Amateur Radio

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Results Of The 1984 CQ WW WPX SSB Contest . . . p. 23

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THE RADIO AMATEUR'S JOURNAL

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TR-7950, watts to see!

TR-7950/7930

The TR-7950/7930 has become the unanimous choice of the 2 meter FM operator! It stands alone in features, performance and reliability, with no other rig even close!

The TR-7950/7930 features a large L.C.D. display that is easy to read in direct sunlight and is back lighted for comfortable night-time viewing. It displays TRANS/REC frequencies, memory channel, repeater offset (+, S, −), sub-tone number (F-0, 1, 2, 3) tone, scan, and memory scan lock-out. It includes an LED S/RF bar meter, and LED indicators for reverse, center TUNING, PRIORITY and ON AIR. The 21 multi-function memory channels store frequency, repeater offset, and optional sub-tone channels. Memories 1 through 15 are for simplex or ±600 Hz offset. Memory pairs 16/17 and 18/19 are paired for non-standard repeater offset. Memories "A" and "B" set upper and lower scan limits, or are for simplex or ±600 kHz offset. In MEMORY mode, a circle of light appears around the memory selector knob. When the memory selector knob is rotated in either direction to channel 1, an audible "beep" sounds.

With 45 big watts, the TR-7950 is the most powerful 2 meter FM rig you can buy. The TR-7930 with a modest 25 watts is also available. A HI/LOW power switch allows power reduction to approx. 5 watts.

Other key features include: Programmable band-scan width, Center stop during band-scan, with indicator. Scan stops on busy channel and resume scan is automatic (time 5 sec. adjustable) or carrier operated. A scan delay of approx. 1.5 sec. is built-in. Scanning can also be accomplished with UP/DOWN microphone or "SC" key on front panel. Programmable priority alert can be set into any of 21 memory channels. With Alert switch "ON," a dual "beep" sounds when signal is present. The microprocessor is pre-programmed for simplex or ±600 kHz offset in accordance with the 2 meter band plan, with an "OS" key to allow manual changes in offset. The keyboard functions as a 16-key autopatch encoder during transmit. Frequency coverage is 142.000-148.995 MHz, and it has a repeater reverse switch and mobile mounting bracket. All these features are available in one compact, lightweight rig.

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TR-7950 optional accessories:

TU-79, three frequency tone unit, KPS-12 fixed-station power supply (7950), KPS-7A fixed-station power supply (7930), SP-40 mobile speaker, SP-50 mobile speaker, MC-55 mobile microphone with time-out timer, MC-46 16-key autopatch UP/DOWN mic, SW-100A/B power meters, PG-3A noise filter.

More information on the TR-7950/7930 is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

Specifications and prices are subject to change without notice or obligation.

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TS-830S

TS-830S...a "top notch" field proven performer.

The TS-830S is the HF transceiver that delivers the performance the others can only talk about.

Kenwood's TS-830S offers you every conceivable operating feature built-in for 160-10 meters, including the WARC bands. Key operating features such as wide receiver dynamic range, variable band width tuning, notch filter, adjustable noise-blanker, IF shift (pass-band tuning), and receive capability of WWV on 10 MHz, have established the TS-830S as the first choice of the serious Amateur.

Two 6146B's in the final assure you of rugged, reliable service. The fluorescent tube digital display, RF speech processor, narrow/wide filter selection on CW/SSB monitor circuit and receiver (RIT) and transmitter (XIT) incremental tuning, add to the operating ease and enjoyment of the TS-830S.

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Optional accessories:

- SP-230 external speaker.
- VFO-230 remote digital VFO-with five memories, digital display.
- VFO-240 remote analog VFO.
- AT-230 antenna tuner.
- YG-455C (500 Hz) or YG-455CN (250 Hz) CW filter for 455 kHz IF.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter for 8.83 MHz IF.
- KB-1 deluxe heavyweight knob.

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The TS-530SP, solid dependability at a price everyone can afford!

Optional accessories:

- SP-230 external speaker with selectable audio filters.
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- VFO-230 remote digital VFO.
- MC-50 desk microphone.
- AT-230 antenna tuner/SWR/power meter.
- KB-1 deluxe VFO knob.
- YK-88C (500 Hz) or TK-88CN (270 Hz) CW filter.
- YK-88SN (1.8 kHz) narrow SSB filter.

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The Radio Amateur's Journal

ON THE COVER: That forlorn look belongs to Harvey Wasserman, K2BOG, who reminds us that we all can't be winners in the WPX Contest, but we can sure try. Maybe next year, Harvey. Photo by Larry Mulvehill, WB2ZPI.

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Zero Bias AN EDITORIAL

How cold was it? Well, tundra fans, I'm here to tell you it was real cold in Chicago the end of January. Dick and I flew out to Chicago for the annual Wheaton ARC event and arrived in time to experience −12° for the first time. We thought that was cold. No way!

We were met at the airport by Bill Henry of HAL Communications, and he drove us first to the hotel and then to the Arlington Race Track where the one-day hamfest takes place. After setting up the booths, we went back to the hotel. Bob Locher of Bencher joined us there for dinner and casually said that if we couldn't get the cars started in the morning to call him at home, as it would be getting cold on Sunday. Evidently −12° isn't really considered cold, or cold enough. Bob was right. By morning it was −27° with a wind-chill factor of −80°, and nothing parked outside that evening was running. That's cold. True to his word, Bob (our hero) came through and picked us up and took us to the hamfest. He also shuttled back and forth to the hotel trying to get the HAL van and Bill's car going. Of course, he kept reminding us that "when all else fails, CW gets through." The van finally coughed to life late in the afternoon, just in time to get Dick and me back to the airport for our flight home. The 5:00 p.m. flight left promptly at 8:00 p.m., and so it was after midnight when we finally arrived home.

Was it worth it? For those who braved the elements and trudged on over to the race track, it certainly was. There was plenty to see, and there was some really great stuff at the fleamarket. My suitcase was several pounds heavier on the return trip due to meeting up with a few unexpected bargains. Understandably, the attendance was down due to the unexpected weather, but it still is a great hamfest with all of the excitement and enthusiasm that only a one-day event can bring. It's one of those conditions where you haven't the time nor the luxury to think about something. If you see it and you want it, you have to make a deal right there and then. You can't come back later or tomorrow, as it will be gone.

33rd Anniversary

For more years than many of us have been amateurs, George Jacobs, W3ASK, has been bringing *CQ* readers the latest up-to-date propagation information. This month George marks the beginning of his 34th year as Propagation Editor. George and the Propagation column are synonymous. Over the years amateurs have come to accept a Propagation column (in whatever amateur radio magazine they read), 27-day recurrence forecasts, and highly accurate band-by-band breakdowns of propagation predictions as an "always been" or something that just evolved. It didn't just evolve or happen by accident. George has perhaps made it look too easy.

These past 33 years have seen a growing interest in propagation, and we at *CQ* have been fortunate in having George with us. We are proud that his work has also attracted the work of other notables in the field and that through his efforts we were able to present their works. So thanks, George, for the past 33 years, and here's looking forward to the next 33 years.

Travels With CQ

March will see us at the Orlando Hamcation and Computer Show plus the Charlotte Hamfest and Computerfair. If you're anywhere nearby, make it a point to attend these events. Hamfests are an important part of our hobby and should be supported by all of you. They are becoming the single most important attraction to newcomers to amateur radio who are coming to see what we actually do and to judge how seriously they want to become part of what we do. Also, as you might surmize from the titles of more and more "hamfests," the emphasis is broadening to take in other interests and specialties, and that's a good sign.

Between when this is written and March, we also will have been to the Tropical Hamboree in Miami and the LIMARC Hamfair here on Long Island. I'll report on both of those events next month.

I would suggest that you check the Announcements column in this issue to see if there is anything happening near your home this month. Try and make it a point to take part. Take your kids (and perhaps some of their friends) to see what it's all about. Take a friend or a neighbor, too. You are the best salesman there is for amateur radio.

One further suggestion to the organizations who put on these events. How about a "tour guide"? Many clubs have official tables set up with literature and programs so that there is some basic information available for the attendee to take home. How about a few people whose sole responsibility is to take small groups around the exhibit area and the fleamarket and explain what all this stuff is that's so exciting to the rest of us? I'm sure that if you check with some of the equipment manufacturers exhibiting at the hamfest (preferably in advance) they might be able to come up with a demonstration geared for a small group of newcomers. It doesn't have to be an elaborate production, just a sincere welcoming effort.

While I'm in the suggesting mood, how about establishing a hamfest position of "Resident Scrounge"? This functionary would be responsible for the newly licensed, or about to be licensed, attendee who falls within the stereotypical description of the struggling youth with no money who wants to put on a KW for all bands, with beams and towers, and spend somewhere around $97.43. Seriously, though, this "Resident Scrounge" could help the neophyte scouring the fleamarket to put together a functional station that falls within his budget. Sometimes, the abundance of new and used equipment at a hamfest can and does intimidate the newcomer.

It all boils down to determining how helpful and encouraging we are going to be so that amateur radio will grow. There's no magic wand or simple solution that will make it all happen overnight. The basic movement in a positive growth for amateur radio will come when we as individuals are willing to work and do something towards that growth.

Unlike the U.S. Marines, we need more than a few good men and women. We, too, have our lore and tradition to attract newcomers, but when all else fails, we still cannot conscript. We have to ask ourselves a simple question: "Why is it that while we have something very good to offer, there are so few takers?" How good the offer is depends on who knows about it in the first place and how hard it is to get. We already know the offer is good; we know that from first-hand experience. We (and that means all of us) have to tell someone else. How hard is it to get? Without direct help and encouragement it's almost impossible. The volunteer examiner program was, to say the least, a philosophical step in that direction to make things easier. In some areas it seems to have made things much tougher. Why not try a simple, direct approach without an "official" this or that or a "sanctioned" this or that and ask yourself, "What am I going to do about it?"

73, Alan, K2EEK

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" . . . Any operator capable of copying code will come out of a few sessions with the good Doctor a better operator, or a much better operator . . . This is a serious Trainer for anyone interested in contests or DX. I guarantee it will make you a better operator." . . ." *Bob Locher, W9KNI, CQ Review, October 1984.*

"I haven't had so much fun since I was a teenager. Doctor DX is the closest thing to the fountain of youth I have found." . . . *Jack Gutzeit, W2LZX, CQ Magazine.*

"This is the sort of simulator we've all looked for—a trainer to permit new DX/contesters to sharpen skills off the air, a simulator to permit possible DXpeditioners to get the feel of operating 'on the other end,' a fun club program and a brief peek into the awesome technology of tomorrow, up and running 'today.' Congratulations indeed to Advanced Electronic Applications, Inc." . . . *Ellen White, W1YL/4, How's DX column, QST Magazine, October 1984.*

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" . . . Boy, does it simulate! . . . The highest praise should go to the programmer or programming team that brought us this software . . . If you have worked all of the bugs out of your contest station, you will want to 'work out with Doctor DX' to improve the most important piece of equipment in your shack—the operator." . . . *Jeff Ward, K8KA, QST New Product Review, December 1984.*

"Super" . . . *Ron Spiro, W2AO.*

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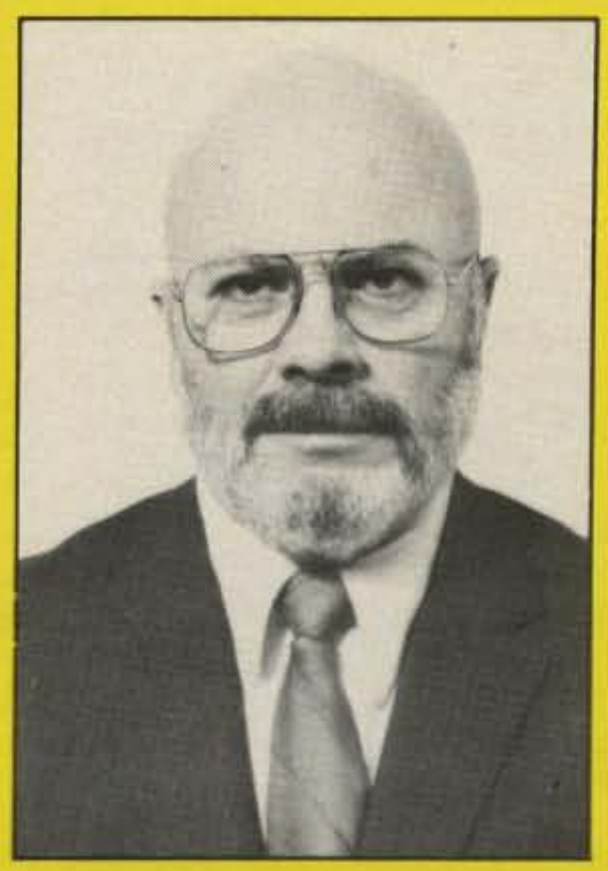
Absolutely incredible!!! Please continue with *more* of the same . . . Love C.W. but have been off the air for years due to T.V.I. . . . Please introduce more programs similar to Dr. DX . . . This is a fantastic source of enjoyment!!!!!! . . . *D.T., Sun City, AZ.*



AEA Congratulates Dale Appleton NB7Y on being the first to receive all DR DX Awards.

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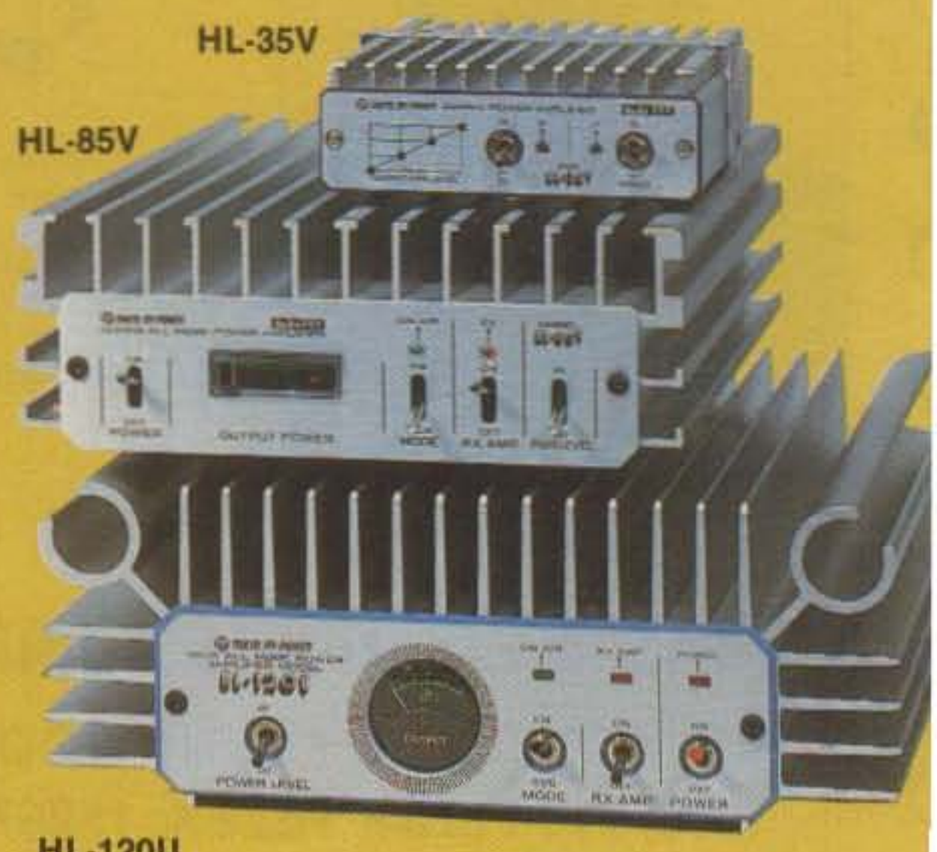

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The SP-230 meter has the same functions for HF through the two meter band as well as the voltage function. The 150/15 Watt power range is well suited for today's mobile radio setup and the compact meter head still contains an easy-to-read backlighted meter with on-the-air indicator light. The remote-mount sensor has plenty of cable to be convenient for mounting, including the dc cable for the meter light and on-air indicator power. (The dc is not necessary for power measurement, only for the lights.) When you want to know WATTS WHAT talk to WELZ for answers.

SP-430 VHF/UHF

SP-230 HF/VHF

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Our Readers Say:

Schematic Correction

Editor, *CQ:*

I want to alert you to an error in the schematic diagram in my article "How To Add C.W. Break-In To The Kenwood TR-9000" in the December 1984 issue of *CQ* on page 54. The 15 uF capacitor in the upper-left-hand corner of the schematic diagram should be connected between Pin 16 and Ground, *not* in series with the 12 volt line as shown. The circuit will not operate as shown, so perhaps you may want to print a correction to avoid discouraged builders. I will certainly reply directly to any inquiries I receive by mail or telephone concerning the article.

Thank you for printing my article. I hope that both *CQ* and your readers will benefit from my efforts.

John L. Rehak, N6HI
Garden Grove, CA

Suggestions For Improvement

Editor, *CQ:*

What can we do for amateur radio? In reply to your editorial in November, 1984 *CQ*, and to Steve Strachan, KA5KBM's letter to *CQ*, I am motivated to make some suggestions.

I believe the ARRL attempted to reflect the views of the Ham population on the No-Code license issue, even though that view may have been short sighted and in retrospect perhaps wrong.

I believe there is an economic need for more VHF space for commercial users. (This may be true in other parts of the spectrum as well.)

There does seem to be a shortage of youth in the Amateur Radio Service.

Here are some suggestions to consider:

1. Authorize FM Repeaters for CB under the control of licensed operators (hams or new licensees). This will bring CB back to life with new capabilities on existing channels and with proper controls.

2. Assign new CB Repeater channels in 220 MHz. Provide limited use, No-Code licenses as upgrades for CBers in this band, and provide a path into Ham Radio for them. This will draw the youth into the hobby.

I don't believe that economics should determine who gets a band allocation. If so, lots of other allocations need to be changed. Does Ham Radio have to fill up the band (220) to justify having it? That's nonsense.

Hams are doing an excellent job of policing the hobby and running the license exams. They can do the CB repeater management and the licensing as well. I believe this concept will solve the youth problem, the No-Code issue, and will prevent a repeat of the CB disaster of the 70's.

The experimentation of Amateurs in new technologies for use of spectrum space will help to solve the shortage experienced by both Amateur Radio and commercial users.

J. H. "Staff" Stafford, NJ8F
Delaware, OH

A New Use For Dr. DX

Editor, *CQ:*

I've been reading with interest several reviews of AEA's new wonder "Dr. DX." These have appeared prominently in the radio journals.

As an avid CW DXer, I really don't know what to think. One of the outspoken local DXers was very blunt: "That's stupid!" he said.

I do have some reservations myself. I understand that "Dr. DX" is not only a game, but a training tool for the DXer/contester. It is supposed to simulate real operating conditions. However, nowhere did I read that the machine throws carriers on rare DX stations.

Does it simulate bozos who call a DX station in a pileup continuously without ever listening to hear if there is an answer?

Do the DX stations make 400 QSOs in a row without IDing? Are there "policemen" who blot out the DX station while informing others "he's listening up"? Finally, there is no way to test a real DX'ers mettle without having programmed some "slims" into "Dr. DX." These, of course, would have weird callsigns and would not follow standard propagation patterns. And since they're bogus, they wouldn't count on your "Dr. DX" score.

My cynical local DXer friend also commented that the real computer hackers out there will crack the program and send in a list of all the callsigns for AEA's awards without having "worked" them.

Actually, none of this matters much to me. What I would like to see is a DX foundation set up to buy a supply of "Dr. DX." They would then track down all the lids who give grief to the deserving and donate the games to them. At least it might keep these clowns off the air so the rest of us can enjoy DXing as it was meant to be.

Tom Fitzpatrick, WB4FOT
Lexington, KY

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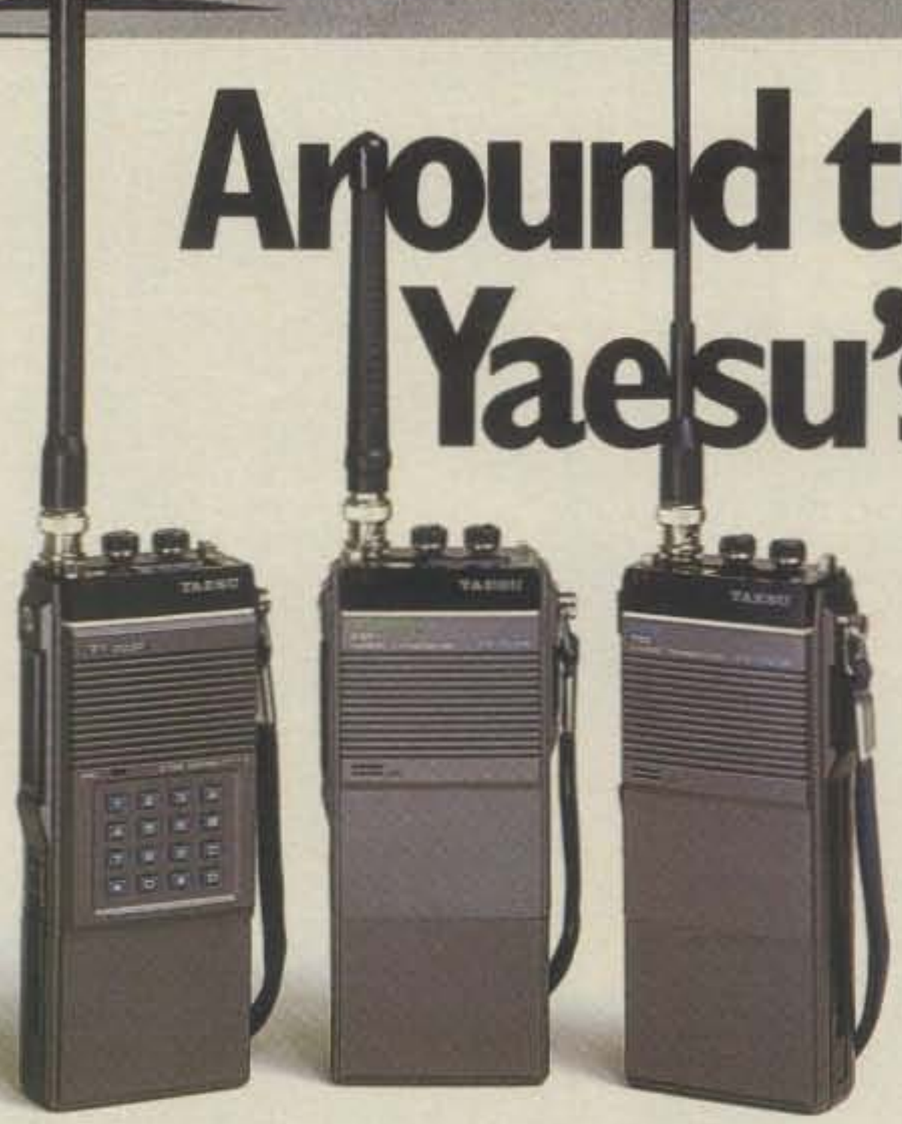

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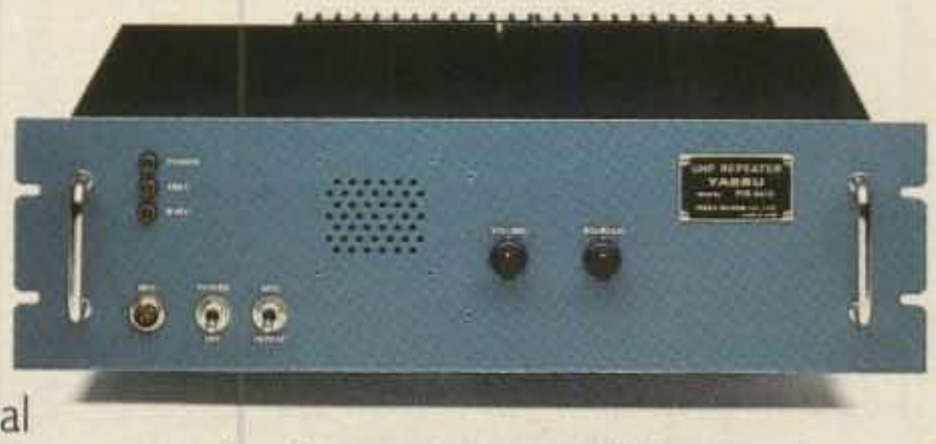

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A BARE BONES PROJECT

This bare-bones linear won't win a prize for beauty (sorry, Irwin), but it works, is easy to build, uses readily available parts, and is very easy on the wallet.

A Surplus KW Amplifier

BY IRWIN R. WOLFE*, W6HHN

With the present state of the art of highly sophisticated, moderately priced transceivers, few, if any, amateurs would attempt to build their own. On the other hand, linear amplifier construction is popular among amateurs who still like to design and build some of their own equipment. The availability of components for such a project at fleamarkets, swap meets, and stores selling surplus components can make such a project especially attractive. The total cost of building both the amplifier and power supply can be a small fraction of the cost of a commercial rig.

The linear amplifier described here is easy to build and will deliver 500 watts to an antenna. The difference between working "barefoot" and using a linear amplifier is considerable when signals are weak and noise and QRM hamper your QSO. For DXers a linear is a must to "get through" when conditions are poor. Almost all parts for this amplifier were acquired at fleamarkets and surplus supply stores—hence the name of this article.

The tube chosen was the very popular hi-mu triode, a 3–500Z. This tube lends itself to a grounded grid, cathode-driven circuit. It requires about 60 watts of drive for full output power, which is readily available from any present-day transceiver. The cathode coil is easily made, and the circuit metering is bare bones; just the plate current and plate voltage are monitored. A 0–800 DC milliammeter is used for reading plate current. A 0–1 DC milliammeter is used in conjunction with a series multiplier to indicate plate voltage. Most amateurs have (or should have) an external VSWR bridge and RF output indicators.

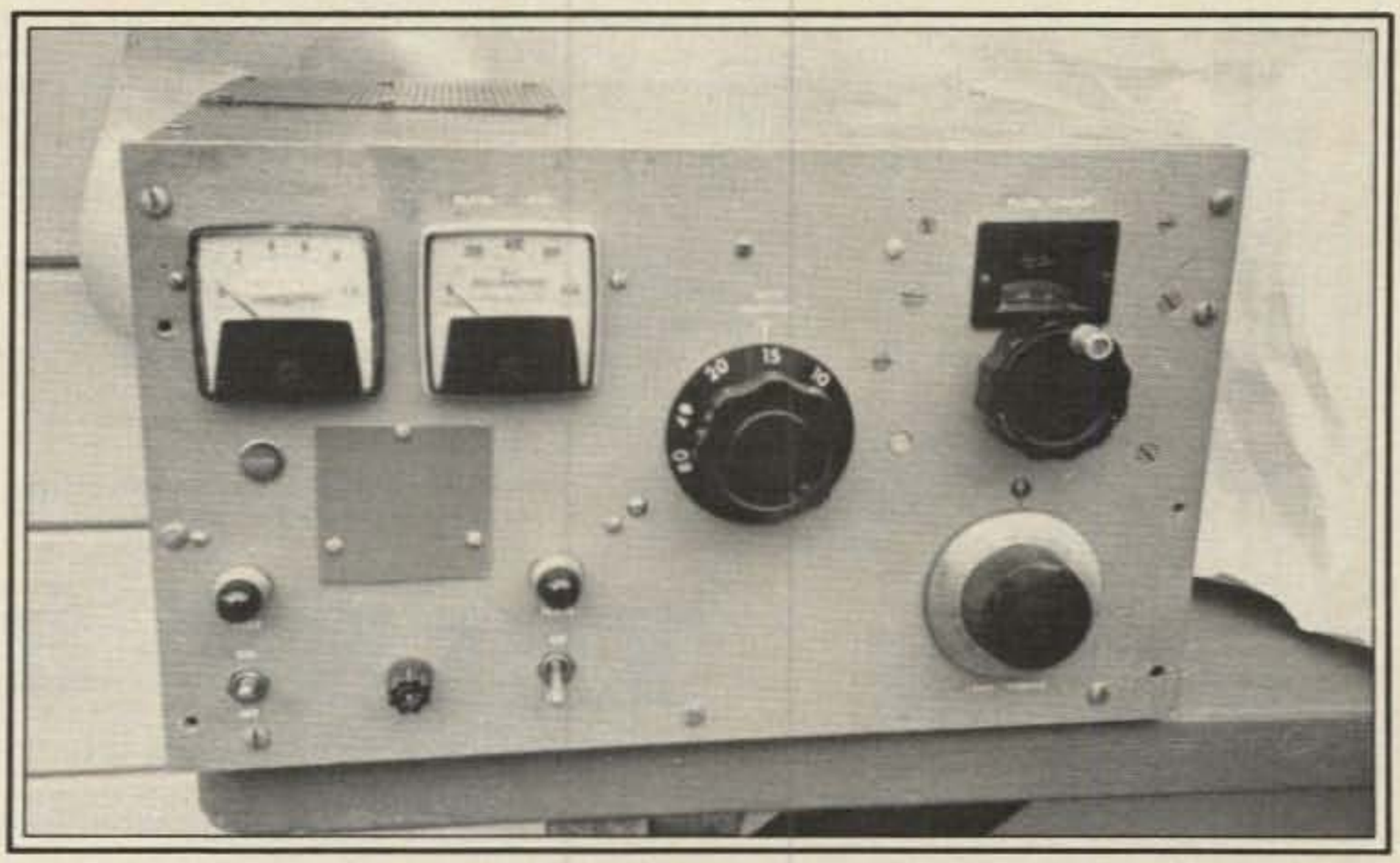
Power Supply Construction

The power supply presented a bit of a problem, since I could not find the proper rated transformer to deliver between 2 and 2½ kv at about 400 ma. At a local surplus store I came across a nice-looking, moderately priced transformer that was rated for 980 volts at 800 ma. At the same store I came across a few capacitors rated 20 mFd at 2400 volts. The price was right, and a voltage doubling circuit would deliver a bit over 2000 volts DC. I also found the hum level low enough so that additional filtering was unnecessary. A series of silicon diodes mounted on a phenolic board did the rectifying. All the components fitted in a 10″ × 10″ × 10″ box, which my prolific junk box yielded.

Power Supply Variations

If you locate a plate transformer with 2000 or 2500 volts each side of the center-tap, with a current rating of about 400 milliamperes, a full-wave rectifier with a choke input filter will be okay. On the oth-

Front view of the amplifier. The bandswitch is in the center. The meters measure plate voltage (left) and plate current (right). Plate tuning is via the turns-counter control (upper right), which tunes the vacuum variable, and the antenna-loading control is at the bottom right. The filament switch and indicator are on the bottom left. The fuse holder is between this and the optional plate switch.



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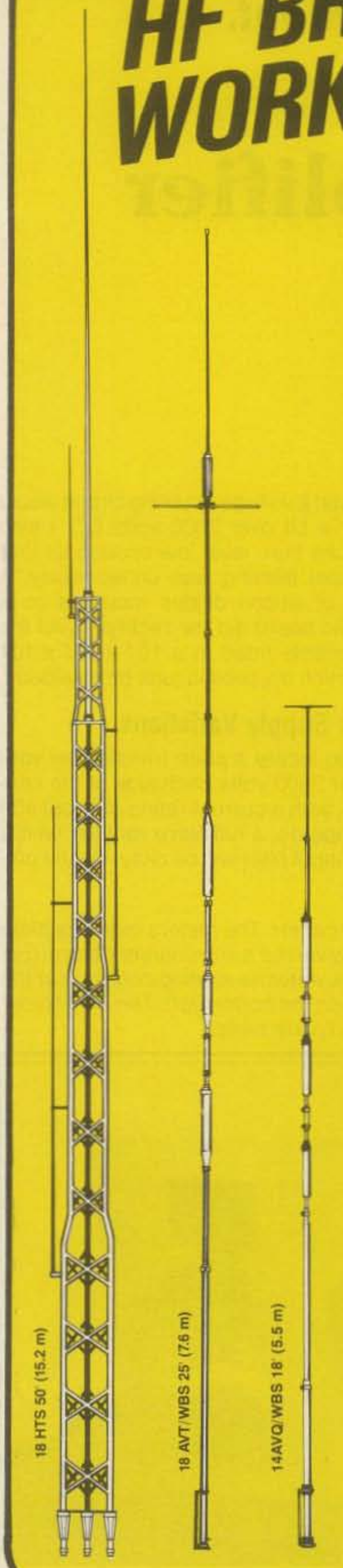

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18 HTS (80-10 meters. 160 meters with optional loading coil) The superb reliability of the 18 HTS is manifest in installations now over 20 years old. And, with the improvements we made over the years, the 18HTS is now better than ever. Automatic band selection is achieved through a unique stub decoupling system which effectively isolates various sections of the antenna so that an electrical ¼ wavelength (or odd multiple ¼ wavelength) exists on all bands. For example, outstanding broadband performance on 20, 15 and 10 meters is achieved with an extended ⅝ wave collinear. On 80 meters bandwidth is approximately 250 kHz at 2:1 VSWR. With the optional base loading coil exceptional performance is also provided at 160 meters. The galvanized tower requires no guying and withstands winds to 100 mph (160 km/h). A special hinged base allows complete assembly at ground level and permits easy raising and lowering. Includes stainless steel hardware. WARC kits to be available.

Other Hy-Gain vertical multiband antennas are available though not shown here. The 12AVQS (20, 15, 10 meter) is similar to 18AVT above but with VSWR of 1.5:1 or less on all bands. The 18VS (80-10 meter) comes with a base loading coil and may be installed on a short mast driven into the ground. All include stainless steel hardware.

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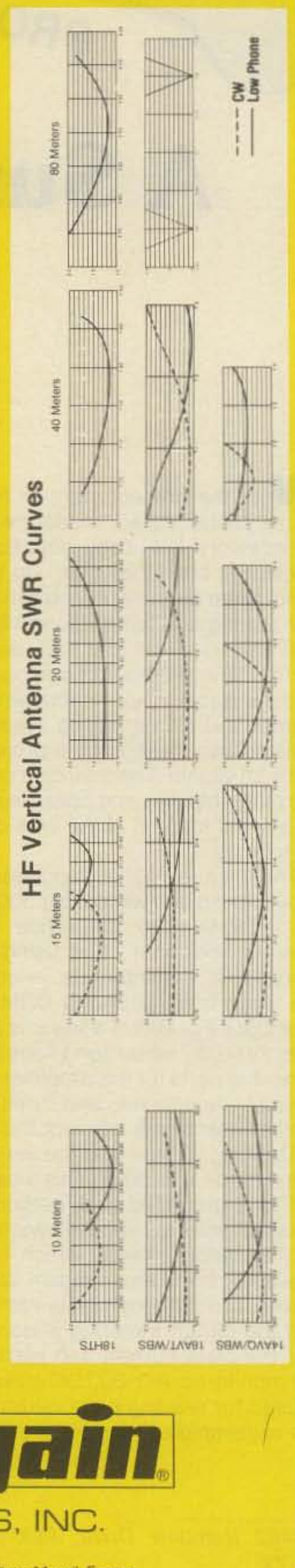

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** ST-200ET/400ET Batteries are not fully compatible with BC-30/35 drop in chargers.

SPECIFICATION	ST-200ET	ST-400ET
GENERAL		
Frequency Range	144-147.995	440-449.995
Battery Pack (V/mAHr)	8.4/250	8.4/250
Receive Squelched Norm	18 mA	22 mA
RX At Full Volume	130 mA	130 mA
Transmit (Low Power)	220 mA	300 mA
Transmit (High Power)	550 mA	700 mA
Dimensions mm	60 × 170 × 40	60 × 170 × 40
Weight (with Battery)	490 gms	490 gms
TRANSMITTER		
Output Pwr. (Hi, Lo)	1.5W, 0.15W	1.5W, 0.15W
Spurious Transmitted	< −60dBc	< −60dBc
Deviation Limit	5 kHz	5 kHz
Pickup Device	Condenser Mic	Condenser Mic
RECEIVER		
Receiving System	Dbl. Superhet.	Dbl. Superhet.
I.F. Frequencies	10.695 1st 455 kHz 2nd	21.6 1st 455 kHz 2nd
Receive Sensitivity	< 0.25 uV @ 12dB	< 0.35 uV @12 dB
I.F. Bandwidth	30 kHz @ −60dB	30 kHz @ −60 dB
Operating Temp	−10-+60 C	−10-+60 C

ACCESSORIES

SKT-BA Battery Case
SKT-PA DC/DC Conv.
ST-MC Mobile Charger
SKT-LC Leatherette Case
HSA-1/HBM-1 Headset/Mic
STK-BP Battery Pack
STK-BC Battery Charger

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SPECIFICATION	KR-500	KR-400
Input Voltage	117/230 VAC	115/230 VAC
Power Consumption	30 VA	40 VA
Motor Voltage	24 Volts 2 phase	24 Volts 2 phase
Rotation Time	61 Sec @ 60 Hz	50 Sec @ 60 Hz
End Stop Type	Mechanical	Mechanical
Rotational Torque	350 in-lbs	340 in-lbs
Stationary Brake Torque	1750 in-lbs	1500 in-lbs
Vertical Load Max	N/A	440 lbs
Maximum Mast Size	1.5-2.5 in. dia.	1.5-2.5 in. dia
Maximum Mounting Size	1.25-1.625 in. dia.	1.5-2.5 in. dia.
Cable Type	6-#22	6-#22 or larger
Dimensions		
Control	4.33" × 6" × 7.5"	4.33" × 6" × 7.5" aprx.
Rotator		10.63" × 7" dia.
Weight	5.5 lbs.	9.9 lbs

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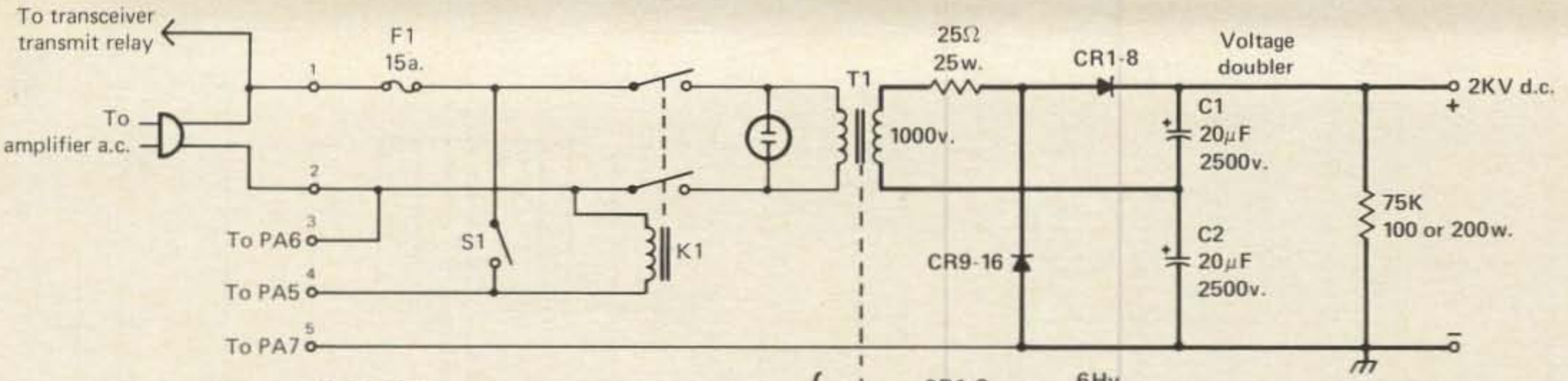


Parts List

C1, C2: 20 mF at 2500 volts. These can be series-connected electrolytics, 4–80 mF at 600 volts.
CR1–8 & CR9–16: 600 volt 1 amp diodes wired in series, 16 required
K1: DPDT relay, 115 VAC coil, 15 amp contacts
R1: 75K, 100 to 200 watts, bleeder resistor
T1: see text

ALTERNATE HV CIRCUITS

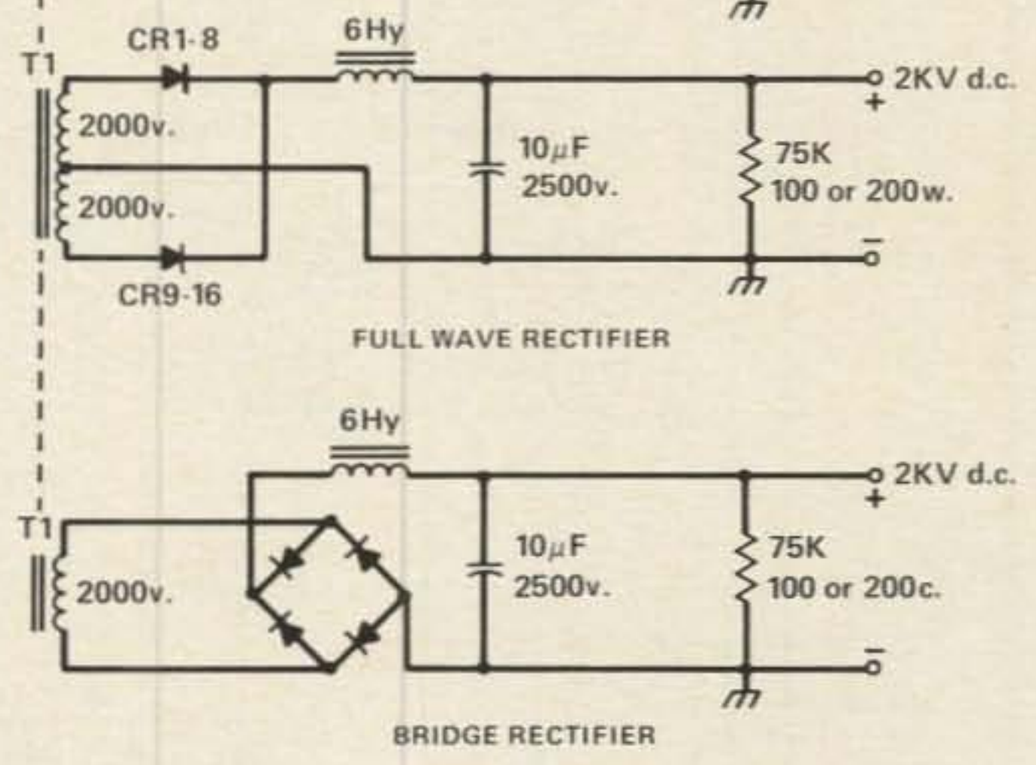


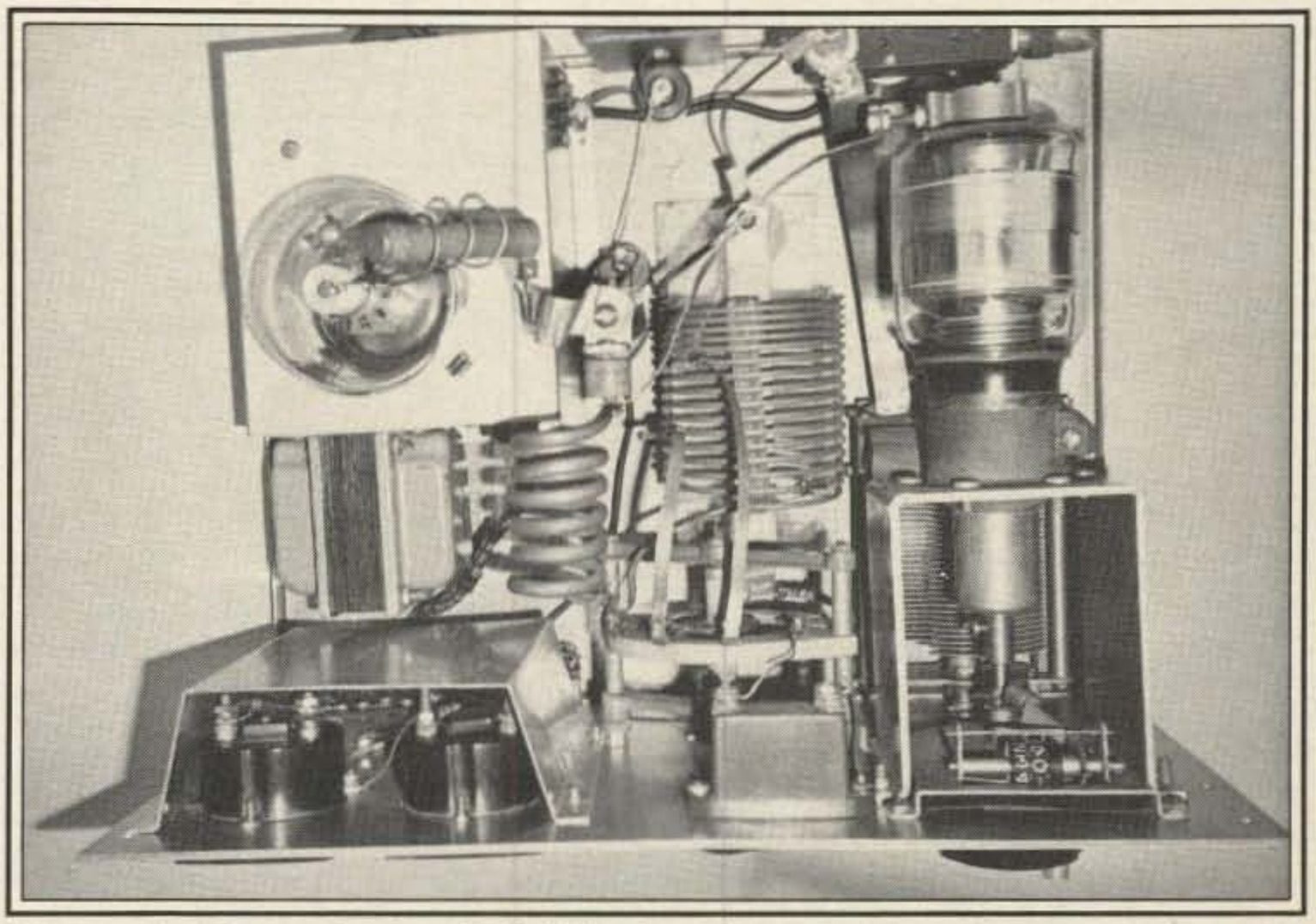
Fig. 1– Schematic diagram of the high-voltage power supply. Also shown are two other versions: full-wave rectification and bridge rectification. The choice of power supply depends on available components.

er hand, if you find one with 2000 or 2500 full secondary voltage at 400 ma, you should then use a bridge rectifier with a choke input filter. The choke could be between 6 and 10 Henries at 400 ma. The filter capacitor should be 4 to 10 mFd.

Amplifier Construction

Now for the major components for the amplifier. The 3-500Z tube (or 3-400Z, which has a higher gain but similar output characteristics) is available used for about $50 or less. I see them advertised regularly in classified ads at $85 for new tubes. Variable capacitors are easily obtained at fleamarkets and range from $5 to $10 for a plate tuning capacitor. Vacuum variables go for $15 to $25. I picked up my vacuum variable for $15. Loading capacitors are usually the ganged receiving type and go for a couple of dollars. The plate tuning coil will run about $5. For the 10 meter part of the coil, I wound 5 turns of ¼ inch copper tubing on a 1 inch form. Filament transformers are generally available from surplus stores. The various fixed capacitors and resistors are also readily available at almost all surplus stores. The bandswitch is another item I found in good supply at fleamarkets as well as surplus houses. Some clubs have a swap table at their monthly get-togethers. During a recent vacation trip to New Zealand, I attended an amateur radio club meeting in Christchurch, and they had a room full of used electronic components for homebrew adherents for either swap or sale.

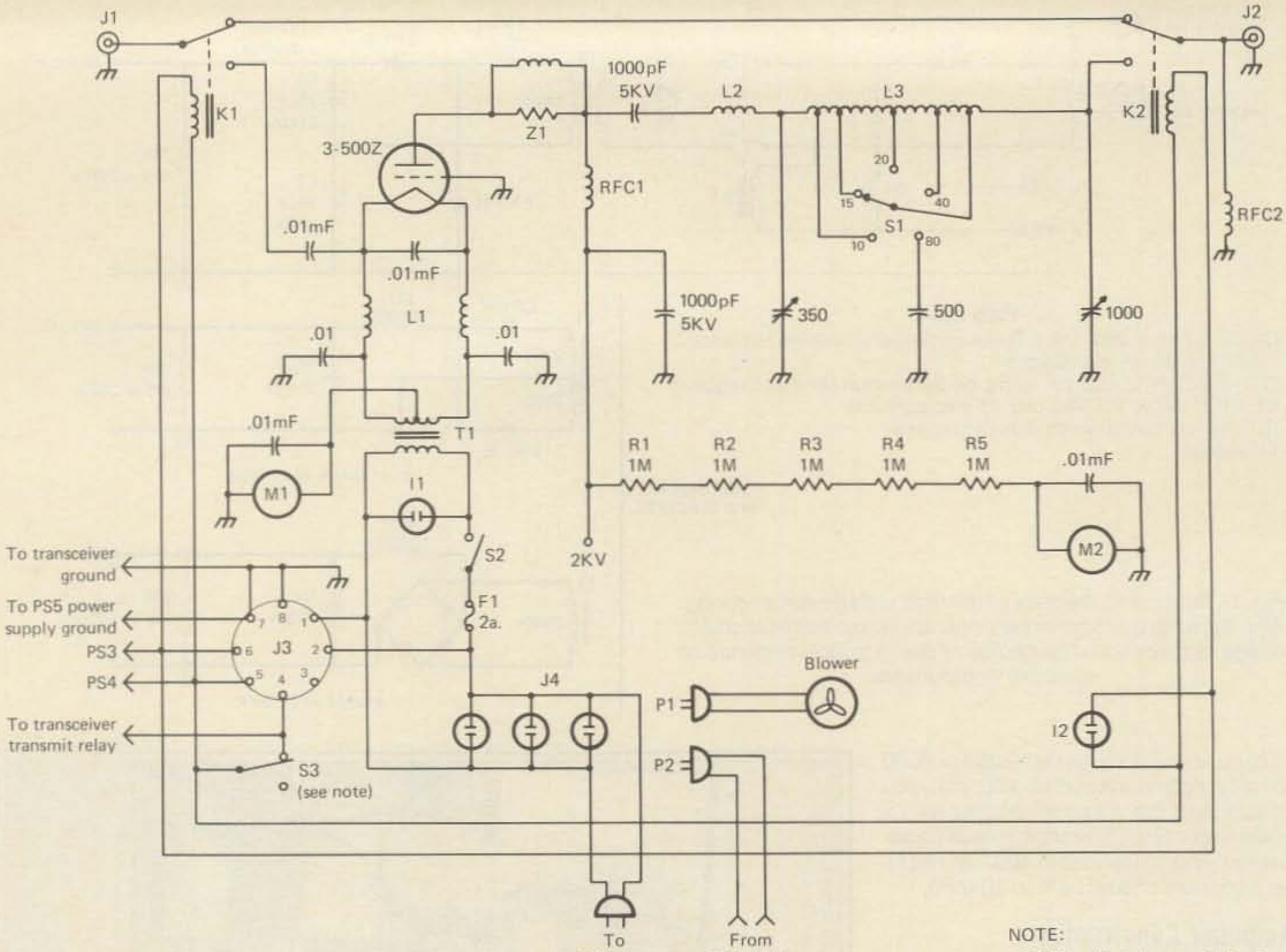
The plate RF choke is another easy-to-make homebrew job. I made mine by winding #30 enamelled wire on a ¾" × 5½" ceramic standoff insulator. Both ends are internally threaded, and so I screwed a headless bolt into one end as far as it would go, and then threaded a nut tightly against the standoff. The bolt was inserted in a hand drill, which I fastened in a vise, and thus I had a winding machine. One hand turned the drill and the other guided the wire being wound. Pieces of scotch tape were used to hold the ends in place at about ½ inch from the ends.



The top view shows the metal shield for the meters and the relatively simple wiring. The 80 meter capacitor is bolted to the front panel.

The packaging should hold no problems. There are no exacting dimensions one must follow as long as the components can be arranged and spaced comfortably. For the more ambitious, another tube and socket could be added to get more power output, but that would entail building a heavier duty power supply. In my own experience with amplifiers in running twice the power, the 3 dB increase, or one S-unit, was hardly noticeable.

In commercial linear amplifiers, a relay or a pair of them are used to connect the RF output of the transceiver to the input of the amplifier and to connect the amplifier output to the antenna. During "barefoot" operation, the transceiver output is connected to the antenna through the unenergized transfer relays. Relays are one of the most common components at fleamarkets. I found a relay



NOTE:
If S3 is deleted, connect 4 to 5.

Parts List

B1: whisper or muffin fan
C1, C2: 1000 pF 5 kv (Centralab 858 S)
C3: same as C1 or 500 pF TV doorknob
C4: 10 to 350 pF variable, 2500 volt spacing, or vacuum variable
C5: 20 to 1000 pF (or 1500) receiving-type variable capacitor
C6: 500 pF 5000 volt 5 amp mica, or use 2 C1 types in parallel
F1: fuseholder, panel type, 2 amp fuse
I1, I2: panel indicator lights, neon type, for 115 ac volts
J1, J2: UHF receptacle, type 83 IR
J3: 2 or 3 AC outlet receptacle
J4: high-voltage terminal, banana-receptacle type
J5: octal socket
L1: see text
L2: air-wound inductor, 5 turns thin tubing, or heavy wire 1½ inch diameter
L3: air-wound inductor 18 to 22 turns, 3 inch diameter
M1: 0 to 500 or 800 DC milliamperes
M2: 0 to 1 DC milliamperes
RFC 1 & 2: see text
RFC 3: 250 mH 100 ma choke
S1: single-pole 5-position ceramic switch 5 kv insulation
S2, S3: SPST toggle switches 5 amp
T1: filament transformer 115 volt primary, 5 volt 15 amp secondary
Z1: parasitic suppressor, 4 turns air-spaced wound around a 10 ohm 5 watt noninductive resistor (carbon or composition)

Fig. 2– Schematic diagram for the surplus linear amplifier.

with ceramic insulation for the input circuit and used an SPDT coaxial relay that I had for the output circuit.

The cathode coil (L1) is home brew. My first attempt was to follow a handbook-described coil using #14 enamelled wire on a 1 inch form with 6½ inch of bi-filar winding. On measuring the filament voltage at the socket I found it to be 4.4 volts, a 0.6 voltage drop across the coil. Rewinding the coil with #12 wire did not improve matters. I had access to a good impedance bridge, and after measuring the inductance of the coil, I fashioned a powdered iron core from a discarded TV horizontal output transformer by grinding off the end sections to make it straight, and wound a bi-filar winding of only 3 inches. The inductance was the same as the air-wound coil, and the voltage drop across the coil was only 0.15 volts. The filament voltage at the socket terminals was 4.88 volts, close enough for proper filament voltage operation.

The cabinet I used was one I picked up for a song and was 9" × 15" × 12" deep. However, any cabinet large enough to accommodate the components will do. I cut a 6" × 6" opening in the top cover of the cabinet directly above where the tube sits for venting the hot air. The opening was covered with a piece of perforated aluminum. A 4½ inch circular hole was cut in the back of the cabinet facing the tube, and a whisper fan was mounted there to provide ventilation for the tube.

The 9" × 15" front panel has all the controls for switching bands and plate and loading capacitors. Two toggle switches with neon indicators are used. The one on the left places the amplifier in operation. It energizes the filament, transfer relay, and power supply. The second toggle switch is used only to interrupt the high voltage supply, but can be eliminated. The panel I used was salvaged from another piece of equipment, hence the panel patches.

Using the Amplifier

Tuning up for multiband operation should be done with the transceiver in CW mode. Drive control set at minimum, increase drive until the plate current in-

dicates about 50 milliamperes above the 100 ma resting current. Tune the plate tuning capacitor until a plate current dip is obtained. You could also observe the external RF output meter for a maximum output reading. Adjust the loading capacitor for best output reading and readjust the plate tuning. After the initial tuning up, make a note of the dial reading and proceed to the next band and repeat the tuning procedures.

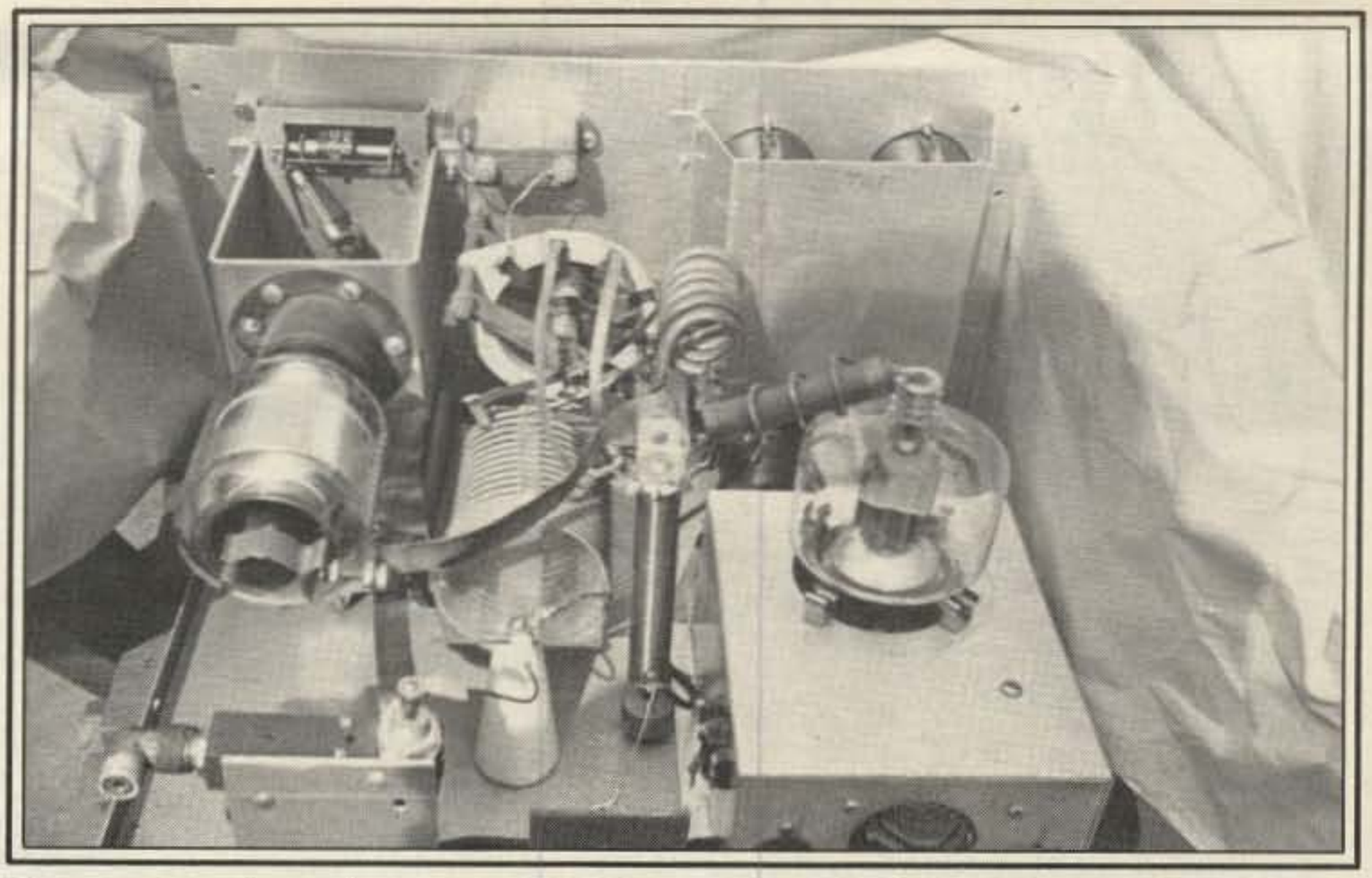
Additional Constructional Information

Every do-it-yourself amateur will incorporate his own ideas in building a rig from a published article. The following are ideas that I used in building this amplifier and that may be of some help.

An octal socket at the rear of the small chassis containing the tube socket is used to make all the connections to the amplifier except for the high-voltage and RF terminals. The high-voltage terminal is a banana-plug receptacle mounted on a 2½ inch square piece of plastic. UHF receptacles, 83 IR, are used for both RF in and output terminals. On the octal socket terminals one and two are used for AC power input. Three is not used. Four connects to the transceiver, normally open, push-to-talk relay. Five and six connect to the relay coil in the power supply. Seven and eight are ground connections, one for the transceiver and the other for the power supply. A three-way AC outlet is also fastened at the rear chassis and connects to terminals one and two. One position is used for the AC plug from the power supply, the other to the whisper fan, and the third to my desk lamp.

The Circuit

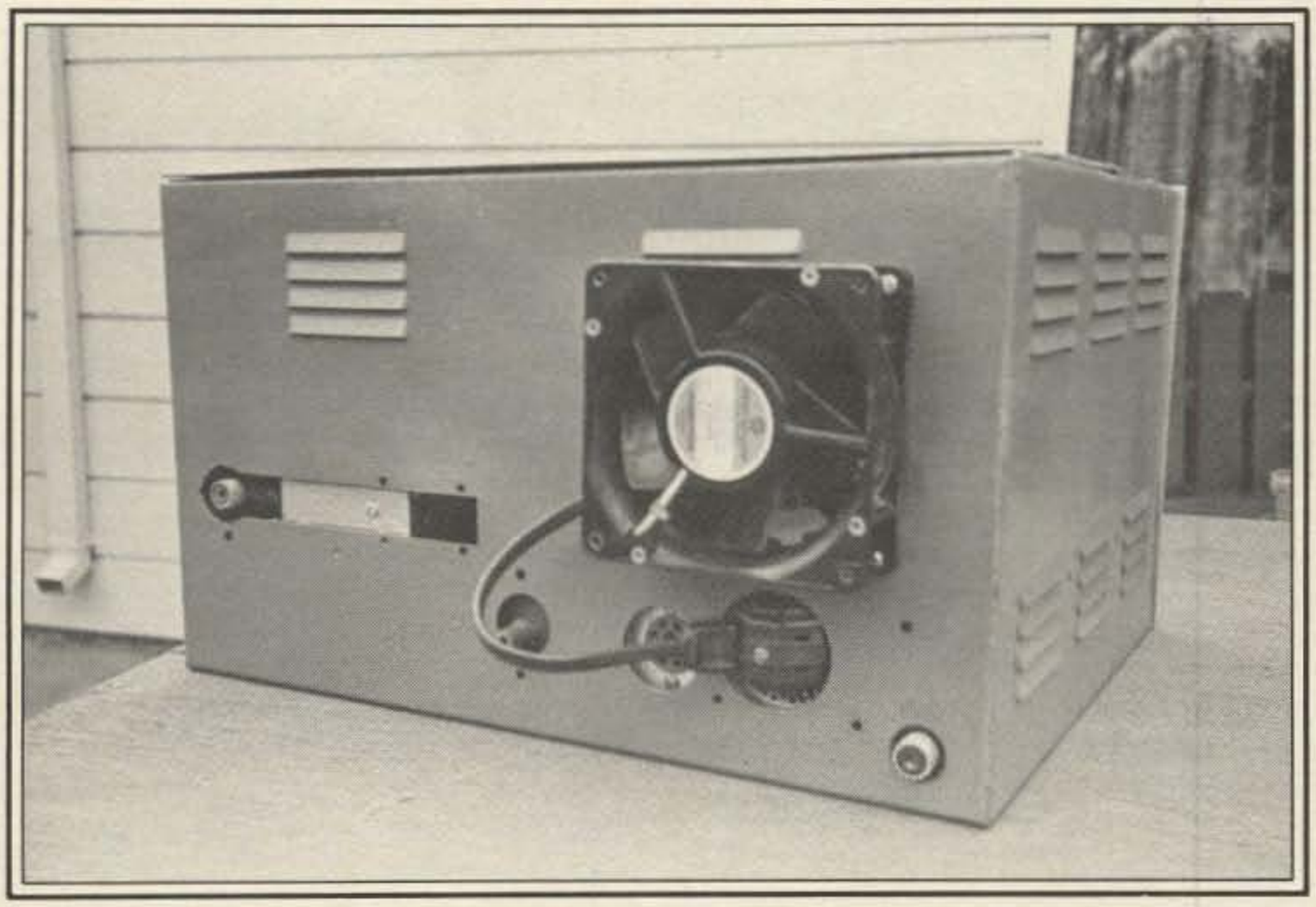
The circuit is a conventional grounded-grid cathode-fed input. The RF output circuit is the usual pi-network. My variable loading capacitor was not quite adequate for 80 meter operation, so a fixed capacitor was used to parallel it in the 80 meter position of the bandswitch. As mentioned earlier, a 0–1 DC milliammeter is used as a plate voltage indicator. Five 1 megohm 2 watt resistors in series were used as the multiplier, converting it to a 0–5 kilovolt meter. Calibration was done by comparing its reading with the reading on my fairly accurate VOM, which has a 5 kv range. The reading was low, and one of the 1 megohm resistors was shunted with a few different values until the right resistor value was found and soldered into place. A sticker on the meter face reminds me to multiply the indicated reading by five. Component costs vary, but nevertheless, the total cost of this unit was under $100. The amplifier operated beautifully.



The rear view shows the coax relay (RF output) on the left. The HV connector is mounted on the plastic square (center). The tube chassis has (left to right) J3, J4, and J1.

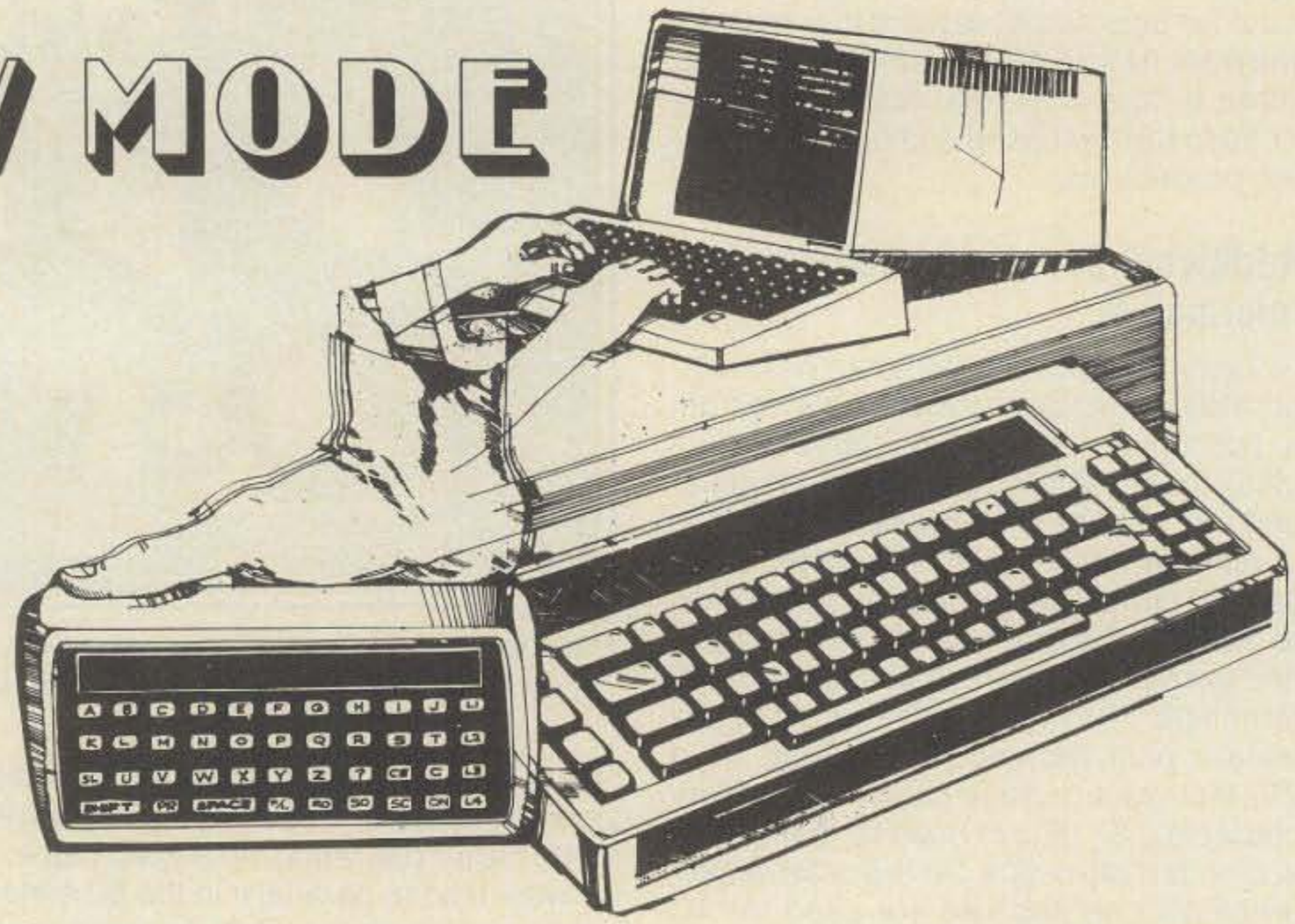
Obviously, if your junk-box is more elaborate or you locate better components at a reasonable price, use them. Also remember that you are dealing with high voltage. At all times protect yourself and others who may come near this rig by properly building in safeguards for its use and maintenance. CQ

With the amplifier in the cabinet, the muffin fan is plugged into J4.



Remember your first QSO? KC0UM helps us relive that exciting moment as he delves into the unknown.

THE NEW MODE



BY ROGER BJERKE*, KC0UM

Do you remember your first radio contact as a Novice? Were your palms wet, your face hot, and your stomach queasy while you were trying to decide whether or not to answer that slow CQ? Were your knees knocking so loud that the dog thought someone was at the door and started barking? Were your hands shaking so fast that you could have threaded a running sewing machine when you finally took the plunge and answered that guy who just had to be as slow as you?

Would you ever want to experience anything like that again? Most of you are probably saying, "You bet!" This is because the exhilaration of the first actual QSO far outweighs the misgivings that you had about it beforehand. How would you ever recapture that exhilaration? Let me tell you how I came close just recently.

Our 1982 tax return went for a shiny new Apple IIe computer. Although the XYL wasn't entirely convinced of the practicality of this purchase, she agreed to it when I explained the importance of our kids, age 8 and 7, getting a headstart in the computer age.

After going through a few months of educational discs and lots of games, the kids were showing some proficiency at the computer. I felt that it was now safe to mention to the XYL that some amateurs were actually using their computers for sending and receiving radioteletype signals, not to mention Morse code. From that point on our computer was labeled another one of *my* "toys." I think her suspicions were aroused even before that point, though, when I started logging my 3905 Century Club net contacts on the computer.

Since I hadn't been served with divorce papers and my food had no discernible traces of arsenic in it after a month, I decided to start saving my pennies for an interface unit and software to put my Apple "on the air."

Choosing the right interface is a story in itself, but let it suffice to say that a radio club demonstration and lots of advice convinced me to spend twice as much as I had budgeted.

January 29 at 2:10 p.m.: A call comes to my office. "UPS was just here with your latest toy," my XYL growls sweetly, knowing I had been waiting for it for the last three days. "Great," I yell. "I'll be right home." Slamming down the phone, I run out the door. Fortunately, the boss is out of town.

January 29 at 2:30 p.m.: Packing paper is strewn on the living room floor by this time, and I am pulling the little jewel out of the box. "It sure looks cheap," the XYL compliments. "It's what's inside that matters; it's a fabulous little piece of technology," I counter.

January 29 at 3:20 p.m.: I'm back at the office, reviewing the instruction manuals and software language. Won't that clock ever hit five?

January 29 at 5:30 p.m.: I say to the XYL, "I'm soldering these wires onto these connectors now, dear. I'll eat supper later, ok?"

January 30 at 1:30 a.m.: Oh (expletive deleted), I should have known that the computer joystick would have to be disconnected before things would work right!

January 30 at 2:00 a.m.: ZZZZZZZ.

January 30 at 12:15 p.m.: Why in the world are all those RYRYRYRYRYRY's coming up on the screen? I'm going to have to do some reading about this RTTY, I guess!

January 30 at 6:00 p.m.: "I'm right in the middle of something, dear. I'm really not too hungry tonight anyway." Let's see now, what page was that on?

January 31 at 12:05 p.m.: "Call me when dinner's ready, dear. I'm going to run downstairs to listen awhile."

January 31 at 12:15 p.m.: Hmmm, let's see if we can find a CQ here on 20 meters. There we are, a good steady stream of RYRYRYRYRY's. "RYRYRYRYRY CQ CQ CQ de W6RSZ W6RSZ W6RSZ, PAUL IN FRANKLIN CITY CA. KKK."

Well, is was now or never! What's this, sweat on my palms? RYRYRYRYRYRYRY W6RSZ W6RSZ de KC0UM KC0UM KC0UM ROGER IN WAHPETON, ND KKK."

"RYRYRYRYRYRYRY KC0UM de W6RSZ." . . . and so it went, a 20 minute QSO, enjoyable to say the least and solid "print." That's what we veteran RTTY ops call solid copy.

January 31 at 1:10 p.m.: On my way back to work memories of my first Novice contact way back in '79 emerge. Boy, I can't wait until tonight when I can try the other bands.

Let's see now, what would it take to build a converter for that old model 35 TTY to get hard copy? What's this AMTOR all about? I wonder when that RTTY World Championship that I was reading about is held? What would it be like to make a satellite contact?

Maybe you won't get as excited as I did about this "new" mode, but I do guarantee a good time! CQ

*623 N Fourth St., Wahpeton, ND 58075

Tadao Katsuta, JH7DNO, #1 all band from Asia, is shown here taking a break from running W's.

The crew of perennial powerhouse LZ2KTS, this year's #2 multi-single entry from Europe and #5 worldwide. Left to right LZ2HE, KZ2CC, LZ2DF, and LZ2PD.

Andreas Mavrides, 5B4LP, is the new Asiatic record holder on 3.5 MHz and #2 world high.

RESULTS OF THE 1984 CQ WORLD WIDE WPX S.S.B. CONTEST

BY STEVE BOLIA*, N8BJQ/6

Joel, KG6DX, seems happy with his all-band effort, which put him #6 worldwide and #2 in Oceania.

Rare DX and plenty of new prefixes made this year's CQ WW WPX SSB contest a rousing success. The first contest appearance of XU1SS, along with activity from China, Kermadec, and Juan Fernandez, made for one of the most exciting DX contest weekends in years. Many were fortunate enough to work BY4AA, W6QL/CEØ, or one of the ZL8's from Kermadec during the course of the weekend. Not as many were lucky enough to work XU1SS; however, the operators were pleased with their first try at contesting and have promised to be back again.

Generally, all-band scores came down a little from last year. However, single-band and low-band scores continue to rise to record levels. Even though propagation was not as good as previous years, high scores and records could still be had by those who were willing to work for them. Oceania was the place to be, with three of the seven single op category winners coming from the Pacific area. Les, VK2WU, outdistanced K3ZO/HK3 and the rest of the single ops to take all-band honors with an outstanding 5.9M points. FO8JP came out on top on 14 MHz, and Glenn, T32AF, squeezed by Yuri, VE3BMV, to take the top spot on 7 MHz. Both Glenn and Yuri, along with VO1CV, easily surpassed FM7CD's 7 MHz record set last year. With low-band scores on the rise, somebody should top 3M points in the 1985 contest.

