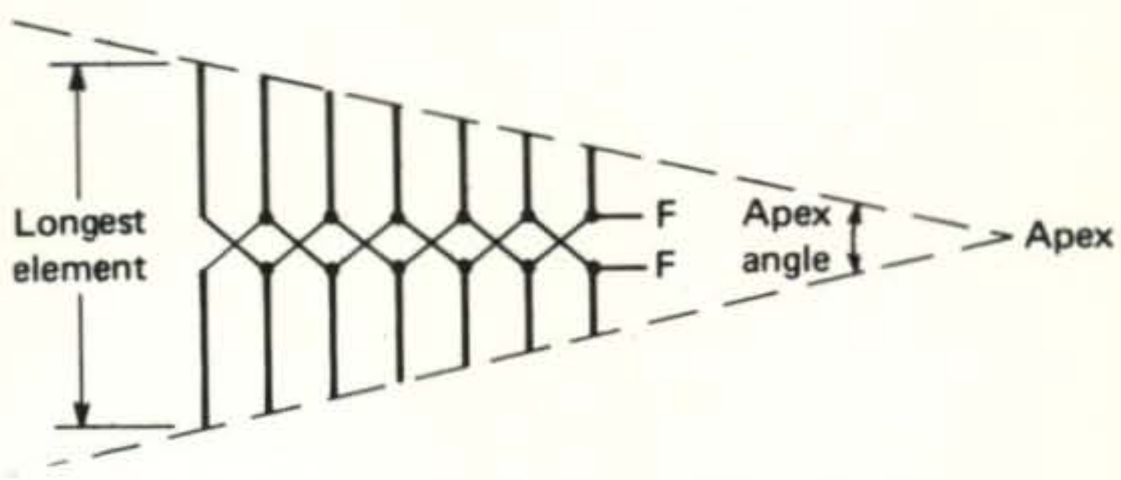


Fig. 3—The log periodic dipole antenna. Successive dipole elements are fed out of phase by a common transmission line to produce a beam pattern at the apex of the array. The lowest usable frequency is determined when the longest element approaches a half-wavelength. The highest usable frequency is determined by the length of the shortest element. The antenna is fed at F-F with a balanced line, or coaxial line and balun.

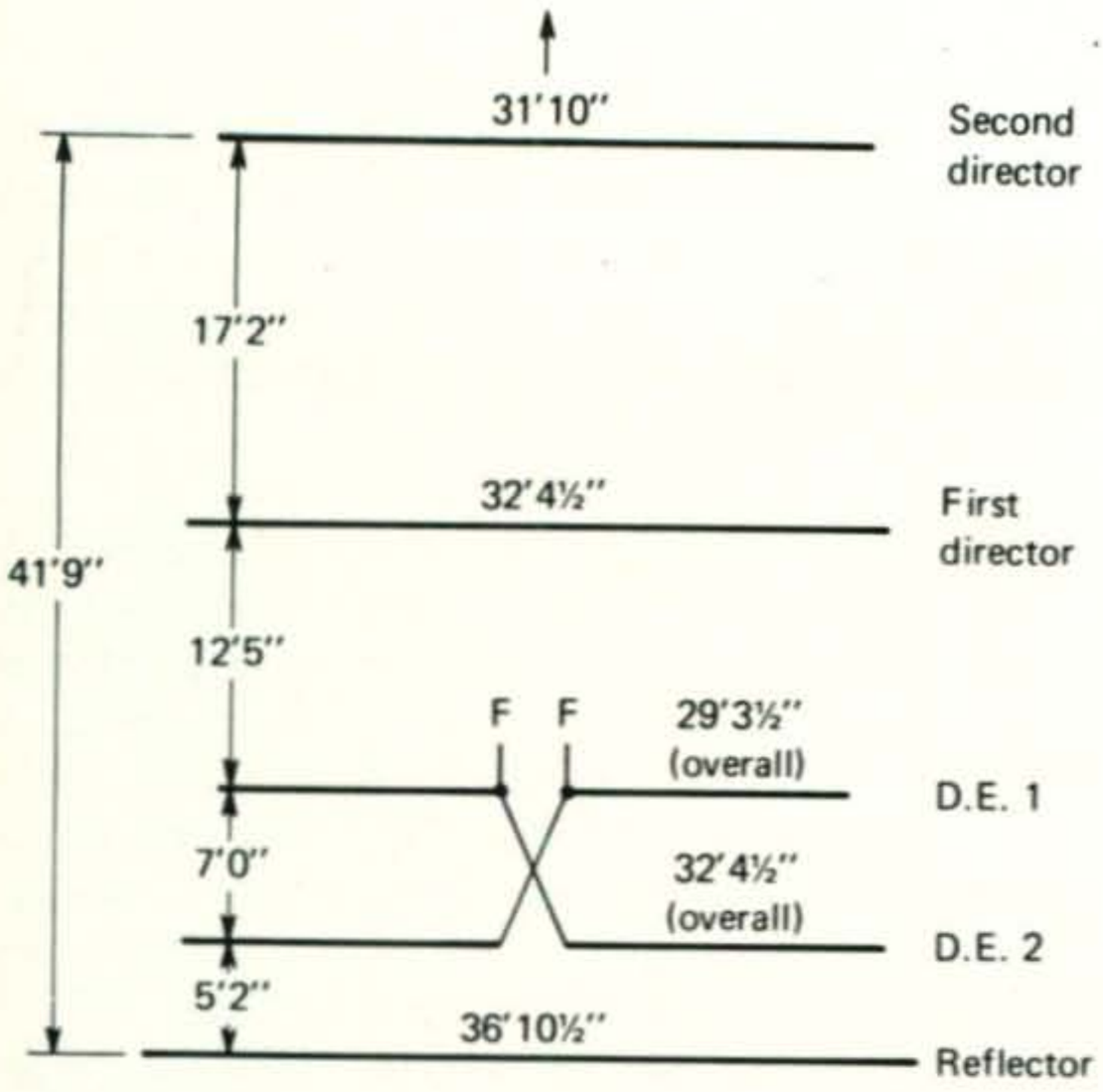


Fig. 4—The KLM 20 meter "big gun." Covering the range of 13.9 MHz to 14.4 MHz, the KLM design provides 9 db forward gain over a dipole across the operating span. Front-to-back ratio is 30 db at the design frequency of 14.25 MHz. Antenna is built on a 42 foot boom and is fed at points F-F with a 50 ohm line and a coaxial, half-wave balun which provides a 200 ohm termination to match the antenna. Antenna dimensions provided by K6MYC.

Pendergast bent over the drawing. "This is the antenna design that shot me out of the saddle on 20 meters," he announced.

"Well, it is a 5 element structure, using two log-driven elements. That makes it about equivalent in power gain to a 4 element Yagi. Only difference is, you can actually get this gain all across the operating range. And it is difficult to do that with a simple Yagi. Mike claims 9 db forward gain over the operating range, as compared against a dipole, and I see no reason to doubt him."

Pendergast peered at the drawing and I continued. "Notice that reflector spacing is narrow to conserve boom length, which is an important factor on a large antenna. The front-to-back ratio is affected very little with reflector spacing in the range of .08 wavelength to .25 wavelength. Forward gain rises 0.3 db with the reflectors spaced out at .25 wavelength, but this is hardly worth the extra boom length.

"The spacing of the driven element pair is adjusted to provide a 200 ohm impedance for the antenna feed point. Spacing variations here have little effect on antenna performance. Notice that the lengths of the two driven elements are diffierent. The lengths are affected by the proximity of the reflector and the first parasitic element and these lengths, when properly adjusted, provide the proper bandwidth in this configuration.

"First director spacing is adjusted to achieve a match at the feed point and also has a significant effect on the front-to-back ratio. The length of the element also affects these parameters, but has the most effect on the antenna gain."

Pendergast picked up the manuscript and began reading again.

* * * * *

The forward director, which is the shortest, is used to control the high frequency response of the antenna. Adjusting the length controls this parameter. The spacing of the outer director also has a significant effect on the front-to-back ratio of the array.

The individual spacings of the two directors are adjusted for maximum forward gain and a high front-to-back ratio. Adjustments are then made to the driven element lengths to bring the impedance match to provide a s.w.r. of 1.2, or better, over the 500 kHz range covering 13.9 MHz to 14.4 MHz.

In this particular design, the directors exert a high degree of control over the front-to-back ratio, not only how much, but also where the highest ratio occurs in the passband. Since 14.2 to 14.25 MHz is probably the most desirable place to have the best front-to-back ratio, the director spacing and lengths are adjusted to provide at least 30 db ratio, or better, in that frequency region. The front-to-back ratio decreases to 20 db, or better, at 13.9 MHz and 14.4 MHz. Maximum gain varies only 0.2 db over the complete passband of the antenna.

* * * * *

"Wow," said Pendergast. "My 4 element Yagi has only about 15 db front-to-back ratio in the phone band, and even worse at 14.0 MHz!"

"Yagi antennas are not noted for good front-to-back ratio, except when expressly designed for it. Then you always run the risk of losing forward gain," I replied.

"Let's digress for a moment and talk about directors," I said.

"Directors will do their job over quite a wide frequency range. The big problem with most common Yagi designs, using a single driven

[*Continued on page 66*]

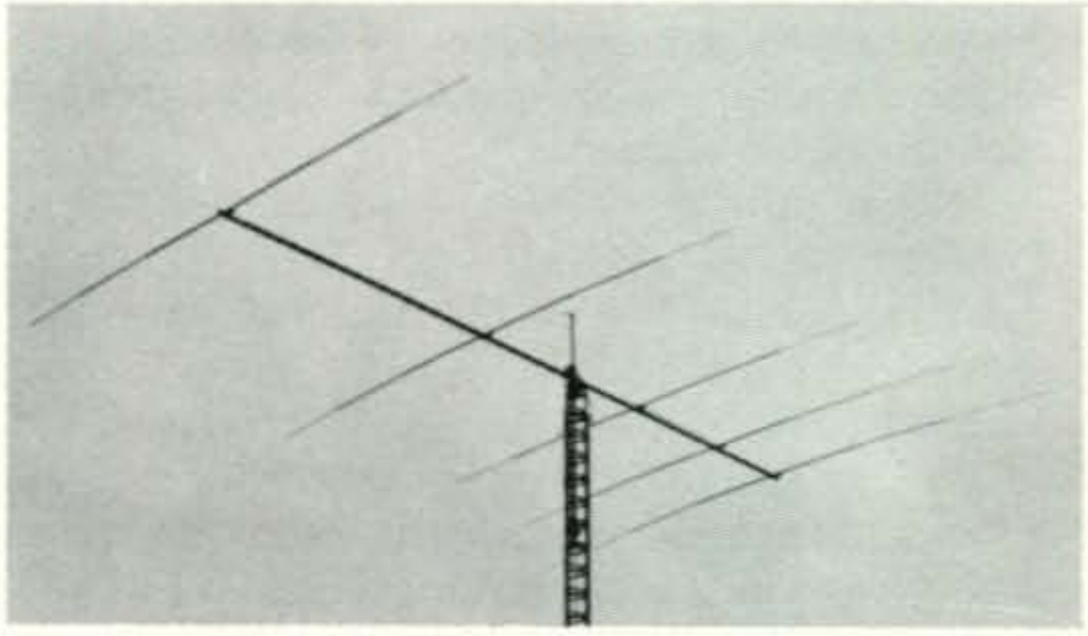
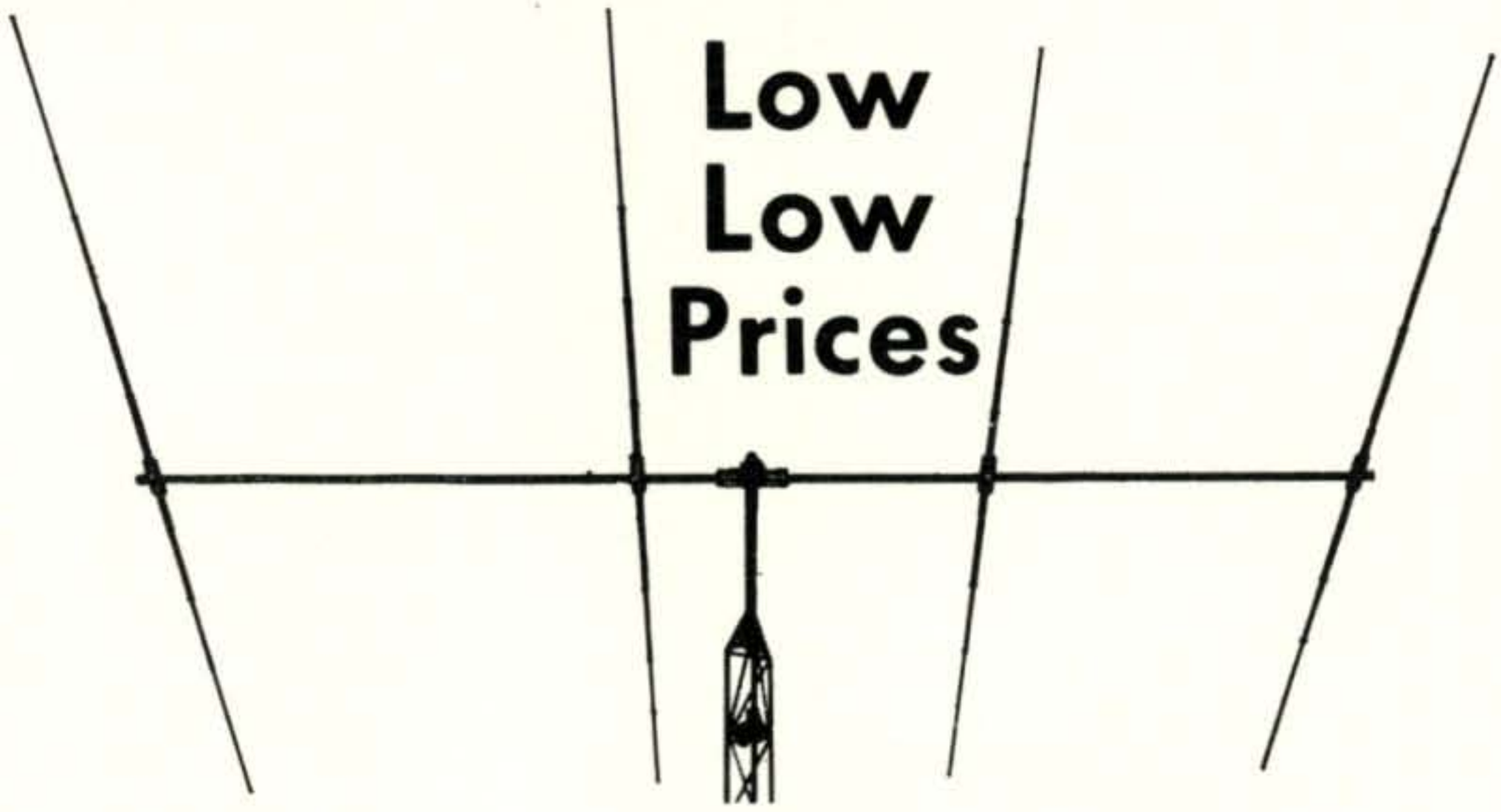


Fig. 5—The KLM "big gun" at K6HCP that dominates 20 meters. Boom is 42 feet long and gain over a dipole is 9 decibels.

Wilson Electronics

WILSON 204 MONOBANDER



The Wilson 204 is the best and most economical antenna of its type on the market. Four elements on a 26' boom with Gamma Match (No balun required) make for high performance on CW & phone across the entire 20 meter band.

The 204 Monobander is built rugged at the high stress points yet using taper swaged slotted tubing permits larger diameter tubing where it counts, for maximum strength with minimum wind loading. Wind load 99.8 lbs. at 80 MPH. Surface area 3.9 sq. ft., Weight 50 lbs., Boom 2" OD.

All Wilson Monoband and Duoband beams have the following common features:

- Taper Swaged Tubing
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- 2" or 3" Aluminum Booms
- Adjustable Gamma Match 52 Ω
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- **M204** 4 ele. 20, 26' 2" OD **$109.00**
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- **M105** 5 ele. 10, 20', 2" OD **$ 69.00**
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- **M104** 4 ele. 10, 17', 2" OD **$ 49.00**
- **M340** 3 ele. 40, 40', 3" OD **$349.00**
- **M240** 2 ele. 40, 16', 3" OD **$199.00**
- **M520** 5 ele. 20, 40', 3" OD **$189.00**
- **M715** 7 ele. 15, 40', 3" OD **$149.00**
- **DB45** 4 ele. 15, 5 ele. 10, 26', 2" OD **$119.00**
- **DB43** 4 ele. 15, 3 ele. 10, 20', 2" OD **$ 99.00**
- **DB54** 5 ele. 20, 4 ele. 15, 40', 3" OD **$209.00**

All Wilson Antennas are FACTORY DIRECT ONLY! The new low prices are possible by eliminating the dealer's discount. All antennas in stock. If you order your antenna by April 15th you may purchase a CDR Ham II for $124.00 or a CDR CD44 for $84.00. Order by Phone, COD. All 2" Boom antennas shipped UPS or PP. 3" by truck.

Wilson Electronics Corporation

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White House Agency Rips Off Amateur Radio!

BY WILLIAM I. ORR*, W6SAI

As through this world I've rambled,
I've seen lots of funny men.
Some will rob you with a six-gun,
Some with a fountain pen.

—Woody Guthrie

PRESIDENT Ford has publicly stated, on many an occasion, that interference and meddling by White House agencies in the affairs of various departments of the Federal Government is at an end.

Radio amateurs and concerned citizens will be troubled to know that unwarranted White House interference is continuing, especially with regard to the proposed FCC Docket 19759. After the period of time for comments and reply comments for the Docket had lapsed, the Office of Telecommunications Policy (OTP) of the White House injected its strongly-worded comments concerning the Docket.

For those radio amateurs who don't remember Docket 19759, it is the infamous proposal to reassign a one MHz portion of the Radio Amateur assignment of 220-225 MHz to the Citizens Radio Service.

More than two months had elapsed after the filing period had closed when the White House agency sent the following letter to the FCC:

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

DEPUTY DIRECTOR

December 27, 1974

Honorable Richard E. Wiley
Chairman
Federal Communications Commission
Washington, D.C. 20554

Dear Dick:

As you know, the proposed reallocation of the band 223-225 MHz for a new Class E Citizens Radio Service has been under reconsideration within the Executive Branch primarily in view of potential interference to established Government radio services in the same and adjacent portions of the radio spectrum.

Based on a recent engineering analysis and a spectrum planning review, we believe that the potential interference problem is manageable and not therefore an obstacle to establishment of the proposed service. We have concluded however that certain conditions should be applied to ensure compatibility between the Citizens Radio Service and Federal Government operations in the vicinity of 225 MHz. (See Enclosure 1).

We also reviewed the rationale in support of this new proposed radio service, and have reaffirmed our earlier view that there is a definite need for a disciplined radio service responsive to the needs and interests of the private citizen which establishment of the Class E service would satisfy. For example, using the two megahertz of spectrum offered, eighty FM radio channels could be made available to meet many of the currently unfilled communications needs of a nation on the move.

Estimates of the industrial activity contribution of such a service suggest a market size approaching half a billion dollars per year ... an additional matter to be considered carefully in light of the current economic situation.

As noted in our March 29, 1972 letter, this office continues to support the mission and objectives of the Amateur Radio Service and we have, therefore once again, carefully considered the Amateurs' objections to Class E. In this particular instance, however, we feel that a larger public need for radio justifies the foregoing reallocation. The fact remains that amateurs could continue to use the band involved, provided they complied with the rules applicable to the new radio service.

In view of the delay already inherent in this proceeding, it is urged that every consideration be given to expeditious action on this matter by the Commission.

Sincerely,

John Eger
Acting Director

Enclosure

Conditions Applicable to Sharing Between the Citizens Radio Service and Government Operations in the Vicinity of 225 MHz

- The allocation for the Citizens Radio Service should be accommodated between 222-224 MHz.
- This service should not be authorized earlier than May 1, 1975.
- The provisions of Footnotes NG68 and US121 as modified, should be enforced strictly.
- The effective radiated power permitted in this service should not exceed 50 watts for mobile stations and 400 watts for base and repeater stations.

Additionally, and pursuant to earlier inputs from the Interdepartment Radio Advisory Committee, it is recommended that:

- Three 25 kHz channels be designated for Government use in the 222-224 MHz band; two for exclusive Government use and one for Government/non-Government intercommunications only;
- The above individual channels be separated 300 to 500 kHz, with no more than 1 MHz between the highest and lowest channel;
- The use of these channels be essentially as now allowed on the 27 MHz Government Short-Distance Low-Powered Channels pursuant to the provisions of Section 4.2.1 of the OTP Manual.

In my opinion, this letter is a clear-cut example of unwarranted and unjustified meddling by the White House agency in a civil matter that is the proper jurisdiction of the FCC.

The OTP proposal to transfer frequencies legally assigned to the Amateur Radio Service over to the Citizens Radio Service is a violation of, and in complete disregard of, the Radio Regulations of the International Telecommunications Union, an international body to which

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, NY 11050.

the United States is a member and signatory power. Figure 1 is an excerpt from the ITU Regulations which shows clearly that the frequencies in question are assigned to the Amateur Radio Service in world Region 2, which includes North America. Interestingly enough, the so-called Citizens Radio Service (an invention of the FCC) is *not* included at all in the official ITU allocation table!

Although flexibility exists within the ITU framework for nations to alter allocations within national borders, it is unusual for them to do so, and it is questionable whether CB radio warrants such a change.

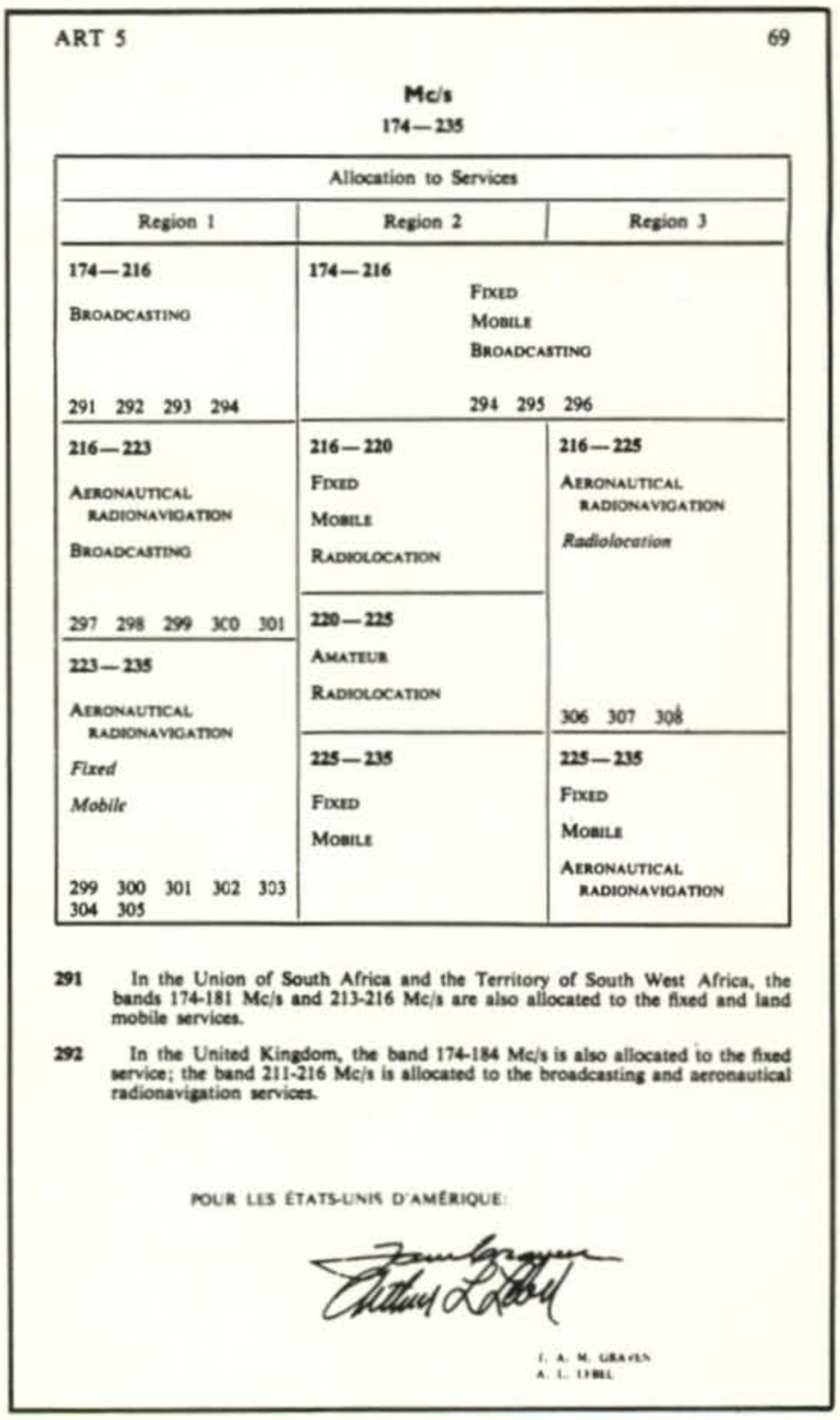
Apparently other countries don't think so. I understand that complaints to the U.S. State Department on the proposed treaty violation suggested by the OTP and contemplated by the FCC have been delivered by Mexico and Canada.

The OTP letter to the FCC raises the question of the charter and real need of the Office of Telecommunications Policy and its degree of influence exerted on FCC policy matters. Aside from determining governmental use of the airways and suggesting *overall* communications policy, the determined and continuing effort of the OTP to ram the new Class E Citizens Radio Service into an existing frequency assignment seems contrary to the idea of good government.

The Office of Telecommunications Policy not only encourages the FCC to "railroad" this unwise proposal through in the matter of a few months, but also suggests that the original proposal for one megahertz for CB radio be *expanded to two megahertz!* In addition, the CB band is placed in the middle of the amateur band, with the radio amateur assignments acting as guard bands on each side of the CB assignment!

Well, no thanks! It doesn't take a very weighty intellect to predict what will happen to this cozy arrangement, based upon the continuing illegal operations in the 11 meter CB band: the CBers will surely spread out into the amateur guard bands until they occupy the whole 5 MHz chunk from 220 MHz to 225 MHz—and perhaps even more!

No doubt the White House agency contemplated that the radio hams would stand firm in the way of CB expansion and prevent CBers from running amok into the adjacent Services on either side of the amateur assignment. This is a vain hope and the only conclusion that can be drawn is that the OTP views an eventual CB takeover of the whole 5 MHz assignment with equanimity! Pretty sneaky, I'll say.



ART 5 69

Mc/s
174—235

Allocation to Services		
Region 1	Region 2	Region 3
174—216 BROADCASTING 291 292 293 294	174—216 FIXED MOBILE BROADCASTING 294 295 296	
216—223 AERONAUTICAL RADIONAVIGATION BROADCASTING 297 298 299 300 301	216—220 FIXED MOBILE RADIOLOCATION	216—225 AERONAUTICAL RADIONAVIGATION *Radiolocation*
223—235 AERONAUTICAL RADIONAVIGATION *Fixed* *Mobile* 299 300 301 302 303 304 305	220—225 AMATEUR RADIOLOCATION	306 307 308
	225—235 FIXED MOBILE	225—235 FIXED MOBILE AERONAUTICAL RADIONAVIGATION

291 In the Union of South Africa and the Territory of South West Africa, the bands 174-181 Mc/s and 213-216 Mc/s are also allocated to the fixed and land mobile services.

292 In the United Kingdom, the band 174-184 Mc/s is also allocated to the fixed service; the band 211-216 Mc/s is allocated to the broadcasting and aeronautical radionavigation services.

POUR LES ÉTATS-UNIS D'AMÉRIQUE:

T. A. M. CRAVEN
A. L. LEBEL

Fig. 1—A reproduction of page 69 and the signatures of the U.S. delegation leaders to the 1959 International Telecommunications Conference. Article 5, covering frequency allocations, shows clearly that the frequency range of 220 MHz to 225 MHz for Region 2 is allocated to AMATEUR and RADIOLOCATION. The FCC Rules and Regulation duplicate this allocation, with additional footnotes stating that the Amateur Radio Service shall not interfere with the Radiolocation service and that amateur operation is restricted in various small areas of the United States to reduce interference with radiolocation devices. The document is signed by the delegation leaders of all ITU countries attending the conference. Shown are the U.S. signatures: T.A.M. Craven and Arthur L. Lebel. Notice that no mention of the Citizens Radio Service exists in this allocation, nor in any other ITU allocations. The Citizens Radio Service is an unhappy invention of the FCC and is not an internationally recognized Radio Service.

The Curious OTP Letter

A close reading of the OTP letter to the FCC brings some interesting questions to light. Paragraph one of the letter states that, "the proposed reallocation of the band 223-225 MHz for a new class E Citizens Radio Service has been under reconsideration within the Executive Branch . . ."

I'll gently pass by the observation that perhaps the Executive Branch of the White House

is not a proper place for such consideration, as events of the past year point out the susceptibility of this office to political pressure, payoff and cover-up. Instead, I'll concentrate on the implication in this paragraph of the letter that infers that studies have been taken and that other documents exist on this subject. The writer is aware that a letter from the OTP to the FCC was written in March, 1972, urging the FCC to take affirmative action on the Class E CB proposal. This letter was made public as an appendix to Docket 19759 by the FCC. A second letter from the Department of the Air Force, dated 3/6/72 to the OTP (which was not made public) stated, "in view of Citizens Radio Service history of undisciplined operations, uncontrolled sharing of the frequency resource under consideration is *not* feasible."

It would be of great interest to radio amateurs, and the general public, if the White House agency memoranda, studies and correspondence on this subject be made public, as the OTP is dealing with frequencies that are civil, not government, and not a subject for White House management and manipulation.

Paragraph two of the OTP letter to the FCC states, "based on a recent engineering analysis and a spectrum planning review, we believe that the potential interference problem is manageable and not therefore an obstacle to establishment of the proposed service."

The OTP engineering analysis, if it exists, should be made public, as well as the planning review as this conclusion boggles the mind of anyone who is aware of what is going on in the CB 11 meter band. It is painfully obvious that the White House agency is either out of touch with reality, or prefers to see life through rose-colored glasses. Surely, the OTP has read the annual FCC reports on the CB radio situation?

The FCC Annual Report on CB Radio

For the record, and in case the OTP is obtuse to the facts of life, the FCC Annual Report has condemned the illegal aspects of CB operation every year since 1959. For example, in 1963, the FCC report says, in part, "misuse of Citizens Radio Stations operating privileges is so prevalent in some areas as to threaten the continued usefulness of the Service." Then, in 1963 the FCC report says, "many non-identifying stations are not only cluttering up class D channels, but are also conducting clandestine operations on the frequencies allotted to the Industrial Radio Service."

And so it goes. In 1972 the FCC Annual Report stated, "Citizens Radio continues to be a major source of violation seriously inhibiting the use of the Service."

The whole melancholy and disruptive history of the present CB radio misdeeds and wholesale disregard of FCC rules is spelled out by the FCC itself. Any amateur, listening in the range of 25 MHz to 30 MHz on a spring day when propagation is good will hear hundreds of illegal CB stations spread across the whole 5 MHz range! How, then, does the White House agency come to the amazing and unsubstantiated conclusion that "the potential interference problem is manageable?" *By whom is it manageable?*

Living With the Air Defense Command

The frequency allocation of 220 MHz to 225 MHz in the FCC allocation table is foot-noted (NG-13) to the effect that amateur radio operation must not interfere with government "radiolocation" service in this range. *Radio amateurs have demonstrated their ability to live with military installations in this band.* A case in point: The WR6ABH repeater, located in Santa Clara county, California, has a special command link to de-activate the repeater whenever the 220 MHz band is required to be interference-free. There are recorded instances of the repeater complying with a government request to close down, *and the repeater instantly closed down.* Would the future CB repeaters suggested by the White House agency do the same, based upon past compliance with the law by the Citizens Radio Service? Don't bet your money on it!

