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Seasons Greetings

THE RADIO AMATEUR'S JOURNAL

TS-130S/V

"Small wonder"...speech processor, N/W switch, IF shift, digital display

The compact, all solid-state HF SSB/CW mobile or fixed station TS-130 Series transceiver covers 3.5 to 29.7 MHz, including the three new bands.

TS-130 SERIES FEATURES:

- 80-10 meters, including the new 10, 18, and 24-MHz bands. Receives WWV.
- TS-130S runs 200 W PEP/160 W DC input on 80-15 meters and 160 W PEP/140 W DC on 12 and 10 meters. TS-130V runs 25 W PEP/20 W DC input on all bands.
- Built-in speech processor.
- Narrow/wide filter selection on both CW (500 Hz or 270 Hz) and SSB (1.8 kHz) with optional filters.
- Automatic selection of sideband mode (LSB on 40 meters and below, and USB on 30 meters and above). SSB REVERSE switch provided.
- Built-in digital display.
- Built-in RF attenuator.
- IF shift (passband tuning).
- Effective noise blanker.

OPTIONAL ACCESSORIES:

- PS-30 base-station power supply.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter.
- YK-88SN (1.8 kHz) narrow SSB filter.
- AT-130 compact antenna tuner (80-10 meters, including three new bands).
- SP-120 external speaker.
- VFO-120 remote VFO.
- MB-100 mobile mounting bracket.
- PS-20 base-station power supply for TS-130V.

Optional DFC-230 Digital Frequency Controller
Frequency control in 20-Hz steps with UP/DOWN microphone (supplied with DFC-230). Four memories and digital display. (Also operates with TS-120S, TS-530S, and TS-830S.)

PS-30 SP-120 TS-130S VFO-120

SP-230 TS-830S VFO-230 AT-230

TS-830S

"Top-notch"...VBT, notch, IF shift, wide dynamic range

The TS-830S has every conceivable operating feature built-in for 160-10 meters (including the three new bands). It combines a high dynamic range with variable bandwidth tuning (VBT), IF shift, and an IF notch filter, as well as very sharp filters in the 455-kHz second IF. Its optional VFO-230 remote digital VFO provides five memories.

TS-830S FEATURES:

- LSB, USB, and CW on 160-10 meters, including the new 10, 18, and 24-MHz bands. Receives WWV.
- Wide receiver dynamic range. Junction FETs in the balanced mixer, MOSFET RF amplifier at low level, and dual resonator for each band.
- Variable bandwidth tuning (VBT). Varies IF filter passband width.
- Notch filter (high-Q active circuit in 455-kHz second IF.
- IF shift (passband tuning).
- Built-in digital display (six digits, fluorescent tubes), analog dial, and display hold (DH) switch.
- Noise-blanker threshold level control.
- 6146B final with RF negative feedback. Runs 220 W PEP (SSB)/180 W DC (CW) input on all bands.
- Built-in RF speech processor.
- Narrow/wide filter selection on CW.
- SSB monitor circuit to check transmitted audio quality.
- RIT (receiver incremental tuning) and XIT (transmitter incremental tuning).

OPTIONAL ACCESSORIES:

- SP-230 external speaker with selectable audio filters.
- VFO-230 external digital VFO with 20-Hz steps, five memories, digital display.
- AT-230 antenna tuner/SWR and power meter/antenna switch 160-10 meters, including three new bands.
- 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.
- (VFOs for TS-830S, TS-530S, TS-130 Series, and TS-120S are compatible with all four series of transceivers.)

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TRIO-KENWOOD COMMUNICATIONS
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Digital world clock with two 24-hour displays, quartz time base

The HC-10 digital world clock with dual 24-hour display shows local time and the time in 10 preprogrammed plus two programmable time zones.

R-600

"Now hear this"... digital display, front speaker, easy tuning

The R-600 is a high performance, general coverage communications receiver covering 150 kHz to 30 MHz in 30 bands, at an affordable price. Use of PLL synthesized circuitry provides high accuracy of frequency with maximum ease of operation.

R-600 FEATURES:

- 150 KHz to 30 MHz continuous coverage, AM, SSB, or CW.
- 30 bands, each 1 MHz wide, for easier tuning.
- Five digit frequency display, with 1 KHz resolution.
- 6 kHz IF filter for AM (wide), and 2.7 kHz filters for SSB, CW and AM (narrow).
- Up-conversion PLL circuit, for improved sensitivity, selectivity, and stability.
- Communications type noise blanker eliminates "pulse-type" noise.
- RF Attenuator allows 20 dB attenuation of strong signals.
- Tone control.
- Front mounted speaker.
- "S" meter, with 1 to 5 SIMPO scale, plus standard scale.
- Coaxial, and wire antenna terminals for 2 MHz to 30 MHz. Wire terminals for 150 KHz to 2 MHz.
- 100, 120, 220, and 240 VAC, 50/60 Hz. Selector switch on rear panel.
- Optional 13.8 VDC operation, using DCK-1 cable kit.
- Other features include carrying handle, headphone jack, and record jack.

OPTIONAL ACCESSORIES:

- DCK-1 DC Cable kit.
- SP-100 External Speaker.

R-1000

"Hear there and everywhere"... easy tuning, digital display

The R-1000 is an amazingly easy-to-operate, high-performance, communications receiver, covering 200 kHz to 30 MHz in 30 bands. This PLL synthesized receiver features a digital frequency display and analog dial, plus a quartz digital clock and timer.

R-1000 FEATURES:

- Covers 200 kHz to 30 MHz continuously.
- 30 bands, each 1 MHz wide.
- Five-digit frequency display with 1-kHz resolution and analog dial with precise gear dial mechanism.
- Built-in 12-hour quartz digital clock with timer to turn on radio for scheduled listening or control a recorder through remote terminal.
- Step attenuator to prevent overload.
- Three IF filters for optimum AM, SSB, CW. 12-kHz and 6-kHz (adaptable to 6-kHz and 2.7-kHz) for AM wide and narrow, and 2.7-kHz filter for high-quality SSB (USB and LSB) and CW reception.
- Effective noise blanker.
- Terminal for external tape recorder.
- Tone control.
- Built-in 4-inch speaker.
- Dimmer switch to control intensity of S-meter and other panel lights and digital display.
- Wire antenna terminals for 200 kHz to 2 MHz and 2 MHz to 30 MHz. Coax terminal for 2 MHz to 30 MHz.
- Voltage selector for 100, 120, 220, and 240 VAC. Also adaptable to operate on 13.8 VDC with optional DCK-1 kit.

OPTIONAL ACCESSORIES:

- SP-100 matching external speaker.
- HS-6 lightweight, open-air headphone set.
- HS-5 and HS-4 headphones.
- DCK-1 modification kit for 12-VDC operation.

SP-100 R-1000

HS-5

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CQ The Radio Amateur's Journal

ON THE COVER: Once again, via the talents of John Rogers, W2ADC, we look in on CQville during the holiday season. Wassail and happy holidays to all.

DECEMBER 1981 **VOL. 37, NO. 12**

FEATURES

DEPARTMENTS

Zero Bias

AN EDITORIAL

Well, the holiday season is upon us once again, and again we all have our wish lists out for Santa to fill. Whether it's a new piece of equipment or a new antenna, it's sure nice to wish and dream that this just might be the year you'll need that giant sized sock next to the fireplace.

December 1981 also marks the birthday celebration of the OSCAR program. It was only 20 years ago that the first OSCAR was launched at 2041 GMT on December 12, 1961. Starting as an idea by *CQ*'s Don Stoner, W6TNS, a satellite program was proposed utilizing amateur radio's vast technological resources. The name OSCAR was coined by Don, and he got the ball running for a Project OSCAR Committee, which led to the first launch 20 years ago. It sounds simple today in retrospect, but it was quite a vision for W6TNS and for the folks at *CQ* during that time. Thanks Don.

On The Road Again

It's beginning to sound like a song by Willie Nelson, and the melody lingers on. On the road again, indeed. It was back to the Chicago area for Radio-Expo on September 19th and 20th. The crowds were good, and it looked like most hams were in a buying mood. As Murphy would have it, our shipment of *CQ*'s didn't arrive (they still haven't been located), and so our display consisted of whatever I managed to carry with me on the plane. I'm glad to say that it didn't stop the many people from stopping by the booth to say hello and subscribe.

The next Friday I went to Washington, D.C. to attend a NIAC meeting at the FCC. By day's end I was on a working committee with both Wayne Green (of *73* magazine fame) and Chris Imlay (who has been filling in for Bob Booth of the League). Our little *troika* should help dispel the myth that we can't all agree on the same thing, and perhaps we can act in concert for some common good—namely amateur radio.

On Friday evening I flew from Washington, D.C. to Norfolk, Virginia and then drove to Virginia Beach where I met Dick. That weekend (September 26th and 27th) was the Roanoke Division Convention. This Convention was held at the Virginia Beach Arts and Conference Center, which is one of the nicest facilities I've ever been in. The lighting was uniform and at a comfortable level, and the air-conditioning was set at just the right temperature to keep everyone comfortable. It was certainly spacious enough to accommodate the crowds that showed up. Attendance was significantly up from the previous year, and the indoor flea market was loaded with goodies. I managed to buy a terrific relay and an old apothecary jar plus a jar of local raw honey. Since it was also off season (after Labor Day), the hotel rates were at least half the normal rate, and the local restaurants were also great buys.

The following weekend found Dick, Jack, and me flying down to Houston for the Houston Com-Vention 81. First let me say that Houston is really a big town geographically. The last time I was in Houston was 20 years ago, and like anything else, the changes were startling. It's really quite a city now. The Convention was held at the Astro Village Hotel across the street from the Astrodome, and needless to say, the accommodations were plush. I'd like to think that perhaps someday a Houston Convention could fill the Astrodome, but for this year at least it wasn't possible, since some musical group called "The Rolling Stones" already had it booked. So the few thousand of us who showed up had a great time at the hotel instead. We did have a treat, though, in that R.L. Drake unveiled their new TR-5 at the show. Delivery should take place to dealers at about the beginning of the year, so plan a trip to your local Drake dealer to see one. It's so new at the moment that they didn't have literature available yet.

I arrived home Sunday night and managed to put a few days in at the office. On Wednesday I flew to San Diego, California, arriving at about 3:00 a.m. (N.Y. time), and after a night's (or morning's) sleep I was picked up by Marv Druskoff, the Sales Manager for Cubic Communications. He drove me up to Oceanside, where I toured the plant that turns out the Astro-103's among other products. I'll have some pictures of the plant to show you a little later on. After lunch Marv and I went back to San Diego for a tour of the corporate headquarters of Cubic itself. Karen Purdy, the Senior Public Relations Representative of Cubic, gave us the full tour of the operation excluding, of course, classified areas where they produce equipment for the government. It was large and impressive. By the way, that same musical group had followed me to San Diego from Houston and was appearing there.

On Thursday night I flew to Phoenix for the 1981 ARRL Southwestern Division Convention in Scottsdale. Lew McCoy, W1ICP, and his wife Martha and Charlie Mulkin, W7KB, and his wife met me at the airport and took me for some Mexican food prior to settling in for the night. It was a great feast and certainly enjoyable company. The show started at noon on Friday, and the crowd remained enthusiastic all weekend. I ran out of *CQ*'s on Saturday afternoon and could have used another case or two. Most of what we brought was sold, and there was very little to carry back. While any show attendance is modest in comparison to Dayton, it was been my experience this past year that people have been coming out and supporting their local shows, and our reception in particular has been extremely good. Many thanks to all of you who have given us the support and words of encouragement during this past year.

We have one more show planned for this year and perhaps a few side trips which I will report on in later issues. The year is winding up very well for us, and truly we have you to thank.

I would also like to thank John Rogers, W2ADC, for once again providing us with a beautiful holiday cover. The winter scene is tranquil and perhaps reminds us of a peaceful time gone by. I think that once in a while we all have to stop and catch sight of that dream and that place.

As 1982 approaches and with the holiday season upon us, I'd like to extend to all of you our best wishes and felicitations for a happy holiday and new year.

73, Alan, K2EEK

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"This is the most QSO's ever from Kingman and all were barefoot. A few times generators ran out of gas during rainstorms with rigs operating on TX... no problem with voltage drop, and no damage. No tuners were used... only your rigs and (antennas). The wind blew continuously from 20 knots to 50-60 knots and we literally had to open the tent to let the rain out, salt water and spray everywhere, watches quit, keyers and linear (other brands) quit after the first QSO – arcing due to salt spray, but the TEN-TECs never even got warm when the tent was around 100°F.

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Announcing

● **Bethlehem, West Virginia Expedition** - The Triple States Radio Amateur Club will operate from Bethlehem, West Virginia from December 17 to December 21 from 1400 to 2300 UTC daily. Operating frequencies for WD8DDL/8 will be 7.275, 14.325, 21.425, and 28.550 MHz on s.s.b., and 7.110, 14.075, 21.110, and 28.110 MHz on c.w. A special holiday season card will be sent to all contacts. Send an s.a.s.e. to TSRAC, 26 Maple Lane, Bethlehem, Wheeling, WV 26003.

● **Frostfest '82** - Frostfest '82 will be held on Sunday, January 10, from 8 a.m. to 4 p.m. at the Virginia State Fairgrounds, Richmond VA. There will be approximately one acre of indoor heated space. All flea market tables will be inside, with outside space available for tailgaters. Contests, prizes. Admission will be $3. Fleamarket tables $6.50 per 8 foot table, tailgaters $2. For more information, call Joe Stern at 804-737-0333 after 6 p.m. Monday through Friday. Talk-in on 146.34/94, 146.28/88, and 146.52.

● **Courage Center Handi-Ham System Hamfest** - This annual winter hamfest will be held on Saturday, December 5, at the Eagles Club in Fairbault, Minnesota. Flea market, dinner at noon, program, and prizes. For more information, contact Don Franz, WØFIT, 1114 Frand Ave., Albert Lea, MN 56007.

● **Christmas, Florida 1981** - The Coronado Wireless Association will operate from Old Fort Christmas, Florida from 1500 to 2400 UTC Saturday, December 19 and from 1300 to 2200 UTC Sunday, December 20. Listen for K4HML on 7281, 14281, 21581 kHz and 60 kHz up from low end on c.w. A special QSL will be sent. For more information, contact K4HML, Box 1, Edgewater, FL 32032.

● **10th Annual Midwinter Swapfest** - This swapfest sponsored by the West Allis RAC will be held Saturday, January 9 beginning at 8 a.m. at the Waukesha County Exposition Center. Prizes, refreshments. Tickets are $2 in advance, $3 at the door. Reserved tables are $3, $2 at the door. Free tables on balcony. All indoor swapfest. For more information, contact 1982 Swapfest, P.O. Box 1072, Milwaukee, WI 53201.

● **VWOA Certificates of Recognition To Be Granted** - The Veteran Wireless Operators Association will grant certificates of recognition to persons who operated and maintained ARC and/or spark transmitters while serving as radio operators aboard American flag vessels. Ceremonies will take place at the 57th VWOA Annual Awards Dinner in New York, NY sometime during the month of May 1982. If you qualify, please send your name, address, name of the vessel, and the year you served aboard the ship. Any facts, including pictures, equipment, etc., will be helpful. Forward the info to Harvey R. Butt, Sr., Secretary, VWOA, 118 River Drive, Annapolis, MD 21403. Applications must be received no later than December 1, 1981.

● **RTTY Art Contest** - The Chicago RTTY Repeater Society has announced its first RTTY Art Contest which will run until February 28, 1982. The contest is open to all radio amateurs and their families, and entries must be original and not have been transmitted before November 1, 1981. Entrants must supply one unspliced 5 level tape and three prints for each entry submitted. There is no limit on running time, and a maximum of 72 characters per line may be used. Entries must be compatible with machines which downshift on space. At least 3 functions must be used to terminate each line—carriage return, line feed, letters. Winner will be awarded a model 33 ASR with modem. Send entries to Howie, WA9KEK, 1752 North Austin Ave., Chicago, IL 60639.

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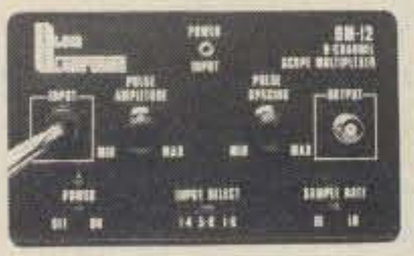

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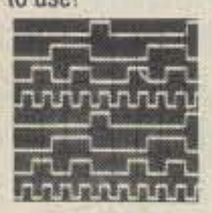

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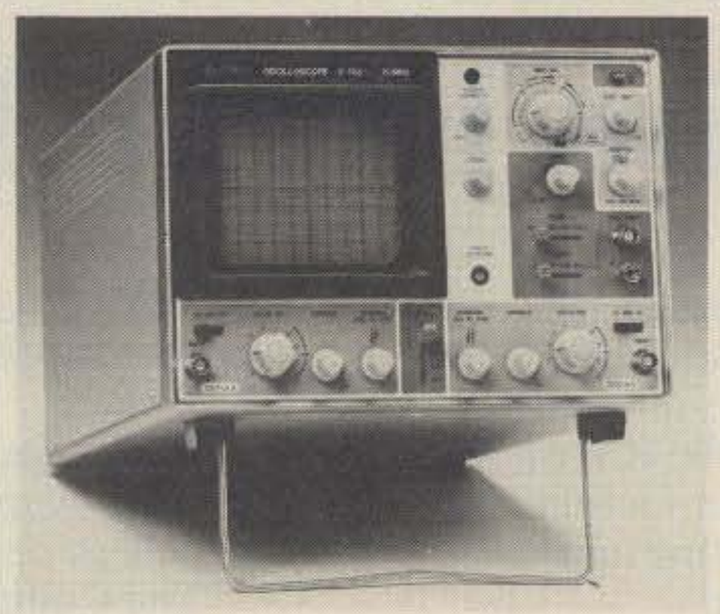

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External	Over 1Vp-p (V sync-signal)

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	2 – 15MHz	1.5div	800mV

Trigger slope	±
Sweep time	0.2μs/div – 0.2s/div ± 5%, 19 calibrated steps
Sweep-time magnifier	10 times (± 7%)
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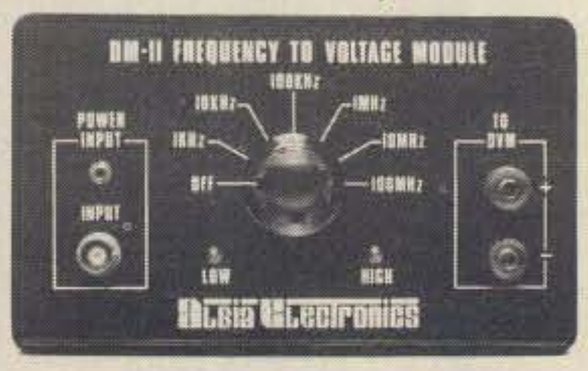

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CIRCLE 126 ON READER SERVICE CARD

HOW TO BUILD A HOME-BREW ASCII KEYBOARD CONTROLLER

PART I—HOW IT WORKS

The completed controller circuit board and keyboard switch assembly are shown mounted on a wooden base. The keyboard is like a typewriter keyboard, and the SHIFT keys switch it from lower- to upper-case ASCII code. The interconnecting cable running from the back of the keyboard assembly connects to a parallel port on the author's home-brew 8080A microcomputer.

Say You Saw It In CQ

Do you need a keyboard for your computer or other home project? You can build your own ASCII keyboard controller, which has the following impressive features:

- Simple design; requires only a few evenings for construction.
- Inexpensive; uses readily available TTL circuits and parts.
- Provides upper and lower case ASCII code; eight bit parallel data to the computer.
- Two-key rollover, and keyswitch debounce features, to ensure accurate error-free performance.
- Adaptable to either polled or interrupt operation; a **CHARACTER READY** signal output and controller **RESET** are provided.
- All interfaces TTL compatible.
- Requires only +5 volts for operation; less than 380 milliamperes load.

There are a number of ASCII keyboards commercially available to microcomputer hobbyists. There are also kits for building keyboards and LSI chips specially designed for keyboard applications. But for dyed-in-the-wool electronics hobbyists who get their kicks from building their own equipment from scratch for the enjoyment and educational experience, this article offers complete instructions for building a home-brew ASCII keyboard controller with impressive features. The reader who tackles this project will be well rewarded for the time he spends. "Experimenters" will also appreciate that the keyboard controller circuit presented is a versatile circuit which can easily be adapted to the requirements of their own special applications.

BY EDWARD J. WORNER JR.*

Fifteen years ago I was employed by the same company I work for now. I worked as an electronics technician, and I thoroughly enjoyed my work with electronics. But one day my boss presented an interesting proposal: "How would you like to learn computer programming, Ed?" he inquired. Well, that was a challenging opportunity that I couldn't resist, especially since the company was fully prepared to foot the bill for my training. Within a few weeks I found myself writing Fortran programs for a living. I quickly decided that I liked programming, and as a result I have continued to write programs for fifteen years. I started by writing programs in Fortran, and later I wrote programs in machine language. Unfortunately, as time passed my skills as an electronics technician were called upon less and less. Like many of the people in today's computer programming field, I had become a computerized "retread." But electronics remained my "first love," and I managed to dabble in it just enough to keep my hand in.

Anyone who does very much serious programming eventually entertains the idea of having his very own computer that he can use any time, and that he doesn't have to share with anyone else. I'm no exception. But until recent years, the cost of computer equipment and its maintenance were far too prohibitive for any computer hobbyist to consider seriously. The advent of the microprocessor has changed that, though. About five years ago I started working with microprocessors. We began using them at work to drive realtime control systems, which test navigational Star Trackers destined for use on NASA's Space Shuttle. I was immediately entranced by microprocessors. They're easy to program and simple to interface; I like to think of them as the Tinkertoys™ of the computer industry. The low cost of the mass-produced microprocessor makes it a natural for building real "smarts" into electronic systems. But just as important to you and me, the low cost of microprocessor and support chips has placed some fairly sophisticated computer hardware within the reach of the electronics hobbyist. The power of today's $15 microprocessor chip easily rivals the computing power of the $30,000 computer mainframes built with discrete components that I worked with a decade ago.

I spent two years acquainting myself with microprocessors. After that time I felt confident that with my background in both computing and electronics it would be possible for me to build and maintain my own microcomputer system. So, about three years ago, with the encouragement of my co-workers, I began building my microcomputer.

Development Of The ASCII Keyboard

Once the construction of my microcomputer main board was underway, I began thinking about the peripherals I would need. One of the first peripheral devices I considered was a keyboard, a relatively inexpensive way to provide extensive input capability. At the same time, since my electronic skills were a shade rusty, I needed additional projects to practice on. So after a little research into keyboard polling techniques, the structure of ASCII code (American Standard Code for Information Interchange), and microprocessor interfacing techniques, I resolved to build my own keyboard. I felt it would be an excellent home project, because it would be a good learning experience, and just because it would be fun. It didn't take long to set down specifications for the keyboard design. Those guidelines are presented in the preamble to this article. The single most important feature of the design was that the keyboard circuitry itself would poll the keyswitches and provide the ASCII character codes for the keys struck. This would free the computer from that time-consuming task. It was also imperative to supply appropriate handshake signals which would provide for either polled or interrupt operation.

It took a few weeks of my spare time to design a keyboard circuit, build it, and get it working. The result is shown in the photo. It was a very interesting project that dealt with many of the classic problems of asynchronous communications. The resulting keyboard controller circuit and its construction are described in the remainder of this article. Using the instructions provided, a reader can build his own ASCII keyboard in just a few evenings at minimal cost.

Circuit Description

The keyboard controller circuit schematic is shown in fig. 1. It is designed to continuously poll the switches of an unencoded keyboard, and to provide the appropriate ASCII code at an eight bit parallel port for any key depressed. Whenever a key is pressed, a **CHARACTER READY** signal is generated. The **RESET** line is provided for a computer to clear the CHARACTER READY signal and resume the polling operation.

The heart of the controller is a seven bit binary counter with a one bit prescaler. A pair of 74193 counters (IC1 and IC2) make up this counter chain. The prescaler is driven by a 555 timer (IC3) configured as an oscillator. The 555 timing components are selected to provide a 12 kilo-Hertz clock to the prescaler. The rate of the clock is not critical; it provides for the polling of the complete keyboard on the order of 50 times per second. To avoid

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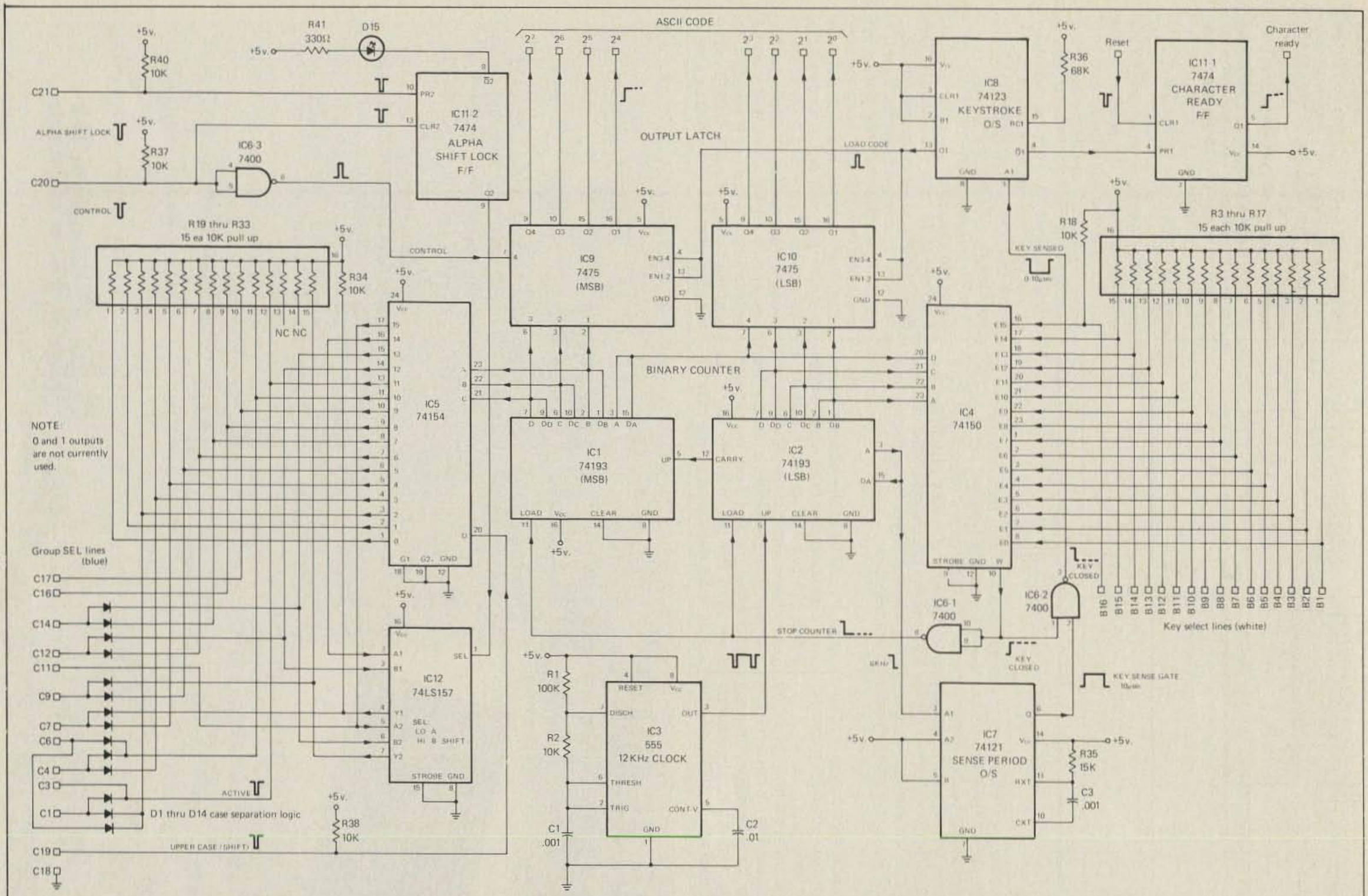

Fig. 1– The design of the keyboard controller circuit frees the computer from the task of polling the keyboard for keyswitch closures. The controller circuit itself polls the keyswitch array continuously waiting for key closures. A CHARACTER READY signal tells the computer when a key is struck, and the appropriate ASCII code for the key struck is provided at the eight bit parallel output. The polling scheme employed provides both upper- and lower-case ASCII codes. Highly reliable keyswitch sensing and debouncing methods are employed to guarantee proper keyboard operation.