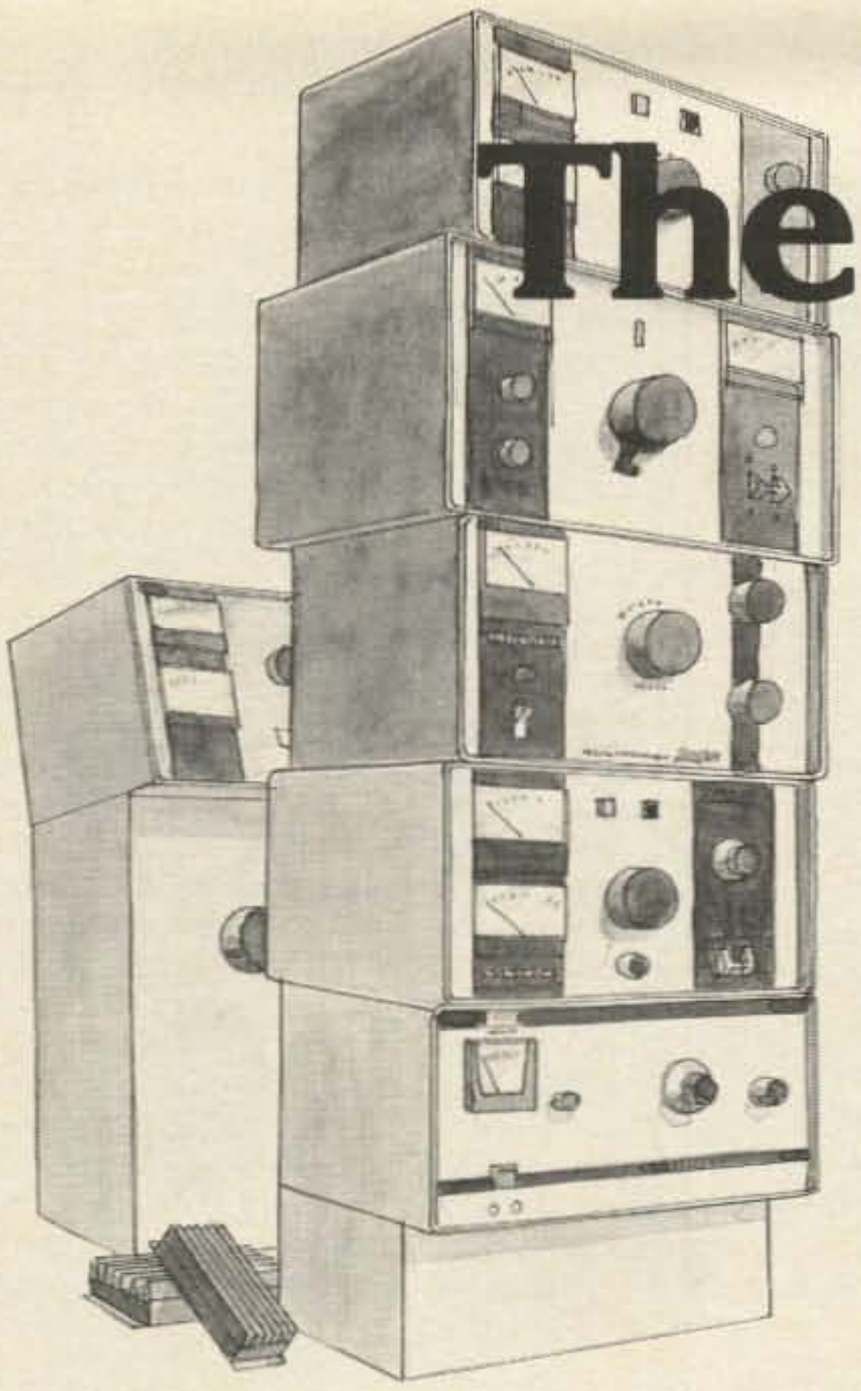
Not to be outdone by the high-power stations, Stu, H44R, shattered W8ILC's QRPp record with 1.5M points in his first try at QRPp contesting. Stu made over 1500 QSO's using less than 5 watts. Not too bad for the first try. I think he'll be back. South America also fared pretty well, with world record performances by Ralf, CE6EZ, on 28 MHz and Alberto, 4M3AZC, on 3.5 MHz. Ralf keeps proving that 10 meters is still alive and kicking. While he did not get a record, Raul, CX7BY, led the world on 21 MHz. Top band honors go to Africa this year, with Francisco, EA9KF, our first African entry on 160, edging out LZ2BE for the top spot and a new record. The competition was pretty stiff with the top six finishers topping the old record. All together six world records were broken, along with three USA records and eleven continental marks. Not too bad for less than ideal conditions.

In the US, the top three single ops held their positions from last year, with John, K2VV, repeating as the top gun. KC1F, KRØY, and KQ2M all went over 3M points to give John a run for his money. Willy, WB3GCG, set out to capture the USA 1.8 MHz record and did just that, topping W8LRL's record by 13,000 points. On 40 meters Gary Caldwell, WA6VEF, operated KI6P to a new American record and in the process became the first USA op to top one million points. That's quite a feat considering all the split-frequency operating that has to be done, along with fighting the broadcast stations for a clear frequency. USA 28 MHz honors go to KN5H, with Dave, K5GN, at NA5R edging out Art, N2AU, for 21 MHz honors and Dean, WAØTKJ, claiming the top spot on 14 MHz. On 3.8 MHz N7DF/Ø used his impressive antenna system to claim the USA #1 spot.

Multi-operator honors go to the crew of ZZ5EG, who emerged as the top multi-single team with 14M plus points, and a new South American record. Second place goes to KD7P/NH2 with a new Oceania record 9.7M points. After winning all the multi-single trophies the past few years, VP2EC switched to multi-multi and went after the world record of NP4A. However, the flu bug followed them to Anguilla, and Gordon, Ray, and Sheila did not get the record this year, but still finished with 17.5M points and a new prefix record (897) to beat out YUDX club station YZ1EXY and KH6XX. Watch out next year, Pedro. Randy and the boys at

*c/o CQ Magazine.

The HENRY REPORT...



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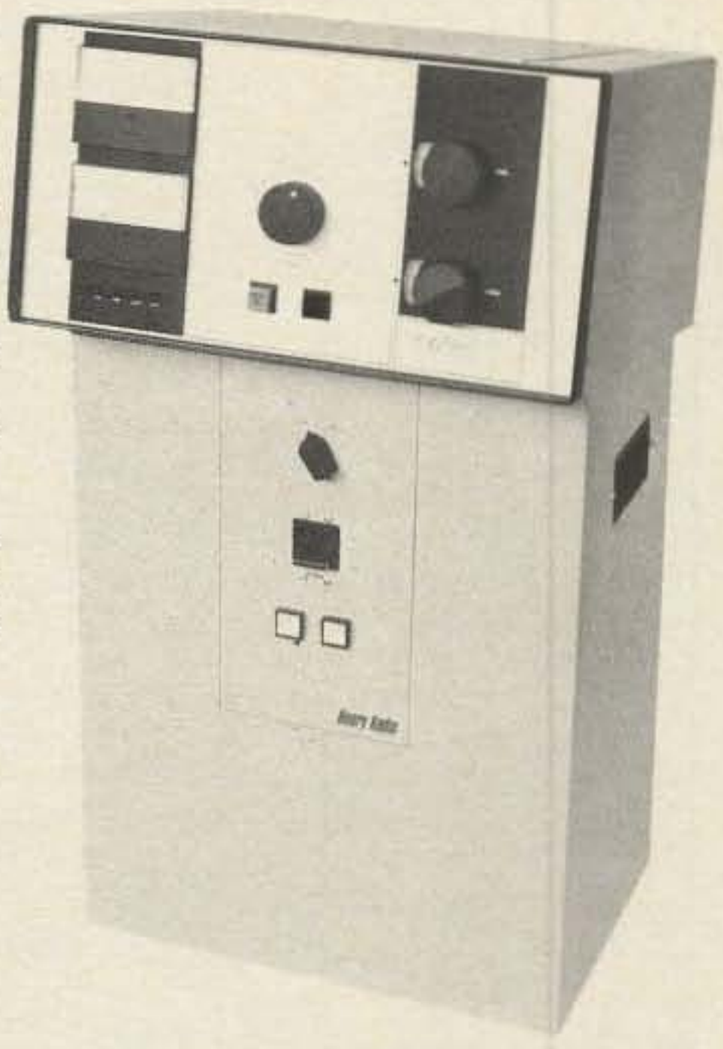
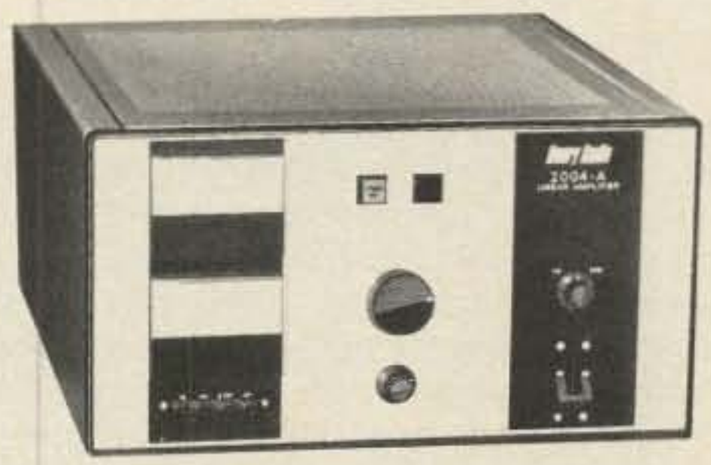


2002-A...a bright new rework of our popular 2002 2 meter amplifier. Uses the new Eimac 3CX800A7. The RF chassis uses a 1/4 wave length strip line design for extreme reliability. It provides 2000 watts input for SSB and 1000 watts input for CW. Because this tube is rated at an unheard of 15dB gain, only about 25 watts drive is required for full output.



2004-A is identical to the 2002A except that it is set up for the 430 to 450 MHz band. This amplifier uses a 1/2 wave strip line and offers all of the same specifications as the 2002A.

1002-A A rack mount 2 meter amplifier with the same design as the 2002A, except using one 8874 tube for 1/2 power specifications. Rated at 600 watts PEP output and 300 watts continuous carrier output. It employs the same strip line design as the 2002A.

1004-A...a rack mount half-power version of the 2004A. Covers the 430 to 450 MHz band using a 1/2 wave strip line design.

Henry amateur amplifiers are available from select dealers throughout the U.S. and are being exported to amateurs all over the world. In addition to our broad line of commercial FCC type accepted amplifiers we offer special RF power generators for industrial and scientific users. Call or write Ted Shannon or Mary Silva for full information.

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CIRCLE 28 ON READER SERVICE CARD

KH6XX would have finished with a much higher score but lost several prime hours when they became involved in what later turned out to be a hoax. Mike, KH6ND, along with Randy and a few others spent several hours assisting the Coast Guard with communications from a "ship" that claimed to be sinking off the coast of Hawaii. After several hours of using the station for relaying communications between the "ship" in distress and the Coast Guard, it was determined that the whole episode was a hoax. By then the Coast Guard had spent almost $13,000 on the rescue, and KH6XX had lost 4 hours of prime 10 and 15 meter operating time. The guys did get some favorable local publicity and proved that contesters are good for something besides calling "*CQ* Contest" and taking up the whole band.

N5AU, with a new USA record score of 6.3M, repeats as USA multi-single champion, with N4WW and W7RM providing lots of competition. In the multi-multi class, NG5X battled it out with NM5L for the top spot, with NG5X emerging victorious with 7.4M points.

This year's contest expedition trophy winner is WA4EMA, for his 28 MHz operation as WA4EMA/KP2. Proving that there is still lots of activity on 10, Chuck finished as the top 10 meter station in North America.

Speaking of trophies, there have been several changes made to the trophy list from previous years. Some have been deleted, others have new donors, and a couple of new ones have been added. For a list of WPX trophies for 1985, refer to the 1985 rules, which were published in the January issue, or drop a request to *CQ* for a copy of these rules. One of the trophies was inadvertently left out of the rules, and that is the SSB Single Operator, Single Band, Europe—Myron E. Crofoot, WB4VQO Award. Many thanks go to K4IA, HI8GB, the Kansas City DX Club, and Lance Johnson Eng., who stepped forward and picked up sponsorship of some of our problem trophies. Without their help, several trophies, both past and present, could not have been awarded.

Duplicates seemed to be a problem this year, with one station being disqualified and several having scores reduced. Remember that all dupes must be identified and no credit taken for them. Failure to do so is unfair to others, and may result in disqualification. Also, signing portable when operating outside of the area or country shown by your callsign is mandatory.

As many of you know, I am no longer in Dayton, having been transferred to southern California (I now must sign portable 6). To eliminate problems with lost or late logs, etc., all contest logs and correspondence should be sent to me via CQ Magazine, 76 N. Broadway, Hicksville, NY 11801. **Please mark WPX contest on the envelope** and it will get to me.

In the odds and ends department, did you know that the longest standing WPX record is the African multi-single record set by 9E3USA way back in 1969? With the change in band conditions, Africa might be a nice place to plan your next club expedition. Complete WPX records can be found elsewhere in this issue.

Many thanks to go W8IMZ and W8ILC for their help with the logs. Ron spent much of the summer criss-crossing the country with the Olympic Torch Relay team, but he still found the time to check logs when he was in town. Bernie, although trying to get out of the log-checking business, again put in many nights going over the almost 1600 logs received. For this year only, Bernie will handle the CW contest results as a favor to me. Starting with the 1985 WPX SSB Contest, I will again handle both contests. Special thanks also go to Ed Sleight, K4SB, who provided some much needed software support, in addition to donating a trophy. Without their help, this would not be possible. Also thanks to *CQ* Contest Director W1WY for his guidance and invaluable help with trophies. Thanks also to JH1KRC and JA1HQG for sending along the XU1SS log.

Finally, many thanks to all those who took part this year. Next year's SSB contest will be 30 & 31 March 1985. Hope to see you then!

73, Steve, N8BJQ/6

Random Comments

"BY4AA answering my *CQ* Test on 21.294 MHz . . . *N7TT*. Band conditions on HF deteriorated—10 meters was almost completely dead on Sunday . . . *W7GUR*. Condx bad but still had a great time on 28 MC!! . . . *WB7FDQ*. This contest sounded like *CQ* WPX South America on 28 MHz . . . *WB7RFA*. Total wipeout to Europe. Glad to have a Saturday opening to JA . . . *N7RO*. Always a great contest. It's a lot of fun being the station everyone wants to work for a change . . . *AI8S*. Worked 40 QSO's with ant. laying on gnd . . . *K8CW*. First time in this contest. Really enjoyed it. Be back next year with amp and more time . . . *KD8PT*. Good contest—conditions not the best. Enjoyed it never the less . . . *W8HU*. Great opening to VK on 10 at start of contest. Computer failure (my program logic) and a pretty YL limited my operating time . . . *WD8IXE*. Great contest. Lots of fun until Sunday morning when propagation went down the tubes . . . *NE8T*.

Condx good on 80 meters both nights to Europe. Too band more EU stations don't listen in the American band. Many had quite

TROPHY WINNERS

SINGLE OPERATOR - ALL BAND

WORLD - North Florida DX Assn. Trophy. Won by: **Les Cullen, VK2WU.**
U.S.A. - Bob Epstein, K8IA Trophy. Won by: **Stu Santelmann, KC1F.**
AFRICA - Ed Sleight, K4SB Trophy. Won by: **Station ZS1CT; op. Roland Mensch, DK3GI.**
CANADA - Steve Bolia, N8BJQ Trophy. Won by: **D.W.G. Thorne, VE3LDT.**
CARIB/CA - Arturo Gigante, Jr., HI8GB Trophy. Won by: **Larry Wilson, HH2WL.**
EUROPE - Bernie Welch, W8IMZ Trophy. Won by: **Cliff A. Saccalis, J41JG.**
JAPAN - Palm Garden Radio Club Trophy. Won by: **Tadao Katsuta, JH7DNO.**
SOUTH AMERICA: Ron Moorefield, W8ILC Trophy. Won by: **Alfred A. Laun III, K3ZO/HK3.**
WORLD QRPp - Dayton Amateur Radio Assn. Trophy. Won by: **Stuart Honeysett, H44R.**

SINGLE OPERATOR SINGLE BAND

WORLD - John N. Reichert, N4RV Trophy. Won by: **Jean Pierre Thomas, FO8JP.**
U.S.A. - Richardson Wireless Klub Trophy. Won by: **Station NA5R; op. David McCarty, K5GN.**
U.S.A. - 7 MHz - William Diggins, WA8LXJ Trophy. Won by: **Station KI6P; op. Gary Caldwell, WA6VEF.**
U.S.A. - 21 MHz - Ted Pauck, Jr., K8NA Trophy. Won by: **Arthur Hubert, N2AU.**
CANADA - Gene Krehbiel, VE7KB Trophy. Won by: **Yuri Blanarovich, VE3BMV.**
EUROPE: Myron E. Crofoot, WB4VQO Trophy. Won by: **Paul Pogrebnyak, UB5MBP.**
JAPAN - Ken Ruddock, K6HNZ Trophy. Won by: **Masashi Tanaka, JR1WHW.**
WORLD - 1.8 MHz - Arch Doty, Jr., K8CFU/4 Trophy. Won by: **Francisco Jose Loprena Farran, EA9KF.**
WORLD - 7 MHz - William Diggins, WA8LXJ Trophy. Won by: **Glenn Y. Arakaki, T32AF.**
WORLD - 21 MHz - Lee Wical, KH6BZF Trophy. Won by: **Raul Roji, CX7BY.**
JAPAN - 28 MHz - Joe Arcure, W3HNK & Toshi Kusano, JA1ELY (Terry Appelton, W4GSM Memorial Trophy). Won by: **Isao Nakashima, JH1RNZ.**

MULTI-OPERATOR SINGLE TRANSMITTER

WORLD - Mike Badolato, W5MYA Trophy. Won by: **Station ZZ5EG; ops. PY5EG, PY5CA, N5FA, PY5VV, and PY5ALP.**

MULTI-OPERATOR MULTI-TRANSMITTER

WORLD - Henry Thel, VE7WJ Trophy. Won by: **Station VP2EC; ops. N5AU, KC5EA, and KA5QIK.**
U.S.A. - Burt Curwen, KL7IRT Trophy. Won by: **Station NG5X; ops. NG5X, W5ZR, N5AN, WØMJ, and W5WMU.**

CONTEST EXPEDITION

WORLD - Kansas City DX Club Trophy. Won by: **Charles C. Smith, Jr., WA4EMA/KP2.**

(The **WORLD Club Competition** Trophy and the **U.S.A. Club Competition** Trophy winners will be announced with the C.W. results, as each is a combined SSB and CW award.)

One of this year's flu victims, Carmelo, KP4HC, sweats it out. Carmelo was one of the ops at NP4CC.

CQ World-Wide WPX Contest
SSB: March 30–31
CW: May 25–26

nice signals . . . *KU8E*. Worked 2 new countries. Also had the flu with 102 deg. temp. and hardly any voice. My congrats to all those who could understand me!! . . . *KC8JH*. First time for WPX Contest. Enjoyed working so many different countries. Sure was fine way to try out new rig . . .*KA9LWL*. We often hear them say, we just ran JA, but we midwesterns know, we're in a black hole . . . *KM9P*. Age 13. First contest alone. Cut short due to severe cold . . . *N9EJL*. Too long a wait till next March . . . *KR9G*. Great JA opening on 15 meters Saturday. Conditions Sunday made up for it . . . *KRØY*. First WPX. Great fun in spite of snow static & poor prop . . . *KCØWP*. I broke in the new neighbors at the new QTH. One of them heard me over the phone while it was hung up . . . *KSØT*. Worst conditions on 10 here in the Midwest in years! . . . *ABØX*. Biggest thrill—when ZL8BQD called me and then had to explain he was a DX Expedition . . . *KVØK*.

I must have loyal supporters. When I left a frequency to tune the band and returned 15 min. later, I asked if it was in use. Someone replied that N7DF was using it . . . *N7DF/Ø*. Poor DX on 75M but still had a ball . . . *KØCS*. Condx vy poor for WPX on 80. Need more DX participation . . . *WØJU*. Was right on schedule, then got up Sunday morning to find out I was on a different planet . . . *KY6I*. Having the beam heading 90 deg. off indicated doesn't help . . . *WB6JMS*. Working BY4AA was a nice bonus! . . . *KV6H*. Blew linear plate choke during contest. Repaired and jumped back in . . . *NM6L*. WPX is always fun. You guys always have great prop. at least one day of the contest . . . *WB6FCR*. Really amazing 10 meter condx into Europe considering the solar cycle. (50 MHz also open into S. America.) . . . *WA5IYX*. Severe conditions for non-beam type small pistol . . . *NN5T*. Excellent Europe opening on 10 Sat. morning—used only TH6 at 65 feet . . . *KN5H*. What a way to spend my birthday . . . *NA5S*. Solar flares can either ruin propagation or enhance it. This weekend was a little of both . . . *NA5R/K5GN*. Couldn't break pileups on some nice ones . . . *KA1CLV*. Could not spend much time, but got 3 new countries. Someday I'll have a real rig and antenna . . . *KB1GN*.

Contest ended early for me. I sold both my rigs before it was even half over. Didn't get new rigs in time . . . *KT1O*. Again this year, it's easy to dupe when almost all contacts are multipliers . . . *AA1M*. Condx worse than last year, but score still ended up higher—not high enough though . . . *K2VV*. One of the best JA runs in years on 15 Sat. night—240! . . . *KQ2M*. Ten meters was a disaster, but I still went over 1000 QSO's and 1,000,000 points for the first time . . . *KF2O*. Conditions were so bad Sunday afternoon, that I think people duped me just for something to do . . . *N2AU*. Who said "People who live in apartments can't enjoy contests"? . . . *KY2J*. WPX is a strategist's dream—requires choice of band(s) to optimize prefix count. Tnx JA & US! . . . *KC3EK*. Ten meters was a big disappointment. Where were all those "exotic" USA prefixes? . . . *AC3T*. Worked 7 new band countries including 4U1UN for an any-band country . . . *KQ3V*. Contest was great, even though QRN was abundant. Keep up the great work . . . *WB3GCG*. Still the best contest of the year! Lots of fun scoring this one on a C-64 . . . *AI2C/4*. Sure glad 10 meters opened Sat. morn.! . . . *WC4E*.

Very fun contest. Like the mandatory rest periods . . . *KG4W*. Compared to last year, I worked more bands with more QSO's, more points, and more multipliers and more time off . . . *WK4F*. Up and down propagation on this band at this QTH. Got all I called. The best a new country . . . *WB4VQO*. Power went out at 2100Z on Sunday. Fired up small Honda Generator and operated with 100w to end. Broke record after the outage . . . *N5AU*. Amp went out twice. Just happy to finish . . . *NO4J*. Birthday was Mar. 25. Score was a definite present . . . *KY2P*. In middle of JA's power line helped with 10 over S9 noise. First big try not QRP. Sure is more fun to be told how loud you are!! . . . *KZ2E*. Amazed to work Shanthini, VU2GO on 10 meters. Condx pretty good overall . . .

U.S.A. TOP SCORES SINGLE OPERATOR

ALL BAND

K2VV	3,383,466	K6HNZ	2,284,512
KC1F	**3,212,008**	AF5K	2,169,114
KR0Y	3,189,312	K5RX	1,688,852
KQ2M	3,010,535	K5MR	1,668,048
AI6V	2,647,555	N7TT	1,488,027

SINGLE BAND

28 MHz

KN5H	927,291
NU4Y	821,178
NA5S	687,346
WB7FDQ	369,929
KM9P	175,449
ND0E	144,236
WB7RFA	93,790

21 MHz

NA5R	**1,683,190**
N2AU	**1,603,166**
WA6DBC	1,394,886
KG5U	978,025
N6AW	953,146
KM5K	861,643
WB6FCR	761,852

14 MHz

WA0TKJ	615,150
W5FO	536,019
KE5CK	425,880
K0RWL	272,580
KA5W	219,726
WA5IGD	170,808
W5VGX	93,946

7 MHz

KI6P	**1,158,606**
K9MWM/0	369,180
AB7L/9	326,032
WB5YLT	25,530
WD4DII	13,640
W4MGX	3,744

3.8 MHz

N7DF/0	148,930
KM5R	124,002
KJ9D	122,508
N4OH	120,934
KU8E	109,920
KQ3V	76,384
W8IMZ	50,652

1.8 MHz

WB3GCG	43,368
N4SF	18,832
KC8JH	17,082
AA4MM	15,554
KE2C	9,204
N7CKD	2,728
KA7AUH	2,640

QRP/p

KH6CP/3	A	176,436	W6YVK	A	58,191
K5IID	A	127,650	W6CN	28	29,997
WA0VBW	A	61,272	W6YMH	21	28,910

MULTI-OPERATOR SINGLE TRANSMITTER

N5AU	6,301,977	NO4J	2,528,838
N4WW	5,812,138	KY0S	2,451,780
W7RM	5,800,090	KY2P	2,159,343
KW8N	3,222,590	KI2P	1,915,254
AK6A	2,690,345	KZ2E	1,545,914

MULTI-OPERATOR MULTI-TRANSMITTER

NG5X	**7,480,044**	NM5L	6,083,385

W0HBH. Amp went up in smoke with only 2 hrs. to go—DARN! . . . *WD9INF/8*. This was our first WPX test and the first contest the wife (N7FNW) and I both operated together. We both agree it was lots of fun . . . *KA7KDU*. UK7PAL first call on 20 in a pileup running QRP! . . . *K5IID*. I had intestinal flu on Saturday, which gives new meaning to the phrase "contest runs" . . . *WA0VBW*. My favorite contest. Despite the static bursts, they could hear my 3 watts on the East Coast . . . *N7NV*.

Thanks for nice contest . . . *JT1BG*. It's a lot of fun to have a pileup from USA . . . *JA1YFG/JL1BLW*. Got a new one on 10M! Very much enjoyed . . . *JH1MTR*. The propagation on 28 MHz was not so good; however, long path still recognized . . . *JH1RNZ*. I've taken part in the WPX Contest for the first time. Though the propagation was not so good, I enjoyed myself very much . . . *JH4UYB*. Very hard to work on 75 meter band in JA, because it is so narrow. QRM . . . *JA2AAQ*. Hitting 2000 contacts was an achievement we didn't expect . . . *5Z4RS*. For the first time we had the honour to receive a foreign operateur to help us. N5FA was very fast . . . *ZZ5EG*. From 24/3 17 GMT to 23 GMT without linear, QRT. A really strenuous job against "the big guns." God help QRP stations . . . *LU1DRC*. Excellent contest—already looking to 1985 . . . *VE4CCC*. Contests and aurora definitely do not mix . . . *YV1CC*.

Enjoyed myself very much again, but Sunday not too good. I think I am getting too old for contests, but just to hear the old timers in the DX countries calling makes me participate . . . *VE4RP*. Worked VU2GO on a poor band . . . *VE1YX*. If I only had a bigger signal. Two elements don't make the grade on 20 . . . *VO1QU*. Tnx to US boys for 244 multipliers. Had open director on 3 ele. Yagi. Bad wx did not permit repair before contest. Super contest—getting better . . . *VE3BMV*. The most effort I ever put into a contest, and it sure did pay off . . . *VO1CV*. Special tnx to the people who only worked me once. Nice to have "CK3" for this one! Tnx D.O.C. . . . *CK3IPR*. After this contest I think it's time to rewrite propagation textbooks. As an example, 10 meters opened only after dark and then over the most difficult paths into deep Asia and Africa. Never heard a US station on 10 . . . *KL7Y*. Sure was great being DX for the first time . . . *KG9N/C6A*. Nice to be called by BY4AA and have a QRM-free QSO with Tom (VE7BC) . . . *TI5MRC/VE3MR*.

Heard more stations than I worked, but worked more than I did in the last *CQ* contest . . . *HI8LC*. First time in an SSB contest all the way, thanks to the flu that got Eduardo . . . *KP4EQF/KP4HF*. Unbelievable number of dupes from US stations. One called 4 times . . . *WA4EMA/KP2*. My first attempt at QRP contesting. Had been surprised by what could be achieved casually DXing using less than 5 watts, but was staggered by the contest results . . . *H44R*. Being called by ZL8 was a big surprise . . . *VK2WU*. Good long-path conditions to Europe on 15 and 20 . . . *KG6DX*. My thanks to KD7P/NH2 for sharing his contest duping program—such a relief. Also was very happy with the low percentage of dupes . . . *T32AF*. Ten meter conditions were very good for my first amateur contest. Band changed from USA to Japan and back again several times each day, so there were always some stations to work . . . *ZL1ANJ*. Excellent operating manners from JA's and W's . . . *ZL4BO*. Saturday's operation was interrupted by a neighbor with a mysterious talking doorbell and a "self-actuating" garage door! . . . *VE5ADA*. Good signals from Europe. No activity in Africa . . . *EA9KF*. My first WPX. Should have discovered this contest earlier . . . *ZS1CT/DK3GI*.

Got so confused with scoring that I had to call in computer assistance. Maybe robots should operate station . . . *ZS6BRZ*. Strange how some "single op" entries seem to have more than one voice . . . *PP2ZDD*. Who says we are on the down slope of the present solar cycle? This year's conditions on 10 were among the best ever during the contest weekend. DX came in from all continents with outstanding signals. Never hear so many strange prefixes before . . . *CE6EZ*. All those new USA prefixes sure add up to plenty of multipliers . . . *K3ZO/HK3*. Only good propagation was to my neighbor's TV set . . . *HD1OT*. Vy bad condx, especially on Sunday on 21 MC. No stn stronger than 1. Andorra is surrounded by mountains— bad contest QTH . . . *C30BAX*. There were not enough stations from North America working split on 75m and 40m . . . *PI1GOE*. Our first attempt. Enjoyed by all operators . . . *GB4TVI*. Tnx for again organizing enjoyable contest. Shame we had trouble with antennas, rigs, and linears. Two linears and one TS-430 went QRT . . . *GB0WPX*. Who switched off the propagation on Sunday? I expected to do not less than 2 million . . . *UA3AMB*. Very poor conditions and high QRN and static restricted the operation period . . . *5B4EP*.

Station Operators
Multi-Operator Single Transmitter

N5AU: K5ZD, KM5X, N5RZ, WB5VZL. **N4WW** & NX4N. **W7RM** & W7WA, NA7P, KB7G. **KW8N** & N8ATR, KC8MK, KA8KPS, KC8XK, N8DMM, WD8RZG, KV8M. **AK6A** & N6ADI, WA6DJS, WA6FGV, WD5GOZ, N6HK, W6TKF, WB6TNB, N6VR, KA6VOY. **NO4J** & WA4B, NR4E, N4GIH, KD4SU, N4UF, W4MET, NF4L, NU4Y, WD4ITK. **KY0S** & N0EBM, AD0O. **KY2P** & KY2O, KA2OJM. **KI2P** & KA2CDE, KC2UF, N2HR, N6IN, WA2GBJ, KA2QWU, N2CIC. **KZ2E** & W2HPF, KB2SG, KA2TPA. **KS9O** & KC9XM, KA9DVY. **KX9G** & N9NC, N9NB, KK9W, DL9DAX/W9, KX9S, KC9RG. **W0HBH** & WB0IUN, WD0GML, KC9AL. **WD9INF/8** & K9EC, K8AQM, KA8JJF, KA8ALG, WD8CRY, KC8KQ. **KE9Y** & KA9FXO, WB9JKI, KC9TD, N9AGM. **KD8AX** & KC8GX, N8ECH. **KG7Z/8** & N0DWR. **W3KWH** & AK3J, N3DHC, WA3FYJ, W3IOH, W3SVJ, K3PBY, K3RYA, KA3ITM, KA3LIW, KA3GQO, KA3HBL, KA3KSD. **WD8QDQ** & WA9GQT, AE8L, KC8GG, WD8JAW. **KA7KDU** & N7FNW. **KJ0G** & K0GAS. **KD5RW** & KA5DLM, KA5BOO. **NV4G** & NU4B. **KA2NDX/1** & W0MHK. **KW2D** & WA2UYM, KC2KK.

NC6M & WD6GRW, WA6SGQ, WB6LSC, WB6LOQ, N6DXB, KA6MXC, N6HDH, KB6DZW. **NE2W** & KH6WX. **NP4CC** & KP4BZ, NP4Z, KP4HC. **VE6OU** & VE3BVD. **CK3UOT:** VE3KZ, VE3AER, VE3CYX, VE3CTF, VE3CKR. **VE5ADA** & VE5GF, VE5AE, Darcy. **VE7UBC:** VE7CMK, VE7BRU, VE7DES, VE7ACY, VE7FJE, VE3FXT, VE7CNF, VE7EWU. **5Z4RS:** 5Z4DD, 5Z4RT, 5Z4GM, 5Z4DK, 5Z4RY, 5Z4DS, 5Z4BM, 5Z4KM. **ZS6YO** & ZS6PT, ZS6AL, ZS6CDG. **JG1ZUY:** JG1ILF, JG1IMM, JI1QQI, JA6-9330, JH7PKU. **JA9ZKE:** JA9CZE, JA9NFO, JA9PPC, JA9RPU, JA9SSY. **JH3YJM:** JA3XGF, JH3QKV, JF3UYI, JI3AFL, JA4UDP, JA4XKL. **HZ1AB:** W7KJJ, K0JJ, G4FTC, WA6BRE, G3ZSS, WB7TTX. **JA6YAI:** JH6VLF, JR6EZE, JR6GAG, JE6MQW, JE6UWI, JH0FKC.

WORLD TOP SCORES
SINGLE OPERATOR

ALL BAND

VK2WU	**5,928,934**	**KC1F**	**3,212,008**
K3ZO/HK3	**5,064,329**	KR0Y	3,189,312
LU8DQ	4,878,418	PP2ZDD	3,186,531
ZS1CT	**4,461,805**	KQ2M	3,010,535
LU1BR	4,253,256	AI6V	2,647,555
KG6DX	3,399,936	CE3DNP	2,450,085
K2VV	3,383,466	K6HNZ	2,284,512

SINGLE BAND

28 MHz		21 MHz	
CE6EZ	5,437,936	**CX7BY**	**2,937,927**
LU4DM	2,788,524	**UB5MBP**	**2,524,860**
PY5BAB	2,557,632	JA2APA	2,418,710
ZS6BRZ	1,839,825	P42J	2,318,754
ZY5IW	1,746,936	OH6AM	2,226,884
ZY2FZ	1,675,800	UB5IJK	2,200,152
LU2HAO	1,557,626	5B4MF	2,175,642

14 MHz		7 MHz	
FO8JP	**3,121,736**	**T32AF**	**2,991,352**
G3FXB	2,339,337	**VE3BMV**	**2,827,440**
SM2EKM	1,913,457	VO1CV	2,465,850
HI3EMS	1,794,520	IO3MAU	1,767,048
YT3M	1,731,957	YU7AD	1,582,098
WP4AOH	1,477,952	**KI6P**	**1,158,606**
SM2CEW	1,454,227	OH1RY	1,043,088

3.5 MHz		1.8 MHz	
4M3AZC	1,158,132	**EA9KF**	**264,100**
5B4LP	763,458	LZ2BE	261,504
VE3IY	721,392	VE3CDX	205,824
CK3IPR	576,114	YU3EF	106,568
UO5OAO	415,426	VE3MFA	91,200
SP3IBS	410,704	IN3DYG	88,608
Y56YF	368,220	I5MXX	65,016

QRP/p

H44R	**A**	**1,575,904**	UA0SGL	14	38,625
OK3CGP	A	317,900	SM5ARR	7	1,700
NP4KA	28	309,468	SP5FKW	3.5	9,882
JR7GYC	21	70,266	UY5XE	1.8	25,110

MULTI-OPERATOR
SINGLE TRANSMITTER

ZZ5EG	**14,758,625**	VK6DU	6,150,616
KD7P/NH2	9,752,600	HG6N	5,917,842
IO5BGM	8,608,545	HG5A	5,845,280
NP4CC	8,249,885	N4WW	5,812,138
LZ2KTS	7,414,240	W7RM	5,800,090
Y34K	6,996,220	VK3FY	5,455,827
N5AU	6,301,977	F9IE	5,270,220

MULTI-OPERATOR
MULTI-TRANSMITTER

VP2EC	**17,559,672**	KL7RA	6,883,176
YZ1EXY	14,503,141	NM5L	6,083,385
KH6XX	11,117,556	CE3AA	2,986,812
JA9YBA	9,560,464	JA3YKC	2,274,015
NG5X	**7,480,044**	UK4WAB	1,698,070

JA7UAA: JH7CUO, JH7RVD, JH7UJN, JE7HLZ, JE7QCQ, JJ1MVV. **5B4ES:** The English School Radio Club. **JA7YBJ:** JR7MPT, JR7OCO, JR7SLG, JE7ENK, JE7MKQ, JE7MTI.

JA6YDH: JR6GHN, JR6QHK, JR6QPB, JE6PSL, JR6PKJ, JE6VFJ. **JA7YFB:** JJ1GZY, JH7XMO, JR7GYC, JR7JLU, JR7LCI. **JA7YAL:** JH7VXM, JH7MEV, JR7VSE, JF7ACN, JR7UWK, JR7TNW, JR7QWW. **JA0ZAV:** JA0VHI, JA0OSV, JA0TEN, JA0RUG. **JA3YCT:** JK3JTJ, JL3FPD, JG3HFE, JI3OPA, JI3QDA, JJ3QXW, JK3FXN, Shigeto. **JA0YCR:** JH0NOS, JH0NLB, JR0GMC. **JH6ZYZ:** JA6-32712, JF6VFJ, R. Tomoshige. **JA6YBR:** JF6QZE, JF6LOK, JE6USQ, JE6QFE. **XU1SS:** Ravy, Rum, Au. **IO5BGM:** I6MPN, I5SDG, I5NPH, IK5BAF, I0IJ, I8MPO. **LZ2KTS:** LZ2HE, LZ2PO, LZ2DF, LZ2CC. **Y34K:** Y21DK, Y21YK, Y23EK, Y24UK, Y29AK. **HG6N:** HA6ND, HA6NN, HA6OQ, HA6ON, HA6NY, HA6NQ, HA6NF. **HG5A:** HA5FN, HA5OM, HA5GF, HA5ML, HA5WE, HA5UA, HA5PP, HA7SU. **F9IE:** F6CTT, F6BDN, F6HRP, F6GLH. **OH8AA:** OH6EI, OH8MA, OH8PF, OH8VJ. **OK6DX:** OK2FD, OK2JS. **Y44ZI** & Y31WI, Y26DI/A, Y24RK. **Y31M:** Y25TM, Y22OM, Y21GM. **HG6V:** Simon, Suzster, Varga, Macsuga, Wingender, Peto.

GB0WAS: Lichfield A.R.S. Group. **SK6RR:** SM6CVT, SM6LRR, SM6LGW. **SL0ZG:** SM0DJZ, G4JVG, SM0AJU. **Y33ZB:** Y33TB, Y33UB, Y33XB. **OK7MM:** OK3CQW, OK3CUM, OK3CPN. **DL0JK:** DK1DU, DK2XX, DK6FT, DK8ZL, DF2ZN, DF7FR. **YT3T:** YU3BQ, YU3DE, YU3EIJ, YU3DRW. **YZ1U:** Club Group. **IO9HLO** & IT9KZW, IW9AQS, IT9PTV, IT9GNG, IT9FXY, Guiseppe. **HA3KNA:** HA3OV, HA3FTA, HA3OU, HA3NS, HA3NU. **G8JC:** G3TQD, G3TQZ, T4OPD, G4RBD, G4RMV, G4UXC, G4WIX, G8ASO, G8NWR, G6DZH, G6ZYA. **ED6MDX:** EA6MR, EA6MQ, EA6JW, EA6KZ. **OK2KMR:** OK2SSS, OK2SAA. **SP9PDF:** SP6AXW, SP6BGB, SP9BMQ, SP9EES, SP9MDS, SP9MQE, SP9MRN. **DL0UE:** DJ5FT, DL3LU, DL7BI. **HG1Z:** Fersatl, Biczo, Tarsoly, Borsai, Gosetolai, Harsduyi. **OK3KII:** Club Group. **SK6AW:** SM6EHY, SM6DED. **GB0WPX:** G4EOF, G4GEE, G4VCN, G4UXU, G4NPX, G4DRS, G4JQL, G6ELH, G4IAQ, G4IAR. **ON8BK** & ON4KIP, ON5FI, ON7LM, ONL-6672. **LZ1KOZ:** Michail, Plamen, Stefan. **GB2WRR:** G3ZGA, G3KWT, G3ZBA, G3XWH, G4EZI, G4DZI, G4EZX, G4ATZ, G3VTY.

OK3KAG: OK3CDX, OK3-27164. **HA1KSA:** Felber, Muller, Teyluiz, Kovacs, Zogo, Bereczls. **ED3CBE:** EA3BOW, EA3BOX, EA3CVA, EA3DDU, EA3DGO, EA3EID. **I8FOQ** & I8CZW, IK8DOI, I8LWL, IK8DNM, I8DVJ, IK8CWD. **SP5KVW:** Club Group. **SK2AU:** SM2DQS, SM2NTU, SM2NPR, SM2EIL. **HA2KMR/P:** T. Jozsef, H. Tabor, T. Attila, T. Csaba, P. Janos, J. Laszlo. **HB9BLQ** & HB9CIP, HB9CVN. **DL0TS:** DF1ZA, DF7ZQ, DF9OW, DJ9KM, DK1NB, DK1ND, DK3ZV, DK6WK. **GB4TVI:** G4NUL, G4RTD, G3XJL, G3ZXX, G6AHD, G6IKS, G6IWB, G3ZVW. **EA3NA** & EA3DQN. **ED4RCD:** EA7FCV, EA1CRB, EA4BFI, EA5BRA, EA5CBS, EA4CVR. **Y54ZL:** Y24RL, Y54RL. **SP2PCX:** SP2JKC, SP2AYC, SP2HJL, SP2JGY. **YO3KWJ:** YO3JW, YO3QK, YO3JU. **YO8KOD:** YO8CHI, YO8DDP, YO8CAR. **OK1KUR:** Club Group. **LA2S:** Club Group. **HA4KYH:** Kovacs, HA-4-008, HA4XX, HA4YO. **SP1PBW:** Club Group.

PI1GOE: Pupils of Christelijk Lyceum voor Zeeland. **SP1KIZ:** SP1APZ, SP1JVE, SP1II, SP1OT. **SP7PGK:** Club Group. **OE3GBB:** Club Group. **YU4EZC:** Gajic, YU4RS-1556. **OK2KYC:** Club Group. **OK1ORA:** OK1-22310, OK1AYD. **Y31ZJ:** Y31QJ, Y31WJ. **YU1AHX:** Club Group. **HB9Z:** HB9CFC, HB9RE. **HA1KTD:** M. Ferenc, D. Zoltan, V. Laszlo, M. Gabor. **OK1KZW:** OK1DGE, OK1DQW. **YO6KNT:** YO6AHP, YO6AZL. **YU3T:** Rajko, Simon, Zoran. **SP9PTO:** Club Group. **OK1KTW:** Club Group. **OK1KAZ:** Club Group. **SP5ZBL:** Boy Scouts Club. **HA5KFV:** 2 Ops. **OH3AT:** OH3DC, OH3FS, OH3MP. **SP9ZHR:** SP9EMI, SP9MRQ. **OK2KVI:** Club Group. **OK3KNS:** Club Group. **C30BAX:** DL4BAM, DF5BW. **SP7KTE:** Students Radio Club. **OK1KLV:** Club Group. **KD7P/NH2** & KJ9W. **VK6DU** & VK6NSD. **VK3FY** & VK3DMU, VK3DXI, VK3CCD. **ZL2AH** & Sylvia. **ZZ5EG:** PY5EG, PY5CA, N5FA, PY5VV, PY5ALP. **LU1DRC:** LU8EKC, LU1EIV, LU3DJH, LU5DH, LU2DWS, LU2DYX, LU2DJX, LU1EHY.

UK7PAL: UL7PAE, UL7PAO, UL7PBY, UL7PCZ, UL7PEZ, UL7-023-158, UL7-023-434. **UK9ADT:** UA9AIS, UA9AKI, UA9AOA, UA9APU, UA9QC, UM8NKW. **UK9FER:** UA9FDW, UA9FAR, UA9FAL, UA9FAJ, UA9-140-808. **UK0AAB:** UA0AGI, UA0AFQ, UA0-103-712, UA0-103-712, UA0-103-239, UA0-103-235, UA0-103-713. **UK7LAH:** UL7LEZ, UL7LDK, RL7LAH, UL7-026-177. **UK9FEN:** UA9FIS, UA9FKM, UA9FAZ. **UK8MFA:** UM1MDW, UM8MAG, UM8-036-100. **UK8JBE:** UJ8-040-207, UJ8-040-233, UJ8-040-228. **UK9ADS:** UA9AML, UA9ABV, UA9AMG. **UK8JBD:** UJ8JMM, UJ8JCF, UJ8-040-78. **UK0SAV:** UA0SDT, UA0SNR, UA0SMM, UA0-124-490. **UK6GAS:** Club Group. **UK9CAC:** UA9CBW, UA9-154-1745, RA9CVZ. **UK7CAO:** Yuri, Slava, Aleksej. **UK9XBD:** Anatoly, Slava. **UK9UCZ:** UA9-130-275, RA9UCP, RA9UCD. **UK0QBE:** UA0QWJ, UA0-098-107, UA0-098-121. **UK2RDX:** UR2RRJ, UR2QD, UR2REZ, UR2RNJ, UR2RNA, UR2RNX. **UK6LAZ:** UA6AUN, UA6-150-1240, UA6-150-1103, UA6-150-262, UA6-150-1060, UA6-150-1135.

UK4FAV: UA4FCM, UA4FDS. **UK2BBB:** UP2PX, UP2BBB, UP2-028-1052. **UK2FAA:** UA2FCZ, UA2FEM, UA2FEW, UA2FFD, UA2FAW. **UK2GAB:** Yuri, Alex. **UK2PRC:** UP2BBM, UP2BAW, UP2BDM, UP2BIL. **UK2PCR:** UP2BFN, UP2BFI, UP2BKP, UP2BMW, UP2BNY, UP2BNC, UP2BOA, UP2BOE, UP2BJQ, UP2-038-918. **UK4HAL:** 5 Ops. **R1Z:** UA1ZX,

North American 3.5 MHz record holder, and #3 in the world, Jim Roberts, VE3IY, gets a few pointers from son, Chris.

UA1ZWW, UW1YY, UA1-1435. **UK3QBM:** UA3QDW, UA3QML, UA3QGO, UA3QRZ. **UK5IZZ:** UB5-073-1272, UB5-073-1259, UB5-073-3131. **UK5IAZ:** UB5-073-1474, UB5-073-1277, UB5-073-3322. **UK2BCC:** UP2BDW, UP2BJK, UP2-038-346, UP2-038-1656. **UK4WAA:** Igor, David, Vlad, Oleg. **UK4HBB:** UA4-133-1861, UA4-133-237, UA4-133-272, UA4HFG, UA4-133-1171. **UK5IFN:** UB5IRX, EZ5IRC, UB5IKF, UB5IIX. **UK3DBG:** Bruck V., Egorov A., Sipachev V., Voronin G., Vorobiev V. **UK2PAP:** UP2OX, UP2BLW, UP2BLR. **UK3ABO:** UA3-170-339, UA3-170-559. **UK3QAZ:** UA3QOQ, UA3QKZ, UA3QDR. **UK2BBX:** UP2BCO, UP2BCT, UP2-038-1643.

UK4LAA: UA4LCQ, RA4LAG, UA4LBQ, UA4-164-271. **UK2GAZ:** UQ2-037-221, UQ2-037-081. **UK1AAW:** UA1-169-2008, UA1-169-2009, UA1-169-2116. **UK3WAF:** UA3-135-101, RA3WCG, UA3WBB, UA3WBW, UA3WCX. **UK2TAB:** UR2RMI, UR2RKB, UR2-083-1551. **UK4HBU:** Club Group. **UK5IBS:** UB5IJZ, UB5-073-3860, UB5-073-1302. **UK5CAT:** UB5CAY, RB5CCP, UB5-080-70. **UK3SAO:** UA3-151-508, UA3-151-507, UA3-151-506. **UK5HAB:** UB5-071-73, UB5HAC. **UK4SAM:** UA4-091-244, UA4-091-171, UA4-091-217. **UK5LAX:** UB5LHG, UB5-077-1370, UB5LRY. **UK2WAY:** Ivan, Leonid, Dmitry. **UK2AAF:** Sergey, Dmitry, Eugene. **UK1ABC:** UA9-165-942, UA1ALN, UA1ADB. **UK5UBE:** UB5ULI, UB5-065-2083, UB5-065-2074. **UK6HBK:** UA6-108-1620, UA6-108-1664, UA6-108-1740. **UK4PAE:** UA4-094-426, UA4RC, UA4RF. **UK3TCJ:** Eugen, Nick, Igor. **UK2GJW:** UQ2GNI, UQ2-037-294. **UK5WAC:** Vladimir, Jaroslav, Nicolaj. **UK5OAR:** Slawa, Igor, Oleg.

UK2BFM: UP2-038-1170, UP2-038-1168, UP2-038-1166, UP2-038-1169. **UK3TBF:** Andrei, Serge. **UK3ACB:** Slava, Serge, Pavel. **UK5EDI:** UB5EQG, EZ5EGK, UB5ELE. **UK4PNQ:** Club Group. **UK5IGL:** UB5IAN, RB5IYZ, EZ5IEE. **UK5LAS:** Natasha, Alla, Helen. **UK5VAA:** Alex, Val. **UK5UAN:** UB5UMD, UB5-065-2229, UB5-065-2242, UB5-065-2255. **UK5RAL:** UB5RBL, UB5REN. **UK2WAM:** UC2WBP, UC2WJ, Al.

Multi-Operator Multi-Transmitter

VP2EC: N5AU, KC5EA, KA5QIK. **YZ1EXY:** YU1PKC, YU1EW, YU1UU, YU1FW, YU1RL, YU1DW, YU1EA, YU1UA, YU1OYA, YU1PZO, YU7KV, Slavko, Dragan, Val. **KH6XX** & KH6LW, KH6SC, WH6ABM, KH6ND. **JA9YBA:** JJ1BTC, JR2GMC, JI2NPL, JA9LNJ, JA9OTX, JA9QCE, JA9QWJ, JA9VBW, JA9VDA, JH0CAZ, JH0VUG. **NG5X** & W5ZR, N5AN, W0MJ, W5WMU. **KL7RA** & AL7CQ, AL7CG, AL7AF, NL7V, NL7M, KL7UN, KL7IEH. **NM5L** & NM5M, K5LZO, KC5M, K5RVK, K2TNO, KE5IV, WB5RUS, KA5SBS, N5AF, WA5POK, W5ASP, WA5PQK, KD5SP, KF4VS, K5IY, KB5FU, K5YCP. **CE3AA:** Radio Club of Chile. **JA3YKC:** JG3HJG, JG3LLB, JK3GRR, JR6NWN, JE3MAS. **UK4WAB:** K. Blinov, I. Blinov, B. Baranov, A. Enoktaev, V. Krylov, Klepanov, G. Sakerin, R. Sailfullin. **W6QL/CE0:** W6QL, W6KG, CE3ACA. **UK9CCF:** UA9CWI, EZ9CBA, UA9-154-1511, UA9CVY. **SP6ZFU:** Club Group. **JA6YBX:** JF6TSS, JF6VVI, JG6BLV, JF6LWU. **JA7YDX:** JR7FDJ, JR7RPD, JR7RZM, JR7VUV, JE7BDM, JE7IQQ, JE7OAZ, JE7GEP, JF7DGB. **CX1FU** & CX3IW, CX1BBJ, CX5CP, CX3DI, CX2DDY, CX1MM. **JA3YCK:** JA3BCT, JI3QYW, JK3QIP. **JR2YZB:** JE2MDE, JE2RDJ, JF2NXS, JF2ONG.

QRPp SECTION WORLDWIDE

H44R	**A**	**1,575,904**	**1552**	**352**
OK3CGP	**A**	**317,900**	**532**	**289**
JH0LFE	**A**	**216,591**	**284**	**219**
KH6CP/3	**A**	**176,436**	**358**	**234**
K5IID	**A**	**127,650**	**305**	**222**
LA1XDA	**A**	**62,860**	**384**	**140**
WA8VBW	**A**	**61,272**	**195**	**138**
GM4ELV	**A**	**58,247**	**263**	**157**
W6YVK	**A**	**58,191**	**243**	**163**
AD2Y	**A**	**54,405**	**198**	**155**
N8CQA	**A**	**45,756**	**165**	**123**
JH3LCU/1	"	43,788	162	123
JO1LDY	"	41,265	158	131
WA7KLK	**A**	**29,700**	**147**	**110**
AH6EK	**A**	**25,840**	**126**	**76**
UB5AAL	**A**	**29,106**	**152**	**99**
ED2SN	**A**	**27,454**	**166**	**106**
YO6DBL	**A**	**25,009**	**139**	**89**
N8AXA	"	24,024	107	84
UA3DJG	"	20,437	122	107
WD9IYT	"	**16,992**	**103**	**96**
VE2AEJ/3	"	15,549	86	71
WA4OID	**A**	**14,508**	**101**	**78**
JP1POE	"	8,835	67	57
W8VSK	"	8,555	73	59
UA3ARI	"	7,980	97	42
UB5XCM	"	7,260	67	60
UC2ACT	**A**	**4,576**	**52**	**44**
YO2CMI	"	4,558	51	43
EA3DNC	"	84	7	7
NP4KA	**28**	**309,468**	**624**	**222**
4X6IF	**28**	**246,956**	**396**	**214**
JI3BFG	**28**	**37,632**	**171**	**112**
UA6AUD	**28**	**34,068**	**151**	**102**
W6CN	**28**	**29,997**	**143**	**101**
JF2GYH	"	20,124	100	86
RA3DKE	"	15,168	93	79
JH0ALB	"	13,740	91	60
KI9A	**28**	**13,041**	**93**	**63**
RA3DQP	"	9,250	70	50
OK1HCH	**28**	**8,820**	**68**	**49**
UC2AFM	**28**	**6,048**	**57**	**42**
EA3ERT	**28**	**4,251**	**77**	**39**
ED1CJJ	"	4,214	67	43
Y26JD	"	675	23	15
VE5ACY	**28**	**468**	**14**	**13**
RO5OCN	**28**	**340**	**12**	**10**
SM0JEM	**28**	**300**	**14**	**10**
JR7GYC	**21**	**70,266**	**212**	**147**
SP1HJK	**21**	**29,704**	**141**	**94**
W6YMH	**21**	**28,910**	**139**	**118**
JF1JLW	"	15,808	89	76
UB5FDM	**21**	**10,062**	**116**	**86**
YO6AFP	**21**	**9,593**	**81**	**53**
JR4NIV	"	2,852	38	31
UB5YDX	"	2,574	45	39
UB5VAA	"	2,080	33	26
JG3MSD	"	1,458	33	27
UB5DAG	"	1,173	25	23
UA0SGL	**14**	**38,625**	**158**	**103**
IK8BOK	**14**	**31,200**	**155**	**120**
OK8ACW	**14**	**29,532**	**174**	**107**
		(Op: UA9WDP)		
JA1KFX	**14**	**14,168**	**90**	**77**
HA1TD	**14**	**2,736**	**59**	**36**
EA1BBG	**14**	**220**	**14**	**14**
SM5ARR	**7**	**1,700**	**30**	**25**
SP5FKW	**3.5**	**9,882**	**86**	**61**
OK1AIJ	**3.5**	**6,200**	**68**	**50**
N7NV	**3.5**	**690**	**30**	**23**
JK1QLH	**3.5**	**120**	**7**	**5**
Y25SH	3.5	16	4	4
UY5XE	**1.8**	**25,110**	**136**	**81**
RB5IIU	"	18,834	127	73
OK1MP	**1.8**	**6,490**	**63**	**55**
EZ3AEB	**1.8**	**2,958**	**53**	**29**
RA3IFE	"	2,752	46	32
EZ3DEU	"	1,440	33	20
EZ5HCO	"	140	17	14

SINGLE OPERATOR NORTH AMERICA

UNITED STATES

KC1F	**A**	**3,212,008**	**2187**	**622**
N1AFC	**A**	**133,980**	**338**	**231**
KA1EKR	"	96,398	238	157
KQ1F	"	93,272	238	178
KA1CLV	"	72,981	203	159
KE1E	"	52,746	197	149
W1HX	"	38,180	137	115
KB1GN	"	13,920	89	80
KA1F	"	11,760	81	70
KT1O	"	5,644	76	68
W1TUM	"	2,613	47	39
N1AHP	"	1,575	40	35
KS1J	**28**	**14,100**	**100**	**75**
K1TR	**21**	**752,350**	**792**	**410**
K1KJT	"	407,364	554	332
W1BK	"	69,596	185	137
W1IHN	"	66,341	202	163
AA1M	**14**	**47,680**	**198**	**160**
K1RB	"	23,324	112	98
WA1NCN	"	3,920	61	56
K2VV	**A**	**3,383,466**	**2190**	**643**
KQ2M	**A**	**3,010,535**	**1960**	**635**
KF2O	**A**	**1,190,646**	**1059**	**459**
KS2M	"	197,880	361	255
W2PHT	"	70,035	203	145
K2QF	"	57,744	173	144
KW2J	"	39,360	159	123
NF2K	"	20,944	134	112
KA2RLW	"	20,458	135	106
N2BSA	"	18,122	93	82
N2EKL	"	9,086	84	77
KT2D	"	5,712	60	48
N2AIF	"	4,389	35	33
W2KTF	"	336	16	16
W2KZE	**28**	**31,030**	**141**	**107**
KC2X	"	15,120	100	84
N2AU	**21**	**1,603,166**	**1250**	**514**
KY2J	"	67,643	213	173
KA2RVO	"	1,785	36	35
KE2C	**1.8**	**9,204**	**153**	**78**
W3GM	**A**	**862,521**	**830**	**443**
W3ARK	**A**	**346,698**	**514**	**306**
KC3EK	"	120,481	283	211
W3FQE	"	87,492	220	138
KF3C	"	54,621	185	153
N3AOE	"	34,430	125	110
WA3VPL	"	7,906	71	59
AC3T	**28**	**74,227**	**344**	**199**
W3BGN	"	31,473	160	117
K3NTD	"	513	22	19
N3GB	**21**	**182,466**	**377**	**218**
K3UA	"	30,300	155	100
WA3DMH	**14**	**85,140**	**217**	**180**
K3ND	"	34,668	130	107
KQ3V	**3.8**	**76,384**	**384**	**217**
W3ICM	"	23,232	176	132
WB3GCG	**1.8**	**43,368**	**398**	**156**
WI4R	**A**	**1,463,772**	**1283**	**547**
AI2C/4	**A**	**1,405,536**	**1208**	**484**
WC4E	**A**	**1,248,160**	**1435**	**580**
KG4W	"	787,332	830	407
WI4K	"	564,400	822	400
W4WKQ	"	310,678	572	326
KF4HK	"	303,009	483	307
K4OD	"	297,080	443	280
WO4L	"	118,574	251	202
WY4T	"	112,860	365	209
WN4VAU	"	100,050	366	230
W4UYC	"	93,330	223	153
W4WJJ	"	88,480	235	160
W4BV	"	71,724	191	139
WK4F	"	58,362	155	137
KE4XY	"	14,100	78	75
W4KMS	"	10,400	95	80
NU4Y	**28**	**821,178**	**968**	**411**
WB4VQO	"	45,313	150	113
WG4P	**14**	**2,350**	**49**	**47**
N4EUK	"	1,564	37	34
WD4DII	**7**	**13,640**	**203**	**110**
W4MGX	"	3,744	41	36
N4OH	**3.8**	**120,934**	**453**	**253**
N4SF	**1.8**	**18,832**	**203**	**107**
AA4MM	**1.8**	**15,554**	**192**	**101**
AF5K	**A**	**2,169,114**	**1593**	**582**
K5RX	**A**	**1,688,852**	**1370**	**524**
K5MR	**A**	**1,668,048**	**1250**	**496**
WA5IYX	"	152,515	353	235
NN5T	"	51,450	200	147
KB5UW	"	32,264	145	109
W5EIJ	"	19,339	103	83
KN5H	**28**	**927,291**	**1063**	**453**
NA5S	**28**	**687,346**	**1045**	**398**
NA5R	**21**	**1,683,190**	**1500**	**562**
			(Op: K5GN)	
KG5U	**21**	**978,025**	**1191**	**475**
KM5K	"	861,643	664	463
WB5LYT	"	21,600	117	108
WN5MBS	"	18,720	115	104
W5FO	**14**	**536,019**	**880**	**407**
KE5CK	**14**	**425,880**	**1038**	**420**
KA5W	"	219,726	532	313
WA5IGD	"	170,808	371	264
W5VGX	"	93,946	420	214
KV5F	"	1,440	37	36
WB5YLT	**7**	**25,530**	**164**	**115**
KM5R	**3.8**	**124,002**	**455**	**249**
AI6V	**A**	**2,647,555**	**2203**	**551**
K6HZZ	**A**	**2,284,512**	**1762**	**424**
KI6O	**A**	**897,066**	**1078**	**366**
K6EID	"	827,525	826	395
K6SG	"	704,506	798	341
W2KVA/6	"	356,319	562	249
KY6I	"	347,760	582	270
WB6JMS	"	242,088	427	262
KV6H	"	191,268	416	253
NE6I	"	81,464	233	136
KE6PQ	"	46,368	182	138
KG6AM	"	40,590	165	110
N6JMV	"	33,020	180	130
NM6L	"	24,453	174	143
N6JM	"	12,255	72	57
W6OUL	"	8,400	67	56
KA6HQW	"	1,200	28	24
WA6DBC	**21**	**1,394,886**	**1446**	**383**
N6AW	**21**	**953,146**	**1055**	**362**
WB6FCR	"	761,852	918	364
AA6EE	14	1,708	31	28
KI6P	**7**	**1,158,606**	**1175**	**337**
		(Op: WA6VEF)		
N7TT	**A**	**1,488,027**	**1410**	**489**
W7FP	**A**	**877,680**	**942**	**424**
KS7T	"	283,500	626	315
W7GUR	"	159,745	349	215
W7TWL	"	145,824	340	168
KT7G	"	138,432	330	206
KC7V	"	97,311	262	163
WA7OEM	"	29,505	138	105
KX7J	"	3,960	50	44
KU7A	"	70	7	7
WB7FDO	**28**	**369,929**	**778**	**301**
WB7RFA	"	93,790	301	166
WB7WQE	"	7,752	66	57
N7RO	**21**	**387,376**	**700**	**284**
NC7S	"	89,950	463	257
W7AYY	"	68,202	199	162
W7RIR	"	2,738	38	37
WA7CGR	**14**	**3,795**	**39**	**33**
K7GWK	**3.8**	**19,404**	**140**	**98**
N7CKD	**1.8**	**2,728**	**75**	**62**
KA7AUH	"	2,640	53	44
AI8S	**A**	**1,111,268**	**1095**	**514**
N8BJQ	**A**	**664,578**	**771**	**397**
N8BTU	"	332,986	574	331
K8CW	"	332,664	505	334
W8UPH	"	250,690	421	265
KD8PT	"	46,112	164	131
K8KUH	"	43,952	160	134
W8HU	"	24,200	111	88
N8EKS	"	24,010	114	98
AD8C	"	15,246	106	99
KA8MPT	"	10,496	76	64
KC8UP	"	3,200	43	40
WD8PAQ	**28**	**23,790**	**134**	**130**
WD8IXE	"	14,348	98	68
KZ8Y	**21**	**417,834**	**566**	**334**
NE8T	"	274,208	487	304
KU8E	**3.8**	**109,920**	**419**	**240**
W8IMZ	**3.8**	**50,652**	**410**	**201**
W8UVZ	"	5,772	99	78
KC8JH	**1.8**	**17,082**	**200**	**117**
KU8V	"	1,748	53	46
KV9S	**A**	**957,456**	**1244**	**488**
KC9EW	**A**	**128,048**	**301**	**212**
K9YAX	"	64,242	175	166
W9PNE	"	50,336	166	121
NA9J	"	44,485	201	155
W9SOM	"	44,472	223	102
AJ9U	"	41,808	181	156
W9TNZ	"	39,786	149	114
KX9B	"	19,270	112	94
W9LYN	"	10,956	80	66
KA9LWL	"	5,406	62	53
KA9OPV	"	324	12	12
KM9P	**28**	**175,449**	**477**	**251**
KQ9L	**21**	**599,676**	**728**	**363**
KS9J	"	22,785	118	93
N9EJL	**14**	**88,616**	**343**	**212**
KR9G	"	87,776	245	211
N9CIW	"	19,184	123	109
AB7L/9	**7**	**326,032**	**570**	**328**
			(Op: W9RE)	
KJ9D	**3.8**	**122,508**	**457**	**246**
			(Op: KK9V)	
KR0Y	**A**	**3,189,312**	**2001**	**672**
KV0I	**A**	**432,278**	**895**	**401**
KC0XX	**A**	**429,693**	**641**	**319**
N0BSH	"	359,632	537	338
KK0L	"	331,545	588	345
K0UK	"	330,052	436	218
N0ZA	"	270,204	420	267
W0GOQ	"	262,605	540	305
KB0G	"	257,450	417	271
WB0CHS	"	111,780	412	230
W0PPF	"	107,200	252	200
KC0SV	"	99,840	274	208
KC0WP	"	89,100	316	220
KS0T	"	85,428	256	189
KB0U	"	76,557	224	169
WB0ISW	"	40,600	151	116
KM0R	"	38,784	175	128
K0YBX	"	18,880	92	80
W0WUU	"	6,864	58	48
KA0QIA	"	4,100	97	82
W0RSG	"	2,403	30	27
W0KEA	"	1,134	29	27
ND0E	**28**	**144,236**	**418**	**214**
AB0X	"	55,650	226	150
W0GOR	"	22,120	114	79
KV0K	**21**	**414,852**	**836**	**362**
WA0TKJ	**14**	**615,150**	**1068**	**450**
K0RWL	"	272,580	526	330
K9MWM/0	**7**	**369,180**	**456**	**210**
N7DF/0	**3.8**	**148,930**	**517**	**281**
K0CS	"	19,584	216	136
W0JU	"	8,216	90	79

ALASKA

KL7Y	**A**	**1,702,552**	**1295**	**487**
KL7XO	"	122,094	247	171
KL7SK	**14**	**374,136**	**548**	**262**

CONTINENTAL LEADERS

ASIA

AB	**JH7DNO**	**2,247,000**
28	UA9CSS	767,404
21	JA2APA	2,418,710
14	JH8TRP	887,682
7	JA5BJC	771,064
3.5	5B4LP	763,458
1.8	RA9AKM	44,460

AFRICA

AB	**ZS1CT**	**4,461,805**
28	ZS6BRZ	1,839,825
21	No Entry	
14	ED8ACH	1,339,338
7	No Entry	
3.5	EA8ZS	8,856
1.8	**EA9KF**	**264,100**

EUROPE

AB	**J41JG**	**1,667,576**
28	UA6LAX	315,288
21	**UB5MBP**	**2,524,860**
14	G3FXB	2,339,337
7	IO3MAU	1,767,048
3.5	UO5OAO	415,426
1.8	LZ2BE	261,504

NORTH AMERICA

AB	K2VV	3,383,466
28	**WA4EMA/KP2**	**1,213,632**
21	KP4EQF	2,152,296
14	HI3EMS	1,794,520
7	VE3BMV	2,827,440
3.5	VE3IY	721,392
1.8	VE3CDX	205,824

SOUTH AMERICA

AB	**K3ZO/HK3**	**5,064,329**
28	CE6EZ	5,437,936
21	**CX7BY**	**2,937,927**
14	CE3DPD	489,216
7	YV2IF	691,092
3.5	4M3AZC	1,158,132
1.8	YV5JEA	40,320

OCEANIA

AB	**VK2WU**	**5,928,934**
28	ZL1ANJ	1,271,872
21	DU1NH	549,612
14	**FO8JP**	**3,121,736**
7	**T32AF**	**2,991,352**
3.5	No Entry	
1.8	No Entry	

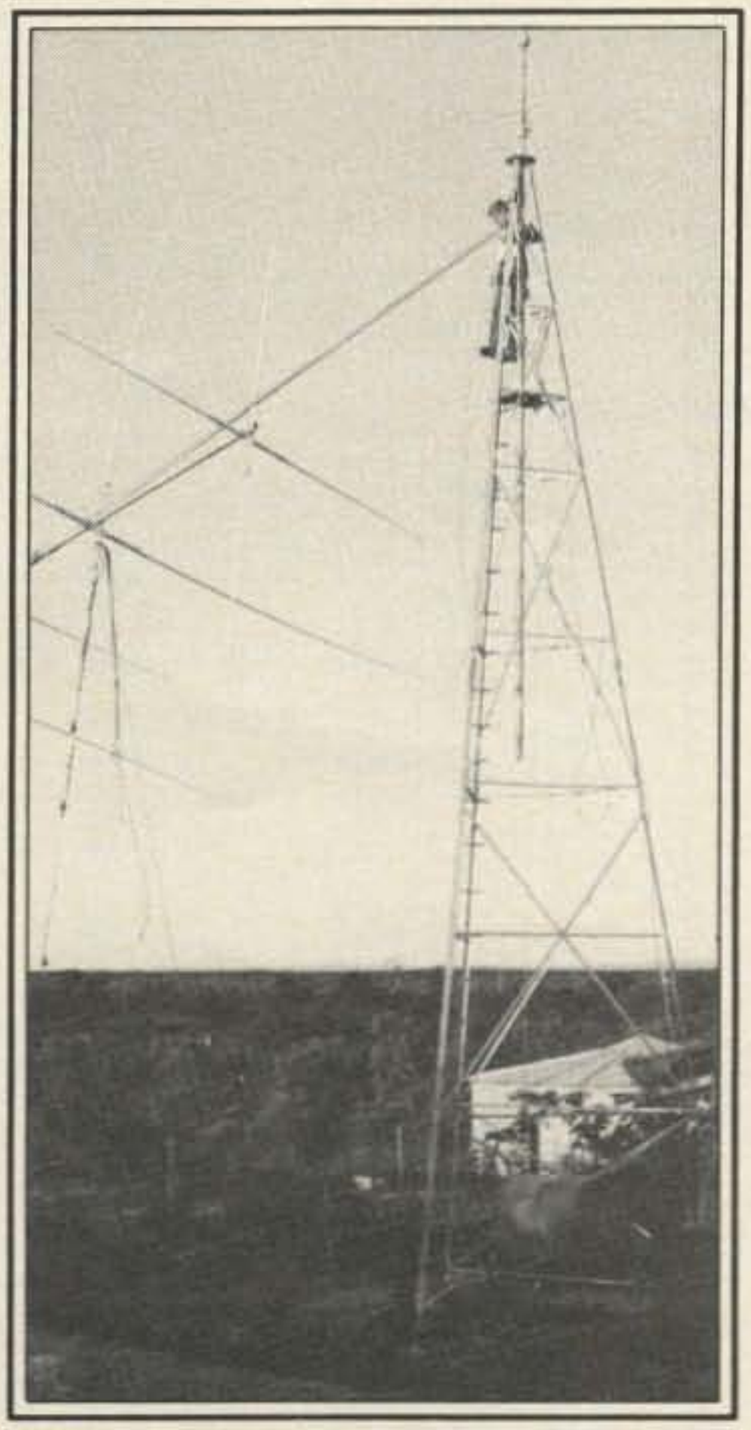
MULTI-SINGLE

AS	JG1ZUY	4,860,406
AF	5Z4RS	3,033,360
EU	IO5BGM	8,608,545
NA	NP4CC	8,249,885
SA	**ZZ5EG**	**14,758,625**
OC	KD7P/NH2	9,752,600

MULTI-MULTI

AS	JA9YBA	9,560,464
AF	No Entry	
EU	YZ1EXY	14,503,141
NA	**VP2EC**	**17,559,672**
SA	CE3AA	2,986,812
OC	KH6XX	11,117,556

European all-band leader Chris, SV1JG, gave many a new prefix with his special contest call, J41JG.



Raising the four-element quad at VK6DU (Down Under). On the tower is VK6NSD.

BAHAMAS

KG9N/C6A	A	431,055	710	279

BARBADOS

KA2ORK/8P6	14	292,575	596	235

CANADA

VE3LDT	A	997,512	712	467
VE6CHW	A	580,108	732	323
VE4CCC	A	536,200	628	350
VY1CW	A	530,865	815	251
VY1CC	"	447,990	631	274
VE7BSM	A	376,327	519	259
CK3CKR	"	335,342	412	238
VE4RP	"	276,640	403	247
CK3EZU	"	69,322	194	137
VE2FTU	A	68,976	199	144
VE2EW	"	36,620	115	102
VE5AFF	A	28,785	125	101
VE8XO	A	19,224	112	72
VE2WA/3	"	12,328	70	67
VO1AW	A	3,605	36	35
VE1YX	28	1,053,352	1316	373
VE3KKB	21	553,611	614	327
CK3FEA	"	325,314	479	279
VE2PD	21	45,994	145	122
VE4AKN	21	23,000	104	92
VE3EEW	14	1,288,050	1284	465
VE6BBP	14	534,750	819	310
VO1QU	14	429,590	576	323
VE7EJK	14	421,670	628	298
VE8DX	14	57,739	307	181
VE7EDA	"	49,724	160	124
VE2DRN	"	47,436	165	134
VE3BMV	7	2,827,440	1369	462
VO1CV	7	2,465,850	1232	425
VE3IY	3.5	721,392	710	266
CK3IPR	"	576,114	687	231
VE3CRG	"	128,874	227	141
		(Op: VE2ZP)		
VE7AO	3.5	60,802	141	101
VE1AIH	3.5	13,056	62	51
VE3CDX	1.8	205,824	397	134
VE3MFA	"	91,200	254	96
VE3BBN	"	28,520	122	62

COSTA RICA

TI5MRC	A	711,621	824	333
		(Op: VE3MR)		

CUBA

CO2HS	A	98,277	209	141

DOMINICAN REPUBLIC

HI8GB	A	807,666	810	454
HI8LC	28	403,155	631	279
HI3EMS	14	1,794,520	1695	475

GREENLAND

OX3ZM	A	16,800	80	75

HAITI

HH2WL	A	1,562,401	1636	439

MEXICO

XE1LLS	28	480,165	857	255

PUERTO RICO

KP4EQF	21	2,152,296	1793	537
		(Op: KP4HF)		
WP4AOH	14	1,477,952	1539	448

U.S. VIRGIN IS.

WA4EMA/KP2	28	1,213,632	1719	344

AFRICA

CANARY ISLANDS

ED8ACH	14	1,339,338	1042	429
EA8ZS	3.8	8,856	41	36

CUETA

EA9KF	1.8	264,100	322	139

DJIBOUTI

J28DM	28	467,082	678	231

MADEIRA ISLANDS

CT3DJ	A	7,222	53	46

SOUTH AFRICA

ZS1CT	A	4,461,805	2640	565
		(Op: DK3GI)		
ZS6WB	"	29,667	113	93
ZS6BRZ	28	1,839,825	1285	481
ZS6CDJ	28	1,402,984	1141	422

ASIA

CYPRUS

5B4MF	A	2,175,642	1955	434
5B4LP	3.5	763,458	578	222
5B4EP	1.8	12,720	56	40

HONG KONG

VS6JJ	A	48,895	239	127

ISRAEL

4Z4TR	21	1,055,774	1119	334
4X6DK	1.8	5,238	33	27

JAPAN

JH7DNO	A	2,247,000	1470	525
JA1YFG	A	2,121,872	1503	493
		(Op: JL1BLW)		
JA1YCL	A	1,386,896	1232	427
		(Op: JH8DUG)		
JF1SEK	"	1,163,670	1030	395
JA6BIF	"	432,250	592	266
JE6JVJ	"	381,615	542	247
JA6LDD	"	302,400	396	225
JF3CCN	"	220,662	411	207
JE3VXD	"	191,490	342	195
JR7OMD/2	"	154,400	350	175
JA4ESR	"	129,744	290	153
JM1WZP	"	114,003	247	159
JH7AJY	"	113,876	271	166
JL1CWS	"	100,674	254	153
JR3XEX	"	81,018	212	126
JA6CM	"	78,110	201	146
JA1ALX	"	60,852	162	132
JA1JGP	"	55,968	162	132
JH9CAV	"	54,756	180	117
JA6AKV	"	39,270	137	102
JP1TRJ	"	35,329	138	103
JA4HCK	"	30,912	140	84
JH8XUP	"	27,784	134	92
JA5EO	"	22,876	129	76
JA6PL	"	18,432	91	72
JG3NKP	"	16,560	84	72
JH1MTR	"	16,320	84	68
JE7GRW	"	13,790	90	70
JA5BBY/1	"	13,230	71	70
JH4WBY	"	10,004	83	61
JA1IT	"	7,728	57	48
JR8GFM	"	6,923	61	43
JA1AAV	"	5,734	51	47
JH1XIT	"	5,693	51	41
JG2VMN	"	5,670	61	35
JG6DIF	"	5,513	50	37
JA8EJO	"	4,978	47	38
JE1ARQ	"	4,182	45	34
JE7XNN	"	3,552	49	32
JG2OAJ	"	3,384	45	36
JH2XTV	"	3,072	33	32
JN1TEO	"	2,700	37	30
JE7OXJ	"	1,716	40	33
JH1FJK	"	1,134	22	21
JA8CJY	"	874	20	19
JE7FMW	"	585	17	15
JH2WHS	"	476	14	14
JE1TTO	"	464	16	15
JI2NQS	"	161	8	7
JK1LRH	"	40	4	4
JR1ZDJ	"	3	4	3
JH1RNZ	28	429,828	667	294
JF1EEK	28	193,698	383	211
JO1CRA	28	171,390	388	197
JA8TPE	"	157,212	366	198
JM1SMY	"	90,882	251	153
JA6EFT	"	53,824	190	116
JR7OEF	"	46,398	187	114
JA7ZWD	"	34,056	152	86
		(Op: JA7HQK)		
JA7NZE	"	30,855	149	85
JH1UUT	"	30,555	140	97
JA2MFF	"	30,129	133	83
JA1EEG	"	17,500	102	70
JA3BBG	"	15,662	111	82
JE3GAR	"	13,455	91	65
JA1AAT	"	11,984	79	56
JO1FCD	"	10,726	80	62
JR4WLV	"	9,434	82	53
JA1FO	"	8,694	78	46
JR8QMO	"	6,048	59	42
JE1PJR	"	5,198	59	46
JR8QMP	"	4,992	51	39
JA2EAB	"	4,958	53	37
JA4AQR	"	4,641	46	39
JR1OYL	"	4,370	47	38
JA3RBC	"	2,001	31	23
JR4UBQ	"	1,776	32	24
JQ1AML	"	858	30	26
JA1BNW	"	378	14	9
JJ3RDH	"	270	11	10
JO1MCC	"	184	9	8
JA2APA	21	2,418,710	1608	545
JR1WHW	21	1,556,256	1219	464
JH7LRS	21	1,263,494	1048	433
JA2YKA	"	1,254,662	1038	439
		(Op: JF2DQJ)		
JM1MGP	"	1,140,975	1027	461
JK1RJQ	"	466,032	558	336
JA2BNN	"	323,840	518	253
JI1QLB	"	165,640	301	205
JA7GYR	"	137,158	284	194
JA8UJY	"	107,743	248	163
JL1EJU	"	82,295	220	151
JA5YAN	"	79,577	210	151
JP1HDK	"	73,308	221	150
JL1KCO	"	47,400	165	120
JH8TDZ	"	47,355	151	123
JN1AJU	"	46,746	165	126
JR8SGE	"	26,700	123	89
JR7UOL	"	24,026	112	82
JH5IRT	"	23,970	120	85
JE7DOT	"	22,320	114	90
JA1MXY	"	13,715	87	65
JI2PBZ	"	12,864	92	64
JP1FZA	"	8,533	64	53
JG1WIC	"	7,261	60	53
JP1TVZ	"	4,800	45	40
JH1GIC	"	4,719	41	39
JF6DRR	"	4,305	50	41
JH6CMM	"	3,367	38	37
JA6QDU	"	2,093	31	23
JL1EJO	"	1,647	34	27
JF6TMH	"	1,232	33	28
JP1DPC	"	1,104	24	23
JA5EPE	"	1,083	21	19
JR3OGE/1	"	1,080	20	20
JE7SWJ	"	992	34	31
JA8JIM	"	954	21	18
JE6GIQ	"	954	20	18
JH8SGG	"	420	14	14
JP1TYX	"	341	11	11
JH8TUD	"	189	9	9
JR4HTB	"	135	9	9
JM1GPV	"	84	6	6
JH8TRP	14	887,682	853	394
JR6PGB	14	497,952	610	312
JH4UYB	"	471,530	602	305
JA7YCQ	"	133,224	291	182
		(Op: JR7MZC)		
JH1APK	"	70,984	187	152
JE1GZB	"	16,948	101	76
JA7RXU	"	7,755	63	55
JR1ZIT	"	2,610	35	30
		(Op: JH6NBW)		
JG1TIX	"	275	11	11
JA5BJC	7	771,064	566	281
JA2BAY	7	510,448	511	244
JA4AQR	"	520	10	10
JR6LDI	"	14,250	65	57
JR1DTN	"	8,970	46	39
JA2SAP/1	"	5,952	36	32
JA2AAQ	3.5	27,360	97	80

MONGOLIA

JT1BG	A	14,400	160	72

OGASAWARA ISLANDS

JD1BDB	21	20,724	304	66
		(Op: JI3DNR)		

WEST MALAYSIA

9M2DC	A	37,905	321	95

U.S.S.R.