The Footnote to the Frequency Allocation

Will the new, proposed CB service be expected to comply with the footnote to the FCC regulations that gives "radiolocation" priority in this band? Or will the government be willing to give up the footnote? If they are willing to give it up, it is strange that they are currently requiring amateurs to live with it. The thought remains that the footnote is only given up under *commercial pressure*. If it is not given up, who will enforce it? FCC? The White House agency? If CBers or CB repeaters cause interference to radiolocation facilities, who will cause this interference to cease?

Why Does the White House Agency Love the CBers?

Perhaps the real reason for the OTP's tender, loving care of the Citizens Radio Service is expressed in the fourth paragraph of the OTP letter to the FCC which says, "estimates of the industrial activity contribution of such a service suggests a market size approaching half a billion dollars a year."

And now we have arrived at the meat of the cocoanut! *Money!* If the dollar market establishes the policy of the OTP in regards to communication frequency allocations, then I suggest the OTP contemplate auctioning off the VHF Mobile Service bands and the broadcast band to the highest bidders and stop pretending

that serious problems do not exist in their proposal to foist an unwanted, expanded CB radio assignment into an existing frequency assignment.

A Slap at Amateur Radio

Finally, in this bold and crass attempt to influence the FCC, the White House agency letter gratuitously insults the Amateur Radio Service by suggesting slyly that amateurs could "continue to use the band involved, *provided they complied with the rules applicable to the new radio service.*"

Good God! If they did, they would be the only ones that would do so! Who, may I ask, has in the past continually broken the FCC Rules and Regulations on a mass basis, the amateurs or the CBers? The statement begs for the contempt it deserves.

The IRAC Proposal

Buried in the footnote of the OTP letter to the FCC is a recommendation from IRAC (Interdepartmental Radio Advisory Committee, the government counterpart of the FCC that handles frequency assignments for non-civil communications). IRAC recommends that, in the proposed 222-224 MHz chunk of spectrum to be ripped off amateur radio:

> "Three 25 kHz channels be designated for Government use in the 222-224 MHz band; two for exclusive Government use and one for Government/non-Government intercommunication only; the above individual channels be separated 300 to 500 kHz, with no more than 1 MHz between the highest and lowest channel; the use of these channels be essentially as now allowed on the 27 MHz Government short-distance, low-powered channels . . ."

An interesting question is, why does the Government want 3 channels, spaced out among the proposed CB channels in this fashion? The IRAC recommendation provides no answer, or reason for the request.

Amateurs with a good memory will remember the ruckus a year or so ago when somebody in the government (OTP?) proposed a special radio system where by electronic means the TV channels could be taken over in an "emergency" for complete audience coverage of a government message. This was quickly shot down, as it smacked too much of Big Brother snooping on the citizen. Perhaps the IRAC proposal of 3 government channels in the new CB spectrum is an end-run to accomplish the same objective. If not this, then what? A powerful f.m. transmitter, a mobile one at that, could "capture" the CB audience, blocking adjacent channels and overpowering communication in the CB band. This is only an educated guess on the part of the author, but funnier things than that have happened to the unsuspecting public in the last year or two!

At the very least, the IRAC proposal bears close public scrutiny, and should not be buried almost as an afterthought to the OTP proposal.

Where Now?

Curiously enough, the CBers themselves do not seem to be interested in the v.h.f. assignment being pushed by the OTP, judging from the insignificant amount of comment filed with the FCC on the Class E Docket. It seems strange that the OTP is pushing so hard for this new CB service, unless it is to help prime the pump for the *Electronic Industries Association*.

In any event, where there is smoke there is fire. It would seem timely for a Congressional investigation of the Office of Telecommunications Policy of the White House. What is its charter? How does it interact with the FCC and IRAC? The tip of the iceberg shows in the OTP letter to the FCC. Is the OTP the unofficial voice of the *Electronics Industries Association?* The EIA's strong support of the quick-buck CB market is well known.

Why did not the FCC toss the original EIA proposal (RM-1747) out the window when it was born? They had every right to do this, as the proposal was in violation of the regulations of the ITU, upon which the FCC assignments are based.

And now the CB monster has grown until it demands half of the 224 MHz radio amateur frequency assignment. What will the next bite devour? If the OTP is as bold as it is, and the FCC as vacillating as it seems to be, the outlook for amateur radio in the United States is not encouraging. ■

Addendum

The following is an Editorial from *Broadcasting* magazine for Jan. 27, 1975:

Right The First Time

For reasons that are still unclear, the Office of Telecommunication Policy has been rescued from the oblivion marked for it by Roy Ash, Director of the Office of Management and Budget, and at first approved by President Ford. Mr. Ash wanted to give the Commerce Department OTP's job of assigning frequencies among government users and abolish 50-odd jobs at OTP.

The decision was reversed after a curious political mixture of OTP supporters in the Senate and House called the White House. Too bad. Mr. Ash and President Ford were on the right track.

OTP is budgeted at more than $9 million, of which a little more than half is ticketed for research to be performed by the Commerce Department. That is a lot of money to spend in these times for unessential policy making. OTP's frequency assignment could be performed by a good engineer with access to a computer. The rest of its work, if abandoned, would leave no discernable hole.

COP's COLUMN

BY COPTHORNE MACDONALD,*
WØORX

New Emergencies?

Ham radio has risen to its shining best in times of natural and personal disaster. It has done this by providing a vehicle for humanly important communications at times when other means of communication were non-existent or too slow. Hurricanes, earthquakes, and medical emergencies in far-off lands are examples familiar to all of us.

The pervasive uneasiness and lack of public confidence reported in recent opinion polls, coupled with the gloomy economic and ecological forecasts which have been bombarding us for the past several years have started some hams thinking. Are there new kinds of emergencies on the horizon for which we should prepare? Are there new roles for ham radio, when and if economic or ecological disaster strikes? Are there ways in which ham radio can help ward off difficult times—at least for some individuals?

My natural inclinations are toward optimism. I'm a pretty cheerful sort of a guy, and not given much to moaning and groaning. Yet the messages I've been getting say probable trouble ahead. We start with an extremely complex economic system in the industrial nations. Writers such as systems analyst Roberto Vacca point out that as a system becomes larger, and its parts more interrelated, it becomes more vulnerable to breakdown. My own rough analogy is to building with children's blocks. The higher you build the structure, the more likely it is to topple over due to outside forces and the misplacement of individual blocks. (In his very pessimistic book, *The Coming Dark Age*, Vacca goes rather deeply into this matter of vulnerability.)

OK, it's vulnerable, but it has been hanging in there in all its complexity for many years now. True enough. But two specters have now arisen. The first is the increasing shortage of raw materials with attendant price increases. (The existing economic system grew up with cheap, abundant, raw materials as a basic groundrule. Shortages rock the system with ripples, waves, or tidal waves depending on the magnitude of the shortage and degree of need for the material. *Limit to Growth* goes into this aspect of the problem in great detail.)

The second specter has been termed "monetary crisis." Except in the very simplest economic systems it is impractical to exchange goods for other goods most of the time. The basic linkage in any economic system is some portable means of transferring value. Historically, such diverse things as gold, wampum, and paper dollar bills have worked fine so long as there was general agreement on the value represented by the portable exchange device. If, through some process or other, people should stop considering those dollar bills to be acceptable indicators of value, the various pieces of the economic system would no longer be able to interact with each other.

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, NY 11050.

Fig. 1—The Wincharger Model 1222H wind generator on a 10 foot tower.

Needed Info Via Ham Radio

The successful ways of dealing with hard times, if they come, will be the same as they were in pioneer days. Security comes through a combination of self-sufficiency and mutual aid; taking care of ourselves as best we can, and helping our neighbors when we are able. Most of us are a long way from a state of self-sufficiency. We live in a world where we tend to be experts in some narrow field. Self-sufficiency requires a broad-based competence. Getting from here to there requires information. Part of that information has been written down in books, but much of it is in people's heads. *The Mother Earth News* magazine has started a modest directory of hams willing to act as on-the-air information resources on various subjects. WAØRUS, who has built over 30

geodesic dome homes, has offered on-the-air help to people trying to build their own. WØQPO/7 and WBØLNJ have also offered advice on building inexpensive houses. If you're just getting into gardening you might want to talk with WBØAZR, WA7BKR, WB4BDO, W8HYD, WB6ZWH, or WA2HVY/7. If you're thinking of powering your rig with the sun or wind then WA5CCZ, WA7BKR, WAØRUS, K7UXF, or WA3OWT might be able to offer some worthwhile suggestions.

This is the very crude beginning of a ham-radio-based information service, but it is a beginning. Mitt Nodacker, WA7TFE, feels that RTTY is the logical mode to use in an information transfer system, and is working with a number of other hams and computer enthusiasts to set up such a network. Mark Barker, K3RZG/2, has suggested in considerable detail a computer indexing system which would allow large numbers of hams to register their interests and areas of competence in a computer memory. An individual wanting information on a particular subject could query the computer (by RTTY perhaps) and find out who to contact. Since there are IC chips available which permit conversion from 5-bit/start/stop Baudot (RTTY) code to 8-bit ASCII (computer) code and vice versa, computer-RTTY tie-ins are quite possible. Mitt is coordinating the activities of the RTTY Technical Group and if you'd like to get involved in this end of things, write to him at Box 8557, Pocatello, Idaho 83209.

Becoming more competent in more areas of basic living is something each of us can do now, and ham radio can help us do it.

Communications In The "New Disasters"

In the sort of disasters we hams are used to, the problem has been to bring help from the healthy, functioning, prosperous outside world to the scene of the disaster. The need for amateur communications, while intense in the first stages, generally lessens as problems are solved, disrupted telephone service is restored, etc. A small gasoline generator with a 5 to 55 gallon supply of gas has been the ham's ideal emergency power source. On the rare occasions when communications must extend for several weeks, one can usually count on the arrival of more gasoline as part of the relief effort.

A generalized economic/societal breakdown would be a different sort of disaster, with different groundrules and different communication needs. There would be on healthy outside world capable of supplying massive aid. If telephone service went out, it might stay out for a long, long time. Gasoline supplies would probably dry up rapidly.

In very hard times there are two possible ways for individuals to deal with the situation. The first might be called the "law of the human jungle" approach where the strong and well armed take what they need at the expense of the rest. The other approach is cooperating and sharing to make the best of a bad situation. *The primary role of ham radio in a generalized breakdown would be to make it easier for people to cooperate with one another.* Regional and local exchanges of food, medicine, and other necessities could be arranged. Law enforcement aid could be summoned. People in particularly dire straits could make their

Fig. 2—For best operation a wind generator must be mounted well above surrounding objects. (From the Wincharger instruction manual.)

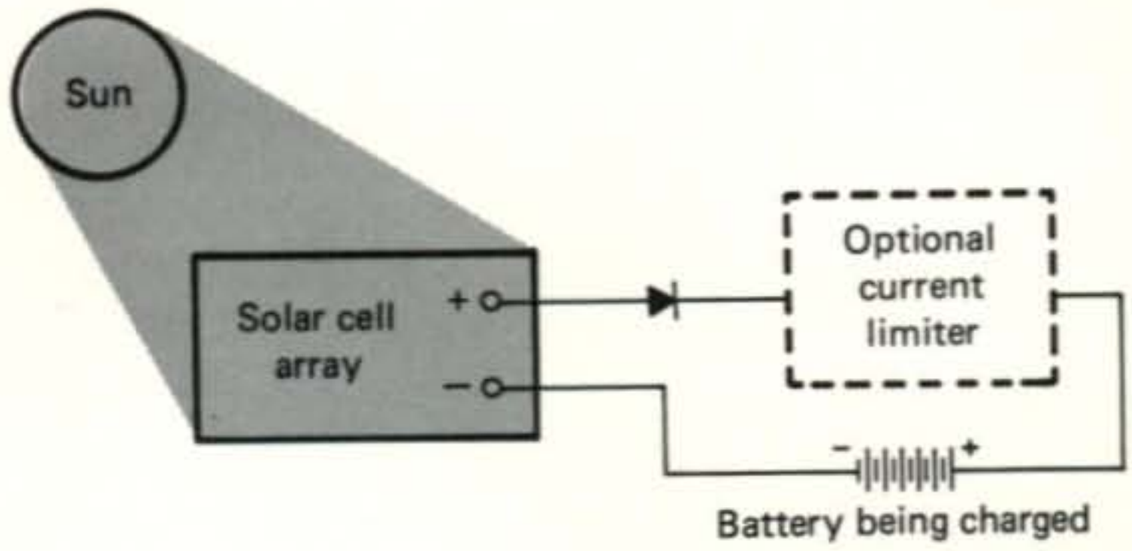


Fig. 3—A diode is needed when charging batteries with a solar cell array to automatically disconnect the array when the light level drops. (Ni-Cad batteries may also require a current limiter to limit the charging rate.)

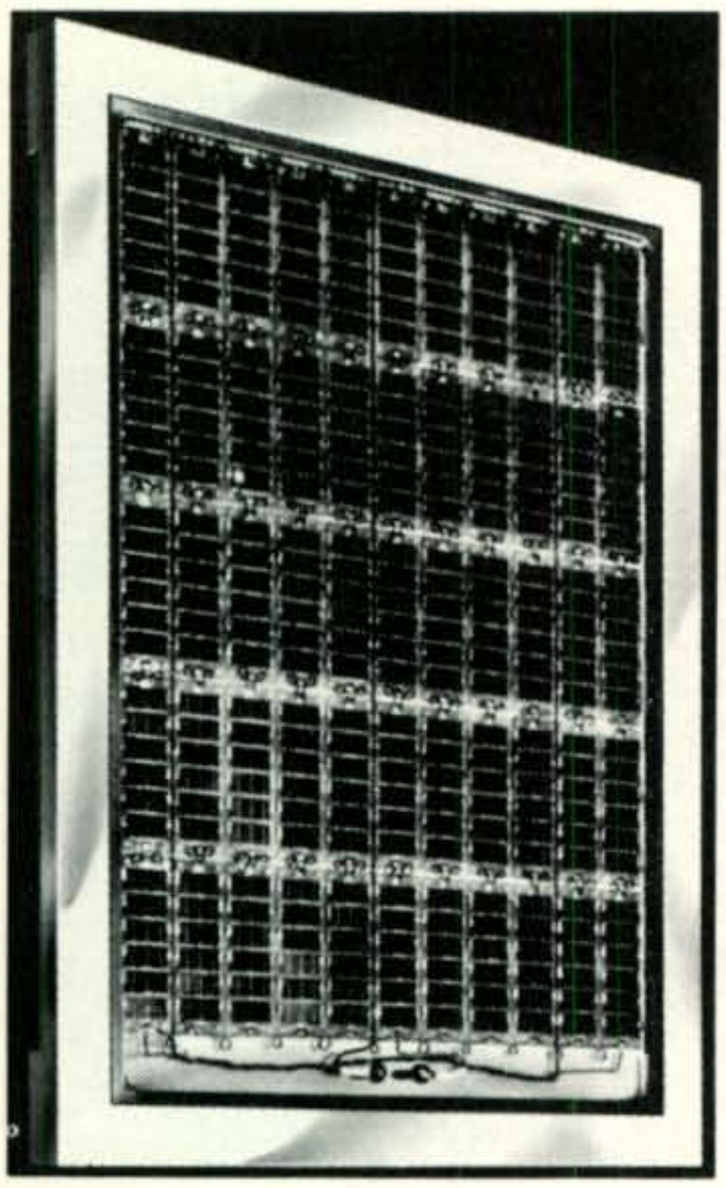


Fig. 4—This Solar Systems 5 watt array will deliver 400 ma of charging current to a 12 volt battery in sunlight.

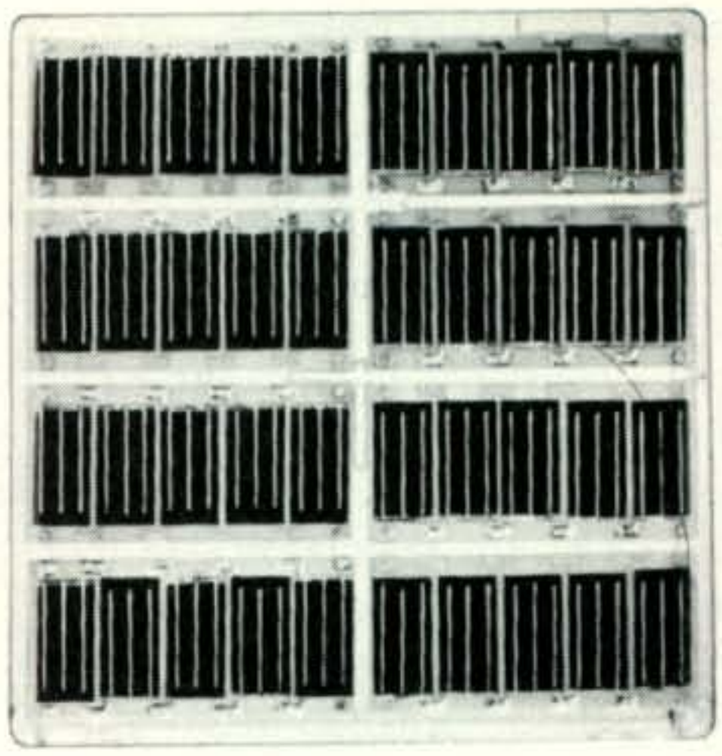


Fig. 5—This low power solar cell array is rated at 8 volts, 80 ma. (Solar Systems, Inc. Type SPM-75-8.)

situations known. Information on various self-sufficiency skills could be passed along to those just awakening to the need for them.

Natural Power

Gasoline generators would be useless in an emergency of this type, except in the early stages. Keeping rigs on the air would require a continuous source of power independent of fossil fuels. Wind and solar power are the most likely candidates, and it was heartening to see ARRL establish a "Natural Power" category in last year's Field Day. Such power sources not only make ecological sense, but they are the only ones we can count on "no matter what." With the expected influx of Communicator Class licensees we will have for the first time an amateur communication capability that reaches into every corner of a given urban and suburban area. If you happen to be involved with setting up one of those new 144, 220, and 420 MHz repeaters to serve the new licensees, please give strong consideration to powering it by the sun or wind. And for your hand held transceiver, consider getting two sets of nicad batteries, with one set kept on charge at all times from an array of solar cells. If you are an h.f. operator, look into natural power sources for your rig too.

There have already been several articles on wind and solar power in ham publications, and we will be seeing more. Here I'd like to introduce you to some commercial sources. I haven't used any of these items personally, but thought it would be worthwhile to pass the word along anyway.

To my knowledge, the only wind generator currently manufactured in the U.S. is the "Wincharger" manufactured by Dyna Technology, Box 3263, Sioux City, Iowa 51102. Their model 1222H is designed to charge a 12 volt battery. It has a 6 foot long propeller which drives the generator shaft directly. At 260 r.p.m. the generator starts to charge the battery. The charging current varies from 0 at 260 r.p.m. to 12 amps at 700 r.p.m. (the speed at which the air-brake type speed governor comes into play). It takes a wind speed of 7 m.p.h. for the generator to reach 260 r.p.m., and 23 m.p.h. to reach 700 r.p.m. By all means check the monthly wind speed data for your locality before investing in a wind generator and deciding on the battery capacity you will need. Then make some allowance for error since wind velocity is affected by local terrain, height above ground, etc. The manufacturer rates the useable energy per month at 20 KWH for 10 m.p.h. average winds. (10 m.p.h. *average* is windy!) The 1222H is currently priced at $445.00 including a 5 foot tower, but less battery.

If your location is not particularly windy, but is sunny, solar power may be the best answer. Spectrolab (12500 Gladstone Avenue, Sylmar, CA 91342) sells solar arrays specifically designed to power unattended mountain top repeaters. If you are seriously considering solar power for your group's repeater, I suggest that you contact them. Given data on current drain, expected operating time in each mode of operation, and the repeater's location, Spectrolab's computer can calculate the exact array current and battery capacity required. The complete systems they supply are guaranteed for 10 years. Arrays of solar cells are expensive: roughly $400 for an array capable of delivering 600 ma at 14 volts in the noonday sun.

Solar Systems, Inc. (8124 N. Central Park,

[*Continued on page 66*]

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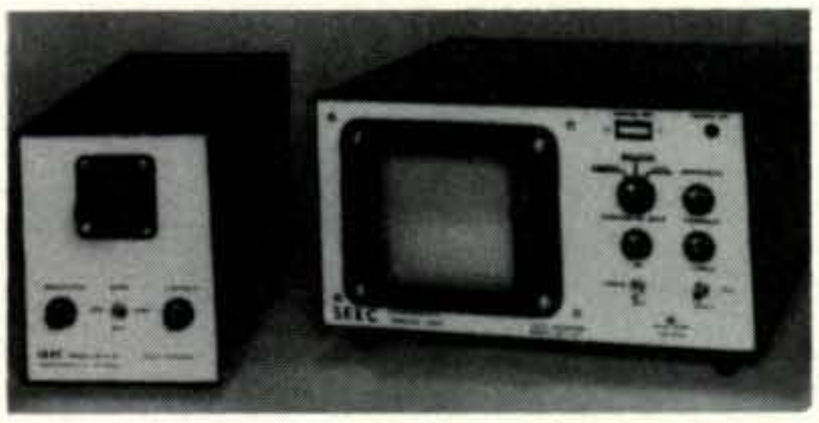

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MATH'S NOTES

BY IRWIN MATH,* WA2NDM

As you will recall, last month we completed our discussion of r.f. amplifiers for six and two meters employing FETS. This month we will consider mixers and local oscillators suitable for use with these amplifiers to provide complete converters or front ends for v.h.f. receivers.

When designing a mixer for use in v.h.f. service there are two basic approaches. One can either choose an active circuit employing devices such as transistors or vacuum tubes, and then the stage will exhibit some gain, or one can use a passive circuit such as a balanced mixer or even just a simple diode in a suitable circuit.

A straight forward diode or balanced type of mixer will always exhibit some loss although they are capable of very low levels of distortion due to overloading. With the use of hot carrier diodes, such mixers are also capable of very low noise figures at the higher frequencies.

Fig. 1 is a schematic of a typical balanced mixer for reference purposes as construction details are beyond the scope of this discussion.

*5 Melville Lane, Great Neck, N.Y. 11023.

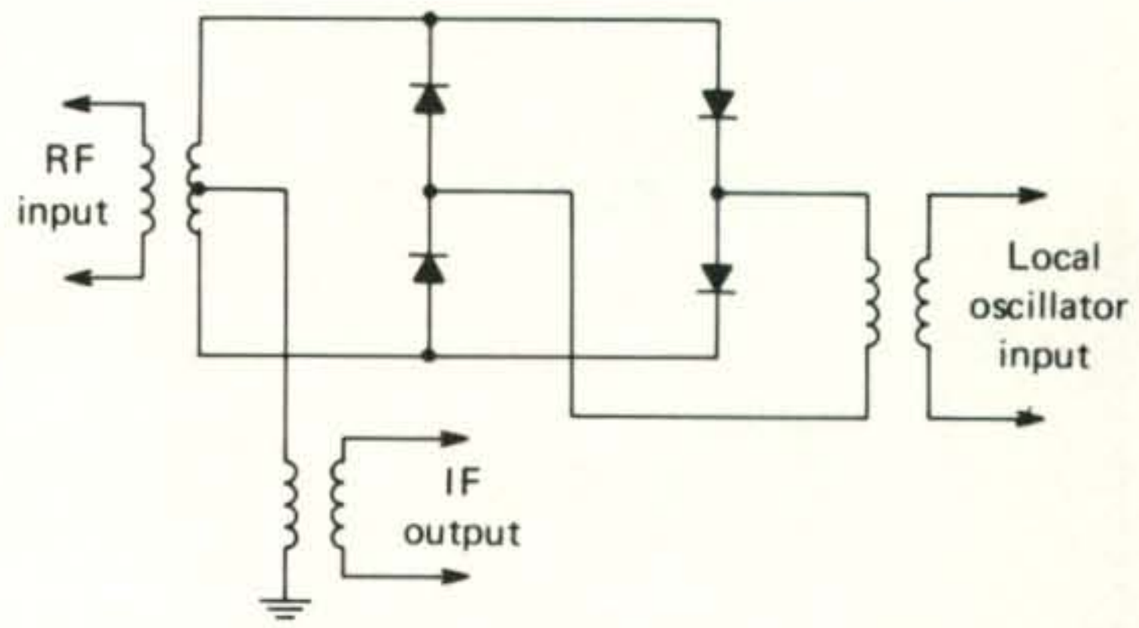

Fig. 1—Typical balanced mixer discussed in the text.

If hot-carrier type of diodes are not used in this configuration, then the four diodes employed must be very carefully chosen for matched characteristics.

The mixer stage that we prefer for our converter, and the one we will discuss here is an active one employing a dual gate MOSFET as shown in Fig. 2. In the circuit shown, we have chosen the RCA 40673 for several reasons, i.e.:

A. It is readily available
B. It is inexpensive
C. It offers conversion gain at both 50 MHz and 144 MHz
D. It is a protected gate device that is as easy to handle as a bipolar transistor
E. It is superior to other types of transistors in resistance to overloading
F. It exhibits relatively low noise in converter service

Many versions of mixers employing this device have been built and proper operation is not critical or difficult to achieve. R.f. from the preceeding amplifier is fed to one gate of the transistor while local oscillation energy is fed to the other gate. The high input impedances

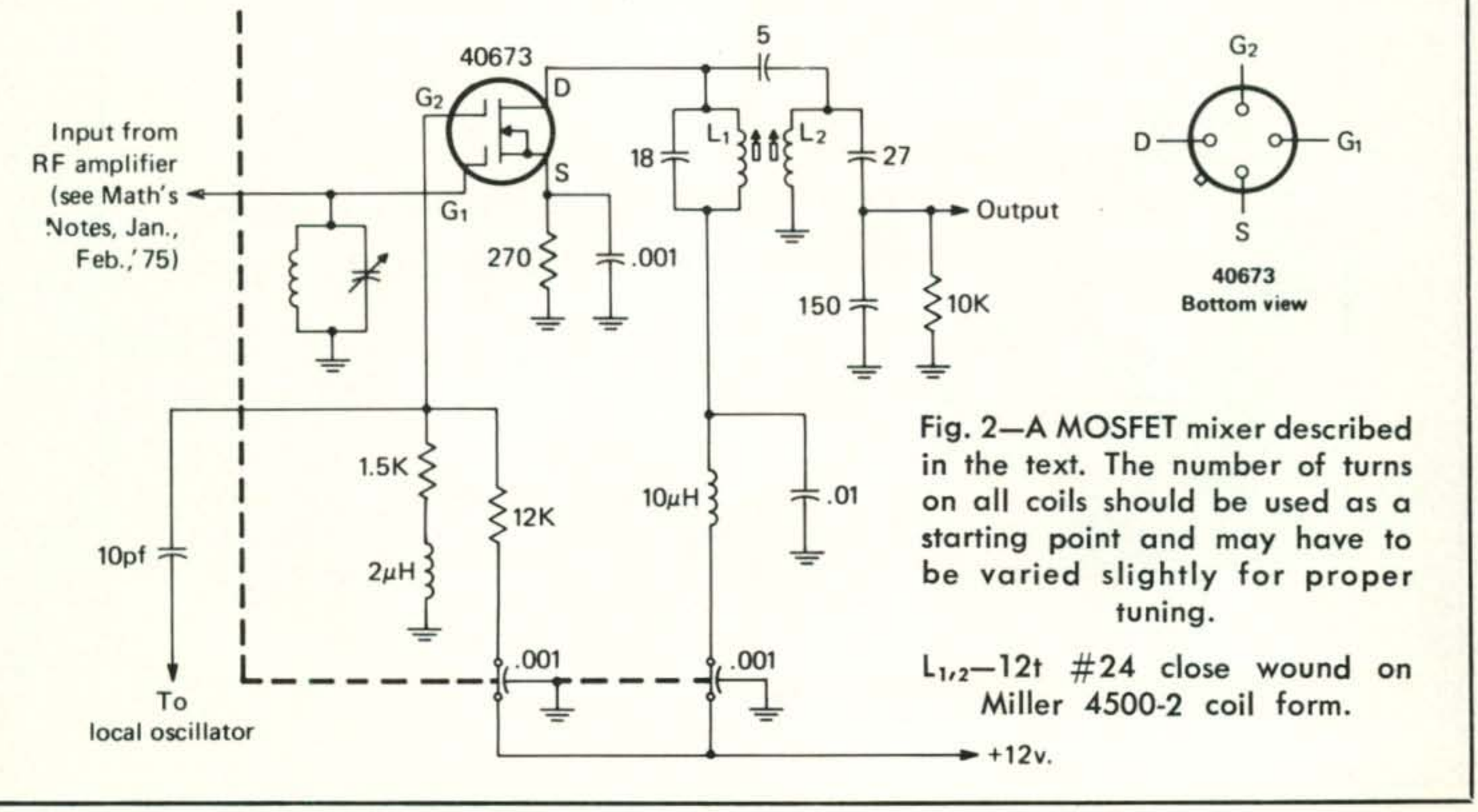

Fig. 2—A MOSFET mixer described in the text. The number of turns on all coils should be used as a starting point and may have to be varied slightly for proper tuning.

$L_{1,2}$—12t #24 close wound on Miller 4500-2 coil form.

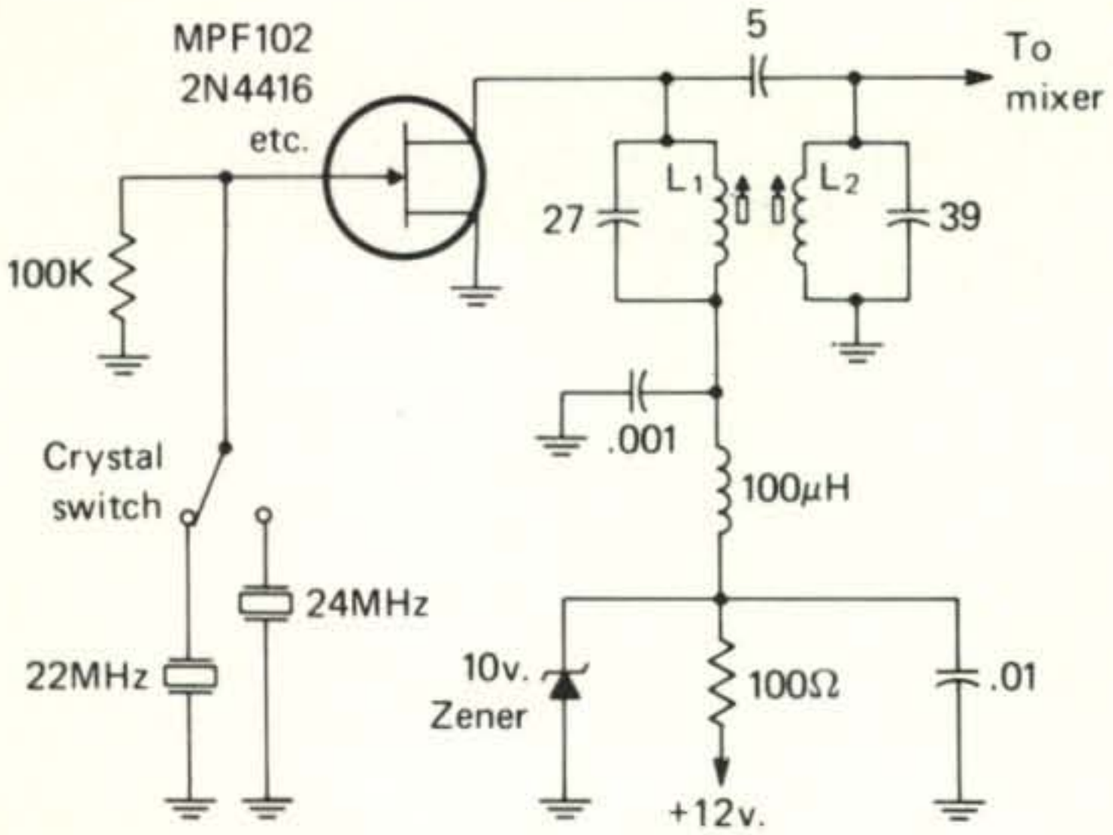

Fig. 3—A local oscillator for a 6 meter converter. $L_{1,2}$—12t #24 close wound on Miller 4500-2 form.

of both gates produce very little loading of either the preceeding r.f. amplifier's tuned circuits or the local oscillator's tuned circuits and therefore allows reasonably high Q's to be obtained resulting in very low spurious signal generation in the stage.

