CQ

CQ World Wide DX Contest C.W. Results page 22

June 1976

June 1975
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8240 The Radio Amateur's Journal

Heathkit "104"...

...new performance standard for SSB transceivers

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***

SB-614 station monitor shows you how clean your signal is

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 5 x 7", 3.2-ohm speaker. And there's room inside for the HP-1144 power supply. With connector cable and plug.

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Kit HW-202, 11 lbs., mailable **179.95***

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Order from Heath, mail certificates to crystal mftr., get the crystals you specify, postpaid.

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*RVD-2110 9-inch Monitor/TV shown is optional

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RVD-1005 Video Unit: $575. RVD-2110 Monitor TV: $150. DKB-2010 TTY/CW Keyboard: $425.
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JUNE, 1975 VOL. 31, NO. 6

The Radio Amateur's Journal

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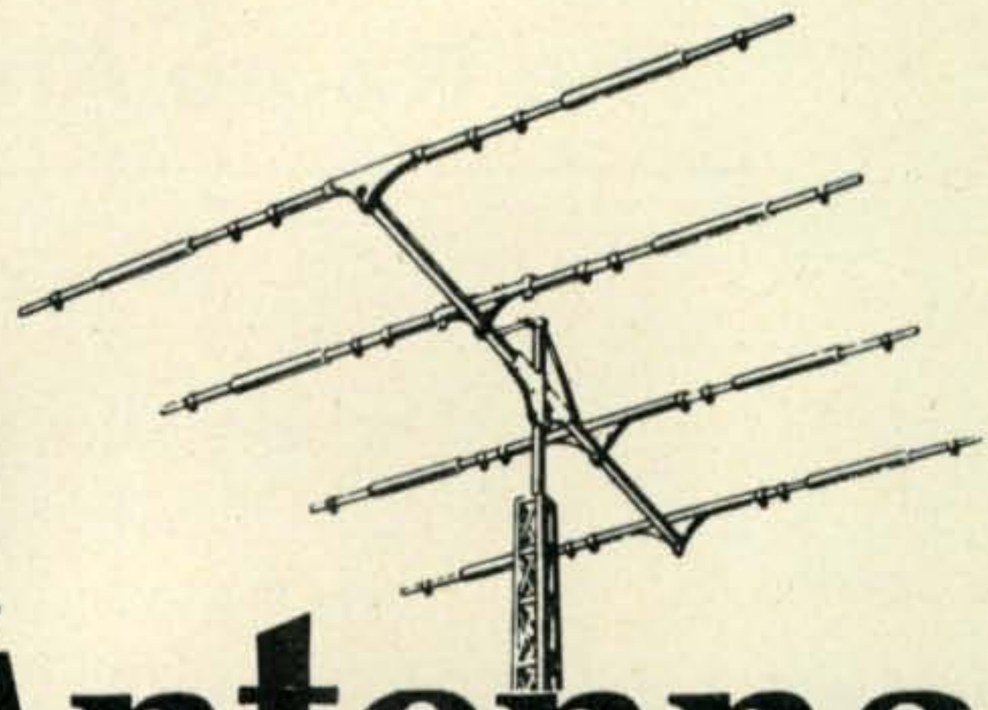

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TB-3HA	8 dB	20-22 dB	16′ x 1.5″	28′-2″	16′	100 mph	110 lbs.	4 sq. ft.	44 lbs.
TB-2A	5 dB	16-18 dB	6.5′ x 1.5″	27′-8″	14′-3″	80 mph	60 lbs.	1.8 sq. ft.	18 lbs.
MB-40H	4 dB	16-18 dB	15.75′ x 1.5″	30′-4″	17′-6″	100 mph	80 lbs.	2.5 sq. ft.	40 lbs.

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WARC Preparation

The year 1979 may seem to be a long way off, but it really isn't, so far as the tedious and complicated task our country faces in preparing for the ITU's next World Administrative Radio Converence. The next WARC, as it is commonly referred to, isscheduled for 1979. The entire radio spectrum will be up for grabs again at the Conference and there will be lots of competition between the various radio services to determine who gets what frequencies, and between the more than 150 countries that are expected to participate. Our main concern, of course is to see that the Amateur Service gets its fair share of the frequency pie.

The Federal Communications Commission has the responsibility for developing national policies and positions for the 1979 Conference, for the non-governmental radio services including the Amateur Service. A special high-level *Steering Committee* has been formed within the Commission to coordinate its efforts in planning for the Conference. Public input to the Steering Committee will be through *Working Groups* to be formed for each radio service, which will act in an advisory capacity to the Commission.

We're pleased to report that an *Amateur Service Working Group* has been formed and that it has already begun the serious task of planning for the Conference. On May 8 a full day meeting was held between the Working Group and the FCC, at FCC headquarters in Washington, D.C. Among the approximately forty radio amateurs attending this initial meeting were representatives from the ARRL, from industry, from several radio clubs and organizations, as well as individual radio amateurs with previous conference and other international experience.

The task and purpose of the meeting was aptly stated in the following introductory remarks of A. Prose Walker, Chairman of the meeting and Chief of the FCC's Amateur and CB Division:

> "This could be a golden opportunity for Amateur Radio. We're in a position, hopefully, to shape Amateur Radio for the remainder of the century and well beyond. Our goal is to do everything possible to strengthen Amateur Radio's position at the 1979 Converence. Our task won't be an easy one, and no one can guarantee that we will succeed. That's why we are here today--- to get things started in the right direction, and to give it our best."

Several task forces were established and Chairman named to formulate frequency requirements for the Amateur Service, band-by-band throughout the entire radio spectrum. Perhaps the most important task force, *Basis and Purpose,* was assigned to Herbert "Pete" Hoover, W6APW. Pete will be responsible for pulling together every argument that can be used to defend Amateur Radio at the Conference, and to justify frequency allocations.

We expect to be hearing a lot more about the Amateur Service Working Group in the days and months ahead, as the FCC intensifies its planning efforts for the Conference. Its task is formidable, and the future of Amateur Radio may well depend upon its efforts.

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OUR READERS SAY

Propagation

Editor, *CQ*:

Just a note to let you know that the article on "Breakthrough in Ionospheric Prop Forecast" in your March 1975 *CQ* was of special interest. Keep up the good work on propagation and the monthly forecasts, they are of special interest. All very good.

Leo Haijsman, W4KA
Cape Coral, FL

New Prefixes

Editor, *CQ*:

Re: WØLRN's letter in May *CQ*, he forgot to multiply by the ten call districts. For example the 1 X 1 call blocks would be 10 call areas X 25 calls per area = 250 possible calls. Not 25 as stated in the letter. All the other totals are the same; they should all have another zero added. The total number of possible calls is 16,344,750.

Roger Pender, K5MHG/6
Los Angeles, CA

Copies Available

Editor, *CQ*:

As a magazine collector, I would like to put my ever-growing collection to better use than taking up space. I'll be glad to provide any reader photocopies of any article in any magazine available; there is no cost and return postage is not necessary. All issues of *73 Magazine*, *Popular Electronics* and *Electronics Illustrated*, *CQ* from 1947, *QST* from 1921, and some issues of *Ham Radio* and others are available.

Donald Erickson, SWL WPE6DIQ
Riverside, CA

160M. Transmitter

Editor, *CQ*:

I received my advanced "author's" copy of the April issue of *CQ*. I have checked the article very carefully and find no errors or omissions in the literal text; however, there are two errors in the schematic, fig. 1. They are as follows:

1. You show C63 that is tied by the v.f.o. tuning mechanism to C65.

2. You show the so-called free end of the roller coil L52 as being permanently grounded. It is not; i.e. - this end of the coil connects to nothing with the amount of inductance being a function of the position of the roller contact on L52. L52 ties to ground via the pick-up coil inside of T54.

These two errors in the schematic are relatively minor and would pose no problem to the experienced builder, but someone who is not very sharp on circuitry might run into some quandry if he followed or tried to follow the schematic vs what he actually was seeing in the set's wiring. So I pass this information along for whatever further action you desire.

I was pleased to see G&G's ad for these sets, since the latest catalogue from Fair does not show them any more.

James L. Weeks, W6FNG
Wrightwood, CA

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Announcements

● **Tacoma Washington** — The Quarter Century Wireless Association is holding its Annual meeting in Tacoma, Washington at the Holiday Motor Inn on June 14th & 15th, 1975. For committee information, W7JAN(Vince) W7MFG (Cliff), W7AZI (Roy) and W7OS (Doc). ● **Boonville, MO** — The Annual Hambutchers' picnic will be held in Harley Park at Boonville, Missouri, on Father's Day, June 15th, 1975. For further information : write Glen Amick, K0DSQ, New Franklin, MO 65274. ● **Severna, Park, Maryland** — On Sunday June 15th the Maryland Mobileers Amateur Radio Club will hold it's annual Hamfest at the Anne Arundal Community College. For more information contact Larry Russo, Rt 6 Box 295, Pasadena, Maryland 21122. (301)437-0799.

● **New Zealand 10m. Beacon** — ZL2MHF, an NZART - sponsored beacon on 28.170 MHz is on the air as part of RSGB's World Wide 10m. Beacon network. Modulation is F1, with the call-sign given every 10 seconds. Power is 90w. input. Location is Mount Climie, near Wellington, 890m. above sea level. Send reception reports to NZART, P.O. Box 40212, Upper Hutt, New Zealand.

● **Georgetown, Kentucky** — The Central Kentucky Hamfest will be held on June 15, 1975 at the country World Convention Center located at the interstate 75 and Georgetown KY interchange. Doors open at 8 am with refreshments and Fleamarket. For additional information, contact: Bob Lunsford, WB4DPG, Route no. 4, Georgetown, KY 40324. ● **Akron, Ohio** — The Goodyear Amateur Radio Club, WA8UXP (Akron) will hold its 8th annual Fathers Day Hamfest Picnic on June 15, 1975, at Wingfoot Lake Park, (One mile west of Suffield, Ohio on County Rd, no. 87.Swap and Shop and prizes every hour beginning at 10:00 am For details, tickets maps and program write to Floyd T. Gilbert, WB8ALK, 1976 Newdale Ave., Akron, OH 44320. ● **Rome, New York** — The Rome Radio Club sponsores its 23rd annual 'Ham Family Day" on Sunday June 22, 1975 at Beck's Grove, 10 miles west of Rome, NY. For tickets and reservations, send a SASE to Rome Radio Club, Box 721, Rome NY 13440. ● **Jacksonville Illinois** — The Jacksonville area Amateur Radio Club will hold their 11th annual Hamfest, Sunday, June 29, 1975 at the Morgan County Fairgrounds. A large trading area will be available rain or shine. For more information, Write to Rodney N. Jackson WA9NZF, Jacksonville Area Amateur Radio Club-Jacksonville, IL 62650. ● **Manassas, Virginia** — On Sunday, June 8, 1975 the Ole Virginia Hams A.R.C., Inc. will hold their hamfest at the Prince William County Fairground 1/2 mile south of Manasas on Rt. 234. For information contact: Tim Wayne, WA4GVX, 1708 Sharp Drive, Woodbridge, VA 22191. ● **Willow Springs, Illinois** — The Six Meter Club of Chicago, Inc. will hold its 18th Annual Hamfest at Santa Fe Park, 91st Street and Wolf Road in Willow Springs, IL on June 8th 1975. For further information and advance tickets, contact: Val Hellwig, K9ZWV, 3420 S. 60th Court, Cicero, IL 60650.

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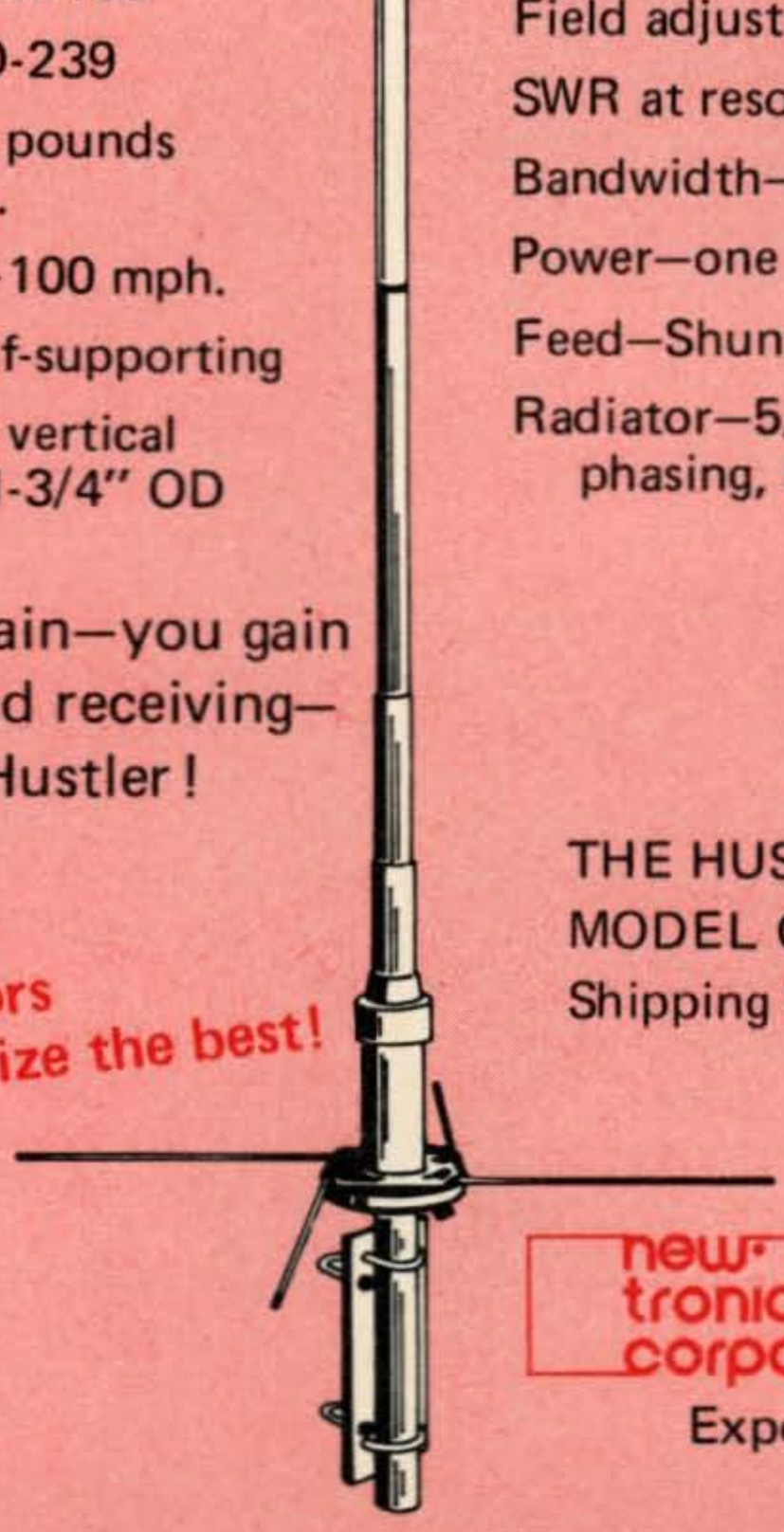

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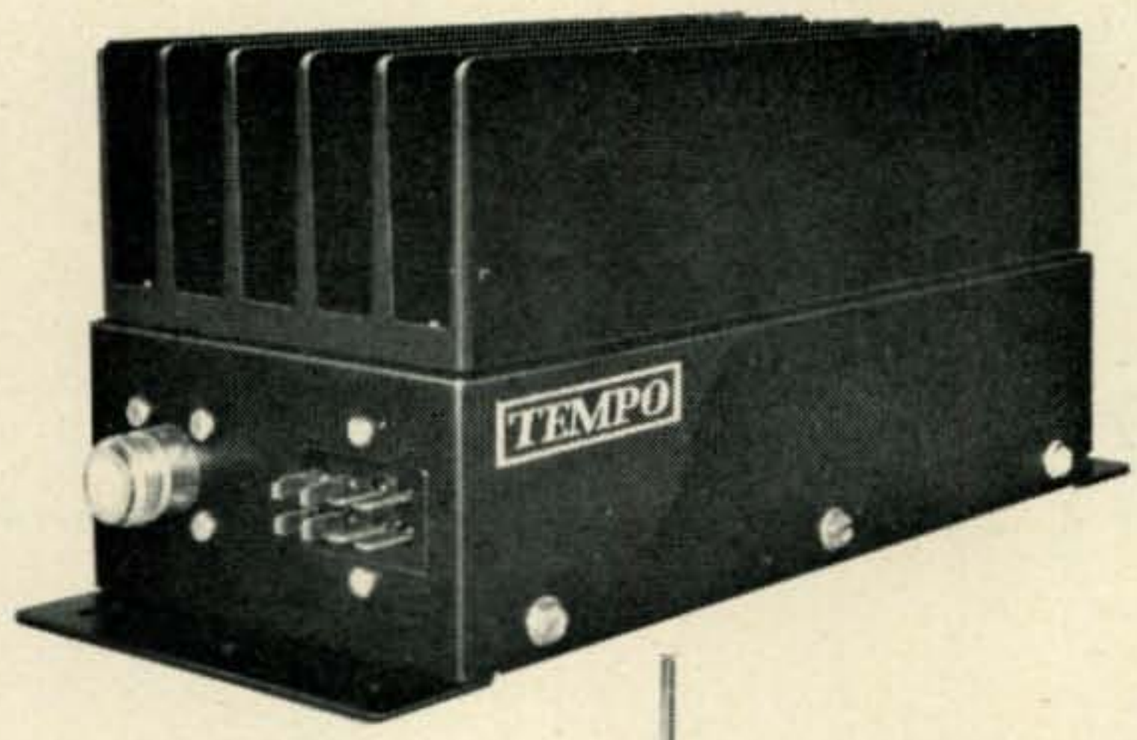

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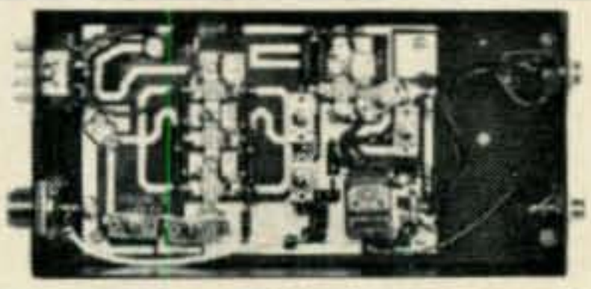

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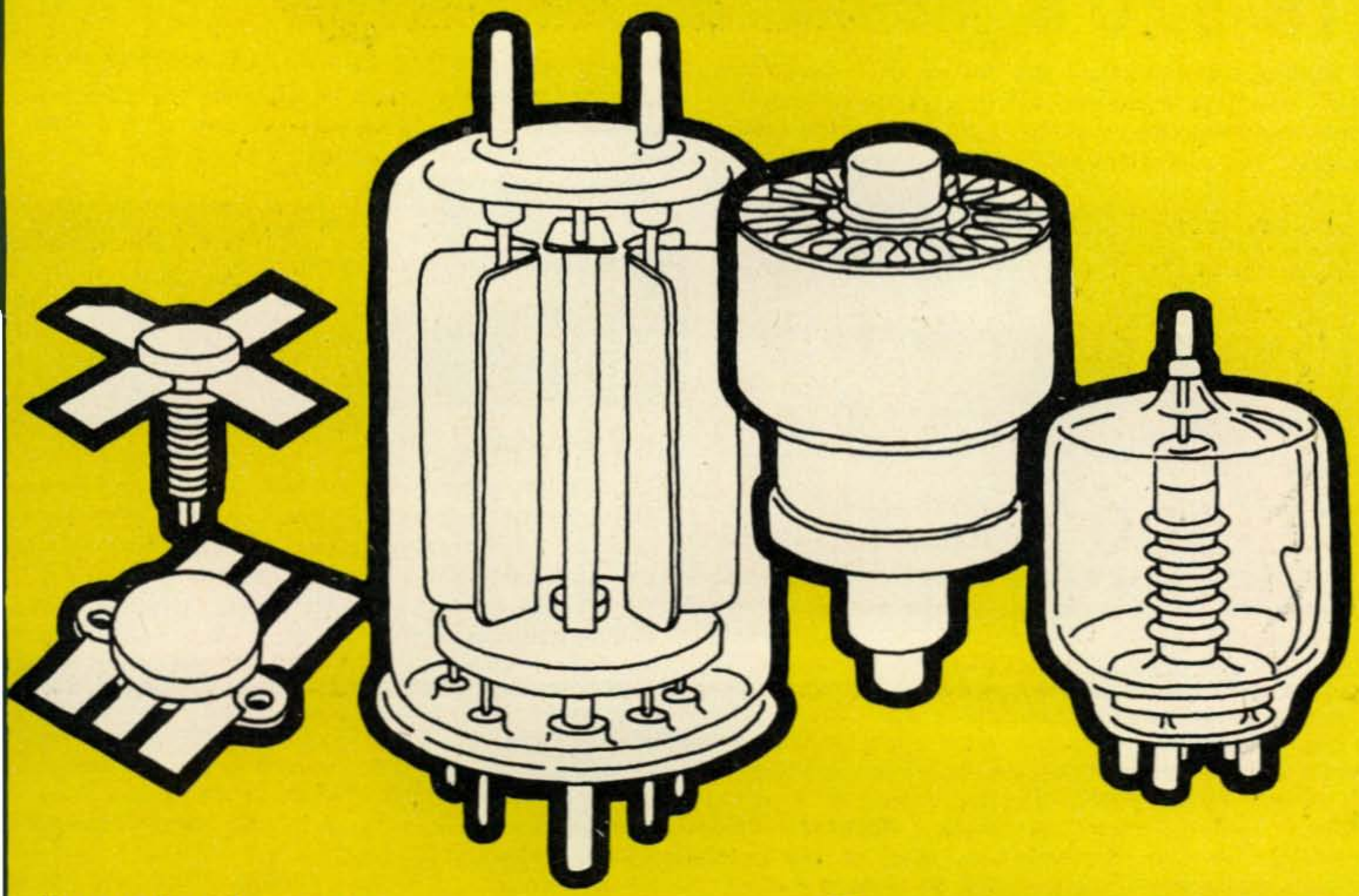

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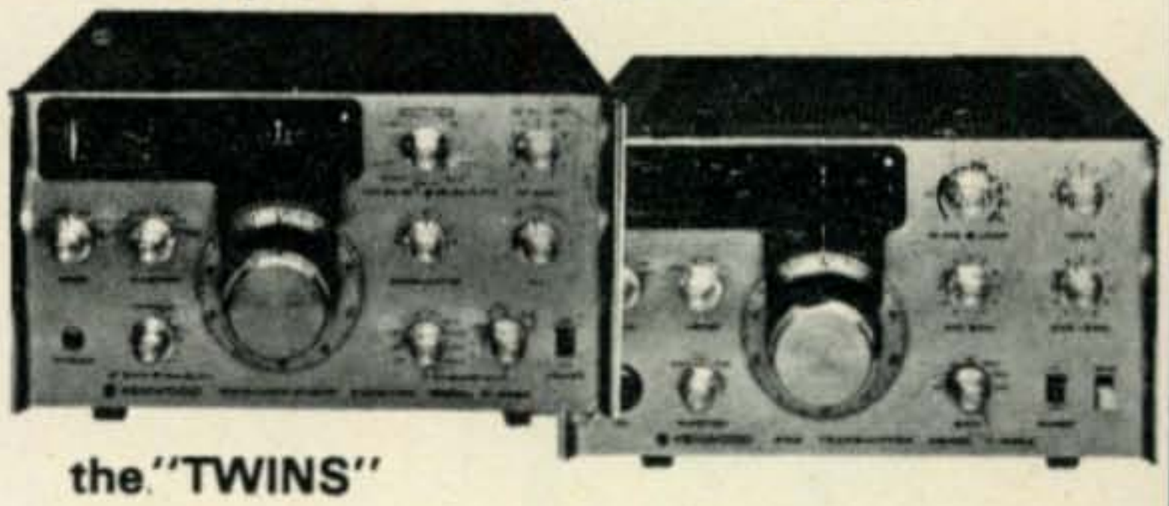

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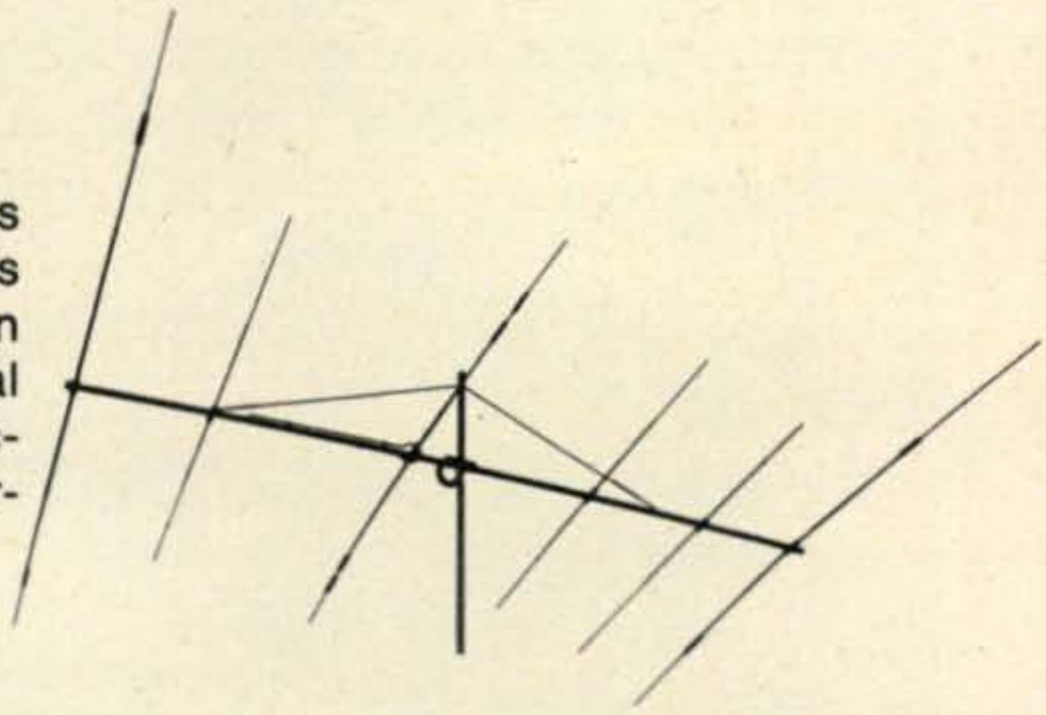

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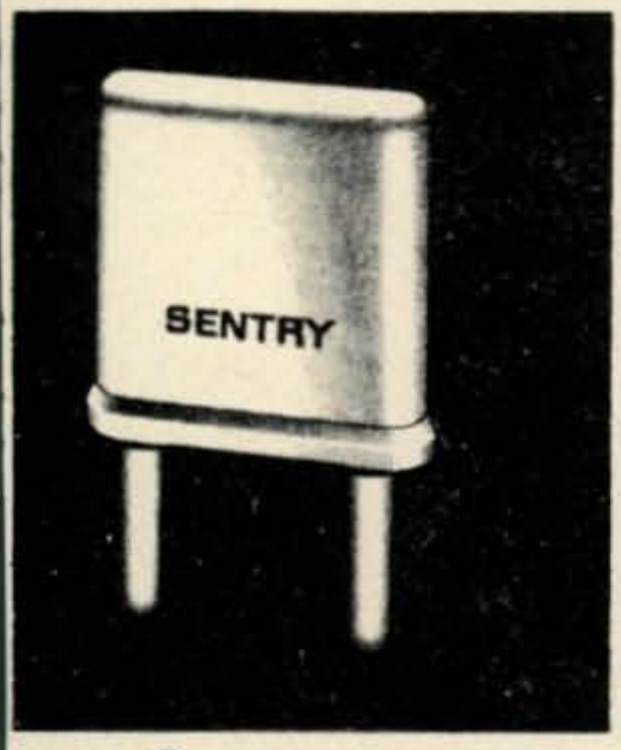

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RF Impedance Measuring Instruments

BY JOHN J. NAGLE,* K4KJ

In a previous article[1] I discussed the General Radio 916 family of r.f. impedance bridges. While this instrument is a popular r.f. impedance measuring instrument, particularly in the field of antenna measurements, it is by no means the only device available for this purpose. In this article I will describe several other laboratory grade r.f. impedance measuring instruments, many of which are becoming available at used equipment houses and in flea markets at prices amateurs can afford to pay. Some of these instruments are obsolete in the sense that they are no longer being manufactured and are being discarded by government and commercial laboratories for more modern equipment. This obsolescence, however, does not affect their continued utility for making accurate measurements. As these instruments are, for the most part, passive devices with nothing to burn out and are operated at very low power levels, they are inherently long-lived devices and will find many useful applications around a ham shack.

The first instrument to be discussed is the General Radio 821-A Twin-T impedance-measuring circuit; an overall view of this instrument is shown in fig. 1.

Historically, this instrument is one of the earliest commercially available r.f. measuring devices, being introduced about the same time as the 916 in the late 1930's; it measures impedance, or more exactly admittance, as a parallel combination of conductance and susceptance, $Y = G + jB$, as shown in fig. 2. This is the complement of the equivalent series impedance $Z = R \pm jX$ as measured by the 916 family of bridges.

As its name implies, the twin-T circuit consists of two T-networks in parallel. The first is composed of $C_1 - C_2 - R$, while the second is the $C - LC_3 - C$ network. These are shown separately in fig. 3, while the basic circuit is shown in fig. 4. When the transmission through the two T-networks is equal in magnitude and opposite in phase, a null will appear at the detector terminals and the network is said to be balanced. This circuit has the advantage that

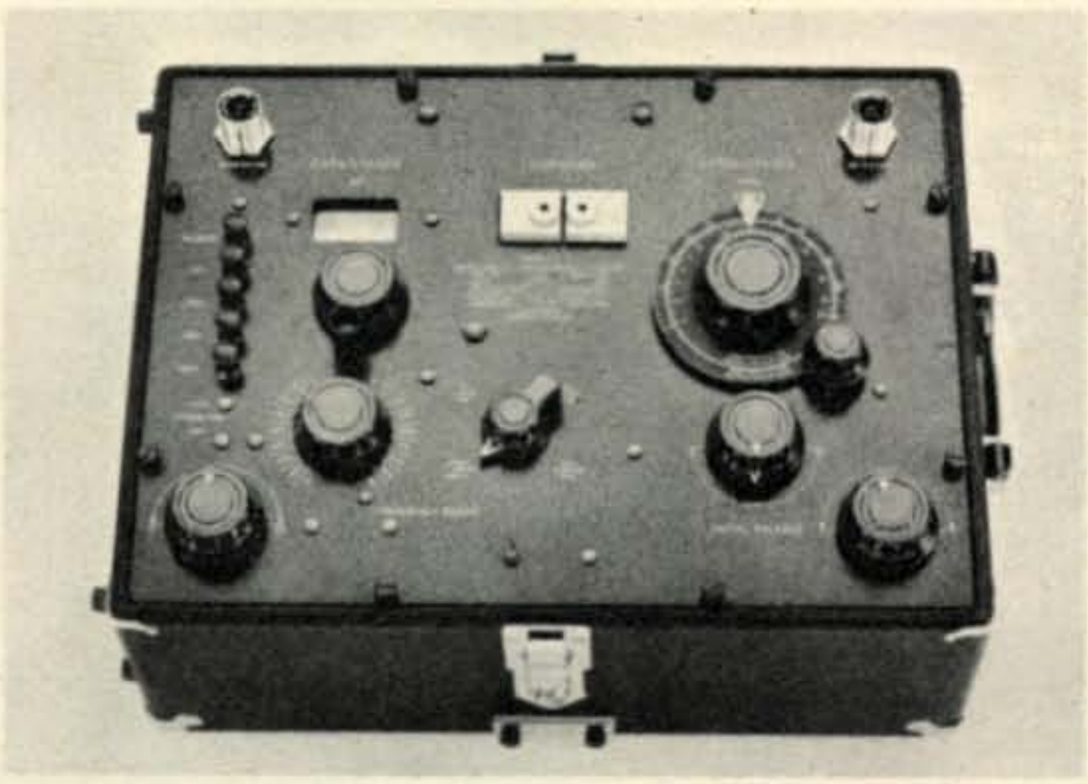

Fig. 1—The General Radio 821-A twin-T impedance measuring bridge. This is a later production unit and uses the GR-874 series connectors for the generator and detector. (Photo courtesy General Radio Co.)

one side of the generator, detector, and unknown terminals are all grounded, thereby eliminating the transformer which is necessary in the 916 family of bridges.

Like the 916, this instrument operates on the substitution principle; the circuit is first balanced by using initial balance controls with the unknown terminals open-circuited and the conductance dial set to zero. The capacitance dial may then be set to any convenient value. The device to be measured is then connected across the unknown terminals and the instrument rebalanced with the conductance and capacity controls. The variable capacitor, C_2 in fig. 4, is calibrated in conductance (μmhos). It is direct reading at 1 MHz and 3 MHz; a frequency correction factor must be used at other frequencies. The control, C_3, is a precision variable capacitor calibrated directly in pf. The susceptance or reactive component is calculated from the change in capacity necessary to obtain a new balance.

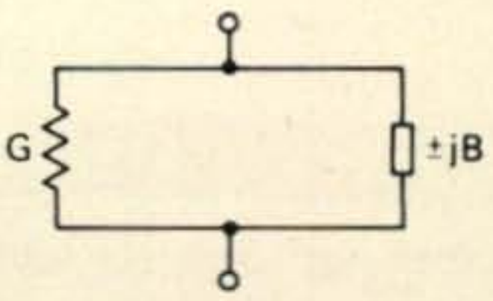

Fig. 2—Parallel combination of conductance and susceptance. The rectangle ±jB will be either a capacitor or an inductor.

*12330 Lawyers Road, Herndon, VA 22070.

[1]"Impedance Measurements at Radio Frequencies," John J. Nagle, *CQ*, Nov. '74, pp. 18-24.

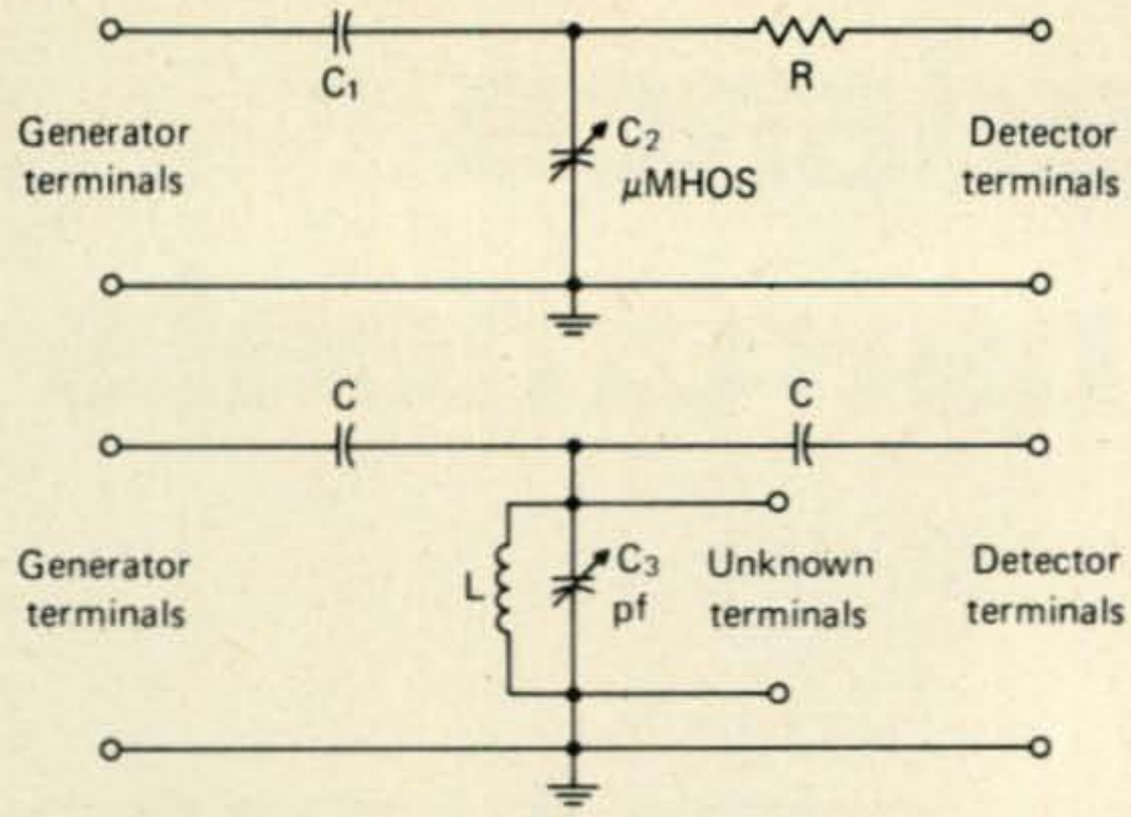

Fig. 3—The two basic T-networks of the twin-T impedance measuring circuit. The two networks are in parallel.

The principal specifications of this instrument are:

FREQUENCY RANGE: 460 kHz to 40 MHz
CONDUCTANCE RANGE VARIES FROM:
0 to 100 μmhos at 1 MHz
to 0 to 3000 μmhos at 30 MHz

The susceptance is obtained from a precision variable capacitor which is calibrated to fractions of a picofarad over a total range of 1000 pf. The susceptance range, therefore, depends on the test frequency and where on the dial an initial balance is obtained.

From the specifications, it can be seen that the 821-A is designed to measure relatively high impedances. At 10 MHz this instrument measures conductance from 0 to 1000 μmhos. Since 1000 μmhos of conductance is the equivalent of 1000 ohms of resistance, a conductance range of 0 - 1000 μmhos is equivalent to an open circuit (infinite ohms) down to 1000 ohms. The 821-A thus complements the 916 family in that the 916 measures low impedances, 0 to 1000 ohms resistive, while the 821-A measures high impedances, from 1000 ohms up. An additional advantage of the 821-A is that because it has a precision variable capacitor directly calibrated to 0.2 pf, the instrument can be used to measure small values of capacity and inductance. I have found the 821-A a very convenient instrument for routine measurements in the workshop.

The same general considerations apply in buying a used 821-A as for a 916 or any other piece of used equipment. Does the unit appear to be in good mechanical condition? Do all the controls operate freely? Does the unit show any signs of mechanical or electrical abuse? Are any parts missing? This last is critical because this instrument has long been out of production and replacement parts cannot be obtained from the manufacturer.

Early production of the 821-A incorporated GR series 774 connectors for the generator and detector terminals; these connectors no longer are in production. GR supplied two coaxial cables with matching connectors with the instruments. If these cables are not with the instrument you are considering, an adapter to go from GR 774 to UHF connectors may be made, as described in my previous article;[1] see figs. 7 and 8 thereof. Later production models of this instrument use the current 874 connectors which are in production and for which adapters can be obtained.

For those with access to a good technical library, reference 2 gives a very interesting and readable description of the theory and design of the 821-A. Reference 3 provides a discussion of various types of T neworks for impedance measurements, while reference 4 covers the problems of high impedance measurements at radio frequencies.

The second instrument to be described is the General Radio 1601-A VHF Impedance Bridge, shown in fig. 5. This bridge is essentially a higher frequency version of the 916-A bridge, measuring equivalent series impedance in the frequency range 25 - 165 MHz. The 1601-A would appear to be especially useful to those doing antenna work in the lower v.h.f. region —the 10, 6, and 2 meter amateur bands.

There were comparatively few of these instruments manufactured. The v.h.f. bridge came out in the early 1950's and was in production for only a few years before it was superseded by the GR 1602-A.

A GR-1602-A u.h.f. admittance meter is shown in fig. 6; it measures a parallel combination of conductance and susceptance range over a frequency range of 40 - 1500 MHz. The conductance and susceptance range of the meter are such as to make the instrument use-

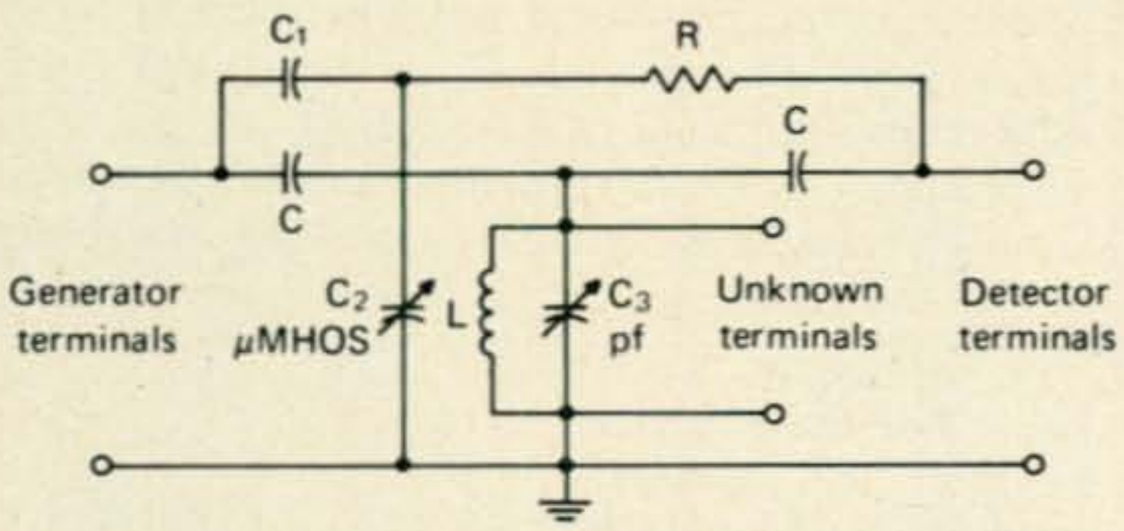

Fig. 4—The basic circuit of the twin-T network. Note that one terminal of the generator, detector and unknown terminals is grounded.

[2]"The Twin-T. A New Type of Null Instrument for Measuring Impedance at Frequencies up to 30 Megacycles." D. B. Sinclair. *Proc. IRE*, Volume 28, No. 7, July '40, pp. 310-318.
[3]"Bridge-T and Parallel-T Null Circuits for Measurements at Radio Frequencies." W. N. Tuttle, *Proc. IRE*, Vol. 28, No. 1, Jan. '40, pp. 23-39.
[4]"Bridged-T Measurement of High Resistances at Radio Frequencies." P. M. Honnell, *Proc. IRE*, Vol. 28, No. 2, Feb. '40, pp. 88-90.

ful for antenna and transmission line measurements in the v.h.f. and lower u.h.f. regions.

Although this instrument is still in the GR catalog, a surprisingly large number of them are turning up in second-hand sources at reasonable prices. In buying a second-hand instrument, be sure you obtain the conductance and susceptance standards that go with the meter. These are necessary to use the instrument. The conductance standard is a 50 ohm termination, for which any high quality termination that can be adapted to the General Radio 874 series of connectors can be used. The susceptance standards are a more difficult problem. The lowest frequency (40—150 MHz) standard is a variable capacitor calibrated in frequency; the higher frequency standards used an adjustable stub. While these standards are still available from General Radio, they are on the expensive side for most amateurs, to the extent that, even if you were given the meter free, but lacking the standards, just obtaining the standards would cost more than you would probably care to spend for a complete instrument. Therefore, make certain that you get standards with the instrument. If possible, the standards should have the same serial number as the instrument itself.

So far, we have discussed measuring instruments manufactured by the General Radio Co. Historically, GR is one of the oldest companies specializing in this type of measuring equipment, so that more GR equipment is coming into the second-hand market than equipment of other manufacturers. While GR is an old and well respected firm, they are by no means the only such firm.

I will now discuss three instruments by the Hewlett-Packard Co. The first of these is the H-P 803 v.h.f. bridge, shown in fig. 7. The important specifications are:

FREQUENCY RANGE: 55 MHz to 500 MHz useful to 5 MHz, but at reduced accuracy and measuring range.

IMPEDANCE RANGE: This bridge measures impedance in terms of magnitude and phase angle. *Magnitude:* 2 to 2000 ohms direct reading. *Phase Angle:* —90 degrees to +90 degrees at 55 MHz and above direct reading at 100 MHz

It is relatively easy to convert a magnitude and phase angle to the resistive and reactive components. The 803 reads $Z/0°$; so that the

Resistive component = Z Cos 0 and

Reactive component = Z Sin 0.

This product is easily obtained on a slide rule or scientific calculator. A reading of 57.6 30° ohms would be

$Z = 57.6 \text{ Cos } 30° + j57.6 \text{ Sin } 30°$

$= 50 + j28.9$ ohms.

From these specifications it can be seen that this instrument will be convenient for matching antennas in the 50 to 450 MHz amateur bands.

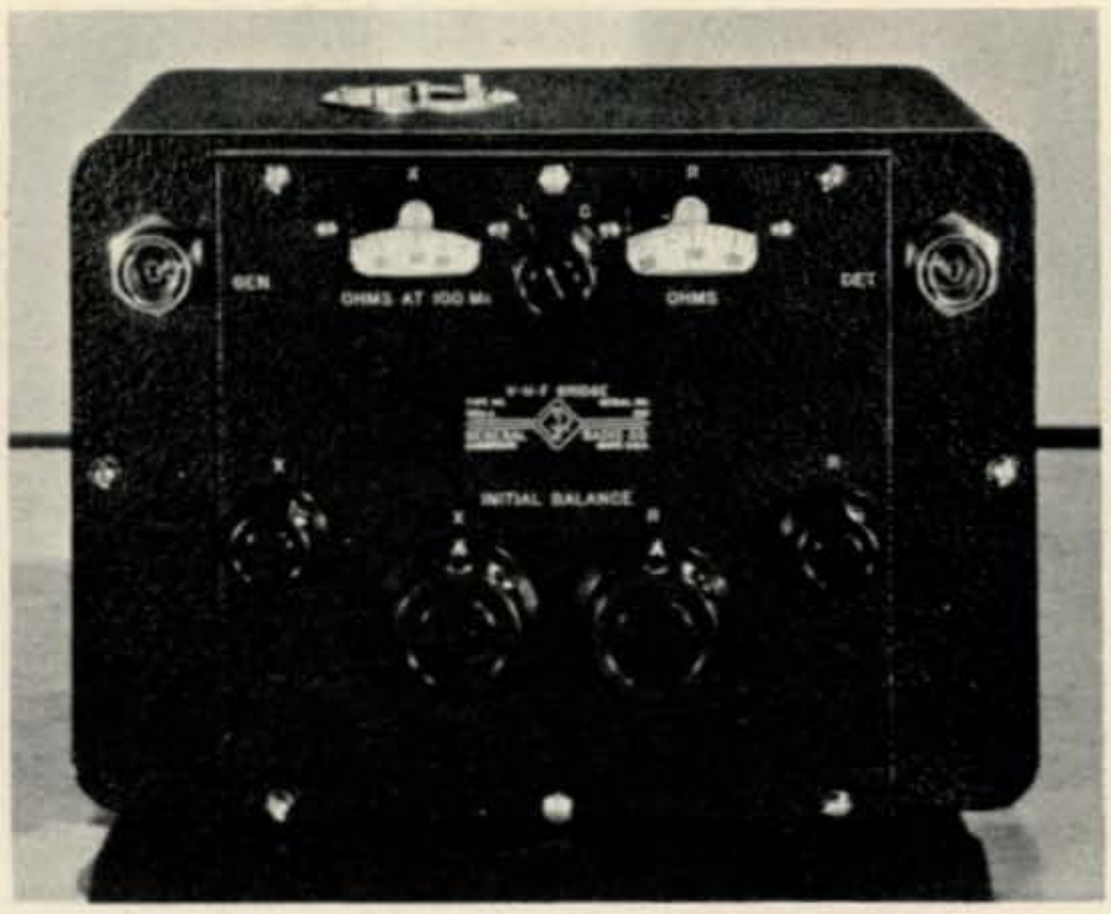

Fig. 5—The General Radio 1601-A v.h.f. bridge. (Photo courtesy General Radio Co.)

The instrument is convenient to use; the "Generator" and "Detector" connectors are BNC while the "Unknown" terminal is a type N.

When buying a used instrument, try to find one that has a dust cap for the "Unknown" connector attached. This is actually a special shorting cap; it is used to short-circuit the "Unknown" terminal when checking the calibration at 500 MHz. Not only must the original cap be used for calibration, but the cap must be rotated to the proper position; its position is correct when the red dot on the cap face is at the top. The bridge can be used without the original cap, but the calibration cannot be checked. Also, correction charts were supplied for each instrument by the factory to enable

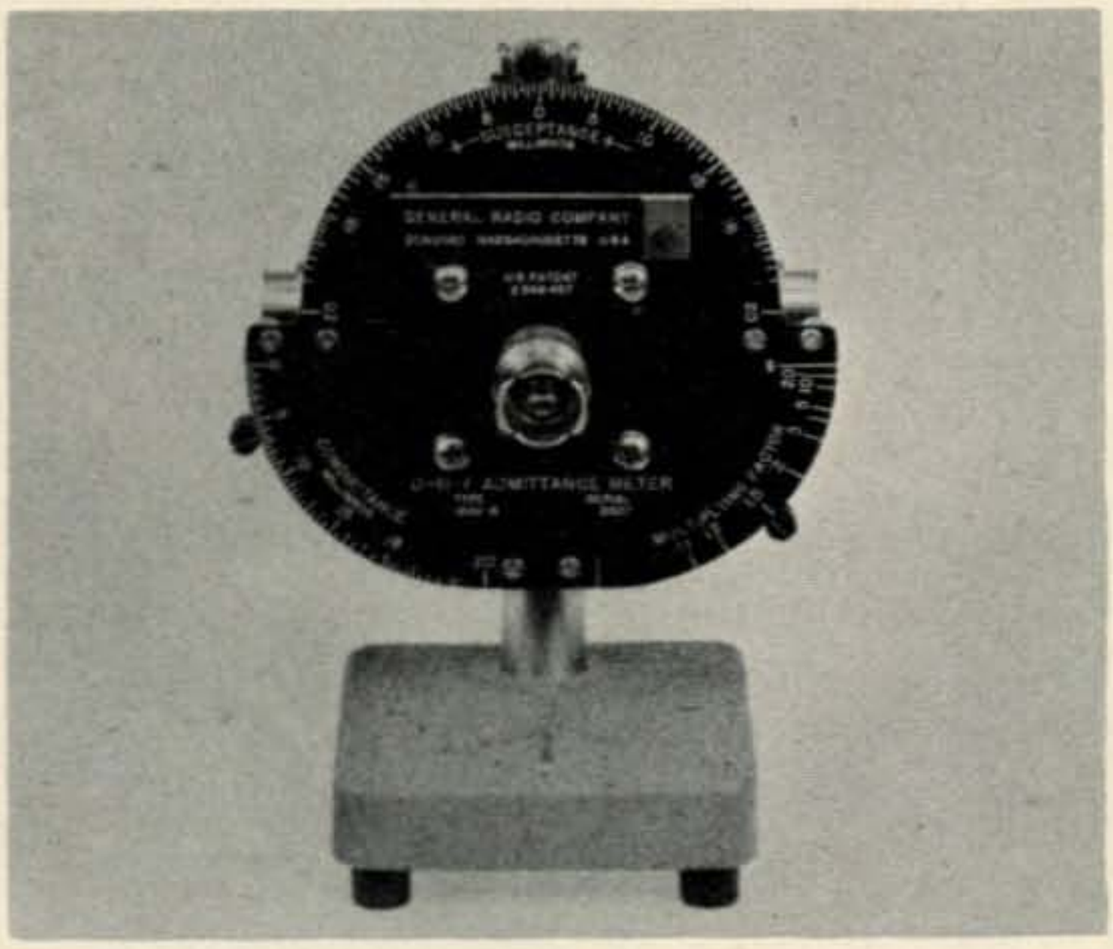

Fig. 6—This is the GR 1602-B u.h.f. admittance meter. The susceptance standard plugs in the top, the conductance standard plugs in the left-hand connector, the unknown in the right-hand connector. The detector and generator connect to the front and rear (not shown) connectors respectively. (Photo courtesy General Radio Co.)