ARMENIA

EZ6GAW	1.8	3,680	28	23

ASIATIC

UA9MR	A	1,516,320	1453	416
UW9WK	A	1,510,152	1413	356
UA9FAT	A	1,323,736	1117	337
UA9AED	"	683,359	800	277
UA9MQ	"	103,208	243	152
UA9YBY	"	61,920	175	96
UA9QAQ	"	16,832	94	64
UA9CSS	28	767,404	1174	326
RA9UAD	28	340,340	1430	238
UA9YHD	"	183,073	494	187
UA9XEQ	"	168,912	396	153
UA9NP	"	64,698	231	123
RA9YJP	"	56,000	211	125
UA9OBS	"	23,798	148	73
UA9URF	"	6,165	60	45
RA9COW	"	4,760	48	40
UA9CCI	21	1,186,328	1464	374
UW9CL	"	205,545	403	213
UA9XSQ	14	8,748	58	54
UA9OO	"	363	11	11
UA9YE	7	750,960	691	252
RA9AKM	1.8	44,460	155	57
RA9UDB	"	100	10	10
UA8SGJ	A	60,720	216	138
UA0CCW	"	2,304	22	18
UA8SMA	28	568,964	1279	268
UA0TO	"	474,715	853	263
UA0QEP	"	63,714	322	123
UA0LBM	"	10,030	71	59
UA0FEP	"	7,406	64	46
UA0SCP	21	816,930	1780	290
UA0ZCQ	"	120,448	781	128
UA0CDM	"	52,000	517	100
UA0ACG	"	29,058	127	87
UA0JEH	14	48,140	229	116
UA0XAK	"	43,734	186	111
UA0CFX	"	7,661	55	47
UK0CAG	"	3,780	58	36
		(Op: UA0CGN)		
UA0SLN	"	341	13	11
UA8FCL	7	34,416	229	72
UA8FOH	3.5	10,500	67	42

GEORGIA

RF6QAI	28	284,862	548	197
UF6FKK	14	41,006	150	101

KAZACH

UL7QF	A	1,658,652	1660	402
UL7EAJ	"	23,051	119	89
UL7PEI	28	83,266	350	158
UL7MAX	"	468	14	13
UL7LCW	3.5	63,840	159	76

KIRGHIZ

UM8MXF	21	220,320	423	204

TADZHIK

RJ8JCF	28	332,886	588	218
UJ8JKO	7	107,474	189	109

UZBEK

UI8LNC	28	360,732	860	276
UI8ZAA	3.5	29,650	109	50

EUROPE

ANDORRA

C31OF	A	59,052	200	133

AUSTRIA

OE3DSA	14	377,610	653	307

BALEARIC ISLANDS

EA6GP	A	91,656	292	171
EA6DE	"	68,886	242	129
EA6OA	21	81,951	338	177
EA6RZ	3.5	2,516	36	34

BELGIUM

ON4XG	A	139,104	346	207
ON4ADG	A	73,780	246	155
ON5CZ	"	52,138	205	131
ON5FV	21	28,923	148	93

BULGARIA

LZ1QV	A	1,126,586	1377	437
LZ2PP	A	1,105,605	1650	395
LZ1CW	"	45,080	154	92
LZ1KAU	"	41,500	200	100
		(Op: Ivatio)		
LZ2KRU	"	19,910	103	55
		(Op: Rosen)		
LZ1HY	"	11,284	80	62
LZ1BJ	"	7,395	68	51
LZ1ZN	21	283,529	520	281
LZ2TT	14	178,596	515	242
LZ1KWS	"	132,335	395	199
		(Op: LZ1L-69)		
LZ2BE	1.8	261,504	826	144

CRETE

SV8DC	21	86,856	278	168

CZECHOSLOVAKIA

OK3CSC	A	1,574,208	1490	432
OK1ARI	A	945,928	966	373
OK2BTI	A	876,880	1104	388
OK2RU	"	738,088	864	376
OK1AJN	"	288,097	504	251
OK3CRH	"	236,096	589	217
OK1BB	"	197,890	411	257
OK2BVE	"	176,204	466	196
OK1KZ	"	132,432	357	178
OK1EP	"	98,835	233	165
OK1DBM	"	95,400	270	159
OK3CNP	"	68,881	242	159
OK2PDE	"	37,060	137	109
OK1MIZ	"	34,578	180	113
OK2SPJ	"	32,373	132	99
OK1DMS/P	"	30,600	150	102
OK2BQL	"	12,600	76	63
OK2PBG	"	5,500	63	50
OK2ABU	"	4,800	47	40
OK1MHI	"	1,624	33	28
OK2TH	"	949	33	23
OK1AD	"	490	18	14
OK2SWD	"	375	15	15
OK2BHQ	28	6,160	52	40
OK3CKF	21	78,364	235	143
OK1ANS	"	48	4	4
OK1ALQ	14	67,050	234	149
OK3KV	"	17,710	168	77
OK1DIE	"	10,117	111	67
OK2PDC	"	6,498	104	57
OK2KNP	"	1,377	34	27
OK2BSA	"	846	19	18
OK1TN	7	866,112	947	347
OK1AZI	"	215,028	450	198
OK2SPS	"	182	16	14
OK2HI	3.5	89,518	316	143
OK1DLA	3.5	38,520	181	107
OK3KLJ	"	34,368	185	96
OK2BTC	"	14,204	106	67
OK3CTX	"	10,962	90	63
OK1MNV	"	2,220	38	30
OK2LN	"	880	23	20
OK3CQD	1.8	13,200	104	66
OK2QX	"	9,794	82	59
OK1DDS	"	5,184	54	48

DENMARK

OZ5EV	A	452,304	553	349
OZ8ME	A	89,976	400	163
OZ1FRR	"	47,355	171	123
OZ1ASP	"	26,790	151	94
OZ4NA	"	25,830	169	105
OZ4ZT	"	23,265	132	99
OZ1CFV	"	13,593	160	69
OZ1ACB	"	8,990	69	62
OZ6EI	"	8,432	88	68
OZ8IE	"	5,699	53	41
OZ1FFG	"	5,670	89	42
OZ1FKV	"	4,320	68	48
OZ6PP	"	351	14	13
OZ1DYI	14	460	23	20
OZ4MD	7	58,760	200	130
OZ1APA	"	5,952	61	48
OZ3ZK	3.5	15,052	107	71

ENGLAND

G4UPS	A	125,255	305	205
G2AJB	"	53,978	219	137
G3GUP	"	23,364	161	99
G3XWZ	21	400,862	612	274
G3NT	"	26,199	180	71
G3FXB	14	2,339,337	1802	533

FAROE ISLANDS

OY9R	A	924	24	22

FINLAND

OH2BJG	A	210,924	496	252
OH1BV	A	197,736	355	231
OH7NW	"	75,190	301	146
OH6PX	"	68,926	313	143
OH7EU	"	61,740	206	147
OH2BVE	"	51,888	221	138
OH2BYS	"	38,610	180	135
OH5MQ	"	37,120	191	116
OH1XX	"	32,395	115	95
OH2BFS	"	11,175	99	75
OH3BU	"	27	3	3
OH1TD	28	15,168	86	64
OH7YF	"	5,336	55	46
OH6AM	21	2,226,884	1884	484
		(Op: OH6LK)		
OH1AB	21	535,188	708	309
		(Op: OH1HS)		
OH2HE	"	505,833	782	309
OH3EB	"	37,048	213	88
OH2BUU	"	25,620	176	105
OH2BYX	"	12,480	85	78
OH7KA	"	7,169	73	67
OH2KI	"	1,102	20	19
OH1PY	"	75	5	5
OH1AF	14	1,322,288	1440	484
		(Op: OH1EH)		
OH3RF	"	710,800	978	400
OH4PW	"	64,183	285	173
OH1RY	7	1,043,088	1090	372

FRANCE

F6FMT	A	408,575	629	295
F6AOJ	A	323,023	431	317
F6EBN	"	281,247	528	241
F6ENT	"	47,376	160	141
FE8TM	"	28,080	146	104
F6GDK	"	25,048	150	101
F6EWX	"	22,019	130	97
F6ENV	"	4,559	60	47
F6BVB	28	18,796	124	74

GERMANY (FRG)

DA2ER	A	1,333,536	1182	479
DJ8BA	A	633,969	714	347
DF7NJ	"	545,266	871	337
DL3NBL	"	248,645	559	223
DL8AAE	"	190,483	407	239
DK1FW	"	187,480	350	215
DK5DS	"	166,740	353	210
DL1BBO	"	132,012	331	193
DL1EK	"	65,808	212	144
DL1AM	"	64,963	169	167
DL4LAX	"	56,090	257	142
DF2RG	"	20,610	111	90
DJ2YE	"	13,114	86	83
DL7FR	"	1,876	30	28
DL6RAI	28	165,612	340	222
DF8XC	21	1,097,341	1096	413
DL8PC	14	1,357,065	1241	477
DL8OH	7	221,774	441	217
DL8MBS	3.5	104,940	338	159

GERMANY (GDR)

Y22JJ	A	554,648	727	356
Y32KE	A	547,740	808	340
Y54UA	A	434,000	620	310
Y47ON	"	291,048	610	268
Y38YK	"	283,880	638	235
Y78VL	"	215,775	477	225

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Y36UE	"	209,076	491	228
Y37UF	"	185,419	537	221
Y53XF	"	172,949	418	217
Y42QO	"	149,532	421	204
Y48ZA	"	139,876	437	187
Y75XH	"	132,240	407	190
Y38YE	"	128,700	308	225
Y24SK	"	124,542	360	187
Y54TA	"	109,062	310	166
Y36YM	"	96,840	280	180
Y47VN	"	95,904	319	162
Y34XF	"	80,352	287	162
Y49XN	"	65,888	279	142
Y35TB	"	46,068	183	132
Y24LE	"	42,586	171	107
Y22HF	"	39,960	158	111
Y37XJ	"	35,496	150	102
Y31LO	"	33,598	185	107
Y32ZF	"	30,674	163	98
Y43RO	"	29,890	154	98
Y54ZI	"	29,294	150	97
Y38TI	"	28,611	156	99
Y67ZG	"	24,672	131	96
Y45SA	"	23,700	135	100
Y41YN	"	23,064	140	93
Y39JA	"	20,768	136	88
Y45PA	"	18,490	121	86
Y24NG	"	16,590	93	79
Y23DG	"	16,008	90	69
Y38WI	"	15,048	109	76
Y59ZF	"	11,315	100	73
Y31ZE	"	9,982	74	62
Y26KO	"	9,408	107	64
Y32PI	"	8,723	91	61
Y56ZA	"	8,640	91	54
Y57SO	"	6,850	63	50
Y24DF	"	6,758	80	62
Y33TA	"	6,708	60	52
Y49RF	"	6,642	70	54
Y47YM	"	6,204	55	44
Y35UB	"	5,733	60	49
Y25BL	"	5,358	49	38
Y23LG	"	5,336	53	46
Y47PF	"	4,576	74	44
Y57ZL	"	2,759	40	31
Y22XO	"	2,607	35	33
Y38ZB	"	2,590	37	35
Y44WA	"	2,142	38	34
Y27GL	"	2,088	31	29
Y21XC	"	2,079	35	27
Y57RH	"	1,536	28	24
Y45VJ	"	1,134	28	27
Y47SF	"	1,092	24	21
Y23FK	"	990	20	18
Y33VL	"	690	16	15
V53VL	"	612	21	18
Y75YL	"	612	22	18
Y44TN	"	585	18	15
Y69VG	"	476	21	17
Y51XG	"	476	14	14
Y21HB	"	308	12	11
Y36WN	"	280	12	10
Y32ZN	"	60	7	6
Y41YM	"	42	7	7
Y23TL	"	30	5	5
Y33UJ	**28**	**10,704**	**95**	**48**
Y22YE	"	6,321	55	43
Y37RL	"	5,461	48	43
Y21WM	"	4,692	57	34
Y62XG	"	901	20	17
Y43SO	"	78	6	6
Y23ZE/A	"	6	2	2
Y37ZE	**21**	**35,934**	**152**	**106**
Y87XL	"	25,017	126	93
Y64YG	"	14,070	85	70
Y26TL	"	9,512	89	58
Y51TG	"	4,484	46	38
Y24IF/P	"	319	11	11
Y54WO	"	310	11	10
Y21HF/A	"	140	10	10
Y31SG	"	135	9	9
Y48ZF	"	48	4	4
Y25HL	**14**	**71,048**	**250**	**166**
Y51YJ	**14**	**50,141**	**251**	**133**
Y26KN	"	44,352	220	132
Y51ZE	"	23,782	142	94
Y55XG	"	8,760	88	73
Y22BK	"	6,426	60	54
Y22BC	"	833	17	17
Y31RB	"	770	25	22
Y21IC	"	396	12	11
Y22YJ	"	286	12	11
Y23UJ	"	48	4	4
Y24JJ	"	21	3	3
Y22WF	**7**	**154,290**	**412**	**185**
Y54VA	"	51,788	207	107
Y37WO	"	19,656	122	78
Y2200	"	19,352	130	82
Y21QH/A	"	180	10	9
Y56YF	**3.5**	**368,220**	**719**	**255**
Y57WJ	**3.5**	**217,000**	**459**	**217**
Y320C	"	156,364	453	194
Y24YH	"	21,750	145	87
Y26VM	"	13,800	108	75
Y23XF	"	4,312	58	44
Y25MG	"	1,296	18	18
Y22TO	**1.8**	**1,426**	**27**	**23**

GREECE

J41JG	**A**	**1,667,576**	**2065**	**472**
J41IT	**28**	**41,262**	**225**	**69**

HUNGARY

HA8UB	**A**	**718,002**	**1022**	**339**
HA5KDB	**A**	**677,236**	**1000**	**361**
		(Op: Csaba)		
HA8IT	"	411,720	768	292
HA8ZO	"	164,410	353	205
HA3NU	"	66,240	288	138
HA4XG	"	13,930	96	70
HA5FA	"	11,832	85	68
HA7PW	"	9,100	65	50
HA5KKN	**28**	**115,784**	**326**	**164**
		(Op: HA500)		
HA8KAX	"	100,734	250	163
		(Op: J. Devenyi)		
HG5AAP	"	35,625	148	95
HA2PP	"	884	33	26
HA5XW	**7**	**206,226**	**490**	**201**
HA8IE	**3.5**	**356,174**	**680**	**247**

ICELAND

KD5YG/TF	**A**	**84,728**	**252**	**189**

IRELAND

EI4DW	**A**	**191,733**	**465**	**237**

ISLE OF MAN

GD4GWO	**A**	**80,012**	**324**	**166**

ITALY

I6NOA	**A**	**924,140**	**941**	**410**
I02MQP	**A**	**209,312**	**451**	**248**
I6IQU	"	148,302	365	214
I2VXJ	**28**	**161,400**	**362**	**200**
I4CSP	**21**	**98,629**	**235**	**179**
DL3ME/IN3	"	9,912	95	56
I08KPV	**14**	**574,740**	**882**	**372**
I03MAU	**7**	**1,767,048**	**1121**	**426**
I5FCK	"	765,906	852	321
IN3DYG	**1.8**	**88,608**	**302**	**142**
I5MXX	"	65,016	258	129

JERSEY IS.

GJ5AGA	**A**	**86,912**	**278**	**194**
		(Op: K4II)		

LUXEMBOURG

LX1RQ	**A**	**27,522**	**176**	**99**

THE NETHERLANDS

PA0ZH	**A**	**516,710**	**761**	**326**
PA0LIE	**A**	**58,236**	**232**	**138**
PA0KDM	"	37,296	174	111
PA3CNY	"	9,660	84	70
PA3AFF	"	4,950	58	45
PA0WNB	**28**	**7,548**	**69**	**51**
PA3CEF	**21**	**765,135**	**804**	**347**
PA0QX	**14**	**84,564**	**307**	**162**

NORWAY

LA4O	**A**	**553,946**	**928**	**346**
		(Op: LA9HW)		
LA3KBA	**A**	**156,456**	**428**	**212**
LA6UL	"	151,648	404	224
LA9SN	"	128,128	313	208
LA7NDA	"	77,686	336	179
LA3JAA	"	65,411	222	149
LA0DY	"	59,631	223	143
LA4FA	"	6,248	56	44
LA2AD	"	4,074	43	42
LA5BS	"	3,100	36	31
LA5XAA	"	520	14	13
LA5TBA	"	210	10	10
LA9DI	**21**	**53,055**	**163**	**135**
LA2IZ	"	17,404	120	76
LA7SI	"	943	25	23
LF7R	**14**	**168,642**	**502**	**243**
		(Op: LA1HCA)		
LA7ZCA	"	2,728	49	31
LA4HW	**7**	**48,488**	**175**	**116**
LF7R	"	23,814	147	81
		(Op: LA1QDA)		
LA2GN	"	1,392	29	24
LA9PT	**3.5**	**57,792**	**225**	**129**
LA5QK	"	28,000	141	100

POLAND

SP7KTF	**A**	**316,275**	**674**	**264**
		(Op: SP7LIH)		
SP1FPG	**A**	**199,368**	**444**	**234**
SP7AWA	"	157,685	327	235
SP6CZ	"	155,445	305	241
SP3XR/3	"	123,888	255	178
SP6DVP	"	121,444	270	194
SP1LOP	"	97,788	291	174
SP3HZG	"	42,720	176	120
SP7FQI	"	38,918	182	122
SP6JKH	"	34,600	195	100
SP3IOE	"	34,556	167	106
SP9BBH	"	34,008	184	104
SP9AKD	"	23,402	139	81
SP9PRO	"	23,392	142	86
		(Op: SP9LJD)		
SP1DMD	"	21,465	134	81
SP6JIR	"	7,350	96	49
SP3COP	"	7,280	57	52
SP5LKE	"	6,742	57	49
SP5LCG	"	2,178	37	33
SP4DC	"	560	14	14
SP9CTW	**28**	**35,776**	**141**	**104**
SP9HWN	**28**	**32,777**	**155**	**73**
SP9MQH	"	21,175	111	77
SP2FAP	"	14,848	88	64
SP7IIT	"	3,104	35	32
SP6CYV	"	2,756	39	26
SP9BQF	"	1,909	29	23
SP2UUU	"	1,638	26	21
SP5CBA	"	1,575	29	21
SP4DGN	"	270	11	10
SP5ENA	"	75	5	5
SP3JHY	**21**	**18,318**	**106**	**71**
SP5XD	"	13,926	91	66
SP9DWT	"	10,553	75	61
SP7DZA	"	1,650	26	25
SP9AVZ	**14**	**14,596**	**129**	**82**
SP1CHV	"	5,633	91	43
SP9EML	"	1,000	20	20
SP9CLO	"	682	27	22
SP6GF	**7**	**124,772**	**331**	**169**
SP4GFG	"	**144**	**9**	**9**
SP3IBS	**3.5**	**410,704**	**676**	**266**
SP6CDK	**3.5**	**92,272**	**327**	**146**
SP9MQO	"	52,800	244	120
SP4CUF	"	33,990	174	103
SP9HZF	"	28,830	174	93
SP7CKF	"	12,222	107	63
SP1MHS	"	1,716	33	33
SP8DYY	"	1,716	33	26
SP7MTH	"	1,450	29	25
SP2FAS	"	924	22	22
SP5INQ	**1.8**	**42,824**	**182**	**106**
SP3AGE	"	26,040	147	84

PORTUGAL

CQ6UA	**A**	**1,491,658**	**1264**	**491**
		(Op: CT1UA)		
CU6AHU	"	40,194	156	126
		(Op: CT1AHU)		
CT1VY	"	21,084	98	84
CT1AV	**28**	**61,028**	**170**	**146**
CT1UO	**21**	**1,496**	**34**	**22**
CT1CHF	**14**	**41,038**	**213**	**142**
CT1FL	**3.5**	**17,728**	**81**	**64**

ROMANIA

YO3CD	**A**	**436,711**	**721**	**319**
YO4BXX	**A**	**434,700**	**772**	**315**
YO2BEH	"	224,301	554	231
YO2ARV	"	158,424	470	184
YO9CBZ	"	117,980	416	170
YO8BSE	"	66,712	328	157
YO2BTW	"	64,251	317	121
YO6AVB	"	53,730	230	135
YO5ANN	"	40,020	186	116
YO2CJ	"	10,915	79	59
YO4DCF	"	10,374	87	57
YO9AHX	"	10,100	90	65
YO4ATW	"	336	14	14
YO6KEA	**28**	**69,068**	**210**	**124**
		(Op: YO6AWR)		
YO9KIG	"	5,661	53	37
		(Op: YO9AFY)		
YO5AAT	"	1,206	25	18
YO7APA	"	1,200	24	20
YO2AQB	"	420	14	12
YO9HT	**21**	**61,614**	**242**	**126**
YO9CUF/3	**7**	**21,962**	**134**	**79**
YO6KNX	**3.5**	**44,352**	**215**	**112**
		(Op: YO6BUR)		
YO2DFA	**3.5**	**26,680**	**151**	**92**
YO6CRP	"	21,222	141	81
YO8CIY	"	16,920	110	90
YO5BRZ	"	15,400	122	70
YO6BQT	"	14,766	112	69
YO2BZV	"	11,446	96	59
YO6BZH	"	7,446	78	51
YO2CRW	"	3,400	50	34

SARDINIA ISLAND

IS0AEQ	**21**	**501,904**	**714**	**304**

SCOTLAND

GM4RFE	**A**	**190,800**	**500**	**225**

SHETLAND ISLANDS

GM4GPN	**A**	**295,331**	**602**	**281**

SICILIY

IT9BBD	**28**	**17,110**	**137**	**59**

SPAIN

EA2IA	**A**	**190,986**	**423**	**229**
EA1AWW	**A**	**171,488**	**397**	**233**
EA1CVY	"	117,369	344	207
EA3NU	"	110,340	296	180
EA3EEY	"	72,576	244	162
EA5RCH	"	56,581	201	137
		(Op: EA5EQL)		
EA5JC	"	55,104	220	123
EA2CR	"	43,608	180	138
EA3EGI	"	29,916	172	108
EA2ABJ	"	27,528	155	111
EC4BIR	"	18,308	128	92
EA5AEN	"	10,434	97	74
EA5DFO	"	9,240	73	66
EA5CIT	"	7,597	80	71
EA5BMF	"	3,150	42	35
EA3CXV	"	760	20	20
EA2OJ	"	40	4	4
EA5DVL	**28**	**5,160**	**54**	**43**
EA3DMP	"	6,063	64	47
EA3ELZ	"	3,808	81	34
EA3DXD	"	940	37	20
EA3CUD	"	75	5	5
EA1BCK	**21**	**81,144**	**256**	**161**
EC4BSI	**21**	**21,944**	**178**	**104**
EA3ENE	"	17,510	102	85
EA1CIM	"	15,225	103	87
EA4BKE	"	13,035	80	79
EC5BLF	"	12,410	120	85
EC2AFP	"	1,334	33	29
EC3BPO	"	432	16	16
EC7CST	"	153	17	9
EA7EHE	"	**17,576**	**137**	**104**
EA3EOC	"	2,240	36	32
EA3BWX	"	260	14	13

SVALBARD ISLAND

JW5NM	**A**	**231,894**	**754**	**234**

SWEDEN

SK3AH	**A**	**203,211**	**410**	**201**
		(Op: SM3COL)		
SM0BDS	**A**	**30,495**	**127**	**107**
SM5AWR	"	19,006	130	86
SM0KNV	"	15,552	95	81
SM5CSS	"	4,788	44	38
SM6JY	"	3,230	59	38
SM6MSG	"	720	18	16
SM0MC	"	207	9	9
SM6LIF	**28**	**17,710**	**94**	**70**
SM0MLL	**28**	**12,276**	**86**	**62**
SM5BDV	"	7,395	63	51
SM5DYC	"	5,616	63	39
SM2OTU	"	3,648	50	32
SM0FM	"	1,992	31	24
SM5NWX	"	1,533	31	21
SM6IJF	"	1,311	30	19
SM2NTU	"	663	19	17
SM6HQK	**21**	**31,672**	**148**	**107**
SM7TV	"	10,836	83	63
SM2EKM	**14**	**1,913,457**	**1760**	**559**
SM2CEW	**14**	**1,454,227**	**1498**	**529**
SM3LIV	"	41,839	253	139
SM6LPF	"	15,470	154	91
SM6BGG	**7**	**116,820**	**258**	**165**
SM6BJI	**3.5**	**71,556**	**254**	**134**

SWITZERLAND

HB9AAA	**A**	**162,180**	**300**	**212**

WALES

GW4BKG	**21**	**538,798**	**682**	**299**

YUGOSLAVIA

YU2OB	**A**	**326,772**	**508**	**313**
YU7SF	**A**	**91,040**	**277**	**160**
YU3SB	"	85,936	269	164
YU3HA	"	83,611	210	121
YU8DX	"	75,208	292	158
YU5RK	"	16,192	117	92
YT3L	**21**	**1,174,529**	**1097**	**401**
		(Op: YU3WE)		
YU3C	**21**	**971,931**	**956**	**381**
		(Op: YU3GO)		
YU5XTC	"	112,179	304	183
YU1PJQ/4	"	5,405	72	47
YT3M	**14**	**1,731,957**	**1559**	**501**
		(Op: YU3ZO)		
YU4EBL	**14**	**1,263,210**	**1276**	**474**
		(Op: Branka)		
YU3TW	"	7,493	100	59
YU7AD	**7**	**1,582,098**	**1032**	**417**
YU3DCR	**3.5**	**197,800**	**467**	**200**
		(Op: YU3IX)		
YU3EF	**1.8**	**106,568**	**325**	**154**

U.S.S.R. EUROPEAN

UA3DRB	**A**	**423,054**	**590**	**342**
UV3DN	**A**	**313,117**	**725**	**288**
UA6LCN	**A**	**278,460**	**504**	**221**
UA3AAH	"	275,187	582	269
UA3DQS	"	273,257	537	263
UA3TN	"	250,955	480	265
UW6LC	"	125,775	346	195
UW1BM	"	117,360	387	180
UA1QCM	"	111,925	436	185
UA6AKT	"	89,324	250	163
UA1WBL	"	53,070	179	122
UA3GAZ	"	50,112	220	144
UK1ADR	"	46,053	305	119
		(Op: UA1-160-1052)		
UA3DUA	"	45,195	151	131
UA6HKN	"	38,556	176	108
UA4DD	"	37,922	175	134
UA3AQR	"	33,674	159	113
UA3PBY	"	33,136	173	109
UW4NN	"	29,440	138	115
UA3AHA	"	16,598	96	86
UA6HAC	"	16,182	123	87
UK6AJN	"	11,323	89	67
		(Op: RA6AMH)		
UW3DZ	"	10,614	79	61
UA6XCU	"	9,009	68	63
UA3ARI	"	7,980	97	42
UA3OQF	"	5,700	53	38
UA3AMV	"	4,140	53	46
UA3QHZ	"	4,028	53	38
UA6AJG	"	3,654	38	36
UA3DRT	"	1,280	25	20
UA3VEF	"	924	22	22
UA6LAX	**28**	**315,288**	**598**	**232**
UA6LZQ	**28**	**203,626**	**522**	**226**
UA6LDX	**28**	**198,235**	**492**	**205**
UA3ZDN	"	197,400	471	200
UA6PCE	"	165,393	396	207
UA6HHF	"	100,782	359	198
UA6AJF	"	94,792	348	164
UA4CDL	"	74,576	252	158
UA6ABM	"	66,080	219	118
UA3TAG	"	64,512	249	144
UA3GBY	"	54,054	188	126
RA3DAD	"	33,915	154	105
RA3DDU	"	18,282	98	66
UA3TES	"	18,040	116	82
UA3TGO	"	17,280	112	80
UA3AGW	"	15,480	90	72
RA1AEG	"	8,775	82	65
UA6LJE	"	8,062	71	58
UA6LTA	"	5,610	61	51
RA6AJI	"	5,166	54	41
UA3TFO	"	3,900	46	39
UA3XBB	"	2,442	42	33
UA3XDF	"	1,988	35	28
UA3DNV	"	1,647	34	27
UA6ALV	"	1,600	30	25
UA6LMT	"	546	14	13
UA3AMB	**21**	**1,350,900**	**1377**	**395**
UA3ECF	**21**	**660,330**	**967**	**290**
UA4AHT	"	405,080	731	328
UA1AWO	"	364,623	609	291
UV3MM	"	20,493	151	81
UW1AE	**14**	**231,840**	**561**	**288**
UA1AET	"	63,840	274	168
UV3TQ	"	30,956	166	109
UA3QBC	"	3,402	53	42
UA4ACA	"	2,016	30	28
UA4WBJ	"	651	23	21
UA4FDE	**7**	**486**	**22**	**18**
UA4PMK	**3.5**	**124,068**	**316**	**147**
UA4UBC	"	14,732	107	58
UA3GGQ	"	378	9	9
UA4CGZ	**1.8**	**4,148**	**53**	**34**
EZ3AEB	"	2,958	53	29

BYELORUSSIA

UC2IDC	**A**	**165,038**	**415**	**179**
UC2CFA	"	16,478	97	77
UC2LBE	"	1,562	28	22
UK2AAP	"	1,508	30	26
		(Op: Max)		
UC2WBL	**28**	**5,720**	**52**	**44**
UC2OBP	**21**	**105,957**	**343**	**183**
UC2LBK	**14**	**12,480**	**100**	**78**
UC2OBZ	"	7,392	64	56
UC2AFZ	**3.5**	**31,816**	**176**	**82**

ESTONIA

UR2RNG	**28**	**3,040**	**41**	**32**
UR2TBG	**21**	**507,164**	**763**	**307**
UR2OI	"	260	10	10
UK2TAF	**14**	**4,980**	**80**	**60**
				(Op: Juri)
UR2RHF	**7**	**58,464**	**206**	**126**
UR2ROA	**1.8**	**4,816**	**56**	**43**

KALININGRAD

UA2EC	**A**	**405,756**	**700**	**289**
UA2FFC	**14**	**217,113**	**570**	**247**

KARELIAN

UA1NBR	**28**	**3,224**	**69**	**52**
UA1NBF	**7**	**123,066**	**351**	**159**

LATVIA

UQ2GCN	**21**	**95,370**	**301**	**170**
UQ2GFN	**7**	**635,400**	**861**	**300**
UQ2GCW	**3.5**	**15,500**	**118**	**62**
UQ2GMR	"	10,400	104	50
RQ2GHU	**1.8**	**6,120**	**71**	**40**

LITHUANIA

UP2BEX	**A**	**729,444**	**1044**	**356**
UP2NK	**A**	**592,245**	**826**	**321**
UP2PBW	"	559,629	843	329
UP2BBF	"	496,440	968	280
UP2BDX	"	49,257	221	117
UP2PCK	"	36,396	194	108
UP2BKZ	"	1,748	28	23
UP2DM	**28**	**39,984**	**154**	**102**
UP2BNR	"	31,155	133	93
UP2PBZ	**21**	**45,008**	**187**	**116**
UP2ND	"	38,870	182	115
UP2BCG	"	22,246	120	98
UP2OU	**14**	**130,935**	**438**	**215**
UP2BCD	"	68,708	255	178
UP2PAW	"	21,939	153	103
UP2BZ	**7**	**33,904**	**149**	**104**
UP2BHI	"	14,016	92	73
UP2BCR	**3.5**	**245,068**	**579**	**197**

UP2DQ	"	2,400	36	30
UP2BLF	1.8	60	6	6

MOLDAVIA

UO5OWN	**A**	**45,339**	**215**	**119**
UO5OHH	**21**	**30,992**	**160**	**104**
UO5OCL	**14**	**43,806**	**226**	**147**
UO5OAO	**3.5**	**415,426**	**721**	**253**

UKRAINE

UB5VAZ	**A**	**900,726**	**1311**	**366**
UB5MAA	**A**	**518,340**	**855**	**326**
UB5NQ	"	498,624	828	318
UT5RY	"	457,776	837	306
UB5ICS	"	307,980	631	290
UY5TE	"	214,120	570	212
UB5JFX	"	194,922	460	238
UB5IIQ	"	147,320	324	232
UB5MLP	"	126,911	335	179
UB5IET	"	123,120	307	162
UB5UKO	"	109,163	268	173
UB5IHR	"	67,541	231	137
UT5BP	"	27,819	133	99
UB5GBC	"	21,804	103	79
UB5IMO	"	21,296	111	88
UB5VCK	"	18,920	106	86
UY5PC	"	15,330	92	73
UB5UKW	"	11,592	70	56
UB5UBI	"	7,215	84	65
UB5MMR	**28**	**200,508**	**434**	**196**
UB5MGV	"	48,564	195	114
RB5CDD	"	8,855	72	55
UB5RCA	"	6,120	63	40
UB5QMK	"	4,840	53	40
UB5ILZ	"	220	12	10
UB5MBP	**21**	**2,524,860**	**2121**	**507**
UB5IJK	**21**	**2,200,152**	**1990**	**500**
UB5ITU	"	364,284	638	249
UT5GM	"	81,326	230	157
UB5QBG	"	40,828	150	118
UB5MFR	"	15,228	117	81
UB5UGO	"	10,624	76	64
UB5EAU	"	4,048	47	44
UB5YDX	"	2,574	45	39
UY5VA	**14**	**1,362,309**	**1747**	**507**
UB5UCF	"	224,076	591	263
UB5HAF	"	7,672	69	56
UB5MNO	**7**	**211,200**	**400**	**192**
UB5IPJ	"	91,872	296	144
UB5EEP	**3.5**	**1,800**	**36**	**25**
UB5UHF	**1.8**	**17,750**	**121**	**71**
EY5IHH	"	75	6	5
UT5YQ	"	40	5	5

OCEANIA

AUSTRALIA

VK2WU	**A**	**5,928,934**	**3134**	**638**
VK2APK	"	733,200	738	312
VK2BQS	"	255,873	445	201
VK1LF	**A**	**2,759**	**33**	**31**
VK3BY	**28**	**324,891**	**589**	**191**
VK1SR	**28**	**135,767**	**345**	**137**
VK4KWO	**21**	**40,800**	**148**	**96**
VK2AYK	**14**	**331,016**	**446**	**257**
VK3SM	**14**	**70,704**	**176**	**144**

FRENCH POLYNESIA

FO8IW	**A**	**318,365**	**536**	**205**
FO8JP	**14**	**3,121,736**	**2207**	**488**

GUAM

KG6DX	**A**	**3,399,936**	**2528**	**456**

KIRIBATI

T32AF	**7**	**2,991,352**	**1414**	**364**

NEW ZEALAND

ZL1IM	**A**	**130,720**	**294**	**160**
ZL1ANJ	**28**	**1,271,872**	**1333**	**334**
ZL8AAJ	**14**	**934,912**	**911**	**352**
				(Op: K7OX)
ZL4BO	**7**	**835,354**	**603**	**247**

PHILIPPINES

DU1NH	**21**	**549,612**	**976**	**189**
K1BAZ/DU1	**14**	**46,512**	**171**	**102**

SOUTH AMERICA

ARGENTINA

LU8DQ	**A**	**4,878,418**	**2654**	**626**
				(Op: LU6ETB)
LU1BR	**A**	**4,253,256**	**2375**	**609**
LU4DM	**28**	**2,788,524**	**1818**	**522**
LU2HAO	**28**	**1,557,626**	**1257**	**434**
LU1VK	"	602,000	689	301
LU1MBB	**14**	**245,520**	**389**	**220**
LU8ESU	"	233,244	350	228

BOLIVIA

CP5MP	**21**	**143,370**	**280**	**177**

BRAZIL

PP2ZDD	**A**	**3,186,531**	**2023**	**531**
PY2WE	**A**	**592,350**	**638**	**330**
PT7AUI	"	310,973	415	247
ZY6AAZ	"	165,400	501	200
ZY6FH	"	129,258	281	167
PY2RLQ	"	124,184	258	172
PT2TF	"	58,080	164	132
PY2RE/4	"	55,629	180	137
PY1OL	"	23,715	106	85
ZY6ABZ	"	15,675	80	75
PY6ACP	"	364	14	14
PY5BAB	**28**	**2,557,632**	**1648**	**528**
ZY5IW	**28**	**1,746,936**	**1322**	**456**
ZY2FZ	**28**	**1,675,800**	**1295**	**441**
PY1TIA	"	28,227	124	97
ZY5NW	**21**	**1,014,232**	**910**	**388**
ZY5AAT	"	579,740	703	287
PY3BC	**14**	**23,318**	**99**	**89**
PY1VT	"	19,950	104	75
ZY3ZZ	**7**	**49,278**	**114**	**86**

CHILE

CE3DNP	**A**	**2,450,085**	**1595**	**465**
CE4EBJ	**A**	**874,500**	**914**	**330**
CE3BYL	"	495,045	613	285
CE4BQO	"	413,007	520	277
CE4ETZ	"	98,425	233	155
CE3AEZ	"	1,512	26	24
CE6EZ	**28**	**5,437,936**	**2852**	**644**
CE3DKZ	**28**	**1,028,435**	**1036**	**355**
CE3ZI	"	822,690	856	330
CE3DPD	**14**	**489,216**	**600**	**294**
CE6DFY	"	105,270	227	165
CE1DOF	"	43,890	146	114
CE6DBI	**7**	**56,454**	**158**	**97**

COLOMBIA

K3ZO/HK3	**A**	**5,064,329**	**2782**	**577**
HK1FQM	"	299,892	493	201
HK3DMC	**21**	**210,630**	**342**	**210**

EASTER ISLAND

CE8AE	**A**	**937,066**	**1049**	**299**

ECUADOR

HD1OT	**21**	**283,210**	**389**	**254**

NETHERLAND ANTILLES

P42J	**21**	**2,318,754**	**1761**	**446**
				(Op: W1BIH)

PARAGUAY

ZP5JCY	**A**	**850,509**	**844**	**363**
ZP5LOB	21	752	17	16

URUGUAY

CX2VC	A	78	6	6
CX7BY	**21**	**2,937,927**	**1865**	**537**
CX8BBO	"	18	3	3

VENEZUELA

YV7QP	**28**	**602,112**	**700**	**294**
YV6BTF	**21**	**18,144**	**98**	**72**
YV2IF	**7**	**691,092**	**503**	**237**
4M3AZC	**3.8**	**1,158,132**	**635**	**309**
YV5JEA	**1.8**	**40,320**	**110**	**63**

MULTI-OPERATOR SINGLE TRANSMITTER

UNITED STATES

N5AU	**6,301,977**	**2918**	**759**
N4WW	**5,812,138**	**2758**	**817**
W7RM	**5,800,090**	**3132**	**635**
KW8N	**3,222,590**	**2142**	**665**
AK6A	**2,690,345**	**1843**	**553**
NO4J	2,528,838	2063	642
KY8S	**2,451,780**	**1918**	**530**
KY2P	**2,159,343**	**1664**	**603**
KI2P	1,915,254	1660	561
KZ2E	1,545,914	1287	526
KS9O	**1,425,960**	**1293**	**510**
KX9G	1,147,740	1239	517
W8HBH	1,123,375	1077	473
WD9INF/8	936,067	953	473
KE9Y	892,184	1038	487
KD8AX	747,340	990	430
KG7Z/8	527,520	976	420
W3KWH	**387,374**	**532**	**317**
WD8QDQ	270,712	448	274
KA7KDU	263,410	416	265
KJ8G	192,226	391	223
KD5RW	136,735	338	205
NV4G	132,020	341	230
KA2NDX/1	**128,753**	**300**	**199**
KW2D	53,720	194	158
NC6M	45,752	212	152
NE2W	24,860	152	113

NORTH AMERICA

NP4CC	**8,249,885**	**4501**	**755**
VE6OU	**4,376,820**	**2776**	**613**
CK3UOT	**3,280,662**	**1898**	**594**
VE5ADA	**2,145,436**	**1664**	**514**
VE7UBC	**1,955,898**	**1640**	**399**

AFRICA

5Z4RS	**3,033,360**	**1933**	**528**
ZS6YO	**1,989,150**	**1488**	**447**

ASIA

JG1ZUY	**4,860,406**	**2598**	**673**
JA9ZKE	**4,351,914**	**2473**	**609**
JH3YJM	3,266,673	2043	573
HZ1AB	**2,649,767**	**1929**	**487**
JA6YAI	2,448,593	1760	499
JA7YAA	2,245,001	1540	499
5B4ES	**1,627,008**	**1468**	**384**
JA7YBJ	962,962	744	481
JA6YDH	916,506	926	354
JA7YFB	791,574	824	329
JA7YAL	718,320	761	328
JA0ZAV	386,974	556	262
JA3YCT	183,136	349	194
JA0YCR	177,386	320	242
JH6ZYZ	92,736	277	138
JA6YBR	31,065	120	95
XU1SS	**336**	**20**	**14**

EUROPE

I05BGM	**8,608,545**	**3767**	**765**
LZ2KTS	**7,414,240**	**4055**	**745**
Y34K	**6,996,220**	**3602**	**770**
HG6N	**5,917,842**	**3278**	**701**
HG5A	5,845,280	3265	680
F9IE	**5,270,220**	**2894**	**670**
OH8AA	**4,100,992**	**2731**	**644**
OK6DX	**4,059,636**	**2516**	**651**
Y44ZI	3,992,789	2446	641
Y31M	3,335,439	2454	597
HG6V	3,318,169	2406	613
GB8WAS	**3,103,912**	**2407**	**602**
SK6RR	**3,097,913**	**2267**	**577**
SL8ZG	2,502,438	2028	579
Y33ZB	2,429,068	2042	526
OK7MM	2,422,651	2101	511
DL8JK	**2,406,240**	**1912**	**557**
YT3T	**2,014,464**	**1675**	**516**
YZ1U	1,904,884	1981	514
I09HLO	**1,708,900**	**1567**	**460**
HA3KNA	1,639,050	1610	490
G8JC	1,593,417	1394	483
ED6MDX	**1,572,088**	**1515**	**469**
SP5KVW	**1,375,360**	**1328**	**614**
OK2KMR	1,300,520	1332	410
SP9PDF	1,236,270	1229	435
DL8UE	1,167,360	1176	456
HG1Z	1,100,713	1193	419
OK3KII	1,072,275	1163	425
SK6AW	1,025,460	1162	422
GB8WPX	1,014,244	1289	407
ON8BK	**923,936**	**1092**	**416**
LZ1KOZ	868,608	1195	384
GB2WRR	864,512	961	352
OK3KAG	859,404	1308	364
HA1KSA	853,200	1240	360
ED3CBE	**832,680**	**1080**	**405**
I8FOQ	824,568	978	408
SK2AU	811,314	1064	411
HA2KMR/p	745,878	1032	354
HB9BLQ	**584,896**	**792**	**304**
DL8TS	561,460	804	335
SP6ZFU	538,850	803	325
GB4TVI	503,644	802	332
EA3NA	503,163	695	333
ED4RCD	441,612	703	348
Y54ZL	428,659	851	293
SP2PCX	385,548	757	267
YO3KWJ•	**371,188**	**651**	**284**
YO8KOD	355,750	659	250
OK1KUR	332,724	709	238
LA2S	**321,687**	**511**	**279**
HA4KYH	300,599	615	247
SP1PBW	250,390	501	245
PI1GOE	**233,445**	**543**	**237**
SP1KIZ	213,815	571	205
SP7PGK	213,408	545	216
OE3GBB	**209,660**	**444**	**220**
YU4EZC	209,168	468	272
OK2KYC	184,912	481	208
OK1ORA	121,183	403	179
Y31ZJ	110,390	372	166
YU1AHX	110,201	359	173
HB9Z	67,340	230	148
HA1KTD	55,692	234	119
OK1KZW	53,100	200	150
YO6KNT	51,632	200	112
YU3T	48,735	205	135
SP9PTO	47,160	195	120
OK1KTW	35,520	171	111
OK1KAZ	31,212	172	108
SP5ZBL	29,998	167	106
HA7KLG	29,032	144	76
HA5KFV	24,570	150	91
OH3AT	16,324	124	77
SP9ZHR	15,050	109	70
OK2KVI	14,784	104	66
OK3KNS	12,496	132	88
C38BAX	**11,322**	**108**	**74**
LZ1KKR	3,885	44	37
HA5KDW	558	26	18
HA5KHS	558	26	18
SP7KTE	264	14	12
OK1KLV	176	12	8

Bob Gromen, WD8PAQ, USA 8th District 28 MHz leader again in '84.

OCEANIA

KD7P/NH2	**9,752,600**	**4853**	**620**
VK6DU	**6,150,616**	**3816**	**542**
VK3FY	**5,455,827**	**2891**	**633**
ZL2AH	**1,693,136**	**1656**	**356**

SOUTH AMERICA

ZZ5EG	**14,758,625**	**5515**	**875**
LU1DRC	**2,078,433**	**1626**	**441**

U.S.S. R. CLUB STATIONS ASIA

UK7PAL	**4,686,246**	**3171**	**581**
UK9ADT	**3,747,780**	**2194**	**569**
UK9FER	3,711,207	2552	537
UK8AAB	**2,708,142**	**2169**	**519**
UK7LAH	2,461,587	2080	421
UK9FEN	1,763,538	1400	398
UK8MFA	**1,383,499**	**1430**	**403**
UK8JBE	**798,018**	**859**	**338**
UK9ADS	724,130	1027	290
UK8JBD	723,996	877	338
UK0SAV	723,424	1144	296
UK6GAS	**687,810**	**837**	**303**
UK9CAC	632,073	809	247
UK7CAO	493,020	699	249
UK9XBD	374,000	566	200
UK9UCZ	347,268	549	258
UK8MAF	143,338	361	149
UK0QBE	39,641	346	49
UK9UDD	1,422	20	18

EUROPE

UK2RDX	**4,529,740**	**3020**	**630**
UK6LAZ	**4,187,480**	**3113**	**614**
UK4FAV	3,813,174	2606	607
UK2BBB	**3,647,475**	**2485**	**585**
UK2FAA	**3,630,720**	**2280**	**640**
UK2GAB	**2,753,633**	**2020**	**563**
UK2PRC	2,408,731	2067	559
UK2PCR	2,333,637	1777	513
UK4HAL	2,256,838	2306	466
R1Z	1,345,342	1620	466
UK3QBM	1,344,700	1652	425
UK5IZZ	**1,330,044**	**1484**	**474**
UK5IAZ	1,203,456	1268	384
UK2BCC	1,177,460	1299	452
UK4WAA	1,130,976	1417	408
UK4HBB	1,111,171	1388	401
UK5IFN	949,240	1199	380
UK3DBG	941,137	1300	391
UK2PAP	894,608	962	374
UK3ABO	725,781	1000	323
UK3QAZ	691,328	1076	352
UK2BBX	592,296	894	348
UK4LAA	557,690	1128	310
UK2GAZ	532,350	684	315
UK1AAW	416,008	940	298
UK3WAF	390,319	819	269
UK2TAB	**365,300**	**702**	**281**
UK4HBU	340,868	841	254
UK5IBS	306,432	733	228
UK5CAT	241,680	589	265
UK5HAB	192,816	454	206
UK3SAO	181,996	504	263
UK4SAM	165,213	538	211
UK5LAX	155,660	353	215
UK2WAY	**134,403**	**408**	**213**
UK2AAF	121,948	406	172
UK1ABC	119,119	457	187
UK5UBE	109,560	358	166
UK6HBK	105,525	372	201
UK4PAE	92,568	307	168
UK3TCJ	91,039	360	149
UK2GJW	80,332	301	133
UK5WAC	66,720	199	139
UK5OAR	**64,080**	**320**	**178**
UK2BBM	61,248	326	116
UK3TBF	58,144	220	158
UK3ACB	47,233	267	149
UK5EDI	43,792	242	120
UK4PNQ	19,900	147	100
UK5IGL	17,974	130	86
UK5LAS	13,035	111	79
UK5VAA	9,720	89	72
UK5IEX	7,700	78	50
UK5UAN	5,928	88	52
UK5RAL	4,770	55	45
UK2WAM	4,136	55	44
UZ6HWY	544	19	17

MULTI-OPERATOR MULTI-TRANSMITTER WORLDWIDE

VP2EC	**17,559,672**	**7393**	**897**
YZ1EXY	**14,503,141**	**6525**	**881**
KH6XX	**11,117,556**	**5258**	**667**
JA9YBA	**9,560,464**	**4144**	**773**
NG5X	**7,480,044**	**4167**	**858**
KL7RA	**6,883,176**	**3433**	**708**
NM5L	6,083,385	4383	805
CE3AA	**2,986,812**	**2008**	**509**
JA3YKC	2,274,015	1581	505
UK4WAB	**1,698,070**	**1821**	**430**
W6QL/CE8	**1,389,024**	**1199**	**424**
UK9CCF	**956,475**	**974**	**325**
SP6FZU	**538,850**	**803**	**325**
JA6YBX	368,280	547	330
JA7YDX	313,052	497	244
CX1FU	**243,724**	**426**	**218**
JA3YCK	18,904	109	68
JR2YZB	11,895	92	61

DISQUALIFIED: YT6A—Excessive duplicates.

CHECK LOGS: The following were used for cross-checking. Check logs and SWL logs are always greatly appreciated. Thank you: 4K1GAG, 5H3RF, EA1CXI, EA6RCM, HA1KRR, KA2SAS, KA6ISE/CE3, KA7FEF, KV4AM, LA0EH, LA2EG, LA6BBA, LA9PCA, OH8DX/W6, PA0GBY, PA0KFF/Mobile, PA0TV, RA1ASK, RA3AGN, RA3DPD, UA1AGG, UA1CIQ, UA1ODP, UA3DMB, UA3TAM, UA4NAA, UA6AKB, UA6ARP, UA6LQZ, UA9WDM, UA9YBR, UB5UBU, UK1OAZ, UK3DBV, UK3MAX, UK3MBR, UK3SJJ, UK4CAW, UK4PAA, UK4WAQ, UK5WBF, UK5WBG, UK9OAX, UL7LBM, UM8MDE, UP2-038-1677, UT5DK, UV3FD, UW3RR, UZ6HWF, VE4AEX, W1PM, W1WY, Y2-9278/G62, Y25ID/A, Y26SO, Y48RO, Y58SA, Y66ZN, Y67ZI/Y34RI, ZY2OO.

HF Equipment	Regular	SALE
IC-740* 9-band 200w PEP xcvr w/mic	$1099.00	**869.95**

***FREE PS-740** Internal Power Supply &
$50 Factory Rebate - until gone!

PS-740 Internal power supply	159.00	**149.95**
***EX-241** Marker unit	20.00	
***EX-242** FM unit	39.00	
***EX-243** Electronic keyer unit	50.00	
***FL-45** 500 Hz CW filter (1st IF)	59.50	
***FL-54** 270 Hz CW filter (1st IF)	47.50	
***FL-52A** 500 Hz CW filter (2nd IF)	96.50	**89.95**
***FL-53A** 250 Hz CW filter (2nd IF)	96.50	**89.95**
***FL-44A** SSB filter (2nd IF)	159.00	**144.95**
SM-5 8-pin electret desk microphone	39.00	
HM-10 Scanning mobile microphone	39.50	
MB-12 Mobile mount	19.50	

**Options also for IC-745 listed below*

IC-730 8-band 200w PEP xcvr w/mic	$829.00	**569.95**
FL-30 SSB filter (passband tuning)	59.50	
FL-44A SSB filter (2nd IF)	159.00	**144.95**
FL-45 500 Hz CW filter	59.50	
EX-195 Marker unit	39.00	
EX-202 LDA interface; 730/2KL/AH-1	27.50	
EX-203 150 Hz CW audio filter	39.00	
EX-205 Transverter switching unit	29.00	
SM-5 8-pin electret desk microphone	39.00	
HM-10 Scanning mobile microphone	39.50	
MB-5 Mobile mount	19.50	
IC-720A 9-band xcvr/.1-30 MHz rcvr	$1349.00	**869.95**
FL-32 500 Hz CW filter	59.50	
FL-34 5.2 kHz AM filter	49.50	
SM-5 8-pin electret desk microphone	39.00	
MB-5 Mobile mount	19.50	
IC-745 9-band xcvr w/.1-30 Mhz rcvr	$999.00	**789.95**
PS-35 Internal power supply	160.00	**144.95**
CFJ-455K5 2.8 kHz wide SSB filter	4.00	
HM-12 Hand microphone	39.50	
SM-6 Desk microphone	39.00	

**See IC-740 list above for other options (*)*

IC-751 9-band xcvr/.1-30 MHz rcvr	$1399.00	**1199**
PS-35 Internal power supply	160.00	**144.95**
FL-32 500 Hz CW filter (1st IF)	59.50	
FL-63 250 Hz CW filter (1st IF)	48.50	
FL-52A 500 Hz CW filter (2nd IF)	96.50	**89.95**
FL-53A 250 Hz CW filter (2nd IF)	96.50	**89.95**
FL-33 AM filter	31.50	
FL-70 2.8 Khz wide SSB filter	46.50	
HM-12 Hand microphone	39.50	
SM-6 Desk microphone	39.00	
CR-64 High stability reference xtal	56.00	
RC-10 External frequency controller	35.00	
MB-18 Mobile mount	19.50	

Options: 720/730/740/745/751	Regular	SALE
PS-15 20A external power supply	$149.00	**134.95**
EX-144 Adaptor for CF-1/PS-15	6.50	

ICOM

Options - continued	Regular	SALE
CF-1 Cooling fan for PS-15	45.00	
EX-310 Voice synth for 751, R-71A	39.95	
SP-3 External base station speaker	49.50	
Speaker/Phone patch - specify radio	139.00	**129.95**
BC-10A Memory back-up	8.50	
EX-2 Relay box with marker	34.00	
AT-100 100w 8-band automatic ant tuner	349.00	**314.95**
AT-500 500w 9-band automatic ant tuner	449.00	**399.95**
AH-1 5-band mobile antenna w/tuner	289.00	**259.95**
PS-30 Systems p/s w/cord, 6-pin plug	259.95	**233.95**
OPC Optional cord, specify 2 or 4-pin	5.50	
GC-4 World clock	99.95	**94.95**

HF linear amplifier	Regular	SALE
IC-2KL w/ps 160-15m solid state amp	1795.00	**1299**

VHF/UHF base multi-modes	Regular	SALE
IC-551D 80 Watt 6m transceiver	$699.00	**599.95**
EX-106 FM option	125.00	**112.95**
BC-10A Memory back-up	8.50	
SM-2 Electret desk microphone	39.00	
IC-271H 100w 2m FM/SSB/CW xcvr	899.00	**759.95**
PS-35 Internal power supply	160.00	**144.95**
PS-15 external power supply	149.00	**134.95**
CF-1 Cooling fan for PS-15	45.00	
EX-144 PS-15/CF-1 fan adaptor	6.50	
AG-25 Mast mtd. GaSFET preamp	84.95	
IC-471H 75w 430-450 SSB/CW/FM xcvr	1099.00	**989.95**
PS-35 Internal power supply	160.00	**144.95**
PS-15 20A power supply	149.00	**134.95**
CF-1 Cooling fan for PS-15	45.00	
EX-144 PS-15/CF-1 fan adaptor	6.50	
AG-35 Mast mounted preamp	84.95	
IC-271A 25w 2m FM/SSB/CW xcvr	699.00	**619.95**
PS-25 Internal power supply	99.00	**89.95**
AG-20/EX-338 2m preamplifier	56.95	
IC-471A 25w 430-450 SSB/CW/FM xcvr	799.00	**699.95**
AG-1 Mast mounted 15dB preamp	89.00	
PS-25 Internal power supply	99.00	**89.95**

Common accessories for 271A/H and 471A/H		
SM-6 Desk microphone	39.00	
EX-310 Voice sythesizer	39.95	
TS-32 CommSpec encode/decoder	59.95	
UT-15 Encoder/decoder interface	12.50	
UT-15S UT-15S w/TS-32 installed	79.95	

VHF/UHF mobile multi-modes		
IC-290H 25w 2m SSB/FM xcvr, TTP mic	549.00	**489.95**
IC-490A 10w 430-440 SSB/FM/CW xcvr	649.00	**579.95**

VHF/UHF/1.2 GHz FM	Regular	SALE
IC-22U 10w 2m FM non-digital xcvr	299.00	**249.95**
EX-199 Remote frequency selector	35.00	
IC-27A Compact 25w 2m FM w/TTP mic	369.00	**329.95**
IC-27H Compact 45w 2m FM w/TTP mic	409.00	**369.95**
IC-37A Compact 25w 220 FM, TTP mic	449.00	**299.95**
IC-47A Compact 25w 440 FM, TTP mic	469.00	**419.95**
UT-16/EX-388 Voice synthesizer	29.95	
IC-120 1w 1.2 GHz FM transceiver	499.00	**449.95**
ML-12 10w amplifier	339.00	**299.95**

6m portable	Regular	SALE
IC-505 3/10w 6m port. SSB/CW xcvr	$449.00	**399.95**
BP-10 Internal Nicad battery pack	79.50	
BP-15 AC charger	12.50	
EX-248 FM unit	49.50	
LC-10 Leather case	34.95	
SP-4 Remote speaker	24.95	

Hand-held Transceivers		
Deluxe models	**Regular**	**SALE**
IC-02AT for 2m	349.00	**299.95**
IC-04AT for 440 MHz	379.00	**329.95**
Standard models	**Regular**	**SALE**
IC-2A for 2m	239.50	**189.95**
IC-2AT with TTP	269.50	**199.95**
IC-3AT 220 MHz, TTP	299.95	**239.95**
IC-4AT 440 MHz, TTP	299.95	**239.95**

Accessories for Deluxe models	Regular
BP-7 425mah/13.2V Nicad Pak - use BC-35	67.50
BP-8 800mah/8.4V Nicad Pak - use BC-35	62.50
BC-35 Drop in desk charger for all batteries	69.00
BC-60 6-position gang charger, all batts **SALE**	359.95
BC-16U Wall charger for BP7/BP8	10.00
LC-11 Vinyl case	17.95
LC-14 Vinyl case for Dlx using BP-7/8	17.95
LC-02AT Leather case for Dlx models w/BP-7/8	39.95

Accessories for both models	Regular
BP-2 425mah/7.2V Nicad Pak - use BC35	39.50
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	29.50
BP-4 Alkaline battery case	12.50
BP-5 425mah/10.8V Nicad Pak - use BC35	49.50
CA-2 Telescoping 2m antenna	10.00
CA-5 5/8-wave telescoping 2m antenna	18.95
FA-2 Extra 2m flexible antenna	10.00
CP-1 Cig. lighter plug/cord for BP3 or Dlx	9.50
DC-1 DC operation pak for standard models	17.50
LC-2AT Leather case for standard models	34.95
RB-1 Vinyl waterproof radio bag	30.00
HH-SS Handheld shoulder strap	14.95
HM-9 Speaker microphone	34.50
HS10 Boom microphone/headset	19.50
HS-10SA Vox unit for HS-10 & Deluxe only	19.50
HS-10SB PTT unit for HS-10	19.50
ML-1 2m 2.3w in/10w out amplifier **SALE**	79.95
ML-25 2m 2.3w in 20w out amplifier **SALE**	179.95
SS-32M Commspec 32-tone encoder	29.95

Shortwave receivers	Regular	SALE
R-71A 100 Khz-30 Mhz digital receiver	$799.00	**689.95**
FL-32 500 Hz CW filter	59.50	
EX-310 Voice synthesizer	39.95	
RC-11 Wireless remote controller	59.95	
CR-64 High stability oscillator xtal	56.00	
R-70 100 Khz-30 Mhz digital receiver	749.00	**569.95**
EX-257 FM unit	38.00	
IC-7072 Transceive interface, 720A	112.50	
FL-44A SSB filter (2nd IF)	159.00	**144.95**
FL-63 250 Hz CW filter (1st IF)	48.50	
SP-3 External speaker	49.50	
CK-70 (EX-299) 12v DC option	9.95	
MB-12 Mobile mount	19.50	

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CQ REVIEWS:

The Butternut HF6V Multiband Vertical Antenna

BY LEW MCCOY*, W1ICP

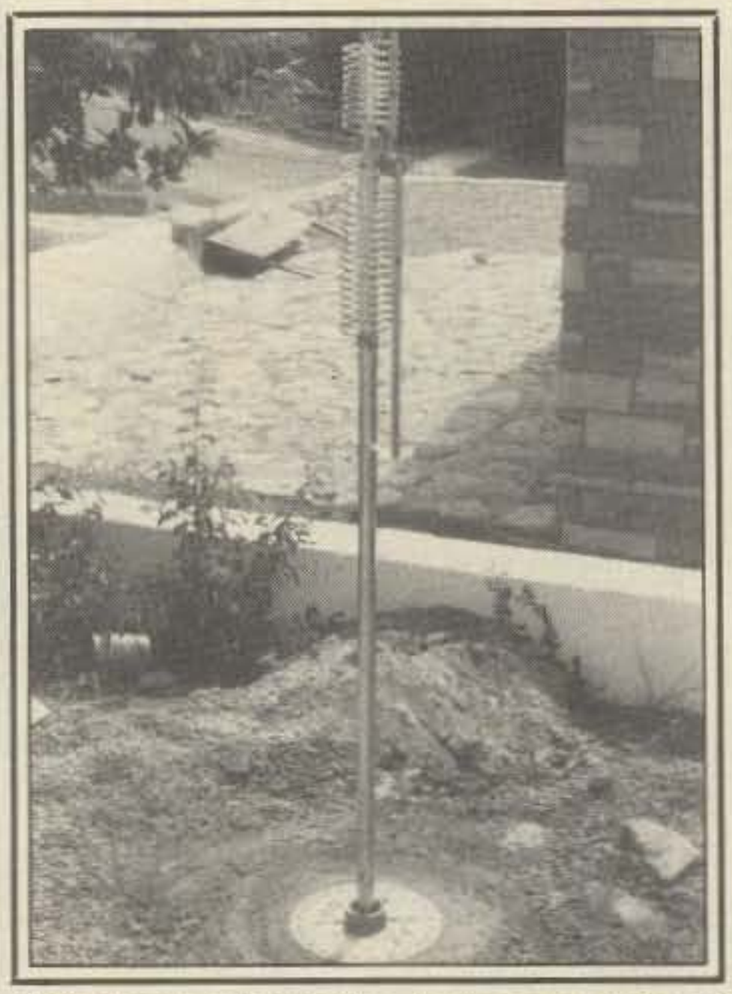
When giving antenna lectures at conventions and club meetings I am asked what I think of the Butternut vertical multiband antenna system. I have always had to express ignorance because I never had the opportunity to test or use one. At the last Dallas convention I had a chance to talk to the designer of the Butternut, and he offered to send me one of the latest models, the HF6V, and necessary add-ons to cover all the bands from 160 through 10 meters. I was more than happy to get a chance to become familiar with the system and do a review of the product for *CQ*.

What It Is

The HF6V is basically a six-band vertical covering 80/75 meters on up through 10 meters. Additional kits are available to make the antenna work on 160 plus the two newer WARC bands, 18 and 24 MHz. The antenna I tested had all these additions—in other words, it covered them all.

The reader might profit from some basic knowledge about verticals, particularly thinking in terms of using 50 ohm impedance cable as a feedline. An electrical quarter-wavelength has a relatively low impedance if fed on the end. By "relatively low," typical values such as 30 to 40 ohms impedance are encountered. When a quarter-wavelength vertical is used, the impedance is controlled to a great degree by the earth ground—or ground plane of wires used as a ground. I'll talk more about that later. In any case, keep the quarter-wave low-impedance information in mind during this review. I should add that any *odd* multiples of a quarter wave will also be low impedance.

The HF6V is 26 feet high. On 15 meters a quarter-wavelength vertical would be on the order of 11 feet. The HF6V operates (electrically) as a slightly extended quarter wave on 15 meters and a quarter-wave decoupler provides practically loss-



This photo shows the bottom portion of the HF6V installed on the GP-1 base. The job of installing 50 radials hadn't yet been started in New Mexico hardpan—and I do mean "hard."

less isolation of the upper half of the antenna. (Also keep in mind that the bottom portion of the vertical is the primary "working" part.)

On 20 the entire vertical operates as a ⅜ wavelength vertical. The ⅜ wavelength raises the radiation resistance on 20 and provides greater bandwidth (broad, low SWR). On 10 it operates as a ¼-wavelength vertical and again, higher radiation resistance and better bandwidth.

On 40 and 80 meters appropriate L-C circuits are used to obtain electrical resonance (as on 160). On 30 meters the overall height of the antenna is greater than a quarter wavelength, so a series L-C circuit is used to short a portion of the 40 meter inductor during operation on 30 meters. In fact, L-C circuits are used on 40, 80, and 160 to obtain resonance. This, of course, requires coils, and in the case of the Butternut antenna, they are of very large diameter and are air-wound coils to obtain the maximum possible efficiency.

The coils on the Butternut are constructed from large-diameter wire and are very rugged and well made. In fact, all of the hardware and aluminum tubing is excellent material. When making coil adjustments, Butternut simplifies the adjustment procedures. Easy-to-adjust thumb screws are used on the coils and taps. This provides smooth adjustment for correct settings.

The TBR-160 HD is the add-on kit to provide 160 meter operation. It consists primarily of a large coil and capacitor, with necessary hardware. Likewise, the A-18-24 kit is an add-on kit for the two newer bands—when we get them. It was impossible to check SWR on these two bands because, of course, it is illegal to transmit there. However, it was obvious that the system resonated in good fashion by the gain in signal on reception.

Constructional Details

The HF6V is designed to withstand winds up to 80 mph without guying, and that is the way we installed it. As pointed out by the manufacturer, if you live in a high wind area, you could use a set of short non-conductive guys. A mounting post which has an insulator at the top is provided. In this case I happen to have the GP-1 base plate made by Lance Johnson Engineering (I did a product review of the GP-1 in the August 1984 issue). This base plate was used in the installation, as you can see in the photograph. Cement was poured for the base rod and base plate, and the antenna was then installed.

Directions were very clear and no problems were encountered. The directions are written in a step-by-step process, so they are easy to follow. Considerable detail is provided on the subject of grounds and radials. Treatment of exactly what is a good ground, two- and three-wire ground planes, and ground radial systems are too lengthy to cover in this review. However, a recent article by Arch Doty in *CQ* and several articles by Dr. Jerry Sevick, W2FMI, a few years back in *QST* more than cover the subject. Suffice it to say, I am a disciple of Sevick, and his ground rules (excuse the pun) for a good

*Technical Consultant, CQ, 200 Idaho St., Silver City, NM 88061

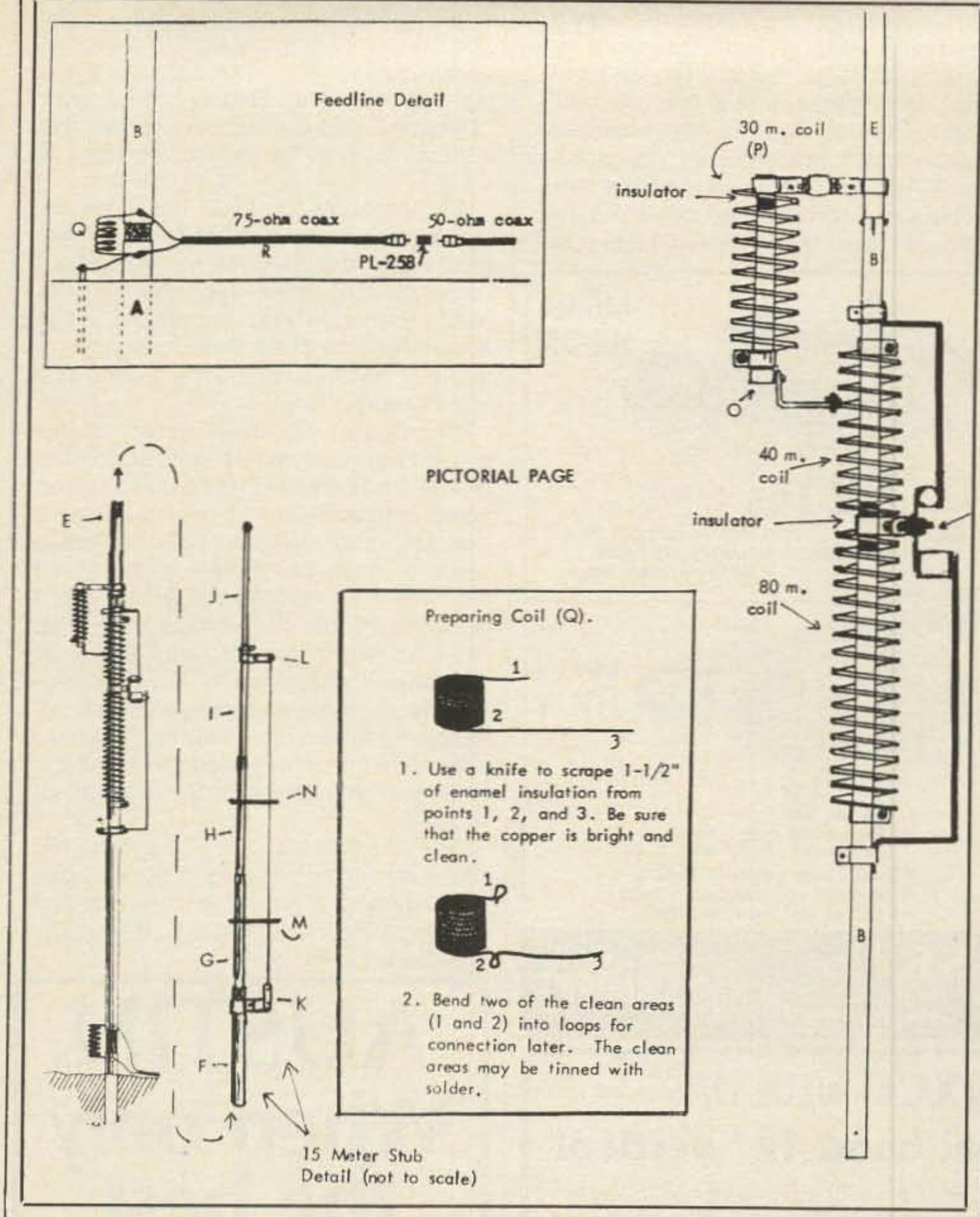


Fig. 1– Here is an excerpt from the excellent instruction manual.

ground are rather simple. One needs about 30 to 40 radials which should be no shorter than two-tenths of a wavelength long for the lowest frequency band (or about 50 feet on 80 meters). Such a ground will pretty well establish the theoretical base impedance of a vertical. In other words, your vertical will have the "text book" value of impedance and losses will be minimized.

We (I say "we" because we consisted of Dean Battishill, W5LAJ, and myself) installed the antenna at W5LAJ's location. We laid down 48 radials, all 50 feet long or longer, and in as many directions as possible. First, though, we ran SWR curves on all the bands with only a water-pipe ground. We then ran the same tests when the complete ground system was installed. Those tests certainly proved Sevick's contentions, because you could see the impedances "fit" into the right category when the complete radial system was installed. Also, we gave the Butternut vertical everything a good vertical should have.

I could have drawn SWR curves for the Butternut, but it is easier to tell you what the SWR was for each band. On 160 the bandwidth for a 2 to 1 SWR was about 60 kHz. We matched the antenna for a 1 to 1 at 1842, and the SWR went to 2 to 1 at 1870 and 1810. On 80 the bandwidth was a little broader, being matched at 3925 and going to 2 to 1 at 3875 and 3960. On 40 the SWR was 2.2 to 1 at 7000 kHz, dropping quickly to a match of 1 to 1 at 7100 kHz and then slowly up to 2.5 to 1 at 7300. On 20 the match was ridiculously good, mostly 1 to 1 across the entire band; the worst case condition was at 14000 kHz, where it was 1.2 to 1! On 15 it was the same story—essentially flat across the entire band. At 10 meters the SWR was 1.3 to 1 at 28000 kHz, going down to 1.2 to 1 at 28.5 and then up to 2 to 1 at 29 MHz. Oh yes, at 10150 kHz the match was 1 to 1. You'll note than the

SWR figures are excellent for broadband coverage, except of course on 80 or 160, where the vertical is short.

Performance

We had a couple of comparison antennas to work against. One was a horizontal 80 meter dipole using tuned feeders for all-band operation, and the other was a 2-element 15 meter quad. We installed a coax switch in the system so we could switch in either of the antennas to make on-the-air tests. Surprisingly, at least to me, the vertical with its fine ground system outperformed the horizontal dipole—in most instances! Even more startling was when 15 opened and we had a chance to compare the quad to the vertical on long DX. The vertical was usually one "S" unit or more better. In fact, I got a real chuckle out of something W5LAJ said. We were comparing the antennas on some JAs and the vertical proved better than the quad. Dean, W5LAJ, said, "Doggone, I sure wish I could rotate this vertical; think of the signal I would have then!"

On short-haul contacts the other antennas did a better job, but the lower vertical angle from the Butternut worked out better on long haul—regardless of the band. Frankly, I was impressed. However, I think the antenna performance reaffirmed my belief in a good ground system of radials.

Of course I would be remiss if I discussed a vertical compared to horizontally polarized antennas and didn't mention noise. In most receiving locations there is certainly more vertically polarized noise radiation than horizontal, at least that which bothers amateur reception. There is no doubt that the vertical picked up more noise than the horizontal antennas—however, not seriously. To me, "serious" would mean knocking out weak signals, and in the city enviroment where this antenna was tested, the vertical noise pickup was definitely there, but not too bad.

The HF6V lists for $169.50 and the 160 meter add-on kit lists for $55.50. For additional details, write to the manufacturer: Butternut Electronics, 405 E. Market St., Lockhart, Texas 78644.

Here is a tongue-in-cheek look at VE5AFG's arrival in Saskatchewan.

The Rare Land

BY BILL ASH*, VE5AFG

From the first moment I received my amateur radio license in 1977, my heart was captured by the lure of operating from some rare, unknown territory. But it was not to be, at least not until October of 1981.

I had glanced over my QSL cards and log books, and found they were full of rare contacts such as Botswana, Ceuta, and Mellish Reef, etc., but none stood out like the rare VE5 card from Gerald Lamson, VE5YZ, my only contact from a strange place called Saskatchewan.

Further checks were implemented, and it was discovered that Saskatchewan was a vast area located in the northwest portion of North America. It is a region governed by Canada, a country lying to the east and west of Saskatchewan itself. The main occupation of the natives is farming. This was the total information package I was able to put together. Even after living here for a while, my knowledge of this land with its many contrasts of native cultures and widely varying temperatures remains as sparse as the land itself. But I am getting ahead of my story, so let's return to October 1981 and the great decision to investigate this unknown land.

With only one contact in all of this great area, I felt this was to be the location for future operations. I assumed that since Canada controlled this area, there would be electricity somewhere. However, just in case, no rig was carried on our original flight over the territory; no need to scare the natives with technology at that point. My original plan was to enter this area in the dead of night and observe the natives unnoticed, but a flight over this area soon drove this idea from my head, for below me stretched a vast land with no trees. There was no cover for a hidden approach. My heart sank, but I had come this far and I was not about to turn back. My thoughts turned to my friends, Dutch, WA2AWS, probably comfortable in his Riverton, New Jersey, home, and Bart, WA4PIM, who I guessed was working late in his office at WAMB in Nashville. I wasn't sure that I wouldn't rather be like them, safe in their own corners of the world. I glanced at my XYL, Sue, and I could see she too had her doubts, but we each supported the other and she whispered "let's land" in an unsure voice.