Double tuned circuits are employed at the output of the mixer to aid in achieving the proper i.f. bandpass and these tuned circuits should be adjusted with the aid of a sweep generator for best results. We have used such tuning in all of our previous r.f. amplifier discussions as the final result from a receiver or converter employing this type of interstage coupling is so superior to single tuned circuits that I am certain you will be as impressed with the results as I was the first time I used it.

To complete the mixer, resistance divider biasing is used to place the operating point of the transistor at the optimum point for mixer operation.

All that is now left to allow the previous circuits to properly receive signals is the application of energy from a suitable local oscillator.

To keep spurious responses to a minimum, particularly beating of harmonics of the local oscillator with undesirable signals, it is best to use a high starting frequency in the local oscillator scheme with as few multiplying stages as possible. For six meters we have successfully used an i.f. of 28-30 MHz and a local oscillator (crystal controlled) of either 22 MHz or 24 MHz depending on which half of the band we were interested in. In both cases crystals at the two previous mentioned frequencies were used with no multiplication. Fig. 3 is a schematic of a suitable oscillator for use with a six meter front end. Note the use, again, of a double tuned output to assure a pure local oscillator signal. In the case of a two meter converter, the oscillator may be modified as shown in fig. 4 by employing another transistor as a conventional doubler. In this case a 58 or 60 MHz crystal is doubled to again produce an i.f. of 28-30 MHz. In the case of the two meter oscillator, it is advisable to shield the oscillator tank from the doubler tank to prevent any undesired coupling problems.

One final word about converters such as the ones we have discussed these past months; when building such devices, be absolutely certain that only the proper signals are able to get to the various vital points. This means no skimping on shielding, careful layout, and most of all good v.h.f wiring techniques. We are in the process of building both a six and two meter converter along the lines mentioned and will report on the operation of each unit as it is completed.

See you next month, 73, WA2NDM

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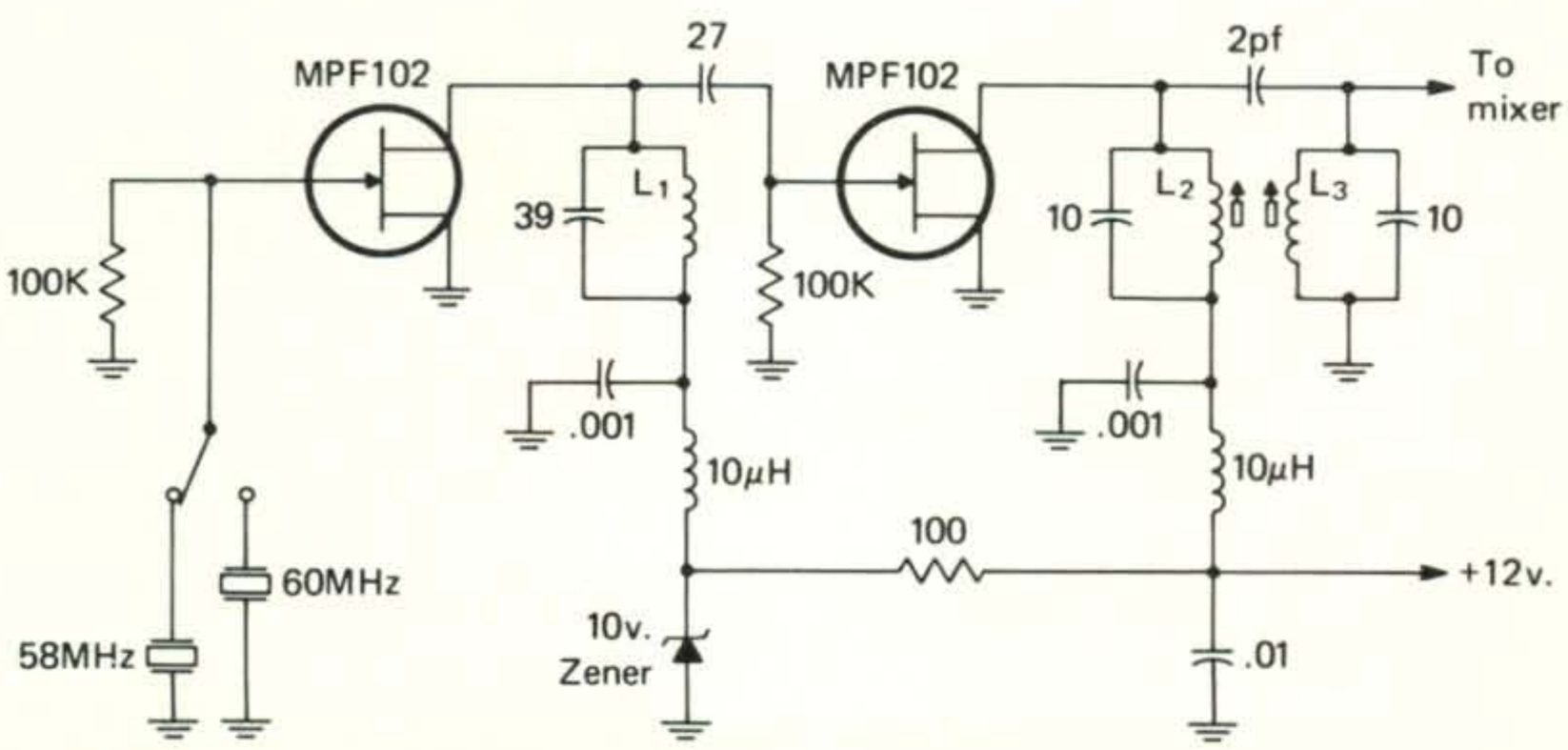
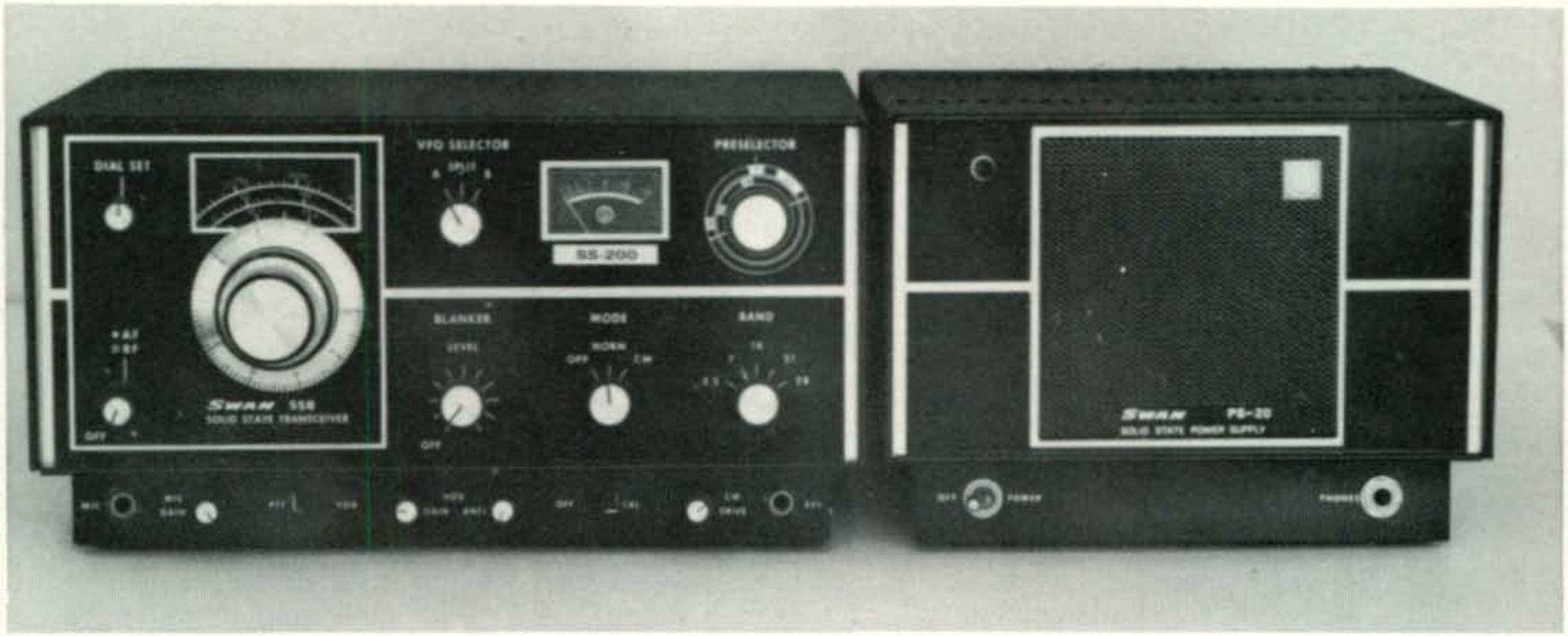


Fig. 4—A local oscillator for a 2 meter converter. L_1—5t #24 on Miller 4500-4 form.

$L_{2,3}$—4t #24 3/8" long on Miller 4500-4 form.



Front panel view of Swan's SS-200 all-solid-state 200 watt transceiver. The PS-20 power supply at the right, a suitable companion for the SS-200, provides power for the transceiver and contains a speaker.

CQ Reviews: The Swan SS-200 Solid-State Transceiver

BY COPTHORNE MacDONALD,* W0ORX

THE SS-200 is one of a family of all-solid-state transceivers manufactured by Swan. The basic unit is the SS-15 which runs 15 watts input. The SS-100, SS-200, and SS-200A transceivers employ plug-in final amplifiers with increasing power handling capabilities of 100, 200, and 300 watts p.e.p. The SS-200 is rated at 200 watts p.e.p. and c.w. input on all bands from 80 thru 10 meters. The transceiver features full calibrated v.f.o. coverage of all frequencies in the above bands, normal and reverse sideband selection, VOX or push-to-talk operation on s.s.b., semi-break-in on c.w., a 25 kHz calibrator, c.w. sidetone, dual-ratio v.f.o. tuning dial, broad-banded "no tuning" transmitter circuits, an effective receiver noise blanker, "infinite v.s.w.r." protection for the output transistors, provision for an external v.f.o. for split frequency operation, and WWV reception on both 10 and 15 MHz. The SS-200 can be powered from a storage battery having a nominal voltage of 13.5 volts, or from the Swan PS-20 power supply available as an accessory. The unit requires the use of an external speaker or headphones. (A speaker is built into the PS-20.)

Basic Operation

Signal flow through the SS-200 in the receive mode is shown in the block diagram of fig. 1. The incoming signal is amplified by a dual-gate MOSFET. A two-gang PRESELECTOR control adjusts the resonant frequency of tuned circuits at the input and output of this amplifier stage, and is adjusted by the operator to peak the amplitude of signals in the band being used. The r.f. amplifier output is converted to the 5.5 MHz intermediate frequency by mixing with the v.f.o. output in a dual-gate MOSFET mixer. (On 80 and 40 meters the v.f.o. frequency is 5.5 MHz *above* the received frequency, and on 20, 15, and 10, it is 5.5 MHz *below*.) The mixer output is amplified by a pair of push-pull connected FETs to drive the 2.7 kHz wide crystal lattice filter. These FETs also act as fast acting switches controlled by the noise blanker detection and control circuitry. Dual-gate MOSFETs are used as first and second i.f. amplifier stages and as the product detector. An IC audio amp drives a two-transistor output stage.

In the transmit mode, signals flow as shown in the block diagram of fig. 2. The mike input is buffered with a FET source follower, and amplified by an IC audio amplifier. A diode-ring type balanced modulator mixes the audio and the output of a 5.500 MHz crystal oscillator to generate a dual sideband suppressed carrier signal. Only one sideband passes through the crystal lattice filter. This 5.5 MHz s.s.b. signal is amplified by the same two stage i.f. amplifier used on "receive," and is con-

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, NY 11050.

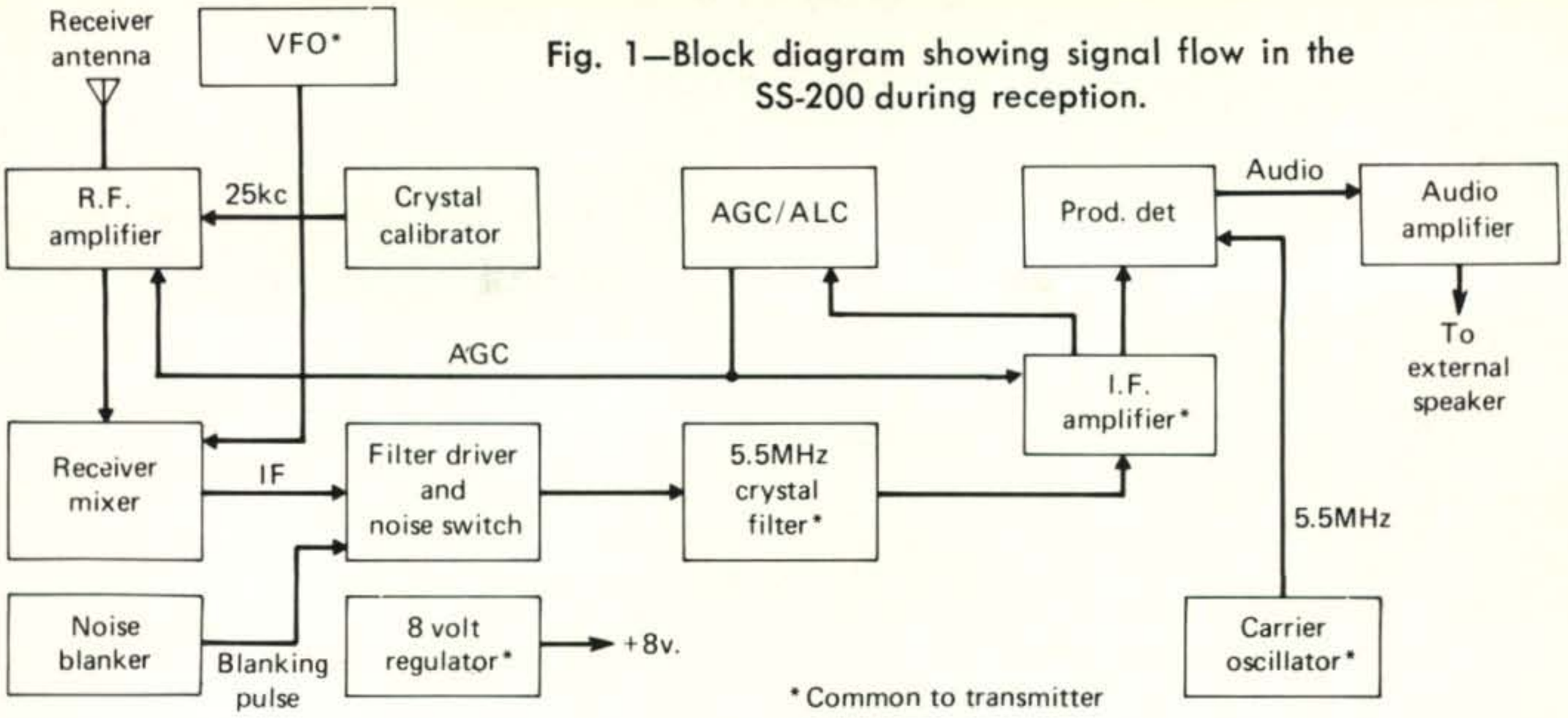


Fig. 1—Block diagram showing signal flow in the SS-200 during reception.

verted to transmit frequency in an IC mixer. The amplifier stage which follows the mixer employs bandswitch-selected circuits, broadband tuned to cover the individual band in use. All stages following this stage are untuned broadband amplifiers which cover the entire 3.5 to 29.7 MHz range. The final amplifier output is passed through a low pass filter tailored to the band in use, and switched-in automatically by the bandswitch. Both the power going to the antenna, and the reflected power, are monitored to generate an a.l.c. control signal which regulates the drive to the final amplifier. This provides the usual a.l.c. a.g.c. type drive control, and also protects the output transistors if the load impedance is far from the rated 25 to 100 ohms.

The mixing scheme used permits the 5500 kHz crystal to be used for s.s.b. generation when the "Normal" sideband is in use. ("Normal" being l.s.b. on 75 and 40, and u.s.b. on 20, 15, and 10 meters.) A 5503.3 kHz crystal permits operation on the "opposite" sideband, but the v.f.o must be manually retuned to keep the on-air suppressed carrier frequency the same.

C.W.

C.w. is generated in the r.f. stages, in contrast with some transceivers that start the process with an audio oscillator. A diode-switched capacitor pulls the frequency of the 5.5 MHz crystal oscillator into the crystal filter passband when the rig is in the c.w. mode. The keyed stage is the IC which mixes the v.f.o. and 5.5 MHz oscillator outputs to produce the final output frequency. A keying transistor controls the supply voltage to the mixer. The keying waveform is shaped to produce an r.f. envelope risetime of about 1 millisecond, and a delay time of about 5 ms. A sidetone audio oscillator provides an audible keyed tone in speaker or headphones. A pot on the rear panel of the transceiver controls sidetone level. The VOX circuitry comes into play when the operator wants to use the semi-break-in mode. A separate VOX C.W. DELAY control has been provided so that the operator can choose a

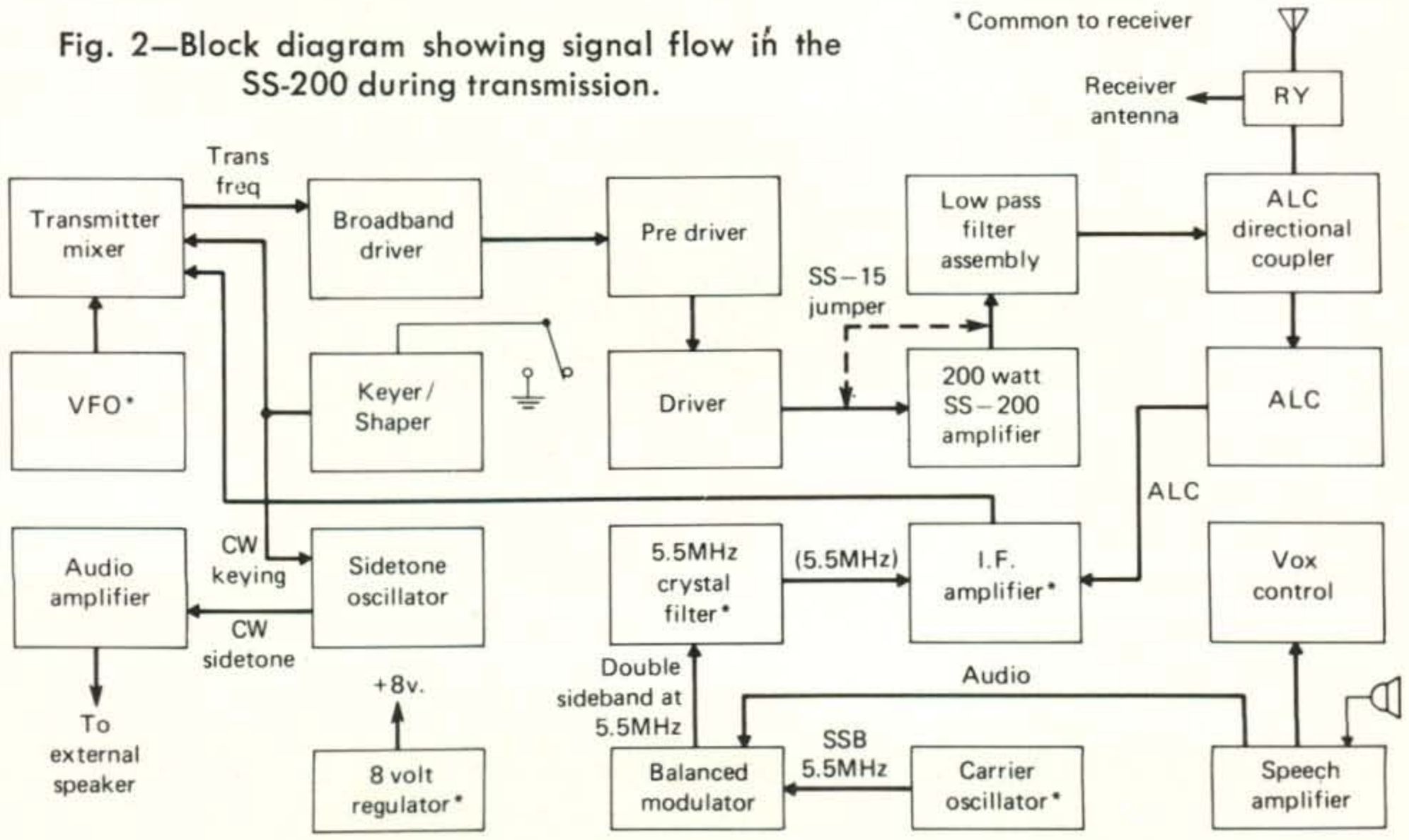
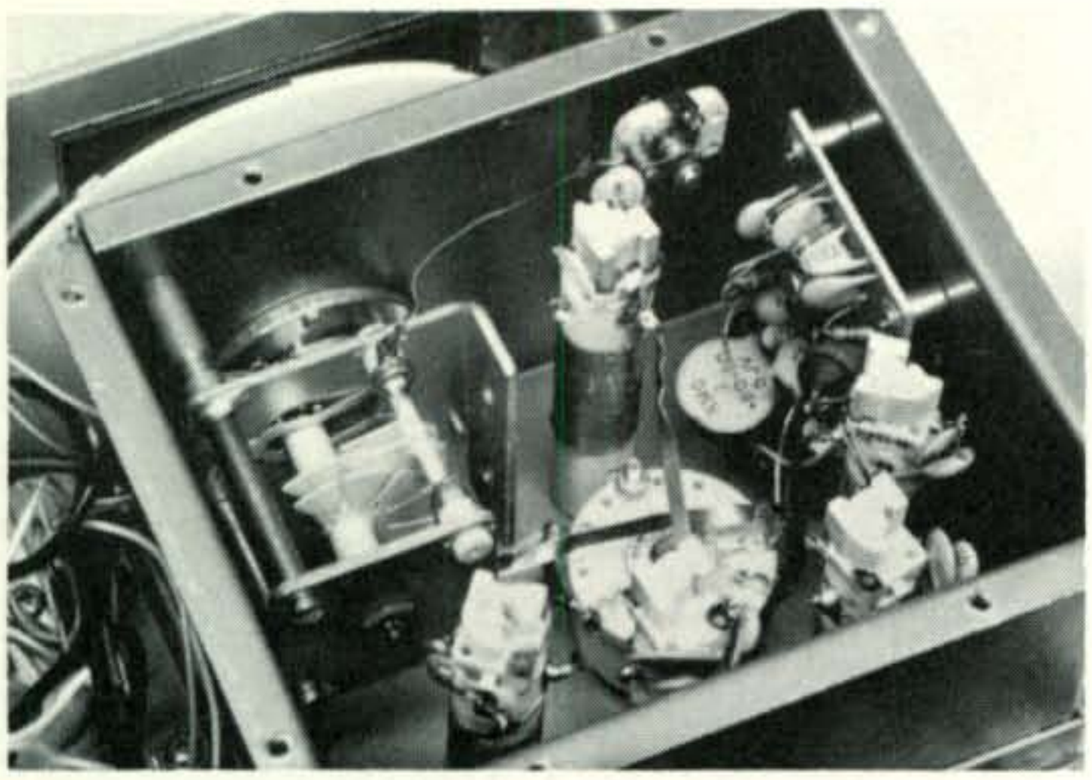


Fig. 2—Block diagram showing signal flow in the SS-200 during transmission.



The v.f.o. compartment with cover removed showing the main tuning capacitor on the left, oscillator board on the right, v.f.o. bandswitch section, and the five v.f.o. tank circuits.

hold-in time on c.w. which is different from the hold-in delay he prefers in phone operation. While the rig was designed primarily for those who stress phone operation (there is no provision for a narrow bandwidth crystal filter for example), care was obviously taken to offer the best c.w. operation possible without adding significantly to the cost of the rig.

Noise Blanker

The noise blanker does an excellent job of reducing, and in many cases actually eliminating, ignition noise and some types of power line arc noise. A wideband MOSFET amplifier amplifies any broad spectrum noise pulses appearing at the output of the receiver mixer. They are rectified and shaped into pulses which are then used to open-circuit the path for the noise pulses on their way to the crystal filter. The balanced FET noise switch is effective in opening the circuit very rapidly without introducing switching transient noise into the system. A front panel control turns the blanker on and off and sets the threshold level. Using an effective noise blanker like this one is something that must be tried to be appreciated. It's one of those "something for nothing" things that we are naturally skeptical of!

V.F.O.

The SS-200 uses a bandswitched v.f.o. operating at somewhat higher frequencies than found in most s.s.b. transceivers. The v.f.o. frequencies at the low edge of each band are 9 MHz on 80 meters, 12.5 MHz on 40, 8.5 MHz on 20, 15.5 MHz on 15, and 22.5 MHz on 10. There are five ceramic core inductors, each with its own bandset and temperature compensation capacitors. These v.f.o. "tank circuits" are individually switched into the v.f.o. oscillator circuit which uses a dual-gate MOSFET as oscillator. The oscillator itself is followed by two buffer stages. A two speed drive (6:1 and 36:1) is connected to the main tuning capacitor. The 80 and 10 meter bands each has its own dial scale. The 40, 20, and 15 meter bands share the same "0 to 450" scale. The scales are marked in 5 kHz increments on all bands except 10 meters where the increment is 20 kHz. A circular scale attached to the 6:1 knob, and a hairline, provide 1 kHz reference marks on 40, 20, and 15. They do not help in determining the actual frequency, but do make it easy to move up or down in frequency a few kHz with precision. A DIAL SET front panel control allows the v.f.o. frequency to be trimmed so that the 25 kHz markers occur at the correct points on the dial scale. If reasonable care is used in this procedure, it is possible to set the dial to within 1 or 2 kHz of a desired frequency on the four lower bands.

The v.f.o. stability seemed quite adequate during many hours of casual sideband operation. To see just how good it was, tests were run at an operating frequency of 21.1 MHz (a v.f.o. frequency of 15.6 MHz). The results of this test are shown in fig. three. A slight down-frequency drift was noted in the receive mode. Another curve was run in the transmit mode with a c.w. key-down duty cycle of 25%, and natural convection cooling. The final amplifier heat sink gets quite hot—hotter than normally experienced operating sideband. The drift in this case was up-frequency and greater.

To see what magnitude of drift could be expected when large extremes of ambient temperature were encounterd, such as wintertime mobile operation where the car interior goes from cold to warm in a short time, the transceiver was cooled to 32°F and then brought into a 75°F room. A gradual down-frequency drift of 1700 Hz was experienced in the receive mode during the first hour of this rather severe test.

The v.f.o. tuning is smooth and displayed no detectable backlash in the test unit. One rotation of the outer knob changes the frequency by roughly 100 kHz on the 80 thru 15 meter

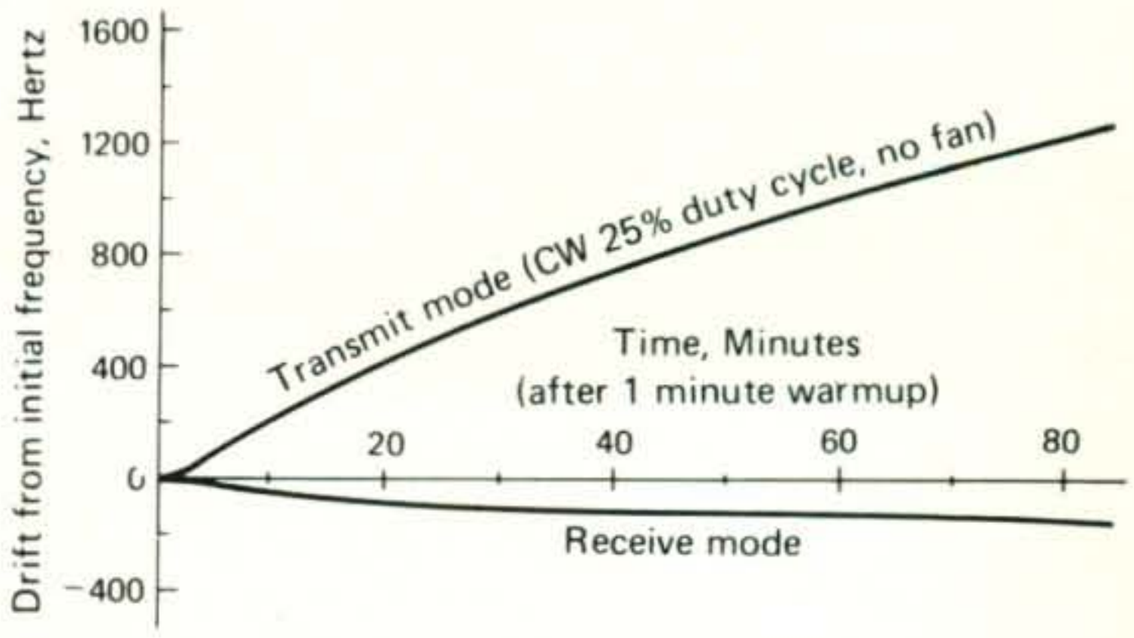


Fig. 3—Measured drift characteristics at 21.1 MHz The 200 watt amplifier showing the broadband ferrite matching transformers. The transistor studs are fastened directly to the heat sink.