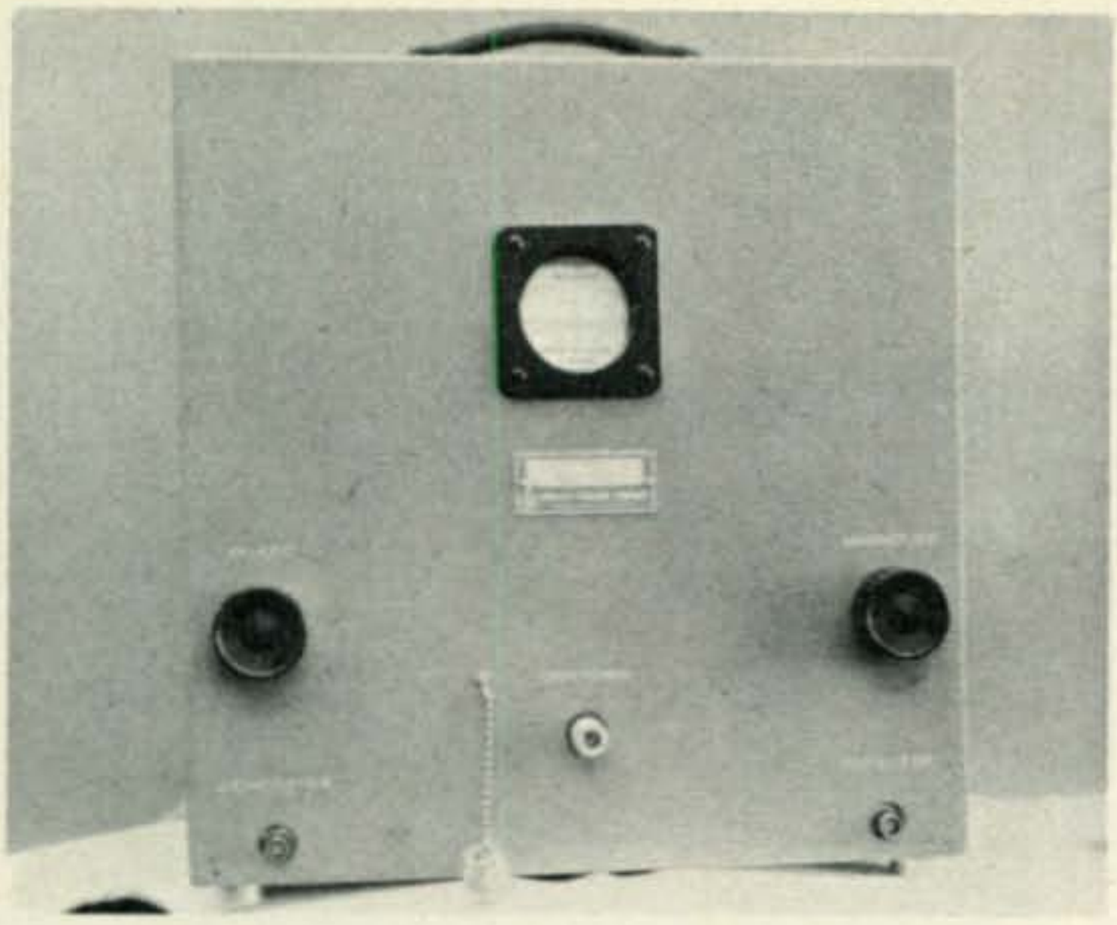

Fig. 7—A dead front view of the H-P 803A v.h.f. bridge. A dust cover hanging near the unknown terminal is actually a shorting cap used to calibrate the bridge at 500 MHz.

the magnitude to be corrected to ± 2 percent and the phase to ± 1.2 degrees. More accurate measurements can be obtained if these charts are available. As always, check to see that the controls operate freely and that there is no evidence of mechanical damage or abuse.

If you hope to rehabilitate an 803, you should know that the maintenance manual warns that the instrument will be damaged if either front or rear cover is removed! This makes one wonder how it was put together!

The second H-P instrument to be described is the 250B RX Meter; a photograph is shown in fig. 8. This instrument has proven to be very popular in commercial laboratories; it was originally designed and sold by the Boonton Radio Co. of Boonton, N.J. and is still spoken of by many older engineers as the "Boonton RX meter." Hewlett-Packard took over the manufacture of this instrument when they bought Boonton several years ago.

The RX meter reads the parallel combination

Fig. 8—The Hewlett-Packard (Boonton) RX meter. This package contains the generator and detector as well as the measuring bridge, thereby making a very convenient unit. (Photo courtesy the Hewlett-Packard Co.)

of resistance and reactance over a frequency range of 500 kHz to 250 MHz. The resistance range is 15 to 100,000 ohms; the reactance range is 0 to 20 pf capacitive. Inductive reactance is measured in terms of negative capacity. The inductive reactance is equal to that required to resonate the negative capacity reading at the test frequency. The range of negative capacity is 0 to 100 pf.

This meter is particularly convenient to use since the generator and detector are built-in; thus it is not necessary to buy a signal generator and receiver or find space on the work bench, or on the roof, to put these accessories. However, this convenience makes it difficult to find this instrument on the used equipment market because most laboratories tend to hang on to them; when they can be found, they are relatively expensive.

Two adapter kits are available for special applications. One is a coaxial adapter which converts the screw-type terminals normally supplied to a type N connector for transmission line measurements. The second is a transistor test jig for measuring transistor circuit parameters.

If you contemplate buying a used RX meter, be sure to check the two "R" (for resistance) balance controls; one is a coarse balance; the other, a fine balance. The controls are actually variable resistors and tend to become "noisy" after extensive use. This noise manifests itself in erratic meter movements, particularly near the balance point. Erratic resistance balance controls should certainly be considered in the price, as these controls may be difficult for a home experimenter to replace and expensive to have done professionally.

As the final instrument to be discussed, I have shown the H-P vector impedance meter, not because the average amateur will see very many of them in flea markets for a long time, but as a preview of things to come. A view is shown in fig. 9. This meter is, in every sense, a modern instrument. Set the frequency dial to the desired frequency, connect the unknown impedance to the probe and read the magnitude of the impedance on one meter and the phase angle on another. How lazy can you get?

In spite of the convenience offered by the last two instruments with their built-in detectors, a word of caution is in order. When measuring antenna parameters in the presence of interference, which is almost always the case on the ham bands, the detectors almost always go wrong because they cannot null in the presence of interference. There is no cheap substitute for the human ear as a filter. It takes a multimillion dollar computer installation to distinguish a desired signal in a strong noise or interference background as well as an experienced radio operator (or transcriber) can do with a good pair of headphones.

Manufacturer and Model	Frequency Range	Instrument Measures	Resistive or Conductance Range	Reactive or Susceptance Range	Comments
GR 916A/1606 RF Impedance Bridge	450 kHz—60 MHz	Series equivalent impedance	0—1000 ohms	0—$\frac{5000 \text{ ohms}}{f_{mc}}$ both inductive and capacitive	The 916A requires two transformers to cover frequency range.
G-R 821A Twin-T Admittance Measuring Circuit	450 kHz—40 MHz	Parallel equivalent admittance	0—10,000 μmhos (depends on frequency)	Equivalent to $\pm$ 1000pf of capacity	Useful for measuring relatively high impedances.
G-R 1601 RF Impedance Bridge	25—165 MHz	Series equivalent impedance	0—1000 ohms		V.h.f. equivalent of GR 916A.
GR 1602 UHF Admittance Meter	25—1500 MHz	Parallel equivalent admittance	0—μmhos	0—μmhos	Requires external conductance and susceptance standards.
HP 803A VHF Bridge	55—500 MHz	Series equivalent impedance	2—2000 ohms	$\pm$90 degrees at 55 MHz and above	Measures impedance as a magnitude and phase angle.
HP 250 RX Meter	500 kHz to 250 MHz	Parallel equivalent resistance and reactance	15—100K ohms	+ 20 pf cap. —100 pf ind.	Has built-in generator and detector.
HP 4815A	500 kHz to 108 MHz	Series equivalent impedance	10—100K ohms	$\pm$ 90 degrees	Not readily available used.

Table I—Summary of the characteristics of various R.F. impedance measuring instruments.

Fig. 9—The Hewlett-Packard 4815A r.f. vector impedance meter. With this current-production unit, a single probe excites the circuit under test and measures both impedance and phase angle directly.

In this article, as well as in a previous one, we have described some of the laboratory grade r.f. impedance measuring equipment available in the used equipment market and given some tips on what to look for in purchasing this equipment. The characteristics of the equipment discussed are summarized in Table I.

Due to space limitations, I have not been able to describe some of the uses and applications of these instruments. If "ye olde editor" of *CQ* agrees, a future article will be devoted to this subject. ■

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1974 CQ WORLD-WIDE DX CONTEST CW RESULTS

BY FRED CAPOSSELA,* K6SSS ex-W2IWC/6

REMEMBER how close the Phone contest was?

Well, the c.w. wasn't.

Something else the contest wasn't, was that it didn't happen to fall on Thanksgiving weekend. It falls on the last full weekend of November. Regardless of Thanksgiving.

Victory By .0003%

Just because the top Single Op/All Band scores weren't as close as the Phone test, don't make the mistake of thinking that the competition wasn't close. Take a look at the 4th, 5th, 7th, 8th and 9th place finishers. As little as .0003% separates them. Which works out to be about ½ a QSO! Margins of victory like that are just one reason we check logs as closely as we do.

DXpeditions Slug It Out

A number of DXpeditions went Multi-Single. And the competition was red-hot. OH2BH followed up his championship performance in the Phone contest by joining OD5HC and OH2MM in the mountains 4,000 feet above Beirut where they piloted OD5IQ to a new world record. Not only did a computer score their log, it also printed out their QSL cards. Right on their heels came the FY7AA gang posting a new South American record.

New York's Order of Boiled Owls set a new African mark from a luxury hotel as CT3WA, while halfway around the world in a grass hut, three Californians broke the Oceania record from FWØAA.

Overachievement Dept.

The Multi-Multi PJ9JT gang set out to beat the 1970 world record the hard way. At the bottom of the sunspot cycle, and they might have done it, too, if ten meters had been kinder to them.

Someone who did break a record was CR6IK who owns the new 14 MHz title. He's joined by other brand-new record holders ZL1AMO, KP4EAJ, YU3DBC, 4X4NJ, PAØHIP and K1PBW.

On the subject of overachieving, hats off to the members of the Potomac Valley Radio Club who demolished their 1969 Club record with a staggering 53,869,662 points.

Big Guns Beware!

You're in for some real competition when WN2SJG and WN9MMR drop the "N" from their calls. On the 15 meter Novice band alone,

*Director, *CQ* DX Contest Committee.

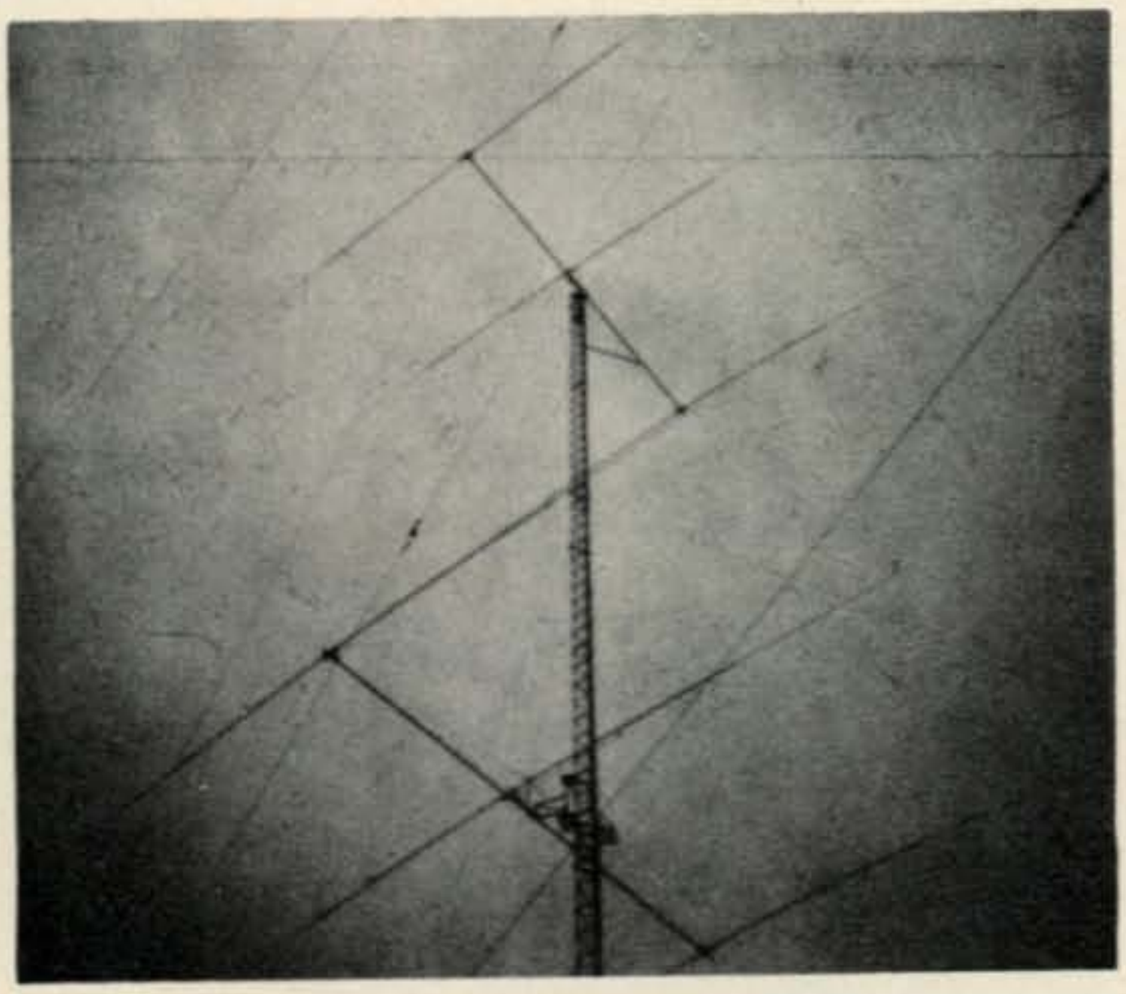
SJG ran up a record 21,024 points, 154 QSOs and a multiplier of 48!

Disqualification: A Word About the Word

If I may get serious for a moment, I'd like to talk about the word, disqualification; exactly what it means, and doesn't mean. Disqualification means one thing: that there has been a rule infraction. That, and only that. There is not—and there can never be—a judgment made as to a contestant's motivation or intent. The only thing we—or anybody else—can judge is whether or not there has been a rule infraction. That's why if somehow the impression has been created that disqualification might carry the slightest implication of motivation, let me state "absolutely not." As I said at the Contest Forum at Dayton, I'll be the first to offer an apology. By the same token, I would also like to be the first to apologize for any "trigger happy" individuals who might have jumped to conclusions, because there are no conclusions to be drawn. As long as men compete in championships—the Super Bowl, Wimbleton or World-Wide DX Contests, there will be referees. And from time to time, there will be rule infractions. And disqualifications. But let's understand what they mean, and do not mean.

Surefire Way to Get Into "QRM"

Simple. Just write about anything except conditions. Don't misunderstand. I'm not against interesting propagation news (like long path on 1.8 or 28 MHz). It's just that I *know* "conditions weren't as good as last year." Tell me something I don't know. Which leaves the field wide open. And, by the way, don't forget to send in photographs with your log and comments.



This is why WB5DTX gets out so well on 40. That's right, 3 over 3! Top beam is at 165' and the lower one is at 85 feet. With W5BJA at the controls, WB5DTX took second world high on 7 MHz.

TROPHY WINNERS

Single-Operator Single Band

M. C. da Dilva Wilches, CR6IK (14 MHz)
World C.W. Trophy
W2JT Memorial Trophy (NJDXA)

John Bazley, G3HCT
European 14 MHz C.W. Trophy
G2LB Memorial Trophy

Single-Operator All Band

Gary Stillwell, YJ8GS (W6NJU)
World C.W. Trophy
Donor: Larry LeKashman, W2AB

Pete Chamalian, W1BGD/2
USA C.W. Trophy
Donor: Frankford Radio Club

Jerome A. Kolata, Jr., CT2BN
European C.W. Trophy
Donor: W3AU Operators

Micheal Reininga, KP4EAS
Carib./C.A. C.W. Trophy
Donor: Harold Fox, W3AA

H. C. DeWet, ZE1JV
African C.W. Trophy
Donor: Gordon Marshall, W6RR

Owen Jackson, A9XU
Asian C.W. Trophy
Donor: Japan CQ Magazine

Maurice Caplan, VS5MC
Oceania C.W. Trophy
Donor: Maui A.R.C.

Multi-Operator Single Transmitter

OD5IQ (Oprs. OH2BH, OH2MM, OD5HC)
World C.W. Trophy
Donor: Anthony Susen, W3AOH

Multi-Operator Multi-Transmitter

PJ9JT (Oprs. DJ3KR, K4GKD, PJ2ARI, PJ2VD, W1BIH, W1GNC, W1TX, W3LPL, WA1STN, WA1STO)
World C.W. Trophy
Donor: Hazard Reeves, K2GL

Expedition Trophy

CT3WA (Oprs. K2JP, W2AO, W2AX, W2AYJ, W2GC, W2GGE, W2IRV, WB2CKS)
Donor: Stuart Meyer, W2GHK

New for 1975 & 1976

The Committee is conducting an extensive statistical analysis of the entire contest during 1975. So you can expect very little in the way of changes for the upcoming fall contests. However, we are giving consideration to establishing several brand-new categories of competition for 1976. Possible new categories include QRP, OSCAR, SSTV, RTTY and Novice. We are also looking into perhaps expanding classes of Club competition to equalize clubs of various sizes and DX-pedition scores. Needless to say, we'd like to hear from you.

USA TOP SCORES

Single-Op. All Band

W1BGD/2	1,133,847	K4YF	873,072
K3YUA	1,100,924	W3LPL	858,484
WA1PID	1,027,424	W2DXL	816,120
WB4YLG	1,010,330	K6UA	804,340
W6RR	904,096	WB4BGY	803,586

Single-Op. Single Band

28 MHz		7 MHz	
WA5RTG	9,000	WB5DTX	156,960
K2QBW	8,639	WA8ZDF	146,792
W6HX	7,954	K2LWR	113,080
WB4UYD	7,650	W6ITY	112,963
WA4DRU	7,399	W6ILP	70,500
WA5STI	7,392	WB5DIZ	61,542
21 MHz		**3.5 MHz**	
W4KFC	161,880	W3MFW	71,874
W4WSF	133,380	W4YHD	63,518
W2NIN	118,770	W4CRW	43,600
W6YRA	117,852	W6NLZ	21,168
K4PHY	106,106	W7KAR	21,168
W1PIV	100,582	VE3DXV/W6	18,327
14 MHz		**1.8 MHz**	
K6SDR	223,560	K1PBW	9,750
W4AAV	181,630	WB8APH	7,626
K8IDE	162,250	W1BB	6,279
WA0CVS	139,971	W3IN	3,914
W9KNI	136,736	K5JVF	576
WØPCO	131,806	WB9BUV	204

Multi-Op. Single Trans.

K4GSU	1,601,024	WA5LES	1,013,320
WA1NRV	1,222,800	W2YD	1,005,480
W2GXD	1,082,112	WB2SQN	959,008

Multi-Op. Multi-Trans.

W3AU	3,623,116	W3GPE	2,556,180
W2PV	3,339,215	W7SFA	2,057,442
W3WJD	2,802,096	W3GM	1,741,165

Please, Please, Please

Stop breaking my heart. Stop recopying your logs. Every year I see log after log with 500 to 3,000 contacts recopied—by hand. It ain't necessary. Honest. Use carbon paper or make a photocopy. Rewrite any illegible calls in the margins. And drop it in the mail. The contest is supposed to be fun. And recopying logs ain't fun. You can better spend the time getting ready for the *CQ* 160 or ARRL DX Tests. Besides, recopying logs can introduce errors no matter how careful you are.

You also don't have to write down 59904 two thousand times. Just write in the variations. Same thing goes for your QSO points. And for country multipliers, just write in the prefix. Don't worry about how to spell Ecuador or Uruguay.

Over the past several years, the logs have been getting better and better. Frankly, we're delighted. And the credit is all yours. My suggestions are an attempt to make it even easier, for both of us.

And, please, don't wait until two weeks before the contest to send in for log sheets. That's when everybody else remembers. It makes for quite a crunch at the *CQ* office. We'd hate to disappoint you. Send in now. Or a month from now. But not the second week of October, please.

Your-Secret-Is-Safe-With-Me (cont.)

Seems a large unnamed Multi-Multi managed to work a member of the Contest Committee on two bands. And managed to log his call wrong—both times. As fate would have it, the particular member turned out to be the one who checked the Multi's log. And, which Committee member missed the contest completely because he thought it was always on Thanksgiving weekend?

What's It All Add Up To?

I thought you'd never ask. The 1974 *CQ* World-Wide DX Contest added up to exactly 467 lbs. of logs. I kept track. And that doesn't include approximately 500 USSR logs we always receive via sea mail. The Phone logs came in OK as usual, but we have yet to receive the c.w., and must conclude regrettably that they were lost in transit. If we do receive them, we will publish an addendum to the results.

Tnx, Tnx, Tnx

As you know, this was my baptism of fire at handling the Results. Fortunately, I had a lot of good people helping me. I can't thank them enough. But I can bring them back for an encore: our Chairman, Frank Anzalone, W1WY; regulars Gene Walsh, K2KUR; Bob Cox, K3EST; Bernie Welch, W8IMZ; Dave Donnelly, WB2SQN; and Dick Norton, W6DGH. And new Members Larry Weaver, W6JPH; Glen Rattmann, W6MAR; Jim Neiger, W6BHY; Phil Goetz, W6DQX; Larry Brockman, WA6EPQ and Fred Laun, W9SZR. And an extra big thank you to Marguerite Fagella at *CQ*.

Good luck with your antenna work over the summer. Just remember, if it didn't fall down last year, it probably isn't big enough.

The c.w. Contest is November 29th and 30th (Thanksgiving weekend, this year). And, if things go as planned, I hope to see you during the Phone weekend (October 25th & 26th) from CEØ. 73, Fred K6SSS, ex-W2IWC/6

The FWØAA Multi-Single crew—exactly the way you'd picture a DX-pedition to a South Pacific island. That's WB6LTJ, K6RIR, K6YFZ.

DX QRM

Great thrill to turn up from 21 to 28 MHz. and after giving a long call on what appeared to be a completely dead band, have it explode on top of me . . . *ZL1AFW*. Changed QTH's. Hope to be ready for '75 . . . *ZL3GQ*. It's been a long time since we've had a serious bash at the contest . . . *VK5NO*. Have to put up a big beam for 40 next year . . . *JA2JW*. I slept too much during the contest . . . *JF1XID*. Sorry about my slow keying . . . *JA1JIX*. The conditions on 10 were poor . . . *JR1IJV*. 10 Meter band conditions were FB! . . . *JA7MZB*. Had some QSO's with East Coast USA stations for the first time! . . . *JR3PYW*. I worked YJ8GS and 5 other new countries, I am looking forward to the next one . . . *OK1FCA*. Was really surprised to hear many VK's on 28 MHz, even one ZL . . . OK3EA. Thank you for the fun and two new countries . . . *F2XW*. My first CQ WW DX entry, and I am certain it will not be the last . . . *G4DBW*. DX stations outside Europe should use 1.800-1.805 for TX and 1.825-1.830 for RX . . . *DJ4KW*. 1975 will be better! . . . *HA6NP*. CQ WW DX Contest should be an official championship of world and continents . . . *SP9DH*. Condx very poor at 60° North! . . . *SM5BHW*. Special portable QTH for CQ WW; 1244 meters high . . . *OK1IDK/P*. I heard many interesting stations on 1.8 MHz: VK6HD, OD5IQ, and 8Q6AG . . . *OK1ATP*. The Maiden Head and District Radio Club is awarding a trophy to its member making the best entry this year! Most enjoyable contest . . . *G3ZPK*. The British Airways Amateur Radio Group (G3NAF) hopes to make a real effort next year . . . . *G3HZL*. Real thrill to work OX3AB short path on ten meters with all the W6, W7's calling . . . *ZL2ACP*. New bobtail gave better results than forty meter dipoles of past years . . . *ZE5JJ*. 160 opened several hours before sunset here but no stations were worked until five hours later. Guess no one listens for KH6 until later . . . *KH6CHC*. Wish those multi-op stations would run better check lists . . . *A9XU*. Luckily spotted openings to Europe on ten meters, both nights of the contest, which helped the multiplier total . . . *WB4KSE/KW6*. Working all bands with a monoband antenna is for the birds. After waiting four months, I received my new antenna one week after the Test . . . naturally . . . *KG6JAR*. Enjoyed all the QSO's, especially one with Brazil on 160 . . . *ZD7PS*. I apologize for so few contacts on 40-80 meters. Conditions were good but my "hotel" antennas were poor . . . *8Q6AH*. Enjoyed the Test as usual, but I'm nearing 62 and find that I cannot last more than a few hours at a time . . . *ZE3JO*. Copy is rough here due to splatter from a broadcast station only one quarter mile away from the shack . . . *9M2FK*. Although we had to barter for rice and coconuts for four days due to a local strike, we hung in there for the contest . . . *FW0AA*. Had power failure the first night so I arranged for emergency power to run rig the second night . . . *4X4NJ*. Very few USA stations heard here in Jakarta . . . *YB0ABV*. Twenty was blanketed with JA stations during the day, and conditions were rather poor at night . . . *BV2A*. Ten seems dead now but it opened up for the contest . . . *VU2JA*.

Operating high above Beirut, new Multi-Single champion OD5IQ scored just under 4 million. Congratulations to team OH2BH, OH2MM, OD5HC.

Third World high Multi-Single CT3WA expedition by Order of Boiled Owls. W2AO, W2AYJ, W2AX. Owls not caught by the camera K2JP, W2GC, W2GGE, W2IRV, WB2CKS.

Surprised with results on ten but eighty never warmed up . . . *KH6CF*. Enjoyed 239 QSO's with my completely homemade receiver and transmitter . . . . *VU2JN*. Sorry for not working all who called, the S-9 noise level at times made it rough . . . *EL2FT*. Only worked the first 24 hours since I didn't know the rules, due to lack of publicity in our magazines here . . . *VK3MR*. Too many 599 reports received, I don't have that good a signal! . . . *SV0WTT*. Variable propagation conditions made this one hard work! . . . *9H1CH*. Condx fair, called CR6, ZS2, EL2. VK5 on ten mtrs . . . *HB9QA*. Lots of fun to operate as DX . . . *GC5AGA*. Good CNDX on 3.5 MHz . . . *YU3DBC*. My suggestion to you is to reverse the date for the Phone and CW portions each second year . . . *OZ1LO*. Biggest thrill was to catch WB4KSE/KW6 on 28 MHz when your not even able to work any YU! . . . *SM7EAN*. My linear amplifier went QRT, will be on next year with QRO! . . . *OK2RZ*. I will remember when I turned my beam to the north and KX6BB gave me a call, A new one for me! . . . *SM2DMU*. I worked my first W on 3.5 MHz, fun! The QRM was less fun, except on 28 MHz . . . *SM5EOS*. Very hard work with QRP! . . . *DM2CMF*. Forecast winds 9-10 gales. I abandoned *QTH* for shelter, returned Noon Monday, all ants. wrecked! . . . *G3GRL/P*. Made first Wales-South Pole *QSO* on 160 mtr, enjoyed giving many others a new country . . . *GW3VCB*. Better *CNDX* than last year! . . . *GM3ZRC*. Nine technical failures during first 20 hrs. Condx generally very poor . . . *OH3MG*. See you in the 1975 test! . . . *SP2KDT*. It was a great contest with a lot of activity and for once we did not suffer from any aurora effects! . . . *SK2DR*. Bands closed 2nd day—no 10 meter openings . . . *KL7H1K*. Was trying to work so many JA's that W6VNJ became JH4NJ . . . *KL7HNN*. Very pleasant setting a new Canadian record for 3.5 single-band . . . *VX1KE*. Sorry my time was so limited . . . *VE1EK*. Enjoyed working many of my old California friends in the 'test . . . *W6BYB/VE1*. The FT-101B packed it in at 0810 of the second day—had to fall back on the NCX-3 & do without 21 & 28 MHz. Have you ever tried to work a contest with a receiver without incremental tuning? . . . *VE3EJK*. Tough going with no Pacific stations and not enough time. Used to operate as 5H3LV . . . *VE3EUP*. Propagation better than in the phone portion, but not that many W's . . . *VE3BMV*. Band was in very good shape for the weekend and am really sorry wasn't able to work the first 5½ hours. Big help to 5B-DXCC . . . *VE3EDC*. Spent 0545-0805 calling Europeans (on 160)—guess I need a bigger antenna . . . *VE3GFY*. Thanks for another great test . . . *VE3ECP*. Not much coming thru on 10! . . . *VE5XU*. Using 2 watts r.f. Output . . . *ZF1JH*. Am thankful for all the contacts I got and will be pleased to QSL via K4VW (ex-W4CKB) . . . *TI2BEV*. Most of the time running 10 watts due to BCI—max. power of 40 watts used for Hawaii and New Zealand contacts . . . *OX3AB*. Each year I am improving my score and enjoy the *CQ* DX Contest more, as it is presently the best contest on the amateur bands . . . *HR1AT*. My first contest ever—found the rules in Oct. 1971 *CQ* as my September '74 *CQ* hasn't arrived yet. Now to battle with the QSLs . . .

VP2LAW. This was my private contest expedition to St. Pierre. Most grateful to FP8AP for providing the wonderful ham shack and the TR4; Also to FP8FU and FP8CT who helped me to set up the antennas . . . *FPØBG*. Thanks very much for the contest. I enjoyed it very much . . . *LU8BAO*. The second day of the contest at my QTH very QRN—rainy, stormy . . . *LU9FAN*. Poor conditions make a 7 MHz single-band operation too tedious! . . . *PY7AKQ/8*. Too many other things this weekend to get serious so the amplifier was left off . . . *HC1CW*. Blew the linear's power transformer the first night (after using it for 10 minutes. Sunday morning, I blew one of my final tubes (no spares) and worked the last 14 hours with less than 100 watts (didn't want to blow the only 6DQ5 left). Also thanks to Murphy, I worked lots of weak sigs for several hours, till I noticed the 9 v. battery for my converter had gone down to 4 V! . . . *CV8B*. If no a.m. ham activity in 3501-3520 portion, could easily double score . . . *CX9BT*. Will be back next year. Ran into the test by pure accident. Thanks! . . . *SM5LH/YV5*. Local weather was just too nice to stay on the air all day. Spent several hours sightseeing . . . *ZF1AL*. Roger (KP4TIN) and Richard (F2QQ) joined me only 2 days before the contest. We erected a second 60 foot tower and put up 2 beams in one afternoon & were ready just in time. Wasted a lot of time on pile-ups too big to handle, but we're in practice for the next one. FY7AE lent us a R4B which had a filter, and it sure helped! My partners left the day after the contest . . . for them, it was a very short DXpedition . . . *FY7AA (opr. F5QQ)*. I called Dial-A-Prop with direct dialing from Birmingham on Thursday for forecast—bang on! . . . *G3HCT*. Just moved to new QTH, the antenna just stuck in ground in the garden, many hours calling people and not being heard! . . . *G3TXF*. Where was Italy in the CW weekend?! . . . *G4BVH*. Activity restricted on 40 mtr due to local TV system in passband . . . *G3ZQW*. One should divide the contest into "input-classes" so low input stn's have better chances! . . . *DK9FY*. The most rare and suprising DX was 8QGAG on 160 mtrs. I heard him calling CQ and he came back on first call . . . *DL1FF*. I was very glad to work my first 4X4 on 160 mtr, I had a lot of fun on this band . . . *DL6EN*. Working new prefix CQ7IZ biggest thrill . . . *DK4PH*. Best wishes for all the crew for your heavy job in counting and verifying all logs! . . . *YO7NA*. Had to give up because of keyer failure the second day . . . *HG5EA*. No opening at all on 28MHz . . . *OY6FRA*. VY psed with 160 mtrs . . . *EI1AA*. Had to miss last year because of power crisis, nice to be back but the sunspots have sure sagged! . . . *G3SSO*. Our quad worked only on the first afternoon . . . *HA9KPU*. 7MHz fantastic opening into all continents! . . . *DLØWU*. MNI TKS for the very nice diplomas I have received from the WW DX Test . . . *OZ7HT*. Thanks to DX stations for their patience in establishing contacts . . . *G3UKS*. Condx were poor for DX on 7MHz but contest was FB . . . *UB5TQ*. One of the more popular contests—congrats . . . *I2FGP*. One of my problems was that I was behind a mountain that cuts off lots of multipliers in Africa and South America, tried to change QTH's in middle of contest and got stuck in snow so had to return to original QTH . . . *C31IL*. Lots of activity and fair conditions, but a definite absence of multipliers . . . *CT2BN*. Had to plan to work on 80 mtrs but my antenna was not ready in time. The weather was too bad, next year! . . . *HB9KC*. My first CW Contest . . . *I3AWK*. Planned to make it on 10 mtrs, but 10 seems quite dead so switched to 15 mtrs . . . *I1EFC*. I'll make another try next year . . . *LB3B*. Results could have been better, but have no aerial for 80 mtrs . . . *OE6HZG*. Nice to be back in my own small way, last time was from 9V1—It's easier there!! . . . *GM3WRN*. My first contest; enjoyed it, but fatigue biggest problem on 1.8 MHz—missed 6Y5BF . . . *GM4AGG*. Condx on 1.8 MHz VFB, had a ball working 4 new countries on 160, when 8Q6AG called me I nearly jumped through the ceiling! . . . *PA0HIP*.

USA QRM

Why don't you supply cross-check logs? . . . *K2FL*. Annoyance is DX who fail to identify . . . *W2HAE*. Why wasn't anyone in the Novice bands? . . . *WN2QDP*. Believe it or not, I got engaged this same weekend . . . *W3HBJ*. Sure wish DX stations signed their calls more often . . . *K4GFH*. Except for 160 meters, all QSO's were with five watts . . . *W4WHK*. Would prefer an earlier contest date . . . *WØIUB*. I sure enjoy the CQWW DX contest. Keep them coming! . . . *WØPCO*. Was great working several new countries including the Maldives . . . *WA7FAB*. Turn on zones 2, 6, 34 next year for 20 CW . . . *W3AFM*. Quite surprised that an inverted vee can work so well, but never again without a beam . . . *WA2UJM*. Extremely heavy thunder storms Saturday night and Sunday morning held score down . . . *W5QKR*. Great fun with flea power . . . *WA3SZI*. Was running a long string of JA's toward the end of the contest. Was quite surprised when YBØABV called me in the pileup!! . . . *W6BJH*. Hardest country to work was U.S.A.—another U.S. station doesn't want to work another U.S. station . . . *K9UQN*. Boy! What a waste of scarce energy! Hi . . . *K3DR*. First CQ DX contest . . . *WA7VZX*. I was only able to be home and on the air for about 10 minutes in this one. You can use it to check against the other logs . . . *WØDAD/1*. Forty meters is fun with stacked beams! . . . *WB5DTX (Opr. W5BJA)*. How sweet it is! 45 JA' on 7 MHz wish I could have operated whole contest . . . *K2LWR*. As usual, this is the best DX contest for a single op, single band CW man. Thanks for the fun! . . . *W6ILP*. Where was Europe? CT1-EA-DM-G-GC-GI-GM-HB9-LA-LZ-OE-ON-OZ-OX-PA-UR-UQ-U05-SV-YO? ? ? The only Europeans here were YU-YU-YU-YU and YU's! ! ! — 4U1ITU makes the 181 country on 40m hr . . . *WB5DIZ*. Ten meter conditions were probably better than most of the scores will indicate. The band was open much of the time without many signals coming through. Could have used more activity! Also, tell W3ASK his Dial-A-Prop was right on the nose again. Good show, George! . . . *K2QBW*. Activity on 10m. seemed down—many hours of just hearing the same 10 DX stations! . . . *WA4DRU*. Many thanks to the dedicated log checkers! . . . *W4KFC*. Surprised to work KS6DH long path in the early morning local time. I think it's more fun being stateside. Heavy line noise hurt my score . . . *K4PHY*. The 15-meter band finally opened to Japan the next to the last hour of the contest . . . *WA8KCX*. Propagation seemed pretty fair on this band (15) but I think there could have been more participation by DX stations . . . *WA1NKK/1*. It is most frustrating to listen to the East Coast and Midwest work Europe for hours when the West Coast had no opening either morning! . . . *KØGJD/6*. The *only* Europeans I heard Sunday, called *me*, one after another! . . . *WA7TDZ/7*. Condtions not fantastic, but lots of fun! . . . *W2NVB*. This was my first *CQ* WW DX contest. It sure was fun! My FT101-B and

[*Continued on page 67*]

WORLD TOP SCORES

Single-Op All Band

KH6RS	2,738,904	K3YUA	1,100,924
YJ8GS	1,213,086	KH6IJ	1,028,146
VS5MC	1,146,964	KP4DPN	
A9XU	1,134,864		1,027,812
W1BGD/2		WA1PID	1,027,424
	1,133,847	WB4YLG	
			1,010,330

Single-Op Single Band

28 MHz		7 MHz	
WB4KSE/KW6		ZL1AMO	174,867
	207,662	WB5DTX	156,960
CV8B	165,675	WA8ZDF	146,792
WA8UZZ/4X4		PY7AKQ/8	
	47,215		137,112
ZL2ACP	30,432	VE3BMV	133,017
I1BAY	24,381	K2LWR	113,080
YU3ER	14,839		
21 MHz		**3.5 MHz**	
CR6OZ	292,020	YU3DBC	135,408
W4KFC	161,880	UB5CI	112,674
W4WSF	133,380	W3MFW	71,874
OH2BCP	126,540	VX1KE	70,311
W2NIN	118,770	OH1XX	65,920
W6YRA	117,852	W4YHD	63,518
14 MHz		**1.8 MHz**	
CR6IK	925,386	PA0HIP	12,704
G3HCT	300,978	GM4AGG	11,118
DLØPG	267,344	K1PBW	9,750
K6SDR	223,560	GD4BEG	8,760
OZ5DX	191,180	WB8APH	7,626
W4AAV	181,630	GM3YOR	6,336

Multi-Op. Single Trans.

OD5IQ	3,970,912	KP4EAJ	2,683,525
FY7AA	3,750,121	4M5ANT	
CT3WA	3,003,196		2,090,556
		LU8DQ	1,705,788

Multi-Op. Multi Trans.

PJ9JT	9,753,500	W3WJD	2,802,096
W3AU	3,623,116	W3GPE	2,556,180
W2PV	3,339,215	6Y5BF	2,403,156

Number groups after call letters denotes following: Band, (A-all) Final Score, Number of QSOs, Zones and Countries. Certificate winners are listed Bold Face.

SINGLE OPERATOR ALL BAND NORTH AMERICA

UNITED STATES

WA1PID						
	A	**1,027,424**	**926**	**110**	**278**	
			(opr. K0DQI)			
W1BPW	"	**769,332**	**744**	**110**	**256**	
W1PL	"	407,690	503	95	200	
WA1NZT	"	178,849	292	76	153	
WA1LKX	"	108,035	253	55	100	
WA1SCX	"	47,517	146	53	88	
WA1QNF	"	35,454	124	41	73	
WA1FBX	"	33,920	120	33	73	
W1VV	"	23,956	87	38	68	
W1GPK	"	19,700	77	42	58	
W1CNU	"	13,452	58	30	46	
W1OPJ	"	9,735	63	20	35	
K4JAT/1	"	8,700	58	28	47	
W1OR	"	8,000	46	24	40	
W1PLJ	"	3,626	36	12	25	
WA1QBH	"	532	10	9	10	
K1LWI	**28**	**6,625**	**56**	**21**	**32**	
K1IIK	"	240	9	5	7	
W1PIV	**21**	**100,584**	**350**	**26**	**73**	
WA1NKK/1	"	68,288	247	25	72	
WA1FCN	"	820	16	8	12	
K1FEB	**14**	**87,885**	**290**	**32**	**73**	
K1HVV	"	77,697	299	26	63	
WA1SKV	"	29,638	142	20	53	
WØDAD/1	"	45	3	2	3	
K1NOL	**7**	**58,580**	**206**	**27**	**74**	
W1WAI	"	23,331	113	24	53	
W1CMH	"	2,960	30	12	25	
W1SWX	3.5	703	16	7	12	
K1PBW	**1.8**	**9,750**	**94**	**14**	**25**	
W1BB	"	**6,279**	**59**	**13**	**26**	
W1BGD/2						
	A	**1,133,847**	**936**	**125**	**304**	
W2DXL	"	**816,120**	**793**	**104**	**256**	
K2TQC	"	566,544	647	96	223	
K2FL	"	172,516	272	81	155	
W2FVS	"	117,414	225	70	128	
WA2MBP	"	109,040	261	49	96	
W2HNO	"	107,748	244	57	107	
W2HO	"	98,952	190	62	124	
WA2ZWH	"	90,210	213	56	99	
WA2BLV	"	89,628	237	48	84	
W2HEU	"	86,673	196	54	113	
W2UI	"	80,676	190	57	105	
W2LYL	"	70,022	166	60	97	
K2MFY	"	57,018	173	45	84	
K2ER	"	44,880	141	35	75	
W2AZO	"	44,064	107	57	96	
K2AU	"	43,125	132	43	72	
WB2HZH	"	37,286	139	36	67	
W2HAE	"	35,960	114	44	72	
K2JOC	"	31,234	119	37	60	
WA2DLV	"	28,050	107	36	66	
W2HL	"	17,458	74	32	54	
W2CVW	"	16,076	68	31	57	
WA2CXQ	"	9,880	50	31	45	
WB2WZA	"	9,513	61	27	36	
W2MB	"	5,096	38	20	32	
WN2QDP	"	1,590	30	14	16	
K2QBW	**28**	**8,639**	**68**	**18**	**35**	
WB2NDR	"	1,404	26	10	16	
W2NIN	**21**	**118,770**	**384**	**27**	**80**	
WA2HZR	"	39,396	166	23	61	
W2NVB	"	24,500	151	19	38	
			(Opr. WA2COS)			
WN2SJG	"	**21,024**	**154**	**14**	**34**	
K2FE	"	11,450	80	17	33	
WA2LJM	"	9,823	75	15	32	
WA2UJM	**14**	**82,080**	**269**	**28**	**80**	
K2GI	"	14,504	89	15	41	
W2EUO	"	8,460	67	13	34	
K2LWR	**7**	**113,080**	**355**	**31**	**79**	
			(Opr. WA2BCK)			
K2TXC	3.5	9,911	70	15	38	
WA2AUB	"	1,586	25	8	18	
K3YUA	**A**	**1,100,924**	**1001**	**110**	**272**	
W3LPL	"	**858,484**	**835**	**108**	**250**	
			(Opr. W9SZR)			
K3GJD	"	**790,362**	**812**	**107**	**235**	
K3CY	"	736,848	724	105	252	
W3GRF	"	667,212	691	102	236	
W3BGN	"	544,180	602	99	223	
W3VT	"	539,068	560	106	240	
W3QOR	"	447,903	518	105	208	
W3NZ	"	329,184	421	89	199	
W3OV	"	297,216	413	84	174	
W3MFJ	"	230,928	417	52	152	
W3XW	"	219,830	329	83	164	
W3KFQ	"	206,848	459	79	123	
K3BW	"	201,600	322	67	158	
W3GRS	"	166,656	276	70	154	
W3KT	"	160,908	277	71	141	
W3FA	"	140,180	250	75	140	
W3HBJ	"	116,171	235	56	123	
W3BB	"	111,375	235	57	108	
W3ARK	"	98,527	215	58	111	
K3AV	"	97,230	169	72	138	
W3ALB	"	80,080	162	62	114	
K3TGM	"	65,262	166	48	98	
W3RAB	"	53,793	135	48	91	
W3ZJ	"	49,590	131	57	88	
W3KV	"	43,310	118	36	86	
W3GHM	"	35,375	106	49	76	
WA3ATP	"	30,186	102	44	73	
W3CGS	"	21,004	84	33	56	
W3HVM	"	17,850	68	44	58	
WA3EPB	"	14,448	65	34	52	
			(Opr. W3EVW)			
WA3DMH	"	7,482	54	19	39	
W3CBF	"	3,128	31	12	22	
W3DRD	"	1,128	20	9	15	
W3EVW	"	425	9	8	9	
W3ZSR	**21**	**66,402**	**227**	**28**	**74**	
WA3OSJ	"	1,392	20	9	15	
W3AFM	**14**	**85,422**	**221**	**34**	**104**	
W3DBT	"	**84,672**	**259**	**34**	**78**	
WA3SZI	"	54,055	201	26	69	
K3IGJ	"	32,589	160	20	51	
K3DR	"	2,480	41	16	24	
W3EZT	**7**	**19,390**	**103**	**21**	**49**	
W3MFW	**3.5**	**71,874**	**275**	**26**	**73**	
WA3AFQ	"	13,524	108	13	36	
W3CRE	"	1,276	26	8	14	
W3IN	**1.8**	**3,914**	**43**	**14**	**24**	
WB4YLG						
	A	**1,010,330**	**1002**	**103**	**252**	
K4YF	"	**873,072**	**892**	**107**	**237**	
WB4BGY	"	**803,586**	**782**	**106**	**255**	
W4YWX	"	**763,224**	**716**	**124**	**268**	
K4PQL	"	604,836	692	100	217	
WB4AEX	"	529,210	658	94	189	
K4DBZ	"	509,507	634	92	197	
W4KXV	"	442,080	515	98	209	
K4TBN	"	367,444	433	95	213	
W4MYA	"	236,302	347	86	167	
W4EZ	"	195,858	297	77	157	
W4DM	"	177,029	305	71	140	
WB4OGW	"	171,600	291	71	149	
KØCMF/4	"	144,900	255	71	136	
K4HWW	"	107,937	227	62	117	
K4ZRX	"	102,984	230	58	110	
K4OD	"	102,528	221	62	116	
WB4RUA	"	86,800	171	77	123	
W4BAA	"	85,995	167	76	119	
K4GFH	"	69,913	172	52	99	
W4YZC	"	63,342	143	55	107	
K4ND	"	62,776	143	58	94	
K4JM	"	59,094	145	58	89	
W4DFU	"	58,880	235	47	81	
			(Opr. WA4GAJ)			
WA4BTQ	"	56,242	185	45	77	
WB4FOT	"	50,806	142	54	79	
K4ZA	"	49,319	128	54	95	
K4KA	"	40,467	119	55	86	
W4GF	"	39,798	112	49	85	
W4ORT	"	33,920	103	51	77	
WA4MSU	"	30,264	112	37	60	
W4HOS	"	29,040	100	41	69	
W4JHK	"	28,600	101	34	66	
K4BAI	"	23,808	92	39	57	
K4AUL	"	21,120	82	34	62	
W4ZSH	"	16,112	81	26	50	
W4WHK	"	9,039	52	30	39	
K4WVT	"	8,378	48	31	40	
K4EJG	"	6,490	42	25	34	
W4ZTB	"	5,841	35	27	32	
W4OGG	"	864	29	12	12	
WB4UYD	**28**	**7,650**	**69**	**17**	**33**	
WA4DRU	"	**7,399**	**64**	**17**	**32**	
W4EEO	"	1,827	22	11	18	
K4TWJ	"	510	15	7	10	
W4KFC	**21**	**161,880**	**489**	**27**	**87**	
W4WSF	"	**133,380**	**433**	**29**	**79**	
K4PHY	"	**106,106**	**352**	**28**	**78**	
WA4OSM	"	10,696	66	18	38	
W4AAV	**14**	**181,630**	**453**	**36**	**99**	
K4JWD	"	4,056	39	16	23	
W4JUK	"	1,725	24	11	14	
WA6CXK/4	**7**	**31,914**	**154**	**24**	**57**	
W4QQN	"	25,956	146	21	42	
WA4APG	"	8,930	76	17	30	
W4YHD	**3.5**	**63,518**	**256**	**22**	**69**	
W4CRW	"	**43,600**	**200**	**18**	**62**	
K5TSR	**A**	**195,083**	**327**	**84**	**133**	
K5ZJP	"	144,837	261	85	124	
W5OB	"	107,365	214	77	120	
W5OSJ	"	66,297	179	60	87	
W5PAQ	"	52,540	142	58	84	
WB5HOD	"	37,752	136	53	68	
W5HIC	"	32,385	99	52	75	
W5UO	"	30,940	103	52	78	
WA5VDH	"	24,072	99	46	56	
W5BE	"	23,490	97	38	49	
K5BLV	"	20,485	88	35	50	
K5TFG	"	11,627	61	33	44	
WA5TPO	"	10,404	51	28	40	
W5LPO	"	8,584	54	26	32	
K5PFL	"	6,649	43	28	33	
WA5FTP/5	"	3,900	38	17	22	
K5YMY	"	2,294	31	18	19	
W5SOD	"	285	8	7	8	
K5LZJ	"	90	6	5	4	
WA5RTG	**28**	**9,000**	**86**	**16**	**34**	
WA5STI	"	**7,392**	**66**	**16**	**32**	
K5ABV	**21**	**57,855**	**221**	**28**	**67**	
WA5ZNY	**14**	**99,800**	**350**	**29**	**71**	
W5QKR	"	77,871	298	31	70	
			(Opr. WA5YMW)			
K5KSI	"	**57,630**	**198**	**31**	**71**	
WB5DTX	**7**	**156,960**	**563**	**28**	**68**	
			(Opr. W5BJA)			
WB5DIZ	"	**61,542**	**274**	**28**	**50**	
W5WZQ	"	33,150	154	25	53	
W5LUJ	**3.5**	**17,751**	**111**	**19**	**42**	
W5RTQ	"	13,104	109	19	29	
K5JVF	**1.8**	**576**	**16**	**8**	**10**	
W6RR	"	**904,096**	**1,051**	**113**	**191**	
K6UA	"	**804,340**	**911**	**121**	**186**	
			(Opr. W6BHY)			
W6PLH	"	712,954	961	101	152	
W6MAR	"	693,714	965	98	151	
K6OVJ	"	672,221	920	94	159	
W6OKK	"	398,772	660	82	130	
WA6KZI	"	381,175	680	72	121	
W6DQX	"	315,768	499	90	133	
W6HJP	"	294,372	475	87	135	
W6BIP	"	242,385	444	82	113	
WA6JVD	"	222,968	420	76	112	
W6EYY	"	217,562	435	80	101	
K6DR	"	217,516	396	82	106	
W6RZE	"	163,012	353	74	92	
W6NKR	"	136,528	261	72	112	
K6AYA	"	130,432	326	55	73	
K6UJS	"	90,288	259	60	72	
WA6GFY	"	77,550	297	45	49	
			(Opr. WB6EXW)			
K6OC	"	56,875	154	49	76	
W6RNF	"	55,176	165	50	71	
W6CS	"	54,144	144	64	80	
W6AM	"	51,220	152	58	72	
G3DPX/W6	"	44,110	139	51	59	
K6YYQ/6	"	37,525	140	47	48	
WA6LBP	"	35,547	109	52	71	
W6PRP	"	25,704	88	45	63	
W6KYA	"	23,604	102	38	46	
WB6ZHD	"	22,468	96	37	45	
W6CLM	"	21,150	108	35	40	
W6SC	"	16,576	90	27	37	
WA6UFY	"	12,688	79	31	30	
W6RQZ	"	8,400	57	21	35	
W6EJ	"	6,608	40	23	36	
K6QPH	"	6,025	45	27	28	
WA6OWM	"	5,920	52	18	22	
W6YKS	"	5,824	40	24	32	
W6GBY	"	4,544	49	15	17	
WA6ORJ/6	"	4,410	43	22	20	
W6HJ	"	2,378	28	13	16	
W6EJA	"	1,349	24	9	10	
K5MHG/6	"	72	4	4	4	
W6HX	**28**	**7,954**	**74**	**14**	**27**	
W6YRA	**21**	**117,852**	**483**	**29**	**55**	
			(Opr. WA6ABP)			
KØGJD/6	"	57,201	288	24	45	
W6ID	"	5,671	40	22	31	
W6MI	"	3,456	40	13	19	
K6SDR	**14**	**223,560**	**660**	**37**	**85**	
WB6KBK	"	**124,080**	**394**	**33**	**77**	
K6AO	"	75,429	324	28	59	
W6BJH	"	47,795	212	28	51	
W6FF	"	14,986	96	23	36	
W6BYH	"	156	13	5	7	
W6ITY	**7**	**112,963**	**466**	**29**	**54**	
W6ILP	"	**70,500**	**321**	**25**	**50**	
K6OZL	"	60,672	265	30	49	
WA6AHF	"	34,398	243	20	29	
			(Opr. WA6PMK)			
K6TZX	"	1,311	22	10	13	
W6NLZ	**3.5**	**21,168**	**138**	**20**	**34**	
VE3DXV/W6	"	**18,327**	**165**	**17**	**24**	
K6NA	"	7,449	75	15	24	
W7IR	**A**	**796,975**	**807**	**129**	**226**	
K3MNT/7		596,700	1060	80	115	
W7TML	"	543,840	831	91	149	
W9IRH/7	"	517,532	829	84	134	
W7WMY	"	195,454	430	71	90	
W7YBX	"	111,622	294	56	78	
W7LZF	"	95,408	259	56	78	
WA7UQG	"	89,726	289	56	63	
WA7NUH	"	58,397	158	55	78	
WA7JCB	"	42,804	175	38	49	
W7MCU	"	21,412	83	47	54	
W7LR	"	15,879	74	34	45	
W7OF	"	10,990	57	24	46	
K7EFB	"	702	20	7	6	
K7MOK	"	480	15	6	6	
W7VRO	**21**	**50,740**	**300**	**22**	**37**	
WA7TDZ/7	"	33,443	220	22	31	
W7AYY	"	29,232	166	25	38	
W7FAB	**14**	**86,933**	**385**	**26**	**51**	
K7RSC	"	37,940	372	13	22	
WA7VZX	"	2,310	40	10	11	
WA7ZWU	**7**	**51,900**	**302**	**22**	**38**	
W7KAR	**3.5**	**18,920**	**161**	**17**	**26**	
W7JLU	"	11,880	151	13	17	
W7YTN	"	11,305	122	14	21	
WA7OAU	**1.8**	**81**	**11**	**5**	**4**	
W8LHE	**A**	**285,033**	**388**	**93**	**184**	
WA8TBQ	"	258,741	382	76	183	
K8LUU	"	80,270	249	36	79	
W8KZO	"	64,824	156	55	93	
W8DSO	"	50,673	143	46	81	
WA8AWH	"	46,340	134	53	87	
W8WVU	"	23,220	97	45	63	
W3GN/8	"	16,274	75	46	57	
W8TWA	"	12,246	60	30	48	
W8BDO	"	12,089	60	30	47	
K8OYG	"	480	15	7	8	
WB8NVD	**28**	**1,218**	**22**	**12**	**17**	
WA8KCX	**21**	**91,008**	**327**	**25**	**71**	
K8IDE	**14**	**162,250**	**474**	**35**	**83**	
WA8ZDF	**7**	**146,792**	**448**	**30**	**88**	
			(Opr. K8HLR)			
W8CNL	"	3,366	37	13	21	
WB8EUN	**3.5**	**4,060**	**50**	**14**	**21**	
WB8APH	**1.8**	**7,626**	**89**	**13**	**28**	
W9LT	**A**	**536,607**	**606**	**111**	**216**	
W9RER	"	454,197	543	98	205	
K9KDI	"	431,750	493	106	208	
W9RX	"	243,535	346	93	172	
W9LF	"	182,055	299	79	150	
K9UWA	"	150,792	311	73	110	
W9PJT	"	141,360	323	71	119	
W9DWQ	"	107,858	199	67	132	
W9RQM	"	84,906	175	67	111	
W9JI	"	80,282	199	54	83	
K9UKM	"	75,650	165	63	115	
W9YYG	"	70,550	166	70	100	
W9WYB	"	62,400	149	59	101	
W9SFR	"	55,944	123	65	103	
WA9BWY	"	32,750	116	52	73	
W9OEQ	"	16,200	75	32	49	
W9QWM	"	9,282	56	32	46	
WN9MMR	"	4,232	48	20	26	
K9DAF	**28**	**1,624**	**133**	**12**	**28**	
W9LKI	**21**	**24,820**	**129**	**22**	**46**	
WB9FRG	"	**24,411**	**113**	**24**	**55**	
W9OHH	"	8,428	61	17	32	
WB9NME	"	836	16	7	12	
W9KNI	**14**	**136,736**	**383**	**35**	**91**	
WB9LHI	"	75,428	252	34	75	