We decided our only approach was a daytime landing with the hope that we wouldn't be spotted. How I wished that I had let VE5YZ know I was coming so he could guide me in my endeavor, but alas, it was too late. We were here, and I didn't know where to locate Gerald, as he was in a native village called Rokeby, a place the location of which remains a mystery to me to this day.

My thoughts were soon interrupted as the wheels of the plane touched down. We found ourselves in a large populated area, obviously a trade center where natives meet. This reassured us, as we seemed to be unnoticed here in Regina.

We had chosen the right area, as we were able to observe native activity without detection. Our appearance was not unlike that of the locals, and we were surprised to find we could understand the local dialect, which appeared to be a cross between English and some western jargon that was rather colorful and quite pleasant to listen to. Our original impressions were rather reassuring, so we elected to press on deeper into the region in hopes of locating a suitable location for the future station I had planned.

It didn't take long to locate a local means of transporation. We boarded a Greyhound bus and headed for the interior, trying to keep ourselves as inconspicuous as possible, while the urge to question others around us about this wonderous land became almost overwhelming. We did, however, manage to be silent and observe the wonders nature had seen fit to give this area—vast flat lands, marred only by native villages set here and there with hundreds of miles between them. Everywhere the beauty of the land stood out with the golden remains of native farming. The crops had been long removed, but the remains shone with a golden glow that only wheat fields can produce when the evening rays of a fiery sunset caress this land.

Time moved quickly for us, and we soon found ourselves in a beautiful little village called Swift Current. The natives went out of their way to welcome us, and we were immediately put at our ease. We were surprised to discover there were indeed a few amateur radio operators hidden among the huts of the village. I was unsure what to expect when they approached me, but my mind was soon off and running with plans of my station, as they assured me we were safe, and I was welcomed into their ranks.

The daily endeavors of the natives were not vast in scope. Most went about peacefully, passing their days farming wheat or raising cattle, although a few seemed engrossed by a black liquid they pumped from the ground. These people seemed too busy to answer questions, so we left them to pump the oil.

I felt it was time to get the information I had gathered to the outside world, and serious work began to get a station on the air. I managed to get a short message to Dick, VE1AI, in Dartmouth, Nova Scotia, telling him I needed equipment.

Dick, being no stanger to unusual environments, having operated from VO2 land, Sable Island, and St. Pauls, knew just what to do. After a few months of effort, a Ten-Tec Omni was set up in the upper level of a multilevel native dwelling. An antenna was fabricated from the remains of a CB vertical (the closest most natives had come to radio technology). This type of antenna went unnoticed by the natives, who might have been scared off by the real thing.

The D.O.C. managed to find a license for me, and my wildest dream is now realized whenever a ham says "Tnx my first Saskatchewan," an almost daily occurrence now. So look for me on 10 meters, and I'll be glad to say hello and confirm this rare and beautiful land I now have the pleasure of calling home. CQ

*301 Seventh Ave. N.W., Swift Current, Saskatchewan, S9H 0Z1, Canada

CQ World-Wide WPX/S.S.B. Contest All-Time Records

BY STEVE BOLIA, N8BJQ, Director, CQ WPX Contest

The contest is held each year on the last full weekend of March. The All-Time Records will be updated and published annually. The method of computing final scores has changed several times since 1957. Data following the calls below are: year of operation, total score, and number of prefix multipliers.

WORLD RECORD HOLDERS

Single Operator

1.8	EA9KF('84)	264,100	139
3.5	4M3AZC('84)	1,158,132	262
7.0	T32AF('84)	2,991,352	364
14	ZY5EG('83)	3,869,828	596
21	HC9A('81)	6,025,770	615
28	CE6EZ('84)	5,437,936	644
AB	PJ2FR('83)	7,484,994	594
QRP/p	H44R('84)	1,575,904	352

Multi-Operator Single Xmtr.

	VP2EC('83)	15,238,880	820

Multi-Operator Multi-Xmtr.

	NP4A('82)	24,065,600	890

U.S.A. RECORD HOLDERS

Single Operator

1.8	WB3GCG('84)	43,368	156
3.5	KI6P('83)	524,356	307
7.0	KI6P('84)	1,158,606	337
14	K8NA('82)	2,252,688	568
21	AI7B('82)	4,151,232	576
28	N5AU('82)	3,094,249	571
AB	AB0I('82)	4,107,378	578
QRPp	W8ILC('82)	1,044,012	459

Multi-Op Single Xmtr.

	N5AU('84)	6,301,977	759

Multi-Op Multi-Xmtr.

	AI6V('81)	12,529,608	728

CLUB RECORD
YU DX Club ('81) 41,003,768

WPX (Prefix) RECORD
VP2EC('84) 897

QRPp RECORD
H44R('84) 1,575,904

CONTINENTAL RECORD HOLDERS

AFRICA

1.8	EA9KF('84)	264,100	139
3.5	CT3BD('80)	181,412	133
7.0	SM0GMG/CT3('82)	1,021,592	286
14	CN8CY('83)	1,742,569	449
21	EL2AV('81)	4,617,530	557
28	CN8CY('82)	2,947,811	487
AB	ZS1CT('84)	4,461,805	565

ASIA

1.8	RA9AKM('84)	44,460	57
3.5	5B4LP('84)	763,458	222
7.0	JA5BJC('84)	771,064	281
14	4X4UH('82)	2,288,646	477
21	4X0U('81)	2,823,916	514
28	4X4UH('80)	2,718,760	440
AB	4X1X('82)	3,932,586	529

EUROPE

1.8	LZ2BE('84)	261,504	144
3.5	DJ4PT('81)	745,216	328
7.0	IO3MAU('84)	1,767,048	426
14	4N3ZV('81)	3,586,240	560
21	OH0BH('83)	3,977,684	501
28	YU3MY('80)	3,530,016	412
AB	Y24UK('82)	6,285,436	586

Multi-Op Single Xmtr.

AF	CT3/OH2BC('78)	4,377,450	385
AS	UK9AAN('80)	11,152,020	660
EU	9A1ONU('80)	13,362,486	723
NA	VP2EC('83)	15,238,880	820
OC	KD7P/NH2('84)	9,752,600	620
SA	ZY5EG('84)	14,758,625	875

NORTH AMERICA

1.8	VE3CDX('84)	205,824	134
3.5	VE3IY('84)	721,392	266
7.0	VE3BMV('84)	2,827,440	462
14	KP4BZ('83)	2,803,784	584
21	AI7B('82)	4,151,232	576
28	FG0DYM/FS7('80)	3,304,752	484
AB	VP2MRA('83)	5,511,352	616

OCEANIA

1.8	T32AF('83)	16,872	37
3.5	KH6XX('78)	305,080	115
7.0	T32AF('84)	2,991,352	364
14	VR3AH('79)	3,526,153	437
21	VK4QK('80)	2,592,216	396
28	KB7IJ/KH2('82)	4,743,144	504
AB	KH6XX('82)	6,242,967	531

SOUTH AMERICA

1.8	YV5JEA('84)	40,320	63
3.5	4M3AZC('84)	1,158,132	309
7.0	YY3BQS('83)	1,664,096	323
14	ZY5EG('83)	3,869,828	596
21	HC9A('81)	6,025,770	615
28	CE6EZ('84)	5,437,936	644
AB	PJ2FR('83)	7,484,994	594

Multi-Op Multi-Xmtr.

AF	9E3USA('69)	2,398,192	296
AS	UK9AAN('78)	10,702,776	532
EU	YZ1EXY('84)	14,503,141	881
NA	NP4A('82)	24,065,600	890
OC	KH6XX('81)	19,345,473	669
SA	ZZ5CA('80)	12,545,616	664

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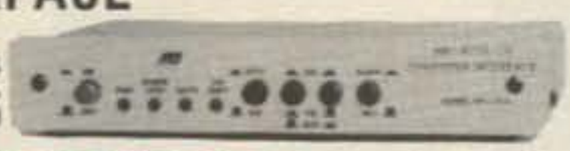

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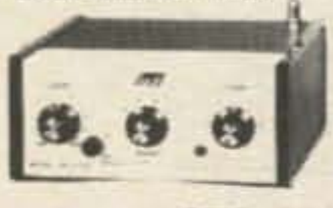

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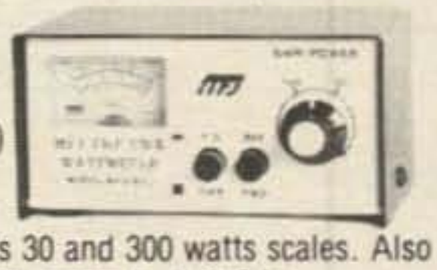

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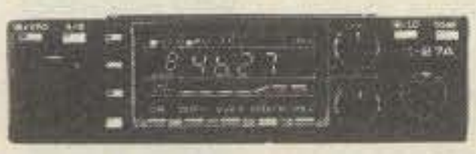

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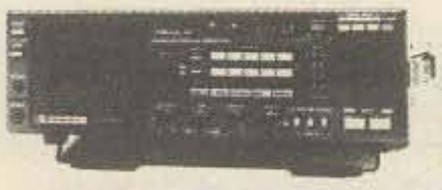

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Announcing

• **Tri-Town RAC HF Net** - The Tri-Town Radio Amateur Club of Hazelcrest (Suburban Chicago), Illinois, has announced the formation of a weekly informational HF net. The net will meet each Saturday morning at 1500 UTC on 3.925 MHz and will use the Tri-Town club call of W9VT. The club also sponsors a weekly 2 meter FM net on 146.49 MHz. That net is primarily concerned with the passing of club traffic as well as news about amateur radio. It can be heard on Wednesday evenings at 0200 hours UTC. You can communicate with the Tri-Town Radio Amateur Club by checking into either net or by writing to P.O. Box 302, Hazelcrest, IL 60429.

• **DX Repeater For Southeast Michigan** - The DX repeater for southeast Michigan is operational on the 2 meter 145.13 MHz repeater frequency (144.53 MHz input). The repeater is intended for DX and contest spotting and information. It is open to all DXers for their use (no PL required). Repeater call K8NA/R. All DXers passing through the southeast Michigan area are invited to check in.

• **Interior Alaska Operating Event and Award Certificate** - During March contacts with members of the Arctic Amateur Radio Club will be confirmed with special QSL cards. The AARC will mount a 48-hour contest-style operation during the race from 0000Z March 15 to 0000Z March 17 on 80 meters through 70 cm using club call sign KL7KC. Submit QSL from KL7KC dated March 15, 16, or 17 and cards from any two members of the AARC dated March 1984 (or a list of contacts certified by an official radio club or two other radio amateurs) to quality for the award certificate. Endorsements for working up to 25 additional club members during March are available. Submit info to Arctic Amateur Radio Club, P.O. Box 81389, Fairbanks, AK 99708. Include $5.00 to cover the costs.

• **VO3OWG Special Event** - VO3OWG will operate a special event station from the site of the Ontario Winter Games in St. Catharines, Ontario, Canada, from March 3–17. The club will offer a special QSL card and possibility of a special prefix for this event. Operation will be on CW, RTTY, and SSB from 160 to 10 meters. Send an SASE (9″×4″) to NPARC, Inc., VO3OWG, P.O. Box 692, St. Catharines, Ontario, L2S 2S2 Canada.

• **WA6AGD From Marysville, California** - The Yuba-Sutter ARC will operate WA6AGD to commemorate the 105th annual parade and festival in honor of BOK KAI, the Chinese Water God, from 1600Z March 23 to 0400Z March 24 using the low end of the General phone band of 75, 40, and 20 (also 147.450 simplex). For certificate send QSL and SASE to WA6AGD, c/o BOK KAI, Marysville, CA 95901.

• **The following events are slated for March:**

Feb. 22–24, **Cincinnati ARRL '85, Fifth Annual Ohio State Convention & Fleamarket,** Sharonville, OH. Contact Cincinnati ARRL '85, P.O. Box 11300, Cincinnati, OH 45211 (tele. 513-921-3844).

Mar. 2, **Milwaukee School of Engineering ARC Swapfest,** Milwaukee, WI. Contact W9HHX, 1025 N. Milwaukee St., Room C-6, Milwaukee, WI 53201 (tele. Pete at 414-347-1099).

Mar. 3, **Teays ARC 7th Annual Hamfest,** K.C. Lodge, 2 miles north of Circleville, OH. Contact Len Campbell, WB8PPH, 8951 State Rte #8, Circleville, OH 43113.

Mar. 3, **Mount Tom ARA Fleamarket,** Chicopee, MA. Contact Mickey Yale, N1CDR, 6 Laurel Terrace, Westfield, MA 01085 (tele. 1-413-562-1027).

Mar. 3, **Computer Central, Des Plaines, IL.** Contact Computer Central, 1506 Central Ave., Deerfield, IL 60015 (tele. 312-940-7547).

Mar. 8, **Split Rock ARA Ham Auction,** Morris Plains, NJ. Contact Split Rock ARA, P.O. Box 3, Whippany, NJ 07981.

Mar. 9, **Holland ARC Amateur Radio Auction,** Hudsonville, MI. Contact Dan Ruiter, KC8KN, 7106 Michael Dr., Hudsonville, MI 49426.

Mar. 10, **Indiana Hamfest,** Indianapolis, IN. Contact Aileen Scales, KC9YA, 3142 Market Place, Bloomington, IN 47401 (SASE) (tele. 812-339-4446).

Mar. 16, **Interstate Repeater Society Fleamarket,** Hudson, NH. Contact Interstate Repeater Society, P.O. Box 693, Derry, NH 03038 (tele. 603-889-3479).

Mar. 17, **Midland ARC St. Patrick's Swapfest,** Midland, TX. Contact Midland ARC, P.O. Box 4401, Midland, TX 79704.

Mar. 17, **Delaware Valley Radio Assoc. Fleamarket,** Trenton, NJ. Contact KB2ZY, Box 441B, RD#1, Stockton, NJ 08559 (SASE).

Mar. 17, **Conemaugh Valley ARC Hamfest,** East Taylor Fire Hall, 4 miles north of Johnstown, PA. Contact Conemaugh Valley ARC, 22829 Bedford St., Johnstown, PA 15904.

Mar. 23, **Columbus Swapfest,** Columbus, IN. Contact WD9HTN, 11941 W. Sawmill Rd., Columbus, IN 47201.

Mar. 24, **Randolph ARA Hamfest,** Winchester, IN. Contact RARA, Box 162, Winchester, IN 47394 (tele. WB9UZZ at 317-584-4995).

Mar. 24, **Southeastern Michigan ARA Swap & Shop,** Grosse Pointe, MI. Contact SEMARA, P.O. Box 646, St. Clair Shores, MI 48080.

Mar. 24, **19/79 ARA Fleamarket,** Lynn, MA. Contact 19/79 ARA, P.O. Box 171, Chelsea, MA 02150.

Mar. 30, **Shore Points ARC Springfest '85,** Egg Harbor City, NJ. Contact SPARC, Box 142, Absecon, NJ 08201.

Mar. 30, **Columbus, GA, ARC Hamfest,** Columbus, GA. Contact George M. Reitz, N4AGO, RR2, Box 22D, Seale, AL 36875 (tele. 205-855-2204).

Mar. 30, **Hobbie Hi Tech 85,** Fargo, ND. Contact Tim Gooding, WD0GUR, 1006 Sheyenne St., West Fargo, ND 58078 (tele. 701-282-6630).

Mar. 31, **Rock River ARC Hamfest,** Lee County 4-H Center, Amboy, Dixon, IL. Contact Shirley Webb, KA9HGZ, 618 Orchard St., Dixon, IL 61021 (tele. 815-284-3811).

Mar. 31, **LAMARSFEST '85,** Grayslake, IL. Contact LAMARS, Box 751, Libertyville, IL 60048 (tele. 312-255-8717).

Mar. 31, **Lake County Hamfest & Computerfest,** Madison, OH. Contact Lake County Hamfest Committee, 713 W. Jackson, Painesville, OH 44077 (SASE) (tele. 216-953-9784).

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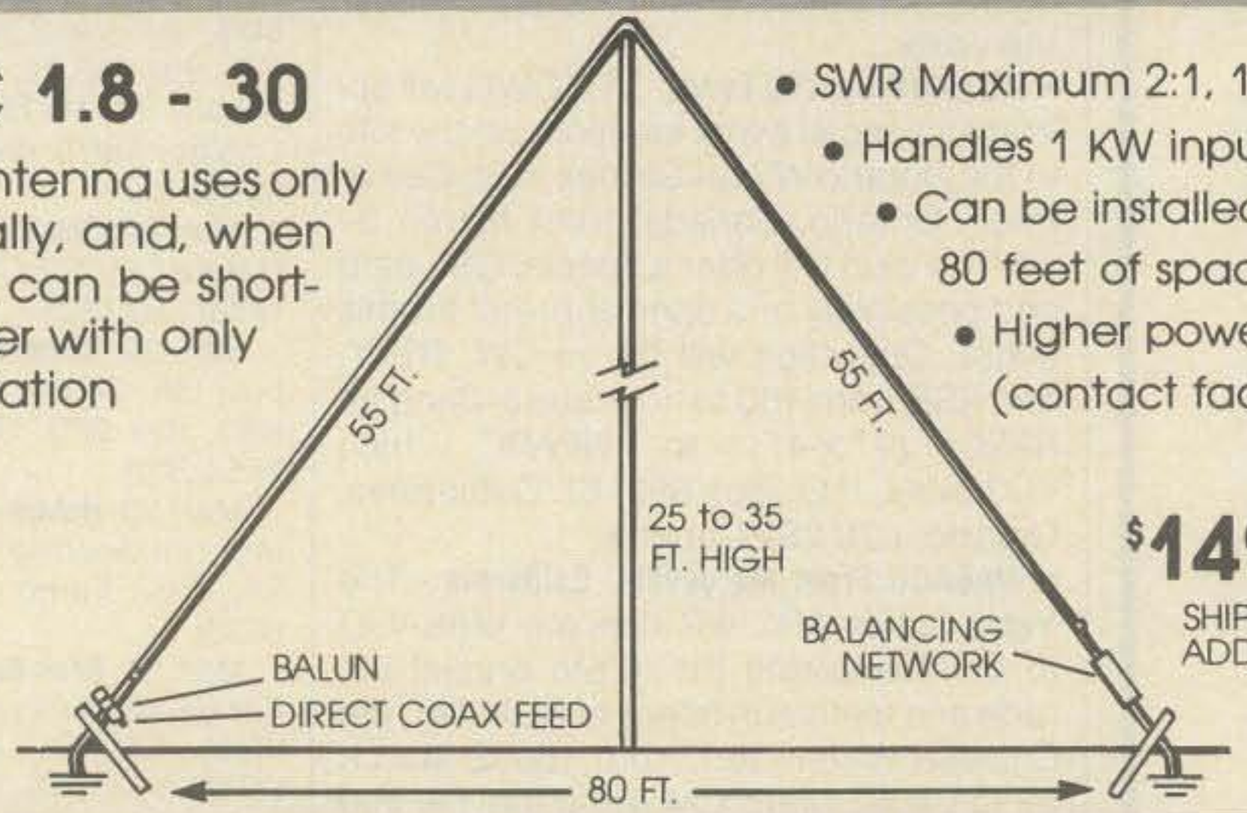

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A DXpedition to Tonga, Niue, and Samoa

Part I

BY TONY WARD*, VE3IAT

"You are the rudest, most arrogant, most inconsiderate operator I've heard in an age. . . . " I settle back in my seat; the phones buzz shrilly in my aching head. I feel very tired and very depressed. It is September 1980, day 21 of our 3 week jaunt around the Pacific, and 10 feet behind me Ron, ZL1AMO, is still whipping them through on CW. The frequency is 28595. There are 1½ hours to go before final shutdown. I've cut off someone for asking yet *again* what country A35TW is, and there is a WB6 out there who hates me!

"I've been listening to you all week and I've never witnessed . . ." the diatribe continues. Good Lord, another of these guys who watch a hated TV program right through before turning it off in disgust and writing to their congressman. I try to explain it to him.

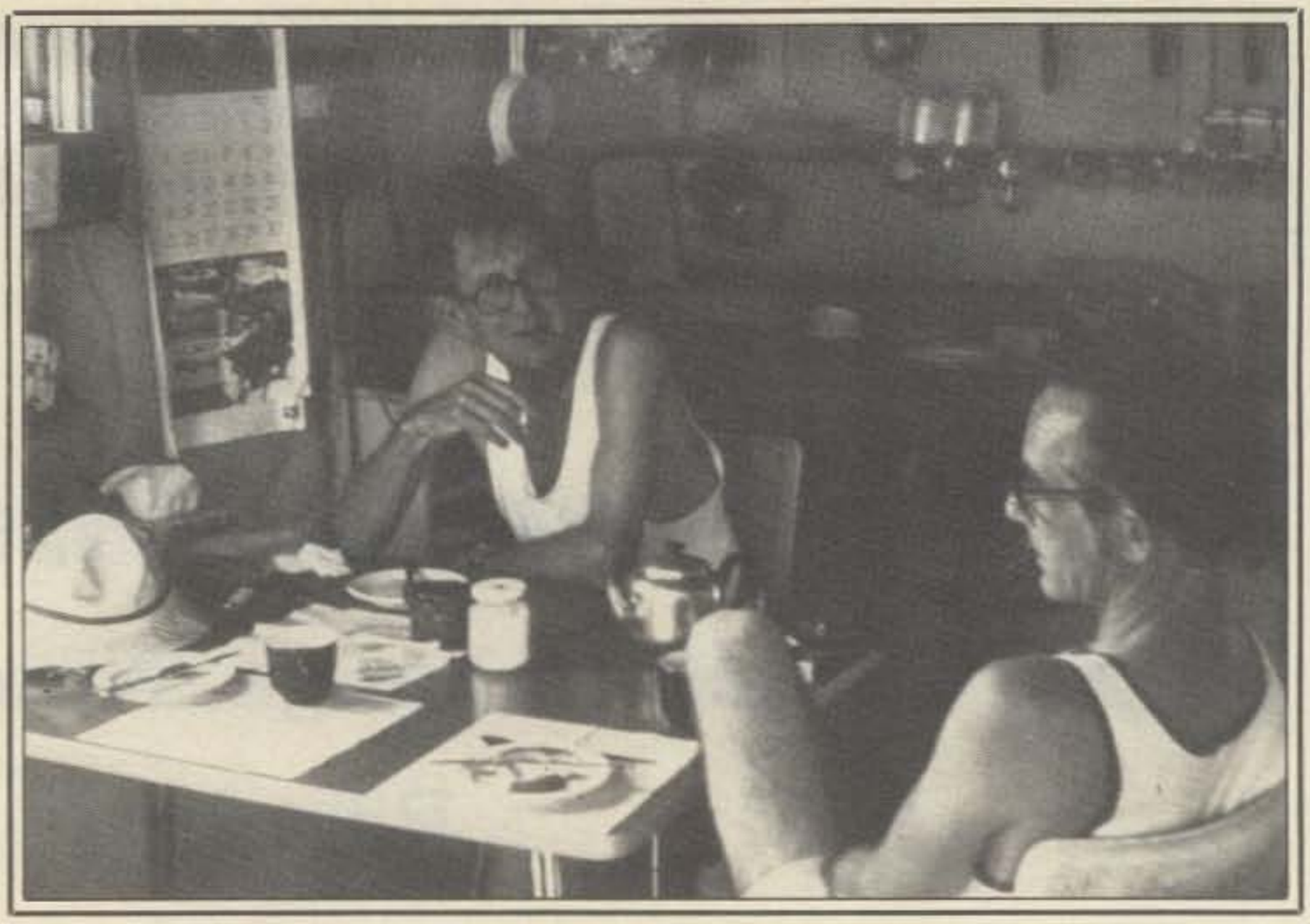
"Listen, between us we've worked over 26,000 contacts in a very short period of time. You don't *need* to ask me what country I'm in. A35 has been in every callbook and country list for years, and if that fails, there are thousands of amateurs on the air who would be happy to tell you. But now you've stopped the pileup and perhaps 25 of your fellow amateurs will miss the contact because I'm sitting here trying to explain myself to you. I know I'm being rude, I'm sorry about it, but right now I haven't the time or energy to cope with irrelevant questions. All I want from you is a signal report and your call sign. All you need from me is a call, report, and QSL manager. The rest you can get anytime. If you want to ragchew, then fine. I love to ragchew. But this is not the time nor the place."

The author, Tony Ward, signing ZK2TW.

He's not convinced, of course, and I'm too tired to care anymore. "A35 Tango Willy QRZ." The roar starts again as if there had been no interruption. Anonymity descends like a blanket over the pileup, although two minutes later a W4 says, "I'm in the log already; just wanted to say I agree with you." "Thanks," I say, and move on. I'm going much slower now, only three a minutes down from the five or so before the interruption, but I'm not pushing so hard and can resist the temptation to jump on the ten or so per hour who tell me, "The name is Bob; Baker,

*200 Craydon Rd., Whitby, Ont., L1N 2B6 Canada

Ron, ZL1AMO, operating A35EA, sifts through the pileup to pick out the rare ones.



Harry, ZK2AE, shares a leisurely breakfast with Ron, ZL1AMO, at Harry's QTH.

Oboe, Baker." ("Don't you think I can spell Bob, Bob?")

It is six hours later and dusk high over the South Pacific. I'm reading a book, and the steady drone of the south-flying 737 is soothing music. The cabin attendant is asking me patiently for the third time whether I would like tea or coffee, and I've finally made the decision. From the seat behind Ron taps me on the shoulder: "You sure slowed down *his* pileup," he grins. My answering smile is wry, and I'm pensive as I settle back with my drink.

The madness has faded now, but at the time I was sure I could write the definitive analysis of the DXpedition pileup. Images flocked unbidden through my brain. I became a processing machine—perhaps a meat grinder, or an insufficient ocean for the lemmings that hurled themselves into my surf. Sounds a bit strong. Certainly dehumanization takes place at either end of the path. To hear a person's name was an annoyance—half a QSO lost. To hear a name phonetically was a major irritant—a whole potential contact down the drain. I wanted to strike a rhythm and hold it above all else—next, next, next. I need your call and my report, all else redundant. But you, you are a person and must assert your uniqueness. . . . "The name is Bob; Baker Ocean Baker." The conflict arises because my aim and yours are different and largely incompatible. Have you ever danced away from the rig with shining eyes having worked a *really* rare one and screaming, "I got the —" to a startled wife and family and settled to a euphoria only faintly dimmed by guilt at the meaning of your involuntary exclamation. Visitors such as us to rare rocks and unpeopled places seek the situation. Seldom so the residents who, perhaps emerging for the odd contest caper, hide in cobwebbed corners of the bands, mumbling and blurring calls on the exchange, keeping skeds with friendly voices, and trying, for their own sanity, to ignore the eager uproar of demand with each over. For the demand *is* insatiable. Right now a successor beams from Niue, and hearing just the roar, you'd think we'd never been there, nor Sam or Darryl before us.

The pace of life is fast on a DXpedition. Sleep comes slowly despite the strain, and wakefulness is nearly instant. Away from the rig a good CW man like Ron shows mild symptoms of withdrawal after about two hours—usually a pronounced twitch in the right hand. Meals are gulped, not savoured. The inevitable scuffles with airlines over lost luggage are fought with ritual intensity; the real losers are the lemmings poised beyond the band. I wear three caps. As geographer, photographer, and amateur I'm pulled 3 ways, but the tug from 20 defeats the others with ease, and for 18 hours a day the two of us persist at the dials.

The surprise for me was that so much of the radio day in fact was not spent at the business end of a pileup. Particularly on 10 meters contacts more typically came steadily at a medium pace with perhaps 6 or fewer calling at a time. A surprising amount of time was spent beating a dead band. Stations working us at such moments paused to express amazement that no one else could hear us, but the other is a fickle fluid, and the openings were often tiny in the area they covered. Such times also saw the special opening to otherwise neglected areas, and we tried not to fritter away the time with chatter. The daily regime varied little. Prenoon openings were rare, and we spent mornings sight-seeing or fiddling with our magic wires and poles. True work started at about 1 p.m. (0000Z), and we alternated 10 and 15 CW and SSB trying to hit the east-coast peak for each. JA's and the west coast were always there to plug the gaps. D-layer absorption persists late on 20 in the tropics, and seldom was there much reward to be had before 5 p.m. (0400Z). One of us then headed for 40 meters for sparse but valued European and Latin contacts, while the other retreated to relative slumber on a chosen net to work the few in special areas along difficult paths and to repay old debts to electronic hosts. Dinner was a rushed affair; the early evening was too valuable to squander, with Europe panting at us on 15 and perhaps on 10. When conditions were weak, Ron held sway on CW, while on better nights SSB took the beam and spotlight. Local skeds on 40 were seen at 0830Z, and we randomly scanner for the best paths and bands. Nightly at 0900 and 1000Z I donned long underwear and headed for obscurity and lonely foolishness on 160 meters.

From this point on, each night, the clamour was on 40 and 20 as we carefully opened the States peeling, then back from east to west like a candy bar wrapper, until the last Willie-six faded into his local sunrise at around 3 or 4 a.m.

I don't remember when it started any more than I understood why it happened. A New Zealander, licensed first during a 10-year stay in Canada, I returned to New Zealand late in 1978 with my Canadian wife, Janet, and stern instructions to put on a few rocks for the lads at home. It had to wait. A teaching career to start again and setting up yet another household postponed prosperity, and I watched with envy as Ian, ZL1BCG; Dave and Aola, ZL1AMN and ZL1ALE, went tropical in

Some of Harry ZK2AE's willing helpers "ham" it up for the camera.

1979, and Ron and Chuck, ZL1ADI, "did" Chatham, Pitcairn, and Northern Cook.

By early 1980 it seemed that the three week break in August would be ideal. Chuck had settled into a demanding job, but Ron (self-employed in the taxi business) could get away. Ian's holidays were out of phase with mine, and he took a solo jaunt to Wallis Island. Inflation snapped about the heels; airfares to paradise rose 50 percent in one year. The same money would have taken me to Los Angeles and back—in fact, well over twice the distance. The chosen targets seemed best.

Without ambition to be cast-away at the whim of some demented, gin-soaked skipper of an island trader, a regular air service seemed essential to me. Tonga, 1500 miles northeast of Auckland, was the closest; Niue, relatively the rarest; Samoa, the best-known to me and the one for which I had a license already. It was also populated by a small but friendly tribe of local amateurs: Phil, 5W1AU, Marty, 5W1AT, and Peter, 5W1BZ. On Niue our contact was Harry, ZK2AE, who emerged for a regular weekly sked on 80 meters. He greeted our intentions warmly enough, proferred the use of his shack, and implied further assistance once we had been inspected. Tonga was a closed book to us. Rick, A35RB, was stateside and John, A35JL, hard to find on the bands. Ron's contacts via his business gave us an address to stay with a Tongan family, and hurried pauses in the pileup gave us more background from Sam, K5YY. A complicated swap with Mike, ZL1BIL, gave me back my old FL2500 (see later under heading "unmitigated disasters"), and Roly, ZL1BQD, made the providential leap to a TH5, freeing his TH33Jr for use. John, ZL1AAS, decided a 30 foot knockdown pole would be of use, and he slapped together a minor masterpiece on his lawn; Ron pried a TH3Jr from a friend, and it was bag-packing time in the suburbs.

Murphy first peered murkily at us at the airport—day one of that annual NZ fever known as the August holidays. The plane was full and the 44 pound baggage allowance strictly enforced. My big bag (remote VFO, speech processor, assorted underwear) scraped in. Ron sacrificed a tuner (ripped from Derek, ZK1BOQ's station) and a box of random car parts for our Tongan hosts. His beam had been sent on before to Harry. I stood sweating palely in the slow Auckland dawn with 66 pounds of "hand-carried luggage" concealed about my person. To whit: one FT101EX in wooden carrying case; one large camera bag full of assorted electronic goodies, tools, and cable; one Nikon slung around neck (no room in camera bag); one Sony TCF2001 receiver, duty-free, brand-new, and dearly beloved already. It was to become a familiar sensation. With all their other faults, no airline charged us excess baggage the whole trip. My beam and linear took the short journey to the freight department. (See later under heading "short journeys to obscurity.")

I bid fond farewells to parents and to long-suffering Janet and creaked towards security as my limbs strove to adjust to the unaccustomed load. The lady was friendly and efficient. "Looks like the makings of a first-class bomb" she greeted the opening of my bag. "Now if *I'd* said that you'd have thrown me in jail," I demurred. She laughed. The Yaesu caused mild consternation. Momentary forgetfulness and understandable nervousness had made me blurt "transceiver" instead of the more neutral and safer "radio," when asked what it was. It took some work to satisfy them that I could not inadvertently jam air-ground transmissions. I did promise that in the event of a ditching I'd be able to summon help inside of days if they would only stay afloat, and all of a sudden we were in the air and off.

The Kingdom of Tonga defies capsule comment. Imagine the largest collection of potholes you can, squeezed into a realm the size of central Los Angeles and presided over by the biggest man in the king-business: His Majesty King Taufa'ahua IV, 7'4" and 350 lbs. I will return to the potholes. Of His Majesty I can tell you little except that when one makes the idle greeting "How goes it?" on Tongatapu, the response can be "The King does well," as perhaps he does, slipping around the island in his Mercedes 300 SEL. As everywhere, a smile will get you miles in Tonga and a surly "another day, another banana republic" attitude is a recipe for a dip in carefully orchestrated beaurocratic treacle. The major shock was the temperature; at 57° it was no warmer than Auckland, 1500 miles polewards. From the air it seemed some friendly deity had tipped a bucket of brown mud over the land, for all was wet. Seldom more than 10 feet above sea level, the coral of Tonga drains water reluctantly to the ocean, and small boys shiver enthusiastically in the swamps that make for perfect RF ground.

Ebeneezer Flugelhorn's fifth rule for a rational transport system is strictly adhered to in Tonga. The island is 20 miles long with the captial, Nuku'alofa, at one end and the airport at the other, as far away as it can reasonably get. We rode the taxi to town like rodeo stars aboard a bucking pothole-probing survivor of a thousand demolition derbys, scattering pigs, chickens, small boys, and discarded shock absorbers in our wake.

If the weather was cool, our reception was warm. Lao and Peina, our Tongan hosts, could hardly have made us more welcome, turning over to us the whole front area of their large house. Fifty foot coconut trees beckoned invitingly from the backyard, but there was little rush, since we could not be licensed until Monday, two days hence. I enjoyed listening on the new Sony, trying out all its fancy bells and whistles, but we were anxious to get going and walks around the muddy streets did little to cool our energies.

God gets up early in Tonga. I *think* the first gong started at about 5 a.m. Certainly, by 8 a.m. most of Tonga was in church. No taxis ply for hire, no shops open, no planes may land. The only money changing hands goes from parishioner to church. Those of you who have witnessed the somnolent splendour of Sunday in Auckland would regard it as mad riot when compared to sabbath noon in Nuku'alofa. We were lucky to get our antennas up—a 40 meter dipole and a 210 foot longwire—and that night we eagerly scanned the bands in anxious impotence.

If Sunday was a day of peace, Monday was mayhem. As the clock mourned the old week, the peace of the night was shattered by the arrival of midnight guests, the squealing of festive pigs, and the crackling of the roasting fires, and the happy, noisy chaos reigned till dawn. Lao laughed at my enquiry. "Monday is a big morning in Tonga," he said. Well, it certainly was for us. Freshly licensed, we hit the airways before lunch as the bands opened, and by Tuesday evening we had 4000 QSOs logged. I began to wonder whether all the extra hassle over the absent beams and linear was worth it.

Wednesday noon saw us at the airport once more, having survived one of those taxi trips that should be banished to cheap fiction rather than clutter up real life. A random fuel blockage gave a tension to our progress that was sadly out of place in relaxed Tonga. We needn't have worried. A large consignment of watermelons seemed to have priority over passengers ("But Ron, I thought this was Polynesia not *Melo*nesia."), and the apparently necessary individual checking was a leisurely process. Anyway, the plane was nearly two hours late, and the question on everyone's lips was less "when" than "if" it would arrive, and would we ever get to Niue.

(To Be Continued)

CQ REVIEWS:

BY JOHN J. SCHULTZ*, W4FA

The Barker and Williamson AS-40/AS-20

Trap Dipoles and Model 593 Coaxial Switch

As many amateurs are probably aware, Barker and Williamson (B&W) offers a quite extensive line of trap-type dipole antennas. Some are specialized for just one or two bands, while others are multiband. Which particular antenna might be of interest depends, of course, on which bands are desired and how much room one has in which to put up an antenna. B&W also offers an extensive range of coaxial switches. Although this article will only cover two of their multiband dipoles and one of their coaxial switches, the same general comments should be applicable to most of the B&W product line.

The AS-40 and AS-20 Antennas

The AS-40 is an approximately 40 foot long dipole that is designed for operation on 40, 20, 15, and 10 meters, erected either as an inverted Vee or as a regular flattop antenna strung between two elevated supports. The AS-20 operates on 20, 15, and 10 meters and is approximately 23 feet long. The layout of both antennas is shown in fig. 1.

As can be seen from fig. 1(A), the AS-40 has three pairs of traps. The traps operate in the classic fashion, in that on 10 meters the TR-10 traps form parallel resonant circuits to isolate the dipole formed by the 8'5" long center wires. On 15 and 20 meters the respective trap-pairs perform the same function. On 40 meters, since all of the parallel resonant traps are operating below their resonant frequency, they present an inductive reactance and act as loading coils only. The AS-20 shown in fig. 1(B) operates in a similar manner, except that both trap-pairs operate as loading coils on 20 meters.

A typical trap element as used in the AS-40 and AS-20 antenna. The trap enclosure is of PVC and fully enclosed. The wire connections at one end are factory assembled.

One may wonder why the B&W antennas use so many trap-pairs, since various trap-type dipole antenna designs have been developed using fewer traps. Unfortunately, using fewer traps usually leads to compromises in one or more directions. Since the B&W antennas form the electrical equivalent of a ½-wavelength dipole on each band, the radiation pattern remains essentially the same on each band—a big factor unless one only wants to use an antenna which will simply "radiate" on several bands. The use of individual trap-pairs for each band also means that the antenna wire lengths between traps (or after the outer pair of traps for the lowest band of operation) can be trimmed for resonance *independently* for each band being used. Therefore, there is a lot to be said in favor of the classic individual trap-pair idea for a multiband antenna, although homebrewers tend to shy away from such designs since obviously several pairs of traps have to be constructed.

The AS-40 and AS-20 antennas come neatly packed in a rather small 12½ inch square by 5 inch high box. They are complete with all the necessary antenna wire (very good quality No. 14 stranded), a center insulator which has an eyelet for hanging, end-insulators, and comprehensive instructions. Looking at the components for the antenna, one is rather impressed by their quality. The traps themselves are enclosed in white PVC tubing, which has two PVC end bells cemented to it. Each end bell has an eyelet (dabbed with some varnish to ensure that its fastening nut doesn't move after being tight-

*c/o CQ Magazine

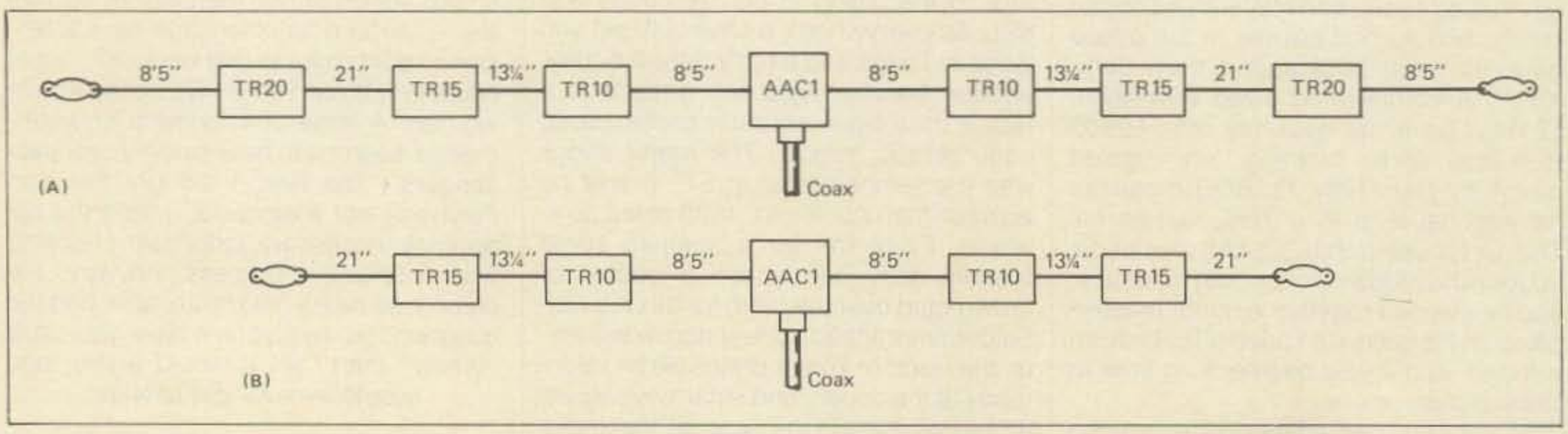
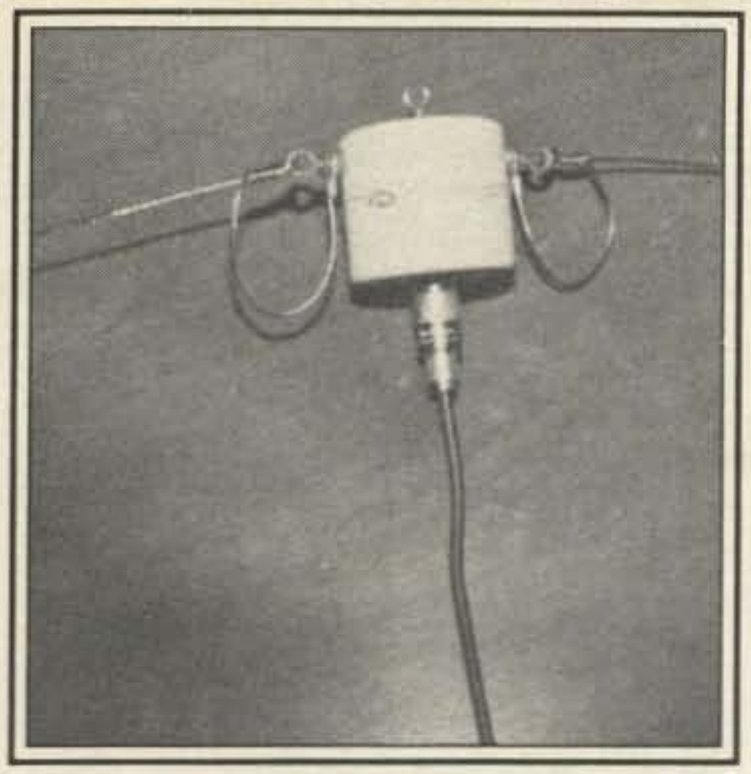


Fig. 1– Physical dimensions for the AS-40 antenna (A) and the AS-20 antenna (B).



The center insulator/support as supplied with the AS-40 and AS-20. All antenna wire connections are factory assembled.

ened), and a cable lug for wire attachment. One end of each trap has the antenna wire already attached at the factory. The soldering and assembly are very well done. Everything, in fact, is factory assembled except for those wire segments which must be left undone so a user can adjust the antenna to resonance in each band. Each trap measures 2⅝ inches in diameter by 6¼ inches long and weighs about 10 ounces.

The center insulator is assembled in the same fashion as the traps (PVC end bells over PVC tubing), but is only 2½ inches long. The SO-239 connector in one end bell is of the single-hole-mounting type, which is of some advantage since it doesn't require any external fastening hardware which could deteriorate over a period of time. As was mentioned, it has an eyelet for hanging, and the two 8′5″ antenna wires which attach to it are factory assembled. The center insulator does not encompass a balun, however.

Assembling and Using the Antenna

One could dimension the antenna as shown in fig. 1, and if the antennas are erected reasonably in the clear, the SWR is likely to be low across each band. However, it is much more desirable to adjust the wire lengths on each band for the lowest possible SWR. This doesn't require any equipment beyond an SWR meter, but it does take a small amount of time. The antennas are initially assembled as B&W specifies with the wire going to one end of each trap loosely twisted around the eyelet on the trap. The antenna is then elevated, the SWR on 10 meters checked, and the wire portion affecting 10 meter operation trimmed for lowest SWR at a desired operating frequency. When the correct wire length is determined, the wire is twisted around the eyelet, soldered to the wire lug associated with the eyelet, and the excess wire cut away. As regards wire attachment to the traps, one simply can follow the example of the way the factory connections are made to one end of each trap. A similar procedure is followed for each band. It is not a bad idea to put a bit of polyurethane sealer around each solder lug.

If one takes a bit of time with this procedure, one will achieve an antenna resonant exactly where desired in each band and of sufficient physical integrity such that it should last for years of service under even the worst of weather conditions. Typical SWR curves are shown in fig. 2. As B&W notes with the antennas' instructions, it is difficult to erect the AS-40 as a flattop antenna without some sort of support for the center due to the weight of the traps and a coaxial feedline. Without such support, the center will tend to droop. The AS-20 is a bit better in this regard. Of course, the electrical performance is not greatly affected if there is a slight center droop, but an inverted-Vee installation with maximum height at the center is definitely the best way to use the AS-40 and AS-20 antennas.

Two AS-40 and AS-20 antennas were erected and tried in a number of orientations and configurations. No great new antenna principles were discovered, with the antennas working well installed in inverted Vee, sloping or flattop fashion. Of course, except for extreme short-skip coverage on a lower frequency band like 40 meters, performance of any dipole antenna varies almost directly with how high and in the clear one can get the center of the antenna. On a band like 40 meters, if one is interested at different times in short-skip and DX contacts, there is a certain luxury involved in having two dipoles available one each at a

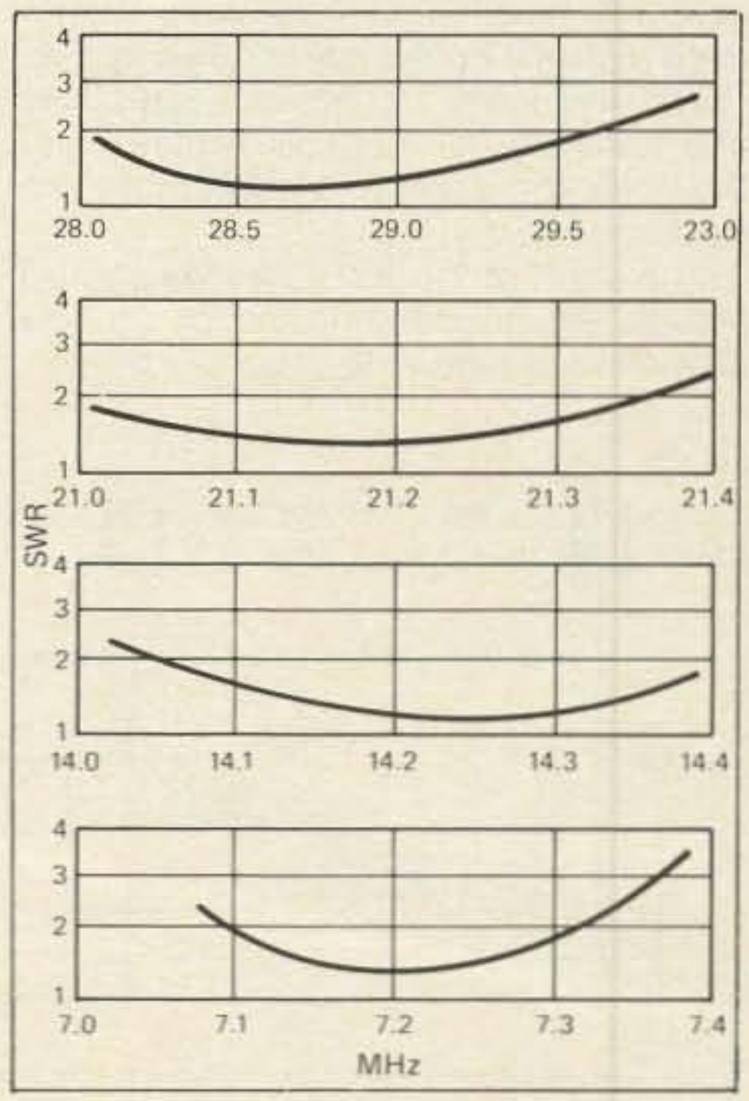


Fig. 2– Typical SWR performance with the antennas installed as inverted Vees (center 30 feet high and the ends about 18 feet high). The power rating of both antennas is 1 kw (2 kw PEP). Only the top three graphs apply to the AS-20.

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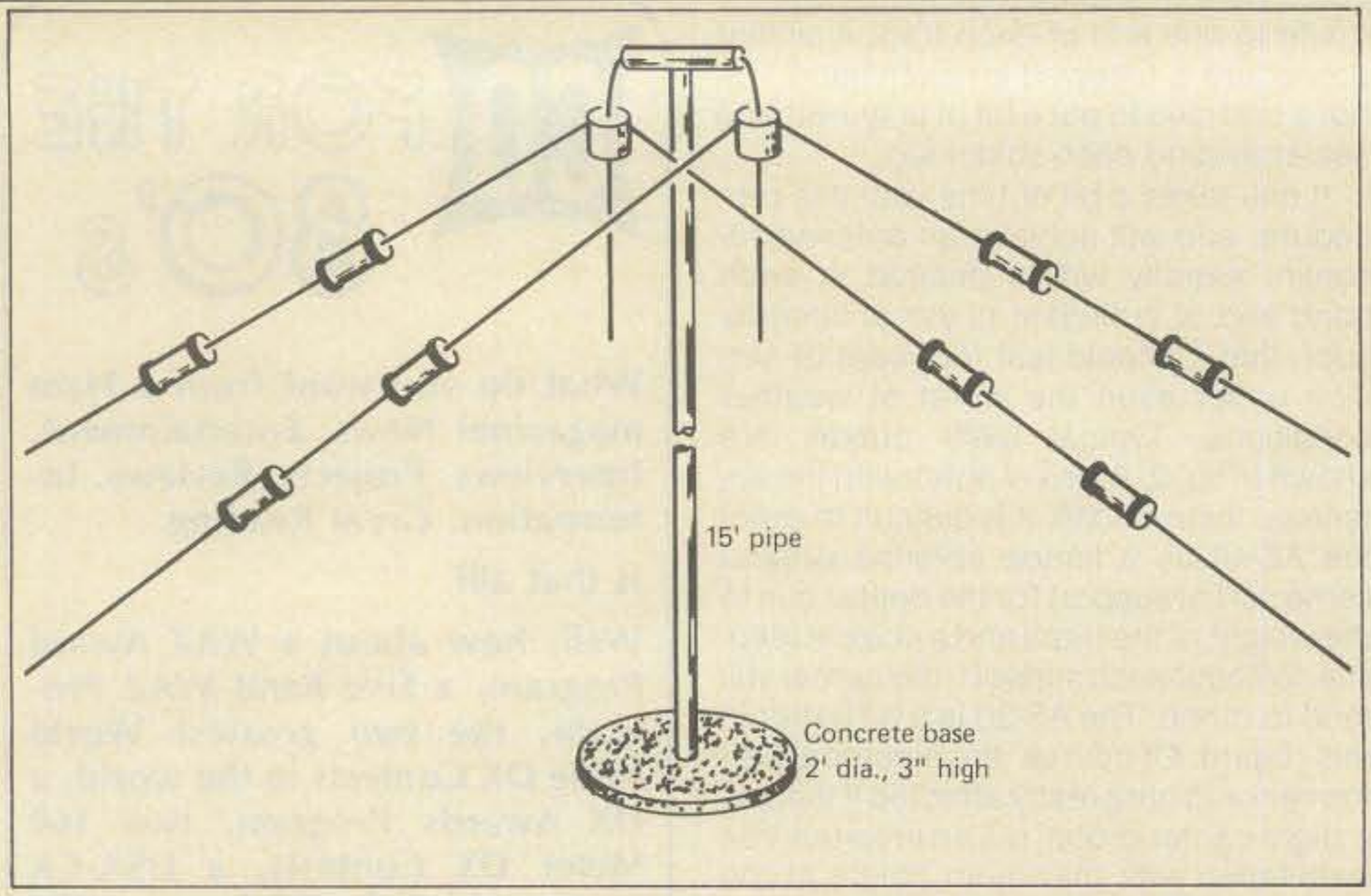


Fig. 3– Two AS-20 antennas were used at right angles to each other. Separate but equal length coaxial feedlines were run from each antenna into the shack to be used in conjunction with the switching shown in fig. 4.

low (⅛ to ¼ wavelength) height and at an elevated height (½ wavelength or more).

The main reason for experimenting a bit with two of each of the antennas, however, was to see what extra operational advantage could possibly be gained by using two of the same antennas from a single middle support mast. Since both antennas are relatively short, they lend themselves nicely to the idea of acting simultaneously as radiators and guy wires for a single center mast. Fig. 3 shows an interesting setup that was tried on a flat-top-roof house in SV5 land using AS-20's. It's not too unusual in that area to have a long TV mast imbedded in a round or square concrete block that sits on a flat roof and the mast guyed against high winds in some sort of fashion. The two AS-20's were installed as shown in fig. 3 (as though they were guy wires) with a separate coaxial line coming from each antenna into the shack as shown in fig. 4. The switching in the shack allowed the selection of either antenna alone or the phasing of both as a "turnstile" antenna for an omnidirectional pattern.

Readers who are not familiar with a turnstile antenna might refer to any antenna textbook. The classic turnstile antenna is simply two dipoles at right angles with the feed to each antenna phased 90 degrees. With coaxial line feed to each antenna, it is possible to achieve the phasing simply by inserting an extra ¼ wavelength of coaxial cable run in the transmission line to either antenna. The only problems are that the ¼ wavelength section will have a different physical length on each band of operation, and when one parallels the transmission lines, the load impedance presented to the transmitter output is halved. The latter can easily be accommodated using a broadband step-up balun or antenna tuner. Anyway, the setup used was a bit primitive, but technically correct. There was a distinct advantage observed in being able to choose between the omnidirectional turnstile pattern and either of the dipole patterns, depending upon the band and QRM conditions.

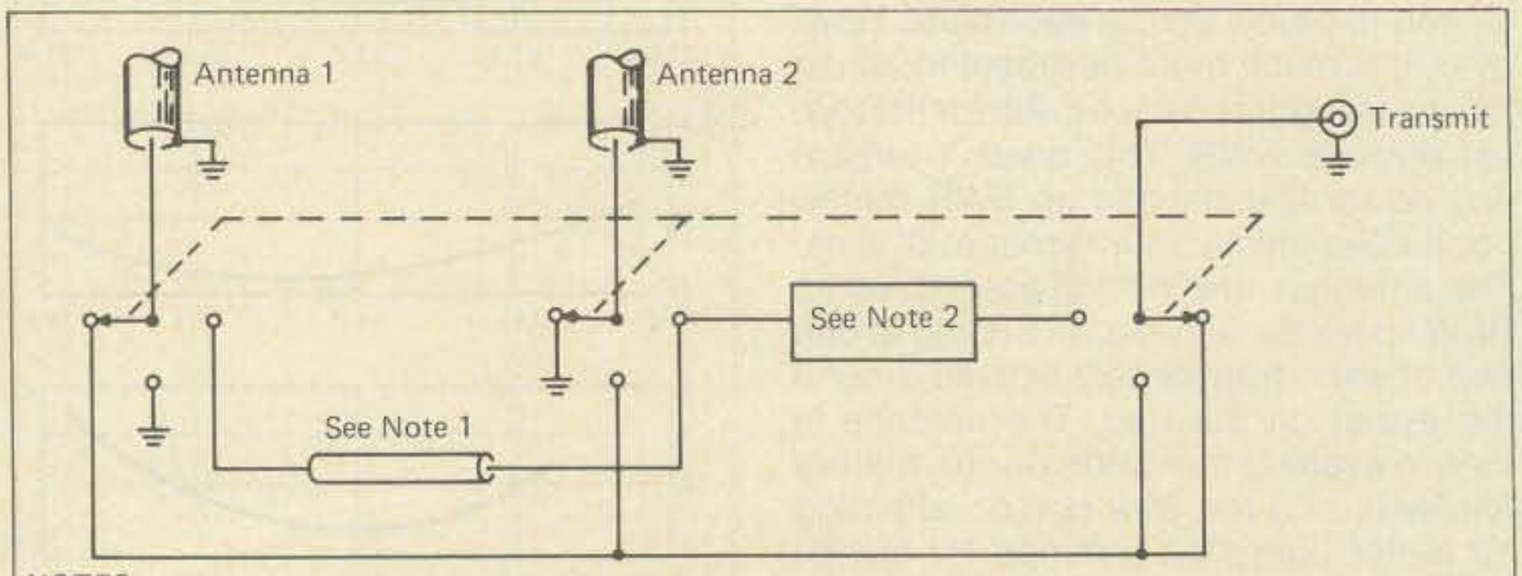
The next step was to see if the two antennas could be phased to provide some directivity with gain. In this case the dipoles were not used at right angles to each other, but rather one dipole was configured as a sloping forward dipole and the other as a sloping background dipole. The phasing sections were lengthened to be the equivalent of 135 degrees. There was indeed noticeable directivity and moderate gain (2–3 dB?) noted along the open line direction between the two sloping dipoles.

The point of the foregoing was not to present any refined information on how multiple trap-type antennas may be configured. However, the point is that if one is using trap-type antennas which act as true dipoles on each band of operation, it is possible to configure two of them in any of the classic textbook configurations for two-element antennas provided they are phased and/or spaced properly on a given band. The B&W AS-40 and AS-20 antennas would appear to lend themselves ideally to this application. Therefore, one could start with one antenna and add another later on as application ideas develop.

The B&W No. 593 Coaxial Switch

The 593 switch was used at times along with the AS-40 and AS-20 antennas. It is basically a single pole, three-position, grounding-type switch (non-selected outputs are grounded). It is rated at 1 kw up to 150 MHz. As can be seen from the internal photograph, the switch consists of a ceramic insulated double-sided switch wafer. The upper section makes the output selection, while the lower section (not visible in the photograph) has a rotating grounding ring. The enclosure, which has four SO-239 connectors mounted on its rear panel, measures about 5″×3″×2″. The unit is simply and neatly wired. However, the use of pop rivets to fasten the SO-239's to the enclosure didn't, at first, appear to be the best of ideas. But, it must be admitted that after many tries at attaching and detaching coaxial connectors to the switch, the SO-239's remain as firmly in place as ever. Electrical measurements also confirmed that the SO-239's remained firmly in place.

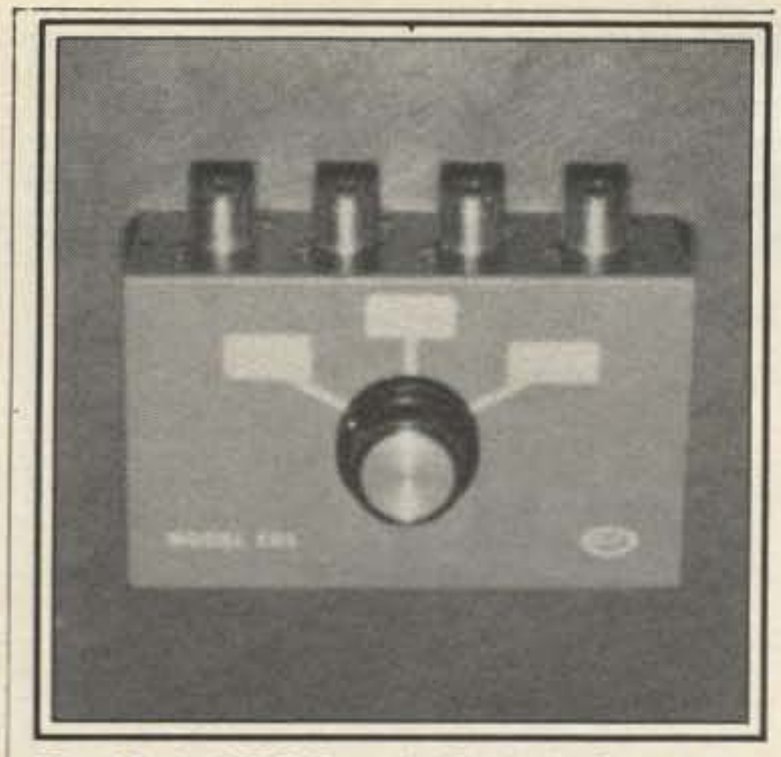
An extremely easy modification is possible to the 593 switch such that an extra "off" switch position is provided whereby all three output SO-239's are grounded. This feature may not be of much interest if the 593 is used to switch between, say, two active antennas and a dummy load, since the switch can be turned to the dummy-load position when a station is closed down. However, if the extra "all-grounded" position is desired, only a sim-



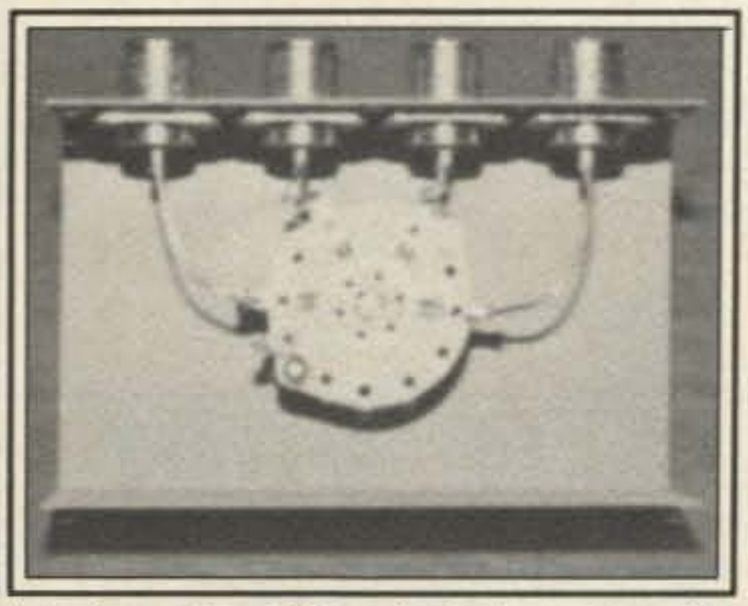
NOTES:

1. Coaxial phasing line (same coax as used for feedline). ¼λ long (taking velocity factor into account) on band of interest.
2. 1:2 step-up transformer. Probably not needed if an antenna tuner is in use.

Fig. 4– Switching setup used to select either AS-20 alone or to phase both as a "turnstile" antenna. The switching could be expanded as desired for phasing of two antennas on more than one band.



The Model 593 Coaxial Switch. One common input SO-239 connector and three output connectors are on one side panel of the switch.



Interior of the 593 switch. A good quality switch with stealite insulation provides both for the selection of a desired output and for the grounding of the nonselected antenna outputs.

ple tab, which limits switch travel and which is very obvious once one looks inside the 593, has to be bent outward to allow the switch to rotate a further position, either to the right or left, of the three marked switch positions on the front panel of the 593. The small tab need not be removed, only slightly bent to allow further switch rotation.

The gray/white color scheme of the 593 fits in nicely with almost any equipment. The white blocks of each switch position on the front panel of the 593 allow one to pencil-in the designation of the antenna connected to the respective output SO-239 connector. The 593 was used at the kw level on the HF bands and performed without any problems. There is plenty of room in the enclosure to include a transient suppressor, if desired.

Summary

The B&W AS-40 and AS-20 antennas and the Model 593 Coaxial Switch all proved to be very good quality products. The average home-brewer would particularly be hard pressed to duplicate the quality of any of the items. The AS-20 antenna retails for $99.00 and the AS-40 for $129.00. They are manufactured by Barker & Williamson, 10 Canal Street, Bristol, PA 19007.

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CIRCLE 66 ON READER SERVICE CARD

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a regular feature by
THEODORE J. COHEN, N4XX

THE INS AND OUTS OF THE WASHINGTON SCENE

Goldwater Asks Fowler To "Keep Hands Off 220"

In a strongly worded letter to FCC Chairman Mark S. Fowler, Senator Barry Goldwater (R., AZ) warned the Commission that changing the Amateur service's allocation at 220 MHz was the wrong thing to do. Here's the full text of the letter to Mr. Fowler:

Dear Mark:

More and more, I am getting word that the Federal Communications Commission might be considering a rulemaking aimed at reducing the 220 MHz allocation used by amateurs on a shared basis with the government. Now, this isn't going to set well and I think the Commission would be wrong in doing this.

There is an increasing demand for more services to the public which use the radio waves, and most importantly, some new technologies being developed through experimentation permit more signals to coexist within the present bands. I think we especially need to encourage these. But, let's not knock down amateur radio once again in our efforts. The 220 MHz band is where we amateurs can do a lot of experimentation with these new technologies that will benefit all spectrum users. Removing these frequencies from amateur use is unnecessary and would be shortsighted.

Do, I ask you to keep hands off 220. It's needed for continued amateur experimentation, like the hams always have done.

With best wishes,
(signed) Barry
Barry Goldwater

Commission Action on 900 MHz Band May Reduce Pressure on 220 MHz Amateur Band

As discussed last month, the Commission, in late November 1984, met to decide on nine competing petitions for allocations in the 900 MHz band. Among the services that were granted new spectrum space were the Private Land Mobile service, the newly created Land Mobile Satellite service (LMSS; a NASA initiative), the Common-Carrier Cellular services and a service used by the broadcast industry. For all intents and purposes, the Commission, in denying an allocation for the proposed Personal Radio Communications Service (PRCS), killed the idea for such a service, at least in the top 20 markets. The door was left open, however, for implementation of a "PRCS-type" service in smaller markets.

One surprise during the proceedings was the denial of an allocation for in-flight telephone service. Though one operator of such a service was able to obtain a one-year extension of his temporary authorization, the survival of this service is anything but assured.

The Commissioners' actions at 900 MHz could act to reduce pressure on the amateur 220 MHz from the Land Mobile Communications Council (LMCC) and STI, Inc. Both had petitioned the Commission to reallocate all or portions of the 220 MHz band to the Land Mobile service and to permit the use of a more spectrum-efficient modulation technique in that band (specifically, amplitude companded sideband [ACSB]). However, the Commissioners, in requiring the use of 12.5 kHz channel separation in the new Private Land Mobile allocations at 900 MHz, essentially required the use of such modulation techniques. This could result in both LMCC and STI withdrawing their petitions, though this has not happened as we go to press.

Kowalski Closes Book on Amateur Net Dialog

In this column for July 1984, Ray Kowalski, Chief, Special Services Division, Private Radio Bureau, FCC, asked amateurs to enter into a "dialog" with him on the subject of net operations. With the ARRL's inquiry into that subject now complete, here are Ray's remarks in the matter:

"I received several thoughtful letters from *CQ* readers who provided me with their insights. As you might expect, however, no clear-cut concensus emerged from this correspondence.

"Net operations have been a personal interest of mine since 1976. Interference by and to a net on 40 meters was the subject of my first assignment in the Private Radio Bureau. I concluded that interference in the context of HF nets might be the product of silent or conflicting FCC rules on the subject. The rules permit nets to operate on a frequency for as long as they like; yet, no person or net has an exclusive right to any frequency. It seemed to me that interference resulted when either of these truths was carried to the extreme. If the interference could be stemmed by a rule change, I felt all we had to learn was what change to propose.

"I posed eight questions to your readers as well as to the Executive Committee of the American Radio Relay League. The ARRL, in turn, also requested input from its members. I feel, therefore, that there has been a considerable amount of exposure of my main inquiry: should there be a regulatory response to the problem of interference by/to HF nets?

"The League's Executive Committee performed a study and submitted a report to its Board of Directors dated October 2, 1984. It concluded that, 'New, specific rules regarding net operation are not required, and should neither be proposed nor supported by ARRL.' In reaching this conclusion, the study found that a certain amount of interference is tolerable—even expected—in the Amateur service. The concept of a 'clear frequency' is unrealistic, according to the study. Instead, the study points to the fact that often operation on an already occupied frequency will not result in interference. Rather than new rules, the study recommends better education of hams, especially new hams, to the realities of HF communications; more voluntary adherence to band plans; and enforcement of existing rules where true malicious interference is found.

"The clear message of the ARRL study is that rulemaking is not in order here. No one is in a better position to know the conditions which prevail in the amateur HF bands nationwide than the ARRL. Since they have determined that there is no nationwide problem which ought to be addressed in rulemaking, I will not substitute my limited observations for theirs. The FCC guards against trying to regulate when no regulation is needed, and this should be no exception.

"I thank *CQ*, your readers, and the American Radio Relay League for their assistance.

"s/Raymond A. Kowalski"

No-Code Still a Subject Of Discussion

The subject of a "no-code" license refuses to die. Even after the FCC's action earlier this year, various informal proposals for the creation of such a license class—or a new communications service—still surface from time to time in Washington.

In a letter to the ARRL, for example, Phil Anderson, President of Kantronics, Inc., congratulated the League on the goals that it set for growth in the Amateur service, and expressed the belief that the goals could be met "if (the ARRL) makes room for the young computer hobbyists, and at the same time (does) not require

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that they be able to copy code or send code at 5 WPM."

Anderson noted that his wife teaches school at the junior-high level, and that virtually all of the students in her school are crazy about computers. However, not one is a ham. Said Anderson: "I believe that these kids would become hams if they thought they could link their computers together (using VHF links)." The creation of a no-code license with digital privileges would not only help amateur radio grow, said Anderson, but it might also help retain many of the Novices who are currently deserting our ranks in droves.

The subject of a no-code license was also raised by *The Westlink Report*. In commenting on the FCC's decision regarding allocations in the 900 MHz band (see above), *Westlink* noted that dismissal of a petition to create a Public Radio Communications Service (PRCS) in the U.S. might refuel interest in the creation of a non-technical radio "play toy" service similar to the Citizens Radio service. The new service, if one was created, would provide for the use of repeater stations and telephone interconnects such as those proposed for the PRCS.

If a no-code communications service is created by the FCC, we should keep the following in mind:

1. The new service will not be part of the Amateur service (Robert Foosaner, Chief of the Private Radio Bureau, FCC, has made this abundantly clear); and

2. There is a chance that the frequency band(s) assigned to the new service would be carved out of a VHF or UHF band now assigned to the Amateur service.

Goldwater Considers Introducing Resolution on Antennas

By the time this is read, it is possible that Senator Barry Goldwater, K7UGA (R, AZ), will have introduced a resolution into the 99th Congress on antenna restrictions. Specifically, the resolution will urge the FCC to ensure that local zoning laws and other ordinances do not limit citizen use of satellite-supplied services and amateur radio communications. The language of the resolution was developed by the Senator's staff in consultation with representatives of the ARRL. If introduced, the resolution would be extremely timely, given the Commission's current consideration of PRB-1, an inquiry into antenna restrictions imposed by local zoning boards.

National Bureau of Standards To Study TVI

Radio frequency interference (RFI), and one of its better-known forms, television interference (TVI), are subjects well known to amateur operators. Each year the FCC receives tens of thousands of RFI complaints involving devices such as television receivers, video cassette recorders, and high-fidelity audio systems. And even though the Commission now has the authority to impose susceptibility standards on electronic home-entertainment products, it has yet to act in this area.

Enter the National Bureau of Standards (NBS). According to the IEEE's *Spectrum* magazine, this agency, under a contract from the Electronic Industries Association (EIA) in Washington, DC, will soon begin a study on the susceptibility of video and audio products to conducted interference. According to a spokesman for the EIA, the NBS will attempt "to relate the current measured in the leads to electromagnetic field strength at the apparatus—an area in which only a small amount of data is available." The study, however, will not address two other interference modes: that caused by radiation received at the antenna and direct radiation into a device from the outside.

The EIA has also asked the NBS to propose test procedures for minimizing interference and to evaluate measurement techniques proposed by other or-ganizations.

For more information, contact Electronic Industries Association, Attn: Mr. Eb Tingley, 2001 Eye St. NW, Washington, DC 20006, phone (202) 457-4975.

FCC Releases Analysis Of Interference From "Part 15" Devices

The Commission has released a study by the Field Operations Bureau entitled "Analysis of Interference from Sources Regulated by Part 15." Written by Joseph P. Casey of the FOB's Inspection and Investigations Branch, the study was initiated as a result of the substantial increase in the number of RFI complaints that cited "Part 15" devices as the interference source. These devices produce RF radiation incidental to their operation, and include everything from hair dryers and electric razors, to coin-operated video games, home computers, and cordless telephones. Among the study's findings are the following:

•Electronic home entertainment equipment is particularly susceptible to interference from Part 15 sources.

•Amateur operators experience only a small amount of interference from Part 15 devices, though the number of complaints to the Commission from amateurs could rise if the Part 15 interference problem gets worse.

•Other users of the radio spectrum are relatively immune to interference from Part 15 devices.

•Increases in interference from Part 15 sources do not pose any unusual threat to the safety-related use of the spectrum.

•A surprisingly small number of RFI complaints were received concerning devices which require FCC authorizations. This speaks well of the Office of Science and Technology's equipment authorization program.

•Over 60% of all interference from Part 15 sources is electrical (that is, conducted, device radiated) interference of one kind or another.

As a result of the study, Casey made the following recommendations:

1. Modify the FOB data collection system to capture data on electrical interference on a regular basis;

2. Develop a self-help brochure to assist complainants in locating and eliminating electrical interference.

Government Seizes Electronic Equipment Valued At $500,000

In late 1984, engineers from the New York District Office of the FCC, working in cooperation with special agents of the U.S. Customs Service and the U.S. Attorney for the Eastern District of New York, seized over 2700 pieces of electronic equipment imported into the U.S. from the Far East for illegal sale here. The equipment included CB transceivers, FM receivers, and other devices having a total estimated value of $500,000.

The CB transceivers, it should be noted, were capable of operating on unauthorized frequencies at power levels in excess of that permitted by the Commission's Rules. Further, these radios were not "type accepted," and constituted a potential source of interference to essential radio services and electronic home-entertainment equipment.

The government's action is the result of a two-year investigation by the Commission into the importation and marketing of non-type-accepted equipment by Granada Electronics of Brooklyn, NY. Granada was identified as a major distributor of such illegal merchandise following the search and seizure operation.

ARRL Files Request on Automatic Control of Digital Communications

The League has filed a petition with the Commission to allow automatic control of digital communications above 30 MHz. In its Petition for Rule Making, the ARRL argued that "the level of amateur experimentation with digital communications has progressed to the point that automatic control of digital communications is both feasible and necessary to facilitate further development of such experimentation." Specific reference was made to the growing use of computer-based message systems.

Should the Commission initiate rulemaking procedures in this area, one issue that would have to be addressed pertains to the responsibility of the station licensee for proper station operation. To this end, the League noted that its Board of Directors has adopted interim

standards for the use of digital communications within the Amateur and Amateur-Satellite services.

A rule-making (RM) number has not yet been assigned to this matter.

FCC Acts To Protect Aeronautical Communications From CATVI

In finalizing a long outstanding proceeding (Docket no. 21006; FCC Docket 84-516), the Commission has amended its rules to prevent cable television signal interference to aeronautical communication and to radio navigation systems. Before cable television systems can operate on frequencies allocated for aeronautical radio, they must meet frequency offset, monitoring, and cumulative signal leakage requirements. This, says the Commission, will ensure the safety of life while allowing maximum possible use of broadband cable systems.

A request by the ARRL for similar protection to operations in the Amateur service was denied by the Commission late last year.

Fee For Amateur Exams Rises 4%

The new fee for amateur exams in 1985 is $4.16, a 4% increase over the 1984 fee of $4.00. According to John Johnston, Chief, Personal Radio Branch, Special Services Division, PRB, FCC, the increase is a result of a 4% increase in the Consumer Price Index. Johnston noted that the $4.16 fee is the maximum that can be charged any one examinee for any one examination, regardless of the number of elements involved. However, the fee can be less, he said, with some examiners charging nothing at all.

Radio Club of America Inducts First Senior Members

The Radio Club of America, the world's first radio communications society, recently inducted its first Senior Members. The new Senior Members, whose applications were approved at the Club's annual Board Meeting in New York City late last year, included Albert D. Helrick, K2BLA; John J. Kelleher, W4ZC; Frederick G. Suffield; and your Washington Editor.

Also honored by the Club at its 1984 Annual Banquet were several other amateurs. The awards made included the following:

The Sarnoff Citation—For Significant Contributions to the Advancement of Electronic Communications: Robert M. Atkin, Jr., K2LCU, President, Naval War College Foundation.

The President's Award—For Unselfish Dedication to the Support of the Radio Club of America: Joseph F. Walker, Sr., W5ZPO, Former Vice President of Communications, Phillips Petroleum.

Action Continues in Appeal On AM Ruling

Late last year a United States Court of Appeals order issued by Acting Chief Judge Wright, for the District of Columbia Circuit, accepted Glenn A. Baxter's (K1MAN's) brief, which appealed the FCC's AM power-reduction ruling scheduled to take effect in January 1990 (Docket 82-624). The order further granted Baxter's motion to dispense with the appendix and to record excerpts filed in October. According to Baxter, the action overrides one FCC motion to require the complicated appendix and another motion to strike his brief on technical grounds.