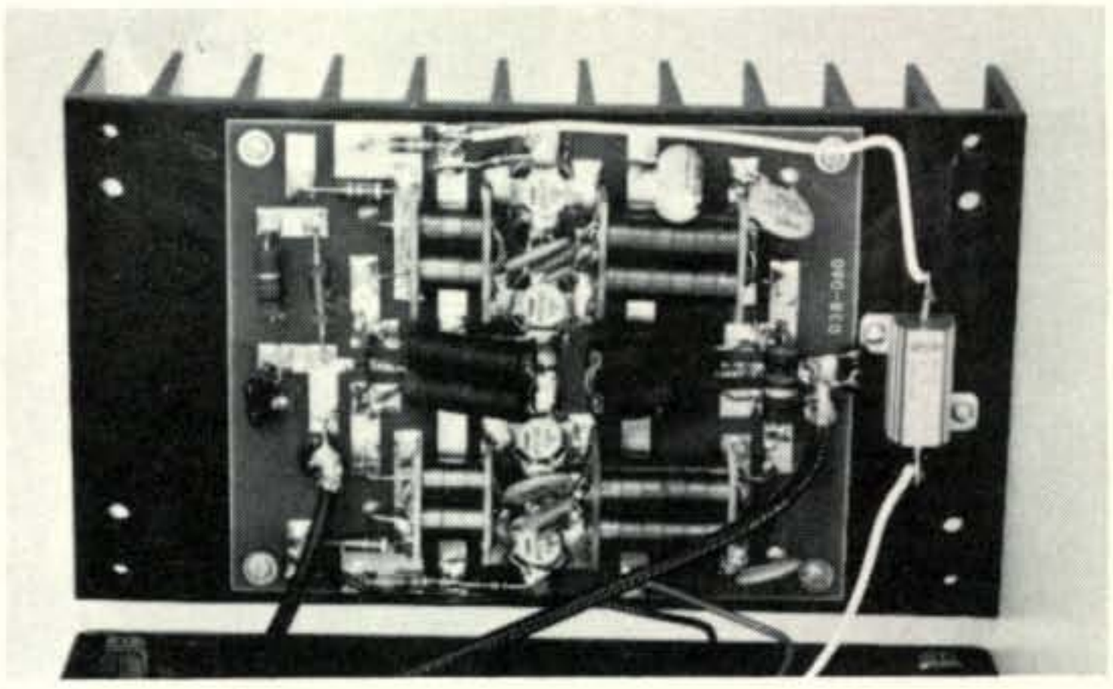
bands. The inner (36:1) knob changes the frequency by about 17 kHz per rotation, which is slow enough for easy tuning of s.s.b. signals. While not normally a problem, it was noted that there is some "play" in the bandswitching mechanism which causes a shift in frequency of one kHz or so if the bandswitch is moved through its range of play.

Final Amplifier

The SS-200 reaches its 200 watt power level by combining the output of two 100 watt push-pull linear amplifiers. All four transistors are bolted to an 8½ × 4⅝ × 2 inch finned aluminum heat sink which forms part of the plug-in amplifier unit. The r.f. power transistors used are manufactured by TRW, a company which produces a whole line of transistors designed specifically for h.f. linear amplifier service. Broadband transformers at the amplifier input and output maintain a satisfactory impedance match over the full 3.5 to 29.7 MHz range.

The 1N4005 diodes and the low resistance divider network provide the stiff d.c. bias source required for linear operation. The push-pull transistor configuration minimizes even-order harmonic generation. The switched low-pass filters (on the main chassis) complete the harmonic suppression efforts. It is of course possible to drive an amplifier of this type into non-linear operation just as one can overdrive a tube amplifier. Excessive drive is prevented in the SS-200 by monitoring the output power with a "directional wattmeter" type circuit. When the forward power reaches a preset level of about 100 watts, a d.c. control voltage is developed which reduces the gain of the i.f. amplifiers, thus preventing excessive drive to the final. Even normal drive under conditions of a bad load mismatch could damage the output transistors. To prevent this from happening even with an infinite mismatch (short or open), the *reflected power* is also monitored. When the reflected power reaches 25 watts or more, additional gain reduction voltage is developed. (25 watts reflected power in this instance represents a v.s.w.r. of about 3:1.) Swan recommends keeping the v.s.w.r. below 2:1, and as close to 1:1 as possible. They also warn that any outboard linear amp driven by the SS-200 should have an input impedance in this 25 to 100 ohm range. (A homebrew final using a pair of 3-400Z grounded-grid triodes was driven by the SS-200 with no problems.)

While the a.l.c. circuit limits the peak power to a safe level, high average power modes such as continuous key-down c.w., RTTY, or SSTV will eventually overheat the transistors unless the heat sink is fan cooled. Swan recommends that a "whisper type" fan be directed at the heat sink if key-down transmission is needed for more than three minutes. The important



The 200 watt amplifier showing the broadband ferrite matching transformers. The transistor studs are fastened directly to the heat sink.

thing, they say, is keeping the heat sink temperature below 158°F as measured at the transistor studs. Since most hams do not have the capability of measuring this temperature accurately, this reviewer's suggestion is to play it safe. Adjust operating practice and any flow of cooling air so that the heat sink is never too hot to hold onto continuously with the fingers. The life of any power transistor depends on its operating temperature, and on the number of times it is cycled up and down in temperature. The cooler a power transistor runs, the longer it will live.

Swan's warranty covers semiconductor replacement for 90 days after purchase, with a one year warranty on the rest of the unit. (Shortly after the test unit was originally shipped to *CQ*, the power transistors failed during a test. The problem, Swan said, was faulty installation of the transistors on the heat sink. No problem was encountered with the replacements.)

Power Supply and Accessories

The SS-200 requires an a.c. power supply or battery capable of delivering at least 11 volts at the key-down supply current of 20 amps, and no more than 15 volts under no load conditions. SS-200 specifications are measured and guaranteed at an input voltage of 13.5 volts. Power output will typically drop by more than 30% as the power supply is reduced from 13.5 to 11.5 volts. The SS-200 contains an internal 8 volt regulator which delivers constant voltage to all low level circuits, including the v.f.o., so long as the input voltage is above 11 volts. Current drain on the supply varies from about 500 ma in the receive mode, to 20 amps on s.s.b. voice peaks and key-down c.w. operation.

One means of powering the SS-200 is the Swan PS-20 power supply available as an accessory. This supply is capable of delivering up to 20 amps at a regulated +13.5 volts. Four 2N3055 power transistors function as series regulators, but the heat sink temperature rises rapidly under key down conditions. Forced air

cooling of this heat sink is also required for high duty-cycle modes of operation, as we found out when one of the power transistors failed after 9 minutes of key down operation. This unit has a built-in front-facing speaker which delivers good communications quality audio.

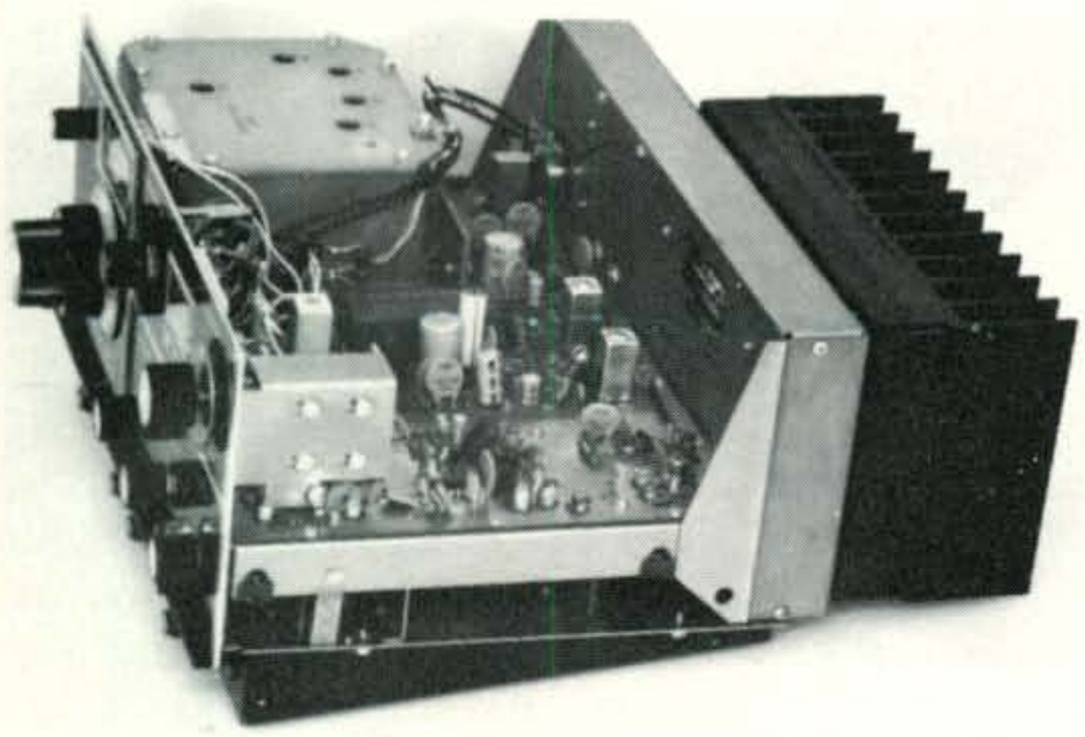
Many users will want to take advantage of the SS-200's ability to operate efficiently from battery power. A 12 volt automobile storage battery coupled with an a.c.-operated charger is one way of powering the unit in the shack, and having an emergency power source at the same time. The SS-200 was tried on battery power with the expected good results. To stretch battery life in a real emergency, the SS-200's power amplifier could be removed and a jumper substituted, converting the transceiver into an SS-15 producing 5 watts output. Average supply current in the s.s.b. mode is approximately 800 ma for the SS-15, versus 6 amps for the SS-200.

In addition to the PS-20 power supply, Swan offers two other accessories. The SS-208 external v.f.o. plugs into the accessory jack at the rear of the SS-200, and permits split-frequency operation with reception on one frequency in a band, and transmission on another. The SS-16B filter is an extremely steep-skirted 16 pole crystal lattice filter, available to replace the standard filter. The 6db/60db shape factor of the SS-16B filter is given as 1.28 versus 1.7 for the standard filter.

Construction

The SS-200 and PS-20 cabinets are steel with a combination of black wrinkle and smoothly finished black surfaces. Some internal and trim parts are aluminum. The U-shaped case top and sides can be removed by removing four screws.

The front panel controls are the two-speed main tuning control, dial set, power on/off and a.f. gain, r.f. gain, blanker off and level, C.W./ Normal SB/ Opposite SB mode switch, band-switch, v.f.o. selector, preselector, mike gain, PTT/VOX switch, VOX gain, anti-VOX gain, calibrator on/off, and c.w. drive. The mike jack (3-circuit, ¼ inch, "phone" type) and key jack (2-circuit, ¼ inch, "phone" type) also appear on the front panel.



A view of the SS-200 with cover removed showing the main circuit board, the VFO enclosure at the left rear of the photo, and the 200 watt solid-state amplifier and heat sink at the right.

Internal controls are s.s.b. VOX delay, c.w. VOX delay, S-meter sensitivity, and calibrator zero-beat.

Double sided PC boards are used for the larger r.f. boards where the shielding effect of large ground plane areas is useful. All PC boards are the epoxy-glass type. Dimensions of the SS-200 are approximately 12½"w. × 6"h × 13"d. Weight is 19 pounds.

Performance

Some of *CQ*'s test data has already been given in other parts of this review. The rest of our findings follow.

Swan specifies a minimum *input* level of 200 watts p.e.p., or 200 watts d.c. on c.w., but does not specify a minimum efficiency or output level. The unit was tested in the *CQ* lab and found to deliver 130 watts c.w. output power on all bands, and 110 w. p.e.p. on s.s.b.

Other Swan specifications (with *CQ*'s measurements in parentheses) are: RECEIVER SENSITIVITY: 0.5 microvolts for S+N/N of 10 db (0.5 μv). IMAGE REJECTION: —55 db at 30 MHz; —75 db at 3 MHz (—54 at 29.5 MHz; —90 at 3.5 MHz). CRYSTAL FILTER SHAPE FACTOR: 1.7 (1.7). DISTORTION: Down approximately 30 db. CARRIER SUPPRESSION: Greater than 60 db (60 db).

S.s.b. operation with the SS-200 was a pleasure in both fixed station use, and while operating portable from a 12 volt car battery. It clearly demonstrates that the day of the all-solid-state 200 watt transceiver has arrived. The amplifier heat sink temperature rise in normal s.s.b. operation is fairly low, even without fan cooling. The freedom from transmitter tuning and tuneup is appreciated. The VOX is quite satisfactory if you are not one of those bothered by the sound of the relay clicking. The a.l.c. circuit effectively prevents flattopping when the rig drives a load of the proper impedance. While v.f.o. drift could be a nuisance under conditions of changing temperature, it was not a problem in normal s.s.b. operation on 75, 40 and 20. The crystal filter bandwidth is wide enough to give good quality audio response, yet steep sided enough to give good rejection of adjacent channel signals. The performance of the adjustable threshold noise blanker is excellent.

The "Preliminary Operations Manual" supplied with the unit is informative and fairly

[*Continued on page 63*]

Form Approved
OMB No. 41-S74125

NBS QUESTIONNAIRE FOR USERS OF WWV, WWVH SERVICES

1. TO WHAT EXTENT DO YOU USE THE FOLLOWING FREQUENCIES?

	FREQUENTLY	SOMETIMES	RARELY	NEVER
2.5 MHz				
5				
10				
15				
20				
25				

2. HOW IMPORTANT ARE THE FOLLOWING FREQUENCIES FOR YOUR OPERATION?

	VERY IMPORTANT	SOMEWHAT IMPORTANT	RELATIVELY UNIMPORTANT	VERY UNIMPORTANT
2.5 MHz				
5				
10				
15				
20				
25				

3. HOW OFTEN DO YOU USE THE FOLLOWING?

	FREQUENTLY	SOMETIMES	RARELY	NEVER
WWV				
WWVH				
TELEPHONE NO. (303) 499-7111				

4. HOW OFTEN DO YOU EXPERIENCE HARMFUL INTERFERENCE BETWEEN NBS BROADCASTS AND OTHER TIME/FREQUENCY TRANSMISSIONS?
CHECK ONE:

NEVER ☐ SELDOM ☐ OFTEN ☐ FREQUENTLY ☐

5. IN WHAT APPROXIMATE GEOGRAPHICAL AREA DO YOU MAKE USE OF WWV/WWVH SIGNALS? _____

_____

6. TO WHAT EXTENT DO YOU USE THE FOLLOWING INFORMATION?

	FREQUENTLY	SOMETIMES	RARELY	NEVER
TIME OF DAY: VOICE				
TIME OF DAY: BCD CODE				
ONE-SECOND TICKS				
STANDARD FREQUENCY				
DUT 1 VALUES				
WEATHER				
GEOALERTS				
PROPAGATION FORECASTS				

(OVER)

NBS Surveys WWV/WWVH Users

tear off, fold lengthwise and mail in number 10 envelope.

In response to government-wide efforts to reduce operating costs and conserve energy, the National Bureau of Standards is considering various alternatives for operating stations WWV and WWVH. Interested listeners to these stations are being asked to provide information, via the tear-off questionnaire on these two pages, which will help set priorities and guide decision-making processes with respect to these services. Examples of possible changes include the elimination of some broadcast frequencies from WWV and/or WWVH or reductions in transmitted power on some frequencies.

[*Continued overleaf*]

7. HOW IMPORTANT FOR YOUR OPERATION IS EACH OF THE FOLLOWING CATEGORIES OF INFORMATION AS SUPPLIED BY WWV/WWVH?

	VERY IMPORTANT	SOMEWHAT IMPORTANT	RELATIVELY UNIMPORTANT	VERY UNIMPORTANT
TIME OF DAY: VOICE				
TIME OF DAY: BCD CODE				
ONE-SECOND TICKS				
DUT 1 VALUES				
WEATHER				
GEOALERTS				
PROPAGATION FORECASTS				

8. HOW WOULD YOU CHARACTERIZE THE SIGNAL WHICH IS TYPICAL FOR YOU?

	MORE THAN ADEQUATE	ADEQUATE	MARGINAL	USELESS
SIGNAL STRENGTH				
ACCURACY OF TIME AND/OR FREQUENCY				

9. PLEASE CHECK THE CATEGORIES IN THE TWO LISTS BELOW WHICH MOST ACCURATELY CHARACTERIZE YOUR USE OF NBS FREQUENCY AND TIME SERVICES.

USER CLASSIFICATION

___ GOV'T: MILITARY
___ GOV'T: CIVILIAN
___ EQUIP. MANUFACTURING
___ NAVIGATION
___ AVIATION/AEROSPACE
___ TELEPHONE INDUSTRY
___ ELECTRIC POWER INDUSTRY
___ STANDARDS LAB
___ SHIPPING/BOATING INDUSTRY
___ PLEASURE BOATING
___ UNIVERSITY
___ COMMUNICATIONS INDUSTRY
___ SEISMOLOGY/GEOPHYSICS
___ OTHER (PLEASE SPECIFY):

_____

_____

PRINCIPAL USE

___ HOBBY (OTHER THAN AMATEUR RADIO)
___ AMATEUR RADIO
___ CALIBRATION OF WATCHES/CLOCKS
___ NAVIGATION/POSITION LOCATION
___ COMMUNICATIONS SYSTEMS
___ SCIENTIFIC DATA MONITORING
___ INSTRUMENT CALIBRATION
___ ROCKET/SATELLITE TRACKING
___ STORM WARNINGS
___ GEOALERTS
___ PROPAGATION FORECASTS
___ ASTRONOMY

___ OTHER (PLEASE SPECIFY):

_____

_____

10. ARE THERE OTHER SERVICES WE SHOULD ADD? YES ☐ NO ☐

IF YES, WHAT SERVICES? _____

11. DO YOUR RESPONSES TO THE ABOVE OFFICIALLY REPRESENT MORE THAN YOUR OWN PERSONAL INVOLVEMENTS? YES ☐ NO ☐

IF YES, PLEASE EXPLAIN _____

_____

12. COMMENTS:

As a result of greatly increased energy costs at the Hawaiian station, WWVH, comments have already been solicited from users regarding a proposed 50% reduction of power at 5, 10, and 15 MHz from WWVH only. So many objections to this proposal have been received from users that NBS has decided to explore other possible means of cost and energy reductions. It is hoped that the responses to this questionnaire will allow NBS to provide the services needed most within their financial constraints and at an efficient level of energy use. Thus, it is very desirable that you provide thoughtful responses to the enclosed questions.

Deadline for comments is May 1, 1975. Be sure to fill in both sides of the questionnaire.

Mail to:

WWV/WWVH Survey
National Bureau of Standards
Time and Frequency Division
Boulder, Colorado 80302

QRPp

LOW-LOW POWER OPERATING

BY ADRIAN WEISS,* K8EEG

Solid State V.F.O. Design Notes

With the QRPp Transmitter Design Contest underway (see December issue for announcement), I hope that many of you are looking around for circuit ideas. It seems only appropriate that the QRPp column be devoted to aspects of design. Since the v.f.o. is usually the first problem encountered by the designer, that seems a good place to begin.

V.F.O. Transistors

The choice of transistor or FET used in the v.f.o. oscillator stage is important in achieving a stable circuit. The device characteristics which are important are: f_T, beta or forward gain (transconductance for FET's), output capacitance, power dissipating rating, and thermal resistance figure.

A widely accepted rule of thumb calls for selection of a device with an f_T of ten times the operating frequency. Due to the large supply of v.h.f. and u.h.f. devices, there are quite a few that fill this requirement, High gain is another requirement. Oscillation can be readily attained in most circuits with a high f_T, high beta device. Spec sheets for FET's do not provide an f_T figure, but merely specify v.h.f or u.h.f. as the upper frequency limit at which the device exhibits gain.

The output capacitance of the device should be low at the operating voltage to minimize the effects of junction capacitance upon frequency stability. This is partly dependent upon the device itself, and upon operating conditions, as is the thermal resistance figure. Cross indicates the importance of thermal resistance characteristics as a design consideration.[1] In any functioning device, power is dissipated as heat which directly affects operational characteristics, principally junction capacitance, gain, and f_T. In Cross's "figure of merit" evaluation technique, a device is rated to its f_T and beta, and inversely to its output capacitance, the d.c. power input, and the thermal resistance figure. Assuming constant operating conditions (say 5.3v at 1.1ma emitter current = 5.8 mw input), the device with the lowest output capacitance and thermal resistance figure, and highest f_T and beta, will be superior as an oscillator device with respect to frequency stability as it is affected by internal characteristics of the oscillator transistor. The "top-five" devices according to Cross's system are: 2N1141 (merit = 400), 2N918 (merit = 154), 2N963 (merit = 150), and the 2N700A (merit = 110). More recent devices could probably be found to better these. The MPS6514 which has appeared in a number of recent designs has both higher f_T and beta than the 2N1141, but its thermal resistance figure (0.375°C/mw vs. 0.1°C/mw) is higher, as is its output capacitance (4 pf vs. 2 pf). A search of the spec sheets probably would turn up something better than both.

The above considerations apply to FET's in v.f.o. circuits. The high input impedance of the FET makes it particularly attractive in v.f.o. circuits. This minimizes loading of the v.f.o. tuned circuit. FET's are noted for their excellent power handling capability, and spec sheets do not include thermal resistance figures. Quite a few v.h.f. and u.h.f FET's are available and have found use in v.f.o. circuits, including the HEP802, MPF102, 2N4416, 3N128, and others. Hanchett's paper remains the classic on use of FET's in v.f.o. circuits.

*213 Forest Ave., Vermillion, SD 57069.

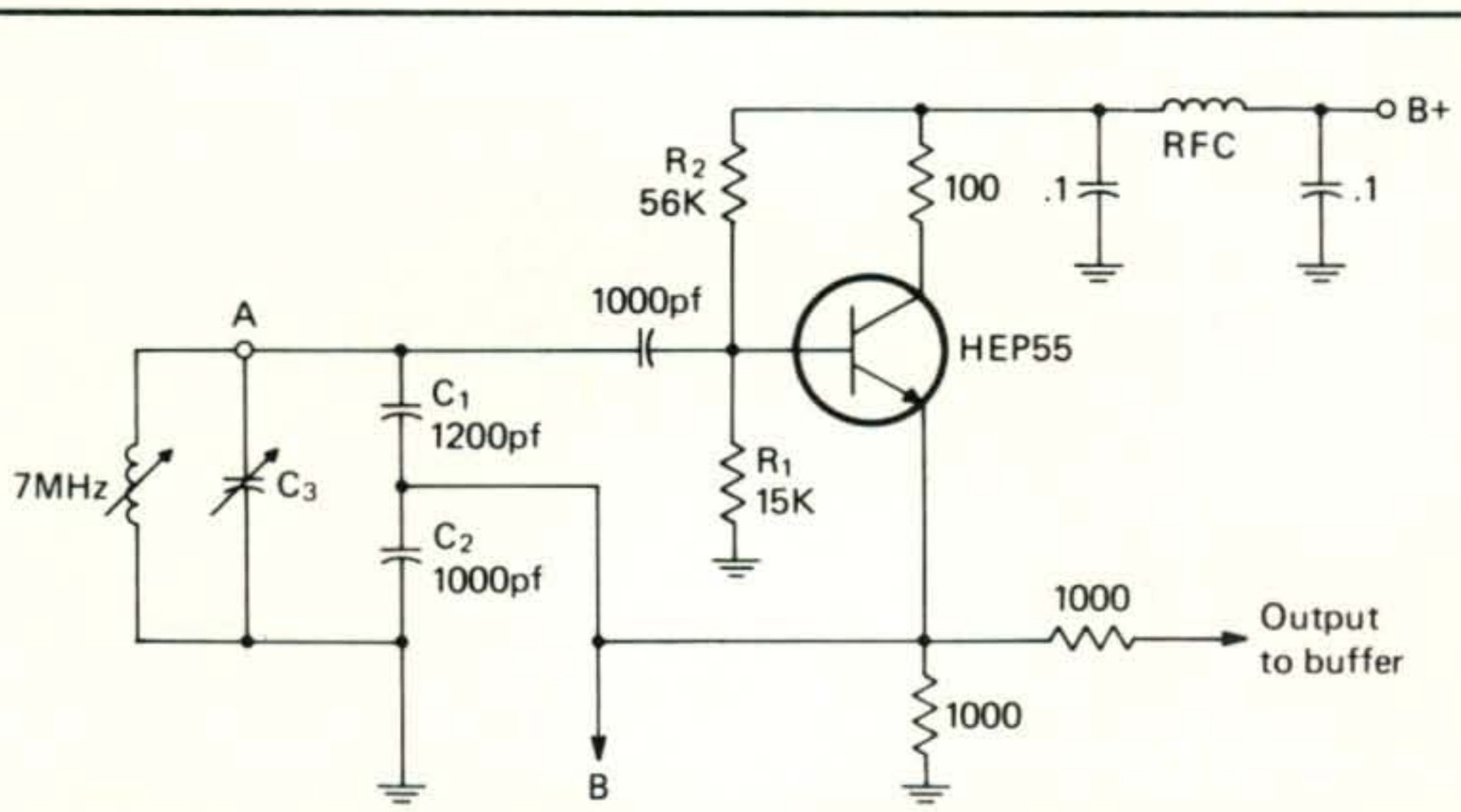


Fig. 1 — A Colpitts oscillator (from the ARRL Handbook, 1972 ed., p. 169). C_3 when connected at A should be a low value (approx. 15-30 pf); for when connected at B, a higher value (150 pf) is needed to produce the same bandspread. L_1 = 0.68 — 1.25 μh slug tuned for 7 MHz.

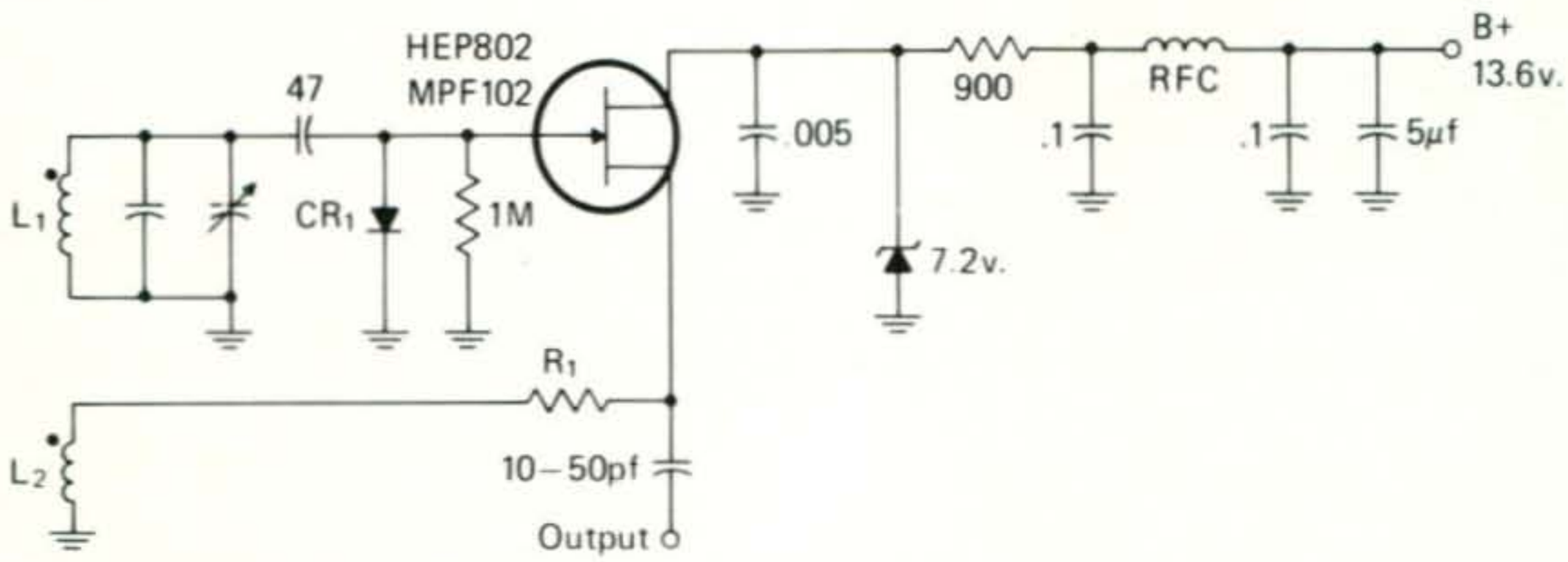


Fig. 2—A Hartley oscillator. CR is a fast switching diode (1N914) to clip positive peaks of cycle to reduce harmonic currents and stabilize bias. L_1 & L_2 are approx. 4:1 ratio. Both windings are in the same direction and twist.

II Operating Conditions

In general, a primary design objective is to keep oscillator dissipation at as low a level as possible to avoid junction temperature related frequency drift. Even the most inherently circuit configurations can drift if operated at too high a power dissipation level. Very little is achieved by "pushing" the oscillator device. A survey of published solid-state designs indicates that power dissipation is in the neighborhood of 3-10mw, with collector/drain voltages rarely exceeding 9 v.d.c.—with most operated at about 6v.d.c.—at a few ma current. Such power levels allow ready oscillation and adequate output to later buffer-amplifier stages.

Different oscillator circuits have some specific requirements. In general, bipolar devices have appeared in the Colpitts and Clapp circuits (see Fig. 1). Bias resistors R_1 and R_2 will vary for different devices and should be determined experimentally. A specific bias level will enhance stability. In oscillators intended to cover a wide range of frequency (80-10m or so), the feedback circuit (Figure 1, C_1 and C_2) may be a source of difficulty. Values large enough for low end of the range may make oscillation at the high end difficult or impossible, even when u.h.f. devices are used. This is true of the Clapp, Colpitts, Vacker, and Seiler circuits. The Hartley (see Fig. 2) utilizes inductive feedback and will usually oscillate up into the v.h.f. region with a u.h.f FET. The feedback tickler should be as small as will permit healthy oscillation. D.c. bias can be controlled with R_1 if desired. A multiband v.f.o. using this circuit appears in reference 3. The primary to tickler ratio worked as high as 5:1 on the low end. A later version operated on the half-frequency through a doubler to make temperature compensation easier, as well as increase v.f.o. isolation and decrease "pulling."

A prime consideration is supply voltage regulation. Generally, a single zener diode is used, but when operation with weak batteries and the resulting load-no-load voltage swing is contemplated, double zener regulation is adviseable, as in reference 3. For best results, the zener should regulate the oscillator stage itself, rather than all stages in the v.f.o. Dropping resistors should be selected so that the zener draws about 5ma. This provides an adequate hedge against changing supply voltages under load.

By-passing and filtering the d.c. supply line is essential for obtaining adequate r.f. isolation from later amplifier stages. If r.f. from later stages reaches the oscillator through the supply voltage line, it will very noticeably affect frequency stability. In many cases where homebrewers attribute excessive key-down frequency pull to poor supply regulation, the problem is actually inadequate isolation of the v.f.o. from later r.f. stages. Minimum practice is insertion

Brice Anderson, W9PNE, with his "Sucrets Special" QRP rig (featured in *The Milliwatt*, April, 1973, p. 9) with about 150 mw output from a 9 volt battery, W9PNE's exploits with super-low power have been noted in earlier columns. A rundown is: WAS & 32 DXCC at 280 mw output; 37 WAS & 9 DXCC with 100 mw output; 27 WAS & 4 DXCC with 50 mw output; and 11 WAS & 2 DXCC with 25 mw output. During the ARRL 160 Test, he worked several stations and a new DX country (!) with 200 mw output! Incidentally he ran up 248 QSO's in the 160 Test with 3.5 watts output, including KV4, HH, TI2, & 2F-1. Bruce uses plain old single wire antennas to accomplish these feats.