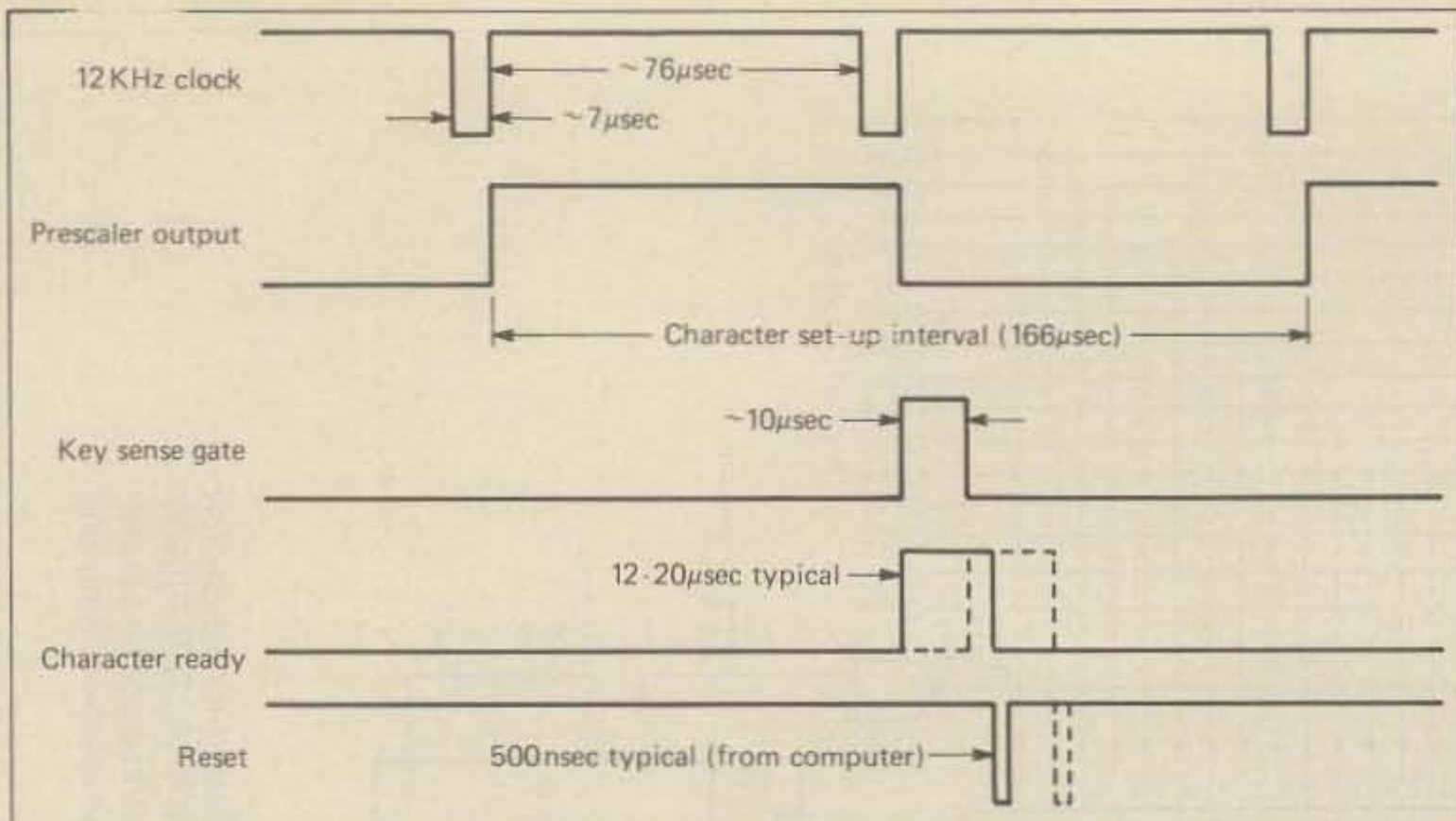

Fig. 2– The keyboard controller timing waveforms are shown. The controller circuit uses a KEY SENSE GATE which ensures that key closures are detected only at the middle of the key polling period, when the respective ASCII code in the counter is certain to be stable. This ensures a high keyboard accuracy. The KEY SENSE GATE is kept short so that the computer can't sense the same key closure more than once, and this effectively debounces the keyboard. The computer resets the controller after reading the ASCII character code.

keyswitch bounce, each switch is actually sampled for only about 10 microseconds during a poll.

The binary counter controls the polling function as follows. The seven bit counter runs continuously while waiting for a key closure. The four lower bits of the counter drive a 74150 data selector (IC4), and the upper three bits of the counter drive a 74154 demultiplexer (IC5) whose strobe inputs are tied low so that it acts as a commutator. The sixteen data lines into the selector are employed as sense lines, while either the first eight or last eight lines from the demultiplexer serve as strobe lines, depending on the case selected. A sixteen-by-eight switch polling matrix is formed by the sense and strobe lines. Since these lines would usually float open, some pull-up is provided to each of them to encourage signals that might otherwise be sluggish to have a little "snap." For each binary value that appears in the seven bit counter, then, a single pair of strobe and sense lines is active. This polling circuit is employed as an ASCII encoder *by treating the binary values in the counter as ASCII character codes.* For example, when the binary code for an ASCII "A" appears in the counter, the particular pair of strobe/sense lines which are active are those connected to the "A" keyswitch on the keyboard. If the "A" switch is depressed at that time, the output of the 74150 selector (IC4, pin 10) goes high, signaling the closure.

When any key is depressed, the controller must respond by supplying the appropriate ASCII code and a CHARACTER READY signal to the computer interface. This is accomplished as follows. First, it is necessary to stop the polling while the key is held down. This prevents the controller from reporting the same key over and over, poll after poll. It also has the side benefit of providing 2-key rollover, because if a second key is depressed before a preceding key is released, it will be sensed after the first key *is* released. To stop the polling, the **KEY CLOSED** signal from pin 10 of IC4 is inverted by a nand

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gate (IC6-1) and applied to the $\overline{\text{LOAD}}$ inputs of the counter string. Since the data **OUTPUTS** from the eight stages of the counter and prescaler are fed back to their respective data **INPUTS**, the $\overline{\text{LOAD}}$ strobe effectively stops the counter from advancing even though the clocking pulses continue.

The purpose of the prescaler stage interconnection to the 74121 one-shot (IC7) is to provide a key sense gate which can be used to test for key closures when the ASCII codes are certain to be valid. This technique ensures a very high keyboard accuracy. Refer to the key sense timing diagram in fig. 2. Each ASCII code appears in the counter for about 166 microseconds (two clock intervals). The rising edge of the prescaler output occurs right at the middle of this character period, and it is used to trigger the **SENSE PERIOD** one-shot (IC7). The timing components of this 74121 are selected to deliver a 10 microsecond **KEY SENSE GATE** pulse at this point. By eliminating the possibility of sensing for key closure at the beginning or end of a character period, race conditions that might occur when the character code changes are avoided.

The KEY SENSE GATE is used to test for key closures. If any given key switch is closed when its sense gate occurs, a **KEY SENSED** signal appears at the output of the associated nand gate (IC6-2, pin 3). This negative going signal then triggers the **KEYSTROKE** one-shot (IC8). The KEYSTROKE one-shot ensures that the CHARACTER READY signal is latched once for each keystroke. The timing components of the 74123 KEYSTROKE one-shot are selected to deliver a short strobe pulse of about 500 nanoseconds, and this pulse initiates two subsequent functions. First, it is used to strobe the current contents of the counter (the ASCII code) into the eight bit **OUTPUT LATCH** (IC9 and IC10). And second, the negative going version of the pulse is used to set the CHARACTER READY flip/flop (IC11), indicating that the ASCII code is now available to the computer.

Case Select

This ASCII keyboard design employs a rather unusual case select mechanism. The reader may have already examined the controller schematic (fig. 1) looking for conventional logic which generates the 2^5 bit of the ASCII code as a function of the case selected and the state of the 2^6 bit of the code. But this method was not used, because it only works for part of the ASCII set, and it will not accommodate the pairing of the characters on some keys. Case selection is handled in a different way that is much more effective.

Note that the ASCII code counter (not counting the prescaler bit) is only seven bits long. The four lower bits of the code are routed to the 74150 data selector (IC4) to control the KEY SELECT lines, leaving only three bits to be routed to the 74154 demultiplexer (IC5). The fourth input to the 74154 is the **CASE SELECT** signal, and it controls whether the upper eight or lower eight **GROUP SELECT** signals are active. Thus, the controller actually scans through all 128 possible ASCII codes for either upper *or* lower case, depending on whether the **SHIFT** key is depressed. This arrangement accommodates all of the special conditions of the keyboard without difficulty. Keys that operate only in lower case (BACKSPACE, TAB, LINE FEED, ESCAPE, and CARRIAGE RETURN) are driven by just one strobe line. No upper-case strobe lines reach those keys. But most key groups must be driven by two separate group select signals (one for each case), so they are routed through separation diodes which prevent unwanted signal feedback into the inactive (high) 74154 outputs.

Note that for the dual case keyboard to work properly the four lower order bits of the codes for characters that are paired on keys *must* be the same. Fortunately, this turns out to be true for the ANSI-style keyboard I used (which is certainly more than a coincidence). The **SPACE** bar is a special case. It is desirable to have the SPACE bar respond in upper or lower case. Therefore, both an upper- and lower-case strobe line are routed to it through separation diodes. It responds with the same ASCII code in either case.

Control Mode

The **CONTROL** bit (most significant bit) of the ASCII codes issued by the keyboard controller simply relates the state of the CONTROL key when the keystroke one-shot fires. Thus, if the CONTROL key is depressed and a key is struck, the resulting ASCII code will have its CONTROL bit on. Note that the CONTROL function works for upper or lower case. It is therefore possible to generate, for example, a **CONTROL-SHIFTED-E** if desired.

Keyboard Debounce

Effective keyboard switch debouncing is provided by correct choice of the duration of the key sense gate and the polling period. Refer to the key sense timing diagram in fig. 2. Note that any given key switch closure may occur before, or even during, its respective sense gate. No matter how narrow the sense gate is made, if closure *does* occur during the gate contact bounce could retrigger the KEYSTROKE one-shot. However, this problem is solved easily. The computer can't respond to the same key stroke more than once if it doesn't have time to detect the CHARACTER READY signal and then reset the CHARACTER READY flip/flop *before the KEY SENSE GATE goes low again*, as shown in fig. 2. Thus, the KEY SENSE GATE is purposely kept to less than the time of a few microprocessor instructions, or about 10 microseconds. If the keyboard is to be used with a microprocessor faster than the 8080A, it may be advisable to shorten the key sense gate accordingly.

Another problem to contend with is the possibility that contact bounce may occur when a key is released. Fortunately, it turns out that this isn't a real problem either. Since the ASCII code counter is stopped while a key is pressed, the depressed key can't be sensed again until one polling period (21 milliseconds) after it is released, and contact bouncing should cease long before then.

Typing Speed

My own typing speed doesn't exceed about 10 words per minute, and the performance of my ASCII keyboard controller has proven very satisfactory for me for more than two years. But even a much faster typist should find the keyboard response adequate. The counter in the controller scans (cycles) through the 128 possible character codes at the rate of 166 microseconds per character, which gives it a basic polling period of about 21 milliseconds (roughly 50 polls per second). At a breathtaking rate of 80 words per minute (approximately seven characters per second) the average period between characters would be about 140 milliseconds, or better than six times longer than the basic polling period. Therefore, the polling rate should be quite adequate *as long as the typist holds each key down for a minimum of 21 milliseconds* to ensure the sensing of the key stroke.

As previously described, the keyboard controller features 2-key rollover. A second key can be depressed before the preceding key is released, and it will be sensed within 21 milliseconds after the first key is released. This rollover capability, combined with the effective keyboard debounce provisions of the controller, ensures accurate, trouble-free performance. When the keyboard is interfaced to a computer, it is difficult for a typist to exceed its capabilities, especially when it is used in the interrupt configuration.

Power Considerations

The ASCII keyboard controller circuit requires only a 5 volt supply to power its TTL circuitry. Using standard TTL integrated circuits, it uses a maximum of 370 milliamperes. I measured about 290 milliamperes with my prototype circuit. The keyboard assembly can be built with its own power supply, or it can obtain its power from the computer's power supply as mine does. My prototype uses standard TTL integrated circuits. But at the operating speed of this circuit, it should be possible to use low power Schottky (LS) integrated circuits for all but the 555, 74121, and the 74150, which have no LS equivalent. This would reduce the current consumption to less than 160 milliamperes.

In the next installment we will take up construction details.

To Be Continued

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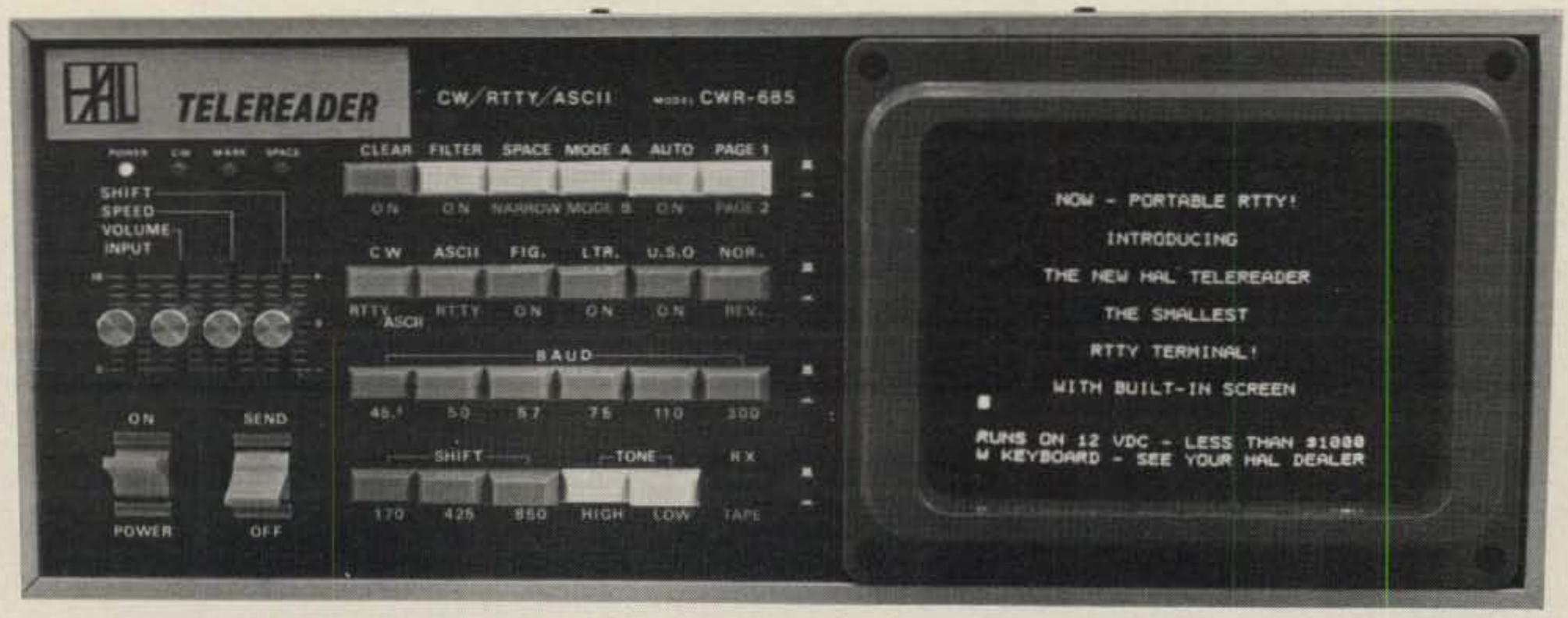

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In this installment we pick up our discussion of Quads with a rundown on the various types of quads and some special configurations.

A Primer: The Cubical Quad Antenna

Part II—Picking The Right Quad For The Job

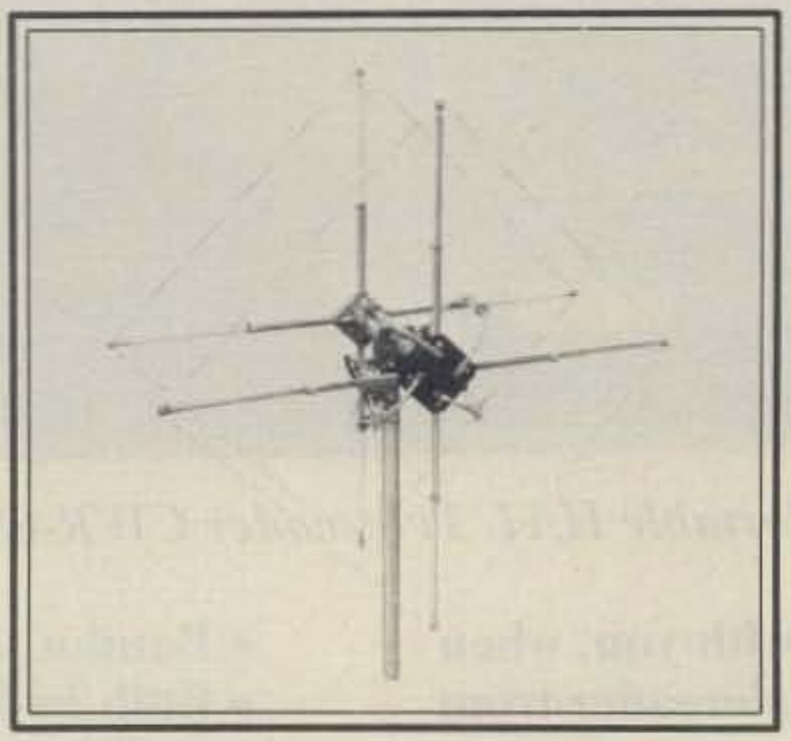
BY KARL T. THURBER, JR.*, W8FX

In Part I (August 1981 *CQ*, p. 20) we began our series with the basic descriptions and distinctions of the cubical quad antenna. In Part II we move from a generalized overview to a discussion of specific quad types and configurations. Part II also begins our discussion of feeding, matching, and tuning the cubical quad antenna.

Multiband Quads

The cubical quad lends itself to multiband operation by means of concentric quad loops mounted on a single framework. The most popular arrangement, as one might expect, is the triband quad for 20, 15, and 10 meters. Interaction between the loops can cause some problems, although these are usually not too severe. Depending on specific construction techniques, F/B radio and forward gain may be adversely affected on one or more bands due to interaction, although this is usually less of a problem than with the Yagi. No traps are required, as with the multiband Yagi, although special arrangements must be provided for feeding the separate radiator loops; this can present some special problems, to be detailed later. Obviously, the "optimum" 0.12-wavelength element-to-element spacing cannot be maintained on all bands.

One approach to the element spacing problem is characterized by the so-called boomless quad, in which element-to-element spacing is proportionally maintained for close-to-optimum performance from a theoretical standpoint. In this design, which is, for want of better words to describe it, even more "three dimensionally structured" than is the conventional concentric-loop multiband quad, the individual band quad frames are mounted at varying distances along the spreaders from the central spider. This multidimensional nesting can result in a cumbersome array, particularly in 3- and 4-element models. However, fairly even performance can be maintained from band to band, and feedpoint impedances are easier to control. The leader in the boomless approach is Gem-Quad, a Canadian firm that offers a moderately priced line of two- and multi-element tribanders.[1]



Avanti places this interesting 10 meter beam, the AH028.9B, in a category all its own. Resembling a quad, it's referred to as a polarity diversity loop antenna; it features switchable horizontal/vertical polarity, 1.5 dB gain over a comparable quad, and claimed 32 dB F/B ratio. The "polar diversity" feature, whereby the operator can switch polarity at will, is said to minimize signal fading, enable OSCAR satellite access for a longer period, and virtually eliminate phase distortion in 10 meter f.m. operation. Antenna has 3 driven elements and 2 reflector elements on a 4½-foot beam. Turning radius is 6 feet and weight is 13 lbs.

Specialized H.F. Quads

The two-element cubical quad is to the quad family as the three-element Yagi is to the Yagi clan: it's the basic standard. However, there are a number of other quads for h.f. use that have found good acceptance. These include multi-element arrays, mini-quads, hybrids, delta quads, and several types of dual polarity beams. Quads and their close cousins have also found application at v.h.f. and u.h.f. (more on high-band applications later).

Let's look first at some specialized quad configurations for use on the h.f. bands.

Multi-Element, Multiband Arrays

Quads tend to get unruly if expanded to three or four elements, although the results may justify the added difficulty of

*317 Poplar Drive, Millbrook, AL 36054

[1] *CQ Reviews: The Gem-Quad Antenna, by Karl T. Thurber, W8FX, CQ July 1981, p. 58.*

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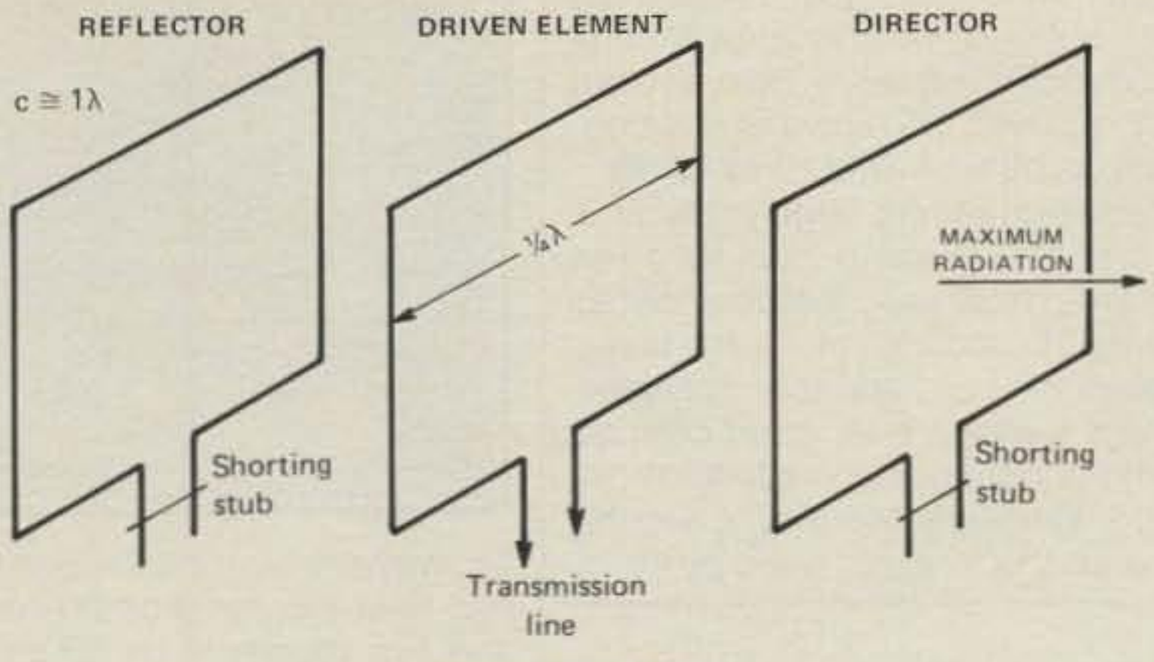


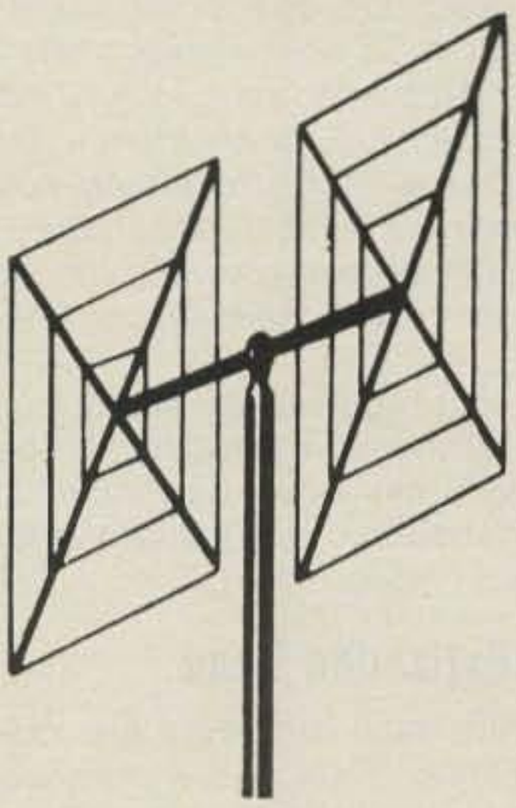
(A) SINGLE-BAND QUAD

A typical, three-element, single-band quad is shown here. It consists of three full-wave loops serving as reflector, driven element, and director. Maximum radiation is as shown, occurring in a line perpendicular to the plane of the loops. Horizontal polarization results from feeding at the bottom.