K9CLO	"	58,378	210	30	71
K9UQN	"	9,504	65	19	35
W9YT	**7**	**53,004**	**237**	**27**	**57**
		(Opr. K9LBQ)			
WB9BWU	"	50,130	217	28	62
		(Opr. WA8RXM)			
WA9JCO	"	20,770	128	20	42
W9DY	**3.5**	**3,813**	**36**	**14**	**27**
WA9HEU	"	3,392	45	12	20
W9UDK	"	2,700	40	13	17
WB9BUV	**1.8**	**204**	**17**	**6**	**6**
WØHP	**A**	**419,188**	**538**	**107**	**201**
WØIUB	"	157,410	305	72	126
WAØVDX	"	157,325	273	84	133
WØNAR	"	68,400	180	62	90
WØHBH	"	67,270	156	61	94
WØBMM	"	37,485	118	47	72
WAØYEF	"	22,977	86	47	64
WAØFBQ	"	17,721	90	36	63
WØFHE	"	16,435	67	42	53
WAØTAS	"	13,020	63	37	47
WBØGQP	"	3,740	44	19	25
WØMHK	**28**	**2,112**	**31**	**11**	**21**
WAØVBW	"	1,058	19	9	14
WB6KGJ/Ø	**21**	**21,840**	**158**	**21**	**27**
KØARS	"	3,780	33	16	29
WBØLTD	"	3,162	34	16	18
WAØCVS	**14**	**139,971**	**436**	**35**	**76**
WØPCO	**"**	**131,806**	**407**	**34**	**84**
KØLUZ	"	41,412	180	30	54
W2GUH/0	"	13,863	127	32	77
WØOXN	**7**	**11,822**	**97**	**19**	**27**

Alaska

KL7HIK	**A**	**175,714**	**701**	**40**	**58**
KL7EWA	"	71,400	435	36	34
KL7HNN	**14**	**14,144**	**170**	**17**	**17**
KL7EWP	"	1,870	42	9	8
KL7HRP	**7**	**20,532**	**277**	**12**	**17**

Bermuda

WA1RFM/VP9					
	A	**402,864**	**1,102**	**58**	**110**

Canada

VX1AW	**A**	**43,806**	**171**	**30**	**68**
VX1KE	**3.5**	**70,311**	**409**	**15**	**54**
VE1CD	**A**	**254,521**	**520**	**72**	**127**
VE1EK	"	7,452	56	24	30
W6BYB/VE1	**21**	**11,502**	**88**	**16**	**38**
VE2AYU	**A**	**228,360**	**625**	**57**	**108**
VE2WA	"	93,314	481	72	122
VE3BVD/3					
	"	**121,788**	**338**	**56**	**97**
VE3HD		41,040	121	56	79
VE3EJK	"	32,448	123	38	66
VE3BZ	"	28,120	104	37	58
VE3BR	"	15,244	77	27	47
VE3EUP	**21**	**13,632**	**108**	**17**	**31**
VE3BBH	**14**	**69,300**	**310**	**29**	**61**
VE3BMV	**7**	**133,017**	**569**	**28**	**73**
VE3EDC	**3.5**	**42,444**	**381**	**18**	**36**
VE3GFY	**1.8**	**1,168**	**76**	**4**	**4**
VE3ECP	"	544	72	2	2
VE5XU	**28**	**624**	**16**	**8**	**8**
VE5RA	**21**	**32,214**	**389**	**16**	**23**
VE6VK	**14**	**28,470**	**173**	**25**	**40**
VE6CEC	"	3,705	93	10	9
VE6APN	"	3,108	70	10	11
VA7WJ	**7**	**95,645**	**743**	**19**	**36**
		(Opr. VE7AON)			
VE7IQ	3.5	1,507	68	6	5
VE8OO	**14**	**82,928**	**500**	**24**	**49**

Canal Zone

KZ5AA	**1.8**	**966**	**33**	**7**	**7**

Cayman Islands

ZF1JH	**A**	**8,481**	**126**	**18**	**15**

Costa Rica

TI2BEV	**A**	**684,991**	**2080**	**59**	**98**

Dominican Republic

HI8LC	**7**	**7,440**	**228**	**7**	**9**

Greenland

OX3DL	**A**	**281,252**	**858**	**52**	**97**
OX3AB	"	39,520	235	33	47
OX3RA	"	5,740	102	12	16
OX3CS	7	444	17	5	7

Honduras

HR1AT	**A**	**224,264**	**778**	**57**	**79**

Mexico

XE2MX	**A**	**28,880**	**328**	**19**	**21**

Puerto Rico

KP4DPN	**A**				
		1,027,812	**1498**	**88**	**203**
KP4EAS	"	791,586	1705	72	142
KP4AXM	"	15,132	189	19	20
		(Opr. K1OTI)			

St. Lucia

VP2LAW	**A**	**34,245**	**366**	**18**	**27**

St. Pierre

FPØBG	**A**	**144,668**	**574**	**42**	**76**

Sint Maarten

PJ8YCQ	**A**	**327,820**	**792**	**65**	**120**

Virgin Islands

KV4AM	A	7,850	66	19	31

AFRICA

Angola

CR6JF	**A**	**2,574**	**45**	**12**	**10**
CR6OZ	**21**	**292,020**	**1,057**	**23**	**70**
CR6IK	**14**	**925,386**	**2,021**	**38**	**116**

Canary Islands

EA8CS	**A**	**127,761**	**387**	**39**	**72**

Madeira Islands

DJ6QT/CT3	**A**	**88,176**	**232**	**50**	**82**

Mauritania

5T5CJ	**A**	**263,652**	**520**	**65**	**108**

Reunion Island

FRØBCS	**A**	**635,160**	**1,069**	**62**	**139**

Rhodesia

ZE1JV	**A**	**932,652**	**1,246**	**80**	**172**
ZE1BL	"	205,500	505	45	92
ZE3JO	"	137,160	347	41	94
ZE5JJ	**7**	**53,754**	**297**	**23**	**39**

Sierra Leone

9L1JT	**3.5**	**6,831**	**71**	**14**	**19**

South Africa

ZS6JM	**A**	**83,607**	**303**	**43**	**50**
ZS2CW	"	43,824	174	32	56

St. Helena Is.

ZD7PS	**A**	**361,494**	**914**	**48**	**85**

ASIA

Bahrain

A9XU	**A**	**1,134,864**	**1,376**	**80**	**216**

Hong Kong

VS6DD	**A**	**76,191**	**463**	**40**	**69**
VS6BL	**21**	**16,017**	**164**	**20**	**37**

India

VU2JN	**A**	**68,608**	**239**	**51**	**83**
VU2ABC	"	66,640	221	42	77
VU2JA	28	160	6	5	5
VU2HQ	**14**	**21,158**	**130**	**26**	**45**

Iran

EP2MW	**A**	**100,084**	**313**	**44**	**87**

Israel

WA8UZZ/4X4					
	28	**47,215**	**231**	**20**	**15**
4X4LC	**14**	**113,958**	**497**	**26**	**52**
4X4NJ	**1.8**	**4,818**	**76**	**6**	**16**

Japan

JA2JW	**A**	**828,338**	**1036**	**99**	**183**
JF1XID	**"**	**440,562**	**803**	**78**	**124**
JA2IYJ	**"**	**358,288**	**645**	**84**	**112**
JA7AKQ	**"**	**328,520**	**641**	**77**	**114**
JA1GDN	"	267,735	507	84	111
JG1CDM	"	186,667	409	70	103
JA1XMS	"	181,240	392	76	94
JA6CLO	"	154,728	360	72	96
JA3ERG	"	152,100	340	69	100
JA3FYC	"	150,705	374	64	89
JE1HJJ	"	148,878	343	70	92
JA3MIO	"	146,791	295	74	107
JA3AA	"	140,112	343	75	93
JA6AKW	"	118,902	335	56	77
JA7YOJ	"	117,600	306	66	81
		(Opr. JA7GQB)			
JR1CCT	"	107,870	348	56	59
JA1JKG	"	104,181	320	55	68
JA2CMM	"	102,697	305	53	66
JA2CPD	"	99,308	294	53	69
JA5CEK/3	"	93,015	310	52	65
JR1VMC	"	82,420	235	51	79
JA2PFO	"	75,632	314	56	60
JH1SVO	"	72,726	198	59	79
JA1BNW	"	66,997	203	50	69
JA1EMX	"	62,860	176	59	81
JR2BPV	"	61,104	198	47	67
JH3AQX	"	53,607	200	47	60
JA1FIJ	"	49,914	162	56	62
JA7IKH	"	49,852	188	48	55
JA8FBM	"	44,838	171	40	54
JA1BSU	"	43,026	165	49	52
JA6EKZ	"	36,045	171	42	47
JH3LCU	"	28,480	141	36	44
JA4DZ	"	25,344	132	33	39
JA1CFJ	"	22,200	112	38	36
JA7SL	"	17,995	161	30	29
JA1AIU	"	16,092	109	26	28
JA8OTE	"	14,274	93	31	30
JA8BKI	"	12,352	75	30	34
JAØEJZ	"	12,261	83	30	31
JA4BTD	"	11,159	75	31	32

CLUB SCORES

United States

Potomac Valley Radio Club	**53,869,662**
Frankford Radio Club	34,769,716
Murphy's Marauders	16,538,313
Richardson Wireless Klub	16,014,186
Southern California DX Club	13,184,906
South Florida Contest Club	12,010,622
Western Washington DX Club	6,954,778
San Diego DX Club	5,587,099
Northern California DX Club	4,733,563
North Florida DX Association	4,531,007
Indianapolis DX Association	3,982,019
Northern California Contest Club	3,869,189
Southeastern DX Club	3,214,043
Order of Boiled Owls of New York	3,102,148
Columbus Amateur Radio Club	2,975,505
Central Virginia Contest Club	2,626,688
North Illinois DX Association	2,548,772
Wireless Institute of the Northeast	2,480,336
Texas DX Society	2,433,936
Delta DX Association	1,255,198
Williamette Valley DX Club	1,194,037
Michigan DX Association	818,085
Alamo DX Amigos	654,940
Twin City DX Association	545,245
Cedar Valley Amateur Radio Club	417,775
Bluegrass Amateur Radio Club	402,401
South Florida DX Asociation	172,494
St. Louis Amateur Radio Club	168,347
Johnson County Amateur Radio Club	121,614

Canada

Toronto DX Club	2,894,395
Calgary Amateur Radio Assoc.	53,168

DX Clubs

Rhine-Ruhr DX Assoc. (Germ.)	16,594,861
Honolulu DX Club	5,598,433
South German DX Group	4,847,858
West Indies DX Club	3,914,134
Saar-Pfalz DX Club (Germ.)	3,327,184
Danish DX Group	3,034,592
Channel Contest Group	2,956,893
YU DX Club	1,612,252
Central Radio Club of Czechoslovakia	1,094,138
SP DX Club	705,804
Kaunas Polytechnic Inst. Radio Club	609,425
Tallin Radio Club	506,458
Radio Club of the Germ. Dem. Rep.	482,739
Radio Club OS1JEK	357,032
Swiss DX Club	120,363
Vasteras Radio Club	69,132
SP7PZN Club	6,996

JA2BNN	"	11,022	67	30	36	JA1LB	"	253	9	6	5	OK1AJY	"	27,234	199	28	74	OK2PGU	"	1,320	60	4	16
JAØSWT	"	10,980	103	21	24	JR3STC	"	30	3	3	3	OK1BLC	"	26,762	234	19	57	OK1MIX	"	1,040	89	3	13
JA1CVP	"	10,388	76	27	26	JH1HTK	"	10	5	1	1	OK2LN	"	26,592	211	25	71	OK2KUM	"	986	62	3	14
JH1LKH	"	8,892	72	27	30	**JA1CWZ**	**7**	**93,310**	**397**	**30**	**56**	OK2PDL	"	24,476	211	37	79			(Opr. OK2BKD)			
JAØGZ	"	8,037	67	25	22	**JA2CCT**	**"**	**28,944**	**194**	**20**	**34**	OK3RJB	"	24,115	319	12	53	OL8CCH	"	912	44	4	15
JA9BOH	"	7,987	58	23	26	**JA2EKR**	**"**	**27,216**	**181**	**21**	**35**	OK3TBG	"	24,030	236	21	69	OK3KVE	"	756	47	4	14
JH2EVL	"	7,844	54	26	27	JA2INO	"	26,832	186	19	33	OK2BEF	"	23,577	242	18	69	OK1DXW	"	726	56	2	11
JR2FNL	"	7,304	60	22	22	JA3VOV	"	19,150	144	20	30	OK1MAA	"	18,700	200	16	69	OL8CDQ	"	714	39	3	14
JA1JIX	"	6,560	60	19	21	JE1LPZ	"	19,084	141	19	33	OK1MWN	"	17,680	133	22	58	OL1AQL	"	663	44	3	14
JA7OXR	"	6,300	68	18	18	JA2AIR	"	15,984	126	20	28	OK1FCA	"	17,680	133	22	58	OK1KKJ/p	"	390	27	3	12
JA2QVQ	"	5,684	42	25	24	JR1BVY	"	15,756	142	16	23	OK1FJS	"	17,064	203	19	53			(Opr. OK1MCW)			
JR1FVW	"	5,390	52	18	17	JA1PPW	"	11,130	93	18	17	OK1DAV	"	16,936	124	17	56	OL8CCR	"	384	33	3	9
JA9LX	"	4,030	48	17	14	JA4JIG	"	8,621	87	16	21	OK2BJU	"	11,868	132	20	49	OK2BNY	"	351	30	2	11
JA9YE	"	3,774	41	16	18	JA1NLX	"	8,316	94	17	16	OK2PEQ	"	9,164	115	18	40	OL5AQR	"	288	24	2	10
JA1YJF	"	3,708	55	15	21	JA1HOM	"	6,825	74	15	20	OK3YCW	"	8,977	179	10	37	OK1FBH	"	280	14	3	11
		(Opr. WA3VWJ)				JA1SEM	"	4,293	57	13	14	OK2PAE	"	8,778	57	26	40	OLØGDF	"	276	28	3	9
JF1UJF	"	3,614	52	14	12	JA2EDA	"	1,848	55	6	6	OK1KZ	"	8,694	140	14	49	OL9CDD	"	276	26	2	10
JAØHXV	"	3,400	45	18	16	JF1SVV	"	1,273	24	9	10	OK3TRP	"	7,316	115	15	44	OL9CBJ	"	273	21	3	10
JA1BBZ	"	2,808	46	12	14	JA4NLO	"	536	25	4	4	OK1DA	"	5,661	55	18	33	OL8CCG	"	264	30	2	10
JA1GL	"	1,395	21	15	16	JA4GXS	"	90	10	2	1	OK1AEH	"	5,570	69	19	39	OLØCBH	"	242	21	3	8
JA4AQR/3	"	1,239	25	11	10	JAØBOP	"	81	9	2	1	OK2BIP	"	3,577	35	18	31	OL6AQP	"	221	16	3	10
JR3STC	"	943	19	11	12	JA9LVD	"	77	5	4	3	OK2PAH	"	3,240	28	20	25	OK2PGF	"	117	12	3	10
JA1BUI	"	893	21	10	9	JR3TZU	"	64	5	4	4	OK1MSP	"	2,080	26	19	21	OL6ASQ/p	"	70	8	2	8
JA2UJ	"	580	20	6	4	**JA6WGE**	**3.5**	**11,554**	**103**	**23**	**30**	OK2BCI	"	1,750	23	15	20	OK1ARO	"	56	18	2	5
JA2EG	"	462	11	8	6	**JH1APZ**	**"**	**9,553**	**104**	**17**	**24**	OK3KIO	"	1,562	71	6	16	OL8CCS	"	36	6	2	4
JA3AVO	"	238	7	7	7	JA3IW	"	7,676	89	16	22	**OK3WM**	**28**	**4,840**	**47**	**16**	**28**	OK1AIJ	"	30	6	2	4
JH3UBF	"	224	12	4	4	JA1DQT	"	6,440	68	18	22	OK3CGP	"	243	11	7	9			Denmark			
JR6CF	"	152	7	4	4	JA1DUH	"	4,440	61	14	16	**OK2RO**	**21**	**31,296**	**185**	**23**	**41**	**OZ1LO**	**A**	**600,799**	**1069**	**82**	**225**
JH3BJN/3	"	12	2	2	2	JA8DNV	"	3,978	52	14	20	OK3EE	"	24,786	127	28	53	OZ7BG	"	119,340	315	54	141
JA6UBK	**28**	**11,137**	**96**	**16**	**27**	JH1KLA	"	3,240	55	12	15	OK1AVD	"	24,455	142	26	47	OZ5ME	"	75,500	355	40	111
JH1BNC	**"**	**7,783**	**70**	**16**	**27**	JA3BEA	"	3,074	53	15	14	OK1ARZ	"	19,040	139	21	35	OZ5QU	"	39,446	222	35	86
JH1CXE	"	5,004	53	14	22	**JA7NI**	**1.8**	**350**	**14**	**5**	**5**	OK2SLS	"	17,340	114	21	39	OZ2NU	"	36,708	225	31	83
JR1IJV	"	4,862	56	13	21	JA5EZI	"	80	5	5	5	OK1FDG	"	14,976	99	22	42	OZ4HW	"	22,278	158	27	67
JA1XZF	"	4,752	49	13	23	**KA2AD**	**14**	**157,257**	**575**	**34**	**67**	OK1AOJ	"	12,095	122	15	26	OZ6XR	"	17,200	185	21	59
JA8CSG	"	3,500	49	10	15			Khmer Republic				OK1KIR	"	5,617	51	15	26	OZ6XT	"	16,576	68	29	45
JA7MZB	"	2,236	32	10	16	XU1DX	A	294	7	7	7	OK1AHV	"	5,110	52	14	21	OZ1AMP	"	10,010	111	21	44
JA2SWH	"	1,344	20	12	16			Maldive Islands				**OK3CHK**	**14**	**89,182**	**384**	**34**	**89**	OZ6PI	"	8,965	110	18	37
JH1PZN	**21**	**15,077**	**465**	**31**	**58**	**8Q6AH**	**A**	**507,338**	**876**	**79**	**168**	**OK3ZAA**	**"**	**85,995**	**457**	**29**	**76**	OZ9OI	"	7,590	75	24	45
JH1BBT	**"**	**102,706**	**411**	**30**	**59**	**8Q6AG**	**1.8**	**779**	**25**	**9**	**10**	**OK1TA**	**"**	**82,570**	**336**	**30**	**85**	OZ1W	"	5,876	57	20	32
JA1RUJ	"	51,903	267	27	46			Republic of China				OK3ZWA	"	57,240	415	21	69	OZ1VY	"	4,264	40	21	31
JA8GQ	"	46,053	263	24	39	**BV2A**	**14**	**8,397**	**265**	**12**	**15**	OK1DKR	"	41,360	219	26	68	**OZ7AN**	**21**	**7,304**	**87**	**14**	**30**
JA3JRI	"	32,690	180	25	45			Thailand				OK3CES	"	28,032	240	20	53	OZ6ZS	"	396	9	9	9
JA1OLT	"	32,330	191	**25**	**36**	**HS2AIG**	**A**	**432,820**	**936**	**95**	**173**	OK3IAG	"	21,584	183	20	56	**OZ5DX**	**14**	**191,180**	**850**	**34**	**87**
JR1PYW	"	31,720	192	23	42			West Malaysia				OK2BGR	"	15,936	146	18	46	OZ7YL	"	19,338	153	20	46
JH2WMN	"	28,408	208	21	32	**9M2CX**	**A**	**293,114**	**712**	**83**	**150**	OK3CEK	"	15,312	121	18	48	OZ2GC	"	6,479	128	10	21
JG1REA	"	22,770	133	26	43	9M2FK	"	19,964	215	29	33	OK2BIT	"	9,494	122	10	37	**OZ7HT**	**3.5**	**48,312**	**640**	**14**	**47**
JH2RVP	"	21,924	147	21	33			Yemen				OK1APS	"	7,144	74	15	32	OZ8XO	"	285	19	3	12
JA9CWJ	"	20,532	126	23	36	**4W1GM**	**A**	**128,232**	**374**	**38**	**79**	OK3CAU	"	6,149	102	11	32			England			
JA6ZFY	"	19,376	133	21	35			Asiatic Russia				OK3YCV	"	5,548	108	7	31	**G3FXB**	**A**	**798,814**	**1069**	**85**	**222**
		(Opr. JA6RXF)				UA9CN	A	11,914	100	16	30	OK1ATZ	"	3,960	35	16	29	**G3MXJ**	**"**	**652,769**	**897**	**95**	**242**
JH2NDJ	"	15,088	121	21	25	UA9YAT	21	2,700	96	6	12	OK1KCI	"	1,792	30	9	19	G3SXW	"	263,514	606	59	163
JH2FSE/3	"	14,382	115	20	31	**UWØAF**	**A**	**275,674**	**620**	**71**	**132**	OK2BCB	"	1,701	43	7	20	G3GRL/p	"	213,490	501	66	119
JA7HRF	"	11,550	99	19	23	UAØLU	"	45,344	429	19	33	OK1MSS	"	360	8	7	8	G4ALG	"	98,150	462	36	115
JH6DVA	"	10,692	80	23	31	**UWØFB**	**3.5**	**2,002**	**135**	**5**	**6**	**OK3OM**	**7**	**112,136**	**655**	**26**	**81**	G3ZQW	"	54,120	254	35	88
JA5BLF	"	10,678	105	18	20			EUROPE				**OK2BOB**	**"**	**91,361**	**529**	**26**	**77**	G2AJB	"	40,377	253	35	94
JF1RWZ	"	7,650	86	16	18			Andorra				OK1DWA	"	61,364	484	23	69	G3PK	"	28,835	262	19	60
JE1WIH	"	6,460	65	16	22	**C31IL**	**A**	**22,149**	**207**	**21**	**48**	OK2QX	"	53,203	443	19	64	G3NAF	"	19,006	148	23	63
JR1SQU	"	5,066	55	16	18			(Opr. WA9INK)				OK3ALE	"	28,860	204	19	59	G3MWZ	"	10,168	97	18	44
JH1VMI	"	3,278	53	10	12			Austria				OK2SGW	"	16,440	193	14	46	G3VLL	"	9,150	86	22	53
JA2GXD	"	1,638	33	9	9	**OE6HZG**	**A**	**105,490**	**424**	**39**	**98**	OK3EQ	"	5,632	111	9	35	G4DBW	"	400	21	6	14
JA2DWH	"	1,404	28	9	9			Azores				OK1AES	"	4,410	119	6	29	**G2BOZ**	**28**	**3,655**	**51**	**13**	**30**
JAØIAD	"	525	15	7	8	**CT2BN**	**A**	**826,760**	**1766**	**59**	**161**	OK1FSM	"	4,012	98	8	26	**G3RZI**	**21**	**90,240**	**390**	**27**	**69**
JE3EVC	"	468	14	7	6			Belgium				OK1ARF	"	1,516	69	4	18	**G3HCT**	**14**	**300,978**	**946**	**35**	**103**
JA4ZU	"	72	4	4	4	**ON4XG**	**A**	**130,130**	**408**	**51**	**118**	OK1DH	"	627	13	7	12	**G3KMO**	**"**	**146,475**	**676**	**27**	**78**
JE1RAM	"	36	4	2	1	ON4GO	"	66,062	293	37	97	**OK1ALW**	**3.5**	**61,575**	**555**	**17**	**58**	**G3KDB**	**"**	**129,470**	**620**	**30**	**80**
JA2MGE	**14**	**178,524**	**581**	**34**	**74**	**ON5TO**	**14**	**6,528**	**168**	**9**	**25**	**OK1APJ**	**"**	**43,834**	**570**	**12**	**50**	G3PVA	"	51,982	353	23	56
JA9AG	**"**	**89,170**	**433**	**26**	**48**	ON5WL	"	2,418	85	6	20	OK2BLG	"	29,412	447	9	48	G4BVH	"	25,186	302	13	36
JA2INS	**"**	**88,305**	**303**	**34**	**71**			Bulgaria				OK2HI	"	22,504	318	10	40	G3IKY	"	21,724	305	14	38
JA3GOK	"	53,508	251	30	48	**LZ1AG**	**A**	**80,813**	**215**	**63**	**148**	OK1FQL	"	18,384	353	9	39	G8DI	"	12,528	220	12	36
JA2TH	"	47,231	234	26	47	LZ1KBG	"	61,832	359	35	96	OK1DHJ	"	14,976	294	7	41	G3UJG	"	4,396	118	6	22
JA3CKB/1	"	31,906	230	23	30	LZ1NJ	"	41,640	278	31	89	OK1DOK	"	13,719	165	12	39	G6NK	"	1,512	46	4	14
JA2FW/1	"	24,603	168	22	37	LZ2KBA	"	17,505	342	8	37	OK2UAS	"	11,154	229	7	32	**G3TXF**	**7**	**19,836**	**300**	**12**	**45**
JA3IBU	"	21,638	153	20	42	LZ1CW	"	17,460	67	39	58	OK2PEG	"	8,742	148	9	38	**G3UKS**	**3.5**	**57,646**	**520**	**12**	**63**
JR1XFS	"	19,588	135	23	36	LZ1MH	"	10,872	123	23	49	OK1DAM	"	5,408	175	5	27	**G3KWK**	**"**	**50,700**	**542**	**13**	**52**
JG1RVR	"	18,645	142	22	33	LZ2KBS	"	8,400	104	15	33	OK2PFX	"	5,110	138	6	29	G3ESF	"	42,351	533	10	47
JAØSC	"	17,556	127	23	34	**LZ1FI**	**21**	**21,672**	**167**	**16**	**40**	OK2PGR	"	5,032	156	5	29	G4BUE	"	25,380	343	9	38
JA1DFQ	"	14,522	98	22	31	**LZ2US**	**14**	**58,320**	**421**	**24**	**66**	OK2BBQ	"	4,865	133	7	28			Faeroe Islands			
JA1KQX	"	14,364	100	21	33	**LZ1KW**	**7**	**65,902**	**600**	**21**	**62**	OK3YCL	"	4,862	138	6	28	**OY2O**	**A**	**123,992**	**1022**	**22**	**66**
JA9FT	"	9,955	66	22	33	LZ1ZQ	3.5	527	29	5	12	OK2BNZ	"	3,536	99	5	29	OY4M	14	105	13	2	5
JA4EE	"	9,690	68	25	32			Czechoslovakia				OK3RJS	"	2,436	96	4	25			Federal Republic of Germany			
JA5FDJ	"	9,614	80	18	28	**OK2RZ**	**A**	**779,399**	**1,030**	**96**	**265**	OK1DLA	"	2,190	71	5	25	**DK3GI**	**A**	**822.866**	**1210**	**89**	**242**
JG1PGJ	"	9,154	88	19	27	**OK3KFF**	**"**	**147,694**	**449**	**54**	**122**	OK1IBL	"	1,792	58	6	22	**DJ2HH**	**"**	**649,165**	**821**	**83**	**232**
JH3XDY	"	9,129	84	21	30			(Opr. OK3TMR)				OK2SSI	"	1,495	64	4	19	**DK4PH**	**"**	**404,863**	**690**	**74**	**177**
JA7KTY	"	6,560	58	17	23	**OK2BJJ**	**"**	**94,287**	**335**	**47**	**112**	OK1MRA	"	1,305	46	4	25	DJ6TK	"	367,062	678	79	183
JA1PAQ	"	5,880	44	24	32	OK3EA	"	62,456	165	58	90	OK1XC	"	1,269	36	6	21	DK6NJ	"	322,505	630	74	191
JA2KZ	"	3,894	66	16	17	OK2BBJ	"	61,962	254	43	95	OK1DPK	"	320	20	4	12	DJ2TI	"	265,580	552	77	194
JA4CLL	"	3,150	43	15	20	OK1AOR	"	61,053	273	40	101	OK1YR	"	220	22	2	8	DJ4ZR	"	189,912	452	59	134
JA1SGU	"	2,144	49	14	18	OK2PAW	"	60,768	352	37	107	OK1MZO	"	75	16	1	4	DL1YA	"	188,320			
JA7EYL	"	1,944	32	13	14	OK3CGG	"	55,341	319	19	39	**OK1ATP**	**1.8**	**4,671**	**135**	**7**	**20**	DL8YR	"	169,081	406	63	146
JA2HFB	"	1,536	38	7	9	OK2BDE	"	44,608	139	52	84	**OK1MMW**	**"**	**3,013**	**120**	**5**	**18**	DJ4UF	"	134,128	349	60	142
JA8ABR	"	1,026	24	10	9	OK2BSA	"	30,345	142	32	53	OK1IDK/p	"	2,116	83	5	18	DK9FY	"	131,566	561	44	113
JH1EJA	"	686	19	8	6	OK1MKU	"	30,090	209	24	78	OK1AXD	"	1,957	99	5	14	DK7ZB	"	127,605	448	40	101
JA1AAT	"	480	16	7	5	OK3KFO	"	28,620	229	27	79	OK1HBT	"	1,476	72	4	14	DL1JF	"	120,540	355	57	139

BAND-BY-BAND BREAKDOWN — TOP ALL BAND SCORES

Number groups indicate: QSO's/Zones/Countries on each band.

WORLD TOP SINGLE OPERATOR – ALL BAND

Station	1.8	3.8	7	14	21	28
KH6RS	19/ 5/ 4	361/15/19	709/28/37	760/34/ 59	904/27/35	404/14/17
YJ8GS		43/ 8/ 9	106/12/13	371/24/ 44	936/26/47	270/22/33
VS5MC		53/ 8/11	126/16/17	603/30/ 66	479/23/43	164/19/41
A9XU		83/ 8/27	228/11/33	392/25/ 60	473/19/61	200/17/35
W1BGD/2		118/17/50	189/28/69	300/34/ 82	283/26/69	46/19/34
K3YUA		108/17/47	209/22/62	361/32/ 74	296/24/68	27/15/21
KH6IJ	37/ 5/ 3	64/11/10	172/13/17	578/27/ 45	647/21/28	173/12/14
KP4DPN		182/14/37	507/18/42	406/25/ 61	279/19/47	124/12/16
WA1PID		62/14/41	98/19/51	355/33/ 84	379/28/76	32/16/26
WB4YLG		63/14/34	220/20/58	320/32/ 75	370/22/64	24/11/17

USA TOP SINGLE OPERATOR – ALL BAND

Station	1.8	3.8	7	14	21	28
W1BGD/2		118/17/50	189/28/69	300/34/ 82	283/26/69	46/19/34
K3YUA		108/17/47	209/22/62	361/32/ 74	296/24/68	27/15/21
WA1PID		62/14/41	98/19/51	355/33/ 84	379/28/76	32/16/26
WB4YLG		63/14/34	220/20/58	320/32/ 75	370/22/64	24/11/17
W6RR		67/14/18	239/24/34	348/34/ 69	329/24/39	68/17/31
K4YF	2/ 2/ 2	56/16/29	137/22/49	328/31/ 74	328/23/62	41/13/21
W3LPL		121/16/46	151/23/56	305/34/ 81	239/26/57	19/ 9/10
W2DXL		9 16/41	139/21/55	214/29/ 67	312/24/68	37/14/25
K6UA	10/ 8/ 8	85/19/26	358/26/40	188/31/ 55	232/24/34	38/13/23
WB4BGY		106/18/52	145/20/49	320/31/ 75	181/23/54	31/14/25

WORLD TOP MULTI-OPERATOR – SINGLE TRANSMITTER

OD5IQ	33/ 7/14	326/12/50	660/24/71	777/31/ 86	793/28/72	377/18/51
FY7AA	19/ 5/ 6	117/14/33	627/19/56	1137/32/ 82	1033/28/78	275/22/34
CT3WA		452/13/55	655/20/60	602/27/ 71	932/26/69	57/14/24
KP4EAJ	22/ 5/ 6	226/13/28	922/19/46	797/30/ 77	1058/27/73	323/15/20
4M5ANT	11/ 4/ 6	144/12/31	343/19/48	804/30/ 75	568/28/65	145/14/19
LU8DQ	8/ 5/ 3	46/11/17	108/13/19	747/29/ 63	814/27/68	247/16/23

USA TOP MULTI-OPERATOR – SINGLE TRANSMITTER

K4GSU	11/ 7/ 7	109/21/55	368/28/83	406/35/ 88	232/25/71	47/18/34
WA1NRV	4/ 2/ 2	126/16/47	123/20/57	409/30/ 82	379/25/78	36/16/25
W2GXD	2/ 2/ 2	76/15/37	115/25/59	391/32/ 82	357/24/69	41/14/23
WA5LES		17/13/16	518/26/56	188/32/ 56	321/26/67	35/14/23
W2YD	7/ 3/ 4	133/17/48	156/21/62	357/31/ 80	273/23/58	24/13/18
WB2SON		72/14/34	109/21/54	336/32/ 82	372/25/73	26/13/21

WORLD TOP MULTI-OPERATOR – MULTI-TRANSMITTER

PJ9JT	56/ 8/ 9	522/17/46	1332/23/70	2408/36/113	1438/34/87	820/19/38
W3AU	44/14/24	244/21/66	424/33/97	763/38/111	576/26/86	84/21/44
W2PV	58/ 9/19	211/22/62	419/32/94	735/37/106	614/28/88	110/20/40
W3WJD	26/ 7/ 7	255/22/66	252/29/81	725/35/107	569/27/85	77/19/37
W3GPE		189/21/58	422/28/88	650/35/101	487/25/84	78/19/36
6Y5BF	122/ 7/11	407/ 9/14	893/18/43	902/28/ 57	1008/20/47	533/13/27

USA TOP MULTI-OPERATOR – MULTI-TRANSMITTER

W3AU	44/14/24	244/21/66	424/33/97	763/38/111	576/26/86	84/21/44
W2PV	58/ 9/19	211/22/62	419/32/94	735/37/106	614/28/88	110/20/40
W3WJD	26/ 7/ 7	255/22/66	252/29/81	725/35/107	569/27/85	77/19/37
W3GPE		189/21/58	422/28/88	650/35/101	487/25/84	78/19/36
W7SFA	31/ 9/ 8	217/18/31	553/31/58	585/35/ 83	384/31/50	84/13/24
W3GM	26/12/19	141/19/52	246/30/78	472/32/ 88	344/25/73	56/18/33

DJ5GG	"	99,912	302	57	127	OH5MJ	"	27,178	132	30	77	DM4YEL	"	13,851	68	36	45	HA1SN	"	3,840	102	7	25
DJ3XK	"	94,221	311	53	118	OH2BHG	"	21,931	169	26	65	DM2AMK	"	11,692	103	23	56	**HA5HS**	**7**	**39,770**	**298**	**21**	**61**
DL9TJ	"	93,141	330	38	93	OH2BCV	"	21,576	69	53	63	DM2CHM	"	10,660	55	34	48	HA1SB	"	12,291	200	11	40
DJØYZ	"	92,325	411	45	110	OH7OQ	"	17,136	88	32	69	DM3SBM	"	4,264	53	14	38	HA2KSC	"	12,224	146	15	49
DL8AN	"	90,876	236	55	117	OH3TA	"	15,288	128	27	51	DM3WMJ	"	3,999	55	16	27	**HA3KNA**	**3.5**	**43,218**	**586**	**13**	**50**
DL2JO	"	85,824	313	46	103	OH9TD	"	5,796	60	17	46	DM2CRJ	"	3,960	84	11	34	**HA1YI**	"	**40,299**	**587**	**12**	**45**
DL1ES	"	76,066	346	34	112	OH7SQ	"	3,337	71	16	31	DM2AHE	"	3,082	53	15	31	HA4XT	"	36,992	482	13	51
DL1GN	"	66,736	248	50	122	OH4SF	"	1,386	20	15	18	DM2ACL	"	2,440	41	15	25	HA9PG	"	22,540	426	11	38
DK5JA	"	57,510	198	40	95	OH2BMP	"	208	9	8	8	DM2BUB	"	2,379	54	10	29	HA3PT	"	9,720	247	6	34
DL7LV	"	46,512	180	53	91	OH3XJ	21					DM3ZBE	"	1,976	47	13	25	HA1TI	"	8,505	241	6	29
DK8KD	"	42,350	251	30	80	**OH2BCP**	**21**	**126,540**	**526**	**31**	**80**	DM2CJJ	"	1,500	22	14	16	HA1YZE	"	4,205	154	5	24
DJØXT	"	42,504	140	53	85	OH4SL	"	62,790	334	25	66	**DM2DUK**	**28**	**7,020**	**74**	**17**	**35**	HA1TO	"	3,660	129	5	25
DJ6SI	"	38,808	216	36	90	OH2BNC	"	28,336	155	27	61	DM2DEK/A	"	54	3	3	3	HA7LS	"	1,054	63	4	13
DL8BU	"	36,750	188	33	72	OH8ND	"	14,840	169	17	39	DM2AYK	"	24	2	2	2			Iceland			
DK1DB	"	36,504	204	35	89	OH2BPC	"	8,640	68	18	42	DM2CEK/DM4NFM						**TF3AX**	**A**	**8,814**	**123**	**11**	**28**
DL8IG	"	36,050	166	31	72	OH2BCD	"	3,000	57	10	20		"	24	2	2	2	TF3IRA	14	2,725	64	8	17
DL6BP	"	24,900	154	29	54	OH6UM	"	819	29	6	15	**DM2CKD**	**21**	**11,748**	**110**	**15**	**29**			(Opr. TF3KB)			
DK8KC	"	19,491	182	23	66	OH6JW	"	312	16	6	7	**DM2AJH**	**"**	**11,394**	**77**	**20**	**34**	TF3AC	"	153	9	3	6
DK7GL	"	17,172	101	37	69							DM3UE	"	2,730	35	15	20			Isle of Man			
DL8UF	"	16,965	141	16	49	OH7UV	"	12	3	2	2	DM2DIL	"	1,512	38	7	7	**GD4BEG**	**1.8**	**8,760**	**243**	**8**	**22**
DK4EX	"	16,660	139	21	49	**OH3PE**	**14**	**30,180**	**329**	**17**	**43**	DM4ZFM/A	"	1,288	55	4	4			Italy			
DJ1LD	"	13,300	94	28	48	**OH2LU**	**"**	**27,968**	**221**	**21**	**43**	DM2BML	"	1,218	42	13	16	**IC8CQF**	**A**	**125,022**	**422**	**42**	**92**
DJ5QK	"	9,715	104	19	48	OH6MM	"	20,160	259	13	43	**DM3PCK**	**14**	**18,915**	**160**	**19**	**46**	**I1BAY**	**28**	**24,381**	**157**	**27**	**54**
DJØVO	"	6,864	76	16	23	OH7QU	"	17,995	200	16	45	DM2FBL	"	10,736	130	18	43	**I3AWK**	**21**	**4,480**	**69**	**12**	**20**
DK5NV	"	1,980	34	11	11	OH2BOQ	"	9,555	144	11	38	DM3FDO	"	10,720	89	19	48	I1EFC	"	2,860	64	9	17
DL1MD	"	500				**OH5TS**	**7**	**52,954**	**367**	**22**	**61**	DM2CHN	"	5,781	111	10	31	**I3FDZ**	**14**	**22,479**	**243**	**16**	**43**
DK7MG	28	1,984	28	12	19	**OH6ZH**	**"**	**34,340**	**264**	**23**	**62**	DM3XUE/A	"	3,564	40	16	28	I2FGP	"	22,330	139	24	46
DK5KY	**21**	**99,283**	**393**	**30**	**71**	OH1PS	"	15,611	137	18	49	DM2BCF	"	1,768	52	7	20	I2DNM	"	1,566	51	7	20
DL1KS	"	6,528	50	20	28	OH6RC	"	7,020	107	12	40	DM2CYE	"	465	16	7	8	**I3LID**	**7**	**51,100**	**436**	**22**	**63**
DL1TH	"	2,919	57	7	14	OH5ML	"	800	41	4	16	DM3CF	"	228	7	6	6	**I3GNQ**	**3.5**	**27,968**	**463**	**8**	**38**
DF1QQ	"	2,047	42	11	12	**OH1XX**	**3.5**	**65,920**	**602**	**19**	**16**	**DM2FFL**	**7**	**11,250**	**194**	**10**	**40**	**I2BVS**	**"**	**18,336**	**327**	**9**	**39**
DJ5SN	14					OH1TN	"	28,490	308	17	53	DM2CHE	"	760	40	5	14	I1SOP	"	4,970	94	8	27
DLØPG	**"**	**267,344**	**913**	**33**	**91**	OH3XT	"	27,403	297	15	52	DM2CXE	"	578	22	5	12	I5MPN	"	3,132	61	9	27
		(Opr. DK3BJ)				OH6LB	"	4,040	82	6	34	DM2FDM	"	540	72	5	18			Jersey			
DL8CM	"	150,998	623	28	75	OH7UB	"	4,004	131	5	23	DM2AOM/A	"	432	32	3	11	**GC5AGA**	**A**	**162,810**	**524**	**47**	**115**
DJ7RJ	"	61,304	286	26	71	OH1LU	"	315	13	4	11	**DM4SL**	**3.5**	**3,969**	**150**	**4**	**23**					(Opr. K4II)	
DJ5WM	"	40,836	237	24	58	OH4TH	"	208	15	4	9			(Opr. DM4UCI)						Malta			
DJ7PT	"	35,422	218	26	63	**OH2BW**	**1.8**	**4,175**	**151**	**6**	**19**	DM4SHJ	"	2,454	123	6	28	**9H1CH**	**21**	**88,504**	**497**	**25**	**67**
DJ2JX	"	20,618	182	16	45	**OH2BO**	**"**	**4,050**	**123**	**9**	**21**	DM5XI	"	1,120	56	4	16			The Netherlands			
DK5VO	"	15,275	195	13	34	OH1IJ	"	1,065	69	3	12	DM3YPE	"	1,050	18	9	16	**PAØTAU**	**A**	**131,453**	**339**	**64**	**147**
DL3CW	"	9,180	92	13	38	OH1VP/3	"	442	35	2	11	DM4WPF	"	741	39	4	15	PAØVB	"	39,424	228	33	79
DJ7SN	"	2,112	11	21	42			France						Greece				PAØTA	"	14,580	78	33	57
DL7AV	**7**	**106,785**	**523**	**29**	**84**	**F5IN**	**A**	**589,056**	**1495**	**64**	**144**	**SVØWTT**	**A**	**43,560**	**178**	**48**	**84**	PI1ARS	14	9,405	101	18	39
DJ5PA	**"**	**96,390**	**539**	**25**	**80**	**F6BPP**	**"**	**313,336**	**848**	**60**	**152**			(Opr. W6GBG)				PAØVGA	"	143	9	4	7
DL8CH	"	44,714	316	18	61	F2XW	"	66,875	237	45	80	**SVØWGG**	**7**	**6,475**	**162**	**7**	**28**	PAØUV	"	45	5	2	1
DL6WE	"	11,571	139	12	45	F6DDP	"	53,956	236	30	64			(Opr. K2UOP)				**PAØHIP**	**1.8**	**12,704**	**328**	**9**	**23**
DJ8FF	"	4,366	105	8	29	F9BB	"	41,952	206	33	81			Hungary						Northern Ireland			
DL1FF	**1.8**	**5,152**	**114**	**10**	**22**	F5AI	"	984	57	8	9	**HA4YO**	**A**	**170,563**	**568**	**52**	**139**	**GI6YM**	**A**	**162,324**	**531**	**46**	**121**
DK8FZ	"	2,055	145	3	12	**F2VO**	**21**	**7,854**	**86**	**14**	**20**	HA9KOV	"	97,650	351	53	122					(Opr. GI5UR)	
DL6EN	"	2,006	120	3	14	German Democratic Republic						HAØHN/9	"	87,954	447	36	101	**GI3JEX**	**"**	**108,406**	**480**	**38**	**96**
DK6MN	"	1,140	53	5	14	**DM2BJD**	**A**	**283,004**	**507**	**80**	**198**	HA3HH	"	75,046	293	42	115			Norway			
DJ4KW	"	988	6	13	47	**DM3YBF**	**"**	**171,306**	**640**	**51**	**137**	HA1ZD	"	32,224	219	28	78	**LA2Q**	**A**	**33,500**	**283**	**24**	**76**
		Finland				DM3NKF	"	69,600	505	24	96	HA6NP	"	3,256	37	17	27	LB3B	"	18,144	183	23	61
OH7NW	**A**	**64,160**	**263**	**39**	**121**	DM2CYO	"	52,094	177	42	86	HAØMI	"	2,880	75	9	28	LA2IE	"	10,305	142	14	31
OH5RZ	**"**	**50,864**	**278**	**36**	**100**	DM5UUL	"	33,924	179	35	97	**HA5KFB**	**28**	**1,674**	**23**	**13**	**18**	LA8CE	"	8,710	96	18	49
OH2BJH	"	43,995	288	32	73	DM2CMF	"	25,200	125	32	68	**HA3GJ**	**21**	**34,997**	**193**	**26**	**53**	LA5NM	"	4,048	83	12	32
OH7UE	"	42,510	226	34	96	DM5SDL	"	21,115	126	32	67	**HA7LF**	**14**	**77,366**	**453**	**25**	**76**	LA7CM	"	3,604	98	11	23
OH7NJ	"	29,290	203	31	70	DM2CCM	"	20,202	134	24	77	HA5BA	"	13,132	190	20	29	LA5AP	"	3,465	105	7	26
						DM5JL	"	18,582	257	17	52	HA7MG	"	10,927	139	14	35	LA2YT	21	527	19	6	11