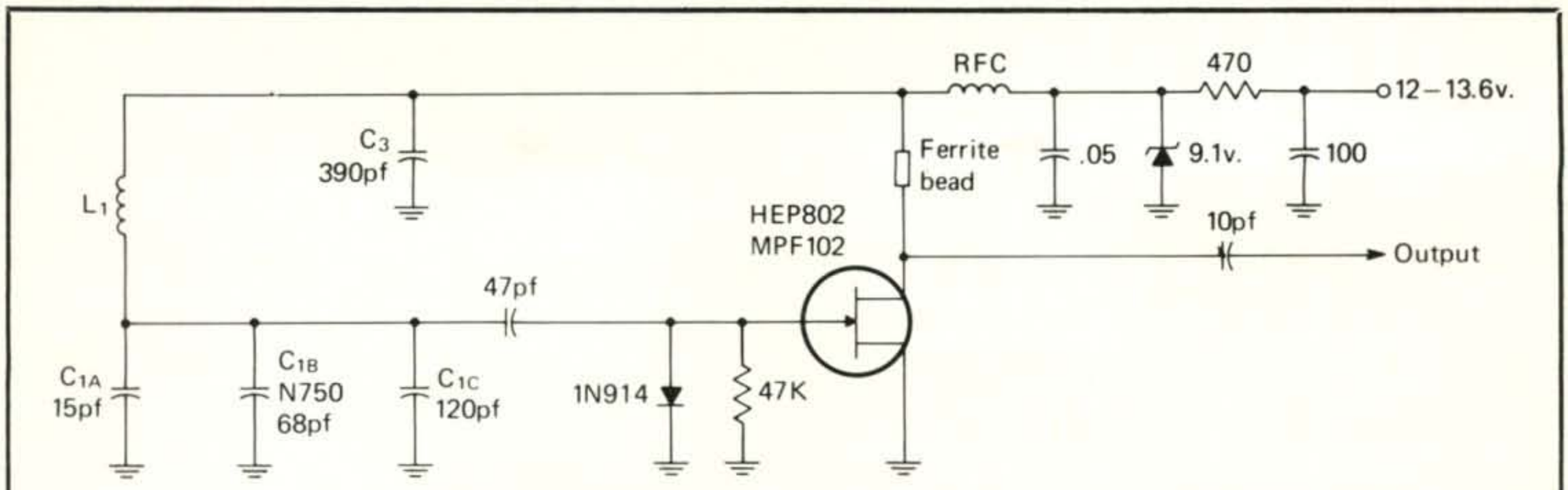


Fig. 3—A Vacker Oscillator. L_1, $C_{1A/B/C}$ & C_3 resonate to desired frequency.

of an r.f. choke plus by-pass capacitors in the B+ line; preferably, it should enter the v.f.o. enclosure through a feed-through capacitor. The collectors of untuned buffer-amplifier stages following the oscillator should be adequately bypassed and isolation enhanced either through an r.f. choke or small value resistor (100 ohms or so). Output from the v.f.o. should be through shielded cable which is grounded at both ends.

Temperature compensation in the oscillator tuned circuit, and in the v.f.o. housing, is crucial to drift-free operation. At minimum, the v.f.o. enclosure should be draft-free. The thicker the enclosure material, the longer the thermal delay and hence the less effect ambient temperature variants have upon frequency stability. Ambient temperature variations will affect the tuned circuit more quickly if the enclosure is very small. Loosely stuffing the space left in the enclosure with fiberglass insulating material increases temperature isolation.[4]

Because an ideal enclosure is usually beyond the average homebrewer, temperature compensation of the v.f.o. tuned circuit is necessary and not very difficult. It should be the final step in construction. Once the v.f.o. is completed and in the enclosure, the rate of thermal drift (always downward in frequency) can be noted by moving a small lightbulb to within about a half-foot from the enclosure. A rough graph can be used to monitor the decrease in drift vs. time while different combinations of N100 or N750 disc ceramics and fixed capacitors are substituted for an original fixed capacitor in the tuned circuit. Once drift takes an upward direction, too much compensation has been inserted, and a slightly smaller N100 or N750 should be used. DeMaw cautions against the use of silver micas in the tuned circuit because of heating caused by circulating r.f. currents, and calls for the use of polystyrene types instead, which are very stable with respect to changes in temperature.[5] At least, one should use NPO disc ceramics. With a bit of patience, the above process will lead to a combination of N750 and fixed capacitance that will slow thermal drift to a negligible rate. Luck helps a bit. A Vacker circuit used in a 20m transmitter by this writer was drift compensated by the above manner, and the ultimate result was about 300 Hz drift with a temperature shift of 65-110 degrees F. In practical conditions, it is rock-solid (see Fig. 3).

We're out of space this month, but we'll continue with these design notes in future columns.

QRPP NET

Sessions are Tuesday evenings at 2200 EST (Wednesday, 0300 GMT) on 3540 ± 3kHz. K8EEG/ϕ will call for check-ins for first fifteen minutes, and then go down the list for station-to-station calls. Those not wishing to follow this route are invited to move off frequency and call CQ QRPP. We'll make this time and frequency the official QRPp calling session everyday for those who wish to use it. Argonaut Clubbers will use the Tuesday evening session until other plans are devised.

Hope to see many of you on the air.

73, Ade, K8EEG/ϕ

References

[1]H. Cross, "Selection of VFO Transistors," *ham radio* (November, 1969), p. 74.

[2]G. D. Hanchett, "The Field Effect Transistor as a Stable VFO Element," *QST* (December, 1966), p. 11.

[3]A. Weiss, "A Multiband FET VFO QRPP Transmitter," *ham radio* (July, 1972), p. 39.

[4]V. Aumala, "High Stability VFO," *ham radio* (January, 1972), p. 27, used a cast-aluminum box with 3/16 inch walls to achieve a ten minute thermal delay. The advantage here is that any temperature variation not present for at least ten minutes will have no effect on the v.f.o. frequency.

[5]D. DeMaw, "More Basics on Solid-State Transmitter Design," *QST* (November, 1974), p. 22.

NOVICE SHACK

BY HERBERT S. BRIER,* W9EGQ

Renewable Novice C.W. And Phone Licenses Proposed

Chances are that, if your Novice license has over a year to go, you will be able to renew it when it expires and every five years thereafter, if you wish. If it will expire in less than a year, you will probably have to wait for a couple of months before you can apply for a new, renewable Novice license. These possibilities are the result of a proposal by the Federal Communications Commission to make the Novice license a 5-year, renewable license. The proposal is one of many included in FCC Docket #20282 released in December. The docket, which divides the amateur spectrum at 29 MHz into two parts—the Short-Wave or High-Frequency series below 29 MHz, and the u.h.f./v.h.f. series above 29 MHz, will affect all presently-licensed and prospective amateurs.

The present Novice, General, and Advanced class licenses will be modified somewhat and govern operations on the lower frequencies; and a new Communicator, a modified Technician, and a new Experimenter license will govern the u.h.f./v.h.f. spectrum.

The Communicator License

The proposed new Communicator license is the FCC's answer to the many requests for a no-code amateur phone license. It proposes to authorize f.m. (F3) phone operations on the amateur frequencies above 144 MHz with a maximum transmitter power input of 250 watts. Applicants for the license will qualify for it by passing an elementary written test covering amateur regulations and v.h.f./u.h.f. phone techniques. The examination will be conducted by mail under the supervision of two volunteer examiners, and the license will be for five years and will be renewable. We emphasize that the Communicator examination breaks with United States amateur tradition by omitting a code test.

Besides extending the Novice license term from two to five years and making it renewable, the new proposal boosts its power limit from 75 watts to 250 watts input. The Novice license will still authorize c.w. privileges in the present Novice segments of the 3.5, 7, 21, and 28-Mhz bands, and its examination will remain a 5-w.p.m. code test and an elementary written test covering amateur regulations and techniques conducted by mail with the assistance of volunteer examiners.

A significant tightening of the rules governing all amateur licenses issued by mail is evident in the FCC docket. Two witnesses will be required, both over 21 years of age and neither related to the applicant. At least one of the witnesses must have a license higher than the one being applied for. Extra, Advanced, and General class licensees may act as principle examiners for the Novice examination; and Extra, Experimenter, and Technician licenses for Communicator examinations, each assisted by another licensed examiner.

Another sign of the tightening of the by-mail procedures is the change of the Technician license from one routinely issued by mail to one obtained by going to an FCC office and passing its 5-w.p.m. code test and written test. If the applicant is physically disabled or lives more than 175 miles from the nearest established FCC office, however, all classes of licenses above the Novice and Communicator classes will be obtainable by mail. But if they are so obtained for any reason except disability, the licensees must appear at an FCC office and pass the appropriate examination before an official examiner within five years; otherwise, the license will not be renewed. Furthermore, if the licensee moves within 175 mils of an established examination point or if a new examination point is established within 175 miles of his address, he will have one year to pass the examination before an official examiner, or the license will be cancelled. Licenses issued by mail for reasons of disability will be renewed indefinitely, as long as the disability lasts.

Space does not permit discussing other proposals not of immediate concern to beginning amateurs, except to mention that the proposed Experimenter class license will authorize all amateur privileges above 29 MHz. Its examination will consist of a 5-w.p.m. code test and an Advanced type written exam.

All of the proposals are subject to change, and it will probably be a minimum of over six months before they are adopted in any form. Probably the best way to meet the challenge of the docket is to try to get your General or Advanced class license before that time. You will then retain all or most of the Technician and Experimenter privileges when the new rules go into effect without taking more tests.

Using Q and Procedure Signals

The other day, I ran across a discussion on whether it was wise to use Q signals and other procedure signals originally designed for radio-

*385 Johnson St., Gary, Ind. 46402.

telegraph operation on phone. Actually, the most important consideration in using these signals is not on what mode they are used but whether they make communications easier or more accurate. Unfortunately, they do neither as used by many operators. For example, how often have you heard or made a transmission something like "WN1ABC DE WN9XYZ R R R R. SRI missed UR name and MI signal report. QRM is bad here. Please repeat your QTH . . ."?

There are several common errors in that example. One, the procedure signal "R" means nothing more nor less than "Received" or "I acknowledge reception of your transmission." Therefore, the transmission starts out, "I copied everything you sent. I copied. I copied. I copied. I did not copy." And "QRM is bad here" doesn't say anything more than "QRM" by itself, which means "I am troubled by interference." Similarly, "Please repeat your QTH" takes longer to send than "QTH"?" which means, "What is your position in lattitude and longitude (or by any other indication)?"

The point is that a Q signal asks a question when followed by a question mark and makes a statement when the question mark is omitted. Their meanings are listed in the Call Book, amateur radio handbook, in the booklet *How to Operate an Amateur Radio Station*, included in the *Gateway to Amateur Radio (License Manual*, etc.) from ARRL, and on the front cover of ARRL log books. Therefore, there is not much excuse for using them inaccurately.

Luis Plinio Caamano, HI8LC, Apartado Postal 88, Santo Domingo, Dominican Republic, wins the 1-year subscription for CQ Magazine in our Monthly Photo Contest. Luis is active from 1.8 MHz to 148 MHz. He uses a Heathkit SB-301 receiver and SB-401 transmitter and SB-220 KW amplifier feeding inverted V antennas for the lowver frequencies and a Hy-Gain TH-4 tri-band beam for 10, 15, and 20 meters. He is very active on the Novice bands to give Novices a "HI" contact. QSL direct or via W2KF. If you want to enter our Monthly Photo Contest, send a sharp picture (preferably black and white) of yourself and station and some details about your equipment and amateur career in care of Herbert S. Brier, W9EGQ, 385 Johnson St., Gary, Ind. 46402.

News And Views

Richard Fillipiak, WN9LDW, 404 Erie Ave., Sheboygan, Wisconsin 53081, takes exception to the statement by WA0DXZ in the November, 1974, NOVICE SHACK that Novices can't work DX by calling "CQ." "I have about 60 countries in about the full two years with my Novice license. Most of the time, I call "CQ DX," and I'd say that I have worked about 90 per cent of my DX that way. I run a FTDX-401 into a 4-element triband beam up 60 feet on 15 meters, a 40-meter dipole on 40, and a "long wire" on 80 meters." Our comment on the matter is that the advice most U.S. amateurs can work more DX by calling individual stations than by calling "CQ DX" is based on the U.S. station having an average signal, and that most DX stations raise too many U.S. signals on their own CQ's to call individual stations for routine contacts. But WN9LDW's 4-element beam, 60-feet high is not your average Novice antenna and probably makes his signal an "S" unit or two above the average Novice signal. When you work **Ann, WN2WXT, Fred, WB2WYN** (formerly WN2-FLT) and **Bob, WN2WXY,** you are working graduates of a mini-course at Maple Hill High School, Castleton, N.Y., conducted by **John F. Kienzle, WA2UON,** RD #1, Nassau, N.Y. 12123, Social Science teacher assisted by **Al, WB2CGN.** These "mini-courses" are a comparatively new idea in schools across the country. Contact WA2UON for more information on them . . . **Larry Cotariu, WA9MZS,** Skokie, Ill., has been shaking up the "troops" by operating his father's Novice station, WN9-PRQ, outside the Novice bands (phone and c.w.) by signing both calls—WN9PRQ/WA9-MZS—therefore his father's call has worked 12 states and five countries outside of the Novice bands, legally, too. It seems to us to be doing things the hard way, but it shows Larry really reads the fine print in the FCC regulations.

Bob Fields, WN6WUW, Box 884, El Sobrante, Calif. 94803, uses a Heathkit Apache transmitter and a Hammarlund HQ-170 receiver in conjunction with a Hy-Gain 18-AVT vertical antenna. The antenna is mounted on the roof of the shack. Thirty-one states and Canada and Mexico are his totals on 80 and 40 meters. Bob is 26 and is an Inventory Controller for a chemical company and is a Business Administration major at San Francisco

[*Continued on page 63*]

DX

BY JERRY HAGEN,* WA6GLD

THE contest season is now in full swing and hopefully we can all work some good DX including a few new countries or prefixes! Don't forget the WPX Contest which will be held on March 29-30 this year. Quite a few special prefixes are normally active in this SSB Contest. Good luck and don't forget to submit your log to *CQ* if you are active in the WPX Contest.

Contest to Develop Dxpedition Operating Practices

The LIDXA is sponsoring a unique contest which should be of interest to all DXers. We will publish the winning entry when it is announced.

In order to assist in the improvement of the caliber of future DXpedition operations, the Long Island DX Association is sponsoring a contest to develop a set of precepts and/or suggestions for DXpedition operations.

Contest entries to include criteria to be followed by both the DX station and by those amateurs wishing to work the DXpedition.

The Long Island DX Association will award the following prizes for the best entries received in this contest to develop DXpedition operating practices as follows:

1st Prize—Three (3) years subscribtion to *LIDXA Bulletin.*

2nd Prize—Two (2) years subscription to *LIDXA Bulletin.*

3rd Prize—One (1) year subscription to *LIDXA Bulletin.*

Winners will be announced in the first June issue of the Long Island DX Bulletin and other selected amateur publications.

Entries should be received by the Long Island DX Association as early as possible in March to be considered. The entries should be sent to: LIDXA, P.O. Box 73, Westbury, New York 11590, U.S.A.

*P.O. Box 1271, Covina, CA 91722

Gary, YJ8GS is shown at the beginning of the 1974 CQ CW WW DX Contest. The special DX Hat brought 2500 QSO's in the contest! QSL's go to Gary's home call, W6NJU in Fair Oaks, California.

The CQ DX Award Program

C.W. DX

170.....K6SF
171.....OK1AEH

2×SSB DX

378.....XE2MX
379.....K6AQV
380.....UA4CO
381.....UL7NW
382.....WB2JJN

Endorsements

C.W.: W6PT-320
2×S.S.B.: TI2HP-320

Complete rules and application forms for the *CQ* DX Award program may be obtained by sending a business size, self-addressed stamped envelope to DX Editor, P.O. Box 1271, Covina CA 91722—USA.

DXing From New Hebrides

The following account of W6NJU's operation from New Hebrides as YJ8GS appeared in *The World Radio News* for January 1975. The

The WAZ Program

Single Band WAZ
20 Meter Phone

4.....LU1BAR

S.S.B. WAZ

1236.....JA2AAQ
1237.....LU1BAR
1238.....IT9AZS
1239.....YU2OB
1240.....WØOVL
1241.....W5ILR/TF
1242.....JA6GDG
1243.....DL6QT
1244.....DJ3HJ
1245.....DJ6XG

C.W.—Phone WAZ

3785.....K6TUL
3786.....WA4LDM
3787.....W3HCW
3788.....SP9UH
3789.....W4QQN
3790.....YU2BOP
3791.....W7GYP
3792.....EA4MY
3793.....DL6GN
3794.....JA2IU
3795.....DM3PQO
3796.....UY5OQ
3797.....UB5NS
3798.....UK9HAC

Phone WAZ

502.....I8LEL

Complete rules for the Single Band WAZ Program are shown on pgs. 57-58 of the December, 1972 issue of *CQ*. Complete rules for regular WAZ may be found on pgs. 64-66 of the June, 1970 issue. Application blanks are reprints of the rules for all WAZ awards may be obtained by sending a self-addressed, stamped enevelope to the Assistant DX Editor, P.O. Box 205, Winter Haven, FL 33880.

CQ DX AWARD HONOR ROLL

The *CQ* DX Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more countries for the mode indicated. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard. The total number of current countries on the DXCC list as of this listing is 321.

C.W.

W6PT 320	W4IC 309	WØAUB 304	W4BQY 299	K1SHN 289
K6EC 316	W4YWX 309	W6ISQ 303	DL3RK 298	WA6EPQ 288
W6ID 316	W9DWQ 305	K6LEB 302	W6NJU 294	WA8DXA 287
W8KPL 314	ON4QX 304	VK3AHQ 301	WA6MWG 293	DJ7CX 281
W8LY 310				

2×SSB

TI2HP 320	W6KTE 314	K4RTA 308	K9WEH 301	YV1LA 289
W2TP 320	W9DWQ 314	W9KRU 308	WB6DXU 300	OE1FF 288
W2RGV 319	W9JT 314	VE3GMT 307	K6AQV 299	WAØKDI 288
DL9OH 318	F9RM 313	K3GKU 307	K8DYZ 299	DJ7CX 287
IØAMU 318	G3FKM 313	K6EC 307	HP1JC 298	DL6KG 287
WA2RAU 318	I8AA 313	F9MS 306	WØYDB 298	K1KNQ 287
W9ILW 318	SM6CKS 313	WA3IKK 306	K4HJE 297	DL1MD 286
K2FL 317	WA2EOQ 313	W9QLD 306	W6FW 297	OE3WWB 286
W4EEE 316	W2QK 313	XE1AE 306	DK2BI 296	K8GQG 286
W4NJF 316	W6RKP 313	OZ3SK 305	YV1KZ 296	W3CRE 284
SM5SB 315	K6WR 313	KH6BB 305	G3RWQ 295	DK1FW 282
W3AZD 315	K4MQG 312	ZL1AGO 305	W90HH 295	VA7WJ 282
W4IC 315	F2MO 311	VE2WY 304	YS1O 295	WB6PNB 282
W4SSU 315	IØZV 311	W2CNQ 304	K1SHN 294	W6TCQ 282
W6EUF 315	I8YRK 310	G3DO 303	W8ZOK 293	K8PYD 282
W6REH 315	W6NJU 310	WA6AHF 303	WAØCPX 293	WA2VEG 280
I8KDB 314	ZL3NS 310	W6KZS 303	W0SFU 291	OK1MP 279
IT9JT 314	ZS6LW 310	VE3MJ 302	G3KYF 290	W6HUR 279
VE3MR 314	W3DJZ 309	OE2EGL 301	WB2RLK 290	I1WT 275
W3NKM 314	WA6MWG 309	SM6CWK 301	W6FET 290	VE7HP 275
W6EL 314	W6YMV 309	WA2HSX 301	XE2YP 289	

author, Gary Stilwell, is a former *CQ* DX Committee Member and is currently on the ARRL DX Advisory Committee.

"Efate, an island of the New Hebrides condominium, is fairly level with dense green vegetation. Bob Lusk, YJ8BL, our host, had said we would move faster through customs if we used the French side as most people automatically go through the British side. Bob was right and we would have sailed through if I hadn't misplaced some of my entrance documents.

"After five years of weekly schedules we had finally met for an eyeball QSO. I had carried with me a rotator for Bob's beam and after clearance through customs we were on our way to an enjoyable five day stay.

"Bob was very gracious and fortunately band conditions were much better than they had been when I left the states. In all over 2,500 contacts were made. I had the opportunity to work several stations on 75 meters and even made a few contacts on that band with the East Coast of the United States.

"Most U.S. tourist do not go through YJ8 in the normal course of their travels, therefore it appeared somewhat rare for someone from the United States to be visiting. The shopping atmosphere at Port Villa was quite different from that in Fiji and shopping in the local stores was quite a pleasure. We were able one day to go out to one of the local beaches and enjoy the fine swimming and a look at the beautiful underwater life in that area.

"Bob also hosted a party in which most of the active YJ8's on Efate attended. It was

The Twin City DX Association recently hosted Bob Stone, VK5PB in Minneapolis. Shown left to right are Bob, WØSFU the winner of CQ 20 Meter Phone WAZ #1, Ed, WØGYH first Minnesota 5BDXCC, VK5PB, and CQ DX Committee member Bill, WØYDB.

Jim Rafferty, WA9UCE/6-KP6KR (R) receives honorary lifetime membership in the Arkansas DX Association from ADXA president, W5KGJ, (L) at the ADXA's annual banquet in Hot Springs, Arkansas, in early December. Jim presented a program on this year's Kingman Reef DXpedition.

This is Rick, WA5VDH a member of the CQ WPX Honor Roll, with his DX Hound! Rick's FB Wallpaper includes WAZ, CQ CW DX Award, and Mixed, C.W. and S.S.B. WPX!

very interesting to chat with these people and to discuss Amateur Radio with them.

"Of course from this location the JA stations are quite plentiful. Whenever we would get on, if all else failed there would be JA anxiously awaiting a contact. The *CQ* World Wide CW Contest was quite an experience and it was exciting to hear a band like 10 meters open to Europe at midnight. It was extremely difficult to come down to 40 or 80 meters to work a few W's when 15 and 10 produced many more contacts during the 0800 and 1200 GMT time period.

"Unfortunately the five days went extremely fast, and the time came to continue with the trip. As we lifted off the runway heading for Noumea, New Caledonia the rest of the travels became anticlimactic."

Centennial Call Signs

The FCC is still considering ground rules for Special Prefixes in 1976. Prefix blocks currently allocated to the US are W/WA-WZ, K/KA-KZ, AA-AL, and NA-NV. The FCC will accept any suggestions of plans which are "Self Assignable" and avoid prefixes which are used for possessions and those which may be used in the license restructuring which has been proposed. There are already some call sign issuance changes being made on the West Coast. The WC6 calls are being skipped and WD6 calls are being issued in California, while WB7 prefixes are being issued in the seventh call area before the end of the WA7 series was issued.

Most Wanted Country

DX News Sheet has recently listed the "most wanted" countries based on the response of 157 of the world's top DXers. The leading ten countries are shown below with the number needing them in parenthesis. Keep in mind that this is a world-wide poll and not necessarily indicative of the US only. For instance, it is possible that a US poll would place Iraq as "more rare" than Bouvet and So. Sandwich Islands.

1. Clipperton (147)
2. Bouvet (139)
3. So. Sandwich (129)
4. China (126)
5. Iraq (108)
6. Iraq/Arabia Neutral Zone (107)
7. Burma (97)
8. Sikkim (95)
9. Mellish Reef (89)
10. Kamaran Island (87)

10 Meter Activity Day

The RSGB has announced a 10 Meter Activity Day on March 16, 1975. This is not a contest but a propagation exercise to test the 10 meter band at the minimum stage of the sun spot cycle. All amateurs are asked to send a list of stations worked or heard showing the GMT time, mode and frequency. An S.A.E. and IRC will provide a detailed report of the test period if wanted. Mail lists to: RSGB 10 Meter Activity Day, C/O David A. Whitaker, Hillcourt 57, Green Lane, Harrogate, North Yorkshire, England.

73, Jerry, WA6GLD

The WPX Program

Mixed

465.....K9HLW
466.....VE3DXV/W6
467.....WB4RUA

C.W.

1369.....WA2DFC
1370.....UB5GBD
1371.....UK9HAC
1372.....UA1RJ
1373.....UK4AAI
1374.....UY5ZH
1375.....OK1IBF

2×SSB

827.....DL7PD
828.....CT1BY
829.....WA6EGL/TF

VPX

82.....UQ2-037-3/UA0
83.....UA9-167-134

Endorsements

Mixed: PA0SNG-1050, WB4KZG-950, G5GH-750, VE3-DXV/W6-500, K9HLW-450
C.W.: DL1QT-950, W9AUB-850, WA5VDH-600, WA2-EAH, KH6HC, IØZQ-500, W0MHK-350
2×S.S.B.: W4NJF-1200, W4WSF, PA0SNG, I8AA-900, PY3BXW-750, WB9EBO-500, WA1JMP-400, CT1BY-350
160 Meters: W4WSF, OK2DB, OK1TA, OK1AJJ, OK2BOB, OK1IBF
80 Meters: OK1TA
40 Meters: OK1TA
20 Meters: OK1TA, UB5GBD, UY5ZH, UA3-27320
15 Meters: OK1TA
10 Meters: G5GH, OK1TA
Africa: WA2EAH
Europe: UB5GBD, UA1RJ, UY5ZH, OK1IBF, UA3-27320
North America: WA4EMP, WA2EAH

Complete rules for WPX, WPNX and VPX may be found on page 67 of the February 1972 issue of *CQ*. Application forms and reprints of the rules may be obtained by sending a business size, self-addressed, stamped envelope to WPX Award Manager, P.O. Box 1271, Covina, CA 91722—USA.

Propagation

BY GEORGE JACOBS,* W3ASK

WWV now includes current readings of *solar flux* and *geomagnetic activity* on its propagtion broadcasts made *fourteen minutes* past each hour on *2.5, 5, 10, 15, 20* and *25 MHz*. The availability of this data to the radio amateur greatly simplifies do-it-yourself forecasting of daily changes expected in h.f. propagation conditions.

The Editor of this column has teamed up with Theodore Cohen, W4UMF, to write a special article which describes how the solar flux and geomagnetic activity data now broadcast on WWV, along with the *Propagation Charts* appearing monthly in this column, will permit radio amateurs to make their own day-to-day forecasts for any path and for any h.f. band, for up to 28 days in advance. Entitled *A Breakthrough In Simplifying Ionospheric Propagation Forecasts*, it appears elsewhere in this issue of *CQ*.

H.f. propagation conditions usually undergo noticeable change during March, as the sun appears higher in the northern sky and the length of daylight increases in the northern hemisphere. Spring propagation conditions, which begin during March, are typified by *fewer* east-west DX openings on the *10* and *15 meter* bands. (to Europe and the Far East, for example); a *greater* number of hours in which DX openings can occur on *15* and *20 meters; fewer* hours for DX openings on *40, 80* and *160 meters;* a seasonal *increase* in the level of static on all h.f. bands, and an *improvement* in v.h.f. ionospheric propagation.

During March and continuing through April, a considerable seasonal improvement is expected in propagation conditions over long paths between the northern and southern hemispheres. This results from the relatively similar h.f. propagation conditions that exist in the temperate regions of the northern hemisphere (where it is spring) and the southern hemisphere (where it is fall), as compared to the more extreme conditions that exist when it is summer in one hemisphere and winter in the other. A similar condition also occurs when it is fall in the northern hemisphere and spring in the south.

*11307 Clara Street, Silver Spring, MD 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For March, 1975

	Rating & Forecast Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date *March*				
Above Normal: 8-9, 21-23	A	A-B	B-C	C
Normal: 1-2, 7, 10, 12-13, 16-18, 20, 24-29	A-B	B-C	C-D	D-E
Below Normal: 3, 6, 11, 14-15, 19, 30-31	B-C	C-D	D-E	E
Disturbed: 4-5	C-D	D	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals.

B—Good opening, moderately strong signals with little fading or noise.

C—Fair opening, signals between moderately strong and weak, with some fading and noise.

D—Poor opening, signals weak with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation* index associated with particular band opening from Propagation Charts appearing on the following pages.

2. With the *propagation index*, use the above table to find the expected signal quality associated with the particular opening for any day of the month. For example, all openings shown in the Charts with a *propagation index* of (3) will be fair-to-good (B-C) on Mar. 1-2, fair-to-poor (C-D) on the 3rd and poor (D) Mar. 4-5, etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, or subscribe to MAIL-A-PROP, P.O. Box 86, Northport, N.Y. 11768.

Improved inter-hemispheric openings are expected this month on *15, 20* and *40 meters* from the USA to Australasia, South America, southern Africa and similar southern areas. Some improvements on these paths may also be noticeable on *10, 80* and *160 meters*.

The best bands for DX propagation during March should be *15* and *20 meters* during the day; *20* and *40 meters* during the early evening, and *40* and *80 meters* during the hours of darkness. For more specific information, refer to the *DX Propagation Charts* which appeared in last month's column. This month's column contains *Short-Skip Propagation Charts* which are valid for both *March* and *April*, as well as *Propagation Charts* centered on Alaska and Hawaii. The Short-Skip Charts contain band opening forecasts for predominantly one-hop paths, ranging in distance between approximately 50 and 2300 miles.

For day-to-day changes in h.f. propagation conditions expected during March, see the *Last Minute Forecast*, which appears at the beginning of this column.

Sunspot Cycle

The Swiss Federal Solar Observatory reports a monthly mean sunspot number of 20.4 for December, 1974. This results in a running smoothed sunspot number of 36, centered on June, 1974. A smoothed sunspot number of 26 is forecast for March, 1975, as the present cycle continues to decline very slowly towards a minimum.

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters), as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts, the predicted times of openings are found under the appropriate Meter band column (10 through 80 Meters) for a particular geographical region of the continental USA, as shown in the left hand column of the Charts. An * indicates 80 Meter openings. Openings on 160 Meters are likely to occur during those times when 80 Meter openings are shown with a *propagation index* of (2), or higher.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

3. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. On the Short-Skip Chart appropriate *Standard* time is used at the *path midpoint*. For example, on a circuit between Maine and Florida, the time shown would be EST; on a circuit between N.Y. and Texas, the time would be CST, etc. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones, add 2 hours in the PST zone, 3 hours in MST zone; 4 hours in CST zone; and 5 hours in the EST zone. Add 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *Standard* time in other areas of the USA, subtract 8 hours in PST zone, 7 hours in MST zone, 6 hours in CST zone, 5 hours in EST zone. For example, at 20 GMT it is 15 or 3 P.M. in NYC.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts c.w. or 300 watts p.e.p. on sideband; The Alaska and Hawaii Charts are based upon a transmitter power of 250 watts cw or 1 kw p.e.p. on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level; for each 10db loss, it will lower by one level.

5. Propagation data contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

V.h.f. Ionospheric Openings

The possibilities for ionospheric openings on the v.h.f. bands usually improve during March and the spring months.

A seasonal increase in short-skip openings due to sporadic-E propagtion generally begins during March, and an occasional *6 meter* opening may be possible by this mode during the month. Sporadic-E openings most often occur during the daylight hours, over distances between approximately 1000 and 1400 miles.

Auroral activity often peaks during March, especially during periods when h.f. conditions are below normal or disturbed. Best dates to check are March 3-6, 11, 14-15, 19 and 30-31.

Not much meteor activity expected during March, but some might be possible for very brief periods during minor showers that may occur March 14-15 and 24-25.

In southern states, check the *6 meter* band for possible trans-equatorial scatter propagation (TE) towards South America between 8 and 11 p.m., local time.

Contest Info

March is a month of DX Contests. Conditions are expected to be Normal during the ARRL DX Phone Contest on March 1-2. Below Normal conditions are forecast for the first day of the ARRL DX C.W. Contest on March 15, but they should improve to Normal on the 16th, the second day of the Contest. It looks like Normal conditions on March 29th for the opening day of the *CQ* WW WPX SSB Contest, but conditions may slip Below Normal on the 30th.

Anniversary

This column marks the beginning of my 25th year as Propagation Editor for *CQ*. I want to again thank all of you, whom, over the years have taken the time to drop me a line expressing an interest in radio propagation and in this column in particular. During the years ahead I intend to continue to keep radio amateurs advised of propagation conditions in this column and to explain some of the behavior patterns of the natural phenomena that make h.f. communications possible.

