CQ

June 1972
$1.00

CQ Reviews the Ross & White 2-meter FM Transceiver



In this issue:

- **Build An Antique 2-Tube DX Receiver**
- **DXing from the Adriatic Islands**
- **CQ Tests the Heathkit Digital Voltmeter**

The Radio Amateur's Journal

08240

New digital readout



Provides precise readout of frequencies on all Heathkit receivers & transceivers

New Heathkit SB-650 Digital Frequency Display... another "first" from the hams at Heath.

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And talk about compatibility. The SB-650 is designed to team up with all Heathkit SB-Series Receivers and Heathkit SB- or HW-Series Multiband Transceivers. When it's in combo with a transceiver, the "650" calculates and displays both transmitted and received frequencies. To make installation easier, the SB-650 manual fully describes and illustrates all inter-connections necessary for the specific Heath gear you own.

The addition of a Digital Frequency Display will in no way degrade your station's performance — and when teamed with budget equipment, such as the Heathkit HW-101, the SB-650 can give you pinpoint tuning accuracy to rival transceivers costing hundreds of dollars more!

The all solid-state circuitry uses 35 ICs and six transistors. An IC voltage regulator protects the devices from failure due to overvoltage, a common problem with discrete regulators. A built-in memory assures non-blinking operation, and there's a special circuit to minimize last-digit jitter.

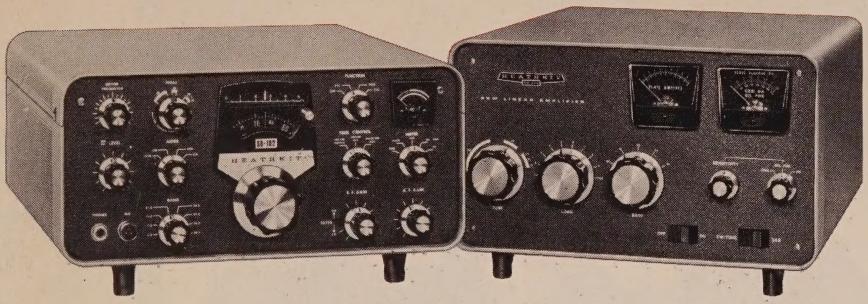
Your SB-650 assembles in just four to five hours ... because IC's and display tubes plug into sockets on the double-sided glass epoxy board. And because there are no tuned circuits, only four easy internal adjustments are needed to get your "650" peaked up and ready to go.

The SB-650 Digital Frequency Display. It's got to be one of the most "up-and-coming" pieces of ham gear ever offered. It's another trend-setting "first" you can count on... from the hams at Heath.

Kit SB-650, 9 lbs., mailable **$179.95***

SB-650 SPECIFICATIONS — Frequency Range: 3-40 MHz (80-10 meters). **Frequency Display:** 6 display tubes (kHz to 5 places, plus tenths of kHz.) **Maximum Viewing Distance:** 30 ft. **Maximum Input Signal:** 5v rms. **Accuracy:** 100 Hz ±1 count. **Compute Time:** 160 msec. **Sensitivity:** Adjustable. **Input Impedance:** 2000 ohms. **Internally Generated Spurious Frequencies:** Approx. 0.25 uV equivalent signal level. **Crystal (clock) Frequency:** 1 MHz. **Crystal Aging Rate:** Approx. 10 ppm/yr. **Ambient Crystal Stability:** Approx. 10 ppm from +10 to +65° C. **Ambient Operating Temperature:** 0°-+40° C. **Ambient Storage Temperature:** −55° to +80° C. **Power Source:** 120/240 VAC, 50/60 Hz, 10 W. **Dimensions:** 3½" H x10" W x 10" D.

meets its match in the Heathkit "Maxi-Rig"



team the new Heathkit SB-650 Digital Frequency Display with the SB-102 Transceiver and SB-220 Linear for the ultimate in computer-age communications.

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The SB-102 is the value leader because you build it yourself to save on initial investment and service. Simple circuit board/wiring harness construction gets it all together. Order your round-trip ticket to the world now — the famous Heathkit SB-102 SSB/CW Transceiver. Combine it with the new SB-650 Digital Frequency Display, shown at left, for the ultimate in positive station identification.

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Kit HP-13A, DC supply, 7 lbs. **69.95***

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JUNE, 1972 VOL. 28, NO. 6

CQ The Radio Amateur's Journal

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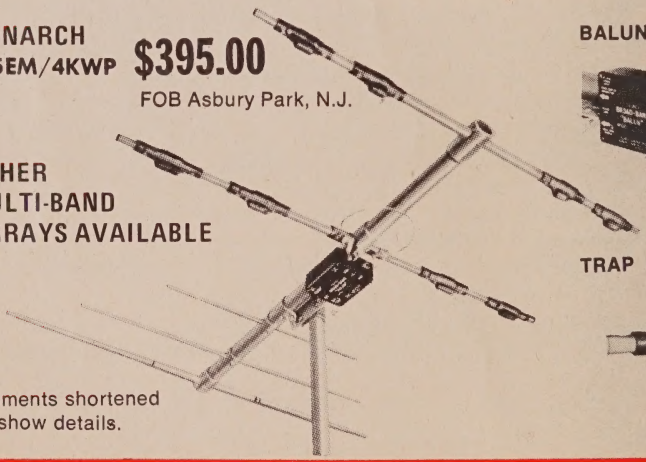
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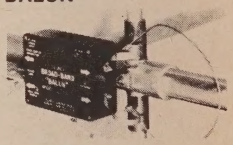
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Guest Editorial

"What's Past Is Prologue..."

An address delivered by A. Prose Walker, W4BW, Chief, Amateur and Citizens Division, Federal Communications Commission, on March 11, 1972 at the Old Timers Club Banquet of the Quarter Century Wireless Association at Gaithersburg, Maryland.

THE selection of a subject for tonight was somewhat difficult. There were three categories which seemed to fit the occasion. First I thought of talking about "The Good Old Days," but there are many of you here who know much more than I about that era . . . who can better recall the virtues of spark, the pungent smell of ozone, the blinking of the "slop jar" rectifiers, 1 mHz-wide amateur bands without much QRM. So I gave up on that one.

The next possibility seemed to be the "troublesome present." That is a subject that I probably know something about, but I have been talking about such matters recently, at Las Vegas, Dallas and Miami, and most of you know what I think about many subjects which concern amateurs today. Furthermore, your speaker on this occasion last year, Mr. Burch, talked about one of the most troublesome aspects of current problems, the interpretation of Section 97.39 of the rules, commonly known as the "Eye Bank Docket." But neither that subject nor a lot of others are yet resolved. Probably it seems to you that it will take some kind of miracle to conclude most of the pending matters. Well, I think that miracle has happened, for we now have a John Johnston with us in our division, as Chief of the Rules and Legal Branch, responsible for the resolution of pending matters.

So rather than try to further elucidate any of those, I decided to discuss the only subject left, the "questionable future."

According to an old Chinese proverb, "It is extremely difficult to prophesy, especially with respect to the future."

But there are signs and events, if properly interpreted, which may give us the jump on the natural evolution of things in amateur radio, or perhaps even guide them to a more proper conclusion. At least it might provide the opportunity for a head start; whether we take advantage of it is up to us.

In respect to the "questionable future," turn your minds, if you will, to the potential of satellite communication for amateur radio, as has already been demonstrated commercially, I know that you thrilled a couple of weeks ago to the sight and sound of our President and the events surrounding his trip to China. Last summer in Geneva, the ITU established the amateur satellite service . . . ASS . . . One of our well known pundits who is often in error but never in doubt, says that if we sit on it we are sure to lose it . . . which is generally the history of spectrum allocations . . . as it should be.

Recently, I had the opportunity of hearing some ideas on a "professional" amateur satellite from Bill Eitel, W6UF, well known to all of you as one of the founders of Eimac, and a leader in the communications industry. We didn't have much time to work out the details, but Bill's idea stimulated some additional thinking about the kind of satellite he perhaps had in mind. During the next few minutes, let's think about that satellite . . . what it might be . . . what it could do . . . the limitations that probably will be imposed on it . . . and the best way to use it, not only for amateurs but for the benefit of mankind.

I say mankind, because we shall think about something that could be beyond the normal concept of the "public interest, convenience and necessity."

All of the five OSCARS launched to date have been short-lived, low altitude, non-synchronous orbiting satellites. Those that did contain repeater/transponders or whatever you wish to call them, were available to only a small number of amateurs throughout the world . . . amateurs who had unusual competence to track the satellites and top-notch equipment for receiving and

transmitting. The people who were instrumental in building and launching them deserve a tremendous amount of credit for their pioneering achievements. Without their work, it is most unlikely that the ITU would have established the Amateur Satellite Service . . . it wasn't easy even with their achievements . . . and we didn't get everything we wanted, but at least we got our foot one inch further in the door. Let's speculate briefly about the major technical characteristics of one version of this "professional" amateur satellite (with apologies to Bill Eitel if this isn't quite what he had in mind).

One of the major objectives is that it be available over a long period of time: not just a month or 6 weeks, but a period of several years.

Predicted life of satellites today is in the order of five years, whether we could obtain that is debatable, perhaps, but it should be operable for at least a couple of years. This requirement is synonymous with a solar cell power supply, backed up by batteries.

Secondly, for the satellite to be generally available, its orbit must be such that complicated orbit prediction is not required nor complex tracking equipment necessary. Third, and this is almost a part of point two, availability to all amateurs of the world at one time or another, points to a near-geostationary satellite; one which slowly drifts around the world remaining available for periods of weeks or even months to amateurs in any particular hemisphere. This is the kind of satellite I would like to discuss . . . not a toy, but a "professional" amateur communication satellite, the limitations of which are only those imposed by cost considerations and the decision to put it into orbit.

Perhaps you are skeptical at this point. Instead of thinking about it in terms of resources, turn your thoughts around 180°. For centuries it has been true that the availability of the resource produced the decision to accomplish the objective. Within the past decade that has changed, and now it is the decision to accomplish the task which brings about the resource necessary for the job. Throughout the relatively short period of our engagements in space exploration, the decision was first made to do the job . . . then we set about providing the resource which resulted in the technology and hardware to probe the outer limits of the earth's atmosphere and beyond. This list of man's accomplishments in space is long; Explorer, Vanguard, Topside Sounders, Earth Resources Satellites, Orbiting Astronomical Observatory, Solar Observatory, Geodetic Observatory, Weather Satellites, not overlooking the series of manned flights starting with Mercury, Gemini, Apollo, and now Skylab and Shuttle.

Without denying the "fall-out" benefits from this gigantic effort, none of these endeavors have really been for the direct benefit of the common man. This may well be the shining opportunity to bring the benefits of satellite technology down to at least a segment of the population of the world through a "professional" amateur satellite. If the decision to put this kind of satellite in orbit were made by the Director of the OTP or the President of the United States, how many of you doubt that it would go up? Why not have it ready for the bicentennial celebration of our country in 1976? I hope and believe that this will come about, somehow, somewhere, in some way. I know that Bill Eitel is thinking seriously about the prospects. The technology is here . . . are the amateurs ready?

What kind of satellite is this? It must be reasonably small and lightweight, but this depends on economics. It must have enough r.f. power output and bandwidth to permit its simultaneous use by a number of amateurs. Without going "overboard" and just for discussion, let's assume that it has 20 watts output. The operating frequencies probably should be as high as possible without ruling out general participation by amateurs. Let's choose a satellite with an up-link frequency in the 435-438 mHz band and the down-link in the 144-146 mHz band. The choice of these frequencies is probably rather good because on 435-438 mHz, remember, the ITU has told us that we must have the capability of eliminating potential interference to other shared services in that band. Obviously, it is easier to prevent interference from the ground than on a satellite. On the ground we can realize substantial antenna gain at that frequency. This *could* be done on the satellite, but there are other aspects to consider. As an aside, one of the currently planned satellite experiments in conjunction with ATS-G will be using a 30 foot dish in space, having a gain of 18 dbi (Syncart).

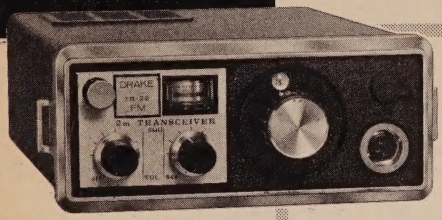
To the uninitiated, some of the terms used in space work are confusing. We don't speak of field strength in microvolts per meter, but of power flux density, dbw/m^2. The origin for this and other terms came from the field of micro-wave communication where they speak of signal levels in terms of quantities of energy (flux) per unit area. The term dbw/m^2 simply means a number

[*continued on page 88*]

Mr. Walker has advised that the arithmetic in his example is in error in that the path losses should have been about 176 db at 435 mHz and 166 db at 146 mHz. Thus the system in the example would have less capacity and/or signal-to-noise ratio than indicated. However, various configurations of ground and satellite equipment characteristics can be assumed, each giving different capabilities for an overall system. Needless to say, the example used was not intended to be used in a hardware proposal for a system.

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Land Of Electronics is offering free code and theory courses leading to an amateur license. They will be given every Wednesday evening at 8:00 at 400 South Main Street, Lombard, Illinois 60148. Anyone interested can call Phil, K9DTB, at 312-495-1234 for further information.

Chadron, Nebraska

The Pine Ridge Amateur Radio Club of Chadron, Nebraska will hold their annual Hamfest/Picnic at Chadron State Park, located 9 miles south of Chadron on Hwy. 385 Sunday, June 4, 1972. All amateurs and families welcome. Bring a covered dish and your own utensils. Soft drinks and coffee furnished. No admittance charge.

Rome, New York

The Rome Radio Club, Inc. sponsors its 20th consecutive Ham Family Day on Sunday, June 4th 1972 at Beck's Grove, 10 miles west of Rome, New York. Technical Talks and Demonstrations, V.H.F. Roundtable, Contests, Ladies and Kids programs. The Post Office Traffic Net will hold their annual meeting here and there will be a big MARS Meeting plus a Flea Market. Lots of prizes. Registration starts at 1100 with a chicken and steak dinner served at 5:00 P.M. Advance adult reservations $5.50. Children under 12 $2.00, under 6 free. At the gate . . . $.50 a ticket extra. Send your reservations to: Rome Radio Club, Inc., P.O. Box #721, Rome, N.Y. 13440.

Oglesby, Illinois

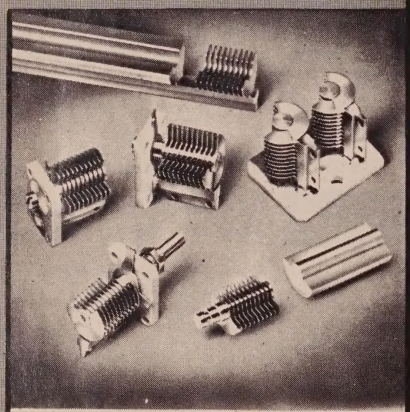
The Starved Rock Radio Club Hamfest will be held June 4th at the La Salle County 4-H Home and Picnic Area Southwest of Ottawa, Illinois, just off Illinois Route 71. Follow big Yellow Hamfest signs from the South end of the Illinois river bridge at Ottawa. Free coffee and doughnuts at 10 A.M., food available on the grounds and ample parking space. Free swap row. Advance registrations, until the deadline, May 24—$1.50. At the gate $2.00. For more information, contact SRRC, W9MKS, RFD #1, Box 171, Oglesby, Illinois, 61348.

Huntington, West Virginia

The Tri-State Amateur Radio Association will have its 10th annual Hamfest at Camden Park, Huntington, West Virginia, June 4, 1972 from 11 A.M. to 4 P.M. Activities: C.W. Contest, QSL Bulletin Board, Flea Market, Prizes for the Oldest Ham, The Youngest Ham and the Ham from Fartherest-away. Drawings for the Major prizes at 4 P.M., featuring: Drake TR 4 and Drake TR22. You do not have to be present to win major prize. Tickets are $1.25 ea. or 5 for $5.00, available, by mail from Tri-State Amateur Radio Association, P.O. Box 1295, Huntington, West Virginia 25715.

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Arlington, Virginia

On-the-air amateur radio facilities will be provided by the Chief of Naval Operations (CNO) amateur radio station, K4NAA, during the Armed Forces Communication and Electronics Association (AFCEA) convention in June. K4NAA is the official AFCEA convention amateur radio station and convention delegates with amateur radio licenses are invited to operate the Navy's amateur facilities to contact friends during the convention on June 6, 7, and 8, 1972. The K4NAA portable station will be operational from 0900 to 2200 E.D.S.T. with two available positions for c.w. and s.s.b. on the 10, 15, 20, 40 and 80 meter bands. Licensed amateurs throughout the world are invited to make contact during the AFCEA convention and a specially designed QSL card, signed by the Chief of Naval Operations, Admiral E. R. Zumwalt Jr., has been prepared and will be sent to acknowledge all contacts. The U.S. Navy and AFCEA invite all amateur radio enthusiasts to visit K4NAA on June 6, 7, and 8, 1972.

Atlanta, Georgia

The Atlanta Amateur Radio Club will hold its Annual Hamfest on the Mall at the Lenox Square Shopping Center, on June 10th and 11th. A banquet will be held Saturday night, June 10th, with entertainment. Main prizes include your choice of a Drake TR-4 transceiver with a.c. supply or a RCA Home Stereo Center. A Regency HR-2A will also be given along with a host of other fine prizes. Experts on Teletype, FM, DX and many other subjects will be present. If you are a swap-shop enthusiast, you won't want to miss this fantastic event. For further information, contact W4JM, James Gundrey, 2498 Echo Drive, N. E., Atlanta, Georgia 30345.

Hollywood, Florida

The Hollywood Amateur Radio Club has applied for the call KE4FLA for Florida Amateur Radio Week and Field Day, June 18-25. Approximate frequencies used will be 70kHz in the bands on c.w.; on phone: 3930, 7230, 14330, 21430, 28530. QSL's should be sent to W4OZF, 2311 W. Nassau Dr., Miramar, Florida 33023.

Akron, Ohio

The Goodyear Amateur Radio Club will hold its 5th Annual Hamfest Picnic on June 18th at Goodyear Wingfoot Lake Park east of Akron, 1 mile west of Suffield, Ohio on County Rd. 87 near Ohio Rte. 43. Join us for an enjoyable day of entertainment, swap-and-shop, prize awards, and good fellowship. Refreshments, displays, huge flea market. Hours: 10:00 a.m. to 6:00 p.m. Family admission $2 prepaid, $2.50 at gate. For details write to Eugene J. Cooke K80RL, 3079 Rosebay Blvd., Norton, OH. 44203.

Englewood, New Jersey

The Englewood Amateur Radio Association announces that the week of June 18 through the 24th has been proclaimed Amateur Radio Week in Englewood. WA2RIN, WA2NVG and WA2CCF attended while his Honor Walter S. Taylor, Mayor of Englewood signed the proclamation.

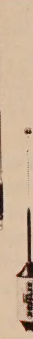
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Model RM-80	80 meter resonator	14.50

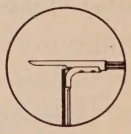
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Model RM-80S	80 meter resonator	24.95

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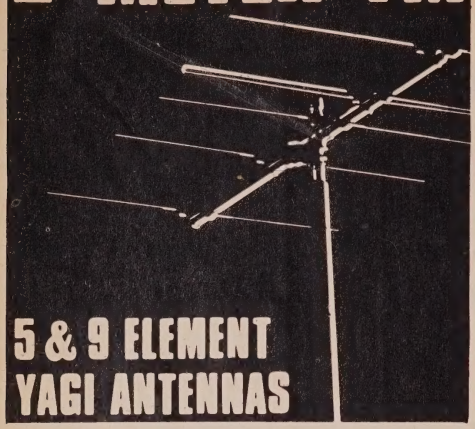


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Q AND A

WILFRED M. SCHERER,* W2AEF

V.F.O. Problems

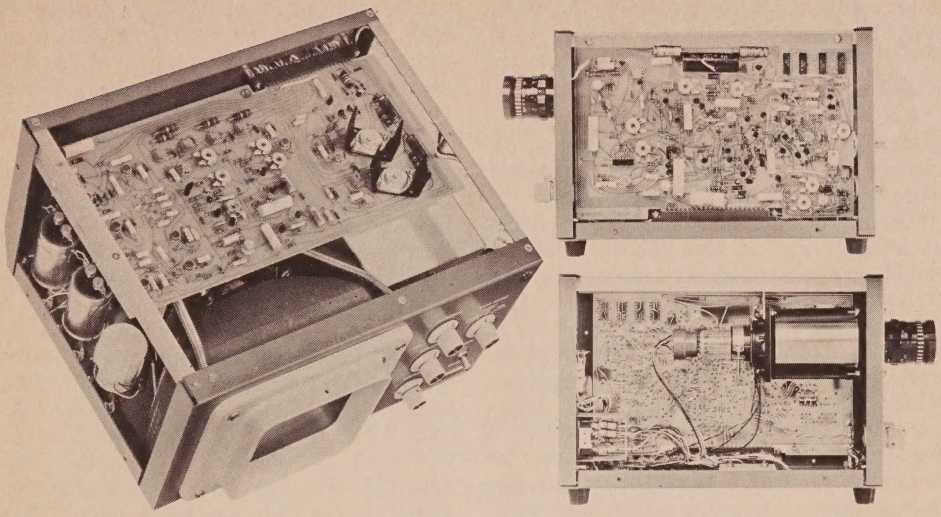
We have been receiving an increasing number of queries related to v.f.o. problems. Quite a few of these situations have been taken up in past Q & A Columns. The solutions to many of these difficulties usually falls within the same realm in each case, so after the following replies we shall call a temporary moratorium on v.f.o. difficulties and suggest that readers with such problems refer to the applicable information found below and in former Q & A Columns.

Frequency Instability With Gonset 76

QUESTION: I have a Gonset 76 where in the a.m. position it loses about 5 kHz when warming up, but after that it remains pretty well fixed until you push against the chassis. Then, when the key is plugged in and switch to b.f.o., all stability is gone. A person's walking across the room can change the frequency as much as 10 kHz. When you throw the B-plus or v.f.o. switch again, the set changes 10 kHz. Where shall I look for the trouble?

ANSWER: The frequency instability you experience with the Gonset 76 Transceiver appears to be a mechanical one with the v.f.o., or possibly the b.f.o. The approach then is to make sure all leads are well soldered (these might be touched up with a hot soldering iron), that all nuts and screws are tight, that shielding, cabinet and panel are stable, that sockets are okay, that tubes are tight, etc. There may be a bad v.f.o. or buffer tube. Make sure the tuning-capacitor wipers are clean (use a contact cleaner if needed) and that the drive mechanism for the tuning and dialing is firm and operating properly. Make sure the key and any switch contacts are clean and that wafer switches are properly aligned and seat firmly at the detents. Contact cleaner

*Technical Director, *CQ*.



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may also be needed at these switches. If the v.f.o. employs a slug-tuned inductor, make sure the slug is tight and not wobbly. A defective padding capacitor also could be the culprit.

V.F.O. Stability for RTTY With DX-100

QUESTION: Do you have any suggestions for making the v.f.o. of a DX-100 transmitter more stable to permit RTTY operation?

ANSWER: Any attempt to improve the stability of the v.f.o. in the DX-100 probably would be a matter of experimentation with temperature-compensating capacitors. This requires a determination of the direction in which the frequency drifts and providing the additional compensation or de-compensation accordingly. If the frequency goes downward, negative capacitance compensation is required (lowering capacitance causes the frequency to rise). Conversely, if the frequency creeps upward, positive, zero compensation or less negative compensation than already employed may be needed.

If the present drift appears to be quite excessive, look for defective components such as mica capacitors, temperature-compensating capacitors, bandswitch contacts, loose v.f.o. coil slug, tube, etc. A defective 12BY7 buffer also could be cause.

The only other suggestion is to keep the v.f.o. and buffer heaters turned on at all times, even when not operating the rig. This may require a separate heater transformer for these stages.

Drift With Apache TX-1

QUESTION: Any suggestions on how to reduce excessive frequency drift of the v.f.o. in the Apache TX-1?

ANSWER: Better stabilization of the v.f.o. in the Apache TX-1 may require different temperature compensation of capacitors at C_{10}, C_{14}, C_{17}, or C_{19}. If the difficulty occurs not only one band, the change would involve only the capacitor related to that band. Other capacitors that may require attention, due to a defect thereof, are C_{11}, C_{13}, C_{15}, C_{16}, C_{18}, C_{21}, C_{24}, C_{29}, C_{30}, C_{31}. Make sure M_{18} (NE-2) is okay. Also check the VR tube, as well as the v.f.o. and buffer tubes. Check R_9. For other suggestions, refer to the previous answers on the subject.

FTdx 560 On C.W.

QUESTION: Will the FTdx 560 work on c.w. without the c.w. filter?

[*Continued on page 92*]

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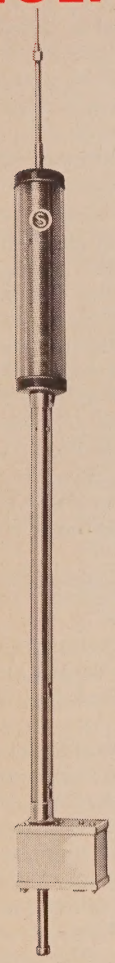
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A Modern 2-Tube DX Receiver To Meet 1931's Strict Operating Standards

BY WILLIAM I. ORR,* W6SAI

Let's face it. Today's 1931 amateur operation is tough business, especially for the DX Hound. With over 20,000 licensed amateurs in the U.S. and literally hundreds of operators on 20 meters around the world, DX-chasing can be a frustrating and difficult experience, especially for the operator having a poor receiver. Last night, for example, YI6KR in Mosul, Iraq was coming through QSA 5 and R 6. He called CQ on 14,405 kc and was literally swamped by at least six or eight stations, jammed into the high end of the band between 14,390 kc and 14,400 kc, all calling him madly! What razor-sharp receiver would suffice in such a jam-up? With this type of bedlam in 1931, imagine what the QRM will be in 40 years (1972) when a rare DX station may have as man as ten or twenty callers at one time! To complicate matters, more and more amateurs are running higher and higher power. Many DX chasers are running upwards of 50 to 100 watts and it is rumored that certain prominent California amateurs are running as much as 500 watts. Fantastic! Obviously, such a situation calls for a receiver of the highest caliber.

THOSE following the trend of amateur radio cannot help but be conscious of two important developments in receiver construction. These are, of course, the a.c. operated receiver and the newly developed screen grid detector tube. The practicability of the a.c. receiver has been pointed out by many, and the testimony of experts has convinced even the most skeptical operator that the screen grid tube is vastly more sensitive than the triode.

Aside from the greater sensitivity of the newly developed type 24 tube as a detector and the consequent advantages of using it in any type of receiver, there is a great deal of satisfaction in being able to plug into a light socket and run the set—and know there is no battery to be charged after several hours of continuous operation!

The 1931 Regenerative DX Receiver

This compact, sensitive receiver is the old "standby" regenerative detector and one-step audio amplifier. Most active amateurs need no introduction to this circuit, having used it at one time or another. This improved, 1931 version is shown in the schematic, and the various photographs show the layout of parts, which is not critical.

A departure is taken in this design in that the receiver is built upon an aluminum chassis, rather than a breadboard. The panel, too, is sheathed with aluminum on the rear, to reduce unwanted hand capacity to an absolute minimum. On the panel are mounted the variable-ratio tuning dial at center, the band-set condenser at the left and the regeneration potentiometer at the right. The remaining components are mounted on the chassis.

Three sockets are required, one for the plug-in coils and two for the tubes; the variety used in this set are sub-panel sockets of the type widely used by broadcast receiver manufacturers. Some of the mail order houses carry them if they are difficult to obtain locally. Note that the a.c. tubes require the new 5-prong sockets, whereas the coil takes the standard 4-prong socket.

Chassis Layout

The chassis is bent up out of one piece of aluminum. The deck is 12 inches long and 5

*48 Campbell Lane, Menlo Park, CA 94025

inches deep, with a 1/2-inch lip along the rear edge to give greater rigidity. Two end pieces support the chassis so that one inch clearance exists under it. Two additional aluminum brackets bolt the chassis securely to the panel. Behind the panel, an aluminum shield plate measuring 12 inches by 4½ inches high completes the assembly, which is held together by brass screws of 6-32 thread. All ground connections go directly to the chassis, and electrical continuity exists between all aluminum parts, including the panel shield. As a result, no common ground buss wire is required, as with the more popular breadboard construction.

The only unusual component is the National S-101 audio coupling unit, which is shown in its component parts in the schematic. If it cannot be obtained, a suitable choke is listed in the parts list, and a replacement unit may be built at home. [EDITOR'S NOTE: W6SAI is overcome by nostalgia. The National coupling unit is as rare as hen's teeth. They were hard to find even in the "good old days."]

Insulated, pusk-back wire is used for all connections, except the ones to the tuning condensers, and these are made with tinned #14 wire for rigidity. Antenna terminals are mounted at one end of the set, on a triangular brace, and the earphone jacks are at the opposite end of the set.

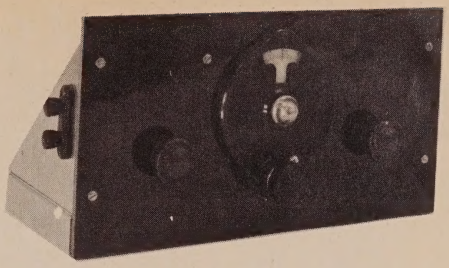
Point-to-point wiring is used, the only precaution being to place the filament center-tap resistor at the detector socket to minimize tunable hum. All power connections are made to a binding post strip mounted on the rear edge of the chassis, which may be seen in the rear and bottom photographs.

The grid-leak and condenser are supported from the front panel of the receiver on a small ceramic standoff insulator to permit the shortest possible grid connection to the 24 tube, whose grid terminal is at the top, rather than on the base, as is the case with most tubes. The erstwhile grid connection on the base is wired to the screen element of the tube.

The cathode type tubes take nearly a minute to warm up, and operate from a 2.5 volt a.c. supply. The tubes draw several amperes of filament current so the builder must take care to see that a full 2.5 volts is delivered at the tube sockets by the power supply.

Bandspread Tuning

A simple bandspread tuning scheme is



The two tube DX receiver. Simplicity of design and ease of tuning are combined in this sensitive 1931-style regenerative receiver that you can build yourself. Centered on the panel is the variable ratio "Velvet Vernier" tuning dial which gives over 50 degrees of bandspread on the ham bands. To the left is the bandset condenser and to the right is the regeneration control potentiometer. Antenna and ground terminals are at the left of the receiver, on the aluminum side bracket. The panel is made of a piece of Masonite, spray-painted black with a coat of clear epoxy over it. The panel is backed by an aluminum sheet to reduce hand capacity when tuning for the weak DX signals.

used, with the parallel BANDSETTING variable condenser placed conveniently at the side of the main tuning dial. Once the amateur band is properly located by the bandsetting condenser, all tuning is done with the BANDSPREAD condenser attached to the "Velvet Vernier" tuning dial. A separate plug-in coil is used for each amateur band. Each coil has two windings. The larger winding is the inductor for the tuned grid circuit and the smaller winding is the feedback, or "tickler" winding. Care should be taken that both windings are wound in the same direction on the form! Coil data is provided in the chart for the 160, 80, 40 and 20 meter bands. The receiver even works well on ultra-high frequencies, such as the unexplored 10 meter amateur band.

The receiver design, by the way, is taken from one built by George Grammer, and described by him in the December, 1930 issue of *QST* magazine, and the writer takes no credit for this simple and effective circuit. Those readers interested in obtaining more background material on this fine set are referred to that article.

A final note before adjustment and tuning

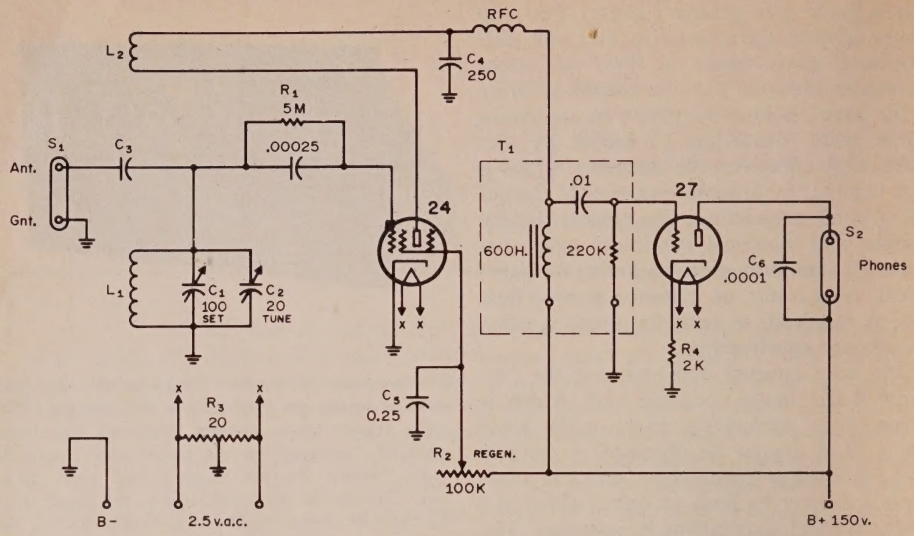


Fig. 1—Schematic of DX receiver.

C_1—100 mmf bandset condenser. Hammarlund "Star" midget SM-100, or equivalent.
C_2—20 mmf bandspread condenser. Hammarlund "Star" midget SM-20, or equivalent.
C_3—About 5 mmf. Twist lead from antenna terminal around grid lead about three or four times. Adjust for best signal strength.
C_4—250 mmf micra. Aerovox type 1460.
C_5—0.25 mf non-inductive paper condenser. Girard-Hopkins type PY.
C_6—.0001 mmf. Aerovox type 1468.
R_1—5 megohm grid leak. Aerovox "Metalohm."
R_2—100,000 ohm potentiometer. Centralab or Electrad.
R_3—20 ohm center-tap filament resistor. Pilot.
R_4—2000 ohms, 1 watt. IRC.
T_1—National S-101 Audio coupler. If unavailable, use Allied Knight [Knight] 350 henry, 5 ma choke [stock number 54A2350].
S_1, S_2—Twin Terminal strip. EBY 22-S.
RFC—2½ mh National R-100.
Coils—See coil table. Or use Bud "Lo-Coil" kit #222 (4 prong, 2 winding).
NOTE: Component specifications taken from "Radio's Master Encyclopedia", first edition, 1935.

is discussed: this receiver uses blue glass *Arcturus* tubes, as they have proven beyond a doubt to be super-sensitive for shortwave reception, and much superior to the colorless glass tubes, commonly used by many unthinking amateurs.

Receiver Tuning and Alignment

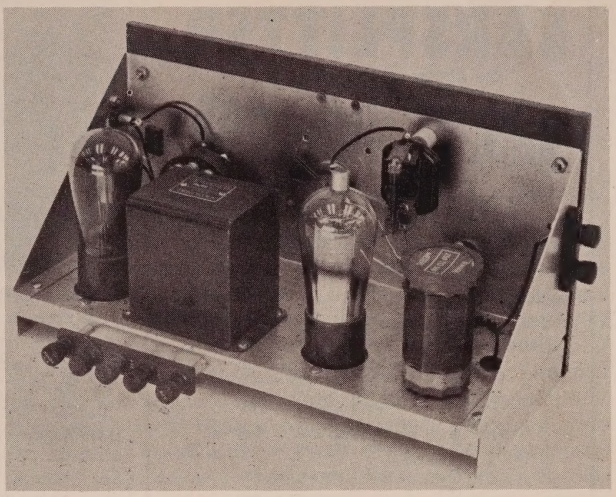
The only complicated part of receiver construction is winding the plug-in coils. Several manufacturers make plug-in coil sets, and they may be used with this receiver, provided the tickler winding turns are adjusted by experiment to make regeneration occur about at mid-point on the screen grid control. Most manufactured coils have too many tickler turns for the super-sensitive 24 tube, and turns must be removed for proper operation of the coil set.

The reader should be warned to follow the pin sequence on the coils to insure that the windings go to the correct points in the circuit and, finally, he should be alerted to the fact that the coil pins should be thoroughly cleaned of flux and solder to make sure contact with the socket receptacle is firm and sure.

Since all readers are familiar with coil winding procedures, these details will be skipped and we will consider receiver tuning and alignment.

Tuning and Alignment

The receiver will work well with a plate potential of from 90 to 250 volts, with the higher voltages providing slightly louder signals. After plate voltage is applied and the



Rear view of receiver. Major components are mounted to the aluminum chassis, which is used in place of the popular breadboard. At the right is the plug-in coil, with the 24 tube to its left. The grid leak and grid condenser are mounted to the aluminum panel by means of a small standoff insulator. Next to the detector is the audio coupling unit, and at the left hand end of the chassis is the 27 audio amplifier stage. Earphone terminals are mounted in the far aluminum side bracket. Power leads terminate at the five binding posts mounted on a bakelite strip at the rear of the chassis.

tubes warm, touch the grid cap of the 24 with your finger, a click or buzz should be heard, depending upon the setting of the regeneration control. With a 15 foot antenna connected, and the receiver grounded to the radiator or heating system in your home, you are ready to receive signals. Advance the regeneration control until you hear the soft "plop" of regeneration, and start looking for signals. If all is well, you will hear many of them as you tune back and forth. If not, make sure of your connections and that your earphones are plugged in.