The next step in the proceedings is for the FCC to file their brief in response to Baxter's arguments. This was not due until 30 January 1985. Whether oral arguments will be required in the case has not been decided. Regardless, the Court of Appeals will decide this case on the basis of whether or not the FCC was erroneous or arbitrary in ordering the 1990 AM power reduction.

Your Washington Editor thanks Mr. David Siddall, K3ZJ, for his contributions to this month's column.

Ticket Talk

BY DICK BASH*, KL7IHP

Beware the Ides of March and welcome to the March column of *Ticket Talk*, a column devoted to answering questions you may have about the amateur radio licensing structure. If you still have questions, please write me c/o *CQ* or else at the address shown below. *A reply will be sent to those enclosing a self addressed stamped envelope.* If you can't wait for an answer, either call me at (415) 278-8275 between 10AM and 6PM, Monday thru Friday, California time, or else call your local FCC Field Office.

Test Questions

This issue I'll deal with some of the questions found in the new Technician/General PR Bulletin 1035B, dated November, 1984. If you need a copy of this Bulletin, mail your request to the FCC, Private Radio Bureau, Washington, D.C. 20554.

Power Questions

Those hams planning to take the Technician/General written test (called Element 3 by the FCC and the examiners) may find questions asking how much power an amateur station may use when operating on a specified frequency. Having reviewed this question in PR Bulletin 1035B dated November, 1984, I see a few potential problems for the test taker. Let's go over them and avoid the pitfalls!

First of all, three of the questions ask you for maximum power levels *on Novice Class frequencies!* So, learn the Novice frequencies. Here they are:

3700-3750 kHz
7100-7150 kHz (but it's 7050-7075 when in Regions 1 or 3)
21100-21200 kHz
28100-28200 kHz

Per 97.67(d), on any Novice frequency and especially on the frequencies of 3725 kHz, 7.125 MHz and 21.150 MHz (these are the Novice frequencies that are specified in questions 3A-3.3, 3.5, and 3.7 of PR Bulletin 1035B) you are limited to using 200 watts peak envelope power (p.e.p.). Per 97.67(b), you are permitted 1500 watts p.e.p. on other than Novice frequencies. For test purposes, the frequencies asked in the questions are 1825 kHz, 7080 kHz, and 146.52 MHz. So, *R*ead *T*he *F*unny *Q*uestion (RTFQ) *carefully* and be sure you know you can't use 1500 watts p.e.p. on the Novice sub-bands, regardless of the level of license you hold.

Beacon Power Limitations

Questions asking the maximum transmitting power of an amateur radio station in beacon operation are, in this writer's opinion just plain dumb, but they have to ask something and you'd better understand about beacons.

First of all, a "beacon station" is one which is sending out a signal on a more or less continuous basis. It is officially defined in 97.3(l) as *one-way radio communication conducted in order to facilitate measurement of radio equipment characteristics, adjustment of radio equipment, observation of propagation or transmission phenomena, or other related experimental activities.* There are a few to be found on 10 and 6 meters. Anyway, their purpose is to send out a signal so that when you hear it you'll know that you have the ability to receive signals from whatever part of the world/country in which the beacon is situated. Thus the beacon acts as a sort of "lighthouse" for hams. If anyone knows of any of other frequencies, please send me a list of them.

The Rules specify in 97.67(e) that a beacon station is limited to 100 watts p.e.p. Know that number for test time!

The Language We Use!

If you are making station identification by telephony (meaning *voice*), what language(s) must be used? You may speak to your German friend all day and speak nothing but German but when you i.d. your station using voice it must be in the English language, if you hold an FCC amateur radio license. See 97.84(g)(2). Once again, the identification must be in English because the folks monitoring the airwaves may not speak anything else. So, chat away in Swahili if you are able but i.d. your station in English!

Phonetics—What Does the FCC Want?

Many hams can be heard on the air using some of the weirdest phonetics imaginable and it's perfectly legal and sort of silly. Also found in 97.84(g)(2) is the following statement:

...the Commission encourages the use of a nationally or internationally recognized standard phonetic alphabet as an aid for correct telephony identification.

Gentle reader, permit me to suggest the use of the ICAO (International Civil Aviation Organization) and ITU (International Telecommunications Union) phonetic alphabet. This is the one used by the sharpies in ham radio and is currently used all over the world. Where do you find a copy of it? Right here in the pages of *CQ Magazine*, of course! It's also conveniently found on the inside back cover of the ARRL's logbook. Here it is. Learn, use it, and forget the cutsey stuff you hear. You senior hams may wish to make note of this too. It's no longer "Able, Baker, Charlie, Dog," etc.

Bash Educational Services, Inc., P.O. Box 2115, San Leandro, CA 94577

Letter	Phonetic
A	Alpha
B	Bravo
C	Charlie
D	Delta
E	Echo
F	Foxtrot
G	Golf
H	Hotel
I	India
J	Juliett
K	Kilo
L	Lima
M	Mike
N	November
O	Oscar
P	Papa
Q	Quebec
R	Romeo
S	Sierra
T	Tango
U	Uniform
V	Victor
W	Whiskey
X	X-ray
Y	Yankee
Z	Zulu

One major advantage of using these particular phonetics is that all of the DX stations you work will understand them! Every ham radio instructor recommends these also. While the FCC may not go on record as endorsing these, I can assure you that in private conversations with FCC employees, they sure wish hams would use them.

One-Way Communications

You may be asked the following question (3A-7.2):

What is a one-way communication?

The question is, in my opinion, misleading because I cannot find "one-way communication" defined in 97.3 of the FCC Rules. However, in 97.91 the Rules tell you which one-way communications (besides our old friend "beacon operation" and also radio control operation) are permitted and will not be construed by the FCC as broadcasting. These are (a) emergency communications, including bona fide drill practices; (b) information bulletins (like the W1AW broadcasts) consisting solely of subject matter having direct interest to the amateur radio service as such; (c) round-table group discussions with each station taking a turn at transmitting to other stations of the group; and (d) code practice transmissions (like W1AW does and also W6QIE on the West coast) intended for persons learning or improving proficiency in the International Morse Code.

If you get this question on your test, you now have enough information to be able to answer it. I am curious as to what the right answer is because the question is actually phrased incorrectly. Oh well, I realize that I am a picky person but, when it comes to tests, I like things 100% right, not 50% or 75% right! 73 de KL7IHP

Antennas

a monthly feature by
KARL T. THURBER, JR., W8FX

DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

Antennas: A Look at "Annie"

This month in CQ author Thurber describes an interesting and novel antenna analysis program known as "Annie." If you're a serious student of the antenna arts and sciences, we think you will find this month's column especially interesting and useful. —K2EEK

In last month's Antennas column we presented Part IV of "Product Peek," the last column in the series. We highlighted the products offered by Skylane Quads, Certified Communications, Ten-Tec, and BHC. We digressed for a tongue-in-cheek review of "Murphy's Engineering Laws," and we ventured that these cussed "laws" were, in fact, quite relevant to antenna design and construction! We then presented a compendium of notes on vertical antenna grounding and radial systems, courtesy of Don Newcomb, W0DN, of Butternut Electronics.

This month in the column, it's time for an examination of an exceptionally useful and substantial software package for the Apple and Commodore 64, one that's right up our alley: "Annie," by James C. Rautio, AJ3K. Following our look at Annie, we'll make note of "H*A*R*K," a small but interesting group of SWLs, hams, and experimenters. We will also reiterate the merits of a promising multiband dipole design, the G5RV, and close out this month's column with some notes on new ham software. Let's begin with our date with "Annie."

Annie

When I share my enthusiasm for the personal computer with a friend or acquaintance, I don't know how many times the question comes back, "What would I ever *do* with one?" The many uses for computers, especially in the hamshack, are well known to most readers of *CQ*, and readers of this column in particular. Sometimes, though, it seems that while there are a wide range of hamshack applications for the PC, the specifically antenna-oriented applications don't just "pop out" at once.

In fact, many of the so-called antenna programs I've seen are, frankly, trival. Once you've dimensioned a few dipoles, Yagis, and Quads with them, what do you do next? What little serious technical software was available was either too difficult or too expensive for most amateurs,

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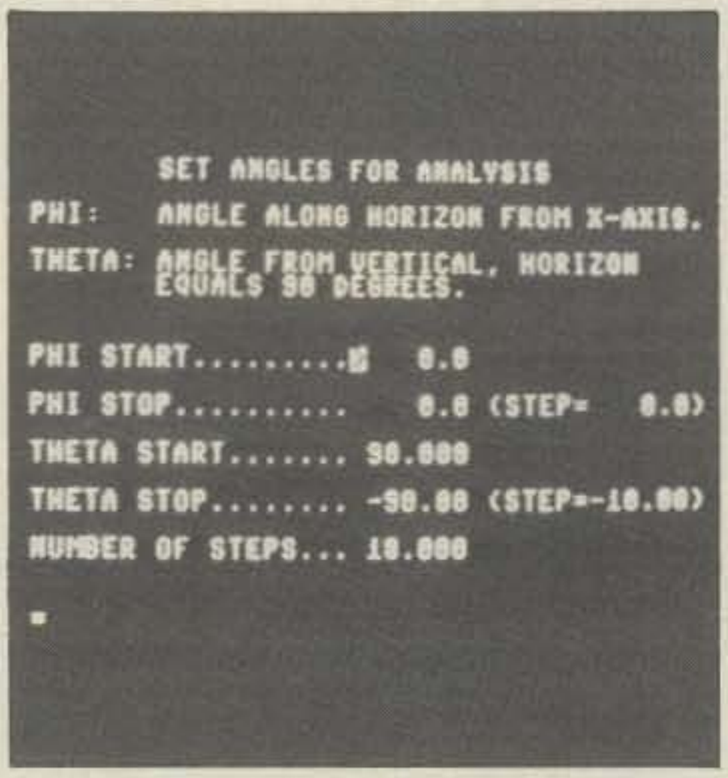
"Annie" main menu screen offers eight major program options, plus an option to end the program. Each option is described in the accompanying text. (W8FX photo)



"Annie's" Set Angles Menu form allows you to tell the program what directions (or angles) it is to analyze, in terms of Phi and Theta. A blinking cursor (visible here) can be moved about the form to enter and change data. (W8FX photo)

and most was not designed to run on the types of PCs amateurs would tend to own and use in the shack.

All that changed when I received a preliminary copy of Jim Rautio's Annie Antenna Analysis Software package. This package, available for both the Apple series of PC as well as the Commodore 64, is a very advanced, flexible, and fast program designed to handle a wide variety of antenna design, development, and analysis chores. The program allows you to analyze most any HF or VHF antenna—dipoles, verticals, beams, longwires, and many others—with a considerable degree of confidence and precision.

Most of use have at least a general idea of what theoretical, textbook antenna radiation patterns for most common antennas look like—especially those nice, neatly rounded "free space" or perfect-ground patterns. But few of us really know, or can easily visualize, the real-world effects on those antenna patterns caused by the ground plane which underlies them.

Undoubtedly, the most sophisticated feature of AJ3K's program is its capability to include the effects of real ground on the antenna being analyzed—effects which can have a significant impact on antenna pattern and overall performance. This means including a "real" ground, with a real conductivity and a real dielectric constant, in the program's computational makeup. This kind of power is a real breakthrough, and heretofore was only available on large minicomputers and mainframes—not on a home computer with a memory in the 64K region.

The program is menu-driven and makes use of a number of screen "forms" to avoid lengthy, frustrating computer question-and-answer sessions to obtain program input data. The main menu consists of eight main options, plus a ninth used to exit the program; the main options, in turn, lead the user to various sub-menus or forms for data input. Probably the best way to visualize the program's workings is to briefly run through the main menu options one by one.

1. Ground Plane Menu. This is the first main option. By using it you may select the characteristics of the ground to be used in your antenna analysis, or, if you like, you can choose to ignore ground effects. The menu screen shows some typical ground-plane characteristics from which you can choose, or if you have precise information, you can input that. Factors considered included ground conductivity, frequency of operation, and ground dielectric constant (Epsilon). While some guesswork may be involved in inputting ground-plane data, knowing your type soil and referring to conductivity maps (such as found in recent editions of *The ARRL Antenna Book)* can reduce much of the guesswork.

2. Set Angles Menu. Before the program can go about calculating the antenna pattern, it must be told what directions (or angles) it is to analyze. These angles are defined in this portion of the program. Basically, two angles are defined and set here: (1) Phi, the angle along the horizon from the X-axis; and (2) Theta, the angle

from the vertical (where the horizon equals 90 degrees).

When you first run the program, it is set up to look at a "Theta cut," which is usually the best way to visualize the pattern of an antenna with the ground plane considered. This view will enable you to determine the Theta angle at which maximum radiation occurs, or in other words, determine whether the antenna is a low-angle or high-angle radiator, or something in between. After doing a "Theta cut," you can then let Phi vary to see the directive nature of the antenna. After some practice, the complete "solid" pattern can usually be visualized from study of these two patterns.

3. Define Array Menu. The choice of main menu option 3 allows you to define your antenna, or set of antennas, for analysis by the program. The program looks at antennas as arrays and elements. A single element type can be a dipole, monopole, or even an isotropic source. An array is a group of elements (or even just a single element) radiating as a single antenna. The program can calculate up to four arrays simultaneously, each array having up to 16 elements. This menu screen or form allows you to define, for each array, each element in terms of its description (dipole, monopole, or isotropic), length (in terms of wavelength), position, and orientation within the array. The business of defining the array can become quite complex, but for most common amateur antennas it's not all that involved, and only one array is normally used.

4. Tabulate Data Menu. Main menu option 4 provides a tabulated listing of your antenna pattern in a precise numerical form, either on the computer video screen or on paper, using a printer. The entire antenna description (specified previously in using the program) can be listed for documentation purposes, too. Printout can be customized in terms of what you would like to display for each array used. Here you can also tell the program the attributes of your video monitor and printer—for example, the number of columns and lines per page.

5. Plot Data Menu. No analysis program is really complete unless it has a plotting capability; this is the key to communicating results. Main menu option 5 gets you into the high-resolution graphics mode, and you can virtually let the computer do the plotting automatically, displaying the results to the screen after a short time. Or, you can customize the plot, altering its position on the screen (x and y coordinates), setting plot size or magnification, adjusting aspect ratio (to achieve a perfect circle on your video monitor), and setting the value of the plot's outer edge (scale offset).

The plot produced closely resembles the familiar polar grid system used for antenna plots in most amateur and technical publications. The plot may be stored to disk or tape (disk only on the Apple) for later use, and the graphics hardcopy option will cause the screen image to be printed out by your printer. Conveniently, the program allows you to print out several antenna plots on the same screen or page, with lines being either solid, dashed, dotted, or dot-dashed for readability. I should point out that while the program's graphics hardcopy routine will plot a hi-res screen on an Epson FX-80 printer, if you have a different printer you may need to provide your own graphics hardcopy routine. Or, you can dump the plots to disk or tape, and then retrieve them later, printing the plots using whatever graphics hardcopy routine you may have.

6. Disk/Tape Access. Once you have created an antenna, you may wish to store the antenna's complete description (such as positions, rotations, phasings, etc.) on magnetic media for later retrieval. Main menu option 7 allows you to store the data, while option 6 lets you read back the data into the program. You also can use option 7 to conveniently create a "ZERO ANT" file which actually contains no antenna in it. By reading in this "empty" data file after completing one analysis, you can start the next analysis with a clean slate. While the disk/tape access option is intended primarily for antenna

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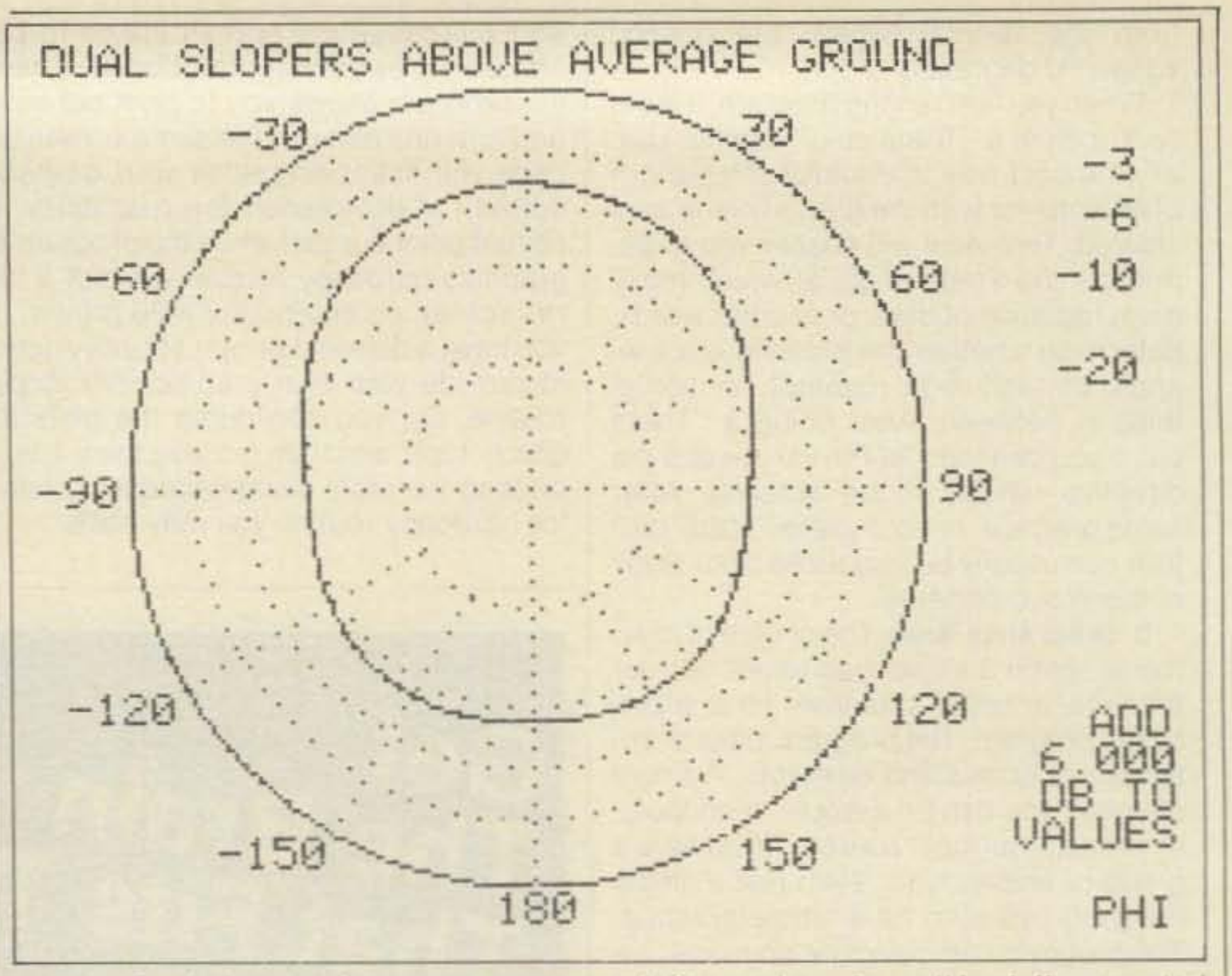

Fig. 1– Dual slopers above average ground. Shown here is an "Annie"-generated polar plot of two slopers, supported from one tower, fed in phase. The apex angle is 120 degrees. The "Phi-cut" shown here depicts the antenna's directivity at 30 degrees above the horizon.

data files, if you specify a plot file, the file will be read into the hi-res memory properly, and may be displayed on the screen.

7. Length Conversion Calculator. Not an integrated part of the program, but a handy "bonus" is this calculation option. It makes quick work of conversion between feet, meters, and wavelength. You can change any of the five numbers (labeled meters, feet, inches, wavelengths, and MHz) in the menu. When you change any one number, all of the other numbers are instantly updated to reflect the number that you changed. Neat!

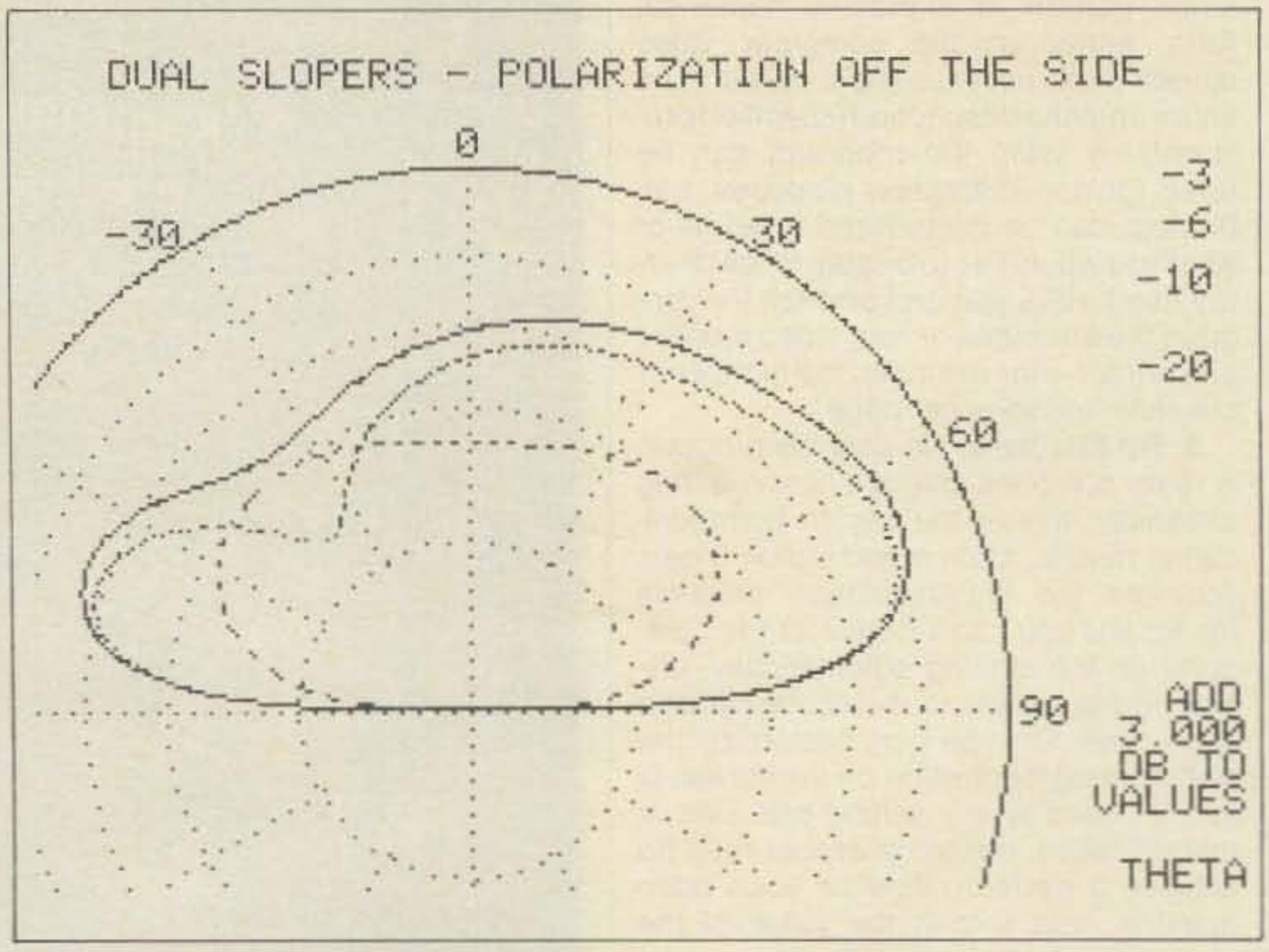

Fig. 2– Dual slopers—polarization off the side. Shown here is an "Annie"-generated vertical (Theta) cut at an azimuth of 30 degrees off of the main beam. The solid line is total gain, the dotted line is the vertical polarization component, and the dashed line is the horizontal polarization component. The ground plane assumed is that of an "average" ground (ground conductivity of 5 millimhos/meter, Epsilon = 15, at an operating frequency of 3.5 MHz).

How capable is the "Annie"? Up to four arrays can be included for simultaneous analysis, with up to 16 elements per array. Up to 218 "analysis directions" may be calculated. Elements may be dipoles or monopoles of any size, or isotropic. For really complex theoretical or commercial work, the arrays may be "nested" so that an entire *array* may be used as an individual *element* of another array; thus, the maximum number of elements that the program can calculate at one time is 16 to the fourth power, or over 65,000 elements! In addition, physical orientation and the phase and power fed to any element can be independently adjusted.

Types of antennas that can be handled by the program include dipoles, slopers, sagging/supported dipoles, inverted Vees, longwires, verticals, and arrays of all of the above elements. Gain may be tabulated in terms of total, horizontal, or vertical gain. Other useful data that may be tabulated include polarization "sense," axial ratio, tilt, phase, and other technical aspects.

How accurate is "Annie"? Some assumptions have been made in the program, such as assuming a sinusoidal current distribution, not calculating input impedance, and using reflection coefficients in including the effects of ground on the antenna patterns. The program also does not automatically include the effects of mutual coupling between elements (such as in a Yagi), and the effects of element and capacitance have not been accounted for. So, as usual, a half-wave dipole will physically be about 5% shorter than a half-wavelength.

Nevertheless, with all things considered, if your antenna is more than about 0.4 wavelength high, the tabulated results are quite good. Below about 0.4 wavelength, there may be some error, but even so only approaching about 2 dB in the worst case, according to the program's author. This estimation is based on comparison with an industry standard for analysis of wire antennas that uses a specialized numerical technique known as "methods of moments," in which a computer analysis typically requires an overnight run to analyze a single antenna!

Figs. 1 and 2 show typical graphics hardcopy printouts generated by the Apple version of the program. Fig. 1 is a printout showing dual slopers above average ground, while fig. 2 represents dual slopers with polarization off the side. All of the accompanying screen photos were made using the Commodore 64 version of the program.

The programs for either PC are available from James C. Rautio, AJ3K, of Sonnet Software. The address is 4397 Luna Course, Liverpool, NY 13088. Price for the Apple disk versions (II+ or //e) is $49.95, while the Commodore 64 version (disk or tape) is $39.95. A 50-plus page illustrated user's manual is included with the package.

For those who wish to explore further the avenues opened by analysis programs such as this, I suggest careful reading of the *Antenna Book*, chapters 2 and 15. I also recommend study of AJ3K's *QST* series, "The Effects of Real Ground on Antennas," which was based largely on computer analysis of a wide range of familiar amateur antennas. The series appeared in the February, April, June, August, and November 1984 issues of *QST*. You might be surprised to learn what "Annie" has to say about slopers (good) and Vees (not so good)!

H*A*R*K

A letter to your editor from Arnold Timm, of Electronic Avocations, 2308 Garfield, Apt. #304, Minneapolis, MN 55405, announced formation of "H*A*R*K," or "Hear Amateur Radio (Over)." This unusual name represents a small but enthusiastic and diverse group of SWLs, amateurs, Part 15 users, and electronic experimenters who have formed the group as a "non-profit service promoting radio hobbies." The group publishes a newsletter, *Radio Archives*, to exchange news and views among members. According to Arnold, who is ex-WN0LFM and WB0YDL (and who may be back on the air again with a new call by the time this appears in print), member-

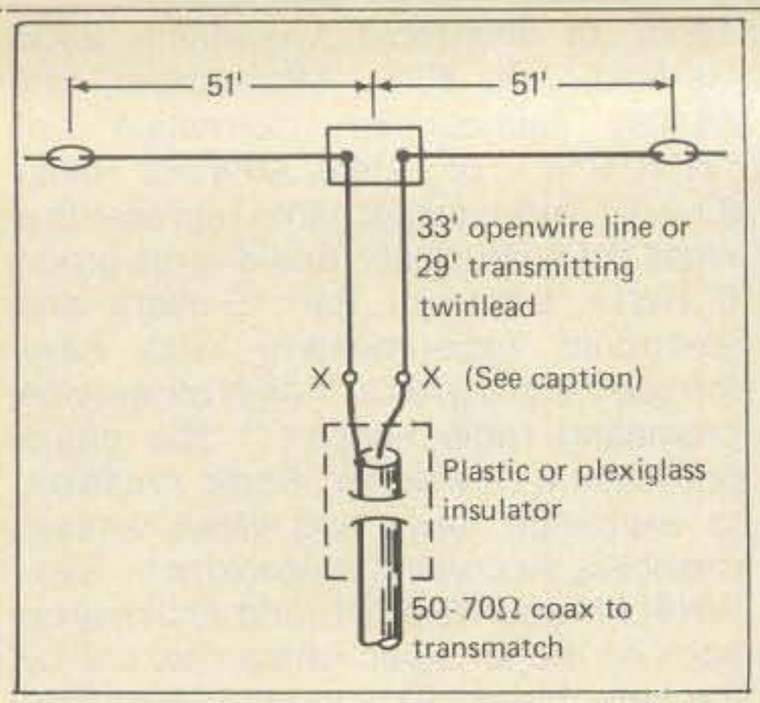

Fig. 3– G5RV multiband antenna. The G5RV multiband dipole can be configured in several ways. Most designs place the flattop at 102 feet overall, fed with a 33 foot length of openwire line, or a 29 foot length of twinlead. The antenna may be fed directly at points X-X by the balanced output of an antenna tuner or transmatch, or it may be fed using a 66 foot or greater length of coaxial cable, as shown above. If coax is used, a transmatch to handle unbalanced line is required at the transmitter end. Use of coax may be tricky, and may result in undesirable line radiation, matching and loading problems, and significant line loss on the higher bands.

ship and subscriptions are priced nominally at $1.00. Contact Arnold directly for details on H*A*R*K.

The G5RV Returns

Excepting perhaps the "mainstay" half-wave dipole and quarter-wave vertical, antennas come and go in popularity almost as quickly as do fashions. "Out" for several years has been the G5RV, popularized by Louis Varney, G5RV, but it's coming back "in" as a very simple and inexpensive multiband dipole. Its new-found popularity (initially, it seems, with overseas operators) is largely due to interest in the new WARC-generated amateur bands at 10, 18, and 24 MHz. Basically, the G5RV is a 102 foor flattop fed in the center with a pre-cut length of twinlead or openwire line. As such, it operates much as a shortened dipole on 75 and 80 meters and as a sort of extended center-fed Zepp on the higher bands.

Several versions of the antenna have been seen. One popular version, and the one I prefer, uses a 33 foot length of openwire line (or a 29 foot length of twinlead) and connects directly to a balanced antenna tuner. This version should be fairly easy to match on all bands, and the use of openwire feed promotes extremely low line loss, which is virtually negligible on the HF bands despite high SWR on the line.

A second version uses the same 33 or 29 foot length of balanced feedline, as above, but this in turn connects to a 66 foot or longer section of low-impedance coax. The coax is run to a transmatch at

```
]LIST

10  REM  CBM-64 REFLECTED POWER
20  REM  BY LEW MC COY W1ICP
30  REM  CQ, FEBRUARY 1983
40  REM  CBM-64 BY K. THURBER, W8FX
50  REM  REWRITTEN FROM SEP 1983 CQ BY
60  REM  LOUIS J. JACOBS JR. KN9V
70  REM  MODIFIED BY LOUIS J. JACOBS JR.
80  REM   REWRITTEN FROM JULY 1984 CQ FOR
90  REM  THE APPLE II+ BY JOHN WEAKLY
100  REM  WA8ZEO/4
110  HOME : REM  CLEAR THE SCREEN
120  INPUT "OPTIONS: VIDEO OR PRINTER ? V/P -> ";O$
130  HOME
140  PRINT
150  PRINT "*** DETERMINING REFLECTED POWER ***"
160  PRINT : PRINT
170  PRINT : INPUT "ENTER FORWARD POWER (WATTS) ";F
180  PRINT
190  INPUT "ENTER MAXIMUM VSWR ";VM
200  PRINT
210  INPUT "ENTER VSWR STEP SIZE ";S
220  IF O$ = "V" THEN  HOME : GOTO 250
230 D$ = "": REM  CTRL-D
240  PRINT D$;"PR#1": REM  ACTIVATE PRINTER IN SLOT #1
245  PRINT  CHR$ (9) +  CHR$ (56) +  CHR$ (48) +  CHR$ (78): REM  CTRL-I80
     N FOR PRINTER CONTROL
246  REM  FOR 80 CHR PRINTING
250  PRINT  SPC( 7)"FORWARD POWER IS ";F;" WATTS"
255  IF O$ = "P" THEN SR = 11:ST = 4: GOTO 260
258 SR = 5:ST = 5: REM    NUMBER OF SPACES
260  PRINT
270  PRINT "VSWR"; SPC( SR)"REFLT'D PWR "; SPC( ST)"TRUE RAD PWR"
280  PRINT : GOSUB 500: REM   CALCULATION SUBROUTINE
290  IF O$ = "V" THEN  GOTO 310
300  PRINT D$;"PR#0": REM  TURN PRINTER OFF
310  PRINT : INPUT "DO YOU WANT TO DO ANOTHER CALCULATION ? Y/N ";C$
320  IF C$ = "Y" THEN  GOTO 110
330  HOME : END
500  REM  CALCULATION SUBROUTINE
510  FOR V = 1 TO VM STEP S
520 R = F * (((V - 1) / (V + 1)) * ((V - 1) / (V + 1))):T = F - R
530  IF O$ = "P" THEN  PRINT V,R,T
535  IF O$ = "V" THEN  PRINT  TAB( 1)V; TAB( 10)R; TAB( 27)T
540  NEXT V
550  RETURN

]
```

Fig. 4– Reflected power program for the Apple.

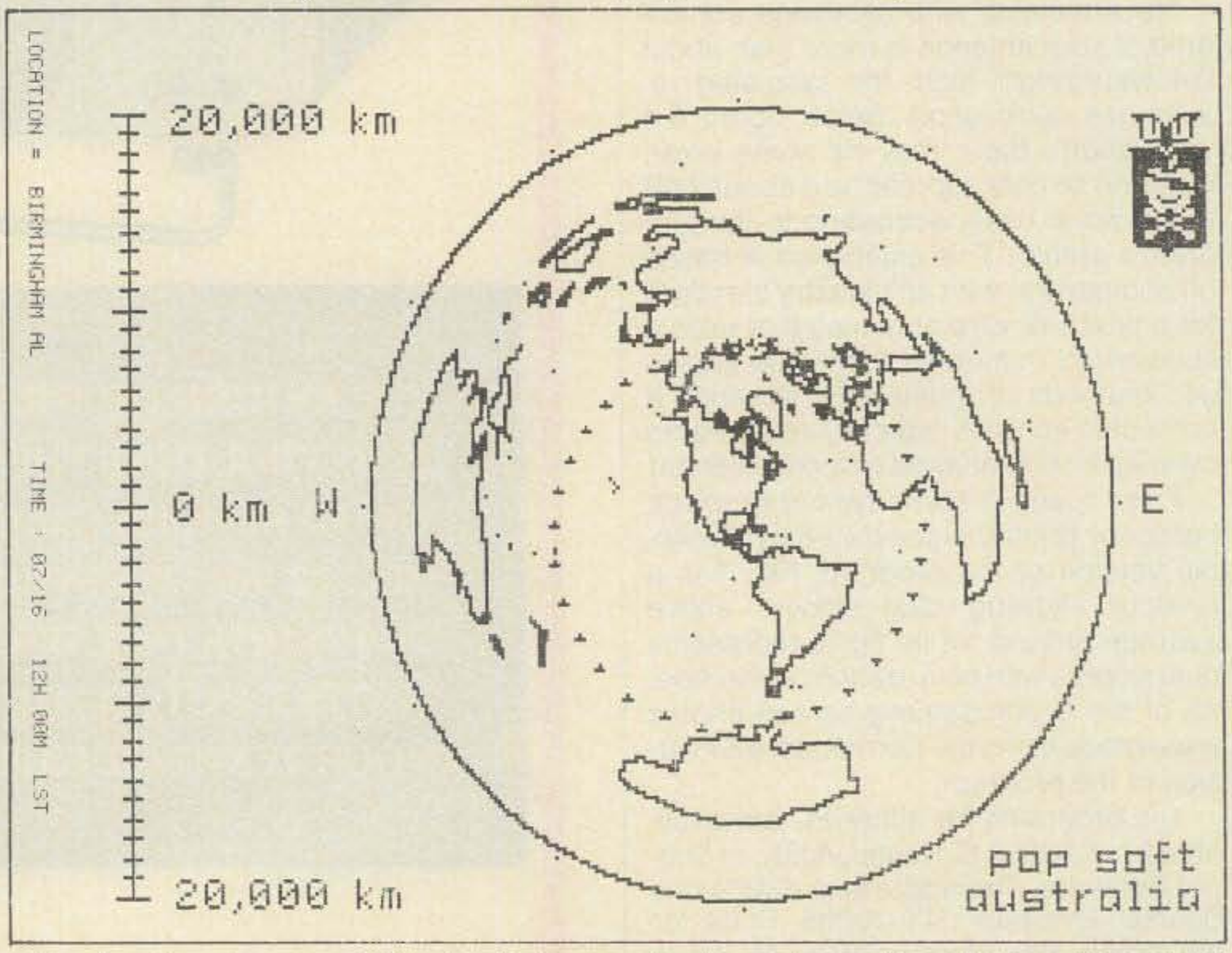

Fig. 5– Ham I-generated azimuthal map is shown here. Based on a "standard location" of Birmingham, Alabama, the map shows the "gray line" for an assumed date and time. Since the plot is taken at midday, the gray line shown does not pass through Birmingham. The Ham I program can store two standard locations, and it also provides other information such as bearing and distance to a target area, sun transit time, and sunrise/set times. Map precision is approximately 2 degrees.

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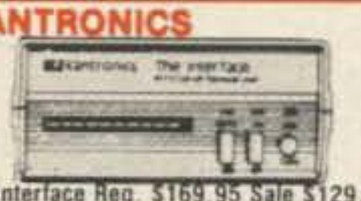
AMERITRON AL-80 SALE $599!

AL-80 1000W Output (single 3-500Z)	$599
AL-82 1500W Output (pr 3-500Z tubes)	$1199
AL-1200 1500W Output (3CX-1200 tube)	$1299
RCS-8 5 Pos Remote Antenna Switch	$119
ATR-15 1500W Antenna Tuner	$259

KANTRONICS



The Interface Reg. $169.95 Sale $129.95
The Interface II Reg. $269.95 Sale $239.95
CHALLENGER $89.95 UNIVERSAL TU $189.95

Apple Amtor Soft/Hamtext	$139	VIC-20 Hamsoft	49
Vic-20 Amtor Soft	89	Hamtext VIC-20	99
Model 64 Amtor Soft	89	Hamtext Model-64	99
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HAL SALE! NEW RTTY/CW COMPUTER INTERFACES

CRI-100 List $249 SALE $229.95!
CRI-200 List $299 SALE $269.95!

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CORSAIR List $1169
Deluxe AC Supply List $199
Both Items—Yours for $1169!

425 Titan New 3KW amplifier in stock-only $2195!

TEN-TEC
New 2M HT
Full Featured!
List $319 Sale $279.95!

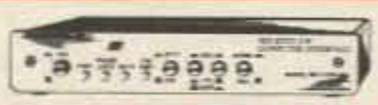
4229 2KW Tuner Kit $189.95!

SANTEC

ST142 $249
ST222 $279
ST442 $289
LS202 $229

KDK FM2033

List $339 Sale $299



MFJ 1224 COMPUTER INTERFACE $89.95

202B Noise Bridge	$59.95
250 2KW Oil Load	$35.95
422 Keyer/Paddle	$89.95
901 300W Tuner	$59.95
941C 300 W Tuner	$89.95
989 Deluxe 2KW	$299.95

OSCAR/VHF DX EQUIPMENT

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TR9130 2m All Mode 25W	$CALL
TR711A 2m Base 25W	$CALL
TR9500 70cm All Mode	$CALL
TR811A 70cm Base 25W	$CALL

ICOM

IC290H 2m All Mode 25W	$469
IC271A 2m Base 25W	$599
IC271H 2m Base 100W	$789
IC490A 70cm All Mode 10W	$579
IC471A 70cm Base 25W	$689
IC471H 70cm Base 75W	$949

YAESU

FT290R 2m All Mode 2W	$349
FT726R Triband All Mode	$779
726/70 70cm module	$269
726/SU Duplex Module	$95
FT790R 70cm All Mode 1W	$349

TEN-TEC

2510 Satellite Station	$439

ROTORS

Ken Pro KR500 Elev Rotor	$189
Ken Pro KR400 Azim Rotor	$149
Alliance HD73 Azim Rotor	$99
Hy-Gain Ham 4 Azim Rotor	$219

AMPLIFIERS

MIRAGE

B108 2m 80W out/10W in	$159
B1016 2m 160W out/10W in	$249
B3016 2m 160W out/30W in	$199
D24 70cm 40W out/2W in	$179
D1010N 70cm 100W out/10W in	$289

THL CORP.

HL110V 2m 100W out/3-10W in	$219
HL160/25 2m 160W out 25W in	$269
HL160V 2m 160W out/3-10W in	$289
HL45U 70cm 45W out/10W in	$179
HL90U 70cm 90W out/10W in	$319

ANTENNAS

CUSHCRAFT

A144-20T 2m 20el cir pol	$75
416TB 70cm cir pol	$59
PS4 70cm Circularity Switch	$69
AOP1 2m/70cm Oscar Pack	$149

KLM

2m-14c 14el 2m w/cir switch	$89
2m-22C 22el 2m w/cir switch	$119
435-18C 70cm w/cir switch	$119

HARDLINE & HELIAX

½" Aluminum Hardline	$.79/ft
½" LDF-50 Heliax	$1.69/ft

OSCAR PACKAGE DEALS

PACKAGE #1

Ten-Tec 2510 Satellite Station	List $489
THL HL45U 70cm 45W Amplifier	List $199
THL HRA-2 2m Mast Mount Preamp	List $159
Cushcraft AOP-1 Antenna Package	List $219
Ken-Pro KR500 Elevation Rotor	List $189
Alliance HD73 Azimuth Rotor	List $219
South River 10ft Roof Tripod	List $59

TOTAL LIST PRICE $1533
PACKAGE PRICE—ONLY $1249 DELIVERED!
SAVE OVER $300!!

PACKAGE #2

Yaesu FT290R 2m Transceiver	List $399
Yaesu FT790R 70cm Transceiver	List $399
Mirage D24 70cm 40W Amplifier	List $210
THL HRA-2 2m Mast Mount Preamp	List $159
Cushcraft AOP-1 Antenna Package	List $219
Ken-Pro KR500 Elevation Rotor	List $189
Alliance HD73 Azimuth Rotor	List $219
South River 10ft Roof Tripod	List $59

TOTAL LIST PRICE $1853
PACKAGE PRICE—ONLY $1499 DELIVERED!
SAVE OVER $375!!

PACKAGE #3

Kenwood TR9130 or Icom IC290H	List $549
Kenwood TR9500 or Icom IC490A	List $649
Mirage D1010N 70cm 100W Amplifier	List $347
THL HRA-2 2m Mast Mount Preamp	List $159
KLM 2M-14C 14el 2m Satellite Ant	List $112
KLM 435-18C 70cm Satellite Ant	List $145
Ken-Pro KR500 Elevation Rotor	List $189
Alliance HD73 Azimuth Rotor	List $219
South River 10ft Roof Tripod	List $59

TOTAL LIST PRICE $2428
PACKAGE PRICE—ONLY $1999 DELIVERED!
SAVE OVER $450!!

PACKAGE #4

Yaesu FT726R VHF/UHF Duplex Xcvr	List $899
430/726 70cm Module	List $289
SU/726 Sat Duplex Unit	List $109
Mirage D1010N 70cm 100W Amplifier	List $347
THL HRA-2 2m Mast Mount Preamp	List $159
KLM 2M-14C 14el 2m Satellite Ant	List $112
KLM 435-18C 70cm Satellite Ant	List $145
Ken-Pro KR500 Elevation Rotor	List $189
Alliance HD73 Azimuth Rotor	List $219
South River 10ft Roof Tripod	List $59

TOTAL LIST PRICE $2527
PACKAGE PRICE—ONLY $2125 DELIVERED!
SAVE OVER $425!!

Select Low Loss Transmission Line, Coax, Rotor Cable and Power Supplies from Listing in our other advertisements.

We can substitute items and make any changes needed to fit your requirements. Please call for our Special Sale Prices and SAVE $$$.

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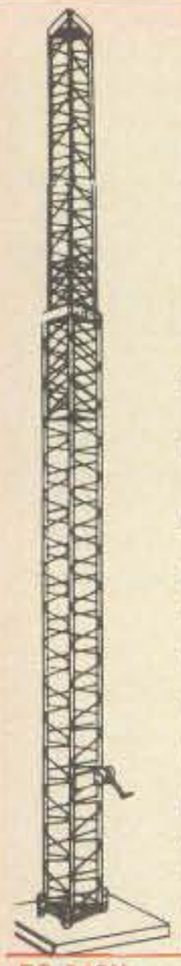
CIRCLE 138 ON READER SERVICE CARD

ANTENNA/TOWER SALE!



hy-gain

CRANKUP SALE!

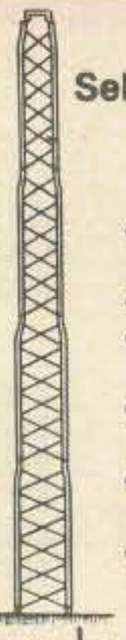
All Models Shipped Factory Direct—Freight Paid*!

Check these features:

- All steel construction
- Hot dip galvanized after fabrication
- Complete with base and rotor plate
- Totally self-supporting—no guys needed

Model	Height	Load	Sale Price
HG37SS	37 ft.	9 sq. ft.,	$749
HG52SS	52 ft.	9 sq. ft.,	$1099
HG54HD	54 ft.	16 sq. ft.,	$1699
HG70HD	70 ft.	16 sq. ft.,	$2699

Masts—Thrust Bearings—Other Accessories Available—Call! Prices Shown Are Your Total Delivered Price In Continental U.S.A.!



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Self Supporting Towers On SALE!

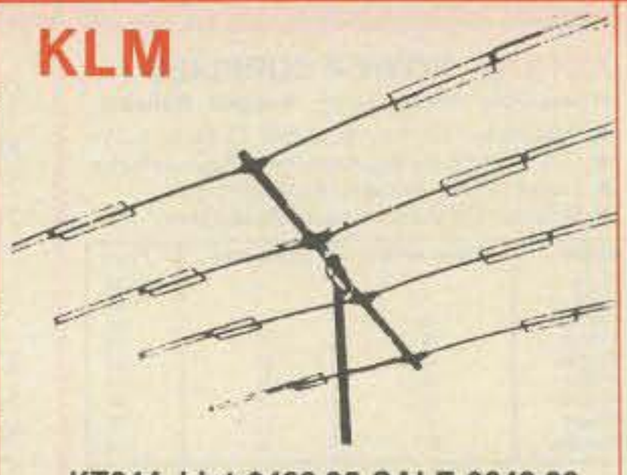
FREIGHT PREPAID

- All Steel Construction—Rugged
- Galvanized Finish—Long Life
- Totally Free Standing—No Guy Wires
- America's Best Tower Buy—Compare Save $
- Complete With Base and Rotor Plate
- In Stock Now—Fast Delivery

Model	Height	Ant. Load*	Weight	Delivered Price*
HBX40	40 ft	10 sq ft	164	$329
HBX48	48 ft	10 sq ft	303	$429
HBX56	56 ft	10 sq ft	385	$499
HDBX40	40 ft	18 sq ft	281	$399
HDBX48	48 ft	18 sq ft	363	$489

***Your Total Delivered Price Anywhere in Continental 48 States. Antenna Load Based on 70 MPH Wind.**

KLM



KT34A List $433.95 SALE $349.00
KT34XA List $633.95 SALE $499.00

The new concept in triband antenna design. Gain and band width all in one compact package. VSWR curves.

BUTTERNUT ELECTRONICS CO.

HF6V $129 Delivered (Cont. USA)

- Full Legal Power 80/10 Meters
- Optional Stub Tuned Radial Kit Model STR II $29
- Optional Roof Mounting Kit Model RMK II $49 (includes STR II)
- Optional 160 Meter Resonator Kit Model TBR 160HD $49

New 80/40 Meter Vertical Antenna HF2V $129 Delivered (Continental USA)

- Optional 160 Meter Resonator Kit Model TBR 160S $49

TRI-EX TOWERS

W36-36 ft. Crank Up (9 sq. ft. ant.)	$579
WT51-51 ft. Crank Up (9 sq. ft. ant.)	$899
LM470D-70 ft. Crank Up (motorized) (16 sq. ft. ant.)	$3199

RG-213U

$.29/ft $279/1000 ft Up to 600 ft via UPS

- RG-213/U—95% Bare Copper Shield
- Mil-Spec Non-contaminating Jacket for longer life than RG8 cables.
- Our RG-213/U uses virgin materials.
- Guaranteed Highest Quality!

RG-8X

$.19/ft $179/1000 ft

- RG8X—95% Bare Copper Shield
- Non-contaminating Vinyl Jacket
- Low Loss Foam Dielectric

Coaxial Cable Loss Characteristics (DB/100 ft)

Cable Type	Imped.	10MHz	30MHz	150MHz	450MHz
RG-213/U	50	.6	.9	2.3	5.2
RG8X	52	.8	1.2	3.5	6.8
RG-58/U	52	1.4	1.9	6.0	12.5
½" Alum	50	.3	.5	1.2	2.2
½" Heliax	50	.2	.4	.9	1.6
⅞" Heliax	50	.1	.2	.5	.9

HARDLINE/HELIAX™

Lowest Loss for VHF/UHF!

½" Alum. w/poly Jacket	$.79/ft
½" LDF4-50 Andrew Heliax ™	$1.69/ft
⅞" LDF5-50 Andrew Heliax ™	$3.99/ft

select connectors below.

HARDLINE & HELIAX™ CONNECTORS

Cable Type	UHF FML	UHF MALE	N FML	N MALE
½" Alum	$19	$19	$19	$25
½" Heliax ™	$22	$22	$22	$22
⅞" Heliax ™	$49	$49	$49	$49

AMPHENOL CONNECTORS

Silver PL259	$1.25	UG23D N Female	$2.95
UG21B N Male	$2.95		

ANTENNA WIRE & ACCESSORIES

14 Ga. Stranded Copperweld	$.10/ft
450 Ohm H.D. Line	$.16/ft
18 Ga. Copper coated steel wire ¼ mile long	$30
H.D. End Insulators	$2/ea
Van Gorden 1:1 Balun	$11
Van Gorden Center Insulator	$6

HUSTLER

		6BTV 80-10 mtr Vert	$129
4BTV 40-10 mtr Vert	$89	5BTV 80-10 mtr Vert	$109
G6-144B 2-mtr Base	$89	G7-144 2-mtr Base	$119

Mobile Resonators	10m	15m	20m	40m	75m
400W Standard	$16	$17	$19	$22	$26
2KW Super	$20	$22	$25	$29	$39

Bumper Mounts - Springs - Folding Masts in Stock!

CUSHCRAFT

MULTI-BAND HF ANTENNAS

A3 3-el Tribander	$219	A4 4-el Tribander	$289
R3 20/15/10mtr Vert	$279	A743/A744 40mtr Kit	$75

HF MONO-BAND ANTENNAS

10-3CD	$ 95	10-4CD	$109
15-3CD	$119	15-4CD	$129
20-3CD	$199	20-4CD	$279
40-2CD	$289	D40	$149

VHF/UHF BEAMS

A50-5	$ 79	617B	$199
214B	$ 79	3219	$ 95
220B	$ 95	424B	$ 79

OSCAR/TWIST ANTENNAS

A144-10T	$ 52	A144-20T	$ 75
A147-20T	$ 63	416TB	$ 59
A14TMB	$ 29	PS4	$ 69

VHF/UHF FM ANTENNAS

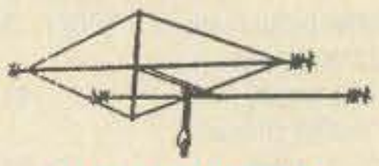
A147-4	$ 29	A147-11	$ 49
214FB	$ 79	228FB	$219
A449-6	$ 29	ARX2B	$ 39

HY-GAIN

Discoverer 2-el 40-mtr Beam	**$319**
Discoverer 3-el Conversion Kit	**$199**
Explorer-14	$309
QK710 30/40 mtr. Add-On-Kit	$79
V2S 2-mtr Base Vertical	$49
TH5MK2S Broad Band 5-el Triband Beam	$389
TH7DXS 7-el Triband Beam	$439
TH3JRS 3-el Triband Beam	$189
TH2MK3S 2-el Triband Beam	$179
205BAS 5-el 20-mtr Beam	$349
155BAS 5-el 15-mtr Beam	$199
105BAS 5-el 10-mtr Beam	$129
204BAS 4-el 20-mtr Beam	$259
64BS 4-el 6-mtr Beam	$69
66BS 6-el 6-mtr Beam	$135
18HTS 80-10 mtr Hy-Tower Vertical	$439
LC-160 160-mtr Coil Kit for 18HTS	$45
214BS 14-el 2-mtr Beam	$49
2BDQ 80/40 mtr Trap Dipole	$69
5BDQ 80-10 mtr Trap Dipole	$129
BN86 80-10 mtr KW Balun W/Coax Seal	$22

MOSLEY

Pro37 7-el Triband Beam	$469
CL-33 e-el Triband Beam	$279
TA-33 3-el Triband Beam	$249
TA-33JR 3-el Triband Beam	$189
TA40KR 40 mtr Kit for TA33	$119



MINI-PRODUCTS HQ-1

LIST $182.50 SALE $159

- Wing Span - 11 ft
- Boom - 54 in. long
- Wind Area - 1.5 sq ft
- 1200W P.E.P. Input

ALPHA DELTA COMMUNICATIONS

Transi-Trap™ Surge Protectors—In Stock Now!

Model LT 200W UHF Type	$19
Model HT 2KW UHF Type	$29
RT 200W Deluxe UHF Type	$29
RT/N 200W Deluxe N Type	$32
HV 2KW Deluxe UHF Type	$32
HV/N 2KW Deluxe N Type	$35

KLM

KT34A 4-el Broad Band Triband Beam	$349
KT34XA 6-el Broad Band Triband Beam	$499
80m-1 80-mtr Rotatable Dipole	$595
40m-1 40-mtr Rotatable Dipole	$179
40m-2 2-el 40-mtr Beam	$309
40m-3 3-el 40-mtr Beam	$459
40m-4 4-el 40-mtr Beam	$649
2m-13LBA 13-el 2-mtr Beam	$79
2m-14C 14-el 2-mtr Satellite Antenna	$89
2m-16LBX NEW-16-el 2-mtr Beam	$99
2m-22C NEW-22-el 2-mtr Satellite Antenna	$119
432-30LBX NEW-30-el-432 MHz Antenna	$99
435-18C 435 MHz Satellite Antenna W/CS-2	$119
432-16LB 16-el 432 MHz Beam	$69

ROTORS & CABLES

Alliance HD73 (10.7 sq ft rating)	$99
Alliance U110 (3 sq ft rating)	$49
Telex HAM 4 (15 sq ft rating)	$219
Telex Tailtwister (20 sq ft rating)	$269
Telex HDR300 Heavy Duty (25 sq ft rating)	$519
Kenpro KR-500 Heavy duty elevation rotor	$189
KLM EL-3000 Moon Tracker Elevation Rotator	$369

Standard 8 cond cable $.19/ft (vinyl jacket 2-#18 & 6-#22 ga)
Heavy Duty 8 Cond cable $.36/ft (vinyl jacket 2-#16 & 6-#18 ga)

SOUTH RIVER ROOF TRIPODS

HDT-3 3 ft Tripod	$19	HDT-5 5 ft Tripod	$29
HDT-10 10 ft Tripod	$49	HDT-15 15 ft Tripod	$69

Heavy Duty Tripods include mtg hdw-UPS Shippable

ROHN GUYED TOWERS

10 ft Stack Sections

20G $39.50 25G $49.50
45G $112.50 55G $134.50

All 20G, 25G, 45G and 55G Accessories In Stock at Discount Prices - CALL!

Foldover Towers

Model	Height	Ant Load*	Price
FK2548	48 ft	15.4 sq ft	$899
FK2558	58 ft	13.3 sq ft	$949
FK2568	68 ft	11.7 sq ft	$999
FK4544	44 ft	34.8 sq ft	$1199
FK4554	54 ft	29.1 sq ft	$1299
FK4564	64 ft	28.4 sq ft	$1399
25G Foldover Double Guy Kit			$219
45G Foldover Double Guy Kit			$249

*Above antenna loads for 70 MPH winds and Guys at Hinge & Apex.

TOWER/GUY HARDWARE

3/16 "EHS Guywire (3990 lb rating)	$.15/ft
1/4 "EHS Guywire (6000 lb rating)	$.18/ft
5/32 " 7 x 7 Aircraft Cable (2700 lb rating)	$.15/ft
3/16 "CCM Cable Clamp (3/16 " or 5/32 " Cable)	$.45
1/4 "CCM Cable Clamp (1/4 " Cable)	$.55
1/4 "TH Thimble (fits all sizes)	$.45
3/8EE (3/8 " Eye & Eye Turnbuckle)	$6.95
3/8 "EJ (3/8 " Eye & Jaw Turnbuckle)	$7.95
1/2 "EE (1/2 " Eye & Eye Turnbuckle)	$9.95
1/2 "EJ (1/2 " Eye & Jaw Turnbuckle)	$10.95
3/16 " Preformed Guy Grip	$2.49
1/4 " Preformed Guy Grip	$2.99
6 " Diam - 4 ft Long Earth Screw Anchor	$14.95
500D Guy Insulator (5/32 " or 3/16 " Cable)	$1.69
502 Guy Insulator (1/4 " Cable)	$2.99
5/8 " Diam - 8 ft Copper Clad Ground Rod	$12.95

PHILLYSTRAN GUY CABLE

HPTG2100 Guy Cable (2100 lb rating)	$.29/ft
HPTG4000 Guy Cable (4000 lb rating)	$.49/ft
HPTG6700 Guy Cable (6700 lb rating)	$.69/ft
9901LD Cable End (for 2100/4000 cable)	$7.95
9902LD Cable End (for 6700 cable)	$8.95
Socketfast Potting Compound	$14.95

GALVANIZED STEEL MASTS

Heavy Duty Steel Masts 2 in OD - Galvanized Finish

Length	5 FT	10 FT	15 FT	20 FT
.12 in Wall	$25	$49	$59	$79
.18 in Wall	$39	$69	$99	$129
.25 in Wall	$69	$129	$189	$249

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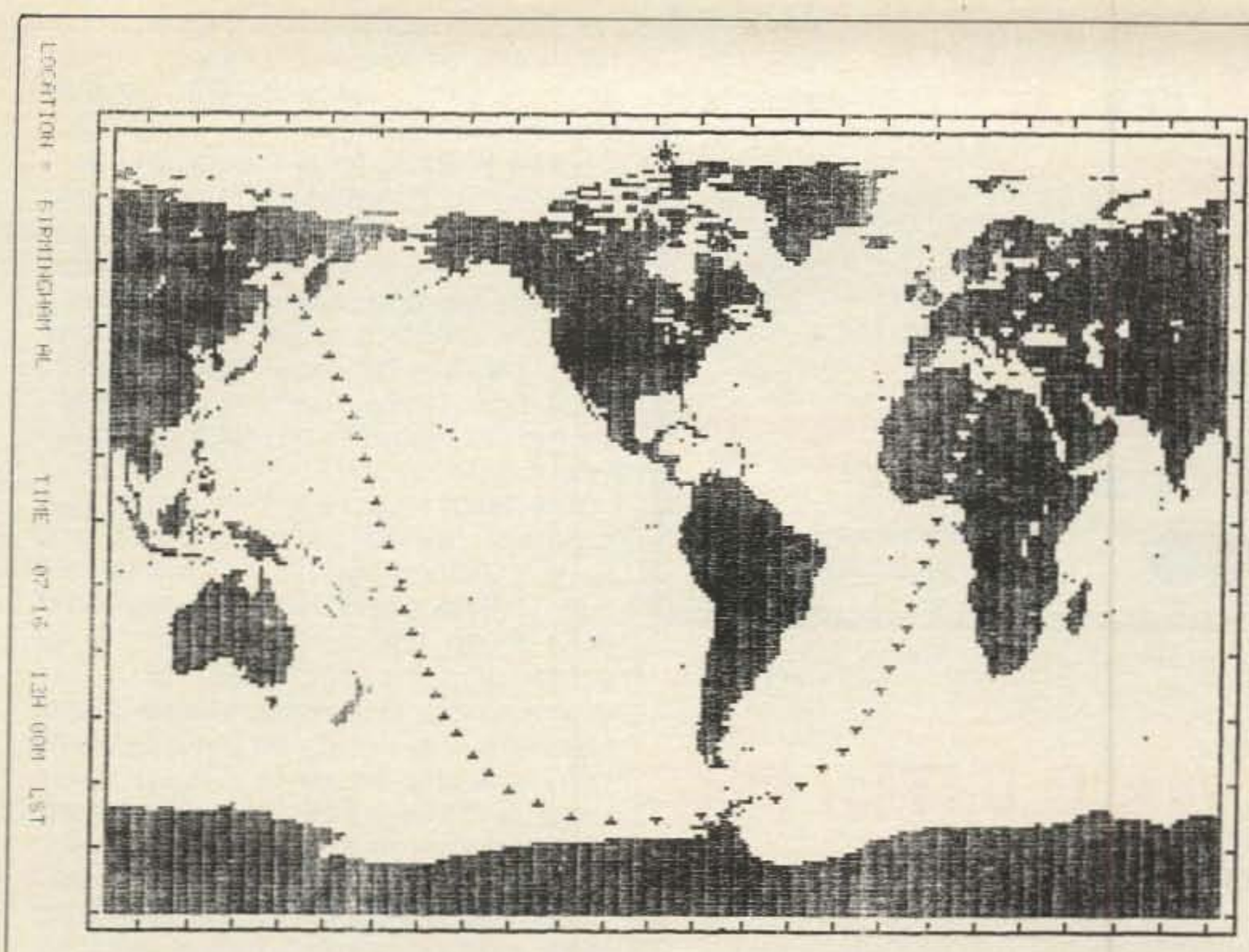


Fig. 6– Shown here is a high-resolution screen dump of the Ham I rectangular map, with an example "gray line" drawn based on Birmingham, Alabama. Rectangular map claimed precision is approximately one degree. The Ham I program package, available from Pop Soft Australia, is designed for the Apple II + with 48K, disk drive, and optional printer. The plot is taken at midday local time, so the gray line does not pass through Birmingham.

the station, which is required to reduce the line's end impedance to a low-enough value for the transmitter or transceiver to handle. Coax, of course, wasn't really designed to be handled this way, and line loss on the higher bands can be significant. But its use does simplify the problems involved with handling openwire line within the hamshack. Fig. 3 shows overall antenna configuration.

The G5RV is certainly one of the simplest and most inexpensive antennas you can erect, but it is one that should produce good results if (1) care is taken to erect it high and in the clear; and (2) care is taken in routing the twinlead or openwire line. The antenna can even be operated on 160 meters by tying the feeders together at the bottom and operating the antenna against ground as a random-length, top-loaded vertical.

Do we have any G5RV users in the *CQ* audience?

Software Notes

Our discussion of "Annie" nearly ran us out of room this month, but before closing there are a few software items which I would still like to squeeze in.

The Radio Amateur's Software Guide. Harold G. Peach, Jr., N4FLZ, has announced his intention to publish a comprehensive guide to available amateur radio software. *The Radio Amateur's Software Guide* will highlight a wide range of hamshack software, and will provide relevant information on the company (or individual) producing the software, as well as a 50-word-maximum description of programs offered.

While at the time this column was written the exact price and publication date were not available, the book should be available by the time this column appears in print. For further information, contact the publisher, N4FLZ, at 2070 Garden Springs Drive, #143, Lexington, KY 40504-3449.

Reflected Power Lives! Back in the February 1983 issue, *CQ* Technical Representative Lew McCoy, W1ICP, published a short TRS-80 program which nicely showed the relationships between forward and reflected power, and SWR. I modified the program for the Commodore 64, which modification later appeared in the column. Several further modifications were published based on reader contributions.

A modification of the C-64 program which allowed for choice of video presentation or printer output was provided by Louis J. Jacobs, Jr., KN9V, and was published in the July 1984 column. Realizing that we have yet to publish an Apple program listing in the Antennas column, reader John Weakly, WA8ZEO/4, provided still another version of the program, this time for the Apple II + . It is essentially the same program as that of KN9V, somewhat shortened, with selectable video or printer output. It assumes that the printer is in the Apple's slot #1. The program listing is shown in fig. 4. If any of you Apple types find any (horrors!) "bugs" in the program, let me know, and

be sure to let John know as well. His address is 6417 Newcastle Rd., Fayetteville, NC 28303.

"Ham I" DXing Aid. From down under comes word from Roland T. Pop, who has developed an Apple-based computer "DX aid" for SWLs and amateurs alike, which he has dubbed the Ham I. According to the program author, the Ham I provides gray-line DX capabilities similar to those provided by mechanical aids such as the DX Edge™, but with computer flexibility.

The Ham I package consists of four separate related basic programs and several utility programs which total well over 100K in length. The gray-line predictions make use of the Apple's hi-res screen graphics capabilities.

The program stores two standard locations sets, which may be practically any two locations on earth. The program draws and stores both a rectangular and an azimuthal (great circle) map for each standard location. The gray line (a sunrise/sunset propagation phenomenon discussed in several previous columns) can be drawn on either map for any given time and date. The program also computes bearing and distance between any of the two standard locations and practically any other location. Also computed is the sun transit time for any date (useful for rotator dial calibration) and sunrise/sunset times for any date.

A very minor drawback, but an interesting one: The program will not accept coordinates in a narrow band approximately plus or minus 0.1 degree around the equator, or at 90 or 180 degrees longitude. Otherwise, some 99.5% of the planet's surface is free of calculation limitations. According to Roland, the rectangular map's precision is about one degree, while the azimuthal map's precision is about two degrees.

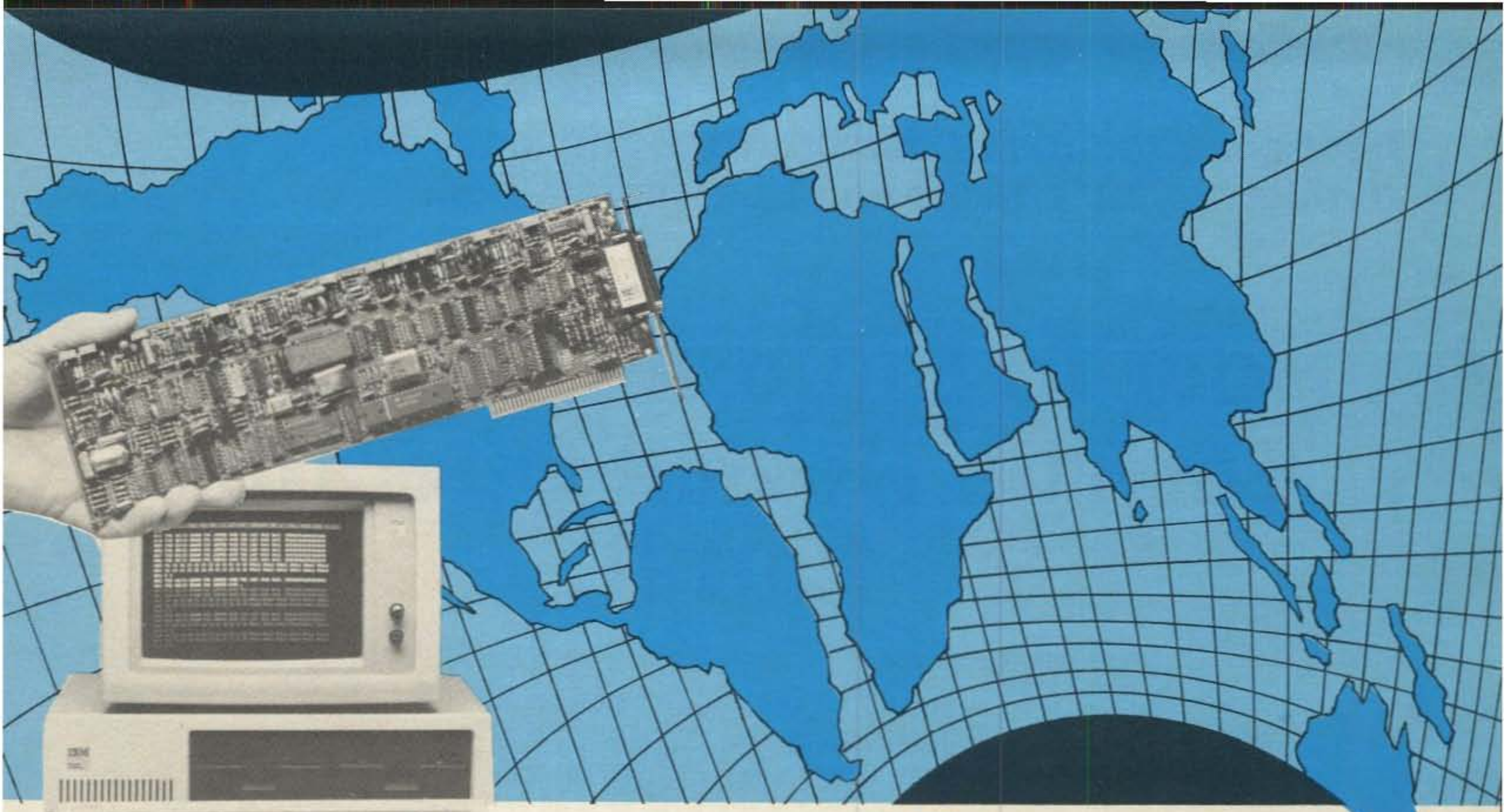
The package requires an Apple II+ with 48K memory and a disk drive. While the use of a printer is optional, the program supports most printers with a hi-res screen dump capability. The package is priced at $50 U.S., plus $5 postage and handling. The user's manual is available in either French or English. Fig. 5 depicts a typical Ham I azimuthal map, while fig. 6 shows an example rectangular map produced by the program. Note the "gray line" which appears on each.

For more information on the Ham I, contact Pop Soft Australia at Post Office Box U-1911, 6001 Perth, Australia.

Wrap-Up

This month we have featured the highly useful antenna analysis program, "Annie," developed by Jim Rautio, AJ3K. We also took note of the fledgling experimenters' association H*A*R*K, and we focused attention on a versatile multiband dipole based on the classic G5RV design. Finally, we presented several timely software topics, this time giving equal access to our many "Apple-byting" friends.

73, Karl, W8FX



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In Part II, the conclusion of this article, we begin with filter construction of design No. 2 and move on through wiring checks and filter installation.

How To Build A C.W. Filter For The Novice Operator

Part II

BY ED WETHERHOLD*, W3NQN

To demonstrate the construction procedure, design #2 (Fc = 756 Hz, L2 = 86 mH) was assembled and tested. The components listed in fig. 4 were wired in accordance with the pictorial diagram in fig. 5. An empty cardboard candy box 3¾" × 7¼" × 1¾" provided an inexpensive and easily worked container for the filter parts. Figs. 6 and 7 show the front-top and bottom views of the filter assembly.

Inductors L1, L5, L2, and L4 were fastened to the bottom of the box by passing Tinnerman clips over the ¼ inch mounting studs of the potted filter case (see fig. 7). About 1/16 inch was filed off the tips of each of the four studs so the box would lay flat on a desk top. Four self-adhesive, plastic mounting feet on the bottom corners of the box provided a stable base for the filter.

All capacitors were stuck to the nearest convenient mounting surface with Scotch® 3M mounting tape. Inductor L3 was stuck on the bottom of the box with mounting tape after one turn was removed from each winding. Holes in the bottom of the cardboard box were easily cut with an X-Acto® knife for the inductor mounting studs, d.p.d.t. switch, phone plug cord, and phone jack. After this the parts were mounted on the bottom and sides of the box. The two 8/500 ohm transformers initially were held in place with mounting tape, and then a rubberized cement was poured over the transformer sides to further secure the transformers to the inside of the box. After all components were securely fastened, the interconnections were made (except for R1 and R2) in accordance with the pictorial diagram in fig. 5. To eliminate any ground coupling problems, all connections were wired individually to the system ground at the junction of C3 and the ground terminal of J1.

*102 Archwood Ave., Annapolis, MD 21401

Filter Wiring Checkout Procedure

An ohmmeter and Table II can be used to check for wiring errors. To make this check, switch your ohmmeter to the "X1" ohms scale and put one test probe on the first "From" node listed in Table II and shown in fig. 5. Place the other test probe on "Ground." The meter should indicate the resistance listed under the appropriate column in Table II. Continue the resistance checks until all node-to-node resistance checks have been completed. Any gross difference between the Table II and measured values indicates an error that must be corrected. For example, an open circuit reading from node 1 to ground indicates perhaps a cold solder joint in one of the several connections in this part of the filter circuit.

After the inductor wiring was checked, two 150 ohm resistors were connected between T1 and L1, and between T2 and L5 to terminate both ends of the filter within 10% of 648 ohms. Although only four potted inductors are shown in fig. 4, the box is large enough to accommodate more inductors, and a filter from the second or third group of designs in Table I could have been installed instead. A design from the fourth group (#13–16) requires a total of 10 potted inductors, and a larger box is needed for this design.

The cover was installed to complete the assembly after holes were cut in the top of the box to accommodate the switch, cord, and jack. The ease of assembly is indicated in the pictorial diagram and photographs, and the Novice should have little trouble in building this low-cost c.w. filter over one weekend.

Comparison of Calculated and Measured Filter Performances

The most suitable test to reveal deficiences in a filter design or performance is to measure the filter's relative attenuation response and its insertion loss at the 0 dB reference frequency. These measurements will show if the filter design is correct and if the filter was wired correctly. The effect of the inductor Q on the filter response can also be noted.

Fig. 8 shows the measured and computer-calculated relative attenuation responses of design #2. The continuous curve was made by a computer-plotter that calculated and plotted the theoretical response based on the component values of design #2. The fact that the performance data in Table I agrees with the computer-calculated response indicates that the Table I data is correct.