LA9M	"	273	22	4	9
LA4LN	**14**	**9,594**	**181**	**8**	**37**
LA4PQ	"	9,240	160	10	23
LB1D	"	9,239	151	12	35
LA8GK	"	8,906	81	21	40
LA6NI	"	5,320	80	12	28
LA6U	**7**	**8,415**	**119**	**11**	**40**
Poland					
SP9BPF	**A**	**227,470**	**612**	**61**	**169**
SQ9ABE	**"**	**171,648**	**517**	**58**	**134**
SQ8EDQ	"	105,924	293	47	135
SP8EMO	"	82,636	386	38	108
SQ9BDQ	"	79,820	266	44	127
SP7CTY	"	74,646	238	53	121
SP9AGS	"	54,094	272	33	89
SP5AFL	"	48,544	235	42	106
SQ1AFU	"	42,408	245	33	99
SQ2KFQ	"	40,020	191	35	80
(Opr. SP2HGG)					
SP1BHX	"	28,644	118	44	82
SP9NH	"	26,481	200	20	77
SQ7CKF	"	25,668	238	23	69
SQ2AOB	"	21,830	73	52	66
SP9FTK	"	20,979	327	10	53
SQ7EJS	"	17,459	205	15	64
SP9DWT	"	17,328	185	20	56
SQ8AWP	"	16,038	141	25	56
SQ8ASP	"	14,076	145	18	50
SP1FIC	"	13,530	144	17	65
SP2AHD	"	8,778	124	17	49
SP5ATO	"	5,060	41	18	26
SP9OS	"	3,504	56	18	31
SQ6LK	"	1,800	36	10	20
SP7IFX	"	986	36	6	23
SP9FMD	"	900	24	11	19
SQ2EPU	"	682	15	9	13
SQ9FEW	"	266	13	6	18
SP5TT	**21**	**25,578**	**146**	**24**	**39**
SQ8AWL	"	12,354	89	20	38
SQ8AWN	"	8,869	75	17	32
SQ8ARK	"	7,410	74	15	23
SQ6BFK	"	4,473	75	11	10
SQ2FBC	"	1,152	20	11	13
SQ8ADF	"	1,050	28	7	8
SP2AVE	**14**	**67,303**	**376**	**28**	**79**
SP2BMX	"	25,760	235	19	51
SP8GQU	"	23,655	246	14	43
SQ7ATA	"	22,440	160	20	46
SQ8AOV	"	19,197	116	27	54
SP8HZZ	"	16,660	132	18	50
SP5EZI	"	16,184	233	15	41
SQ7ASZ	"	14,746	115	21	52
SQ8FNA	"	9,735	116	13	42
SP5GMK	"	8,492	127	14	30
SP6BPY	"	7,367	139	15	38
SP6HFC	"	6,664	99	14	35
SQ5AD	"	6,006	50	19	44
SQ6FER	"	4,558	53	15	38
SP9CCA	"	1,953	37	10	21
SP9ALW	"	1,950	49	9	21
SP5FLA	"	1,656	56	7	16
SP9ADU	"	1,421	22	11	18
SQ8HPW	"	1,127	42	6	17
SQ3EVZ	"	432	17	6	10
SP9AVZ	"	56	6	2	5
SP5ARN	**7**	**44,880**	**365**	**19**	**61**
SQ9ABU	"	17,018	166	16	51
SP8AIS	"	9,890	192	8	35
SP2HNF	"	9,675	185	7	36
SQ9AAB	"	6,270	210	5	28
SQ7CVW	"	1,846	62	6	20
SP4GHT	"	1,144	40	6	20
SQ3DOI	"	760	14	8	12
SP3FYX	"	384	22	5	11
SP9GAN	'	15	3	2	3
SP9DH	**3.5**	**43,400**	**516**	**13**	**57**
SQ4BGR	**"**	**35,746**	**507**	**13**	**48**
SP5KGT	"	21,372	333	11	41
SQ2FAX	"	16,356	319	8	39
SP6ZCZ	"	15,162	391	6	32
SP5GIQ	"	14,620	338	8	35
SP9UH	"	13,140	263	7	38
SP9FKP	"	11,653	284	7	36
SP3HUU	"	4,988	175	5	24
SP3FZB	"	4,860	150	4	26
SQ9AKD	"	4,352	130	5	27
SP9ADV	"	4,059	117	7	26
SQ8DHJ	"	3,904	109	6	26
SP9EMI	"	3,640	133	5	23
SQ3BLP	"	2,899	114	5	22
SP9HVV	"	2,856	115	5	19
SP2FAP	"	2,850	101	5	25
SP7IFM	"	2,800	103	5	23
SP9ERC	"	2,640	113	5	19
SP9HXN/8	"	2,436	81	5	24
SP6FEK	"	1,932	65	5	23
SP6EQZ	"	1,748	73	5	18
SP9FKQ	"	1,612	57	6	20
SQ7DQQ	"	1,364	63	5	17
SQ6KB	"	1,342	63	4	18
SP2IIO	"	1,207	72	5	12
SQ6UK	"	1,128	47	4	20
SP5GOR	"	1,012	44	5	18
SP9HVN	"	247	20	3	10
SP4HHX	"	238	16	4	10
SP2HYO	"	238	15	5	9
Portugal					
CT1QN	**7**	**24,516**	**274**	**12**	**42**
Romania					
YO7DL	**A**	**132,765**	**514**	**39**	**128**
YO6APP	"	39,663	294	26	87
YO9APJ	"	31,812	148	45	97
YO2ARV	"	28,452	280	19	67
YO2KCB	"	20,793	131	22	65
YO2QY	"	5,335	45	24	31
YO5KDL	"	5,028	128	10	30
(Opr. YO5ASW)					
YO7IY	"	4,987	89	15	44
YO7BGA	"	3,034	80	9	28
YO2BIN	"	1,682	56	8	21
YO8GF	"	754	23	9	17
YO3JW	**28**	**2,304**	**31**	**13**	**19**
YO8AHL	21	11,229	95	21	36
YO3AC	**14**	**113,775**	**539**	**30**	**81**
YO6EX	**"**	**109,980**	**561**	**32**	**85**
YO5BQ	"	39,950	300	21	64
YO4XF	"	8,415	116	12	43
YO9GP	"	4,753	61	15	34
YO4ASD	"	368	19	5	11
YO3BEJ	**7**	**12,126**	**254**	**8**	**34**
YO5ALH	"	11,424	256	8	34
YO9BGV	"	9,975	129	13	44
YO9BCZ	"	1,750	58	6	19
YO7VO	**3.5**	**14,960**	**314**	**8**	**36**
YO5AT	**"**	**10,476**	**278**	**6**	**30**
Sardinia					
IS0BDO	**A**	**75,710**	**383**	**41**	**93**
Scotland					
GM3WRN	**14**	**12,150**	**214**	**12**	**33**
GM4AGG	**1.8**	**11,118**	**242**	**10**	**24**
(Opr. GM4DAE)					
GM3YOR/P	"	6,336	177	10	22
Sicily					
IT9AF	**21**	**91,908**	**490**	**26**	**66**
Spain					
EA5BS	**A**	**276,315**	**935**	**48**	**147**
EA7VN	"	3,960	65	12	24
EA4BV	21	3,745	53	10	25
EA2CR	"	2,325	43	10	15
Sweden					
SM5CEU	**A**	**423,934**	**843**	**81**	**202**
SM5BPJ	**"**	**379,769**	**668**	**85**	**211**
SM0CCE	**"**	**273,510**	**590**	**71**	**199**
SM7EAN	"	189,930	711	55	140
SM0BYD	"	119,930	483	50	129
SM5DNI	"	113,022	319	55	134
SM7ID	"	90,090	361	42	123
SM6CMU	"	88,020	224	46	117
SM7KU	"	81,054	324	43	128
SM6BZE	"	63,000	220	44	106
SM0CCM	"	61,650	190	45	107
SM5EOS	"	55,577	244	42	107
SM7CMV	"	25,056	147	31	65
SM5BAX	"	18,531	112	28	59
SM5DLR	"	14,924	136	24	58
SM3DXV	"	8,645	75	20	45
SM5EEY	"	6,768	69	24	48
SM7BVO	"	6,615	87	17	32
SM7GTD	"	2,772	80	7	26
SM5CLE	"	2,112	36	16	32
SM0GMG	"	900	22	10	15
SM5BHW	**28**	**2,244**	**34**	**12**	**21**
SM5DRW	**21**	**24,543**	**144**	**23**	**58**
SM5ACQ	"	7,803	80	15	36
SM7VY	"	1,825	33	11	14
SM5FEX	"	726	13	10	12
SM2DMU	**14**	**101,370**	**591**	**24**	**69**
SM5BRS	"	33,022	260	21	58
SM5DRW	"	24,543	144	23	58
SM6JY	"	9,129	137	12	39
SM3DMP	"	4,983	128	8	25
SM5UQ	"	4,095	98	8	27
SM0FY	"	3,772	36	16	30
SM5FUG	"	2,782	52	12	26
SM0BVQ	"	2,728	73	7	24
SM6DVZ	"	850	50	5	13
SM2DYW	"	0	1	1	1
SM0TW	**7**	**31,176**	**307**	**17**	**55**
SM5EQW	**3.5**	**3,335**	**105**	**6**	**23**
Switzerland					
HB9QA	**A**	**95,632**	**351**	**50**	**122**
HB9ALQ	"	78,720	311	45	115
HB9DX	21	7,540	55	20	38
HB9KC	7	3,854	66	8	33
Ukraine S.S.R.					
UB5VK	A	12,852	129	19	49
UB5TQ	**7**	**18,972**	**218**	**16**	**43**
UB5CI	**3.5**	**112,674**	**864**	**22**	**67**
Wales					
GW3SYL	**A**	**105,504**	**375**	**49**	**108**
GW3XNS	**1.8**	**552**	**47**	**2**	**10**
Yugoslavia					
YU2CDS	**A**	**753,651**	**1,050**	**95**	**214**
(Opr. YU2RNE)					
YU2OB	**"**	**312,320**	**667**	**66**	**190**
YU1NGO	**"**	**114,631**	**393**	**48**	**139**
YU3ER	**28**	**14,839**	**95**	**23**	**48**
YU2RKC	"	3,549	36	15	24
YU3EYZ	**21**	**57,964**	**316**	**24**	**62**
YU1ELM	"	35,629	235	21	58
(Opr. YU1OFT)					
YU1SF	**14**	**10,350**	**161**	**10**	**40**
YU1EXY	**7**	**107,536**	**604**	**24**	**80**
YU3TPM	"	33,327	279	16	53
YU1OCZ	"	18,644	221	11	48
YU3TCQ	"				
YU3DBC	**3.5**	**135,408**	**853**	**22**	**69**
U.S.S.R.					
UW3EH	**A**	**42,602**	**223**	**31**	**88**
UA6HYL	"	7,345	78	23	42
UA1DF	"	1,542	34	19	27

OCEANIA

American Samoa					
KS6DH	**A**	**399,317**	**747**	**83**	**110**
Australia					
VK2GW	**A**	**458,344**	**859**	**65**	**119**
VK2BBB	"	6,512	62	19	18
VK3MR	**A**	**265,512**	**496**	**71**	**113**
VK3OP	**7**	**31,800**	**209**	**24**	**29**
VK3APN	"	24,645	163	23	30
VK3XB	3.5	756	23	6	6
VK4UR	**A**	**176,981**	**475**	**54**	**77**
VK2BZM/4	"	152,750	424	53	77
VK4XA	**21**	**81,508**	**403**	**25**	**46**
VK6RU	**A**	**159,250**	**447**	**52**	**73**
Brunei					
VS5MC		**1,146,964**	**1,425**	**96**	**178**
Gilbert Islands					
VR1AA	**A**	**132,447**	**314**	**74**	**85**
Guam					
KG6JAR	**A**	**342,912**	**862**	**52**	**89**
Hawaii					
KH6RS*					
	A	2,738,904	3,157	123	171
(Opr. W6DGH)					
KH6IJ	**A**	**1,028,146**	**1,671**	**89**	**117**
KH6CF	**A**	**636,922**	**1,156**	**83**	**104**
KH6BYG	"	118,332	527	38	38
KH6HQG	"	39,442	187	37	37
KH6HGL	**21**	**39,001**	**312**	**18**	**25**

*Committee Member, Ineligible for Award.

KH6IGC	**14**	**117,734**	**470**	**33**	**53**
KH6IJA	"	21,320	193	17	24
KH6IAC	"	4,485	115	7	6
KH6HSW	**7**	**59,192**	**417**	**19**	**30**
KH6CHC	**1.8**	**891**	**33**	**5**	**4**
Indonesia					
YB0ABV	**A**	**65,653**	**216**	**44**	**69**
Marshall Islands					
KX6BB	**14**	**22,491**	**168**	**24**	**25**
New Caledonia					
FK8BV		**143,276**	**428**	**56**	**63**
New Hebrides					
YJ8GS	**A**	**1,213,086**	**1,726**	**92**	**146**
New Zealand					
ZL3GG	**A**	**911,760**	**1,209**	**97**	**165**
ZL1AFW	"	374,421	928	59	78
ZL2AKW	"	3,700	36	15	22
ZL2ACP	**28**	**30,432**	**221**	**18**	**30**
ZL1AMM	**21**	**89,756**	**413**	**24**	**52**
ZL1AMO	**7**	**174,867**	**770**	**25**	**52**
[illegible]land					
WB4KSE/KW6					
	28	**207,662**	**794**	**28**	**63**

SOUTH AMERICA

Argentina					
LU3EX	**A**	**119,880**	**301**	**50**	**85**
LU8BAO	"	58,800	202	42	63
LU9FAN	**14**	**149,283**	**521**	**32**	**65**
Bolivia					
CP1EU	**A**	**159,016**	**381**	**58**	**85**
Brazil					
PY7AOR	A	152	8	4	4
PY2FYG	"	90	5	5	5
PT2CJ	**14**	**21,267**	**145**	**16**	**35**
PY2FQV	"	10,624	113	13	19
PY1EIR	"	2,820	79	7	5
PY7AKQ/8	**7**	**137,112**	**575**	**23**	**64**
PT2GOK	"	56,000	274	21	49
PY7YH	"	2,242	41	10	9
PY2FXH	**3.5**	**12,420**	**58**	**16**	**30**
PY3APH	"	3,278	56	10	12
PY2FUS	"	2,808	44	12	12
Ecuador					
HC1CW	**A**	**133,348**	**430**	**45**	**61**
Uruguay					
CV8B	**28**	**165,675**	**748**	**27**	**48**
CX9BT	**3.5**	**38,589**	**235**	**20**	**37**
Venezuela					
SM5LH/YV5	14	1,290	30	8	7

MULTI OPERATOR SINGLE TRANSMITTER

United States				
WA1NRV	**1,222,800**	**1077**	**109**	**291**
WA1UBC	13,920	70	31	49
W2GXD	**1,082,112**	**982**	**112**	**272**
W2YD	**1,005,480**	**950**	**108**	**270**
WB2SQN*	959,008	914	104	264
W2RHE	75,432	162	62	106
W3BWZ	**385,586**	**492**	**87**	**191**
K4GSU	**1,601,024**	**1173**	**134**	**338**
K4VX	**836,964**	**847**	**104**	**243**
K4UT	808,150	782	109	241

*Committee Member — Ineligible for Award.

Looking pleased with their effort, the team at SK2DR —top SM Multi-Single. SM2EKM, SM2CEW, SM2BLY, SM2FRI, SM2CLY, SM2ELN.

W4QCW	733,020	686	112	268
K4YFQ	801,856	862	101	251
W4OZF	246,198	442	77	145
WA4ZHB	239,682	336	87	171
WB4EME	153,700	285	75	137
K4FW	136,000	237	61	139
W4MII	120,780	252	68	112
WB4HQE	58,968	174	38	88
WA5LES	**1,013,320**	**1079**	**111**	**218**
WA5RXT	472,871	573	103	198
W6KG	**517,548**	**2537**	**86**	**118**
W1ARR/6	336,990	811	57	84
K6HIH	255,020	543	68	96
W7NQ	**946,332**	**1137**	**107**	**184**
W7DAZ	245,280	542	65	95
W8ROF	**500,717**	**589**	**94**	**213**
W8KIT	294,327	372	102	195
W8UM	264,940	378	85	175
W9ZTD	**504,674**	**561**	**112**	**222**
Cayman Is.				
ZF1AL	**228,160**	**869**	**52**	**72**
Puerto Rico				
KP4EAJ	**2,683,525**	**3343**	**109**	**250**

AFRICA

Liberia				
EL2FT	**1,470,392**	**2041**	**75**	**167**
Madeira Is.				
CT3WA	**3,003,196**	**2698**	**100**	**279**

ASIA

Israel				
4Z4IX	**1,693,467**	**1903**	**80**	**223**
Japan				
JA2YAB	**524,394**	**820**	**92**	**142**
JA5YCS	51,612	212	42	50
JA2ZAP	23,408	126	36	41
Lebanon				
OD5IQ	**3,970,912**	**2966**	**120**	**344**
U.S.S.R.				
UK9FER	**459,368**	**895**	**42**	**140**

EUROPE

Belgium				
ON5KH	**98,294**	**446**	**37**	**82**
ON4UB	91,434	417	43	104
Bulgaria				
LZ1KDP	**552,120**	**1090**	**90**	**231**
LZ2KEF	**345,681**	**1106**	**56**	**161**
LZ2KAD	277,344	869	62	154
LZ2KSB	240,552	710	62	172
LZ1KCP	75,364	654	22	61
LZ2KHM	54,806	320	27	107
LZ2KDI	54,536	614	17	51
LZ1KBU	45,900	381	26	76
LZ2KWD	12,172	268	12	38
Czechoslovakia				
OK3KAG	**516,420**	**1003**	**84**	**218**
OK1KSO/P	**482,220**	**804**	**76**	**206**
OK1KTI	311,640	616	78	167
OK3KAP	274,224	1182	70	162
OK1KPU	181,830	646	54	120
OK3RKA	97,856	414	39	117
OK3OSNP	47,610	255	43	72
OK1KCD	36,076	203	37	79
OK3KTY	35,451	195	38	79
OK2KYK	23,920	180	24	68
OK2KOO	23,067	159	38	61
OK1KRQ	21,931	169	28	63
OK1KYS	16,524	90	30	38
OK3KGQ	12,432	169	20	36
OK3KJX	5,166	121	8	34
OK1KUK	4,836	151	5	26
OK3KPN	2,232	91	5	19
OK1OFK	2,208	43	12	20
OK1KCF	693	31	5	16
OK1KRS	481	40	2	11
England				
G3SSO	**668,721**	**1057**	**81**	**222**
G3GJL	195,360	541	49	136
G4BTJ	171,304	422	57	139
G3NIS	146,028	541	44	128
Faeroe Islands				
OY6FRA	**279,993**	**1161**	**50**	**151**
Federal Republic of Germany				
DLØWU	**1,239,592**	**1539**	**98**	**258**
DLØKF	**823,548**	**1189**	**103**	**271**
DKØTU	**812,748**	**1180**	**100**	**256**
DLØWN	314,706	626	75	179
DLØII	274,896	941	51	133
DF1SV	59,143	258	44	75
Finland				
OH6AK	**283,136**	**652**	**64**	**160**

Disqualifications

Duplicates: KV4FZ, ZL1ARV.
Unverifiable Contacts: DJ7MI, EA-2IA.
Unverifiable Multipliers: K6CQF, ZS6IW.

Hungary				
HG5A	**1,249,563**	**1633**	**108**	**271**
HAØKLE	438,480	831	85	205
HA5KKP/2	407,175	954	80	187
HG8U	404,202	812	87	216
HA5KFN	330,966	848	63	164
HA7KLG	312,420	764	69	177
HA5KKB	258,420	646	67	169
HA5KBM	253,590	560	70	144
HA8KVG	243,090	739	59	160
HA7KLC	207,900	588	62	158
HAØKLA	167,240	493	56	129
HAØKHW	158,172	516	55	141
HA2KRB	119,112	411	51	117
HA5KAS	111,784	402	46	132
HA9KPU	110,505	495	48	111
HA2KRL	109,076	467	42	106
HAØKLU	105,938	449	46	115
HA6KVB	91,316	494	43	105
HA6KNI	76,073	433	36	91
HA2KMB	61,625	358	37	88
HA1KZU	50,544	422	30	78
HA7KMW	43,382	313	24	85
HA7KMS	41,446	291	31	75
HA1KSL	41,055	197	37	78
HA7KMY	23,936	345	13	51
HA1KVM	19,068	185	26	58
Ireland				
EI1AA	**158,110**	**743**	**36**	**127**
I.T.U.				
4U1ITU	**278,391**	**748**	**61**	**152**
Netherlands				
PA9AEH	**159,132**	**614**	**51**	**127**
PI1PT	35,712	224	28	68
Poland				
SP9PDJ	**74,031**	**304**	**39**	**94**
SQ9KRT	53,110	386	27	86
SQ4PBI	48,864	454	18	78
SQ3PTE	48,708	389	25	83
SP9KMQ	38,340	342	23	67
SQ5PSL	31,913	318	26	71
SP1KBK	31,140	255	24	66
SP2ZHB	22,750	228	30	61
SQ9KGC	21,995	230	19	64
SP5KMB	11,395	254	10	43
SPZKDT	8,947	108	23	50
SP9PBN	6,579	171	10	33
SQ1KKO	4,650	121	10	20
Romania				
YO4KCZ	**844,284**	**1574**	**85**	**237**
YO8KGA	156,264	510	56	148
YO8KAN	34,128	184	35	73
YO6KEW	3,680	73	10	36
YO3KBC	220	8	5	5
Scotland				
GM3ZRC	**77,085**	**426**	**33**	**102**
Sweden				
SK2DR	**795,872**	**1469**	**80**	**228**
SM5AOE	**647,615**	**1133**	**87**	**226**
SK6BA	579,550	915	97	238
SK2AU	331,444	1091	51	121
SMØBDS	93,687	408	42	125
Wales				
GW3UCB	**9,477**	**255**	**8**	**19**
Yugoslavia				
YU1BCD	**1,601,900**	**1724**	**110**	**305**
YU2CBM	258,720	613	73	151
YU2ACF	106,777	391	54	133
YU2CBV	56,515	269	37	90
YU2BOP	44,712	316	32	76
YU2BTU	15,326	100	30	49
U.S.S.R.				
UK4HAW	**228,660**	**600**	**53**	**169**

OCEANIA

Australia				
VK5NO	**1,058,130**	**1346**	**87**	**183**
Wallis Island				
FWØAA	**1,149,644**	**2082**	**80**	**114**

SOUTH AMERICA

Argentina				
LU8DQ	**1,705,788**	**1970**	**101**	**193**
Brazil				
PY1EMM	**254,492**	**589**	**45**	**104**
French Guiana				
FY7AA	**3,750,121**	**3208**	**120**	**289**
Venezuela				
4M5ANT	**2,090,556**	**2015**	**107**	**244**

MULTI-OPERATOR MULTI TRANSMITTER

NORTH AMERICA

W3AU	**3,623,116**	**2135**	**153**	**428**
W2PV	**3,339,215**	**2147**	**148**	**409**
W3WJD	**2,802,096**	**1904**	**139**	**383**
W3GPE	**2,556,180**	**1826**	**128**	**367**
6Y5BF	**2,403,156**	**3865**	**95**	**199**
W7SFA	**2,057,442**	**1854**	**137**	**254**
W3GM	1,741,165	1265	136	343
W3FRY	1,609,097	1256	127	330
WA6EPQ	**1,057,398**	**1195**	**109**	**200**
WA3ATX	888,573	803	116	277
K2CW/2	744,192	783	105	237
W3TV	696,766	785	95	222
WA5JMK	**688,800**	**719**	**112**	**238**
W5KFL	598,794	716	108	210
W3BYX	115,427	247	50	119

ASIA

JA3YKC	**978,576**	**1191**	**109**	**195**
JA2YEF	603,140	871	110	155
JA9YBA	316,078	627	89	122
JA1YSI	16,524	107	32	36

EUROPE

OH3MG	**1,867,600**	**2334**	**123**	**337**
SK5AJ	**1,404,200**	**1961**	**109**	**304**
SQ6PAZ	**139,573**	**582**	**45**	**112**
SQ3KEY	45,017	332	30	79

SOUTH AMERICA

PJ9JT	**9,753,500**	**6576**	**137**	**363**
YV5RT	**1,022,684**	**1232**	**87**	**197**

Our deep thanks to the following stations who sent in check logs, and to those whose logs we solicitied for checking purposes:
W7BYL, W6AOB, W5UO, W6PHE, W2ATR, W3HAM, WA2KTM, K9VSO, WA9MIO, WB2QMU, K4LMK, W1MTN, WA1LIT, W2EGJ, K3CB, W3URE, W2REX, W1KGR/2, K4JUD, W3LEZ, W2HQN, WA4REX, WA2AWK, W2EYM, K9JIM, K4JD, W4FZW, W1BBC, WB2DKZ, K4TJ, K3JJO, K4TWJ, WA3TER, W4NH, W3ZDK, WB8JSS, W3BY, K2JE, K4QR, W6OL, K6SF, W1ONX, WB9GFC, WB6FSF, W1BJJ, W1TW, WA2FCC, K4ON, K7NHG, WB2RGT, W3BY, W2RUK, W9JI, W1BE, W3DYP, W2GYS, W7SR, W8FKL, K2IA, W2EOE, DJ1ZB, DK5OS, DL1KD, DM2ARO, DM2ABE, DM2BTO, DM2CLM, DM2CPE, DM2CUG, DM2DEO, DM2DGO, DM2DZH, DM2EXH, DM3EA, DM3XM, DM3PQO, DM3WDJ, DM3XTL, DM4SF, DM4YZA, DM4ZEL, DM5IG, DM6TAH, HG5EA, LA2BG, LA2KD, LA6HL, LA7SI, LZ2KR, OH1PI, OH1PS, OH2BOZ, OH2BPN, OH2RL, OH5TS, OH5YX, OH6JW, OH6LB, OK1AVD, OK1DK, OK1IAR, OK1DOK, OK1JDJ, OK1KRS, OK1MAW, OK1MIN, OK1QH, OK1XJ, OK2BCH, OK2BOV, OK2KZR, OK2SBJ, OK2SWD, OK3BH, OK3BT, OK3CIU, OK3CGP, OK3MM, OK3QQ, OK3RJS, OK3TBN, OK3TFH, OK3YCM, OK3YDP, OK3YL, OZ2EOZ4QX, OZ7JZ, OZ7SG, PA0PHK, PA0PLM, SM5BGO, SM5BHW, SM5CFH, SM6COR, SM6CZU, SM6DSW, SM7EH, SM7TV, SM0IX, SP2AVE, SP2AIB, SP3KPN, SP3DOI, SP4KKV, SP5GOL, SP5DIR, SP4ACG, SP5GLD, SP5KGT, SP6DB, SP8KGI, SP9AMH, SP9AVZ, SQ1AGE, SQ3BYZ, SQ4BGR, SQ7CDH, SQ8HPW, SQ8AWL, YO7NA, YO9BCZ, YU3AE/X, YU3AE, YU3DOX, YU3NP, UA1ZEX, UA3DL, UA3TAM, U23RV, UA6HBU, UA0AT, UW0FB, UB5TH, UB5CI, UK5EAG, UK5LAK, UK5FAQ, G2TA, ZL3GQ, ZL1AF, KG4AA, ON4CZ, YU1NGO, ØY5NS, LA2IE, OE5AHL, F8FE, PY2FYG, OH3TA, 9V1SH.

STATION OPERATORS

Multi-Operator, Single-Transmitter

CT3WA: K2JP, W2AO, W2AX, W2AYJ, W2GC, W2GGE, W2IRV, WB2CKS. **DLØKL:** DJ4PX, DK7NM, DJ2EH, DK6NN. **DLØWU:** DJ4AX, DJ8SW, DK4TP. **DLØKF:** DL1FL, DL2ZT, DLZBO, DJ7SW, DK6LG, DK7LN, DC5OH, DC4LS. **DKØTU:** DA2QC, DK5GB, DK6QI, DK1PD, DL7HN, DLFNE, DL7ON, DL7QU, DL7SI. **DLØII:** DJZYE, DK8EY, DJ2YA, DJ5PE, DJ5PC, DJ8JP, DJ4TJ. **DF1SV** & DK5SF, DJ3TU. **EI1AA:** EI2BB, EI2CA, EISCL, EI7CC, EI8CC. **EL2FT** & EL2JC. **FWØAA:** K6RIR, K6YFZ, WB6LTJ. **FY7AA:** KP4TIN, F2QQ, F5QQ. **G3SSO:** G2HDU, G3LCJ, G3MZV, G3PEO, G3SNN, G8KG. **G3GJL:** G3RMF, G3TOD, G4CXM, G4CNY, G3TQZ, GYBXS. **G4BTJ:** G3PDL, G3VIP. **G3NIS:** G3RSF, G3RSP, G3TVW. **GM3ZRC:** GM3LYI, GM3XNJ. **GW3UCB:** G3XZK, G4BRK, G4ACC, G4BZD. **HG5A:** HA5HO, HA5HP, HA5FM, HA5MK, Zoltan. **HAØKLE:** HAØLO, HAØLM, HAØLZ, HAØMK, HAØMJ. **HA5KKP/2:** Zoltan, Marozsan, Basta. **HG8A:** HA8UD, HA8UI, HA8VC, HA8ZR, HA8UU. **HA1KVM:** Jozsef, Istvan, Miklos, HA1VA. **HA7KMY:** Bela, Tibor, Ferenc, Istudn. **HA1KSL:** HA1SL, HA1SP, HA1TP, HA1TR. **HA7KMS:** Mihaily, Jozsef, Lajos, Laszlo. **HA7KMW:** Tari, Fodor, Tatai, HA7MW. **HA9KPU:** Istvan, Janos, Laszlo, Laszlo, Janos. **HAZKRL:** Ferenc, Joszef, Herczegi. **HAØKLU:** Gyozo, Laszlo, Gabor, Sandor, Mihaly. **HA6KVB:** Laszlo, Janos, Istvan, Peter, Joszef. **HA6KNI:** Laci, Lajos, Janos, Gyuri, Dodi. **HAZKMB:** Laci, Sandor, Gyorgy, Balazs. **HA1KZU:** Kavoly Bela. **HA7KLG:** H7-033, H7-032, H7-031, H7-015, HA7MC. **HA5KKB:** HA5KB, HA5LX, Fay, Szilagyi, Lukacs. **HA5KBM:** HA5BM, HA5-076 Kiraly. **HA8KVG:** Jeno, Attila, Istvan, Laszlo. **HA7KLC:** H7-025, H7-051. **HAOKLA:** HAØLD, HAØ544, HAØ543. **HAØKHW:** Sandor, Janos, HAØHW. **HA2KRB:** Deli, Oravetz, Tavaszi, Karrati, Tultz. **HA5KAS:** HA5-304, HA5CE, HA5FJ, HA5FZ, HA7TN. **HA5KFN:** Dobrovitz, Kertesz, Szecsi, Szollar, Sandor. **JA2YAB:** JA2BP, JA2BY, JA2DV, JA2HO, JA2IU, JA2ANA, JA2CXF, JA2FRG, JA2HZA JH2DMY, JA2GST. **JA2ZAP:** Club. **JA5YCS:** JA5EZI, JA5KFD, JA5NNF. **KP4EAJ** & W5UDK, WA8RGJ. **LU8DQ** & LU1DZ, LU1DAY. **OD5IQ:** OD5HC, OH2BH, OH2MM. **OH6AK:** OH6RE, OH6LV, OH6KI, OH6JG. **OK1KSO/P:** OK1AEZ, OK1AAU, OK1ADH, OK1AMX, OK1SF, OK1TS. **OK3KAP:** OK3TFM, OK3TMF, OK3TPV, OK3TFN. **OK1KPU:** OK1JDX, Ladislav, OK1AXA. **OK1KUK:** OK1IDD, OK1FDL.

[*Continued on page 67*]

CQ Reviews: The EBC-144 JR. 2 Meter FM Transceiver

BY NORMAN STERNBERG,* W2JUP

It is rare that this writer gets the opportunity to evaluate a piece of equipment offering a real challenge to one's measurement ability. But this is one of those occasions. The equipment in question, the EBC—144 JR, produced by the Emergency Beacon Corporation, of New Rochelle, New York, is state-of-the-art in both design and execution. Following the appearance of several external synthesizer units on the market, the EBC-144 JR. is the first 2 meter f.m. radio to appear, complete with synthesizer and medium-power amplifier all in one very smartly designed professional-looking package. It has the physical aspect of commercial avionics equipment rather than ham gear, and although intended for amateur service has some performance characteristics that I would like to see in aircraft radios.

The EBC-144 JR. measures 6⅝ W. x 2⅞ H. x 11" D. excluding knobs and feet and weighs in at 6 pounds including mounting bracket. Front panel controls are self evident from the photo and are explained further in the text. The buttons on either side of the Mode switch are indicator lamps to show which set of thumbwheel switches are in use.

The Circuit

Figure 1 is a simplified block diagram of the transceiver. Signals from the antenna flow through the solid-state switch to the first r.f. amplifier. This consists of two low-noise, wide dynamic range 3N140 fet's, providing about 20 db gain with five poles of bandpass filtering over the 144 to 148 MHz range for the reduction of spurious, image and cross modulation products. This two stage r.f. amplifier feeds a 3N341 dual-gate mixer, which in turn feeds an 8 pole crystal filter at 10.7 MHz, with a 6 db bandwidth of 13 kHz. This is followed by a two stage i.f. amplifier using a pair of 2N3563s with about 30 db of gain and a low noise figure. Then, a 2 pole crystal filter also at 10.7 MHz, again with a bandwidth of 13 kHz. The output of the 2 pole filter drives a CA3089E IC which provides the necessary f.m. limiters and detector, as well as a signal strength output for an S meter. The recovered audio feeds a noise-operated audio squelch module and then a uA706 IC audio amplifier furnishing about 5 watts of audio to the internal speaker and the external speaker jack.

The dual-thumbwheel synthesizer chain controls a VCO operating in the 133.3 to 137.3 MHz range for receiving, and in the 144 to 148 MHz range for transmitting. The VCO is directly modulated by the input audio signal for legitimate f.m., while its output feeds the transmit chain and loop mixer via an isolation amplifier. The VCO signal is heterodyned with either a 119.3 MHz signal for receive or a 132 MHz signal for transmit. The output of this mixer is a lower frequency signal in the 12 to 16 or 14 to 18 MHz range.

A variable frequency divider divides the 12 to 16 or 14 to 18 MHz signals down to approximately 5 kHz. This 5 kHz signal is then compared in a phase detector with a very stable 5 kHz reference signal to produce a d.c. error signal related to the difference between the divider output and the reference. This d.c. error signal is filtered to remove the 5 kHz component and applied to the VCO for frequency correction.

The divide ratio of the variable divider is determined by the settings of the thumbwheel switches, and/or by the Mode switch setting. The variable divider is a counter which is preloaded with a number from 1400 to 1800 and counts down to zero for receive and 200 for transmit. To achieve an offset for repeater operation the divider is programmed to count down to a different number: 140 for +600 kHz offset; 260 for −600 kHz offset. Each count changes the transmit offset by 10 kHz. The counter is followed by a flip-flop which further divides the counter output by two giving a total divide ratio of 2800 to 3600. Programming an additional count at this point produces

*FM Editor, *CQ*

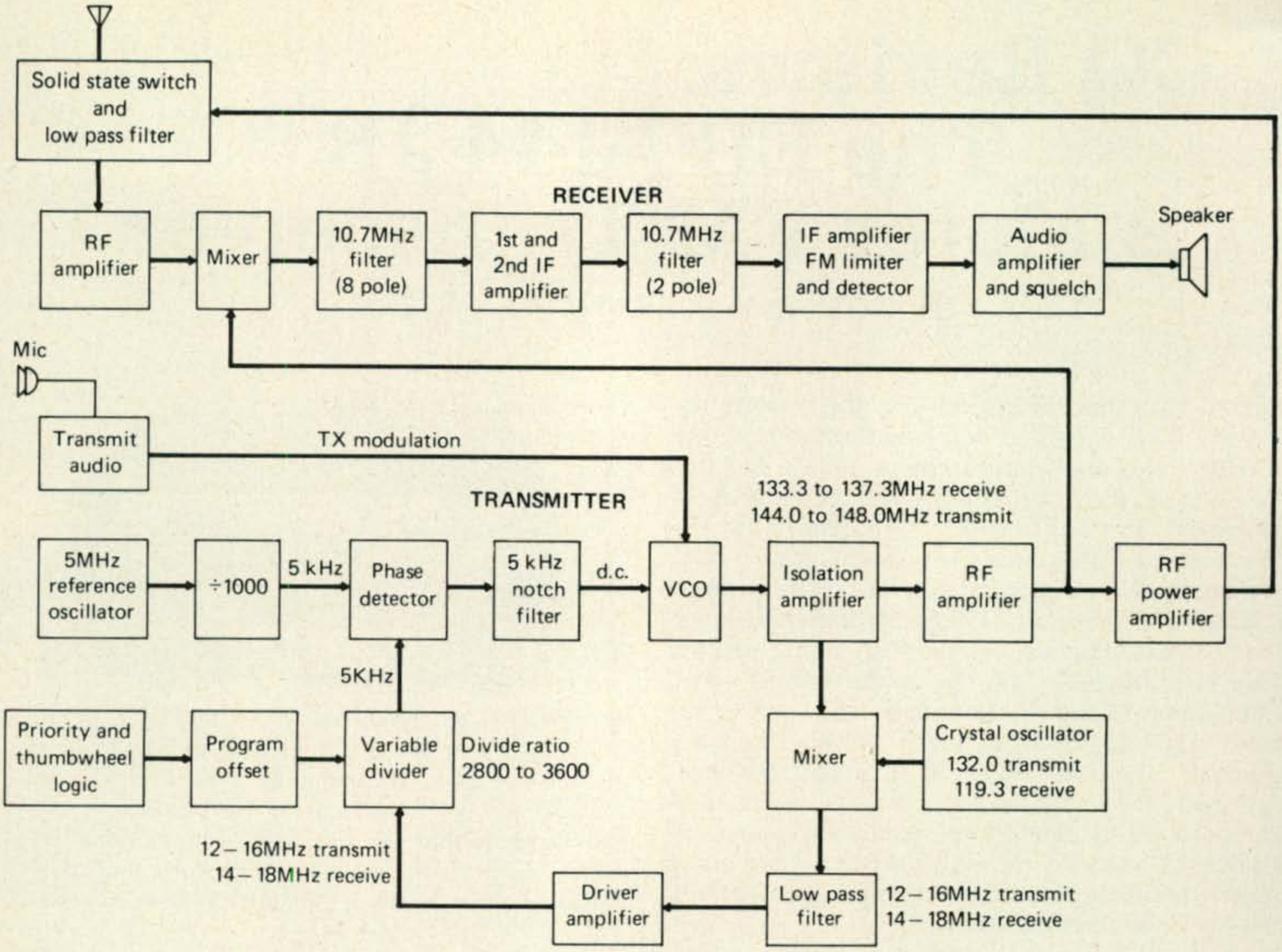


Fig. 1—Block diagram of the EBC 144 JR. showing the frequency synthesizer scheme.

a 5 kHz increment in the VCO's frequency. The technique of pre-programming the counter and counting down to 140, 200 or 260 is termed "Early Zero Sensing" by EBC, and permits the use of greatly simplified logic, with the thumbwheel switches programming the counter/divider directly without the use of diode matrixes, etc.

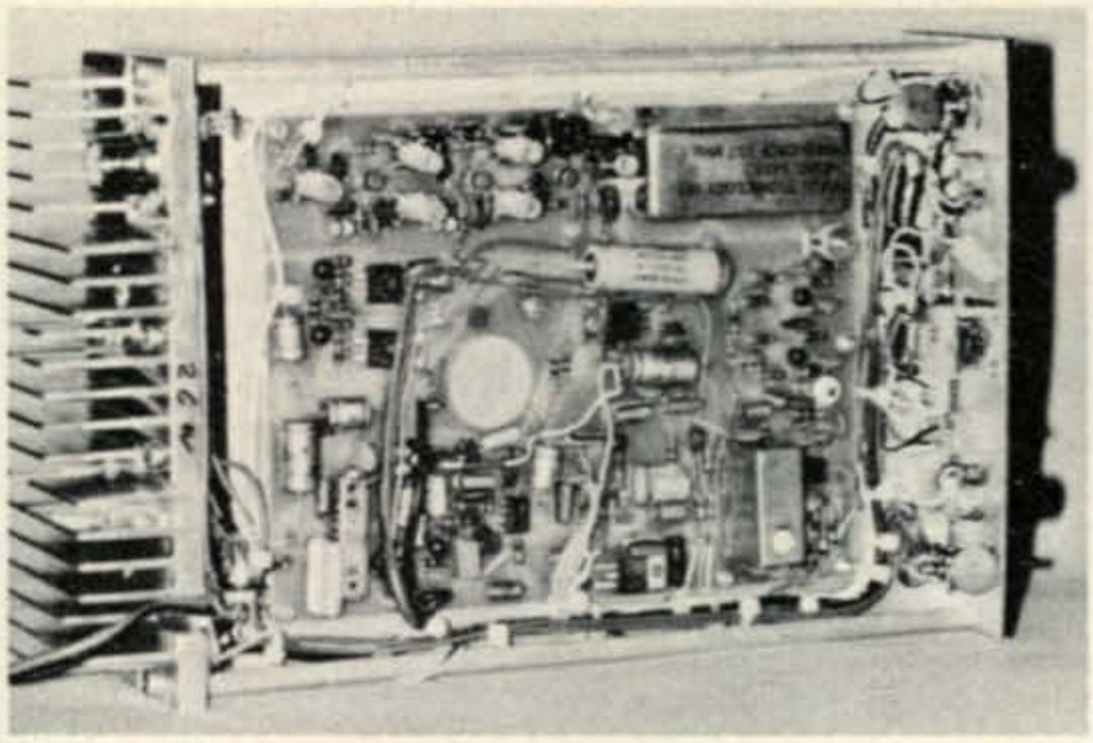
The output of the VCO is amplified and drives a 2N4427, then a 2N6080 driver stage, which feeds the 2N6082 final amplifier to an output of nominally 20 watts. The output stage feeds a solid-state antenna switching network and a three-section low pass filter and matching network.

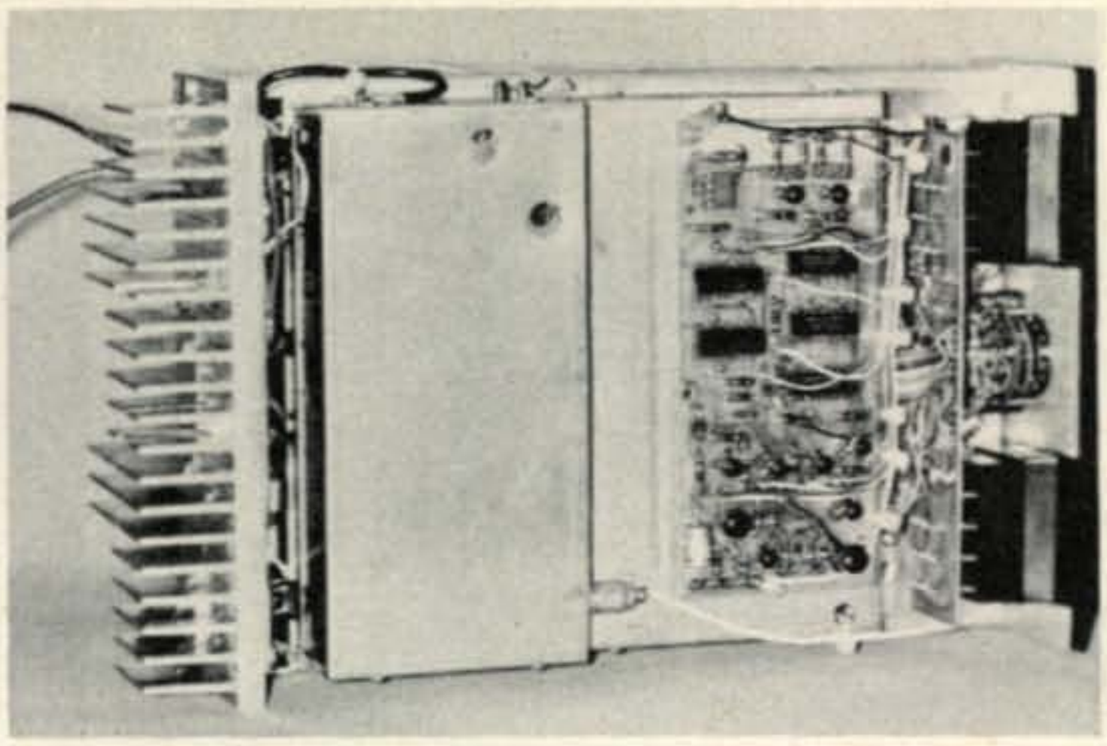
Performance

Initial tests were run on serial number 104 during a period of about five weeks, and due to the nature of the results obtained, this writer made an unexepected visit to the factory and requested that the unit be exchanged for another serial number selected at random from the production line. All major measurements were repeated using identical techniques and the results obtained in the first run were found to be essentially the same for the random-selected serial number 147A.

The EBC-144 JR. is the finest piece of two meter f.m. gear this writer has used to date. It is the first truly narrow-band receiver that we have seen and it appears to be totally free from transmitter spurious signals. It operates in high-signal levels like no other receiver this writer has ever handled. For example, connected to a "long John" fifteen-element yagi on a 28 foot boom pointed at the WR2ADM repeater only 1.8 miles from our house, with the repeater running about 250 watts ERP, the EBC-144 JR. shows no trace of that repeater when tuned 15 kHz above or below the repeater frequency. As a matter of fact, we were able to work easily through a repeater in Connecticut only 15 kHz off the local machine with no sign of adjacent channel interference. All other transceivers in use failed this test miserably, including a well-known commercial f.m. unit with a narrow filter.

The narrow-band performance of this receiver is so striking that it will introduce problems for some repeater operators. The unit will accept no more than 7 kHz deviation without producing audio distrtion, and the less-informed users will complain that the receiver has "lousy audio." In addition, if the output frequency of the repeater being received is more than one kHz off the nominal frequency, distortion at even normal narrow-band deviation will appear. This has been proven here in our local area where we have two re-





Bottom view (left) of the '144 JR. showing the heavy aluminum heat sink which comprises the entire rear panel of the rig. Portions of the extruded fins are milled away to provide mounting space for the output UHF connector and the PA transistors. Top view of the EBC-144 JR. (right) shows some of the extensive shielding used internally.

peaters available on the same frequency. For a time the local machine was about two kHz higher than the nominal and sounded very rough, although another repeater on the same frequency in nearby Connecticut was quite clean.

I would suggest that when users of the EBC-144 JR. think that the audio is lousy, check to see what the other station sounds like on the input frequency of the repeater. You may be pleasantly surprised. It is obvious that quite a few repeaters are neither on frequency nor set for proper deviation.

All measurements were performed with a supply voltage of 13.5 volts. Total power demand was 1.05 amperes in the receive mode and 5.1 amperes in the transmit mode. With this primary voltage, output power into a dummy load measured 20.5 watts plus or minus 2 watts from 143.5 MHz to 148.5 MHz, which would be about a 1 db variation in power over the band. Power output for primary voltages between 10.0 and 18.6 volts varied from about 12 watts to just over 30 watts. The performance of the synthesis and logic circuits did not vary over these voltage extremes.

The equipment was subjected to temperature variations from 20 to 125° fahrenheit, with no noticeable problems. On one occasion, the unit was placed in the home freezer overnite, then removed and plugged in after 9 hours in the freezer. It came up immediately with no observable problems. The consideration here, of course, was to simulate the effects found when one's car sits out in the freezing weather all night without a garage, and the gear remains in the car. Previous experience has shown the very low temperatures to be a problem for some of the semi-synthesized radios on the market. The higher temperatures are not unusual when one lets the rig sit in the car parked all day at Jones' beach on a summer Sunday afternoon. The EBC-144 JR. survived these tests and should prove one of the few units on the ham market capable of maintaining it's "cool" under such trying environmental circumstances.

One question that has plagued me for years is the case of "duty-cycle." This is of paramount importance to many of us who run a.f.s.k. radioteletype on two meter f.m. In RTTY transmissions can run twenty to thirty minutes in duration, and, frankly, I have been through hell making modifications in all kinds of rice box radios and even commercial f.m. gear to reach a point where a half-hour tape can be sent without watching the transmitter dissolve into a ball of steaming metal and plastic!

I must confess that I have been unable to kill the EBC-144 JR. Without any modifications, the rigs tested here were able to run a.f.s.k. RTTY for up to sixty minutes without anything more than a hot heat sink. No significant drop off of power was observed. This speaks well for the design and construction of the power amplifier.

One of the more outstanding characteristics of the EBC-144 JR. is its ability to exist in an area of multiple high-power repeaters without developing an acute case of Bubonic Intermodulation. I live in a location where there are two high power two meter repeaters within several miles of me and each other, along with some local fellows who run fair power levels on 146.94 MHz. Past experience has shown the majority of equipmeent used at this location sooner or later falls prey to the evils of IM in the front end due to high signal levels. In three months of careful observation, the EBC-144 JR. has yet to reproduce signals not specifically intended to appear where they appear. In other words, the excellent front end characteristics along with the single-conversion techniques employed make this the only receiver that I have enjoyed here at home that is exempt from the usual problems. A rare bird, indeed!

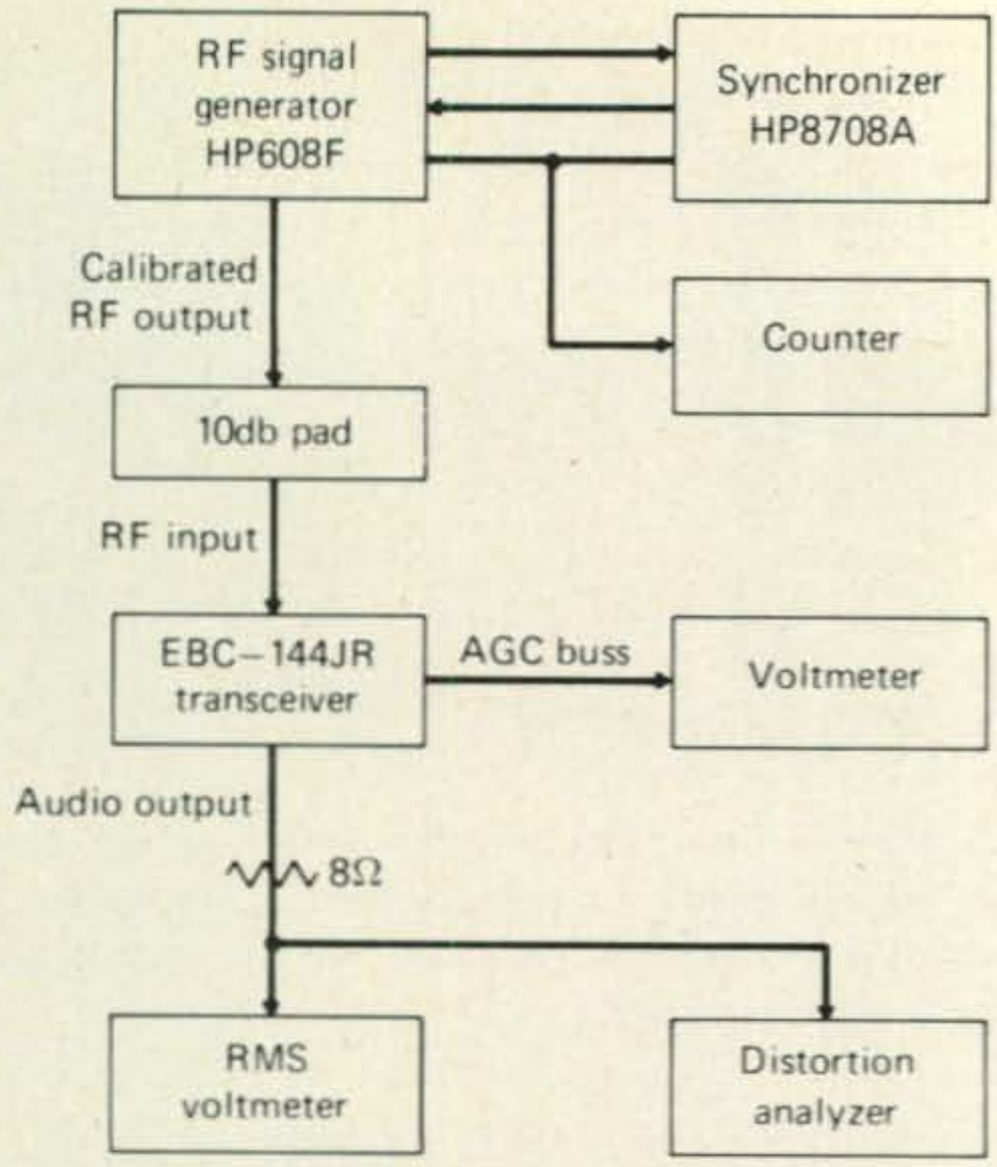


Fig. 2—Test equipment setup used for receiver performance measurements.