Once amateur signals are heard, by adjusting the band-set condenser, the high frequency end of the band should be found by trial and error, as the main tuning dial is adjusted for near-minimum capacitance on the bandspread condenser. With the band-set condenser properly adjusted, the high end of the 80 meter band will fall about 10 on the main dial, and the low frequency end about 70. That's *real* bandspread!

And how does the little receiver work? Very well. With a 50 foot antenna, Europeans have been heard on 40 meters from the west coast and Africans and South Americans have been heard on 80 meters. [EDITOR'S NOTE: The receiver works well on s.s.b., too!]

Final Notes

There are a few disadvantages resulting from coupling the detector tube directly to the antenna, most of which can be overcome with care. One of these is the effect of the antenna on receiver tuning. Unless the antenna is tightly strung and rigidly supported there may be a waver in the note of incoming signals when the antenna swings in the wind. An indoor antenna will stop this annoying problem.

The size of the antenna coupling condenser is fairly critical. If it is too great, sensitivity may suffer and the recever may overload on

Table I—
Coil Winding Data for 2 tube DX Receiver

Coils are wound on 1½" diameter forms, 4 prong.

160 meters—Primary, L_1: 70 turns #32 silk covered wire, closewound.
Tickler, L_2: 10 turns #32 silk covered wire, closewound, about 1/8 inch below primary winding.

80 meters—Primary, L_1: 37 turns #22 d.c.c., closewound.
Tickler, L_2: 6 turns #22 d.c.c., closewound, about 1/4-inch below primary winding.

40 meters—Primary, L_1: 19 turns #22, spaced 3/4-inch long.
Tickler, L_2: 4 turns #22, about 1/4-inch below primary winding.

20 meters—Primary, L_1: 8 turns #22, spaced about 1/2-inch long.
Tickler, L_2: 4 turns #22, about 1/4-inch below primary winding.

NOTE: Primary winding goes to "grid" and "filament" pins of coil form. Grounded end of primary winding is at bottom end of form. Secondary winding goes below primary winding, wound in same direction. If set refuses to oscillate, reverse secondary winding connections at socket terminal.

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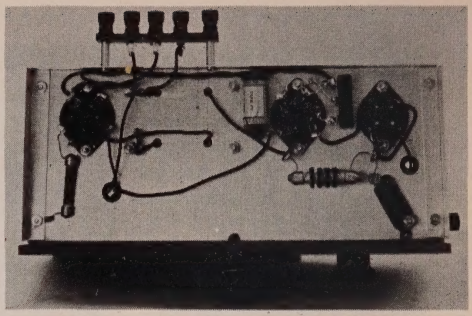
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Under-chassis view of receiver. Simplicity of wiring is a feature of this regenerative receiver. Components are mounted tastefully about the area, using as short leads as possible. At the left is the 27 socket, with the 24 socket and coil socket at right. The filament center-tap resistor is placed across the terminals of the detector socket. Only 5 parts under the chassis!

strong local signals. Coupling should be as loose as possible.

Finally, the problem of "dead spots" should be noted. When the receiver tunes across the resonant frequency of the antenna it may be difficult, if not impossible, to make the detector oscillate in the vicinity of such points. Lowering the capacity of the coupling condenser will help, or the antenna length should be changed so that resonance does not occur in any ham band.

Receiver Hum?

Those not used to the new a.c. tubes may question the hum level of the receiver. Detector tubes vary considerably with respect to hum, so it is wise to try a few different ones and choose the one with the lowest hum. Although not shown in the photographs, it was found necessary to add an aluminum tube shield around the detector tube, especially when the set was operated in the vicinity of light lines. The use of a tube shield and "hand picking" the 24 tube will result in a hum level that is almost inaudible.

A Companion Transmitter

Once you have gotten the "hang" of operating this fine receiver, you should be ready for your next construction project. This will be a 1931-style c.w. transmitter for 80 meters using a reliable and rugged 210 tube in the popular Hartley circuit. Watch for it! [NOTE: The receiver described in this article, and much of the information is taken from "A Two Tube A.C. Receiver," by George Grammer, in the December, 1930 issue of *QST*.] ■

A High-Selectivity I.F. Filter

BY IRVING M. GOTTLIEB,* W6HDM

THE basic selectivity of the 450 kHz i.f. channel in both single and double conversion receivers can, in many cases, be appreciatively improved by a passive-filter technique. The method to be described *does* require a fair measure of patience and a healthy zest for experimentation. Nonetheless, its implementation is well within the domain of minor surgery. Although the presentation will be oriented towards the practical, this article will not attempt to spell out the specific modus-operandi for a particular receiver via a regimented how-to-do procedure. Nor will this innovation be represented as competitive with a nice, but expensive mechanical-filter in its ability to suppress off-channel interference. It is only asserted that many receivers can be considerably benefitted, and with downright minimal outlay of the media of inflation!

*931 Olive St., Menlo Park, Cal. 94025

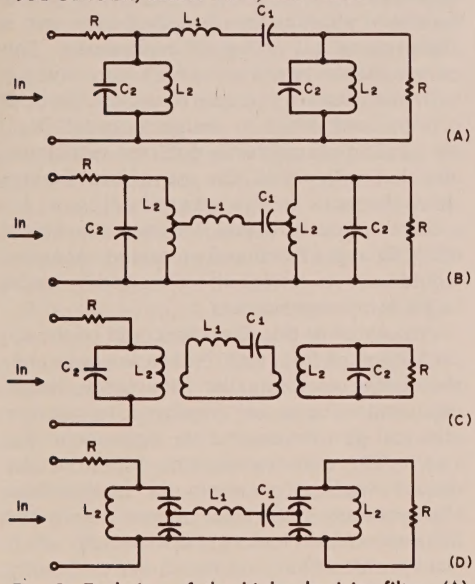


Fig. 1—Evolution of the high-selectivity filter. (A) Circuit of pi-section image-parameter filter. (B) Equivalent circuit with an internal impedance step-down arrangement. (C) Equivalent circuit with an alternate step-down technique. (D) A third method for affecting internal step-down of impedance so that practical values of L_1 and C_1 can be used. It was decided that this method would be the easiest to implement.

An apropos prelude to actual construction involves a few words about i.f. transformers and bandpass filters. The frequency response of conventional i.f. transformers is generally attained by slightly *overcoupling* two high-Q resonant circuits. By overcoupling, is implied an inductive coupling somewhat in excess of the tightest coupling which would still produce a single maxima in the overall response-curve. Actually, the overcoupling, and its resultant double-humped response is a means for the avoidance of the more needle-shaped response of single high-Q tank circuits. It is true that the single-tank response can be selective enough to provide high discrimination between closely-spaced signals. But such selectivity is not very kind to modulated carriers. (To obtain steep skirts, the designer would be forced to cascade a number of such "universal resonance" type responses and the bandwidth would be too narrow for reasonable fidelity in the passage of a.m., s.s.b., or narrow f.m. signals. And stagger-tuning is not too different from the overcoupling technique insofar as concerns the net response.) What is needed, of course, is a flat-topped response, wide enough to offer equitable passage to the more significant of the modulation sideband-frequencies. Admittedly, the conventional i.f. transformer does well in this regard, but it appears reasonable to suppose that still better results would obtain if we could narrow the bandwidth somewhat, and simultaneously steepen the slope of the skirts, *i.e.*, a closer approach to the ideal rectangular-response.

A rectangular frequency response curve would represent the beautiful situation wherein full accommodation of the significant modulation-sidebands could be had, along with optimum discrimination of off-channel interference. It is no great secret that such response is hotly pursued, but never quite captured. Of course, mechanical filters and multiple-stage i.f. channels are capable of producing quite steep skirts. And relevant to this are the frustrations filter designers have felt about the matter. For years, near-rectangular responses have been designed into

networks intended for bandpass functions in telephone work. But these have been implemented for *audio and low-carrier frequencies,* say to 40 kHz. When attempts are made to extend the design of such bandpass filters to the 450 kHz region, we wind up with impractical elements such as multihenry-inductors and fractional-picofarad capacitors. And the picture is even worse when we think of higher impedance levels than the nominal 600 ohms used in the telephone industry.

In order to alleviate the above-mentioned frustrations, the author indulged in some experiments with combinations of i.f. transformers. Figure 1 shows some of the ideas investigated. These configurations did seem to suggest the possibility of improving the response of the conventional i.f. transformer. The experimentation was guided by the following premises:

1. The insertion loss which might accompany a more rectangular response is not of adverse consequence providing it is kept within reasonable bounds. Although, it would not be desirable to deplete the gain of an i.f. channel too much, most receivers probably have an *excess* of available i.f. gain. So, if a moderate loss of i.f. gain accompanies a decided enhancement of the i.f. skirt selectivity, there will ensue an overall improvement of performance. (Moreover, there are generally ways in which a fair share of lost gain can be recaptured.)

2. Inasmuch as the author does not possess winding equipment or sophisticated bridges, it was decided to seek the desired improvements *without winding or modifying inductors.* This might seem to be too much to hope for, but wait!

3. Finally, no active circuitry, op-amps, *Q*-multipliers, regeneration, etc. Only *passive LC* networks would be allowable. The motivation here is that we are not seeking the needle-shaped selectivity depicted in fig. 2, but rather, a reasonable approximation to the rectangular shape of the ideal response also shown in fig. 2.

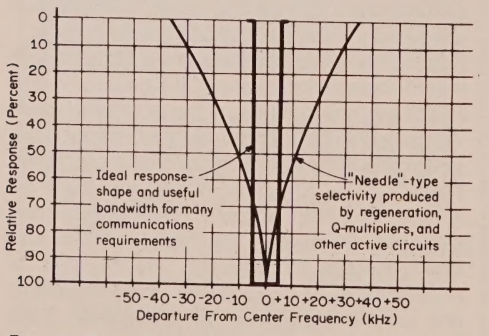


Fig. 2—Desirable and not-so-desirable response curves.

Having now imposed masochistic obstacles in our path, let us explore the possibilities of overcoming them and arriving at something good. The network shown in fig. 1(A) is a full-pi section bandpass filter in which the elements are determined from the principles of image-parameter theory. This formidable-sounding method is not really difficult to use inasmuch as the formulas for the filter elements are simple algebraic-equations. The beauty of this basic network is that one can obtain very nice bandpass responses when it is used as a building block of a more extensive filter. Even the single section can produce a more-desirable response than obtains from overcoupled tanks. And when used in conjunction with a slightly modified, or "m-derived" section, the skirts of the response curve can be made even steeper. The only rub in the above statements is that practical implementation, though easy at 10 kHz, is impossible at 450 kHz. The series-arm would consist of an inductor of many henrys and a capacitor of a fraction of a picofarad. The only suitable hardware which can comply with such values is a quartz crystal. Since it is not our objective to design a crystal filter, we have to search for a different technique, one that will permit the use of reasonably-sized elements. In the network of fig. 1(A) a large inductor would self-resonate below 450 kHz and a fractional-picofarad capacitor would have its desired effect masked by much larger stray-capacitances.

A way out of this dilemma could be the arrangement of fig. 1(B). Now a lower impedance series arm (smaller inductance, larger capacitance) can be employed to achieve identical performance to the network of fig. 1(A). The auto-transformer action of the tapped windings preserves the mathematically-necessary impedance match within the filter network. It looks good, especially when one considers that impedance varies directly as the *square* of the number of active turns. For example, a center-tap would provide one fourth the full-winding impedance. Great, but who wants to horse around with the miles of fine wire on an i.f. coil? Such a lazy approach to one's goal leads to the link-coupled version of fig. 1(C). This could, indeed, be the way to fly. However, in view of the re-

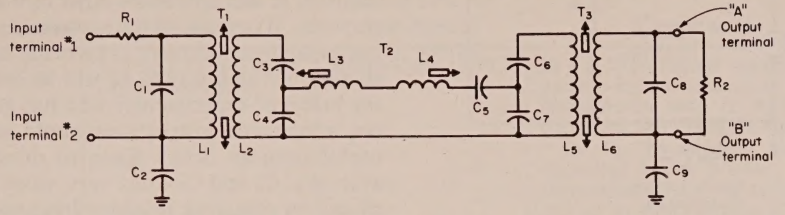


Fig. 3—The circuit of the high-selectivity i.f. filter. R_1 and R_2 are used only during bench-testing and alignment outside of the receiver. Capacitors C_2 and C_9 do not produce any resonances in the filter. They are large bypass capacitors and are intended to provide a low-impendance a.c. path to ground. These capacitors can be ignored during bench-testing and alignment outside of the receiver. See Table I for the values of the components used in the filter.

stricted working-space inside of a small i.f.-transformer, it could be easier said than done. And one would have to contend with the coupling-coefficient between the link and the i.f. coil. No, there must be an *easier* way yet!

To make a long story short, the easier way turns out to be the configuration of fig. 1(D), for it turns out that impedance-reduction can also be accomplished by a *capacitive divider*. This is intriguing because we have now reconciled much of the incompatibility that often exists between theory and practice. This being so, let's refer to fig. 3, and to Table I for the basic information needed to implement this idea. Our efforts should be rewarded by a frequency-response similar to that shown in fig. 4. The insertion loss of the high-selectivity filter is about 4 db greater than that of one of the i.f. transformers used in the conventional way. But, the response is *much-more selective* and many receivers should perform in a more desirable manner when modified with this filter.

With regard to i.f. transformers T_1 and T_3, disconnect the leads of one winding from their connector pins. This also accomplishes disconnection of the plastic-encapsulated resonating capacitor. Next, substitute the series-connected capacitors, C_3, C_4 in one transformer, C_6, C_7 in the other. These capacitors have to be physically small so that they can be inserted within the inner structure of the plastic framework of the assembly. Otherwise, it will not be possible to replace the shield cans when the filter is ready for installation in the receiver. (Although the smaller mica-capacitors are OK for this purpose, the author in retrospect would suggest consideration be given to ceramic capacitors. For example, the Mallory "discap" is available in several different temperature coefficients, and the flat shape of the small-100 volt units should make for easy packaging.)

Now let's tackle the series-arm, comprised of T_2 and T_5. The road to high Q in a series-resonant tank is via large inductance and small capacitance. Because of stray capacitances and ye olde law of diminishing returns, it was determined that it would not be too rewarding to resonate with less than, say 12 pf. To get into this ball-park, the series-connected coils of a 262 kHz i.f.-transformer are used. First, disconnect the coil leads from the connecting pins in order to remove the original parallel-resonating capacitors. The coil must then be connected in series, but it is necessary to achieve the right phase-relationship so that the net inductance will be the *highest* of its two possibilities. Using the test setup of fig. 5, determine the phasing which yields the *lowest* resonant frequency. Having done this, cement or tape a 12 pf capacitor to the inner structure of the transformer. The two leads of the resultant series tank are brought out opposite sides of the assembly so that they can be passed through 11/16" slots cut in opposite faces of the shield can.

Next, connect up the entire filter-circuit as shown in fig. 3. Do not replace the shield cans yet. Use the test procedure indicated in fig. 6

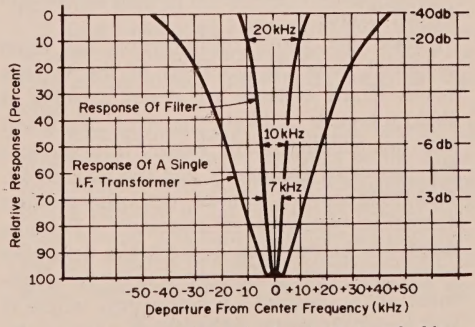


Fig. 4—Response of the high-selectivity i.f. filter.

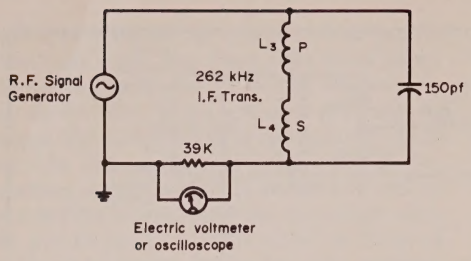


Fig. 5—Test procedure for phasing the connections of i.f. transformer T_2 in fig. 3. The series connection of the coils which results in the lowest resonant frequency is correct. Resonance is indicated by a dip in the response of the monitoring instrument. Be sure that the coils are disconnected from their original resonating capacitors. After the desired information is obtained, the 150 pf capacitor is discarded. No test need be made of the series resonance behavior of these i.f. coils.

to ascertain that the filter network is functional. The output monitoring instrument can be either an electronic voltmeter or an appropriate 'scope. In the latter case, it is desirable to use a x10 divider probe to avoid excessive detuning of the secondary of T_3. All cores should be initially adjusted to their midway positions. (A special nylon tool is available which allows adjustment of either core in a given transformer from the *top* of the unit. Thus, the descriptive-name "top-tuned.") Do not initially strive for alignment at a desired i.f. frequency. Rather, by patient adjustment of both the cores in T_1, T_2, and T_3, and the r.f. generator frequency, try for an initial alignment no matter what frequency this occurs at. It will be found, particularly at the final stages of optimization, that there is some interdependence among the adjustments and it is necessary to repeat the procedure a number of times. However, once the gross adjustments have been made and it is felt that subsequent optimization is in the nature of refinement, the generator frequency should be left alone.

After the above optimization has been achieved, note the positions of the various cores. If any of them are at one extreme of their travel, it is likely that true alignment was not accomplished. Taking into account the generator frequency and the desired i.f. mid-frequency, it can be determined what corrective measure is necessary. Perhaps none will be required because the next step of the alignment procedure is to try for alignment at the desired i.f. frequency, where it will hopefully be found that each core can be adjusted to one side or the other of maximum response. If not, one of the associated resonating capacitors will have to be made larger or smaller. (Which way to go will be evident to the brand of experimenter who has gone this far, so detailed instructions would serve no useful purpose here.) Keep in mind, however, that C_3 and C_6 exert *very much greater* effects on changing resonant-frequency than do C_4 and C_7. Also, if other circumstances allow, the author suggests that alignment be finalized at about 445 kHz. (This was the center frequency of the response shown in fig. 4.)

When it is felt that the response of fig. 4 has been essentially duplicated, the i.f. transformer assemblies can be inserted into their shield cans. The three cans can then be taped together to form a fairly compact overall filter-unit. An alternative packaging technique is to mount the three i.f. transformer assemblies within a metal box with external dimensions of approximately 2¾" x 2" x 4". Such boxes are readily obtainable at the larger dealers in electronics gear. If such a box is used, insert shim-stock partitions between the transformers so that the filter will not be degraded by stray coupling.

In conclusion, those with the fervor of the born-experimenter can investigate the following suggestions:

1. By making capacitors C_4 and C_7 somewhat smaller, the insertion loss of the filter can be reduced. (With prescribed component-values, the insertion loss is about 4 db greater than one obtains from a single i.f. transformer used in the conventional manner.) The bandwidth and selectivity of the filter will then be somewhat degraded, but not drastically if this modification is not pursued too far. Conversely, if more insertion loss can be toler-

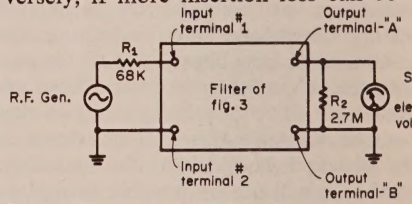


Fig. 6—Test procedure for alignment of the high selectivity filter. Note that the large bypass capacitors, C_2 and C_9 are not used for the test. Consideration should be given to the capacitance of the output monitoring instrument so that no more than about 10 pf is added to the output circuit. The objective is to optimize the output by adjustment of the permeability slugs in the three i.f. transformers of the filter.

Component	Description and Rating	Manufacturer and Model	Comments
T_1, T_3	455 kHz "Top-Tuned" i.f. transformer.	Miller-Type 16-PC1	In T_1, the original resonating capacitor in the secondary (L_2) is disconnected and is replaced by the series combination, C_3 and C_4. In T_2, the original resonating capacitor in the primary (L_5) is disconnected and is replaced by the series combination, C_6 and C_7.
T_2	262 kHz "Top-Tuned" i.f. transformer.	Miller-Type 14-H1	In the filter circuit, the primary and secondary coils are both disconnected from their original resonating capacitors. The two coils are then connected in series aiding and series-resonated by C_5.
C_1, C_8	Original resonating-capacitors.		The i.f. coil connections to these capacitors remain intact.
C_3, C_6	"Small" mica-capacitors of impedance transformation network. 120pf, 5%-100 v.	Cornell-Dublier, Sprague, Centralab. EM, etc.	These capacitors are critical in their effects on resonance.
C_4, C_7	"Large" mica-capacitors of impedance transformation network. 1300 pf, 5%-100 v.	Cornell-Dublier, Sprague, Centralab, EM, etc.	These capacitors are not critical in their effects on resonance.
C_2, C_9	Ceramic disc capacitors. .02 mf.	Mallory, Centralab, Sprague, etc.	These capacitors provide a.c. ground paths to shields and chassis of receiver.
C_5	Mica capacitor for series-arm. 13pf, 5%-100 v.	Cornell-Dublier, Sprague, Centralab, EM, etc.	Try for resonance in completed filter circuit.
R_1	Simulating resistance for internal impedance of generator (mixer or i.f. amplifier) 68K, 1/2w.		Use only during tests. Remove when filter is installed in receiver.
R_2	Simulating resistance for load (grid-return) 2.7 meg., 1/2w.		Use only during tests. Remove when filter is installed in receiver.

Table I—List of components for the filter of fig. 3

ated, C_4 and C_7 can be made somewhat *larger* and the selectivity of the filter will be sharpened. *Fortunately, C_4 and C_7 can be varied over an appreciable range with relatively little effect on resonance* which is primarily governed by C_3 and C_6.

2. A compromise was made in the arrangement of T_2 to minimize surgery. An even closer-approach to rectangular response can be had if the two coils of T_2 are moved so that they are physically adjacent and share a common permeability-slug. Under such conditions, series resonance occurs in the 8 to 10 pf rather than in the 12 to 15 pf region.

3. In all instances, better filter-performance obtains at lower frequencies, say 430 kHz than at the higher frequencies, such as 460 kHz.

4. The author investigated the matter of *grounding* of the inner circuitry of the filter. Experiments were conducted with grounding of the junction of C_4 and C_7 as well as with other circuit junctions. No such ground connection yielded beneficial results; indeed, at least some degradation of the response ap-

[*Continued on page 80*]

Tips For Working DX



BY GILBERT C. FORD,* W7OXD

ONE of the biggest thrills in ham radio is working DX. To talk personally with a fellow hobbyist in a distant part of the world is still exciting even in this modern day of advanced technology. No one can define precisely what a DX contact is, and we all know that a contact that is fantastic DX on eighty meters may be just ordinary on the fifteen meter band. A QSO that is just run of the mill for the experienced DX man with kilowatt, 100-foot tower and five element beam may seem like the contact of a lifetime to the ham who has just had his license a few months. Generally, however, for a ham living in the United States, any contact with a station outside the continental United States and the lower tier of Canadian provinces is considered DX.

Why Work DX?

Why do hams like to work DX? Although each of us may have our own special private reasons for enjoying DX contacts, these reasons tend to be much the same for all hams. A certain pride of accomplishment comes along with doing the unusual, and talking with a fellow hobbyist on the opposite side of the world is something the ordinary citizen does not often do. Such contacts are still difficult enough to give most of us a distinct feeling of accomplishment. And for those with collector instincts there are QSL cards and awards, awards of enough different types to appeal to and satisfy almost anyone's psychological needs in this area.

The ability to work DX serves as an excellent proof of performance of your station. If you can work AP2KS in East Pakistan, or LZ1TD in Bulgaria, your station really must be all right. And there is no better way to get familiar with the vagarities of the ionosphere than to become a serious DX-er. You will soon become quite aware of the F-layer, diurnal and seasonal variations in propagation characteristics, and the eleven-year sunspot cycle.

Although most hams do not take advantage to any extent of their opportunities to learn about the countries they contact, DX contacts nonetheless do afford an unequaled opportunity for learning about the geography, climate, customs, and culture of other parts of the world. All that is necessary is to develop a modest amount of skill in asking the right questions.

*415 E. Sherman Ave., Nampa, Idaho 83651.

Kinds of DX

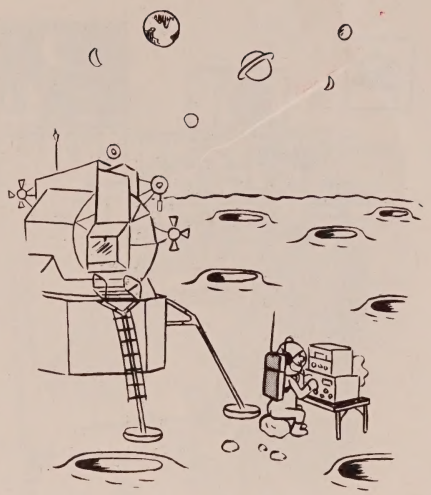
There are really only two kinds of DX stations, rare and common, with, of course, some gradations in between. The rarity of a DX country is not determined primarily by how far away it is but by how few amateurs are on the air there. The really rare DX countries have no active amateurs, and your only hope of collecting a QSL from them depends upon a DX-expedition setting up a station there temporarily. A contact with a country halfway around the world can be a common DX-QSO, if the country has a large population of amateurs. The prime example of this type of situation is Japan with is burgeoning ham population. Once you have made any kind of start as a DX-er, you will soon have had many JA contacts.

Styles of DX Contacts

To a certain extent the type of QSO you have with DX stations is up to you. You can have a short, snappy, concise, contest-style contact with an exchange of signal reports, QTHs, handles, and then 73, and it's all over, or you can enjoy a leisurely rag-chew style exchange of interesting information about your stations, how you earn your living, and the unusual features of life in your respective countries. You don't always have a choice. Your contact may be in a hurry to work a lot of stations, and if he is a rare catch, a lot of your buddies will be waiting on frequency anxious to snare him as soon as you let him go. But if he is from a country which would generally be considered common and if he seems at all inclined, try to draw him out into an interesting conversation by giving him some unusual facts about your area or life style, and by asking some leading questions. You will be pleasantly surprised by the response you will usually get. If he seems anxious to get away, by all means graciously let him go and look for a more interesting type. With a little practice and some advance planning, you'll soon be a master at turning what would otherwise be a routine DXQSO into an exciting experience.

Station Requirements

What kind of station do you need to work DX easily and successfully? Hams work DX with all kinds of gear, ranging from simple homemade QRP rigs delivering only a watt or two to a dipole up to stations having separate kilowatt amplifiers for each band feeding rotatable six-element beams 150 feet in the air. But most DX contacts are made with equipment somewhere in between these two extremes. The average DX station runs about 150 watts to a three-element Yagi or a two-element quad up 35 or 40 feet. Only a few of them have higher power or more elaborate antenna systems. Since reciprocity is nearly always valid for radio transmission paths, you can be sure that if you run 150 watts or so to a simple beam, the DX stations will hear you if you can hear them. However, you can improve your ability to hear them by pushing your beam up to 70 to 100 feet above ground, and of course they will hear you better, too. The amount of energy radiated or received at the low angles important in DX work improves markedly as you get your antenna higher in the air. Only a few enterprising hams use a rotatable beam for DX work on 40 and 80 meters. On these bands you might consider a fixed direction beam if there is a particular geographic area of special interest to you. But in any case, mount your antenna as high and in the clear as possible.



An unusual QTH often works wonders.

Is High Power Necessary To Work DX?

High power isn't really necessary, but it is sometimes helpful. High power doesn't help at all in receiving, and being able to hear DX is more than half the battle. High power matters most when you are fighting for a DX station's attention in a pile-up, or under conditions of heavy QRM.

In summary, to work DX with relative ease you should plan on being able to radiate

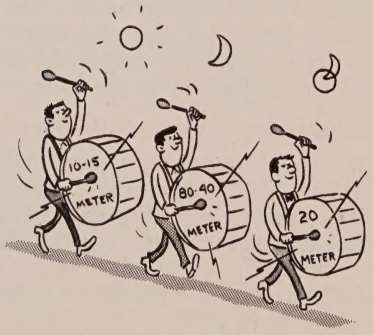


You won't hear many stations from a country when it is 3a.m. their time.

100 watts or so by means of efficient beam antenna, for example a two-element quad or a three-element Yagi, and to have a receiver that is stable, has good selectivity, and a sensitivity in the range 0.3 to 1.0 μv for 10 db $(S+N)/N$ ratio. If you can meet these basic requirements, you will be able to work lots of DX. Putting your antenna up to 70 feet or higher and increasing power to the legal limit will improve your results, but probably not as much as you might expect. Increasing power output by a factor of 10 will make a 10 db increase, or approximately two S-units difference. These two S-units will be of importance to you mainly during marginal conditions.

Best Time of Day To Work DX

Except for weekends, the times most of us can operate are restricted by our work and sleep schedules, and it is helpful to remember that these same restrictions hold true for DX stations as well. Even if the ionosphere is cooperating, you won't hear many stations from a country when it is 3 A.M. there local time. Other factors being equal, the number of stations you will hear from a DX country will go through two maxima each day, a minor peak during the early morning hours and a major peak during the late afternoon and early evening. Morning and evening here refer to local time in the DX-country. The peaks will be somewhat evened out on weekends when the constraint imposed by working hours is removed. Of course the other factors, chiefly the state of the ionosphere, usually aren't constant during the day. The point is that in addition to the ionospheric propagation charts you should also consider what the local time is in the country you are trying to contact.



Some bands require daytime, others prefer a night path, while another is not too particular.

Best Band For DX

No one band can be really said to be best for DX. The 20, 15, and 10-meter bands are usually thought of as the standard DX bands, but DX is worked on all bands. Year in and year out, probably more DX is worked on 20 meters than any other single band, but during the years of sunspot maximum the 10 and 15-meter bands can perform fantastically well. But when the number of sunspots begins to wane, first the 10-meter band fades and eventually also 15, but the amount of ionospheric absorption at the lower amateur frequencies decreases, and as a result the 80 and 40-meter bands become real DX bands.

The propagation characteristics of the common amateur bands can be summed up by the following simple ideas. The 10 and 15-meter bands require a sunlit or daylight path, the 80 and 40-meter bands require a dark or night-time path for DX propagation, while the 20-meter band will produce DX contacts over either a daylight or night-time path, or a combination of the two. These ideas can be refined considerably by studying the propagation charts, but they do tell you basically what you need to know about the propagation characteristics of the different bands.

Phone or CW

Which mode is best for DX, phone or c.w.? From a strictly technical viewpoint, c.w. has the edge by a few db in regard to receiving efficiency, and frequently when a band has gone out for phone to Europe, for example,

you can still make DL and G contacts in the c.w. segments of the band. But it must be admitted that certain parts of the world are not well represented on c.w. This effect is especially noticeable with Latin America. You can find some Central and South American stations on c.w., but for every c.w. signal from this part of the world, there are twenty on phone. DX signals do have the advantage of bringing you the flavor of distant places. Clipped British accents and Continental style English really add authenticity to a DX contact.

Probably the most satisfactory answer to the phone versus c.w. question is to plan to do some of both. Variety adds to the fun of working DX.

How To Listen For DX

The serious DX man will spend a lot of his operating time listening, and his success in finding DX depends on a few simple principles. Certain situations always alert the experienced DX-er to the presence of a DX station. The most obvious of these is of course the pile-up, but there are other somewhat more subtle indicators to look for. On phone, any time you hear an American ham talking slowly and deliberately with careful enunciation, the probability is high that he is in contact with DX, and if you hang around the frequency you are likely to get a chance to work the DX too. In tuning around, give special attention to weak signals, especially those having a wavery, quavery character. Of course when the ionosphere is fully cooperative, DX signals may be as strong and clear as locals. Under these conditions on phone you can still listen for non-American accents, and on either phone or c.w. you can pick up clues from the information being exchanged. Comments about weather or the local time are often helpful aids in deducing what part of the world is the source of particular signals. If all else fails, you can listen long enough to pick up call letters.

How To Initiate The DX Contact

If you should hear a DX station calling CQ, the situation is completely straightforward. All you have to do is call him, and hope that a dozen other stations haven't had the same idea. If the DX is of the common variety, there won't be too much competition and you'll probably land him, but if he is rare, a pile-up may immediately ensue. Don't give up—persistence and careful timing of your



You will become aware of the F-layer, diurnal and seasonal variations in propagation characteristics, and the 11 year sunspot cycle.

calls can still bring you success. Two important don'ts should be observed. Don't call while a contact is still in progress, and don't call while the DX station is transmitting. He won't be able to hear you if he is transmitting. If your state is a rare one, be sure to give the name of your state when calling. I have found that mentioning my QTH, Idaho, often works wonders.

Does it pay to call CQDX? Generally not, but again if you live in a rare state, as I do, a CQDX works extremely well in raising the more common type of DX and may even turn up something rather rare on occasion since a surprising number of foreign hams are working towards WAS.

If you are really serious about working 300 countries or more, you are going to have to keep track of all the DX expeditions and other one-time operations from the zero ham population areas of the world, but my advice is not to take working DX that seriously. Settle on some more easily obtained goal such as a DXCC certificate, and have fun while doing it. In my opinion, it's a lot more rewarding to talk to a real Bulgarian or Spaniard in his native country than it is to have a 60-second QSO with a fellow American, even if he is operating from some previously uninhabited rock off the coast of Madagascar.

[*Continued on page 82*]

Noise and Noise Generators

Part II

By JOHN J. NAGLE,* K4KJ

Noise generators can take several forms, depending upon their application and the funds available. Described here is one type which is useful to the amateur.

LAST month's installment discussed the nature of receiver noise, methods of measuring it, and discussed types of noise generators. This month's discussion will center around design considerations of noise generators.

The basic circuit of the thermionic diode noise generator is shown in fig. 2.

The diode is operated in a temperature limited condition, *i.e.*, all of the electrons leaving the filament arrive at the anode. The resistor R matches the input impedance of the receiver under test. C_t represents the stray capacity of the tube; L_s, the series inductance of the leads within the tube and socket while C_s is the stray capacity of the socket, load resistor, and output connector. The inductance of L_s is relatively small at the frequencies under consideration, being such as to resonate with typical stray capacities at about 700 mHz. L_s can therefore be neglected. Also neglected will be the effects of transit time which, for the tube used, cause an error of only 0.2 db at approximately 500 mHz.

Neglecting the inductance and transit time reduces the circuit of fig. 2 to that of fig. 3 which we will consider to be a practical circuit.

The theory of the generator is based on the assumption that all the diode noise current flows through the resistor, R. As the frequency increases, the stray capacitance, C_s, causes the diode load impedance to decrease thus lowering the noise power output and causing the noise figure measurement to be high. The effect is the same as the fall-off in the high frequency response of a video amplifier. At a frequency where the capacitive reactance is equal to the resistance, the noise power output for a given d.c. plate current will be one-half of (or 3 db down from) the low frequency noise power output. In a typical noise generator, the stray capacitance is 12.3 pf so that with a 50 ohm resistor the half-power frequency is 270 mHz or with a 70 ohm resistor, 200 mHz. Bear in mind that the error will be greater at higher frequencies and less at lower frequencies. At frequencies one-third those given above (90 mHz and 66.6 mHz), the noise generator will be in error by 1 db.

*12330 Lawyers Road, Herdon, Va. 22070

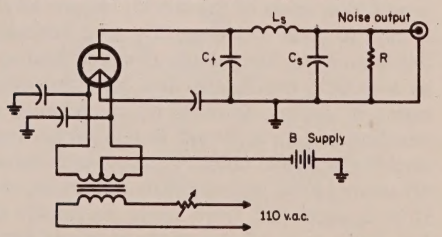


Fig. 2—Basic schematic of a thermionic diode noise generator.

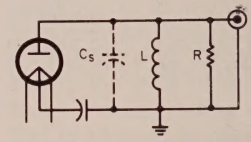


Fig. 4—Single channel compensation of shunt capacity.

The accuracy of the diode circuit at high frequencies can be improved by counteracting the effect of the stray capacity. This can be done in either of two ways: first, an inductor can be placed across the load resistor to resonate with the stray capacity at the frequency of interest. This is shown in fig. 4.

This arrangement is convenient when the noise generator is to be used over a relatively narrow range of frequencies. Commercial noise generators are available using this

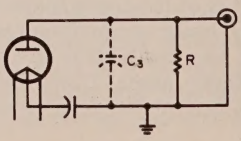


Fig. 3—Simplified schematic neglecting series lead inductance.

principle; a range switch is provided to switch inductances for covering the frequency ranges of interest, usually the various TV channels.

This arrangement has the advantage that it is relatively easy to adjust. A grip dip meter is coupled to the inductance and the inductance varied until resonance occurs at the desired center frequency. It is necessary, of course, to disconnect the load resistor; otherwise, the Q of the circuit will be so low that it will not be possible to obtain a meaningful dip of the grid dip meter. This arrangement gives accurate results over a relatively narrow frequency range, but becomes inconvenient to use when a wide range of frequencies must be covered.

A second method is to rearrange the components into the circuit shown in fig. 5; the frequency range may be extended from the high audio through v.h.f. without bandswitching or other readjustments.

The principle is the same as that used to extend the frequency range of a video amplifier. Since the impedances are so low, the 3 db frequency can be extended to several hundred megacycles.