The small circles near the plotted response are the measured values of relative attenuation. Except for frequencies near the lower and upper cutoff frequencies, there is good agreement between the theoretical and measured responses. This indicates that the inductors and capacitors have the correct values, and the filter was properly wired and terminated. The slight differences between the calculated and measured values around the 3 dB level are due to inductor losses which cause the passband to become rounded

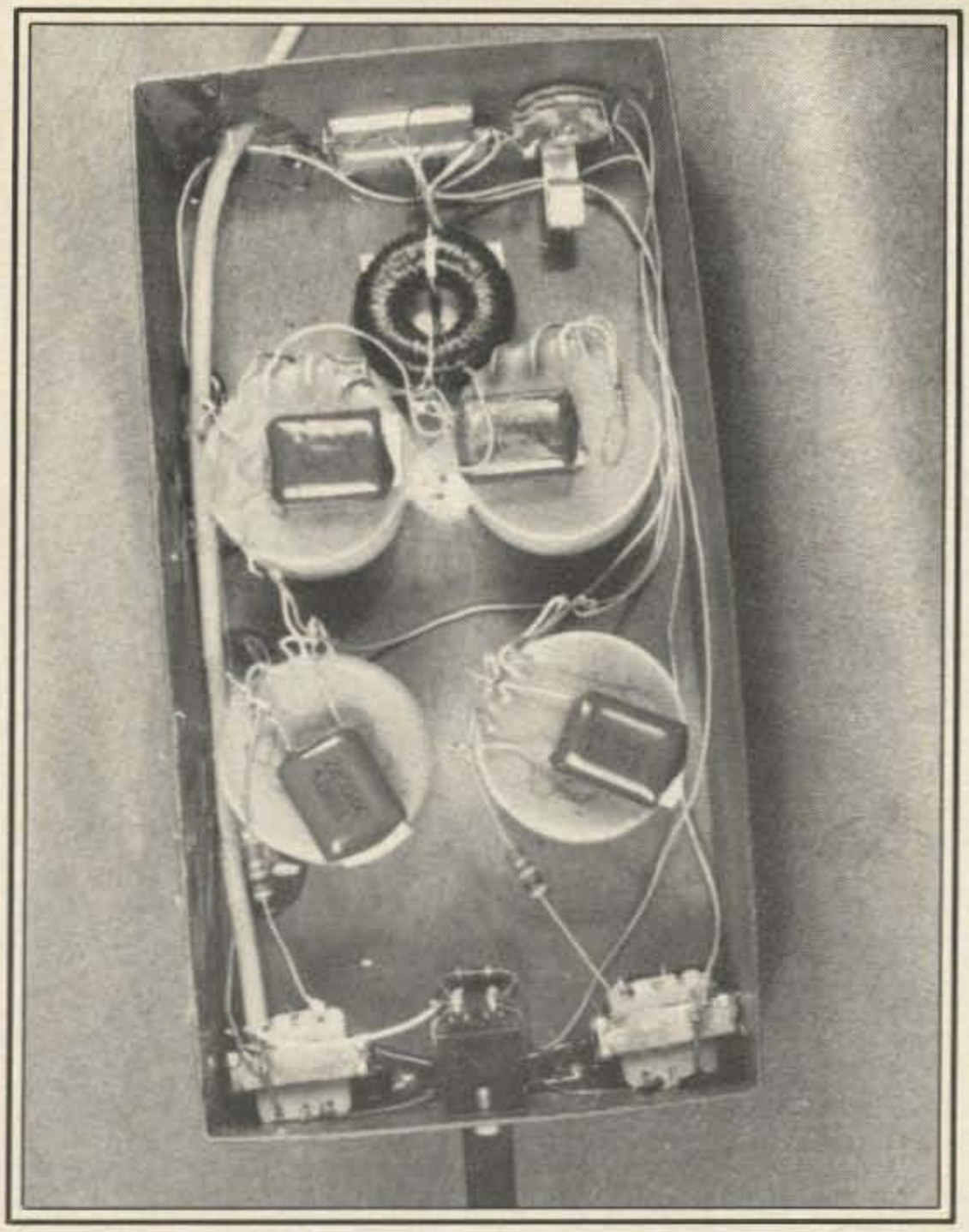
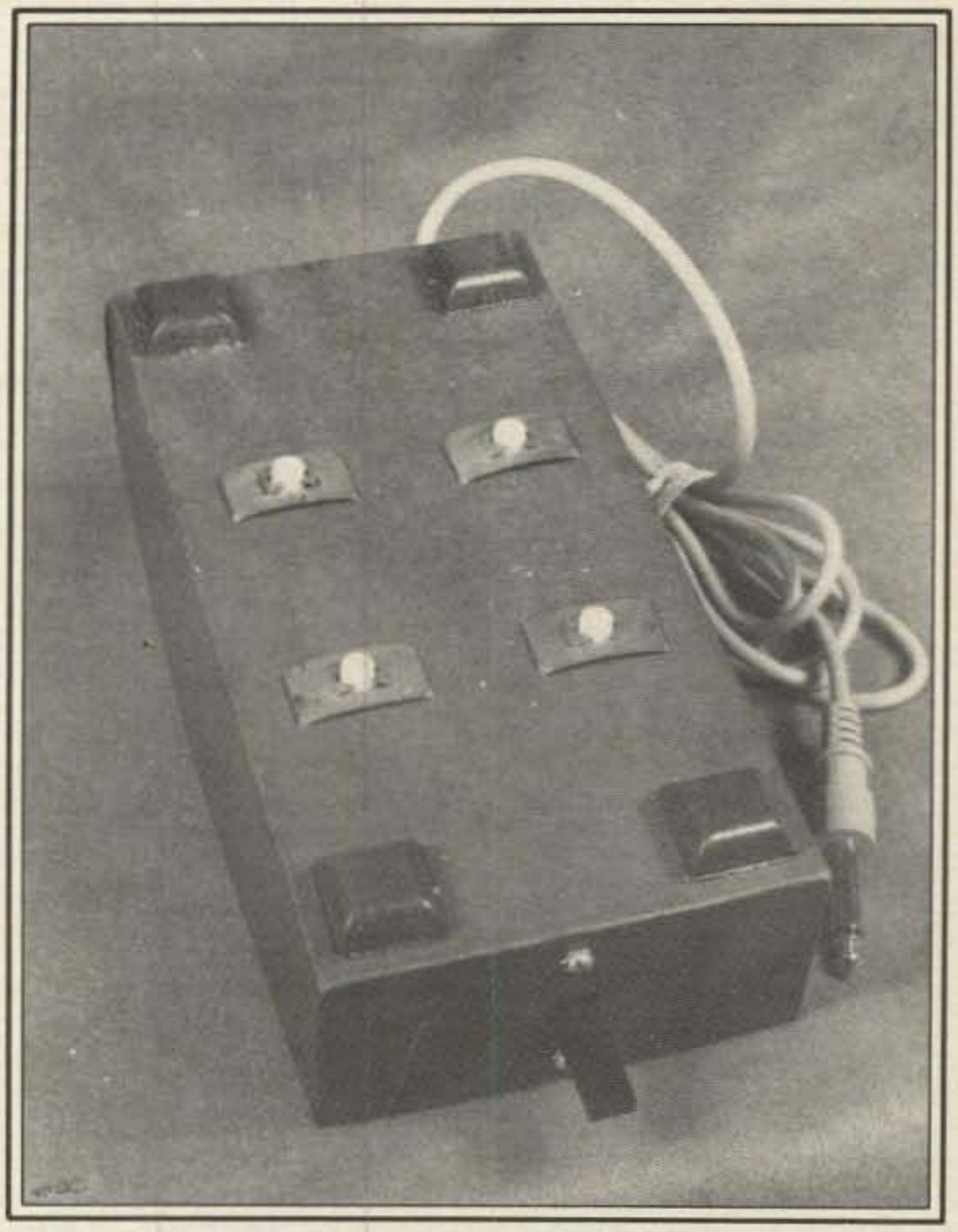


Fig. 6– This photograph shows the placement of the filter components inside the cardboard box. Capacitor C3 was stuck to the back of the box with mounting tape. The other four capacitors were stuck to the tops of the potted inductors with mounting tape. Rubber cement was used to fasten the phone cord and transformers to the sides of the box. The unpotted inductor (L3) was secured to the bottom of the box with mounting tape.

Fig. 7– The photograph shows how the potted inductors are fastened to the bottom of the cardboard box with Tinnerman clips. Holes are easily cut in the cardboard box with an X-Acto® knife.



at the cutoff frequencies. This effect becomes more pronounced in those designs having narrower passbands. The measured response test was made without transformers T1 and T2 so only the deficiencies of the filter would be measured.

The effect of component losses is evident in the filter insertion loss measurement. This measurement is performed by establishing a reference output voltage across a load resistance of 648 ohms and at a frequency of 756 Hz. The filter then is removed from the circuit, and the load is connected to where the filter input was connected. The output voltage is again measured, and the dB increase in level indicates the signal loss caused by the filter. In the case of design #2 the insertion loss was 1.7 dB, which is typical for this type of filter and bandwidth. For the narrowest bandwidth, the insertion loss is less than 3 dB. Although the passive filter does have loss, you can see that it usually is so small that it seldom will be noticed.

Take note that the passband of design #2 is flat over a considerable frequency span. The actual 1 dB frequencies were measured at 594 and 988 Hz, or a bandwidth of 394 Hz. However, when looking at the filter schematic diagram in fig. 4 and noting that all the resonant circuits are tuned to the same frequency (756 Hz), you would think the filter response would have a very sharp and narrow response at this frequency. However, instead the passband is flat on both sides of the center frequency! This is a consequence of the component values interacting in such a manner so as to keep the passband flat over the specified bandwidth. This flat passband response indicates that the filter will not ring; however, more signals will pass through to make the reception of one signal more difficult. As the passband is narrowed for better selectivity, the tendency of the filter to ring increases, but even with the narrowest designs (#13 to 16 in Table I) there is no discernible ringing.

Filter Installation

Design #2 was matched to 8/500 ohm transformers for installation in an 8 ohm audio system. For a 4 ohm audio system the center taps of the low-impedance windings of the transformers are used to provide the proper match. To match any filter to audio systems having higher impedance levels (500 to 1000 ohms), omit the transformers altogether and add resistance in series or parallel to compensate for any remaining mismatch. For example, the Heathkit HW-8 has a 1000 ohm audio output impedance, and filter designs 5 through 12 can be connected directly to the HW-8 audio output jack because its impedance is practically within 10% of the filter's design termination impedance. For a satisfactory match when using designs 1–4 with the HW-8, place an 1800 ohm resistor across the HW-8 output to provide the proper filter termination; for designs 13–16, add a 270 ohm resistor in series with the HW-8 output.

If you have an 8 ohm headset, you must use the proper transformer to change the low impedance of the headset to the design impedance of the filter. As previously explained, correct any slight remaining mismatch by adding a resistor in parallel or series between the filter and transformer. If you have a high-impedance headset, measure its resistance and then add resistance (probably in parallel) to correctly terminate the filter. For example, the surplus headset ANB-H-1 has a resistance of about 2.2k ohms, and a 2.2k ohm resistor should be placed in parallel with the headset to provide approximately 1.1k ohms for designs

Nodes[1] From	Nodes[1] To	Inductors Involved[1]	RESISTANCE (Ohms)[2] Filter Design Numbers (from Table 1) 1 - 4	5 - 8	9 - 12	13 - 16
1	GROUND	L1	← 6.0 →			
2		1/2 of L1	← 3.0 →			
3		L2 + 1/2 of L3	8.4	14.4	20.4	26.4
4		1/2 of L3	← 2.4 →			
5		L3	← 4.8 →			
6		L4 + 1/2 of L5	9.0	15	21	27
7		1/2 of L5	← 3.0 →			
8		L5	← 6.0 →			
3	4	L2	6.0	12	18	24
6	7	L4	6.0	12	18	24

Table II– Node-to-node resistances of the Novice c.w. filter. (See figs. 3 and 4 for the node locations and the inductors involved.) Use these approximate resistance values as a check to see if you wired the filter correctly. Gross differences between your measured values and those in the table indicate a wiring error. For example, a measured short or open, or a measured value that differs by more than 50% from the table value, indicates a wiring error is likely. The listed resistance values are for R1 and R2 disconnected at T1 and T2.

9–12. In all cases, ½ watt, 10% resistors are satisfactory.

Conclusion

The final test is in actually using the filter, and the effect of this filter on QRM has to be experienced to be appreciated. Even the design with the widest bandwidth eliminates enough QRM so that operating fatigue is greatly reduced. The narrower designs provide more selectivity with no ringing, but receiver tuning becomes more critical. More than 500 amateurs have constructed the 5-resonator filter, and they are well satisfied with its performance. I am sure that you, too, will be equally as pleased.

Summary

The characteristics of a passive c.w. filter suitable for Novice construction and use were discussed, and designs with four different bandwidths were listed. Low-cost surplus inductors kept the filter cost under $15. One design was assembled to demonstrate the filter construction, and procedures for checking the filter wiring were provided. The filter attenuation response was measured, and it was compared with the computer-plotted

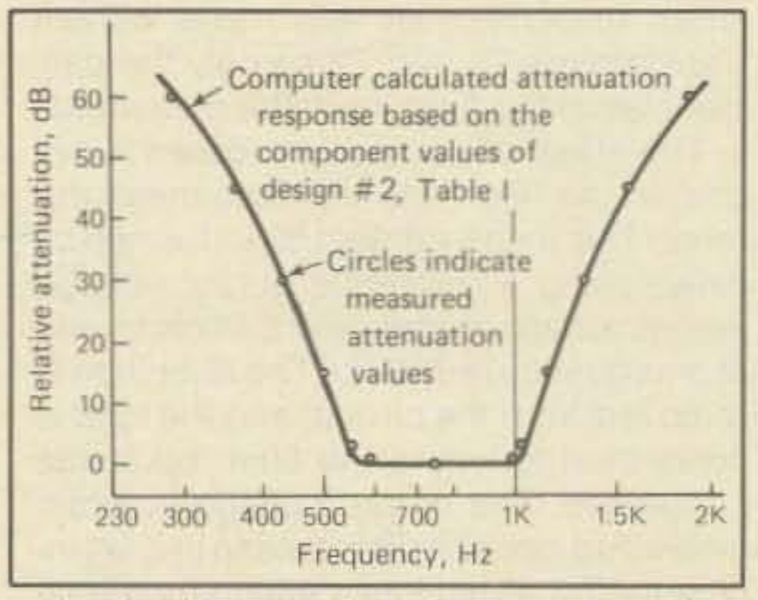


Fig. 8– Measured and computer-calculated relative attenuation responses of filter design #2. All attenuation levels were measured relative to the attenuation at 756 Hz, which was taken as 0 dB. The measured insertion loss at 756 Hz was 1.7 dB.

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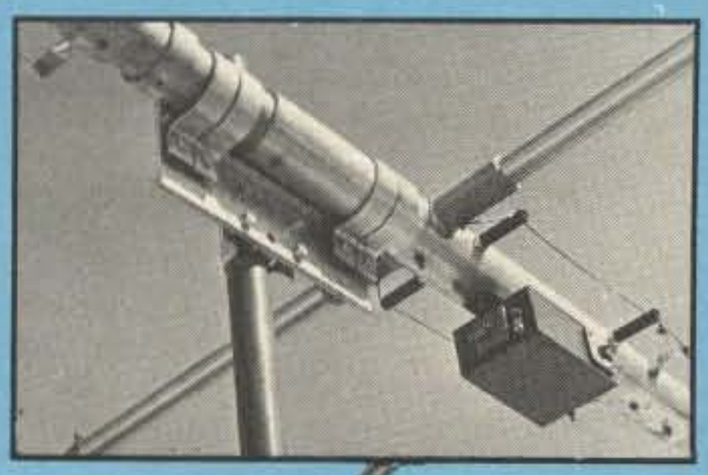

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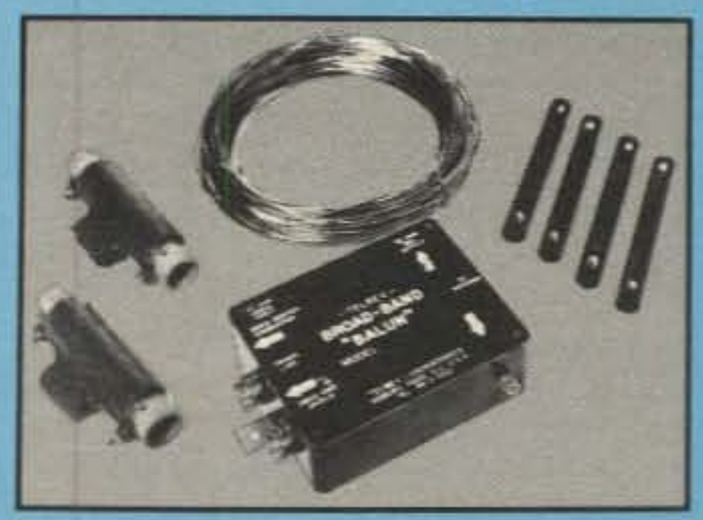

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15M845	15 Meter 8 element	(15 DBD)	1268.00	975.00
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20M646	20 Meter 6 element	(14 DBD)	1294.00	995.00
40M214	40 Meter 2 element	(5.6 DBD)	865.00	665.00
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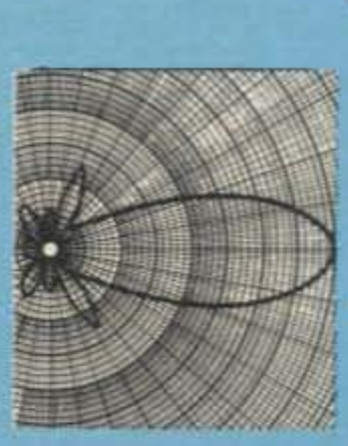

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response to show that the design and components used were correct. The superior performance, easy construction, and low cost make this filter especially appealing to the Novice operator.

Acknowledgments

The author gratefully acknowledges the assistance of Joseph Gutowski in reviewing the manuscript, and of Barry Travis, N4FNZ, for his review and helpful comments and for his distributing copies of the manuscript to members of the Arlington Amatuer Radio Club of Virginia.

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Appendix A

Equations relating parameters of a bandpass filter response. All frequencies are in Hz.

1. $Fc = [(Fup)(Flo)]^{1/2}$ where Fc is the geometric center frequency of the filter passband, Fup is the upper frequency on the response curve for any given attenuation level, and Flo is the lower frequency at the same attenuation level.

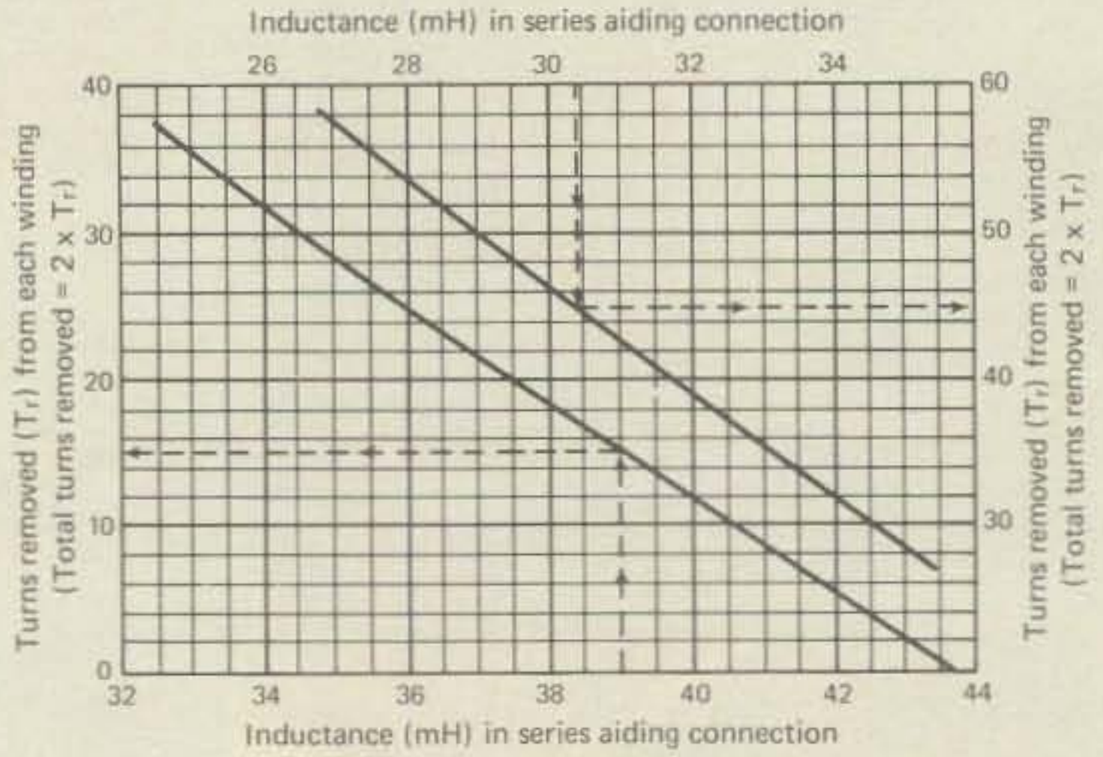
2. $BW = Fup - Flo$, where BW is the bandwidth at the attenuation level of the Fup and Flo frequencies.

3. $Flo = -BW/2 + [(BW/2)^2 + Fc^2]^{1/2}$ for any given attenuation level. This is an important equation, for it permits you to calculate the theoretical lower frequency of a bandpass response when you know only the bandwidth at a particular attenuation level and the center frequency. For example, design #3, Table I has a 494 Hz 3 dB bandwidth and a 747 Hz center frequency. The 3 dB lower frequency on the response curve is calculated as follows:

$$\begin{aligned} Flo &= -494/2 + [(494/2)^2 + 747^2]^{1/2} \\ &= -247 + [61009 + 558009]^{1/2} \\ &= -247 + 786.8 \\ &= 539.8 \\ &= 540 \end{aligned}$$

4. $Fhi = Flo + BW$. For the above example: $Fhi = 540 + 494 = 1034$.

5. 3 dB Relative Bandwidth $= 100(BW/Fc)\%$. For example, design #3, Table I has a theoretical 3 dB relative bandwidth of $100(494/747) = 66.1\%$.



Appendix B

Inductance vs. turns to remove from a surplus 44 mH inductor to obtain a desired L2 value (with center tap). (Applicable for a 44 mH inductor having windings on opposite halves of core.)

To use the graph, find the desired L3 inductance on the lower or upper horizontal scale. Read the corresponding turns to remove from each winding on the appropriate vertical scale. For example, to get 39.0 mH, remove 15 turns each of the two windings of the 44 mH inductor. The total turns removed is 30.

After the proper number of turns has been removed from each winding, connect the *start* lead (with sleeve) of one winding to the *finish* lead (no sleeve) of the other winding. The junction of these two leads is the inductor center tap. Connect the other two leads across capacitor C3.

Although the actual unmodified inductance at Tr = zero is only 43.7 mH, this value can be used for those designs requiring 44.0 mH, because the difference is less than 1%. If desired, one turn can be added to each winding to obtain an inductance within 0.5% of 44.0 mH.

Note: The polyurethane film insulation is easily removed with some solder and a hot iron (750°F).

Novice

a monthly feature by
BILL WELSH, W6DDB

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Electric Power For Fixed Stations

I have never seen figures showing percentages of amateurs who operate fixed (home) versus mobile (vehicle) stations. However, I am sure that such figures would support my opinion that an overwhelming majority of amateurs operate only from fixed stations. In addition, many of the amateurs who operate mobile and/or portable also operate fixed stations. A fixed station is one that is operated from the geographic location shown on the station license.

Almost all modern amateur rigs are transceivers (combination transmitter and receiver units) which are primarily designed to provide mobile SSB (single sideband) voice communication capability, and are designed to be powered by a vehicle's 12 volt DC system. The only time most of these mobile transceivers are ever in a car (or any other vehicle) is when they are being transported from the point of purchase (store) to a fixed station (home). Consequently, these transceivers are normally operated in conjunction with a power supply which converts house power (commonly 117 volt, 60 Hertz, single phase) from AC to the required DC. These AC-to-DC supplies are sometimes built into transceivers, but they are more commonly one of several external accessories offered to complement transceivers. Many amateurs purchase power supplies offered by the transceiver manufacturer because such supplies match the appearance of the transceiver, and they may include built-in features such as a loudspeaker and clock. Other amateurs purchase a standard power supply (such as Astron) and use it with any transceiver, or with any other device requiring a low DC input voltage. It is less expensive to buy a standard power supply in lieu of the custom-made one offered with a transceiver.

Regardless of whether one uses a transceiver or a separate receiver and transmitter combination, most fixed stations are operated from standard 117 VAC house power. This input electric power merits consideration. A good fixed station installation includes a safe electrical input power configuration with adequate current capability.

The standard residential electrical service to an American home is a three-wire input providing 234 volts (end-to-end) at 60 Hertz and single phase. The third (center) wire is the neutral, providing a nominal 117 VAC between this neutral wire and each outer (end) wire. The current available to most older homes is 60 amps, whereas most newer homes have a 100 amp service. The current actually available in a home depends on the line length between the outside (pole) transformer and the residence. If this line is short, more current is available to the home. Homes containing electric heating have 150 to 200 ampere service. The input voltage (line-to-neutral) can be any value between 110 and 125, and it is usually above 115. The average input voltage throughout our country is 117 VAC. Public utility commissions control electric power requirements in many states.

Most new amateurs simply plug their equipment into baseboard outlets. This may be adequate, but it usually is not suitable. Home outlets are usually rated at 15 amps, and a typical modern station can exceed 15 amps. There is also the fact that the baseboard outlet used to power an amateur radio station may be used to power household appliances connected to the same line. As little as a 3 volt drop (117 to 114, as an example) causes noticeable blinking of lights, which is likely to be disturbing to other people in the home.

It is advisable to at least run a separate line into the shack from the electrical distribution board. It is even better to have this dedicated line provide a three-wire, 234 VAC feed to the shack; this enables you to balance the electrical load between the neutral and each outer (end) lead to achieve maximum efficiency (minimum operating cost). Use a special connector (electric-range type) as the three-wire outlet in the shack. Never break the neutral line with a fuse, switch, or circuit breaker because that would leave 234 VAC connected from end to end of the three-wire input. Just the outside (end) lines are broken by such devices. The special heavy-duty line installation may have to be accomplished by a licensed electrician; check your local rules.

Linears, and similar heavy current loads in the shack, should be powered from a 234 VAC line if they are designed to accept this input. Many pieces of amateur equipment are designed for 234 VAC operation. This 234 VAC input power capability is a feature to consider when purchasing equipment that requires a high input current.

State and federal codes require most electronic equipment to have three-wire AC power cords. Two wires carry 117 VAC power to the equipment, and the third wire connects the equipment (chassis, frame, case) to the electrical ground established for the distribution system of the residence. This equipment-cord ground wire minimizes the possibility of people or pets receiving an electrical shock in the radio shack. If your outlets do not have receptacles that accept three-prong plugs, use a three-to-two adapter between your three-wire equipment cord and the two-prong electrical receptacle. Connect this adapter with your equipment turned off to minimize voltage buildup on the ground (third) wire. Loosen the center machine screw holding the wall-receptacle cover plate in

Jean-Pierre Frossard, KB4GID, of Athens, Georgia, is a 15-year-old high-school senior who moved from France to America about three years ago. His station includes Heath SB-400 and SB-301 twins plus three dipole antennas strung up in the attic of the apartment building in which he lives. He has contacted amateurs in all states, plus more than 40 countries. Jean-Pierre won first place for Georgia in the 1984 ARRL Novice Round-up Contest. His favorite band is 15 meters because it provides him with many opportunities to work other countries. His other interests are Scouting, stamp collecting, and exhibiting at science fairs. He has an ARRL code proficiency certificate with the 15 wpm endorsement, and he expects to earn the 20 wpm sticker soon.

2814 Empire Ave., Burbank, CA 91504

place. Slip the lug of the adapter's green (ground) lead under the head of the loosened screw, and secure it in place by tightening this machine screw. Plug the two-prong adapter into the electrical receptacle, and plug the three-wire equipment cord connector into the adapter receptacle. If your equipment does not include a three-wire power cord, it is wise to replace its two-wire cord with a three-wire cord to provide an extra margin of safety in your shack. A three-wire input power cord is an asset one should consider when selecting equipment.

A common accessory amateurs purchase for their shacks is the powerline strip. These strips include a three-wire cord (6 to 15 feet long) and a plug for connection to a 117 VAC three-wire electrical power receptacle in the shack. Powerline strips contain about three to nine three-wire outlets, a switch, and a power on indicator light, plus a fuse or circuit breaker. These strips are available in several configurations, and some include built-in surge protection to eliminate any possibility of equipment being damaged by high transient voltages fed into the home when outside power lines are struck by electrical discharges or other high-level transient voltages.

Determine how many receptacles you require on the powerline strip and ascertain the total current drain your station can impose on the strip. These figures will enable you to select the proper strip to meet your shack's requirements. Add the individual power requirements of each unit to be plugged into the powerline strip. Divide the resultant power total by 117 to obtain the total current that will be drawn through the strip's fuse or circuit breaker. Select a strip that is able to handle your station's total current requirement, even though you may not expect to ever have everything drawing maximum current at the same time.

If you can do so, mount the powerline strip where metal objects cannot possibly fall across the metal prongs of a plug that is not fully inserted into a strip receptacle. A good place to mount a strip is under the back lip of the operating table. It is best to mount the powerline strip to the operating table/desk, or to an adjacent structure behind the operating position. Do not leave the strip loose. If it is convenient to do so, mount the strip such that the ground holes in the receptacles are up, and the dual (high side) blade holes are down. This provides an extra degree of safety in case a metallic object falls between an equipment plug and a powerline strip receptacle.

It is nice to have the ability to throw a single switch or circuit breaker to remove AC input power from all station equipment; the use of a powerline strip is one way to achieve this feature. Removing station input AC power reduces the possibility of anyone getting hurt in your station or anyone operating it without your know-

Francis Ferguson, KA7OLI, of Portland, Oregon, is over 70 years old. Francis is retired; he previously worked as an electrical appliance repairman, electrician's helper, and TV antenna installer. Francis operates an FT-7B transciever with a 40/15 meter dipole antenna.

ledge. There are also power-switch locks which are key actuated; these provide increased assurance that no one will operate your station without your permission.

Do not leave AC power cords loose and dangling. Most amateurs do not trim cords to meet existing length requirements because they may want the extra cord length in a future changed station layout. It is a simple task to fold extra cord into a neat bundle and to secure it with an elastic band, tape, or twine.

Avoid the use of extension cords and cube taps in the shack. If you must use an extension cord as a temporary measure, use a heavy-duty three-wire cord. Cube taps are portable electric outlets with one pair of male prongs (that are inserted in the power receptacle), and three sets of female receptacles in a molded (or plastic) cube. A cube tap is used to provide three AC plug connections from a single receptacle. If you must use a cube tap as part of a temporary installation, use the type that has a three-wire plug and three-wire receptacles.

Filters are often necessary to complete a good electrical installation in an amateur radio station. You may find that you need a filter to stop household appliances (refrigerators, hair dryers, vacuum cleaners, light dimmers, etc.) from interfering with reception when you are operating. The problem could be the reverse situation, requiring the installation of a power-line RFI filter to eliminate interference your station equipment (usually the transmitter) is causing to household electronic devices. There are many types of power-line RFI filters, but they generally fall into three categories. Type R filters have double T sections; they provide line-to-line and line-to-ground filtering actions. Type R filters are extremely effective, and they are also the most expensive filters. Type K filters contain double L sections; they provide line-to-line and line-to-ground filtering actions. The type K filter is not quite as effective as the type R filter, but it is satisfactory in almost all cases. Type B filters provide just line-to-ground filtering action, but this is all that is needed to eliminate most RF interference problems. Audio interference input and output filters are also available to eliminate audio frequency interference problems.

It is possible that your station may include an AC/DC radio or a TV receiver that contains a transformerless power supply. This type of supply presents a potential electrical shock hazard because one side of the input power is connected to the equipment chassis. It is good to remove such equipment from the shack. If you must use it, an isolation transformer should be inserted between the AC/DC equipment and the AC power receptacle to provide some degree of safety.

When you erect an antenna, keep the antenna and its feedline clear of input power lines and telephone lines. Position the antenna and feedline where they cannot fall across input power lines, and where input power lines cannot fall across them. Do not position an antenna or feedline where it runs parallel and close to input AC power lines or telephone lines. If you must cross a telephone line, do so as close as possible to 90 degrees to minimize coupling between these wires.

Establish an excellent radio frequency (RF) ground to complete the safety aspects of your radio station. A good ground reduces background noise, enabling one to hear weak signals; it also increases transmitting and receiving efficiency of most types of antennas. Use ground braid (not wire) to connect the station to the external RF ground, and to connect each piece of station equipment to the ground stud on the rear apron of the transceiver/transmitter.

If you have a piece of equipment that blows the correct value fuse, do not attempt to cure the problem by using a fuse which has a higher current rating. Find the problem and correct it before a minor problem develops into a catastrophic failure.

American amateurs occasionally acquire foreign-made equipment that is not built for export. Such equipment is intended to be operated using the input AC power that is common to the country where it is manufactured. If you have such equipment, check it to make certain it is wired for 117 VAC operation. The correct input setting is sometimes switch selectable, but it more commonly involves unsoldering the high (switched) side of the AC input wire from an unwanted primary tap (105 vclt, for example) on the power transformer and soldering it to the 117 VAC primary tap. The common AC power input to a Japanese residence is 100/105 volts, 50/60 Hertz, single phase. If a unit is wired to operate on 105 VAC input power, but is operated with 117 VAC input power, its power dissipation is in-

creased about 24 percent. If the equipment is wired for 100 volt operation, but is connected to a 117 VAC input, power dissipation is increased almost 37 percent. The load (transceiver) remains the same, regardless of the input voltage level. Consequently, the current increases when the input voltage increases. Since power is the product of voltage multiplied by current, the power increase associated with this type of input voltage increase is of major importance. This increase can damage the equipment.

Last but not least, you are advised to borrow a copy of the National Electric Code (NEC) manual from your local public library or any convenient source. Article 800 of the NEC covers communication circuits. Article 820 of the NEC covers community antenna television and radio distribution systems. If you have an interest in cable television (CATV) and/or cable television interference (CATVI), I advise you to read the CATVI article in the March and April 1984 *CQ* Novice columns.

The NEC is the "bible" with regard to electrical wiring. Article 810 of the NEC covers radio and television equipment. Part C of article 810 details the requirements of antenna systems for amateur transmitting and receiving stations. A few of its basic points are as follows:

Antenna Size. Where hard-drawn copper is used with a maximum open span that is less than 150 feet, 14-gauge wire is the minimum acceptable size; if the open span exceeds 150 feet, 10-gauge wire is the minimum acceptable size. Where copper-clad steel (copperweld), bronze, or other high-strength material is used with a maximum open span that is less than 150 feet, 14-gauge wire is the minimum acceptable size; if the open span exceeds 150 feet, 12-gauge wire is the minimum acceptable size.

Feedline Conductors' Size. Transmitter output feedlines shall consist of conductors that are at least as large as antenna conductors for comparable open spans.

Building Clearance. Antenna conductors and transmitter output feedlines shall be securely mounted to building surface(s) at least 3 inches away from such surface(s). Nonabsorbent insulating supports shall be used. Treated pins or brackets with insulators having at least 3 inch creepage and airgap (total) distance suffice in this application. An exception to this requirement, which is of great importance to amateurs who use coaxial cable feedlines, is that feedline conductors enclosed in continuous metallic shielding (that is effectively and permanently grounded) is not required to meet the preceding requirements.

Feedline Building Exit. Other than feedlines protected with continuous metallic shielding that is effectively and permanently grounded (coaxial cable), transmitter output feedlines must exit/enter buildings by one of three methods. **(1)** Through a rigid, nonabsorbent, and noncombustible insulating tube or bushing. **(2)** Through an opening provided for the feedline, wherein feedline conductors are firmly secured to provide at least 2 inches clearance from the adjacent structure. **(3)** Through a drilled window pane.

Arlin Rowse, KAØRKB, of Chambers, Nebraska, has been an amateur since September 1983. His station includes a Kenwood TS-530-S transceiver, an 80/40/15 meter dipole, and a 10 meter vertical antenna. Most of his operation is on the 15 and 80 meter bands. Arlin has worked about half of the states so far.

Protection Against Accidental Contact. Transmitter output feedlines shall be positioned such that accidental contact with them is difficult (unlikely).

Antenna Dischargers. Each conductor of a feedline for an outdoor antenna shall be provided with an antenna discharger (or other suitable device) that will drain static charges from the antenna system. One exception to this requirement is where a continuous metallic shield (coaxial cable) is used, which is effectively and permanently grounded. The other exception to the preceding requirement is an antenna that is permanently and effectively grounded when not in use.

Grounding Conductors. Protective (static discharge) grounding conductors for transmitters/transceivers must be at least as large as the feedline conductors used in the same station. In no case may the grounding conductors be less than 10-gauge copper, bronze, or copper-clad steel. In no case may the operating ground conductor for a transmitting station be less than 14-gauge copper, or its equivalent.

Chapters one through four of the NEC provide detailed requirements for wiring from the power source to (and between) equipment connected to the interior wiring system. Sections 640-3 through 640-5 of the NEC contain modifications to chapters one through four. Article 640 contains wiring details applicable to radio-frequency and audio-frequency equipment, including loudspeakers. The material contained in these NEC chapters and articles is too extensive to be covered in this column. I simply want you to know where it can be found.

Several previous Novice columns contain information related to this general subject. A few of these items are "Amateur Radio Station Installation Tips" (November 1977 through March 1978), "Amateur Radio Station Grounding" (September through November 1978), "Station Installation Information" (December 1982), and "Electric Shock" (April 1983).

73, Bill, W6DDB

CQ SHOWCASE

Datong FL-3 Audio Filter From AllComm/Spectrum West

AllComm/Spectrum West has announced the availability of the Datong FL-3 multimode audio filter. The FL-3 includes both a low- and high-pass filter fully tunable from 200 to 3500 Hz. The skirts are steep, and there are two notch filters: one which operates automatically to locate and eliminate tune-up whistles and steady tone interference, and a second which tunes manually from 200–3500 Hz. For those using RTTY and CW a special tuning mode will combine the low, high, and peak-notch filters into a single 12-pole filter while maintaining the non-interacting control for center frequency and bandwidth. All functions and controls are calibrated, and the unit can be used with any type receiver in series with the loud speaker or phone jacks.

AllComm is offering a "Test Listen" program so that interested customers can hear the FL-3 before purchasing. Those interested are asked to send $1 to cover postage and handling (overseas $1.50), with their name and address, and in return they will receive a C-60 cassette with a brief demonstration of the Datong products. The cassette is theirs to keep as well as a certificate good for $5.00 off the price of the FL-3. For the cassette, contact AllComm/Spectrum West, Datong Test Listen, 5717 NE 56th St., Seattle, WA 98105, or for more information circle number 106 on the reader service card.

Palomar Engineers Two-Digit DTMF Decoder

Palomar Engineers has announced a two-digit sequential DTMF decoder. A two-digit DTMF code closes a relay and a third DTMF digit opens it. The decoder, Model P-202, features ½ ampere 115 volt relay contacts, dual bandpass filters, quartz crystal frequency control, and operation over an extended temperature

range and over a wide range of signal levels. It is highly immune to false triggering. Operation is from 12 to 30 volts DC. DTMF coding is factory set to order, but it can be changed by moving circuit board jumpers. Price is $125.

For more information, contact Palomar Engineers, 1924-F W. Mission Road, Escondido, CA 92025, or circle number 103 on the reader service card.

HAL AMTOR-10A AMTOR Code Converter

Added to the HAL CWR6850 Telereader, the AMTOR-10A unit allows transmission and reception of radio teleprinter signals with the added feature of error correction. The ITU 7-unit code is used for error correction as defined by CCIR Recommendation 476-2. The AMTOR-10A is a code and speed (baud rate) converter unit that when used with the CWR6850 allows 7-unit AMTOR code communications at 100 baud while retaining communications capability with the standard 5-unit BAUDOT code from 20 to 100 baud and the 8-unit ASCII code from 75 to 200 baud. The AMTOR-10A is designed to easily interface with the CWR6850 while retaining all of the standard features of the unit, including CW operational capability.

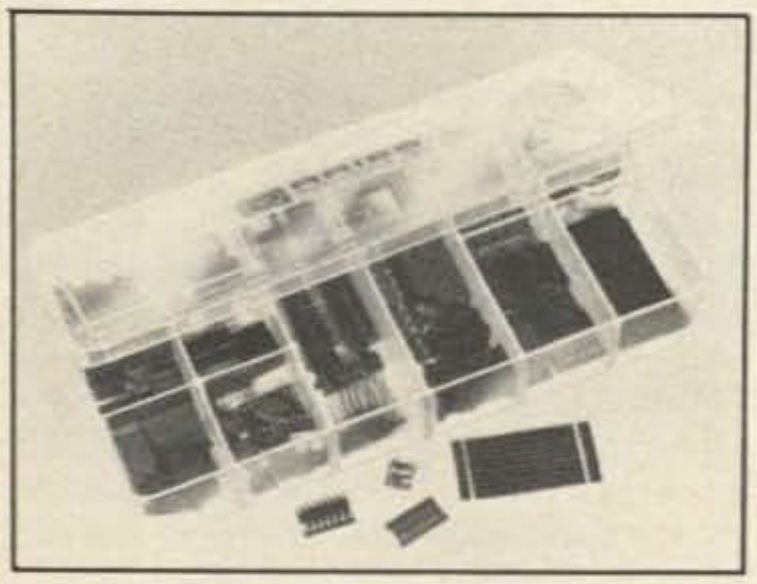
The AMTOR-10A Code Converter sells for $395. For more information, contact HAL Communications Corp., P.O. Box 365, Urbana, IL 61801, or circle number 105 on the reader service card.

Xitek RX-1000 RTTY/CW Computer Interface

The RX-1000 RTTY-CW Computer Interface gives the capability to utilize a computer for sending/receiving RTTY, AMTOR, ASCII, and CW. Virtually any hardware interface requirement on the market can be matched. You can use your favorite software with a VIC-20, Apple, TRS-80, TI99/4A, and others to communicate with the world of RTTY through the RX-1000. The RX-1000 utilizes full-wave FM demodulation with pre and post limiter filters. Separate bandpass filtering is provided for each of the three shifts—not detuning to accommodate all. Detection is made on either mark or space to track selectively fading signals. An automatic threshold level is actively resetting on each mark and space pulse. Low pass filtering is optimized for performance up to 110 baud. The CW filter is centered at 800 Hz at the factory, but may be adjusted up to 2125 Hz. Switch selectable TTL logic levels are set for each input with an internal dip switch so interface signal polarity requirements can be matched individually.

The panel with LED indicator lights and pushbutton switches is housed in a black cabinet. External signal connections are made at the rear panel through one PCB edge connector and flat cable assembly (available separately). Power comes in through a separate jack on the rear panel. Options available include RS 232 levels. An operator's manual is included with each unit. For more information, contact Xitek Electronics, P.O. Box 472952, Garland, TX 75047, or circle number 104 on the reader service card.

Aries Electronics Component Engineer's Sample Case



Aries Electronics, Inc. has made available a component engineer's sample case containing over 100 pieces of various connector products which the company makes. Included are sockets, Vertisockets® , elevator sockets, and single-row sockets (both stamped and collet pin versions), headers, programmable headers, switches, shorting plugs, jumper assemblies, etc. Worth over $100 if purchased individually, these parts come in a compartmentalised plastic case and sell for $30 (order part No.SB-100).

For more information, contact Aries Electronics, Inc., P.O. Box 130, Frenchtown, NJ 08825, or circle number 101 on the reader service card.

Texas Instruments Understanding Series™

Written and edited by experts in the fields of science and electronics, Texas Instruments' Understanding Series™ features easy-to-read text highlighted by numerous illustrations, all designed for learning the subject step by step. Ten titles in the new format have been issued in the first quarter of 1985. Plans are underway to expand the series to 36. Included in the first ten books are: *Understanding Automation Systems, Automotive Electronics, Communications Systems, Computer Science, Data Communications, Digital Electronics, Digital Troubleshooting, Microprocessors, Solid State Electronics,* and *Telephone Electronics.*

The Understanding Series is available through bookstores, college stores, and libraries. For additional information, contact Texas Instruments Incorporated, Information Publishing Center, P.O. Box 225474, MS 8218, Dallas TX 75265, or circle number 102 on the reader service card.

No-83-84

Awards

a monthly feature by
DOROTHY H. JOHNSON, WB9RCY

NEWS OF CERTIFICATE AND AWARD COLLECTING

The story of the month as told by Flo is:

Florence Reitzel, KU7F
All Counties #466, 2-16-84

"Most of us can remember that moment when we received our last county for the USA-CA Award, but there had to be a beginning. Mine started with a rash statement by a friend. My OM was helping a friend study for her Novice license. Her old man, who was a ham, told me that he did not think I could learn enough to get a license. I immediately enrolled in a local radio class and 14 weeks later came home with a General class license. Until that time I had no interest in amateur radio, even though Irv (my OM, KU7E) had tried to get me interested. Needless to say, at this point Irv's hamshack became my domain.

"We had always had a mobile rig in our car for our weekend travels to and from our lake home in Chelan County. In August 1980, while scanning the 20 meter band, I heard someone call for a number one mobile. I responded and was picked up immediately by K4QFK, who was acting as NCS for the County Hunters Net. Since my signal was so weak he asked ZL2ACP to assist. I can never thank those two fellows enough for their patience in explaining the net operation to me. I had so much fun putting out the counties during the next few weeks that I decided to try to join the elite group of USA-CA holders.

"After many hours of monitoring 14.336, working as NCS or assistant, and mobiling many miles myself, I was down to only seven counties left to go.

"On January 14, 1984 I checked into 14.336 and was informed that four of my needed counties were coming up that weekend. Monday, January 16 found me with only three Georgia counties left to work. Orv, VE3BFJ, was planning to leave that day for Georgia and said he would get those three counties for me. I was committed to work as NCS on another net at 1830, so Mary, KC5UO, volunteered to let me know when Orv reached one of my counties. Two hours later I was back on 14.336 with only Lincoln County, Georgia remaining. By this time band conditions were poor, but were beginning to improve some. I had consumed gallons of coffee and had stopped counting the cigarettes smoked. I was a bundle of nerves. When Orv informed the net he was in Lincoln County, I was barely able to utter the words 'QSL 5/9.' It was time for the nail biting to begin while I waited for the confirmations to come in.

Flo, KU7F, at the county line of Jefferson County, Oregon.

"Through my association with the USA-CA County Hunters and my friendship with ZL2ACP I had become aware of another group of county hunters—the New Zealand group on 15 meters. There are only 112 counties in New Zealand, but they are difficult to acquire. Rushing from 14.336 to 21.385 at 0200 GMT became a way of life in our shack. After five months and five days of daily monitoring I became the first YL ever to work all the New Zealand counties. To date I am still the only YL outside of New Zealand to accomplish this.

"February 9, 1984, all confirmations were in, the records were checked and certified, and were mailed to the award custodian in the 10 a.m. mail. At 1 p.m. on the same day we were off to New Zealand for a month-long visit.

"We took our ICOM 730, Hustler antenna, and resonators along with us to New Zealand. We were determined to make radio contact from as many New Zealand counties as we passed through each day. Eight a.m. New Zealand time found us saying 'good morning' on 40 meters to our New Zealand friends. They traveled with us daily as we passed through county after county, always ready to give us help with directions or whatever we needed. If and when the 10 meter band opened up we operated there as directed by our friends, who kept close watch for openings on all the bands. At 0200 GMT we operated on 21.385 for our Stateside friends, and they never failed us even when the propagation did. At 0400 GMT we were on 14.285 and at 0800 we went to the 80 meter band for the ZL Awards Net, where we had made so many friends. We operated from 63 of the 112 New Zealand counties during the month, and one ZL amateur had a contact with us in every county. During that time I qualified for three awards under the SL0AJC call. I also finished my ZLCHC/All YL, which was the biggest thrill of all.

"All this started with a call for a number one mobile on 14.336. Other than thanking VE3BFJ for the last three counties for USA-CA, it would be impossible to thank all of those who made this possible. There are so many. Special thanks must go to the mobile stations who do so much for so many with so few rewards. Many thanks to everyone for one of the greatest experiences of my life.—73/88, Florence Reitzel, KU7F."

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333 South Lincoln Ave., Mundelein, IL 60060

Special Honor Roll
All Counties

#485 Robin J. "Bob" Disbrow, WB2ZSO, 10-27-84
#486 Al Garrett, KG5J, 11-30-84
#487 Clifford D. Jones, K4CCW, 11-30-84
#488 Dorothy F. Jones, K4BZV, 11-30-84

New Endorsement, All 20M Mobile, SSB
George Readman, WB6VRR, #217, 3-9-79
Endorsement Added 11-12-84

Awards Issued

Bob Disbrow, WB2ZSO, finished his last 76 counties and sent for All Counties #485, 10-27-84, Mixed.

KG5J, Al Garrett, completed all 3076 for All Counties #486, 11-30-84, Mixed.

Cliff Jones, K4CCW, made contacts with mobile stations and qualified for All Counties #487, 500 through 2500 endorsed all 20M Mobile, SSB; 2500 through 3076 endorsed all Mobile, SSB, 11-30-84.

Not to be outdone by her OM, Dorothy Jones, K4BZV, sent for All Counties #488, Mixed, 11-30-84.

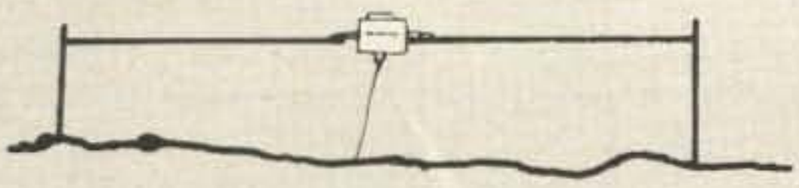
George Readman, WB6VRR, who has All Counties #217, 3-9-79, added a new endorsement to his certificate—all 20M Mobile, SSB, 11-12-84.

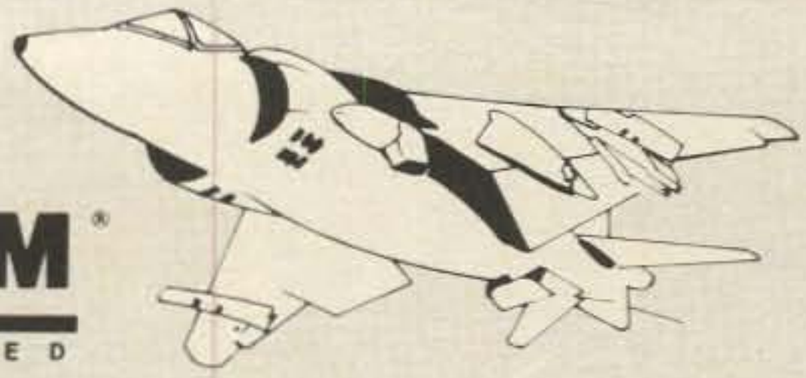
Richard Goodall, G2AFQ, continues to increase his score and has qualified for USA-CA 3000 #514, Mixed, 11-3-84.

Jack Sherman, VE4AT, who always has a fine signal from Manitoba, sent for USA-CA 2500 #577 and USA-CA #515, all SSB, 11-15-84.

Ed Sanders, WA6VJP, has passed another mile post and has USA-CA 3000 #516, all 2 × CW, 11-29-84. Besides working the counties on CW, Ed is enthusiastic about operating CW from mobile.

Larry Chapman, NE8V, sent for USA-CA 500 #1982 through USA-CA 2500 #576, all 20M Mobile, SSB, 10-24-84.





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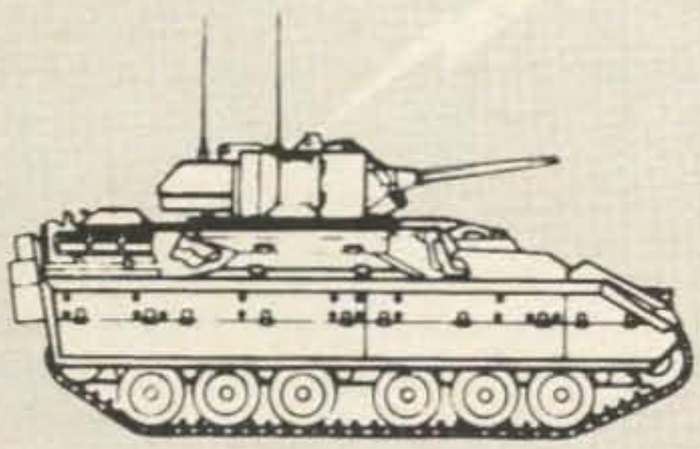

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CIRCLE 22 ON READER SERVICE CARD

USA-CA Honor Roll

3000		WB8BMX	632	N2ARE	864
G2AFQ	514	KG5J	633	KA4SAX	865
VE4AT	515	K4CCW	634	KG5J	866
WA6VJP	516	K4BZV	635	K4CCW	867
KG5J	517			K4BZV	868
K4CCW	518	**1500**			
K4BZV	519	NE8V	699	**500**	
		KA4SAX	700	NE8V	1982
2500		WB8BMX	701	N2ARE	1983
NE8V	576	KG5J	702	LU1VK	1984
VE4AT	577	K4CCW	703	KA9HKB	1985
KG5J	578	K4BZV	704	OZ5EDR	1986
K4CCW	579			UJ8JCQ	1987
K4BZV	580	**1000**		KG5J	1988
		NE8V	862	K4CCW	1989
2000		G5PO	863	K4BZV	1990
NE8V	631				

ZL0AJC (aka KU7F) operating mobile at the county line of Waimea and Golden Bay Counties in New Zealand.

Alan R. Carpenter, WB8BMX, sent for USA-CA 2000 #632, Mixed, 11-23-84.

Doug Allerston, G5PQ, qualified for USA-CA 1000 #863, Mixed.

Ira L. Bell, KA4SAX, whose fine mobile signal we hear from Tennessee, has added gold seals to his certificate for USA-CA 1000 #865 and USA-CA 1500 #700, all 20M Mobile, SSB, 11-21-84.

Larry Chapman, NE8V, sent for USA-CA 500 #1983 and USA-CA 1000 #864, all from his mobile station, all 20M.

USA-CA 500 certificates to:

Larry Chapman, NE8V, #1982, 20M Mobile, SSB, 10-24-84.

Joseph D. Gardner, N2ARE, #1983, all from mobile station, 20M, 11-10-84.

Francisco De Cesare, LU1VK, #1984, all SSB, 11-15-84, #2 to Argentina.

Don Denbow, KA9HKB, #1985, all Novice bands, 11-21-84.

OZ5EDR, Copenhagen Division of EDR (Club Station), #1986, Mixed, 11-26-84.

Alexander L. Rubstov, UJ8JCQ, #1987, Mixed, 11-29-84 (see photo).

Al Garrett, KG5J, #1988, Mixed, 11-30-84.

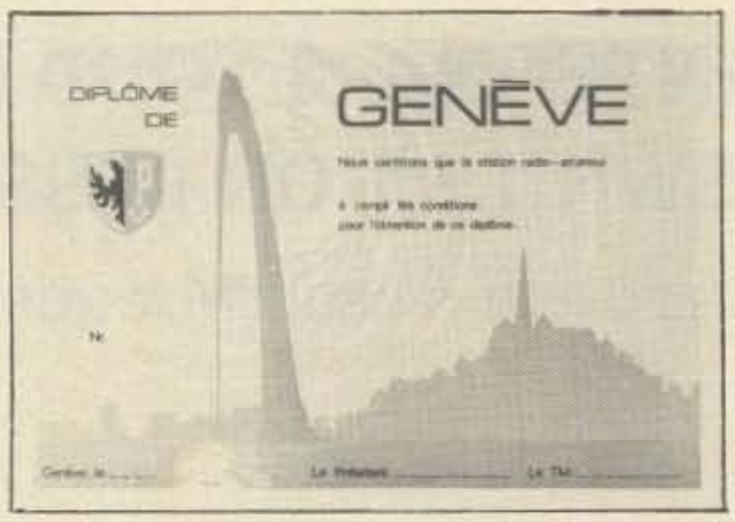
Clifford G. Jones, K4CCW, #1989, all 20M Mobile, SSB, 11-10-84.

Dorothy F. Jones, K4BZV, #1990, Mixed, 11-30-84.

Awards Available

Diplome de Geneve (Award of Geneva). A four-color certificate is issued by the Geneva Section of USKA. Work six different stations resident and operating in the canton of Geneva (abbreviated GE in the H-26 contest) using any band and mode. Special prefixes do not count separately (for example, HB7G = HB9G, 4U9ITU = 4U1ITU). Applicants outside Europe need only four different stations. This award is also available to SWL's.

Send applications with log extract and 7 IRC's or $3.00 US to HB9G, P.O. Box 917, CH-1211 Geneva 3, Switzerland. This award was first issued in 1970. However, there have been some recent changes in the rules.



Diplome de Geneve (Award of Geneva).

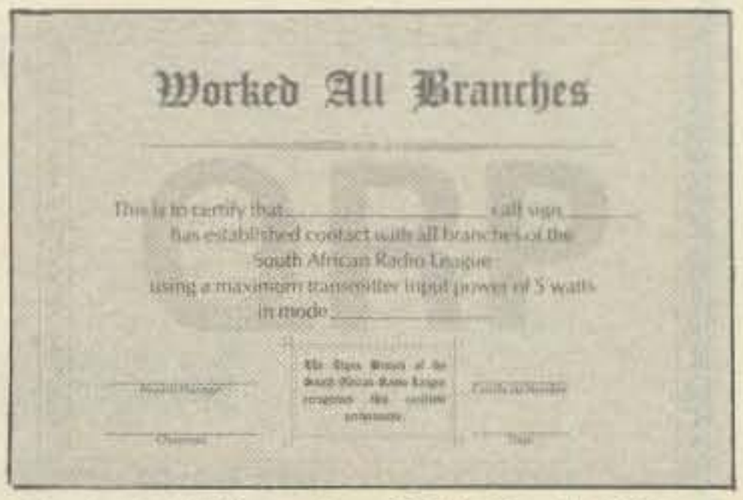
Worked 100 Regions (Oblasts) of the USSR. The award R-100-0 is issued to all licensed radio amateurs (and SWL's) all over the world who have fulfilled the following conditions. To obtain the award it is necessary to carry out two-way contacts with radio stations in 100 regions (oblasts) of the USSR. The award consists of three classes: 1st class—contacts on 3.5 MHz only; 2nd class—contacts on 7 MHz only; 3rd class—contacts on any amateur band. All contacts are to be made on CW or phone only for basic awards. Contacts for endorsements may be made on mixed mode. Minimum reports of 357 on CW and 33 on phone are required.

All contacts after January 1, 1957 are valid. The cost of the award is 1 rouble or 14 IRC's. Application must include a list of the contacts with date, call, mode, and frequency, and must be sent to Central Radio Club, P.O. Box 88, Moscow, USSR. QSL cards must be submitted with application, along with return postage for registered mail.

(Note: A complete record book for this award, containing a list of USSR Oblasts valid from 1984-05-01, deleted regions, letter of application, etc., is available from Bengt Hogkvist, SM6DEC, Bldbarsstigen 11B, S-546 00 Karlsborg, Sweden. The cost, for printing and postage, is $2.00 U.S. or 7 IRC's.)

South African Radio League—Worked All Branches—QRP. This award is open to all QRP operators using a maximum DC input power to transmitter final stage of 5 watts, or equivalent power. Applicants must have made contact with at least one amateur in each of the branches of the S.A. Radio League which are in existence at the time of the application. Contacts must be made on or after January 1, 1984 and may be made on any amateur band. Contacts may be made on CW, SSB, FM, or AM, and the certificate will be suitably inscribed.

Application must be made on the proper application form, which is available from the Award Manager and must be accompanied by R1 (One Rand) or equivalent and QSL cards confirming the contacts. The QSL cards must have the name of the branch to which the amateur belongs clearly marked on it. The award is free to Algoa Branch members. The applicant must have made all contacts from



Worked All Branches QRP, South African Radio League.

Alex, UJ8JCQ, USA-CA 500 #1987, operating RJ6R in Oblast 042 last July. Although his QTH is Dushanbe, Alex frequently makes expeditions to more remote areas of his country. In the past he has operated from Oblasts 182, 041, and 183. He is quite active on 20 meter CW. Photo and information courtesy K8PYD.

within a radius of 100 kilometers of his base station. All stations contacted for this award must have been situated within a radius of 100 kilometers of their branch meeting place at the time of contact. Failure to abide by the rules of the award may result in disqualification. The decision of the Award Manager will be final.

Send application and fee to: The Awards Manager, Worked All Branches, Algoa Branch, S.A. Radio League, P.O. Box 10050, Linton Grange, Port Elizabeth 6015, South Africa.

Notes

County Hunter's Supplies Available. The B & B Shop, 1348 Pinewood Drive, Woodbury, Minnesota 55125, has the following supplies for amateurs who are working for the USA-CA Award: County Hunters Handbook, $3.00; County Hunters Directory containing addresses, new calls, etc., of active county hunters, $6.00 for third-class mail or $7.00 for first-class mail; and computerized reply card stock $13.00 for 500 cards or $25.00 for 1000 cards, postage paid to U.S. only. Bill also prints mobile reply cards and QSL cards. Send SASE for his brochure.

The Counties Award Record Book is available from *CQ* Magazine, 76 North Broadway, Hicksville, NY 11801 for $1.25. This book is required for the basic application for USA-CA.

The so-called "team" contacts, wherein one person acknowledges a signal report and another returns a signal report while both amateur calls are logged, will not be accepted for purposes of the USA-CA Award for contacts made after April 1, 1984.

In Northern Illinois we are beginning to look forward to springtime. I hope all is well in your part of the world.

73, Dorothy, WB9RCY

Dig it out of the attic or pick up one at a fleamarket, as there's more life left in that old DX-60. For a few bucks you now have a "new" 30 meter rig.

Using The Heathkit DX-60 Transmitter On 30 Meters

BY BILL PARDUE*, KQ5I

Yes, the Heathkit DX-60, or any similar Novice transmitter for that matter, can be used on the 30 meter band without modification to oscillator or tank circuitry.

While listening to the 30 meter activity on my general-coverage R-390/A receiver and wishing I could join in on the fun, I started brainstorming an idea on how to get on the band without having to resort to a heavy cash outlay for a new rig. Gazing about my shack, my eyes settled upon my trusty Heathkit DX-60 transmitter. Hmmm! I wondered if my DX-60 could be made to work on 30 meters without modification?

I knew that if my idea was to work, experimenting would be necessary. My dummy load, r.f. wattmeter, and frequency counter were pressed into service along with my cigar-box collection of oddball crystals. Much to my delight, while sifting through my box of rocks I discovered a 10.140 MHz crystal that was salvaged from an old CB set many months ago. I plugged this crystal into the transmitter's crystal socket, placed the band switch on 7 MHz, fired up the rig into the dummy load, and read a whopping 45 watts r.f. out. I then checked the frequency counter. Yep, 10.144 MHz still within the band. Hey! Look out 30 meters, here I come.

Next I checked the grid drive, which was not bad. It needed some improvement, however, so I adjusted the 40 meter driver coil for maximum while observing the grid current indicated on the rig's panel meter. This improved driver tuning and increased power output.

After the initial trial testing of the rig on a dummy load, I was ready for a trial run on the air. I hurriedly cut a dipole for the 30 meter band and hustled it up to a height of 27 feet between a nearby pine tree and my 30 foot tower. I was anxious to try my wings for the first time on 30 meters, but at the same time I was cautious, wanting to be absolutely sure everything was okay with the rig. In order to be sure, the rig was connected to my inline s.w.r./r.f. wattmeter and frequency counter. My doubts were quickly squelched as the rig loaded up with 45 watts out and on frequency.

Care must be taken when loading the rig to ensure that the final amplifier is tuned to resonance. Be sure you get a good dip on the plate current meter. Monitor your signal on your receiver. If you tune the transmitter off resonance, you will note that the c.w. tone takes on a raspy sound. I also noted that if the transmitter was tuned off resonance, the s.w.r. would rise. So for a good clean signal, be sure to follow the above-mentioned steps.

Now fully satisfied that the rig was on frequency and that my signal was as pure as the state of the art would allow, I belted out my first CQ on my 10.144 MHz rock-bound unmodified rig. It was well past midnight when my first CQ went out over the air, and my call was answered by a G3 station in London, England. He promptly welcomed me to 30 meters and gave me a 579 RST report.

Conclusion: If you would like to try the 30 meter band without additional cash outlay, this project is for you. I would also recommend the purchase of four or five 10 MHz crystals from Jan Crystal Company (P.O. Box 06017, Ft. Myers, FL 33906, phone 813-936-2397). Recommended crystal frequencies to order would be 10.103, 10.105, 10.120, and 10.127 MHz. These frequencies seem to be where the greatest activity lies.

I hope to hear more DX-60s on 30 meters soon. 73s and good luck.

*303 Patton Ave., Biloxi, MS 39531

VHF

a monthly feature by
STEVE KATZ, WB2WIK

PRINCIPLES, PRACTICES, AND PROJECTS FOR THE VHFER

Hello again, VHF fans! I hope you read the first two installments of this new column, as they discussed influences on VHF propagation, path losses, and ionospheric/tropospheric effects which enhance propagation to allow long-range communications through the UHF spectrum. Now we are ready to delve into the types of equipment used to assemble a VHF station and what results we can expect from our investment.

An early decision must be made regarding the mode(s) of desired operation: CW, SSB, FM, RTTY/Packet, and TV are all popular VHF modes, but I'll assume that readers of this article are primarily interested in VHF DX (weak-signal) work which would limit our discussion to the only appropriate modes, CW and SSB.[1]

The newly licensed amateur who owns no station equipment and the experienced ham who already has a large investment in HF/DX band equipment will likely follow different courses in pursuit of VHF/UHF station capability. With a goal of "the ultimate" in performance, such as would be required for moonbounce work, there is a logical course for anyone to follow *if* their budget permits. Homebrewing some of the station equipment can be educational, fun, and a real money-saving measure. However, I'd not recommend inexperienced builders to tackle VHF equipment other than small station accessories. There are just too many chances for error, which will likely lead to really disappointing results. Experienced equipment builders, on the other hand, may find the construction of a kilowatt power amplifier for 432 MHz an easy weekend project. In any case, I'd recommend that nearly anyone begin with modest commercially-made equipment and build on that foundation as desired for improved performance.

Two meters is undoubtedly the most important VHF band in North America, and likely everywhere else. "Two" offers excellent local communications and the opportunity for DX to thousands of miles as discussed previously in this column. Operation at 144 MHz rarely causes TVI/RFI problems, and for modest communications requirements the antennas used are quite small and easily installed. Further, equipment for this band is readily available and not unreasonably expensive. For all these reasons, 2 meters is a great VHF "starter" band, and setting up a 144 MHz station is probably a recommendable effort for the VHF neophyte. Many enthusiastic VHFers who avidly pursue DX on 50–1296 MHz or beyond started out on just 144 MHz.

There are at least two popular approaches to establishing a station for 144 MHz. "Multimode" transceivers, many of which are of Japanese manufacture, are very popular; VHF "transverters," which translate the operating capabilities of HF equipment to VHF and many of which are of European manufacture, are also popular, especially with amateurs who already own HF equipment.

A typical "multimode" transceiver—such as the ICOM IC-211, IC-251, IC-260, IC-271, or IC-290; Kenwood TS-700; Yaesu FT-221, FT-225, or FT-726 and others—might generate 10 to 25 watts peak output power, have an internal VFO or tunable frequency synthesizer covering the entire amateur band, a modest receiver, and capability for SSB/CW/FM (and possibly AM) modes. Often these transceivers are oriented toward the FM/repeater or casual SSB/CW operator and therefore lack the sophistication of their HF counterparts. They typically do not have provision for internal, selectable IF filters of various bandwidths which can be optimized for each mode; they usually lack effective noise blankers, CW QSK (break-in) operation, and amplifier keying provisions. Many multimodes lack SSB VOX (voice-operated transmission) provision. The newer, more elaborate multimode rigs, such as the ICOM IC-271H with its 100 watt output and the Yaesu FT-726R with its expandable frequency-band provision, are becoming more like their HF counterparts.

The built-in digital frequency displays in the VHF multimode rigs do not actually measure the operating frequency at VHF, but rather measure a lower intermediate frequency used for the ultimate generation of the VHF signal or possibly measure the number of pulses applied to the synthesizer programming unit by virtue of shaft rotations or optical interruptions. In any case, most of these rigs, while displaying a resolution of one ppm[10] or better, aren't nearly that accurate in their actual measurement. This can lead to misleading the operator to think his rig is accurate to 100 Hz, when in reality his display might be 5 kHz off!

The receiver sections of most multimode transceivers are not up to the standards of the popular HF transceivers, although I'm certain they're getting better with each new generation of equipment. The multimodes I've tested suffer poor sensitivity, often brought about by the liberal use of lossy miniature signal-carrying wiring (subminiature coaxial cable) and low-quality RF switching relays or components. Many times the simple addition of a high-quality RF preamplifier will remedy the sensitivity problem to a degree, but such modifications can create new problems, such as poor resistance to overload from strong signals or increased intensity of internally generated spurious signals.

Despite all their drawbacks, however, multimode transceivers remain the most popular path for new VHFers to follow, and rightfully so, for these little rigs can deliver a lot of operating pleasure for a small investment. Older multimodes can be found for sale at fleamarkets for as little as $200 and can represent a new oprator's primary expense in the hobby.

The *other* popular way for a newcomer to the VHF bands to equip himself for operation on 50, 144, 220, 432, or 1296 MHz is to add a VHF/UHF *transverter* to his existing equipment. Some of the HF equipment manufacturers have sold their own "mating" transverters over the years—e.g., the Kenwood TV-502 transverter, which is an accessory to the popular TS-520/TS-820 series of HF transceivers—but many VHF ops have found the best transverters are those made by the European VHF/UHF specialty houses such as Microwave Modules of Liverpool, England. It is not my intent to recommend any particular brand or model of equipment, so I'll try to remain as objective as possible and offer only occasional opinions on these matters.

It is no secret that Europeans take their VHFing *very* seriously and populate their VHF/UHF bands more heavily, often using more sophisticated equipment than we Americans. It should be no surprise, therefore, that some of the very best VHF/UHF gear comes from the U.K., Sweden, and West Germany. It is likely that the Japanese, with their magnificent ability for taking a good idea and making it better (not to mention less expensive), will develop VHF/UHF gear of sophistication and performance to rival the Europeans'. In the meantime, I'll offer my candid opinion that the European gear—if you can get it—works fabulously.

Positively the most popular VHF/UHF transverters sold in North America are the Microwave Modules series of products (British). These little "black boxes" are reliable, small, inexpensive, and very

24 Louis Dr., Budd Lake, NJ 07828

effective. The 50–432 MHz models deliver about 10 watts output with just a few milliwatts drive at 28 MHz, and the 1296 MHz model delivers 1 to 2 watts. The receiver sections are excellent—sensitive and quite free of internally generated spurious responses. These transverters connect to nearly any type of 28 MHz IF equipment with a minimum of effort, although in truth I must point out that their factory-supplied installation/hookup instructions are sketchy. The 144 MHz model sells for about $250 U.S. funds new and can be found at fleamarkets for about $150.

The advantage of using a transverter, rather than a multimode VHF transceiver? Probably the biggest user benefit is the luxury of having at your disposal all the features the HF rig employs: VOX, QSK (break-in), noise blanker, dual VFO's, selectable IF filters, receiver passband tuning, notch filters, variable AGC, RIT/XIT, etc. Whatever your HF rig does, including those things it does well and that you may really appreciate, it will continue to do on VHF with the addition of a transverter. If you just love that $150 razor-sharp CW filter you have installed in your HF rig, you'll also love having it on 2 meters. If you just can't imagine life without variable bandwidth tuning, you wont't have to. You'll still have the feature on VHF.

Many of the recent HF transceivers, back to the TS-520/FT-101 generation of equipment—even back to the old Heath SB-300/SB-400/SB-100 series—have provision for the *simple* addition of a VHF transverter using rear-panel prewired receptacles and panel switches; other equipment might not, but can usually be modified for transverter operation in one evening's time. If this confuses you, ask a local established VHFer for help, or write to me and I'll try to help via mail.

Incidentally, there is a large resource of used and rather old-fashioned VHF transverters, such as the old Hallicrafters HA-2/HA-6 (for 144 and 50 MHz, respectively), the Drake TC-2/TC-6, and the Heath SB-500, which were manufactured in the 1960s and into the early 1970s and which functioned quite well. These units can often be picked up for a song and make good foundations on which to build a VHF station. The Hallicrafters units, especially, can be a great deal. These units, while about 20 years old, run about 100 watts PEP output power from a type 5894 dual tetrode tube, a real workhorse VHF device. Many of these older transverters can be successfully interfaced with nearly *any* type of HF gear. Collins Radio sold plug-in transverter to mate with their KWM-2 and S-line series way back in the early sixties; the model 62S1, which covered the 50 and 144 MHz bands and had a 4X150A power amplifier capable of delivering about 120 watts PEP output, was quite ahead of its time, and also rather expensive. These rigs are still available.

Now what about an *antenna*? Again, there are many choices, and your most important considerations should include: (1) frequency of operation (desired band); (2) space available (physical size); (3) support available (mast, tower, etc.); (4) budget ($).

Continuing with our discussion based on the selection of 144 MHz as the band of choice for newcomers, we know the answer to #1. Regarding #2, #3, and #4, my recommendation is not to skimp in this area. Erect the largest and the best antenna system you can afford. Not that it is wise to go crazy erecting superduper arrays covering the entire neighborhood and requiring a tank engine for rotation—at least not for a first-time antenna! But it is important to stress proper *polarization* and adequate antenna *height* and *clearance* to assure even a modicum of success; operator enjoyment is doubtlessly linked to a feeling of achievement.

For all popular VHF/UHF modes *other* than FM, *horizontal* polarization is used universally. Vertically polarized antennas will prove very poor performers for SSB/CW (weak-signal) work, since everyone is using horizontally polarized antennas and the cross-polarization losses at VHF can be so high as to make QSOs almost impossible. It is true that lunar-reflected waves exhibit polarity rotation, and various types of wave refraction/reflection common to tropospheric communications can also exhibit polarity shifts. Nonetheless, horizontal polarization is the standard and will tend to work best in the majority of cases.

As with HF (3–30 MHz) systems, the rule is "the higher, the better" regarding antenna height. Unlike with HF systems, there can be a practical limit to antenna height, because transmission line losses can often cancel height gain, especially at the upper UHF spectrum where feedline losses become a major obstacle. My personal goal and advice: achieve the maximum antenna clearance (from nearby obstructions) possible while minimizing feedline length.

If you have 50 foot tall trees forming a solid barrier in all directions from your location, I'd surely advise installing your VHF antennas above the treetops at perhaps 60 feet. However, if you have 125 foot tall trees, it may be impossible or impractical to get above them. All is not lost in such a situation. It may be possible to install your antennas *below* the maximum foliage so that the only obstruction will be the trunks of the trees, which are likely spaced far enough apart to allow good VHF work. The use of common sense, and perhaps some advice from a local VHFer or two, should lead anyone to a usable antenna site and installation. In all cases the antennas should be installed above local surrounding homes, utility poles, and associated wiring, and whatever obstructions can be cleared without difficulty.

While there are as many antenna designs as days in the year, for the most

part VHFers have settled on Yagis, quads, quagis, and collinears.

A VHF Yagi—or parasitic "beam" with one or more driven elements, a reflector system, and one or more director elements all of the same plane and colocated on a single boom—is designed and looks similar to those which are so popular for HF work. Typical VHF Yagis are 1 to 2 wavelengths long for 50 MHz, 2 to 4 wavelengths long for 144 and 220 MHz, and 4 to 8 wavelengths long for 432 MHz. Forward gain is related to design parameters (element length, element spacing, number of elements, etc.) and boom length, and is usually about 10 times the boom length in wavelengths (expressed arithmetically). For example, a 21 foot long Yagi for 144 MHz would have an approximate gain (in consideration of proper design) as follows:

$$10 \times \frac{21 \times 12''}{81''} = 10 \times 3.11 \text{ wavelengths} = 31.1$$

A gain of 31.1 expressed in dB is 10 $\log_{10}$ 31.1, or 14.9 dB over a dipole. You can rely on the formula to check the accuracy of the claims màde by commercial antenna manufacturers. If you see an ad claiming 17 dBd[1] gain with a 2-wavelength boom, don't believe it! Per the formula, a 2-wavelength Yagi of modern design would have about 13 dBd gain.

VHF quads, like their HF counterparts, use one-wavelength loops, rather than half-wavelength linear rods, as elements, but otherwise are quite similar to Yagis. There is a popular belief that quads generate somewhat more gain for a given number of elements and boom length than do Yagis, but modern research indicates the difference is slight—perhaps 10 percent, in favor of the quad. While there are a number of U.S.-made VHF Yagi products on the market today, I do not know of any commercially made VHF quads. This may be because VHF Yagis, with their linear rod elements, can be more easily packaged and shipped than quads with their large full-wave loops. I've heard many active VHFers using presumably homebrew quad antennas, and their signals are quite respectable.

Quagis are unique beam antennas which combine the qualities and advantages of the Yagi and quad designs. The quagi was the invention of a noted American VHFer, Dr. Wayne Overbeck, N6NB, who wrote a series of articles for *QST* in the late 1970s revealing the design approach, final design parameters, construction, and performance evaluations of these excellent antennas. Again, I know of no commercially manufactured quagis but many active VHFers are using quagis with great success.

Collinear arrays for VHF were once very popular, probably for their broadbanded nature and large capture area. The collinear design is a phased array of horizontally-opposed half-wave elements usually stacked in bays and having solid reflector elements, one wave long, spaced about 0.2 wavelengths behind the driven elements. Even stacked collinear systems of 16 and 32 elements have rather broad front lobes and wide bandwidth (as compared with Yagis), making their construction less critical than would be the case for the other beam antennas discussed. Collinear arrays can offer considerable forward gain at low radiation angles, making them ideal DX antennas. Their popularity faded during the 1970s when many new and really excellent VHF Yagi products appeared on the market. The Cushcraft Company (U.S.) manufactured an excellent VHF collinear product line called "DX Arrays" which were well-built and affordable, but innovative high-gain Yagi products have almost entirely captured the VHF antenna market of late.

There are several U.S. manufacturers of high-gain, low-cost VHF/UHF Yagi products including Cushcraft, Hy-Gain, KLM, and Telrex. A noted French manufacturer, Tonna, sells their excellent F9FT VHF/UHF Yagi products via importers, and T.E.T. also sells their VHF products via importing agents. This information is not intended to be promotional in any way, but simply introduces the concept of many available choices for commercially manufactured VHF antenna systems. New manufacturers who might add to the vast array of merchandise available are always welcome!

Any antenna type may be "stacked" for additional gain, and *doubling* the antenna size adds about 3 dB gain to the system; e.g., "stacking" two 14-element 144 MHz Yagis which each offer 14 dBd gain would yield a total gain of about 17 dBd (*not* 28 dBd!) for the array. Stacking two such 28-element systems might yield a total gain of 20 dBd for the 56-element array, and so on. Optimum stacking dimensions and instructions are nearly always provided with the commercial antennas, but experimentation may be required to find optimum spacings for homebrew systems. Generally, spacing between bays is 0.4 to 0.6 times the boom length for common Yagi designs.

Feedline loss is a very important consideration at VHF and becomes more so at UHF. The common "RG8/U" type coaxial cables, while very popular for use in the 3–30 MHz region, are not efficient at VHF and can cause nearly complete signal loss at the upper UHF spectrum. Thankfully, better cables are available at reasonable cost, and it behooves most of us to make use of the low-loss solid-conductor types for 2 meter, 1¼ meter, 70 cm, and 23 cm work. Next month we will deal with transmission line types and their differences, selecting a cable for *your* station, and accessories every VHFer needs to evaluate his own station's performance. Until then, happy VHFing!

73, Steve, WB2WIK

Footnotes

1. CW might include keyed modes other than Morse. Computer-generated communication can be useful for weak-signal work as long as it occupies bandwidths not exceeding that required for AM, or about 3 kHz; the high-rate modes occupying more bandwidth are legal on some of our VHF bands, but cannot offer the excellent signal-to-noise advantages of A1 or A3j.