73, George, W3ASK

CQ Short-Skip Propagation Chart
March & April, 1975
Local Standard Time
At Path Mid-Point

Band (Meters)	*Distance Between Stations (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	*Nil*	08-19 (0-1)	08-13 (1-0) 13-16 (1) 16-19 (1-0)
15	*Nil*	08-16 (0-1)	09-12 (1) 12-17 (1-2) 17-18 (0-1)	08-09 (0-1) 09-10 (1) 10-13 (1-2) 13-14 (2) 14-17 (2-3) 17-18 (1-2) 18-20 (0-1)
20	*Nil*	07-08 (0-1) 08-09 (0-2) 09-14 (0-3) 14-16 (0-2) 16-23 (0-1)	07-08 (1) 08-09 (2) 09-10 (3) 10-14 (3-4) 14-16 (2-4) 16-18 (1-4) 18-19 (1-3) 19-20 (1-2) 20-23 (1) 23-05 (0-1)	06-07 (0-1) 07-08 (1-2) 08-09 (2-3) 09-10 (3) 10-15 (4-3) 15-18 (4) 18-19 (3) 19-20 (2-3) 20-21 (1-2) 21-05 (1) 05-06 (0-2)

#See explanation in "How To Use Short-Skip Charts" in box at the beginning of this column.
* Indicates best time for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2), or higher.

40	07-09 (0-1) 09-10 (0-2) 10-12 (2-3) 12-17 (3-4) 17-19 (2-3) 19-20 (1-2) 20-22 (0-1)	06-07 (0-2) 07-09 (1-4) 09-10 (2-4) 10-15 (4-3) 15-17 (4) 17-19 (3-4) 19-20 (2-4) 20-22 (1-2) 22-00 (0-2) 00-06 (0-1)	06-07 (1) 07-08 (4-2) 08-15 (3-1) 15-17 (4-2) 17-19 (4-3) 19-20 (4) 20-22 (2-4) 22-00 (2-3) 00-06 (1-2)	06-08 (2-1) 08-15 (1-0) 15-16 (2-0) 16-17 (2-1) 17-19 (3-2) 19-21 (4-3) 21-22 (4) 22-00 (3-4) 00-02 (2-3) 02-06 (2)
80	07-08 (2-3) 08-11 (3-4) 11-18 (4) 18-20 (3-4) 20-22 (2-3) 22-00 (1-2) 00-06 (1) 06-07 (1-2)	07-08 (3-2) 08-11 (4-1) 11-16 (4-0) 16-18 (4-2) 18-20 (4-3) 20-22 (3-4) 22-00 (2-4) 00-06 (1-2) 06-07 (2)	07-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-00 (4) 00-05 (2-3) 05-07 (2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-00 (4-3) 00-05 (3) 05-07 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3) 22-03 (4) 03-05 (4-3)	05-06 (1) 06-19 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-3) 03-05 (3-2)	05-06 (0-1) 06-19 (0) 19-20 (1-0) 20-22 (2) 22-03 (3-2) 03-05 (2-1)

ALASKA
Openings Given In GMT

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	*Nil*	22-00 (1)	22-00 (1) 00-02 (2) 02-04 (1)	06-13 (1) 07-12 (1)*
Central USA	*Nil*	20-22 (1) 22-00 (2) 00-01 (1)	22-00 (1) 00-03 (2) 03-05 (1)	07-09 (1) 09-12 (2) 12-14 (1) 07-12 (1)*
Western USA	*Nil*	20-22 (1) 22-00 (2) 00-03 (1)	19-22 (1) 22-00 (2) 00-02 (3) 02-04 (2) 04-06 (1)	06-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-15 (1) 08-10 (1)* 10-12 (2)* 12-14 (1)*

HAWAII
Openings Given In Hawaiian Standard Time

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	*Nil*	08-11 (1) 11-13 (2) 13-14 (3) 14-15 (2) 15-16 (1)	02-05 (1) 05-07 (2) 07-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-21 (1)	18-19 (1) 19-21 (2) 21-00 (3) 00-02 (2) 02-03 (1) 19-21 (1)* 21-00 (2)* 00-02 (1)*
Central USA	11-15 (1)	08-09 (1) 09-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	03-05 (1) 05-08 (2) 08-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-21 (2) 21-23 (1)	18-19 (1) 19-21 (2) 21-01 (3) 01-04 (2) 04-05 (1) 19-21 (1)* 21-01 (3)* 01-02 (2)* 02-03 (1)*
Western USA	11-15 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	02-04 (1) 04-06 (2) 06-09 (4) 09-11 (3) 11-13 (2) 13-15 (3) 15-17 (4) 17-19 (3) 19-21 (2) 21-23 (1)	17-19 (1) 19-20 (2) 20-23 (4) 23-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-21 (2)* 21-04 (3)* 04-05 (2)* 05-06 (1)*

Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All Counties
#118 L. Frank Coursey, G4JZ, 11-7-74

THE "Story of The Month" for March is:

Claude S. Cain, K9HRC
(All Counties #104, 5-10-73)

It is amazing that so many of us think we do not have a "Story" to tell, but we all do! It is impossible to go through even a few years of amateur radio, County Hunting, etc.—without lots of interesting things happening.

Claude is very modest but I'll pass along the information that Bertha, WA4BMC (bless her soul) was able to pry from him.

"My first license was received in 1958, but I did not get interested in County Hunting until February 23, 1970 when I made my first contact for a County with WA8TQD/M8 in Belmont County, Ohio on 20 meters, Before that time I had given out many mobile contacts on the 20 meter Independent CH Net.

"My XYL, Hazel, K9QGR (USA-CA-500-#51, dated 1-18-62) has been County Hunting for a long time and should have them *ALL*, long before you read this.

"Most of my contacts were made on the 20 meter ICHN but I did make about 60 contacts on 40 and 75.

The rig was, and still is, a TR4 with a 4 BTV antenna and my last county came via W4LXI on April 25, 1973 and was New Hanover, N.C.

"I'd like to thank all the mobile operators, for without them I wonder how many of us would ever work all the counties.

"I am 65 years old and have been retired, because of a disability, since 1967. I was a farmer in Central Illinois for about 15 years and before that I owned a camera shop in Los Angeles".

Claude waited until he had them *all* and on May 10, 1973 received USA-CA-500 through USA-CA-3000 endorsed All 14 Phone. Now we will see how long it takes for Hazel, K9QGR to get around to the paper work necessary for her *All Counties.*

Awards Issued

As noted in the Special Honor Roll, Frank Coursey, G4JZ became the 4th *All Counties Award* winner outside the Continental USA. The others were ZL1KG, #52, 3-3-71; TG9UZ, #59, 6-7-71; and VE3CBY, #83, 8-12-72.

Cletus Dunn, W1DIT (like Riley Dunn, WAØCEL) nearly dunn them *all* and was issued USA-CA-3000.

Wes Lynn, WAØYFQ was issued USA-CA-500 through USA-CA-2500 endorsed *All* S.S.B.

Mixed USA-CA-500 Awards went to:
Bob Lamberton, WA3QNT and
Hartwin Weiss, WA3KWD.

Awards

Australian Chapter 66 of ICHC are sponsoring two new Awards based on the Australian Commonwealth Electorates, they being the source of their members of parliament. Although no cost is listed, QSL cards are required with your application, so I must assume return postage should be included. An official checking list of Electorates and full details and rules may be obtained by sending 30c in stamps (US stamps ok) to the Sec. Custodian, Mr. Jack Guther, VK3APU, 17 Foulds Court, Montrose, Victoria. Australia 3765. Contacts made on and from 1 January 1973 are eligible. If QSLs do not list the Electorate, VK2ZA, Mr. A. A. B. Slight (president) 31 Lamrock Ave., Bondi Beach, N. S. Wales, Australia 2026, has promised to help if you give him the call sign, date of QSO and name of town or suburb —may I suggest you send him a S.A.E. & IRC and in the future ask each VK his *FEDERAL* Electorate.

A.C.E. 25 Award: Issued for establishing two-way radio contact in at least 25 Australian Commonwealth Electorates. This basic Award requires contacts with 9-VK2s, 6-VK3s, 4-VK4s, 2-VK5s, and one each for VK1, 6, 7, and 8. Stickers are awarded for 50, 75 and 100, contacts which may be at random after the first 25.

*P.O. Box 73, Rochelle Park, N.J. 07662.

YLs/XYLs at Ft. Wayne.

USA-CA HONOR ROLL

3000	2000	500
W1DIT 144	WAØYFQ ..211	WA3QNT ..1025
2500....	1500	WAØYFQ ..1026
WA0YFQ ..179	WAØYFQ ..253	WA3KWD 1027
	1000	
	WAØYFQ ..343	

County Hunters at ICHN/MARAC Ft. Wayne.

A.C.E. 125 Award: Issued for making two-way contact with amateurs in **all** (125) Australian Commonwealth Electorates.

MARAC 2nd Time Around Award: (All Counties) details and foto later, if you can not wait, write (with S.A.S.E.) WØSJE.

Vastmanland County Radio Society Awards (Vasteras, Sweden): Which include *Worked American Capital Cities; Worked Asian Capital Cities; Worked African Capital Cities; Worked European Capital Cities* and many others soon, but if you can not wait, write: Urban Eugenius, SM5BTX, Patrullgatan 6, S-723 47 Vasteras, Sweden. And for data on *Worked 100 SM* and/or *100 SM5*, write Harry Akesson, SM5WI, Vitmaragatan 2, S-722 26 Vasteras, Sweden.

Notes

Sorry for delays, space scarce, am doing the best I can, and I do miss things—some delays mine, some are others.

Here are two fotos, long delayed from Fort Wayne—'73—First row—W9ZHD, WA9NKN, WØSZC, W8ZCV, K8KOM, W5HDK, WB4WDY, WAØEVO, WAØDCQ, W9DRL, WB4FBS, W9CTA/7, WØBL, K9CSL, WB6EXT, W9SOM, W9MNE and W8UOQ.

Second row: WA8QQM, WA9OBR, HB9AW, W3SQA, W7OK, K3ORP, WA5YSC, K3NEZ, W4IZR, K2KQC, W8WUT, W8MKM, WB8FTH, WA4LSU, W9CNG, VE4QZ, K3VQO, W4UYC, WBØELJ, WAØWOB and W4ISF.

Third row: W3GWA, K4ZA, WA9EZP, WA3GLJ, K4RQX, W9UZC, WB9IMH, K8IQB, WA2AEA, K9EMV, K5KDG, W8OA, VE3CBY, W9IWJ, W4ISE, WA9GOH, WA5FRN, WA8ZBA, K8DCR, WB4TNY, WB9DCZ, KØYGH, K3FFJ, W8NXN, KØARS, K3LXN and WA4VAP.

Fourth row: KØIFL, K3JZY, K9KKX, W8CXS, WAØUPL/8, W9LHG/Ø, WA4ULL, W3RWJ, K1VKY, K2PFC, W7IEB, WØSJE, WA9BHH, K9GTQ, W4UVP, K9DCJ, WAØGZA, WB4WBP, K8QWY, K1IIK, W1DIT, W9SDK, W4IGW, W3FVU and W6CCM.

And the XYL Picture Identification: Sorry, had to cut names, First row: W9ZHD, XYL, W3FVU XYL, WA9BHH XYL, K2KQC, WAØEVO XYL, K3ORP XYL, W9DRL XYL, WA9OBR XYL and W6CCM XYL.

Second row: WA9QQM, K4RQX XYL, W7IEB XYL, W8WUT, WB9IMH, K3ORP XYL, W4IGW XYL, K9DCJ XYL, W7CDH, W4IZR, and WB6EXT XYL.

Third row: W9IWJ XYL, W3GWA XYL, WA9EZP, WA3GLJ, K2PFC XYL, WA2AEA XYL, WA8ZBA XYL, W1DIT XYL, KØARS XYL, W9SDK XYL, WA4LSU XYL, K3FFJ XYL, WAØWOB XYL, and WB4WBP XYL.

Fourth row: KØYGH XYL, W3SQA XYL, WN3VBZ, WB8FTH XYL, WØSZC XYL, WBØELJ XYL, W3RWJ XYL, WAØGZA XYL, K5KDG XYL, W4ISF XYL, K9CSL XYL, WB4WDY XYL and W9SOM XYL.

Sorry, again all space gone, please write and tell me, how was your month?

73, Ed., W2GT

A.C.E. 25 Award

A.C.E. 125 Award

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Mar.	1-2	ARRL DX Phone Contest
*Mar.	8-9	YL-OM C.W. Contest
*Mar.	8-9	Commonwealth Contest
Mar.	15-16	ARRL DX C. W. Contest
*Mar.	22-23	Tennessee QSO Party
*Mar.	22-24	BARTG RTTY Contest
*Mar.	22-24	Prairie Dog QSO Party
Mar.	**29-30**	**CQ WW WPX SSB Contest**
Mar.	29-Apr. 6	Easter Week WAS Contest
Apr.	4-6	Novice QSO Party
Apr.	5-6	Florida QSO Party
Apr.	5-6	Polish C.W. DX Contest
Apr.	12-13	Swiss (H-22) Contest
Apr.	12-13	County Hunters SSB
Apr.	12-14	Virginia QSO Party
Apr.	19-20	Bermuda Phone Contest
Apr.	19-20	WAEDC RTTY Contest
Apr.	19-21	Ø District QSO Party
Apr.	26-27	PACC Phone/C.W. Contest
May	2-5	CHC/FHC/HTH Party
May	3-4	Bermuda C.W. Contest
May	3-5	Connecticut QSO Party
May	10	World Telecomm. Phone
May	17	World Telecomm. C.W.
May	17-18	YL ISSBers QSO Party
May	17-19	Michigan QSO Party

*Covered in last month's Calendar

Easter Week WAS Contest

From 0001 March 29 to 2359 April 6. (GMT)

The Radio Society of Greater Brooklyn organized this one. The object being to work all states during the contest period.

You can use all bands and modes.

Exchange: Signal report, state and name.

Scoring: Only the number of states you work count as your score.

Awards: Station working WAS in the shortest time is the overall winner. Those making WAS during the contest period will also receive certificates. Special recognition will be given if it is accomplished on a single band, RTTY, SSTV, QRP and etc.

Send your log indicating states worked, equipment used and etc. to: Frank Grossman, WB2BXO, 9519 Avenue M, Brooklyn, N.Y. 11236.

*14 Sherwood Road, Stamford, Conn. 06905.

Novice QSO Party

Starts: 1800 GMT Friday, April 4
Ends: 0600 GMT Sunday, April 6

This one is again sponsored by the International Novice ARA and open to all class amateur stations. The object of course is to work Novice stations in the US Novice bands.

Exchange: Signal report and name.

Scoring: For Novices, multiply total number of QSO's by the number of different prefixes worked. Non-Novices use different novice prefixes worked for their multiplier. (i.e. WN4, WN8, OA3N and etc.) The same station may be worked once only.

Novice Bands: 3700—3750, 7100—7150, 21100—21200, 28100—28200.

Awards: There will be appropiate awards for Novice and non-Novice winners.

Following prefixes will identify novice stations: EL-NX, HC-NXX, HI-NXX, KG4NXX, KZ5XXN, LB-XX, OA-NXX, OL-XXX, VU2-XXZ, WH6XXX, WL7XXX, WN-XXX, WP4-XXX. The dash indicates a numeral and the X a letter in the call.

Logs go to: Andi Anderson, WB5MYV, Boles Route, Waldron, Ark. 72958.

Florida QSO Party

Three Periods (GMT)
1500 to 2000 Saturday, April 5
0000 to 0500 Sunday, April 6
1400 to 2359 Sunday, April 6

This is the 10th annual QSO Party sponsored by *Florida Skip*.

Phone and c.w. are separate contests. The same station may be worked on each band for QSO points. Floridians may work in-state stations but for QSO points only.

Exchange: RS(T) and QTH. County for Fla., state, province or country for others.

Scoring: 1 point per QSO. Fla. use states (49) provinces (12) and DX countries (12) for their multiplier. Max. of 73. (Limit of 12 DX) Out-of-state use Fla. counties. (67)

Frequencies: C.W.—1808, 3580, 7080, 14080, 21080, 28080. Phone—1818, 3980, 7280,14318, 21380, 28580.

Awards: Certificates, phone and c.w. to the top single operator score in each state, province and DX country, and each Florida county. There are also 5 trophies as follows: High single operator in Florida and out-of-state, phone and c.w. And to the Florida Club with the highest aggregate score.

A summary sheet is requested showing the scoring and other pertinent information. Also name and address in BLOCK LETTERS, and a signed declaration that all rules and regulations have been observed. Include a 13c stamp for issue of *Florida Skip* with the results.

Mailing deadline is May 30th to: Florida Skip Contest Committee, P.O. Box 501, Miami Springs, Florida 33166.

Polish C.W. DX Contest

Starts: 1500 GMT Saturday, April 5
Ends: 2400 GMT Sunday, April 6

It's the world working the SP's on all bands 3.5 thru 28 MHz. There are three catagories: Single operator, single and all band; multi-operator, all band only; and s.w.l.

Exchange: RST plus a 3 figure QSO number starting with 001 for foreign stations. Polish stations will send RST and their powiat letters. (i.e. 579AB and etc.)

Scoring: Each QSO with a Polish station counts 3 points. Score a multiplier for each different powiat worked.

Final Score: Multiply the total QSO points by the number of different powiats worked. The same station may be worked on each band for QSO points but a powiat may be counted only *once* as a multiplier.

Awards: Certificates to the top scorers in each catagory, in each continent and each country and call areas of Australia, Canada, USA and USSR.

Contacts for this contest may be credited for the PZK 100 Powiat award in lieu of QSL cards, provided they are confirmed in the logs of SP stations, and an application is made. Include a fee of 7 IRC's.

Use a separate sheet for each band and include a summary sheet with all the scoring information. The usual signed declaration is also requested. The usual disqualification rules will be inforced, including excessive duplicate contacts.

Entries must be postmarked no later than April 30th to PZK Contest Committee, P.O. Box 320, 00-950 Warszawa, Poland.

Swiss H-22 Contest

Starts: 1500 GMT Saturday, April 12
Ends: 1700 GMT Sunday, April 13

Many of the rare Cantons are activated for this contest offering an excellent opportunity for the attractive H-22 certificate.

Contacts may be made on all bands, 1.8 thru 28 MHz, phone and c.w. The same station may be worked on each band for QSO and multiplier credit but only on *one* mode.

Exchange: The RS(T) plus a 3 figure contact number starting with 001. Swiss stations will also include their Canton. (579001/ZH)

The 22 Cantons are: AG, AR, BE, BS, FR, GE, GL, GR, LU, NE, NW, SG, SH, SO, SZ, TG, TI, UR, VD, VS, ZG, ZH.

Scoring: Each QSO counts 3 points. The multiplier is the sum of Cantons worked on each band, a possible 22 from each band.

Final Score: Total QSO points multiplied by the sum of Cantons from all bands.

Awards: Certificates to the top scorers in each country and VE and W/K call areas.

Indicate a Canton in a separate column the first time it is worked on each band. Check your log for duplicate contacts, and include a summary sheet showing the scoring and other information. Your name and address in BLOCK LETTERS and the usual signed declaration.

Mail your log within 30 days to: USKA Traffic Mgr., HB9AHA, im Moos, 5707 Seengen, Switzerland.

1974 WAEDC Contest Results

Trophy Winners

Phone		C.W.	
	Europe	DJ8SW	Europe
UW9AF	Asia	UW9WL	Asia
WB2OEU	N. Amer.	K4VX	N. Amer.
PY4KL	S. Amer.	LU1DZ	S. Amer.
ZE1BL	Africa	W9FRG/6W8	Africa
VK4VU	Oceania	ZL3GQ	Oceania

U.S.A. Results

Phone

WB2OEU	389,256
K1JHX	247,380
WA1STN	192,942
W4WSF	175,676
W2GXD	144,568
K1CSJ	119,394
WA9NPM	23,944
W2LEJ	15,696
WA5VDH	6,204
W3YHR	6,144
W4WRY	5,450
WB4JYB	4,278
WB2NDR	1,368
WA1JZC	864
WA3UHJ	504
W6DGH	40

Multi-Op.

W9YT	37,370

C.W.

K4VX	340,784
W1ZM	334,881
K3GJD	263,700
W1PL	184,032
K4II	142,044
W7IR	66,019
WB4OGW	64,758
W9DD	64,083
WA5ZWC	50,520
W1BPW	46,659
WA2MBP	40,950
WA1LKX	37,600
W1FYZ	37,177
W2CP	37,169
W3ARK	36,562
WB2FNS	25,852
WA1SSH	21,090
WA2DLV	19,276
K4JD	19,275
K9UIY	17,019
WA2EAH	16,200
W2FVS	16,019
W4WSF	14,250
W2KHT	13,430
K8IDE	12,920
W1CNU	12,768
WA5QVI/4	11,259
W3AXW	11,120
W9OHH	8,928
WA3DMH	8,120
WA1STN	7,725
WA3RCA	7,670
W6DQX	6,784
K3MNT/7	6,480
K7NHV	6,204
W4HOS	6,204
W8DSO	5,565
WA3UHJ	4,830
W4ZM	4,069
WA0TAS	2,844
W8O0R	2,124
K3TLX	1,750
WA4KFC	1,482
W7LNG	1,092
W8IBX	1,073
W1CDC	924
W1OPJ	672
WA0KPE/9	550
W6GBY	520
VE2CK/W1	126
WB8OSE	105

Multi-Op.

W3AU	736,421
WA5VDH	32,384
W6BIP	16,308

County Hunters SSB Contest

Starts: 0001 GMT Saturday, April 12
Ends: 2400 GMT Sunday, April 13

This is the 4th annual contest sponsored by the Mobile Amateur Radio Awards Club to increase activity for the County Awards program.

The emphasis this year is on mobile stations with many rule modifications pertaining to them. It is suggested you write to KØARS for details.

Fixed stations may work other fixed stations only *once* but mobiles can be worked for each county or band change.

Exchange: Signal report, county and state. Country for DX stations.

Points: Contacts with a fixed W/K or VE, 1 point, 5 points if its a DX station, 10 points if its a mobile. (Portable considered fixed)

Multiplier: Total U.S. counties plus VE stations worked. Counties counted *once* only, VE's each time worked.

Final Score: Total QSO points × counties worked plus VE stations worked.

Frequencies: 3935, 7240, 14290, 21390, 28580. (Avoid Net frequencies, 3943, 7238, 14336. Contacts not valid.)

Awards: Certificates to the top 10 Mobile and fixed stations in the U.S. and Canada and each DXCC country. Four plaques, top fixed U.S. or Canadian, DX station, and 1st and 2nd Mobile station. Only single operator stations eligible.

Log and summary sheets are available by sending a large s.a.s.e. to KØARS.

All entries go to: James Willigham, KØARS, Route 1, Bevier, Missouri 63532 and must be received by June 1st 1975.

Virginia QSO Party

Starts: 1800 GMT Saturday, April 12
Ends: 0200 GMT Monday, April 14

This one is sponsored by the Sterling Park ARC. The same station may be worked on each band and mode, 1.8 thru 28 MHz, for QSO points. And Va. stations may work other in-state stations.

Exchange: QSO no., RS(T) and QTH. County for Va., state province or country for others.

Scoring: One point per QSO. Va. stations multiply total QSO points by sum of states, provinces, countries and Va. counties worked. Others use Va. counties for their multiplier. (max. of 98)

Frequencies: C.W.—60kHz. from low end of each c.w. and Novice bands. Phone—3930, 7230, 14285, 21375, 28575. (check phone bands on even GMT hours.)

Awards: Certificates to high scorers in each state, province, country and Va. county. Also top scoring Novice in and out of state. A special certificate to the top out of state score.

Indicate each new multiplier worked in a separate column on your log, and include a check and summary sheet.

Logs must be received by May 15th and go to: Gary D. Poorman, W4UPJ, 1114 S. Dickenson Ave., Sterling Park, VA 22170.

Bermuda Contest

Phone: April 19-20 C.W.: May 3-4
Starts: 0001 GMT Saturday
Ends: 0200 GMT Sunday

The Radio Society of Bermuda has built this up to a very popular event. Could be the troops have become aware of the special presentation arrangements for the Trophy winner.

Stations in the U.S. and Canada may work the U.K. and VP9s only. While U.K. stations work W/K, VE and VP9s. Phone and c.w. are separate contests with separate awards. Participation is for single operator stations only.

Exchange: RS/RST report and QTH. State for W/K, province for VE, county for the U.K. and Parish for the VP9s.

Scoring: Each completed QSO counts 3 points.

This year the multiplier is determined by the number of Bermuda stations worked on each band, 3.5 thru 28 MHz.

Awards: Certificates to the highest scoring station in each call area of the U.S. and Canada, and each United Kingdom country.

A trophy will be presented to the overall winner in each section, phone and c.w., for North America and the United Kingdom. Presentation will be made at the Annual Banquet held in October. Transportation and accommodations for a week's stay at one of Bermuda's leading hotels will be provided by the Society.

Last year's winners were W1BGD, G3LNS and VP9GE for the phone section, and K1RQE, G3HCT and VP9GO for the c.w. section. (Trophy winners are ineligible for a period of two years, regardless of the section won.)

Logs go to: The Radio Society of Bermuda, P.O. Box 275, Hamilton 5, Bermuda. And must be received no later than June 30th 1975.

Editor's Notes

Certificates for last year's WPX SSB Contest were processed and mailed back in December. If you had one coming and have not received it yet drop a note to Bernie, W8IMZ and Irene will make out a duplicate for you.

Rules for this year's affair appeared in last month's issue. No changes from previous years. Unfortunately this year's dates fall on Easter weekend, so it may conflict with some of your other obligations. However we feel that maintaining a firm date each year is very important. Therefore the WPX SSB Contest will always be found on the last full weekend in March.

The IARC Propagation Contest usually held in February and March has been dropped. The IARC has discontinued issuing CPR awards as of December 31, 1974. Therefore Rundy, K4ZA feels there is no further need for this activity.

Don't forget, for the last minute propagation forecast and special contest predictions call DIAL-A-PROP, 516-883-6223 any time day or night for a recorded message on conditions. Good luck. 73 for now, Frank, W1WY

CQ Check-In

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

THIS month I want to reminisce a bit about the surplus game, and bring some of the newer readers up to date—those who don't remember the acres of jeeps and thousands of Command Sets which flooded the U.S. in 1945 and 1946.

Of late, surplus has been manufacturers' overruns of integrated circuits, and little new in the way of complete and usable transmitting and receiving equipment has shown up. It was not always thus, in fact the oldies still can be found on military sales lists. The supply of BC-453 Command Receivers must be bottomless.

It is hard to remember that radio communications as we know it is only about 50 years old and practical mobile gear was not perfected until the beginning of World War II.

I once began an historical project on the premise that the U.S. had some good designs developed before 1940, and merely proceeded to produce them in quantity for the Allies. It turned out quite soon that we had very little good equipment until the War began in Europe, and we got through on technical luck and borrowing from our friends and enemies.

The SCR-522, a v.h.f. set which all readers over 35 will probably recall, was a U.S. "Chinese copy" of a British-developed set. That's why all those Bendix-made 522's have red crown insignia on them.

The "Gibson Girl," AN/CRT-3, the life raft radio of WW II, still used today in a very slightly improved version, was a British copy of a captured German "notsander" unit, picked up in the English Channel from a German aviator downed in the Battle of Britain.

The famous Command Set, SCR-274N and AN/ARC-5, was the design of a tiny independent company in Boonton, N.J., which had built Jimmy Doolittle's first radio receiver in 1929. Known as Radio Frequency Laboratories, then re-structured as Aircraft Radio Corp., a handful of design engineers worked out the first usable superhetrodyne receivers for military use in aircraft, overcoming military inertia and competition with companies such as Western Electric, Stromberg-Carlson Telephone, and Bendix Radio.

More than a million Command Sets were produced during the War, and afterwards an updated version was built for the Korean War, and installed in light aircraft and helicopters through the 1960's. I have seen 40 year-old BC-453 receivers still serving in Air Force transport aircraft in the 1970's, an incredible lifespan for a piece of electronics gear.

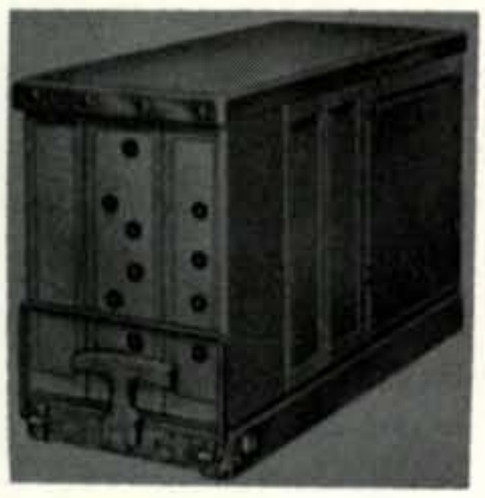
These command units (so-called because they were designed for plane-to-plane command orders) still offer as good a value for amateurs as anything in surplus, and they are still around in the dealers' hands. Fair Radio, Columbia Electronics, John Meshna—all of the old stand-

Table I—Command Receivers

Frequency	Nomenclature	Remarks
190-550 kHz	BC-453	part of Army SCR-274-N
	R-23/ARC-5	part of Navy's version
	R-23-A/ARC-5	updated R-23
	R-148/ARC-5	14 volt version of R-23A
	CBY-46126	early Navy ARA version of BC-453
	R-11A	postwar civilian version of R-23-A
520-1,500 kHz	BC-946-B	SCR-274-N, used chiefly for navigation
	R-24/ARC-5	Navy
	R-10-A	civilian version
	CBY-46103	Navy RAV series
1,500-3,000 kHz	R-25/ARC-7	Navy
	CBY-46104	RAV series
3-6 MHz	BC-454	SCR-274-N
	R-26/ARC-5	Navy
	CBY-46105	RAV, ARA series, Navy
6-9.1 MHz	BC-455	SCR-274-N
	R-27/ARC-5	Navy
	CBY-46107	ARA, RAV
9-13.5 MHz	CBY-46107	RAV series
13.5-20 MHz	CBY-46108	RAV series
	CBY-46083	RAT series
20-27 MHz	CBY-46109	RAV series
	CBY-46084	RAT series
100-156 MHz	R-28/ARC-5	Navy crystal version
100-125 MHz	R-112/ARC-5	tuneable version
125-156 MHz	R-113/ARC-5	tuneable version
108-135 MHz	R-13-Type 12	civilian version
	R-15-Type 12	civilian
	R-445/ARN-30	military R-13
118-148 MHz	R-19-Type 12	civilian version
	R-508/ARC-60	military version
108-135 MHz	R-1021/ARN-30D	crystal controlled (Last in Command Set configuration)

*1502 Stonewall Rd., Alexandria, Va. 22302

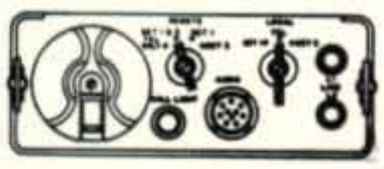
T-278/U TRANSMITTER F.M. 152 to 174 MC approx. 30 watts, crystal control on any two (2) preset freq. Phase shift modulation 15 KC Deviation, CR-27/U crystal unit freq. range 4750-5437.5 KC. multiplied 32 times. With tubes 2/3B4, 3/2E24, 4/5678, 2/5672 and 2/1AD4. Voltages required as shown with DY-93 dynamotor elsewhere on this page. Used **$14.95.** Size: 8½x4½x14½; wt: 12lbs.