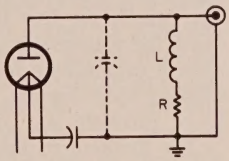


Fig. 5—Broadband compensation of the circuit shunt capacitance.

As can be seen from fig. 5, an inductance is placed in series with the load resistance, R. The value of inductance is adjusted so that it resonates with the stray capacity of the circuit in the frequency range where the response starts to fall off. Thus, the resonant rise of the inductance is used to extend the frequency range of the circuit; as the Q of the circuit is increased, the resonant rise becomes greater. The Q of the circuit must be adjusted so as not to cause the resonant rise to be excessive, however, for this can cause just as much error as the fall-off caused by the stray capacity. Assuming an accuracy of 1 db (voltage constant to within 1.12), it is necessary that the resonant rise be held to less than this value. From Terman's *Radio Engineering*[1], it can be seen that a Q of 0.55 will easily meet the requirements. Since $Q=X_L/R=0.55$ and $R=50$ ohms, we can easily solve for L. The frequency is taken to be the frequency where the response would be down 3 db without compensation. The stray capacity is 12.3 pf and the resistance is 50 ohms so that this frequency is 270 mHz. Substituting this frequency into the above equation and solving for L gives:

$$L=\frac{Q\times R}{2\pi f}=\frac{0.55\times 50}{2\pi\times 270\times 10^6}=0.0162\ \mu\text{h}.$$

For a 72 ohm load resistance, the frequency is 187 mHz and the inductance becomes 0.0366 μh.

From a practical point of view, either of these values of inductance is too small to design; it is necessary to determine the proper inductance experimentally. This can be done by measuring the impedance looking into the output terminals of the noise generator at various frequencies with an RX meter, a GR 1602 admittance meter or a similar device; the diode filament is cold when this measurement is made. The inductance is adjusted until the desired impedance *vs.* frequency curve is obtained. A typical inductor can be obtained by winding one of the resistor leads into a one-turn coil using the shank of a 9/64-inch twist drill bit as a winding form. This one-turn coil extended the 1 db range of the noise generator from less than 125 mHz to over 350 mHz!

Figure 6(A) shows the measured value of the noise generator load impedance as seen looking into the output terminal of the generator. The theoretical response of the generator without compensation is shown by the dotted line. The increase in useful frequency range is readily apparent. The impedance, plotted on an expanded Smith chart, is shown in fig. 6(B) for frequencies up to 300 mHz.

Since the noise diode acts as a constant current source, the noise power output of the noise generator is directly proportional to the resistive component of the diode impedance. As seen from fig. 6(A), this is essentially constant to within ± 1 db to over 350 mHz. At low frequencies the resistive component approaches 52.6 ohms as this is the actual resistance of the nominal 50 ohm resistor used. Actually, accuracies better than 1 db can be obtained by using fig. 6(A) as an instrument calibration curve showing the noise power output versus frequency. Thus at 225 mHz the noise output is 1 db high so that the noise figure as calculated from Eq. (2) will be 1 db too low.

Other accuracies are easily obtainable; if an output constant to within $\pm 1/2$ db is re-

[1]*Radio Engineering*, F. E. Terman, Third Edition, p. 254, fig. 6-18.

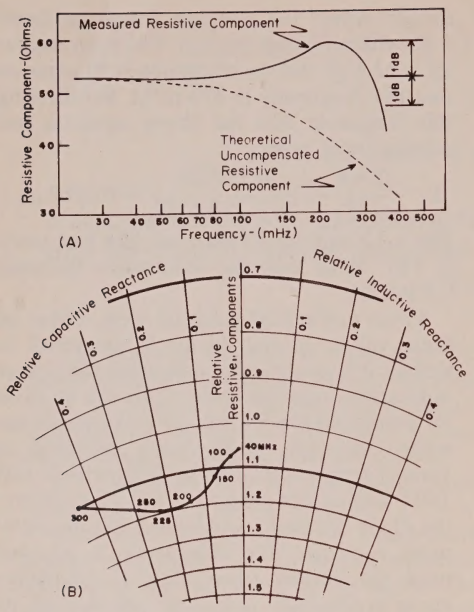


Fig. 6—(A) A plot of the measured value versus frequency of the resistive component of the noise diode load impedance. The dotted line shows the theoretical uncompensated resistive component. (B) An expanded Smith chart plot of the measured diode load impedance between 40 and 300 mHz referenced to 50 ohms.

quired, a smaller coil can be used giving less resonant rise. This will also give a smaller frequency range. If a tolerance of 2 or 3 db is acceptable, a larger coil would be used and a greater frequency response obtained.

The frequency range, for a given accuracy, can also be extended by reducing the stray capacitance. The two most logical places to do this are with the coaxial connector and tube socket; for example, use a BNC connector instead of the u.h.f. type shown. Reducing the capacity by 1 db from the present 12.3 pf to 11.3 pf will increase the high frequency limit for a given accuracy by approximately 8 per cent.

The design of the remainder of the system is relatively straight-forward.

The filament leads to the noise diode should be filtered to prevent line noise from reaching the noise diode and increasing the noise output of the generator. The amount and type of filtering will depend on the amount of line noise in the particular location of the used.

The power supply should be capable of supplying 100-150 volts d.c. at 35-50 ma. The main considerations in selecting an anode voltage are: first, the voltage should be high enough to insure operation in the temperature saturated region. The saturation curve for the 5722 shows a decided knee at 50 volts so that the anode voltage should be well above this value. Second, the anode voltage must not exceed the maximum rated voltage, which for this tube is 200 volts. And third, the voltage should be as high as practicable in minimizing transit time effects. Considering these factors, operation in the vicinity of 150 volts is a good choice.

The filament of the noise diode is usually supplied from a separate filament transformer with a means of voltage control in its primary. An adjustable transformer, such as a Variac, gives smooth control and is convenient. A

[*Continued on page 81*]

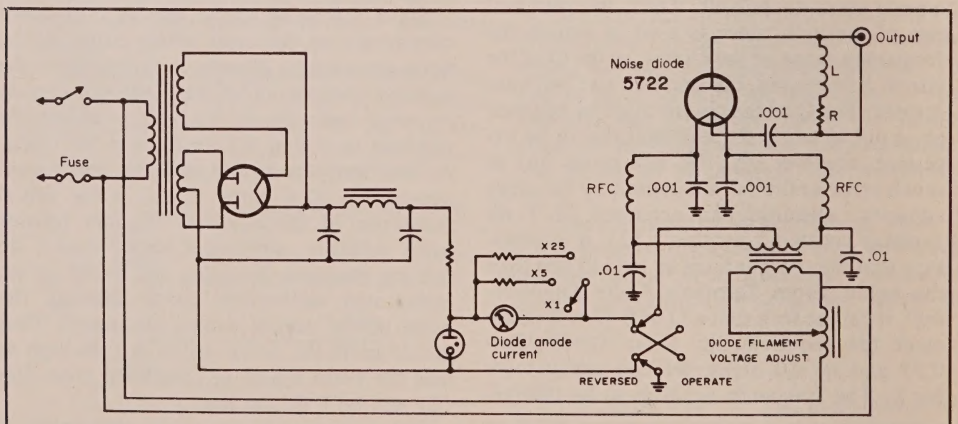


Fig. 7—Typical noise generator schematic diagram.

Getting Ready For The OSCAR-6 Satellite

BY GEORGE JACOBS,* W3ASK

By the time this appears in print, the AMSAT-OSCAR-C (A-O-C) satellite should have been neatly packed and sent on its way to NASA's Western Test Range in California where it will await a piggyback ride into space with an ITOS-D weather satellite.

Although there has been some slippage in the ITOS-D launch date chances now seem good for a late July or early August launch.

The technical characteristics of the A-O-C satellite were discussed last month ("Summer Launch Planned For OSCAR-6"). This article will discuss the satellite's orbit and how to communicate through OSCAR-6.

Once successfully in orbit, the A-O-C satellite will be called OSCAR-6.

OSCAR 6's Orbit

One of the advantages of using a satellite for communications is that its orbit can be calculated and predicted with a high degree of accuracy. Unlike the chance openings upon which ground-based v.h.f. DX contacts depend, it will be possible to predict the times that the OSCAR-6 satellite can be used for communications.

It should be fairly easy to keep track of OSCAR-6 once it is in orbit. NASA plans to place the latest radio amateur satellite into an orbit similar to the one experienced with OSCAR-5; that is, near sun-synchronous, polar, and at an altitude of 900 miles.

Here are the planned parameters that will assist in tracking the satellite:

Inclination: 102 degrees to the equator, which is equivalent to 12 degrees west of north.

Period: The satellite will complete an orbit every 115 minutes.

Velocity: 250 miles a minute.

Equatorial Crossings: Approximately 28.8 degrees of longitude further west for each successive south-to-north crossing.

Satellite Range: Geographically, the satellite will see a circular area approximately 4600 miles in diameter, with the point on earth directly under the satellite as its center.

Direction: The satellite will travel in a north-to-south direction during portions of its orbit that are in daylight and in a south-to-north direction during darkness.

Launch Site: NASA's Western Test Range located near Lompoc, California.

Launch Time: Launch is planned for 9 A.M. PST (1700 GMT).

Geographical latitude will determine how many consecutive orbits will be within range of any location. At 40 degrees north latitude, which is almost the center of the USA, at least *three* consecutive orbits and sometimes four should be within range each evening and morning. At the equator a total of four orbits a day will be within range, while in polar regions almost every orbit will be within range.

During the orbit of closet approach to a specific location, the satellite should remain within communication range for as long as twenty minutes. Passes to the east and west will be heard for progressively shorter duration the further away they are.

Once OSCAR-6 is in orbit, up-to-the-minute orbital information will be transmitted daily by WIAW. These transmissions will include times and longitudes of equatorial crossings, as well as the approximate times that the satellite will be over selected areas.

WIAW normally transmits official ARRL bulletins in c.w. at 0000 and 0400 GMT on 1805, 3580, 7080, 14080, 21080 and 28080 kHz, and voice transmissions at 0100 and 0330 GMT on 1820, 3990, 7290, 14290, 21390 and 28590 kHz. The 0000 and 0100 GMT transmissions are carried Monday through Saturday (GMT), while the 0330 and 0400 GMT transmissions are on Tuesday

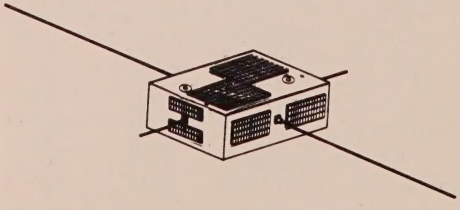


Fig. 1—Artist's conception of the OSCAR 6 two-to-ten-meter amateur radio repeater satellite.

*Space Communications Editor, *CQ*, 11307 Clara St., Silver Spring, Md. 20902

through Saturday. While OSCAR-6 is in orbit these special bulletins may be given on a daily basis and at other times as well.

Similar orbital and other information concerning the OSCAR-6 satellite will be transmitted on special AMSAT h.f. networks. A net serving principally the eastern portion of the U.S. now meets the second and fourth Mondays of each month on 3855kHz at 9 P.M. EDT. A second net meets the second and fourth Sundays of each month on 14280 kHz at 1800 GMT. A third net also presently meets on the second and fourth Sundays of each month, at 1900 GMT on 21280 kHz. All of these nets will meet much more frequently as the launch of OSCAR-6 draws closer, and they will probably meet daily once the satellite is in orbit. Listen for the AMSAT club station call W3ZM on all nets and schedules. Anyone interested in the AMSAT-OSCAR project is invited to check in.

It is also planned to transmit orbital data directly from the OSCAR-6 satellite. A novel electronic memory device, designed specifically for the project, will be aboard the satellite. Called CODESTORE, it is capable of storing messages received in Morse Code for repeated retransmission, upon command, on the satellite's 29.450 mHz beacon transmitter. The memory length of CODESTORE is sufficient to permit storage of approximately 15 words in Morse code. The unit is set to retransmit messages at 13.4 w.p.m. It is hoped to be able to load CODESTORE with orbital data with the following being a typical readout:

"ORBIT 203 1101 Z AT 101W ADD 115R111 MIN AND 28R781 DEG PER ORBIT"

This would mean that OSCAR-6's 203rd orbit should begin by crossing the equator at 101 degrees west longitude at 1101 GMT. The latest period is given at 115.111 minutes, and successive orbits will pass 28.781 degrees of longitude further to the west.

CODESTORE will also be used to transmit other information concerning the satellite, and for other messages of importance.

The orbital data transmitted on WIAW, the AMSAT nets and CODESTORE, together with the parameters given at the beginning of this article should enable the OSCAR-6 satellite to be tracked with high precision. A procedure for using this data to determine acquisition and loss of signal times appears in "Australis-OSCAR 5: Where Its At," by W. Danielson and S. Glick, page 54 of the October, 1969 issue of *QST*.

For those who prefer simpler, but somewhat less accurate orbital data, Table I shows the approximate times to begin listening for the satellite at locations within the USA. The table is based upon a launch time of 9 A.M. PST, and the times shown in the table should be corrected by the amount that the actual launch might differ from this.

The satellite will be in a near sun-synchronous orbit. It will complete 12½ orbits every day and 25 orbits every other day. This means that it will pass over a given location at just about the same local time every other day. On alternate days this will be one hour later than on the interleaved days because of the uncompleted half orbit on these days.

Table I—Approximate Times OSCAR-6 Within Range Of USA (Local Standard Time)

Alternate Days	*Interleaved Days*	*Satellite Direction*	*Approx. Time In Range (Minutes)*
6:55 A.M.	5:55 A.M.	N-S	10
8:50 A.M.	7:50 A.M.	N-S	20
10:45 A.M.	9:45 A.M.	N-S	15
6:55 P.M.	5:55 P.M.	S-N	10
8:50 P.M.	7:50 P.M.	S-N	20
10:45 P.M.	9:45 P.M.	S-N	15

Based on a launch time of 9 A.M. PST

Frequency Info

OSCAR-6 will be a radio-frequency translator, or repeater. It will accept *any* mode of transmission within a 100 kHz-wide passband in the 2-meter band (between 145.90 and 146.00 mHz) and repeat the transmission within a corresponding 100 kHz-wide passband in the 10-meter band (between 29.45 and 29.55 mHz). This means you *transmit* to the satellite on a frequency in the 2-meter passband, and you *listen* for signals repeated by the satellite on a corresponding frequency in the 10-meter passband. The relationship between transmit and receive frequencies are shown in Table II. For example, if you transmit on 145.95 mHz, listen on 29.50 mHz. If you hear a signal on 29.480 mHz and you want to call him, transmit on 145.930 mHz, etc. Keep Table II near your operating position since it can be very useful in rapidly determining where to transmit and where to listen. Note that the repeater does not invert

the passband. In other words, upper sideband transmissions remain upper sideband on the downlink. This represents a change in design resulting from the aircraft flight tests of the OSCAR-6 repeater conducted last year.

The 10-meter receive frequencies shown in Table II will vary slightly due to Doppler shift. As the satellite approaches the ground-based receiving location, its velocity will cause the received signal to be as much as 4 kHz *higher* in frequency. At the point of nearest approach, the Doppler shift should be zero, but as the satellite continues away from the receiving station, the frequency will continue to decrease for about another 4 kHz. The Doppler shift will require slight but almost constant retuning of the received signal, particularly as the satellite passes its point of nearest approach.

OSCAR 6's beacon, telemetry and CODESTORE will operate on 29.45 mHz. A 435.10 mHz beacon with a power output of about 400 milliwatts is under construction as this is being written, and if completed in time it will also transmit telemetry and CODESTORE data.

Communicating Through OSCAR-6

Figure 2 shows how a trans-Atlantic QSO between radio amateurs in NYC and London could take place through the OSCAR-6 satellite. A 4600 mile diameter communication range circle is drawn about each location. The area of intersection is shown by shading. Communications between both locations should be possible when the satellite's orbit passes through this area of mutual visibility.

Assume that W1AW has announced that an OSCAR-6 orbit will cross the equator at 40 degrees west longitude at 2340 GMT (6:40 P.M. EST). Since this is an evening pass, it will be in a south-to-north direction.

The communication range circles and the orbit's path can be plotted on a globe or a suitable map as described in *"Australis-OSCAR 5:* Where It's At," referred to earlier in this article, and as shown in fig. 2.

The distance along the orbital path from the equatorial crossing to the point on the communication range circles where the satellite is first acquired (ACS) is measured as 2500 miles. Since the satellite travels at 250 miles a minute, it will reach this point 10 minutes after crossing the equator, or at 2350 GMT. At this time, with transmitting and receiving antennas pointing towards the satellite on a bearing of 110 degrees, the NYC station begins to call the British station on 145.950 mHz. The London station is listening on 29.50 mHz with his antennas aimed at 220 degrees. He adjusts his receiver a kHz or two higher in frequency to compensate for Doppler shift. The NYC station also tunes his receiver to the same frequency. As soon as he hears his own signal coming through he knows that he has accessed the satellite. The British station also hears the NY station, and responds on the transmitting frequency of 145.950 mHz. Both stations are listening on 29.50 mHz. The London station knows he has accessed the satellite when he hears his own signal in his receiver. Both stations are now in communications through the satellite. To maintain peak reception, both stations will have to adjust their receivers to compensate for the Doppler shift, and they will have to rotate their antennas to keep them pointed towards the satellite.

In the example shown in fig. 2, the distance between AOS (acquisition of signal) and

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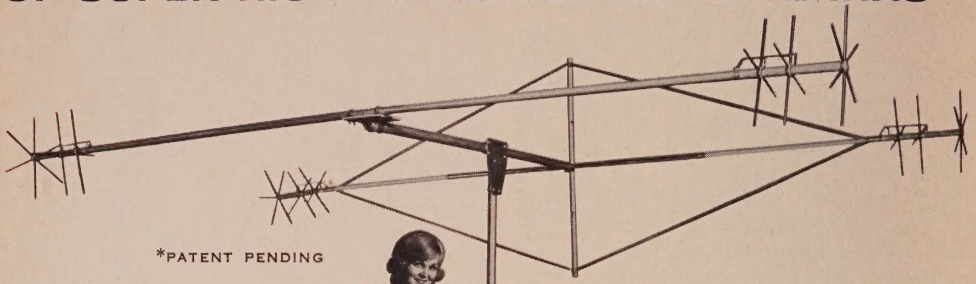
Table II—Relationship Between Transmit and Receive Frequencies Through OSCAR-6

Transmit Freq. mHz	*Corresponding Receive Freq. mHz*
145.900	29.450
145.905	29.455
145.910	29.460
145.915	29.465
145.920	29.470
145.925	29.475
145.930	29.480
145.935	29.485
145.940	29.490
145.945	29.495
145.950	29.500
145.955	29.505
145.960	29.510
145.965	29.515
145.970	29.520
145.975	29.525
145.980	29.530
145.985	29.535
145.990	29.540
145.995	29.545
146.000	29.550

Based on: $F_r = F_t - 116.450$ mHz
$F_t = F_r + 116.450$ mHz

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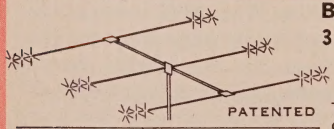
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- 4 Bands 6-10-15 & 20
- Higher Gain
- Higher Front to Back Ratio
- Small Size — (Turning Radius 7′)
- Lightweight — 15 lbs.
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3 ELEMENTS
10-15-20 METERS

Bands	10-15-20 Meters
Power Rating	1400 Watts P. E. P.
Total Boom Length	11′
Turning Radius	7′-10″
Total Weight	23 lbs.
Single Feed Line	52 ohm
SWR at Resonance	1.5 to 1.0 max.

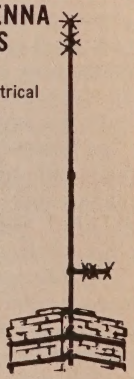
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Power Rating	1400 Watts P.E.P.
Total Weight	6 lbs.
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Adriatic Islands Expedition

BY TINE BRAJNIK,* YU3EY

FOLLOWING the example of many other countries, the Yugoslav DX Club (YU-DXC) was recently formed. Although the club was conceived several years ago, it was not officially founded until June, 1970. The organization established its membership criteria based on awards and contest achievements and began publication of a newsletter, the "YU-DX Bilten," written in Serbo-Croat language.

We confirmed as our first major action the organization of a Yugoslav Islands DX-pedition. Interest for such an activity was high among YU amateurs so we looked with great optimism towards the realization of the idea. However, plans are quite different from the work itself and while many people promised their support, the complete arrangements for the operation including finances and equipment lay on the shoulders of the operators themselves.

We planned operations from eight Yugoslav islands in the Adriatic Sea near the coastal town of Split. We requested permission from the national radio society, SRJ, to use a special prefix for the expedition. Our request was approved and we were assigned the first 4N2 prefix ever issued.

Before departing we made some last-minute arrangements in Split at "Hotel YU2-NEG" as we called the flat of Tom, our DX-pedition leader. Everything was ready on schedule so early in the morning on July 15, 1970 in a small motor boat sat: Tom, YU2-NEG; Ljube, YU1QBC (operator at YU1-BCD); Mujo, YU3TCB; Stojan, YU1NFP; Miro, YU1NXB; Rato and Vlado of YU2-AKL, and Tine, YU3EY. For equipment we brought a Heathkit HW-100, a Swan 500C, a portable Honda generator, a trap dipole, and a three band quad antenna. The operating crew changed during the course of the expedition since the entire operation lasted over a month and such participation is not tourist travel but hard work.

We first landed on a small rocky island named Ciovo, where the first contact using the 4N2 prefix took place. On July 15, 1971 at 1000 GMT the first contact was made; the lucky man was OZ9MV and the operator at 4N2CI was YU3EY. From then on we had almost constant "pile-ups." In less than three days we had over 3300 QSO's. The quad, although only ten feet above ground, and the HW-100 transceiver worked perfectly. Every day stateside stations filled our logs with their outstanding rapid contacts. Such was not possible with the European stations which usually took longer time. Also, we received much encouragement from the American hams, giving us additional motivation to continue.

*c/o Carl G. Kratzer, WA3HRV/2, 402 Eddy St., Apt. 3, Ithaca, N.Y. 14850.



Three of the operators of the YU-DXC expedition on the way to Ciovo Island by motorboat. L. to r.: YU2NEG, YU3EY, YU1QBC).



The Yu DX Club expedition to the Adriatic Islands touched on eight islands off the coast of Yugoslavia. The islands are numbered in the order they are activated. Over 30,000 QSO's were made using the 4N2 prefix.

After three days we moved to Solta Island. At 4N2SO we had probably the strongest signal of any of our operations since the quad was about 50 feet above ground level and the ground was about 500 feet above sea level. From 4N2SO we had about 6000 QSO's in five days though we could not operate full-time due to TVI problems. The TVI was worst on Solta, which is a popular summer resort. Fortunately, our operation did not suffer too much. The weather was beautiful but we had little time to swim or bathe. Solta remains in our memories for the fantastic pile-up of American stations, especially on c.w.

After five days at 4N2SO we moved on to the third island. Between operations we travelled by ferry boat back to Split where we purchased gasoline, food, and other supplies for the next stop. Then we took another boat to the next island. This way we lost only one day between each two islands.

The third operation took place on Brac Island, the largest of the group. 4N2BR was not activated immediately since we all had a common rest the first night. Here, another member who joined us was Pol, YU3BU but YU1NFP had to leave us due to problems with his studies. The whole group was very homogeneous which helped very much on all problems we had during the expedition. From 4N2BR we had good pile-ups again and for the first time conditions were good towards the east and we worked many Japanese stations. From then on the JA boys waited daily for our "beaming far east" calls.

Though many things happened during the DXpedition, more was happy than sad. For example, one night we awoke Mujo, YU3-TCB to take his turn at the rig. He rose slightly, still half-asleep, and muttered, "OK, you're 59, QRZ?"

After four days of operation from Brac we went to Hvar Island. Here we had considerable trouble locating a camping site. After a whole day of running around under the hot sun we finally found a suitable location. If we needed four hours to build a complete station at the first island, this time it was shortened to less than one hour. We became much more proficient as the expedition progressed. The quad antenna was very clumsy to build each time but it was very quick. On Hvar we had our first weather problems. Rain poured for several hours but fortunately the tents stayed together and kept the equipment dry. Then another "miracle" happened—for a while the bands closed so that even Radio Tirana, which normally makes a terrible racket on 40 Meters, could not be heard. After an hour or so conditions returned to

[*Continued on page 86*]



YU3EY with complete luggage at 4N2SO.



Location of 4N2CI on Ciovo Island in Adriatic.

CQ Reviews: The Ross & White RW-Bnd 2-Meter Transceiver

BY GLEN E. ZOOK,* K9STH/5

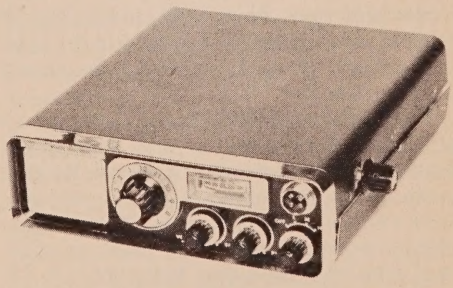
Ross & White Company, already known to the amateur f.m. operator for tone encoders, has recently added a 12 channel, 10 watt output, solid-state 2-meter f.m. unit to their line of amateur f.m. equipment. This transceiver may be equipped for single-tone ("tone burst") operation with a built-in 3 tone encoder. The basic unit is imported from Japan and the tone encoder added stateside. Tone frequencies normally preset are 1800 Hz, 1950 Hz, and 2100 Hz. However, other tones can be preset on special order. The RW-Bnd comes from the factory with crystals for 146.940 mHz simplex operation and 146.34/.94 mHz repeater operation. Also included are microphone, power cable, and mobile mounting bracket. Other features include a 3-position transmit power switch, relative-output/S-meter, and attractive chrome and black styling.

Technical Details

The Ross and White RW-Bnd 2-meter transceiver is a fully solid state unit constructed on phenolic circuit boards. The tone encoder is on epoxy board with provision for changing the preset tone frequencies. Channel switching is accomplished by a 12-position rotary switch.

Transmitter: The transmitting section of the RW-Bnd is fully solid-state using 12 mHz crystals as the frequency source. Crystal multiplication is 12 times, accomplished in a tripler and two doubler stages. Six transistors and three integrated circuits are used in the transmitter. Each crystal has its own warping capacitor to allow adjustment for on-frequency operation. Audio is provided by a dynamic hand-held p.t.t. microphone. Amplification and shaping is provided by a single integrated circuit and associated circuitry. An Instantaneous Devation Control ("IDC") is provided to keep maximum deviation constant. Modulation is by the phase method, giving excellent audio characteristics. The remainder of the transmitting circuitry in the RW-Bnd transceiver is relatively straightforward along conventional design. The final output stages are de-rated sufficiently to allow momentary short or open circuits without damage to the equipment.

Receiver: The receiving section is loaded with JFET's and I.C.'s. The r.f. amplifiers are both JFET, thus giving low noise, low intermod probability, with high gain. The first mixer is also JFET. High i.f. frequency is the usual 10.7 mHz and the low i.f. is 455 kHz. First injection voltage is provided by one of 12 crystals operating in the 45 mHz region and a multiplication of 3. Each crystal is provided with its own warping capacitor to insure on-frequency operation. The high i.f. circuitry consists of a band-pass filter, a bi-polar amplifier, and a ceramic filter (original models had a mechanical filter). Second mixer is another JFET and the remaining low i.f. devices are bi-polar and integrated circuits. The audio stages are included within the integrated circuits and the squelch noise derived. Of note is that early models had both mixers as bipolars.



The Ross & White RW-Bnd 2-meter f.m. transceiver.

*FM Editor, *CQ*.

Tone Encoder: The tone encoder in the Ross & White RW-Bnd transceiver is similar to the TE-2 and TE-5 models marketed as add-on units. This version has three preset tones, usually 1800 Hz, 1950 Hz, and 2100 Hz. However, special frequencies can be ordered or the encoder can be reset in the field. Construction is on a small epoxy board which is installed within the transceiver. The tone selection control is mounted on the right side of the unit near the front. Each time the unit is keyed (and when encoder is in the "on" mode) a 1/2 second burst of tone is sent at the beginning of the transmission. This tone is set with a deviation approximately 3/4 that of maximum voice peaks.

Specifications and Performance

The RW-Bnd was put through an exhaustive test cycle under both actual operating conditions and controlled laboratory conditions. In both cases the unit performed very well in most areas. The input voltage was 13.8 v.d.c. in both field and laboratory usage.

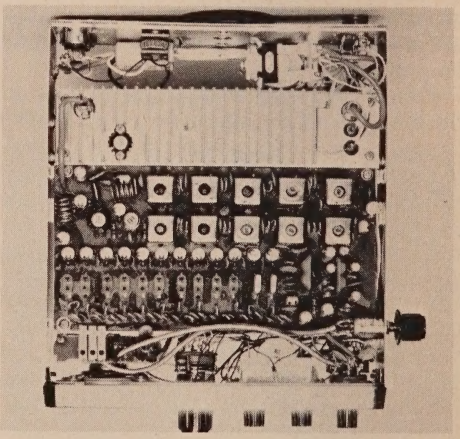
In the low position the transmitter output was about .15 watts; in the medium position about 1.75 watts; and in the high position about 12.5 watts. Transmit audio was excellent as long as the deviation was under ±7 kHz. Above that value the audio with voice modulation became quite un-symmetrical with about twice the deviation on one side as the other. With sine-wave input the deviation was fairly symmetrical to ±15 kHz. However, since most amateur f.m. operation is going towards narrowband or ±5 kHz deviation, the un-symmetrical audio at the higher deviations should present no problems. A second problem was encountered with the RW-Bnd transmitter. Both transmit crystals were pre-set almost exactly 10 kHz high. Ross & White has assured the author that this was an error by the check-out technician and steps have been undertaken to prevent another unit from leaving in the same shape. The crystals did pull onto frequency with no difficulty.

The receiving section checked without any difficulties. Both receive crystals were within tolerance and held there under usage. Receive audio quality was excellent as was performance of the squelch circuitry. All spurious responses were within the −60db specification, with the worst case being the low i.f. image at +910 kHz from desired carrier. This spur was only 62 db down, but all others were 70 db or more down, and all within the 2-meter amateur band. The fact that all spurs which could be determined with an input of 100,000 microvolts were within the amateur band is a great help in areas with a lot of commercial activity. Not one spur could be found in the usual high-band frequencies assigned for commercial use! However, this does not mean that intermod from two or more commercials or from amateur and commercials cannot happen. Just that it is less likely. The unit tested had the ceramic filter rather than the mechanical filter of the earliest models. With the ceramic filter the adjacent channel rejection using the 20 db quieting method was excellent, with the ±30 kHz channel 60 db down and the ±60 kHz channel over 70 db down. Basic sensitivity of the receiver was about 0.2 microvolts for 20 db quieting.

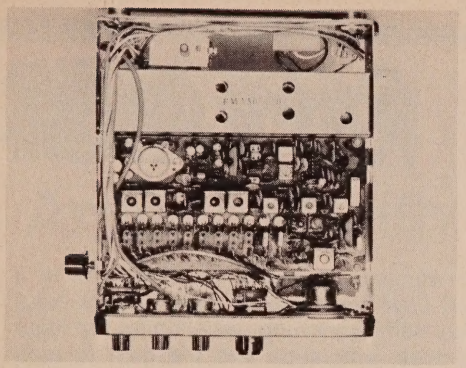
The output of the tone encoder was a very nice looking sine-wave on the 'scope readout of the service monitor. The frequency of the tones were within 5 Hz of center, and the timing was about 0.6 seconds. All in all, very good for tone access repeaters.

Construction

The construction and workmanship in the Ross & White RW-Bnd transceiver is very good overall. The printed circuit boards are well layed out and soldering and workmanship on them is quite good. The hand wired portions are also good. The wires are not run through the terminals and wrapped before



Top view of the Ross & White RW-Bnd transceiver shows the solid-construction.



Underside of the RW Bnd transceiver.

soldering as in most U.S.-built gear, but the connections are bright with good solder joints. Components appear to be of good quality.

General Comments

Like all rigs reviewed previously the Ross & White RW-Bnd has some weak points among the strong points. The distorted audio at the higher deviation levels is a distinct disadvantage to the amateur living in areas still using wideband techniques. However, this would not affect the amateur using narrowband. Second, the switch on the tone-encoder is not labeled. This makes going from "off" to any of the tone frequencies a feat of memory. For the record all the way counter-clockwise is off, then 1800 Hz, 1950 Hz, and 2100 Hz. A labeled knob would make this quite a bit easier. Finally, the instruction manual leaves quite a bit to be desired. Along these lines Ross & White is hard at work improving the manual. Not present in the original manuals are pictorial and board layout information. Also, no tune-up information is present. There is, however, a comprehensive voltage measurement chart. When the manual is updated with the pictorial diagrams and alignment instructions it should prove an excellent manual.

Now, on the plus side, the receiver is one of the better units seen to date. The lack of spurs in the commercial portion of the band (at least in the test unit) is a definite plus. Next, the styling is quite attractive and the size convenient for installation in even the most compact automobiles. Workmanship and materials are of sufficient quality to rate active consideration as well as clean layout and ease of access. Finally, provision for single-tone encoding will be attractive to many amateurs now in areas using tone access, or in the future if tone access becomes a necessity.

The Ross & White RW-Bnd 2-meter f.m. transceiver sells for $359.95 including crystals for 146.940 mHz simplex and 146.34/.94 repeater, microphone, power cable, mounting bracket and tone encoder. If desired the unit can be ordered less encoder for $319.95. For more information contact Ross & White, 50 West Dundee Road, Wheeling, Ill. 60090. —*K9STH/5*

Ross & White RW-BND 2M Transceiver

GENERAL SPECIFICATIONS:

Size: 2.4" × 7.4" × 8.4"

Weight: 3.75 lbs.

Power Requirements: 13.8 v.d.c. @ 0.15a standby; 2.2a transmit

Accessories Furnished: Microphone, installation hardware, power cable, crystals for 146.94/146.94 mHz and 146.34/146.94 mHz operation.

TECHNICAL SPECIFICATIONS:

Receiver:	*Claimed*	*Achieved*
Sensitivity 20 db quieting	0.5 μv	0.2 μv
Adjacent Channel Rejection		
±30 kHz	†	62 db
±60 kHz	†	70 db
Audio Recovery (full quieting signal):		
±5 kHz	5w.	4.3 w.
±7.5 kHz	5w.	4.6 w.
±15 kHz	5w.	5.1 w.
Number of Channels	12	12
Frequency Stability	0.002%	met
Transmitter:		
Power output @ 13.8 v.d.c.		
"L"	0.1 w.	0.15 w.
"M"	1.0 w.	1.75 w.
"H"	10.0 w.	12.5 w.
Preset Deviation	none	±8 kHz
Maximum Deviation	±20 kHz	‡
Number of Channels	12	12
Frequency stability	0.001%	met

† Originally published specifications gave information for mechanical filter. Ceramic filter specifications not available at time of writing.

‡ Maximum deviation was beyond capabilities of author to measure. Test equipment available measures only to ±20 kHz. This point achieved at almost full IDC setting.

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338 Colinear ground plane. 3.4 db gain omnidirectionally. Vertically polarized. 52 ohm match. Radiator of seamless aluminum tubing; radials of solid aluminum rod. VSWR less than 1.5:1. All steel parts iridite treated. Accepts PL-259.

362 SJ2S4 high performance all-driven stacked array. 4 vertically polarized dipoles. 6.2 omnidirectional gain. 52 ohm. May be mounted on mast or roof saddle. Unique phasing and matching harness for perfect parallel phase relationship. Center fed. Broad band response. DC ground.