2. ppm = parts per million; i.e., 144 Hz at 144 MHz is 1 ppm resolution.

3. dBd = dB over a ½-wave dipole. dBi = dB over "isotropic"; isotropic describes an imaginary point-source radiator with equal radiation in all directions.

World of Ideas

a monthly feature by
DAVE INGRAM, K4TWJ

A LOOK AT THE WORLD AROUND US

Understanding Modern Amateur Gear

Electronic technology has progressed tremendously during the last decade, and few people are more aware of that fact than today's radio amateurs. The classic era of vacuum-tube transceivers has drawn to a close with Kenwood's TS-830 and Yaesu's FT-102 apparently being "final contenders." High-power solid-state amplifiers are gaining popularity in both amateur and commercial broadcast circles. There are also some interesting evolutions in general equipment designs. "Up conversion" has become commonplace, and bilateral circuits are everywhere. VFO tuning capacitors are being replaced with light-beam-interrupting flywheels, while mechanical bandswitches are giving away to digitally coded buttons and diode switching. Even equipment servicing methods are beginning to shift from the component level to "full module" concepts. Somewhere along the line, however, it seems that many amateurs are becoming unnecessarily intimidated by recent developments. Indeed, a number of amateurs seem to feel that modern circuits are advancing somewhat beyond their understanding and/or ability to perform minor field servicing when and if required.

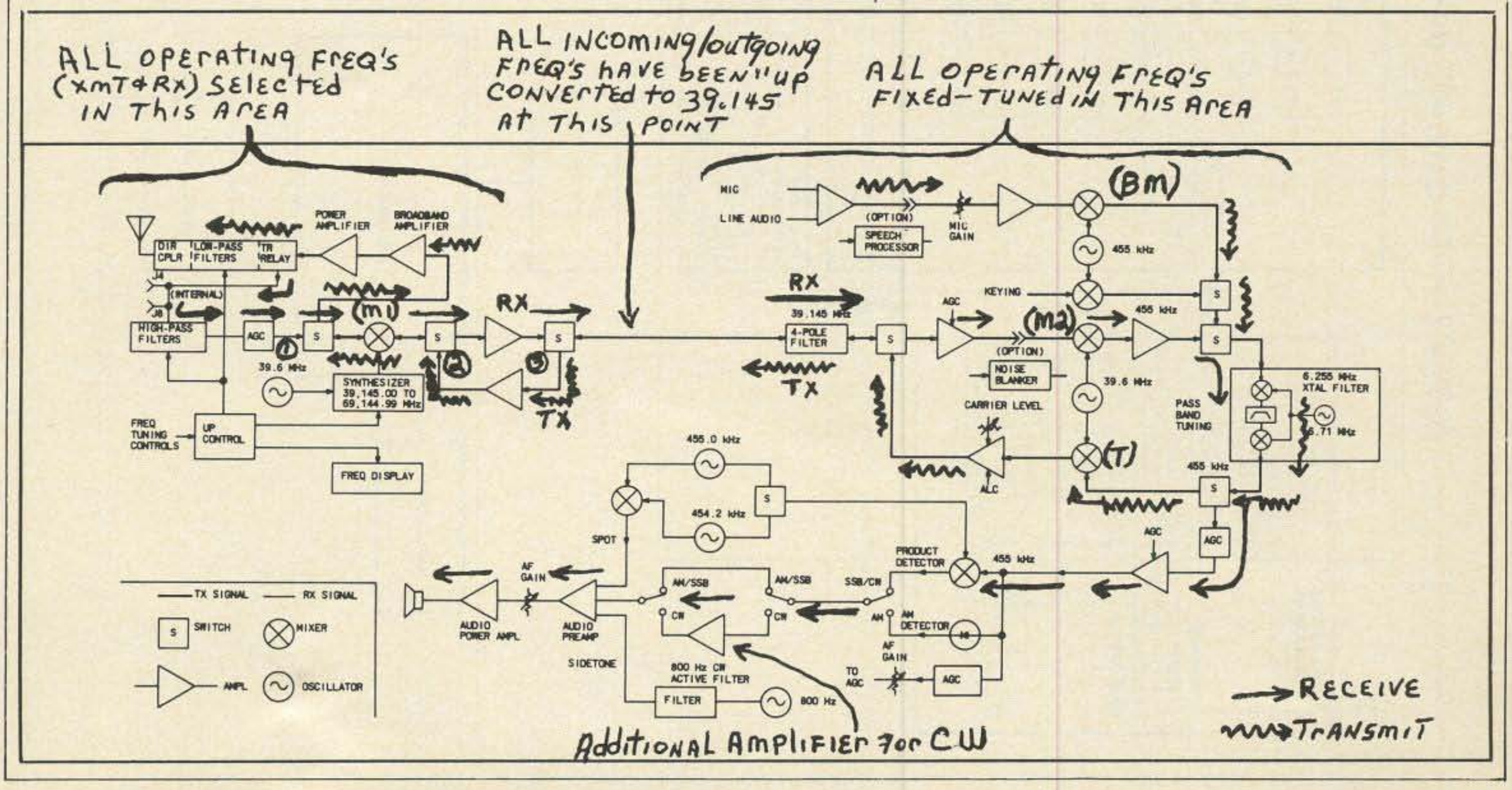
Considering that situation, this month's column is devoted to revitalizing interest in "commonsense electronic reasoning" and regenerating an air of self-confidence among newcomers and old timers alike. Although my discussion won't qualify you for handling major equipment repairs, it should prove useful for understanding basic operational concepts of our modern gear. You should then feel more comfortable about opening a WARC band or two for operation, looking for a poor connection or burned resistor in related stages, or comparing "innards" of rigs before making significant financial investments. Rest assured any time spent becoming familiar with equipment—whether owned or contemplated—will be rewarded tenfold. Anyone who has relinquished his only rig to a distant service center and then suffered additional problems from shipping will surely support our viewpoint. Now I know you're not in the mood for any heavy technical discussions, so relax. We'll keep things simple, okay?

While not all of us are technically oriented individuals (what a dull world that would be!), we all are basically capable of reading a unit's *instruction* or *service manual* and *pencil-following its block-diagram theory of operation.* That authoritative discussion improves our confidence and reduces the possibility of "guessing opinions" on how a rig actually functions, whether it has AF or RF speech compression, its general noise-blanker effectiveness, etc. In fact, it is often possible to visualize both transmit and receive audio quality through block-diagram comparisons of transceivers. Those diagrams are frequently included in free new-equipment literature. Otherwise, you can simply copy that sheet from a unit's instruction manual. If you keep a model-numbered file of block diagrams (along with personal notes on impressive or undesired aspects of each rig), you'll soon have a useful and accurate means of evaluating and selecting a unit which suits your particular interests.

If you find a rig's block diagram or internal circuit board difficult to view, try using a small illuminated magnifier. If the block diagram seems overly complex, try "simplifying" by reading its description a

**Eastwood Village No. 1201 So., Rt. 1, Box 499, Birmingham, AL 35210*

Fig. 1– Functional block diagram of the Collins KWM-380 HF transceiver. Diagram was acquired from manufacturer's free literature of unit. Handwritten notes are explained in the text.



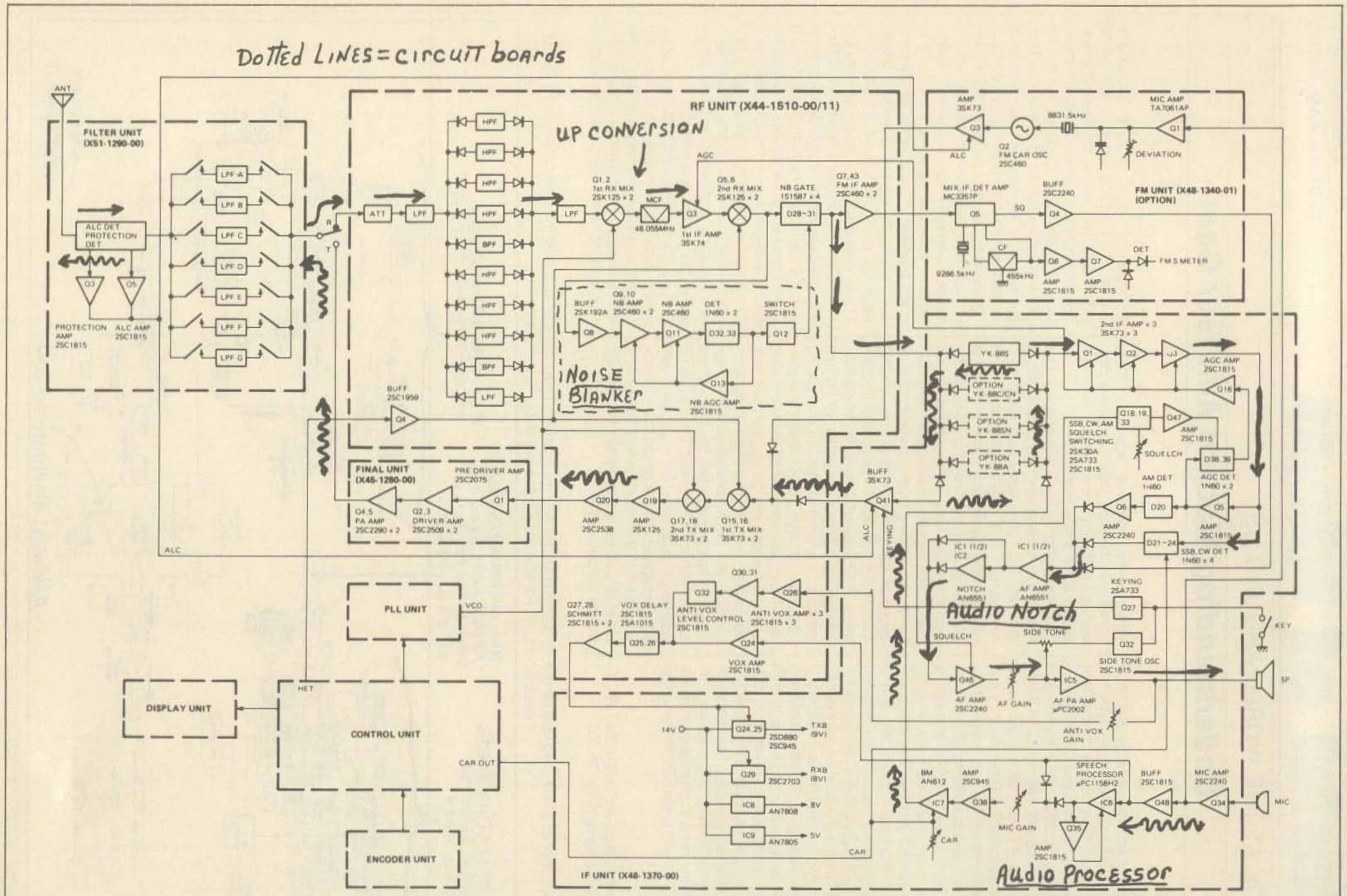


Fig. 2– Block diagram of the Kenwood TS-430 transceiver. Penadded straight lines indicate receive paths, and "squiggled" lines indicate transmit paths. Circuit discussion is in the text.

couple of times and using colored pens to trace or separate actual transmit/receive sections from "frills" or "support sections" (use Xerox copies to avoid marring the master). Once you become familiar with a unit's block diagram, you can expand to studying its schematic and tracing its printed circuit boards. As further encouragement, many service-center repairs involve visibly obvious parts or connector replacements which could be performed by any amateur with a keen eye and a bit of common reasoning.

Visualizing Equipment Designs

The most logical starting point in understanding any amateur transceiver's design and operation involves reviewing its block diagram and generally looking over its internal layout. Later, you can delve further using obvious signposts such as crystal filters or various numbered connectors as guidance between block diagrams, schematics, pictorials, and PC boards themselves. This approach usually simplifies modern rigs to a noticeable degree. Let's pursue that concept further by discussing a unit of established quality, yet understandable design, and one you'll surely recognize. Following general traditions, we'll work from antenna to speaker on receive and from microphone to antenna on transmit.

The block diagram of a Collins KWM-380 is shown in fig. 1. I've hand-marked the basic receive path with straight-arrow lines, and the transmit path with squiggled-arrow lines for your convenience. Let's begin tracing the receive path from antenna, through the T/R relay and high-pass filter, AGC circuit, through diode switch "S," and into the mixer. Notice the directions of the *diagram's printed arrows.* During receive, signals from the mixer move *(left to right)* through a second diode switch (2), an amplifier, a third diode switch (3), and into a 39.145 MHz 4-pole filter. Hold at that point a few minutes while we switch and follow a transmit signal. During transmit, a signal move *(right to left)* through the 4-pole filter, to switch (3), down through the amplifier, up through switch (2), and into the mixer. After "downconversion" to the desired transmit frequency, a final switch (1) routes that signal to the broadband RF amplifier and on to the antenna. Returning now to the 4-pole filter, continue following the receive path through a second mixer (M2) and into a 455 kHz amplifier (39.600 – 39.145 = 455 kHz). Follow that signal through the passband tuning, another amplifier, and into the product detector (455.000 – 454 – 200 = 800 Hz: audio). Follow that audio on to the speaker. In a similar fashion you should now be able to trace the transmit path from the mike, through the balance modulator (BM) and passband filter, through "up conversion mixer" (T), and on to the four-pole filter. Other transceivers are also this simple when stripped of their "frills"; simply be patient and accurate in your tracings.

Now let's take a closer look and highlight some aspects of interest. Notice the speech processor installs in the audio line ("before" the balance modulator) rather than in the RF section. That's usually a "compromising approach." However, Collins uses a special four-band splitter/processor similar to the recently popular Vomax unit for retaining beautiful audio without typical "processor garble." Notice that all signals moving through the four-pole filter are frequency-fixed on 39.145 MHz. This unusually high IF is an indication of "up conversion" (it's higher in frequency than an incoming signal). Circuits to the right and below that filter are essentially tuned to one frequency. Circuits to the left of that filter select operating frequencies according to their mixed differences with the synthesizer (example: 53.150 synthesizer – 14.005 incoming = 39.145 MHz IF; the signal was converted "up"). Essentially, the synthesizer is an accurate signal generator under microprocessor control and with its output directed to a mixer stage. Frequency tuning of the synthesizer could be via a knob or pushbuttons. More on that later. Incidentally, the control section "tells" the synthesizer and filters which ranges are available for transmission and which are "locked out." This transceiver exemplifies the classic Collins philosophy: understandable, efficient, and field serviceable by "quick taught" operators and technicians. Take a few minutes to look over fig. 1 while visualizing its operation, and then follow our upcoming comparison of two popular imported transceivers.

An Interesting Comparison

The block diagrams of Kenwood's model TS-430 and TS-930 transceivers are shown in figs. 2 and 3. Once again this information was freely acquired from the manufacturers' literature. Using concepts exemplified in the previous KWM-380 discussion, let's take a few minutes to trace the signal paths of both units. Again I've "extra traced" them with straight-arrow lines for receive and squiggle-arrow lines for transmit.

Referring to the TS-430 (fig. 2), follow incoming signals through low- and high-pass filters to first mixer Q1. Up conversion in this stage shifts each desired signal to 48.055 MHz. Continue through noise-blanker gate, then down and through filter YK88S (that right corner section was the optional FM unit). Follow the signal through three more amplifiers (Q1, Q2, Q3), down through audio notch and amplifiers, to the speaker. Shifting now to the transmit path, follow signals from the mike, through amplifiers and (audio) processor to balance modulator (IC 7), up and "back the other way" through filter YK88S, through two more mixers and amplifiers, and into the "final unit." That output continues through the low-pass filter and toward the antenna. Not let's delve into similar signal-path tracings with the TS-930. We'll then briefly compare the two units.

The TS-930 block diagram is shown in fig. 3, and I've also "extra marked" its transmit/receive paths for your convenience. Follow received signals through bandpass filters, into RF amplifier Q1, "up converting" mixer Q2 (1), dual 44.93 MHz Monolithic Crystal Filters, notch filter, demodulator, down through audio amplifiers, and to the speaker. Switch now and follow the transmit path from mike, through amplifiers and balance modulator (BM), up through the 455 kHz filter, down through buffers and processor, up through more amplifiers and mixers (Q57, Q56, Q42, Q41, etc.), on through the final unit and low-pass filters, and toward the antenna. Not let's begin comparing diagrams and noting differences.

Notice the sections enclosed within the dotted lines on each diagram. These sections represent individual PC boards inside each transceiver. Notice also the liberal use of buffer stages in Japanese designs. The TS-430 and TS-930 both employ "up conversion," but their resultant IF's are different: 48.055 MHz in the 430 and 44.930 MHz in the 930—academic, but interesting. There is one optional filter area in the 430 (YK88--), and two optional filter areas in the 930 (8.83 MHz and 455 kHz). The 930's IF skirts are thus slightly more rigid than the 430's skirts. This highlights an interesting point, however.

Let's assume you install a narrow SSB filter in the 430's "YK88SN" position and activate it via the rig's front-panel switch. The bandwidth will be reduced from roughly 2.4 kHz to 1.8 kHz on *receive* (there was also a trade-off of good receive audio quality for good QRM reduction). During transmit, the unit switches over to the broader YK88S for wider bandwidth and full audio quality (and splatter, if your mike gain is too high). Notice there isn't a position for a narrow SSB filter in the 930. Let's assume you install 2.1 kHz (Fox Tango) SSB filters *in place of* the 3 kHz SSB filters in the 930. Overall bandwidth will be reduced from the rig's wide 2.7 span to provide QRM reduction during receive, but the resultant narrow bandwidth will also restrict somewhat transmitted audio quality. An alternate path isn't available for the transmitted signal (are you a stickler for DX or superb transmitted audio?). Notice the 930's notch filter is *"before"* the demodulator (and IF notch), and the 430's notch filter is *"after"* the demodulator (a less desirable AF notch). The 430's speech processor is *before* the balance modulator (a basic audio-level processor). The 930's speech processor is *after* the balance modulator (a more effective IF level processor). If you haven't spotted this

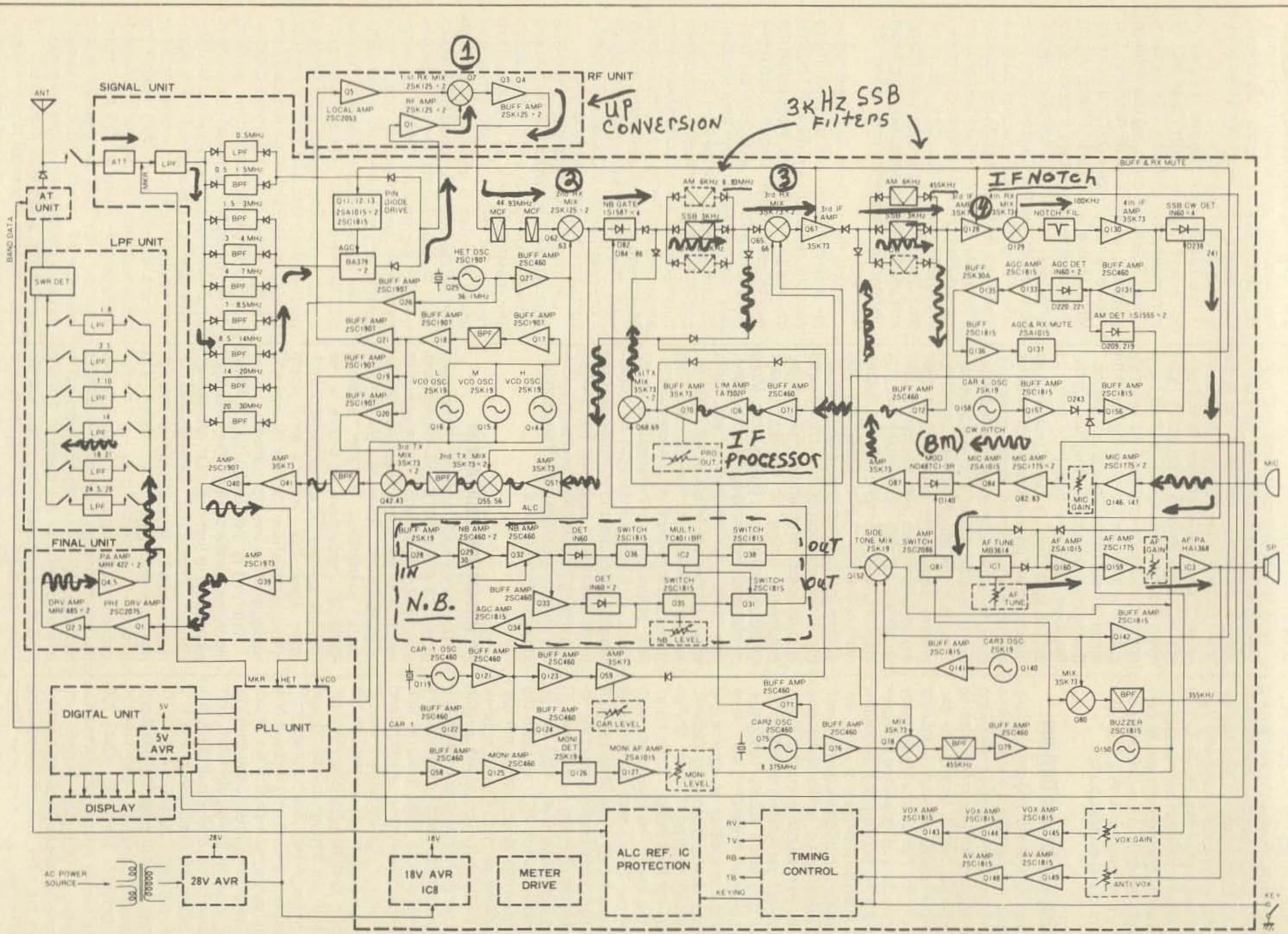


Fig. 3– Block diagram of the Kenwood TS-930 transceiver. Discussion of this unit and direct comparison to other transceiver is discussed in the text.

stage, look "two buffers" after the 455 kHz filter. Next, let's compare noise blankers. The 430 includes 6 sections; the 930 includes 12 sections (gates of each excluded).

Take a close look at the 430's 250 watt "final unit": a pair of 2SC2290 transistors driven by a 2SC509, predriven by a 2SC2075. This popular arrangement is found in many "200 watt" transceivers (one example is the TS-130). Either those other rigs are flat "loafing" or this rig is being "pushed." Is there really 25 watts difference in outputs of those rigs?

The "heartbeat" of both the TS-930 and TS-430 is their digital/control sections. These stages determine (among other things) which oscillators and filters are enabled for various bands/frequencies. Whenever a particular band is selected for operation, corresponding binary counts are fed to decoders on frequency selecting boards (0100 = 80m, 1100 = 40m, 0010 = 30m, etc.). After decoding, diode switches or RF-capable relays are activated to "bring in line" their related circuits. One example is the bank of filters on each diagram's left side. Nonamateur frequencies can be transmit-disabled simply by deleting their binary counts. The previous concepts also hold true for the KWM-380 and other microprocessor-controlled rigs.

The frequency synthesizers or PLL units in our rigs under consideration are not "tuning capacitor controlled VFO's," but are high-frequency digital counters programmed via integrated circuits and pulse-generating flywheels. There is a tightly sealed box containing a light chopping wheel behind the main tuning knob. Two LEDs are on one side of the wheel, and two phototransistors are on the other side. As the knob is turned, one beam is broken before the other (establishing whether to count up or down). The synthesized counter then "follows" pulse interruptions and produces a corresponding output frequency to mixer stages. This discussion could obviously continue many more pages, so we'll "break off" at this point and tally your responses before proceeding with expansions. If you find my approach to technical concepts useful, let me know . . . and soon. Fair enough?

Using Your Abilities

Some of you may be saying the previous discussion was interesting, but it didn't tell you exactly how to fix a particular transceiver problem. True, but this wasn't intended as a crash course in amateur radio technology. You can add your own reasoning abilities, however, and realize some very beneficial results.

Consider, for example, some of the concepts regarding dynamic troubleshooting (working with signals on energized equipment). The received signal path from antenna input to speaker is essentially a series circuit. A single break anywhere in that path can prevent the receiver from operating. That break can be located by signal injection. Place an audio tone on the speaker terminals. If it's heard, lower the level and move back toward the antenna a stage at a time until it's lost or you reach the demodulator. Shift to appropriate IF ranges and levels, then continue "working backwards" stage by stage toward the antenna connector. Your injected signal will disappear when you cross the defective stage. This same concept can be modified and used with transmitters. Inject proper frequency signals moving from the final toward the mike until output is lost. The key items in these techniques are a block diagram, schematic, pictorial layout, and your own logical thinking.

Today's circuits are more complex and compact than those of yesteryear. The situation usually necessitates using new-style tools: illuminated magnifiers, small needlenose, small dikes, very low wattage irons, and small PC board type solder. Think of it as working on jewelry and you'll have a good mental advantage.

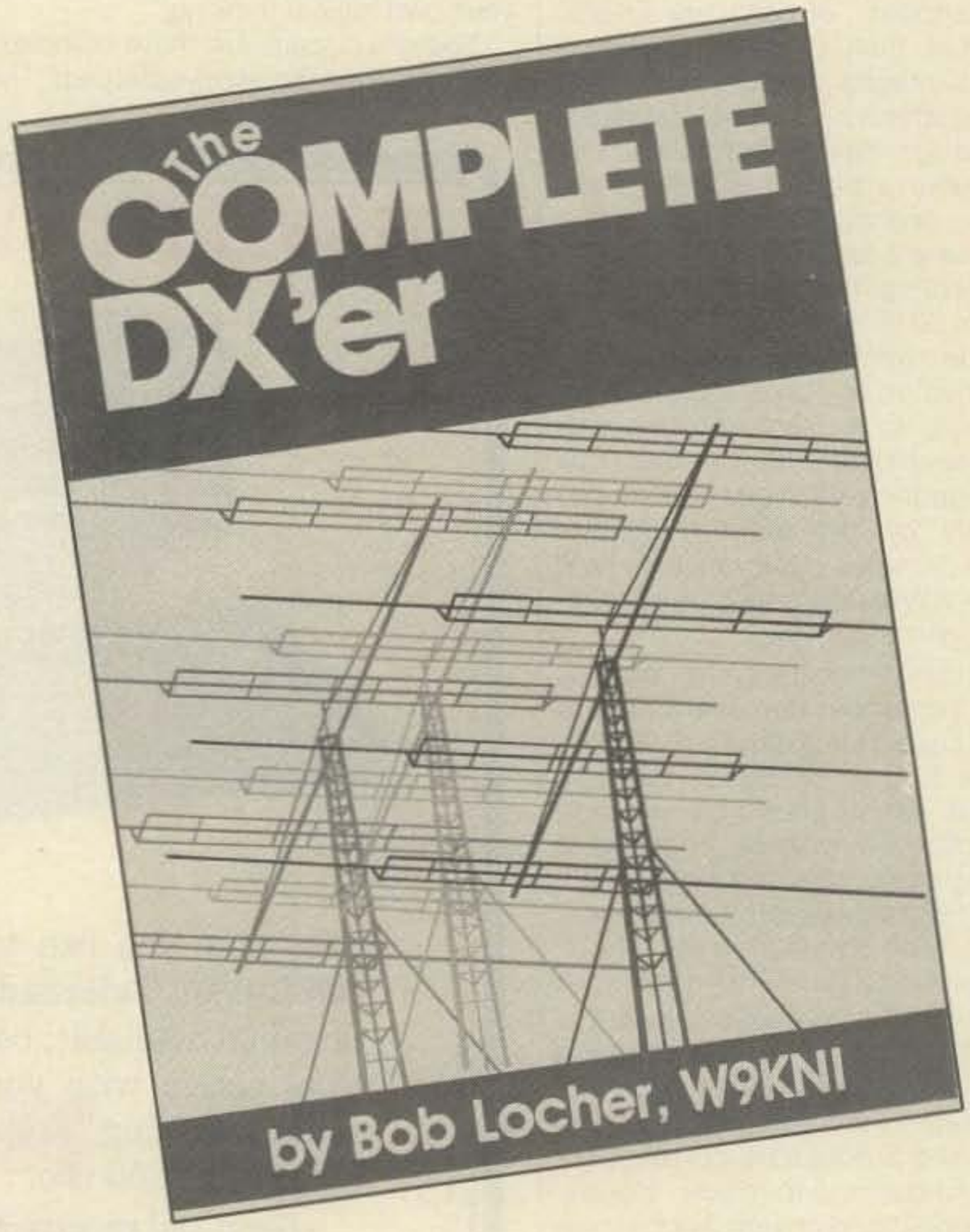
Most people have a general skepticism or fear of the unknown, be it a new auto or an uncharted desert isle. As we learn more about those "unfamiliars," however, we realize not only how to appreciate them, but also how to use them to our advantage. You needn't be a mechanic to enjoy driving an auto, but knowing something about what's under the hood truly has its benefits.

73, Dave, K4TWJ

CQ Book Review:

The Complete DX'er by Bob Locher, W9KNI

BY LEW MCCOY*, W1ICP



I would guess that nearly every amateur who works on the low bands, 80 through 10, at some time or other is bitten by the DX bug. Working DX is what got me into amateur radio, and I still get a thrill out of sharing a rare one. There have been several books written about working DX, and I have read them all. However, without the slightest reservations, Bob Locher, W9KNI, has certainly written the best in *The Complete DX'er*.

The book itself is 187 pages, paperback, and consists of 24 very well-written and absorbing chapters. There are chapters on subjects such as basic listening, intermediate listening, basic equipment, graduate hunting (!), and so on. Bob has a writing style that is easy to read and keeps the reader's interest. Not only that, but even an old codger like me learned a lot about the techniques of chasing, catching, logging, and QSLing DX.

I was more than a little surprised to find that Bob had quoted me at the beginning of his chapter "The DXer and His Environment." I have been asked many times over the years, particularly at antenna or DX lectures, what I considered the ideal DX location. I have always answered, "The ideal QTH is an island in the middle of a salt marsh, atop a high plateau!" (That is why I moved to Silver City, NM. That's the kind of QTH I now have. Hah!)

Whether you are an old timer or a newcomer—particularly a newcomer—to DX, this book is a must for your shack if you have even the slightest interest in working DX.

The book is available from *CQ*, price $10.95 plus $2.00 shipping and handling.

Technical Consultant, CQ, 200 Idaho St., Silver City, NM 88061

It's hard to think of a simpler way, or even a more frugal way, of getting up an antenna. If you have limited funds or limited space, check out this solution offered by W8TYX.

A Horizontal Loop Antenna For 40 Meters

BY H.H. HUNTER*, W8TYX

When my only antenna (a roof-mounted vertical for 7 MHz) failed during the winter, I was not able to repair it because of the cold weather. I needed a replacement, but no trees, towers, or tall buildings were available as supports. After some experimentation I arrived at a (more or less) horizontal loop antenna which has performed surprisingly well.

Fig. 1 shows the general layout of the loop antenna. It is a closed loop with a total electrical length of about one wavelength at 7 MHz. I used No. 20 copper wire because that is what I had; the size of the wire is not important. The loop begins under the house eave about 8 feet above the ground and continues to the corner of the house about 24 feet away. The loop continues from the corner of the house to the corner of the garage about 24 feet further. The corner of the garage is about 7 feet above the ground. From there the loop continues to the peak of the garage roof about 11 feet; this is the highest part of the loop and is about 11 feet above the ground. The loop then continues to the far corner of the garage, about 19 feet and at a height of about 7 feet. From there the loop goes to the eave under another corner of the house, a distance of about 25 feet; height here is about 8 feet. The loop then goes vertically down the side of the house about 5 feet; the purpose of this "jog" in the loop is to add length and make the antenna resonant at the desired frequency in the 7 MHz band. The loop then goes horizontally for a distance of about 7 feet, and then more or less vertically back up to the eave, and horizontally for a distance of 6 feet back to the starting point.

The loop is fed at the starting point with RG-8 coaxial cable. One end of the loop is connected to the center conductor of the coaxial cable, and the other end of the loop is connected to the shield.

The "jog" in the loop, described above,

1106 Carolyn Ave., Columbus, OH 43224

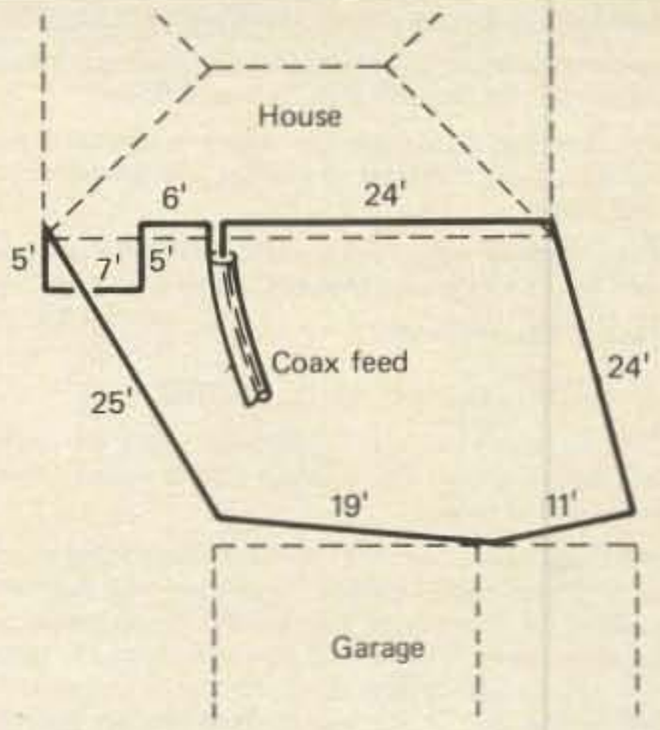


Fig. 1– The general layout for the loop antenna. Later on the author shortened it to take advantage of the 30 meter band.

was not in the original version of the antenna; it was added after measurements with a noise bridge showed that the resonant frequency of the antenna was too high. The dimensions cited above were not "designed." Rather, I used the space and the supports that were available and then adjusted the overall length of the loop to make it resonant at the desired frequency near the low end of the 40 meter band.

If you build a similar antenna, use what you have in the way of space and supports and start with a total length of the loop equal to about one wavelength at the desired operating frequency. A wavelength is given by the expression:

$$\lambda = \frac{935}{f}$$

where: λ = wavelength in feet
f = frequency in megaHertz

After you have erected the loop with the calculated total length, measure its resonant frequency using a grid-dip meter, an s.w.r. bridge, or a noise bridge. The calculated length is just a starting point. The resonant frequency of the antenna will be affected by the presence of

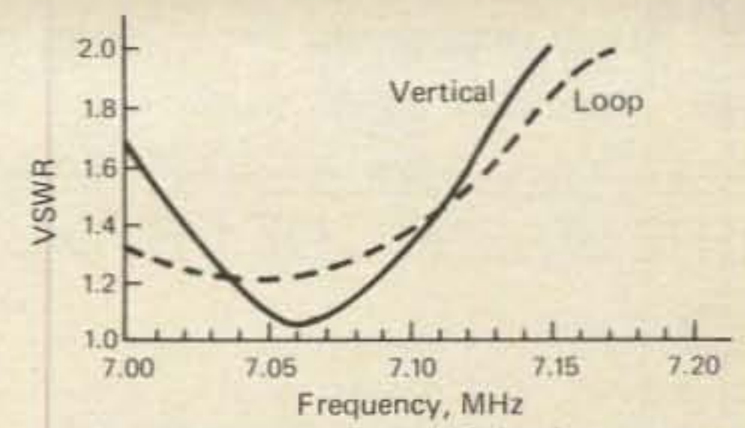


Fig. 2– The v.s.w.r. plot of the loop antenna as compared to the author's vertical.

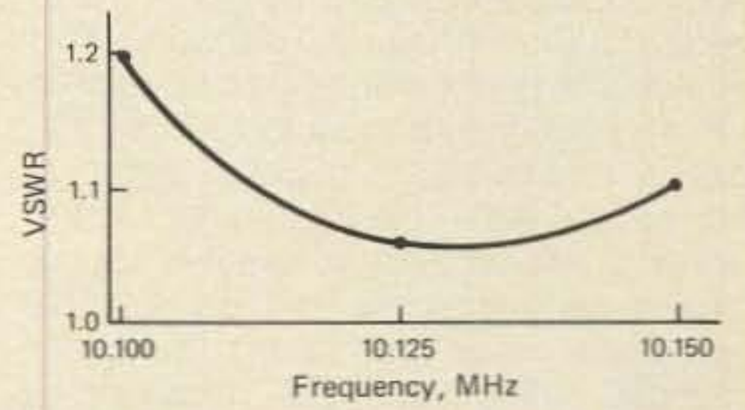


Fig. 3–The v.s.w.r. plot of the antenna when modified for 30 meters.

nearby objects and the height above the ground. Adjust the length of the loop to obtain the desired resonant frequency. An increase in length will decrease the resonant frequency while a decrease in length will increase it.

Fig. 2 shows the v.s.w.r. of the completed loop as a function of frequency for the 40 meter band. These measurements were made at the far end of a 50 foot length of RG-8 coaxial cable which was connected to the loop. The bandwidth for a reasonable v.s.w.r. covers most of the c.w. portion of the 40 meter band. I do not have equipment to measure the impedance of the antenna, but the minimum v.s.w.r. of 1.2 to 1 indicates that the driving impedance at resonance is a reasonable match for the 50 ohm impedance of the coaxial feedline. Measurements of my (repaired) vertical antenna are shown for comparison.

A horizontal loop antenna radiates most of its energy at high angles with respect to the earth. Therefore, this is not a low-angle DX antenna. However, on 7 MHz it performed well on short hops out to a few hundred miles. The best DX I worked using this antenna was OK1APV in Czechoslovakia, but band conditions were good that night. It consistently performed well with stations out to about 500 miles; beyond that distance my vertical antenna did better.

After the 10 MHz band opened, I shortened the overall length of the loop and made it resonant for that band. Fig. 3 shows the v.s.w.r. of that loop across the 30 meter band; it is less than 1.2 to 1 over the entire band. I have worked VK3AGW twice using this simple antenna.

If you are stuck without an antenna, or just want to try a different type of antenna, give this horizontal loop a try. It's not a world beater for DX, but it is simple, easy to put up and adjust, and works reasonably well—a good combination. CQ

Propagation

a monthly feature by
GEORGE JACOBS, W3ASK

THE SCIENCE OF PREDICTING RADIO CONDITIONS

On March 21 the *Vernal Equinox* occurs. This is the day when the sun crosses the equator on its apparent travel into the northern sky. On this day the hours of darkness and daylight are of equal duration throughout the world. This equinoctial phenomenon has its related effects upon high-frequency radio propagation conditions throughout most of March and April. On circuits within the northern hemisphere, where it is spring, expect daytime usable frequencies to be somewhat lower than during the winter months, while nighttime frequencies should be a bit higher. For paths within the southern hemisphere, where it is fall, opposite effects will be noted.

The most interesting propagation changes should occur on the longer openings between the northern and southern hemispheres—for example, from the USA to South America; to the South Pacific; to Central and Southern Africa, etc. Because it is spring in the northern hemisphere and fall in the southern hemisphere, the ionosphere is more similar and stable than during the winter and summer seasons. This "equalization" in conditions should produce a marked improvement in openings between both hemispheres on all bands between *160* and *10* meters. The best times to look for these openings are shortly before local sunrise and again shortly after local sunset on the *160, 80,* and *40* meter bands, and for an hour or two after sunrise and again for an hour or two before sunset on *20* meters. On *15* and *10* meters, check for inter-hemispheric openings towards the southeast and south from a few hours before noon through the early afternoon hours. Check later in the afternoon for openings towards the south and southwest and towards the west.

Twenty meters is expected to be the best band for DX propagation from sunrise to sunset during March, followed by *15* meters. A few *10* meter DX openings are also forecast for March, mainly to southern and tropical areas during the daylight hours.

During the period between sunset and sunrise, *40* meters is expected to be the optimum band for DX propagation, with good openings forecast to many areas of the world. Some fairly good DX openings are also predicted for *80* meters during the hours of darkness, and some *160* meter DX openings may also be possible during this period. When propagation conditions are High Normal or better, the *20* meter band may also remain open to some areas of the world during the hours of darkness.

For specific times of DX openings for each amateur band *10* through *160* meters during March, refer to the DX Propagation Charts which appeared in last month's column. This month's column contains Short-Skip Propagation Charts for March and April, as well as charts centered on Hawaii and Alaska. The Short-Skip Charts contain propagation forecasts for distances between approximately 50 and 2300 miles.

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

11307 Clara Street, Silver Spring, MD 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for March 1985

	Expected Signal Quality			
Propagation Index	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 9, 13	**A**	**A**	**B**	**C**
High Normal: 8, 11, 14, 20, 25	**A**	**B**	**C**	**C-D**
Low Normal: 4, 7, 10, 12, 15, 17-19, 21-22, 24, 26-27, 31	**A-B**	**B-C**	**C-D**	**D-E**
Below Normal: 1, 3, 5-6, 16, 23, 28, 30	**B-C**	**C-D**	**D-E**	**E**
Disturbed: 2, 29	**C-E**	**D-E**	**E**	**E**

Where expected signal quality is: **A—Excellent opening, exceptionally strong, steady signals greater than S9.**

B—Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S6, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. **Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.**
2. **With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be fair-to-poor (C-D) on the 1st, poor-to-nil (D-E) on the 2nd, fair-to-poor (C-D) on the 3rd, good-to-fair (B-C) on the 4th, etc. Conditions varying between Low and Below Normal are expected during the March 30–31 Phone weekend of the CQ WW WPX Contest.**

1984 CQ DX Contest Critique

Relatively stable HF propagation conditions occurred during both the Phone and CW *CQ* WW DX Contest weekends. Conditions were mainly Low Normal during the Phone weekend of October 27-28, much as predicted. Conditions during the CW weekend of November 24-25 were generally High Normal, which was somewhat better than expected.

NOAA reports that the 2800 MHz solar flux as measured at the Ottawa Observatory was 70, which is extremely low. The daily sunspot numbers as reported from the Royal Observatory of Belgium were 8 on the 27th and 0 on the 28th. The geomagnetic field was relatively stable worldwide, with Fredericksburg reporting an A-index of 6 on the 27th, and a reported level of 14 at Anchorage. On the 28th levels of 7 and 12, respectively, were recorded. These levels of solar flux and A-indices are typical of Low Normal conditions during the moderatly low phase of the present sunspot cycle.

Band openings were pretty much as expected. Early returns appear to confirm a significant drop in *10* and *15* meter DX openings when compared to Phone Contest periods during higher levels of solar activity. Twenty meters appears to have held up very well, and there seems to have been a slight improvement in low-band conditions. Although solar activity was very low during the Phone Contest weekend, relatively stable geomagnetic conditions permitted an exciting degree of worldwide DX activity. Several observers point out that conditions on October 27–28 were the best during the entire month of October.

Conditions during the CW Contest weekend of November 24–25 were somewhat better than forecast. The 2800 MHz solar flux was reported as 83 on the 24th and 85 on the 25th. Daily sunspot numbers were recorded as 47 and 59, respectively. The geomagnetic A-index was measured as 9 at Fredericksburg and 11 at Anchorage on the 24th, and 6 and 7, respectively, on the 25th. These solar and geomagnetic levels are typical of High Normal conditions on the HF bands.

Band openings were a bit better during the CW weekend as compared to the Phone weekend, and there were somewhat more *10* and *15* meter openings reported. Again, conditions during the CW Contest weekend were reported by several observers to have been the best for the entire month of November.

In summary, while there were fewer *10* and *15* meter openings during the 1984 *CQ* World-Wide DX Contest, and scores may be somewhat lower this year in some categories, Mother Nature cooperated, and conditions were as good as or better than expected.

VHF Ionospheric Openings

Chances look a little better for ionospheric openings on the VHF bands during March. A seasonal increase is expected in short-skip sporadic-*E* type openings on *10* meters, and an occasional opening may also be possible on *6* me-

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters) as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate Meter band column (10 through 80 Meters) for a particular geographical region of the continental USA as shown in the left hand column of the Charts. An * indicates the best time to listen for 80 meter openings.

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

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

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

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

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

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

Short-Skip Propagation Chart
March & April, 1985
Local Standard Time
At Path Mid-Point

Band (Meters)	Distance Between Stations (Miles) 50-250	250-750	750-1300	1300-2300
10	Nil	Nil	08-19 (0-1)	08-13 (1-0) 13-16 (1) 16-19 (1-0)
15	Nil	08-16 (0-1)	09-12 (1) 12-17 (1-2) 17-18 (0-1)	08-09 (0-1) 09-10 (1) 10-13 (1-2) 13-14 (2) 14-17 (2-3) 17-18 (1-2) 18-20 (0-1)
20	Nil	07-08 (0-1) 08-09 (0-2) 09-14 (0-3) 14-16 (0-2) 16-23 (0-1)	07-08 (1) 08-09 (2) 09-10 (3) 10-14 (3-4) 14-16 (2-4) 16-18 (1-4) 18-19 (1-3) 19-20 (1-2) 20-23 (1) 23-05 (0-1)	06-07 (0-1) 07-08 (1-2) 08-09 (2-3) 09-10 (3) 10-15 (4-3) 15-18 (4) 18-19 (3) 19-20 (2-3) 20-21 (1-2) 21-05 (1) 05-06 (0-2)
40	07-09 (0-1) 09-10 (0-2) 10-12 (2-3) 12-17 (3-4) 17-19 (2-3) 19-20 (1-2) 20-22 (0-1)	06-07 (0-2) 07-09 (1-4) 09-10 (2-4) 10-15 (4-3) 15-17 (4) 17-19 (3-4) 19-20 (2-4) 20-22 (1-2) 22-00 (0-2) 00-06 (0-1)	06-07 (1) 07-08 (4-2) 08-15 (3-1) 15-17 (4-2) 17-19 (4-3) 19-20 (4) 20-22 (2-4) 22-00 (2-3) 00-06 (1-2)	06-08 (2-1) 08-15 (1-0) 15-16 (2-0) 16-17 (2-1) 17-19 (3-2) 19-21 (4-3) 21-22 (4) 22-00 (3-4) 00-02 (2-3) 02-06 (2)
80	07-08 (2-3) 08-11 (3-4) 11-18 (4) 18-20 (3-4) 20-22 (2-3) 22-00 (1-2) 00-06 (1) 06-07 (1-2)	07-08 (3-2) 08-11 (4-1) 11-16 (4-0) 16-18 (4-2) 18-20 (4-3) 20-22 (3-4) 22-00 (2-4) 00-06 (1-2) 06-07 (2)	07-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-00 (4) 00-05 (2-3) 05-07 (2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-00 (4-3) 00-05 (3) 05-07 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3) 22-03 (4) 03-05 (4-3)	05-06 (1) 06-19 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-3) 03-05 (3-2)	05-06 (0-1) 06-19 (0) 19-20 (1-0) 20-22 (2) 22-03 (3-2) 03-05 (2-1)

ALASKA
Openings Given in GMT

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

HAWAII
Openings Given in Hawaiian Standard Time

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

Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.
#See explanation in "How To Use Short-Skip Charts" in box at the beginning of this column.
*Indicates best time for 80 meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a forecast rating of (2) or higher.

ters. These openings are more likely to occur during the daylight hours over distances between approximately 1000 and 1400 miles.

There is also a good chance for some widespread auroral activity on the VHF bands, especially when the HF bands are Below Normal or Disturbed. Check the Last Minute Forecast at the beginning of this column for those days that are likely to be in these categories during March.

Not much meteor activity is expected this month, but some might be possible during minor showers that may occur March 14–15 and March 24–25.

Solar Cycle

The present sunspot cycle continues to decline at a steady pace. The Royal Observatory of Belgium reports a monthly mean sunspot number of 22 centered on November 1984. This results in a 12-month running smoothed sunspot number, upon which the cycle is based, of 47 for June 1984.

A smoothed sunspot number in the low 30's is forecast for March 1985.

34th Anniversary

This month's column marks the beginning of my 34th year as Propagation Editor of *CQ*. I have found conducting this column a very stimulating and interesting sidelight to my deep interest in amateur radio. I want to thank all of you, who over the years have taken the time to drop me a line expressing an interest in radio propagation and in this column in particular. I also feel that special recognition is due the editors and publishers of *CQ* for recognizing the importance of familiarizing radio amateurs with propagation forecasts. With the impending low period of the present sunspot cycle, I am looking forward to continuing to bring to readers of *CQ* the very latest news and forecasts for the HF amateur bands.

73, George, W3ASK

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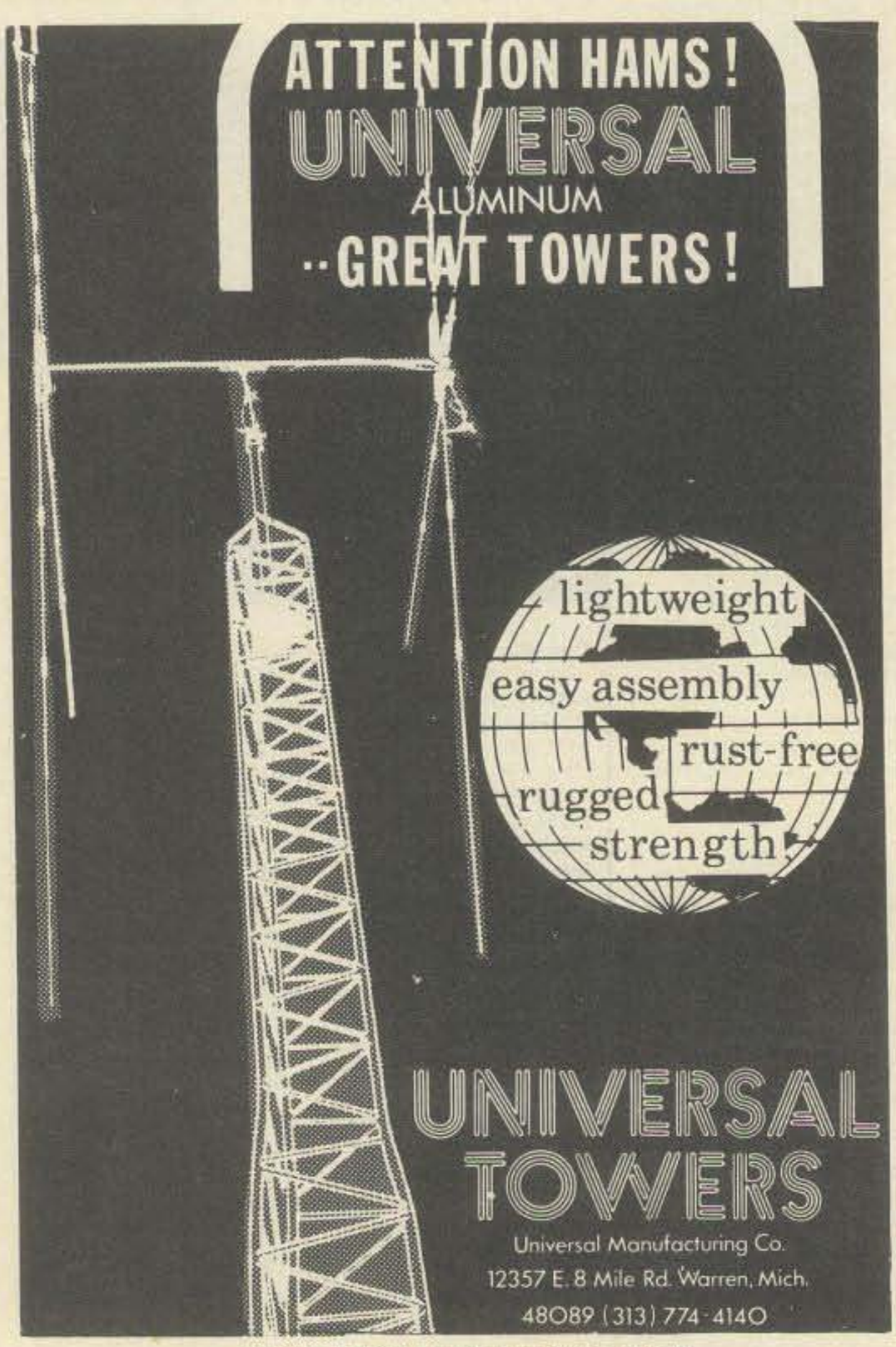
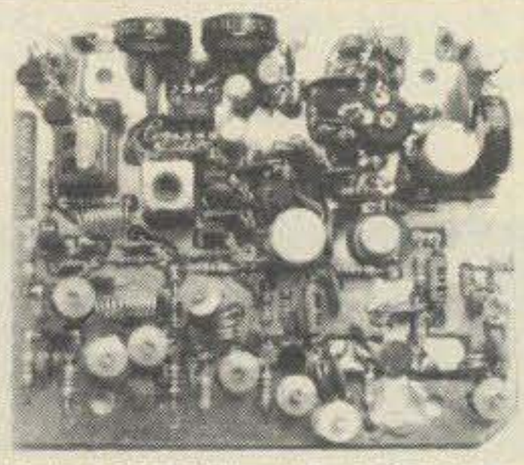


CIRCLE 118 ON READER SERVICE CARD

AMATEUR TELEVISION



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CIRCLE 141 ON READER SERVICE CARD

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DX

This month by
JOHN A. ATTAWAY, K4IIF

NEWS OF COMMUNICATIONS AROUND THE WORLD

The sunspots are becoming few, few, and fewer. The bottom of the sunspot cycle is approaching and conditions on the high-frequency bands are poor. DX is harder and harder to find, particularly on 10 and 15 meters.

So, how does the DXer handle this situation? There are two courses of action. First, in order to stay fully active on the bands, he must turn his attention to the lower frequencies. At the peak of a sunspot cycle, 40 meter beams are scarce, but they become commonplace at the low end of the cycle. When 10 meters is dead, 40 can have excellent DX openings in the early morning and late afternoon hours, and don't forget 80 meters. With a reasonable antenna you can find good DX on 80. This is a good time to reread the book on 80 meter DXing by John Devoldere, ON4UN. John is probably the leading authority on 3.5–4.0 MHz DXing.

Another band that may hold some pleasant surprises for you is 160 meters, particularly during the winter months when the static level is low. Transoceanic contacts are becoming commonplace for stations with good antennas for top band.

The second of our suggested courses of action is to process the paperwork for awards already earned. Scout through your QSLs and see what you have already confirmed for WPX, WPX endorsements, single-band WAZ, and the many other *CQ* magazine awards for DXers. Get those cards off to our award managers, and some attractive new wallpaper can be headed your way.

The next step is to search your logs for prefixes, zones, and countries which you have worked but not yet confirmed. Then break out the SASE's and your own QSL cards and have at it. Unfortunately, it is sometimes harder to get a confirmation from a rare station than it is to work him in the first place, but QSLing can be done at any stage of the sunspot cycle. Now is a good time to send for the cards you need for that coveted award.

Spring 1985

Spring is a particularly good time to work on your WPX tally, as the annual CQ WPX SSB Contest takes place the weekend of March 30 and 31, and the annual CQ WPX CW Contest comes up the weekend of May 25 and 26. These are the best weekends of the year to work new prefixes, as prefixes are the contest multiplier and many countries allow their amateurs to use special new prefixes just for these events.

P.O. Box 205, Winter Haven, FL 33880

Italo Martini, I4KDJ, and XYL. Italo recently qualified for CQ's prestigious Single Band WAZ award. He has been licensed since 1978 and is an electrician by profession. He prefers SSB operation.

For those of you unfamiliar with WPX, *CQ* offers certificates for working 400 prefixes by mixed mode, 300 by 2-way SSB, and 300 by 2-way CW. In addition, a special VPX certificate is available to shortwave listeners and a special WPNX for Novices. A Novice may earn WPNX by working 100 prefixes, and over 200 Novices have qualified since this award was added to our program.

Numerous endorsements are also available for prefix hunters. The basic certificate can be endorsed at each 50 prefix level—for example, 350, 400, 450, 500, etc.—and further endorsements are available for bands and continents. The band endorsements include 50 prefixes for 160 meters, 175 for 80 meters, 250 for 40 meters, 300 for 20 meters, 300 for 15 meters, and 300 for 10 meters. To qualify for continental endorsements you must confirm 160 prefixes for North America, 95 for South America, 160 for Europe, 90 for Africa, 75 for Asia, and 60 for Oceania.

To obtain application blanks and complete information on the WPX award program, send an SASE to the WPX Award Manager, Norm Koch, K6ZDL, P.O. Box 1351, Torrance, CA 90505-0351 U.S.A.

XE1IF

The highlight of 1984 for K4IIF was the opportunity to work the CQ World-Wide DX Phone Contest from Mexico City using the callsign XE1IF. Special thanks to Giorgio Torelli, XE1X, Fernando Vallarta, XE1AE, and Manuel De Lera, XE1XF, for making this operation a success. QSL XE1IF to Manuel De Lera, XE1XF, at P.O. Box 907, Mexico 1, D.F., MEXICO.

The WPX Program

Mixed

1139	KB7UY	1141	W9JBR
1140	DJ6DW		

S.S.B.

1692	JG2MWA	1697	G4ARV
1693	HC2IX	1698	PY4VX
1694	KA9JOL	1699	EC4BIR
1695	N3ARV	1700	EA3AQC
1696	SM6DHU		

C.W.

2304	PY2RRG	2306	EA5CP
2305	SM6DHU		

Endorsements

Mixed: 750 SM6DHU. 800 SM6DHU. 850 SM6DHU. 900 SM6DHU, SM4-3434. 950 SM6DHU, I5AFC. 1000 SM6DHU, WD9IIC, VE3FEA. 1050 SM6DHU. 1100 SM6DHU. 1150 SM6DHU. 1200 SM6DHU. 1250 SM6DHU. 1300 SM6DHU.

S.S.B.: 350 N3ARV, I2KKL, JA2KVD, PY4VX, EA3AQC. 400 N3ARV, I2KKL, JA2KVD, PY4VX, EA3AQC. 450 N3ARV, I2KKL, PY4VX, EA3AQC. 500 I1EEW, I3DUB, I2KKL, PY4VX, EA3AQC. 550 I2KKL, PY4VX, AI6Z, EA3AQC. 600 YU5RK, I2KKL, PY4VX, EA3AQC. 650 YU5RK, I2KKL, PY4VX, EA3AQC. 700 I2KKL, PY4VX, EA3AQC. 750 KC9DS, EA3AQC. 800 EA3AQC. 900 I5AFC, WA2FKF. 1550 I3ZKD. 1600 I3ZKD.

C.W.: 350 PY2RRG, JH2TPI. 400 JH2TPI. 450 PA3DBG, KT2C. 550 KN7K. 600 KN7K. 750 AK2H, AI6Z. 900 KA7T. 950 JA1KRU. 1000 JA1KRU. 1050 JA1KRU. 1100 JA1KRU. 1150 VE1MF.

10 meters:	SM6DHU, DE0AAA.
15 meters:	YU5RK, SM6DHU, DE0AAA.
20 meters:	I1EEW, SM6DHU, DE0AAA.
40 meters:	WD9IIC, SM6DHU, DE0AAA.
80 meters:	WD9IIC, SM6DHU, DE0AAA.
160 meters:	W3ARK, DE0AAA, OK1MP.
Asia:	DE0AAA, JG2MWA, YU5RK, SM6DHU, JA2KVD.
Africa:	SM6DHU, DE0AAA, VE3FEA.
No. America:	SM6DHU, DE0AAA.
So. America:	K4CKS, SM6DHU.
Europe:	SM6DHU, DE0AAA.
Oceania:	VE3FEA, SM6DHU, JA2KVD, DE0AAA.

Award of Excellence Plaque Holders: N4MM, K6XP, K2VV, VE2GCO, DL1MD, DJ7CX, DL3RK, WB4SIJ, DL7AA, ON4QX, YU2DX, OK3EA, N4NO, ZL3GQ, W4BQY, I0JX, WA1JMP, K0JN, K4IEX, KF2O, F9RM, CT1FL, WA4QMQ, VE7DP, K9BG, N3ED, NN4Q, KA3A, VE7WJ, YU7DX, VE7IG, N2AC.

Award of Excellence Plaque Holders with 160 Meter Endorsement: K6JG, K5UR, OK1MP, W8CNL, W1JR, W5UR, W8RSW, W8ILC, W1BWS, G4BUE, LU3YL/W4, W9NUF, N4NX, W4CRW.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if air-mail desired) to CQ WPX Awards, P.O. Box 1351, Torrance, CA 90505-0351 U.S.A.

De Extra

Lists and Nets—A Code of Practice. The twin phenomena of lists and nets arose spontaneously in response to a vastly increased world-wide amateur population and an ever-increasing interest in DX awards. In many instances they provide the only means of working a particular DX station, especially on the HF bands. It should be noted that lists are frequently taken at the request of the DX station.

However, there is a feeling in some quarters that QSO's made by this means are somehow less valid or fair than those made under more normal circumstances. It is true that sometimes there are

The WAZ Program

10 Meter Phone

290	K4XG	292	JA9KGU
291	WA4VCC		

15 Meter Phone

209	K9SVL

20 Meter Phone

517	KD5ZM	519	EA4BVE
518	SV8CS		

10 Meter C.W.

54	K4XG

All Band WAZ

S.S.B.

2913	F6GPG	2918	IK1AOD
2914	N8BJQ	2919	W6VZZ
2915	WA2FCW	2920	SV8RX
2916	OH1DG	2921	KC7ET
2917	PA3BZV		

C.W. and Phone

5834	KW7N	5838	SM6LPF
5835	KC0XK	5839	W1RBU
5836	HL4XM	5840	W1JR
5837	N8BJQ	5841	IN3KBZ

Applications and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (37 cents) size 4½ × 9½ to the W A Z Manager, Leo Haijsman, W4KA, 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants forwarding QSL cards either direct to the WAZ manager or to a check point should include sufficient postage for safe return of their QSL cards. The processing fee for all C.Q. awards is $4.00 for subscribers and $10 for non-subscribers. In order to qualify for the subscriber rate, please enclose your latest *CQ* mailing label with your application.

abuses, but it is also true that lists and nets are here to stay. Attempts to discriminate against them in terms of awards would prove fruitless, as "policing" would be unenforceable and administration impossible.

It is therefore highly desirable that general recognition be given to a set of operating standards which would ensure the validity and acceptability of QSO's made by these means. The following suggestions would go some way toward minimizing current criticisms, but please note that these are not advisory notes or procedures. They are suggestions relating to operating standards and ethics.

1. The list operator (LO), when taking the list, should endeavor to ensure a fair and even representation from all those countries calling to participate.

2. It is not desirable to take a list for use at some future date. In the case of poor propagation, however, a running list may be held over and continued when possible.

3. It is highly desirable to establish with the DX station, in advance, how much time he has available, or how many stations can be worked in the time available.

4. A valid QSO requires some minimum two-way exchange of information. As stations are usually addressed by callsign, this information has already been imparted to the DX station. Nevertheless, the LO should seek to avoid passing the entire callsign if possible. A convention has been established that the exchange need only be a correctly received RS report by both parties. It is therefore the responsiblity of the LO at all times to ensure

The DXers gather in Mexico City for the '84 CQ World-Wide Phone Test. Left to right are Juan, XE1XT; John, K4IIF/XE1IF; Fernando, XE1AE; and Giorgio, XE1X. The setting is the hamshack of XE1X. Contest operation by John using the call XE1IF netted about 2600 contacts.

that this is accomplished fairly, accurately, and without assistance. While reports are in order, if necessary, verification of partly received reports is not. Should a relay or guess be suspected by the LO, the transmitting station should be instructed to make a second attempt with a changed report. The LO should not flinch from giving a "negative QSO" when not satisfied with the exchange.

5. It is acceptable practice for the LO to nominate another station to monitor and assist with the procedure in difficult circumstances, due to interference or linking, for example.

6. If conditions fail, the LO should terminate the operation rather than allow a "free for all" under the guise of the list.

7. It is very important that the LO gives out information at regular intervals relating to new lists, QSL Managers, length of current list, etc. This will be of great assistance to waiting stations not on the list, and it will minimize breaking and interference.

(These views were presented to the IARU Region I HF Working Group by the Society's HF Committee. The meeting recommended that it be widely disseminated. It came to CQ via the German DX bulletin DX-NL *edited by Walter Geyrhalter, DL3RK. The views of our readers on this subject would be welcomed by K4IIF and may be forwarded to him at P.O. Box 205, Winter Haven, FL 33880.)*

Working DX in CW Pileups. "K4IIF 599 K" . . . "QSL QRZ" . . . "DEF?" . . . "W6DEF 599 K" . . . "TU QRZ?" . . . "W7Y?" . . . "W7YF 599 K" . . . "QSL QRZ UP 10" . . . "W1WY 338c K" . . .

If you are just getting started in DX and think those first 100 countries are years away, finding yourself in the middle of a DX pileup can be a frightening experience. A DX pileup sounds like utter chaos, and pileups are frequently exactly that. However, there are a few "do's and don'ts" that may help the pain, and might just get you a few more countries.

You can easily recognize a pileup when you tune across 5 kHz or so of a DX band and find a large number of stations simply signing their calls, followed by a few seconds of silence, again followed by everyone (or so it seems) sending their calls again, and so on. These same stations will only rarely send the DX station's callsign, so how do you figure out who the DX station is?

Do not tune into the middle of this mess (as some do) and send "CALL?" You will rarely get an answer, and you will probably just QRM someone, perhaps the DX station himself. Instead, search around the pileup frequency for a station sending copy like that at the beginning of this article. That, more than likely, will be the DXpedition causing the pileup. Incidentally, signal reports from DXpeditions should be taken with a grain of salt! I've seen some pileup QSLs on which "599" was printed by a printing press!

If you decide to join this pileup, just send your own callsign and a go-ahead signal such as "DE W7YF K," or even more simply "W7YF." Any DX station working a pileup knows those stations close to his own frequency are answering his "CQ" or "QRZ," so there is no need for you to send his callsign. From a more practical view, if you send his call before your own, the DX station likely will be replying to another station before you finish signing your own call.

DXpeditions working a pileup do not always give their calls after every brief QSO, so how do you find out who he is? *BY LISTENING!* He may not send his own call more frequently than once every 5 minutes, but sooner or later he will!

Do not call the DX on his own frequency. Most DXpeditions will say "QRZ 2U" or "QRZ 5U," meaning that he is listening 2 kHz or 5 kHz *up* from his transmitting frequency. Even if the DX station doesn't say this, always try to call him a few kHz above or below his frequency to avoid interfering with him if he is answering another station. This is not a problem if you have a separate receiver or transmitter or if you own one of the more common transceivers made in the past few years which have incremental or offset capability—or, obviously, two separate VFO's.

If and when the DXpedition does come back to you with a signal report, make your reply short and sweet—i.e., "QSL UR 599 DE W7YF K." Do *not* start to ragchew; do *not* give your name and QTH! If you do, you may find yourself talking to nobody, and the DX station will be working someone else in line. Remember, DXpeditions are trying to work as many different amateurs as they can in the time they have available, and there are always plenty of others waiting to work them.

Once you make your contact with the rare station, how do you send him a QSL? DX newsletters or the DX columns in magazines such as *CQ* often have this information. But again, *listen to the DX station running the pileup,* even if you have already worked him. Most DXpeditions will send their QSL info every 5 or 10 min-

5 Band WAZ

Standings as of December 1, 1984

All 200 zones worked:

1. ON4UN
2. K4MQG
3. SM4CAN
4. AA6AA
5. W8AH
6. W6KUT
7. EA8AK
8. LA7JO
9. EA3SF
10. OH1XX
11. EA8OZ
12. W0SD
13. K0ZZ
14. ON6OS
15. OK3TCA
16. K6SSS
17. ZL3GQ
18. OK3CGP
19. SM0AJU
20. OZ3PZ
21. I3MAU
22. I2ZGC
23. 4Z4DX
24. N4KE
25. K5UR
26. K9AJ
27. SM3EVR
28. LA5YJ
29. DL3RK
30. N4WJ
31. G3MCS
32. SM5AQD
33. W0MLY
34. I0RIZ
35. ON5NT
36. OH6JW
37. OK1AWZ
38. IV3PRK
39. DJ6RX
40. OH3YI
41. I4RYC
42. ZL1BIL
43. I4EAT
44. ZL1BQD
45. TG9NX
46. XE1J
47. F5VU
48. W3AP
49. YO3AC
50. K3TW
51. XE1OX
52. VE7IG
53. OK1ADM
54. CT1FL
55. WA1AER
56. N4RR
57. UW0MF
58. W4DR
59. OK1MP
60. W1NW
61. OE1ZJ
62. HB9AHL
63. HB9AMO
64. LA6OT
65. UR2QD
66. UK2RDX
67. ZS5LB
68. F6DZU
69. DL4YAH
70. LA7ZO
71. W9ZR
72. W1NG
73. VK9NS
74. N4KG
75. YU7DX
76. DL8MAG
77. OK3DG
78. ZL1BOQ
79. EA9IE
80. DL7HZ
81. DJ9RQ
82. EA5SP
83. EA2IA
84. SP3BQD
85. LZ1NG

The top 13 contenders for 5 Band WAZ:

1. DK5AD, 199
2. JA3EMU, 199
3. N4WW, 199
4. EA8XS, 199
5. K6YRA, 199
6. N4JF, 199
7. W8VUZ, 198
8. LA9GV, 198
9. W6GO, 198
10. K4CEB, 198
11. OK1MG, 198
12. W2YY, 198
13. SM5AKT, 198

294 Stations have attained the 150 zone level

utes, so keep listening and sooner or later you will get it.

Finally, maintain some degree of "circuit self-discipline." In many pileups unfortunately one often hears unknown stations tuning up on the DX station's frequency, or guys sending things like "UP," "LID," "PIRATE," or other unnecessary verbiage which only causes QRM. Don't yield to the temptation to join in. Just because a few act like donkeys is no reason for you to do it, too. Good luck and good DX hunting!

(This article was written by Jack Wichels, W7YF, and first appeared in Totem Tabloid, *the journal of the Western Washington DX Club. We have borrowed it with a couple of minor changes. Tks, Jack—K4IIF.)*

Here and There

New French Prefix System. Effective January 1, 1985, all French amateur radio stations received new prefixes. The new prefixes are based on class of license, but stations in France proper are not handled the same as stations in the overseas territories. Under the new system there are five classes of license: Classes A, B, C, D, and E. DXers will be most interested in Classes B, D, and E, as Classes A and C are for VHF and UHF operation. Class B licensees have privileges on 144 MHz and 28 MHz, plus some CW segments of 7, 14, and 21 MHz bands. Amateurs with Class D and E licenses have full privileges, with Class E reserved for operators with three or more years of experience in Class D.

In continental France, the class of license, A through E, will be designated in the prefix. For example, all F2, F3, F5, F8, and some F6's will become FE2, FE3, FE5, FE8, and FE9, respectively. Other F6's, those who are Class D with less than three years of experience, will use the FD6 prefix. Class B stations will use the FB prefix. New prefixes for club stations, all F2O-, F5O-, F5K-, and F6K-, are indefinite at this time.

New prefixes for stations in Corsica and the other overseas departments and territories will also reflect the class of license, *but with a different number instead of a different letter in the prefix.* Also, several prefixes will change—for example, Corsica from FC to TK, and the French Antarctic Territory and associated islands from FB to FT. The license class for stations outside of continental France is indicated by the numeral as 2 for Class B, 4 for Class D, and 5 for Class E. This explains prefixes such as FH4 and FM4, which began to appear in the autumn of 1984.

Generally, you should be able to recognize your French friends, as their suffixes will remain unchanged.

There is a major change for visitors operating with reciprocal licensing privileges. Instead of receiving French callsigns, they will use their home calls with an appropriate French prefix appended. For example, F/K4IIF, FP/K1AR, and FM/W1WY. (*Thanks,* Les Nouvelles DX *and* QRZ DX.)

FB8W/FT—Crozet. Among those islands associated with the French Antarctic Territories are the Crozet group located in the southwest Indian Ocean about 2000 miles southeast of Capetown, South Africa, and 1500 miles from the coast of Antarctica. The area of these islands is about 116 square miles. They are very rugged, with steep cliffs, and have been the scene of many ship wrecks. Only five of

CQ DX Awards Program

S.S.B.

1378	ZP5MJO	1382	GI4NKF
1379	IK1AOD	1383	KA2MBC
1380	EA3AQC	1384	W9OKL
1381	KB0U	1385	W5LLU

S.S.B. Endorsements

310	KS2I/315	275	N3ARK/286
310	YV1KZ/314	275	VE3DLR/283
310	N7RO/311	275	WA2FKF/278
300	LA7JO/309	275	W5LLU/276
300	W6DN/307	275	G3XTT/275
300	KB8DB/303	200	EA3AQC/213
300	KU9I/303	150	IK1AOD/169
300	W6SN/302	150	WA4PMF/150
275	I5BDE/294	28 MHz	EA3AQC
275	VP9CP/292	28 MHz	KB0U
275	KB0U/291		

C.W. Endorsements

310	ON4QX/315	250	G3XTT/256
275	KA3R/276	200	W6DN/244

Total number of active countries is 315. The basic award fee for subscribers to CQ is $4. For non-subscribers, it is $10. In order to qualify for the reduced subscriber rate, please enclose your latest CQ mailing label with your application. Endorsement stickers are $1.00. Updates not involving the issuance of a sticker are made free when an s.a.s.e. is enclosed for confirmation of total. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business size, No. 10 envelope, self-addressed and stamped, to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. DX stations must include extra postage for air-mail reply. Please make all checks payable to the awards manager.

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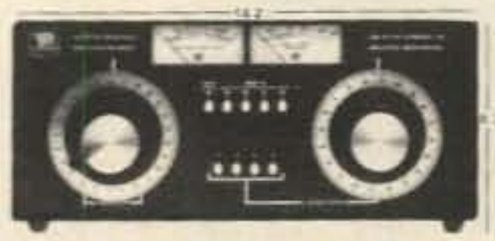

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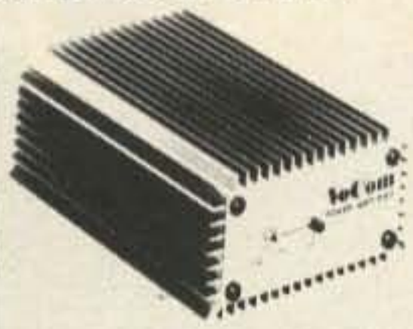

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At age 80, Forrest Pilgrim, W4JD, is one of our most experienced DXers. Forrest has been a radio amateur since 1918 and was first licensed in 1921. He is a winner of WAZ, CW WPX, several contest certificates, and is a member of the DXCC Honor Roll. CW is his preferred mode. Forrest has been married to the same lady for 57 years and is a chemist by profession. His son, Forrest Pilgrim, Jr., AB4H, is also an Honor Roll member.

is reported to be genuine. He has used commercial equipment and a log periodic antenna. QSLs go to G3LQP.

Operator Referral System. Would you like to be a part of a contest or DXpedition operation? N7DF has esablished an Operator Referral System for those interested in such invitations. For registration forms, send SASE to Operator Referrals, Box 125, Holton, KS 66436.

5L. Liberian stations used the 5L prefix in late 1984 to celebrate Liberian Amateur Radio Week.

SZ2COT. This was a special event station to honor the Chess Olympics at Thessaloniki. QSL to SV2SV.

GB0BCL, et al. GB0BCL, GB1BCL, GB2BCL, GB4BCL, GB6BCL, and GB8BCL operated from "Beetle City," Liverpool (BCL) to commemorate the opening of the Beetle City Museum in Liverpool. All QSLs go to G4VKV, c/o Beetle City, P.O. Box 12, Liverpool, England.

Project Blizzard. This expedition had permission to use the callsigns VK0PB and AX0PB from Antarctica and Macquarie Island. QSL requests will be met at the end of March 1985 by QSL Manager Niel Penfold, VK6NE, 2 Moss Court, Kingsley 6026, Western Australia.

Zone 2. One of those rare Zone 2 stations in upper Quebec is VE2EZA in Sept-Iles. Jean can be found weekends on 10 meter phone. His complete address is Jean Richard, 112 Rue Gamache, Sept-Iles, Quebec, Canada G4R 2H2.

Zones 18 and 19 on 80 Meters. UA0FDX (Victor) and UA0FF (Vlad) were reported on 3643 kHz at 0700 GMT. Both are on Sakhalin Island in Zone 19. UA0UV in Zone 18 was heard by a California station at 1400 GMT transmitting on 3644 and listening on 3800 kHz.