The driven element is usually fed by coaxial cable through a balun or gamma match. The parasitic element loops, consisting of the director (about 3% shorter than the driven element) and the reflector (3% longer), usually make use of shorting stubs to facilitate tuning. Optimum element-to-element spacing occurs at 0.12 wavelength.

The two-element quad typically shows a 7 dB gain over the dipole, whereas the three-element version exhibits a 10 dB gain. Quads can be constructed in two- and three-band arrays with good results, although feeding arrangements can become quite complex.

Although elements are usually arranged in the familiar quad shape, promising results have been obtained with other shapes, including diamonds and deltas.



"Classic" multiband quad design is represented by the sketch showing Gotham's 10/15/20-meter 25-pounder. Having a 10-foot boom and a 10-foot turning radius, the antenna is 18 feet square. F/B ratio is 25 dB, s.w.r. 1.05:1 at resonance.

The Gotham design features all metal construction (except for the insulators), galvanized steel boom, aluminum alloy spreaders, universal-type boom mount, and 52-ohm coax feed using no tuning stubs. (Sketch from Gotham Antennas advertising literature.)

(B) CLASSIC TWO-ELEMENT, TRIBAND QUAD

Fig. 1– The multi-element quad. (A) Single-band quads. (B) Classic two-element, triband quad.

construction and installation (fig. 1). Element for element, the cubical quad is a very high performance antenna for both transmitting and receiving; adding elements can be very worthwhile in achieving big-signal status. The reflector accounts for 3 to 5 dB gain, depending on whether directors are also used. Adding a single director increases gain by about 5 dB; adding a second director nets a gain increase of about 2 dB; additional directors yield but a 1 dB increase each. Maximum gain occurs at an element-to-element spacing of 0.12 wavelength. There is little benefit in increasing spacing; gain in fact drops off with extra-wide spacing, and feedpoint impedance increases with the wider spacings to present possible impedance matching problems. F/B ratio increases to 30 dB or more with multi-element quads.

Multiband quads show a relatively narrower usable bandwidth when tuned for maximum gain and optimum F/B ratio. Bandwidth can be improved by offsetting the reflector and director lengths, thus detuning them. The result is a quad that will "hold up" well over a wide h.f. band, such as 10 meters. A deliberately broadbanded three-element quad will exhibit a slightly lower forward gain, roughly comparable to its two-element cousin.

Not to be outdone by its triband, three-element Yagi competitor, multiband, multi-element quads are common, although the nesting of elements, the sheer physical size of the arrays, and matching and tuning complexities can result in formidable problems that the beginner may not be prepared to solve. However, several quad manufacturers offer extra-element extender kits for expanding the basic two-element quad into a three- or four-element version. Although taking a large antenna down for modification isn't fun, in the case of the large quad you may consider purchasing a small but expandable model that will allow you to get your feet wet in assembly and installation techniques before tackling what might otherwise become a completely overwhelming task in installing a large array at the outset.

The Mini-Quad

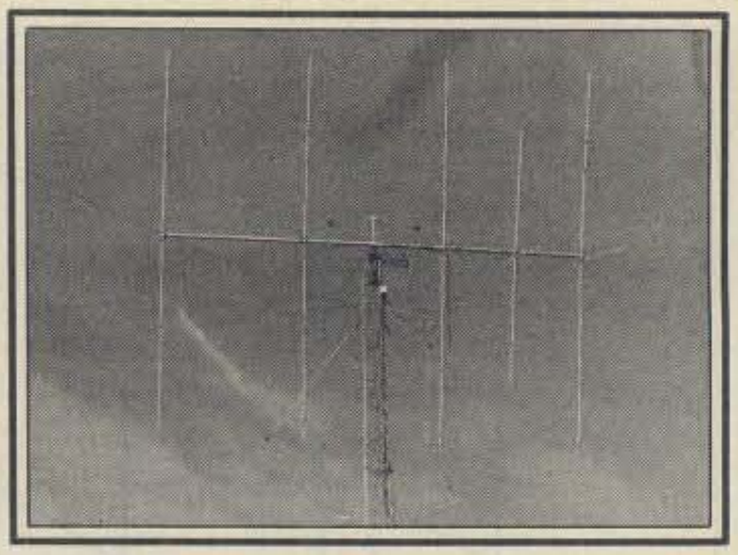
The basic quad is a full wavelength in circumference, but it doesn't have to be. We've covered mini-loops; two-element quads can also be built to smaller-scale dimensions to accommodate apartment, condominium, trailer, or other restricted-space installations. Around-the-loop circumference shouldn't be much less than about 70–75% of full-size dimensions, or 0.7–0.75 wavelength, unless a great loss in radiation efficiency is acceptable. The antenna is usually fed through a stub whose length effectively adds up, with the wire in the antenna, to a full wavelength. Since 20, 15, and 10 meter quads are not overly large unless of three or more elements, there is little advantage in miniaturizing the quad except on the lower bands, 80 and 40 meters, where the dimensions of the full-size quad make installation prohibitively cumbersome. Be prepared to do a good deal of experimentation in stub-tuning the mini-quad or loop.

Some of the guesswork involved in designing miniature quads has been taken out by one firm, Mini-Products, Inc., which offers several quad and quad-like antennas. The company has come up with a miniature CB quad that is also available for business-band applications, so it may have application on 10 meters. The ultra-miniature QCB-1 antenna has but a 54-inch boom and a turning radius of 45 inches. The antenna incorporates the firm's principle of "Hi-pot" (high potential) loading, in which multiple end-loading "hats" are used. This design is said by the manufacturer to allow good efficiency in the Yagi by effectively removing the least useful portion of the antenna, the ends, while retaining the high-current center portion intact. The minia-

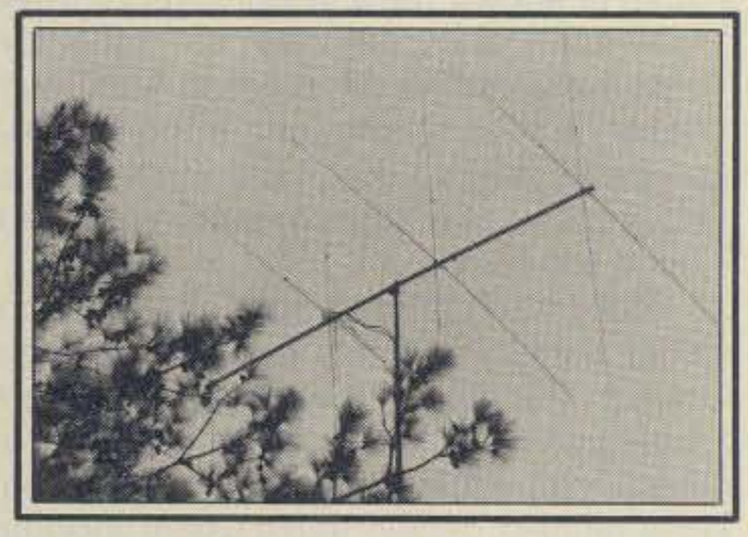
ture QCB-1 has this loading principle applied to the quad. It boasts a 4.5 dB gain over an isotropic source and a 25 dB F/B ratio, all figures being for 27 MHz operation.

A related antenna from the same manufacturer is the HQ-1 miniature hybrid quad. Having the "hi-pot" loading principle applied to both driven element (a Yagi-type dipole) and reflector (a quad element), the antenna has an element length of but 11 feet for 20 through 6 meter operation with reasonable efficiency considering the antenna's small size. A turning radius of slightly over 6 feet and a weight of 15 lbs allow rotation by means of a light-duty TV rotator. A gain of from 4.4 to 6.5 dB over the dipole is claimed, depending on band; F/B is 12 to 17 dB.

The hybrid quad has largely been neglected in recent years, except for a few CB antennas. However, the possibilities of marrying the qualities of the full-wavelength quad element and the half-wavelength Yagi element offer good promise for experimentation, especially for those looking to minimize feedline matching problems and looking for good performance in a roughly Yagi-like design. A hybrid antenna colorfully dubbed the "Quagi" has been developed for both v.h.f. and u.h.f. applications (more on it later).



Shown here is an impressive high-gain array. Four elements on 20 and 15 meters and five elements on 10 offer excellent forward gain and front-to-back/front-to-side ratio figures. (Photo courtesy dB + Enterprises)



Appearing to be a close cousin of the cubical quad, the dual polarization beams popular in CB work hold promise for specialized h.f. work, such as in 10 meter f.m. Due to an f.m. phenomenon known as "capture effect," reversing polarity of the antenna can actually enable two sets of QSO's to take place on the same frequency with minimal interference.

The Expanded Quad

While most amateurs are looking for something small and unobtrusive in an antenna, there is always that small but fortunate group who have the space and wherewithal to install just about anything they may desire. The expanded quad with a circumference of two wavelengths fills this requirement for many and is probably the next best thing to a rhombic.

The expanded quad, or bi-square, is usually designed as a horizontally polarized, single-loop affair due to its large size (fig. 2). It produces a sharp, well-defined figure-eight pattern with a gain of 5 dB over the dipole. Two such single loops may be mounted at right angles to one another and switched to provide close to 360-degree coverage. By using a stub matching and balun arrangement, the expanded quad can be fed with coax for a low-s.w.r. cable run to the transmitter. Some amateurs have even used this type of antenna on more than one band using

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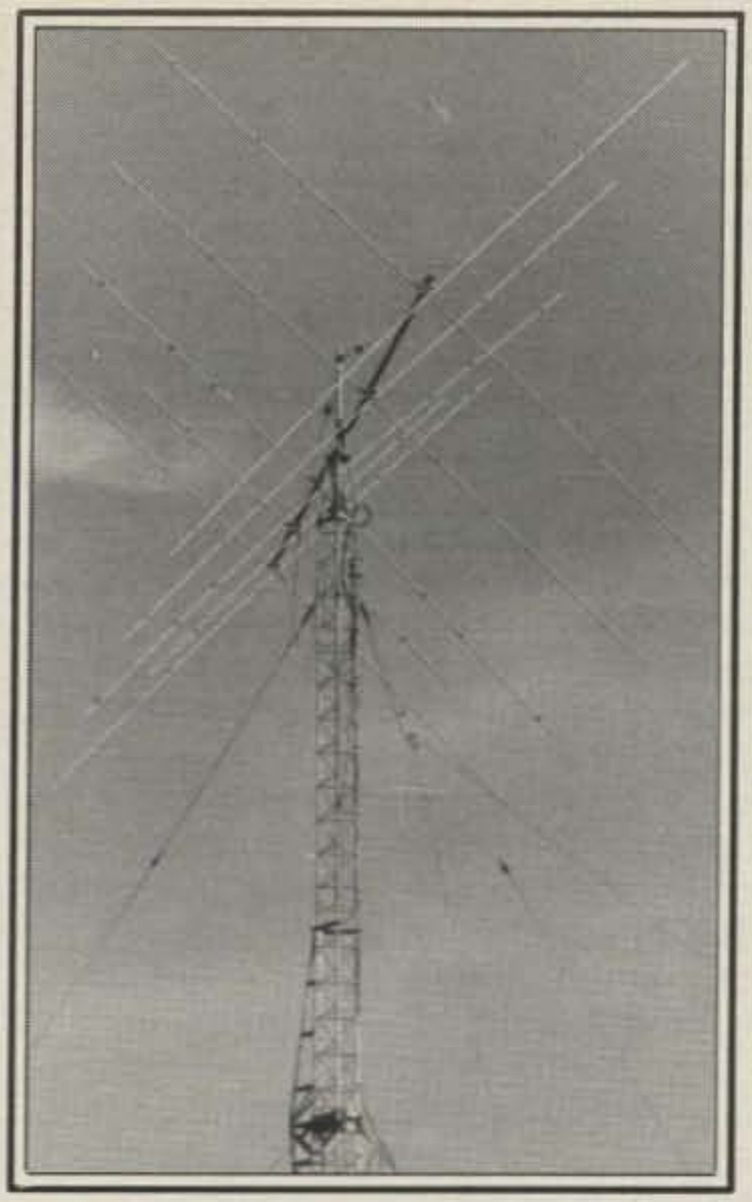


Rugged dB+ Enterprises triband quad boasts extruded aluminum spider and special fiberglass spreaders with a reinforcing core. Array shown here sports four elements on 20 and 15 meters, and five on 10. (Photo dB+ Enterprises)

tuned feeders and an antenna coupler. This is really the old-time "lazy quad," a wire antenna popular on 80 and 160 meters for medium-distance work, and which can be distorted in shape to fit most any lot.

Multi-element expanded quads have dimensions that rule them out for most rotable applications, although gain figures *are* impressive. A two-element array boasts a 9.5 dB gain over a dipole, and a three-element array, an approximate 12 dB gain figure.

Like other quads, the expanded quad can be constructed as a diamond, rectangle, square, or circle, as the situation demands. As you might guess, you've crossed into strictly experimental territory at this point!

The Delta Quad

We have mentioned the delta loop. Two such equilateral-triangular shaped radiators (simply special-case loops of different physical shape than the quad) can be combined to form a quad-like array. Two-element delta quads are not as common as the cubical quad, but can offer equivalent performance. The antenna can be suspended from its apex for a right-side-up appearance, being fed at the middle of the bottom (horizontal) leg of the triangle. Or, it can be mounted upside-down, with the apex at the bottom, and fed at the apex. Each leg is then about ⅓-wavelength, with slightly longer legs used for the reflector and slightly shorter legs for the director, if one is used. Most of what we've said about cubical quads applies to the design and construction of the delta, although some consider the latter's construction simpler and installation less involved. Feedpoint impedance of the two-element delta quad makes for a good match to 75-ohm coax in many cases.

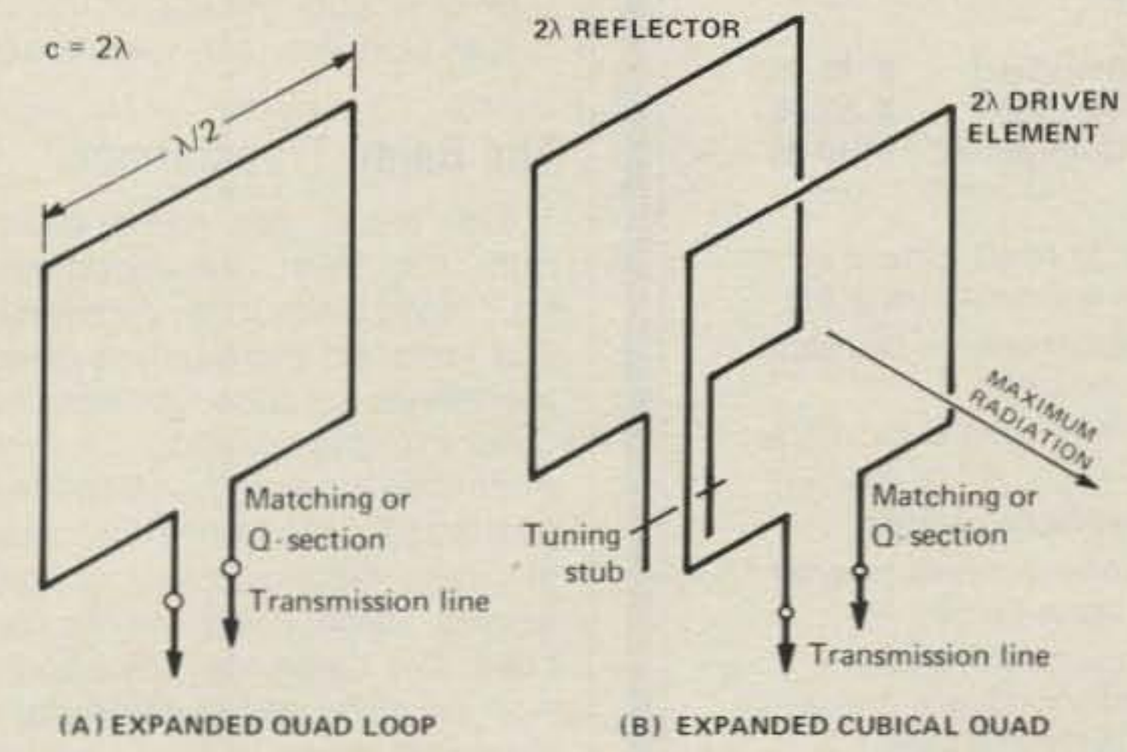
The delta quad is especially favored on 10 meters. I know of one five-element delta quad designed by Arthur Owen, WØWFB, that was described in the *Ten-Ten International Net's Bulletin* some time ago. Art's "delta monster" is mounted on a 26′ 4″ long, 2″ O.D. aluminum boom and yields an estimated gain of more than 13 dB. A gamma match is used to allow convenient coax feed.

Dual-Polarized Beams

Not really quads, but often resembling them, are dual-polarized or crossed-Yagi arrays, especially popular with CBers and 10 meter aficionados. In these so-called "double diversity" configurations, two sets of elements are mounted perpendicularly to one another at each element point on a single boom. Thus, there are two reflectors, two directors, and two driven elements—a total of six elements—in a three-element array. Normally, the two driven elements are fed separately by coaxial cable, with polarization being switched in the shack by means of a coax switch or relay. In some cases, a phasing harness is used to feed both arrays simultaneously. (In determining gain the elements are only counted *once!*)

The dual-polarity array is particularly favored on the higher h.f. bands, and on v.h.f., where polarization makes an immediate and significant difference in point-to-point signal strength. Vertical polarization is almost universally used on the 27 MHz CB band and 2 meter f.m. segments, mainly due to the large number of necessarily vertically polarized mobiles making use of these bands.

This kind of antenna, and close relatives, is also popular on 10. Many serious 10 meter enthusiasts, realizing that a few ionospheric bounces may alter a signal's polarization on the receiving end, have cut down dual-polarity CB beams for amateur use. The resultant "polar diversity" capability, whereby the operator can



The expanded quad loop is a full two wavelengths in circumference, as opposed to the basic loop's circumference of but one wavelength. The expanded loop provides a power gain of about 5 dB over the dipole. Feedpoint impedance is high, 2000 ohms or more, so it's usually fed through a quarter-wave Q-section or other matching device for use with conventional low impedance transmission lines.

Adding a reflector element to the expanded quad loop results in an array having a power gain of about 9.5 dB over the dipole. Element-to-element spacing about 0.12-wavelength is usually employed; resultant antenna pattern is similar to that of the standard quad, but a sharper forward lobe results. Angle of radiation is comparable to that of other quads.

Fig. 2– The expanded quad loop and cubical quad. (A) Expanded quad loop. (B) Expanded cubical quad.

readily switch between horizontal and vertical polarity, can be used to good effect to minimize signal fading and enable OSCAR satellites access for longer periods. Two-meter f.m.'ers have found that the ability to switch polarity can significantly reduce or eliminate signal-garbling phase distortion, as well.

A commercial polar diversity antenna, the Avanti AH028.9B, resembles a quad, although it's actually in a category all its own, it's referred to by the manufacturer as a "polarity diversity loop." The antenna specs claim a slight gain over a comparable quad and a high F/B ratio. Whether or not these impressive figures are attainable in practice, the operator reports I have seen on this unusual 10 meter antenna are good. There is little doubt that dual-polarity arrays will become increasingly popular as we enter the declining years of the sunspot cycle. Flexibility-enhancing 10 meter antenna designs such as these will increase in importance in squeezing the most from a declining band.

Feeding, Matching, and Tuning

No antenna, regardless of how superior a radiator it may be, is any good unless its feedline and matching system enable efficient r.f. transfer from the transmitter. This is an especially important consideration in Yagi beams and quads, where there has been a considerable investment of time, effort, and expense to ensure maximum possible antenna performance. Thus it's quite important to carefully consider the several possible methods of feeding, including their advantages and disadvantages, before embarking on antenna construction or purchase.

As we've indicated, the quad's ancestors lie in the dipole and folded dipole; all are *balanced* antennas. The dipole has a feedpoint impedance of about 70 ohms, for a good match to balanced (parallel conductor) transmission line. The folded dipole has a feedpoint impedance about four times that, nominally 280 ohms, for direct feed with 300-ohm line. The loop, a stretched-out folded dipole, has an impedance of around 125 ohms.

Feedpoint impedance is less predictable in the quad. The driven element's impedance is controlled primarily by the frame-to-frame spacing. In the case of the single-band two-element quad, optimum gain occurs with an element-to-element spacing of 0.12 wavelength. But the feedpoint impedance varies from as little as 40 ohms with an element spacing of .07 wavelength, up to more than 140 ohms with quarter-wavelength (0.25-wavelength) spacing. Typical, .012-wavelength spacing results in a feedpoint impedance in the vicinity of 65 ohms, offering a reasonable match to conveniently available transmission lines. Actual impedance you might expect to encounter will vary, depending on other factors, most notably height above ground and proximity to other objects in the vicinity of the antenna. Parasitic element tuning conditions also have an effect on driven element feedpoint impedance.

As an inherently balanced antenna, when fed at the center with a parallel conductor line, this balance is maintained throughout the system. But if the antenna is fed by means of coaxial cable, system balance is upset since one side of the radiator is connected to the inner conductor and the other side is connected to the braid shield. It's possible for current to flow down over the outside of the coaxial cable; such undesirable, "antenna-like" currents flowing on the outside of the coax contribute to line radiation, and also make determination of true s.w.r. difficult. No amount of antenna adjustment can remedy this undesirable situation.

From this discussion, it's apparent that the problem of quad feeding and matching is a dual one: that of obtaining a proper impedance match *and* of maintaining feedline balance.

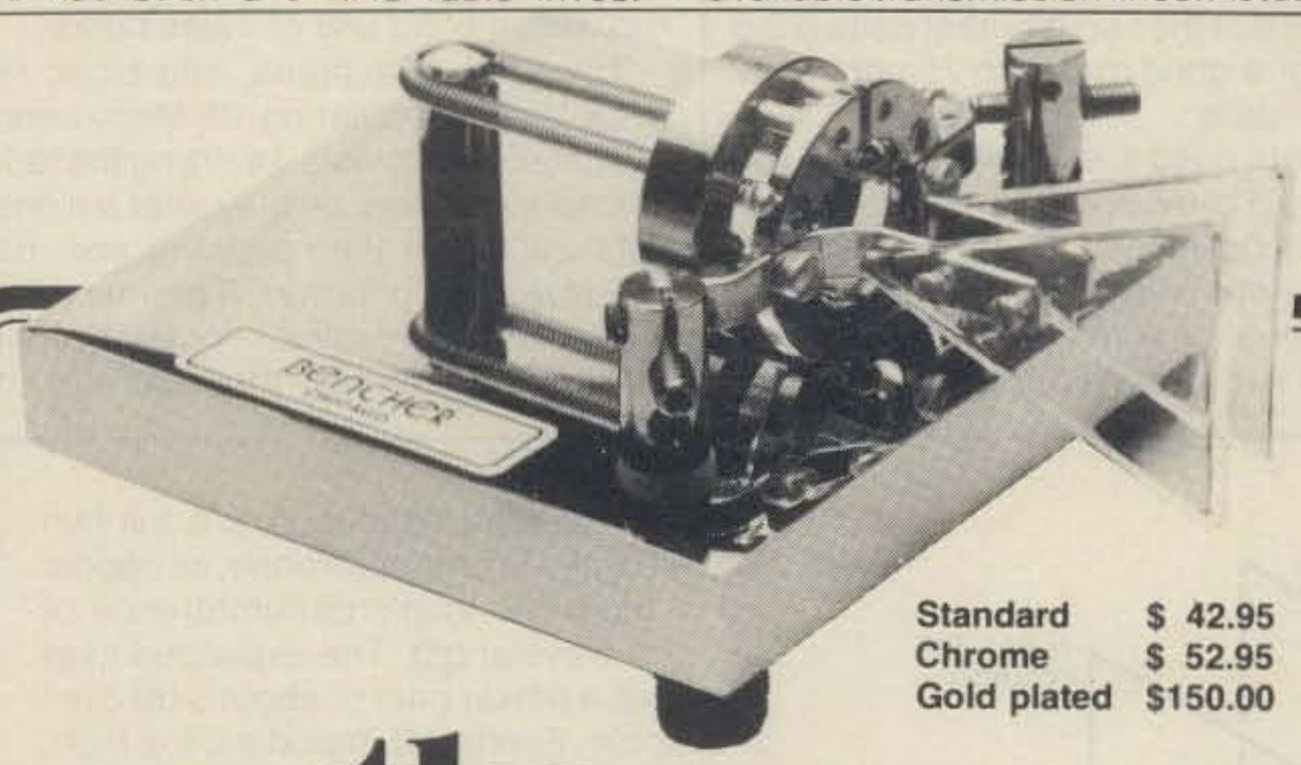
Some amateurs have reported good success in feeding single-band loops with 72-ohm transmitting-type parallel conductor feedline; this results in a reasonably good impedance match and maintenance of feeder system balance. Others have used parallel conductor feed on specialized arrays including expanded and lazy quads on several bands, treating the transmission line as a resonant one and effecting a match to the transmitter through a wide range balanced-line antenna coupler. However, for the usual quad installation, properly matched and terminated coaxial cable constitutes the preferred feeder.

There are a number of ways to feed the quad, some simple and some very complicated. Probably the simplest, other than direct connection of the coax to the driven element, is by means of the balun.

The Balun Transformer

The balun, the name being derived from the term "balanced-to-unbalanced," is the classic device used to prevent line radiation by detuning or decoupling the line for so-called antenna currents in order to reduce or eliminate their adverse effects on antenna performance. The balun may take the form of sections of coaxial cable, metal sleeves, or specially designed, broadband air or ferrite-core coils. The balun may, by appropriate design, be also used as a transformer by designing it so as to step-up or step-down impedances as required at the same time it is effecting balance condition transformation. For these reasons, the balun is a special favorite in both Yagi and quad designs.