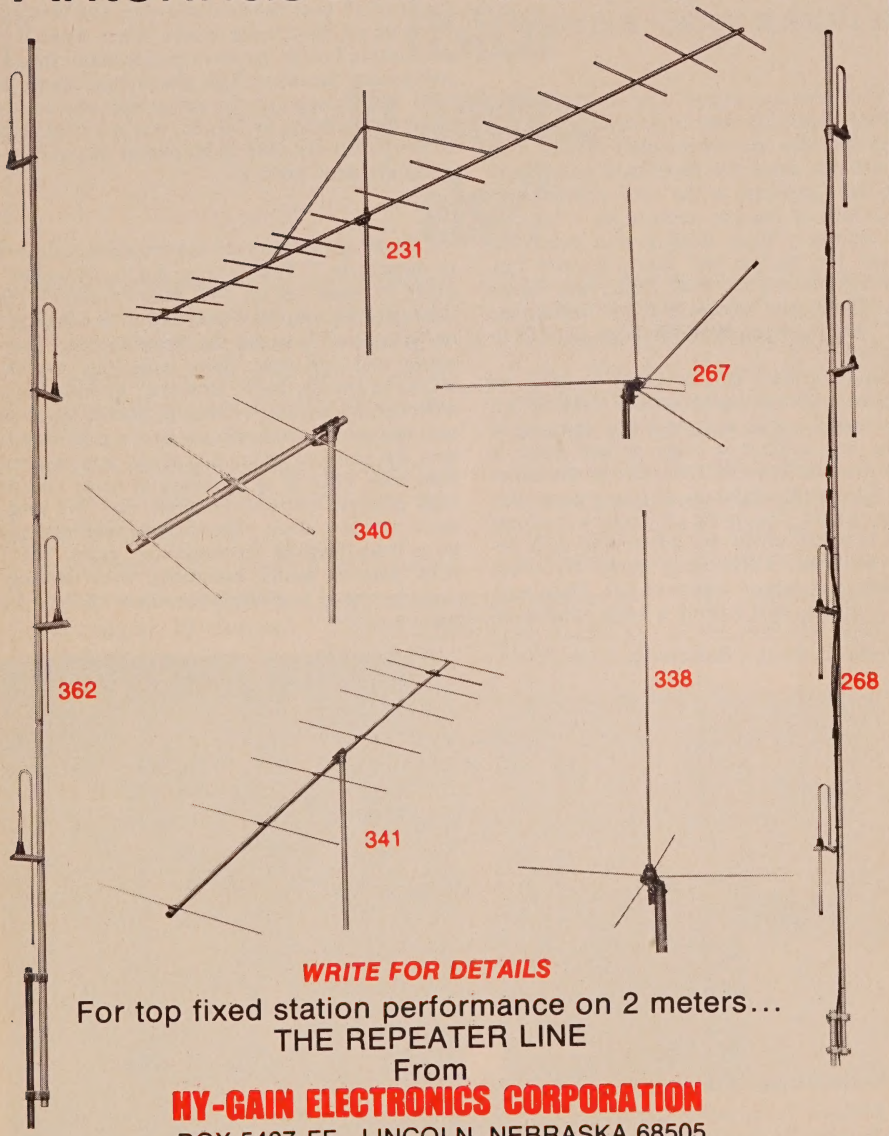
340 3 element high performance beam. 9 db gain. Coaxial balun. Special VHF Beta Match configuration. Unidirectional pattern. VSWR 1.5:1. 52 ohm impedance. Heavy gauge aluminum tubing and tough aluminum rod construction.

341 8 element high performance beam. 14.5 db gain. Coaxial balun. VHF Beta Match. Unidirectional. Boom length 14'. VSWR 1.5:1. 52 ohm feedpoint. Heavy gauge commercial type aluminum construction.

231 15 element high performance beam. 17.8 db gain. Coaxial balun. Beta Match. Unidirectional. Boom length 28'. VSWR 1.5:1. 52 ohm feedpoint. Extra-strength heavy wall commercial aluminum tubing.

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F. M.

BY GLEN E. ZOOK,* K9STH/5

WE'VE been recognized! The 1972 edition of the ARRL *Radio Amateur's Handbook* has recognized f.m. with its own complete section. This is remarkable since the *Handbook* only really recognized transistors in the 1969 edition. Certain portions of the f.m. section are a bit outdated, especially those dealing with standards. However, for the first real efforts towards f.m. by the *Handbook* I say Well Done, and thanks to the ARRL and to f.m.'s friend within the ARRL, Roy Albright, W5EYB, West Gulf Division Director.

As many readers already know, there is an approximate 60 day lag between writing of this column and its arrival at the mailbox. Because of this lag, this column is being written about 1 month after the Repeater Directory hit the newsstands. Comments about the directory have been quite favorable. The prime criticisms were from people in areas which did not report their repeater activities. Fortunately, these areas are now sending in reports right and left. Thus, next month's column will include a large number of update information in the same format as the original directory. This will be published in time for the height of the vacation season. By the way, how do you like the directory and its format?

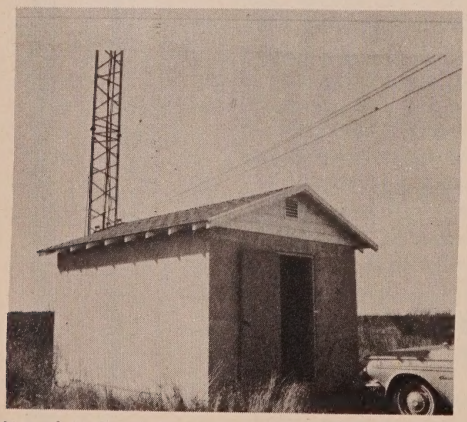
*818 Brentwood Lane, Richardson, Texas 75080.

Photographs

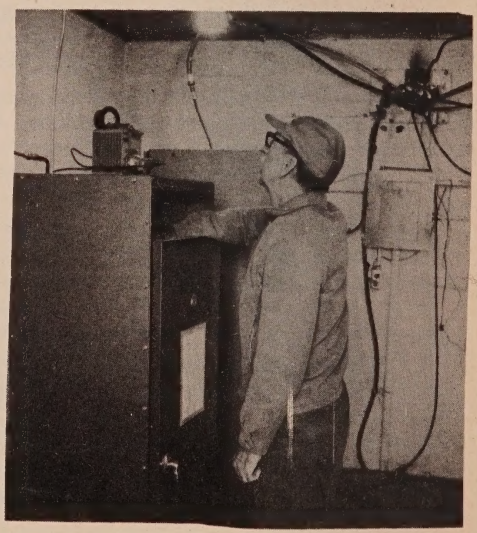
It is obvious that several photographs are accompanying this column. These are the results of efforts by the roving FM cameraman, Tom, WA5KHU. Tom's employment keeps him on the road all over the Southwestern and Western portions of the United States. Since Tom is a very active f.m.'er, he often makes many friends using many repeaters. This gives him a chance to view and photograph the actual sites and equipment for inclusion in *CQ*. So, why not beat Tom to the punch and take some photos of your machine and send them in.

Technical Talk

"My #*@¢$ "Japtrac" intermods everytime I go downtown." "That @*+=##% "Rice Box" hears .76 when I'm on .79." Sound familar? The ham only f.m. rig often referred to as "Japtrac" or "Rice Box" has been the target of many comments and criticisms. Some criticisms are deserved in specific cases. However, intermod and adjacent channel interference problems are often not the fault of the ham only f.m. rig. Sure, you hear the adjacent channel at times, and the unit intermods when in the presence of many and/or high powered commercial units. But, we amateurs are not alone. The commercial services have been fighting intermod for years. Now, with, what it seems, everybody with two-way radio intermod is a definite problem all over the spectrum.



Site of Midland, Texas repeater is about 4 miles south of the city. The receiver antenna is a DB-220, 360' above ground and the transmit antenna is a 5/8 wave groundplane 300' above ground. *(Photo courtesy WA5KHU)*



Vernon, W5BAJ, shown working on the Midland Repeater. *(Photo courtesy WA5KHU)*

Why won't Don Wallace listen to anyone else?

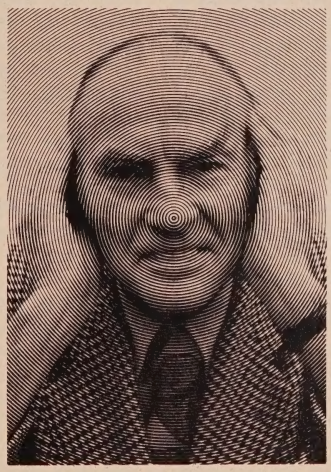
W6AM doesn't have to, since he began using our professional quality VHF-FM 2 meter transceiver with exclusive *Astropoint*. The precise and powerful Astropoint system actually blocks out all interference. So when one of the nation's number one hams is having a 2-way conversation he won't have unwanted interference.

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And there's a lot more that appeals to Don about the SR-C826M than just Astropoint. All silicon semiconductors with solid state circuitry. Ten watts of R.F. output power combined with low power consumption. MOSFET R.F. Amplifiers and mixers. And the list of features goes on.

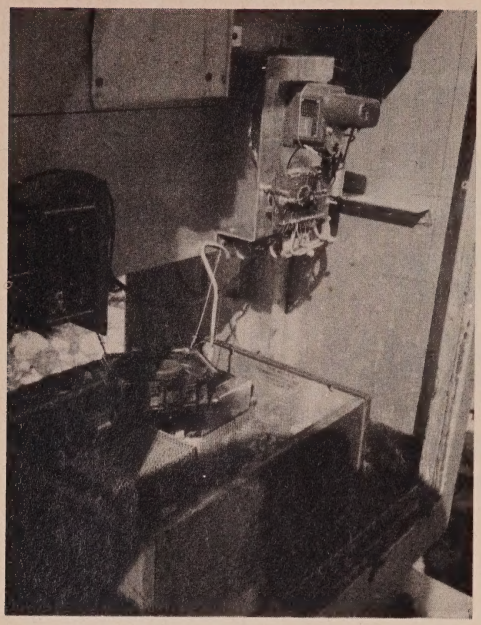
Which is why Don Wallace hasn't been listening to anyone else lately. Not that he's choosy about who he listens to. Just whose equipment he listens on.





For complete specifications and the name of your nearest dealer, write:

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Wilmington, Calif. 90744
(213) 775-6284



Close up of Midland, Texas ARC Repeater. It uses a Sensicon "A" Receiver and RCA-LD Transmitter. *(Photo courtesy WA5KHU)*

Many f.m.'ers have noticed that the older commercial f.m. rigs do not have as many problems as the units designed for amateur f.m. work. This effect is quite apparent when one looks at the spec's. For example, the typical amateur f.m. rig has a spurious response specification of —60 db or better. The same spec holds for the adjacent channel rejection, —60 db. Now, take a look at the older tube-type commercial gear. For example, the Motorola "G" receiver (TA140, etc. series) has an adjacent channel rejection of —100 db at either ±18 kHz or ±32 kHz depending on which Permakay Filter is installed (narrowband or wideband). The spurious response of this receiver is also —100 db. The newer Motrac receivers like the "M" have a spurious rejection of —100 db, an adjacent channel rejection of ±15 kHz at —100 db, and, EIA SINAD intermod spec of —80 db. Thus, the commercial gear is 100 times as good in rejecting spurious and adjacent channel interference.

Why can't the ham only rigs be as good? It's simply a matter of economics. The average top grade commercial f.m. receiving section alone costs more than the entire ham only rig. The manufacturers of the ham only equipment could make the specs on their equipment just as good as the top Motorola, GE, RCA, and others. However, the price would be out of the range of most amateurs. Thus, lower price must bring lower performance. You get what you pay for.

Well, since we must live with the economical units, we must find ways to get rid of the problems. In some cases the addition of a pre-amp to the receiving section has cured intermod ills! This is really due to the additional selectivity of the tuned circuits in the pre-amp and their ability to reject signals in the Commercial bands. Of course the pre-amps are not as wide as the receiver front-end, so one cannot make as great frequency excursions. Fortunately most f.m. activity is confined to about 1 mHz on two meters, and the normal pre-amp has no difficulty covering the segment.

In more severe cases a filter must be added between the receiver and the antenna. This can take the form of a simple strip-line filter as in the ARRL *VHF Manual*. Such a filter can be adjusted by varying the coupling for various bandwidths. The insertion loss is in the neighborhood of 1-2 db, but is often worth it.

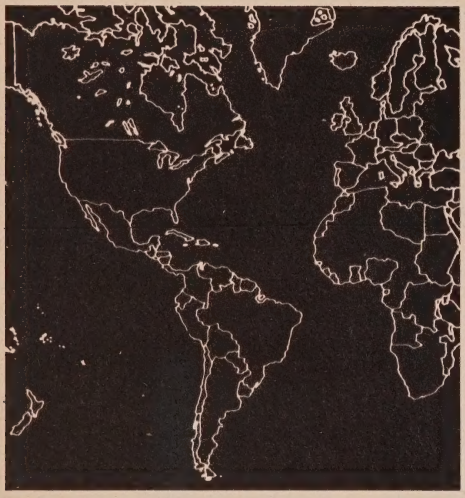
Where single frequency operation is all that is needed, as in a repeater, the cavity often does an excellent job. Since cavities are often used to keep the transmitter out of the receiver, they are normally installed before the intermod problem becomes apparent. The cavity has a higher insertion loss, but it is also very narrow and admits only the desired frequency (for most practical purposes).

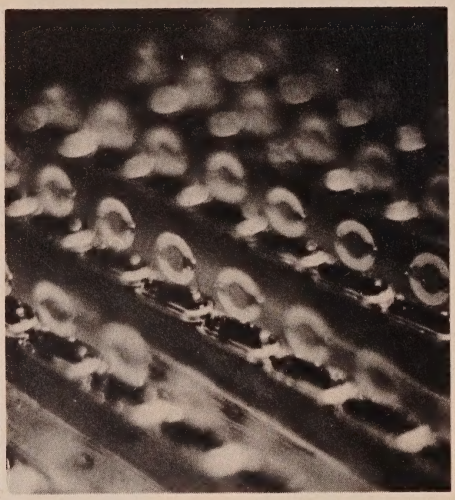
The above cures are helpful only if the mixing and intermod generation takes place within the receiver itself. In other cases the mixing can take place outside the receiver. For example, a rusty joint on a downspout can generate all kinds of mixer products. In this case more drastic action must be taken. If the mixing product falls exactly on the desired frequency there is not much which can be done. However, the product is often just to one side or the other of the desired signal. In these cases a cavity does help at times. However, the best cure is usually the on-frequency crystal filter. These filters are relatively expensive ($150+) but are quite sharp at the operating frequency. Of course the input signals must be stable in frequency to stay within the bandpass of the filter. The insertion loss is between 2-3 db on a typical filter.

Before trying any of the above cures, first try a complete re-alignment of the rig involved. Often a good alignment will reduce or eliminate many problems. Then check the antenna system for corroded joints, connectors, hardware, etc. to keep products from being generated in the antenna system. In mobile installations the strip-line filter is often all that is needed to keep out intermod from commercial sources.

Now, in the case of adjacent channel interference. Realignment of the i.f. coils for a peak can often help here. Since most amateur f.m. is going narrowband, it is not usually necessary to use a sweep generator and keep the i.f. cans tuned broad. In other cases it may be necessary to replace the ceramic or other type of filter with

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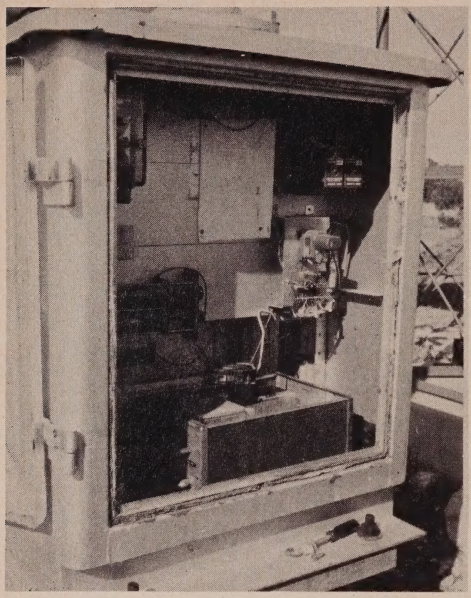
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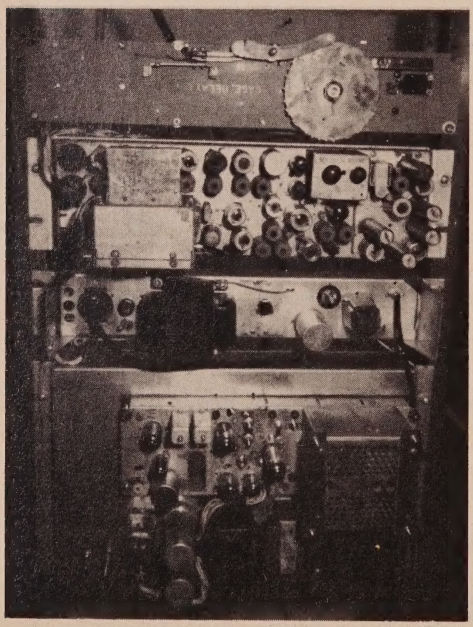
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General Layout of Big Spring, Texas W5AW repeater. Note cavities and cooling fan arrangement. *(Photo courtesy WA5KHU)*



Internal view of the Big Spring, Texas repeater. It consists of a Bendix Mobile unit converted for repeater use. Object in upper right is code wheel lid. *(Photo courtesy WA5KHU)*

a similar type with sharper skirts. This will usually cure all but the most severe problems. If you are trying to work 146.790 mHz in the same building as the repeater with 100 watts output on 146.760 mHz, forget it and move.

As a tip in buying a new piece of gear, take a good look at all the specifications. Remember that channel spacings in many portions of the country are 30 kHz now. Also remember that intermod is a problem in the heart of a major metropolitan area, but that most areas, including the suburbs do not have such a problem. Also, always read the reviews in the major amateur magazines to see how the units functioned under controlled circumstances.

Mini-Review

New-Tronics Corporation, better known by their trade-mark, Hustler, has just come out with a new 2 meter mobile antenna designed for the mobile f.m. operator. The model CGT-144 is different from all other mobile whips on the market at the present time. This antenna is two half waves in phase! The CGT-144 is spec'd at 5 db over a quarter-wave groundplane antenna. Although it is quite long, about 85", it has sufficient gain to make it quite attractive to the amateur in the fringe area or who is running low power

A sample of the CGT-144 was forwarded by New-Tronics to this columnist for evaluation. Since the length is 85", it was decided to mount it on the rear of the XYL's station wagon rather than on top of the van normally used for commuting. The rig in the station wagon is a U43HHT-1130E Motrac running about 50 watts output. The CGT-144 was adjusted for minimum reflected power using a Bird 43 Thru-line Wattmeter. This is accomplished by sliding the whip within the base and tightening a set-screw. Best reflected power was about 2 watts with 50 forward.

After rechecking the Motrac for peak performance on the bench I started out working a local on 146.940 mHz direct. Within minutes other amateurs had joined in. After driving north on US75 for about 1/2 hour I gave up. The signal was still quite copyable, and usually full-quieting to a station about 65 miles away! Not bad at all for direct. In the Richardson area there are a few holes in which a mobile signal is usually lost, or, at best becomes quite noisy. The CGT-144 talked out of these holes with a "full quieting" signal.

Since I do not have a full antennae laboratory at my disposal I cannot adequately judge the absolute gain of the CGT-144. However, I, like most amateurs, am concerned with how the antenna performs, not how it looks on paper. The New-Tronics people informed me that the approximate angle of radiation is 15-20 degrees above the horizon. Also, the theoretical gain of

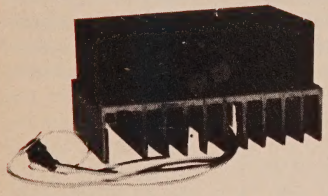
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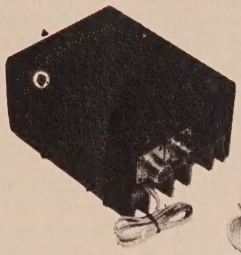
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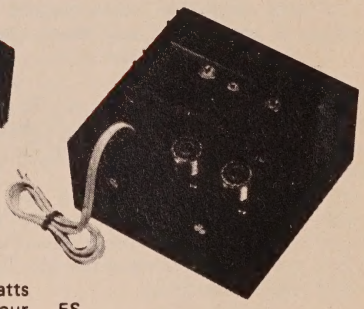
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Alex, W5TOC, shown checking out W5AW, the Big Spring repeater. Repeater site is about 2 miles south of the city on a hill. The receive antenna is a "J" pole about 250' above ground. Transmit antenna is about 220' up. *(Photo courtesy of WA5KHU)*

two half waves in phase is about 6 db. However, the feed of the CGT-144 is such that the top section is starved voltage fed with the slight reduction in gain.

The antenna is available with two types of mounting: 3/4" hole mount; and trunk-lip mounting. The suggested list price was not available at press time, but watch the ads. The CGT-144 is worth considering.

NEWS

More DX news this month! Ansyl, YV5DLT, dropped a card in the mail with the following information about f.m. in Caracas, Venezuela. Their 2 meter f.m. repeater is on a 7000 foot mountain with an input of 145.000 mHz and an output of 147.000 mHz. A second repeater is under construction and will also be at the 7000 foot level. The average level of the city of Caracas is 3000 feet, so those repeaters must romp and stomp. For the simplex operator 146.940 mHz is used extensively. Ansyl has promised more information, so we should be hearing more and more about f.m. in that part of the world.

Texas VHF FM Society: The winter meeting of the Texas VHF-FM Society was held during the later part of February in Corpus-Christi, Texas. Prime discussions were the new Constitution, which was tabled for further rewording; the TIRS or Texas Inter-city Repeater System for connecting repeaters during emergencies; and a 220 mHz band plan for the state. The 220 mHz band plan makes use of several plans which have been proposed in the various publications. Basically it sets aside the 220-220.5 mHz and 222.0-222.5 mHz ranges for DX work as requested by the ARRL. Also, the channel spacings for f.m. are 20 kHz and repeater input/output spacings are 1 mHz to allow simplex operation with the same equipment. The plan is such to place as much activity in the besieged lower 2 mHz as possible. Inputs were placed on the high side similar to the state 450 mHz band plan. Guard channels are provided to keep f.m. away from the DX'ers. A Sketch of the proposed band usage appears as figure 1. The next meeting of the Texas VHF FM Society is planned for Austin in August.

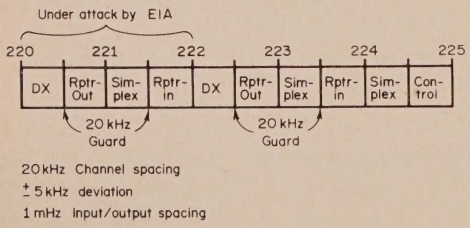


Fig. 1—Texas VHF FM Society 220 Band Plan.

Channel Marker

The schematic of the W5PCX channel marker which appeared last April has an error. The connections to Ulc should be made as shown in figure 2. Also, the prototype model worked well, but subsequent models have had to have pins 6 and 7 of both U2 and U3 grounded for proper operation. Don't quite know why, may be a difference in manufacturers.

Finalè

The last couple month's Technical Talks have been rather devoid of construction. Here's hoping that next month's project works out all right. If so, then back to construction. Now, get out those cameras and head out to the repeater during this warm summer weather. Also, suggestions as to just what you want to see are always needed to keep this column in tip-top shape. So let's have those comments and suggestions. Best of luck and see you next month. 73, Glen, K9STH/5

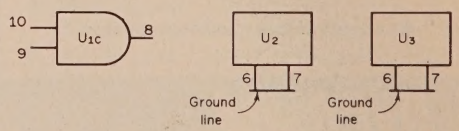


Fig. 2—Corrections and Additions to Channel Marker (April, 1972).

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

LAST month we looked at the different families of Integrated Circuits available and learned a little bit about them. This month we will discuss some practical uses for readily available units.

The most common family of digital integrated circuits available is the TTL 7400 series. These chips are all 30mHz (approx.) logic, fully compatible with each other, and operate from a 5 volt power supply. Almost all of the major types of logic functions are available and the cost for even the most complex chip rarely exceeds $2.00 on the surplus market. Complete technical details pertaining to specific device numbers are available from most of the integrated circuit manufacturers. At the completion of this months column, we have indicated the technical data division addresses of these manufacturers. A short note, describing the chip in question as well as a brief (no more than one or two sentences) description of the intended use will often bring data sheets and application notes that will all but solve the problem. You will have to interpret the data, though, as most companies do not or will not design circuitry for individuals as they are far more concerned with their quantity users. Now to the circuits.

Figure 1 is a schematic diagram of an SN7400 quad 2-input gate which is quite common and very readily available. It contains, as can be seen from the diagram, four (quad) 2-input gates, completely separated from each other. In order for the output of a particular gate to be low, both inputs to the gate must be high. With this thought in mind, we can proceed to fig. 2.

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

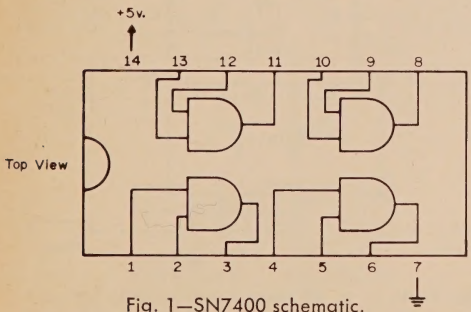


Fig. 1—SN7400 schematic.

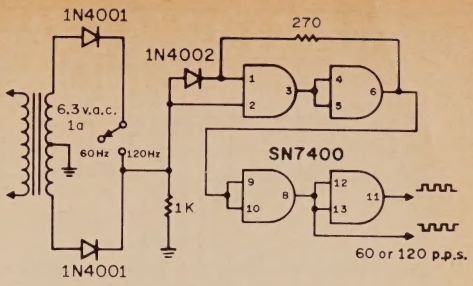


Fig. 2—60/120 p.p.s. pulse generator described in text. Don't forget the +5 volt source for the SN7400.

This circuit is a Schmitt trigger, used to produce accurate, highly stable timing pulses from the a.c. line. Such pulses are perfect for amateur television synchronizing applications as well as all kinds of special timing systems. By connecting a ÷ 60 divider to the output of this "pulse generator" we can obtain 1 pulse per second to an accuracy of about 0.1%, the inherent accuracy of the a.c. line. Such pulses are perfect for digital clock applications.

As can be seen from the schematic, either half wave rectified (60 p.p.s.) or full wave rectified (120 p.p.s.) half sine waves are applied to the input of the first gate. When the input is at the zero point of the wave, the output of the first gate is high thereby making the output of the second low. This low output is fed back through the 270 ohm resistor to the first gate "locking" the output of it to the high state.

As the input now rises, one input to the gate becomes high but the gate will not switch until the diode conducts and allows

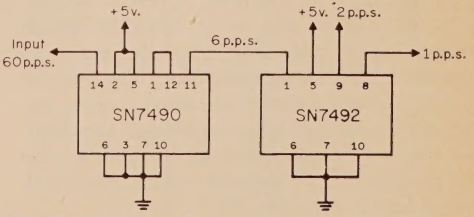


Fig. 3—Divide by 60 circuit. Note that the SN7492 also provides a 2 p.p.s. output.

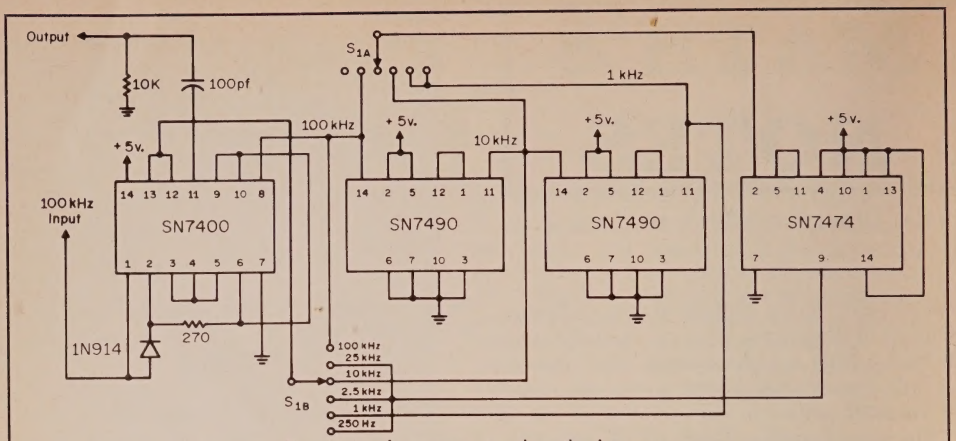


Fig. 4—Marker generator described in text.

both inputs to become high. Only at that point does the gate output become low forcing the following gates output to become high. Again, the feedback through the 270 ohm resistor locks the state. As the input now begins to fall, it can be seen that the first gate will not revert back to the high state until the input falls much lower than the point where the gate originally switched. This is because of the feedback signal that keeps the other input of the gate high. The two remaining gates in the SN7400 are connected as inverters and serve to further "steepen" the rise and fall times of the system.

Figure 3 shows an SN7490 decade divider and an SN7492 ÷6 chip connected as a ÷60 circuit. This configuration, connected to the one just described will provide the accurate 1p.p.s. pulses for the digital clock and similar applications.

The SN7490 can also be used as a frequency divider by employing a trigger (fig. 2.) connected as a driver for it. With a 100kHz frequency standard (present in all good quality receivers) as a signal source, the circuitry shown in fig. 4 will produce harmonic rich markers at 100kHz, 25kHz, 10kHz, 2.5kHz, 1kHz, and even 250kHz which should be of interest to even the most demanding s.s.b. enthusiast. Since the division ratios of these circuits are fixed, inputs can be any frequency up to the limit of the chips. In this way many different frequencies can be produced from a single source. Just think what a v.f.o. driver will do!

By employing a trigger suitable for higher frequencies (the one in fig. 2 is probably only good for a few hundred kHz or so) the SN7490 will divide by 10, any signal up to its limit of about 18—20 mHz.

Another useful 7400 series integrated circuit is the SN74121. This versatile device is a monostable multivibrator, often called a one-shot, with a period that can be anything from 40 nano-seconds to 40 seconds. Figure 5 shows the hookup for this device.

A positive pulse of at least 50 nanoseconds in length into the input pin 5, will cause the circuit to produce an output pulse whose length is directly dependent on the values of R_t and C_t according to the following formula:

Output pulse width = $C_t R_t \log_e 2$.

R_t can vary from as low as 2K to 40K while C_t may be any value from 10 pf to 10 mf. The two charts of fig. 6 will be of great help for those not wishing to do the math, Hi! I might also add that the input pulse can be of any length greater than the previously mentioned value. It is the rise time that fires

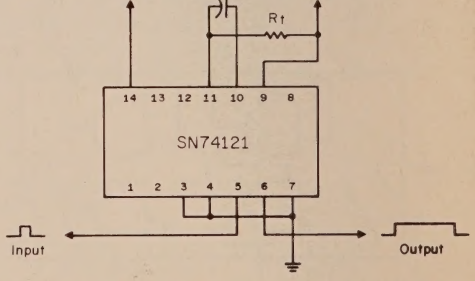
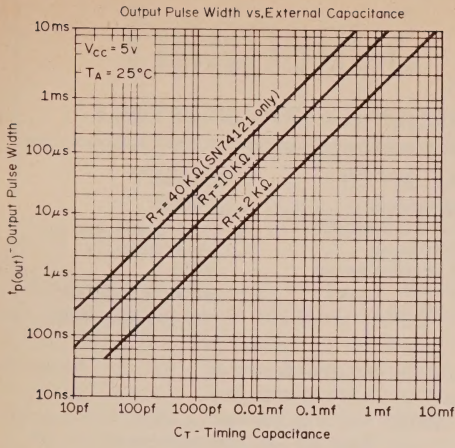


Fig. 5—40 ns to 40 second monostable. See text for values of Rt and Ct.



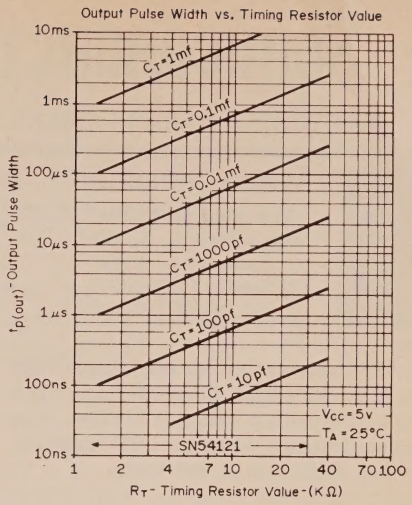


Fig. 6—Timing charts for SN74121.

the circuit and, once fired, the input no longer has any effect.

Other 7400 circuits available but too numerous to outline here in circuitry are: 50 mHz flip-flops (SN74H101); BCD to decimal converters (SN 7441); decade BCD counters (SN7490); Divide by 2, 4, 8, and 16 in one package (SN7493); and Divide by 2, and 6 in one package (SN7492) not to mention a host of other logic functions.

We would be most happy to hear about your accomplishments with digital circuitry, especially where it is of interest to radio amateurs, and will be happy to pass on worthwhile information to our readers.

As promised, here is a list of integrated circuit manufacturers:

MOTOROLA SEMICONDUCTOR PRODUCTS
5005 East McDowell Road
Phoenix, Arizona 85008

FAIRCHILD SEMICONDUCTOR CORP.
313 Fairchild Drive
Mountain View, Calif. 94040

TEXAS INSTRUMENTS INCORPORATED
Marketing & Information Services
P. O. Box 5012 MS 308
Dallas, Texas 75222

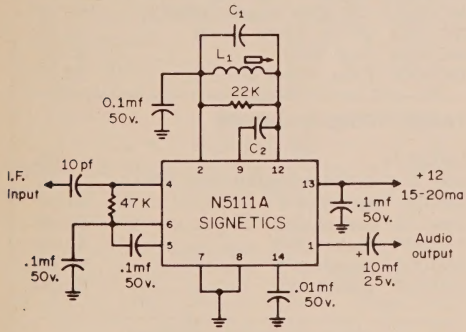
SIGNETICS CORPORATION
811 East Arques Avenue
Sunnyvale, Calif. 94086

RCA
Solid State Division
Somerville, New Jersey 08876

ITT SEMICONDUCTORS
3301 Electronics Way
West Palm Beach, Fla. 33407

Although we rarely repeat information, in response to the nearly 150 hams who have written to me pertaining to two articles I had previously written in November 1971 *CQ*, and February 1972 *CQ*, I am taking this

[*Continued on page 80*]



I.F.	C_1 (pf)	C_2 (pf)	L_1 (µH)
10.7mHz	120	4.7	1.5-3
4.5mHz	120	3.0	7-14
2 mHz	300	3.0	16-30
455kHz	650	3.0	135-240

Fig. 7—Simple f.m. detector circuitry.

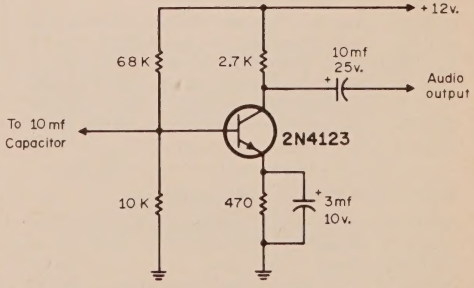


Fig. 8—Simple one stage audio amplifier for use with circuit of fig. 7.

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CA3020A	RCA 1 audio	$3.92
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MC1306P	Motorola ½ W audio	$1.10
MC1350P	High gain RF amp/IF amp	$1.15
MC1357P	FM IF amp Quadrature det	$2.25
MC1496	Hard to find Bal Mod	$3.25
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MFC4010	Multi-purpose wide-band amp	$1.25
MFC8040	Low noise preamp	$1.50
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CQ Reviews: The Heathkit IM-102 Digital Multimeter

BY WILFRED M. SCHERER,* W2AEF

THE trend in recent years has been toward equipment with digital readouts obtained electronically. In line with this the Heath people not so long ago introduced a low-cost frequency counter.[1] They have now come up with another digital instrument, the Model IM-102 Digital Multimeter (DMM) that is an a.c. operated v.o.m. to measure resistances, d.c. and a.c. voltages and currents.

Besides having an up-to-date state-of-the-art device, the advantage gained by the use of the DMM over the analog type of device (those using a mechanical meter movement with pointer and scale) is the attainment of much greater accuracy, higher resolution, direct readout, repeatable readings, correct indications obtained from any viewing angle and regardless of the instrument's physical position. Gone are the errors encountered with parallax problems, interpolation, friction, balance, static electricity and non-linearity.

The IM-102 is a solid-state affair offering an accuracy of 0.2% ±1 digit on five d.c. ranges of 200 mv, 2, 20, 200 and 2000 v. with a resolution of 100 μv on the 200 mv range and up to 1 v. on the 2000 v. range. Adjustment to the stated tolerance is made using a factory-assembled 0.2% precision d.c. calibrator supplied with the kit. A transfer method, using internal circuitry of the IM-102, provides an a.c. accuracy on like ranges of 0.75-1.5% ± 1 digit (40 Hz-10kHz), depending on the range. (1 kv limit on 2000 v.d.c. and 500 v. limit on 2000 v.a.c. ranges. The current ranges are 200 μa, 2, 20, 200 ma and 2 a. with an accuracy of 0.3-0.5% ± 1 digit on d.c. and 1-1.5% ± 1 digit on a.c. (40 Hz-10 kHz). Six resistance ranges are 200, 2K, 20K, 200K, 2M and 20M with an accuracy of 0.5% ± 1 digit, except 1.5% on the two highest ranges.

Note that the percentage of accuracy is based on actual reading, not on a full-scale basis as done with conventional meters where the percentage of error rises at values below full scale. For example; with a meter rated at ±2% of full scale, the tolerance on the 50 v. range is ± 1 volt (.02 × 50) at any point. At 20 volts a 1 v. error amounts to 5%, whereas with a tolerance based on actual reading, the percentage of error is constant over the range.

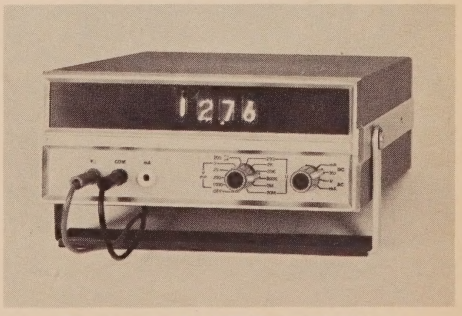
The polarity on d.c. is automatically indicated by a *plus* or *minus* sign at the viewing window, eliminating the need for switching leads under conditions of different polarity.[2] An over-range indicator tells when the measured parameter is greater than the full-scale capability of the range in use. The decimal point is automatically placed on all ranges. Overload protection is obtained with fuses on the volt-ohm input, the current input and a.c. power line. Except on the d.c.v. function, protection also is provided with clamping diodes.