R-394/URECEIVER F.M. 152-172 mc. Single Channel crystal control dual conversion, crystal freq. Range 24.033 to 27.7 third overtone, type CR-32/U, I.F. freq. 7.8 mc & 455 kc. 15 KC Deviation, output impedance 8 OHMS, power, 6 watts squelch and muting circ. Modular construction with plug-in units for easy servicing. 1rst R-F ampl. unit w/tubes 1/5840, 2/1AD4****Local Oscilator unit w/tubes, 2/1AD4, 1/5678, 1/VR31-5783****1st I- F7.8 mc unit w/tubes, 3/5678 *******2nd I-F and discriminator unit with tubes 7/5678****Audio and squelch unit with tubes 3/5678, 1/5672, 1/6AK6 Also 455 KC selective filter unit which is wired, not plug-in. Power supplies, connector, control unit and other items that are used with this set are listed elsewhere on this page. Size: 8½x5¾x14½; wt:19 lbs. Prices: Used good .... **$14.95.**

C-847 RADIO CONTROL Box Used to control the system, has heavy Alnico magnet 4" speaker for monitoring rec. controls for squelch, volume on/off SW. pilot lights and receptacle for H-33 Handset which has UG-77. Size: 9½x5¾x3½; wt: 6 lbs. **Used $8.95.** H-33/PT with cord & UG-77, **Used, $5.95.**

LS-166/U LOUDSPEAKER; Housed in Cast Aluminum Case, speaker is 4" with heavy duty p.m. magnet, matching trans. 600 Ohm input, 8 Ohm output with high- low switching, 6 ft. cord with UG-77 connector plug for use with most GRC, VRC series, sets. Size: 5x5x3½; 5 lbs. Used, **$8.95.**



C-434/GRC CONTROL BOX; Used with GRC-type equipment over two-wire telephone line. Hand-crank magneto generator functions as a single phase 20 HZ ringer. Audio connector on front for use with H-33/PT Handset. Controls for local and remote use, call light and also two 30" cords with UG-77 connectors in the rear compartment. Internal switch for bell or lamp signal. With two Sigma 80030 and one GAC 21031 octal relays. Unit uses two flashlight batteries. 10¼x 8½x3½, wt: 12 lbs. Price: Used, **$10.95,** Less relays, **$6.95.**

H-113/U HEADSET 600 OHM Soft Plastic ear cushions 18" cord w/ PL-54 plug that fits JK-26 Jack(see CD-307 extension cord elsewhere on this page). wt:3lbs.Used-Ex **$3.95.**

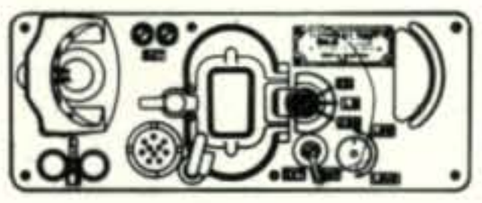
H-63/U HEADSET 600 & OHM BOOM MIC 100 OHM 14" cord with plugs. **$4.95.** Used MIC. or Phone Elements Only, $1. ea.

VIBRATOR TYPE POWER SUPPLIES For use with R-394 & R-257 RECEIVERS. The output of the supplies are the same and are:

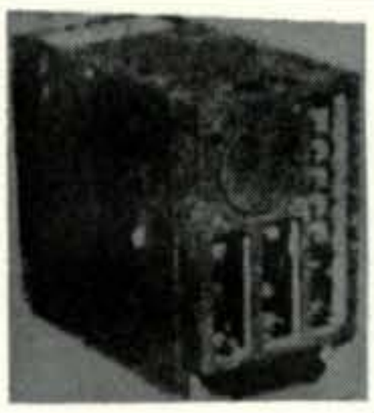
155 Volts DC @ 15 MA.
150 Volts DC @ 5 MA.
140 Volts DC @ 50 MA.
-40 Volts DC @ .5 MA.
6.3 Volts DC @ .45 amps.
6.3 Volts DC @ 1.0 amps.
1.4 Volts DC @ 1.25 amps.

PP-867/U 24 Volts DC @ 1.1 amps. Used, **$4.95**
PP-868/U 12 Volts DC @ 2.0 amps. Used, **$9.95**
PP-869/U 6 Volts DC @ 3.7 amps. Used, **$6.95**

Voltages required are as shown with Dynamotors DY-93/12 V, DY-98/24 V. DY-100/6 v. Size : 8½x4½x14½ wt: 11 lbs. Used, **$12.00.**

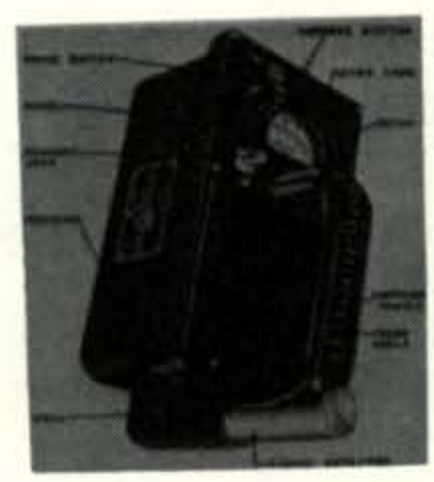


TA-312/PT TELEPHONE SET is a rugged, Lightweight, waterproof field teleph. that can be used outdoors on a desk or wall mounted. Handcrank generator for ringing buzzer. Requires 2/1½ V batt. for local use none req. w/CB. Size: 12x7x4; st: 10 lbs. Used, (with Handset) **$29.50**



BC-603 RECEIVER F.M 20-27.9 MC continuous tuning & preset push button channel selector. With sensitivity squelch & volume controls, 2 watt output to self contained speaker one (1) microvolt sensitivity, 2.65 KC I.F. 10 tubes 3/6AC7, 1/6J5, 2/12SG7, 2/6SL7. 1/6H6 & 1/6V6GT. Voltage required 12/24 volts for filaments, 220 VDC @ 80 MA. For High volt Size: 11½x6¾x12½; wt: 35 lbs. Used, **$20.95**

AN/PDR-27CY RADIAC SET designed to detect gamma and beta radiation or gamma radiation, alone. The presence of radiation is indicated on a milliroentgens per hour meter with scales of 0.5, 5, 50 and 500 selected by a switch. The two most sensitive ranges utilize a NAVY type 5979/BS-1 Geiger-Muller tube in the probe, while the two other ranges use only a NAVY type 5980/BS-2 G-M tube. Only gamma Radiation can be measured on the the two less sensitive ranges. Size: 8x6x 12½ Shpg. wt: 15 lbs. Less batteries. Price: Used, complete, $19.95. Manual for AN/ PDR-27C Radio Set, **$5.00.**



T-195/GRC-19 TRANSMITTER, 1.5 to 20 Mhz in ten bands. Frequency stability 0.03%, plus 1000 Hz. Manual or automatic tuning. Transmitts CW, voice, or FSK. Power output with 50 Ohm antenna: 100 watts @ 1.5 to 12 Mhz; 90 watts @ 12 to 16 Mhz; 80 watts @ 16 to 20 Mhz Audio inputs microphone or 600 Ohm line-meters for PA cathode current, PA grid current, battery voltage and modulation level. With 22 tubes including two 4x150D's. Power required: 22-30 VDC @ 42 amps max. 9 amps. standby. Size: 11½x14¼x22: wt: 122 lbs. Shpg. wt: 150 lbs. Price: Used, reparable, **$50.00.**

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bys still have command sets on hand. For the beginning ham they are marvelous. They require a power supply and a speaker and little more, and are simple, rugged, and beautifully designed.

Dr. Frederick Drake, the chief engineer at A.R.C. was the man who put the Command Sets together, and Paul O. Farnham was the genius who did the receivers.

Before A.R.C. was done, Command type receivers were built covering bands from 190 kHz to 156 Mhz. There were eight low-medium and high-frequency sets, and several v.h.f. sets in the 100-156 MHz range. A "transverter" carried the coverage into the u.h.f. range.

The 190-550 and 520-1,500 kHz receivers were used chiefly for low-frequency navigation and direction-finder work, and in 1945 a v.h.f. set was designed for "omnirange" navigation, eventually culminating in a 190 channel crystal-controlled version spanning 108-135 MHz.

In the middle range, the 3-6, 6-9.1 h.f. receivers were commonly used in air communications, with a few 9-13.5 MHz, 13.5-20 and 20-27 MHz sets built as part of a "liaison" long-range system. Most of the rare eight-receiver RAV models went into patrol blimps —few have survived.

Any reader who knows the whereabouts of a 9-13.5 MHz receiver can gain my eternal good will by pointing me at it. It's the last unit of the entire system which has eluded my collection.

The very common 6-9.1 MHz receivers were easily converted to cover higher frequencies up to 54 MHz. The Eighth Air Force made a conversion of a Command Receiver cover 9-18 MHz to pick up the British air navigation signals of that time.

These receivers were truly the electronic counterpart of Ford's Model A—rugged, simply constructed, yet beautifully engineered to do their job and last and last, they have just gone on and on. The v.h.f. version, which was basically engineered in 1943 and 1944, is still flying quite adequately in many private and military aircraft, here and overseas, and the low frequency set, circa 1935, does its job still as an Adcock range receiver.

Table 1 is a list of the various Command receivers which were built over their 30-year production life-span.

Next month: Command Transmitters. ■

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Novice Shack [*from page 47*]

State University. He is working to get his wife Dee Dee and brother to get their tickets very soon and hopes to earn his General and Advanced tickets in June. Oh yes, Bob graduated from the CB ranks . . . **Jeff Howell, WN9PFZ,** R. R. 6, Box 239, Bedford Ind. 47421, has done enough in his short radio career to rate a feature article in the local newspaper and to be interviewed on Channel-4 TV. But he is keeping the detail secret from the NOVICE SHACK . . . **Ray Biederman, WB6NSJ,** and **Art Baker, WA6MUW,** of the LERC Amateur Radio Club, 2814 Empire Ave., Burbank, Calif., have been helping handicapped boys and girls at the Dr. Joseph Pomeroy Widney High School, Los Angeles, to become radio amateurs. Other club members have donated a few telegraph keys, code-practice oscillators and other items to the effort. In addition, the club will donate any profit from its 10th Annual Hamfest, May 17 and 18th, to help establish a Novice station at the school.

Remember that *your* NOVICE SHACK depends on your news and pictures and suggestions are always welcome. Don't overlook our Photo Contest. Send all material to the address on the first page of the column.

73, Herb, W9EGQ

CQ Reviews SS-200 [*from page 40*]

complete. More complete and definite ground rules for determining acceptable duty cycles for RTTY and SSTV operation would be welcomed. Also, there was no warning at all that the PS-20 heat sink required fan cooling during high duty cycle operation.

The SS-200 is currently available as an SS-200A rated at 300 watts P.E.P. input and priced at $799.95. The PS-20 power supply is priced at $159.95. They are manufactured by Swan Electronics Corporation, 305 Airport Road, Oceanside, CA 92054.

—W∅ORX

Ionospheric Propagation [*from page 19*]

Figure 3 shows solar flux observations for the same period. While solar flux variations are somewhat less erratic than the geomagnetic field, a tendency towards a 28-day recurrence cycle is evident.

Since both solar flux and geomagnetic activity show an approximate 27/28-day recurrence tendency, observation of these parameters can be used to make a forecast for up to 28 days in advance. That is, at this time in the sunspot cycle, to a first approximation, conditions which existed today are very likely to repeat in about 28 days.

Of course, the 28-day forecasts can be derived from the *CQ* Propagation Charts by using fig. 1, and Tables I and II, as discussed earlier.

As an example, suppose this is March 1st, and you want to arrange a schedule from your QTH in the central part of the USA with a friend in Tokyo. Let's place the time of the schedule about a month from now, at 7 P.M. CST, and on 20 meters. The Propagation Chart shows a propagation index of (2) for these circumstances. From Table I, you see that the signal quality expected on this path will be *B* when conditions are Above Normal and *C* when conditions are High Normal. Under poorer conditions it will be *D* or *E*, which is unsuitable.

You begin listening today to WWV at eighteen minutes past each hour (forty-five minutes past each hour on WWVH) for the previous day's values of the solar flux and the A_p index. You are waiting for a combination of solar flux and A_p values that will produce Above Normal or High Normal conditions as defined in fig. 1. Assume this occurs on March 5th, with a solar flux of 88 and an A_p of 3. Adding 28 days to March 5th yields a recurrence date of April 2nd. You can now notify your friend in Tokyo that the best time for a schedule is at 7 P.M. CST on April 2nd, and you can do so with confidence that there is a very good chance it will work out well. Of course, the date and time of the schedule should be sent to your friend in GMT.

Let us look at another way to use these data. Turning to the other end of the spectrum, when conditions are Below Normal or Disturbed on the h.f. bands, there is a good chance that unusual ionospheric propagation may occur on the 50 and 144 MHz bands. Auroral conditions usually accompany radio storms, and they often produce patches of sporadic-E ionization.[6] The h.f. operator's famine often is the v.h.f. operator's feast! This is good enough reason for the amateur interested in v.h.f. propagation to check the WWV broadcasts, and to make use of fig. 1 in this article. When a combination of solar flux and geomagnetic activity falls into the Below Normal or Disturbed regions of fig. 1, it's time to check 50 and 144 MHz for either sporadic-E short-skip openings, or for auroral-reflection type openings. Be especially watchful for such conditions during the spring and fall months, with peaks usually taking place during March and September.

Mail-A-Prop Forecasts

A disadvantage of the WWV radio broadcasts are that if a radio storm should develop, it may not be possible to receive the forecast. To overcome this, and for those users of the h.f. spectrum who can not spare the time to listen to WWV daily or who do not wish to make their own forecasts, there is a subscription service available which does this for you. It is called Mail-A-Prop.

Issued every other week, Mail-A-Prop provides forecasts for a two-week period on a day-to-day basis.

The forecasts are based primarily upon a detailed analysis of solar, geomagnetic and ionospheric data, and are prepared along the lines discussed in this article. It is interesting to note that Mail-A-Prop achieved a record of being well over 90% correct during the past year.

The Mail-A-Prop format changes a bit with each issue, so that over a period of a month or so, the bands (160 through 10 meters), continents and major time periods of the day are covered with detailed forecasts. Detailed short-skip forecasts are also given at least once a month. The three-to-four page, easy-to-read newsletter also contains timely items on radio propagation, solar and geomagnetic activity, progress of the sunspot cycle, v.h.f. ionospheric possibilities, and schedules of meteor showers.

Mail-A-Prop is sent First Class Mail, with Airmail used, if necessary, to reach subscribers in time for full use. An annual subscription (26 issues) is $25.00, postpaid. A six-month subscription is available for $15.00, and a two-month trial subscription, for $5.00. Subscriptions to Mail-A-Prop can be addressed to P.O. Box 86, Northport, New York 11768. A sample copy is available for an s.a.s.e.

A two-to-three minute summary of the Mail-A-Prop forecast is available at any time by dialing (516) 883-6223. Called Dial-A-Prop, the announcement is revised every Tuesday and contains a day-to-day forecast for a complete week. Dial-A-Prop is provided as a public service by *CQ*, and there is no charge for the forecast; the number, however, *is not* toll free.

Conclusion

Solar flux and geomagnetic data broadcast hourly by WWV, along with the Propagation Charts which appear monthly in *CQ*, now make it possible for radio amateurs to make their own day-to-day forecasts and 27/28-day recurrence forecasts for any path, and for any h.f. band. Thus, with most of the mystery now removed from propagation forecasting, more efficient use can be made of the h.f. bands. A knowledge of expected conditions should save time, prevent disappointment, and should provide a higher percentage of successful QSOs. After all, you gain nothing by tuning a dead band, looking for an opening which cannot occur!

Finally, the authors would appreciate hearing from readers using the forecasting methods discussed in this article. We are especially interested in hearing of the results you achieve. ■

[6]"VHF Ionospheric Propagation," Jacobs, G. and Leinwoll, S., *CQ*, Nov. 1969, p. 37.

Antennas [*from page 22*]

element (as opposed to two elements in the KLM antenna), is that with the addition of the various parasitic elements, the Q or circuit selectivity, of the driven element rises sharply and the usable bandwidth shrinks. That gives you a severely restricted s.w.r. curve. If you can properly excite the directors, they will perform well over several hundred kilohertz of the 20 meter band—about 4 percent of the design frequency, in fact.

"The KLM dual driven element excites the directors over a wider frequency range than does the simple dipole, thus providing wide, flat, optimum gain and excellent s.w.r. characteristic.

"The s.w.r. response of the KLM design can be adjusted somewhat by fiddling with the director spacing and length, but since the directors are optimized for gain and front-to-back ratio, anything but very small changes will result in performance degradation.

"Thus, the s.w.r. curve can best be adjusted by paying attention to driven element lengths and spacing. It turns out that the spacing between the driven elements has little effect on s.w.r., but driven element length can be adjusted easily to touch up the s.w.r. figure to less than 1.2 across the operating range. Gross changes in length, of course, will screw up the front-to-back ratio.

"As in any beam design, the dimensions are interlocking to an extent, and you have to know what you're doing, or you'll end up chasing yourself around in a circle."

"I'd sure like to see a KLM antenna," said Pendergast. "How long is the boom?"

"About 42 feet," I replied. "It's a *big gun*, but it takes a big antenna to deliver a big signal. Here's a picture (fig. 5) of the KLM antenna at Mike's station, K6MYC."

"That's the guy who shot me down in the pile up," said Pendergast.

"Well, you now have all the design information to build your own antenna," I replied. "Or, you can get the manufactured model made by KLM Electronics. That's how the antenna got its name."

"The grandfather and first user of the log periodic Yagi antenna was an amateur by the name of Oliver Swan, who perfected this unique concept for long distance television work in the central valley of California. The antenna performed so well that amateurs started using it for DX work on 6 and 2 meters. It consistently outperformed Yagi antennas of equivalent size. K6MYC did a lot of work with the v.h.f. designs, before he perfected the 20 meter version. K6HCP and K6KBE were also in on the project. And these three calls are *very* well known at the v.h.f. antenna measuring contests held each year in California. They are the fellows to beat, and not many guys can whip them, as far as antenna design goes."

"Well," said Pendergast, I'll be looking forward to the March issue of *CQ* to read all about the KLM antenna. Of course, since I have already read the material, by the time the magazine comes out, I'll be an expert!" ■

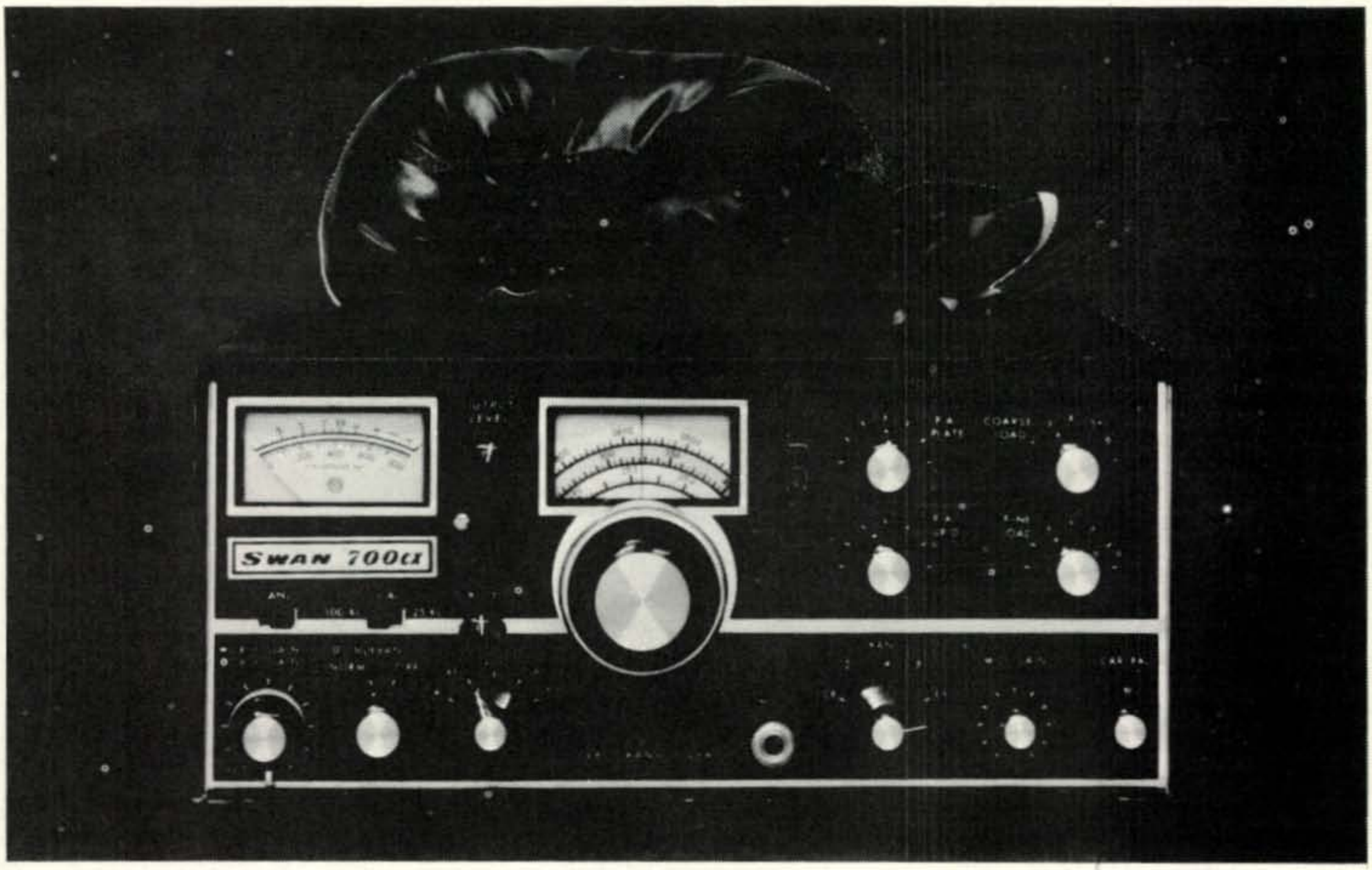
Cop's Column [*from page 30*]

Skokie, Illinois 60076) sells small arrays which appear well suited to charging batteries for hand-held transceivers and low power h.f. rigs such as the Argonaut. For example, their SPM 150-12 solar power module is 7″ × 8″ × 0.44″, costs $100.00, and will deliver a current of 120 ma at 12 volts in direct sunlight.

Because of the high cost per watt of natural power with the sources available today, it is very important that all gear powered by them draw the minimum current possible. Solid-state design is a must, but in itself is not a guarantee of minimum power drain. Pilot lights need to be shut off, and switching should be designed so that only the stages in actual use at any particular time are receiving power.

A Farewell Of Sorts

With very mixed feelings and a large measure of regret I'm passing the word along that this will be the last "Cop's Column," at least for awhile. Cop is on the move again, this time to Halifax, Nova Scotia. While you will still be seeing my byline in *CQ* and elsewhere, I'm just not going to have the time to turn out a worthwhile technical column each and every month. Many thanks for the support you've given me during these past 32 months. We'll still be getting together via the pages of *CQ*, and perhaps now a little more often on the air too. It is one of the ironies of writing regularly for a ham magazine that you don't have much time for hamming! I'm hoping now to have at least a little more time to spend communicating with old friends and meeting new ones. 'Til the next time we meet, Vy 73, Cop, WØORX/VE1

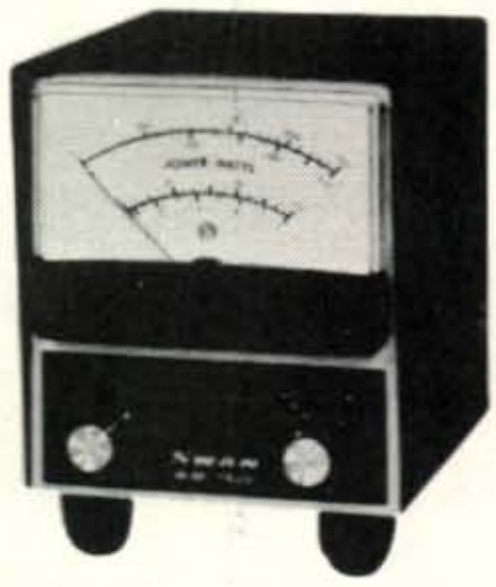


EXPLOSIVE POWER

Here is all the dynamic powerful performance needed to punch through QRM, *without an accessory amplifier*. SWAN's 700CX Champion transceiver lets you enjoy a more responsive value-packed ham station, for less cost-per-watt, than any other rig in its class . . . less than 86¢ per watt if you have your own power supply . . . less than $1.05 per watt with SWAN's 117-XC deluxe AC power supply with matching cabinet and built-in speaker . . . and, less than 98¢ per watt with the 117-X AC power supply.

Quality is not sacrificed. Cross-modulation and front-end overload will not plague or frustrate your communications. This Champion delivers a full 700 watts P.E.P. input on 10, 15, 20, 40 and 80 meters with selectable USB, LSB, AM, or CW with sidetone. For extra frequency coverage, plug in an optional 510-X crystal oscillator. If you want separate transmit and receive frequencies, use a 508 VFO accessory. VOX? Yes, with SWAN's plug-in VX-2 option. You can also hook up an FP-1 telephone patch to the 700CX. Even if you insist on more power, you can obtain the maximum legal limit of 2000 watts by adding a SWAN Mark II linear amplifier.

Whatever your style, the Champion 700CX is a winner. Whether you select the 700CX for your home station, its portability, for mobile use, or for its many compatible accessories—you can count on this Champion to give superior performance — everytime!



With all this talk about cost per watt, you may be interested in SWAN'S WM-1500 In-Line Wattmeter. Read forward or Reverse power on four scales from 0 to 5, 50, 500 and 1500 watts. Accuracy is better than 10% full scale on frequencies from 2 to 30 MHz.
WM-1500 In-Line Wattmeter **$64.95**

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117-X 110V AC Power Supply	$ 79.95
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508 External VFO	$189.95
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Analyze the real expense of your ham station. Add up all your costs and divide by your rated wattage. Find out what you're really paying for every watt you use.

Want quality and functional economy? Here's a suggestion: Install a Swan 1200X Cygnet Linear Amplifier driven by a Swan 300B Cygnet *de novo* Transceiver. Both have internal power supplies, operate 10 through 80 meters, have SSB and CW modes, and utilize 8950 tubes for RF amplification. A built-in speaker and CW sidetone monitor comes with the 300B while the 1200X has excellent metering plus a bypass switch so you can operate barefoot. Swan provides the quality and functions, now look at the economics.

Add the $519.95 price of the 300B to the $299.95 price of the 1200X. Then divide by 1200 watts P.E.P. input. The result is a most respectable power level for a very low cost of just 68¢ per watt!

Try to beat that figure anywhere else, today.

It's pure common sense — the heart of any station is its quality; its power; and, these days, its economy. Investigate the Cygnets — you won't be disappointed. If you still want a few extras, like a VOX or VFO, Swan has them, too. Visit an authorized Swan dealer soon or, if you wish, you can use the coupon below to order your Cygnets now.

Gentlemen:
Please ship the following Swan products best way.

- ☐ 300B Cygnet *de novo* Transceiver (300 watts P.E.P. input) $519.95
- ☐ 300B with SS-16B Super-selective I.F. filter $589.95
- ☐ 1200X Cygnet Linear Amplifier (1200 watts P.E.P. input) $299.95
- ☐ 508 External VFO $189.95
- ☐ 14-A DC Coverter $49.95
- ☐ VX-2 Plug-in VOX $44.95

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- ☐ Full payment enclosed
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CLEGG, SWAN, CUSHCRAFT at prices I dare not publish. Call or write, W0NGS, Bob Smith Electronics, 1226 9th Ave., North, Fort Dodge, Iowa, 50501. (515)576-3886.

COLLECTOR: Is interested in books autographs and other information on early radiotelephone pioneers. Ronald Phillips, 1925 Baltimore, Avenue, Kansas City Missouri 64108. (816)842-9009.

TWO PLASTIC HOLDERS, Frame and Display 40 QSL's for $1.00, or 7 holders enhance 140 cards for $3.00 from your Dealer, or prepaid direct: TEPABCO, Box 198Q, Gallatin, TN 37006.

HAMFEST DATE FOR 1975: May 31st, Marriott Inn is new Headquarters. Information? Write WNY Hamfest, Box 1388, Rochester, NY 14603.

Did you know that supplements to the book, "CQ YL," are available? They bring the book up to date with YLRL Officers through 1973 and the 6th YLRL Convention, held at Long Beach in May '72. If you have a copy of "CQ YL" and would like to add the new supplements (the pages are "slotted" so they fit directly into the "CQ YL" spiral backbone), drop a note with your request to author/publisher, W5RZJ, Louisa Sando, 4417 - 11th St., NW, Albuquerque, NM 87107. Please enclose two 10 cent stamps to cover cost of mailing. The one and only book about YLs in ham radio, "CQ YL," contains 21 chapters, over 600 photographs. Order your autographed copy, or a gift copy, from W5RZJ, $3.00 postpaid.

WANTED FOR $$$ CASH—Back in 1957 the Lionel Train Company made a small set of toy trains specifically designed for girls. It had a pink locomotive and several other cars, all in pastel shades. The set wasn't very popular, hence not too many sold. However, I need this set for my collection, and am willing to pay up to $400 cash for a complete set in mint condition. If you have this item, please write: Dick Cowan, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

FOR SALE: 2 RCA boxed U.S. Army surplus 826's (for Gonset Linears) $5.00, A. Dorhoffer, K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

DAYTON HAMVENTION: At HARA Arena April 25, 26, 27, 1975. Program brochures mailed March 10th. Write for information if you have not attended the last two years, to HAMVENTION, P.O. Box 44, Dayton, OH 45401.

WANT TO BUY: Bird no. 43 Wattmeter and elements. Marty, (215)884-6010.

FOR SALE: Spectra Physics 2.0 mw071 -2 HeNe laser tube, brand new with power supply schematic, $110.00. WA2NDM, 5 Melville Rd., Great Neck, NY 11023.

RUBBER address stamps. Free catalog. 45 type styles. Jackson's, Box 443F, Franklin Park, IL 60131.

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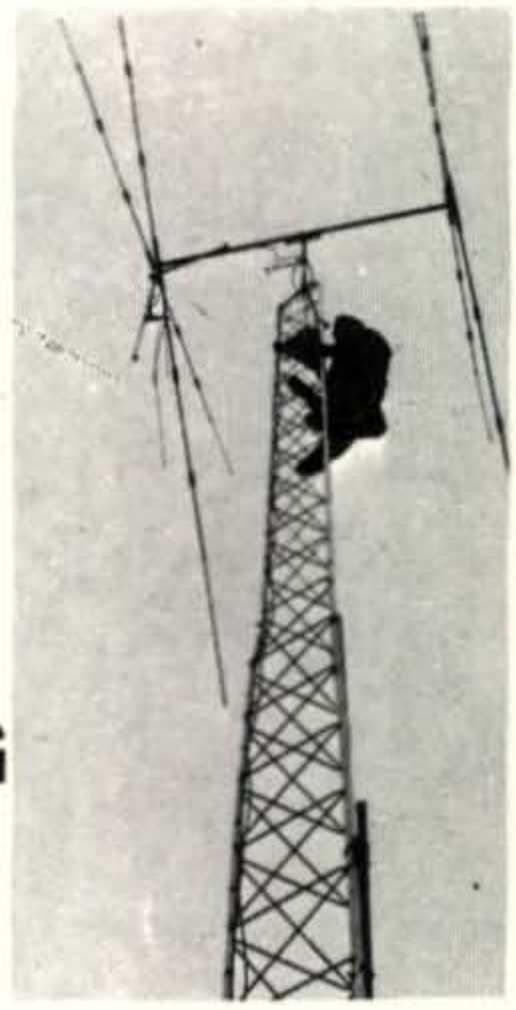

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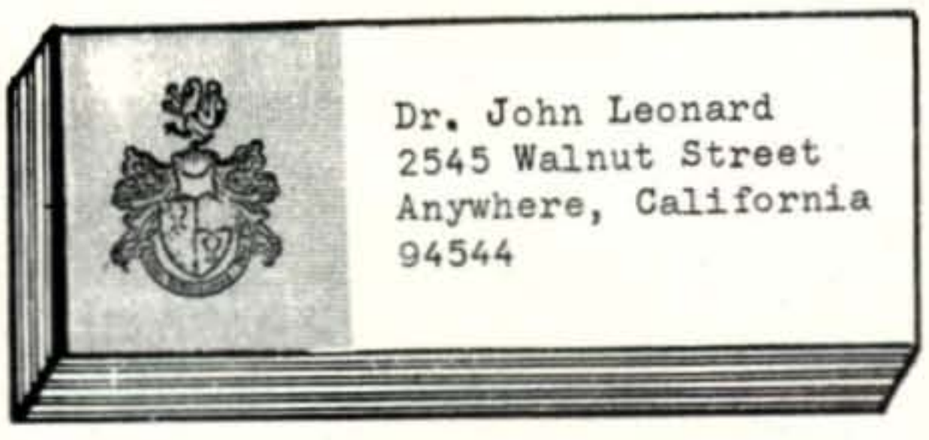

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MAGAZINES FOR SALE: CQ/73/QST/HAM RADIO issues at 10 cents each (plus shipping) from Lockheed Ham Club, 2814 Empire, Burbank, CA 91504. Send list and check. Available issues and any refund due will be sent promptly.