Use of the simple linear balun allows coax to be attached directly to a quad;



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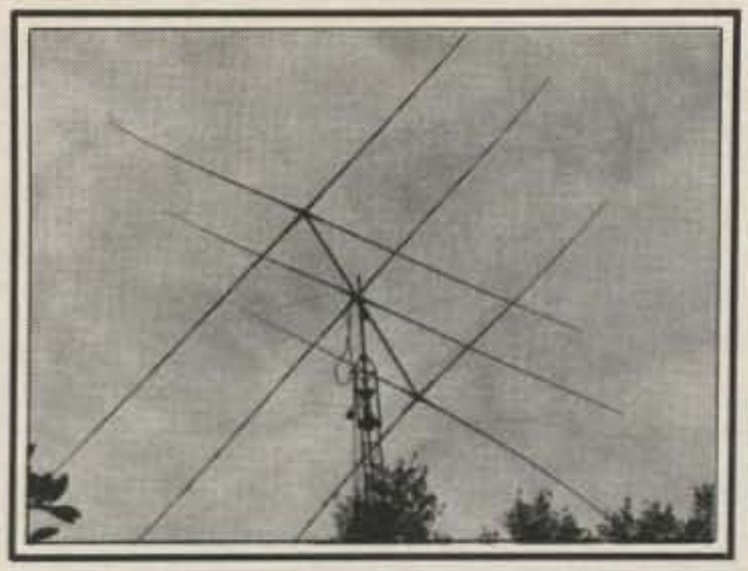

Three-element, three-band cubical quad is large, but sports a gain of about 10 dB over the dipole (12.1 dB against an "isotropic source"); this is comparable to the gain afforded by a four-element Yagi. Note h.f. ring transformer in the photo, used to match the different impedances of the Skylane quad shown on each band to a single feeder. (Photo courtesy Skylane Products)

this kind of balun would be a good choice for a single-band array whose impedance was known to be in the 50- to 70-ohm range. In one simple arrangement, a quarter-wave metallic braid sleeve or shield wire is placed over the transmission line, with no direct electrical connection being made to the driven element at the feedpoint. The shield is jumpered to the coax braid shield at a point one-quarter-wave down the line, where the sleeve ends. This balun won't affect impedance transformation, but it will ensure that the feedline is properly decoupled from the antenna.

Increasingly popular and convenient to use are broadband ferrite-core baluns of 1:1 ratio, that is, baluns that work effectively over the entire h.f. spectrum but which do not have the capability to transform impedance. Using them you can match a 75-ohm quad to a 75-ohm transmission line using a balun, or do the same with a 50-ohm system. But you can't conveniently match, say, a 125-ohm to 50- or 75-ohm cable. As a result of the balun's shortcomings in matching and balancing-out oddball antenna impedances for use with common coaxial cables, the gamma match has come into increasing favor.

The Gamma Match

The gamma match can be used with RG-8/U and RG-11/U or similar cables to effect a good feedline match to the quad, and to place the driven loop at ground potential. The device is a transformer designed to match a low impedance unbalanced transmission line, such as coax, to a relatively high impedance point along a dipole or other driven element, such as a loop. The gamma match, long a favorite of Yagi builders, can be applied, to the quad, although it will be constructed of small-diameter wire rather than tubing, to compensate for the quad's different construction and electrical characteristics.

The gamma match has an added plus: it's what I call a "variable-in, variable-out" device. That is, since it can be continuously adjusted over a wide range of impedances, it can match any common coaxial cable to practically any feedpoint impedance. No matching stubs, Q-sections, baluns, or other devices are required. The use of the gamma match is particularly recommended if especially wide element-to-element spacing is used, as frequently results when feeding multiband arrays on the higher bands. In such cases, feedpoint impedance rises considerably above the nominal 60–75 ohm range, and would be otherwise difficult to properly match to common coaxial cables.

The gamma match normally requires a series capacitor for tuning out residual reactance. The capacitor must be protected, so it is usually mounted in a small, weatherproof box. Some amateurs have used a variation of the standard gamma match known as the coaxial gamma match, made from lengths of coax. Using coax eliminates the capacitor box, but may require that you have a capacity measuring instrument and/or that the capacitance per unit length of the coax being used be known. *The ARRL Antenna Book* contains a wealth of information on the design, construction, and adjustment of gamma matches.

(To Be Continued)

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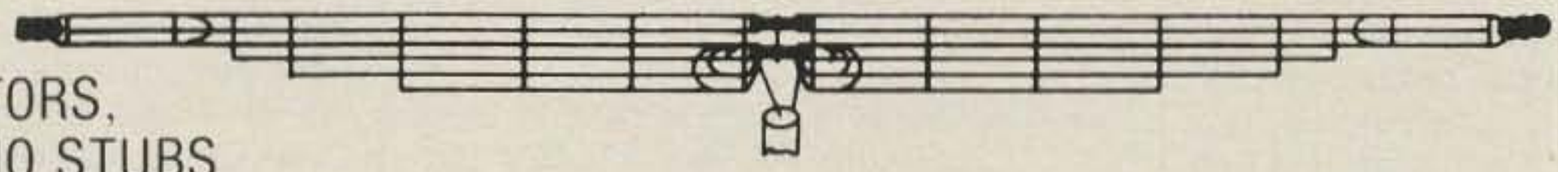

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EXCLUSIVE 66 FOOT, 75-10 METER DIPOLES

- May be installed as inverted vee with negligible effect on performance.
- Fabricated from highstrength 40% copperweld wire - over 500 pounds breaking strength.
- Stainless steel hardware.
- Completely assembled and pre-tuned. No cutting or measuring necessary.
- 1-year limited warranty.
- Patented linear phase loading principle eliminates need for traps, loading coils or stubs.
- Engineering design and manufacturing is backed by our more than 15 years experience.
- Professional grade design - Amateur models are identical to those we produce for commercial industrial systems.
- No antenna tuner required for operation within stated specifications.
- Re-tunable by the user to accomodate site proximity effects.
- HD/A models have female coax connector. Other models have lugs at center insulator.

MODEL	BAND (Meters)	LENGTH (feet)
40-20 HD	40/20	36
40-20 HD/A	40/20	36
75-10 HD	75/40/20/15/10	66
75-10 HD/A	75/40/20/15/10	66
75-10 HD(SP)	75/40/20/15/10	66
75-10 HD(SP)A	75/40/20/15/10	66
75-20 HD	75/40/20	66
75-20 HD/A	75/40/20	66
75-20 HD(SP)	75/40/20	66
75-20 HD(SP)A	75/40/20	66
75-40 HD	75/40	66
75-40 HD/A	75/40	66
75-40 HD(SP)	75/40	66
75-40 HD(SP)A	75/40	66
80-10 HD	80/40/20/15/10	69
80-10 HD/A	80/40/20/15/10	69
80-10 HD(NT)	80/40/20/15/10	69
80-10 HD(NT)A	80/40/20/15/10	69
80-40 HD	80/40/15	69
80-40 HD/A	80/40/15	69
80-40 HD(NT)	80/40/15	69
80-40 HD(NT)A	80/40/15	69

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CIRCLE 129 ON READER SERVICE CARD

Results Of The 22nd Annual CQ 160 Meter C.W. DX Contest

BY DONALD McCLENON*, N4IN

Worldwide conditions for the C.W. contest varied from good to fantastic, depending on where you were. Scores averaged higher than last year, and everyone was adding to his state and country totals while enjoying the operation. Worldwide participation of 985 DX and 1269 W/VE stations was determined from the 363 logs received. With at least 117 more operators at the multi-op stations, there were about 2400 participants.

There were 65 countries active, all 50 states, and all Canadian provinces except NWT/YUK. VE1AK in PEI appears to have worked only EU stations. Choice multipliers included DU, EA, EA8, EL, FG7, GU, HC, HI, HP, I, J7, KL7, LU, OA, OHØ, OY, OZ, UA9, UC2, UD6, UF6, UL7, UO, UP2, UQ2, UR2, VS5, VS6, XE, 4U1, 4X4, 9V1. There were EA9 and SM phonies reported. This year's rare state/province supplier heroes were Alaska KL7GKY, KL7JEF; Idaho N7SU; North Dakota AKØS; New Mexico N5RR; Nevada W7XZ; Wyoming W7TO, N7NG; N.B. VE1AXT; N.F. VO1HP; Alta VE6OU.

A new all-time world high scoring record of 439,200 points was made by K1ZM operating NP4A. He was followed by last year's high scorer KV4FZ at 344,960 points operating under medication with his arm in a cast, and still way above his previous record. Other six figure scores were GD4BEG 180,117; W8LRL 164,912; N2NT 164,256; G3SZA 131,208; OK5TLG/P 113,670; N5JJ 113,550; W2IB 107,920; G3ZYY/A 106,440; GM3IGW 106,132; K5GO 104,874. Top ten scores in the W/VE Single Operator, DX Single Operator, and Worldwide Multi-Operator categories are shown in the score boxes.

Top QSO leaders were N2NT 544; W8LRL 537; NP4A 533; K5GO 529; N5JJ 505; K5RC 500; KØRF 464; W9LT 460; W2IB 458; GD4BEG 456; KB4I 453. Outside W/VE, some of the higher QSO figures are NP4A 533; GD4BEG 456; KV4FZ 450; UK2RDX 341; GM3IGW 338; OK3CXF 315; OK2KZR 314; G3SZA 312; UK2PCR 306; G3RPB 297; OL3AXS 286.

*3075 Florida Ave., Melbourne, FL 32901

Top world scorer K1ZM operating NP4A had the highest multiplier and furnished one to 446 W/VE's.

Top QSO leaders outside NA/EU were KH6CC 168; UF6VAZ 163; JA6LCJ 131; KP4KK/DU2 90; JA7YCQ 86; JA7YEF 84; JA1BK 79; W1BIH/PJ2 74; JH1LKH 73; VS5RP 63.

NP4A tied the 1979 K1PBW multiplier record of 90. He was followed by W8LRL 88; N2NT 87; N4WW 83; KV4FZ 80; AA1K 78; K5GO 77; W2IB and KB4I 76; N5JJ 75. Other DX station multiplier leaders were G3SZA 66; GD4BEG 63; G3ZYY 60; G3RPB, OK5TLG/P 54, GM3IGW, OK3CXF, and UR2RDX 52; OK2KZR and OL3AXS/P 49.

Countries worked leaders were UK2RDX 38; NP4A, G3SZA, and OK3CXF 37; GD4BEG and OK5TLG/P 36; UK2PCR 35; N2NT and OL3AXS/P 34; G3RPB, OK2KZR, and W8LRL 33; DLØKF 32.

High W/VE stations in 10-point contacts were N2NT and W8LRL 100; K6SE 82; K5MM/7 68; K1KI and W7RM 65; W2IB and N5JJ 63; N4WW 57; W7IXZ and WA7OFH 53; VO1HP 52. High DX stations in making 10-point W/VE contacts were NP4A 446; KV4FZ 413; K3OX/VP9 153; KH6CC 146; G3ZYY/A 120; K3SXA/MM 119; GD4BEG 117; G3SZA 112; G3RPB 83; HP1XAT 81; GM3IGW 78.

The following numbers of separate stations were reported active from countries having more than 10 entrants: G 197; JA 154; OK 142; DL 102; UA(1-6) 68; UB 38; YU 30; SP 25; UP 20; GM 19; OH 15; OZ 14; PA 13; HB 12; KH6 11. Since the great Loran QRM decrease, the number of JA to W/VE QSOs has increased dramatically.

Many participants missed out on some good contacts because they did not understand the frequency restrictions applying to a number of DX countries. All USSR countries transmit above 1850 kHz, usually below 1855. OY and OZ stations transmit from 1830 to 1850. They all listen over the whole band, so don't restrict where you listen, or be so specific as to your listening frequencies; you exclude those you would like to work. We got complaints from both DX and W/VE on this.

There were widespread complaints about very strong Caribbean signals blocking the DX window. The guilty stations even complain about each other doing it! These stations do not need the QRM protection of the window, and defeat its purpose by operating there. We may have to treat them the same as W/VEs with regard to disqualification for unsportsmanlike action if the situation does not improve.

No one was disqualified this time, but a number of big scores were reduced by the 4 for 1 penalty exacted when dupes were not so marked in the log. Some "unique" call investigation caused additional score shrinkage. Incomplete or erroneous QSOs should not be counted for credit. You make out much better if you delete them yourself rather than have the scorers do it for you.

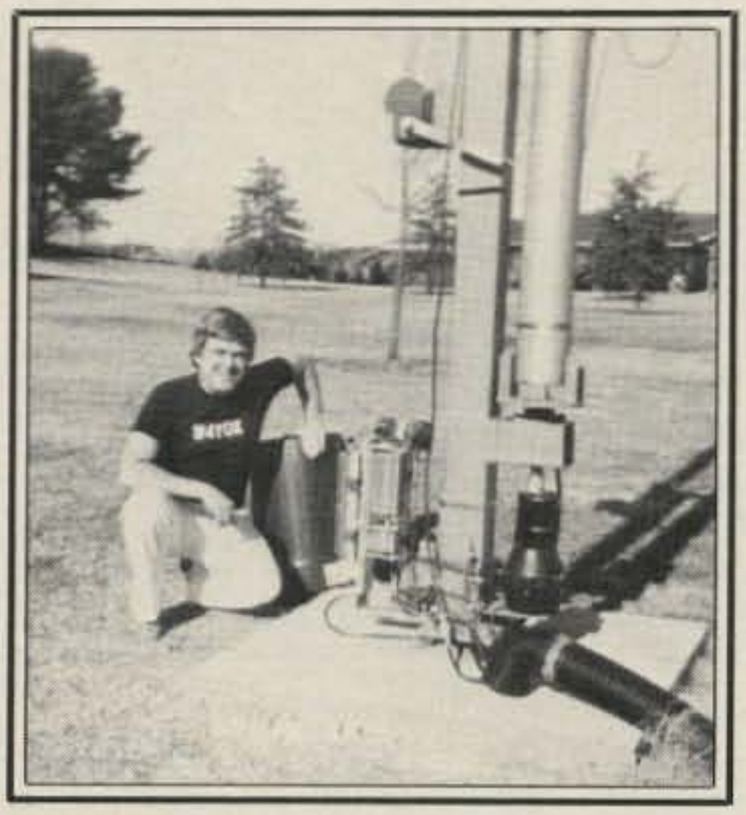
There has never been any kind of club award in this contest, but the summary sheets carry a blank to show club affiliation. As a matter of interest, we totalled all 36 clubs who used this blank, with the results shown in the club listing. PVRC was way out in front, with Yankee Clipper Contest Club second, and Kansas City DX Club third. These were the only ones running to six figures.

Say You Saw It In CQ

TOP 10 W/VE SINGLE OP

W8LRL	164,912	K5RC(K5ZD Op.)	95,192
N2NT	164,256	K6SE	92,862
W2IB	107,920	KØRF(WØUA Op.)	85,760
K5GO	104,874	AA1K	81,432
N4WW	96,778	W3GG	75,480

KB4I used this neat layout and help from N4PN and N4RJ to make the top Georgia score.



W4YOK showing his Wilson tower remote controlled shunt fed tuner.

Top world scorer NP4A will receive the WØAW trophy presented by NCCC. Top USA scorer W8LRL just got by N2NT to win the West Gulf ARC Plaque. Top European scorer GD4BEG wins his second West Gulf ARC Plaque after waiting out his three-year eligibility.

The single and multi-op winner in each state, province, and country for this 22nd annual contest will receive a Certificate.

We need more photos of you and your setup to liven up the results, and please send in your log, no matter how small; we like them all to indicate your interest. Get those antennas and radials installed before it freezes, so you are all set for the next CQ C.W. 160 Meter Contest the last full weekend of January 1982 (Jan. 29, 30, 31). Send s.a.s.e. to CQ Magazine for log and summary sheets. Get twice as many if you also plan to enter the CQ S.S.B. 160 Meter Contest the last full weekend of February (Feb. 26, 27, 28). Good luck on 160.

73, Don, N4IN

Number groups after calls denote score, total QSOs, 10-point QSOs, multiplier, and DXCC countries worked. Multi-op scores follow single-op listings.

SINGLE OPERATORS

Connecticut					
AA1K	81,432	322	50	78	25
K1KI	72,416	236	65	73	24
W1WEF	28,820	206	14	55	15
W1WY	28,184	155	29	52	15
Maine					
K1NBN	10,742	107	6	41	7
Massachusetts					
K1MEM	27,864	122	34	54	20
WB1HIH	15,824	172	3	43	5
W1BB	8,008	51	23	28	15
New Hampshire					
N1EE	68,380	342	46	65	20
Vermont					
K1IK	25,164	205	7	54	8
New Jersey					
N2IN	1,344	38	1	16	2
WV2ZOW	1,008	28	2	14	2
New York					
N2NT	164,256	544	100	87	34
W2IB	107,920	458	63	76	25
K5NA/2	56,680	244	48	65	24
N2KA	10,218	115	4	39	6
W2DW	3,294	53	2	27	4
Maryland					
W3GG	75,480	463	23	68	16
W3YOZ	58,616	307	31	68	20
WB3AVN	40,136	238	27	58	16
K3AO	25,172	163	10	62	12
W3FA	20,176	146	12	52	10
W3GN	15,792	160	7	42	7
K3HPG	6,734	79	3	37	5
W3ICM	690	19	1	15	2
Pennsylvania					
W3BGN	59,520	289	44	64	23
W3AJS	31,806	251	7	57	7
W3AP	25,920	196	11	54	11
W3CNS	25,016	176	15	53	11
W3UHP	8,496	114	1	36	3
LA4LN/W3	216	12	0	9	1
Alabama					
N4KG	34,840	200	17	65	16
Florida					
N4WW	96,778	355	57	83	30
N4IN	63,000	318	33	70	20
W4OO	12,900	94	14	43	11
W4BV	7,200	76	6	36	8
W4PZV	7,140	62	10	35	11
W4MLA	5,700	79	4	30	5
WB4TON	1,024	28	1	16	3
Georgia					
K4BAI	30,528	264	6	53	7
N4UZ	10,960	129	2	40	4
Kentucky					
WB4ASW	38,772	347	3	54	5
W4YOK	26,620	226	4	55	6
North Carolina					
W4TMR	59,094	381	15	67	15
K4JO	9,200	107	2	40	4
South Carolina					
AA4V	49,010	313	16	65	14
Tennessee					
NF4F	7,622	103	0	37	2
K4FW	3,024	56	0	27	2
Virginia					
N4UU	49,530	325	14	65	13
W4DHZ	41,664	280	14	62	13
K4OD	15,640	158	3	46	5
AA4M	14,288	120	8	47	9
N4CMJ	8,732	110	2	37	4
N4MM	8,320	76	7	40	9
KG4W	8,050	83	8	35	7
Arkansas					
K5GO	104,874	529	38	77	22
W5KL	19,136	204	1	46	3
Louisiana					
WA5OIH	12,180	133	3	42	5
WD5DUD	1,024	32	0	16	1
Mississippi					
KC5T	12,320	150	1	40	3
AE5H	11,524	130	1	43	3
W5GWD	176	11	0	8	1
New Mexico					
N5RR	19,686	153	10	51	6
Oklahoma					
N5CG	39,380	342	4	55	6
K5JZN	30,564	259	6	54	7
KK5I	29,920	260	3	55	5
Texas					
K5RC	95,192	500	38	73	19
			(K5ZD Opr)		
K5NW	47,492	339	11	62	10
KM5R	45,704	374	5	58	7
W5QF	15,876	154	2	49	4
K5IS	14,600	134	3	50	5
W5FIX	11,180	118	3	43	5
W5SOD	5,740	70	3	35	5
California					
K6SE	92,862	409	82	63	13
K3VA/6	57,828	310	41	61	12
K6XT	34,768	248	20	53	8
W6AMO	16,650	153	8	45	6
WA6PGB	15,566	145	9	43	6
K6MO	15,050	127	12	43	8
AD6D	13,356	135	6	42	6
K6TS	8,316	110	4	33	5
W6BIP	5,022	81	3	27	5
AA6DX	560	24	1	10	3
AA6EE	448	28	0	8	2
Arizona					
WB7FDQ	44,118	295	23	57	8
Idaho					
KA7BTQ	25,400	246	2	50	4
N7SU	13,248	128	4	46	6
Montana					
KØPP/7	35,420	282	10	55	7
W6BYB/7	28,420	225	5	58	7
Nevada					
W7XZ	27,242	213	11	53	8
Oregon					
K7MM/7	68,090	347	68	55	9
W7ULC	32,816	237	14	56	7
Utah					
N7DF	42,408	316	14	57	7
Washington					
W7RM	75,274	357	65	61	13
			(WA7GCI Opr.)		
N7AM	56,710	271	66	53	9
WA7OFH	45,656	227	53	52	7
W7BYK	16,192	136	12	44	7
W7KJI	8,428	82	4	43	6
K7DU	630	21	0	15	2
W7DRA	600	25	0	12	2
K7IDX	288	12	1	9	3
Wyoming					
W7TO	4,200	70	0	30	2
Michigan					
KC8P	38,418	329	2	57	4
W8VSK	21,318	135	13	57	12
K8CV	3,024	52	1	27	3
W8WVU	1,722	41	0	21	2
KG8J	798	21	0	19	1
Ohio					
KJ8I	23,256	212	4	51	6
K8IP	19,186	149	8	53	9
K8AC	19,074	179	2	51	4
K8US	17,630	207	2	41	4
AA8S	15,980	158	3	47	5
N8BJQ	14,448	160	2	43	3
W8IM	9,576	125	2	36	4
N8TN	6,600	110	0	30	2
WD8ALG	4,736	66	2	32	4
K8MR	2,640	55	0	24	2
N8AXA	8	2	0	2	1
West Virginia					
W8LRL	164,912	537	100	88	33
K8OQL	32,604	234	13	57	13
Illinois					
W9PNE	37,170	255	10	63	11
K9BG	26,790	219	4	57	6
WAØAVL	18,528	185	2	48	4
Indiana					
W9LT	65,536	460	13	64	11
W9RE	13,338	155	4	39	6
Wisconsin					
WØAIH/9	61,380	425	10	66	11
K9DAF	40,992	312	6	61	8
N9AUG	17,136	164	1	51	3
K9YCV	2,350	47	0	25	2
K9GDF	624	26	0	12	2
Colorado					
KØRF	85,760	464	44	67	14
			(WØUA Opr.)		
NØZA	1,760	40	0	22	2
Iowa					
KØRW	9,460	106	1	43	3
KØGVB	4,340	66	1	31	3
Kansas					
WAØTKJ	41,296	332	6	58	8
WØODT	2,700	46	1	27	3
Minnesota					
KØFVF	39,330	333	3	57	5
WØEKS	18,576	156	4	54	6
WBØBQA	6,864	100	1	33	3
Missouri					
NØDX	47,970	321	12	65	12
KØRWL	30,688	266	2	56	4
WØHMA	11,508	129	2	42	4
North Dakota					
AKØS	14,976	152	1	48	3
South Dakota					
WBØRXF	6,808	92	0	37	2
New Brunswick					
VE1AXT	18,920	83	33	44	18
Newfoundland					
VO1HP	33,354	119	52	51	25
Ontario					
VE3BMV	45,260	225	35	62	19
VE3ABG	44,400	314	14	60	12
Manitoba					
VE4RRC	33,770	295	3	55	5
			(VE4VV Opr.)		
Saskatchewan					
VE5XU	27,976	253	4	52	6
VE5RA	15,308	170	2	43	4
Alberta					
VE6OU	31,860	263	8	54	8
British Columbia					
VE7BDO	528	24	0	11	2
Aland Is.					
OHØXX	44,781	269	3	33	31
Asiatic Russia					
UA9MR	3,765	52	0	15	15
EZ9XAD	530	23	0	5	5
Austria					
OE5KE	35,154	219	9	31	26
Bermuda					
K3OX/VP9	55,800	157	153	36	5
Brunei					
VS5RP	3,015	63	4	9	7
Czechoslovakia					
OK3CXF	79,820	315	40	52	37
OL3AXS/P	66,297	286	26	49	34
OK1MAC	48,626	266	15	41	34
OL6AWY	21,816	201	2	27	26
OK2BWM	21,359	171	4	31	29
OK1KPU	18,512	181	1	26	26
OL8CKB	18,150	154	3	30	28
OK1DPM	15,606	149	2	27	26
OK1KFQ	14,050	144	2	25	24
			(OL4BBP Opr.)		
OK1DCF	13,750	146	3	25	23
OK1DOT	13,662	159	0	23	23
OK2HI	12,974	127	4	26	24
OK1DJK	12,360	126	1	24	24
OL8CII	12,052	142	0	23	23
OK2BEJ	11,752	121	3	26	24
OK2BQU	11,350	106	7	25	21
OK3CQR	9,709	140	0	19	19
OL9CJB	9,160	130	0	20	20
OL1AZM/P	9,040	121	0	20	20
OK3ZBU	8,799	109	0	21	21
OL5AZY	8,322	123	0	19	19
OK1DIJ	6,440	38	21	23	13
OK2BMU	6,174	98	0	18	18
OL1BBR	6,137	107	0	17	17
OK2QX	5,795	82	0	19	19
OK3FON	5,624	85	0	19	19
OL1AYV	5,312	100	0	16	16
OK1MIW	4,844	101	0	14	14
OK1DGE	4,425	89	0	15	15
OK1KQH	4,320	69	0	16	16
			(OK1HL Opr.)		
OK2BNW/P	3,598	76	0	14	14
OK1AXK	3,328	56	0	16	16
OK2PDT	3,042	69	0	13	13
OK3TEG	2,422	52	0	14	14
OK2HZ	2,366	43	0	13	13
OL2BBT	2,156	47	0	14	14
OK1MZO	1,540	40	0	11	11
OK2ABU	1,230	42	0	10	10
OK1KSH	990	40	0	9	9
			(OK1WFQ Opr.)		
OK1DKZ/P	980	34	0	10	10
OL5AYF	784	34	0	8	8
OK2BCI	770	11	5	10	8
OL2AYQ	392	11	0	8	8
OK3CWU	160	7	0	5	5
OK1DKH	116	10	0	4	4
Denmark					
OZ7YY	70,932	269	43	46	30
OZ1LO	42,770	241	7	35	31
OZ1W	41,184	257	4	32	30
OZ8O	1,599	26	1	13	13
OZ1AIP	1,180	26	0	10	10
OZ2JZ	702	18	0	9	9
OZ3Y	540	9	3	9	7
OZ1FAO	376	10	0	8	8
Dominica					
J73D	5,225	30	25	19	5
England					
G3SZA	131,208	312	112	66	37
G3ZYY/A	106,440	254	120	60	29
G3XWZ/A	59,175	257	41	45	30
G3VRW	58,545	253	36	45	31
G3XTT	30,381	156	16	39	31
G8VF	9,492	109	0	21	21
European Russia					
UA3AFO	13,662	129	0	23	23