The unit operates from a 120 v.a.c. source (or may be wired for 240 v.a.c.) for which there is a detachable 3-wire polarized line cord with the grounded lead connected to the chassis for personnel protection. Unlike many v.t.v.m.'s, the common-input lead and the

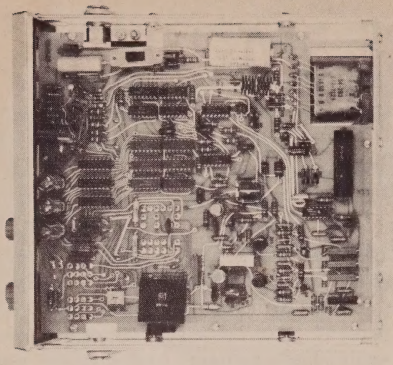
*Technical Director, *CQ*.

[1]"*CQ* Reviews the Heathkit Model IB-101 Frequency Counter," *CQ*, July 1971, p. 47.

[2]The polarity is related to that above or below that at the common lead.



The Heathkit IM-102 Digital Multimeter.



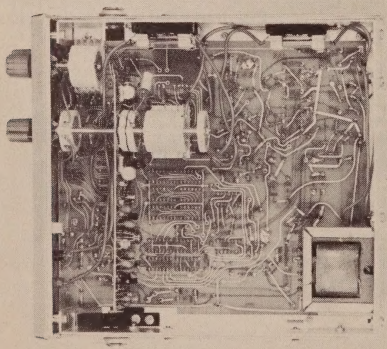
Interior view at top of the IM-102.

circuit-board grounds are isolated from the chassis and the case and may be floated 500 v. above the power-line ground. A high input impedance minimizes circuit loading. For d.c. it is 100M on the 200 mv range, 1000M on the 2 v. range and 10M on the other ones. The a.c.-input impedance is 1M at 150 mmf on all ranges.

Circuitry

A detailed description of the circuitry in the IM-102 and explanation of its operation is too involved to present here (complete data is given in the manual), but basically the set-up is as follows:

All input fuctions are scaled or converted to fundamental ranges of 200 mv or 2v. as the need requires for the particular range setting. The d.c.-voltage measuring arrangement engages a high-impedance bipolar analog-to-digital converter that functions on a patented dual-slope principle.



Bottom view of the IM-102.

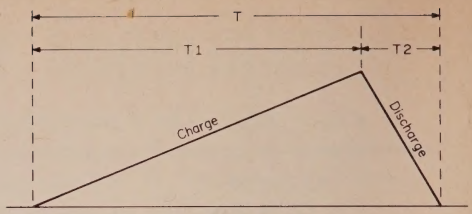


Fig. 1—Charge and discharge times for operation of the IM-102 as explained in the text.

This action is shown at fig. 1. The sum of the two time elements, T1-T2, is the total time, T, required for 8000 pulses of a clock oscillator that functions at 40 kHz (because of this summation, operation is not dependent on clock accuracy or stability). During T1, an integrator charges a capacitor as indicated by the upward-sloping ramp. During T2 the capacitor discharges as shown by the downward-sloping ramp. The ramp down time, T2, is counted, decoded and displayed by cold-cathode Nixie tubes.

A.c.-input voltages are converted to d.c. using an average-responding a.c.-converter setup calibrated in r.m.s. The converter produces a full-scale d.c.-output potential of 2 v. for all a.c. ranges.

Current readings are obtained by measuring the voltage drop across one or more resistors in series with the circuit under test. The resistance network is so arranged that the full-scale potential for all ranges is 200 mv. This is measured using either the d.c. or the a.c. voltage-input circuit as the need requires.

Resistance is measured by passing a constant current through the unknown resistor and then reading the d.c. voltage drop across it. This current is different for each ohms range, running from 1 ma on the 200-ohm range to only 0.1 na on the 20M range.

Construction

The unit is assembled on double-faced printed-circuit boards in much the same fashion as previously described for the Heath frequency counter. Similarly, the panel is die-cast zinc with a tinted viewing window. The unit is housed in a light-weight aluminum case made up of top and bottom U-shaped half-shells. A carrying handle may be used as a tilt-up stand. The various facilities are automatically set up using a 4-position function switch and a 12-position range switch. Input terminals are banana-pin jacks of which there are three; one red, one black

and one white. A black common test lead is assembled with a clip at the test end. The other lead is red and is put together with a test prod on the end of which may be slipped a miniature clip equipped for the purpose.

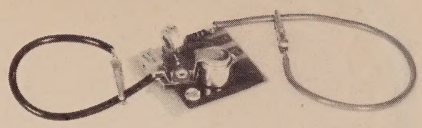
Assembly

It took 14 hours to get our IM-102 together and calibrated, time which may have been shortened had it not been for our current custom of measuring each resistor to make sure it is correct before installation. This is a procedure that might have saved us operational headaches in other cases!

Assembly is made on two circuit boards; a large main one and a small one for the a.c. converter section. Special range and function switches, enclosed in ceramic and designed for circuit-board installations, also are employed. There are 25 diodes, 19 IC's and 18 transistors (including a number of FET's) to be installed. For the IC's, small pins, serving as connectors, are first soldered to the boards. 14-pin sockets are installed for three Nixie tubes which display the last three digits. A vertical neon bulb is used for the first digit when four figures are required and shows up as figure 1 (the highest indication on any range is 1999).[3] Small "trim-pots," some of which are accessible through holes at the rear of the case, are installed for most adjustments.

Calibration

The calibrator consists of a mercury cell in conjunction with a resistive network that is adjusted and sealed at the factory for an output potential of exactly 200 mv. This serves as a standard for calibrating the 200 mv range of the IM-102. After this is done, the mercury cell is switched off and another resistive network is connected to a 3.5 v. point on the DMM circuit board and is adjusted by the user to produce 200 mv across one section of the network as indicated by the 200 mv range previously calibrated. This



The calibrator for the IM-102 is supplied assembled on a small circuit board as shown here.

causes 2 volts to appear across another portion of the network which is then used as the standard to calibrate the 2-volt range. The other ranges automatically then fall in line. Incidentally, the calibrator also may be used to check other high-impedance instruments, such as a v.t.v.m.

A.c. calibration is as follows: With the function switch set for d.c. volts, a display is had of the average value of a half-wave a.c. potential. Such a potential is obtained from the power transformer, through a rectifier, and is applied to a test point where it is adjusted for a reading of +9.00 on the 20 v.d.c. range of the DMM. Since this is the average value, the r.m.s. potential is 9.99+ (1.11 × av.). The circuit is next switched so that a full sine wave from the transformer is applied to the test point (via the adjust control which has already been set) where the r.m.s. potential is now doubled (because of the full-wave action) to 19.998 + volts, close enough to calibrate the a.c. range at 20 v.

The ohms set up is calibrated using precision resistors on the calibrator board plus separate ones supplied with the kit.

Operation and Performance

Not having on hand any other voltage standards or voltmeters with a better rated tolerance than that of the IM-102, we were not in a position to precisely check the accuracy of the instrument; however, comparisons between two IM-102's, calibrated against individual calibrators supplied with each, indicated both instruments to track together within the rated tolerance. Checks against several voltmeters of known accuracy at specific points (recently checked against a commercial precision voltage calibrator) confirmed our belief in the preciseness of the IM-102's.

[*Continued on page 84*]

[3]This is characteristic of a 3½ digit instrument of which the IM-102 is a type. This means that for a four-numeral readout the unit displays three decades up to 999 above which only a *one* can appear as the first significant figure. Hence, the highest normal indication is in terms of 1999; however, the definition also implies some over-range capability which in the case of the IM-102 is rated at 20%. Under such conditions only three digits show up and must be mentally preceded by a *two*. On the other hand, a maximum display of 9999 would require a 4-digit instrument.

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The right antennas for the new FM transceivers...or any 2 meter mobile rig.

Rugged, high riding mobiles. Ready to go where you go, take what you dish out...and deliver every bit of performance your rig is capable of.

261 Commercial duty 1/4 wave, claw mounted roof top whip. Precision tunable to any discrete frequency 108 thru 470 MHz. Complete with 18′ of coax and connector. 17-7 ph stainless steel whip.

260 Same as above. Furnished without coax.

262 Rugged, magnetic mount whip. 108 thru 470 MHz. Great for temporary or semi-permanent no-hole installation. Holds secure to 100 mph. Complete with coax and connector. Base matching coil for 52 ohm match. 17-7 ph stainless steel whip.

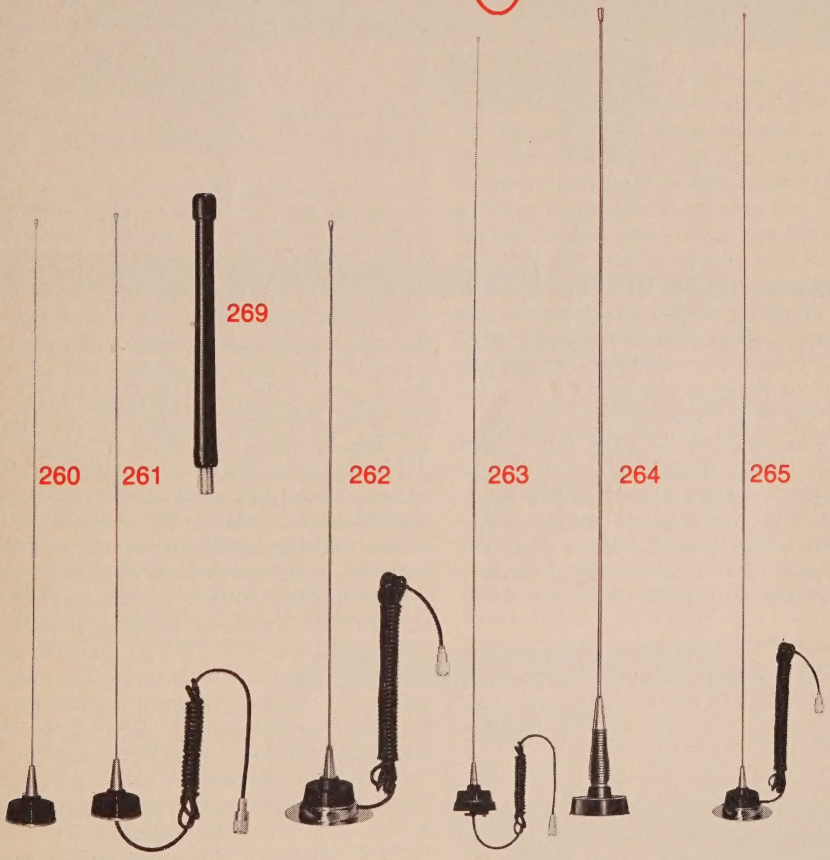
263 Special no-hole trunk lip mount. 3 db gain. 130 thru 174 MHz. 5/8 wave. Complete with 16′ coax. Operates at DC ground. Base matching coil for 52 ohm match. 17-7 ph stainless steel whip.

264 High efficiency, vertically polarized omnidirectional roof top whip. 3 db gain. Perfect 52 ohm match provided by base matching coil with DC ground. Coax and connector furnished.

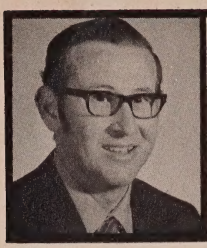
265 Special magnetic mount. 3 db gain. Performance equal to permanent mounts. Holds at 90 mph plus. 12′ of coax and connector. Base matching coil for 52 ohm match. 17-7 ph stainless steel whip. DC ground.

269 Rugged, durable, continuously loaded flexible VHF antenna for portables and walkie talkies. Completely insulated with special vinyl coating. Bends at all angles without breaking or cracking finish. Cannot be accidentally shorted out. Furnished with 5/16-32 base. Fits Motorola HT; Johnson; RCA Personalfone; Federal Sign & Signal; and certain KAAR, Aerotron, Comco and Repco units.

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DX

BY JERRY HAGEN,* WA6GLD

PROBABLY the West Coast's outstanding DX Activity is the Annual DX Conference which is alternately sponsored by the Northern and Southern California DX Clubs. This year's conference was no exception, however for *CQ* it was even more significant as three major award presentations were made to outstanding DXers. Martin Laine, OH2BH was inducted into the *CQ* DX Hall of Fame while Gordon Marshall, W6RR was presented the *CQ* Plaque for High USA Score in the 1970 *CQ* WW Phone Contest and Bob Ferrero was presented the Potomac Valley ARC Cup for the 1970 *CQ* WW Phone Contest. Popularity of the event continued to grow with a final attendance figure of 325 including all call areas except 1, 4 and 8 plus VE, KH6, KL7, DL, OH, VR1, and featured speakers JA1BK, VK9NP, OH2BH and JY9DK. W6ASD/DL5DD won the distance award coming from Germany on a particularly well timed business trip.

Proceedings started with a motion picture of XU1AA operation narrated by JA1BK with some footage of notable DXers in Japan.

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



Glenn Rattmann, W6MAR accepts the SCDXC "DXer of the Year" plaque from SCDXC President Dick Norton, W6DGH.

The CQ DX Award Program

C.W. DX

87.....DK5EL
88.....K2MFY
89.....K6VA

2XS.S.B. DX

197.....I1ZV
198.....PY7AEW
199.....SM5SB
200.....W6YMV
201.....DL6KG
202.....DJ2AA

CQ DX Endorsements

C.W.

K2MFY—150

2XS.S.B.

310 — SM5SB, W6YMV; 300 — G3RWQ, I1ZV, K4RTA; 250—DL6KG, G3KYF; 200 —DJ2AA.

Complete rules for the CQ DX Award Program may be found on page 58 of the January, 1971 issue. Application blanks and copies of the rules may be obtained by sending a business size self-addressed stamped envelope to the Award Manager, P.O. Box 1271, Covina, Ca. 91722 or to the DX Editor.

Next came slides of NCDXC and SCDXC members' stations featuring W6 "Big Guns." *CQ* DX Advisory Committee member W6NJU conducted a DX Forum, concentrating on DXCC country criteria changes being considered by the ARRL DX Advisory Committee. After much discussion and voting the summary vote showed the attendees to be overwhelmingly in favor of maintaining the current DXCC criteria, including unadministered rocks and reefs. The pre-banquet cocktail party was its usual success. The banquet program featured Martin's presentation of the 3C1EG and 3CØAN DXpedition with slides contributing a vivid description of the article which appeared in January *CQ*. NCDXC awards were presented to K6CQF, K4BVD/6, WA6IQM, and K6AHV. The NCDXC DXer of the year was awarded to Don Schlessinger, W6MAV, who has been very active in contests and organizing the W6 QSL Bureau and NCDXC 2-Meter DX Net. SCDXC Awards were made to W6RR, K6LOM, K6RU, W6HX, W6VSS, and W6ANN for DX contest activity while Glenn Rattmann, W6MAR was honored as SCDXC "DXer of the Year." Glenn has been extremely active in DX Contests and was just awarded 5 Band DXCC #126. The evening was capped by the door prize award of a Signal One which was won by WB6NRK.

a winning pair....the "Kenwood twins"

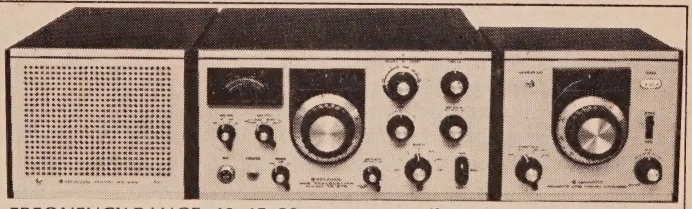


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THE T-599 TRANSMITTER: Clear, stable, selectable side-band, AM and CW • 4-way VFO Flexibility plus Receiver Incremental Tuning (RIT) when used with the R-599 • Amplified ALC • Built-in VOX • Full metering, including cathode current, plate voltage, ALC and relative Power Output • Built-in CW Sidetone monitor and semi-automatic break-in CW • Built-in power supply • Maximum TVI protection • Employs only 3 vacuum tubes • Only $395.00

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FREQUENCY RANGE: 10, 15, 20, 40 & 80 meters (Amateur Bands) ☐ MODES: LSB, USB, CW ☐ INPUT POWER: 500 watts PEP, 300 watts CW nominal. ☐ SENSITIVITY: 3.5-21.6 mHz band; 0.5 uv S/N 10 db 28.0-29.7 mHz band; 1.5 uv S/N 10 db and less than 100 cps frequency drift per 30 minutes after warm-up ☐ SELECTIVITY: SSB more than 2.4 KC (at 6 db) with 2 to 1 slope ratio CW more than 0.5 KC (at 6 db) ☐ A.F. OUTPUT: more than 1 watt (10% distortion) ☐ TUBE & SOLID STATE COMPONENTS: 10 Tubes, 1 IC, 37 Transistors, 4 FET, 52 Diodes ☐ PRICE: $415.00

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Butler, Missouri 64730 816/679-3127

Henry Radio

WPX HONOR ROLL

The WPX Honor Roli 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 operators all-time prefix count.

MIXED

W4OPM	Joe Hiller	1162
VE3GCO	Garry Hammond	903
W8LY	Michael A. Bakos	894
F9RM	Jean-Pierre Guillou	881
DL1CF	Heinz Hildebrand	872
ON4QX	Bob Berge	848
DL1MD	Heribert Rechl	844
K1SHN	Chuck Banta	835
W3PVZ	Joseph M. Olnick	826
W8ROC	Frederick W. Riecks	831
W9WHM	John R. Leary	811
G3DO	D.A.G. Edwards	810
DJ7CX	Leonhard Poelt	808
W4IC	George A. Mack	803
W3GJY	John F. Wojtkiewicz	797
YU1AG	Djura Borosic	797
I6SF	Serafino Franchi	780
WA6MWG	John P. Billon	779
W4BQY	G. B. Fisher	773
W4CRW	Robert C. Sommer	753
WØAUB	Bill Bergmann	752
CT1LN	Paulo J. S. Coelho Vieira	749
KØBLT	Frank Cahoy	733
PY4AP	"Biu" Marra	715
K8UDJ	Charles L. Hutchinson	712
WA5LOB	James Edwards	699
W8GMK	John Marhefka	683
WA6EPQ	Larry Brockman	676
SM7TV	Boris Goransson	674
K2AAC	J. O. Archibald	673
WAØCPX	Edward C. Gray	656
W9ZTD	Leslie Bannon	628
W8KSR	Jon Hodgin	609

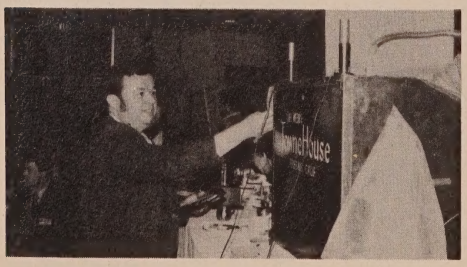
SSB

W4OPM	Joe Hiller	1075
W4NJF	Gay E. Milius	980
DL9OH	Karl Muller	813
W9DWQ	Edward A. Goodbout	803
IØAMU	Alfonso Porretta	759
HP1JC	Juan G. Chen	750
DL1MD	Heribert Rechl	748
I8KDB	Giampaolo Nucciotti	743
K2POA	Arthur B. Johnson	733
WØYDB	W. C. "Bill" Higgins	721
G3DO	D. A. G. Edwards	719
W4IC	George A. Mack	702
K1SHN	Chuck Banta	697
W3DJZ	Arden B. Hopple	694
WA5LOB	James D. Edwards	692
F2MO	Michel Dort	686

CW

W4OPM	Joe Hiller	950
W8LY	Michael A. Bakos	891
W8KPL	William W. Simpson	853
W2HO	W. Vollkommer	825
W2AIW	Charles W. Rogers	813
DL1QT	Helmut Baumert	810
VK3AHQ	Henry Denver	809
ON4QX	Bob Berge	790
W9FD	W. W. Johler	740
WB2FMK	Robert J. Rasche	710
OK2DB	Jaroslav Dufka	693
DJ7CX	Leonhard Poelt	680
K1SHN	Chuck Banta	673
G2GM	F. D. Cawley	667
YU1AG	Djura Borosic	655
W4IC	George A. Mack	652
K2AAC	J. O. Archibald	640
I6SF	Serafino Franchi	639
K1LWI	F. Wendell Boyden	629
W8GMK	John Marhefka	628
SM5BNX	Ake Sundvik	612
VO1AW	Clarence Mitchell	605
VE4OX	D. E. McVittie	600

The DX Breakfast featured a recap of K2IXP's world wide trip and DXpedition to Willis Island where Larry signed VK9NP/W and made an attempt to activate Mellish Reef. A slide of the boat interior after the storm provided good reason for the abandonment of the DXpedition plan.



Ken Anderson, K6CQF receives the NCDXC One Million Point Club Plaque for his score in the 1970 CQ WW Test.

Darleen, WA6FSC gave a charming description of her trip to Jordan and operation as JY9DK. Darleen presented a fascinating story of life at the Palace and the culture and geography of Jordan. The conference closed with a description of operation at 4W1AF and slides of Sana, Yemen by Clyde, W6KNH.

Other notable guests included Stu Meyer, W2GHK/4, John Griggs, W6KW the SW Division ARRL Director and Armond Noble, WB6AUH. Armond is the publisher of *Worldradio*, an amateur radio newspaper which featured the DX Conference in the 28 February 1972 issue. Our thanks to Armond for providing the fine photos for this DX Column. The outstanding conference preparation was provided by General Chairman Frank Cuevas, W6AOA with help from WB6UDC, WB6DXU and W6EJJ.

The WPX Program

S.S.B. WPX

671.....OD5BA
672.....I1ZSQ
673.....JW9DL
674.....K8CSG
675.....WB2NRU
676.....TF2WKE

C.W. WPX

1152.....DK5EL
1153.....SM5RC
1154.....WA2HZR
1155.....SMØPX
1156.....SM6BDW
1157.....OK3AS
1158.....SP9AQY
1159.....OK2BWI
1160.....ZL2GH
1161.....W4YVK
1162.....HB9ANR
1163.....K2LQQ/TF

Mixed WPX

322.....K4IUV
323.....SM7CRJ
324.....WA2HIN
325.....PY6FI
326.....DJ8WD
327.....WB2HNO

WPNX

46.....WN7JKQ
47.....WN4UCC

WPX Endorsements

SSB: W4NJF—1000, DL1MD—750, OD5BA, ZL3NS—700, I1ZSQ—600, W3YHR—450, JA1AG, WB2FMK, W9KAA—400.

CW: K1LWI, JA1AG, KØARS—550, VE1MF—450, SM5ACQ, SM5RC—400, W7IUO—350.

Mixed: DL1MD—850, JA1AG—700, PY6FI—600, WA2EAH—550, SM7CRJ, W3YHR—500, OK3CAU—450.

VPX: W4—10646—350.

160 Meters: DJ8WD.

80 Meters: I1ZSQ, DJ8WD, SP3AIJ.

20 Meters: WA2EAH, I1ZSQ, ZL3NS, SP3AIJ.

15 Meters: SP3AIJ, DL5GJ, WA6TAX.

10 Meters: W9EVD.

Africa: K1LWI, WB4KZG, OD5BA, I1ZSQ.

Asia: OD5BA, I1ZSQ, SP3AIJ, K1LWI.

Europe: WA2HZR, OD5BA, I1ZSQ, DJ8WD, DL5GJ, KØDEQ.

North America: W8GKM, K1LWI, WA2EAH, OD5BA.

Oceania: OD5BA.

South America: OD5BA, W8GKM.

Complete rules for WPX, WPNX and VPX may be found on page 67 of the February, 1972 issue. Application blanks and reprints of the rules may be obtained by sending a business size self-addressed, stamped envelope to Award Manager, P.O. Box 1271, Covina, Ca. 91722 or to the DX Editor.

Here and There In The World of DX

A note from Jack, 9V1QJ states that quite a few 9V1's are active with 9V1NQ being the Singapore Arts President. Jack has relocated to downtown Singapore and hopes to have his beam on top of a 12 story apartment building. 9V1QJ is ex-KR6JD, HL9TJ, and W5NSQ.



Rusty, K4BVD/6 hit the jackpot with two DX Contest Awards from the NCDXC.

Dean, KX6IY says that the KX6 islands of Eniwetok and Kwajalein have separate mail services which may delay QSL delivery if sent to the Bureau Station KX6BU on Kwajalein. Dean suggests that Eniwetok QSL's be sent to KX6BQ.

Bob, WA6ETN suggests that DXers have a copy of Websters Geographical Dictionary to assist in locating DX stations subdivision location and other information.

Dave, CEØAD/6 is awaiting relocation back on Easter Island where he was quite active in the past 2 years.

WPX News

Congratulations to Gay Milius, W4NJF who has just earned the 1000 endorsement to the SSB WPX Award. As of this date only W4OPM, W4LRN, and W4NJF have topped the 1000 mark on any mode.

The special calls DBØMOD and DFØMOD will be activated in commemoration of the summer Olympic games to be held in Munich.

Dick, W9CTY operated from Nepal in October of 1971 with the call 9NCTY which is only the 4th call issued to an amateur in Nepal. This prefix would count for 9NØ. See April *CQ* for the full story.



Left to right: Gordon Marshall, W6RR, WA6GLD and CQ DX Hall of Fame member Martin Laine, OH2BH.



Don Schlessinger, W6MAV, the 1971 NCDXC "DXer of the Year."

LU5DL, LU3DGX and LU1DJU planned to operate from Bahia Anegada Islands in March using the LUØ prefix. Bahia Anegada Islands are located just off the Central Argentina Coast.

The Virginia Century Club operated WJ4-AZF for the 19th Azalea Festival from April 25-30.

USSR Activity using special prefixes from 23 February to 7 June was to commemorate 50 years of radio in the USSR. Each Republic signed the 5Ø prefix for one week beginning with UA5Ø, UB5Ø, UC5Ø and etc. ending with UR5Ø. For WPX only the 1st 3 letters/numbers are counted—thus UB5ØC counts as UB5 and UR5ØA counts as UR5.

Armed Forces Day activity signing WU3-SNA was from the US Naval Academy in Annapolis while KD6USA was used by the South El Monte US Army Reserve Center in California.

Yonton, ex-AC5TY is now signing A51TY which is a mighty rare prefix as well as being exotic Bhutan.

WS3VOA was the special call used by the VOA Amateur Radio Club for the 30th Anniversary of the Voice of America. The primary operators were Tom, W3AEC and *CQ* Propogation Editor W3ASK.



Iris Colvin, W6DOD with NCDXC One Million Point club plaque.

The WAZ Program

S.S.B. WAZ

972.....K1DRN	978.....KC6BK
973.....UA4CZ	979.....DK1YG
974.....W7GSP	980.....CR4AJ
975.....W9WRM	981.....W2OST
976.....FO8BY	982.....SM5BFC
977.....K9WEH	

C.W.—Phone WAZ

3328.....I1YS	3339.....LA3BG
3329.....UR2QD	3340.....PAØDN
3330.....UT5EW	3341.....WB8HAT
3331.....UW3AM	3342.....LZ2EE
3332.....UH8DL	3343.....K7NHG
3333.....UB5LR	3344.....SM7EDJ
3334.....UA4QM	3345.....SMØPX
3335.....UK2BAP	3346.....OH5PA
3336.....KH6HIF	3347.....SM5UH
3337.....DL7NS	3348.....SM7DQC
3338.....DK3GI	3349.....WA2AUB

Complete WAZ rules are shown on pgs. 64-66 of the June, 1970 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, FL 33880.

Pavel, JTØAE was active during the spring on 14 mHz c.w.

The Mexico 6D prefix has been used in contest activity at 6D1AA and XE1J and Crew activated the 6D4 prefix on Revilla Gigedo Island.

Beginning on May 15, 1972 the Okinawa Islands will revert to Japan and the prefix JR6 will be used for Japanese citizens.

The special call WM2GK was used from 14 thru 21 May 1972 in commemoration of the 75th Anniversary of the Marconi-Kemp Bristol Channel Tests. The Garden State Amateur Radio Association and Old Timers Club operated WM2GK from Twin Lights, Highlands, N.J., the site of Marconi's first radio experiments in the US in 1899. Several GB stations and PA9IARU participated in the activity with the Barry College of Further Education Radio Society sponsoring an award for working various stations.

Harold North, VP7NA

DXers the world over lost a great friend with the death of Harold Kendal North, VP-7NA, at 5:30 P.M. on March 4, 1972. Mr. North would have been 60 years old on June 5. He was a radio pioneer in VP7-land and had been President of the Bahamas Amateur

[*continued on page 90*]

New FPM-300, a low-priced, versatile SSB/CW transceiver available at leading electronic distributors.



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This new radio, with built-in AC-DC power supply, is compactly designed with modular construction techniques for effective and reliable service in fixed, portable and mobile use for amateur, Civil Defense, CAP, MARS, RACES and other utility HF Communications Services.

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Milwaukee, Wisconsin 53216

Amateur Radio Center
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Baltimore, Maryland 21211

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Wheaton, Maryland 20902

Electronic International Service Corp.
11305 Elkin Street
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Wheaton, Maryland 20902

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Birmingham, Alabama 35212

Klaus Radio Inc.
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Peoria, Illinois 61614

Ham Radio Center, Inc.
8342 Olive Blvd.
St. Louis, Missouri 63132

Land of Electronics
400 South Main
Lombard, Illinois 60148



Propagation

BY GEORGE JACOBS,* W3ASK

A sudden increase in solar activity during late February and throughout much of March resulted in somewhat better propagation conditions on the amateur h.f. bands than had originally been expected, especially on 10 meters. This increased activity also slowed down somewhat the rate at which the present sunspot cycle is declining. There is no explanation for this sudden increase in solar activity, but short-term changes of this nature do occur from time-to-time.

June's Forecast

Solar activity continues to decline, although at a somewhat slower rate. A smoothed sunspot number of 49 is now forecast for June, 1972. This means that DX propagation conditions on the 10, 15 and 20 meter bands will be somewhat *below* the conditions experienced last summer, when solar activity was at the mid 60 level. Conditions on the 40, 80 and 160 meter bands are expected to be much the same as last year, or perhaps slightly *improved*.

In general, propagation conditions during the summer months of this year should be quite similar to those which occurred during the summer months of 1966, when the solar level was also near 50.

A sharp decrease is expected in DX propagation conditions on 10 meters during June and the summer months. While few openings are predicted, some may still take place to southern and tropical areas of the world during the afternoon hours.

A sharp decrease is also expected for DX openings along most east-west paths on 15 meters. Good conditions are forecast, however, to most southern and tropical areas. DX propagation conditions are expected to peak on this band during the late afternoon hours.

While DX openings to one area of the world or another are forecast almost around-the-clock on 20 meters, propagation conditions are expected to peak on this band during the early evening hours and through most of the darkness period. During June and the summer months, 20 meters should be the optimum band for DX openings from the late afternoon hours through the hours of darkness, and until a few hours after sunrise.

With fewer hours of darkness and a sharp seasonal increase in static levels, DX propagation conditions are expected to be poorer on the 40, 80 and 160 meter bands during June than they were earlier this year.

Despite these poorer conditions, some fairly good DX openings are forecast for 40 and 80 meters during the hours of darkness and the sun-

*11307 Clara Street, Silver Spring, Md. 20902.

LAST MINUTE FORECAST

June, 1972

Days	Rating & Forecast Quality (4)	(3)	(2)	(1)
Above Normal: 4, 9, 15, 20-21, 25-26, 28	A	A	B	C
Normal: 1, 3, 5, 8, 10-12, 14, 16, 18-19, 22, 24, 27, 30	A	B	C	D
Below Normal: 2, 6-7, 13, 17, 23, 29	C	D	D	E
Disturbed: None	D	D	E	E

How To Use These Charts

The following is an explanation of the symbols shown above, and instructions for the use of the *CQ* propagation predictions:

1—Enter Propagation Charts on following pages under appropriate band and distance or geographical area columns. Read predicted times of band openings at intersection of both columns.

2—Following each predicted time of band opening is a forecast rating which indicates the relative number of days the band is expected to open during each month of the forecast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 8 and 13 days; (1) less than 7 days.

On the "Short-Skip" Chart where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

3—With the forecast rating noted above, start with the numbers in parentheses at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meaning: (A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak and considerable fading and noise; E—poor opening, or none at all.

4—This month's DX Propogation Charts are based upon a transmitter power of 250 watts c.w.; 1 kw p.e.p. s.s.b., or 1000 watts d.s.b., into a dipole antenna a quarter-wave above ground on 160 and 80 meters a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

5—Local Standard Time for these predictions is based on the 24-hour system.

6—The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9, and 0 areas. The charts are valid from June 15, 1972, through Aug. 15, 1972 and are prepared from basic propagation data published monthly by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado. and the Western USA Chart in the 6 and 7 areas.

Jan.	91.3	July	81.0
Feb.	79.0	Aug.	61.4
Mar.	60.7	Sept.	50.2
Apr.	71.8	Oct.	51.7
May	57.5	Nov.	63.2
June	49.8	Dec.	82.2

Table I—Official Zurich monthly mean sunspot numbers for 1971.

rise period. What little chance there is for a 160 meter DX opening should also take place during these same time periods.

This month's *CQ* Propagation Charts contain DX predictions for the period June 15 through August 15, 1972. Short-skip predictions for June, for distances between 50 and 2300 miles, and from Hawaii and Alaska to the mainland, appeared in last month's column. Instructions for the use of this month's DX Charts may be found directly below the "Last Minute Forecast" which appears at the beginning of this column.

V.h.f. Ionospheric Openings

Sporadic-E short-skip propagation should increase considerably during June, and this is expected to 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 distances of approximately 2300 miles. An occasional 2 meter short-skip opening, between approximately 1200-1400 miles, may also be possible during periods of intense sporadic-E ionization. Short-skip openings are most likely to occur between 9 A.M. and 1 P.M. and again between 5 P.M. and 9 P.M. local standard time, although they can take place at all other times as well.

No major meteor showers are forecast for June, and very little auroral activity is expected. Check the "Last Minute Forecast," since whatever auroral propagation may be possible during June is most likely to occur on those days forecast to be below normal or disturbed.

Trans-equatorial (TE) scatter propagation is expected to fall off considerably during June, but an occasional opening might be possible between 8 and 11 P.M., local standard time, on north-south paths which cross the geomagnetic equator at approximately right angles. TE openings favor locations in the southern region of the USA, with openings into more northerly areas unlikely during June.

Sunspot Cycle Info

The Swiss Solar Observatory at Zurich reported a monthly mean sunspot number of 92 for February, 1972. This results in a smoother sunspot number of 65, centered on August, 1971.

The Zurich Observatory recently released official sunspot data for 1971. The final values of monthly mean sunspot numbers for the year, those that will appear in scientific record books, are shown in Table I.

Year	Annual Sunspot Number
1964	10.2
1965	15.1
1966	47.0
1967	100.6
1968	105.9
1969	105.5
1970	104.7
1971	66.6

Table II—Annual mean values of solar activity recorded during Cycle 20.

The yearly mean was 66.6, which was considerably lower than the value of 104.5 recorded during 1970. Table II lists the annual mean values of solar activity recorded during the present cycle.

The highest level of solar activity recorded during 1971, according to the Zurich Observatory, took place on January 21, when the daily sunspot count reached 131. The lowest level was recorded on September 11, when solar activity dipped to 16. The sunspot count exceeded 100 on only 45 days during 1971.

The official numbers released by the Zurich Observatory alter slightly the monthly smoothed sunspot numbers reported in this column during the past year. The table of smoothed sunspot numbers shown in "Sunspot Cycle 20- Progress 1971: Prediction 1972" (Table 1, page 32, *CQ* Jan. 1972) should be revised as shown in Table III.

[*Charts start on next page.*]

	1970	1971	1972
January	106	80	59*
February	106	78	57*
March	106	74	55*
April	106	71	53*
May	106	68	51*
June	105	67	49*
July	104	66	47*
August	101	65	45*
September	97	65*	43*
October	94	64*	41*
November	89	63*	39*
December	84	61*	38*

Table III—Smoothed sunspot numbers. Values shown with an asterisk are predicted; all others are observed.