73, John, K4IIF

QSL Information

A22ME to AK1F
A61AA to G3LQP
AH2AZ to P.O. Box 445, Agana, Guam 96910
AH8A to K6EDV
AP2ZA to W6NLG
BT8CD to JR1HHL
BV0W to W4WJ
CE0AE to WA3HUP
C30BBC to F6EGG
ED9CM (Cueta) to EA9IE
EL1F & EL1G to WD9IDS
EL2AT to OE3NH
EL2CD to KE9A
ET3PS to DJ9ZB
FM4DJ to W5JLU
FO0RB to W8LCZ
FW0BX to ZL1AMO
HH2B to N4WW
HH2MC to KB4IT
HH2VP to W1FJ
HI8A to HI8LC
HK0BKX to WB4QFH
HV3SJ to I0DUD
J5WAD to UA4PW
K0AX/KH2 to W4FLA
N6TJ/EA9 to WA6OTU
ON8SB/A to PA3CZA
P29JS to VK9NS
P42J to W1KDD, 122 After Drive, Torrington, CT 06790
P46S to K3UOC
PZ5ES to N8DE
ST2SA to P.O. Box 1533, Khartoum, The Sudan
SV0AC/SV9 (Crete) to WA4GCP
T52JL to OH2JL
TI1C (Oct. 27-28, 1984) to K6VNX
TL8TX to K0VZR
TR8DM to F3CY
TR8DR to W2PD
TR8IG to P.O. Box 740, Libreville, Gabon
TT8CW to F6GXB, P.O. Box 70, 91605 Savign, Cedex, France
V2ARS (by Southwest Ohio DX Association) to K8BA
V3ZZ to KE5KK
VE2USA (Zone 2) to AC8W
VK9MR to VK2WU
VK0YL to VK3AH
VP2MB to N4AR
VP2VCW to N6CW
VQ9DG to WA3HUP
VS6DO to K4CIA
W1BIH/PJ2 to W1KDD, 122 After Drive, Torrington, CT 06790
XE1IF to Manuel G. De Lera, XE1XF, P.O. Box 907, Mexico 1, D.F., Mexico for Oct. 27-28, 1984 only.
XE2SI to K6VNX for Oct. 27-28 and Nov. 24-25, 1984 only.
YB0ARA to K6DLV
YI0BIF to YI1BGD, P.O. Box 5864, Baghdad, Iraq
ZD7CW to N4CID
ZD9CC to ZS2DK
ZF2HB to AA8G
ZP5XDW to N4DW
3X4EX to N4CID
4K1GAG to UQ2OC
4V2C to NQ4I
5H3QM to VE7QM
5R8AL to WA4VDE
5X5GK to JA1BK
5W1EJ to W0WP
5W1EZ to JE1JKL
6D1FIC to K9AUB
6W1HK to W0ZUZ
6W1NG to DL1HH
7X2AB to W2KF
9J2BO to W6ORD
9Y4IH to WB3AKI

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Contest Calendar

a monthly feature by
FRANK ANZALONE, W1WY

NEWS/VIEWS OF ON-THE-AIR COMPETITION

Missing in this month's column are the OOTC QSO Party, the DARC "Corona" RTTY Contest, the IARS CHC Contest, and the Tennessee QSO Party. All of these events are usually held in the month of March, but since we have not heard from them, I have no way of knowing if they have been scheduled this year or if the respective managers neglected to get the announcements out in time.

Two organizations that did send us announcements but did not make it in time are the Rat's Nest & Crooked Stick in January and the American Radio Club's Contest in February. No way can we make the current issue for your event on only a month's or even two month's notice. The indicated dates at the end of each month's commentary are definitely our deadlines.

Typo's and other errors in some of the foreign publications are creating more headaches for the WW Contest Committee. The *CQ* WW Contest rules as published in the German *CQ-DL* magazine stated the contacts between European countries are worth two points, instead of the correct one point value. RSGB's *Communication* magazine had the dates of our WW Contest reversed, showing the phone section in November and the CW in October. Even *QST* added to the confusion. The announcement of our WW in their "Contest Corral" showed last year's mailing address for sending logs. However, N6AR is no longer in California, and K3EST will also be moving to another location soon. In this year's rules we have repeatedly announced that all 1984 contest logs should be send to the *CQ* office in Hicksville, N.Y. *C'est la vie.*

Deadline for announcements of June events is March 15th, and April 15th for the July issue.

Have you checked the expiration date of your license lately?

73 for this time, Frank, W1WY

Worked All Morton Party

0001Z to 2400Z, March 1–31

The members of the Morton Amateur Radio Club of Morton, IL will be active on all bands during March. You should find them about 5 kHz apart up from the bottom edge of the General portion of each CW and phone band, and the Novice bands. Exchange signal reports and identify your state, province, or country.

Certificates will be issued to all stations contacting at least five or more Morton members. (*I assume they will identify themselves in the exchange.—ed.*)

Include a large SASE (3 IRCs for out of country) with your log information to Jim Jones, WD9AEU, 701 Columbus Ave., Morton, IL 61550.

14 Sherwood Road, Stamford, CT 06905

Calendar of Events

	Mar.	1-31	Work All Morton Party
*	Mar.	2-3	ARRL DX Phone Contest
*	Mar.	9-10	QCWA Phone QSO Party
*	Mar.	9-10	West Coast 160 CW Contest
	Mar.	9-10	RSGB Commonwealth Contest
	Mar.	9-10	VIII Cadiz Tacita de Plata
	Mar.	9-11	Virginia QSO Party
	Mar.	10-11	Wisconsin QSO Party
	Mar.	16-17	Bermuda Contest
*	Mar.	16-17	YL-ISSB CW QSO Party
	Mar.	16-17	G-QRP Club Activities
	Mar.	16-17	Kentucky QSO Party
	Mar.	23-24	BARTG RTTY Contest
	Mar.	**30-31**	**CQ WW WPX SSB Contest**
	Apr.	6-7	GARTG SSTV Contest
	Apr.	20-21	VIGO World Fishing Contest
	Apr.	20-21	ARCI QRP SSB Contest
	May	4-5	County Hunters SSB Contest
	May	18-19	ARI International Contest
	May	**25-26**	**CQ WW WPX CW Contest**

**Covered last month.*

Virginia QSO Party

1800Z Sat. to 0200Z Mon., March 9–11

The Sterling Park ARC of Virginia is again sponsoring this year's party. The same station may be worked on each band and each mode; VA stations may work other in-state stations for QSO and multiplier credit; and VA mobiles in each county change.

Exchange: QSO no. (starting with 001) and QTH. County for VA; state, province, or DX country for others.

Scoring: One point per s.s.b. contact, two points if on CW, RTTY, or SSTV. VA stations multiply total QSO points by sum of states, provinces, DX countries, and VA counties worked.

Others multiply total VA QSO points by the number of VA counties worked (maximum of 95).

Frequencies: C.W.—60 kHz up from low end of each band. S.S.B.—3930, 7230, 14285, 21375, and 28575. Also Novice bands on c.w., and both modes on 160 except in the "DX Window."

Awards: Certificates to winners in each state, province, DX country, and VA county. There are five plaques as follows: to top VA single operator stations, c.w./s.s.b., c.w. only, Mobile, QRP, and to the top c.w./s.s.b. out-of-state station.

Indicate each new multiplier in a separate column as it is worked. Include a summary sheet with your log, and an s.a.s.e. if results are desired.

Mailing deadline is April 1st to: Virginia QSO Party, Att: Barry Pybas, KW4I, 313 W. Derby Ave., Sterling Park, VA 22170.

RSGB Commonwealth CW Contest

1200Z Sat. to 1200Z Sun., March 9–11

Only RSGB members residing in the United Kingdom and radio amateurs licensed to operate within the British Commonwealth and British Mandated Territories are eligible to participate.

Contacts between stations in the same call area are not permitted. All the British Isles prefixes count as one call area.

Activity will be on c.w. only, and it is requested that operation be confined to the lower 30 kHz of each band, 3.5 through 28 MHz (except for Novice contacts).

Exchange: RST plus a three-figure QSO number starting with 001.

Scoring: Each contact is worth 5 points. In addition, a bonus of 20 points may be claimed for the first, second, and third contact with each call area on each band.

Entries: May be single or multi-band.

Each band is scored separately and totaled for the final all-band score. There is no multiplier; just add the total QSO and bonus points from each band.

Multi-band scores cannot also be used for single-band awards. You can request that a single band be judged for awards. Only single operator entries will be accepted.

Use a separate log sheet for each band and include a summary sheet showing the scoring and a signed declaration that all rules and regulations have been observed.

There is also an s.w.l. section with rules and scoring same as above. If both stations in contact are heard, they can be reported as separate entries for credit.

Awards: Certificates to the first, second, and third place winners in all areas, both single and multi-band, and three Rose Bowl Trophies for the overall winners.

Logs must be received by May 13th and go to: A.K. Gray, G4DJX, 44 Sherwood Avenue, St. Albans, Herts., AL4 9PQ England.

VIII Cadiz Tacita de Plata Contest

1500Z Sat. to 2200Z Sun., March 9–10

This activity is sponsored by the Cadiz Delegacion of the U.R.E. The objective of the contest seems to be to contact as

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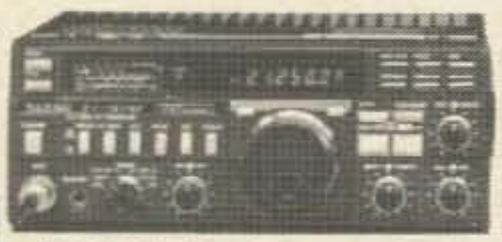

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The massive multi-multi operation at OHØW in the 1982 CQ World-Wide Phone Contest finally received their just reward last summer. At the presentation of the World Champion Plaque were Axel Tigerstedt, OH5NW, President of the SRAL, receiving the plaque; Dr. Reinaldo Leandro, YV5AMH, Ambassador to Finland, who made the presentation for the sponsors, the Radio Club Venezolano; and Bob Thompson, K6SSJ, who filled in for CQ.

many stations in the province of Cadiz as possible.

A brief translation of the rules by your Spanish representative, Angel Padin, EA1QF, is as follows: operation will be on all six bands, 10 through 160 meters, single operator, SSB only.

Exchange: Signal report plus a QSO number starting with 001.

Scoring: Each Cadiz station worked is worth one point. The same station may be contacted once on each band on each day, but allow at least 15 minutes between contacts.

Awards: There are plaques and colorful certificates of Cadiz in several categories.

To be eligible for an award the following minimum scores are required: stations in Europe 50 points, in Africa 25 points, in No. and So. America 25 points, and in Asia and Oceania 5 points. There is an SWL division with a required score of 200 points.

Your list of contacts must be sent in no later than April 15th to: Delegacion Local de U.R.E., P.O. Box 2271, 11080 Cadiz, Spain.

Wisconsin QSO Party

1800Z Sun. to 0100Z Mon., March 10–11

This one is a shorty, only 7 hours, and is again sponsored by the West Allis Radio Amateur Club. The same station may be worked on each band and each mode, and mobiles in each county change. Wisconsin stations may contact other in-state stations for QSO and multiplier credit.

Classes: Single operator, multi-operator, both single and multi-transmitter, Novice/Tech. and club.

Exchange: RS(T) and QTH. County for Wisconsin; state or province for others.

Scoring: Phone QSOs count 1 point; 2 points if on CW.

Wisc. stations multiply total QSO points by (U.S. states + VE provinces + Wisc. counties) worked for their final score. DX contacts count for QSO points only.

Others multiply total Wisc. QSO points by the number of Wisc. counties worked. (maximum of 72).

Wisc. mobiles can add a bonus of 500 points to their final score for each county they operate from outside their own (minimum of 15 QSOs from each county).

Frequencies: CW—3550, 3725, 7050, 7125, 14050, 21150. SSB—3890, 7290, 14290. Other bands may be used.

Awards: To the highest scorers in each state and each province, and the highest aggregate club score. Awards also go to the top scorers in each class for Wisconsin stations.

Logs with more than 100 QSOs must include a separate dupe sheet for each mode with their entry.

Mailing deadline is April 15th to: Wisconsin QSO Party, c/o West Allis Radio Amateur Club, P.O. Box 1072, Milwaukee, WI 53201.

Bermuda Contest

0001Z Sat. to 2400Z Sun., March 16–17

This popular contest is open to amateurs in the U.S., Canada, United Kingdom, and West Germany. Stations in the U.S. and Canada may work the U.K., West Germany, and Bermuda. The U.K. and W. Germany may work the U.S., Canada, and Bermuda.

Activity will be on 3.5, 7, 14, 21 and 28 MHz bands. Cross-band or cross-mode contacts are not permitted. The same station may be worked on each band, phone, and again on CW, providing there is a 30-minute separation between contacts on the same band.

You are limited to 36 hours out of the 48-hour contest period. Off times may be not less than three consecutive hours and must be clearly indicated in the log. Participation is for single operator stations only and must be from their own residence.

Exchange: RS(T) and QTH. Parish for VP9, state for U.S., province for Canada, county for U.K., DOC number for W. Germany.

Scoring: Five points for each QSO. Multiply total by number of different VP9 stations worked on all bands. (Note: It's each VP9 station, not each parish. Counted once only per band regardless of mode used.)

Awards: Certificates to top stations in each U.S. state, VE province, U.K. county, and DL DOK. The overall winner in each of the above areas, however, will receive something more substantial—a trophy to be presented at the society's annual dinner in Bermuda in October. Round-trip transportation and hotel accommodations will be provided for the winners. (*Note:* Winners in '80, '81, '82, '83, and '84 are not eligible.)

Use a separate log sheet for each band and a dupe sheet for logs with 200 or more contacts. A penalty of three contacts will be deducted for each duplicate for which points are claimed. An excess of claimed duplicates means disqualification. The usual signed declaration is also required.

Entries must be received no later than May 31st by the Radio Society of Bermuda, Box HM275, Hamilton, Bermuda.

(Trophy winners for 1984 were K1RM, VE3BGX, G4CNY, DF6PK, and VP9IJ.)

G-QRP Club Activity

The G-QRP Club announces the following schedules for 1985. CW: March 16–17. SSB: May 4–5. CW: September 28–29. CW: December 26 to January 1.

The following times (GMT) and frequencies will be used for CW activities.

0900–1100—14060/21060/28060
1100–1300—3560/7030
1300–1400—10106
1400–1700—14060/21060/28060
1700–1900—3560/7030
1900–2100—14060
2100–2300—3560/7030

Following for SSB operation.

0900–1100—14285/21285/28885
1100–1300—3690/7090
1300–1700—14285/21285/28885
1700–1900—3690/7090
1900–2100—14285
2100–2300—3690/7090

In addition to the above, the G-QRP Club has weekly activity periods on Sundays between 1100Z and 1230Z and again from 1400Z to 1530Z on the above International QRP frequencies.

This is not a contest, but QRPers are invited to participate and report their activity to: Christopher J. Page, G4BUE, Alamosa, The Paddocks, Upper Beeding, Steyning, West Sussex, BN4 3JW England.

Details for membership in the G-QRP Club can be obtained from Fred Garratt, G4HOM, 47 Tilsnead Close, Bruics Heath, Birmingham, B14 5LT England.

Kentucky QSO Party

2100Z to 0700Z Sat., March 16
1400Z to 2200Z Sun., March 17

This is the third annual party sponsored by the Western Kentucky DX Assn. The same station may be worked on each band and each mode, and mobiles in each county change. KY stations may work in-state stations for QSO and multiplier credit.

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

Scoring: Two points for 160 meter QSOs, phone or CW. On all other bands 2 points for CW contacts, 1 point for phone. Combine CW and phone points.

Final Score: KY multiply total QSO points by (states [50] + VE districts [9] + KY counties [120] worked).

Others total KY QSO points by KY counties worked (maximum of 120). DX contacts count for QSO points only.

Kentucky mobiles and portables add 1000 points to their final score for each county operation outside their own. Minimum of 10 contacts per county.

Frequencies: CW—1815 and 60 kHz from bottom of each band. SSB—1840, 3985, 7285, 14285, 21385, 28585. Novice— 3725, 7125, 21125, 28125. KY stations must stay at least 10 minutes on one band or mode.

Awards: Certificates to top scorers in each U.S. state, Canada, DX station, and Novice. Five plaques to the overall winners, KY fixed, KY CW mobile, KY phone mobile, KY portable, and out-of-state station. To all entries with at least 10 contacts goes a participating certificate.

Include a summary sheet and a cross-check list for logs with over 50 contacts per band or mode. Also include a large SASE (40¢) for results and awards.

Mailing deadline for all entries is May 15th to: Western Kentucky DX Assn., Att: William D. Shipe, WM4N, Route #1, Adairville, KY 42202.

B.A.R.T.G. Spring RTTY Contest

0200Z Sat. to 0200Z Mon., March 23–25

This contest has been sponsored for many years by the British Amateur Radio Teleprinter Group and is now being administrated by Peter Adams, G6LZB.

The contest is open to all amateurs in three classes: single operator, multi-operator, multi-operator and SWL. Activity will be on all bands 3.5–28 MHz, but no 10 MHz. Operation is limited to 30 hours out of the 48-hour contest period. The 18 hours off may be taken at any time, but not in less than 3 hour periods.

Exchange: RST plus a three-figure contact number and time in GMT (full four figures).

Points: Contacts with stations within own country 2 points. With stations in other countries 10 points. A bonus of 200 points for each country worked on each band, including own. The same station may be worked on each band for QSO and multiplier credit.

Multiplier: Total number of countries worked on each band and number of continents worked (continents are counted once only). W/K, VE/VO, and VK call areas will be counted as separate multipliers.

Final Score: (A) Total QSO points × country multiplier. (B) Country multiplier × bonus points × continents worked. Add sum of (A) and (B) for your final score.

Short-wave listeners must show call of station being heard, report of message being sent, and call of station being worked.

Awards: Certificates to the top-scoring stations in each class and to the continental leaders, and in each W/K, VE/VO, and VK call area.

Use a separate log sheet for each band and a summary sheet showing the scoring, etc. Log forms are available from G6LZB; include 3 IRCs to cover postage.

Logs must be received by May 31st and go to: Peter Adams, G6LZB, 464 Whippendell Road, Watford, Herts. England WD1 7PT.

CQ World-Wide WPX Contest

SSB: March 30–31 Starts 0000Z Sat.
CW: May 21–26 Ends: 2400Z Sun.

Complete rules were published in the January issue. Rules are the same as those used last year with the same format that has been used previously. Therefore, it would serve little purpose to repeat the rules here, since they are well established world wide.

The definition of the prefix multiplier is spelled out in detail and is not to be confused with the interpretation used by the WPX Award program. Also keep in mind that a station in a call area different from that indicated by its call sign is required to sign portable.

The multiplier is determined by the number of different prefixes worked and is counted *once* only, regardless of how many times it is worked on other bands.

Another point to keep in mind is that in the multi-operator, single transmitter category only one transmitter and only one band may be used during the same 10-minute time period. Picking up a new multiplier on another band during the same time period is definitely prohibited.

An alphabetical/numerical check list of claimed prefixes is now a definite requirement and must be included with your log.

An updated trophy and plaque awards list now shows over 40 awards this year. Therefore, be sure to check the awards now available.

Deadline for submitting your SSB entry is May 10th, and July 10th for the CW section. *Be sure to indicate SSB or CW on the envelope.* This year all logs go to: *CQ* Magazine, WPX Contest, 76 North Broadway, Hicksville, NY 11801.

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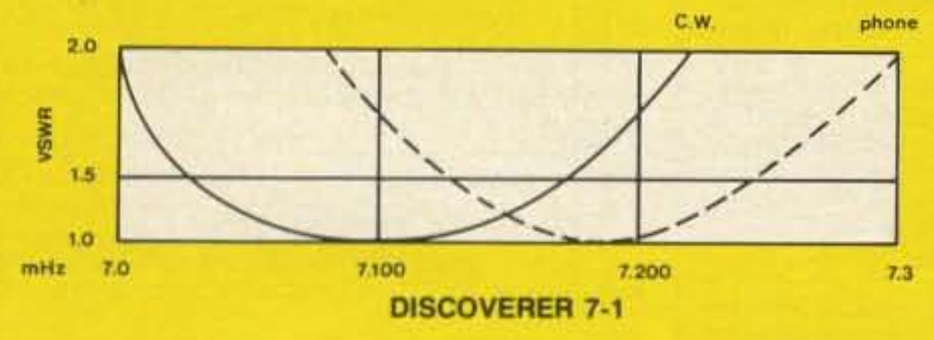
Rediscover 40 meters with the DISCOVERER SERIES Rotatable Dipole or Monoband Beams

This 40 meter antenna series gives you three choices. The Discoverer 7-1 which is a rotatable dipole. Or the Discoverer 7-2, a two-element beam you can upgrade to three elements with a kit.

Whichever you choose, you'll get Hy-Gain's superior mechanical design. Such as tapered tubing to reduce weight and wind surface area. Maintenance-free stainless steel hardware and preformed clamps for an easy, rugged assembly.

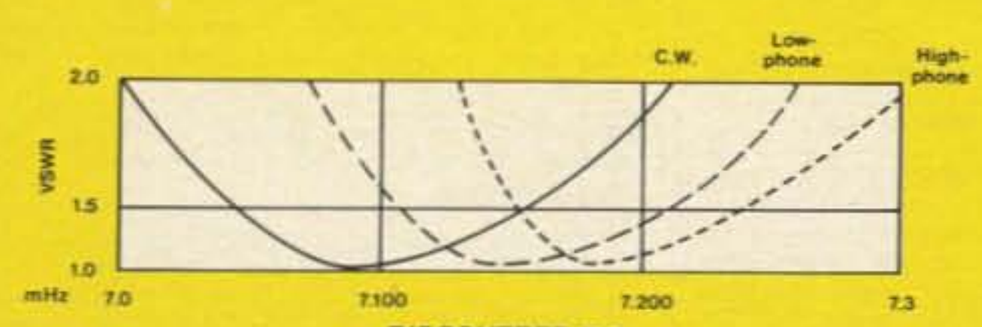
You also get superior performance. Wide bandwidth with SWR of 1.5:1 or less at resonance. High-Q efficiency because there are no high-loss coils. A low voltage feed point that eliminates insulator failure and assures that the antenna can handle twice the new legal power limit.

The Discoverer 7-1 dipole can be added to most existing rotatable beam installations. This model can be tuned to either 30 or 40 meters.



DISCOVERER 7-1

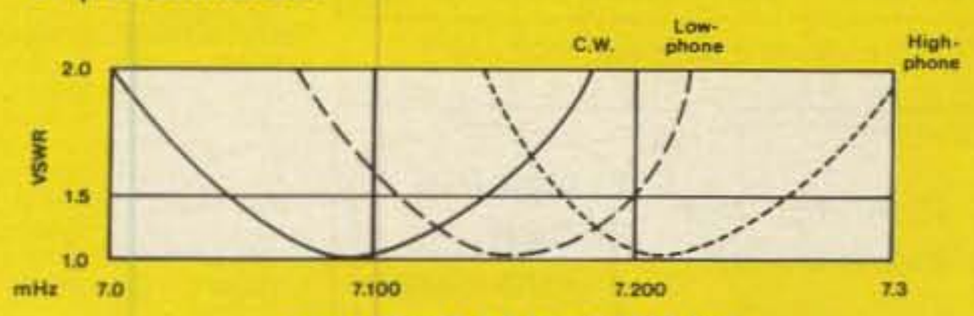
The Discoverer 7-2 requires only a 25 ft. (7.6 m) turning radius and opens communication doors you previously thought possible only on 20 meters. Combining the advantages of high forward gain and a high front-to-back ratio lets you hear and work stations you couldn't read on a dipole or vertical antenna. Best of all, you can upgrade this antenna anytime with the 373S Director Kit.



DISCOVERER 7-2

DISCOVERER 7-2 with Director Kit

By adding the Director Kit to the Discoverer 7-2 you create a three-element beam on a boom of only 35 ft. (10.7 m), that outperforms many of the heavy-weight giants with much longer booms. In fact, the kit doubles the effective radiated power of the Discoverer 7-2, and nearly doubles the front-to-back ratio. And, because the antenna is still more compact than a "giant", you only need a medium-duty tower such as the HG52SS. All of which saves you money and space without compromising safety or performance.



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Closing Date: The 10th day in the third month preceding date of publication. Because the advertisers and equipment contained in Ham Shop have not been investigated, the Publisher of CQ cannot vouch for the merchandise listed therein. Direct all correspondence and ad copy to: CQ Ham Shop, 76 N. Broadway, Hicksville, NY 11801.

MILITARY RADIOS: R-390A, premier communications receiver, .5–30 MHz, 4 mechanical filters, meters sealed (Government removed) operation unaffected: complete/checked $175, complete/unchecked $115, spare parts unit (80% complete, missing PTO/power supply) $65. R-390A Manual reprint $5. CPRC-26 Manpack Radio, compact, transceives 46–54 MHz FM, 6 channels, with battery box, antenna, crystal, handset: $22.50 apiece, $42.50/pair. PRC-510 Backpack Radio (Canadian version of American PRC-10), transceives 38–55 MHz FM continuous tuning, with battery box, headset, antenna: $39.50 apiece, $77.50/pair. ARC-27 Guard Receiver, single channel 220-250 MHz AM: $12.50. R-108 Vehicular/Field Receiver, 20–28 MHz FM: $27.50. 45-Day Replacement Guarantee. Add $9.50 shipping-handling (except R-390A, shipped actual charges collect). Baytronics, Dept. CQ, Box 591, Sandusky, OH 44870.

MODIFIED Your FT-208R? I would like to hear about it. Doug Ransom, VE7ESN, P.O. Box 11, Wycliffe, B.C., Canada V0B 2M0.

QSLs & RUBBER STAMPS—Top Quality! Card Samples and Stamp Information 50¢. Ebbert Graphics D-2, Box 70, Westerville, OH 43081.

NEW KID on block: For QSL free samples write Kings Grove Press, Box 9, Ellerslie, MD 21529. Also custom printing—instructions included. Stamp appreciated.

WANTED: Early Hallicrafter "Skyriders" and "Super Skyriders" with "Silver" panels. Also "Skyrider Commercial" early transmitters such as HT-1, HT-3, HT-19, and other Hallicrafter gear, parts, accessories, manuals. Chuck Dachis, WD5EOG, The Hallicrafter Collector, 4500 Russell Drive, Austin, TX 78745.

QUALITY TOWER ACCESSORIES TO SOLVE YOUR PROBLEMS: SO-1 standoff brackets for small 2 meter, Ringo, TV antennas, $34.50. SO-2 Heavy-duty standoffs for large 2 meter, beams, commercial, $64.50. MA-1 and MA-2 mast adapters put the top of your tower mast to good use, $22.50. GP81 and GP51S Ginpole Kits provide safety for your tower work, $129.50. BG-18 tower mast for those big beams, $249.50. These accessories work fine on all tubing-type towers. Special accessories can be custom made to order. Request our 1983 catalog. Visa, Mastercharge. IIX Equipment Ltd., P.O. Box 9, Oak Lawn, IL 60454. Phone 312-423-0605.

IMRA-International Mission Radio Assn. helps missioners—equipment loaned; weekday net, 14.280 MHz, 2:00–3:00 PM Eastern. 1 Pryer Manor Rd., Larchmont, NY 10538.

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QSL's by W4TG. Prices from $16 per 1000. Send SASE to P.O. Drawer F, Gray, GA 31032.

FOR SALE. CQ/Ham Radio/QST/73 magazines @ 35¢ (thru 1975) and 50¢ (1976-up) each, including shipping. W6LS, 2814 Empire, Burbank, CA 91504.

SCHEMATICS: Radio Receivers, 20's/60's. For details send namebrand, Model No., SASE. Scaramella, P.O. Box 1, Woonsocket, RI 02895-0001.

HELP! Need Collins 30 L-1 linear amplifier for parts. Will pay cash. Poor condition or basket case ok. Contact Jim Mozzillo, 619 Prospect Avenue, Hot Springs, Arkansas 71901.

RUGGED CANADIAN TOWER—COMMERCIAL: Tower manufacturer is offering a heavy-duty self-support tower direct to Hams. Save big on direct order—save even more with exchange rate. Tower is capable of taking up to 60 square feet of antenna. Don't miss the opportunity to buy a well-constructed tower at a super low price. Dealer inquiries invited. TRYLON TOWERS, 21 Howard Avenue, Elmira, Ontario, CANADA N3B 2C9, phone (519) 669-5421.

CUSTOM EMBROIDERED EMBLEMS: CLOISONNE ENAMELED PINS, Your Design, Low Minimum, Excellent Quality, Low Prices, Free Booklet. A.T. Patch Co., Dept. 10, Littleton, NH 03561 (603-444-3423).

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CLANDESTINE CONFIDENTIAL NEWSLETTER: Latest info on secret broadcasters. Six issues $10 US, $13 foreign, US funds. RR4 Box 110, Lake Geneva, WI 53147.

FOR SALE: Kenwood R-300 RCVR., mint cdx, US $200 or nearest offer. VE7EHD, 604-265-3175.

HAM SOFTWARE: Send SASE for free information on Custom Beam Headings, MUF, Morse Trainer, & Code Practice for C-64. No computer? Custom Heading List; $5.95. ULTRA HAM SOFTWARE, Box 119, Macedonia, OH 44056.

WANTED: Old Western Electric, RCA, Cunningham, DeForest, McIntosh, Marantz, Tubes, Amps, Speakers. Maury, 11122 Atwell, Houston, TX 77096.

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SATELLITE TV RECEIVERS, LNA's, Polarotors, Antennas. Drake, Luxor, Toky, Wilson, Dexcel, Ranger, and more. Free price list for SASE. Lowest prices direct to you. G.A.S. Systems, P.O. Box 1593, Hamilton, Montana 59840.

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COMMODORE 64: CW TUTOR (64). Fantastic help learning or improving your reception of Morse Code. Adjustable speed (5 to 30 w.p.m.), tone and word spacing. Available in disk ($10.00) or tape ($8.00) from E.C. Software, Jim Hammer, KO9T, 622 N. Illinois St., Monticello, IN 47960.

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COLLECTOR needs Sig. Corps tubes with VT numbers. Tell me what you have and your price. SASE for my want list. York, Box 365, Fontana, CA 92335.

574TH, 565TH, SAWBNS, will hold its 3rd reunion in Dayton, Ohio, July 1985. Radio, radar, scope operators, maintenance men, and others who are ex-members—meet your buddies there. For details write to Angel M. Zaragoza, W6ZPR, 1571 9th St., San Bernardino, CA 92411.

FOR SALE: New, Tubes 833A, $35.00 ea., 811A, & 807's, $5.00 ea. Many others; send for listing. New Telex Communications Headsets; Model 1210, mono or stereo, $10.00 ea. Model 2400 Amplified Headset with dynamic mike, $30.00 ea. Assorted Simpson Meters, send for list & price. Wm. Kalish, 687 Center Rd., E. Meadow, NY 11554.

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ATLAS 350XL OWNERS GROUP. Free newsletter. Send QSL with rig s/n and SASE. Know people who repair them? Information to share? Questions? Rod Sharp, N5NM, Box 2169A, Santa Fe, NM 87504.

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QRQ—Increase Code speed, enjoyment. Chat like old timers. Get "How to Read Morse Code in Your Head" $3.00 ppd. New system. Ideal for beginners. Com-Viz Publications, Box 215B, Sherman, IL 62684.

MARCH SPECIAL of 2M linear amplifiers, converts your handheld to high power, from as low as 300mw input and 30 watts output. Output protected from infinite VSWR. No tuning required, with RF keyed T/R relay, 13.8 VDC at 6 amps. Send $67.00 in U.S. funds in cheque or money order to Klaus Heidelberger, 429 Midwood Cres., Waterloo/Ont., Canada, N2L 5N4. Tel. (519) 886-5795.

WANTED: Old bugs for my key collection. Vibroplex, Martin, MacDonald, Dunduplex, etc. Also need Spark keys. K5RW, Neal McEwen, 1128 Midway, Richardson, TX 75081.

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BEAM HEADINGS! THE BEST! DX (including longpath) and USA headings customized for your QTH. Shows mileage to target area. $6.00. Tom Fleming, 1634 Baywinds Lane, Sarasota, FL 33581.

FOR SALE: Old German hand Morse keys as used during WW II by the German army. Over 40 years old and in very fine condition. Screws for adjustments in brass and silver contacts. Cord line with 2 pole plug, black plastic case with hinged cover. Old National emblem on it. Weight: 0.8 lbs. Measurements: 3.1" × 1.6" × 5.8". Price including sea post $30. Hand Morse keys from GDR. NEW! Type K 40. This key will be used by the East German army (NVA). Case in black plastic. Screws for adjustments in nickel plated steel. Silver contacts. Without cord line. Built-in steel plate in the support for stability. Weight: 0.88 lbs. Measurements: 2.5" × 1.9" × 5.3". Price including sea post $16. Payments via bank check. If interested, please write for pictures and more information. Klaus Gramowski, DL7NS, Kaiserin-Augusta-Allee 91, D-1000 Berlin 10, West Germany.

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COMMODORE-64 5 BAND DXCC LOG includes custom beam headings, distances to DX plus continent, country, zones, QSOed/QSLed on any band, phone or CW, upon country name or call sign entry. Diskette and instructions $18.99 ppd. Sondor Software, P.O. Box 416, Sarnia, Ontario, Canada N7T 7J2.

BENCHER XZ-2 Audio CW filter with matching power transformer. Excellent, new, $40 postpaid. W8FDN, 371 Claymore Blvd., Richmond Heights, OH 44143.

ICOM IC-125, 5 ch, 25 watt VHF business-band mobile transceiver, new, original $549, sell for $389.95. Call Paul 219-932-2196.

SELL: HW-101 w/HP23A PS, SP600 speaker, CW Filter, RIT $285. HW8 w/PS, RIT, SWR Bridge, $95. Both excellent w/manuals. N6GO, 5408 Simpson, No. Hollywood, CA 91607.

WANTED: AC and switcher supplies for old Motorola H23 and P33 hybrid talkies. Jim, 121 Hilton, Elgin, IL 60120.

FT101E and Turner Expander 500 for sale or trade for TS-830 accessories. K5IC (505) 292-5419.

SELL: 120 foot super heavy-duty steel tower, Mobile mount for TS-120/130. WANT: MATV-CATV materials, tools, amps, etc. Any National equipment dead or alive. T. N. Colbert, 13609 Colony, Burton, OH 44021.

WANTED: RCA transmitting tube manual. Also want RME DB-23 preselector. John Werner, 183 Tacoma, Troy, MI 48084-5424.

JUNIOR HIGH SCHOOL RADIO PROGRAM needs your donations of old equipment, keys, code cassettes, SWL gear. Support amateur radio's future through our youth. JHS 180, Mr. Skloot, 320 B. 104 Street, Rockaway Park, NY 11694.

WANTED: A variac for 220 volts to handle 10 to 20 amps either manually or motor driven. W5PEG, 201 Meadowbrook Dr., Hot Springs, AR 71913.

WWV RECEIVER $35, RF Sig-Gen 80kc to 60mc $30, Hickock Tube tester $30, Audio Sig-Gen $35. K6KZT, 2255 Alexander, Los Osos, CA 93402.

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BURGLAR ALARMS–BOOMING BUSINESS. Easily learned. GET IN NOW. Starting information $2.00 (redeemable with purchase). SECURITY ELECTRONICS INTERNATIONAL, P.O.B. 1456-AQ, Grand Rapids, Michigan 49501.

WANTED: Heath 1100 or 4100 counter. Fred, Box 706, Orange City, FL 32763.

PRE-TUNED five-eighths-wave two-meter magnet-mount antennas, $19.95 complete plus $3.00 shipping. Write for catalog page. George Shira, Rt. #7 Box 258, Anderson, SC 29624.

SELL–TRADE: Everything in ad $25 plus postage. Three identical offers available. 80–40 QRP one-transistor transmitter, 5 assorted variable capacitors: xmitting, broadcast, midget types; following 2 each: ceramic 813 sockets, 3700 kHz FT-243 xtals, AC relays, PL-259–S-239 coax connectors, 88 mH toroids. Joe, 2748 Meade, Detroit, MI 48212.

HELP! Need Heath Sixer. Must be unmodified in working condition. KA5QKU.

WANTED for HALLICRAFTERS SR2000 HURRICANE, SWR MODULE for HA20 DX UNIT. Would appreciate any info for obtaining same. A. Morriss, G4GEN, Pippingford Park, Nutley, Sussex, England.

All *QST* issues 1965 to 1976. All *CQ* issues 1945 to 1963. Make offer. June Wheeler, Silver Lake, WI 53170. Phone 414-889-4240 evenings.

TELEGRAPH and wireless keys wanted. The older the better. Old ads and publications on keys also wanted. Dick Randall, K6ARE, 1263 Lakehurst Rd., Livermore, CA 94550.

HARK HOTLINE: Recording Radio Amateur recollections. Weekends. Brief, 1-(612) 874-9561.

TEN-TEC "Delta" Transcvr; AC Pwr; Speech Processor; JC255a 2M Trcvr; 2M Quad Ant.; Clipperton L Linear. Write for list & prices. L. Basham, W7TCT, 735 Caves Hwy., Cave Junction, OR 97523.

TRADE: Teac X-7 Open Reel recorder, Pioneer Turntable, J. C. Penny Cassette Deck, Magnavox 50 Watt Tuner for Ham Gear. UR list and description gets mine. Bruce Vaughan, N5GIY, Box 203, Springdale, Ark. 72764.

FOR SALE: Swan 600T & 600R with manual, Swan 350C 10–80 manual, Swan 350A 10–80 manual, FT-101 10–80 manual, IC-230 146–148 mike and manual, Midland 500C 12 channel 2 mtr rig and manual. Send SASE for more info to: P.O. Box 518, Whitehouse, FL 32220.

TS820S, VFO-820, CW filter, manuals $650. Butternut HF6V with HD 160 meter coil $110. HW8, needs works $50. KE2N, G. Skloot, 2923 Mandalay Beach Road, Wantagh, NY 11793 (516-221-3535).

WANTED: Kenwood MARS-7600 adapter. C. T. Huth, 130 Hunter St., Tiffin, OH 44883.

SALE: 30L1, mint, $500, pick-up. E. Erickson, W2CVW, 343 Catherine St., So. Amboy, NJ 08879.

SALE: 5B Dipole $40, SB33 xcvr. $135, DX60 cw xmtr. $70, HG10B VFO $37, both $100, R4B/MS4 $175, Radioshack rotator/control & cable $35, Heil Equalizer $45. Jerry, W8MEP, 123 Forest, Pacific Grove, CA 93950.

SALE: Ham CW Station, Heath HX1681, HR1680, PS 23, with spare finals and manuals, $100.00 pick up or pay for shipping. KA2EIO.

ANTIQUES: Sodium rcvr, Howard 430 Hallicrafter S38, Knight rcvr, Supreme 89 tube tester, Lafayette 6mtr transver, etc. List for SASE. WB8HTL, 4394 Urban, Cleveland, OH 44121.

TWO-METER SSB ICOM IC-202 PORTABLE, with mic, original IB, and custom leather handle ready for service, $150 postpaid. Tom Nodst, 1812 Neihardt, Branson, MO 65616 (417-334-8076).

RAYTHEON 4D32 Transmitting Tubes only $30 each. Classic rare Sangamo mica transmitting capacitors, dollar each, 40-year collection vacuum tubes, receiving types, only dollar each. Trade test equipment for Machinist tools. W5QJT, P.O. Box 13151, E. P., TX 79913.

KENWOOD TS-520 w/remote VFO-520. Orig owner, perfect condx, full doc. 110/220/12 volts, CW filter, attenuator. $485 for both. K1VR, 6 Willarch Rd., Lincoln, MA 01773 (617-259-0088, work: 617-899-1025).

FOR SALE: Tempo One with AC 1 power supply in good condition with manual, $200.00. KØHQW, Tort Isaacson, 65 Dellbrook Ct., O'Fallon, MO 63366.

TRADE: Mint ICOM IC-720A with IC-SM5 Mic (no power supply) for 55 to 75 foot crank-up free-standing tower. Rich Wertman, New York, 716-434-3988.

QSX the Grupo Argentino de CW Radiobulletin each Tuesday at 0000Z on 3.524 kHz. Reports to GACW, C. Diehl 2025, Longchamps, BAs. Arg.

WANTED: Pickett N4ES, Omron 12SR, Corvus 500, APF Mark 55, HP32E, etc. State condition and price. K3RCF, Wm. Adams, P.O. Box 1467, Springfield, VA 22151.

HALLICRAFTERS SX101A Rec, HT32A Trans, HT33A Amplifier, New Spare PL172, mike, manuals, pick-up only, $495. J. Wasiewicz, 229 Sarles Lane, Pleasantville, NY 10570.

BIG SQUIRREL CAGE FAN, $15. Don Bishop, NØEA, 5625 S. Sycamore 102, Littleton, CO 80120 (303-794-5067).

SELL: ROBOT 400 SSTV $280; Private Patch II Autopatch $340; Daiwa CN540; phone 415-883-2719.

WANTED: Operator/Service manual(s) for an SBE-33 Txcvr, or borrow one to copy, or will pay reasonable cost 4U to copy if contacted first. OK CallBks K9GTQ.

FOR SALE: D-104 Silver Eagle mike, chrome w/preamp in base $40, Heath VTVM model IM-28 with RF probe $25. WØULU, Fred, after 0100Z 612-459-4643 or callbook address.

ALPHA OWNERS: New Eimac 8874 tubes, $160. Mint KWM2A, round, $695, W9ZR, 1-414-434-2938.

SELL: Used equipment, reasonable, SASE for price list. Joe Bedlovies, 241 Dover St., Bridgeport, CT 06610.

FOR SALE: Kenwood TS520S with 1.8 MHz and 500 Hz filters installed. Spare 2.4 MHz filter. $350.00. N7FKE, 119 Dungeness Bay Blvd., Sequim, WA 98382. (1-206-683-7328).

FOR SALE: Ham Key Iambic Paddle with cord, mint, $10. Alliance Tenna Rotor lite duty $15. WA6HYB Callbook.

CURTIS KEYER, Model EK 480M, wanted, plus a vertical Vibroplex. Dick Randall, 1263 Lakehurst Rd., Livermore, CA 94550.

NAVY-TYPE RCK Radio Receiver, RCA reconditioned, 115–156 MHz AM, Mint Condition, Best Offer. Robert W. Boyd, Box 793, Stn. "A", Montreal, Quebec, Canada H3C 2V5. Tel: (514) 481-4830 after 18:00 hrs.

GONSET GSB 210 Linear Amplifier, $150 plus UPS. J. Wasiewicz, 229 Sarles Ln., Pleasantville, NY 10570.

WANTED: Ham Rotor, M or II or T2X, etc. State condition and price. N8DJB in Callbook or call Craig at 419-352-4465.

HARK HANDBOOK, radio anecdotes, passive, and regen rcvrs. SASE. Timm, 2308 Garfield #304, Mpls., MN 55405.

NATIONAL RADIO CO. equipment, manuals, price list SASE. Dust covers. NCX 3 or 5 plus NCX A, pair $8.95 p.p. Maximilian Fuchs, 11 Plymouth Lane, Swampscott, MA 01907.

PLEASE SEND your club newsletter for my collection. Don Bishop, NØEA, 5625 S. Sycamore 102, Littleton, CO 80120.

FOR SALE: TRS-80 Color Computer 2 upgraded to 64K, w/ manuals and 2 games, $175. Howard Halperin, 4122 W. Flower St., Phoenix, AZ 85019.

FOR SALE: Kenwood TR-2400 $150 or B/O; 28ASR with Flesher 170 TU $300 or B/O (pick up). Stew Davis, K1KTB, 135 Grissom Rd., Manchester, CT 06040.

WANTED: TM11-5820-287 manual on TRC-24 equipment or AM912-TRC RF amplifier diagram. W4LRR, 234 Elden Drive N.E., Atlanta, GA 30342.

SELL: DL-QTC (German); Boonton 260A Q-meter; Gen. Rad. 650A imp. bridge; H.P. X532A freq mtr; H.P. X485B det. Paquee, 53 Jerome Ave., Trumbull, CT 06611.

HEATH GR-54 Receiver, 200 kHz–30 MHz, $50.00. Richard T. Yerian, KE4YC, 849 New Castle Court, Cary, NC 27511 (919-481-1794).

CQ MAGAZINES: Feb. 1946 thru Dec. 1947, 23 issues for $23. You pay postage. Include SASE. Nate Williams, W9GXR, 6915 Prairie Drive, Middleton, WI 53562.

COLLINS 310B exciter, mint, original manual and all coils, professionally TVI proofed, $100. W1WAI, David Allen, 22 Saxony Dr., Sudbury, MA 01776 (617-443-9867).

CLIPPERTON L $390, TEN-TEC 229 2KW Tuner #170, SWR/PWR meter $25. Perfect. All cartons, manuals. Tom Redmon, KC4NX, 404-923-8202.

FOR SALE: (2) Eimac Transmitting Tubes type: 8875, $50 each. RCA Transistors DCV power-supply type WP-704B, $25. Simpson Model 311 VTVM (22MG, impedance) with H.V. & RF PROB, $35. W. D. Shevtchuk, 1 Lois Avenue, Clifton, NJ 07014 (phone (201) 471-3798).

CRYSTAL WALKIE TALKIES WANTED: Hy-Gain 3086 and Midland 13-520. Jim, 121 Hilton, Elgin, IL 60120.

LIKE NEW ICOM 730 with CW narrow filter and power supply, $595. Bill, N6JPH, 415-839-3837.

WANTED: TEN-TEC Argonaut CW/SSB rig with power supply or other small rig. WB4CVH/IT9, Don Trayes, Box 127 Security, FPO NY, NY 09523.

WANTED: Pre-1950 bugs and Spark keys for my collection. Vibroplex, Martin, McElroy, Marconi, DeForest, etc. K5RW, Neal McEwen, 1128 Midway, Richardson, TX 75081.

HEATHKIT GENERAL CLASS COURSE, new condition, u-ship $30. KA3LNN, Gary Pirkkala, 321 E. Northview Ave., New Castle, PA 16105 (412-654-6202).

6M AMP 2–10 in 120W out FM $125; ICOM VHF portable mobile bracket $25; Lafayette HA-600A 0.15–30 MHz solid-state receiver $95; all ppd. Tom Nodst, 1812 Neihardt, Branson, MO 65616 (417-334-8076).

HEATH HR1680 w/spkr $125 and HX1681 w/p.s. $250. All mint cndx w/manuals. Both $350. Will ship. N8EUD 216-836-8647.

ANTENNA TUNER Tokyo Hi-Power model HC-2000 $200. UPS collect, never used, sacrifice. W5RIT, Rt. 2 Box 113, Fayetteville, AR 72701.

WANTED: Used microwave equipment. D. Mitchell, K8UR/1, 1 Cider Mill Lane, Upton, MA 01568 (617-529-4638).

WANTED: Operating and maintenance manual for Johnson Valiant Transmitter. James E. Groll, 1137 West 10th Pl., Mesa, AZ 85201 (602-834-0422).

REBEL broadcasting info. Subscribe to the Clandestine Confidential Newsletter, $10, $13 foreign, US funds, 6 issues. G. L. Dexter, RR4 Box 110, Lake Geneva, WI 53147.

WANTED: Marine Xcvr for 160M; Ameco R-5 solid state rcvr and AT-1 Xmtr. Winston, K4CWQ, P.O. Box 1143, Carrollton, GA 30117.

KENWOOD 520SE w/cw filter $380, MC-50 mic $15, Ham Keyer HK5A w/batt $35. I ship all UPS. Chet Peugh, RR2 Box 144, Chadwick, IL 61014 (815-225-7810 eves).

SWAP my mint Hammarlund HQ-180AC for your equally-mint R-390A. Box 874, Kankakee, IL 60901.

FOR SALE: 4CX250R tubes, new, $12.50 each. Rick Thompson, 626 Valkyie, KI Sawyer AFB, MI 49843.

TS820 with CW filter and VFO-820, manuals, excellent $650. TRS-80 Model I Level 2 16K Computer with monitor, tape drive, and software $395. Local only. G. Skloot, KE2N, 2923 Mandalay Beach Road, Wantagh, NY 11793 (516-221-3535).

SELL: New Drake Aux-7/3 modules, $35. New ICOM IC-HM8 mike, $30. Avanti 2m glass-mount ant, $20. Heath 1390 digital thermometer, $35. KØMK, 690 Vermilion Trail, Gilbert, MN 55741.

NEW RG 164 COAX 75 OHM Low Loss, 1/2 that of RG8U, rated at 10,000 watts, 150' roll $75.00, shipped freight collect. W. R. Hempkins, Rt. 1, Box 273C, Denison, TX 75020.

WILL SELL OR TRADE my mint Hallicrafters SX101-A receiver with speaker for $100. OR make offer, ie. Apple software, guns, ham gear, old radios, etc. KCØUM, 623 N 4th St., Wahpeton, ND 58075.

FOR SALE: Hy-Gain 18AVT/WB trap vertical antenna, 10 to 80 meters, still in box, $70. Charles O'Daniell, 2823 Toehill Cove, Memphis, TN 38128.

HEWLETT-PACKARD Model 606A Signal Generator, 50 kHz to 65 MHz, for Communication Equip. Servicing, $165 or Trade. A Emerald, 8956 Swallow, Fountain Vly, CA 92708, phone (714) 962-5940.

WANTED: Power transformer for Heath Monitor Scope HO-10. Mike Herbstman, KM2F, 345 East 52 St., NY, NY 10022 (212-371-2488).

HEATH SENECA 6 & 2 TX VHF-1 $50. RME 10-20 Conv. (1949) $30. Clem Duval, W8VO, 33727 Brownlea, Sterling Hgts., MI 48077 (1-313-268-2467).

REDWOOD EMPIRE AWARD: Work five Northern California Coast counties for attractive award. $2.00 and GCR list to Redwood Empire DX Asso., Box 4881, Santa Rosa, CA 95402.

WANTED: Yaesu FR-101 SD or D receiver and Teletype "Windfall" enclosure. C. T. Huth, 130 Hunter St., Tiffin, OH 44883.

FOR SALE OR TRADE: 8877/3cx1500A7 full specs when removed. Best offer over $200 or trade for 4-572B's in good shape. Bernie, WDØGMD, 701-774-8001 daytime.

FOR SALE: NATIONAL NC-101x with matching 10" speaker. Make an offer. Good shape, works great. Bernie, WDØGMD, 701-774-8001 daytime.

FOR SALE: Swan 600 transmitter and 600 receiver. Swan 350C with PS and manual. Swan 350A with built-in ac/dc, also has manual. IC-230 with manual and mike, covers 146–148. Midland 13-500 covers 144–148, has eight (8) sets of crystals, comes with mike and manual. Lafayette receiver, covers 6–80 meters, has manual. FT-101E covers 10–160 with mike and manual, wrks only on a/c. For more info send SASE to P.O. Box 518, Whitehouse, FL 32220.

WANTED: Omron 12SR, Pickett N4ES, Corvus 500. State condition and price in first letter. K3RCF, Wm. B. Adams, P.O. Box 1467, Springfield, VA 22151.

WANTED: Hammarlund SP-600-J, JX-26, JX-27, SX-73 (Hallicrafters). Sloan Million, 102 Ithaca, Colorado Springs, CO 80911 (303-392-5605 eves).

WW II Collectors: Japanese back-pack rcvr, 300 to 5800 kc w/5 plug-in tuning units, gd cond., headphones incld. Trade for 2m PLL T/R or offer. W6NHT, 1700 Pine St., Martinez, CA 94553.

ICOM 4AT w/PL-CTCSS dip switch, $180. Don Bishop, NØEA, 5625 S. Sycamore St. #102, Littleton, CO 80120.

CLANDESTINE CONFIDENTIAL NEWSLETTER: Latest info on secret broadcasters. Six issues $10 US, $13 foreign, US funds. RR4 Box 110, Lake Geneva, WI 53147.

HA-600 Lafayette rcvr., solid state, AM, SSB, CW, 150 kHz to 30 MHz, exel. condx. $70, I ship. Pete Carron, 205 Ridgewood Rd., Easton, PA 18042.

CQ MAGAZINES: Jan. 1948 thru Dec. 1949, 24 issues for $25. You pay postage. Include s.a.s.e. Nate Williams, W9GXR, 6915 Prairie Drive, Middleton, WI 53562.

HEATHKIT HR-1680 Receiver with matching speaker and all manuals, $95. Richard Van Aernum, NØEEG, 5295 Hampton St. N.E., Prior Lake, MN 55372 (612-445-7508).

KENWOOD TS-520S, factory alignment, new finals, $400. TS-520SE $375. Both absolutely mint. Manuals. Both $725. W2HWS 516-653-4714.

FOR SALE: 300 Pots (VOL controls) $75, not used, plus UPS Transformers—output, audio, power, etc. Local area. T. Wojciechowski, 97-30 92nd St., Ozone Park, NY 11416 (718-843-6444).

COMMERCIAL-GRADE steatite antenna insulators 2" 20/$5, 4½" or 7" 8/$10. 4-wire xmsn line 10/$10. Add UPS. J. M. Etter, W2ER, 16 Fairline Dr., E. Quogue, NY 11942.

ICOM 730, CW filters, scanning mike, mobile mount, like new, best offer. Alan, WB2DZW, 27 East 65, Apt. 5D, New York, NY 10021 (212-879-7991).

CANADIAN HAMS Heath HR-1680 rcvr, HS-1661 spkr, HW-8 xcvr, HD-1250 dipper, SA-5010 uMatic Keyer. Robert W. Boyd, Box 793, Stn. "A", Montreal, Quebec, Canada H3C 2V5. Tel: (514) 481-4830 after 18:00 hrs.

WANTED: Good 572-B tubes. KØHQW, Tort Isaacson, 65 Dellbrook Ct., O'Fallon, MO 63366.

DRAKE FL250 $30, 4NB unable adjust $30, RME 23A nice $25, DK60 G2C coaxial relay $25, Henry 2K FC30A $7, all prepaid 48. Jack, W7CNL, 3708 Hawthorne Dr., Boise, ID 83703.

HALLICRAFTERS S38D $30, S38E $35, SX86 $70, SX101-M3 $95, S118 $45, HT-32 $95, HT-37 $125. K6KZT, 2255 Alexander, Los Osos, CA 93402.

FOR SALE: Signal One CX7A with spare final and manuals $595. Motorola MX-320 UHF hand-held portable with desk charger and new spare battery $495. John P. Alexander, K6SVL, 28403 Covecrest Drive, Palos Verdes, CA 90274. Phone (213) 377-3807.

YAESU FL-2100B Amplifier, 80–10 meters, mint condition, $300. Ken Claerbout, KE9A, Star Rt. 1 Box 16, Remington, VA 22734 (703-439-8750).

WANTED: 220 MHz rig FM. Also VHF/UHF Amps & Antennas. Clem Duval, 33727 Brownlea, Sterling Hgts., MI 48077.

SELL: Used equipment, reasonable, SASE for price list. Joe Bedlovies, 241 Dover St., Bridgeport, CT 06610.

MFJ-408 keyer or Curtis keyer Model EK 480M wanted. Dick Randall, K6ARE, 1263 Lakehurst Rd., Livermore, CA 94550.

PLEASE SEND me your club newsletter for my collection. Don Bishop, NØEA, 5625 S. Sycamore #102, Littleton, CO 80120.

FT227R Yaesu Memorizer with manual $190. Non-functioning rotor $25 (no shipping, pick up only). Gabe Gargiulo, 160 Elm Street, North Haven, CT 06473.

FOR SALE. Swan 500-C transceiver with AC/DC power supply. Mint condition. Used less than 24 hours. Make offer. Dr. Jack M. Williams, 902 Anderson Drive, Fredericksburg, VA 22405, Telephone: (703) 371-5474.

DAIWA RF440 processor, mint $55; SABTRONICS Model 2000 LED Multi-meter (I built) $50. WANT: EIMAC 3-500Z new. Brad, KA3R.

ELDICO: Transmitter, receiver, ACPS, console (copy of Collins S-2 line) $250. 75S3, 32S3, 516F2, 312B4 $750. W1FBG 603-964-6858.

FOR SALE: Yaesu FT-101B with sp. patch & DC PWR cord, $350 excellent! WANTED: FC-107, SP-107P, FTV-107R. KA7TVT, Lyndel (406) 587-0508.

YAESU 901DM with filters, new tubes, and extra set tubes. All-band FM. FV101Z, external VFO. FC102 antenna tuner. All 3 and manuals. Excellent condition $1095. N8FKD, Frank Phillips, 4926 Fairview, Newton Falls, OH 44444 (phone 216-872-7755).

WANTED: Large Prop-Pitch Motor, must be in good working condition, no junk. W9ZEN, 124 North Glen Ave., Oglesby, IL 61348.

WANTED: Complete construction book and operating manual for Heath Marauder (HX-10) SSB transmitter. If you have these for sale I will buy them. If you have them and I can copy them—that too will be great. Please write: Dr. Jack Williams, 902 Anderson Drive, Fredericksburg, VA 22405.

DRAKE T4XC, R-4C with filters and noise blanker AC-4, MS-4, excellent condition, $550. Rich, AD6X, 866 Yolo Way, Livermore, CA 94550 (415-447-7287).

FOR SALE: Swan 500C with power supply $325. Also Bearcat 101 Scanner w/DC adapter $125. I will ship in Continental US. KA5ORV, 1901 N. Brown E-4, El Paso, TX 79902.

YAESU FT-901, FV-101Z Remote VFO, SP-901 Speaker/Patch, CW Filter, MINT condition. $700. K4XG, Tom Neill, 1525 Crockett Hills, Brentwood, TN 37027 (615-790-2610).

WANTED: 1947, 80, 81, 82, 83 ARRL Handbooks. June 47 QST. All Collins literature for open library. WØRLM, 505 Laredo Rd., Papillion, NE 68046.

SALE: Kenwood TS-530S with CW filter, SP-230, MC-50 mike, mint, $580. MFJ-941C, $60. HD73 rotator, new in box, $75. KF4CR, 205-881-8156, after 6 PM CST.

NEW IC-751 and IC-271A. $1,500.00 Takes Both. Make Offer on either. KG6SL, Thompson, Box 513, Saipan, CM 96950.

RF POWER LABS S.S.H.F. linear/ACPS Model A-1000, 160–15M $850. Collins SC101, etc., complete (75A4/KWSI) $500. F455J-15/I455J-21, $85 each. J. W. Craig, 32 Birchwood Drive, Rye, NH 03870.

KENWOOD TR 7950 $285; Kenwood KPS12 $65, U-ship, excellent condition. KA3LNN, Gary Pirkkala, 321 E. Northview Ave., New Castle, PA 16105 (412-654-6202).

PRECISION E-400 Sweep Generator $25, E-200 Marker Generator $20. Heath Mohican Receiver $15, Capacitor Test Set $18. K6KZT, 2255 Alexander, Los Osos, CA 93402.

FOR SALE: *CQ/Ham Radio/QST/73* magazines @ 35¢ (thru 1975) and 50¢ (1976-up) each, including shipping. W6LS, 2814 Empire, Burbank, CA 91504.

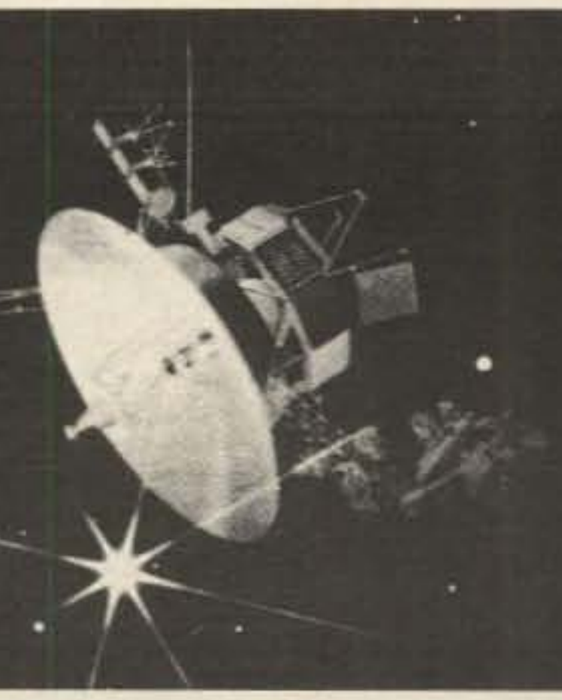
64K COMPUTER SYSTEM, Sinclair ZX-81, Memotech 64K RAM, parallel print I/F, MEMOTEXT eprom word processor, 9"monitor, Q-Save & MUCH tape software $250 ppd. Tom Nodst, 1812 Neihardt, Branson, MO 65616.

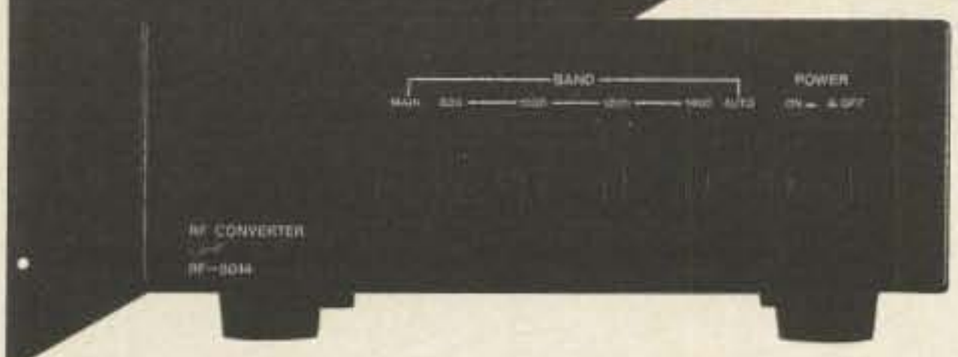
WANTED: Ranger meter and modulation transformer. Con Helber, KØRAX, Star Route 1, Box 96, Middle Brook, MO 63656.

UNINTERRUPTED FREQUENCY COVERAGE
100KHz~1.4GHz with RF CONVERTERS for SX-400 SERIES

SCANNING MONITOR RECEIVER

FIRE · EMERGENCY · MARINE · AIR · SPACE INFORMATION · BUG DETECTOR

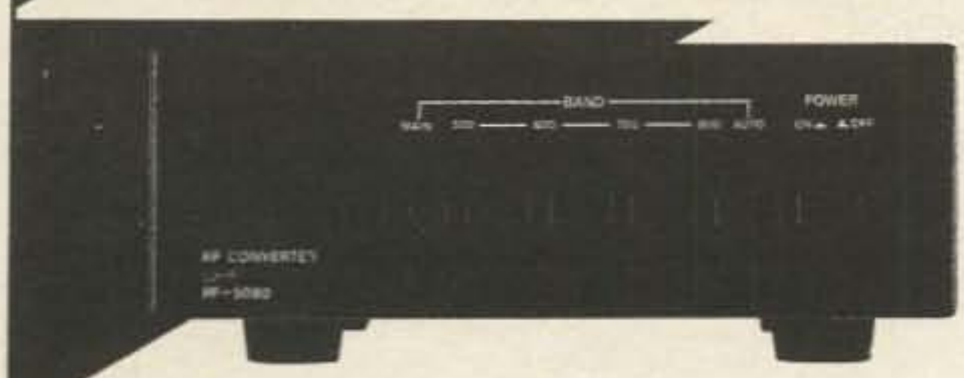




RF-8014 DOWN CONVERTER

800MHz~1.4GHz RF converter for SX-400

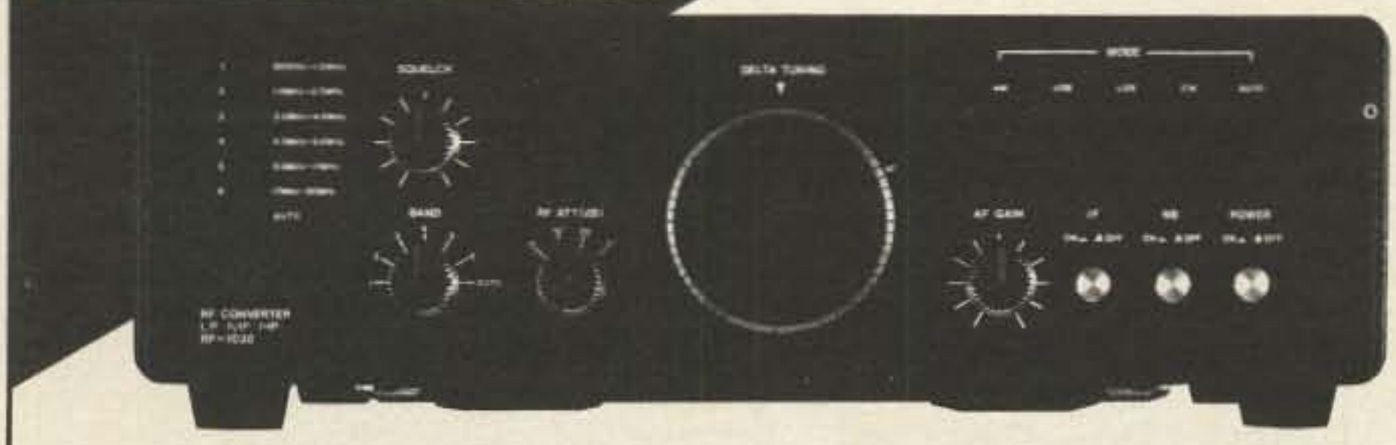
●Bands: •MAIN (to cover 26~520MHz with SX-400)•800MHz~1.0GHz•1.0GHz~1.2GHz •1.2GHz~1.4GHz•AUTO (Automatic control of RF-8014 with an external computer, etc.) ●Frequencies shown in SX-400 display: 500MHz lower between 800MHz~1.0GHz, 700MHz lower between 1~1.2GHz, 900MHz lower between 1.2~1.4GHz. ●Individual Band Switches and LED Indicaters. ●Current Drain: 250mA (approx.) ●Accessories: 1 BNC/M-adapter, 1 Cable with BNC terminals ●Dimensions: W.148×H.51×D.225(mm)



RF-5080 DOWN CONVERTER

500~800MHz RF converter for SX-400

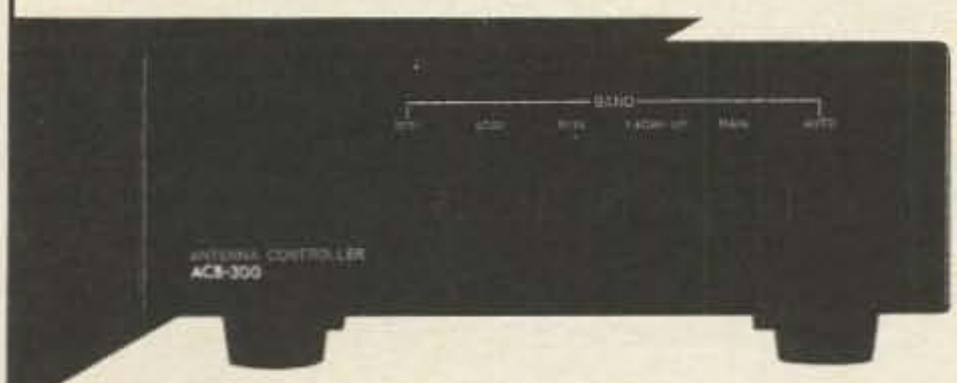
●Bands: •MAIN (to cover 26-520MHz with SX-400)•500~600MHz•600~700MHz•700~800MHz •AUTO (Automatic control of RF-5080 with an external computer, etc.) ●Frequencies shown in SX-400 display: 300MHz lower between 500~600MHz, 400MHz lower between 600~700MHz, 500MHz lower between 700~800MHz. ●Individual Band Switches and LED Indicaters. ●Current Drain: 250mA (approx.) ●Accessories: 1 BNC/M-adapter, 1 Cable with BNC terminals, ●Dimensions: W.148×H.51×D.225(mm)



RF-1030 UP CONVERTER

100KHz~30MHz RF converter for SX-400

●Bands: (1) 100KHz~1MHz, (2) 1~2MHz, (3) 2~4MHz, (4) 4~8MHz, (5) 8~17MHz, (6) 17~30MHz•AUTO (Automatic conrol of 6 bands of RF-1030 with an external computer, etc.) ●Frequencies shown in SX-400 display: 50MHz higher on all bands than the frequencies received. ●Individual Mode Switches and LED Indicaters: AM, USB, LSB, CW, AUTO•CW filter (optional) required for CW reception•AUTO—Automatic Control of modes of RF-1030 with an external computer, etc. ●Band Switch and LED Band Indicaters, Squelch Control, RF Att., AF Gain Control, Delta Tuning, IF ON/OFF Switch, NB (Noise Blanker) Switch. ●Current Drain: 1A (approx.) *Power Supply Unit P-1A (optional) required for RF-1030. ●Accessories: 1 BNC-M-adapter, 2 Cable with BNC terminals ●Dimensions: W.300×H.90×D.233(mm)



ACB-300 ANTENNA CONTROL BOX

Manual and Automatic antenna control system for SX-400 series RF converters

●Individual Band Switches and LED Indicaters: 1030, 5080, 8014, 1.4GHz UP (for reception of 1.4GHz above) AUTO (Automatic control of antennas for RF-1030, RF-5080, RF-8014 and for MAIN scanner) ●Current Drain: 50mA (approx.) ●Accessories: 1 Cable with BNC terminals ●Dimensions: W.148×H.51×D.225(mm)

SX-400

26~520MHz General Coverage Scanner

●Wider Coverage (100KHz~1.4GHz or above) with RF converters (optional). ●Computer controlled memory channel expansion (unlimited), High-Speed reprogramming, Record of Frequencies and Time, and all functions remote controllable with RC-4000 Interface (optional). ●20 memory channels, Momentary recall of any memory channel. ●Continuous normal and limit search without interruptions by birdies. ●Stop Mode Switch for scan or search of modulated signals. ●Quick search of the most important frequency with Priority. ●Selective FM Narrow/Wide Switch for FM/TV listening. ●Variable Delay Control (0~4 Sec.) ●Current Drain: 1A (approx.) ●Dimensions: W.300×H.90×D.233(mm)

RC-4000 DATA INTERFACE **Control of SX-400 series Scanner and RF Converters through Computer.**

●Direct system for NEC 8801A computer. ●High-Speed Reprogramming of 20 channels. ●Scan of unlimited channels stored in computer. ●Record of Frequencies and Time of signals received. ●Automatic Control of Bands and Modes of RF converters and ACB-300.

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FOR SALE: SWAN SWR PWR meter, new, $15. Telex Procom 400, new, $35. FT202R, mint, $90. KAØJDS, 8375 Atlas Ave. S., St. Paul, MN 55075.

WANTED: Used ICOM IC-551 and Drake speech processor. WA4FCC, Johnny E. Carr, Route #2, Rockmart, GA 30153.

YAESU FT-901DM xcvr. with CW filter, extras; FV-901DM VFO, SP-901P spkr/patch. All mint, low hours, $750. KB3TN, (215) 698-2627 eves.

FOR SALE: Cobra 142 GTL AM/SSB base, one year old, GOOD condition, $300. R. Pack, P.O. Box 505, Somerville, TX 77879.

HELP! To keep in touch with my family, a Venezuelan student needs donation of equipment. CB's with SSB are also accepted. R. Lopez, YV1DWO, 1409 Oak St., Melbourne, FL 32901.

FOR SALE: Wilson 1402 2m HT w/leather case $125, Genave GTX-200 $100, GBC B/W cameras $75, call WA6BLB (209) 733-4417.

NEW NOVICE NEWS in Radio Archives. Sample $1. "WAS" net proposed. TIMM, KA@TPZ, 2308 Garfield #304, Minneapolis, MN 55405.

FOR SALE: Heathkit HW101, HP23PS, HS1661 SPKR, and mike. All manuals, exc. cond., $325. Will ship UPS. G. Mead, N5DBW, 7726 Sage Oak, San Antonio, TX 78233.

CANADIAN HAMS: Heath HR-1680 RCVR, HS-1661 SPKR, HW-8 XCVR, HD-1250 Dipper, SA-5010 Umatic Keyer. R.W. Boyd, Box 793, STN "A", Montreal, Quebec. Phone (514) 481-4830 after 18:00 hrs.

WANTED: Copies of Herzberg's *So You Want To Be A Ham* and Morgan's *Boy's First* (and second) *Book of Radio and Electronics*. WB8IPG (313) 362-2706.

CLIPPERTON L 2KW LINEAR $390. TEN-TEC 2KW TUNER $170. Both perfect, original cartons, manuals, cables. Tom Redmon, KC4NX, 404-923-8202.

I WILL TRADE my programmable scanner for a Siltronix, Tempo, Yaesu, Swan, etc., Transceiver with eleven meter capabilities. Mark Bills, P.O. Box 116, Mystic, IA 52574, phone 515-647-2839.

WANTED: YAESU YO-901 Multiscope with optional bandscope. KA6SDZ, 6426 La Punta Drive, Hollywood, CA 90068, phone (213) 465-6844.

FOR SALE: 4CX250R TUBES, new, $28 each, I ship. Rick Thompson, 626 Valkyrie, KI Sawyer AFB, MI 49843.

FOR SALE: Hallicrafters SX-101-A receiver with speaker, $100 or will trade for almost anything. Wanted: Horn Speaker. KCØUM.

HELP: Please donate old books, cassettes, equipment, and parts to our amateur radio/SWL program. Mr. G. Skloot, KE2N, c/o JHS 180, 320 B. 104 Street, Rockaway Park, NY 11694.

B&W AC 3.5–30 broadband 10–80 meter folded dipole, $85.00. Gary, KA3LNN, (412) 654-6202.

FOR SALE: NEW DRAKE L-7 2kW linear, 160–15 meters, less tubes and power supply, $800. K4PFK, Roger Smith, 4920 Liles Road, Raleigh, NC 27606. Phone (919) 851-4280.

FOR SALE: Swan 600T and R with manuals, Swan 350C with PS, Azden 10 FM, Midland 2 meter, IC-230 with mike and manual, FT-101E with manual. More info send SASE to P.O. Box 518, Whitehouse, FL 32220.

COLLINS KWM 380 w/extra freq. Like new. Call or write Ed Connolly, WB5NRX, Ph. 504-467-9030, address 717 N. Upland Ave., Metairie, LA 70003. Best reasonable offer.

STEAL: Mint ICOM 720A, $550, M.O. or certified check, you pay postage. Bob Dodt, Jr., MWCS-18, 1st MAW, FPO, San Francisco, CA 96603.

DRAKE 1000LP Filter $10, H.P. Audio Signal Generator $30, R.F. Signal Generator 80kc to 60mc $30. SASE for list. K6KZT, 2255 Alexander, Los Osos, CA 93402.

TRANSCO Coaxial Switches & Relays—Sell/Trade. Want—Vacuum Relays and Vacuum Capacitors. A. Emerald, 8956 Swallow, Fountain Valley, CA 92708.

HELP! Need schematic for Navy RF amp model AM-1365/URT. W2ZPO, 284 Vly Rd., Schenectady, NY 12309.

WANTED: Heathkit HW-2036 2 meter transceiver unassembled or assembled. Price negotiable. Call evenings at 1630 hrs to 2200 hrs. MST, 602-966-7511, N7FTX.

KENWOOD TS-520SE, CW filter, Fox Tango 1.8 SSB filter, external 520S VFO, SP-520 speaker, new finals, manuals, no scratches, exc. condition. Will ship in original cartons, $425 firm. Harold Hollenbach, 8146 Spruce Dr., Harrisburg, PA 17111.

FOR SALE: Speech Processor. Drake SP75 processor. Used very little and in mint condition. Best offer above $50. Mitch 201-566-4643 evenings.

WANTED: Ten-Tec 505/509, Hammarlund HQ-145 receiver, addresses of international WPE callsign holders for new club. Don Trayes, WB4CVH/WPE3FNB/IT9, Box 127, FPO NY 09523.

WANTED FOR Apple II: Manual for *The Data Factory* by Microlab. Will cover costs. Also any info on digital displays for TR-4. KA1BFV, 31 Duane Ln., Burlington, CT 06013.

WANTED: Collins 312B-4 Speaker Console for S-Line. State condition and price. Nate Williams, W9GXR, 6915 Prairie Drive, Middleton, WI 53562.

WANTED: Drake 2-CQ speaker/Q-multiplier. Max Cornell, KØMC, 6322-A Ibis Ave., Ewa Beach, HI 96706, phone 808-499-1324.

ELMERKIT SURVEY* SASE. TIMM, 2308 Garfield #304, Minneapolis, MN 55405.

WANTED: ARRL Handbooks, 1926-1930. Contact 884 Capitan Street, Thousand Oaks, CA 91320, phone 805-499-1713.

WANTED: HRO/RAS rackmount coil can. I.F. plug-in unit complete for R390. Bearcat Scanner Model IV. K1GVA, 61 Warwick, Portland, ME 04102.

VERTICAL VIBROPLEX wanted. Dick Randall, K6ARE, 1263 Lakehurst Rd., Livermore, CA 94550.

SELL: HALLICRAFTER SX-17 Super Skyrider general communications receiver with matching 12 inch speaker, $50. W2KZT, 70 Mitchell Ave., Poughkeepsie, NY 12603, phone 914-454-4846.

WANTED: TEN-TEC 2591 2M HT. Will swap my ICOM IC-2AT (with TTP). WA9VLK, Box 874, Kankakee, IL 60901.

SELL: 40 year collection of tubes. Write for quotes and requirements for availability. Desperately need instruction manuals for Hallicrafters HT37, and SX-122A receiver. M. Levy, 4141 Krupp Drive, Apt. 1, E.P., TX 79902.

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Filter	Model	Center Freq. (KHz)	-6dB (KHz) Width
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SSB (PBT) XTAL	FL-30	9011.5	2.3
FM Filter	9M15A	9011.5	15 (-3dB)
SSB Narrow (Hygrade Crystal)	FL-44A	455	2.4
OPTIONAL FILTERS			
CW Narrow	FL-52A	455	0.500
CW Narrow	FL-53A	455	0.250
SSB Wide	FL-70	9011.5	2.8
CW Narrow	FL-32	9010.6	0.500
CW Narrow	FL-63	9010.6	0.250
AM	FL-33	9010.0	6.0

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