UA3AGX	11,594	115	0	22	22
UA3DLN	7,280	80	0	20	20
UA4QM	6,460	73	0	20	20
UA3AAH	6,200	68	0	20	20
UA1ZBQ	3,564	66	0	12	12
UA4CK	3,200	46	0	16	16
UA3XCR	2,682	68	0	9	9
UA4HFG	1,903	40	0	11	11
EZ6YAB	1,550	37	0	10	10
Faroe Is.					
OY7ML	5,025	67	0	15	15
Finland					
OH2SX	13,020	127	0	21	21
OH3JR	8,256	70	0	24	24
France					
F8VJ	18,550	70	36	35	18
F3AT	2,665	41	0	13	13
Georgia					
UF6VAZ	23,660	163	6	28	25
Germany, Fed. Rep.					
DK6AS	39,354	162	35	42	27
DJ8FR	19,080	130	8	30	25
DL7HU	15,264	144	0	24	24
DL8CM	10,680	97	1	24	24
DJ3XD	10,560	108	0	22	22
DF3TJ	7,038	93	0	17	17
DK5XF	3,783	66	0	13	13
DK1PF	2,864	40	0	16	16
DJ2YE	711	17	0	9	9
DL7YS	679	23	0	7	7
DF2RG	462	16	0	6	6
Hawaii					
KH6CC	71,668	168	146	46	7
KH6B	12	6	0	1	1
Ireland					
EI9J	45,486	206	34	38	27
Isle of Man					
GD4BEG	180,117	456	117	63	36
Israel					
4X4NJ	4,592	58	0	16	16
Japan					
JA6LCJ	19,981	131	44	29	18
JA1BK	9,261	79	32	21	10
JH1LKH	3,888	73	20	12	8
JA3YKC	2,010	49	11	10	7
			(JE3MAS Opr.)		
JA1DDH	1,914	43	8	11	8
JA3JF	1,248	48	6	8	6
JA6BIF	1,168	39	7	8	6
JA4UIT	22	11	0	1	1
JK1LUY	10	5	0	1	1
Kazakh					
UL7PBY	4,465	47	0	19	19
Lithuania					
UP2BAW	46,375	265	6	35	31
RP2BET	18,504	162	0	24	24
UP2BBF	14,080	145	0	20	20
UP2BAS	3,630	52	0	15	15
EZ2BAO	66	8	0	3	3
Maritime Mobile Region 2					
K3SXA/MM	46,995	122	119	39	5
Moldavia					
UO5AP	19,516	139	1	28	28
Netherlands					
PA0LOU	25,200	167	4	30	28
PA0MS/A	12,940	133	0	20	20
PA0MRN	5,920	74	0	16	16
PA0DIN	2,262	36	0	13	13
Netherlands Antilles					
W1BIH/PJ2	23,868	74	67	34	9
Panama					
HP1XAT	24,070	85	81	29	5
Philippines					
KP4KK/DU2	4,620	90	3	10	9
Poland					
SP9DH	48,421	234	10	41	33
SP5AD	21,918	171	0	26	26
SP1ADM	16,770	122	10	26	22
SP3ACB	11,685	126	0	19	19
SP3HC	3,416	50	0	14	14
SP7AW	3,332	50	0	14	14
SP3GVX	2,676	47	0	12	12
SP9EPY	2,652	42	0	13	13
SP3CMX	2,365	46	0	11	11
SP3BYZ	1,510	32	0	10	10
SP8FHJ	208	11	0	4	4
SP9EEE	14	2	0	2	2
Puerto Rico					
NP4A	439,200	533	446	90	37
			(K1ZM Opr.)		
Scotland					
GM3OXC	3,270	46	0	15	15
Singapore					
9V1TK	45	3	0	3	3
Spain					
EA2OP	15,522	116	4	26	24
Ukraine					
UB5ZAL	32,184	176	10	36	30
UB5AAL	11,000	103	0	22	22
UB5QBG	7,920	84	0	20	20
UB5IF	5,424	72	0	16	16
Virgin Islands					
KV4FZ	344,960	450	413	80	28
Wales					
GW3NYY	21,843	161	2	27	27
GW3GWX	7,353	78	0	19	19
Yugoslavia					
YU2BQR	42,058	246	8	34	31
YU3TOJ	1,750	38	0	10	10
YU7SF	1,384	37	0	8	8
YU7ORQ	658	20	0	7	7
YU4VWQ	70	10	0	2	2

MULTI-OPERATORS

Connecticut					
W1XX	64,740	362	34	65	18
Massachusetts					
W1MX	56,364	282	45	61	19
Rhode Island					
N1DM	23,970	195	15	47	11
Pennsylvania					
K3YTL	7,956	109	2	34	4
Florida					
N4BP	33,972	262	9	57	10
Georgia					
KB4I	85,880	453	28	76	21
Tennessee					
N4ARO	37,968	327	3	56	5
K4JU	6,240	100	1	30	3
Oklahoma					
KM5H	42,600	323	8	60	9
Texas					
N5JJ	113,550	505	63	75	21
W5AC	13,416	148	2	43	4
California					
N6RZ	39,624	257	31	52	8
Arizona					
N7RK	27,846	245	7	51	6
Oregon					
W7IXZ	52,920	278	53	54	10
Washington					
W7XR	56,508	286	67	51	9
AK7F	5,264	82	3	28	5
Michigan					
N8EA	53,676	338	22	63	12
K8AQM	49,140	326	13	65	13
Ohio					
AD8P	68,880	428	16	70	17
W8SDL	36,740	314	5	55	7
Illinois					
KB9OF	29,256	264	3	53	5
WD9GGY	286	13	0	11	2
Wisconsin					
N9AW	28,614	223	7	57	8
Missouri					
WB0UXI	37,164	314	3	57	5
Ontario					
VE3NNN	47,244	357	6	62	8
Asiatic Russia					
UK9SAY	8,020	82	0	20	20
Czechoslovakia					
OK5TLG/P	113,670	409	61	54	36
OK1KSO	85,736	286	55	56	36
OK2KZR	70,952	314	26	49	33
OK1KPA	45,879	245	22	41	30
OK1OAZ	31,894	204	11	37	32
OK1KZD	21,315	176	2	29	28
OK3KAP	19,899	147	9	33	27
OK1OPT	14,542	170	0	22	22
OK1KYS	6,120	81	0	20	20
OK1OXP	4,944	90	0	16	16
OK1KUA	4,725	90	0	15	15
OK3KTY	3,584	64	0	16	16
OK1KTW	3,015	63	0	15	15
England					
G3RPB	94,824	297	83	54	33
Estonia					
UK2RDX	96,564	341	34	52	38
European Russia					
UK3AAC	14,700	152	0	21	21
Germany, Fed. Rep.					
DL0KF	37,146	179	16	41	32
DL0FJ	22,650	157	9	30	25
Hawaii					
KH6DX	952	21	11	7	3
Japan					
JA2YEF	3,936	84	17	12	8
JA7YCQ	2,421	86	11	9	5
JA2YKA	310	16	3	5	4
Lithuania					
UK2PCR	72,312	306	18	46	35
UK2BCC	35,296	220	6	32	29
Scotland					
GM3IGW	106,132	338	78	52	30
Ukraine					
UK5IAZ	11,109	110	0	21	21

Check logs are gratefully acknowledged from the following: W8IMZ, OH1XX, OK1KUJ, OK1XJ, OK3CGI, SP8JMA, UA3EAL, UO5ODB, UT5BN.

Multi-Op Station Crews

W1XX: W1XX, W1JKS. **W1MX:** K1MK, AG4D, AE9Y. **N1DM:** N1DM, WB1FDY. **K3YTL:** WA3YQN, WB3BVF, WB3FKQ, WB3FVT. **N4BP:** N4BP, K4GNP. **KB4I:** KB4I, N4PN, N4RJ. **N4ARO:** N4ARO, KY4L. **K4JU:** K4JU, N4AVF, WA4BSM, WB3FAB, WB4JTR, WD4FVU. **KM5H:** KM5H, AC5B, AC5P, W5CKT, W7FG. **N5JJ:** N5JJ, N5CDO, K5WA, KN5H, WB5WHR. **W5AC:** N5CIY, WB5PYI, WB5WOH, WD5BIK, WD5EGK. **N6RZ:** N6RZ, WB6SHD. **N7RK:** N7RK, K7OX. **W7IXZ:** W7IXZ, K8TEJ. **W7XR:** W7XR, W7TJ, K7SS, AH6Z. **AK7F:** AK7F, K7FR. **N8EA:** N8EA, K8GM. **K8AQM:** K8AQM, KA8ALG. **AD8P:** AD8P, W8FN, WB8WMB. **W8SDL:** W8SDL, WD8ALG, WB8ZGY, W9VNE, WB8RRR, W8USM, W8NSA, N8AOL. **KB9OF:** KB9OF, WD9DZV. **WD9GGY:** WD9GGY, WD9BHK. **N9AW:** N9AW, K9BED, WA9TZE, WD9GUR. **WB0UXI:** WB0UXI, AB0X, AE0K. **VE3NNN:** VE3KZ, VE3MFT. **UK9SAY:** UA9SGW, UA9-167-516, UA9-167-577. **OK5TLG/P:** OK1DFW, OK1DIV, OK1FCW, OK1MMW, OK2BTW, OK3CQW, OL6BCD, E. Federova, B. Mericka. **OK1KSO:** OK1AEZ, OK1JCW, OK1JKT, OK1WT. **OK2KZR:** OK2PEW, OL6BAB, OK2-25093. **OK1KPA:** OK1AFC, OK1MHI. **OK1OAZ:** OK1DFP, OK1-21950. **OK1KZD:** OK1DHJ, others. **OK3KAP:** OK3TPV, others. **OK1OPT:** 3 Oprs. **OK1KYS:** OK1DEY, OK1FRF. **OK1OXP:** Not shown. **OK1KUA:** 3 Oprs. **OK3KTY:** OK3ZGA, others. **OK1KTW:** OK1AAE, others. **G3RPB:** G3RPB, G3RAU, G4IQM. **UK2RDX:** UR2RCN, UR2RRJ, UR2-083-159, UR2-083-161, UR2-083-162. **UK3AAC:** UA3AMW, UL7-031-15/UA3. **DL0KF:** DF6LH, DJ4FZ, DK8LE. **DL0FJ:** DC4LZ, DF5LA, DF7LF, DG3LL, DJ2EA, DK4VP, DK8LN, DL3UR, DL4LV. **KH6DX:** KH6DX, KH6KV. **JA2YEF:** JE2ATB, JH2TBS, JR2UWZ. **JA7YCQ:** JM1RFU, JH0CZQ. **JA2YKA:** JR2GMC, JA4UDP. **UK2PCR:** UP2BBT, UP2BCR, UP2BCT, UP2BDF, UP2BFL, UP2-038-728. **UK2BCC:** UP2BDW, UP2BHK, UP2-038-346. **GM3IGW:** G3IGW, G3BBD, G4MH. **UK5IAZ:** L. Marenets, A. Mityukow, A. Polyakow.

TOP 10 DX SINGLE OP

NP4A(K1ZM Op.)	439,200	OK3CXF	79,820
KV4FZ	344,960	KH6CC	71,668
GD4BEG	180,117	OZ7YY	70,932
G3SZA	131,208	OL3AXS/P	66,297
G3ZYY/A	106,440	G3XWZ/A	59,175

High Illinois scorer W9PNE has been in every running of this contest from its beginning.

Soapbox DX

Nine people worked 9 days in the snow erecting 3-el west yagi, 2-el east yagi, and inverted V antennas over a 130 meter deep canyon. They all seemed to work fine—*OK5TLG/P*. My nearest locals are KP4KK/DU2 and 9V1TK at 600 miles, and VS6DO at 1000 miles! Hope to be here for next year's contest—*VS5RP*. Nice to hear so many countries on the band. My most successful 160 test so far—*G3XTT*. Biggest thrill by far was working two JA's at sunrise the first morning. Also exciting to make WAC by 1000Z the first night—*NP4A*. After years of reliable operation, had to mend the rig five times during the contest—*G3VRW*. Thrilled to get across the pond for the first time. Will definitely be back next year—*HP1XAT*.

Almost fell out of chair when worked W7RM for first Estonia to west coast USA—*UK2RDX*. Excited to work K3VA, but he was portable 6 HI!—*JA6LCJ*. First time in the contest. It sure is a big handicap not to be allowed to use the DX window. CU agn next year—*OZ1LO*. Right hand in a cast and a bit groggy from medication. Was only on a few hours first night, but then decided to give it a shot anyhow—*KV4FZ*. Worked all US I heard, got EL2FY, but couldn't get into EU this time. Anticipate being on again next year—*KP4KK/DU2*.

With so many G stations active, other EU stations work a few G's and then start looking for multipliers. The OK's are in the same boat only worse!—*G3SZA*. Hastily erected inverted vee for the contest. Will try harder next year—*KH6B*. FB contest! Thanks to all competitors and contest committee—*UK2PCR*. Good contest; very interesting—*JA6BIF*. Back to our super castle for first time since 1974—*GM3IGW*. Unusual to have two good nights to USA—*EI9J*. Very thanks for nice contest—*UO5AP, UB5ZAL*.

Soapbox W/VE

Good contest, good operators, and lots of activity—*W9PNE*. Hair stood up on my head while making first Estonia to west coast QSO—*W7RM*. Friday night score: cows 1, Beverage 0, but lots of fun—*KM5H*. Have waited 20 years for a band opening like Saturday's, and was ready for it—*WB3AVN*. Coincidence dept: worked these combinations in pairs K0RW/K0RWL, KM5R/K5MR, N4AR/N4ARO, N4WW/K3WW. Ya gotta watch those dupe sheets!—*K0PP/7*. Fantastic

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List price $749.95/**CE price $499.00**

Bands: LW 150-410 KHz., MW 520-1610 KHz., SW1-5 1.6-30 MHz., FM 87.5-108 MHz.

The new Panasonic RF-6300 Command Series PLL synthesized 8-band portable communications receiver, lets you hear the world. The RF-6300 has features such as microcomputer pre-set tuning and PLL quartz synthesized digital tuner. Microcomputer stores up to 12 different frequencies for push-button recall. FM/MW/LW/SW1-5 reception. Manual tuning knob. Wide/Narrow bandwidth selector. Double superheterodyne system. Fast/Slow manual tuning. Built-in quartz digital alarm clock. 5 inch dynamic PM speaker. 3 antennas. Multi-voltage. Detachable AC cord. Operates on 6 "D" batteries (not included). Made in Japan.

Panasonic
RF-6300

RF-4900

Panasonic® RF-4900

List price $549.95/**CE price $389.00**

Bands: MW 525-1610 KHz., SW1-8 1.6-30 MHz. FM 88-108 MHz.

The Panasonic RF-4900 shortwave receiver features a 5-digit fluorescent display for all 8 SW bands, as well as for AM/FM. AC or battery operation. Full coverage from 1.6 to 30 MHz on SW. Covers SSB and CW. Premix Double Superheterodyne. Fast/slow 2 speed tuning. AFC Switch on FM, narrow/wide selectivity switch for AM and SW. Antenna trimmer. Calibration control. FET RF circuit. Mode switch for AM-CW/SSB. BFO Pitch control. ANL switch for AM. RF gain control. Tuning-Battery meter with meter function switch. Separate bass and treble tone control. Dial light switch. Digital display on/off switch. Separate power switch. Rack type handle. Made in Japan.

Panasonic® RF-3100

Allow 30-120 days for delivery after receipt of order due to the high demand for this product.

List price $369.95/**CE price $269.00**

Bands: MW 525-1610 KHz., SW1-29 1.6-30 MHz. FM 88-108 MHz.

The Panasonic RF-3100 portable 31-Band portable radio has PLL Quartz-Synthesizer tuning that "locks" onto SW stations. Operates on AC or battery. SW frequencies from 1.6 to 30 MHz. are in 29 bands. All-band 5-digit frequency readout. Horizontal design with front mounted controls for shoulder strap operation. Double superheterodyne for clean SW reception. BFO pitch and RF gain controls. Separate bass and treble controls. Wide/Narrow bandwidth selector. Meter for tuning and battery strength. LED operation indicator. Meter light switch. 3½" PM dynamic speaker. Comes with detachable shoulder belt. Battery power (8 "D" batteries not included). Made in Japan.

Panasonic® RF-2900

List price $349.95/**CE price $249.00**

Bands: MW 525-1610 KHz., SW1-3 3.2-30 MHz. FM 88-108 MHz.

The Panasonic RF-2900 is a portable five-band shortwave radio with digital five digit fluorescent frequency display. Full coverage from 3.2 to 30 MHz. on SW. Covers SSB and CW. Double superheterodyne receiver. Fast/slow two speed tuning. AFC switch on FM, narrow/wide selectivity switch for AM and SW. FET RF circuit. BFO switch and pitch control. RF gain control. Tuning battery meter. Separate bass/treble tone control. SW calibration control. Dial light switch. Digital display on/off switch. Separate power switch. Detachable dial hood included. Rack type handle. Includes whip antenna and ferrite core antenna, speaker, earphone, recording output jacks, AC line and detachable adjustable shoulder belt. Made in Japan.

Command Series
RF-2900

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Command series

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Club Scores

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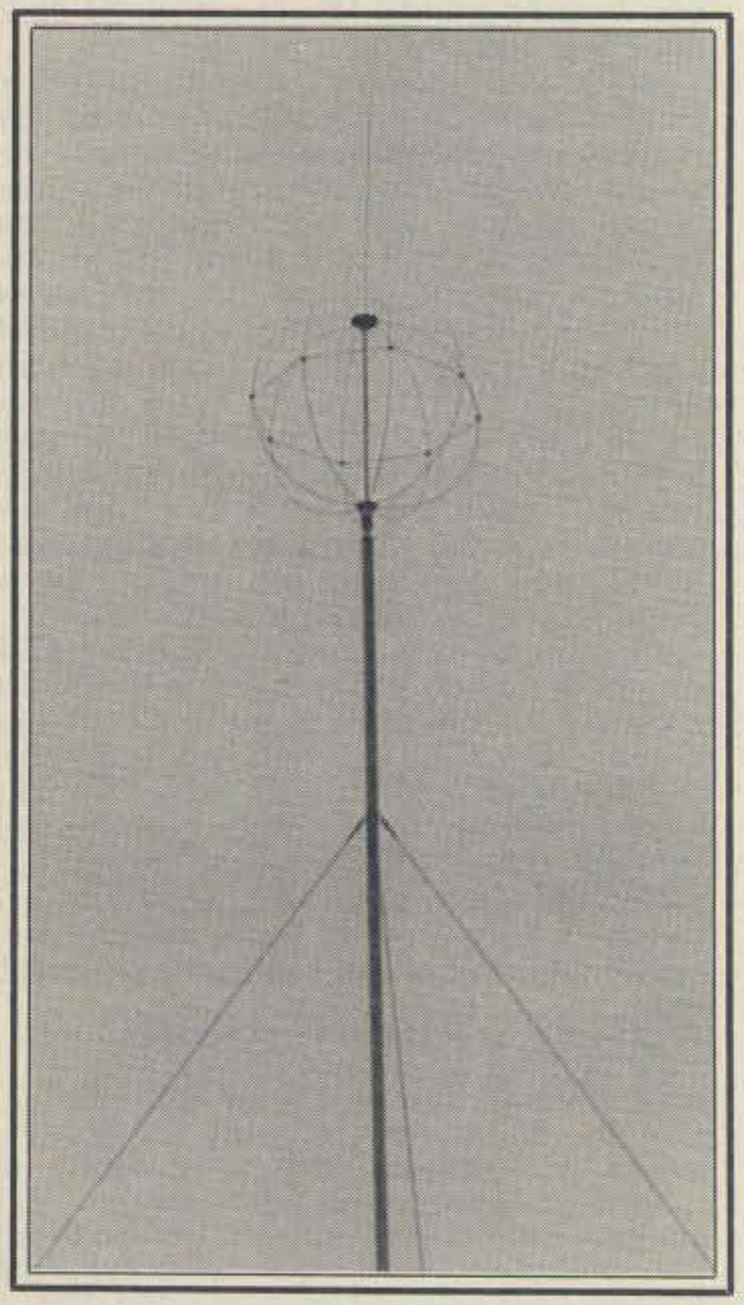
Club Name	Members	Total Score
Potomac Valley Radio Club	**W8LRL**, K3AO, W3FA, W3GN, AA4M, K4OD, N4MM, N4UU	313,830
Yankee Clipper Contest Club	**N2NT**, K1IK, N1EE	257,800
Kansas City DX Club	**WA0TKJ**, K0RWL, WB0UXI	109,148
Tallinn Radio Club	UK2RDX	96,564
Ontario Contest Club	**VE3NNN**, VE3BMV	92,504
Radio Club Chomutov	**OK1KSO**, OK1AXK	89,064
Southeastern DX Club	KB4I	85,880
Long Island DX Assoc.	AA1K	81,432
Kaunas Polytechnic Institute Radio Club	UK2PCR	72,312
Central Arizona DX Assoc.	**WB7FDQ**, N7RK	71,964
Radio Club Bystrice n. Pern	OK2KZR	70,952
Mad River Radio Club	AD8P	68,880
Fort Wayne Radio Club	W9LT	65,536
Club PZK ISKRA	SP9DH	48,421
Radioklub Tesla	OK1KPA	45,879
Radio Club Rade Koncar	YU2BQR	42,058
Northern Ohio ARS	**K8US**, AA8S	33,610
SP DX Club	SP5AD	21,918
Radioklub Praha	OK1KZD	21,315
Radioklub Iskra	OK3KAP	19,899
Ill wind Contesters	WA0AVL	18,528
Radioklub Kozolupy	OK1OPT	14,542
Radioklub Liberec	OK1KFQ	14,050
Moscow Radioclub	UA3AFQ	13,662
Western Washington DX Club	W7KJI	8,428
Murgas ARC	K3YTL	7,956
Radioklub Stochov	OK1KYS	6,120
Radioklub Ustin	OK1KUA	4,725
Radioklub Sedleany	OK1KQH	4,320
CIT Radio Club	JA2YEF	3,936
Radioklub Tatry	OK3KTY	3,584
Klub PZK Poznaniu	SP3HC	3,416
Radioklub Lanskroun	OK1KTW	3,015
Sendai Radio Tech College ARC	JA7YCQ	2,421
Radioklub Rychnov	OK1KSH	990
Nagoya University Radio Club	JA2YKA	310

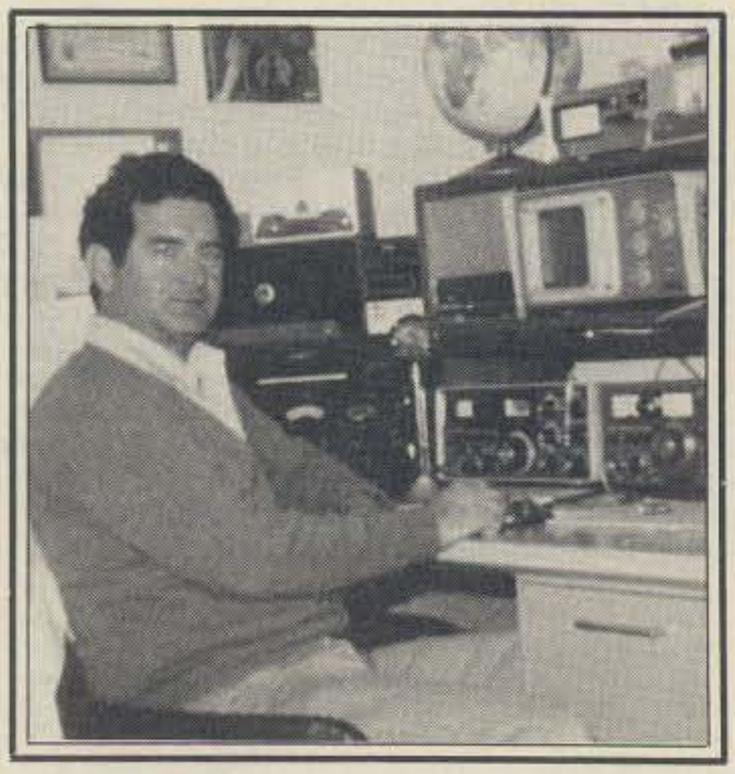
TOP 10 MULTI-OP

OK5TLG/P	113,670	KB4I	85,880
N5JJ	113,550	OK1KSO	85,736
GM3IGW	106,132	UK2PCR	72,312
UK2RDX	96,564	OK2KZR	70,952
G3RPB	94,824	AD8P	68,880

Top Michigan single op KC8P says his son didn't help this much during the contest.



K0PP/7 uses this 6 foot top hat made from 9 CB whips atop his 75 foot minooka.



N4ARO demonstrating how he and KY4L got the top Tennessee score.

openings to EU both nites; sounded like 20 meters!—*AA1K*.

Will be busy this summer burying more radials—*W8IM*. Operator, age 68, needs geritol to keep going during dull no-QSO periods—*VE5XU*. Still no KL7 to complete WAS. Hope to make it before the turn of the century—*K8OQL*. Excellent conditions to Europe. Pleased to work several USSR stations—*VO1HP*. Thanks to G3SZA for first EU QSO in a contest—*K0RF*. Always a great contest. It means a lot to all of us—*K8US*. High point was being called by EA8AK—*N4IN*.

Must do something about my local noise—*VE6OU*. Railroad tracks make good grounds—*K0RW*. Come on fellows, every signal on the band isn't 599; give real reports—*W6AMO*. New on 160, got a kick out of 2 EU QSOs—*K8IP*. When you hear Okla, Texas, and Colo at 2200 UTC, you know they're running illegal power—*K3AO*. A most challenging contest—*WA0AVL*. Wish those big gun EU's would try harder for us western stations—*N0DX*. Got a new country and 3 new states—*N8BJQ*. Happy to get VS6DO; looking forward to next year—*W7XZ*.