June 15-August 15, 1972

Time Zone: EST (24-Hour Time)

EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	*Nil*	14-18 (1)	05-08 (2) 08-11 (1) 11-13 (2) 13-15 (3) 15-19 (4) 19-20 (3) 20-22 (2) 22-05 (1)	19-21 (1) 21-22 (2) 22-00 (3) 00-01 (2) 01-02 (1) 21-23 (1)* 23-00 (2)* 00-01 (1)*
Northern Europe & USSR	*Nil*	14-17 (1)	08-14 (1) 14-18 (2) **18-22 (3)** 22-00 (2) 00-05 (1) 05-08 (2)	20-21 (1) 21-23 (2) 23-01 (1) 20-23 (1)*
Eastern Mediterranean & Middle East	*Nil*	15-17 (1)	11-13 (1) **18-17 (2)** 17-23 (3) 23-00 (2) 00-05 (1) 05-07 (2) 07-09 (1)	19-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
West Africa	*Nil*	**09-11 (1)** 11-13 (2) 13-16 (3) 16-17 (2) 17-19 (1)	02-06 (1) 06-08 (2) 08-14 (1) 14-16 (2) 16-18 (3) 18-22 (4) 22-00 (3) 00-02 (2)	19-21 (1) 21-23 (2) 23-01 (1)
East & Central Africa	*Nil*	12-14 (1) 14-16 (2) 16-18 (1)	13-15 (1) 15-17 (2) 17-20 (3) 20-21 (2) 21-23 (1) 23-01 (2) 01-05 (1)	20-23 (1)
South Africa	*Nil*	09-12 (1)	23-00 (1) 00-03 (2) 03-06 (1) 14-15 (1) 15-17 (2) 17-18 (1)	20-21 (1) 21-23 (2) 23-01 (1) 22-00 (1)*
Central & South Asia	*Nil*	*Nil*	16-19 (1) 19-21 (2) 21-00 (1) 06-08 (1)	18-20 (1)
Southeast Asia	*Nil*	*Nil*	05-06 (1) 06-08 (2) 08-10 (1) 18-20 (1)	*Nil*
Far East	*Nil*	17-19 (1)	05-06 (1) 06-09 (2) 09-11 (1) 19-00 (1)	*Nil*
South Pacific & New Zealand	17-20 (1)	15-17 (1) 17-20 (2) 20-22 (1)	17-20 (1) 20-22 (2) 22-00 (2) 00-02 (4) 02-03 (3) 03-05 (2) 05-08 (1)	00-02 (1) 02-05 (2) 05-07 (1) 03-05 (1)*
Australasia	*Nil*	18-21 (1)	22-00 (1) 00-01 (2) 01-03 (3) 03-04 (2) 04-07 (1) 07-09 (2) 09-11 (1) 15-17 (1)	02-03 (1) 03-05 (2) 05-06 (1) 03-05 (1)*
Northern & Central South America	**10-14 (1)** 14-16 (2) **16-17 (1)**	**07-08 (1)** 08-14 (2) **14-16 (3)** 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	05-06 (2) 06-07 (3) 07-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-22 (4) 22-00 (3) 00-01 (2) 01-05 (1)	20-22 (1) 22-03 (2) 03-05 (1) 22-03 (1)*
Brazil, Argentina, Chile & Uruguay	13-14 (1) 14-16 (2) 16-17 (1)	07-08 (1) 08-10 (2) 10-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-21 (2) 21-23 (1)	15-16 (1) 16-18 (2) 18-19 (3) 19-22 (4) 22-00 (3) 00-02 (2) 02-06 (1) 06-08 (2) 08-10 (1)	23-05 (1) 00-04 (1)*
McMurdo Sound, Antarctica	*Nil*	*Nil*	16-18 (1) 18-22 (2) 22-00 (1)	02-04 (1)

* Predicted times of 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.

Time Zone: CST & MST (24-Hour Time)

CENTRAL USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	*Nil*	14-17 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-19 (3) 19-21 (2) 21-00 (1)	19-22 (1) 22-00 (2) 00-01 (1) 21-23 (1)*
Northern Europe & European USSR	*Nil*	*Nil*	04-06 (1) 06-08 (2) 08-15 (1) 15-22 (2) 22-00 (1)	19-23 (1)
Eastern Mediterranean & Middle East	*Nil*	13-15 (1)	12-16 (1) 16-18 (2) 18-20 (3) 20-22 (2) 22-00 (1) 06-08 (1)	20-23 (1)
West and Central Africa	*Nil*	09-12 (1) 12-16 (2) 16-18 (1)	13-15 (1) 15-17 (2) 17-21 (3) 21-23 (2) 23-01 (1) 04-07 (1)	19-23 (1) 22-23 (1)*
East Africa	*Nil*	11-15 (1)	14-17 (1) 17-20 (2) 20-23 (1) 05-07 (1)	19-22 (1)
South Africa	*Nil*	09-11 (1)	21-23 (1) 23-02 (2) 02-06 (1) 12-14 (1) 14-16 (2) 16-18 (1)	20-22 (1) 22-23 (2) 23-00 (1) 22-00 (1)*
Central & South Asia	*Nil*	*Nil*	16-18 (1) 18-21 (2) 21-00 (1) 04-06 (1) 06-08 (2) 08-09 (1)	*Nil*
Southeast Asia	*Nil*	19-21 (1)	04-06 (1) 06-09 (2) 09-10 (1) 21-22 (1) 22-00 (2) 00-01 (1)	*Nil*
Far East	*Nil*	19-22 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-12 (1) 19-23 (1) 23-02 (2) 02-04 (1)	03-04 (1) 04-05 (2) 06-08 (1)

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

Time Zone: PST (24-Hour Time)

WESTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western Europe & North Africa	*Nil*	14-16 (1)	04-05 (1) 05-07 (2) 07-14 (1) 14-16 (2) 16-19 (3) 19-21 (2) 21-23 (1)	19-22 (1)
Central & Northern Europe & European USSR	*Nil*	*Nil*	04-05 (1) 05-07 (2) 07-09 (1) 12-16 (1) 16-21 (2) 21-00 (1)	19-21 (1)
Eastern Mediter-ranaen & Middle East	*Nil*	*Nil*	16-19 (1) 19-21 (2) 21-22 (1) 05-07 (1)	*Nil*
West & Central Africa	***Nil***	**08-11 (1)** 11-15 (2) 15-17 (1)	**14-17 (1)** 17-19 (2) 19-21 (3) 21-23 (2) 23-02 (1) 06-08 (1)	20-23 (1)
East Africa	*Nil*	12-15 (1)	16-19 (1) 19-21 (2) 21-22 (1)	*Nil*
South Africa	*Nil*	09-11 (2)	14-16 (1) 21-22 (1) 22-00 (2) 00-01 (1) 04-07 (1)	19-22 (1)
Central & South Asia	*Nil*	*Nil*	04-06 (1) 06-08 (2) 08-10 (1) 15-18 (1) 20-22 (1) 22-00 (2) 00-01 (1)	*Nil*
Southeast Asia	*Nil*	09-11 (1) 19-21 (1)	22-00 (1) 00-02 (2) 02-06 (1) 06-08 (3) 08-10 (2) 10-13 (1)	02-06 (1)
Far East	*Nil*	12-14 (1) 19-21 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (4) 02-03 (2) 03-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-14 (1)	01-02 (1) 02-05 (2) 05-06 (1) 02-04 (1)*
South Pacific & New Zealand	15-19 (1)	10-12 (1) 12-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-22 (2) 22-23 (1)	16-18 (1) 18-20 (2) 20-01 (4) 01-05 (2) 05-07 (4) 07-09 (3) 09-10 (2) 10-12 (1)	21-22 (1) 22-00 (2) 00-05 (3) 05-06 (2) 06-07 (1) 23-01 (1)* 01-04 (2)* 04-06 (1)*
Austral-asia	*Nil*	12-14 (1) 14-17 (2) 17-20 (3) 20-21 (2) 21-22 (1)	19-21 (1) 21-23 (2) 23-01 (3) 01-05 (2) 05-08 (3) 08-09 (2) 09-12 (1) 12-14 (2) 14-15 (1)	23-01 (1) 01-03 (2) 03-05 (3) 05-06 (2) 06-07 (1) 01-06 (1)*
Northern & Central South America	10-14 (1) **14-16 (2)** 16-18 (1)	07-10 (1) **10-12 (2)** 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	08-10 (2) 10-13 (1) 13-15 (2) 15-17 (3) 17-21 (4) 21-23 (3) 01-03 (1) 03-05 (2) 05-08 (3)	20-22 (1) 22-03 (2) 03-05 (1) 22-03 (1)*
Brazil, Argentina, Chile & Uruguay	11-16 (1)	07-10 (1) 10-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	13-15 (1) 15-17 (2) 17-18 (3) 18-21 (4) 21-23 (3) 23-00 (2) 00-04 (1) 04-06 (2) 06-09 (1)	21-23 (1) 23-01 (2) 01-03 (1) 23-02 (1)*
McMurdo Sound, Antarctica	*Nil*	*Nil*	16-18 (1) 18-21 (2) 21-23 (1)	02-06 (1)

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Tom Kneitel's own sequel to Vol 1, this volume delivers 159 additional circuits that will appeal to all amateurs. Each circuit is fully described in text with complete schematics. $3.00

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Compiled by Tom Kneitel, WB2AAI, this contains 192 pages of conversion articles, covering almost every piece of surplus gear worth the effort to convert to ham use. $3.00

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All new information on transmission line theory, Attenuation, Impedance, Standing waves, Resonant and nonresonant lines, current distribution, free space 3 dimensional patterns of long wires of all practical length and much, much more by Ken Glanzer. $4.00

The New DX Handbook

Don Miller's 200 pages of valuable technical information and operating aids, most of which has never been published before and can be found in no other volume contains Great Circle Bearing Charts. $5.00

RTTY From A To Z

This new RTTY Classic has been produced to fill the gaps in RTTY knowledge among amateurs and professionals alike. 16 chapters and 224 pages. This book is a must in your technical library. $5.00

103 - Simple Transistor Projects

The aim of this book is to familiarize the beginner and advanced experimenter with the handy source of reference circuits. **$3.45**

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- ☐ Electronic Circuits Handbook II $3.00
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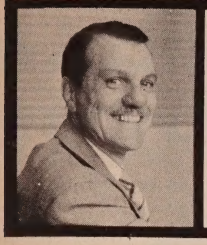
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Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

May	20	YL ISSBers C.W. Contest
May	27-28	YL ISSBers Phone Contest
June	2-5	CHC/FHC/HTH QSO Party
June	3-4	Argentina Contest
June	3-4	RSGB National Field Day
June	4	Minnesota QSO Party
June	10-12	ARRL VHF QSO Party
June	11-15	Mass. Cities & Towns Contest
June	11-17	Mass. Amateur Radio Week
June	24-25	ARRL Field Day
July	1-2	Venezuelian Contest
July	15-16	Space Net VHF Contest
July	22-23	Colombian Contest
July	29-30	County Hunters C.W. Contest
Aug.	5-6	European C.W. DX Contest
Aug.	26-28	Delta QSO Party
Sept.	9-10	European Phone DX Contest
Oct.	7-8	RSGB 21/28 mHz Phone
Oct.	21-22	RSGB 7 mHz C.W. Contest
Oct.	**28-29**	**CQ WW DX Phone Contest**
Nov.	4-5	RSGB 7 mHz Phone Contest
Nov.	**25-26**	**CQ WW DX C.W. Contest**

YL ISSBers QSO Party

C.W.: 0000 GMT May 20 to 2400 GMT May 20
Phone: 0000 GMT May 27 to 2400 GMT May 28

C.W. is a 24 hour contest with one 6 hour rest period. Phone is a 48 hour affair with two 6 hour rest periods. Complete rules in last month's CALENDAR.

Logs go to: John Probst, W4AAA, 8618 W. Park, Ft. Myers, Fla. 33901 and must be received before July 15th.

IARS/CHC/FHC/HTH Party

Starts: 2300 GMT Friday, June 2
Ends: 0600 GMT Monday, June 5

Once again I advise that you send a s.a.s.e. to K6BX for detailed information on this one.

Following are rules in brief.

Exchange: QSO no., report, name, CHC/FHC no., state, county or similar division. Non-members omit no. and send HTH instead.

Scoring: For CHCers: 1 point per QSO with other CHCers, 2 points if it's a HTHer, and 1 additional point if its a YL, B/P, FHC, Novice, CHC-200, Merit or Club station. Double above points if QSO is out of own country. For HTHers: Contacts with other HTHers 1 point, with CHCers 3 points, otherwise same as above.

The same station may be worked on different bands and modes for QSO points.

S.w.l. use same scoring system as HTHers.

Multiplier: Each continent, country, ITU Zone and U.S. state. (counted only once).

Final Score: Total QSO points from all bands × sum of the multiplier. Multi-operator stations divide score by number of operators used.

Frequencies: C.W. — 3575, 3710, 7070, 7160, 14075, 21075, 21090, 21140, 28090. Phone — 3770, 3775, 3790, 3943, 3960, 7070, 7090, 7210, 7260, 7275, 14320, 14340, 21360, 21440, 28620, 28690. For U.S. or DX as allowed.

Awards: The party supports hundreds of certificates and Trophies in the many categories and divisions. A s.a.s.e. will get you a list.

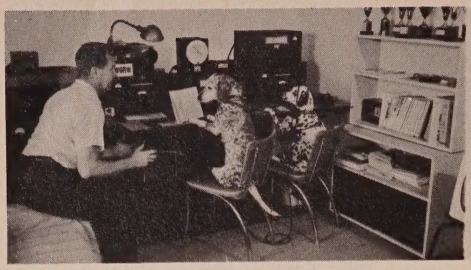
Include additional postage for list showing ITU, IARU, IARC, IARS country, prefix and Zone list, and map.

Send all requests and your logs to: International Amateur Radio Society, K6BX, P.O. Box 385, Bonita, Calif. 92002.



When Don Wallace, W6AM showed up for the CQ WW Contest last Fall, it seemed that most of the contacts were with old friends who indicated their pleasure. Although W6AM still holds many contest records, Don in his 74th year (62 of them in amateur radio) takes it easy now but can still be found on all bands. Besides that impressive display of gear W6AM still has 9 Rhombics that can be directed to 18 different directions at the flip of a switch.

*14 Sherwood Road, Stamford, Conn. 06905



We often hear of the "dog watch" in multitransmitter operation but never gave it much thought. I recently ran across this old photo of Roger Mace giving the night crew at W6RW, last minute instructions.

Argentina Contest

Starts: 0000 GMT Saturday, June 3
Ends: 2400 GMT Sunday, June 4

This one is again being sponsored by the Argentino Radio Club. Activity will be found on all bands, both phone and c.w., and both single and multi-operator categories.

Exchange: RS/RST plus a number indicating number of years in amateur radio.

Scoring: Each LU QSO is worth 3 points, other contacts 1 point. The multiplier is derived from the number of LU states and different countries worked. (Own country may be worked but for multiplier only.)

Final score: Total QSO points from all bands × sum of LU states and different countries.

Awards: Certificates, medals and plaques, to the highest scoring station in each continent, and certificates in each country. Both for phone and c.w. and in each category.

Use separate log for each band, check for duplicate contacts and include a summary sheet with scoring information and equipment description. Your name and address in BLOCK LETTERS.

Mailing deadline is July 31st to Radio Club Argentino, LU DX Contest, P. O. Box 97, Buenos Aires, Argentina.

Minnesota QSO Party

Starts: 0000 GMT Sunday, June 4
Ends: 2400 GMT Sunday, June 4

All bands may be used on both c.w. and phone. There are no time restrictions and Minn. stations may work in state stations.

Exchange: QSO no., RS(T) and QTH. County for Minn., ARRL section or country for others.

Scoring: Total QSO's × (ARRL sections worked on c.w. + sections worked on phone), for Minn. stations. And QSO's × (Minn. counties worked on c.w. + counties worked on phone) for out-of-state stations. (There are 87 counties.)

There is a low power multiplier of 1.25 if input used is 250 watts or less.

There is a bonus of 25 points per mode for Minn. stations if all sections in one call area are worked. Outside stations get a 25 point bonus per mode for every 5 Minn. counties worked.

The bonus points are to be added to the final score after the multiplier.

Frequencies: 3585, 7085, 14085, 21085 and 3985, 7285, 14290, 21385 plus or minus 5 kHz.

Look for phone activity between 0000 - 0400, 0400 - 0800, 1600 - 2000 and c.w. between 0400 - 0800, 1200 - 1600, 2000 - 2400. Avoid nets.

Awards: Certificates to the top scorers in each ARRL section (min. of 10 QSO's) and each Minn. county. (min. of 20 QSO's) Special certificate to leading station in and outside Minn.

Include a check sheet for each band if you make over 50 QSO's. Mailing deadline is June 25th to: Viking Amateur Radio Society, P.O. Box 3, Waseca, Minnesota 56093.

RSGB National Field Day

Starts: 1700 GMT Saturday, June 3
Ends: 1700 GMT Sunday, June 4

While stations outside Great Britain are not eligible to enter this activity, check logs are welcome. A certificate will be awarded to the overseas portable station in each continent whose check logs shows that he contributed the most points to competitors.

Send your check log to: RSGB HF Contests, c/o J. C. Graham, G3TR, The Willows, Church Road, Lowfield Heath, Nr Crawley, Sussex, England.

ARRL VHF QSO Party

Starts: 1900 GMT Saturday, June 10
Ends: 0600 GMT Monday, June 12

You may operate any consecutive 28 hour period during the above times. A s.a.s.e. to ARRL will get you free log forms. Complete rules are in the May issue of *QST*

ARRL Field Day

Starts: 1800 GMT Saturday, June 24
Ends: 2100 GMT Sunday, June 25

This one probably generates more man power activity than any other competition in the country. There's a lot going for it and the May issue of *QST* will tell you all about it.

Additional information and etc. can be secured from Headquarters, 225 Main Street, Newington, Conn. 06111.

Mass. Amateur Radio Week

Starts: 0001 GMT Sunday, June 11
Ends: 2400 GMT Saturday, June 17

This period has been proclaimed Amateur Radio week by the Governor of Massachusetts. If you fulfill the following requirements you will earn a certificate signed by the Governor.

1. Mass. work 16 other Mass. stations.
2. New England work 8 Mass. stations.
3. Rest of U.S. work 5 Mass. stations.
4. DX (inc. KH & KL) 2 Mass. stations.

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ours costs an arm and a leg.

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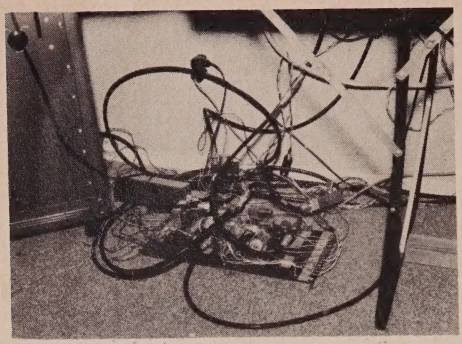
That's because the CX7A has just about every feature you can think of. Including the most sensitive receiver made, the most "talk-powered" 300 watts of power you ever heard, and much more. Like an extra receiver, an RF clipper, a built-in power supply and an electronic keyer.

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Better yet, you go on over to your signal/one dealer and see the rig for yourself. Or write us for a detailed brochure. Once you see the CX7A, you'll be willing to give up an arm and a leg for it. Or at least $2,195.

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The newly coined term "octopus operation" in a multi-operator, single transmitter contest set-up must have originated from this old photo I ran across. The caption called it "The Brain" an electronic device to insure that both finals cannot be operated simultaneously, complete with alarm circuit, lockout and control relays. It did not say who created this brain but I doubt if it was very successfu. (Incidently we frown on this type of operation in our multi-single category.)

Exchange will be signal report, county and state. Certificates will be endorsed for band and mode upon request.

Applications must be received no later than July 31st. Include a #10 s.a.s.e. and send to: William C. Holliday, WA1EZA, 22 Trudy Terrace, Canton, Mass. 02021.

Mass. Cities and Towns Contest

Starts: 0001 GMT Sunday, June 11
Ends: 0400 GMT Thursday, June 15

This has been organized as part of the Mass. Radio Week, but is a separate activity.

Exchange: Signal report, city or town, county and state.

Scoring: One point for each Mass. station worked. And a multiplier for each Mass. city or town. Final score, total Mass. stations worked × sum of cities and towns. (Mobiles do not count as multiplier.)

All bands may be used but a station may be worked only once. Portables and mobiles will be considered as separate entries from each location.

Awards: Certificates to winners in each state, province and country. Entries may be single band or all band, but minimum of 25 points required.

Logs must be received no later than July 31st and go to: Warren Baker, W1DFR, 66 Rexford Street, Mattapan, Mass. 02126.

Venezuela Contest

Starts: 0000 GMT Saturday, July 1
Ends: 2400 GMT Sunday, July 2

This is a phone only contest sponsored by the Radio Club Venezolano commemorating the anniversary of Venezuela's independence.

Use all bands, 10 thru 80. There are three categories, single operator, both single and all band, and multi-operator, single transmitter and multi transmitter.

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

Scoring: One point per contact, 2 points if it's with a YV staiton.

Multiplier: For each country, YV call area and U.S. call area worked on each band.

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

Contacts: *Stations in the Americas:* Work YV's, other American countries and rest of world. *Stations in other continents:* Work YV's and other American countries only.

Awards: There are Trophies and Medals for the leading stations in each category.

In addition, certificates will be awarded to each station with the following totals:

Americas: Working 10 different YV stations and stations in 10 other countries. *Other continents:* Working 5 different YV's and 5 other American 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. *(I can personally vouch that it's a beautiful certificate.)*

Entries must be postmarked no later than August 1st and go to: Radio Club Venezolano, Independence Contest, P.O. Box 2285, Caracas, Venezuela.

Editor's Notes

In answer to the many justifiable complaints regarding missing certificates.

I can tell you with complete assurance that all contest certificates have been mailed, up to and including the 1971 WPX SSB contest.

If you have not received yours drop me a line and give me all the necessary information and your present address.

I am not trying to make any alibies but I sometimes wonder how we are expected to get these awards to some of you fellows.

With the call of the station as the only identification on the log, it sometimes presents quite a problem. This is especially true if it's an overseas entry. Not to mention the ever changing APO addresses. Or the scribbled hieroglyphics we are expected to decipher.

If you expect to change your QTH within 6 months of the mailing date, it would be advisable to include your forwarding address or state-side QTH.

We issue more awards than any other contest in the world, which in itself is quite a job. You can make it a lot easier if you spell out your name and address in BLOCK LETTERS.

73 for now, Frank, W1WY



THE awards PROGRAM



BY ED HOPPER,* W2GT

Special Honor Roll
All Counties

#71—Robert T. Anderson, Jr. WA4LMR, 2-19-72.
#72—James K. Ramsey, WA4ULL, 3-2-72.

THE June, "Story of The Month" is:

Donald W. Schmidt, WAØJRZ

(All Counties #61, 7-27-71)

Don was born November 11, 1936, a birthday present for his father, yes, rather unusual as it was also his father's birthday. He lived in Marion County, Kansas until joining the Air Force in 1958.

Don was raised on a farm where he spent the first 16 years of his life, and then moved to Hillsboro, Kansas, his present QTH.

Graduating from High School in 1954, he spent the next four years working at a dairy making butter and ice cream *(Yummy)*. A correspondence couse in radio and TV servicing was taken during those four years, but Don did not get actively into electronics until 1958 when he entered the Air Force.

Interest in amateur radio blossomed when he was stationed at Harmon AFB in Newfoundland, Canada. There were four amateurs assigned to the same shop with Don and they soon convinced him to get a license. The theory was no problem, but he had to try for a Conditional license instead of a Novice, as a Novice could not then operate in Canada. So after a few months copying code, a license was received in July 1964. Operation was mainly on 20 meters using a Heathkit HW-32 and a vertical.

In March of 1965, Don was assigned to Westover AFB, Massachusetts, and then to Offutt AFB, Nebraska in December 1966.

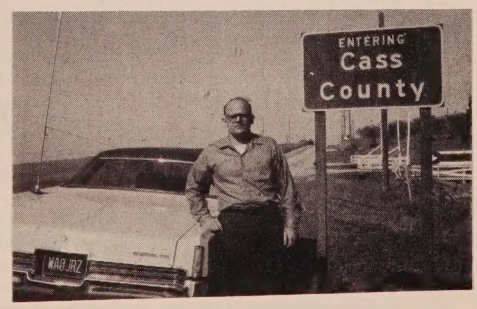
In November 1967 the Galaxy line was obtained and installed in his car. One weekend while driving from Offutt AFB to the home QTH in Kansas, he ran across the County Hunters *(Don says, no pun intended-Hi.)*. John, W8UMR and Arne, W8DCD were the Net controls and they asked Don to run the counties, so, he became hooked on County Hunting.

Many counties in Kansas and Nebraska were given out for months before Don started collecting them for himself. Collecting them has been quite an experience, yes a thoroughly enjoyable one.

It took Don just about three years and four months to collect them all.

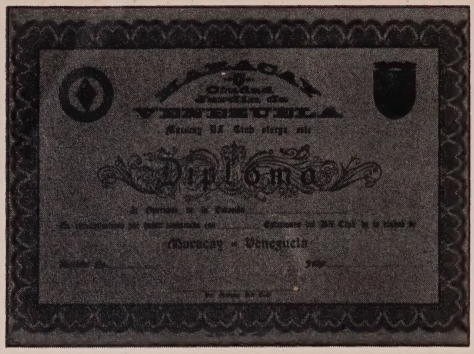
Don greatly appreciates all the help from everyone, especially the mobileers and the Net controls. It became quite a race on July 5, 1971 to see who would give him the last county. Clyde, WA6CCK was in Grant County, Arkansas, and Tom, W7HVH was in Dewey County, Oklahoma at the exact same time. Of course both were needed but copy on W7HVH was minimal, while WA6CCK was good copy. Grant County was worked first and thus Dewey County, Oklahoma made the last county.

Our records show that Don waited until December 16, 1970 to send his first application and was issued 500 #834; 1000 #225; 1500 #154, all endorsed All 14 SSB Mobiles. USA-CA-2000 #123, All 14 SSB; 2500 #97, All SSB and 3000 #65, All Phone. Then on July 27, 1971 he was issued All Counties #61, All Phone.



Don Schmidt, WAØJRZ at Cass County, Nebraska.

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



Maracay Cuidad Jardin De Venezuela Award.

His reaction after working them all seemed rather a let down. Suddenly there was time to catch up on all the projects that were put off while chasing those elusive counties. After catching up on the projects, the lure of County Hunting has returned.

Don moved to another apartment (same address) a few months ago and is unable to install any outside antenna, so his activities are mostly confined to mobile operation, although at times he does run a coax cable out to the car, and using the mobile whips, does check into the Net.

As most of you know, Don started the Cliff Corne, Jr., K9EAB Memorial Award which is issued for working holders of All Counties Awards issued by *CQ*. As described in *CQ*, September 1970, the basic award requires contacts with 10 All Counties Award holders. Send GCR list and 50¢ or 5 IRCs to Don at 220 N. Lincoln, Hillsboro, Kansas 67063. Sponsorship of the Award has now been taken over by MARAC, but Don is still the custodian. As this is being written, 130 such Awards have been issued. There was a foto of Don and Cleo, WAØSHE page 109, *CQ* of March 1971.

Awards

Rose City Award: Sponsored by the Windsor Amateur Radio Club of Windsor, Ontario, Canada. Issued for contacts with WARC members, two way communications with an exchange of reports must be made. Only QSOs after September 1, 1971 will count. Applicants in Essex County in Ontario require 15 contacts; all others require 5 contacts. Send GCR list or QSL cards to: Windsor Amateur Radio Club, P.O. Box 1322, Windsor 14, Ontario, Canada. (Club station is VE3OW).

International Freedom Festival Award: Also sponsored by the Windsor Amateur Radio Club for contacts with WARC members during the period from June 24, 1971 to July 20, 1971. Two way communications with an exchange of reports must be established. Continental USA and Canada applicants require 5 contacts. DX stations require 3 contacts and Essex county in Ontario require 10 contacts. Send GCR list or QSL cards to: Windsor Amateur Radio Club, P.O. Box 1322, Windsor 14, Ontario, Canada.

Worked All States by Amateur Television: (WAS-AT Award). Sponsored by the Dayton Amateur Radio Association, Inc., to encourage and promote the latest mode of communication by Amateur Slow-Scan Television. A handsomely engraved plaque will be presented to the *first Amateur* who completes 50 state two way contacts by SSTV, others should receive a WAS-AT Award. The following rules apply:

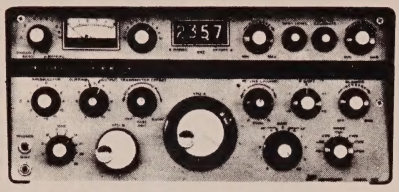
1. Contacts must be made to all 50 states from the same transmitter location starting April 24, 1971.
2. Proof of the SSTV contact shall be a photograph taken of a readable received picture showing the contacted station's call letters or his symbol. In lieu of a foto, a recorded tape (1/4" audio) may be submitted, showing the received foto of the call letters or symbol.
3. A log shall also be submitted showing the station contacted, location, time and date, frequency used, and the type of video equipment of the contacted station. A statement shall accompany the log, stating that the contacts listed are in accordance with the regular station's log and that FCC rules have been complied with on all contacts.
4. Photos and recorded video tapes which are submitted, may be copied by the DARA for the record, but will be returned to the contestant after the award is made.
5. Logs, photos, and tape shall be sent to WAS-AT Award, Dayton Amateur Radio Association, P.O. Box 44, Dayton, Ohio 45401.
6. Any question of contact authenticity will be submitted to an impartial committee, the members of which are not in the contest. Such members will be selected from the various net control stations of the Saturday SSTV Net which operates on 14230 kHz at 1900 GMT.

Maracay Cuidad Jardin De Venezuela Award: Issued by the Maracay DX Club on the 11th anniversary of Radio Club Venezolano Seccional Maracay, to all legally operated amateur stations for two way contacts with Maracay DX Club members after October 1, 1971. QSOs with Maracay DX Club members count for one point on each band (80, 40, 20, 15, and 10 meters). No cross mode permitted, all QSOs must be 2 way phone or 2 way c.w. Applicants require the following: Venezuela stations need 15 points; South and North America need 5 points; Europe and Africa need 4 points; and Asia and Oceania need 3 points. Send a QSL confirming each QSO with summary log to: Award Manager YV4UA, P.O. Box 18, Maracay, Venezuela, S. America. For stations outside Venezuela, include 8 IRCs for air mail postage. Maracay DX Club members include: YV4AZ; 4JB; 4PA; 4QQ; 4UA;

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Radio Club Paraguayo: Issues the following awards in recognition of proficiency and achievement of any amateur or s.w.l. in the world. A ZP contact is obligatory for each award. All contacts must be after May 15, 1952. A GCR list (no QSLs) of contacts with a fee of 5 IRCs for **EACH** award should be sent to: Radio Club Paraguayo, Awards Manager, P.O. Box 512, Asuncion, Paraguay, S. America.

Diploma Paraguay (DP): Issued for confirmed contacts with 15 different ZP stations. South American stations need 15 and 5 are needed for applicants from the rest of the world.

All Mediterranean Countries Award (AMCA): Issued for confirmed contacts in Class A- 40 countries. Class B- 30 countries. Class C- 20 countries. Countries are: CP, ZP, PX, HA, HB, HBØ, HV, LX, OE, OK, UC2, UG6, UO5, 3A, YA, AC, XW8, JT, 9N1, UL7, UM8, AC3, UI8, UH8, UJ8, TZ, XT, 5U7, TT, TL, 5X5, 9X5, 9U5, 7Q7, 9J2, ZE, A2, 7P8, ZD5, 4U1.

Tropics of Cancer and Capricorn Award (TCCA): Issued for confirmed contacts with countries touched by the Tropics of Cancer and Capricorn as follows: Class A-28 countries. Class B- 20 countries. Class C- 12 countries. Countries valid are: Tropic of Cancer: XE, VP7, EA9 (Spanish Sahara), 5T5, TZ, 7X, 5U7, 5A, SU, MP4T, MP4M, VU, XZ2, BY, BV, KH6, AP (E. Pakistan). Tropic of Capricorn: ZP, CE, LU, PY, ZS3, A2, ZS, CR7, 5R8, VK.

All Zone 11 Prefixes (AZ11PX): Issued for confirmed contacts with prefixes if *CQ* WAZ Zone 11, as follows: Class A- 30 prefixes. Class B- 19 prefixes. Class C- 12 prefixes. Prefixes list: ZP1 to ZP9, PY1 to PYØ, and the special prefixes issued for WPX contests.

Diploma Sud-America (DSA): Issued for confirmed contacts with countries located in ITU zones number 12, 13, 14, 15, 16, and 73 as follows: Class A- 28 countries and 6 ITU zones. Class B- 20 countries and 5 ITU zones. Class C- 16 countries and 4 ITU zones. Countries: Zone 12, FY, HC, HK, OA, PJ, PZ, 8R, 9Y4, YV, YVØ. Zone 13, PY north of 16″ 13′ S., PYØ (Fernando de Noronha Island). Zone 14, CE north of 40″ S., CEØZ, CP, ZP, CX, LU north of 40″ S. Zone 15, PY south of 16″ 13′ S., PYØ (St. Peter & St. Paul). Zone 16, CE south of 40″ S., VP8 (Falkland Is.), LU south of 40″ S. Zone 73, VP8/LU-Z (So. Georgia), VP8/LU-Z (So. ence. After trying over 2½ years to get a needed LU-Z/CE9AN-AZ (So. Shetlands).

Notes

Thanks for all the cards and letters regarding Helenmae's illness. Wish I could say that she is 100% again, but perhaps by the time you read this, she will be tip top again. Also thanks for the birthday cards, as it is 3-8, I'll copy Jack Benny and from now on I'll stay at 38, Hi.

After receiving complaints about the poor service in getting the Canadian WAVE/WACAN Awards, I decided to relate my experience. After tring over 2½ years to get a needed QSL, I got help from friends VO1AW and VE1-ATP. I sent the application, list, 22 QSLs and the $2.00 fee to Nortown Amateur Radio Club, VE3NAR, on March 30, 1971. Fortunately I sent all this via registered mail, getting a return

[*Continued on page 92*]

SURPLUS sidelights

BY GORDON ELIOT WHITE*

LETTERS—do we get them, both from *CQ* readers, and from readers of another magazine whose technical editor once recommended me as the chief expert on surplus. It must have saved him a lot of postage, considering what I spent on answers.

I don't mind answering readers' questions, but I do like to get self-addressed stamped envelopes where replies are desired. Those eight cents and a few minutes with the address are insignificant to each individual, but they do add up when the Surplus Editor has to provide them all. And then I get occasional letters with questions—but no return addresses. Sorry. I'm not omniscient.

There is often some delay in getting answers out, due to the pile of letters, the necessity for looking up an answer that may be hard to find, or because I have asked another "expert" for help. I answer all letters as soon as I can, no matter how long it takes.

There are of course a lot of unanswerable questions. There are obscure test sets for which no data seems to exist. I am unable to offer a wide-ranging critique of all the military and civilian receivers made since WW II. I may offer my opinion that the R-390-A is a good set, but I can't cover all the ground such a question would involve.

I do not sell tech manuals. The ones I have are my personal library, and I do not loan them out except in special cases. I can make Xerox copies at the nominal cost to me of 10¢ per page. (I do have some extra copies of a 1960 era test set directory which may help some people, and I ask $5.50, postpaid, for the 1,500 page set.)

I occasionally recommend sources for manuals, but most manual dealers are working on mighty close margins these days. They seldom will answer a query at all without the s.a.s.e.

I love to discuss the Command Sets, particularly with the engineers who worked on all the different designs who write me occasionally. If you are one, I'll do almost anything for you.

I am surely not an expert on strictly civilian amateur gear.

I feel it might be useful to go over some of the mail, and indicate my trend of thought on surplus. For example, a reader in Florida asked my opinion of the BC-1206, the AN/ARN-7, and the low-frequency Command Receiver, for long-wave work.

He wanted to copy European long-wave stations, but did not want to spend too much. He was interested in sensitivity, power supplies, and conversions.

Well, the AN/ARN-7 is an aircraft direction-finder, used in larger aircraft, back in World War II. It covers 100 - 1750 kHz, and requires a separate control box. Functionally, and somewhat physically, it resembles the older Bendix MN-26 RDF, in that it requires desktop space, and a remote control head with wiring and tuning-shaft connections. Ditto on the ARN-6. If you like complexity, these are your dish. The ARN-7 requires a 400 Hz, 115 volt supply, or alternatively, the 12 volt d.c.- powered RA-59-A power supply.

The BC-1206 is the other end of that scale. It is about the size of an old cream cheese box, has its dial and controls right on the front, and needs only a pair of phones and a 24 volt power supply. However, it is a real oddball of a set, using 24 volts on the heaters and the plates. Stability and noise elimination are not awfully good, nor is tuning accuracy or selectivity. It is a bit too compact for its age I might say. It covers 200 - 400 kHz. It has no b.f.o. and the intermediate frequency is 135 kHz.

The Command Receiver looks pretty good, if you do not need that lower 90 kHz of coverage or the broadcast band section of the ARN-7. The R-23-A/ARC-5, particularly, is stable, tuning is accurate, it (like the other two) has a b.f.o., it is small, may be easily converted to local control, and has its own dial. Selectivity of its 85 kHz i.f. is excellent, particularly with the slugs in the UP position in the i.f. cans.

There is nothing wrong with the BC-453, ARA, or R-23 versions of the Command Receivers, but the R-23-A has just a little better stability than the Army sets, and certain audio improvements, in addition to the ARC-5 automatic gain control circuit. You can go ahead and add the R-23-A noise limiter if you like.

Local controls may be added to the front panel. By using 6 volt tubes, the 24 volt set will work on 12 volts a.c., and you need only supply 250 volts B plus power. At the junk price of regulated tube type power supplies these days, it ought to be cheaper to buy than build; a snap. If you want broadcast coverage, use the BC-946, R-24/ARC-5, or the .52-1.5 mHz Command Receiver.

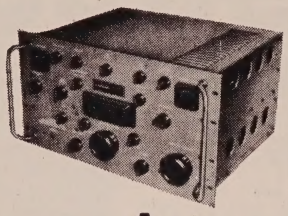
Another reader writes that he has a BC-312 receiver that has the standard intermediate frequency of 455 kHz. He also has a 500 kHz Collins mechanical filter he would like to use with the BC-312. How do I change the i.f.? he asks.