The specified receiver stability of the unit is .001%, which at 146.0 MHz, would be on the order of 1460 Hertz. Lab measurements show the receiver to maintain tolerances well within the spec, on the order of 300 Hertz. Transmitter output frequency falls within 250 Hertz of the nominal values over the entire operating range.

Using the classic methods involving noise figure and established bandwidth, it is possible to predict the maximum theoretical sensitivity of a receiver. But one gets into trouble when the receiver begins to demonstrate sensitivity approaching these limits. Signal generator leakage became a problem while testing the EBC-144 JR. and it became necessary to place the transceiver in a screen room and run the r.f., audio and a.g.c. lines outside the screen room. The receiver was evaluated for both the 12 db SINAD rating and the 20 db quieting standards. Although the specs call for 0.35 μv for 12 db SINAD and 0.30 μv for 20 db quieting, both units tested demonstrated repeatable values of 0.24 μv and 0.20 μv for 12 db SINAD and 20 db quieting respectively.

Figure 2 shows the test equipment setup for receiver measurements.

The use of at least 6 db of attenuation in the output of the signal generator is in accordance with good engineering practices and is essential to maintain some semblance of accuracy in the calibration of the generator attenuator. The generator-synchronizer combination assures the stability of the signal source to within less than 50 Hertz during the test period. With the DVM on the receiver a.g.c. buss, an a.g.c. curve was run, and the parameters established for 3 and 6 db points used to determine the bandwidth limitations The r.m.s. voltmeter serves as the medium for the quieting measurements, with the noise and distortion analyzer functioning for the SINAD tests.

Adjacent channel rejection measured 88 db at 15 kHz. Spurious and image responses were down 70 db.

Figure 3 is the equipment setup for the transmitter performance evaluation. A series of calibrated directional couplers and attenuators serves to reduce signal output levels to values that can be accepted by the spectrum analyzer without risking the generation of internally-produced IM products in the analyzer. Voltages presented to the analyzer were on the order of 20 microwatts, or less. The only spurious signals found in the transmitter output were a pair of symetrical signals about 15 to 18 kHz out from the carrier, at a level of approximately 14 db below carrier. Second harmonic and other unwanted outputs were better than 70 db down from carrier.

Picking Nits

In analyzing receiver performance, the mixing and synthesis schemes were examined to predict receiver spurious signals. A series of receiver spurs was found, as predicted. The two worst offenders occur at 144.535 MHz, and 146.25 MHz and although these two surplus signals are quite evident when the squelch setting is sensitive, they can be squelched out. Measurements showed the signals to be less than 0.04 μv equivalent signal strength, values which any useable incoming signal will easily override.

Another problem awaiting solution is the illumination of the front panel. The thumbwheel switches do not have internal lighting, but I have seen a prototype of an "eyebrow" type external lighting fixture which can be

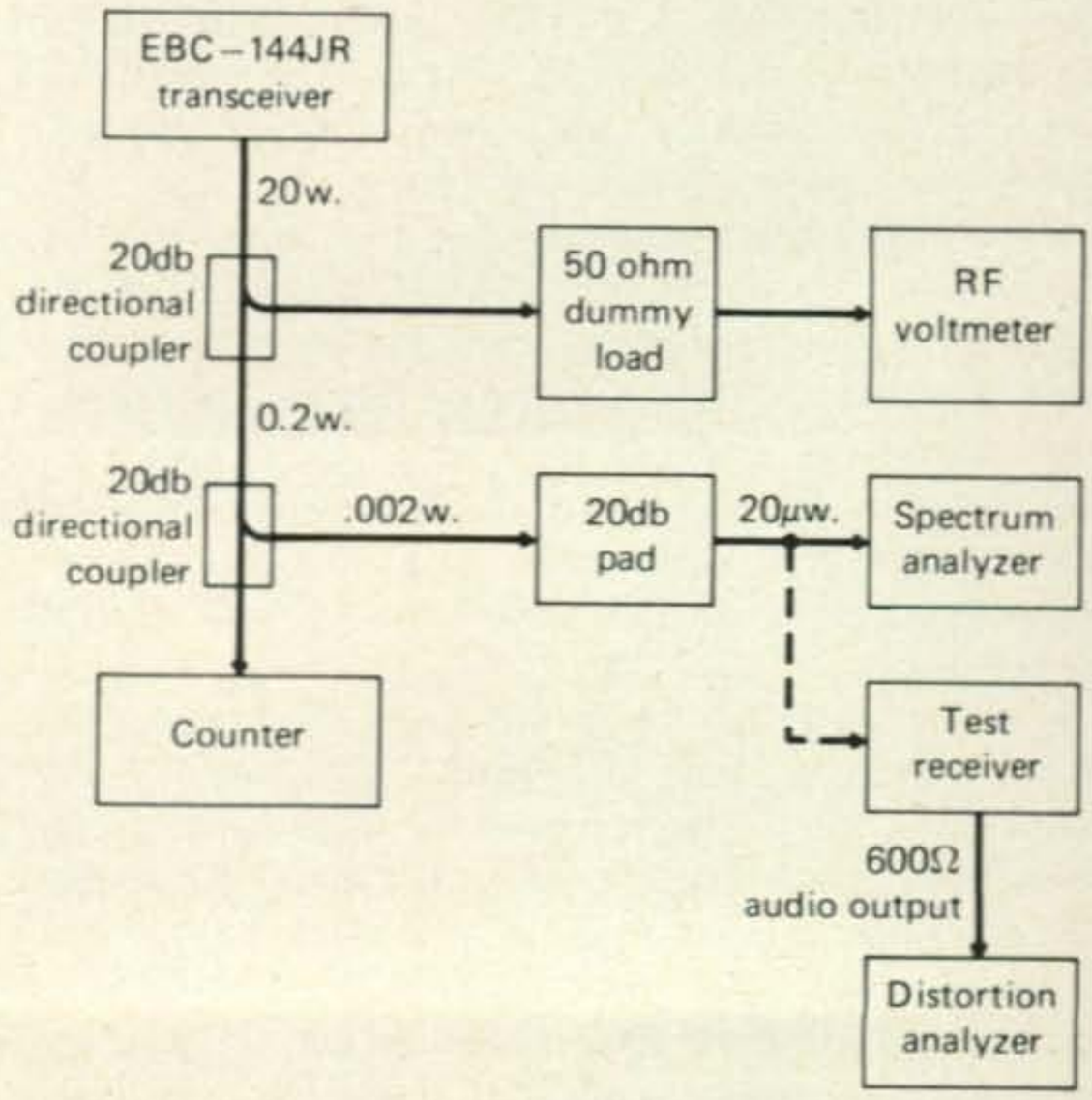


Fig. 3—Test equipment setup for transmitter tests.

added on to the front of the unit. I suggest that EBC speed their efforts in this direction.

Another area that could be improved would be the upper end of the transmitter audio passband. The top end rolls off too fast, with 3000 Hertz being down about 13 db reference to 1000 Hz. While this may not be meaningful in the average voice operator's situation, those of us who will use the rig for a.f.s.k. RTTY will find some problems when working stations with less-than-optimum receivers and demodulators, or through direct, non-regenerative repeaters which in themselves have high-end roll off problems. The pre-emphasis network needs a bit of reworking, a simple matter.

While we pick some nits, EBC could also consider swapping the volume and squelch controls. The presence of the mike jack and plug on the front panel is no problem, but the plug sticks out annoyingly close to the volume control. Since the squelch control gets far less use than the volume control it would seem logical to interchange the position of the two.

Now for the metering. Here, I feel that EBC dropped the ball. The receiver signal strength indication is taken from an output on the detector chip. But between the meter which has no calibration, and the fact that the needle never goes above half scale, those of us who want to orient some kind of a beam with this meter have a bit of a chore on our hands. This meter circuit and the display needs some rework. The same thing for the transmitter output reading. It would be far more interesting to have some kind of a meaningful indication available. Further, although the meter is illuminated after a fashion, it is totally unreadable in the dark. This too needs work!

Operation

Operation of the EBC-144 JR. is unique. Two sets of thumbwheels marked "A" and "B" can be used interchangeably. A three-position toggle switch selects either the "A" or "B" thumbwheels or the Priority mode. Normal or most conventional operation would set the "A" thumbwheel to the output frequency of the repeater being worked, with the mode switch in the "Auto" position. The logic will offset the transmit frequency 600 kHz downward when the first digit in the thumbwheel is "6," and upward when the first digit is "7." Below 146 MHz the offset feature is defeated and the transceiver is automatically in a simplex mode. In the "Reverse" position, the offset is reversed. This mode would be needed when working a repeater whose output frequency is 147.00 MHz. In the "Simplex" position, the unit performs in exactly that manner with reception and transsion on whatever frequency is cranked into the selected thumbwheels. The fourth mode on the mode switch is the "Split" mode, and that will be used for working repeaters with other than

Portent of things to come? The EBC-144 JR. is factory sealed to prevent access to the interior. The whole idea of discouraging the buyer from opening his expensive new toy is alien to amateur radio, although EBC's desire to keep "Harry-the Ham's" handy-dandy alignment tool out of the works is understandable.

600 kHz spacing. In this position, the "A" thumbwheels will set the receiver frequency and the "B" thumbwheels will set the transmit frequency. Thus, one can set up to work any pair of repeater input-output arrangements that any repeater operator can invent. Most flexible!

For use of the Priority feature, the "A" thumbwheels will set up your normal repeater or simplex mode, and you dial up the "B" thumbwheels for the frequency that you wish to monitor on a priority basis. When the toggle switch is set to "Priority," the receiver will take a look at the "B" frequency for a period of about 100 milliseconds every two and one half seconds, and if any signal appears on the "B" channel, the logic will lock the receiver to that channel for the length of time that it is occupied, returning to the "A" channel when the "B" channel signal goes off the air. If the transmit switch is pressed when the receiver has locked to the selected priority channel, then the transmitter will transmit on the priority channel. Very handy feature that will find innumerable applications among users who work several repeaters.

Another handy feature available with the dual-thumbwheel programming is the ability to set up the "B" thumbwheels on the input to the repeater you are working on the "A" thumbwheels. If you happen to work a repeater which has a cranky time-out system, and some of your friends seem to frequently time out the machine, you simply flip the toggle switch over to the preset input and you will be able to copy your "timed-out" buddy if he is within direct contact range. Saves the need for repeats.

One caution before ending this appraisal. Due to the fact that the EBC-144 JR. is designed to work the CAP and MARS frequencies just outside the amateur band limits, some care must be exercised in the early days with the unit. It is possible to inadvertently

[*Continued on page 67*]

A Proposed Method for the Establishment of New Amateur Radio Power Limits

BY JACK QUINN,* W6MZ

Is "1000 watts d.c. input to the final stage" sacred? Why shouldn't it be 2000, 3000 or even 4000 watts? One kilowatt was an arbitrary limit set by the 1922 Radio Act, when spark transmitters were outlawed. At that time it was difficult for the average amateur to attain this power level because of the lack of vacuum tube and component availability. It was the amateur, however, who developed, or caused to be developed, reliable components. The state-of-the-art was therefore expanded to where 1000 watts d.c. input became practical and was easily achieved, both technically and economically. It is 1975, 53 years later, and in actual practice this power limit can be exceeded by the least expensive linear amplifiers available on the market today, even those using parallel sweep tubes.

There will be those who claim that because of technical advances, even lower power limits can be established, but this would only result in a reduction of our present ability to communicate reliably in various classes of service, and over various propagation paths. It would be a step backwards, technically

It is proposed that the present power limit be modified so as to be consistent with equipment *"in common use"* today, yet establish limits which are practical and easily policed.

Recently there have been discussions of various new ways of determining power limitations. These range from d.c. power input, power output, to manfacturer's plate dissipation ratings. All of these methods, however, contain one or more variables, which are subject to interpretation and policing; d.c. input measurements must be done with calibrated meters at the time of operation. Output power measurements are complicated, and require accurate instrumentation. Plate dissipation ratings are arbitrary numbers established by tube manufacturers, which are based upon a given amount of air and back pressure to establish a desired plate dissipation rating. However, it is conceivable that a manufacturer could rate a large tube at a *lower* plate dissipation rating, or conversely, by requiring more air flow, considerably *increase* the dissipation capability of the tube. This variation is brought about by the fact that different types of service are employed in communication systems (Class A, B or C) where plate efficiencies vary, so that flexible data ratings for different classes of service must be established.

There is only one common denominator in a vacuum tube which determines the maximum capability of that device, and that is the manufacturer's rated heater, or filament power. This is a parameter which *very carefully* established by all tube manufacturers and follows rigid, fixed laws of physics. These current/voltage relationships of the emitter cannot be increased with any degree of freedom without suffering short tube life or catastrophic failure.

*Director of Marketing, EIMAC, Division of Varian, 301 Industrial Way, San Carlos, CA 94070.

Type	Qty.	Total Heater Watts (Oxide Cathode)	Total Filament Watts (Thor. Tung.)	Equipment Manufacturer
572B	2	—	51	Heath
4-125A	2	—	65	—
4-250A	2	—	140	—
4-400A	2	—	140	Johnson
4-500A	2	—	204	—
4-1000A	1	—	157	—
4CX1000A	1	57	—	Collins 3OS-1
4CX1500A	1	—	200	Henry
4CX1500B	1	60	—	—
3CX1000A7	1	—	152	—
3CV1500A7	1	—	152	—
8873	2	40	—	Henry, Heath
8874	2 or 3	40 or 60	—	Henry, ETO
8877/3CX1500A7	1	50	—	Henry, ETO
3-500Z	2	—	140	Heath, Drake, Henry
3-400Z	2	—	140	Henry
3-1000Z	1	—	157	BT1
8072	1	17	—	CX-7
833A	2	—	200	—
8122	2	35	—	National
811	4	—	100	Collins 3DL-1
813	2	—	100	

Table I—Partial example of tubes & amplifiers in common use.

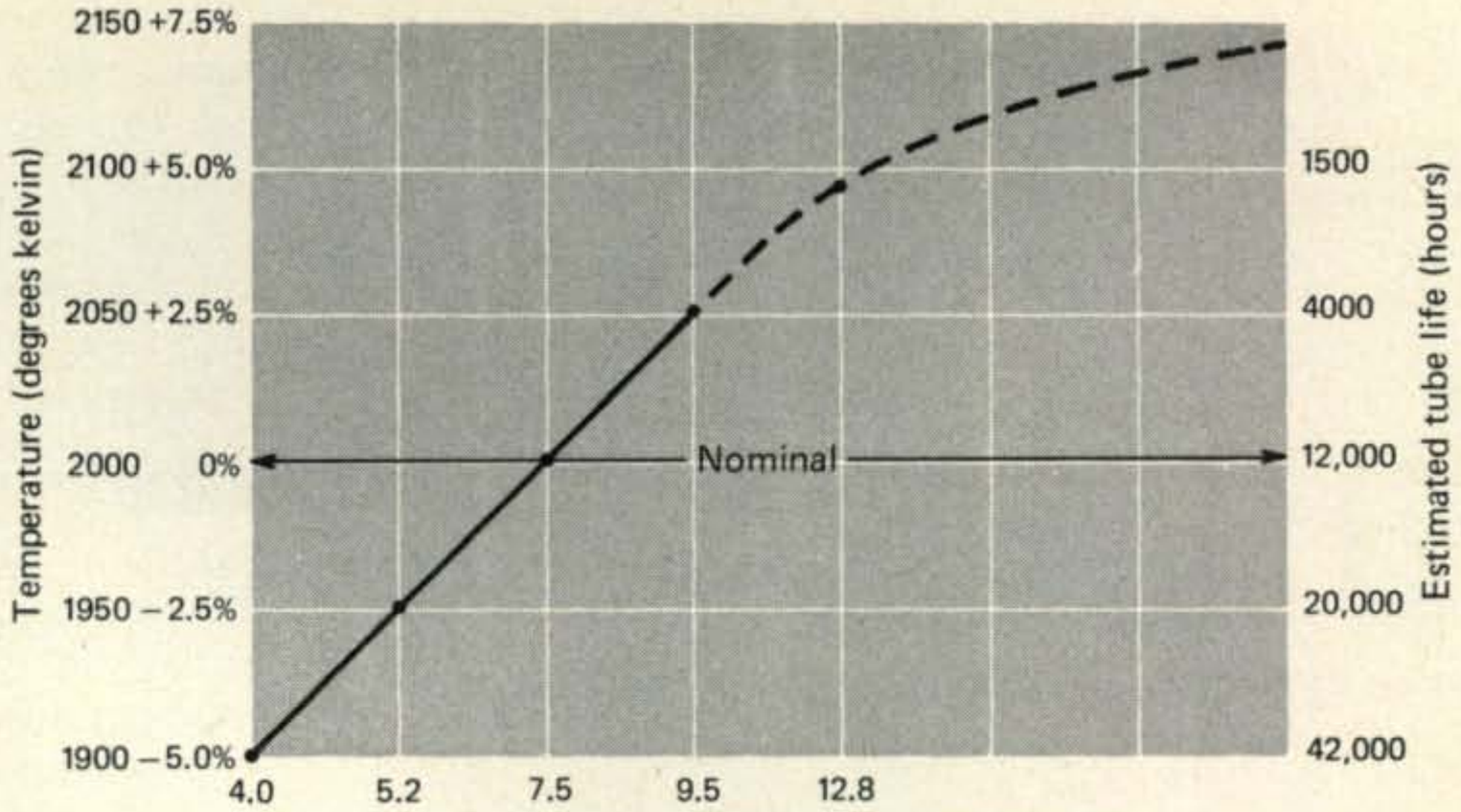


Fig. 1—Thoriated tungsten filament tube temperature / emission / life approximate comparison. Nominal temperatures are manufacturer's filament temperature ratings. Note that if more than one maximum tube rating is used simultaneously, tube life is severely decreased.

Rather than establish new amateur power limitations based upon plate dissipation ratings; and rather than establish a list of approved tube types which must be continuously maintained and up-dated, it is proposed that *certain maximum filament or cathode heater power ratings* be established. For example, Extra, Experimenter and Advanced Class Amateurs could employ an amplifier using one or more thoriated tungsten filament tubes, with a total filament power which does not exceed 200 watts. An amplifier with an indirectly heated oxide cathode tube may have a total heater power which does not exceed 60 watts, according to the manufacturer's ratings. If this were done, ratings could be established based upon a common ground and good, sound, technical background. This would also be compatible with amateur equipment in common use today. (See Table I.)

Power levels for General-Technicians and Communicator-Novice could be scaled down by whatever percentage the Commission deems desirable. If the same differences are used as proposed in Docket 20282, then one-quarter and one-eighth respectively of the above emitter wattages would coincide.

It is reasonable to assume that at sometime in the near future high power transistor amplifiers will be an economically practical reality, and in common use. Perhaps the present input power method for determining power could be used initially, however, it need not be limited to 1000 watts.

If a filament power limitation for each class of license were to be adopted, then it is proposed that no input or output power limitations be imposed upon the amateur. This would predetermine maximum operation conditions, as the tube could only be driven up into plate current saturation. The individual operator could exercise his own initiative and technical ability, using any tube which fell within the above emitter power limits. The same initiative prompts some amateurs to build large antenna systems to enhance their signal strength, all of which adds to the competitive spirit and advances the technical achievements in amateur radio. Again the establishment of total emitter power used in an amateur linear would automatically establish a maximum power, as shown in figures 1 and 2. It should be pointed out that the dotted regions shown on these curves represent diode operating conditions only. In actual practice, if the tubes were operated in this area, under r.f. conditions, it would probably fail within a few hours, due to either control grid or screen grid failure, excessive internal anode temperature, or oxide cathode evaporation, etc. So in view of this, the estimated tube life shown would not be representative at the upper current levels because the tube would probably fail catastrophically, rather than from loss of emission.

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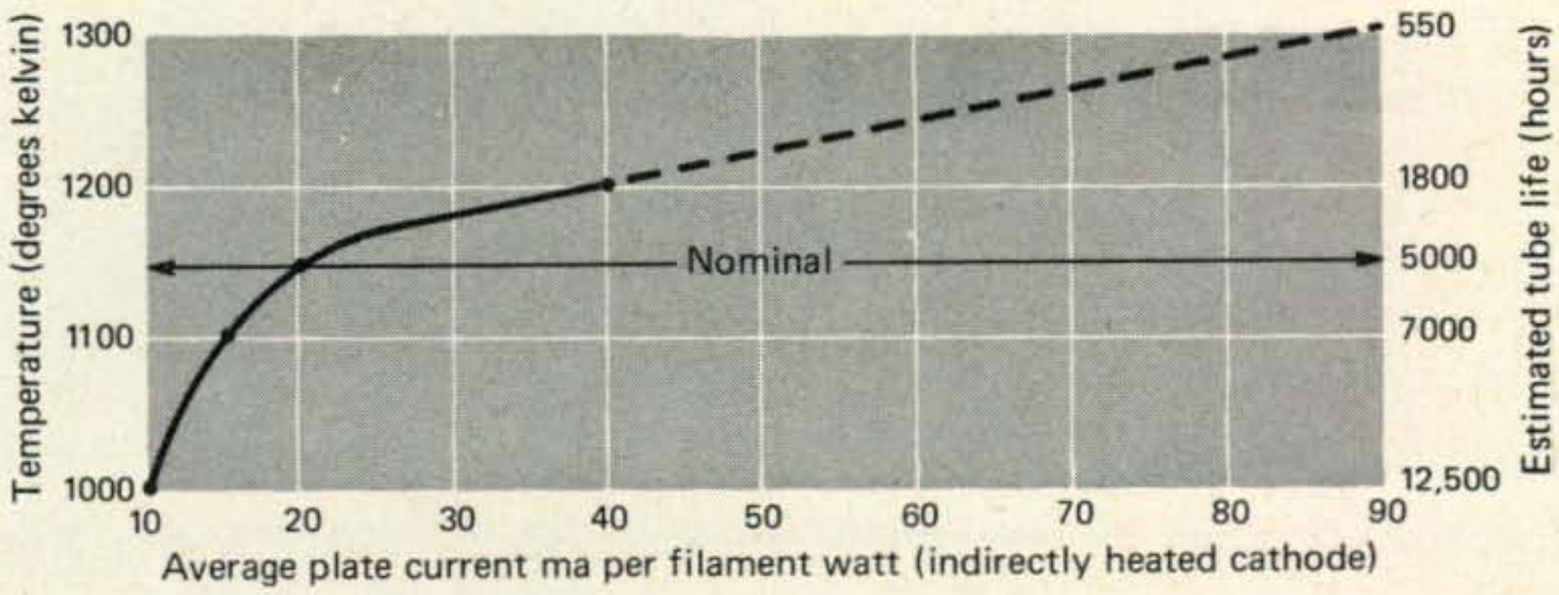

Fig. 2—Oxide cathode temperature / emission / life approximate comparison. Nominal temperatures are manufacturer's filament temperature ratings. Note that if more than one maximum tube rating is used simultaneously, tube life is severely decreased.

antennas

BY WILLIAM I. ORR,* W6SAI

"Aloha!" exclaimed Pendergast sliding easily into my favorite chair. He placed his feet on the operating table, knocking a pile of unanswered QSL cards into the wastebasket. "How was your vacation in Hawaii?"

I carefully fished the cards out of the basket and replied, "It was *great*. I wish I was still over there! In addition to sun and sand and those great *mai tais,* there was plenty of DX. What more could you wish?"

"I know all about the sun and sand and *mai-tais,*" replied Pendergast. "How about telling me about the DX? Did you take a rig over with you?"

"Yes," I replied, "I took a transceiver along. We were in a condominium apartment and I erected an antenna inside the building."

"Inside the building?" repeated my friend. "That sounds interesting. Tell old Pendergast all about it."

"Well, Old Pendergast, the apartment was a frame building with a heavy shingle roof. We were on the second floor, and the peak of the roof was about 28 feet above ground. I didn't want to risk any problems with the manager, so I put the antenna up inside the building. The antenna ran from the front of the living room, up to the peak of the roof, then down to the rear of the bedroom...something like this (fig. 1). I had to drill a tiny hole in the wall at the top to get the wire through, but nobody will ever notice that!"

Pendergast looked at the sketch. "The ends of the antenna don't look very high," he objected.

"Only about 18 feet," I replied. "But let me tell you about the antenna. I think I had a pretty good solution to a difficult problem that a lot of fellows may be up against."

"Very good," said Pendergast, as he took his notebook out of his jacket and prepared to take notes.

"The overall dimension I had to work with was just about 45 feet. I wanted to work 80, 40 and 20 meters. From experience at other portable locations, I felt that a balanced, center-fed antenna system was the best choice from the TVI standpoint, as an end-fed job can sometimes get you into trouble when the electrical wiring of the building is coupled into the ground return system of the antenna. A 20 meter dipole would easily fit into the 45 foot space, so that was chosen as the basic antenna element. I used a ferrite core balun with it and a random length of RG-58/U light-duty coaxial cable."

"What about 40 and 80 meters?" asked Pendergast.

"Well, let's take 40 meters first. I decided that I could add extension tips and tuned traps to make the antenna into a 40 meter radiator. This would provide me with operation on 40 and 20 meters. Before I left on vacation, I strung a test antenna up in my back yard at about the same height I would have in the apartment and ran a set of s.w.r. curves on it. The antenna is shown in fig. 2, trap construc-

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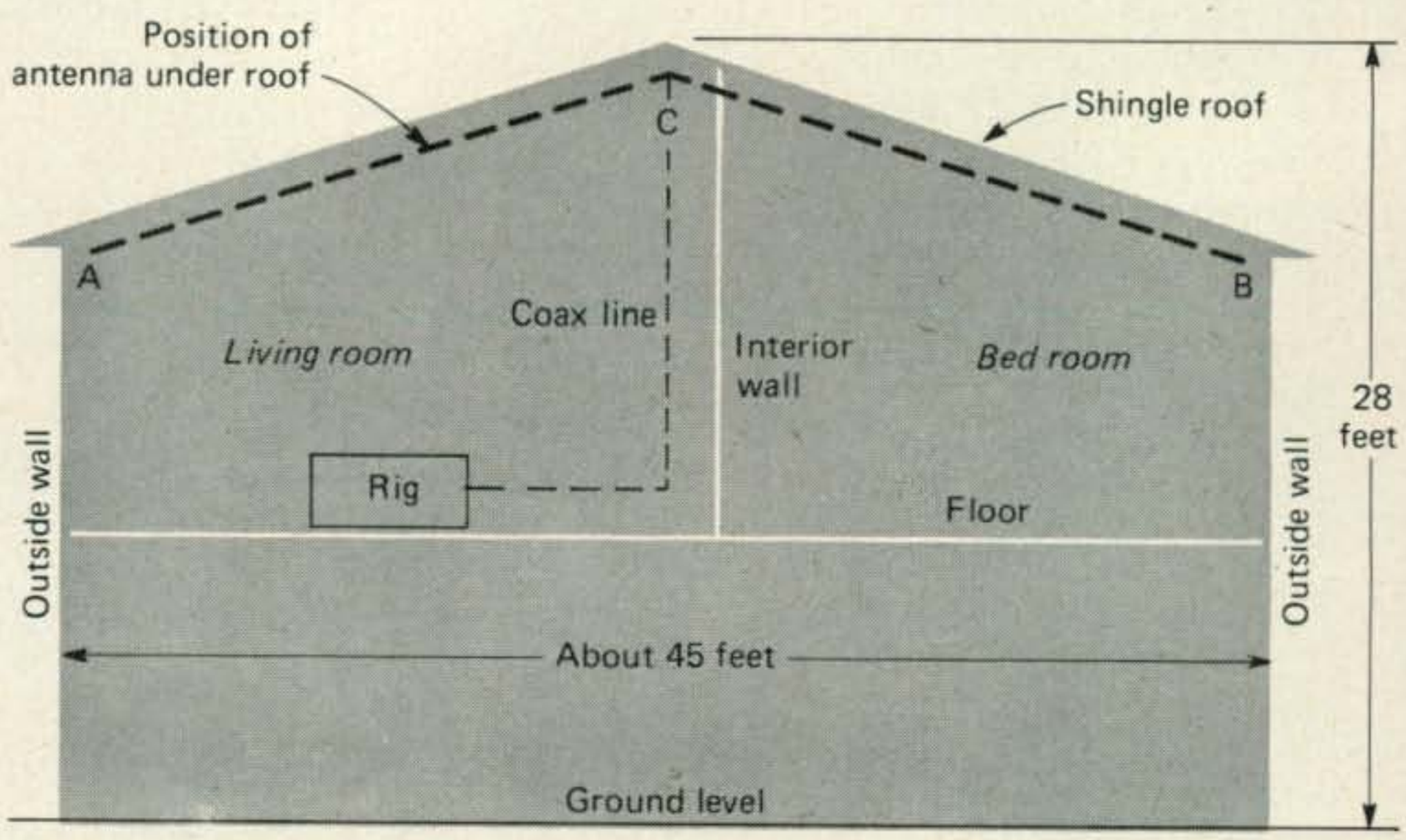


Fig. 1—Simplified elevation view of two story apartment building. Wood frame construction is used and roof is composed of shingles on tar paper and wood backing. The experimental antenna was slung between points A-B-C, with the balun at high point C. A small hole was drilled in the wall between the living room and the bedroom just below the roof so that the antenna wire could pass from the front to the back of the house. Point C is about 28 feet above ground level and points A and B are about 18 feet above ground level.

tion is shown in fig. 3 and the resulting s.w.r. curves are shown in fig. 4. As you can see, the s.w.r. was below 2-to-1 for most of the 20 meter band and below 3-to-1 from 7.1 MHz to 7.3 MHz."

"Can you shift the resonant points of the s.w.r. curves back and forth?" asked Pendergast. "I can see you are a phone man, or appliance operator. What would a *real* ham—a c.w. operator—do about the antenna?"

"If you are so smart, why don't you design the antenna yourself?" I asked. When Pendergast did not reply, I continued.

"You can shift the resonant points anywhere in the band you wish, provided you build the traps correctly. A trap acts as an insulator, or high impedance circuit, on the higher band (20 meters) and as a form of loading coil on the lower band (40 meters). The traps should be self-resonant *lower* that the lowest operating frequency you wish to use on the higher band. Since I wanted to be able to work down to 14.0 MHz, the traps are self-resonant at about 13.9 MHz.

"The first thing you do is to build the traps. Mine are made out of pre-wound, commercial coil stock and a high voltage ceramic capacitor. Resonance is established with the aid of a grid-dip meter and a calibrated receiver. A fraction of a turn at a time is removed from the coil until the trap resonates at the desired frequency. You start out with a few extra turns on the coil and remove them, a half-turn at a time, then a quarter-turn at a time, until you sneak up on the resonant frequency. Grid-dip the trap by itself, in a clear space, with no metal around. I used Millen grid-dip meter and could adjust the traps to within about 20 kHz of where I wanted them. If you are a perfectionist, you can bend the last turn on the coil back and forth and hit the target frequency on the nose."

"The traps don't seem to affect 20 meter operation in any way," mused Pendergast.

"No, they don't," I replied. "The 20 meter doublet works the same whether traps or glass insulators are used at the end, *provided* the trap is tuned outside the low end of the band. If the trap is tuned to a frequency *inside* the band, it seems to affect the length of the antenna."

"Amazing," murmured Pendergast. "Now, how about the 40 meter end sections?"

"Well," I replied," they are determined by the *heuristic* method."

"The *what*?" asked my friend.

"Cut-and-try," I answered." Luckily, a lot of information abounds in various Handbooks and magazine articles on 20-40 meter trap dipoles. I chose a set of tip dimensions from my Handbook *"Wire Antennas for Radio Amateurs"* and they worked right off; on the nose 100 per-cent!

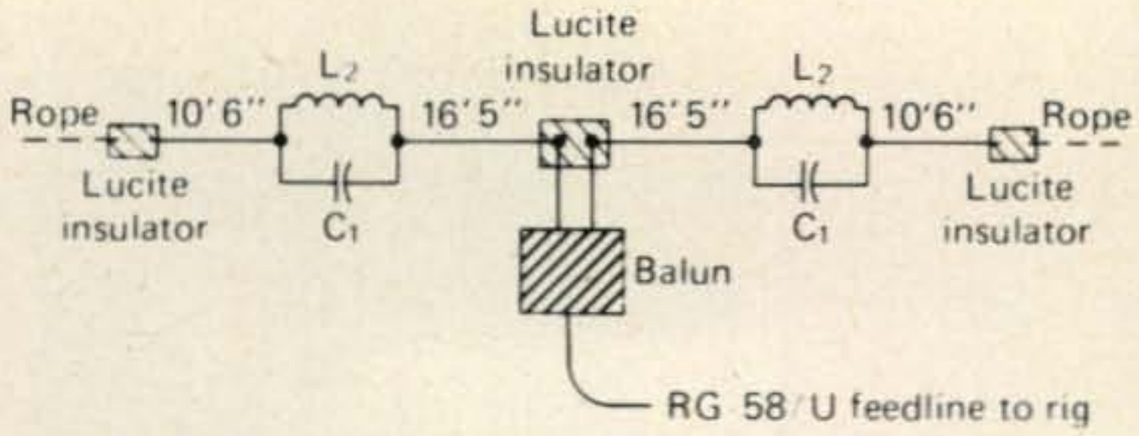
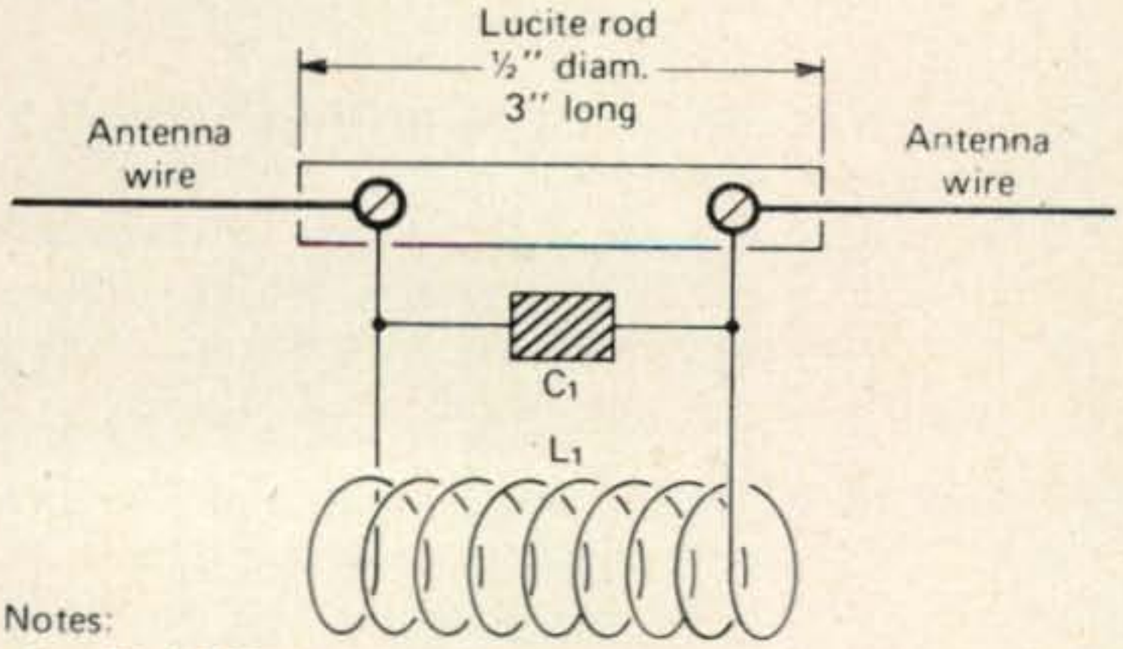
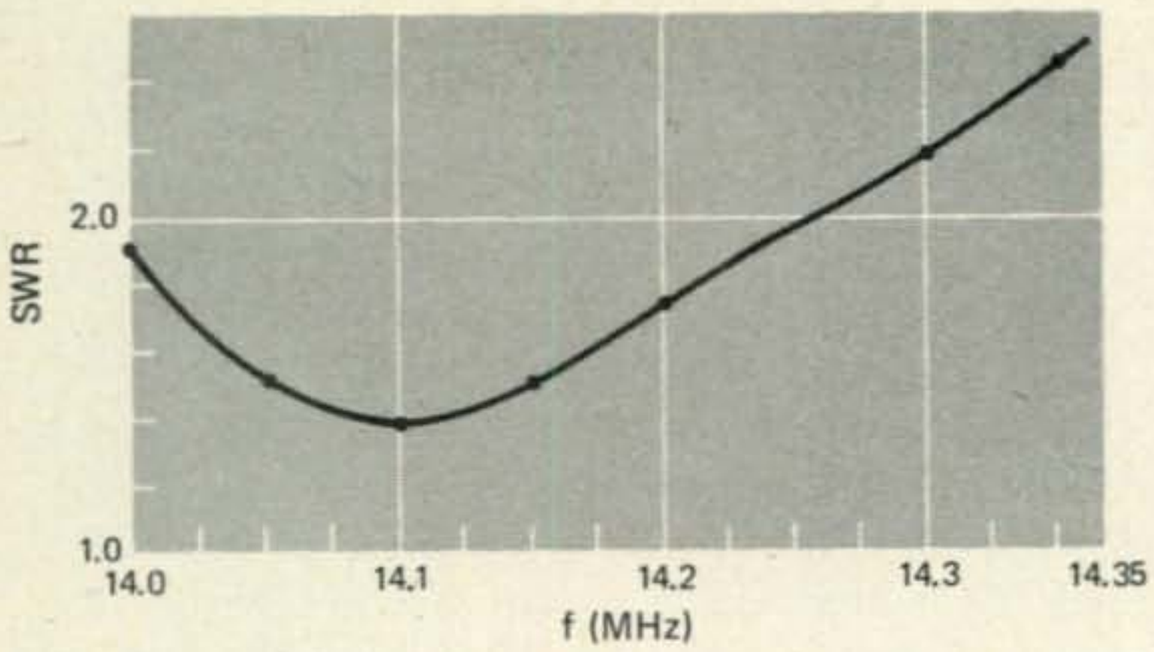


Fig. 2—The 40-20 meter two-band dipole. A 1-to-1 balun is placed at the center of the dipole. Dimensions given are for resonance at 7.25 MHz and 14.1 MHz. If it is desired to change the resonant frequencies, the 20 meter section must be altered first, as adjustments to the center section affect the 40 meter resonance. Once the 20 meter section is adjusted properly, the tip sections may be adjusted for resonance at 40 meters. A set of s.w.r. curves, as shown in fig. 4, should be run, using your exciter and an s.w.r. meter. Dimensions are relatively non-critical provided the traps are made as shown in fig. 3 and the antenna is erected reasonably clear of metallic objects. This antenna was built and tested in the backyard, in the clear, and then moved to the interior location shown in fig. 1 with very little change in the s.w.r. curves. A Bird #43 Reflectometer was used for tests. The balun was a ferrite design described by the author on page 66 of the February, 1975 CQ.

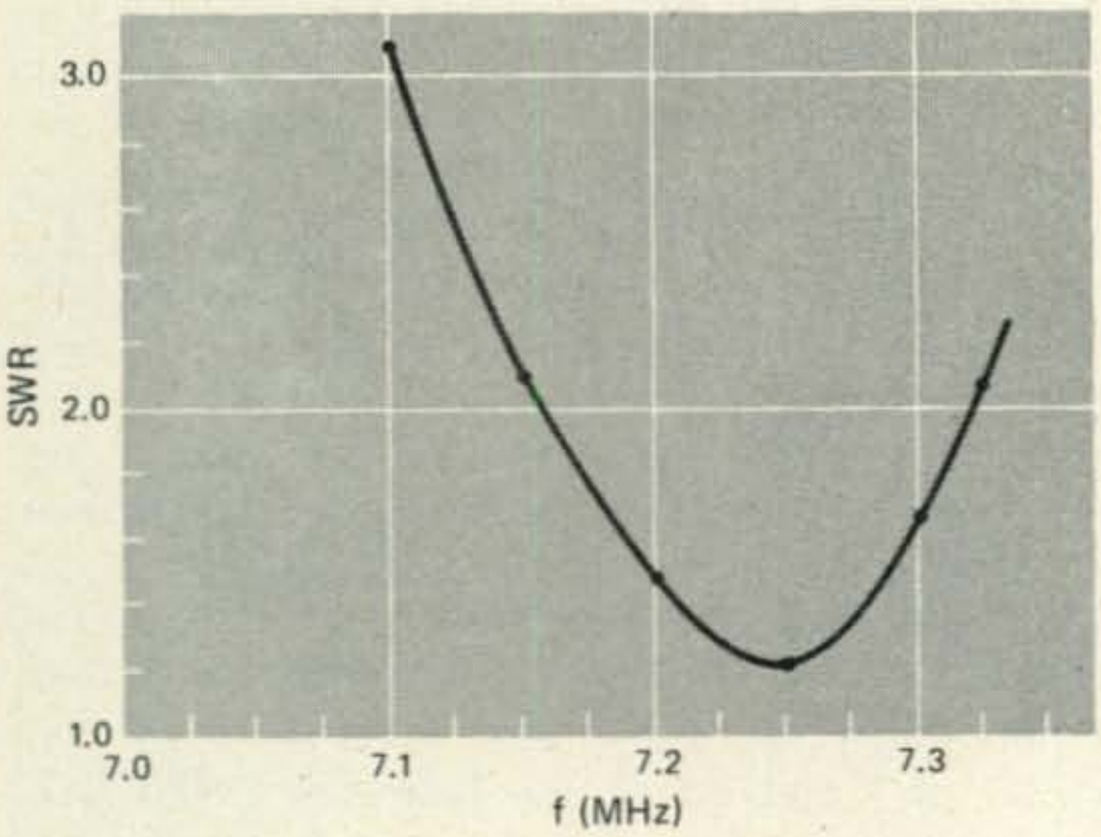


Notes:
C_1 = 25pf, 7.5 kV centralab type 850S.
L_1 = 9 turns no. 12, 2½" ID, 1½" long, 6TPI (B & W 3905–1 or I-Core 2006)

Fig. 3—The 20 meter trap. The coil and capacitor are suspended by their leads from a small insulator cut from a length of lucite rod. It is drilled for 6-32 bolts at each end. Antenna wires are wrapped around the bolts. The trap is assembled and grid-dipped to 13.9 MHz. Adjustment is made by making the coil a little too big and then removing turns, a portion of a turn at a time, until the assembly is self-resonant at the desired frequency. Two traps are required. Once they are adjusted on the bench, they can be put in the antenna and no more adjustments are required to these units. Diameter and turns-per-inch of coil are not critical as long as completed assembly tunes to the desired frequency. Manufactured pre-wound coil stock (I-Core or B&W) is very suitable for trap assembly. These inductors are available from Barry Electronics, 512 Broadway, New York, N.Y. 10012.



(A) 20 meters



(B) 40 meters

Fig. 4—S.w.r. curves for the antenna of fig. 2. The 20 meter section was cut for 14.1 MHz and the 40 meter section for 7.25 MHz. To lower the resinance of the 40 meter section, the tip sections of the antenna should be lengthened a few inches.

"And, as an added bonus, this antenna also works on 15 and 10 meters," I continued. "It works on the third harmonic of the 40 meter dipole for 15 meters and also exhibits a low value of SWR on 10 meters, although the actual operation of the antenna on 10 meters is a more complex matter. So there you have it—an antenna system for 40, 20, 15 and 10 meters that is only about 55 feet long!"

Pendergast scribbed furiously in his notebook. "Very good," he exclaimed. "Now, how about operation on 80 meters?"

"That can be accomplished," I replied, "With certain reservations. Attend! You can work the antenna on 80 meters if you remove the traps and substitute loading coils in place of the traps. You now have a loaded dipole instead of a trap antenna. However, you must understand what is going on before you rush headlong and make the change."

"How do you make the change?" asked Pendergast.

"Well, in this case the antenna was indoors, and wasn't very high above the floor of the second story apartment. My traps were mounted in place with bolts and wing-nuts. I merely removed the nuts, slipped the traps off, and substituted the loading coils in their place. I stood on a chair to do it, and it took about 2 minutes to do the job."

I reached for Pendergast's notebook and drew a picture of the revised 80 meter dipole (fig. 5).

"What's the extra coil in the center?" asked Pendergast.

"One thing at a time, I replied." This is an 80 meter dipole, loaded with coils on each side. For highest efficiency, the coils are very high-Q. They are bolted in place of the traps, as you can see in the illustration.

"The antenna is quite short for 80 meters and, as you know, short antennas have very low radiation resistance. Also, this antenna is going to be mounted very close to the ground. I estimated the radiation resistance would be about 12 ohms, or even less. In addition, I measured the Q of the coils. It was about 350. The coils each have a reactance of around 1400 ohms at the design frequency of 3.8 MHz, so the loss resistance of each coil is 1400/350, or about 4 ohms per coil. Since there are two coils, the loss resistance is the sum, or 8 ohms. Then, there's going to be some more loss resistance introduced by nearby objects when I mount the antenna inside the wood frame building. The total input resistance, then, at the center terminals of the dipole is thus going to be 12 + 8, or 20 ohms, or maybe a little lower."

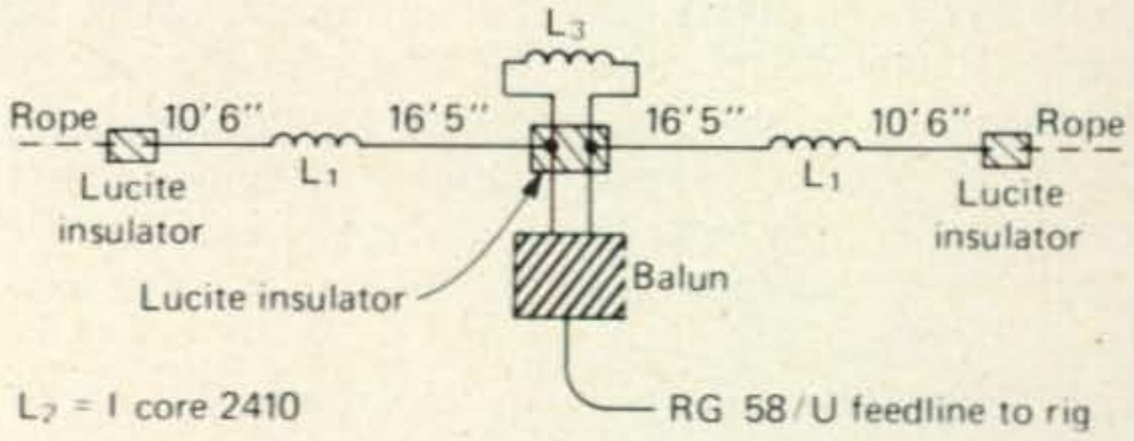


Fig. 5—The 40-20 meter two-band dipole of fig. 2 is reworked for 80 meter operation. Traps L_1-C_1 are removed and loading coil L_2 consists of 38 to 43 turns, 3" diameter, ten turns per inch of I-Core inductor. Approximate inductance is 50 microhenries. Using the above wire lengths, 43 turns resonate at 3.5 MHz, 40 turns for 3.68 MHz, and 39 turns for 3.73 MHz. An end turn of each coil can be trimmed to "zero-in" on a chosen design frequency. In order to raise the feed point impedance, a matching coil L_3 is placed across the feed point. The coil consists of 12 turns, 6 turns per inch, 1¼" diameter (about 2.0 microhenries). All coils are wound with #14 gauge wire. When the 20 meter traps are substituted for the loading coils (to go back to 40/20 meter operation) the matching coil L_3 is left in the circuit as it has little effect on the higher frequency bands.

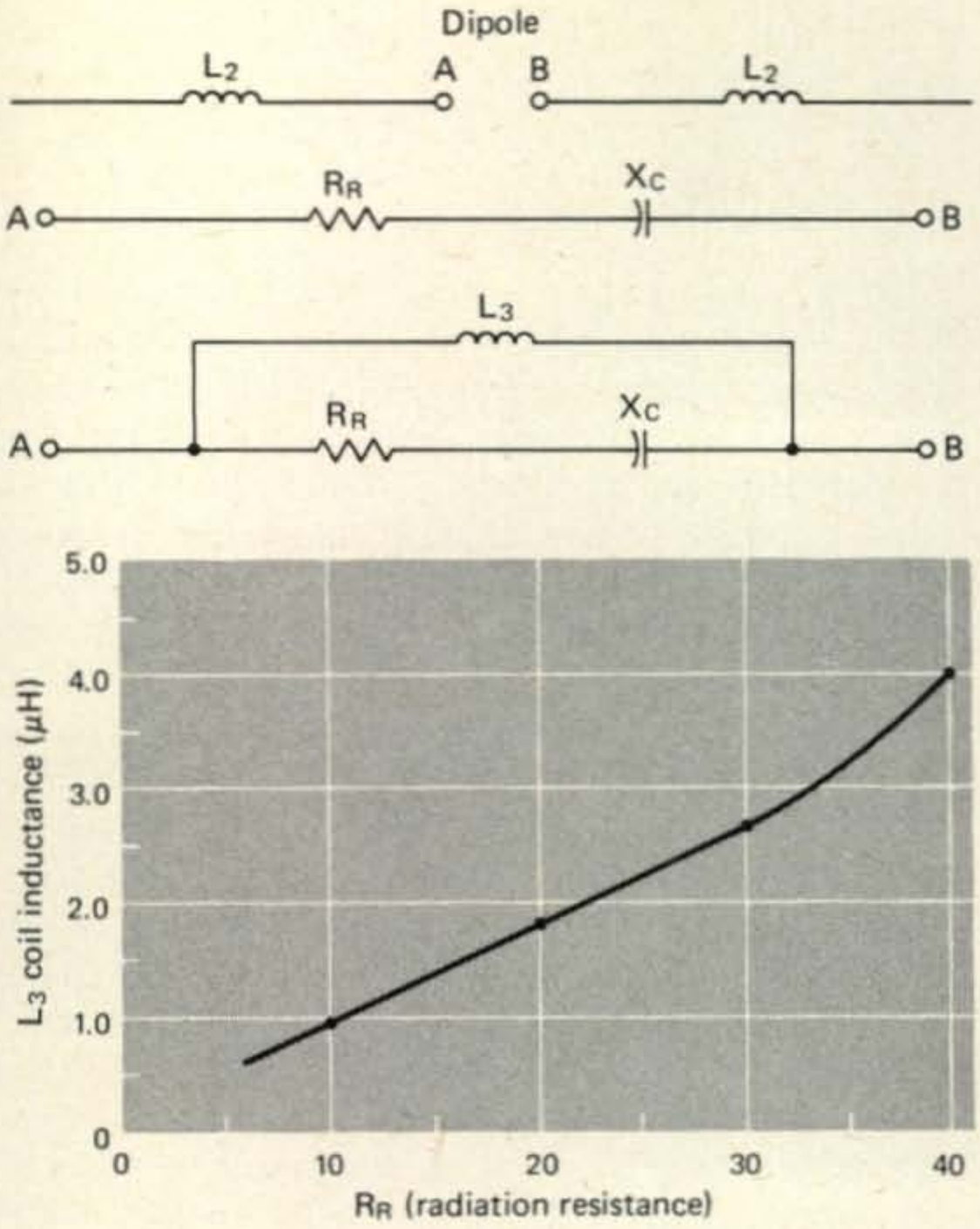


Fig. 6—The dipole element can form a portion of a network whose input impedance over a small range of frequencies is close to 50 ohms. The dipole element, when loaded, as shown in the top illustration, has a low value of radiation resistance and loss resistance whose sum is a function of the degree of loading (and the overall length of the antenna). This low impedance can be made a part of an equivalent parallel resonant circuit in which the total radiation resistance appears in series with the reactive branch of the circuit (center illustration). The input impedance of such a circuit varies nearly inversely with respect to the radiation resistance R_R of the dipole, thus the very low value of radiation resistance of a loaded dipole may be transformed to a larger value which will match the impedance of the transmission line (lower illustration). The radiation resistance of the dipole can be made to appear as a capacitive reactance at the driving point by slightly shortening the element past its normal resonant length. The inductor (L_3) consists of a small coil placed across the terminals of the dipole. The L/C ratio determines the transformation ratio of the network. Typical values for L_3 are shown in the graph for 80 meter operation.