Now to get those Russian QSLs—*N4WW*. Just returned to 160 after 27 years absence. It's a lot different now!—*N4ARO*. Tnx for nice contest—*KJ8I*. Several asked me to at least put the cowboy state on the air, so here's 5 hours worth—*W7TO*. At last I got WAS on 160—*N4MM*. This was my first time on 160 and really enjoyed it. CUAGN next year—*KB9OF*. The world's best 160 test. Sunday AM EU opening best ever heard—*W3BGN*.

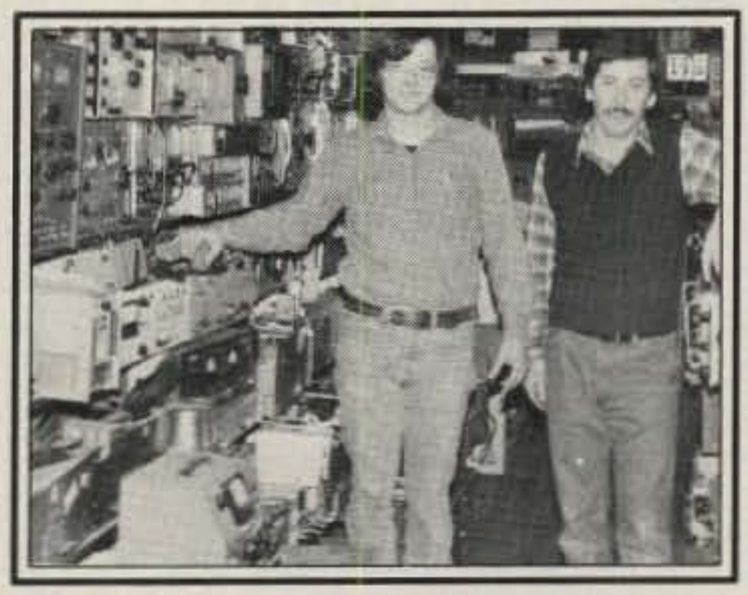
Getting too old; couldn't make it thru the night—*W9LT*. Really surprised at having to keep up a JA dupe sheet—*N5JJ*. Worked my first Europeans on 160—*W1WEF*. Only missed one state; my neighbor SD. How abt that?—*W6BYB/7*. Thanks to N7NG for completing WAS—*N4UU*. My first CQ 160 test and it sure was a thrill for me. Am new to 160 and really having a ball—*N5CG*. This was by far my best contest in 12 years—*W4TMR*.

Say You Saw It In CQ

If you like flipping through the pages of wishbooks, daydreaming about all the equipment you really "need," you'll find the Fair Radio Sales catalog good for at least a week of browsing. A visit to their plant shows where wishes can come true.

The two countermen at Fair Radio Sales: Claude Telles (left) and Gary Stolzenburg, WD8RVZ.

Chuck Colter, shipping supervisor at Fair Radio, checks through another stack of orders.



Phil (left) and George, the two sons of Joseph Sellati, founder and still president of Fair Radio.

A Visit To Fair Radio Sales

BY BRAD FIELD*, W8JJO

Fair Radio, one of the few remaining mail-order surplus equipment houses, still sends out a catalog every spring and a supplement every fall, a survivor of the days, ten or twenty years ago, when dozens of such outfits entertained radio amateurs with their "wishbooks." Like lots of other hams, I have dreamed away some time with catalogs like the one from Fair Radio, looking over the great stuff that I really ought to have, if only as an ornament to my junk box, or that, with a little alteration, would make a handsome addition to my station.

So on the way to the Dayton Hamvention this spring, I stopped off at the plant on Eureka Street in Lima, Ohio to have a look around. It's an interesting place. The arriving visitor is first greeted by a roomful of rows of shelves, stacks, and bins of wonderful things: capacitors, connectors, resistors, coils, cabinets, hardware from the most modest and mundane to the rarest and arcane—a junkboxer's heaven. That is only the tip of it all. The countermen can supply any of the items in the catalog, but a little patience is required. The storage areas behind the counter are vast and deep, and it may take some time simply to make the round-trip walk to where that part of your heart's desire is stacked.

Most of us, of course, do business with Fair Radio by mail, and most of the regular activity there consists of wrapping and sending out mail orders. I interrupted that when I was there. Some orders are very large, but many of them are tiny, single parts. Fair Radio has survived when many other electronic surplus houses have closed, in part because Joe Sellati, the founder, and his sons have always been willing to deal with individuals. Phil and George Sellati are now working full-time with their father. Phil, who has had the EE courses at the University of Dayton, as well as Air Force training in electronics, specializes in testing and checking of equipment. George, with a degree from Ohio State and an M.A. in photography from Iowa, works at selling—and buying—material, as well as preparing the copy and the pictures for the catalog.

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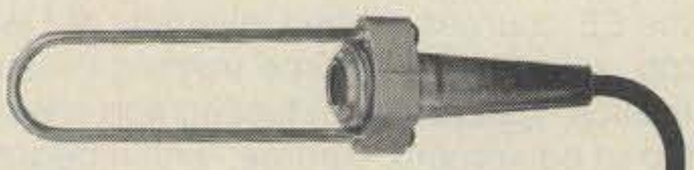
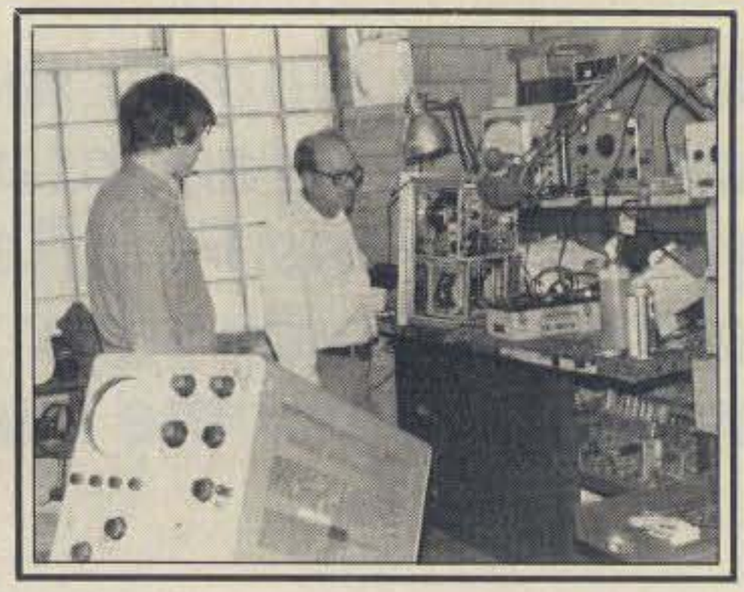


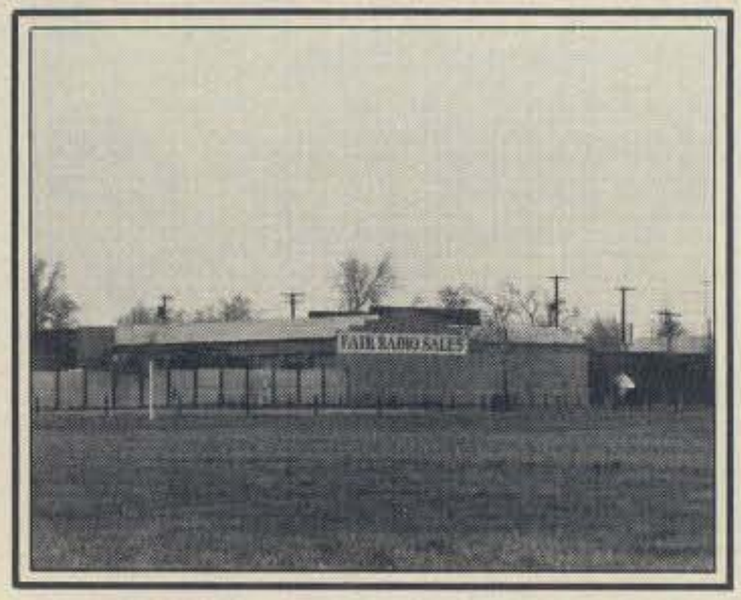
DISTRIBUTORSHIPS AVAILABLE to qualified suppliers of amateur-radio equipment

CIRCLE 125 ON READER SERVICE CARD

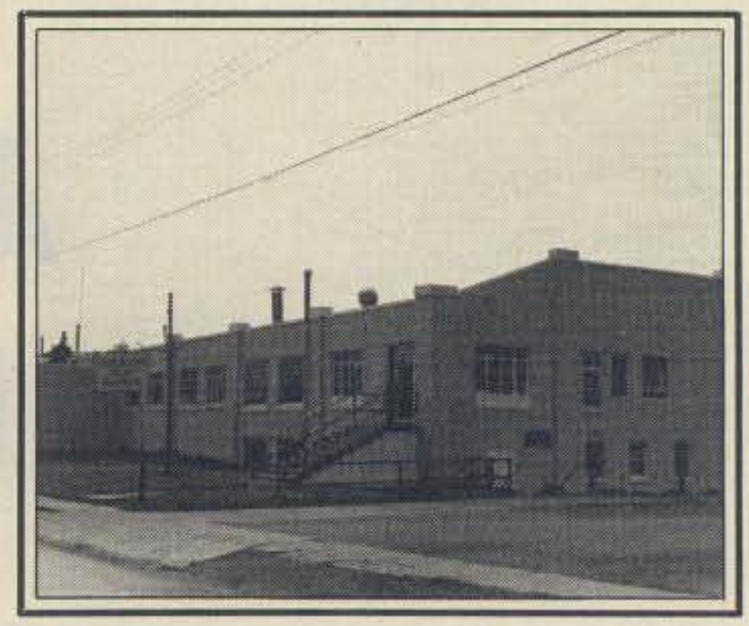
George Sellati, back in the cavernous storage area at Fair Radio, spots an item exactly where he remembered it had been stored.



Phil Sellati (left) and Don Gouin give a piece of gear the "smoke test" to determine how much work it may need.



Fair Radio Sales as seen from the back.



Fair Radio Sales on Eureka Street in Lima, Ohio.

Phil and George began working full-time in 1973 and 1977 respectively, but both of them have, in fact, been in the business all their lives. Joe Sellati began Fair Radio as a "Surplus Store" in downtown Lima, selling everything—clothes, shoes, camping gear, hardware, etc., as well as radio equipment—back in 1947. Later Fair Radio moved out to the edge of town to larger quarters. In 1958, Joe decided to limit himself to electronics gear, and he got rid of the dry goods. But the land at the edge of town became very expensive thanks to the sudden eruption of shopping centers out there, so Fair Radio moved again to their larger present quarters, taking over the buildings of a vacant dairy in Lima. Today twelve people work there full time. Business is steady. Fair Radio still sells the "command sets" that so many hams have rewired as their first transmitters and receivers. Indeed, the U.S. government is still the source for 85 to 90% of their material. They are also moving with the times, handling computer surplus, manufacturers' close-outs, overruns, etc. Two years ago, for instance, they purchased the leftover inventory of a bankrupt matrix printer company, and recently they have invested in some computer games.

George Sellati explains that while the largest number of their customers are individuals buying small lots, the largest dollar amount comes from bigger customers, like universities, and even manufacturing companies. Fair Radio also buys from the "electronic-parts gypsies" who travel from hamfest to hamfest all year long. Business over the years has been fairly constant, slightly increasing every year. Other houses have been directed to other kinds of businesses, have quit, or have been in and out of the surplus market a number of times. Fair Radio, sending out its catalog every spring, has maintained a steady business.

One reason for the constancy is the catalog. Many amateurs depend on it. But these days even the catalog is becoming a heavy expense for Fair Radio. They print about 60,000 and mail out 45,000. At those quantities, they spend aobut 50¢ to print each one, and at today's rates for bulk mailing, about 10¢ to mail each one. They also spend some 52¢ for every copy returned with an incorrect address or with no forwarding address. They therefore have taken to "cleaning" their lists of addresses every

two years, cutting out those who have not ordered anything.

Their present competition for material comes not from other mail-order houses, but from companies in overseas trade, dealers who recondition equipment for export, foreign dealers who buy surplus gear for parts, and the "scrappers." The Taiwan-based "scrappers," George Sellati points out, are particularly aggressive buyers of heavy gear from west-coast sources for their value as scrap metal. Freight rates between Ohio and California, he points out, limit him to bidding on only lighter items from the west coast. One of the ironies of the business is that Fair Radio buys gear for parts, too. They can get nearly as much for a single part from some pieces of gear as they can for the whole box, simply because it is so much cheaper to ship one little item than a big one.

The future, George Sellati says, in general looks like the present, but there are some curious developments. The "nostalgia market" is growing, he says. For instance, some people are restoring old World War II bombers—not to fly them, but just for looks—and an even larger group is working on old military vehicles. They buy authentic radio equipment from Fair Radio to install in their "antiques." Some of that old World War II radio gear is still being released for sale. Every year Fair Radio buys some and sells some, and although the prices for it have gone up, Fair Radio still takes the same markup as they would have, so the business has a kind of eternal sameness to it.

If you take a side trip to Lima to visit Fair Radio, they will not let you visit the area behind the counter where they keep the parts stored. My visit was interruption enough. But take it from me, they have a lot—barns and basements full, racks and shelves rising in buildings some twenty feet high. And they know where all the material is! George Sellati says that his father, for instance, can go back to the inner recesses and lay his hand, on the first try, on any piece of gear that they stock, no matter how many times it has been moved as piles of equipment are moved in and out.

The front rooms alone, where the public is encouraged to wander dreamily through lanes of radio gear, are enough to make a visit to Fair Radio fun. Every catalog has a little map that shows how to get from I-75 to the plant. *Tip:* the map is not to scale. The simpler route is not to bear right at the light on Bellefontaine Avenue, but to go straight ahead on Kibby, press on for about half a mile, cross the railroad tracks, and look for the stop light at Calumet. Turn right on Calumet, heading north; on your right, past the school, across an open field, you'll spot the place. At the stop sign turn right on Eureka Street, and you will find it. It's an amateur's shopping heaven not to be missed! CQ

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CIRCLE 72 ON READER SERVICE CARD

Working DX from an apartment has its problems, but so does working it from the country.

The Cows, The Coax, And I

BY JAMES S. CARROLL*, WA3INA

From the time I became an amateur and really got down to working DX, I used to sit by the rig and listen to "the guns" rag chew about how they worked a certain DXpedition or managed to work some QRP station in Timbuktu. Accordingly, most of them mentioned their 5-mile-long rhomics or stacked 10 over 10 arrays up at levels which come under NASA jurisdiction and which are fed by linears that compete with the Voice of America.

Very seldom have I heard any of these fellows talk about working all the DX with low power and almost no antenna, and to make matters worse, working out of an apartment. This, then, is my story.

No, I don't profess to be a "big gun." Actually, I consider myself to be more of a "water pistol." But in working DX as I have, I had to overcome a few problems, and this story is written to those folks who, like myself, share similar problems.

Having moved into an apartment complex after getting married, there was not much I could do in the way of working DX. I tried loading up the water spout around the building, but this was unsatisfactory, as the master TV antenna was relatively close to it, and the resulting t.v.i. forced me to QRT early. I bought a 12AVQ vertical and tried that. Mounted at ground level and sitting in a clump of bushes to keep from being detected, it worked, but not all that well. Another problem was that in order to keep my vertical from "walking off," it had to be assembled and disassembled every time I finished operating. There had to be another way!

When the possibility came up to move to an apartment in the country that was surrounded by pastureland (not to mention less rent) I jumped at it; the thought of being able to leave my vertical up 24 hours a day was beyond belief. Add to that a QRM-free environment with a good take-off point to the DX, and the matter was settled. I felt I was destined for Honor Roll status; it was just a matter of time.

My apartment is at a beautiful QTH. Sitting up on that hill with no QRM, no line noise, and plenty of room, I thought I'd died and went to "Ham Heaven." Checking with the landlord, he hesitantly allowed me to put up the vertical as long as it caused no problems. The vertical found a permanent resting place and seemed to work fairly well. But my DXCC total just wasn't climbing the way I thought it should. I found myself counting the hours in the pileups and decided to try something different. I'd give the old, reliable dipole a try.

With the area I had to work with, erecting dipoles was no problem. Out in the pastureland I strung my dipoles, and although they seemed to work slightly better, I was still waiting in the pileups. At this point I tried various configurations of wire antennas, mostly in the form of Vee beams. I had wires criss-crossing the pasture, and now the pileups and list went easier. This continued along until one night, while driving his tractor through the pasture, the local farmer caught one of my support ropes and yanked down all my wire antennas. Noticing a car's headlights focused on the tractor, I watched him pull coax and #14 wire off his tractor and heard undiscernable words coming from his direction. Now what to do?

I decided at this point to "damn the torpedoes" and buy a beam. I could not have been more overjoyed to see it arrive, although my enthusiasm was not shared by the landlord. I was not allowed to mount it on the roof, as I had figured. A tower was also out of the question. I was so close yet so far! I decided to build a homemade mast and make it my tower. Using heavy-duty pipe with a light gauge piece running down the center, I was all set. It was mounted out again near the pasture where the farmer had previously done in my antennas, but I had allowed enough for clearance.

It was a rather long run out to the beam, being nearly 200 feet away, and the only obstacle out to it was a barbed wire fence used to keep cattle from straying. It was just a simple matter of jumping the fence to get to the beam. As I didn't have a rotator yet, I felt that the "Armstrong Method" would suffice until a rotator was put up. At least I thought so.

The world of DXing with a beam is so much different than that with a dipole or vertical. Although my beam was only at 27 feet, my receiver seemed to come alive. My last problem, putting up the rotator, would be solved with the arrival of warm weather. With the onset of cold weather, however, another problem came up. In order to turn my beam, the outside temperature had to be above 32°F. When it fell below that, I took my handy blow-torch along to thaw out the mast. Of course, within a few minutes it was frozen stiff again, and this made my DXing rather hard. There was more than one time that, with the blow-torch in hand, I would turn the beam stateside to get on a list, and then torch it again to work the DX. After a little thought I did something

*373 Douglass Dr., Douglassville, PA 19518

Say You Saw It In CQ

that killed two birds with one stone. I constructed a small fireplace out of concrete block at the base of the mast, which, when loaded with all my paper garbage, would keep the mast warm for almost an hour, depending on the amount of garbage used.

Warmer weather was on the way, and I could hardly wait to get the rotator up. One morning, however, I turned the rig on to find nothing coming through. Figuring the propagation had gone sour, I thought nothing more about it until the following day when conditions did not improve. Instead of propagation, it turned out that a pack of stray cattle had wandered up from a lower pasture, and finding themselves at my mast, decided to see if coax is as edible as hay. Finding it was, they chewed it through in four places.

Since that time all cables have been buried, and outside of the discontented cow who snapped a guy wire, the antenna still stands.

If all this sounds like something out of "Ripley's Believe It or Not," it was not meant to. Although some of my solutions were unorthodox, still the "ends justify the means," as my DXCC total is very near 300 countries worked. In some ways I had to work extra hard to get to that total, but I don't regret it. Maybe someday some years from now I'll be on the air telling some fellow about the time the cows chewed my coax.

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Antenna shown is Hy-Gain **TH6DXX** Tri-Band Beam

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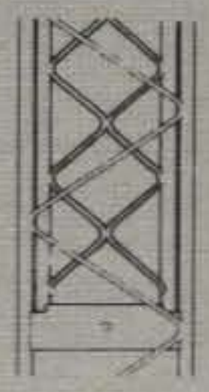

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CIRCLE 36 ON READER SERVICE CARD

R.f.i.—a hot topic these days. It's those few little volts that cause all those big problems.

R.F. Induced Problems And Solid-State RTTY Terminals

BY BILL HENRY*, K9GWT AND JIM BARTLETT†, K1TX

Over the past 10 years, there has been an explosion in RTTY activity on the amateur bands, due largely to readily available solid state RTTY terminal equipment. As the electronic industry in general has become more and more dominated by digital techniques, our interests as amateurs have also expanded to include digital techniques. Today, amateurs are either building their own solid-state digital RTTY equipment or buying commercially manufactured RTTY gear. The solid-state terminals offer many features over their mechanical predecessors, features that were just not feasible with machines. The solid-state terminals are also quieter and smaller than the machines and they don't drip oil on the floor!

However, the digital terminals do have a weakness that rarely bothered a mechanical TTY machine—r.f.i. from the transmitter. Unfortunately, it is the very nature of the small low-voltage device that makes all the extra features possible. Consider, for a moment, the tube radios and RTTY demodulators we used in the 1950–1965 period; the circuits in that equipment operated from a 150 to 300 volt power supply, and stray r.f. voltages of 0.1 to 5 volts would rarely cause a problem. On the other hand, modern digital circuitry operates from a 5 v.d.c. power supply, and a 1 volt stray r.f. signal will definitely affect its operation. The digital circuits are designed to operate at very high switching speeds, and the addition of a 20 or 10 meter r.f. signal will just be interpreted as a high-speed digital signal, often causing the terminal to "blow-off into space." All is not lost, however; a digital terminal can be made to work with even the highest powered amateur transmitter if suitable precautions are taken in both their design and installation. Although each r.f.i. solution tends to be slightly different, depending upon the particular characteristics of each installation, there are some recognized techniques that should help your situation.

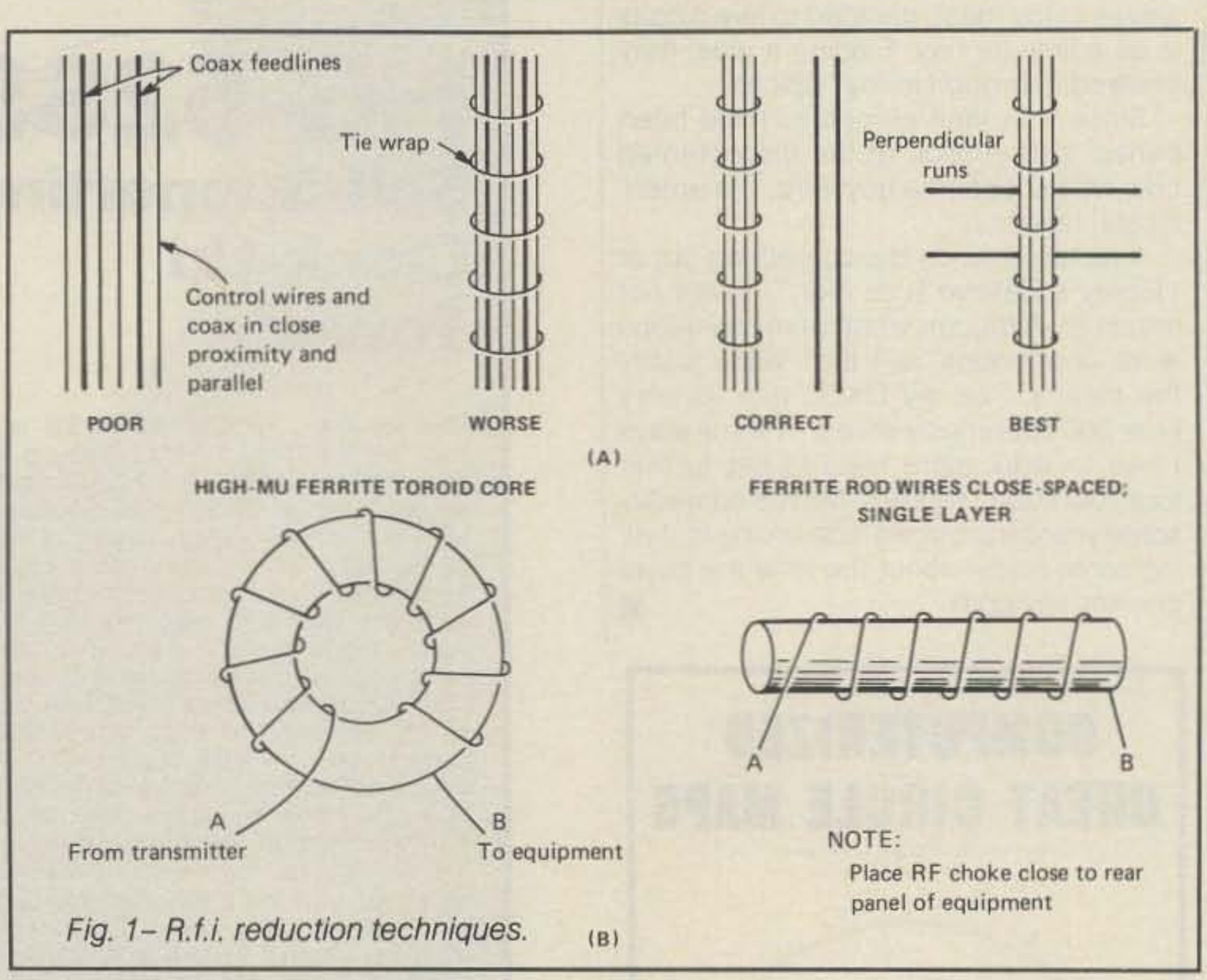

Fig. 1– R.f.i. reduction techniques.

First, the digital terminal **must** be constructed so that it is *itself* well shielded and includes internal r.f. bypassing of all input and output connections (including the a.c. power connection). There is *no* good substitute for a metal shielding enclosure! The shielding and bypassing serve a two-fold purpose: (1) they keep the transmitter r.f. from getting into the terminal, and (2) they keep the digital r.f. "noise" from escaping to interfere with the receiver. The lack of r.f. shielding in plastic cabinets has been a particular problem for amateurs using hobby computers, and it is the reason behind the recent FCC r.f.i. regulations (Part 15, Subpart J) requiring r.f.i. suppression. Some plastic cabinetry now being manufactured includes special conductive coatings to achieve r.f. shielding. However, the shielding materials are expensive, and the do-it-yourself amateur will be time and money ahead if he builds his digital equipment in a metal enclosure.

Most of the commercially available amateur RTTY terminal equipment has been designed to operate in close proximity to radio frequency transmitting and receiving equipment. Particular attention should have been paid to the shielding and by-passing of the terminal circuitry. However, under certain conditions in an r.f.-saturated environment, the terminal may still be susceptible to r.f.-induced interference. This may manifest itself in any of a number of ways, such as partial or complete lack of response to switches or keyboard operations, or erratic behavior of the video display.

The first thing that should be checked if r.f. problems are suspected is the **ground** system. The transmitter should be properly grounded for r.f. (in addition to an electrical safety ground), and all other station equipment grounds should be connected to the transmitter chassis. The r.f. ground should consist of a short length of heavy copper wire or braid terminated at a good earth ground (ground rod, cold water pipe, etc.). If a water system ground is used, be sure that the pipes are 100 percent metal from the

*616 W. Church St., Champaign, IL 61820;
†2109 Branch Drive, Champaign, IL 61820

connection point to the water mains; plastic plumbing obviously will break the ground path. If the distance between your transmitter and ground connection is more than a quarter wavelength at the highest operating frequency, make the ground wire an integral number of half-wavelengths long. If you plan to operate 10 and 15 meters, you may need to run separate ground wires for each band.