Now possibly this could be done. Get the i.f.s out of a Collins 51J4 and put them in. Change the "tracking" of the r.f. and oscillator of the BC 312 to handle a 500 kHz i.f. . . . But you

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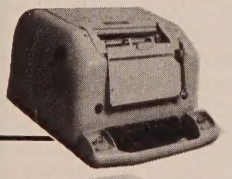
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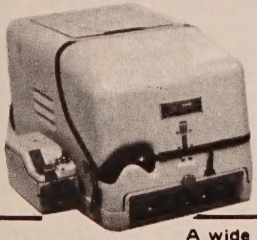
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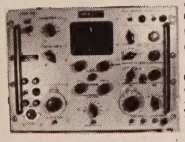


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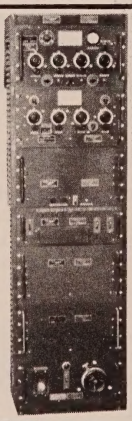
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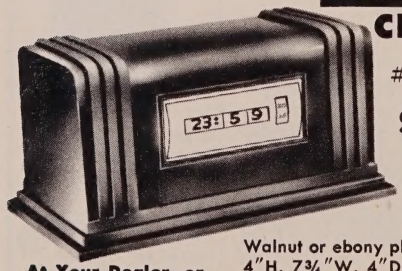
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don't want to bother. If you have to ask how to do that one, you shouldn't. A design engineer might be able to make the set "track" accurately, but about the hardest thing going is to alter the intermediate frequency of a receiver. You might add a second mixer and a crystal oscillator to give you a 500 kHz i.f. following your 455 kHz section, but it would not be any three-hour project.

Another reader asks where the 1000 kHz crystal for the LM or BC-221 frequency meter may be obtained. These are currently available from several crystal manufacturers, one of which, JAN Crystals, 2400 Crystal Drive, Ft. Myers, Florida, 33901 prices them at $5.10 plus 15¢ postage.

One gentleman writes that he has a Northern Radio Variable Master Oscillator, Type 115, model 1, in excellent condition. He wants to convert it to use as a frequency shift keyer. The stability, he notes, is excellent, the unit having aged to the point it has about a 6 Hz per hour stability.

Now the 115 v.m.o. was designed to operate in place of the local oscillator of a pair of SP-600 receivers, in a diversity setup. It is very stable, but is not designed for FSK duty. Northern Radio made the type 105, 327, and 109 frequency shift keyers for FSK transmitting. It is undoubtedly possible to put in diodes and make the 115 v.m.o. into a keyer, but it was not so-designed, and the modification would definitely affect stability. It would be better to see if you could swap the v.m.o. for a keyer, first.

My theory of surplus is to use each set as much like its originally intended service as you can to get the most out of it. Don't tear up a good receiver to make a poor transmitter out of it, for example. The engineers who originated the design usually knew what they were doing. *(not always)* A circuit that is stable in the original may not be in the conversion. If you need a parts collection there are a lot of surplus items that are good for nothing in their original state, and can be torn up with little loss.

I advocate finding the original plugs, if possible, and not hacking up equipment unnecessarily. It leaves the shack better looking, and usually better-operating, in the long run.

Two sets I recently received mail about qualify for my cannabalize list, the AN/SRT-4 and the CAY-5222239 transmitters. Both are huge rack-mounted beasts, the latter a WW II design, the former a product of the 1950's. Both are Navy sets, suitable for battleships. You need a great deal of space and patience to use these jobs, which offer a ton or so of steel capable of a small part of the output of a present-day economy amateur exciter and linear. If you have no funds at all, the SRT-4 might be a possibility. The older stuff will drive you up the wall, and the neighbors, too, with TVI, BCI, maybe hearing aid interference too. ■

JUGE



A message from .....

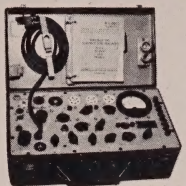
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Math's Notes [*from page 51*]

opportunity to re-publish a schematic diagram with some additional suggestions for an excellent, low cost f.m. converter. Figure 7 is a complete, double checked schematic diagram of the circuit. The address of the nearest Signetics I.C. distributor can be gotten by dropping a line to the main office in the above list.

If enough audio output is not obtained from your converter, the one-stage amplifier shown in fig. 8 will be of interest. One enthusiast who has built a large number of such converters, K2SCI, suggests moving the 3 pf capacitor to pin 10 instead of pin 9 for more audio output. Bill, W2AEF, suggests that receivers with less than 5 kHz i.f. bandwidths be "broadened" by slightly stagger-tuning the i.f. strip about ± 1/2 turn for best audio clarity. Also, be sure that the B+ to the chip is about 12 volts (15-20 ma) and that you adjust the tuned circuit to exactly the point of maximum recovered audio. The circuit to date has been used to successfully convert Gonset I, II, III, and IV's, Heath HW-17 and HW-17A's, Hallicrafters SR-42's, Clegg 22er's, and even a Swan 250 on six meters, not to mention my home station receiver that now has an f.m. position.

See you next month.

73, Irv, WA2NDM

I. F. Filter [*from page 23*]

peared to be the common case. However, it is suggested that such experiments be repeated. With slightly different physical arrangements, it is possible that a desirable grounding-connection might be found.

5. When the filter is installed in the receiver, it would be well to investigate the effect of transposing the relative phase of either the input circuit (L_1) or the output circuit (L_6). Because of stray couplings in a receiver, one connection may prove regenerative and the other, degenerative. If the receiver is plagued with i.f. oscillation, this little twist may prove to be the remedy. (C_2 and C_9 were intended to reduce such effects to a minimum.)

6. Two (or more) such filters may be cascaded by simply joining the output of one to the input of the other. Negligible disturbance will result because the previous resonance, LC, is retained by the new tank-circuitry which now is tuned by $1/2L$ and $2C$. ■

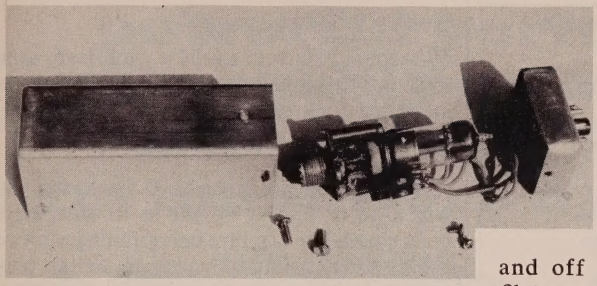


Fig. 8—Photograph of noise generator r.f. head.

Noise Generators [*from page 30*]

variable resistor is much more economical, but does not give very smooth control unless a large resistor is used. Granularity can be improved by using two resistors, one for coarse and the other for a fine control. The alternative is to use a 5 v.a.c. winding on the power transformer and vary the secondary voltage. Primary voltage control on a separate transformer provides a much smoother variation of voltage.

In cases where the noise generator is used as a standard, and a constant output is desired over a long period of time, a precision, regulated, d.c. power supply is used to supply the filament as well as the anode. This refinement is not deemed necessary for general purpose use.

A means must also be provided for measuring the diode plate current. A maximum of 25 ma should be sufficient. This corresponds to a noise figure of 14 db at 50 ohms which is relatively high. As it is also desirable to accurately measure lower values of current, a range switch should be included. A convenient way of doing this is to use a 1 ma movement with two ×5 range multipliers. This gives full-scale readings of 1, 5, and 25 ma.

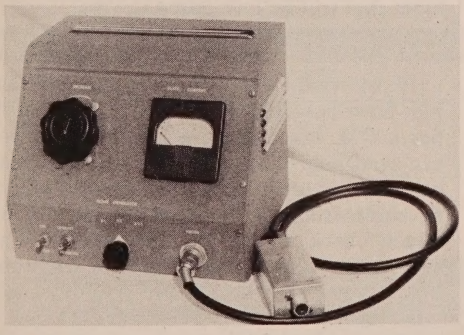


Fig. 9—Overall view of noise generator showing control box and r.f. head.

In making noise figure measurements it is convenient to be able to turn the noise source on and off without having to readjust the filament voltage control. Turning off the diode anode voltage with the filament hot will not completely remove the noise since electrons leaving the filament with a sufficiently high initial velocity will reach the anode giving rise to a small residual noise output. This can be eliminated by putting a negative potential on the anode. The easiest way of doing this is to place a reversing switch in the power supply leads; in the OPERATE position the B+ from the power supply goes to the noise diode anode and the B− to the filament. In the REVERSED position, the connections are reversed which makes the anode negative with respect to the filament and so effectively cuts off the diode and prevents any noise output.

The schematic of a typical noise generator is shown in fig. 7.

A noise generator may be constructed in many forms. One form that has proven to be particularly convenient in operation is a noise generator constructed in two parts: the r.f. head, which contains the noise diode and its assorted circuitry, and the power supply and control circuits.

A photograph of the interior of the r.f. head is shown in fig. 8. The components are mounted in a shielded can with an octal plug. An over-all view is shown in fig. 9. The power supply and control circuitry are housed in a sloping panel cabinet. The noise diode filament, explained above, is operated from a separate transformer. A transformer with an electrostatic shield should be used to reduce line noise from flowing into the diode filament and thence into the receiver under test. Line noise will have the effect of reducing the measured noise figure. If operation is contemplated in areas of high line noise, additional filtering should be placed in the filament leads and perhaps in the primary power leads as well.

Next month, the conclusion of this series will describe applications of the noise generator. ■

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Tips on DX [*from page 27*]

60-second QSO with a fellow American, even if he is operating from some previously uninhabited rock off the coast of Madagascar.

What To Say In A DX Contact

Once you have snagged a DX contact, you will have to play it by ear as to what happens next. If he is a rare one grinding out two QSO's every minute, you had better play along with him and give him the minimum information he wants—usually your name, QTH, his signal report, and a snappy 73. But fortunately most DX contacts can be, and are, a lot more than this.

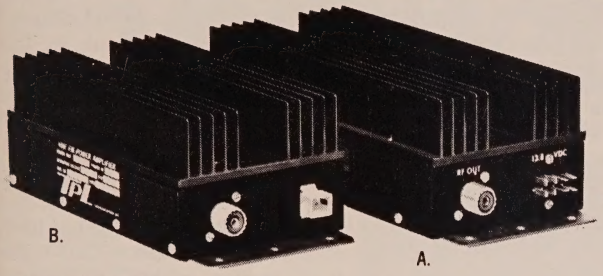
Try to judge how well your contact can speak and understand English. In most cases it will be his second language, and he will appreciate it if you talk slowly and carefully. Try to avoid using idioms that he may have difficulty understanding. You don't need to overdo it, but remember that even if your listener is a G or a VK, your style of English is different from his, and your signal quality isn't improved any by bouncing back and forth three or four times between the ionosphere and the surface of the earth. Listen a few times to the Voice of America broadcasts in English beamed at areas where English is a second language, and you will quickly learn the speed of delivery and the style of expression that work best.

To lift your QSO above the level of the usual trivia about signal reports, QTH, WX, and the like, plan to have something interesting or unusual to tell about yourself, or about the geography or history of your local area. Don't make it too long. Keep it short, snappy, and interesting. End each exchange with a leading question or two to encourage your contact to reciprocate with some facts or ideas that will be interesting to you.

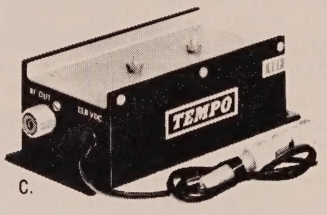
Exchanging QSLs

If you want a QSL from your contact, ask him how he would prefer you to QSL. If he has a QSL manager here in the States, you can send your QSL directly to the manager, being sure to include a self-addressed stamped envelope (s.a.s.e.). If he wants you to QSL direct, check during the QSO to see if his address is OK in the *Callbook*, or have him send his address over the air. Then promptly send him your QSL with a self-addressed envelope and a sufficient number of International Reply Coupons. United States stamps

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B. A.



C.

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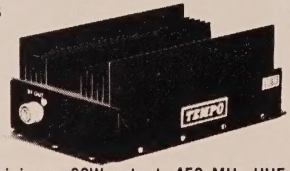
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TPL802B	1 to 3W	80W	2M	$180.00
TPL502	5 to 15W	35-55W	2M	$ 99.00
TPL502B	1 to 3W	45W	2M	$125.00
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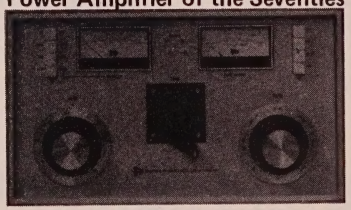
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will be of no use to him. For the more common type DX countries you may prefer to QSL by sending your outgoing cards directly to the foreign bureaus. Their addresses are listed semi-annually in *QST*. Or you may find it more convenient and less expensive to have one of the several private QSL bureaus handle your outgoing QSLs, for a few cents per card. You will find their services and charges described in their ads each month in the various ham magazines. To receive incoming QSL cards, keep a supply of stamped, self-addressed envelopes on file with the appropriate ARRL QSL bureau. Their addresses and detailed information are listed periodically in *QST*.

Working DX is a fascinating aspect of ham radio, but it is only one aspect. Don't get hooked on it to the point where you exclude all other types of ham activity. You will enjoy DX-ing more if you keep it in proper perspective. Good luck, and the best of DX. ■

CQ Reviews: Heath IM-102 [*from page 55*]

Tests against a wide variety of resistance values known to be within 0.5% confirmed the accuracy of the ohms functions. In respect to these readings, it must be kept in mind that the ohms-range scales are designated as the full-scale value (as with volts) and not as a times so-and-so value as most ohm-meters are labelled. For example: the 20K range is the full-scale value with the readings scaled down accordingly. They are not × 20K.[4]

Conclusion

Although the high accuracy of a DMM is not essential for every application related to amateur-radio equipment, it is nice to know certain values to within a close tolerance, particularly involving such cases as selecting resistors for circuit elements such as pads. Besides this, once you get used to a DMM, it is great for convenient measurements enhanced by the automatic polarity indication and the lesser chance of problems with damage to the device that might otherwise occur with many meter-type jobs.[5] As for lab work, there is no question as to the necessity for a device of the caliber afforded by the IM-102.

In addition, the relatively low cost of $229.95 for the IM-102 (kit) is attractive

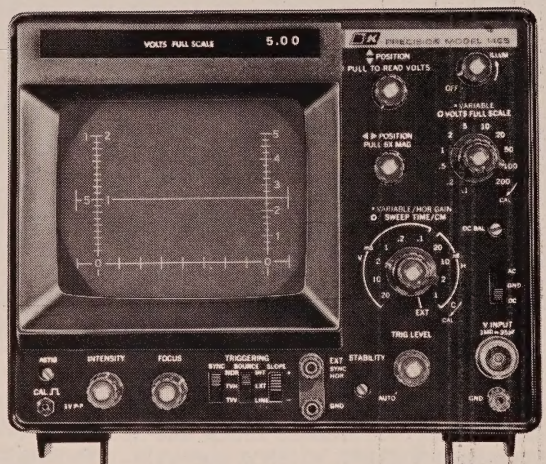
[4]Very high resistance values on the 20M ohms range require up to 10 seconds for a stable and correct reading. All other functions and ranges require 2 seconds or less.

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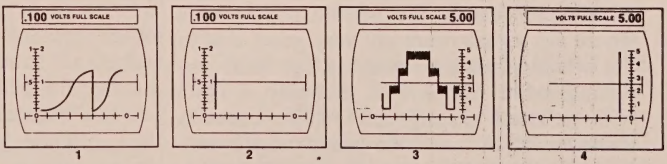
The CALI-BRAIN system increases your efficiency because it lets you measure its peak-to-peak voltage without changing your test set-up. Now you can confirm the manufacturer's service data exactly – checking out typical waveforms and peak-to-peak voltage readings at various test points.

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The entire CALI-BRAIN action is automatic – and takes less than a second. After you have read waveform voltage on the scale, you deactivate CALI-BRAIN system with a single switch, and the waveform is again displayed as before. One probe and one test instrument – lets you concentrate on trouble shooting, not the test equipment!



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[5]One thing that is a little tedious to accomplish is in cases where adjustment of equipment may be desired for a null reading on a DMM, since the DMM indicates values at both sides of a null, making it somewhat confusing as to which direction adjustment must be made as it is conducted back and forth through the proper point during the time the instrument takes to register a change. The unit takes 5 readings/sec.; 2 secs. are required for a stable reading. The process, however, can be somewhat aided by making the adjustment very slowly while watching the polarity indicator for the required directional change. Once the null has been obtained, it can be a more precise one than obtainable with an analog device, because of the higher resolution of the DMM.

Adriatic DXpedition [*from page 36*]

normal. 4N2HV was better known in Japan than in the U.S. since band conditions favored the east at that time. The bands were often poor, but we had fun with our 40 and 80 meter schedules with YU stations. It was very interesting to work YU pile-ups as well as to talk to our friends and families all over the country.

The next stop was Korcula Island, site of 4N2KO. Here YU3BU, YU3EY, and YU3TCB left the group but Graziano, YU3TST, and Leo, YU3TXT, joined the others. This operation was followed by Lopud Island, 4N2LO, Kolocep, 4N2KP, and finally Mjet, 4N2MT. Then our expedition came to an end. The finishing honors were due to YU1QBC, YU1NXB, and YU2NEG who stayed with the expedition from beginning to end.

We could write a whole book on each island and mention the thousands of hams we worked but space does not allow this, of course. We express our thanks to DL9OH, who helped us make lists on 40 and 80 meters where our signals were not very good, and to the whole amateur fraternity for their encouragement. There was probably a QSO with yourself among the 30,000 contacts made during our Adriatic Islands expedition. Incidentally, QSL cards for all 4N2 operations were handled by Tom, YU2NEG and an award is available to amateurs who worked us at several islands. We are most pleased to provide many DXers with a new prefix and are looking forward to conducting other DXpeditions in the future. ■

OSCAR-6 [*from page 33*]

LOS (loss of signal) is measured as 2500 miles. At a velocity of 250 miles per minute, the satellite will remain visible to both stations for about 10 minutes.

In this example it was assumed that both receiving and transmitting antennas were rotatable, ideally in both elevation and azimuth, so that the satellite could be "locked on" at all times. While it is desirable to rotate the antennas in both planes, or at least in the horizontal plane, for working extreme distances through the satellite, simpler antennas can be used for communicating over shorter distances.

If rotatable antennas are not used, AMSAT suggests the use of antenna systems with relatively *wide* beamwidths in both the horizontal and vertical planes. In this way the satellite will remain within the beamwidth of both the transmitting and receiving antennas long enough to permit communications to take place, and without the need for rotation. Horizontal dipoles or vertical antennas a 1/2 wavelength or less above ground will produce wide bandwidths in both planes. Consult any reputable antenna handbook for additional information concerning wide beamwidth antenna systems.

AMSAT calculations show that a 100 watt transmitter, and dipole antennas for both transmitting and receiving, should be adequate for c.w. communication through the

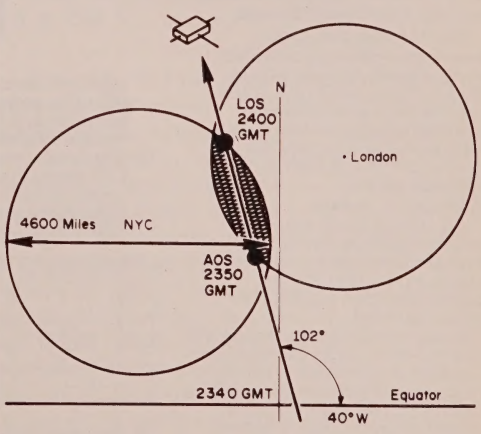


Fig. 2—Orbital arrangement for a trans-Atlantic QSO through the OSCAR 6 amateur radio satellite. The shading represents the area through which the satellite must pass to enable communication between a New York City amateur and a London amateur.

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satellite. An additional gain of at least 8 db will be required in the receiving system to maintain s.s.b. communications. This can be accomplished by the use of a high gain receiving antenna such as a 10-meter Yagi.

Interference Caution

To keep interference to the OSCAR-6 satellite to a minimum, 2-meter stations *not* desiring to communicate through the satellite should make sure they *do not* conduct ground-based communications in the 145.9 to 146.00 mHz passband. Likewise, 10-meter stations should not conduct ground-based communications in the 29.45 to 29.55 mHz passband. Leave these frequencies clear so that they may be available for all those who may want to use the satellite. Amateur radio can be very proud of the results of the OSCAR 3 and 4 repeater satellites, during which time not a single incident of interference was reported between ground-based stations and those using the satellites. It is even more important now that this splendid record be upheld during the period that OSCAR-6 will be in orbit.

The output power of the satellite, approximately 1.3 watts, will be shared by all signals passing through the repeater at the same time. Based upon the results of aircraft flyovers, about ten s.s.b. signals will be the most that the satellite will be able to handle at any one time, although a single, excessively strong signal could capture and block the satellite completely. In an effort to avoid interference and to prevent repeater blocking, AMSAT urges all users of OSCAR-6 to carefully check the receiving passband before transmitting. Be sure to pick a clear spot, and back off on transmitter power to the minimum level required for communications.

The FCC has issued a waver to permit Technicians and Novice class operators to transmit through the OSCAR-6 repeater, even though the repeater operates on the 10-meter band.

OSCAR-6 is an undertaking of AMSAT, the Radio Amateur Satellite Corporation. The group is affiliated with ARRL and receives modest League financial support. AMSAT membership is open to those interested. The AMSAT *Newsletter* sent to all members contains the latest information on amateur radio satellite activity. For a membership application, drop a note and an s.a.s.e. to AMSAT, P.O. Box 27, Washington, D.C. 20044. ■

What's Past Is Prologue [*from page 6*]

of decibels above or below 1 watt of energy or power (flux) per unit area of 1 square meter, and is spoken of as power flux density. In order to relate "pfd" to something all hams are familiar with, keep in mind that 1μv/m of field strength is about equivalent to -147 dbw/m^2.

(I think it would be helpful if the ARRL *Handbook* would include in one of their upcoming editions some further discussion of terms and definitions plus some derivation associated with common terms in amateur radio.)

So this gives us an understandable relationship between power flux density in dbw/m^2 and electric potential between point in space, measured in μv/m. The rest of our discussion is mainly simple arithmetic concerning what we can do with our satellite.

Suppose that "Amateur A" wants to have a QSO with "Amateur B." The former has a 100 watt transmitter with an emission bandwidth of about 20kHz, and a dish or a phased array having a gain of 15 db. Therefore, his effective radiated power relative to an isotropic antenna (e.i.r.p.) is +35 db or about 3 kw. At 435 mHz the attenuation of the signal (commonly called path loss) from "Amateur A" to the satellite, a distance of about 22,000 miles, is 156 db, a negative quantity, so the +35 db of power has shrunk to a -121 dbw/m^2 by the time the signal gets to the satellite. If we assume the satellite receiving antenna gain is +15 db, then the signal at the satellite receiver input will be about -106 dbw, about 40 db above our reference, -147 dbw/m^2, or roughly 100 μvm (we'll leave off the m^2 for it is assumed). So now we have the signal into the satellite receiver.

Let's assume that the satellite receiver we have in mind has a bandwidth of 200 kHz (which will accommodate about 10 f.m. signals simultaneously) and has a noise figure in the order of 10 db, which is about what a real good TV receiver has. Therefore, the total receiver noise power in the 200 kHz bandwidth will be about -141 dbw, and "Amateur A's" signal is about 35 db above the noise at the input of the receiver.

If you want 10 or more simultaneous QSO's and we have only 20 watts output from the satellite transmitter, then any one signal should appropriate only $1/n$ times the available power output, n being the number of QSO's. Skipping a little arithmetic related to the satellite characteristics we find that Mr. A's signal of -106 dbw has now become 0 dbw or 1 watt, taking into account the overall gain of the satellite transmitter, transponder or repeater as you will. On the down-link frequency of 144 mHz, the signal path loss enroute back to earth is nearly 147 db. When we boost the 1 watt output by the satellite antenna gain of 10 db, and then lose the 147 db, we reach Mr. B's antenna at a signal level (remember we now call it power flux density, pfd) of -136 dbw. Add to this the receiver antenna gain of say 10 db, plus a receiver with a noise figure of less than 6 db, and the result is a signal-to-noise ratio of about 28 db. *Great* . . . only in practice it won't be quite that good because of inter-modulation among the 10 or 20 signals passing through the satellite, which will reduce the output signal-to-noise ratio to a value somewhat below that for one signal . . . say about 20 db. This is the reason why the receiver noise figure should be as good as possible, in order not to appreciably add to the noise already present on the incoming signal. If we use f.m., the output s/n will be equal to the input carrier-noise ratio plus the f.m. advantage. We now have a satellite about the equivalent in physical size to the original Early Bird.

One of the greatest problems that amateurs will have to face and overcome (and this is self-regulation), is the necessary discipline to maximize use of the satellite. Our postulated satellite can handle about 20 QSO's simultaneously, depending on exact values of bandwidth and power output. But this capability will be realized only if all participants observe self discipline concerning their e.i.r.p. If some amateurs appropriate more than their fair share of the available power through the satellite, it will leave less for others trying to use the system. Another important aspect of discipline will be listening on the down-link frequency to make sure that the proposed channel is clear in both directions. If this discipline breaks down, the result will be not only QRM in the ordinary sense, but also cross-modulation among signals of unequal power in the satellite receiver and thus lower the s/n ratio for everyone using the satellite.

By now you probably have concluded that all is not as simple as picking up your telephone. Depending upon economics, amateur satellites may be power-limited. Therefore we should maximize the watt-per-dollar product by choosing up-link and down-link frequencies so that we may obtain as much gain on the earth end of the circuit as possible. All the satellite does is take the up-link signal, boost it by the overall satellite gain, and retransmit it on the down-link frequency. Also these frequencies must be carefully chosen with due regard for electromagnetic compatibility on board the satellite, which is a fancy way of saying that we must avoid things like the 3rd harmonic of the down-link transmitter jamming the up-link receiver. Without going into details, the choice of 10 simultaneous QSO's is probably a fairly good figure, even though you are probably thinking, "That ain't much." But bandwidth is directly related to total noise power, and if we theorized on 100 QSO's instead of 10 everyone would have to raise his e.i.r.p. 10 db or the quality of transmission would be reduced.

Probably this is as good a place as any to remark that we seem to always have with us the

question of the best way to utilize bandwidth, whether we are concerned with phone and c.w. on the h.f. bands—or satellite communication. In this case of our satellite, if we consider the use of c.w., it would be possible to hold simultaneously 200 QSO's on the basis of 1 kHz required bandwidth per signal. If you could accept a lower minimum bandwidth of say, 200 cycles per signal for c.w. (which is probably impracticable), we could accommodate 1000 QSO's . . . always keeping in mind the disciplines we mentioned earlier plus a few I haven't touched on. Probably the best and most acceptable solution, as in h.f., is neither all phone nor c.w., but a reasonable mix of both. But in the satellite case, there has to be world-wide adherence to the disciplines built into the system, or the satellite will not function to greatest advantage.

Up to now we have covered the satellite itself, what it could do and the limitations that may be imposed. But to what purpose do we put it? If we are able to convince others that such a satellite is worth the investment, surely there must be some useful purpose. I would not suggest that we should never use it for some or all of the purposes that have been mentioned such as a "satellite DXCC," a "satellite WAS," and "all OSCAR BPL" or perhaps even for just rag chewing, but I have a feeling that these things by themselves will not justify such a satellite. It seems to me that one of the greatest uses of such a satellite can and probably should be for educational purposes, not only to train our own young people in the techniques of satellite communication, but also others around the world . . . using the satellite for the exchange of information, advice and actual experience in satellite communication. The so-called "new and developing" countries of the world have not yet reached an acceptance of amateur radio as a worthwhile utilization of the radio spectrum. Perhaps if they see a benefit such as this, it would impress them with the tremendous promise that amateur radio can have for them in the development of trained people in telecommunication. In the plenaries of the ITU, I can assure you, we need their support.

There is another purpose of such a satellite that should be thoroughly explored. Perhaps it is significant that none of the currently utilized or contemplated commercial satellite systems are specifically designed for use in the event of a natural disaster, epidemics, famines, floods, earthquakes, tidal waves and similar things which afflict mankind. The need for such a system of communication has already been recognized by the ITU. However, no existing space communication system makes provision for specific channels for emergency communication. Will the Amateur Satellite Service be competent to meet the challenge in extending our Charter of 97.1(A)?

"Recognition and enhancement of the value of the amateur service to the public as a voluntary, non-commercial communication service, particularly with respect to providing emergency communications"

or are we "just little boys playing in our basement" as we have often been referred to in the assemblies of the ITU? If we *are* up to the challenge and have what it takes, we could create a lasting impression of competence and worthiness in the eyes of world leaders, not just in the plenaries of the ITU.

Perhaps it is too large a bite to swallow in one piece, but if we don't seek a larger goal than we have before us at present, what is the future of amateur radio? Are we content to become fragmented among ourselves, arguing like spoiled children about who should occupy what portions of our h.f. bands, or even v.h.f., now that we have finally started to earnestly occupy them? Are we fundamentally just a bunch of hobbyists who would idly chatter incessantly over our transmitters which occupy precious spectrum space? How many of you have read recently the basis and purpose of amateur radio contained in Section 97.1 of the rules?

What is our responsibility to future generations who will inhabit "our bands" some day when you and I are "silent keys"? Are we leaving them a legacy for the future based on sound judgment and planning? The growth curve of amateur radio in the United States has been more of less static for a number of years. Not so in certain other countries! Novices have constituted about 8½% of our total; technicians 19%; Conditionals 11½%; General Class 34% and Advanced and Extra Class 26%. Are we attracting a fair percentage of young people to amateur radio? Granted that competition is greater now than it was 50 years ago, but information and learning aids are also more available than they were when you learned the art of wireless communication.

We hear a lot about revolution today in our society. The only apparent impact on amateur radio that I can detect is the increase in illegal operation, the upsurge of foul language to be heard almost any night you turn on your receiver . . . (especially on 75 meter phone) and the apparent desire to lower the qualification for an amateur license. This is not the kind of revolution we need in amateur radio. If we have the imagination to confront and reshape it, we might expect that this revolutionary attitude could be of help to us rather than a hindrance, in planning the future, but if it is to be a help, we must present a challenging view of what the young generation can accomplish, not just what they can get out of it in terms of enjoyment because that's not enough. Young people are keyed to a rapidly changing, complex society . . . almost impossible for an older generation to comprehend. Dr. Robert Hilliard explains it with the statement,

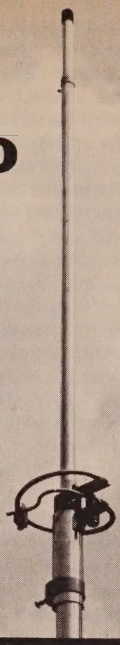
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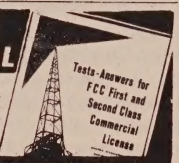


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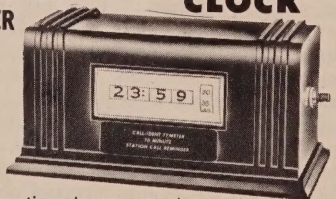
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Today's youngster generally, is not thrilled by the same things that sent you and me into orbit 40 or 50 years ago. He takes for granted what still gives us goose-flesh in our hind-sight perspective of the development of telecommunications. The frontier of amateur radio is in the field of satellites. I fully appreciate the difficulties of trying to keep abreast of things here on earth. Nevertheless, I urge those who have the responsibility for plotting the future course of amateur radio to look far ahead, lest the immediate problems within and outside our ranks occupy too much of our energies to the long term detriment of amateur radio.

Over the next few years, I hope the Commission can erect a few new road signs and perhaps replace some old ones, to assist in the development of amateur radio and keep it going down the right road. Whatever we do, I know you will evaluate it judiciously in the context of our common goal.

In Shakespeare's play "The Tempest," Antonio summed up what seems to me is our position today when he said,

". . . . What's past is prologue, what to come in yours and my discharge." ■

DX [*from page 62*]

Radio Society for many years, and on official overseas advisor to the *CQ* DX Program since 1968. Many amateurs owe their first Bahamas and Zone 8 confirmations to VP7NA. And he opened his home and his station to DX Editor K4IIF for two major contests. Ken died at the Princess Margaret Hospital in Nassau and services were held at St. Mary's Church. He was survived by 7 daughters, 3 brothers, 2 sisters, and 17 grandchildren.

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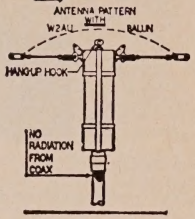
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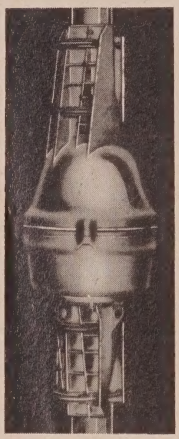
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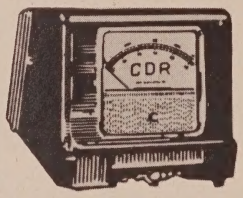
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W6KTE is no longer QSL Manager for the Following stations: HL9KH, XW8AX, XW8AZ, W6BCT/4X4, 9M8KZ, 9Q5DG, 9Q5PI.
73, Jerry, WA6GLD

Q & A [*from page 12*]

ANSWER: Yes, the FTdx-560 will work okay on c.w. without the optional c.w. filter. The only difference without it is that the selectivity on receive will not be as good for c.w. as it would be with the narrower c.w. filter. The normal selectivity of this transceiver is 2.3 kHz @ 6db, whereas the c.w. filter will provide 600 Hz selectivity.

Manual Appeal

A manual for a Precision Apparatus Co. v.t.v.m., series EV-10-S, is desired by Dennis Bookmiller, WB2AIO, 309 Roycroft Blvd., Snyder, N.Y. 14226. If any reader can help in this respect, please contact WB2AIO directly. Thanks. 73, Bill, W2AEF

USA-CA [*from page 75*]

receipt. I finally received my QSLs back on September 30, 1971 but *no* answer to my many letters of complaint. The *awards* arrived on October 15, 1971, although they were dated July 1, 1971. Have never received any explanation nor answer to my letters.

County Hunter QSLs for G4JZ, SM3BCZ, and SM6DHU can be sent to Marv Hagan, WB2SJQ, 353 Woodmere Blvd., Woodmere, N.Y. 11598. Yes, Marv has kindly offered his services as QSL manager for them for CH QSLs only.

Sorry to, finally, hear about the loss of another old friend, Charlie Colman, W3QT.

No other hot news nor space so, How was your month? 73 Ed., W2GT.

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VHF TRANSCEIVERS, amplifiers, spares, test & bench equipment, complete schematic files from Marine & Mobile shop. List from Box 429, Cape May, N.J. 08204.

TO SETTLE ESTATE of W6NIT — SB110A w/HP-23A $250; HQ-170C $120; HO10 monitor scope - $40; Sase for various other equip & instruments. Contact A.A. Trumble, 1311 So. Glendale Ave., Glendale, CA 91205. (213) 242—0718.

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Join QRP ARC Int.: Send sase for info. Corresponding Secy, Earl R. Lawler, W5JLY, Rt. 2, Box 24K, Burnet, TX 78611.

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EXCESS USED EQUIPMENT for sale. Signal generators, counters, voltmeters, communications receivers. Write for list: PIEZO TECHNOLOGY, Inc., P.O. Box 7877, Orlando, FL 32804.

SELL: Ranger II. Perfect condx. Used 40 hrs. Orig owner. Factory wired. Used as a back-up rig in event reg rig broke down. $150 is a fair price. O'Brien, W2EQS, 190 Knickerbocker Rd., Apt. 9, Englewood N.J. 07631. (201) 871—0030.

FCC "TESTS—ANSWERS" . . . Original exam manual for FCC First and Second Class License — plus "Self-Study Ability Test" Proven! $9.95. Satisfaction guaranteed. Command, Box 26348—H, San Francisco, CA 94126.

FREE DELIVERY on Electronic Parts, transistors, diodes, resistors, capacitors and lots more at Rock Bottom Prices. Send today for Free catalog to: BASIC ELECTRONIC COMPONENTS, 3 Fairfield Dr., Rochelle Park, N.J. 07662.

Sell: Motorola HT-200, 4 frequency, 22-82, 82-82, 34-94 and 94-94. Extra battery & Motorola Charger $350. Also Heathkit frequency counter & scaler. Counts 2-175 mhz. Assembled & lab calibrated w/manuals $350. Johnson, WA0PVW, 5544 Blue Ridge Blvd., Raytown, MO 64133.

Drake 2C, 2 CQ, NB, xtl. cal., perfect $200. Eico 720 novice xmtr $45. Instructograph w/code tapes $25. WN4SYM, 1504 Elmhurst Dr., El Paso, TX 79925.

Sell: Hammarlund SP-600, mint cond $275. Collins J51-3, mint cond $275. Both with original speaker. Zonar BR-21 linear amplifier $60. Astatic mike D-104, with stand, new $18. Zonar Communication power mike $10. Call days in Flushing, NY (212) AX 7—0100.

Scopes - Tektronix 545 w/dual trace plug-in, gud condx. Make offer. Heath IO-18, mint $55. WN2-BRQ, 12 Top O'Hill Rd., Wappingers Falls, NY.