REPAIRS: K6BE (415)-548-1889.

HIGH GLOSS QSL CARDS: From $10.95/1000 Full color catalog. $1.00. Lijon Graphics, Box 48, East Longmeadow, Mass. 01028.

NOW paying $2000.00 and up for ARC-94/618T ARC-102/618T, $1200.00 and up for ARC-51BX, $1500.00 and up for 490T-1 antenna couplers. We also need these control boxes-C-6287/ARC-51BX, C-6476/ARC-51BX, C-714E-2. We also need R-1051 receivers RT-662/Grc-106 tranceivers. We buy all late aircraft and ground radio equipment. Also pack radios. We are buyers not talkers. Bring your equipment in and you are paid on the spot. Ship it in and you are paid within 24 hours. We pay all shipping charges. If you want the best price for your equipment. Call us. Call collect if you have and want to sell or trade. We also sell. What do you need? D & R Electronics, R.D. 1, Box 56, Milton - PA 17847. (717)742-4604.

WANTED: CQ, QST, 73, PE, EI and other ham or electronics publications; will buy or swap. Also want Collins R-388, R-389, or R-390A. Donald Erickson, 6059 Essex, Riverside, CA 92504. (714)-687-5910.

MOULTRIE AMATEUR Radio Klub 14th annual hamfest, April 27, 1975, Wyman Park Sullivan. Indoor, outdoor market. Tickets, $1., advanced; $1.50 at gate. Write MARK, P.O. Box 327, Mattoon 61938.

LOOKING FOR old Lionel trains. Interested only in "O" gauge, excellent to like-new condition. Primary interest is locomotives prior to 1952, but will consider complete sets or more recent models. Am willing to buy outright for cash or swap radio gear to meet your needs. Write Dick Cowan, WA2LRO, c/o CQ Magazine, or call 516/883-6200.

NORTHWESTERN Pennsylvania Swapfest, May 3, 1975. Crawford County Fairgrounds, Meadville. Flea Market begins 10am. Free admission, hourly door prizes, refreshments available. Indoors if rain. Talk-in 146.94, 146.04-.64, 29.0 Mhz. Map and details: RAE, Box 844, Erie, PA 16512.

WANT TO BUY: Bolex or Bell & Howell 16MM film editor/viewer, excellent condition thruout; Also, New DVM, Model IM-102. Cashiers Check for Lowest dollar. WA0GYX, George, 1107 N. Scott no. 3, Belton, MO 64012.

MOTOROLA HT220, HT200, Pageboy and Voice Commander service and modifications performed at reasonable rates. Also most makes of two meter amateur gear and VHF monitors such as Regency. WA4FRV, (804)272-8403.

FOR SALE: Old magazines and books R9, Nov. 1934, Dec. 1935. "Radio" Magazine Dec. 1933 through Dec. 1935. R9/Radio (merge issue) Jan. 1936, no. 205 through March 1942, no. 267 (no. 207, March 1936 missing). Books - 1936 "Radio" Antenna Handbook (Hawkins, Smith), 1936 "Radio" Handbook (Jones), 1937 Jones Radio Handbook, 1938 "Radio" Handbook (Jones) 4th ed., 1938 "Radio" Handbook (Smith 5th ed., 1941 "Radio" Handbook (Smith Dawley) 8th ed. hardcover. Magazines and books as package, $60.00 A. Dorhoffer, K2EEK, CQ Magazine, 14 Vanderventer Ave. Port Washington, NY 11050.

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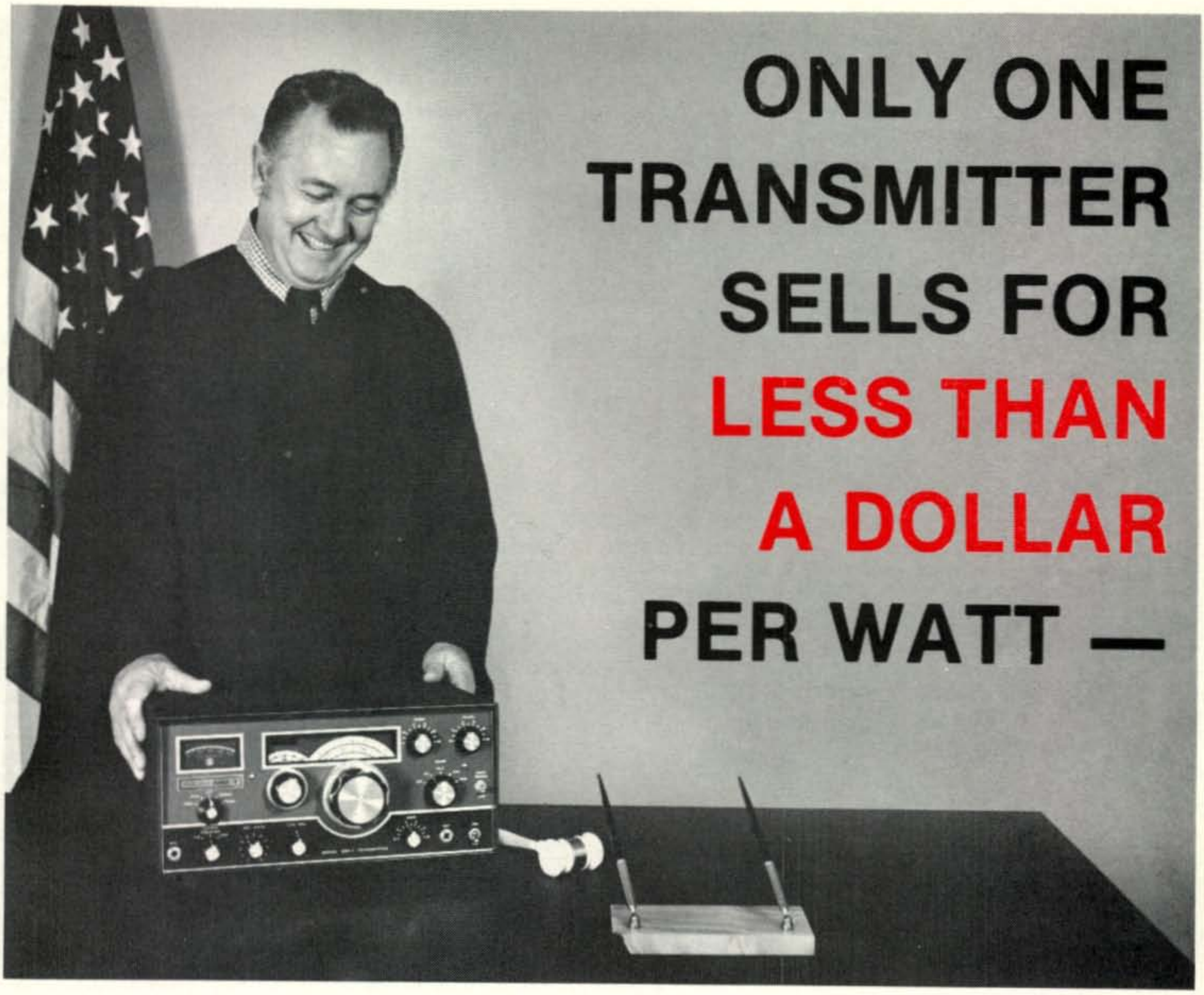
WANTED TO BUY: Battery for PRC-6 Walkie-Talkie WWII 50mc. and besides fec where could I get a license for one? Gene Perryman, Box 1104, Kendrick, Idaho 83537.

FANTASTIC PRICES: 2.5A-1000V Diodes: HEP IR, 4/$1.00. Discounts: Test Equipment, Parts, list 10 cents F&M Electronic Distributors, Box 236, Dept. A Maspeth, NY 11378.



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Compare the cost per watt, then judge for yourself as to which is the best value: The kit retails at $1.67 per watt; the 240 watt unit is $1.41 per watt; the 200 watt rig with the power supply built-in runs $2.30 per watt, while the other 200 watt transmitter costs $2.65 per watt by itself or $3.15 per watt if you buy the power supply recommended.

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600SP	Deluxe Speaker with FP-1 phone patch	**$ 69.96**
510X	Crystal Oscillator	**$ 54.95**
VX-2	Automatic Voice Control	**$ 44.95**
MARK II	Linear Amplifier (2000 watts P.E.P.)	**$749.95**

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WANTED: QST-Jan., Feb., Apr., July, 1917; 1919 except Nov/Dec., Please write air, postage refunded ZL2GX, 152 Lytton Gisborne, New Zealand.

FOR SALE: t4XB Transmitter 160-10 meters like new, $400.00; R4B Receiver 160-10 meters like new $350.00; Heathkit Io-103 scope new, $230. DX60B $50.00; H610 VFO, $30.00, Homebrew linear 4-400A's Table - top unit (Send for photo) $175.00. Homebrew power supply 4000 volts @ 1.2 amps. $150.00 both excellent. Call Mike, WB56YT, 1 405 372 8878 or write 653 B Yorktowne, Stillwater OR 74074.

SELL: Very Reasonable, xmtrs, rcvrs, SASE for list WB9AZQ, 404 E. Emmons, Robinson IL 62454.

WANTED: Tunaverter converter, model SWL 9.5 to 16 mc. Fred Haines, 132 Rural Ave., Lewisburg, PA 17837.

WANTED: Collins 30L-1 Round Emblem, and filters for 75S-3C (RTTY, CW, SSB). SELL: Central Electronics 10B w/coils. Ken, WA5JJB, P.O. Box 355 Nederland, Texas 77627.

WANTED: CRYPTOGRAPHY manuals, books, devices. WN2TSD, 17 Alfred Road, Merrick, NY 11566.

TOWER: 60ft. crankup, tiltover, steel galvanized free standing, E-Z Way, was $1200 new. SASE for data. See in Dana Point, CA 92629 (midway LA/San Diego) Jim, K6AIP, 34022 Blue Lantern, Asking $395.

WANTED: Touch Tone Pads. Price? H. Perozzo, W7UD, 8515 37th West, Tacoma, WA 98466.

WANT TO BUY: Will pay top dollars--hard cash--for old Lionel Trolleys in any condition. Also want old Lionel or Ives Standard Guage trains. Your old clunker may be a collector's dream. Don't be bashful. Write Dick Cowan, c/o CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050. 516-883-6200.

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FREE: 12 Extra Crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Collins, Drake, Ten-Tec, Kenwood, Icom, Swan, Atlas, Standard, Clegg, Genave, Tempo, Midland, Alpha, Hy-Gain, Mosley, CushCraft, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual personal service. Hoosier Electronics, R.R. no. 25, Box 403, Terre Haute Indiana 47802. (812)894-2397.

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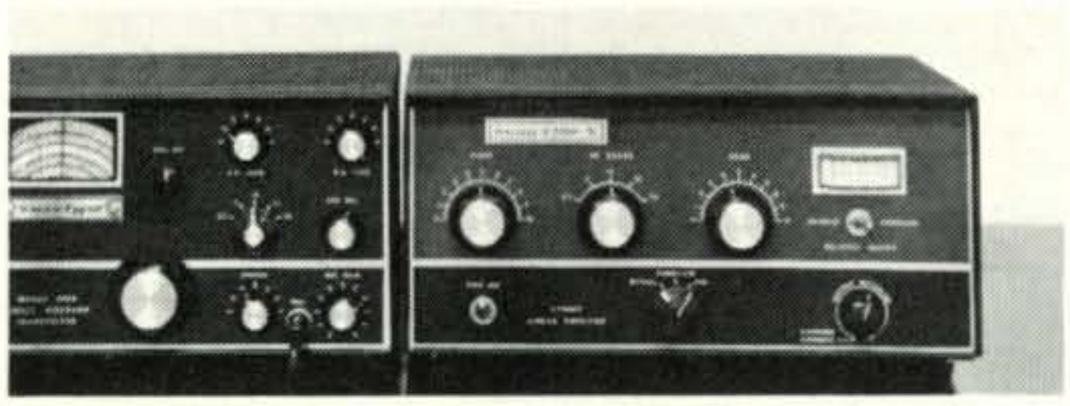

or a little less for a lot less money.

Maybe you've got your sights on a blockbuster rig with maximum legal power. Or you might see yourself as the sophisticated something-less-than-max type who comes away with a goodly amount of change left over. Whichever way you go, when you take that big step up to high power, Swan has the linear amplifiers to help you grow easily and painlessly.

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Our Cygnet 1200X linear amplifier gives you a lot of wallop, too. A full 1200 watts P.E.P. on SSB–as much as a lot of people ever need–it puts you in the big time for less money. Front panel is designed to go with our 300B Cygnet *de novo* transceiver for a perfect decor and performance match-up plus four times the power of the 300B alone. Comes with self-contained power supply and provision for external ALC. Ten through 80 meters.

If you're ready for the big time, see the Mark II and the Cygnet 1200X linear amplifiers at your nearest Swan dealer or order direct from our factory.

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WANTED: Linear Home brewed or Have Yease FT-2 AUTO, One year old to trade or Millen Match box 92200 (LN), John Killar, Rt. 2 Box 894-4, Lake Geneve, WI 53147.

FOR SALE: Johnson Viking GN2 trans. and VFO w/H.B. P.S. A1 condition and works good. K6THQ 1205 Cloverglen, Valinda, Calif. 91744.

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COMPLETE 2 mtr base station $60.00. 110v 30w GE pre-prog 2 freq., w/mike, ant, xtals. No ship. WA4UZM, 324 S. Riverhills Dr., Temple Terrace, Florida, 33617.

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FOR SALE: CLEGG 22'r, $129., Gonset 111, 6M $70, Heath HW-17, 2M, $120. All in perfect condition. K4HHH, Box 274, Port Richey, FL 33568.

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300 WATTS P.E.P.

Now there is enough power, from a completely solid-state transceiver, to enjoy clean contacts everytime—without the bother of tuning! Swans' NEW SS-200A provides you with a nominal P.E.P. input of 300 watts on all single sideband transmissions. Turn it on and you're on the air. You don't have to wait for the set to warm up. And look at all the extra features this rugged station includes:

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Your home station can be readily equipped by adding a PS-20 matching 110V AC power supply or a PS-220 for 220V AC source. Optional accessories include: 610X crystal controlled oscillator, SS-208 VFO, Mark II 2000 watt P.E.P. linear amplifier, microphones, and mobile mounting kits.

See this modern transceiver on your next visit to an authorized Swan dealer or, if you prefer, order direct from Swan Electronics.

SS-200A 300 Watt Transceiver	**$799.95**
PS-20 110V AC Power Supply	**$159.95**
PS-220 220V AC Power Supply	**$169.95**
610X Crystal Oscillator	**$ 54.95**
SS-208 VFO	**$189.95**
Mark II Linear Amplifier	**$749.95**
444 Desk Microphone	**$ 35.95**
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SS-MTK Mobile Mounting Kit	**$ 16.95**
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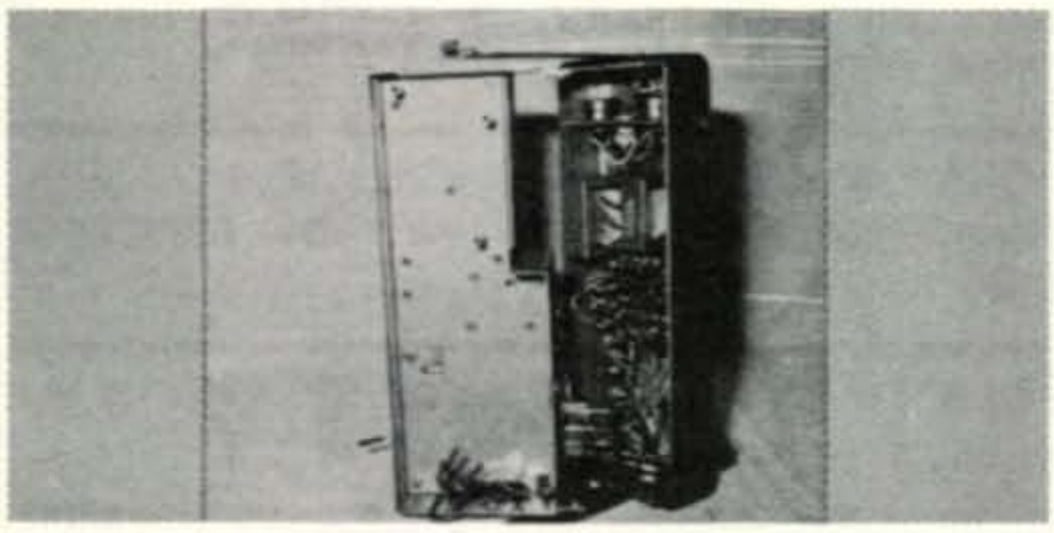
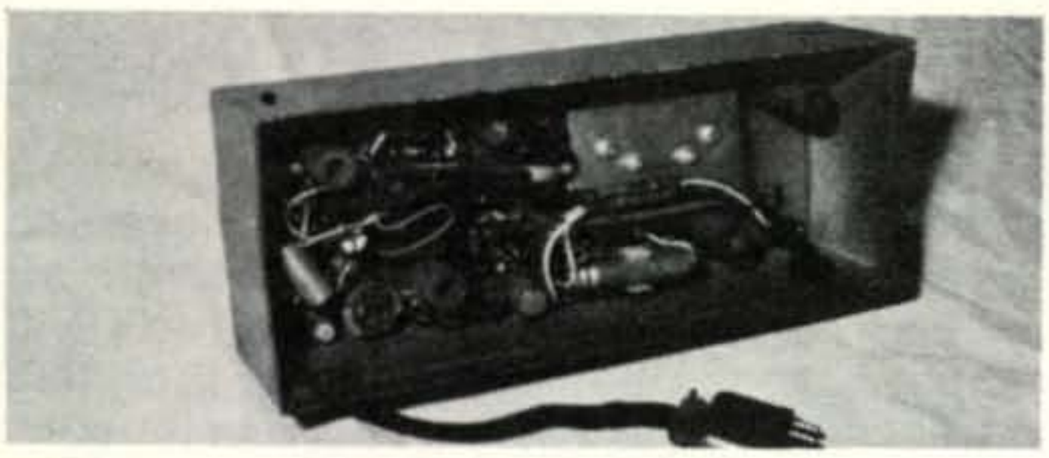
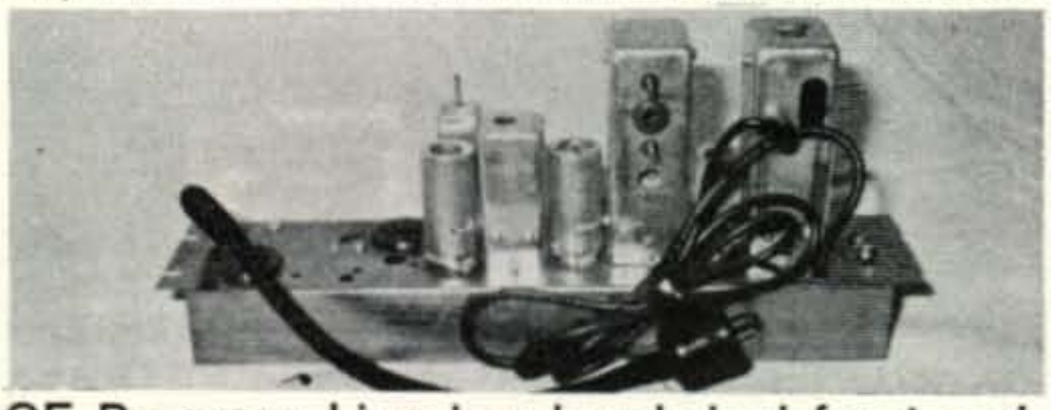
G.E. PARTS AND ACCESSORIES



GE Porta-mobile extended control housing with 10 watt audio amplifier, shp. wt. 10 lbs. $18.

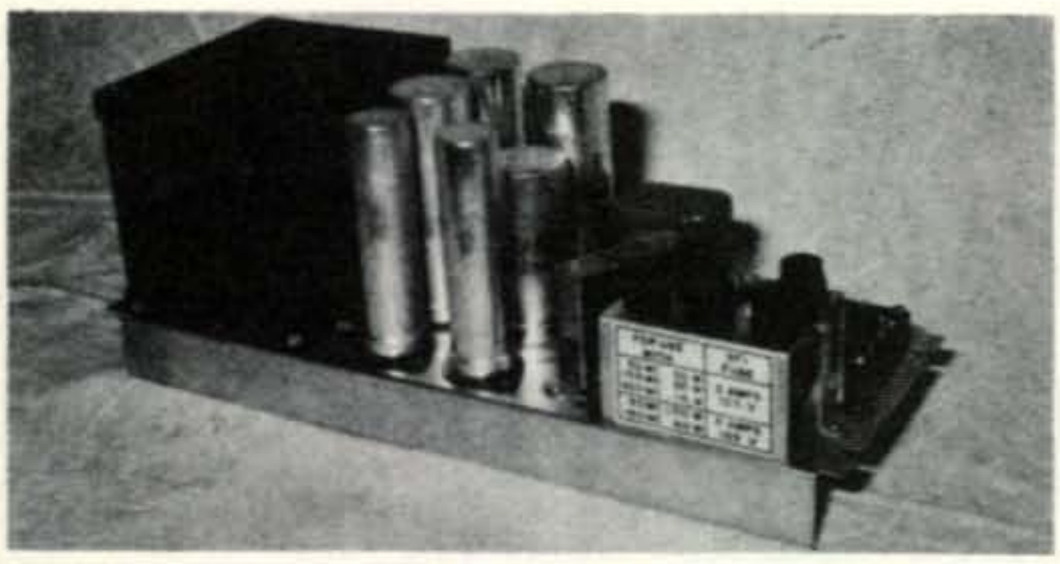


G.E. Transistorized Progress Line 7 pin reed type channel guard (less encoder board) with housing and plug (less reed). Add your own encoder for complete unit, shp. wt. 10 lbs. .....$25.



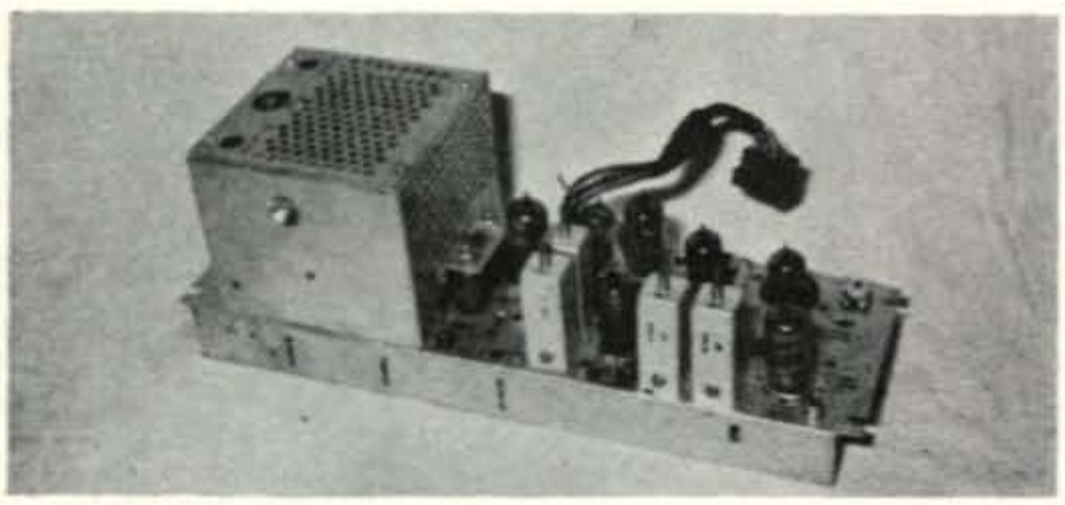
GE Progress Line low band dual front end strip. Can be used for simultaneous monitoring, shp. wt. 10 lbs. .....$15.

R.C.A. STRIPS & COMPONENTS

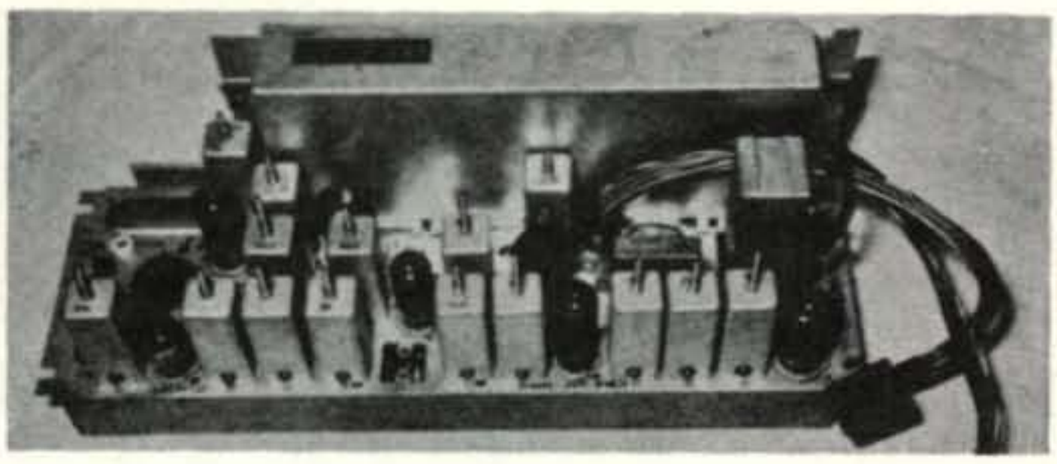


R.C.A. Fleetline series, 110 volt A.C., rack mount, solid state, transmit and receive POWER SUPPLY, complete, shp. wt. 25 lbs. W. 13½," H. 5", D. 5½" $50.

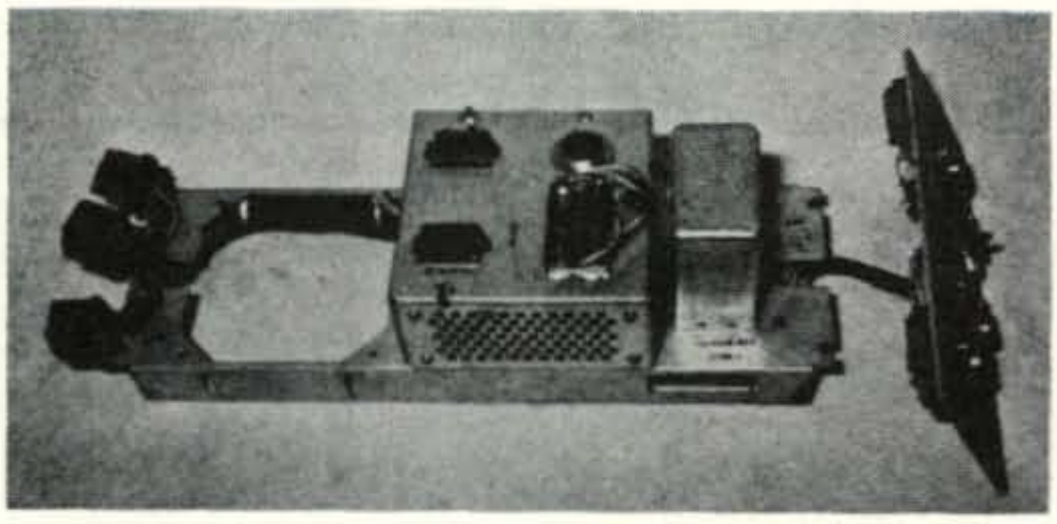
R.C.A. STRIPS & COMPONENTS



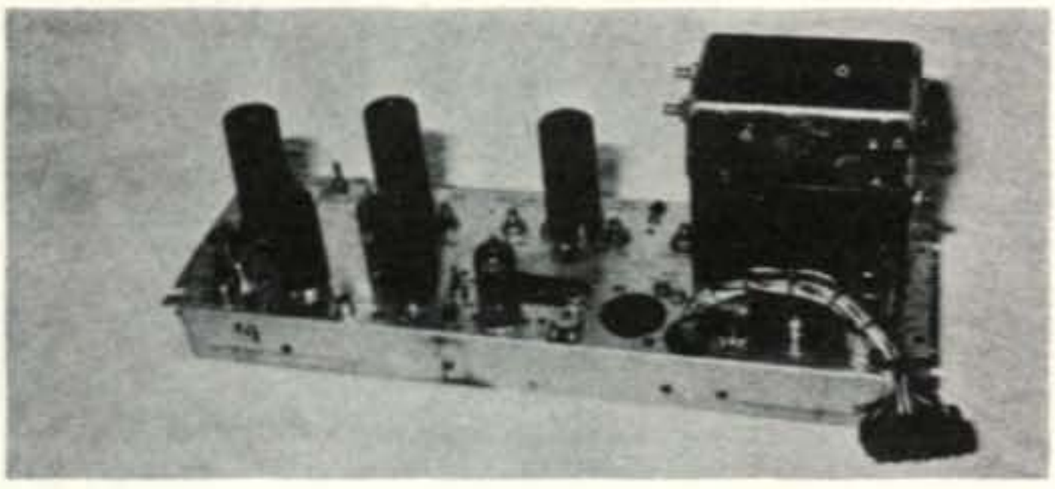
R.C.A. "L.D." series, 30-50 MHz., 50 watt, narrow band, TRANSMITTER strip, complete, shp. wt. 10 lbs. .....$25.



R.C.A. "L.D." series 150-170 MHz., fully narrow band, partially transistorized RECEIVER. Shp. wt. 10 lbs. .....$35.



R.C.A. "L.D." series, 12 volt D.C., solid state, transistorized POWER SUPPLY, 30 and 50 watt (2 transistor) .....$30.
50 and 100 watt (4 transistor) .....$35.
Shp. wt. 10 lbs.



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- Noise blanker
- VOX with break-in CW
- 25 & 100 KHz calibrators
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- Internal speaker

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- 1500/1900Hz tone generator
- Wide range inputs for all mode monitoring-even RTTY

ACCESSORIES AVAILABLE:
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- FV-101B External VFO
- YO-100 Monitor scope
- SP-101B External speaker
- SP-101PB Speaker/Phone Patch
- MMB-1 Mobile mount
- FA-9 Cooling fan
- XF-30C 600Hz CW filter
- YD-844 Desk microphone
- 160 meter crystal

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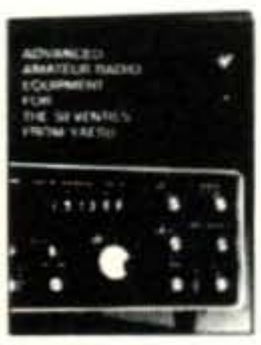

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