Stations located on the second floor of wood frame houses can present special problems for r.f. grounding. One technique that has worked well when none of the usual ground returns work is to spread copper screen material on the floor of the room under the operating position. The equipment ground is then attached to the screen with one or more low inductance leads. The screen creates an "artificial" ground plane in the room. A carpet is usually placed over the screen to improve the appearance of the room! Consult any of the amateur handbooks or antenna books for a more in-depth discussion of grounding techniques.

The best way to confirm that a problem is caused by r.f.-induction is to temporarily eliminate the source. This may be done in stages, starting with a partial reduction in exciter drive, and ending with transmitter shut-off. Since r.f. energy may be induced in the terminal through several paths, connecting the transmitter to a dummy load may not eliminate *all* r.f. related problems, although this is an excellent first step in verifying r.f. problems.

Radiation of r.f. energy from linear amplifiers, antenna tuners, coaxial switches, monitor scopes, and interconnecting coax-cable jumpers is also possible. In fact, it is this type of radiation that is most likely to be coupled into nearby I/O and power cables of the terminal. To locate the point or points of radiation, experiment with different cable arrangements to see if the r.f.-induced problem can be eliminated by reducing coupling between any of the terminal cables and nearby coaxial lines carrying r.f. power. Fig. 1(A) shows several cable arrangements, both good and bad, showing how to keep r.f. coupling to a minimum. Fig. 1(B) shows how to use high-mu (950–2000) ferrite toroids or rods to choke the flow of r.f. on audio and control lines.

If cable rearrangement doesn't yield positive results, then begin eliminating pieces of equipment and sections of coaxial cable until the transmitter is connected directly to a shielded dummy load. As each piece of equipment is removed from the transmission line, check to see if the r.f.-related problems have diminished or disappeared. If the r.f. problem persists with the exciter connected directly to a dummy load, reduce the drive level to see if that eliminates the problem.

If operation into a dummy load does not significantly reduce the r.f.-related problems, disconnect all I/O cables from

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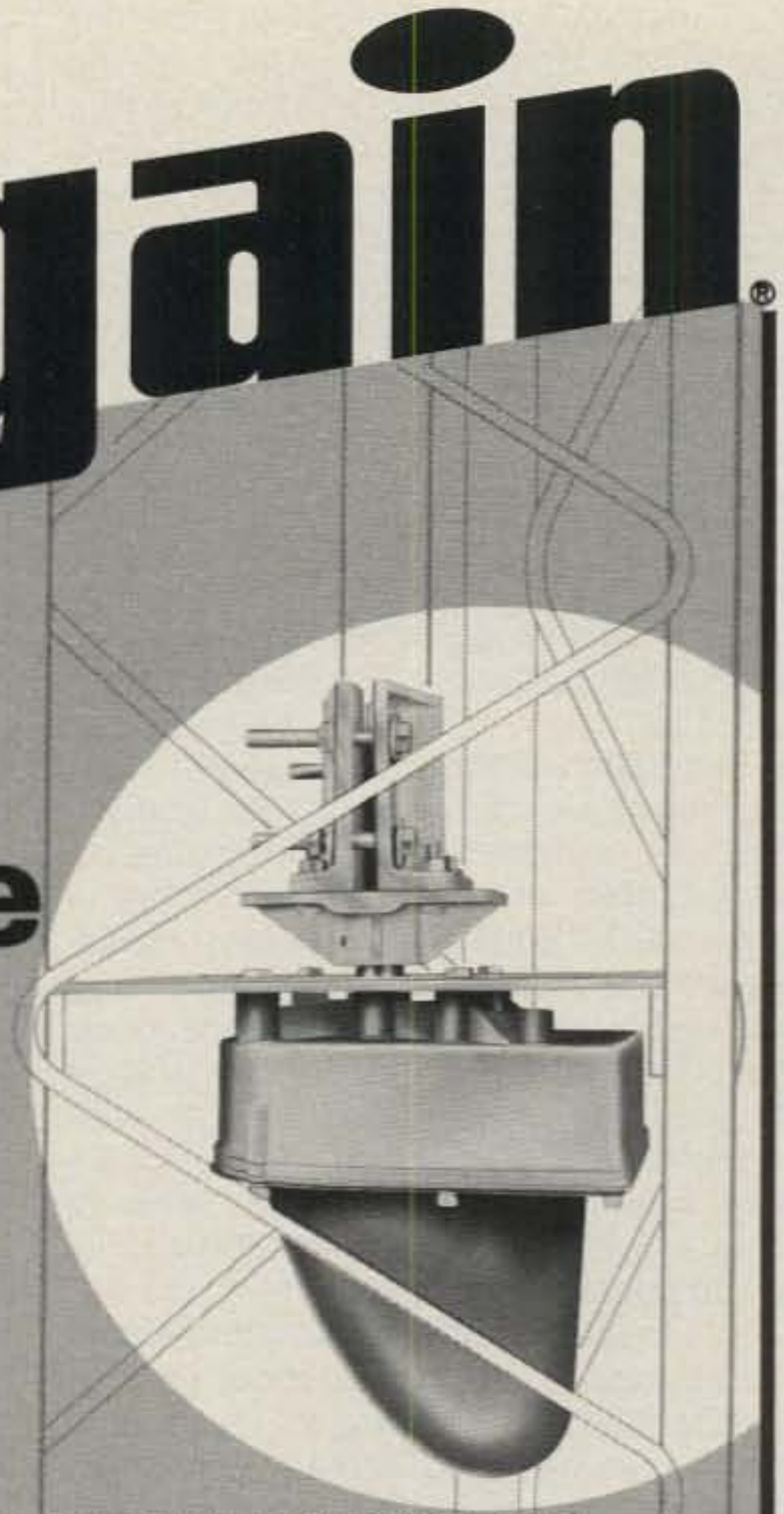
The Beauty and the Beast



Model HDR300 Antenna Rotator

The model HDR300 matches a rugged, heavy-duty rotator with a good-looking, digital-readout control console. This is a military/industrial grade rotator that is priced to be practical for amateur use. The model HDR300 easily handles up to 25 square feet of antenna area with an additional 1.5 safety margin - even in high winds! This new rotator has muscle to spare, with a stall torque of 5000 in-lbs. (567 N·m) - higher than any Amateur Antenna Rotator currently on the market. It also features a brake-holding torque of 7500 in-lbs. (850 N·m) and a mechanical travel of 390°. The HDR300 will support 500 lbs. (227 kg.) and accept masts of 1¾" (44.4 mm) to 3" (76.2 mm) O.D. and uses a 24 Vac motor for safe, reliable operation.

This "state-of-the-art" control console features a digital azimuth readout that is accurate to ±1°. Brake is automatically engaged when you turn the rotator off. Furthermore, the brake release and rotation functions are separate, assuring complete brake control and extended rotator life. A single eight-conductor control cable connects the rotator with the control console.

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the terminal. Test the operation while it is connected only to a.c. power. At the same time, enable the transmitter so that it sends a c.w. signal into a dummy load. If r.f. problems are still present, then r.f. energy is probably being introduced to the terminal through the power cord by way of the common a.c. mains power line. This is usually indicative of poor a.c.-line filtering in the radio transmitter power supply section. Fig. 2(A) shows a common by-pass filter method used in many transmitters. Figure 2(B) shows a "brute-force" a.c. line filter that can be added to the transmitter or other equipment to eliminate the flow of r.f. on the a.c. power line.

In addition to the liberal use of r.f. bypassing capacitors on station equipment, the use of certain antennas may offer reduced levels of r.f. in the radio room in many cases. Whenever possible, use **resonant** dipole, vertical, quad, or Yagi antennas and try to achieve a good impedance match **at the antenna** instead of relying on an antenna tuner. Random-length wire antennas and others that require extensive antenna tuning are more likely to create high levels of r.f. within the vicinity of the operating position.

The location of the transmitting antenna with respect to the radio room also has an effect on the r.f. energy that is coupled into interconnecting cables. Apartment dwellers may have the most difficulty achieving a good installation, since many times an indoor antenna is the only type allowed. Where outdoor antennas are allowed, they should be placed as high as practical. Not only will this provide for better reception and transmission, but it will also reduce the level of r.f. in the shack. Also, if possible, avoid bringing an end of a half-wave dipole in close proximity to the operating position; there is a high voltage field at the ends of the dipole that may be hard to shield.

In general, a shielded, coaxial cable feedline with low s.w.r. is much preferred over open wire, twin-lead, or single wire feed systems. The self-shielding property and lower voltages present act to make the coaxial feedline much less susceptible to radiation of r.f. energy in the shack rather than at the antenna. R.f. energy may also find its way back to the station by conduction down the outside of the coaxial cable shield. This may be a particular problem with half-wave dipoles on 40 and 80 meters that are center-fed with only coaxial cable. A balun at the antenna tends to reduce this problem. Also, dress the coaxial cable from the balun so that it drops *perpendicular* to the dipole, rather than parallel. In stubborn cases, you may find that dropping the coaxial cable clear to the ground and burying it (5 or 6 inches) for the horizontal run to the shack may help reduce r.f coupling considerably. This technique has worked particularly well for second-story station installations. As an alternate to the balun, con-

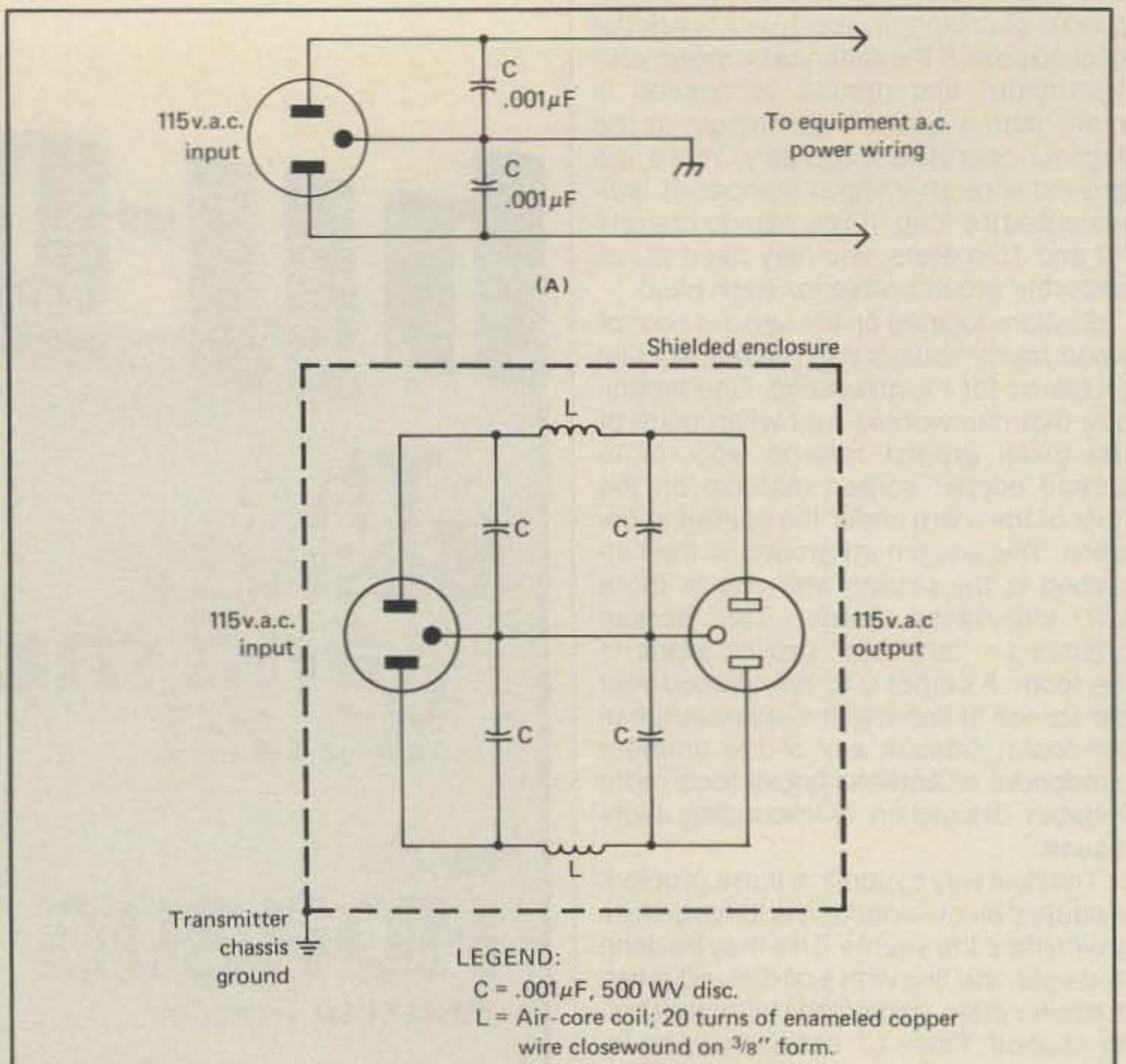

Fig. 2– R.f.i. power line filters.

struction of an r.f. choke out of the coax itself is sometimes effective; wind six or more turns of the coaxial cable in a six inch diameter coil. Place the coil at the antenna and wrap it with electrical tape to hold its shape. If there is a moderate to high s.w.r. on the line (2:1 or more), you may find that varying the length of the line helps, although this is a poor substitute for a properly matched antenna.

Experience has shown that the TV monitor itself may be a source or conductor of r.f. interference. Various circuits of the TV monitor (particularly the sweep circuits) can and do generate r.f. interference which may be heard in the receiver. Also, the video output to the monitor is a wide-bandwidth digital signal with rich harmonic content as is required to produce the crisp character display. If the TV set is poorly shielded (or not at all in some plastic-cabinet models) or lacks proper power line by-passing, the r.f. from the monitor's circuits or from the video output may escape to cause receiver interference. Also, r.f. from the transmitter may enter the monitor and disrupt the monitor or terminal operation. This may be quickly tested by simply disconnecting the video cable from the terminal. There is no substitute for good shielding and bypassing; metal cabinet monitors are highly recommended!

These are some of the r.f.i. suppression techniques that are known to work with digital devices. As we mentioned earlier in the discussion, each r.f.i. problem tends to be unique, and you may have to try some or all of these ideas to solve your own problem. The following is a short bibliography of articles and books where more information about r.f.i. suppression may be found.

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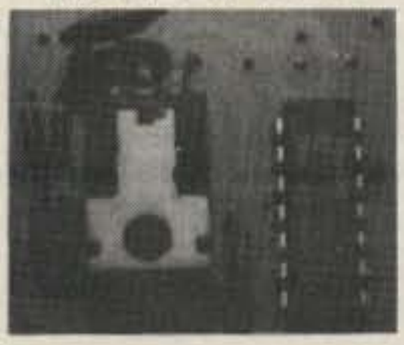

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CIRCLE 85 ON READER SERVICE COUPON

Here are some simple mods for a popular rig. AD5X presents another variation on how to keep your HT fully charged and operational.

TWO FOR THE IC-2A

BY PHIL SALAS*, AD5X

As most of you Icom IC-2A(T) owners know, the 250 mah battery pack that comes with the unit is the only battery pack that doesn't require an expensive battery charger. In addition, the higher amp-hour battery packs are somewhat limited in field/emergency applications due to their requiring a.c. power for charging. As it turns out, there is a solution to these problems that is quite simple and inexpensive. What we are going to do is modify the IC-BP4 battery pack so that it can be charged either with your own home-built wall charger or your own home-built 12 volt charging cord. To begin, you'll need the following items:

1. IC-BP4 battery pack and six nicads.
2. A subminiature phone jack (Radio Shack 274-292, 2 for $1.19).
3. Two subminiature phone plugs (RS 274-289, 2 for 99¢).
4. A 12 v.a.c. 300 ma transformer (RS 273-1385, $2.89).
5. Lighter plug with cord (RS 270-021, $1.89).
6. Four 1N4000 series diodes (RS 276-1101, 2 for 49¢).
7. Three 33 ohm ½ watt resistors (see text).
8. Two 680 ohm ¼ or ½ watt resistors (see text).
9. Two Polaroid "Print Coat" cases or equivalent (the small print applicator cases).
10. Two subminiature s.p.s.t. slide switches (RS 275-406, 2 for 69¢).

The IC-BP4 battery pack has enough internal room to mount a subminiature phone jack inside. Care must be taken in the placement of this jack. The optimum place for this jack is in the IC-BP4 battery pack half which has the top metal plate attached to it which contacts the IC-2A. Incidentally, I modified my subminiature jack so that it is strictly an open circuit jack. This buys you a little more space and is easily done by cutting off the shorting contactor. The jack can now be mounted in the battery pack in the following manner:

First, place the battery-pack shell-half with the metal contacting plate facing up as you look at it. The subminiature jack will be mounted between the top and middle batteries on the right wall of the battery pack 0.6 inches down from the metal contacting plate. Using a sharp pocket knife, carefully cut an indentation in the battery pack half so as to permit mounting of the jack. You will also have to trim away part of the mating battery pack half (refer to fig. 1). Temporarily mount the jack in the battery pack half with the metal contacting plate.

Nicads should be charged at 10% of their rated ampere-hour capacity. In addition, you should put in 140% of the energy that has been taken out. So, first determine the capacity of your nicads. I used 600 mah batteries. Many batteries are 450 mah. In my case I wanted to charge the batteries at 60 ma for 14 hours. If you have the more standard 450 mah batteries, you'll want to charge them at a 45 ma rate for 14 hours.

In order to charge your batteries, you will have to use current-limiting resistors so as to keep the charging current from exceeding 10% of the rated battery mah. Therefore, you will need 92 ohms total resistance for a 45 ma charge rate and 69 ohms total for a 60 ma charge rate.

An unfortunate disadvantage of subminiature phone jacks is that they can easily be shorted momentarily when the plug is inserted. To keep this from happening, I broke up the current limiting resistance so as to put part of the resistance within the battery pack and the rest in the charging line. I split my resistance so as to put 36 ohms in the IC-BP4 and 33 ohms within the charger. For a 45 ma

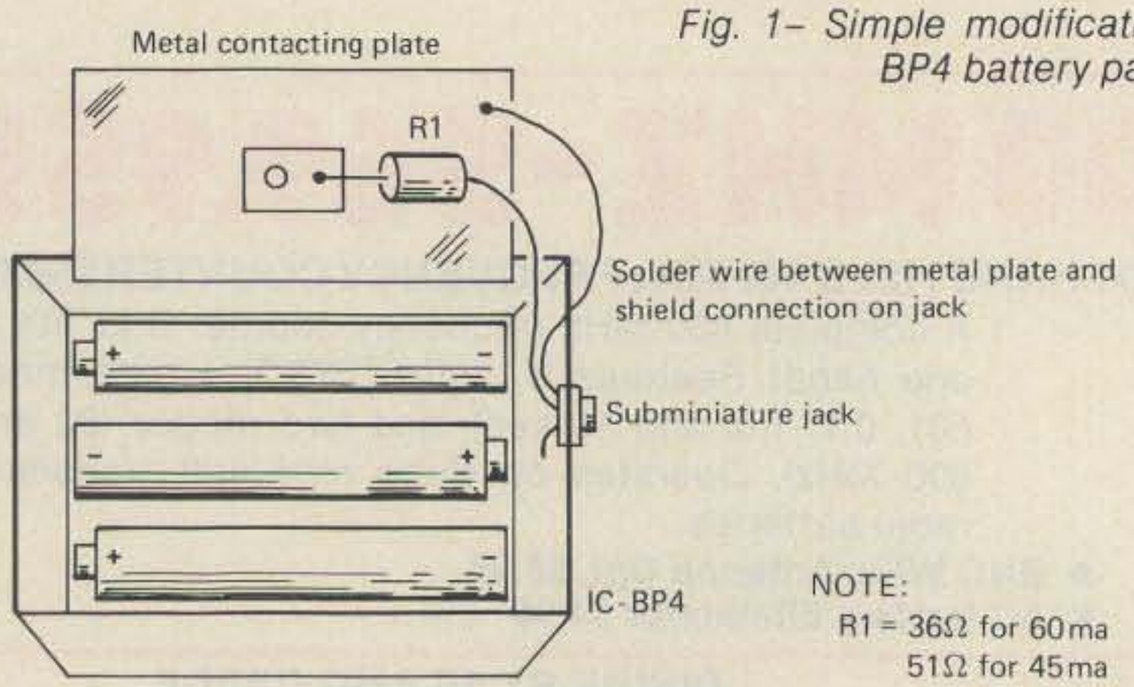

Fig. 1– Simple modifications to the IC-BP4 battery pack.

*707 Auburn Drive, Richardson, TX 75081

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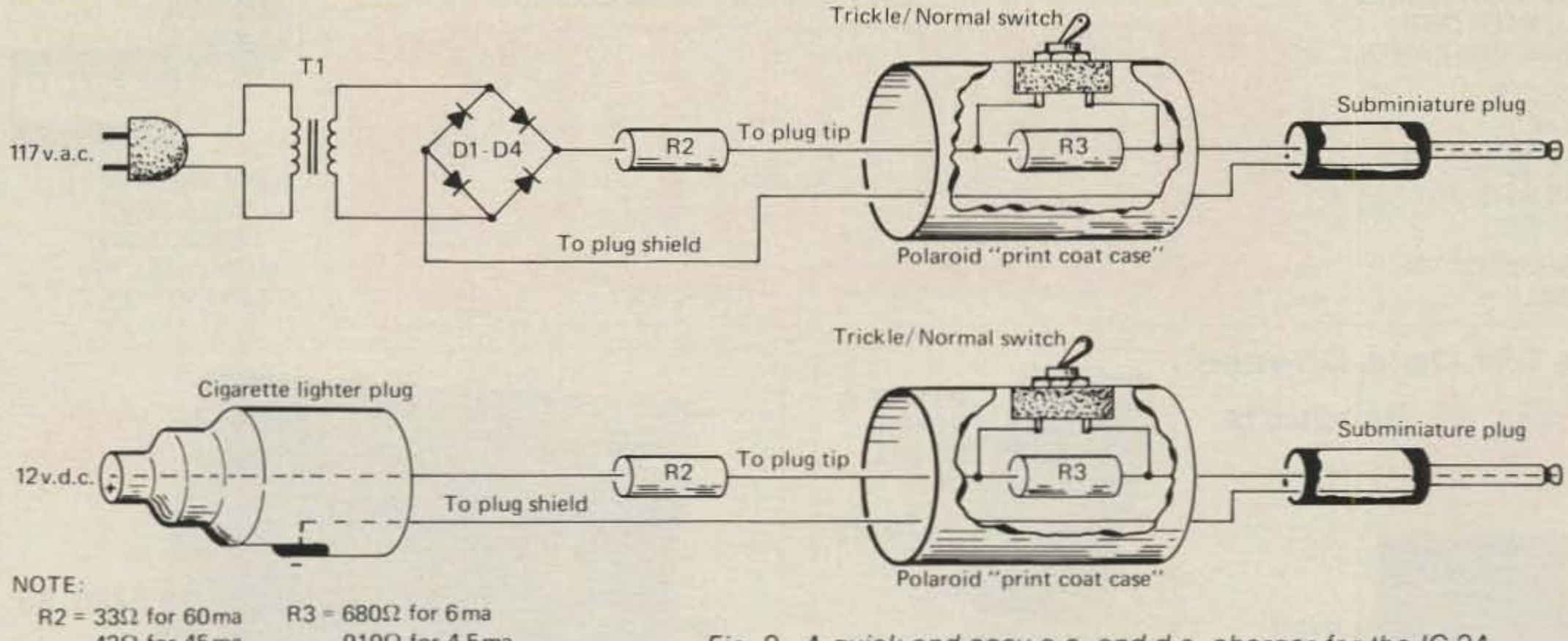

NOTE:

R2 = 33Ω for 60 ma R3 = 680Ω for 6 ma
42Ω for 45 ma. 910Ω for 4.5 ma.

Fig. 2– A quick and easy a.c. and d.c. charger for the IC-2A.

charging rate, I would recommend 51 ohms in the IC-BP4 and 42 ohms in the charging line. Solder the resistor which goes in the IC-BP4 between the center conductor connection on the subminiature jack and the positive battery connection (red wire) on the metal contacting plate. Insulate the resistor leads as necessary to guard against shorts. Solder a wire between the shield connection on the subminiature jack and the negative battery connection (black wire) on the metal contacting plate. Snap the battery case halves together and tighten the mounting nut on the subminiature jack. Your IC-BP4 is ready to be charged. All you need is something to charge it with!

As it turns out, both the wall charger and d.c. cigarette lighter charger are very simple. Refer to the schematics of fig. 2. As a bonus, I included trickle charge capability. The trickle charge circuitry (R3 and switch) is built into a Polaroid® "Print Coat" case, i.e., the case supplied with the applicator and coating for Polaroid® pictures. When the switch shorts R3, charging will be at the normal 10% rate. When R3 is not shorted, the charging rate will drop to the recommended 1% trickle rate. Note that no output filter capacitor is used after the rectifier. With no filter capacitor, you will have a secondary rms d.c. voltage equal to the secondary rms a.c. voltage minus the diode drops. These small Radio Shack transformers put out higher voltages at the low current drain we are using here. I measured an rms d.c. voltage of almost 13.5 volts. Since this is very close to the 13.6 volts available at a car battery, I was able to use the same value resistors in both the a.c. and d.c. charger circuits. Incidentally, if you put an output filter capacitor on your charger, the secondary voltage will go to the peak secondary voltage (around 18 volts d.c.). You would then have to scale your series resistor so as not to exceed the 10% and 1% charging rates. *In no case should you transmit while charging the units from the a.c. charger, since the 120 Hz hum would be severe.*

One final note: If you experience an annoying transformer hum (which I did in two separate units), you can easily rebuild the transformer core and eliminate the problem. Simply remove the metal retainer on the transformer, pull the "I" laminations free, and pull out the "E" laminations. Now, simply peel the laminations apart and then reassemble the "E" laminations in the transformer in an *alternating* manner. By this I mean facing the "E" laminations alternately one way and then another. After the "E" laminations have been reassembled, insert the "I" laminations into the gaps between the edges of the "E" laminations. This is how the transformer should really have been built.