Wanted: service literature on SX-25 general coverage recv. Kerry Fields, 1418 South Baker, Santa Ana, CA 92707.

Ham gear, parts, tubes, mags, old radios to sell or trade. Need scope. TV service gear, ssb eqpt or what have U. Adams, 1402 W 13th St., Panama City, FL

Worked 3A0FN, HB0XJG or WA4WME/LX? QSL directly to Vandergrift, MATCOM-DSO, APO, NY 09052.

Complete Novice Station: DX-60, xtals, vfo, new condx. Knight R-100, mic, key, phones, junk box. $100 Fob WA6IZY, 222 Chollo No. 5, Pleasant Hill CA 94523.

Heathkit 2m am Lunchbox xceiver $18. Swap or sell spare Bearcat scanner xtals $1 ea. Reid, VA Hospital, Wood, WI 53193.

Sell or trade: Drake 2B, 2AC calibrator, Eico 460w scope, Fujica compact delux 35 camera. Gosman, 143 Roxton Rd., Plainview, NY 11803.

Sell: xvtr, xcvr, xmtr, antenna, mikes, etc. Send sase for complete list. K5ZUV/4, P.O. Box 7502, Miami, FL 33155.

Wanted: Inexpensive QTH near Ft. Meade, MD. Small house/room for antennas. WB0BAA, Joe Braun, 1263 Lyle Pl. NW, Atlanta, GA 30318.

Wanted: 5w ss CB transceiver, need not work. F. Lingel, 6 Wirthmore Ln., Lynnfield, MA01940

BC-779 super pro w/ac supply. Works ok $60. Fob W.R. Hempkins, 100 Main, Denison, TX 75020.

Electrovoice 664 w/EV419 desk stand $35. HA-1 to-keyer w/vibroplex key. $35. Both very clean. Hoffer, W1DL, 24 Cherry Rd., Framingham, MA

Sell Drake ML-2 transcvr & tone burst encoder $250 or best offer. 217/328-1468, Clark, 115 Dewey, Urbana, IL 61801.

Heath SB-300 rcvr. am/cw/ssb filters. Excellent condx. WA5GFE. Pick up Houston, TX $190. (713) 664—4639.

Want: Drake T4X. Sell xfmrs 3600-0-3600 @ 1 amp $25. 1.7 amp $40 w/120/240 pri. Paul Bittner, 814 4th St. So., Virginia, MN 55792.

NC-300 w/calibrator 2&6m converters, 20A w/converted vfo all in good condx w/manuals. Best offer. W1GEH (203) 236—4960.

Heath SB-610 $80 firm or trade for Swan 55B ant. Must be in gud condx. Sachnoff, 306 Lincoln No. 19, Columbus, MS 39701.

SB101, HP23 & SB600 professionally wired, $310. HA6, 6m transverter w/ps $75. All in gud condx. WA0JKT, 2504 Pennsylvania Av So., St. Louis Pk., MN 55426.

Heath twoer, keyer, vtvm, etc. Davco DR-30. Sase. Jurow, Box 183, Olympia Fields, IL 60461.

Wanted: Used recv more selective than Hallicrafters SX-140, under $150. Pick up 75 mi of K.C., KS. WN0BUU, (913) 422—5735.

RTTY perforator tape 11/16 wide, 10 rolls per box $5. and $6 per box east & west of Miss. postpaid. Bill's, Box 5864, Asheville, NC 28803.

Professional repair of your rec or transmitter eqpt, or your unused triband ssb transceiver or FM eqpt. Mail your offer for shipping instructions. K4VFA, Lowry, 915 Madison St., Manchester, TN 37355.

BC-221 freq mtr to 20mc w/modulation, calib bk., need pwr supply. $65 PP. WA2FFZ, 335 Blvd., Pitman, NJ 08071.

Wanted: SX25, condx unimportant, but prefer it cheap. Vern Weiss, WA9VLK, 719 W. Water St., Kankakee, IL 60901.

For sale or trade: 75A4 w/3.1kc filter $325. 75S1 - $295. HX-30 $140. Honnold, W6YKM, Box 508, Jackson, CA 95642.

Sell: Swan 240 w/ac ps, excel condx. Galaxy DC ps cables, Webster bandspanner, all $275. Kosbab, WA-0LJF, Milnor, ND 58060.

KNIGHT R100A receiver w/S-meter, crystal calibrator and product detector as per CQ, July 1969 - $65. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

WANT CLEAN COLLINS 51J-4; also Drake C-4, w/manuals & original shipping containers. No junk! First letter give each serial number, condition, price also price for both, if have both. Watson, 700 West Willow St., Long Beach, CA 90806.

RF COAXIAL SWITCHES - DC-1GHZ, 2kw-500W, Electrically operated, free literature. Link, 1000 Monroe Tpk., Monroe, CT 06468.

WESTON Model 489 meter 0-8 and 0-200 v.d.c. - $10. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

ATTENTION NYC HAMS: Put your know-how of communications to work to help prevent and stop crime in your neighborhood. JOIN THE NYC AUXILIARY POLICE. For info write: WB2FJO, A. Schur, P.O. Box 238, Ryder Stat., Brooklyn, N.Y. 11234.

Sell or trade: Surplus APR-5A, 1000-6000mc recv, 110 vac gud condx $75 or 6/2 m gear, what have U? Axsom, 661 NW 75th Ter., Plantation, FL 33313.

Heath SB301/401 w/cw filter, Turner 454C mike, 4BTV vertical, excel condx $525 or best. WB9BXV, 5116 S. Carpenter, Chicago, IL 60609.

CHESS ANYONE? By mail, or radio. Interested? Sase to J.D. Andrews, 24 Cottage St., Melrose, MA 02176.

COUNTY HUNTERS - Mobilers QSL Bureau by CHC's US-CHA program. Write IARS, Inc., Box 385 Bonita, CA 92002 or Mgr. W6CCM.

DAVCO DR-30 receiver - $225.00. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

KWM2, if you have always wanted one, but cost stopped you, write only to W0BNF. 600L wanted.

Munston"Nassau" marine radio telephone with 5-marine channels installed, manual included - $60. Western Electric push-to-talk telephone-type handsets, brand new, original price was $35 each, will sell $15 each. Marine Electronics, 76 New York Av., Halesite, L.I., New York 11743. (516) 427—7199.

THE NOVICE Magazine - a new publication for novices. DX, nets, construction proj., and more. $3/yr (10 issues). 40 cents/copy. 1240-21 st St., Hermosa Beach, CA 90254.

Standard and Sonar Amateur and Marine gear at discount. Full lines available. State Model. Arena Sport, 1169 N. Military Hwy., Norfolk, Va23502.

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

Look for K8ZAS on Field Day, the New Delta Cty A.R. Society Club Sta. from Escanaba, MI. C U on the air.

Wanted: RCA WV98A Senior Voltohmyst SAMS Auto Radio Manuals. Manuals & Service Books. Any help gratefully appreciated. P.L. Williams, 106 S. Jefferson St., Lewisburg, West Virginia.

WARREN ARA's Famous Hamfest, now family style, Aug. 20, Yankee Lake, Ohio. Gigantic flea market, swimming, picnicking, playground, all free. Camping available. Details: QSL W8VTD.

SELL: Perfect equipment. All like new. Henry 2-K2 $495. TR-4 $450. AC-4 $60. RV-4 $60. W-4 $25. Waters 3001 patch $25. Telrex 20M326B20 on the ground and perfect. Ham-M rotator $85. WA8LSO, 1112 Crown St., Kalamazoo, Mich. 49007. 616/344—2232 weekdays eves.

IMPROVE RECEIVER sensitivity and selectivity with solid state F-100 Preselector. Free brochure. Waban Labs., Box 17, So. Sudbury, MA 01776.

7th ANNUAL BURBANK HAMFEST — Will be held 10AM—8PM, Saturday, May 20 at Lockheed Ham Club (W6LS), 2814 Empire, Burbank, CA 91504. This is the only L.A.-area Annual Ham Show and it improves each year!

MICROPHONES - Shure 404C mobile controlled magnetic, $12.50; 201 mobile ceramic - $8.00; 245S uniplex unidirectional - $15.00; 448A noise cancelling - $34.00; 440SL with stand - $20.00; Electro-Voice 674 variable-D Hi-Z dynamic cardiod, $45.00; 630 Hi-Z dynamic - $25.00; 619 Hi-Z and one Lo-Z dynamic - $20.00 each; 600E mobile dynamic - $16.00. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

HAMMARLUND HQ-170A $150; Drake 2NT $70; Heath DX-40/VF-1 $35; new Eimac 304th $20; two 23ch CB sets $90 each; Knight KG-221 150-170mc monitor $20; Lowrance Fish Lo-K-Tor $75; Lafayette capacitor checker $6. WA2MKY, 742 Woodfield Rd., West Hempstead, NY 11552.

Mechanical filters: 455kc for solid state. $12.95 w/instr. E. Jeltrup, Box 361, Mamaroneck, NY 10543.

HW-32 w/calibrator, M-1070 fixed/mbl pwr sup $80 Collins 455 khz mech filt $12. Heath Marauder HX-10 $160. Short, 1240 E. 6 St., Sheldon, Ia 51201.

Model 15 page printer w/WA1JAV de-mod, RCA police band recv. Mini-patch. Poly-comm 6-2, 12v 110v transcvr. Blaupunkt car radio am/fm/marine. Sase w/final offer. WB6HEZ, Box 1422, Romoland, CA 92380.

Capt. Crunch whistles, 2600 cps @ $5.50. 5-line touch-tone phone $29 plus $4 shipping. Card dialer w/cards $68 plus $4. Garton, 1301 W. Estes, Chicago

Wanted: 572B, 100th, 813, 250th, D-104 mike. K8LJQ, 351 Mower Rd., Pinckney, MI 48169.

Grounded grid amplifier. 304-TH, vacuum variables B&W Model 852 inductor $125. W4NJW.

Ameco R5 recv .54 to 54 mhz over 5 bands, includ PCL-P nuvistor preamp. All $40. W3DJD, 205 Ellinger Ave., Ft. Washington, PA 19034.

Sell or trade: Radio Shack Pro 2B police recv $50. Hi-low band Uanc-Uaro 2m preamp $15. 2m 3db gain mbl ant. $10. WB2BEN (617) 273-3832.

Complete years of CQ for 1959 & 1960 required. In binders if possible. L.L. Sharp, VK4NX, 19 Kelso St., Chermside, Queensland 4032, Australia.

Heath TX-1 Apache w/SB10 ssb adaptor, mic & manuals. Mint, one owner $100. WA4VQD, 5005 Fillmore Ave., No. 200, Alexandria, VA 22311.

Sell Model 14 KSR complete $20, reperf $25, TD-$25. Goodman, 5826 S. Western, Chicago, IL 60626

2m gear, rtty, facsimile, much more. Sase for list. WB9HWS, 408-51st St., Western Springs, IL 60558

Excellent HW-32A & HP-13 w/Hustler all for $140. Also, like new R-100A for $60. Schuler, WA3MDH Box 154, Roscoe, PA 15477.

2m FM new Gladding 25 $200. Cert ck or MO, you pay shipping. K2EQB.

Collins KWM2 & matching ac sup, A1 condx $700-firm. Fob O'Brien, 8401 N. Atlantic Av., L-15, Cape Canaveral, FL 32920.

FREE headlight warning indicator, protects car battery. Please include postage. Dr. Gauthier, K6ICS, 9418 Florence Ave., Downey, CA 90240.

Wanted: Collins gear for cash. State condx & lowest price prepaid to my QTH. WA7PPN, 13615 N. 17th Dr., Phoenix, AZ 85029.

Wanted an anemometer - Sell 30S1 $800. John Dwyer, 2285 Holly Ct., Northbrook, IL 60062. 312/272—2443.

VT1/CW933/J platinum filament triodes 50 yrs old still working $10 ea. List sase. J.K. Bach, Ivy Hill, Walden, NY 12586.

Swap or sell - Bergenfield A.R. Klub, May 21, 1:00 at Recreation Center, Legion Dr., Bergenfield, NJ.

Adapters - VG201/U, N to BNC 75 cents. 5 for $2. J. Schrenk, 2707 McDivitt, Madison, WI 53713.

Wanted: digital electronic clock or clock kit, 12 or 24 hrs. Have Model 28ASR teletype unit or hiband fm transcvr for swap or will pay cash. Thomsen, W9-YVP, 8200 S. Tennessee, Claredon Hills, IL 60514.

Sell CE20A $35. Hi band progress line $100. 220v 3 phase, 1/4 hp fans $10 ea. Want USM-32 scope xfmr. Trammell, 1507 White Oak, Martinsville, VA

Oil capacitors: 175 MFD, 6KV. Wt 140 lbs, 22"h x 13"w x 6"d. $80 each. Fob Marty, WB6NWW, (213) 597—2631.

Sell: mint Eico 753, late model, ss vfo w/751 ac sup $135. Plate transformer, 2400v at 1 amp $15. Nastoff, 320 W. 56th Pl., Gary, IN 46408.

For sale: Eico 221 vtvm w/HV probe $30. EMC208 tube tester $20. Sencore FE-14, FEVM, mint $50. All fob. Wendel, 160-20 Grand Central Pkwy., Jamaica, NY 11432.

Collins 75-A4 recv $300. Hammarlund HQ-170 ac recv $250. Both good condx w/orig books. WA4-AUF, 215 Shea St., Portsmouth, VA 23701.

Mint Collins KWM-2 w/Q multiplier, plug-in gold plated relays $650. 312B2 console w/patch, spkr, wattmtr $120. Williams, 2866 N.W. 34th Terr., Ft. Lauderdale, FL 33311.

BTI LK-2000, HD xfmr fact installed, $650. 75S3, 200 cps no. 14482 $450. KWM2, Waters notch $650 51J2 (comm) $400. Ampex 602 $425. Halli SX-62 $100. 516F2 $115. Cert m/o Fob Stolz, (714) 684-3170, (916) 489-8659.

Galaxy 5 Mark 3, ac sup, spkr, vox, calibrator & mbl mount $330. G1000DC sup $70. Rusin, 46 Whelock St., Buffalo, NY 14206. 822—9496.

2m fm, subminiature handi-talkie tubes 2E31, 2E35 5672, 5678, CK512AX, CK6029, more $1—$2 ea., unused, boxed. Motorola station monitor w/manual $125 less channel xtals. RTTY Model 15 page printer, good condx $75. Sase for list. Williams, WA9-BZY/0, L-74 Lake Lotawana, Lees Summit, MO 64063. (913) 236—8555 weekdays.

BTI-LK2000, runs on 117 or 220, excel shape - $400 cash. Fob John Savonis, W1DBS, 410 Blake Rd., New Britain, CT 06053.

Wanted: buy or borrow manual or schematic for Northern Radio type 152, Model One, rtty converter. Need No. 125 plug in units. Al Flitcraft, WA8-GCG, 94 Elm Ct., Chagrin Falls, OH 44022.

Wanted: BC-946(R-24), Continental socket for plug 34-20P; ARC-21 IF strip; all replies answered. J.M. Gunn, Ossipee, N.H. 03864.

Swan 350, 117XC, 14X, VX1 vox; TR-44 rotator; Hvy duty 2kw pr of 4-400A's w/7.2kvdc ps, vacuum variable plate cap, variac - in 4-1/2 foot cabinet. Prefer local. Vince, WA2RSX (212) 892-0339 eves.

Wanted: Heath IP-28 dc supply; HS-24 mob spkr; PM-2 pwr mtr. Also 3-5 pos. coax sw and Hustler 20m tip. Coddington, WB6AWC, 7825 Scotts Valley Rd., Lakeport, CA 95453.

Sell: Waters keyer $35. Want: factory linear, bug, dipmtr, kilowatt console, mbl rig, mike, dummy, coax switch, parts. Dunsworth, Chula Vista, CA 427—9835.

Panalysor SB-3 Model T-200. I.F.500 khz $50. Want books, mags, battery radios or components. before 1925. Spence, 10 S. 771 Clarendon Hills Rd, Apt. 201, Hinsdale, IL 60521.

Motorola P-33 BAM 2m fm, 5w handi-talkie w/ni-cad supply $100. More. CRD Assoc., Box 291, Western Springs, IL 60558.

Sell: Millen scope 90932, $70. Heath keyer $25. Both mint. F. Martin, 202 Kenny St., Fayetteville, NY 13066.

HT-9 transmitter $45, good working order. Also, VFO for sale $39.50 in brand new condx, 80 thru 10 mtrs. WB2YBR, Box 255, Hyde Park, NY.

Wanted: linear amp, prefer SB-2LA, SB1LA or equivalent. VE3BBN, P. Posnikoff, RR1, Port Hope, Ont., Canada.

Wanted: E.H. Scott Philharmonic catalogs. Radio Magazines prior to 1940. Measurements Model 65B or Model 80. R. McNeill, Bx 472, Yorkton, Sask., Canada.

Wanted: old battery radios, need not work. Give price and model number. Also want old toy molds for casting lead figures. McKenzie, 1200 Euclid, Indianola, Iowa 50125.

For sale: Two 4D32 tubes $30 each. Les Myrick, W1PKV, 3 Beaconsfield Dr., Natick, MA 01760.

For sale: Ranger I $50. Frank Rura, WA2KWB, 26 Valley View Rd., Trenton, NJ (609) 585-4188.

Sell or trade: 1 to 2 Ghz TwT amplifier, 15w output, includes FXR freq mtr, Bird Thruline wattmtr, etc. Don, K6YFZ (213) 344—0370.

Tubes: 12AT7 - 52 cents; 6CB6 - 48 cents; 2D21W 75 cents; 6AQ5 - 45 cents; 6AL5 - 18 cents. Carbon Resistors: 1/2w - 2 cents; 1w - 3 cents; 2w - 4 cents. Ken Maas, W9AZA, Burlington, WI 53105.

Pierson KE-93A recv w/ac ps, spkr & dc supply. Mint $75. Charles King, K1ETU, 36 Linsley Ave., Meriden, CT 06450.

51S-1 wanted: No need for oper condx! Mech. compl. pref. You ship to stateside QTH - no export. Send descr. to OH2ZAC, Skonertleden 5-7, 00850 Hfors, FINLAND.

Amateurs & kit builders: complete amateur eqpt service by licensed tech. Kits wired & test for 10% of cost. Call or write WB5AER, J.G. Coshow, 12110 East 24th Pl., Tulsa, OK 74129. (918) 437-3563.

Hammarlund HQ-215, extra xtals & filter. Make offer. Mint condx. Buda, 25 Meacham St., Belleville, NJ 07109.

Wanted: Cliff-Dweller 80-40m rotatable dipole. State condx & price. W3ESR, Frank Hoge, 504 S. Pinehurst Ave., Salisbury, MD 21801.

Model 28 typing reperf LPF w/3 speed gears 60-75-100, sync motor cabinet, mint $140. Want 3 speed gear shift for Model 28ASR, Johnson Matchbox. Keeler, W2NQW, 66 Franklin, Port Jervis, NY 12771

Heath SB-301 w/cw filter for sale. Pro-wired in excellent condx $210. Extra Heath LMO $35. Malt, WA1HUH, 10 Woodridge, Wellesley, MA 02181.

Trade 5" David & White engineers transit, like new for transceiver. Patterson, 666 E. Ocean Blvd., Long Beach, CA 90802.

Will buy your unusable ham gear if fits my experimental needs. State your offer, condition Erickson, 13 Robert Cir., So. Amboy, NJ 08879.

Wanted: old battery radios of early 1920s. Also want lead casting molds and damaged iron toys for repair parts. McKenzie, 1200 W. Euclid, Indianola, Iowa 50125.

Gonset Com III 6 m 110 ac, 12 dc. Heath Seneca trans. 6&2 100 w. Halli SR-34 ac, 110&12 v 6&2 transceiver $135 each. Tate, 8218 Jeffries Ave., Clevelend, OH 44105.

Ham-m w/console, 10' tower, 2 m Hy-gain beam $80 HD-11 q-mult, new $10, Heath Acvtvm, unused $15 Heath tunnel dipper $20. Waters compreamp, mint $15. Berger, K2 HNB, 57 Meeting Ln., Hicksville, NY

Gonset G-76 6-band xcvr w/ps and manual. Cash & carry $85. K6 ARE, Randall, 1263 Lakehurst Rd., Livermore, CA 94550. (415) 443-4482.

DX-60 B, xtal oscillator & 4 xtals $70. SX-99 $55. Ken Nielson, P.O. Box 81, Logan, UT 84321.

Wanted: 3 element tri-band beam. Send infor to John Brewer, Box 724, Jacksonville, AR 72076.

Sell: HQ-110 C & spkr, Ranger II w/manuals and mike. R. Oras, W9 ZEW, 3636 S. 59th Ave., Cicero, IL

Wanted: inexpensive or repairable receiver to be used by a new ham. Tom Dornback, K9 MKX, 2515 College Rd., Downer Grove, IL 60515.

Comaire adjustable 6 m filter, no need for my side band equipment. $20 fob K3 YMN, 2185 Sampson, Pittsburg, PA 15235.

Motorola W43 GGV, 3 freq, 30 w mobile, 2 m FM, P Lid. transmitter. Custom cast iron control head. 94-94, 76-34, 73-19. Ameco preamp on rcvr $135. K2 ABZ, 42 Bulaire Rd., East Rockaway, Ny 11518

Ham Transformers rewound. Jess Price, W4 CLJ, 507 Raehn St., Orlando, FL 32805.

LA-400 C linear 800 w ssb 400 w cw w/manual, relay fer ant, mint condx $50. U pay ship. WA3 LPK, 2300 Louise Ave., Balto., MD 21214.

Sell QST 1922 thru 1959. Best offer entire lot. Zervantian, 6561 Dohrn Cir., Huntington Bch., CA

Johnson Viking Challenger (120 w) cw/am xmtr & Halli SX-99 revr - both $100. Contact K2 SEB (201) 265-2825.

4-1000 grounded grid all-band or single band amplifiers, fully metered, shielded. W4 GD, 3087 Carnes Memphis, TN 38111.

Gonset IV w/vfo $200. Clegg 22'er $150. TX62 w/ vfo $150, Waters coax keyer $50. Drake L4B & MN2000 $700. Spr 4, NB & calibrator $500. K2 ABQ, 3469 Major Dr., Wantagh, NY 11793.

Johnson Viking Matchbox 250-23-3 w/manual, will ship prepaid $70. WA1 NFK, 68 Hawks Hill Rd., New Canaan, CT 06840.

Heath Mohawk recv, excel condx. Will sell or swap. Make offer. W7 INR/6, 360 Sharry Lane, Santa Maria, CA 93454.

HRO-60 w/product detector $150. Band Master Z Match; Cesco Fone Patch; Swan 250 modified by factory. Casey, MD, 500 Norway Av., Cincinnati, OH 45229.

Wanted: SR150 or 160 w/ac supply. State price & condition. W1 FRX, 186 Lincoln St., Melrose, MA.

Wanted: CQ mags pre-1950s. QSTs pre-1940. VE2-AQV/W6, Art Mayoff, 166 Doris Dr., Pleasant Hill, CA 94523.

Wanted: Clean Globe Scout 40 A, Heath VF-1. State conditon, price. WA0 TSP, Box 239, Creston, Iowa

SW2 40, SW1200. SB34, SB2 LA. W7 UD, 3637 W. Grandview, Tacoma, WA 98466.

Railfan Hams: Swap slides of PC, NW, N&SS et ., for those of your area. T.N. Colbert, WA8 MLU, 1008 Englewood, Parma, OH 44134.

HW-16, 1 yr old, exc cond w/25 xtals for 80-40-15, built by NASA soldering expert $99. Bill Wood, WA6 FXS, 3109 4 Hemlock, Barstow, CA 92311.

51 J4, 3 filters ernier cabinet, spkr $425. W6 RQZ, 1330 Curtis St., Berkeley, CA 94702. (415) 526-7345.

Sell or trade: "73" 1963 to Dec 71. CQ Dec 62 to Dec 71 complete since 64. All excellent, no dups. Best offer or trade on SB630 station control or SB-640 vfo. WA2 WHN, 8 Briarcliff, Merrick, NY 11566

Wanted: HA750, HA650, Touchtone telephone. K3 RCF, P.O. Box 1747, Kyattsville, MD 20788.

Wanted: Collins 4A transmitter any condx. Lost mine in move. W3 HK, G.S. VanDyke, Jr., (215) NE 7—8329 or write.

Swap or sell: Unused DX60 B built by electronic technician. WA8 CKB, 10755 Thornview, Sharonville, OH 45241.

Wanted to buy: Heath SB-640 remote VFO for SB-101 transceiver. From dealer or individual. Roberts, W7 DRR, 9251 N. 37th Ave. Phoenix, AZ.

Heath Twoer w/110 & 12 volt supplies. Many modifications, needs some work $35 postpaid. W7 BIF, 107 Wyoming St., Boulder City, NV 89005.

Wanted to buy: Used recorded audio-visual theory instruction for general class license. WN5 GAV, Max Friedman, 1622 Herrin St., Clarksdale, MS 38614.

RTTY Mod 15 $85, Ten-Tec PM2 $35, Paco S-55 scope $50, Seneca 6-2 $75. All clean, fob W7 IUA, 2539 Crozier, Kingman, AZ 86401.

Want: Intnl. Conf. Commns. (ICC) Proceedings 1969-71 at $7 ea. pp. W3 AFM, Paul Rockwell, 5800 Hillburne, Chevey Chase, MD 20015.

D104 w/std $15. Vibroplex $15. 51J $285. Drake 54 $200. 75A2A $160. Variac 4KVA $25. SR150 ac-dc mbl mt ant complete $300. Ford, 56 Gildare, East Northport, NY 11731.

Sell late model SX-117 mint $200. Also R3888, product det excellent $325. Need CV-89A. W4 AIS, 300 Thornwood, Taylors, SC 29687.

Wanted: W8 FYO key lever for electronic keyer, color TV alignment generator. K9 WEH, 201 E. Marion Prospect Heights, IL 60070.

Wanted: Old 250 w UV-204 w/cylinder type plate. Welsh WT-501, Mercury Arc 3,000 v. Rect. W9 LGH 610 Monroe Av., River Forest, IL 60305.

Sell: Galaxy GT-550 w/ACPS like new $400. Ham-Cat resonators complete set. Never used, half price. Woodward, K0 YIO, Box 337, Crane, MO 65633.

Wanted: HW16 good condx, will pay $75 plus UPS. Also want LF601, give tel. Number. Roy Stevens, 1630 W. High, Jackson, MI 49203.

Wanted: Johnson 275 w Matchbox w/o swr in reasonably good condx. Send quote to S. Antosh, WB-5 BNM, 1524 N. Okla., Shawnee, OK 74801.

Radio and electronic library for sale. Send stamp for list & prices. Brown, W8 YET, 7001 Bancroft St, Toledo, OH 43617.

Wanted: Two Eimac 3-500 z triodes in good condx. Heckman, W1 AA, 45 Andrew, Hull, MA 02045.

BC-342 rcvr 1.5-18 mhz w/manual & matching LS-3 spkr. AC pwr. $90. Silbert, White Sulphur Springs, NY 12787.

We buy, sell and trade old radios. Send 10 cents for a copy of Antique Radio Topics. James Fred, R1, Cutler, IN 46920.

Drake 2 nt w/12 xtals on 80 $110. Halli SX130 $90 both mint w/manuals. No ship. WB2 JYP, 1838 Lincoln Ave., Holbrook, NY 11741.

House cleaning - Motorola parts and equipment. Send sase W9 CPF, 225 E Madison St., Villa Park, IL 60181.

300 assorted receiving tubes. New and boxed. Cash or swap for KW tank parts or? WA6 HYB.

Johnson Ranger I, mint condx, manual $80. FOB W2 AGQ, C.K. Taber, Milton, NY 12547.

KWM2 A, 516 F2, 312 B4, in excellent working condition. All for $575 postpaid. WB4 QKB/5, Rt 1, Bx 213, Troy, TX 76579.

Wanted: Eimac 3-400 Z's. Must be new or nearly new. Jim Fleming, K9 FRZ, 7528 W. Bryn Mawr, Chicago, IL 60631. 775-8179.

Sell: HW-32, HG-10 B, CDR-AR22. Manuals. Make offer. Sever, 8464 Cleveland Av N., North Canton, OH 44720.

Apache TX-1 and SB10 ssb adaptor, excel condx w/ manuals. $50 each or $75 both. Fob W6 TTS, 1016 Masonic Ave., Albany, CA 94706.

Lafayette HA-410 xcvr, mint $85. 10 m, 2 el quad ant, new, never used $15. Peter Feely, W2 BAO, 15 Locust Hill, Yonkers, NY 10701.

2 m FM Dumont transceiver, 25 w 34-94, 94-94 $75 WB2 YRM, 1501 Sage Av., Troy, NY 12180. (518) 271—7484.

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KWM1 w/516F1 $250. Halli HA2 $125. HA6 $100 HT37 $150. HT41 $150. SX100 $125. Offers. Jack Osborne, 5636 DelMonte Ct., Santa Rosa, CA.

Heath Apache xmtr. Model TX-1, very good condx will ship. $75. E. H. Ayers, 726 South Lexington, St. Paul, MN 55102.

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HW-22 mobile ps, 40m resonator, mast & mount. DX-100 & SX-140. Reasonable. Ziegler, 2430 W. Coffin, Denison, TX 75020.

220v Variac wanted, at least 3KVA. I'll drive 100 miles to pick up. W1BPW, 3 Elizabeth Drive, Merrimack, NH 03054.

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Sell early years Galaxy science fiction magazine. For details send 8 cents sase to KV4FY, Box 1056, Christiansted, USVI 00820.

KWM-2, teletype, VHF, test, camera, audio gear & computer. Free list. Perera, K2DCY, 410 Riverside Dr., NYC, NY 10025.

B&W coax switches, Ameco preamp & others. Send sase for list. WA3LRJ, 1160 King George Court, Pittsburgh, PA 15237.

Hams - Homeshop fans: Am cleaning my machine shop. Send sase for list. Jeff Kruth, RD 1, Crolls Mill Rd., Slippery Rock, PA 16057.

Wanted: HA2 and HA6 good condx. M. Solomon, Thomasville, AL 36784.

Sale or trade: Like new Sencore SM-152 sweep & marker generator. Make offer. Ed Baker, WA6ZSB, 1575 Lark St., Hanford, CA 93230.

Linear builders send sase for lo priced list of hi power parts and goodies. W6RW, 8600 Skyline Drive, Hollywood, CA 90046.

Wanted: Swan transceiver in good condx that is priced right. Ralph Dorough, 801 N. Catherine St., Terrell, TX 75160.

GE-UHF transmitter/recv mbl unit model ME-42N. 450-470mhz. Sell or trade. Sase for details. Emerald, 8956 Swallow Av., Fountain Vall., CA 92708.

Pr unused 4X150A's & tube cooling fan $11. Cartoned Weston 4-1/2" sq. 100-0-100 microamp. panel mtrs only $4. Simpson boxed 75-0-75 Ua. Galvanometer $4.50 add PP. Samkofsky, 4803 Brenda, Orlando, FL 32806.

Sase for crystal and tube list. K8LJQ, 351 Mower Rd., Pinckney, MI 48169.

Need: straight key, J-38 or similar. Bob Yoksh, WN-0EZR, 1427 No. 63rd Terr., Kansas City, KS66102

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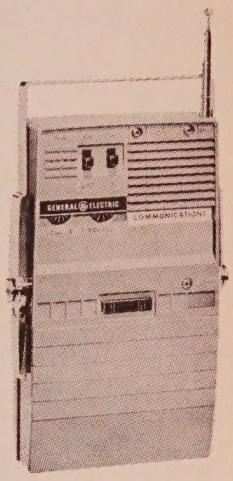
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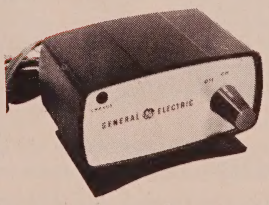
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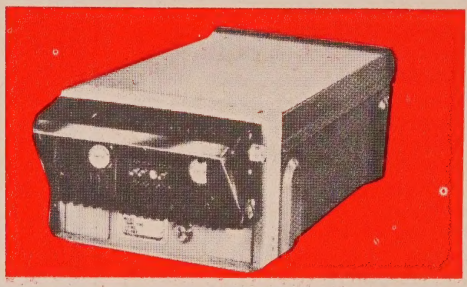
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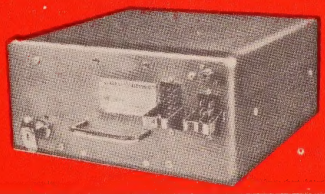
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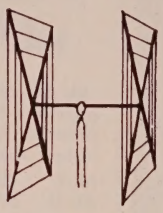
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Shipping Weight: 28 lbs. Net Weight: 25 lbs.
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Operation Mode: All
SWR: 1.05:1 at resonance
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Radiator Terminals: Cinch-Jones two-terminal fittings
Feedline (not furnished); 52 ohm coaxial cable

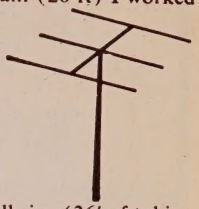
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$37.00
10-15 CUBICAL QUAD	32.00
15-20 CUBICAL QUAD	34.00
TWENTY METER CUBICAL QUAD	27.00
FIFTEEN METER CUBICAL QUAD	26.00
TEN METER CUBICAL QUAD	25.00

(all use single coax feedline)

GOTHAM
1805 Purdy, Dept. CQ, Miami Beach, Fla. 33139

BEAMS The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

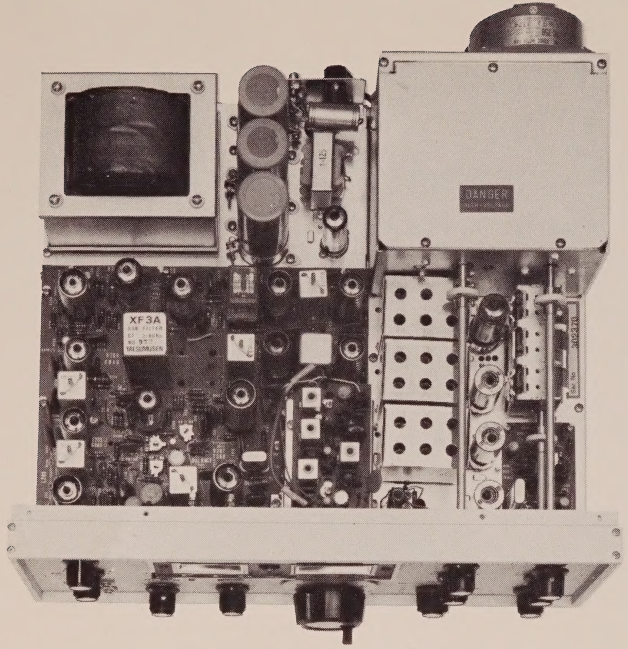
2 EL 20	$21	4 EL 10	20
3 EL 20	27	7 EL 10	34*
4 EL 20	34*	4 EL 6	20
2 EL 15	17	8 EL 6	30*
3 EL 15	21	12 EL 2	27*
4 EL 15	27*	***20' Boom**	
5 EL 15	30*		

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2ODH, WA3DJT, WB2FCB, W2YHH, VE3FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3KT. Moral: It's the antenna that counts! *FLASH!* Switched to 15 c.w. and worked KZ5IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5CLK. OZ4H. and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$14.95
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$16.95
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$18.95

"HOW TO ORDER: Send money order (bank, store, or United States) in full. We ship immediately by best way, charges collect. DEALERS WRITE."



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You're invited to take an inside look at Yaesu's new FTdx 570 transceiver.

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The FTdx 570 is also filled with performance features you won't find in any other rig in its price range. A noise blanker. Built-in power supply. Calibrators, WWV, VOX and a cooling fan. Not to mention 560 watts PEP SSB, 500 watts CW input power. Plus a super-sensitive receiving section. Even a built-in speaker.

For a little extra money, you can have a CW filter included.

Those are the highlights. Send us the coupon, we'll send you the details. Better yet, send us $549.95 and we'll send you the FTdx 570, complete with a one-year warranty. Why wait to get into a Yaesu?



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Longer Life for an Old Timer

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Get an EIMAC 4-400C — the new generation tetrode specifically designed for long-life, high-performance broadcast and FM service. This premium quality tetrode is directly interchangeable with the 4-400A in existing equipment and is recommended for new equipment design.

The EIMAC 4-400C features a low temperature filament structure which retains its initial high level of electron emission for an extended period of time, greatly reducing frequency of tube replacement. This improved filament structure, plus strict processing and quality control, combines with improved current division and low drive requirements to provide a high-quality, long-life product.

Reduce down-time and replacement cost with the EIMAC 4-400C when you re-tube. And use this improved tetrode in your new equipment design. With a maximum plate dissipation of 400 watts, the EIMAC 4-400C provides long-life and consistent performance as an amplifier, oscillator or modulator. Another example of EIMAC's continuing program of quality, reliability and service.

For further information, contact EIMAC, Division of Varian, 301 Industrial Way, San Carlos, Calif. 94070. Or any of the more than 30 Varian/EIMAC Electron Tube and Device Group Sales Offices throughout the world.

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