"Well, with a 50 ohm line, you are in trouble," said Pendergast. "The s.w.r. on the line will be no better than 2-to-1 at the resonant frequency, and will be worse off-frequency."

"You are so right," I replied. And since the antenna is very short, the operating bandwidth is going to be small, so the s.w.r. is going to go up rather rapidly when the antenna is operated off-frequency."

"What is needed is a matching network that will match the 50 ohm transmission line to the 20 ohm antenna. And that's where the center coil comes in. It is placed right across the balun terminals."

"That doesn't look like an impedance matching network to me," objected Pendergast.

"Aha, it is," I replied. "Look at fig. 6. This is a simple, balanced L-network.

The capacity, in this case, is provided by the antenna element, because *if* the antenna is shorter than resonance, it provides a capacitive reactance across the terminals."

"You mean you deliberately detune the loaded dipole a bit so as to provide a capacitive load?" asked Pendergast.

"That's right," I replied. "The whole idea is non-critical. For this antenna, the coil is about 2 microhenries. I didn't even attempt to detune the antenna, because all that happens is that the resonant frequency of the antenna is shifted a bit from the normal value when the center coil is inserted, and the trimming action to shorten the antenna merely re-establishes resonance. Since the whole antenna is cut-and-try, I decided to just add the coil and see what the results were. The first try resulted in an s.w.r. of about 1.5-to-1. I took one turn off the center coil to readjust the impedance match a bit and *voila!*. The s.w.r. at resonance was about 1.2-to-1 (fig. 7). The bandwidth at the 2.5-to-1 s.w.r. points was about 40 kHz."

"Pretty neat," admitted Pendergast "How did you adjust the loading coils?"

"You can zero-in by lowering the antenna until you can reach the center coil with a grid-

[*Continued on page 66*]

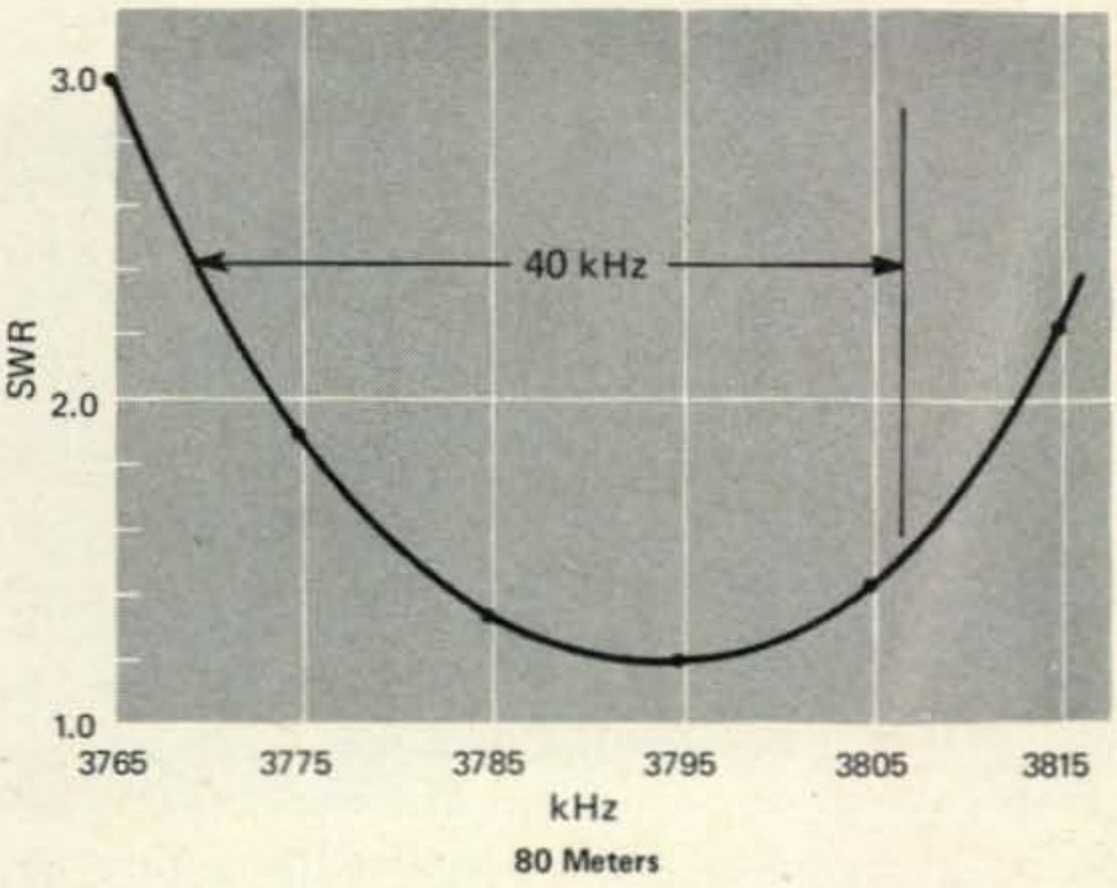


Fig. 7—The s.w.r. response of the loaded 80 meter dipole of fig. 5. Bandwidth between the 2.5 s.w.r. points is just about 40 kHz. S.w.r. at resonance (3787 kHz) is 1.2-to-1. It was desired to move the resonant frequency up to 3805 kHz and this was done by removing 3 inches of wire from each tip of the dipole.

QRPp

LOW-LOW POWER OPERATING

BY ADRIAN WEISS,* K8EEG

Field Day Again!

Well gang, Field Day is here again! I hope that the interest in doing field day the QRPp way will increase even more this year than last. 1974 was a great year for the QRPp effort. Seven stations worked over 100 contacts—quite an improvement over past years. Check out the November, 1974 QRPp Column for a run-down on activities last year.

So far we've awarded five *Milliwatt Field Day Trophies* and you might be interested in the recipients and performances recorded each year. The list is:

1970	K4OCE	220 QSO's	4watts
1971	WA6ABP	137 QSO's	500mw
1972	W7DRA	55 QSO's	1w
1973	WA5WYO	79 QSO's	1w
1974	WØIYP	439 QSO's	4w
1975	?????		

A station may win the award every third year, so the field is open for newcomers each year—give it a try! Whether you win or not, you'll have a great time—unless, of course, Murphy strikes hard.

*213 Forest Ave., Vermillion, SD 57069.

A definite part of FD is enjoying Nature in her prime, and this picture illustrates the point! K6TG pushed the VW to the 9650 ft. level near the Sonora Pass in the Sierra Nevada's for a portable CA QSO Party outing. A pair of 2×4's spliced together provide the center support for a dipole. Worked to the tune of 80 QSO's and first prize for the SJV section.

Let's add to the ideas offered on Field Day in the May 1974 QRPp Column. Antennas remain the crucial factor in any FD effort, so a few words on that subject first.

Antennas

If at all possible, select an antenna that offers some gain over a dipole. Commercial yagis and quads are not the only types of antennas that provide worthwhile gain in comparison to a dipole. There are several types of wire arrays that actually have some advantages in terms of portable setups. Obviously, the fact that the wire and supports for such an array are highly portable is the first advantage. Beyond that is the fact that typical wire arrays require no critical tuning of element lengths, and offer multiband capability when fed through an antenna coupler, as most are. Further, these arrays are bidirectional with the result that one can transmit equally well in two directions without having to rotate them. The "8JK" (see *CQ*, November, 1971, p. 16) is my favorite and is an excellent performer, offering excellent gain with a minimum of cost and effort. Two others are offered for your consideration.

First, the Vee beam requires three supports and is very easy to erect. The antenna is fed at the apex of the Vee through open line which is matched to the transmitter through an antenna coupler. Leg-length is not particularly critical as long as both legs are equal. While maximum gain will occur with the combinations shown in Table I, the antenna will

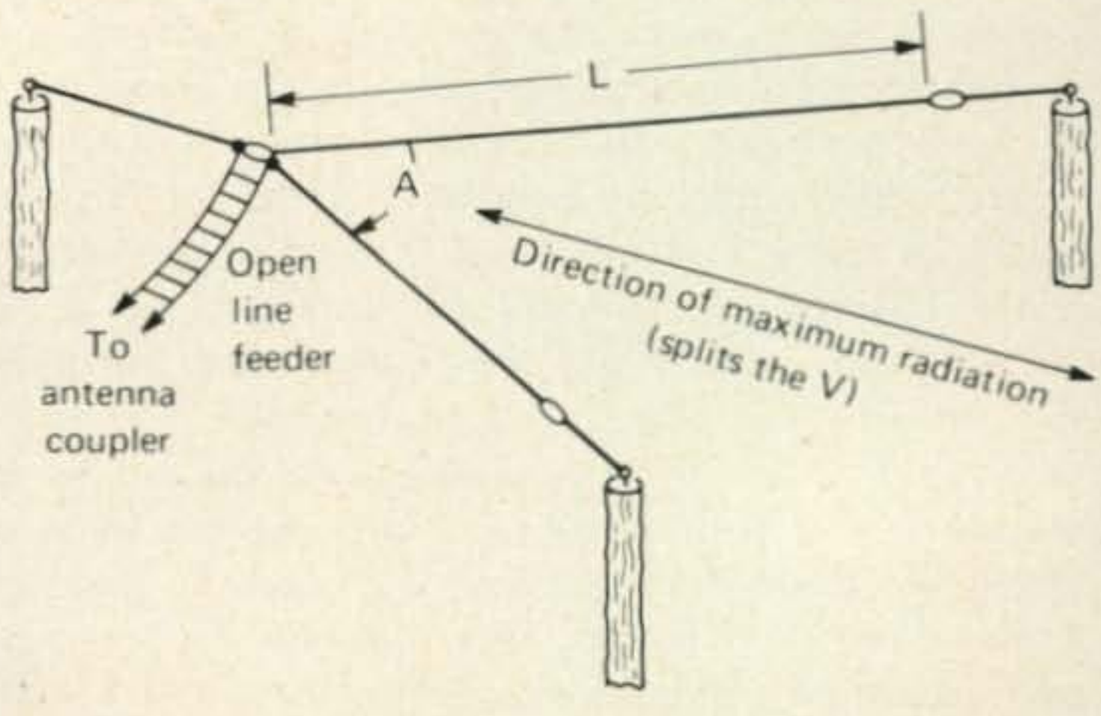


Fig. 1—A Vee beam. Table I below gives L, Angle A and gain figures.

L in wavelengths	*Angle A*	*Gain in db*
1	108°	3
2	70°	4.5
3	57°	5.5
4	47°	6.5
5	43°	7.5
6	37°	8.5

Table I

exhibit worthwhile gain even when those combinations are not exactly followed. The Vee beam will perform well on frequencies higher than its design frequency. With relatively short legs (two wavelengths or so), the radiation pattern will exhibit two broad lobes which become narrower as leg lengths increases. See Fig. 1.

Second a variation of the broadside array known as the Lazy-H (see Fig. 2) requires only two supports. The gain depends upon the element length and spacing, with maximum gain occurring at the 0.6 wavelength mark. The open line feeder is connected to the center of the phasing line which connects the elements, a point which insures that both branches will be in phase Needless to say, the higher that this antenna can be mounted, the better the performance. The bottom elements ought to be at least a quarter-wave off the ground. Radiation is bidirection, perpendicular to the plane of the elements. Leg length is not critical as long as elements are equal. The antenna will perform well on higher frequencies.

In the accompanying photo, WA6ABP's approach for erecting a wire quad is shown. Four bamboo poles are used as spacers for the two loops. A stable center support such as WA6ABP's tower is essential for this type of antenna. Results were excellent.

News And Views

It seems like a long time has passed since I've moved aside and let some of the fellows tell of their experiences. No better time than the present. Let's dip into the mailbag for the remainder of the column. . . . **Charles Kronke, W2AXZ,** 565 Prospect, Little Silver, NJ 07739 writes: "Although I don't have QSL's for many of them, I would like to submit my QRPp DXCC and WAS standings for the column. I have worked 53 countries with ZL

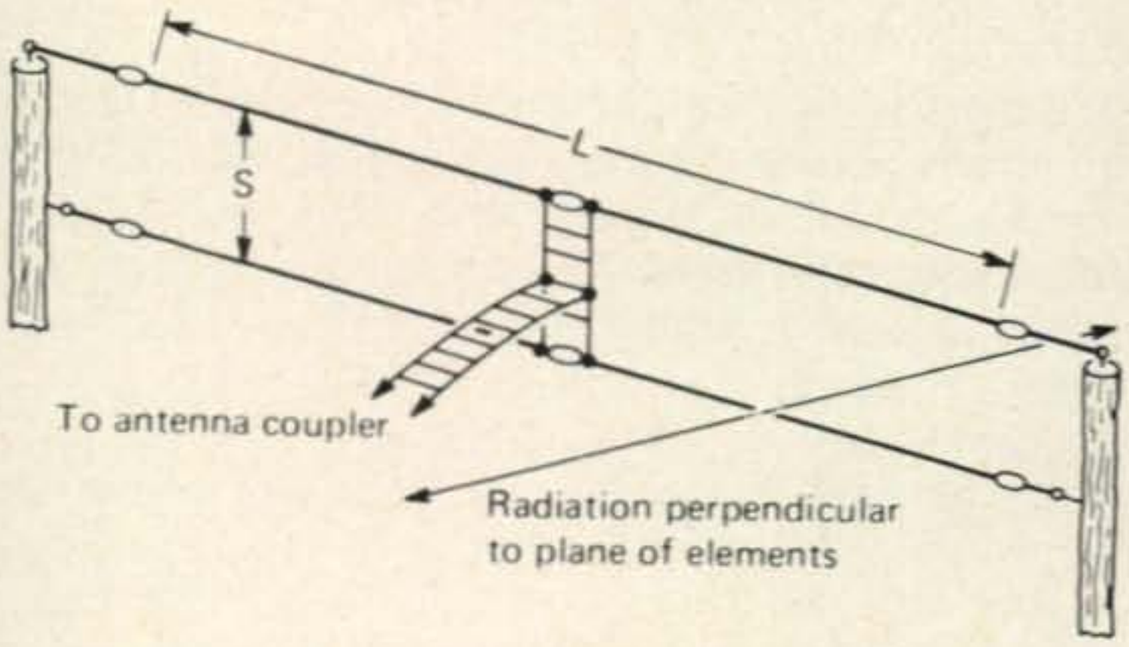


Fig. 2—A lazy-H broadside array. Dimensions: Compromise for 20-15-10 meters, L = 33-40 ft., S = 16-24 ft. Note: maximum gain occurs at 0.6 wavelength spacing. If the elements (L) are a full wavelength, gain will be 3.8 db with .2 wavelength S, 5 db with 0.4 wavelength S, and 6.2 db with 0.6 wavelength S.

The WA6ABP FD setup showing the portable tower supporting a wire quad. Generator is in foreground, and tent at base of tower. Line supporting middle spacers is run off the ends of the picture to ground stakes. 500 milliwatts and this setup was worth 137 QSO's.

being the best DX. 49 states have been worked, KH6 being the only remaining one for WAS. My rig is the HW-7 and it remains unmodified except for some larger tuning knobs and small bypass capacitors added to the power supply to reduce the a.c. hum. The selectivity has been greatly enhanced by adding an MFJ CWF-2 audio filter. My antenna is multi-band Zepp cut half-wave on 80 m using one-inch spaced open wire feed line through a Johnson matchbox. Inputs on the HW-7 are: 20m = 2.5w, 15m = 2w, 40m = 3w. Nearly all the DX was worked on 20m." . . . **Jess Lebow, K8LQJ,** 351 Mower Rd., Pinckney, MI 48169:

The plush operating position (in a VW???) manned by K6TG for the outing. A slab of plywood supports the Argonaut, antenna coupler, and other equipment. While these accommodations probably don't match what is possible in a luxury car, they certainly beat laying on the ground floor of a pup tent!

Cumulative QRPP DXCC Standings 1974

QRPP DXCC

151 K4OCE (5)
118 W2GRR (5)
109 K8EEG/0 (5)
103 K8MFO (5)
103 K4FS/m (5)

86 W4VNE (1)
80 W5TVW (5)
66 ZE7JV (5)
65 WB4WRF (5)
60 K6GKU (5)
58 W2AXZ (2.5)
56 W1JUB (4)
55 K2BG (5)
54 WØQZR (1-5)
52 WA1OFP (3)
W2CRS (2.5)
50 WA8DDI (1)
49 G8PG (5)
K4EXE (5)
45 WBØCGJ (2.5)
44 WA6KGB (5)
43 K1CSD (2)
41 WA3GHC/TF
39 WAØZPT (5)
37 WA6ABP (.8)
36 W3HGX (5)
32 W9PNE (280 mw)
G5BIU (3)
31 W9PNE (200 mw)
WB8FGZ (2)
30 W8ELL (2)
K8BHG (3)
28 VE3BMV (2)
27 WA8KNE/6 (3)
26 K6SGD/EI7CJ
25 W3AVM (2)
W9SCH (5)
23 W3HVD (2)
21 K6SGD (5)
K6EIL/2 (1)
20 WB4OVX (2.5)
19 WB9CWO (2)
K4DAS (3)
18 W4ZRJ (5)
17 W6BRT (3)
W3QBO (2)
16 W4UM (3-40m)
15 K4LD (0.6)
K2VIV (5)
WØIYP (1)
WA7PCZ (4)
14 WA3HBT (5)
13 WA3UDS (.3-.7)
12 K4BNI (3)
11 W4ZRP (2)
WA6WJR (.8)
W6JVA (2)
10 WA2KTW (5)
W6IEU (5)
WB4TNB (1)
9 WA2WGS (2)
WN6WIE (5)
8 W6BRT (3)
7 WA1GZH (5)
KØFRP/6 (2)
WA2MVQ (1)
5 WA7WKO/0 (2.5)
3 WN8OSM (2)
WNØKWO (2)

QRPP WAS Standings 1974

W9PNE (280mw)
K6GKU (2.5)
W4UM (2)
K8EEG/0 (.7)
W6IEU (5)
K4FPF (2)
WØQZR (5)
K8BHG (5)
K8BHG (.98)
K2BG (2)
WA8DDI (1)
W9PNE (5)
WØIYP (1)
W4VNE (1)
W5TVW (2.5)
K4EXE (5)
WBØCGJ (2.5)
K8MFO (2.5)
W7DJU (2.5)
W2AXZ (2)
WA1OFP (2.5)
K1CSD (2)
WB8FSZ (4)

40 States

49 W6BRT (3)
W2CRS (3 SSB)
W9PNE (3-160m)
WA7PCZ (4)
48 WA6KGB (2 SSB)
WA8KNE/6 (3)
47 W4ZRJ (5)
W9PNE (200 mw)
47 WN2TNP (3)
46 W3AVM (5)
WN6WIE (5)
WA8VPD (.8)
WB2CMO (5)
KØOEL (.27w)
45 WN4DWB/8 (2)
W7BBX/4 (.5)
45 W3VQ (5)
43 WB9HPV (2.5)
WN8OSM (2)
WB8FGZ (2)
42 W8ILC (1)
K6SGD (2)
41 W9PNE (0.1w)
WB9CWO (2)
41 WNØKWO (2)
W1GWM (3)
WAØUPO (2)
40 VE2ZK (2.5)
WØQPO/7 (2.5)
WA2KTW (2.5)
W4HIH (2)

30 States

39 WA7UKW/0 (3)
WA2WGS (2)
W4WHK (4)
38 WB9LGZ (2.5)
W2ECW (2)
WB9NOZ (2.5)
K4BNI (2)
37 K4DAS (4)
37 W5JLY (2)
KØFRP/0 (2)
36 W8AVB (0.2-80m)
WBØCJU (2 SSB)
35 K6OVN (2)
WB9LKC (2.5)
K2VIV (5)
34 W3HVD (2)
WA3HBT (2)
33 WA9RMM (2)
32 WB9ASF (2)
WA8YTL (2)
W9PNE (50 MW)
31 WAØAGN (2)
K8LJQ (0.2-80m)
31 K4FS/m (.04)
WB4TNB (1)
W6JEO (2)
30 WA1POZ/5 (2)
ZE7JV (5)

20 States

29 WA3UDS (.3-.7)
27 K4COR (3.5)
27 WA3APN (2)
W9SCH (5)
24 WB4OVX (2.5)
23 WN2TQE (2.5)
19 WB2FHS (2)
11 K9BQL (2)
11 W9PNE (25mw)

"Just a little update since the last note. Really having a QRPp ball with 200 milliwatts into a ground image vertical with 24 radials. I now have over 100 QSO's in 31 states on 40m. Best DX so far is W6. I just built another 200 milliwatt rig for 15m, but only 4 states there so far, with WA the best DX. But I'm looking for better things. I've gotten the local boys interested in QRPp now! P.S. I still need SD!" . . . **Don Karvonen, K8MFO,** 4433 14th NW, Canton, OH 44708: "Just a note from a new QRPp enthusiast. After 300+ DXCC and 5BDXCC, most of which was done with less than 100 watts, I decided to give QRPp a try. Had an HW-7 for a while which whet my appetite. Finally latched onto an Argonaut and then the fun began! In about a month and a half, I've knocked off WAS, WAC, and 70 countries. In the c.w. portion of the SS contest, I made a clean sweep of all 75 sections with the Argonaut in only 14 hours. That included three KH6's and two KL7's, so it was no fluke! My antennas are simple—a 40ft tower holds a Mosley Classic 33 and supports a 137ft centerfed, with the center at 35ft and ends at 10ft. Moral—you can have a ball and still work your share with QRPp. Except for a weekly s.s.b. sked, the Drake line sits idle." *NOTE: K8MFO turned the DXCC QRPp mark in 56 days from first day on QRPp! That seems to be a record. Now Don is sitting and waiting for the elusive cards. Patience!* . . . **Clem, WA9RMM,** 17939 Commercial Ave., Lansing, ILL 60438: "Still following your interesting column. Since starting QRPp, I have now had 30 QSO's at 3w and below. Several have been with a TX-1 module and xtals, and the rest on a PM2B which I put on the air last month. Have worked ten different states so far." **Bill Grim, WØMHK,** 1005 W. Hobart, Knoxville, IA 50138: "I've been a QRPp'r on and off ever since I found that I could work guys with a Heath VF-1 v.f.o. running God only knows how little power! I am now QRO with a Swan 270 and QRPp with an HW-7. I do most of my listening with the Swan. I now have an 80m inverted L configurated mess that loads (sort of!), a 40m inverted V made of stereo speaker wire, and a TH-3JR at 40ft on an aluminum tower. I've had the HW-7 for about six months and have worked 36 states (without trying that hard during contests). Worked over 100 guys in the SS covering 29 states in about 10 hours. I've mainly used the HW-7 looking for DX and have 40 countries worked and what is amazing to me is that I've worked 26 of the 40 in DX contests! And sometimes in pileups! I'll bore you all with a list: W, VE, HK3, KL7, JA3, KH6, CR6, 9Y4, DL, KV4, SM, OH1, ZD3, 4C5, ZS6, LU5, PJ1, ZF1, G3, PY1, KP4, KZ5, VP9, YV6, PAØ, OX3, 5T5, YU2, ZL3, UA9, UK3, F5, FG7, UK2G, EA2, OA4, UK2P, HA, HC1, and I6. I sure enjoyed working 6 continents in

[*Continued on page 66*]

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

OUR topic this month constitutes a slight digression from our normal format but after seeing the "bargain" we are about to describe, we felt that we would like to make our readers aware of this item in some detail.

In our normal search for components and surplus "finds" to pass along in MATH'S NOTES, we came across a series of military surplus gear that seemed ideal for amateur use. This gear is the GRC series of transmitters, recivers, and transceivers, some of which cover the 10 meter and 6 meter bands.

Further investigation turned up one unit in this series that sounded like a "natural" for 6 meter f.m. mobile use and it is the topic for this month.

The unit I am referring to is the RT-70/GRC or RT-70A/GRC (a slightly later version) both of which are surprisingly small lightweight transceivers with the following features:

Freq. Range — 47 — 58.4 MHz, continuously adjustable

Type of Signals—F.M., ± 15 kHz deviation

Receiver type — Dual conversion, always tuned to the same frequency as the transmitter

Sensitivity—25 db signal to noise ratio at 1 microvolt input

Miscellaneous—Fully adjustable squelch, push-to-talk operation, built in .01% calibration, easy to obtain portable radio type tubes, etc.

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

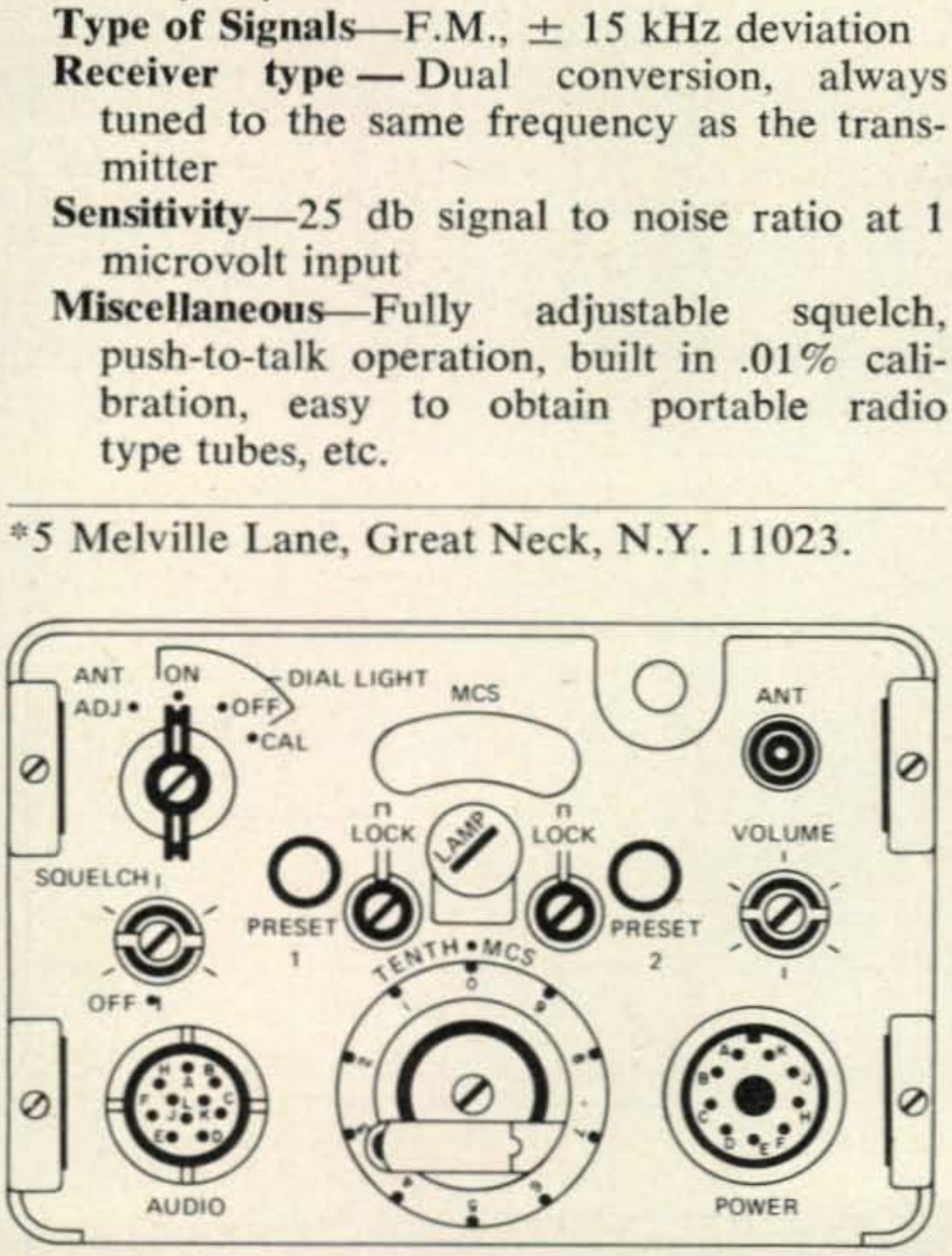


Fig. 1—Front panel layout of the RT-70/GRC unit.

Although power output is rated at ½ watt, the price of the unit is only $22.95.

At this point we were sufficiently interested to obtain a unit and see what was necessary to put it on the air. As it turns out, no modifications at all are necessary to operate wide band f.m. which is allowable from 52.5 MHz to 54 MHz. All that is needed is a suitable microphone and speaker, available as the H-33/PT handset (for $5.95), an antenna, a source of 90 v.d.c. at 100 ma or so, and 6 volts at ½ ampere for the filaments and control circuitry. Fig. 2 is a schematic of a suitable way to obtain these voltages in a mobile installation. When used in this manner, there is a lever switch inside the RT-70 which should be set to the FIELD position.

After fabricating such a power supply or an a.c. line operated version along the lines of Fig. 3, and having decided that wide band f.m. is what you want, hook up power to the rig. Now tune to a desired frequency in the 52.5

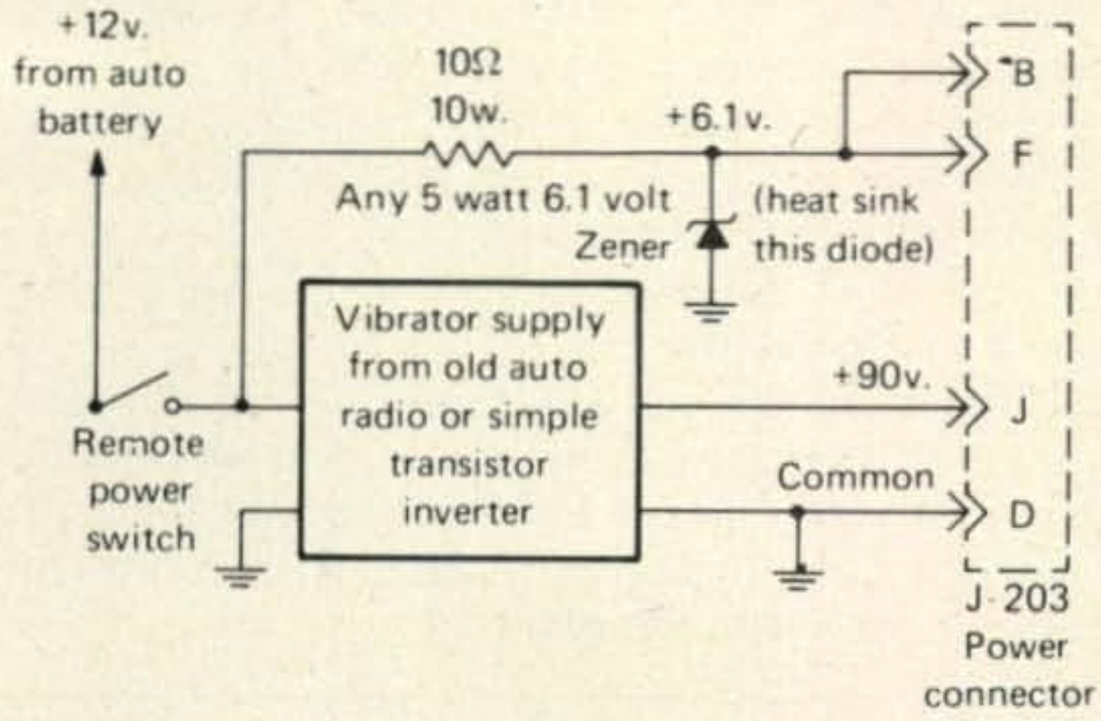
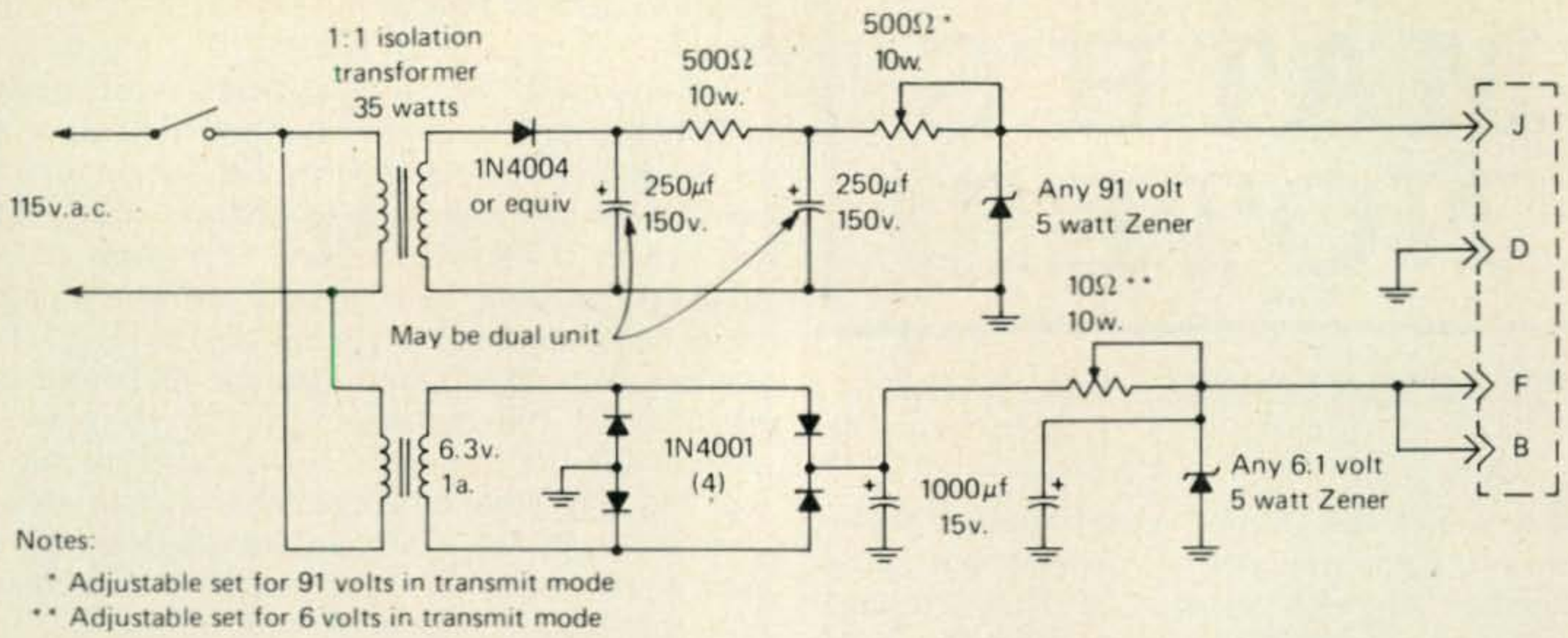


Fig. 2—A simple power supply for the RT-70 transceiver. An a.c. version could be fabricated, applying the proper voltages to the power connector pins as shown.

— 54 MHz range, (remember you have ± 15 kHz deviation while most 6 meter repeaters are using ± 5 kHz deviation and you operate only in a simplex mode so you will probably not be compatable) connect a suitable 50 ohm 6 meter antenna, the handset, and you are on the air! All controls should be self explanatory except for the CAL position of the dial light switch and the ANT ADJ position of this same switch. The CAL position provides 1 MHz markers (.01% accurate) throughout the range of the receiver for calibration purposes (at 50, 51, 52, 53 and 54 MHz for example) and should be used to assure that you are in the band.

The ANT ADJ position is used in conjunction with the antenna matching capacitor accessable from the top of the unit. While in this switch position, with an antenna connected, the capacitor is simply adjusted for maximum quieting. No external signal is required as you



Notes:

* Adjustable set for 91 volts in transmit mode

** Adjustable set for 6 volts in transmit mode

Fig. 3—An a.c. line power supply. Be sure to mount zeners on a suitable heat sink. Resistor values may have to be varied depending on transformers used.

are also tuning on the internal 1 MHz marker and you simply perform this adjustment at a convenient 1 MHz spot on the dial.

Fig. 4 is a block diagram of the rig. All stages are for the most part self explanatory. I would suggest studying the frequency control scheme however, as it is an interesting method of controlling a transmitter and receiver with one crystal. A simplified block of the important points of this scheme is shown in fig. 5.

While we have not done any actual conversion on this rig yet, there are several additional suggestions we would make along the lines of a few changes that could make it into a very versatile and usable 6 meter rig.

1. First of these would be to add the two additional crystals to the 15 MHz oscillator setting the stage for repeater operation as explained in fig. 5.

2. The addition of a solid state f.m. detector instead of the discrimination is also quite desirable to allow adequate recovered audio from the much narrower ± 5 kHz deviation used by amateurs. Suitable circuits, particularly with our old favorite, the N5111 from Signetics have been published in the literature as well as, incidently in our April, 1975 column. Narrow banding the i.f.'s could probably be done by simply cutting out the swamping resistors in several stages and realigning the

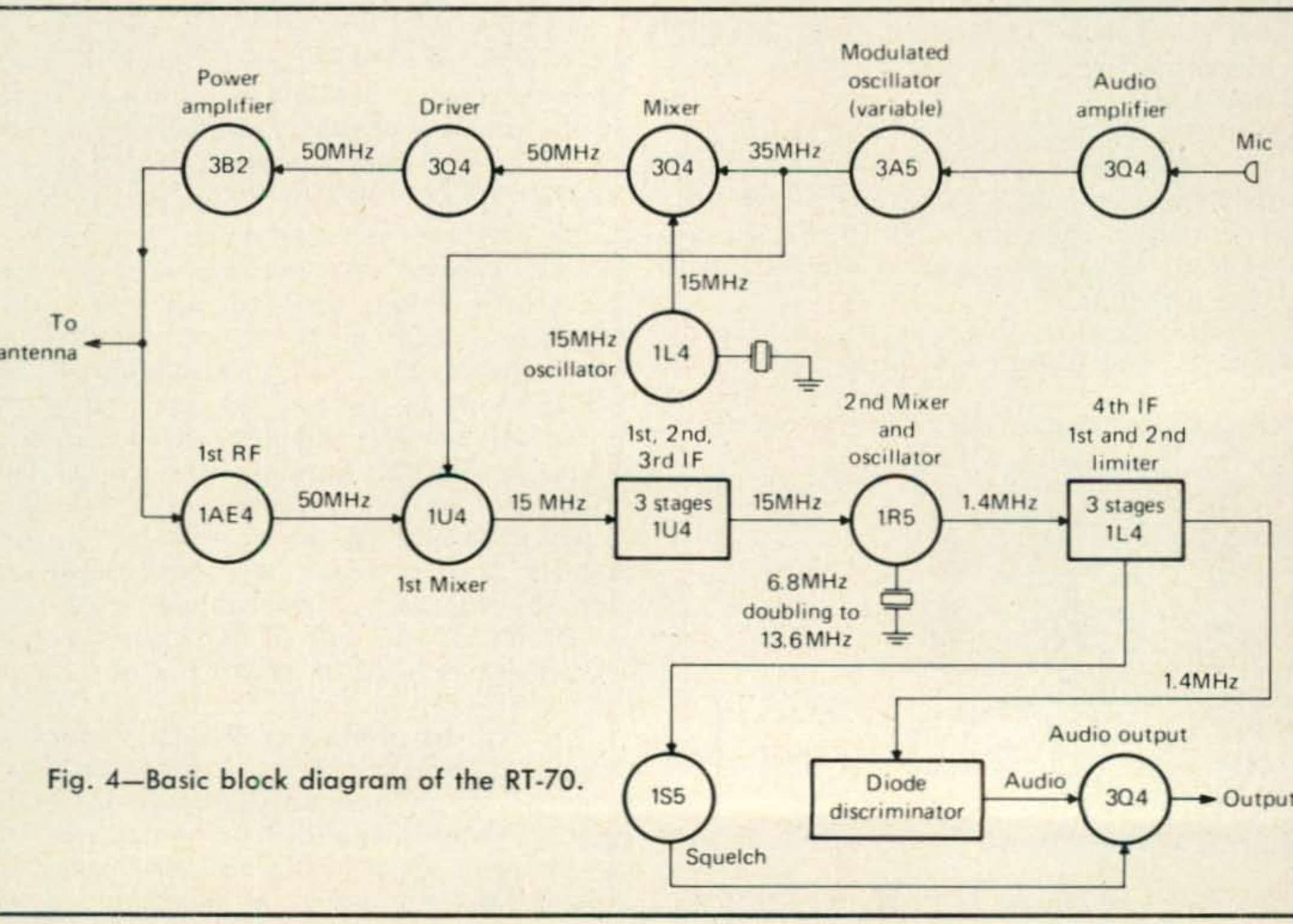
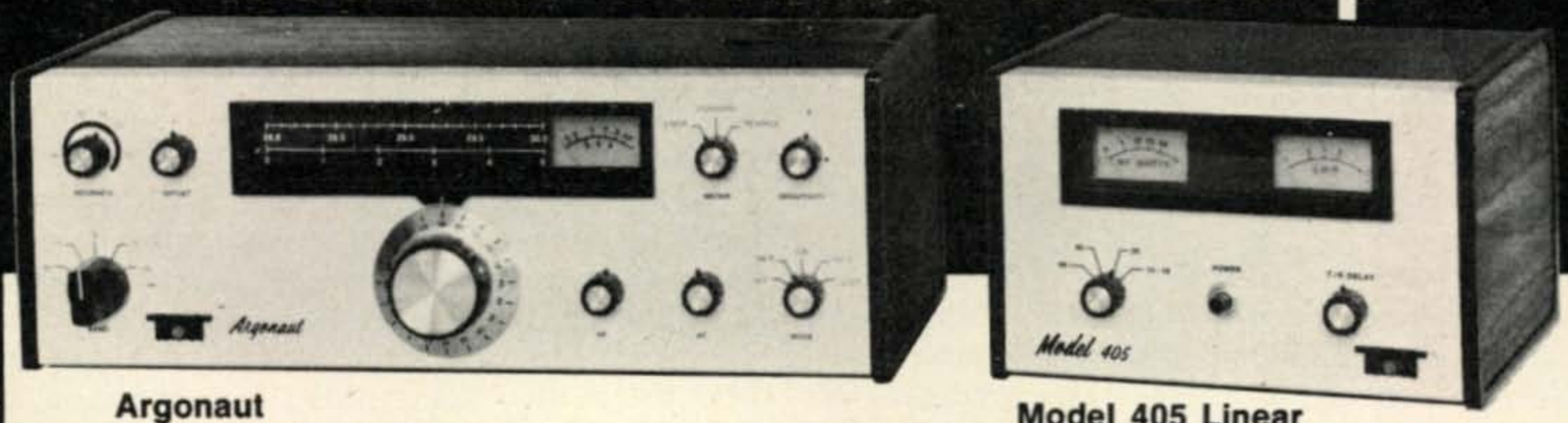


Fig. 4—Basic block diagram of the RT-70.

The Argonaut has become a *Classic* in QRPp



Argonaut **Model 405 Linear**

The sustained demand and the enthusiastic comments from happy Argonaut owners are music to our ears. We designed this portable pair to be fun, and your response tells us that it's just what you've been looking for. The Argonaut and it's companion, the 405 Linear, are here to stay—thanks to you.

Argonaut, Model 505	**$319.00**
Linear, 100 Watt, Model 405	**159.00**
Power Supply for 505 only, Model 210	**27.50**
Power Supply for 505 and 405, Model 251	**99.00**

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whole i.f. strip.

3. If one wishes to continue to use the handset with its carbon microphone, a simple resistive divider or level control in the microphone amplifier stage should allow ± 5 kHz deviation to be achieved. A crystal or ceramic microphone could be employed also by a slight rearrangement of components. Once the deviation is reduced to ± 5 kHz, the entire 6 meter band can then be used with this rig.

4. The 3Q4 audio output stage could also be modified, by changing the output transformer (or using other taps?), to drive a small speaker.

5. And finally, because the rig is f.m., a simple outboard transistorized amplifier could be added between the RT-70 and the antenna in a 2 meter style to raise the output power to say 25-30 watts and similarly, a preamplifier utilizing FETS could be employed to jack up the sensitivity of the receiver if necessary after the other modifications are made. One precaution here is that some means would have to be provided to protect the input of this preamplifier from the r.f. present in the common antenna circuit.

At this point I might add that all circuitry is quite easily accessable and the technical manual for the unit is available and an absolute necessity for anyone planning a detailed conversion. This manual is very complete and literally explains the unit part by part.

I wish to thank Fair Radio Sales Co. Inc., 1016 East Eureka Street, P.O. Box 1105, Lima, Ohio 45802 (419-223-2196) for graciously supplying the equipment and manual and indicate that they have all items in stock at the following prices:

[*Continued on page 66*]

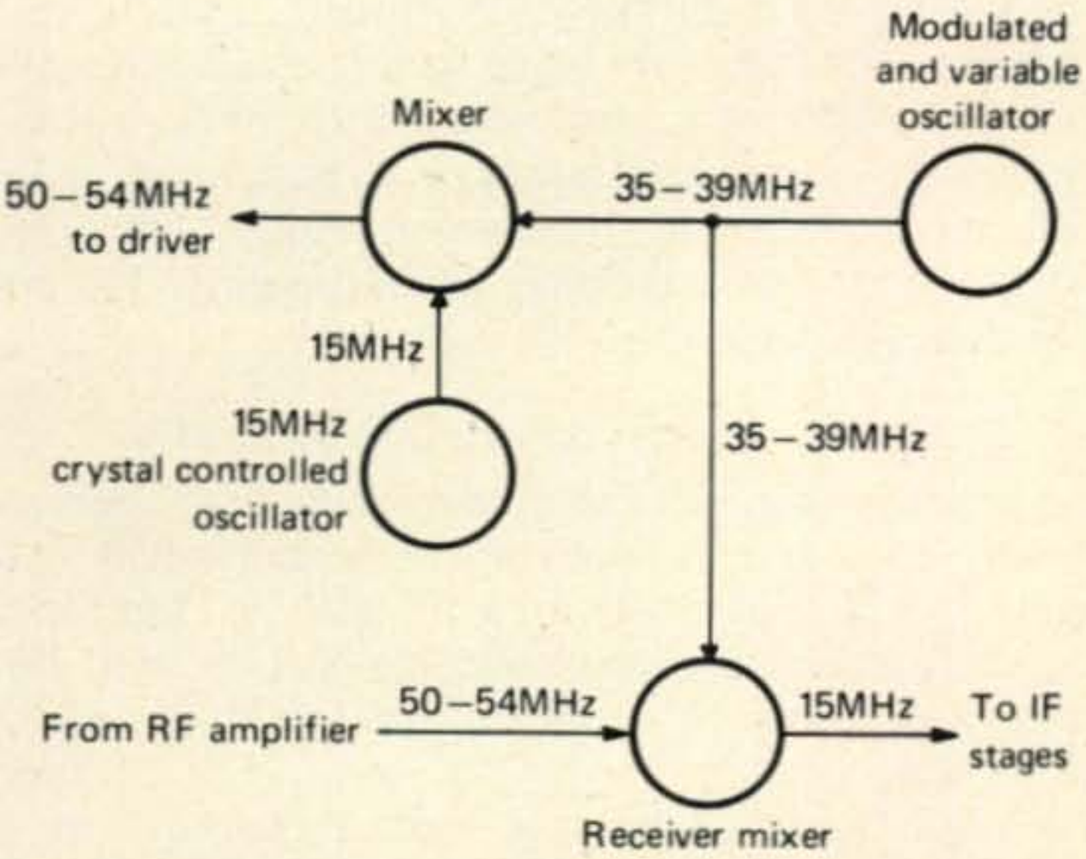

Fig. 5—Frequency control scheme for the RT-70. Note that the modulated oscillator could be a switch selected crystal oscillator and the 15 MHz oscillator could have two additional crystals, ± 600 kHz of 15 MHz giving 3 frequency modes of operation from 1 crystal.

NOVICE SHACK

BY HERBERT S. BRIER,* W9EGQ

CQ DX?

Some contributors to recent "News and Views" have taken opposite positions on the old question as to whether the average U.S. amateur can work more foreign stations by calling "CQ DX" or by calling individual stations. If we define "DX" as stations at least 2000 miles away and located in another country and an "average" amateur as one using a maximum transmitting power of 150 watts and a non-directional antenna, there is no real question that most of the time, he will work more DX by calling individual stations than by calling CQ, DX or otherwise. The reason is simple: numbers.

Why should a DX operator answer your routine CQ and have one chance to make a contact when he can call CQ himself and take his pick of many stations calling him? Furthermore, probably every time he signs off with one station, additional stations will call him until the band fades out or he leaves the air. On the other hand, if you consistently have a stronger signal at the DX location than your competition, you are going to get more than your share of replies, especially if you are located in one of the less populous call areas or states, such as WN7, Wyoming, Idaho, Vermont, and Delaware, and your sending is easy to read. But will you be able to hear the replies? It constantly amazes experienced amateurs who listen in the Novice bands how often they hear DX stations unsuccessfully answer Novice CQ's.

Calling Individual DX Stations

When you call an individual DX station, your chances of raising it are best when it first gets on the air. You will not be the only operator scanning the band for DX to call. But many of these listeners do not really dig down into the receiver noise to hear DX. Rather, as soon as they hear a loud signal calling a DX station, they swish their v.f.o's down to the same frequency, wait for the caller to stand by, and listen for the DX station on the same frequency. And when the original contact is finished, they call the DX station themselves. This is an easy way to locate DX, but it is a hard way to work it. After a couple of calls by loud signals, more and more join the "pile up" of calling stations. Compounding the difficulty, many of the late-comers never actually hear the DX station; instead, they simply call when anybody else calls, making it doubly difficult for the operators who are actually hearing the DX station to make a contact. This sort of nonsense just doesn't exist in the Novice bands, by the way.

When you locate a DX station calling CQ, carefully listen to his full transmission, because sharp DX operators often send instructions like "U5," or "D10," etc., to notify listeners that they will listen for replies 5 kHz above or 10 kHz below their transmitting frequencies in an effort to thin out the interference on their signals. The effort is seldom entirely successful, because many callers blithely ignore the DX station's instructions. Some of them defend their actions by saying that they are using transceivers and have to transmit and receive on the same frequency. Apparently their transceivers do not have calibrated dials that they could move a trifle each time they transmit and receive.

One good thing that a big "pile up" can do for you is that, while your competition are hissing and snarling in it, you can frequently move to another section of the band and raise another DX station by calling "CQ DX." You might even raise the station that the howling mob thinks is on the bottom of the pile. It has happened to me several times. As has been said before, working DX is an art, not a science, in which both operator skill and receiver performance are more important than transmitting power.

The most obvious deficiency of many receivers used on c.w. is insufficient selectivity. The rule of thumb is that if you can read phone signals on it, your receiver has inadequate selectivity for optimum c.w. work. Many newer model s.s.b./c.w. receivers (and transceivers) have provisions for optional, high-selectivity c.w. filters, and older receivers used by many Novices incorporate variable-selectivity crystal filters. In addition, past issues of *CQ* and other amateur publications describe and advertise high-selectivity, audio-frequency filters to be inserted between the receiver and its speaker or headphones. Any of these filters effectively widen the amateur c.w. bands several times. The increased selectivity also increases the effective sensitivity of the receiver by rejecting noise outside of the filter passband. Many amateurs neglect to use the filters, because they make it necessary to tune the receiver much more precisely in order not to pass over signals. The filters may also make the signals sound different. Probably the best

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

way to get maximum benefit from the filter is to use it most of the time. Switching it into the circuit when the desired signal is already covered up by interference improves the possibility that you will never find it again.

"From 5 Watts to 1000 Watts"

Radio Shack has a real winner in its new publication, *From 5 Watts to 1000 Watts*. The 8½ x 11," 153-page, spiral-bound book is a complete programmed course in amateur radio that will take an interested person with no prior code or electronic knowledge past the perilous land of the CB to a Novice, Technician, or General class amateur license.

Chapter one teaches the code via the printed page but advises the student to graduate to a recorded code course or code practice on a shortwave receiver as soon as possible. The remaining three chapters are what impress us, however. Each time a new electronic term, such as *current, voltage, resistance, conductor, semiconductor*, etc., is introduced, its basic concept is explained in simple language illustrated with pictures, drawings, and diagrams. Next, sample problems and multiple-choice questions test the student's grasp of the information. The thought processes necessary to answer the questions are then outlined. Finally, the information is summarized for easy review later in the course. The new book should be of definite value to anyone studying for a Novice, Technician, or General class license.

From 5 Watts to 1000 Watts, Cat. No. 62-2056, is available for $2.25, from any Radio Shack store.

News And Views

We Goofed Department! **John Sanders, WB4ANX,** ARRL Vice Director, Delta Division, 2149 Heatherly Rd., Kingsport, Tenn. 37660, points out that, if FCC 20282 goes through unchanged, only Advanced, Experimenter and Extra licensees will be eligible to act as principle examiners for by-mail examinations . . . Supplementing our remarks in the earlier part of this column, **Gil Baker, W5QPX,** 101 Rita Blanca Trail, Amarillo, Texas 79108, reports that last fall, he operated from Guatamala, El Salvador, and Nicaragua and tried to give WN's a new country without much success. "I heard many signals S6 or better, but few of them seemed to be listening—just CQ'ing. Even though I was running high power to a beam, in good locations, I got very few responses to my CQ's, even though I tuned 10 kHz above my frequency for replies. I also tried calling 'CQ WN' on s.s.b., as I have heard other DX stations do quite often, with few takers. So, WN's tune the band more, and *muchas* DX 73, Gil, ex-HT4IM, 2nd Op, YS1WPE, YN4IM, YN4IM/3."

Michael Wrobel, WN2WIJ, 1271 Erhardt St., Union, N.J. 07083, has a station many old timers would envy. Collins KWM2A transceiver, Hy-Gain TH3MK3, 10, 15, 20 meter beam on a 40-foot tower, a 40-meter dipole, and an 80-meter inverted-V antenna. He also has a frequency counter to check frequencies. Michael has 28 states confirmed and has worked Austria, Brazil, and the Panama Canal Zone. Unfortunately, neither of the two color photos he sent are sharp enough for magazine reproduction . . . **Ted Warnock, WN4JWN,** 5781 W 2 Ct., Hialiah, Fla. 33012 has 48 states worked and confirmed and 23 countries worked in six months. He uses a Heathkit HW-16 c.w. transceiver, and three antennas, an 80-meter dipole, a 40-meter vertical, and a rotary 15-meter dipole. WN4JWN is the Net Control Station (NCS) for the new Novice Early-Bird Net meeting weekdays on 7105 kHz at 1100

[*Continued on page 65*]

Jennifer "Jenny" Tilghman, WN4MHW, 5428 Lonesome Pine Drive, Kingsport, Tenn. 37664, received her ticket a month before her 12th birthday (Feb. 23, 1975). Her first contact was with TI2WX (Costa Rica) who was on phone on 15 meters! She already has 44 states and several South Americans worked. Jenny's dad, WN4-JLW, passed the Advanced test, February 5. Their transceiver is a Heathkit SB-102, and their proudest possession is their new Hy-Gain TH6-DXX triband beam. We are sending WN4MHW a 1-year subscription for CQ for her winning picture. Why not try your luck? Send a sharp picture, preferably black and white, of yourself at your station controls and some information about your radio career to: CQ Novice Shack Photo Contest, c/o Herbert S. Brier, W9EGQ, 385 Johnson St., Gary, Ind. 46402, and we will do the rest. Even if your picture doesn't win, suitable pictures will be published as space permits.

DX

BY JERRY HAGEN,* WA6GLD

TYPICAL June conditions produce fine 20 meter openings over the North Pole during evening hours, however it will be interesting to observe the effect of the extremely low sunspot count which currently exists. If the Polar openings do not occur Serious DXers will have to fight the static of 40 and 80 Meters in hopes of catching some rare Southern Hemisphere DX. In any case it would be worth the time of any DXer to note the comment on Propagation Predictions which is made elsewhere in this column.

DXTRA

As you may have heard; DXers obtaining the ARRL DXCC Award and endorsements will have a new schedule of fees on June 1, 1975. The ARRL has stated that they wish to make the DXCC program financially self-sufficient. The *CQ* DX department is neutral on this issue. However long time DXer W1DGJ has some interesting comments on the matter. Mike states:

"My understanding is that with the new increased fees the operating costs of the DXCC department will be covered and this will make it self-sufficient.

"The contest operator does not pay any fee to have his contest logs checked or to have his score published in QST. The traffic man does not pay any fee for a BPL award (except for the medallion) or to have his traffic count published. No fee is charged for any frequency measuring test.

"Why single out the DXer? I don't mind sharing the cost if the expenses in the department are excessive, but I do feel that part of my ARRL membership fees should be used to operate this department just as tthey are for any other interest."

Mike has some interesting points and he feels that the fees will discourage Amateurs from pursuing DXCC.

USA Prefix Allocation

In March the FCC released information on Amateur call sign composition which included the "N" series as the Amateur call. A format definition of all calls was also included and is shown below:

Composition of Callsign	*Callsign Block*
1 letter, 1 digit, 1 letter	K1A thru K0Z
	N1A thru N0Z
	W1A thru W0Z
1 letter, 1 digit, 2 letters	K1AA thru K0ZZ
	N1AA thru N0ZZ
	W1AA thru W0ZZ
1 letter, 1 digit, 3 letters	N1AAA thru K0ZZZ
	N1AAA thru N0ZZZ
	W1AAA thru W0ZZZ
1 letter, 1 digit, 1 letter	AA1A thru AL0Z
	KA1A thru KZ0Z

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

On the left is Jack, KH6CHC who has been active in CQ Contests and on the right is long-time DXer and KH6 QSL Bureau Manager KH6DQ. *(Photo by W6NJU)*

The WPX Program

Mixed

478.....G4BUE
479.....WB2IWH

C.W.

1384.....OK1CIJ
1385.....OK1BLC
1386.....DL2KL
1387.....YU3NP

2 × SSB

840.....G4BUE
841.....WA1EUO
842.....WA6GFH

Endorsements

Mixed: YU1BCD-1000, WA5VDH-850, WB4SIJ-800, JA1BN-650, WB8AAX-550, WA4SPC, G4BUE-450
CW: WA2HZR, W4WSF-650, OK1CIJ-500, WB8AAX-450, OK1BLC, YU3NP-400, DL2KL-350
2XSSB: OD5BA-1000, CT1PK-800, YU1BCD-750, WB-4KZG-700, W7KOI-500, W4UPJ-450, G4BUE-400
160 Meters: G4BUE
80 Meters: SM4-3958, G4BUE
20 Meters: WDX5FEB, G4BUE
Asia: SM4-3958
Europe: I4BFY, YU3NP, G4BUE, WA1EUO, W4UPJ

Complete rules for WPX 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.

WPX HONOR ROLL

The WPX Honor Roll is based on confirmed *current* prefixes which are submitted by separate application in strict conformance with the *CQ* Master Prefix List. Scores are based on the current prefix total, regardless of an operator's all-time prefix count.

Mixed

W4LRN 1400	W4BQY 1027	WØAUB 929	WAØKDI 824	K8UDJ 750
F9RM 1187	WB2FMK 1020	WA2EAH 900	SM7TV 822	WØSFU 750
WA6MWG 1171	ON4QX 1017	I6SF 893	WA6JVD 812	CT1LN 749
VE3GCO 1142	PAØSNG 1017	K6SDR 887	W6NJU 811	WA5LOB 749
W4CRW 1129	YU2DX 995	YU2OB 881	W9WHM 811	PY4AP 735
W8LY 1116	YU1BCD 987	W4WSF 877	WB4SIJ 808	KØBLT 733
W6TCQ 1106	W9FD 984	DL1CF 872	IØJX 803	K7NHG 719
W3PVZ 1103	WB4KZG 960	K2AAC 863	SM6DHU 803	WA6EPQ 713
W2NUT 1093	YU1AG 957	W4BYU 859	W3YHR 798	PAØVB 706
W8ROC 1072	W4IC 950	G3DO 849	K2ZRO 782	W9ZTD 700
W3GJY 1052	DL1MD 940	WA5VDH 849	JA1AG 765	WAØCPX 693
DJ7CX 1058	K1SHN 934	W6ISQ 847	K6ZDL 750	WA6TAX 655
W3GJY 1052				

C.W.

W8LY 1101	WA6MWG 845	W4BYU 768	W4IC 700	VO1KE 614
W8KPL 1064	YU1BCD 817	YU1AG 760	OK2DB 693	VE4OX 600
W2AIW 972	VK3AHQ 809	W6TCQ 758	W6ISQ 685	OK2QX 600
DL1QT 951	G2GM 801	K1SHN 746	K6ZDL 656	
W9FD 903	K7ABV 801	W3ARK 739	WA2HZR 650	
WB2FMK 890	VO1AW 798	K2AAC 736	K2ZRO 649	
ON4QX 885	WA6JVD 783	SM5BNX 706	WA5VDH 638	
W2HO 885	DJ7CX 782	I6SF 702	K1LWI 629	

2XSSB

W4NJF 1200	W6TCQ 910	W6RKP 822	OK1MP 763	W6YMV 720
F9RM 1135	PAØSNG 908	DK2BI 820	YU1BCD 757	WB4SIJ 708
IØAMU 1061	WØYDB 884	W3DJZ 818	K1SHN 753	WB6DXU 708
W9DWQ 987	K2POA 883	WB2NYM 806	DJ7CX 752	WA6TAX 705
I8KDB 985	ZL3NS 874	W4IC 800	WA2EAH 750	CX2CN 702
IØZV 982	I4ZSQ 861	PY3BXW 776	WA5VDH 650	WB4KZG 700
DL9OH 954	DL1MD 858	W3YHR 773	WA5LOB 747	W2EHB 659
HP1JC 954	F2MO 835	I8YRK 766	OE2EGL 730	CR7IK 613
WA6MWG 930	IT9JT 833	G3DO 765	YU1AG 727	I4LCK 608
CT1PK 923				

NA1A thru NZ0Z
WA1A thru WZ0Z

2 letters, 1 digit, 2 letters AA1AA thru AL0ZZ
KA1AA thru KZ0ZZ
NA1AA thru NZ0ZZ
WA1AA thru WZ0ZZ

2 letters, 1 digit, 3 letters AA1AAA thru AL0ZZZ
KA1AAA thru KZ0ZZZ
NA1AAA thru NZ0ZZZ
WA1AAA thru WZ0ZZZ

There is speculation that the expansion of prefixes will be used in conjunction with the restructuring of the Amateur service which is now being considered.

The CQ DX Award Program

C.W.

175.....I2BVS

2 × SSB

388.....K4ZYU
389.....DK6KK
392.....W9YRA
390.....WB2GUB
391.....JA3AEV

Endorsements

2XSSB: 3.5/7MHz—DL6KG

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.

Propagation Predictions

With the rapid drop in sunspot activity during the last year, your DX log is likely to look quite thin—at least this Editor's does! Let's face the facts, with a smoothed sunspot number in the 20's we can't expect to have the almost round the clock openings on 20 meters and those nice 15 and 10 meter DX openings. Thus the DXer must become much more selective in his operating habits to keep his log from being bare! During the past year *CQ* has published several excellent articles on predicting DX conditions, and sponsors the Dial-A-Prop service. The National Bureau of Standards has added more propaga-

SM3DMP is a communications Engineer and also finds time to collect QSL's for awards.

Shown at the Foothill College Amateur Radio Club Station is Eddy, W6KHS. In February 1974 the Club signed KK6WSL for the opening of their Electronics Museum.

tion information to WWV, and *CQ*'s Propagation Editor provides the "Main-A-Prop" service. With all these aids the DXer can make his operating habits more efficient and perhaps can plan to be active at the times when conditions are the best.

In the opinion of many DXers (including this editor) the most significant indicator is the short term Propagation Forecast Article in the March 1975 issue of *CQ*! This article details how to use Propagation information from the *CQ* Propagation Column and Solar Flux and Geomagnetic Activity information which is available from WWV broadcasts to provide short term propagation predictions.[1] The short term is 28 days which is one rotation of the sun and allows the amateur to project for 28 days based on the previous 28 days data. The ratings used are: above normal, high normal, low normal, below normal and disturbed.

In late March, W4UMF released his forecast for the period of March 26 thru April 15. The forecast included 4 weekend days which were closely monitored by your DX Editor. For March 29th (the first day of the 1975 WPX Contest) a rating of below normal was forecast with low normal being forecast for March 30. On the West Coast, DX openings on the 20 meter band were poor as predicted and the 15 meter band was open for only a period of several hours. As predicted, conditions improved on Sunday, but were still poor. The following weekend prediction was high normal for both April 5th and 6th. The prediction was again accurate as the 20 meter band opened to UI8, UL7 and UA9 on Friday evening (April 4) and a plentiful European opening was experienced from the West Coast on Saturday, April 5th. On April 6th 20 meters was still good, however some degradation was noted.

Thus it appears that the Short Term Propagation Prediction Method outlined in the March Issue of *CQ* is indeed a valuable aid to the DXer.

[1]"A Breakthrough in Simplifying Ionspheric Propagation Forecasts." Jacobs, G., and Cohen, T. J., *CQ*, Mar. '75 p. 16.

Gil, YN41M operating from Bluefields, Nicaragua during 1974. Gil signs W5QPX from his home QTH in Amarillo.

QSL Information

A4XVB via G4DLG
CT2AK via W3HNK
CV8B via W6TCQ
EA5AX via K1WPS
FK8BB via DJ9ZB
FY7AK ('75 ARRL) K3BSY
HC1EE via WA8TDY
HD1QRC via WA8TDY
HCØQRC via WA8TDY
HK4CYX via WA2KWP
HR6SWA via W8CNL
JX2HK via LA3JQ
OE6HZG via W2VMH
P29UC via WA7ILC
VK4AK/NI via W7OK
VP2A via W5NOP
VP2DM via WA1ABV
VP2GRN via W4YHB
VP2LBH via K2IGW
XQ9BIJ via CE2AA
ZF1AU via WA4BTC
3C1AGD via SM3CXS
4X4JS via WA2KWP
4Z4AI via WA2KWP
4Z4IB via WA2KWP
4Z4NNK via WA2KWP
5T5CJ via W4BAA
8P6EZ via W1RED
9J2SJ via W3HHV
9X5KE via WB2EOO
9X5PT via VE3BOZ
73, Jerry, WA6GLD

The WAZ Program

Single Band WAZ 20 Meter C.W.

6.....WA1JMP

20 Meter Phone

7.....W8CNL
8.....I5FCK

S.S.B. WAZ

1251.....EA3JK
1252.....DL6SW
1253.....W4WRY
1254.....W4DQD
1255.....JA3FD
1256.....WAØHZP
1257.....SM5BM
1258.....DJ6QP

C.W.—Phone WAZ

3808.....JA1QXY
3809.....JAØAXV
3810.....JH1VRQ
3811.....JA3BQE
3812.....VE5CJ
3813.....SP2BMX
3814.....W5SBX
3815.....W8SYR
3816.....W9MYG
3817.....WA3AXQ
3818.....WA8VHV
3819.....I5LAN
3820.....F3IJ
3821.....F5RS
3822.....W2CUC
3823.....W4AFS
3824.....WB5BLF
3825.....I3MQ
3826.....HA1VE
3827.....WB5DIZ
3828.....I6ROF
3829.....DL8VV
3830.....DK3UG
3831.....SM5RH
3832.....SMØDL
3833.....GI3JEX
3834.....DJ4KO
3835.....DK6NN
3836.....YU2QK

Phone WAZ

504.....W4DQD
505.....DJ3ST

Complete rules for the Single Band WAZ program appear on pgs. 57-58 of the December, 1972 issue of *CQ*. Complete rules for regular WAZ are found beginning on pg. 46 of the April, 1975 issue. Application blanks and reprints of the rules for all WAZ awards may be obtained by sending a self-addressed, stamped envelope to the Assistant DX Editor, P.O. Box 205, Winter Haven, FL 33880.

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

June	1	WAB LF C.W. Contest
*June	6-9	CHC/FHC/HTH Party
*June	7-8	RSGB National Field Day
June	14-15	ARRL VHF QSO Party
*June	21-22	All Asian Phone Contest
June	28-29	ARRL Field Day
July	5-6	Venezuelan Phone Contest
July	5-6	DL QRP C.W. Contest
July	5-6	Area Code Contest
July	12-13	Ten Ten Net QSO Party
July	12-13	ARRL "Open" CD C.W.
July	19-20	ARRL "Open" CD Phone
July	19-20	Colombian Contest
July	19-20	Space Net VHF Contest
July	20	WAB VHF Contest
July	26-27	World Wide VHF Activity
July	26-28	County Hunters C.W. Party
Aug.	2-3	Illinois QSO Party
Aug.	9-10	European C.W. Contest
Aug.	23-24	All Asian C.W. Contest
Sept.	13-14	European Phone Contest
Sept.	13-14	Washington State QSO Party
Sept.	27-29	Delta QSO Party
Oct.	19-20	Manitoba QSO Party
Oct.	**25-26**	**CQ WW DX Phone Contest**
Nov.	8-9	European RTTY Contest
Nov.	**29-30**	**CQ WW DX C.W. Contest**

*Covered in last month's Calendar

Venezuelan Contest

Starts: 0000 Saturday, July 5
Ends: 2400 Sunday, July 6

This contest sponsored by the Radio Club Venezulano is in commemoration of the anniversary of Venezuela's Independence.

It's a world wide type contest on all bands, 10 thru 80, but phone only. There are three categories, single operator, single and all band, and multi-operator, single and multi transmitter.

Exchange: The RS report plus a 3 figure contact number starting with 001.

Scoring: One point per QSO, 2 points if it's with a YV. Contacts with same country no value.

Multiplier: One for each country and YV and U.S. call areas worked on each band.

Final Score: Total QSO points times the sum of the multiplier from each band.

Awards: There are Trophies for the leading station in each category and for the leaders in following areas: No. America, So. America, Central America, Caribbean, Bolivarian countries, Europe, Africa, Asia and Oceania.

In addition certificates will be awarded to stations with the following totals: *Americas:* Working 20 YV's and stations in 10 other countries. *Other Continents:* Working 5 YV's and stations in 5 other countries. S.w.l.s must report at least 50 stations in the contest.

A remittance of $1.00 or its equivalent in IRC's is requested with each application. (One of the most attractive certificates I've seen)

Entries must be postmarked no later than Sept. 15th to: Radio Club Venezolano, P.O. Box 2285, Caracas 101, Venezuela.

DL QRP C.W. Contest

Starts: 1800 GMT Saturday, July 5
Ends: 1500 GMT Sunday, July 6

The DL Activity Group run two of these QRP contests each year, in January and July.

Power input is limited to 10 watts or less, single operator and c.w. only. QRO stations may participate but only contacts with QRP stations are valid. Limit your operation to 15 hours. The 6 hour rest period may be taken in two parts. Contacts may be made on any 5 bands in the 1.8-28 MHz group.

Exchange: RST plus QSO no. and power input. Add "x" if crystal controlled. (579001/8x) Stations using more than 10 watts indicate QRO instead of power number.

Scoring: Contacts with stations in same country 1 point, other countries same continent 2 points, DX on other continents 3 points. If QSO is with another QRP station add 3 more points. (4 to 6 pts.) If power input less than 3 watts or xtal, double your QSO points. (8 to 12) *(Scoring much too complicated, suggest DJ7ST make some modifications. Ed.)*

Multiplier: Each DXCC country, if on own continent, 2 if on other continents. Plus call areas of JA, PY, VE, VK, W/K, ZS.

Final Score: Total QSO points times the multiplier from each band.

Use separate log sheet for each band and a summary sheet with the scoring, times of rest period and equipment information. Plus the usual signed declaration.

Mailing deadline is July 31st to: Hartmut Weber, DJ7ST, D-3201 Holle, Kleine Ohe 5, West Germany.

Area Code Contest

Starts: 2000 GMT Saturday, July 5
Ends: 2359 GMT Sunday, July 6

This is the first of a series of a novel new contest to be held on Independence Day and Thanksgiving week-ends. Telephone area code numbers will be used in the exchange of which there are over 120 in the U.S. and Canada.

The same station may be worked on each band and mode. Phone and c.w. are separate contests and should be scored separately.

*14 Sherwood Road, Stamford, Conn. 06905.

A happy moment for Darleen HC2YL and Joe HC2OM We don't know if that big smile was induced by the 5BWAS Plaque she had just received or admiration for their beautiful daughter Diane Renee. Or just learning that she was the winner of the DX-YL to Stateside Contest. Congratulations on all counts Darleen.

Exchange: RS(T), Area Code, and state, province or country. (DX use 011 for their code)

Scoring: Each QSO counts 2 points. Multiplier consists of number of different area codes worked plus one additional point for the first DX station worked. (Max. multiplier of approx. 125) Number used in your exchange must be area code of your area. *TWX, Inwats and etc. do not count.*

Frequencies: C.W.—40 kHz in from each band edge. Phone—3910, 7230, 14280, 21380, 28580. Novice—3710, 7110, 21110, 28110.

Awards: Certificates to high scorers in each U.S. call area, VE province, KL7, KH6, KP4, KZ5, XE1, XE2 and overall winner on both phone and c.w. Also DX winner on each continent and top Novice. A Loggers Certificate goes to each out-of-state station working 5 members of the Tacoma Club. (Wash. stations 10 club contacts)

Mailing deadline is July 31st to: Radio Club of Tacoma, RT #1, Box 114, Vaugn, Wash. 98394.

Ten — Ten Net QSO Party

Starts: 0000 GMT Saturday, July 12
Ends: 2400 GMT Sunday, July 13

This is the summer edition of the Ten-Ten International Net of Southern California QSO Party. It's open to all amateurs but non-members are ineligible for awards. They are encouraged however to submit a log and apply for membership. Activity is on 10 meters only but using any mode.

Exchange: Name, QTH, and 10/10 membership number if a member of the Net.

Scoring: For members, 1 point per contact, add another point if it's with a 10/10 member, and 1 additional point if QSO is with out-of-state, province or DX station. That's your score, there is no multiplier, just total your contact points.

Awards: 1st and 2nd place certificates in each U.S. call district, KH6, KL7, and each VE province. And to 11 continental and sub-continental areas over the world.

Indicate the name of your chapter on your log and send it before August 15th to: Grace Dunlap, K5MRU/Ø, Box 13, Rand, Colorado 80473.

Colombian Contest

Starts: 0001 GMT Saturday, July 19
Ends: 2359 GMT Sunday, July 20

This year's contest commemorates the 165th year of Colombia's Independence. Exchange will be on a world wide basis.

All bands, 3.5 thru 28 MHz, phone and c.w., and 3 classes, single operator, single and all band, and multi-operator, single transmitter.

Exchange: RS(T) and 3 figure QSO number.

Scoring: QSO's with HK's 5 points, with stations in North America 3 points, other countries 2 points, and same country 1 point. Multiplier determined by DX countries worked on each band.

Final Score: Sum of QSO points from all bands multiplied by sum of different countries worked on each band.

Awards: A silver cup to the world winner. There are nine plaques, six to the continental winners and three for the top scoring station in each category. Certificates for each country.

A minimum of 50 QSO's must be shown by all awards winners.

Use a separate log sheet for each band, indicate the country only the first time it is worked and include a summary sheet with the scoring, signed declaration and etc. The usual rules of disqualification will be in force.

Mailing deadline is September 30th to: L.C.R.A. Concurso Independencia, Apartado Postal 584, Bogota, Colombia.

Space Net VHF Contest

Starts: 6:00 P.M. Saturday, July 19
Ends: 6:00 P.M. Sunday, July 20
(Local Time)

This event marks the 6th Anniversary of the Apollo space flight. The same station may be worked on each band and mode.

Use any of the v.h.f. bands, 50, 144, 220, and 432 MHz but no repeaters.

Exchange: QSO no. and your Zip Code.

Scoring: Add last two digits of every Zip Code worked on each band and mode. (Zip Code ending in double 00 count 100) Sum of Zip points is your final score, no multiplier.

Awards: To 1st and 2nd place winners in four power classes. 1 - 5, 5 - 25, 25 - 100 and 100 to 1000 watts. Also a Club award.

Note that the above rules are somewhat different from previous Space Net Contests. Mailing deadline is August 17th to: Space Net VHF Contest, Att: A. W. Slapkowski, WB2-MTU, Box 909, Sicklerville, N.J. 08081.

World Wide VHF Activity

Starts: 6:00 P.M. Saturday, July 26
Ends: 10:00 P.M. Sunday, July 27

This is the 5th Annual VHF activity sponsored by the Itchycoo Park ARS. Its open to all single operator stations, only simplex operation is allowed and there is no mode distinction. Club stations limited to one operator for each band.

Each band 50, 144 and 220 MHz will be considered as a separate contest. You may submit more than one log, one for each band.

Exchange: Call, county (or subdivision), and state, province or judicial district.

Scoring: Total QSO's × counties × states, for each individual band.

Awards: Medals and certificates to top three scores on 50 MHz and on 144 MHz. Many other certificates as deemed appropriate.

Entries go to: Itchycoo Park A.R.S., WA3-NUL, Box 1062, Hagerstown, MD 21740.

County Hunters C.W. Contest

Starts: 0000 GMT Saturday, July 26
Ends: 0600 GMT Monday, July 28

The County Hunters Net encourages and invites mobile and portable operation from the less active counties during the contest.

The same station may be worked on each band for QSO points. Portable and mobiles changing counties may also have repeat QSOs. Stations on county lines exchange only one number but each county is counted as a multiplier.

Exchange: QSO no., category (F—fixed, P—portable, M—mobile) RST, state, province or country, and county for US stations.

Scoring: QSO's with fixed stations 1 point, with portable or mobiles 3 points. Multiply total by number of US counties worked. Mobiles and portables score for contacts made within a state.

Frequencies: 3575, 7055, 14070, 21070, 28070.

Awards: Certificates in three categories.

F—Top fixed or fixed portable in each state, province or country, 1000 or more points.

P—Top score in each state by a portable operating from a county other than its normal location, 1000 or more points.

M—Top scoring mobile in each state operating from 3 or more counties, with a minimum of 15 QSOs from each county.

There are Trophies for the Top single operator Portable and Mobile in the United States.

Stations with 100 or more QSOs *must* include a check sheet of counties worked.

Mailing deadline is Sept. 1st to: C.W. County Hunters Net, c/o Jeffrey P. Bechner, W9MSE, 64 North Pioneer Parkway, Fond du Lac, Wisc. 54935.

1974 All Asian C.W. Results
Continental Leaders

Continental Leaders

Oceania	KH6RS	119,038
Asia	UV9AH	85,644
N. Amer.	W7RM	76,446
Europe	UA3QO	27,388
Africa	CR7IZ	20,292
S. Amer.	CX3BH	5,980

All Band

W7RM	76,446
K6OVJ	50,410
W6DGH	15,370
W6DQX	6,720
WB6KBK	6,255
K3MNT/7	5,604

21 MHz

W6HQN/6	1,273
K6AO	532
WA6BVY/6	4

14 MHz

W6AM	13,090
W7NQ/6	12,617
W9IRH/7	11,290
WB6AIN	9,920
VE7ZZ/W7	8,940
W6OAT/6	8,160
K6ZM	6,820
K7IWD	4,350
W6RQZ	1,350
WB6ZUC	270
WB8FUO	110
WA2IDM	24
W4WSF	16
W6MAR	1

7 MHz

WA6YPY	13,149
WA7YTG	10,725
WA6NGG	6,600
WB5DIZ	880

3.5 MHz

K6ERT	2,520
WA1ABW/6	2,006
W7EXM	1,060

1.9 MHz

W7QID	28
K7JCA	24

Multi-Op.

W6OKK	53,808
W6YRA	46,480
W1ARR/6	29,898
W6BIP	27,630

Canada 14 MHz

VE3BBH	156
VE3GFY	56

7 MHz

VA7WJ	7,567

Editor's Notes

Peak DX conditions for the North/South path on 160 is predicted during the month of June and extending into July, according to a report from Paddy EI9J and Rolf PY1RO.

Although the QRN levels are high in the northern hemisphere the opposite is true south of the equator. If you're a 160 buff try checking the band daily starting at about 0000 GMT. You might hit a good night.

You will find the South Americans on the low end 1800 - 08. Check the high section 1930 - 35 for South Africa. And of course the Europeans in the DX Window 1825 - 30.

Openings may be of short duration so keep your contacts short and avoid repeat contacts. And keep in mind that split frequency operation is the accepted procedure on 160.

How about that? Phone Contest results in last month's issue, and the C.W. results in this month's, a full two months earlier than we have been able to accomplish in the past few years. Nice going fellows. Looks like K6SSS (K6SSS?) has got a real live group working for him. Having the operation in one location was in no small way a big factor in this success.

73 for now, Frank, W1WY

THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All Counties

#120—William A. Winnegar, W6CLM, 2-22-75.
#121—George V. Johnson, K2TPS, 3-3-75.
#122—Ken Albrecht, K6BWD, 3-3-75.
#123—Riley M. Dunn, WAØCEL, 3-5-75.
#124—H. Arthur Dechent, WA4WQG, 3-6-75.

THE "Story of The Month" for June, as told by Dick is:

Richard L. Brocaw, K5VYT

(All Counties #112, 11-6-73)

"I was first licensed in 1959 as KN5VYT after having been an s.w.l. for about two years. I was using an old Hallicrafters S-85 and I began to wonder if I could also talk as well as listen. I received my Novice license about two months later and the General came about a year after that. I guess the vital spark that launched my amateur career was provided by Clacy Leonard, W5HDR.

"For a number of years I was attending High School at Las Cruces, New Mexico, and then college at New Mexico State University.

"I joined the Navy in 1967 and was assigned to the *U.S.S. Yorktown* immediately following boot camp. My only notable operation during this time was Christmas 1968 when the *Yorktown* was in the South Pacific recovering the Apollo 8 capsule and I operated the station on board, running Christmas phone patches to the States.

"I was transferred to Norfolk, Virginia in 1970, where I worked in intelligence. This was the first time in almost three years that I could get in some serious hamming. I purchased a Swan 350 for the car, and used it extensively as well as the base club station.

"My first contact with County Hunters was in November 1970. I did not know what was going on, but it seemed like fun. Bertha, WA4BMC sent me all the information, and I was hooked. After being released from the Navy in May 1971. I went back to college and started County Hunting in earnest.

"After graduating from college with a degree in Electrical Engineering, I moved to Albuquerque and took a job with the Public Service Company. At that time I had about 35 Counties to go. It seemed like an impossible task, but in October 1973, I got the last one—Tyler, Texas from WA5YSC.

"I owe a tremendous vote of thanks to hundreds of mobiles and fixed stations, who made #112 a reality for me.

"I plan to stay with the County Hunters and work on other awards, and I will continue to check in whenever I am mobile and try to return the favors with New Mexico Counties".

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

Richard L. Brocaw, K5VYT.

Awards Issued

As indicated by the **Special Honor Roll,** it was a busy month for *All Counties.*

Bill Winnegar, W6CLM grabbed #120, Mixed.

Geo. Johnson, K2TPS won #121, Mixed.

Ken Albrecht, K6BWD/W7EUJ (ex W5PXW) waited until he had them *all* and applied for 500 through *all.*

Riley Dunn, WAØCEL was issued *All Counties* endorsed All S.S.B.

Reverend Arthur Dechent, WA4WQG also waited until he had them *all* and then applied for 500 through *All Counties.* He is Pastor of the Hermitage Baptist Church in a very appropriate place, Churchview, Va.

Howie Bromberg, K1VSJ acquired USA-CA-2500 and 3000. *(Bea, thanks for your great job as NC and help to NC and your many telephone calls.)*

Bea Dietz, WA2GPT was issued USA-CA-2500 endorsed All 14, All S.S.B., All Mobile to Mobile.

Bob Brown, WA3VLB got busy with his paper work and applied for USA-CA-500

USA-CA HONOR ROLL

3000

WA2GPT 145
K6BWD 146
WA4WQG 147

2500

WA2GPT 181
K6BWD 182
K1VSJ 183
WA3VLB 184
WA4WQG 185

2000

K6BWD 215
W2MEI 216
WA3VLB 217
WA4WQG 218

1500

K6BWD 257
WA3VLB 258
WA4WQG 259

1000

K6BWD 347
WA3VLB 348
WA4WQG 349

500

WA2BJN 1036
KØJJV 1037
K3GOO 1038
K6BWD 1039
WA3VLB ..1040
WA4WQG ..1041

The new Bermuda Award. This large certificate (22⅝" × 19") is actually a double sided award featuring the history of the Island in Latin on the reverse side.

through USA-CA-2500, endorsed All S.S.B.

"Steady" Lidell, W2MEI got USA-CA-2000 endorsed All 2 WAY-C.W.

Mixed USA-CA-500 Awards went to:

Dick Auslander, WA2BJN and Jim Brooks, KØJJV.

Dave Ash, K3GOO became the owner of USA-CA-500 endorsed All 75, All Mobile and All S.S.B.

Awards

USA-CA: *Yes* I do issue the United States of America County Awards, send me an s.a.s.e. for the rules.

Daniel Boone Award: New Award Manager is: James G. Grimsby, W9HRF, 1100 East Avenue, Belvidere, Illinois 61008. Thanks to K9LKA/W9CPD and PY2ELZ for this data.

CPR Awards: Hope most of you know that IARC dropped their CPR Awards as of December 31, 1974. Thanks to W1WY and K4ZA for this data.

Worked All Bermuda Award: Issued by the Radio Society of Bermuda to licensed amateurs who submit proof of contact with all nine of the Bermuda Parishes 1. Sandys, 2. Southampton, 3. Warwick, 4. Paget, 5. Pembroke, 6. Devonshire, 7. Smiths, 8. Hamilton, 9. St. Georges.

New rules effective November 1st, 1974.

1. The award is not available to mobile stations, including maritime and aeronautical mobile stations.
2. The award is no longer available on the basis of submitting logs for the annual Bermuda Amateur Radio Contest.
3. The Award is not available to stations operating from within Bermuda.

[*Continued on page 65*]

The MZS Achievement Award.

North Carolina Six Meter Association.

Propagation

BY GEORGE JACOBS,* W3ASK

THE Swiss Federal Solar Observatory reports a monthly mean sunspot number of 11.6 for February, 1975. This is the lowest level reported since August, 1965. February's low activity results in a smoothed sunspot number of 33, centered on August, 1974. The progress of the solar cycle is measured by the smoothed sunspot numbers, and the present cycle has started to decline again after being at a plateau for almost a year.

A smoothed sunspot number of 19 is forecast for June, 1975, and the end of the present cycle is now likely to occur by the middle or end of next year.

The Swiss Observatory also reported the official mean monthly numbers for 1974, as follows:

Jan.	— 27.6	July	— 55.8
Feb.	— 26.0	Aug.	— 33.6
Mar.	— 21.3	Sept.	— 40.2
Apr.	— 40.3	Oct.	— 47.1
May	— 39.5	Nov.	— 25.0
June	— 36.0	Dec.	— 20.5

The highest level of solar activity during 1974 was recorded on October 10, when the count was 114. There were five days during the year when the count exceeded 100. The count was zero on 20 days. The mean number for 1974 was 34.4, the lowest recorded since 1965.

Twenty meters looks like it will be the best band for DX during June. It should open shortly after sunrise and remain open for several hours in almost all directions. When conditions are normal or better, chances are good for openings to Europe, Central and South America, the South Pacific, Australasia and the Far East, before noon-time absorption sets in. A second, and stronger peak is expected during the afternoon and early evening hours, when good openings should be possible towards Europe, Africa, Central and South America and the Middle East. Later in the evening, and until about Midnight, look for peak openings to South America, Antarctica, the South Pacific, Australasia and the Far East.

Not much DX expected on *15 meters* until after noon when the band should open towards Central and South America. The band may also open occasionally from the eastern half of the country towards Africa, and from the western half towards the South Pacific, Australasia and the Far East. Best time to check *15* meters is during the late afternoon.

Few, if any DX openings are expected on *10 meters*, except to those areas of the Caribbean and Central America within a 1300-mile range of short-skip sporadic-E openings from the USA. An occasional longer opening into South America may be possible during the late afternoon hours.

Longer hours of daylight and seasonally higher levels of static should reduce considerably the chances for DX openings on *40, 80* and *160 meters*. Some fairly good openings, however, are forecast to several areas of the world for *40 meters* during the hours of darkness and at sunrise. Occasional openings should also be possible on *80 meters* during the same time period.

Plenty of good short-skip openings are expected on the h.f. bands during the month. For distances less than 250 miles try *80 meters* during the day, *160 meters* at night. For openings between 250 and 750 miles, *40 meters* should be best during the day and *80 meters* at night. For openings beyond 750 miles, *20*

*11307 Clara St., Silver Spring, MD 20902.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For June, 1975

Propagation Index	*Expected Signal Quality* (4)	(3)	(2)	(1)
Date *June*				
Above Normal: 27	A	A	B	C
High Normal: 13-14, 17, 25-26, 28	B	B	C	D
Low Normal: 1, 7, 9-12, 15-16, 18, 22-24, 29	B	C	D	E
Below Normal: 2, 4-6, 8, 19-21, 30	C	D	E	E
Disturbed: 3	D-E	E	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals greater than S9+30 dB.

B—Good opening, moderately strong signals varying between S9 and S9+30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and 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 band opening for any day of the month. For example, an opening shown in the Charts with a *propagation index* of (3) will be fair on June 1st (C); poor on the 2nd (D); and no opening expected on the 3rd (E), etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, subscribe to bi-weekly MAIL-A-PROP, P.O. Box 86, Northport, NY 11768, or check WWV at 14 minutes past each hour.

meters should be optimum during the day and *40 meters* at night. Frequent short-skip, sporadic-E type openings are also expected on *10* and *15 meters* over distances between approximately 600 and 1300 miles.

This month's *CQ* Propagation Charts contain DX predictions for the period June 15 through August 15, 1975. Short-skip Charts for June, for openings between 50 and 2300 miles, and from Hawaii and Alaska, appeared in last month's column.

V.H.F. Ionospheric Openings

Expect a considerable increase in sporadic-E short-skip propagation during June and the summer months. This should result in fairly frequent *6 meter* openings over a range of 1000 to 1400 miles. During periods of widespread ionization, two-hop *6 meter* openings may occasionally be possible up to about 2300 miles. An occasional *2 meter* short-skip openings, between approximately 1200 and 1400 miles, may also be possible during periods of intense sporatic-E ionization. Short-skip openings are most likely to occur between 10 A.M. and 2 P.M. and again between 6 and 10 P.M., local daylight time, although they can occur at other times as well.

Look for some meteor activity between June 7 and 9, which should increase the possibility of meteor-scatter type openings on the v.h.f. bands.

Check the "Last Minute Forecast" at the beginning of this column for those days during June that are expected to be Below Normal or Disturbed on the h.f. bands. These are the days on which auroral and other types of ionospheric propagation may be possible on the v.h.f. bands.

73, George, W3ASK

How To Use The DX Propagation Charts

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, 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.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. 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 Propagation 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.

4. Time 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. Appropriate *daylight* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate Chart 7 hours in the PDT Zone, 6 hours in the MDT Zone, 5 hours in the CDT Zone and 4 in the EDT Zone. For example, 14 in Washington, D.C. is 18 GMT and 20 in Los Angeles is 03 GMT, etc.

5. The charts are based upon a transmitter power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 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 10 db loss, it will lower by one level.

6. 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.

June 15—August 15, 1975
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	*Nil*	15-18 (1)	06-07 (1) 07-08 (2) 08-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-00 (1)	20-22 (1) 22-23 (2) 23-01 (3) 01-02 (2) 02-03 (1) 21-23 (1)* 23-01 (2)* 01-02 (1)*
Northern Europe & European USSR	*Nil*	*Nil*	06-09 (2) 09-15 (1) 15-19 (2) 19-21 (3) 21-23 (2) 23-01 (1)	21-22 (1) 22-00 (2) 00-02 (1) 21-00 (1)*
Eastern Mediterranean & Middle East	*Nil*	11-14 (1) 17-18 (1)	13-15 (1) 15-18 (2) 18-22 (3) 22-00 (2) 00-06 (1) 06-08 (2) 08-09 (1)	20-22 (1) 22-00 (2) 00-01 (1) 22-00 (1)*
Western Africa	*Nil*	11-14 (1) 14-17 (2) 17-18 (1)	00-07 (1) 07-08 (2) 08-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-00 (2)	20-22 (1) 22-00 (2) 00-02 (1) 21-01 (1)*
Eastern & Central Africa	*Nil*	14-17 (1)	16-18 (1) 18-21 (2) 21-23 (1)	22-00 (1)
Southern Africa	*Nil*	11-13 (1)	15-16 (1) 16-18 (2) 18-19 (1) 01-03 (1)	21-22 (1) 22-00 (2) 00-01 (1) 23-01 (1)*
Central & South Asia	*Nil*	*Nil*	08-11 (1) 20-23 (1)	20-22 (1)
Southeast Asia	*Nil*	*Nil*	07-08 (1) 08-09 (2) 09-12 (1) 19-23 (1)	*Nil*
Far East	*Nil*	*Nil*	07-08 (1) 08-10 (2) 10-12 (1) 20-23 (1)	*Nil*
South Pacific & New Zealand	*Nil*	19-22 (1)	19-21 (1) 21-02 (2) 02-04 (1) 07-10 (2)	02-03 (1) 03-06 (2) 06-07 (1) 03-06 (1)*

*Indicates best time to listen 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.

Australasia	*Nil*	19-22 (1)	06-08 (1) 08-10 (2) 10-12 (1) 17-19 (1) 22-00 (1) 00-02 (2) 02-04 (1)	03-04 (1) 04-06 (2) 06-07 (1) 03-06 (1)*
Central America & Northern Countries Of South America	15-17 (1)	14-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	06-07 (1) 07-08 (2) 08-10 (4) 10-12 (3) 12-16 (2) 16-18 (3) 18-22 (4) 22-23 (3) 23-00 (2) 00-02 (1)	20-22 (1) 22-23 (2) 23-03 (3) 03-05 (2) 05-06 (1) 22-00 (1)* 00-03 (2)* 03-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	15-17 (1)	11-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-20 (2) 20-21 (1)	16-18 (1) 18-19 (2) 19-20 (3) 20-22 (4) 22-00 (3) 00-02 (2) 02-06 (1) 06-07 (2) 07-08 (1)	22-00 (1) 00-04 (2) 04-06 (1) 00-05 (1)*
McMurdo Sound, Antarctica	*Nil*	*Nil*	17-19 (1) 19-22 (2) 22-00 (1)	00-04 (1)

Time Zones: CDT & MDT (24-Hour Time)
CENTRAL USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	*Nil*	16-18 (1)	06-08 (1) 08-11 (2) 11-15 (1) 15-17 (2) 17-19 (3) 19-20 (2) 20-22 (1)	20-22 (1) 22-00 (2) 00-02 (1) 21-00 (1)*
Northern Europe & European USSR	*Nil*	*Nil*	05-07 (1) 07-09 (2) 09-15 (1) 15-17 (2) 17-20 (1) 20-22 (2) 22-23 (1)	20-00 (1)
Eastern Mediter-ranean & Middle East	*Nil*	*Nil*	07-09 (1) 14-16 (1) 16-18 (2) 18-20 (1) 20-22 (2) 22-23 (1)	21-00 (1)
Western Africa	*Nil*	14-16 (1)	06-08 (1) 13-15 (1) 15-17 (2) 17-18 (3) 18-19 (2) 19-21 (1)	20-00 (1) 23-01 (1)*
Eastern & Central Africa	*Nil*	*Nil*	16-18 (1) 18-20 (2) 20-22 (1)	20-23 (1)
Southern Africa	*Nil*	10-12 (1)	14-16 (1) 20-22 (1) 22-00 (2) 00-02 (1)	21-23 (1) 23-00 (2) 00-01 (1) 23-01 (1)*
Central & South Asia	*Nil*	*Nil*	09-11 (1) 18-20 (1) 20-22 (2) 22-00 (1)	*Nil*
Southeast Asia	*Nil*	20-22 (1)	08-10 (1) 20-21 (1) 21-23 (2) 23-00 (1)	*Nil*
Far East	*Nil*	20-22 (1)	07-08 (1) 08-11 (2) 11-21 (1) 21-23 (2) 23-01 (1)	04-07 (1)

SUBSCRIBE TODAY
SEE PAGE 76

South Pacific & New Zealand	*Nil*	15-19 (1) 19-21 (2) 21-22 (1)	17-19 (1) 19-22 (2) 22-00 (3) 00-04 (2) 04-07 (1) 07-09 (2) 09-12 (1)	01-03 (1) 03-04 (2) 04-06 (3) 06-07 (2) 07-08 (1) 01-04 (1)* 04-05 (2)* 05-06 (1)*
Austral-asia	*Nil*	16-18 (1) 20-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-17 (1) 20-22 (1) 22-00 (3) 00-02 (2) 02-04 (1)	01-03 (1) 03-06 (2) 06-07 (1) 03-06 (1)*
Central America & Northern Countries Of South America	15-18 (1)	11-14 (1) 14-15 (2) 15-16 (3) 16-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	05-06 (1) 06-07 (3) 07-10 (4) 10-12 (3) 12-16 (2) 16-18 (3) 18-20 (4) 20-22 (3) 22-00 (2) 00-01 (1)	20-22 (1) 22-00 (2) 00-02 (3) 02-04 (2) 04-06 (1) 22-00 (1)* 00-03 (2)* 03-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	14-17 (1)	08-12 (1) 12-15 (2) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-08 (2) 08-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-22 (3) 22-23 (2) 23-00 (1)	21-23 (1) 23-03 (2) 03-04 (1) 22-04 (1)*
McMurdo Sound, Antarctica	*Nil*	*Nil*	17-19 (1) 19-21 (2) 21-23 (1)	03-07 (1)

Time Zone: PDT (24-Hour Time)
WESTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western Europe & North Africa	*Nil*	*Nil*	06-07 (1) 07-08 (2) 08-14 (1) 14-18 (2) 18-20 (1) 22-00 (1)	20-23 (1)
Central & Northern Europe & European USSR	*Nil*	*Nil*	06-07 (1) 07-09 (2) 09-16 (1) 16-18 (2) 18-19 (1) 21-23 (1)	20-22 (1)
Eastern Mediter-ranean & Middle East	*Nil*	*Nil*	06-08 (1) 15-17 (1) 20-21 (1) 21-22 (2) 22-23 (1)	*Nil*
Western Africa	*Nil*	10-14 (1)	07-09 (1) 15-17 (1) 17-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	21-00 (1)
Eastern & Central Africa	*Nil*	*Nil*	15-17 (1) 17-19 (2) 19-20 (1)	*Nil*
Southern Africa	*Nil*	*Nil*	06-08 (1) 15-17 (1) 22-00 (1)	20-21 (1) 21-22 (2) 22-23 (1) 20-22 (1)*
Central & South Asia	*Nil*	*Nil*	07-08 (1) 08-10 (2) 10-11 (1) 18-20 (1) 20-22 (2) 22-23 (1)	*Nil*

[*Continued on page 65*]

SURPLUS sidelights

BY GORDON ELIOT WHITE*

I get quite a bit of mail from readers—I regret I cannot always answer it as quickly as I would like—but it is interesting to hear from you, and I get a lot of ideas, as well as suggestions about the column. Most of the mail involves questions about surplus, and this month I will run down some of the most frequently asked questions, and my answers.

Tom Nelson, of Maple Grove, Minnesota, writes that he desperately needs an operating manual for the AN/ARC-65 transceiver. He relates that he has written almost every possible source, without results.

This is undoubtedly question Number One: where can I find a manual? My first response is to refer the questioner to one of two people who deal in surplus literature, Sam Consalvo, 7218 Roanne Dr., Oxon Hill, Maryland, 20021, or Al Yascavage, Quaker Electronics, Hunlock Creek, Pennsylvania, 18621. These two gentlemen are reliable sources for most of the technical manuals that are available on surplus. If they don't have it, it's probably not to be found.

I recommend sending a self-addressed stamped envelope with a query to either Sam or Al.

My personal library of manuals is not for sale, but as a last resort I can make copies of a few pages if there is no other source for the data that you need. This is not the easiest thing to do—I have no Xerox machine of my own—so I have to charge 25¢ per page copied, and I ask that you try other sources first, since I'm not set up to reprint technical manuals wholesale.

Another question I often get is roughly this ". . . I have a surplus T-278/U transmitter which I would like to convert to a 2-meter amateur rig. Can you tell me if there are any diagrams, instructions, etc., available to help me with this project . . . Also, what is your opinion of this transmitter converted to amateur use?"

The T-278/U is part of a taxi-type transceiver, used by military police and security troops. It is not a combat-type set. It is a 25 watt f.m. system, in the 152-174 mHz band. Power was supplied from a 12 or 24 volt battery, and associated equipment included a receiver, R-394/U, dynamotor DY-93, 98 or 100; PP-867 or 868 power supply, controls, speakers, etc. Althogether is was known as AN/VRC-19.

The R-394/U receiver has generally been converted to amateur use, or to police and fire department monitoring, but I have no data on using the transmitter. It should be a case of changing crystals and re-aligning the set, plus whatever re-wiring is needed to make it operate in a amateur system.

I have never done this conversion myself, nor do I find anything in the amateur magazines on it. Therefore I don't have an opinion on it, except to observe that it has been common in the surplus market for a number of years, but has not attracted much attention. Either it is not very attractive as a conversion piece, or it's a real "sleeper." I think its miniaturized construction makes it a hard item to re-work, and its low power is no real attraction either except possibly for mobile work.

Another sort of question goes like this: "I am looking for three special inductors, marked S-87654. Can you help me to locate them?"

This is needle in the haystack stuff. Unless you can find the mark of a currently-active manufacturer, preferably with his part number, you are probably out of luck. There were literally millions of special electronic components manufactured over the last 30 years, and many have the part number of the circuit in which they were used, such as V-27 on a tube socket. This is no help at all in locating a replacement, and I can't help either except to say, keep looking in surplus houses, and show whatever-it-is to knowledgeable people in electronics parts houses, you may get lucky.

I am often asked if the non-Collins built R-390 and 390A receivers are inferior to those made by Collins. Generally my personal opinion is that the Motorola 390 type receivers are as good as Collins own, particularly since they *do* contain the patented Collins permeability-tuned oscillator. Other manufacturers generally have bought the Collins PTO rather than try to build their own, to meet mil specs.

There have been some R-390-A's built in the last few years that did not meet military requirements, but as a general rule I would say that if you can give the receiver even a cursory bench test, you can assure yourself of getting a reasonably good set. Try the receiver on WWV, and see how good the re-set accuracy is, how accurate the dial calibration, and how great the drift. Remember that even Collins' best required calibration from an internal crystal oscillator, band by band. Initial warm-up is likely to cause even a Collins to drift. After a half hour though, drift should nearly cease, and there should be no "jumps" in frequency. As important, I think, is the smoothness of the tuning gear train. If you have trouble there, even a Collins receiver will be hard to find parts for.

All bands should be checked for operation,

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since 390's are known for an occasional dead band, and noise in the band switch that is hard to run down.

My advice: get a good 390, without worrying whether Collins or Motorola assembled it. Other builders made some good sets, but check before you buy. Also, I know of no foolproof way to tell a Collins 390 from another brand unless you have the genuine Collins on hand to compare it to. Nameplates are easily changed.

I am also asked about the Hammarlund SP-600. As far as I know, Hammarlund is still in business in North Carolina, but I do not have an address for them. I don't know where you can get the extra-deep cabinet the SP-600 requires.

The AN/FRR-59 (AN-WRR-2) general-coverage synthesized receiver is a late-model military set replacing the R-390-A. It is a good unit, but still is rare and very expensive. After I wrote them up in the column in March 1973, the *CQ* advertiser who had them was very quickly sold out.

The R-392 was also written up here (Nov. 1974).

There is still quite a bit of interest in very low frequency work, and I can best refer readers to this column for April 1967 p. 88, when I did a round-up of v.l.f. equipment. There has not been much along in the last seven years, so the 1968 column is still valid.

Generally, for schematics on Surplus electronics, I can best refer readers to the *CQ* publication *Surplus Schematics Handbook,* (no longer available from *CQ*) and for conversion of specific equipment, to *CQ's Surplus Conversion Handbook,* which is available from Cowan Publishing Co., 14 Vanderventer Ave., Port Washington, L.I. New York 11050. ■

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Propagation [*from page 62*]

Southeast Asia	*Nil*	15-17 (1) 20-22 (1)	07-09 (1) 09-11 (2) 11-12 (1) 21-23 (1) 23-00 (2) 00-02 (1)	03-07 (1)
Far East	*Nil*	16-17 (1) 20-21 (1)	07-08 (1) 08-10 (2) 10-13 (1) 20-23 (1) 23-02 (2) 02-03 (1)	02-03 (1) 03-05 (2) 05-07 (1) 03-05 (1)*
South Pacific & New Zealand	*Nil*	12-14 (1) 14-17 (2) 17-20 (3) 20-21 (2) 21-22 (1)	02-06 (1) 06-09 (2) 09-11 (1) 17-20 (1) 20-22 (2) 22-00 (4) 00-02 (2)	00-02 (1) 02-05 (3) 05-07 (2) 07-08 (1) 00-02 (1)* 02-05 (2)* 05-07 (1)*
Austral-asia	*Nil*	16-19 (1) 19-21 (2) 21-22 (1)	19-21 (1) 21-23 (2) 23-01 (3) 01-02 (2) 02-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (1)	00-02 (1) 02-04 (2) 04-06 (3) 06-07 (2) 07-08 (1) 04-05 (1)* 05-06 (2)* 06-07 (1)*
Central America & Northern Countries Of South America	15-18 (1)	10-13 (1) 13-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (1)	05-07-(1) 07-09 (3) 09-11 (2) 11-14 (1) 14-16 (2) 16-18 (3) 18-21 (4) 21-22 (3) 22-23 (2) 23-02 (1)	20-22 (1) 22-00 (2) 00-02 (3) 02-04 (2) 04-05 (1) 21-23 (1)* 23-02 (2)* 02-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	14-16 (1)	10-12 (1) 12-13 (2) 13-14 (3) 14-16 (4) 16-17 (2) 17-18 (1)	04-08 (1) 14-16 (1) 16-18 (2) 18-20 (4) 20-22 (3) 22-23 (2) 23-00 (1)	21-23 (1) 23-02 (2) 02-04 (1) 22-02 (1)*
McMurdo Sound, Antarctica	*Nil*	*Nil*	17-19 (1) 19-21 (2) 21-23 (1)	22-00 (1) 03-06 (1)

Awards [*from page 59*]

4. The Award is *free of charge*.
5. No band or mode endorsements are available.
6. Only one mobile or portable Bermuda station can be included in any application for the award.
7. All contacts must be made from the same QTH or, if the applicant has moved, from within a 25 mile radius of the first contact.
8. *All nine QSL cards* must be submitted to: The Awards Manager, P.O. Box 275, Hamilton 5, Bermuda.

BARA Certificate: Rules and photograph of this award appeared on page 66, *CQ* July 1974. It is issued by the Binghamton ARA, of Binghamton, N.Y. Requests for schedules with the club station W2OW should be sent to BARA president, Phillip Horan, WA2IKO, 4 Nebraska Avenue, Endwell, N.Y. 13760.

The MZS Achievement Certificate: Issued for proof of working one MZS call in each of the 10 call areas of the continental U.S. Any U.S. call that has a suffix of MZS and any date, will help you qualify for this award. There is no charge, send the 10 QSLs to either WA9MZS, 8041 N. Hamlin, Skokie, Illinois 60076 or W8MZS, 20243 Yacama Road, Detroit, Mich., 48203. One can make a good start on this award by checking into the Midwest Amateur Radio Service on 7258, where 3 MZS stations frequent.

North Carolina Six Meter Association Award: The N.C. Six Meter Association was formed to encourage more use of the six meter band. This Award is issued for working five members of the North Carolina Six Meter Assoc. after September 1, 1974. Send log data showing the five calls, date worked and member number with one dollar ($1.00) to: Ken MacNeilage, 191 Biesecker Road, Lexington, N.C. 27292.

Notes

Ran out of space, but want to remind you to be sure to make your reservations for the big annual ICHN/MARAC National Convention July 4th weekend! How was your month? 73, Ed., W2GT.

Novice [*from page 51*]

UT (6:00 A.M., EST). All are invited.

Hans, WP4EBQ, P.O. Box. 524, San Juan, Puerto Rico 00902, is also licensed as **VP2VCN** in the British Virgin Islands. During May and June, he was operating from his Motor Yacht "Joyce" moored off Virgin Gorda, BVI, working phone on 20 and 40 meters and code in the Novice bands. We hope you worked him and that he gets the news to us in time to get a notice in the column before his next DX-pedition . . . **Rich Kuslan, WN1UAW,** 11 Curry Road, Hamden, Conn. 06517, has worked 43 states and 15 countries in 10 weeks on the air using a 40-foot vertical antenna. Rich is very proud of his dad, WA1UBI earning his General ticket the other day. The fact that they are now going to put up a tri-band beam has nothing to do with his pride. Anyway, Rich's code speed is over 25 w.p.m., and he is going for his General or Advanced ticket this summer. Oh, yes! Rich just had his first encounter with the "DX Hogs" that never quit calling. He worked an HV3 (Vatican City) but never did get his report and fiinally lost the station in the interference of other stations calling all the time the HV3 was transmitting!

Remember. The NOVICE SHACK is your column. Send your "News And Views," pictures and suggestions to the address on the first page of the column, and we will do the rest. You do not have to be a Novice to appear; just have something of interest to the young of heart.

73, Herb, W9EGQ

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Math's Notes [*from page 49*]

RT-70/GRC used in good condition with all tubes	$22.95
Handset H-33/PT with attached plug for the RT-70	5.95
Mating power connector	2.50
Instruction Manual TM11-290	5.00

We will be happy to supply exact conversion details after we have modified our unit along the lines indicated if we have enough interest and are most anxious to hear from other amateurs who either have or are planning to do a more elaborate conversion on this unit.

73, Irv, WA2NDM

QRP [*from page 46*]

one weekend with the HW-7. I also plan to take it to VP2M land in a few weeks and operate from VP2MHK." . . . **Duane E. Gardner, WN3TPN,** 467 Lois Drive, Pittsburgh PA 15236: "First of all, I have been working on WAS since receiving my Novice Ticket a year ago and had 44 states confirmed inside of three months with the exception of RI. I borrowed a TenTec Power Mite 5 watt transceiver from a friend while my HW-16 was down for repairs and within a week I'd added RI to the confirmed list. I have made many long distance contacts and have had some fine QSO's with hams in TX, FLA, WIS, etc., with 589 and 599 reports with just five watts, which is as well as I do with the 75 watt HW-16. I use an inverted V and just last night had a great QSO with another Novice in TX (a QRPp'r also, by the way) for almost an hour on 40m. Seems that when I tell a contact that I am using a QRPp rig, I get a 'hi hi' and sure enough he is also, only usually with less "watt-power" than me. Very interesting. How can you tell a QRPp rig from a QRO rig? Nuff said from this end. Keep up the good work."

Other Tidbits

The QRPp Net (3540 kHz, Tuesdays, 2200 EST) has been going quite well. On quiet nights we've been getting up to a dozen checkins with contacts all over. Probably 80 will be dead by the time this appears in print. As noted last month, let's go to 20 meters (Saturdays, 1600Z, 14065 kHz).

A QRPp Club is now underway in England. Write to G. C. Dobbs, G3RJV, 61 Park St., Cleethorpes, S, Humberside, England, for details. Membership open world-wide.

The QRPp WAS and DXCC standings can be found elsewhere. I want to thank all of you who have submitted your standings so that we can present a broad picture of QRPp activity. Till next time, have a good Field Day and drop your entries for the Milliwatt Field Day Trophy to me (copy of ARRL entry form, description of rig and power, check-sheet).

73, Ade, K8EEG

Antennas [*from page 43*]

dip meter. Then, with the feedline removed, adjust the loading coils until the antenna dips where you want it. This entails a bit of fiddling around. However, the 1975 edition of the ARRL *Antenna Book* (13th edition), page 212 has a very handy chart for loading coils which gets you in the ball-park. I followed their information, made the coils about 5 turns too big, and then proceeded to trim the coils, grid-dipping the antenna until I was just about where I wanted to be. Then I raised the antenna in the air, ran an s.w.r. curve on it, and trimmed the coils a fraction of a turn. I found that removing a single turn from each coil changed the 80 meter resonant frequency about 50 kHz, and trimming an inch from each end of the antenna changed the resonant frequency about 10 kHz.

"But you are stuck with the narrow bandwidth no matter what you do. Even so, an operational range of 40 kHz is still enough to work plenty of stations. I centered my antenna at 3.8 MHz."

"Well, since you pre-cut your antenna at home, how did it work in Hawaii?" asked Pendergast.

"Plenty good," I replied. "I worked 6W8DY in Senegal on 80 meter s.s.b. with the antenna mounted in the apartment, using my transceiver. I don't know who was more surprised, the 6W8 or myself! And from KH6 to 6W8 is a *long, long way on any band!*"

"Congratulations," said Pendergast. "That proves the old saying. DX is 90% operator and 10% antenna."

"Thanks," I said. "I guess that's a compliment." ■

[EDITOR'S NOTE: More on this interesting antenna next month.

Power Limits [*from page 39*]

There will, of course, be those who will obtain a few more watts and minimize short tube life by reducing filament power during stand-by, and increasing filament power during r.f. drive conditions, or increasing plate voltage, to maximize plate efficiencies. But, as the old saying goes, "you can't get something for nothing," and equipment and tube manufacturers can tell upon inspection if their product has been abused. One or two db would not be worth the effort.

Presently it is very difficult, if not impossible, for the FCC to monitor and police amateur power limits. By using this technique, if an amateur amplifier were hooked up and using

tubes which had manufacturer's filament ratings in excess of the maximum wattages specified, then the FCC's job would be made infinitely simpler in its policing efforts. It would be a simple black or white infringement of the rules. ■

CQ Reviews EBC-144 Jr. [*from page 37*]

operate outside the band if you are not careful. Double-check your switch settings when you first begin to operate the rig! After a few days, this will become second nature.

Even with a few short-comings, this radio is, in the opinion of this writer, the most important single piece of v.h.f. equipment to enter the amateur radio scene in many years. It will be the forerunner of an entire new class of sophisticated radios which will reflect the constantly advancing state of the art. The EBC-144 JR. will furnish a fine target for the other manufacturers to shoot at. I wish them all the best luck. The only question that I have left is this . . . what will EBC do for an encore?

—W2JUP

QRM [*from page 26*]

3 el. beam certainly helped me a lot! ! See you all next year. Please tell me who has the top Novice record all-time and how many points . . . *WN2SJG*. 15 was a very dependable band to Pacific. Wish I had not had to work all weekend, think I could have run up a good score. Conditions better for c.w. test than fone test . . . *WA4OSM*. 15 put on a great show for the contest Saturday afternoon . . . *WA2LJM*. Bad weekend for me, signals were great but had to go to a funeral out of town on Saturday which shot that day completely and had company part of Sunday . . . *KØARS*. All those KH6's sure sounded like KS6's! . . . *WBØLTD*. No activity from zone 34; missed 4 here — but know JT1KAA, VS6DO and 9M2CX—zones 23, 24 and 28 respectively were on okay . . . *W4AAV*. Move it back to Thanksgiving! On second thought, don't! . . . *W9KNI*. Only 7½ hours of operation before linear transformer cratered . . . *W5WZQ*. Good conditions to JA Saturday morning . . . *WA4APG*. Not much time to operate. Maybe you can use log anyway for check . . . *W8CNL*. Good scores could be gotten on 80 if there was more activity from the rest of the world in general because propagation was good. How about an 80 m. contest like ARRL's 10 m. contest? . . . *W7KAR*. A steady S7 power line noise sure hurt with the weak ones . . . *VE3DXV/W6*. Total it for club total only . . . *W5LUJ*. First night great—had visions of some kind of record in the making (Hi). Second night—local thunderstorms all night long (sob!!) . . . *W5RTQ*. No openings to Europe or Africa this year. Very poor conditions, but lots of fun. Also note a big decrease in operating skills. DX unable to handle pileups . . . *W7JLU*. Disappointed in lack of activity—especially Saturday night . . . *K2TXC*. A few hours well spent . . . *K6NA*. Must study and get extra—really difficult above 3.25 on 80m . . . *WB8EUN*. A pleasure to get into this test after so many years. Was absent due to Thanksgiving previously. How about alternating c.w. first, phone second, etc., each year? . . . *W9DY*. Biggest Thrill: Working three new countries—ST2AY, OD5IQ and DJ8QT/CT3 to bring my total to *122 countries* on 160! The exceptional 160 meter band opening to EU/AF on Sunday morning allowing QSO's in rapid succession, like having a "pipe-line" from here to there!! Fine operators and nice guys on for the test. 160 is "still a gentleman's band!!" Thanks for running such a nice contest . . . *W1BB*. Will be quite surprised if the FY7 proves legit . . . *K5JVF*. Nuts . . . *WA7OAU*. Hope I never have to turn another beam by hand again . . . *W5KFL*. Won Worth Township (both modes now that W3GPE has moved 30 miles away . . . *W3FRY*. Sure is frustrating hearing them so loud on 160 and not be able to work them . . . *W3WJD*.

Operators [*from page 32*]

OK1KRQ: OK1IAM, OK1IVJ, OK1IAV. **OK3KGQ:** OK3-2351, OK3ZAD. **OK3KTY:** OK3ZFB, OK3ZGA. **OK1KCD:** OK1-AWF, PO-8523. **OK3KAG:** OK3CIR, OK3YBD, OK3ZFM, OK3ZAF. **OK1KCF:** OK1KZ, OK1XC. **OK2KOO:** OK2BIP, OK3TBC. **OK3KJX:** OK3EQ, OL8CDQ. **OK1KTL:** OK1OA, OK1AWC, OK1AQT, OK1FCA, OK1AZO, OK1SB, OK1-ATW, OK1TY, OK1APS. **OK2KYK:** OK2PBM, OK2BGH. **OK3KPN:** OK3CJN, OK3ZMJ, OLØCBX. **OK1OFX:** OK1MX, Et. Al. **ON4UB:** ON5MF, ON6VL, ON6MH, ON6QR. **ON5-KH** & ON6HE, ON5UQ, ON5CY, ON6KD, ON5JE, ON6MD. **OY6FRA:** OY2H, OY2J, OY3B, OY3H, OY5NS, OY7YD, OY7M. **LZ2KDP:** LZ1GX, LZ1-F-3Z, LZ-2-H-5Z, LZ1-A-513, LZ1-A-584, Palm Stan. **LZ1KBU:** Hazlov, Sekezly. **LZ1KCP:** Vatev, Slavchev. **LZ2KDI:** Atanas, Tribondy, Muhsin, Jordanov. **LZ2KEF:** Wasilev, Penchev, Marinov. **LZ2KWD:** Georgiev, Georgiev. **LZ2KHM:** Pesvnov, Petrov, Ivanov. **LZ2KAD:** Nerov, Mihailov, Runtchev, Stefenoff. **PA9AEH:** & PAØPN, PA0ABM, PA0INA. **PI1PT:** Van Kessel, Kokee. **PY1EMM:** PY1TC, PY2GRO, PY1ZBJ. **SK2DR:** SM2EKM, SM2CEW. **SK2AU:** SM2DQS, SM2BJE. **SK6BA:** SM6CKU, SM6DHU, SM6EVE, SM6FYJ. **SM5AOE** & SM6BJI, SM5-CZT. **SMØBDS:** SMØGBB, SMØPX. **SP1KBK:** SP1AEN, Zakrzewski. **SP2KDT:** SP2GUB, SP2HMY. **SP2ZHB:** SP2-GRT, SP2HJL. SP2BNF, Pasikowski. **SP5KMB:** SP5FTH, SP5GEV. **SP9PBN:** SP9HZV, SP9GFY, SP9GTR. **SQ4PBI:** SQ4FAL, SQ4FAO, SQ4ELO, **SQ3PTE:** SQ3FLR, SO3HRN. **SQ5PSL:** SP8GNF, SQ7DQN/5, SP3HBW, SP8GAZ. **SQ9-KRT:** SP9HMF, SP9FKQ, SP9ZW. **SQ9KGC:** SP9CUX Et. Al. **UK4HAW** & UA4IU, UA4HAL, UA4HBR. **UK9FER:** UA9-FAJ, UV9FN, UA9FDW, UA9140005. **VK5NO** & Son. **WA1-NRV. WA1UBC** & WA1JSD, WA1LNH. **W2YD** & W2BHM, W2HZY, WA2SRQ. **WB2SQN** & K2KUR. **W2REH** & W2-HHB. **W3BWZ** & W3NL, WA3NGS, K4CFB. **K4GSU** & K4FU, K4KSC, W8FAW, WA8YVR. **K4VX** & WB4SGV. **K4UT** & W4LCP, K4THA. **W4QCW** & WA4QOC, WA8-ZDT. **K4YFQ** & WA4BTC W9JK. **W4OZF** & WA4BTR. **WA4-ZHB:** WA4FCT, WB4HYN, W9QVY, WØPBI. **WB4EMF** & WB4KSS. **K4FW** & W9NN. **W4MII** & WB2QHB, WA6PAQ, K5WTA. **WB4HQE** & WB4FDT. **WA5LES** & W5ARJ W5VQ, K5PFL, WA5WCT. **WA5RXT** & WB5JJE. **W6KG** & W6DOD. **W1ARR/6** & WA6GMR. **K6HIH** & K6AUC. **W7NQ:** W7CFJ, W7JST, WA7VEN. **W7DAZ** & WB7UQV, WN7YPF. **W8ROF** & W8KPL, WA8EDC, WA8LYF. **W8KIT** & WB2FGA. **W8UM:** WA8GGN, WA8PVY, WA8YTL. **W9ZTD** & W9VNE, K9OTB, WB9IVC, WB9BUV. **YO3KBC:** YO3YZ, YO3JE. **YO4KCZ:** YO4HW, YO4SI, YO4ASP, YO4AVR. **YO8KAN:** YO8ME, YO8MI. **YO8KGA:** YO8DD, YO8FZ. **YO6KEW:** YO6ADM, YO6MY. **YU1BCD:** YU1NQW, YU1NZV, YU1ODO, YU1PCF, YU1QBC. **YU2ACF:** Petar, YU1NVT, YU2RPT. **YU2BTU:** YU2RMT Et. Al. **YU2BOP:** YU2ZP Et. Al. **YU2CBM:** Koljatic, Skoko, Grubisic. **YU2CBV:** YU2RKE, YU2RTG. Zeljko, YU2RPY. **ZF1AL** & ZF1CN. **4M5ANT** & YV5AAS, YV5BNR, YV5BZT. **4U1ITU:** HB9AXK, HB9AZD. **4Z4IX** & 4Z4DZ, 4X4WN.

Multi-Operator, Multi-Transmitter

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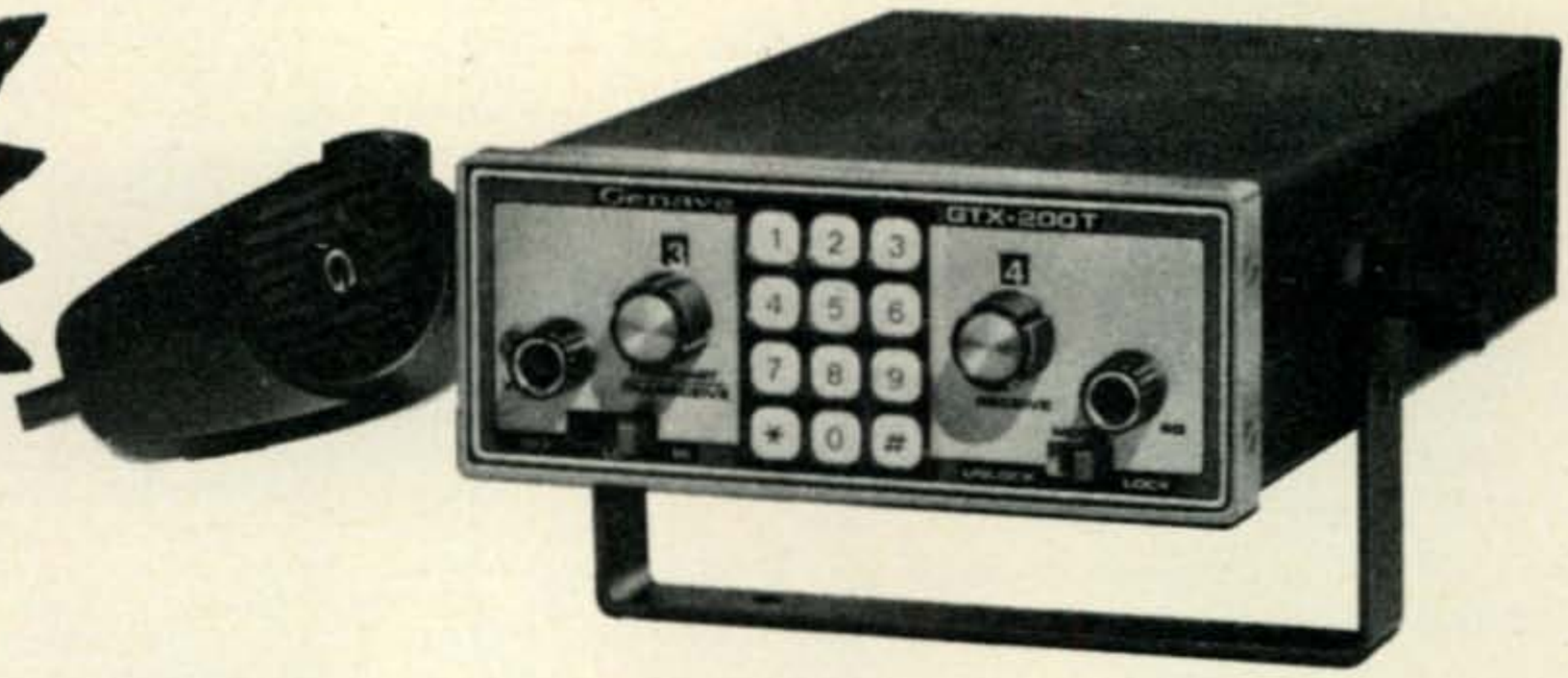

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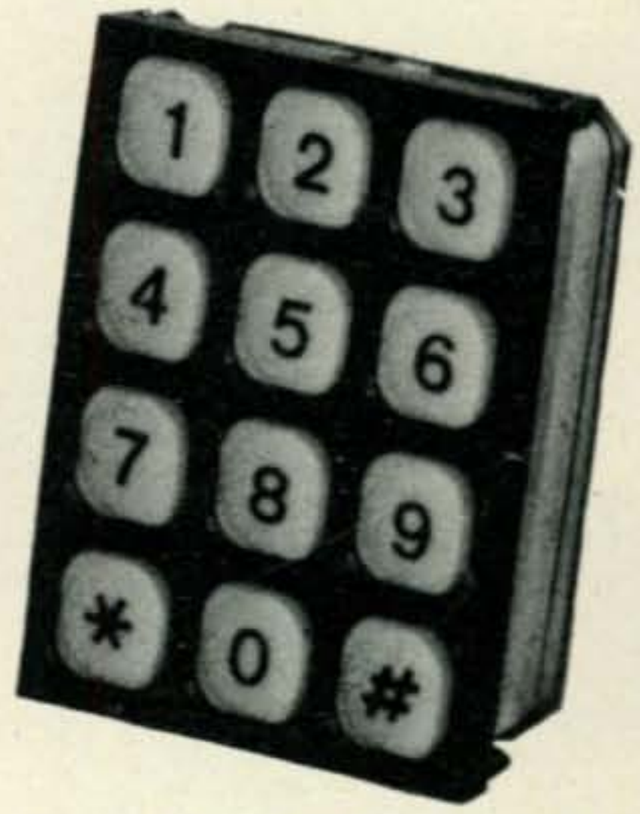

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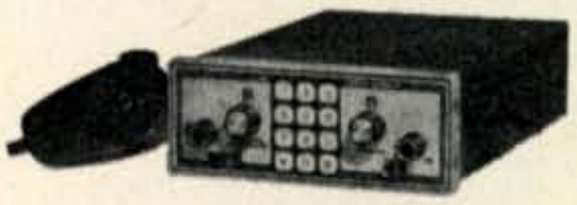
☐ 

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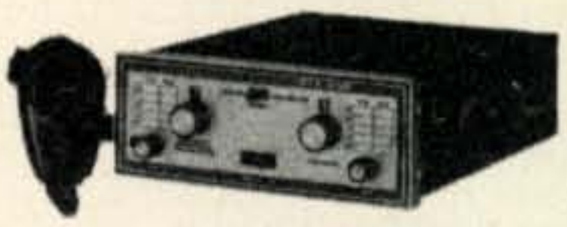
☐ 

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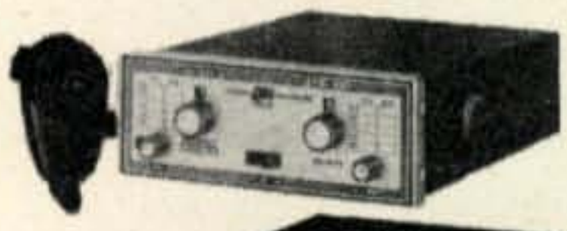
☐ 

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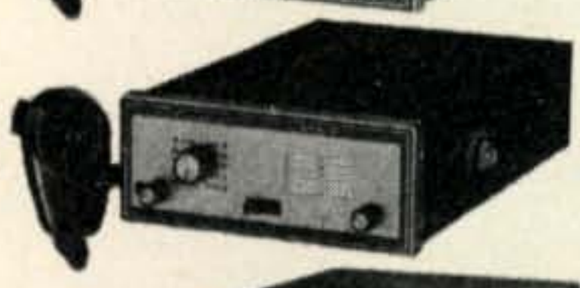
☐ 

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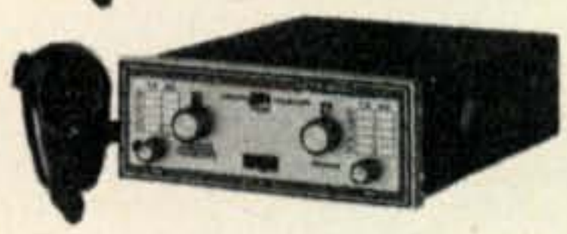
☐ 

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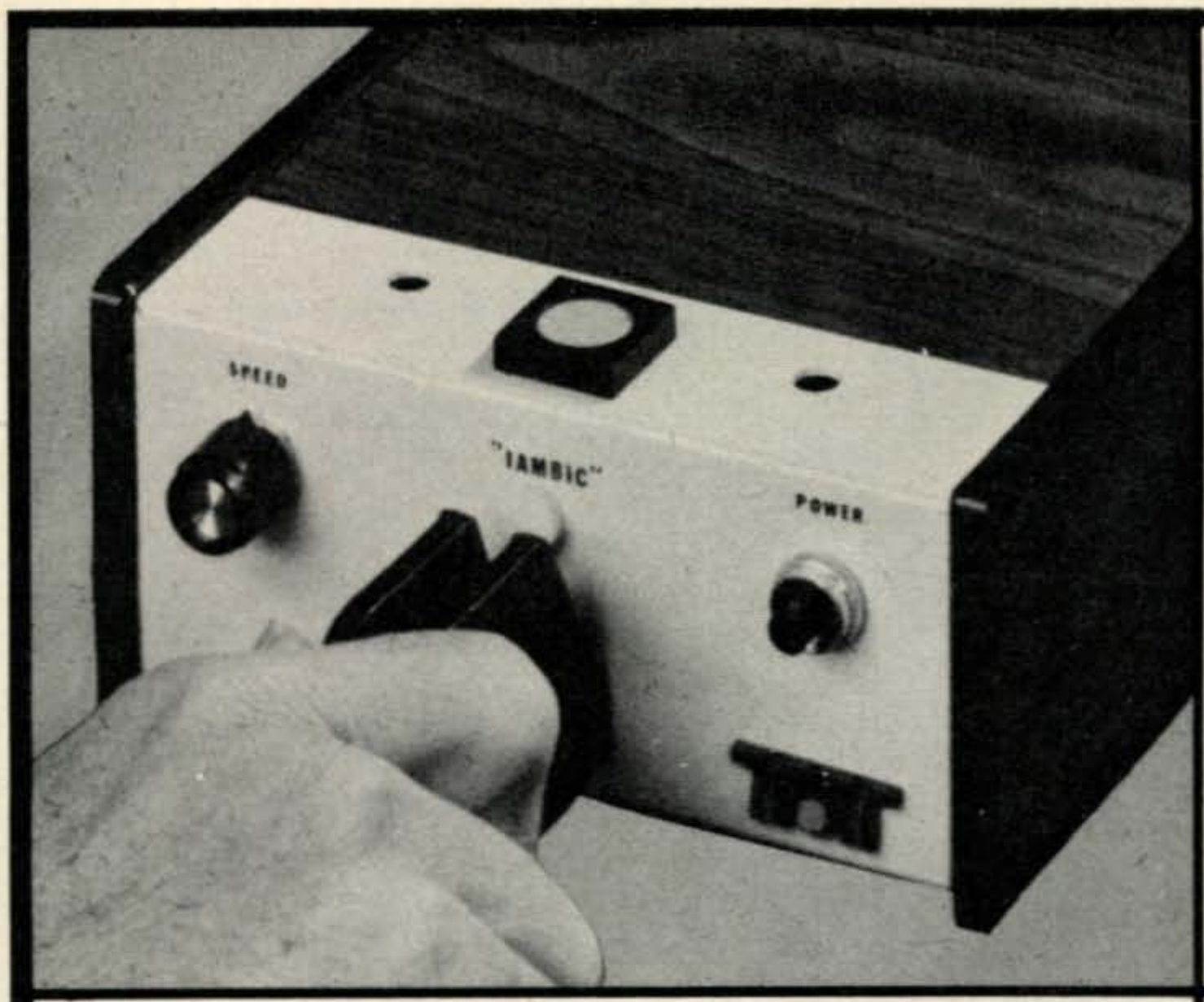

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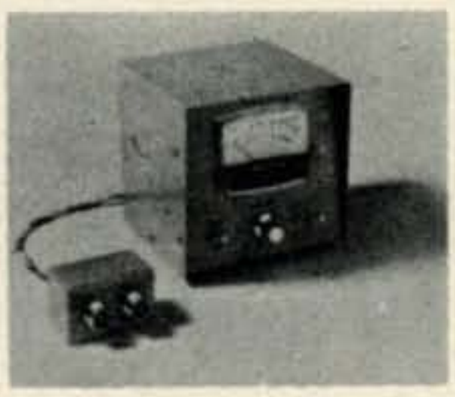

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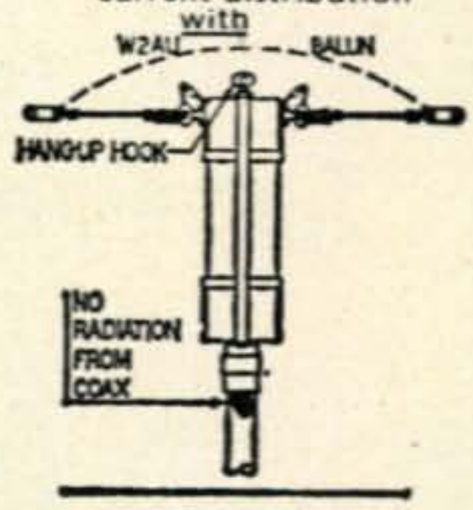

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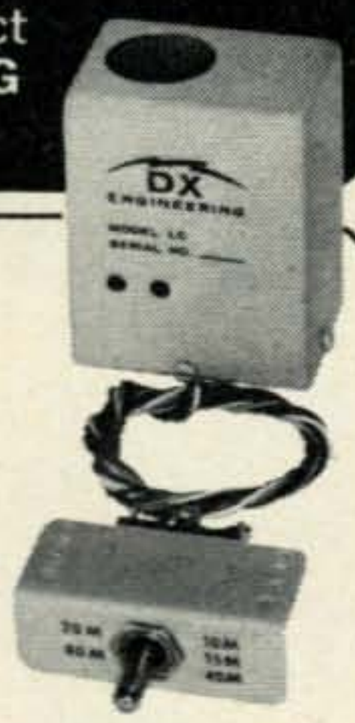

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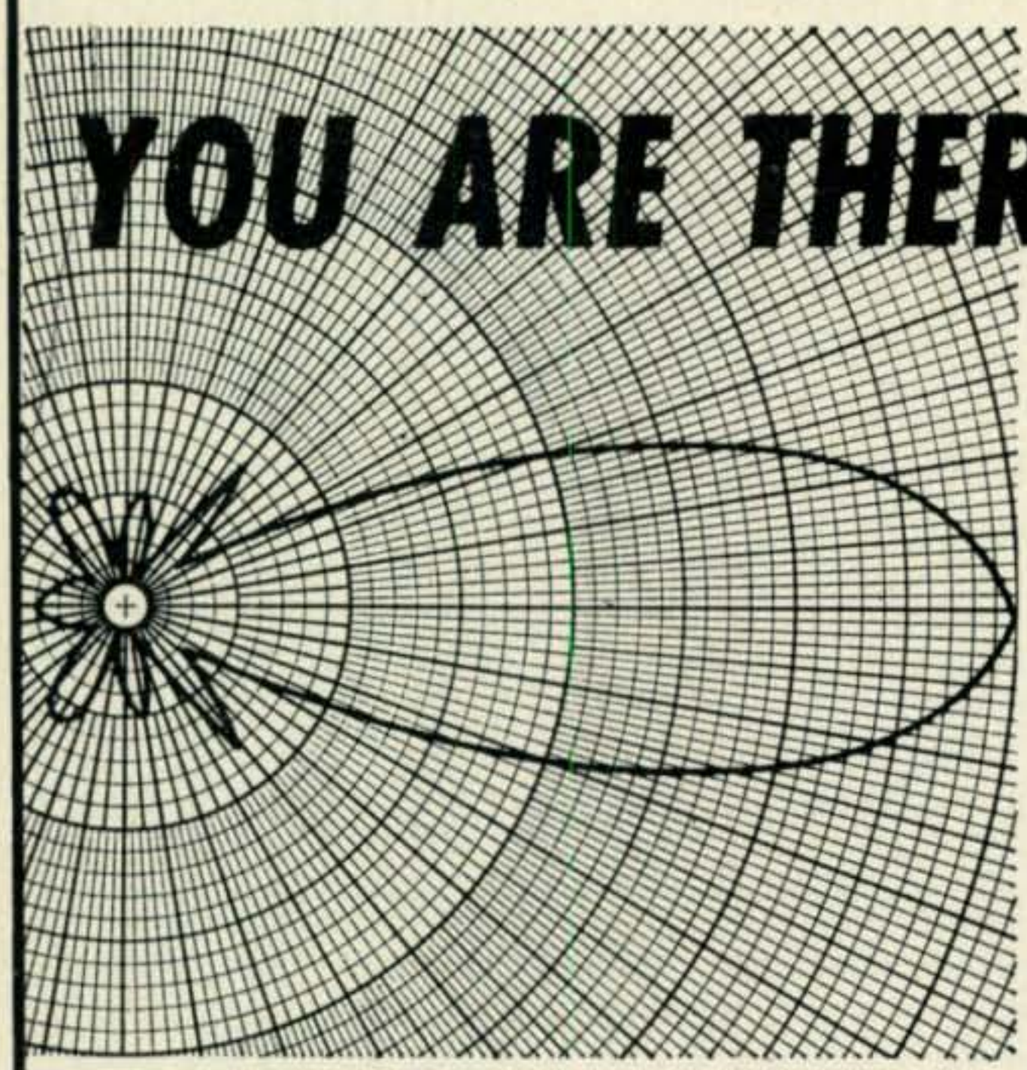

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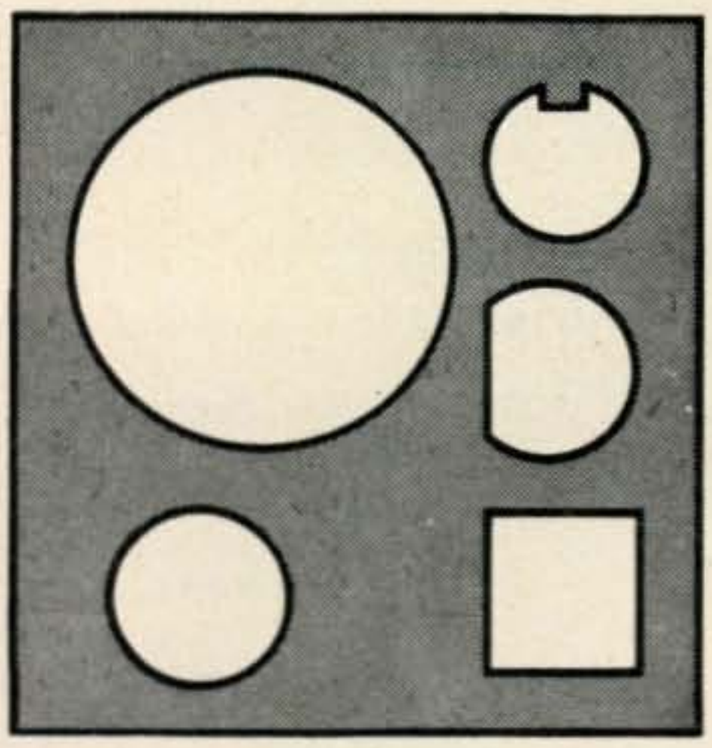

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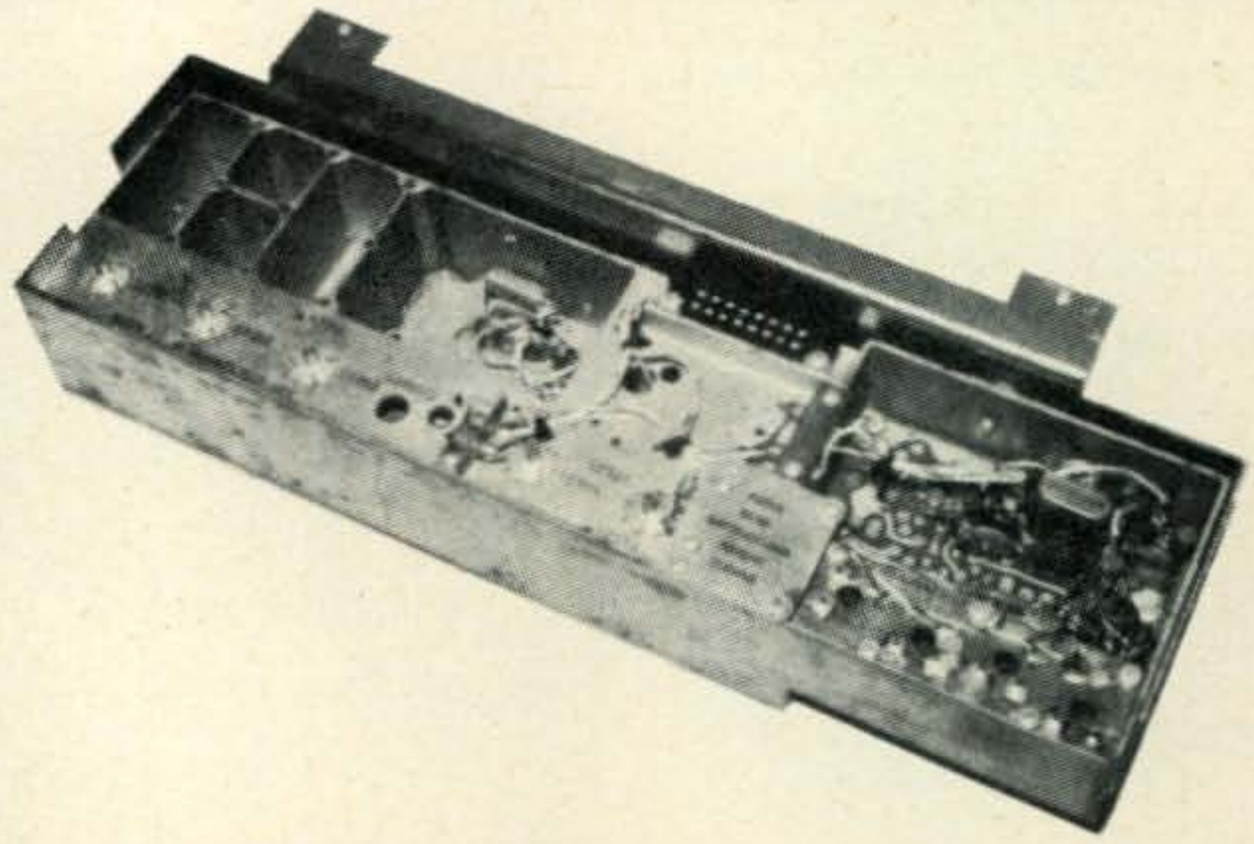

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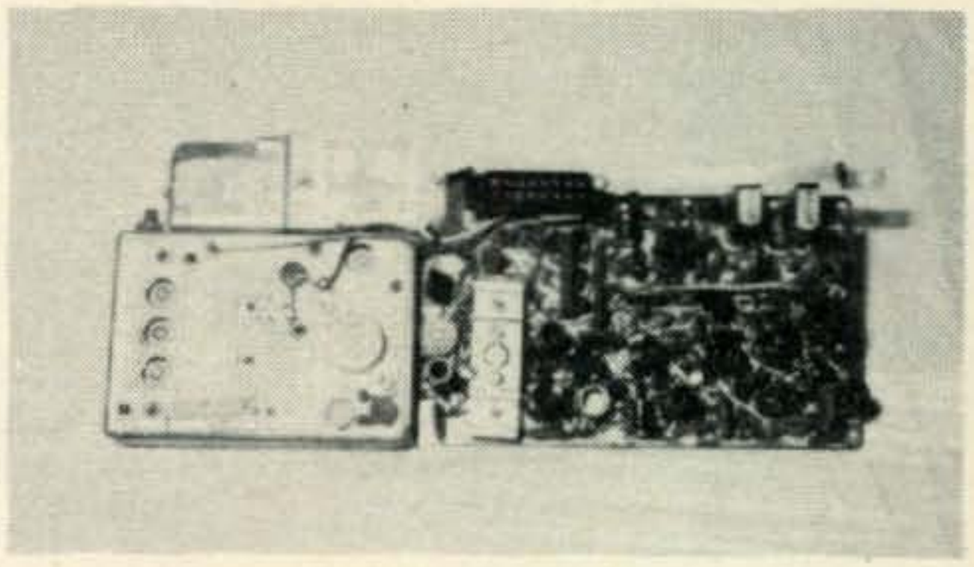

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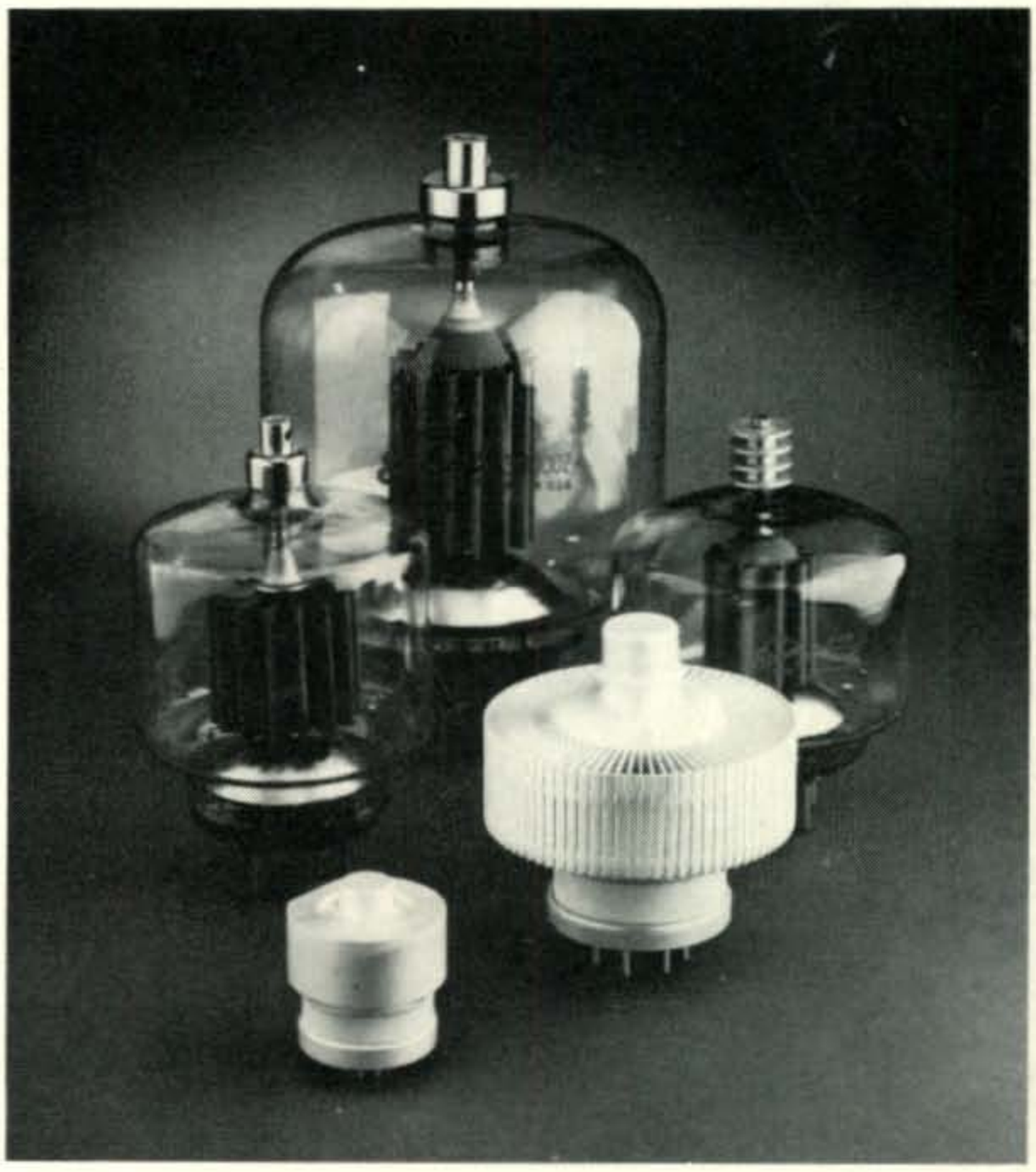

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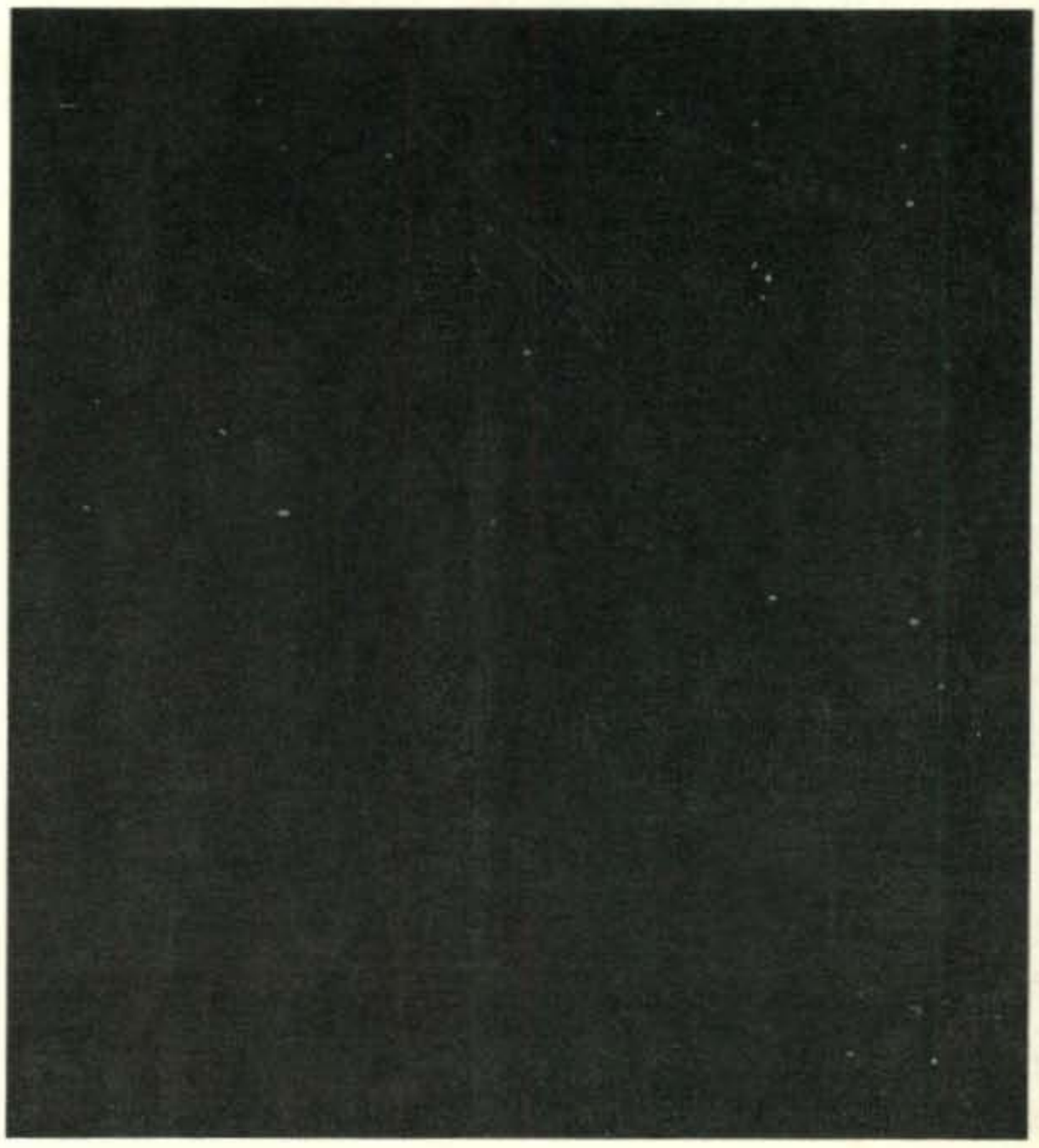

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