Well, there you have it. A few simple mods to your IC-BP4 greatly increases its usefulness and charging convenience. Spend an hour building these chargers and modifying your IC-BP4. It's worth it!

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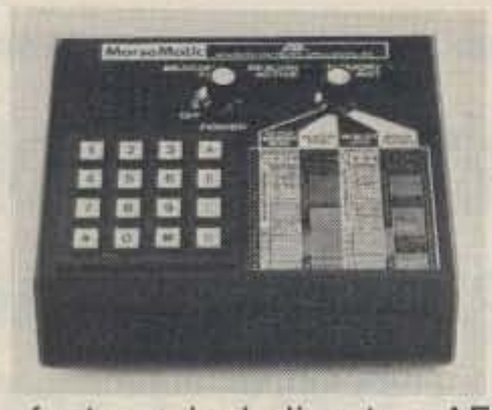

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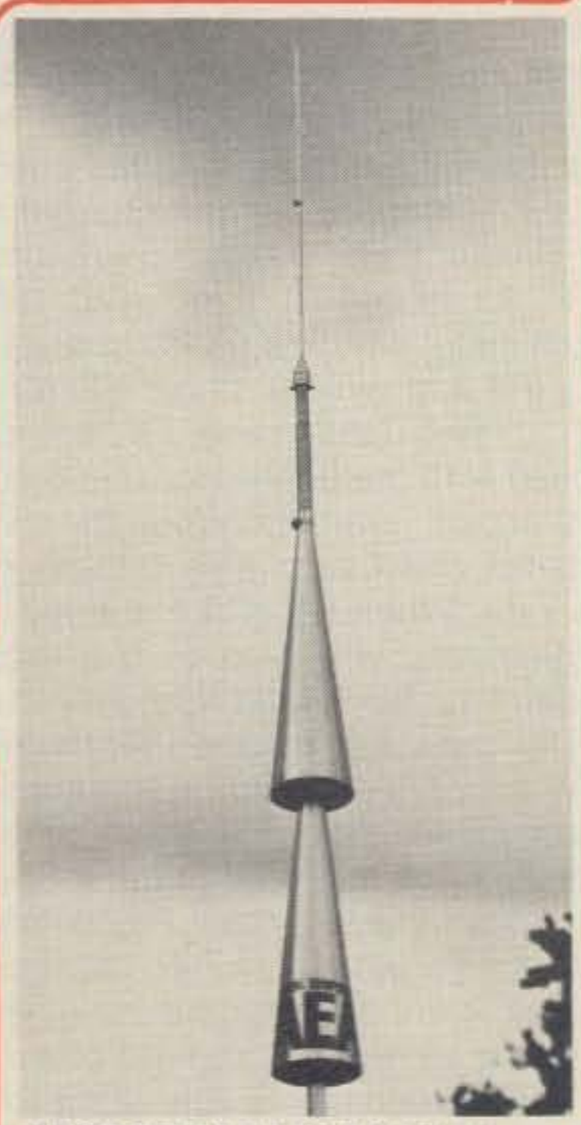

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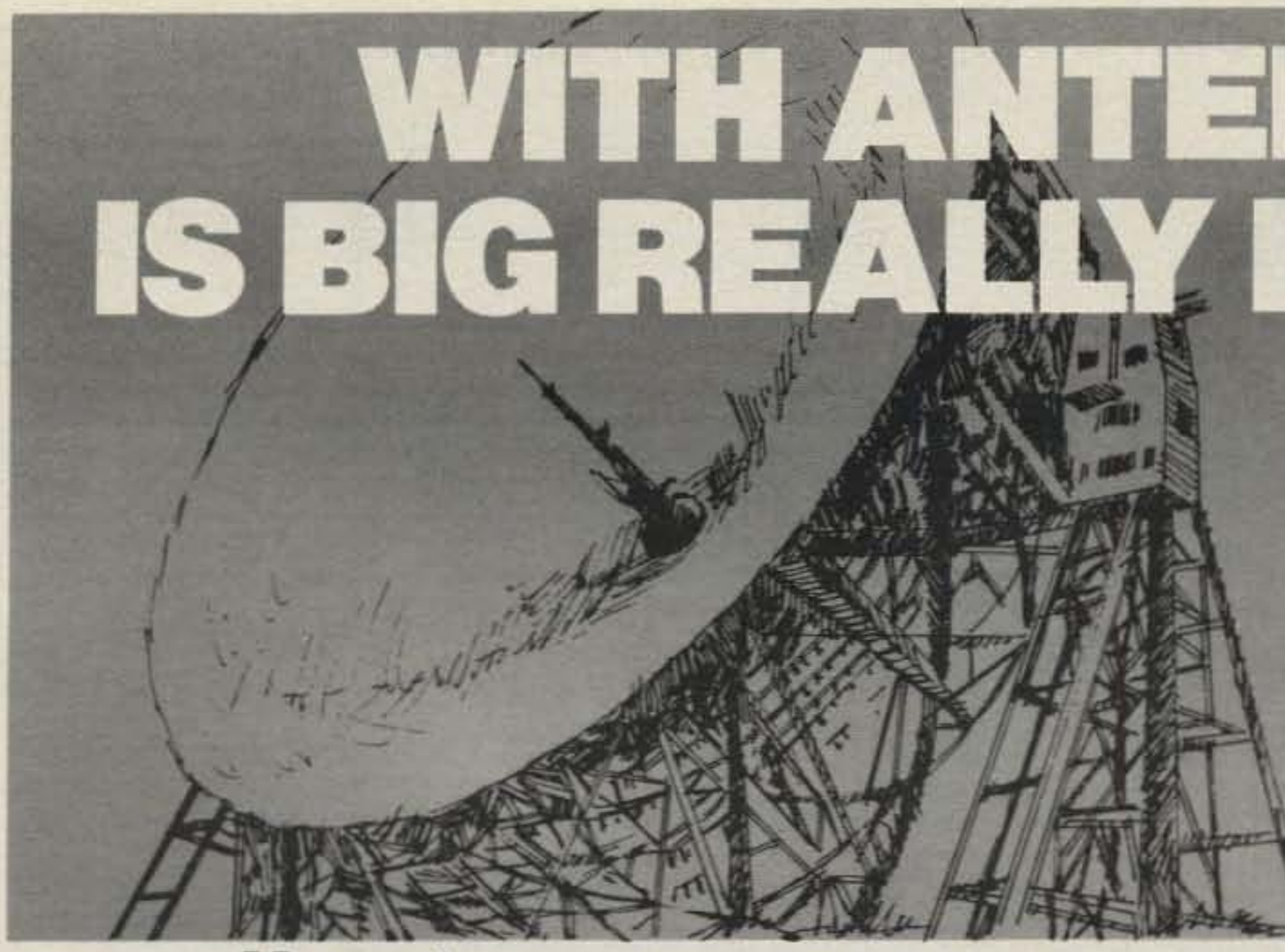

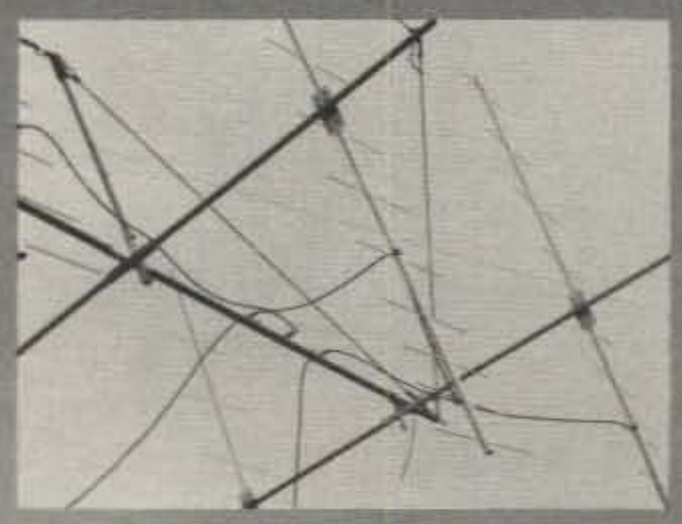

Here is a new and highly accurate method for comparing antennae true efficiency

The present system used for comparing different antennae is by comparison of each antenna's gain. However, usually no consideration is given to the number of elements or length of boom required to obtain that gain.

These factors may be very important. If an 11 element antenna can exhibit the same gain as a 19 element antenna, it may offer the advantage of less weight and less wind resistance, both important to hams living in high wind areas.

Another important facet is that those antennae with more elements than required for optimum performance per given boom length will exhibit lower efficiency which ultimately defeats the purpose you bought it for.

To assist you in evaluating the many different makes and models of antennae available, Lunar has developed a system that allows you to compare antennae on a uniform basis.

The Figure of Merit for Antennae Comparison

Because dBd is so subjective (in some cases not allowed in advertising) we use the manufacturers published beam angles. Since every manufacturer provides beam width specifications in degrees, the Isotropic Directivity may easily be calculated using the standard formula as follows:

$$ID = \frac{41253}{(E \times H)}$$

Isotropic Directivity (ID) equals 41253 divided by the product of the E and H beam angles.

Once you have achieved the ID for a given antenna, its Figure of Merit may be determined by dividing its ID by the number of elements or the boom length of the antenna.

We have established Figures of Merit for several popular antennae and they are shown on the accompanying chart.

As you can see, Lunar's Antennas exhibit Figures of Merit indicative of very high efficiency antennas. For less weight, less wind resistance and higher efficiency, Lunar Antennas are your best buy.

Some Basic Limitations:

The Figure of Merit System is most effective when comparing similar types of antennae. If you use radically different antennae (Eg. a 1 wavelength versus a 3 wavelength beam) the Figure of Merit may not accurately portray the true differences.

# el/boom length in wavelengths	Beam Angles E x H (H = 1.11E)	ID	Fig. Merit ID vs B.L.	Fig. Merit I.D. vs #el
Lunar's NMT 11/144				
11 el/2.57λ	**31 x 34**	**39.14**	**15.23**	**3.56**
Lunar's NMT 11/220				
11 el/2.57λ	**31 x 34**	**39.14**	**15.23**	**3.56**
Tama SST 0719/432				
19 el/5.71λ	**24 x 27**	**63.66**	**11.15**	**3.35**
144				
19 el/3.23λ	28 x 31	47.53	14.71	2.50
13 el/3.16λ	29 x 32	44.45	14.07	3.42
220				
17 el/4.26λ	26 x 29	54.71	12.84	3.22
14 el/3.42λ	36 x 40	28.65	8.38	2.05
432				
16 el/5.27λ	30 x 33	41.67	7.90	2.60
21 el/6.63λ	24 x 27	63.66	9.60	3.03

ID = Isotropic Directivity el = Number of Elements B.L. = Boom Length

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$$L_{\mu H} = \frac{10^6}{68\pi^2 f^2}\left\{\frac{\left[\ln\frac{24\left(\frac{234}{f}-B\right)}{D}-1\right]\left[\left(1-\frac{fB}{234}\right)^2-1\right]}{\frac{234}{f}-B} - \frac{\left[\ln\frac{24\left(\frac{A}{2}-B\right)}{D}-1\right]\left[\left(\frac{\frac{fA}{2}-fB}{234}\right)^2-1\right]}{\frac{A}{2}-B}\right\}$$

where

$L_{\mu H}$ = inductance required for resonance
$\ln$ = natural log
f = frequency, megahertz
A = overall antenna length, feet
B = distance from center to each loading coil, feet
D = diameter of radiator, inches

The program formula from Jerry Hall's article, "Off-Center-Loaded Dipole Antennas."

BY DICK SANDER*, K5QY

This article presents a BASIC language program to design an inductive loaded dipole (fig. 1). The program uses a formula developed by Jerry Hall that appeared in *QST*, September 1974, entitled "Off-Center-Loaded Dipole Antennas."[1] The formula, as it appeared, was quite large and difficult to handle for anyone who did not own a scientific calculator.

With the widespread availability of home computers, this design formula is within reach of many amateurs. The computer that I used was an Apple II Plus, but the program is written so that almost all "BASIC" type computers should operate directly from the listing (fig. 2).

The program calculates the required inductance for any shortened antenna. After the program is loaded, the computer asks for:

A. Frequency in MHz (f)?
B. Total length in feet (A)?
C. Feet from center to loading coil (D).

Keep in mind that there will be two loading coils. It is up to the designer to pick the distance from the center to each coil.

D. Do you want to use the wire table (D)? (Y/N), if yes, you can choose a wire gauge between 10 and 22. If not, you input any diameter of conductor you desire.

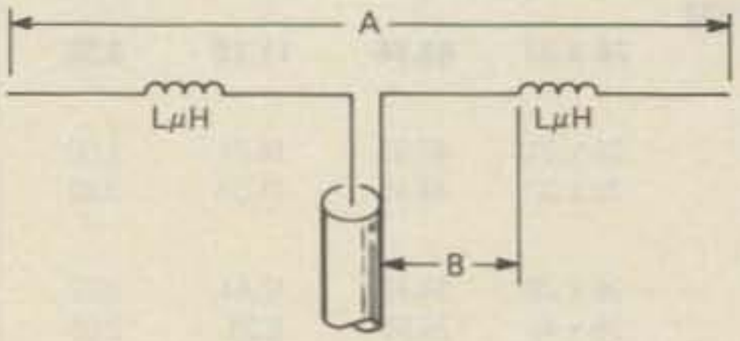

Fig. 1– A loaded dipole antenna.

The inductance is then calculated, and the result is given in microhenries. I've compared several of the antennas described in the *ARRL Antenna Handbook*, and the values check exactly as the computer calls out.

```
5  REM : INPUT DATA
10  HOME
20  PRINT "LOADED DIPOLE DESIGN PROGRAM"
22  PRINT : PRINT
30  INPUT "OPERATING FREQUENCY IN MHZ? ";F
32  PRINT : PRINT
40  INPUT "TOTAL LENGTH IN FEET? ";A
42  PRINT : PRINT
50  INPUT "FEET FROM CENTER TO LOADING COIL? ";B
52  PRINT : PRINT
60 X = ((234 / F) - B)
70 Y = ((A / 2) - B)
80  INPUT "DO YOU WANT TO USE THE WIRE TABLE?  (Y ON N) ";Y$
82  IF Y$ = "Y" THEN  GOSUB 1000
84  IF Y$ = "N" THEN  GOSUB 2000
86  IF Y$ = "Y" THEN 90
87  IF Y$ = "N" THEN 90
88  GOTO 80
90 S1 = 1E6 / (68 * 3.14 ^ 2 * F ^ 2)
100 S2 = 1 / X * ( LOG (24 * X / D) - 1)
110 S3 = (1 - F * B / 234) ^ 2 - 1
120 S4 = 1 / Y * ( LOG (24 * Y / D) - 1)
130 S5 = (Y * F / 234) ^ 2 - 1
140 S6 = S1 * (S2 * S3 - S4 * S5)
143  PRINT : PRINT : PRINT
145  PRINT "LOADING COIL IS ";S6;" MICROHENRYS"
150  END
1000  PRINT
1005  INPUT "WIRE GAUGE (#10 TO # 22)       ";D
1010  IF D = 10 THEN D = .101: RETURN
1020  IF D = 12 THEN D = .081: RETURN
1030  IF D = 14 THEN D = .064: RETURN
1040  IF D = 16 THEN D = .058: RETURN
1050  IF D = 18 THEN D = .032: RETURN
1060  IF D = 20 THEN D = .032: RETURN
1070  IF D = 22 THEN D = .025: RETURN
1075  PRINT
1080  PRINT "WIRE GAUGE MUST BE AN EVEN "
1090  PRINT "NUMBER IN THE RANGE 10 - 22"
1100  PRINT : PRINT : GOTO 1000
2000  PRINT
2010  INPUT "WHAT IS THE ELEMENT DIAMENTER IN INCHES? ";D
2020  RETURN
```

Fig. 2– A computer designed loaded-dipole program listing.

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[1]*Jerry Hall, K1TD, "Off-Center-Loaded Dipole Antennas," QST, September 1974, page 28.*

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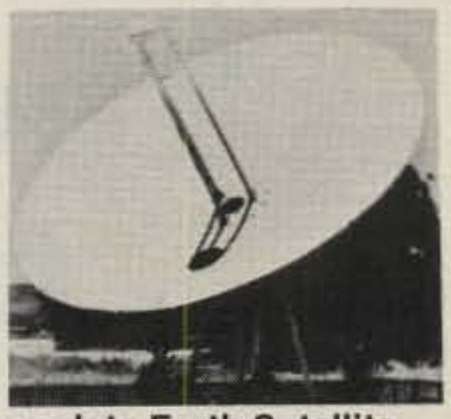

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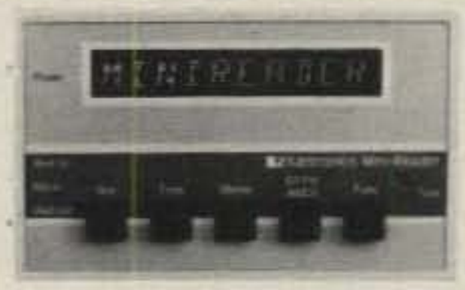

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CQ Reviews:

The Bencher Paddle And MFJ Keyers

BY JOHN J. SCHULTZ*, W4FA

The Bencher paddle has been available for a few years now and has gained deserved popularity. Frankly, it is one of the nicest paddles the author has used. The paddle construction may seem a bit unusual when one first views it in a photograph. This is certainly the case if one is used to the construction of the "bug" type of key where basically a horizontal level is pivoted to move from side to side as the finger paddles are manipulated. In the Bencher design a split ring is used which pivots vertically, one split ring being used for dash operation and the other for dots. The basic idea of this design is shown in fig. 1. The split ring pivots on two nylon bearings (pivoting in and out of the page as shown). A tension spring (the long wrap-around spring one sees in the photograph) pulls the split ring against a mechanical stop. Both the finger paddle and contact arm for one side of the paddle are attached to the split ring. Now, as one presses the finger paddle in the direction indicated, the contact arm will move to come in contact with the contact post. The actual mechanical construction of the paddle is more sophisticated than this description might indicate. Nonetheless, the basic mechanical action is as described.

The paddle is constructed on a heavy steel base which includes three non-skid feet. Most of the parts are brass, chrome-plated, and appear to be of excellent mechanical quality. Only two adjustments are necessary to suit personal preferences for "feel." The finger paddle tension on each paddle is adjustable by means of small set screws which are set into each split ring and which hold the tension spring to each split ring. These set screws are simply run in or out with a small screwdriver to set the desired tension. The contact spacing between the contact arm on each split ring and the contact post is adjusted by running in or out the contact screw set in each contact post. A small hex wrench (of standard size) is supplied to loosen the contact screw so it can be run in or out of the contact post. Once these adjustments are made, they remain perfectly stable over extended operating periods. In fact, for most amateurs, once the comfortable settings are found, they probably will never have to be readjusted.

The keyer, as Bencher says, should give a lifetime of use. Because of the vertical mounting of the split rings, very little pressure appears on the nylon pivots. The only part that may undergo metal fatigue over an extremely extended period would be the tension spring, and this is easily replaceable without tools. The contacts themselves are solid silver with a gold plating. Again, if one is keying milli-

The MFJ-482 "Grandmaster" is a good bet for those who want a full-feature keyer along with some versatile message storage capabilities. MFJ models 484 and 481 belong to the same family of keyers and are also worth looking into. The 484 provides still more message storage capabilities and control features. The 481 contains adequate but basic message storage capabilities but still with a full-feature iambic keyer.

*c/o CQ Magazine

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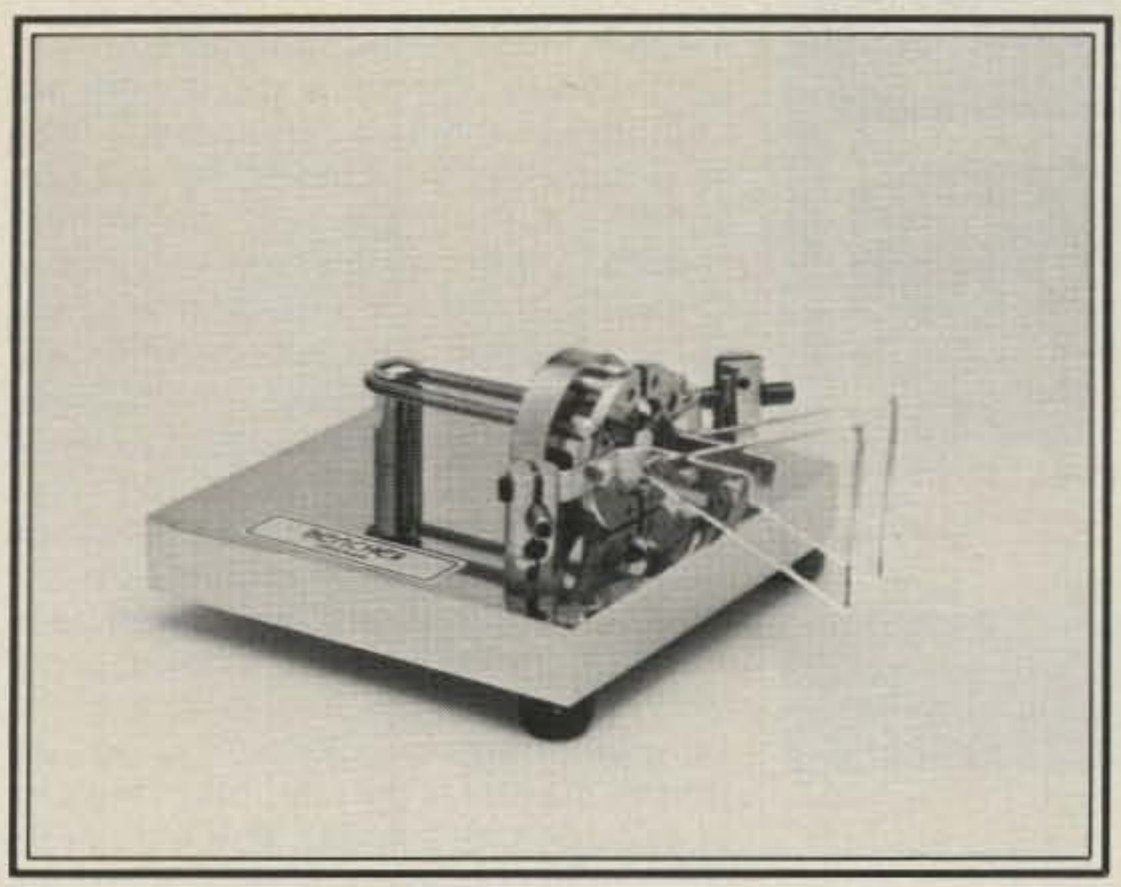

The Bencher paddle has developed a well deserved reputation for having a very good "feel." The basic mechanical action of the paddle is illustrated in fig. 1.

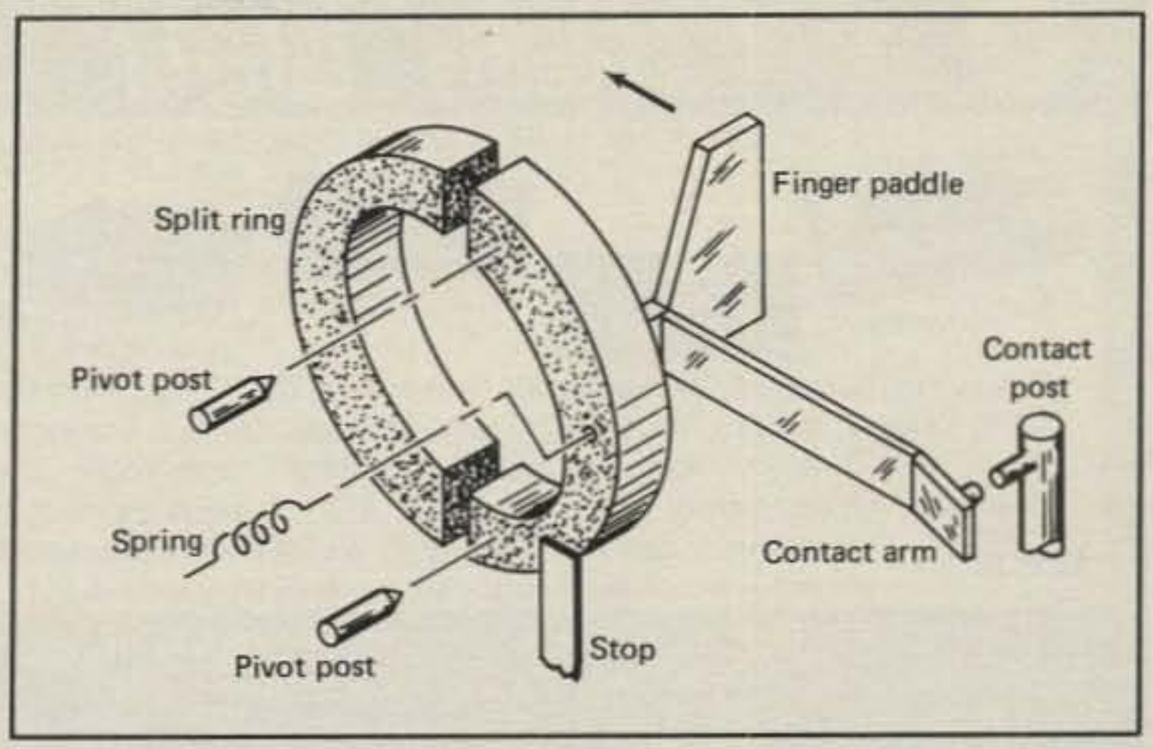

Fig 1– The basic operation of the Bencher paddle is not all that easy to follow from a photo. This simplified sketch illustrates the basic action for one finger paddle. A spring holds a vertical split ring against two stationary pivot posts. Moving the paddle moves the contact arm against a contact post (both the finger paddle and contact arm are fastened to the split ring).

amperes or less, as is usually the case with a keyer, they should last forever. In fact, they are most likely to be destroyed by careless cleaning more than anything else. As Bencher suggests, clean them only by running a clean piece of paper across them.

The instruction sheet provided with the paddle is short but perfectly clear. Interestingly enough, it is bi-lingual, in English and German, although the paddle is not widely advertised or sold in Germany.

The paddle is a perfect mate to various MFJ keyers (or vice versa). The MFJ "Grandmaster" series of memory keyers all provide a sophisticated memory keyer function using CMOS IC's plus various degrees of message storage capability using RAM's. The top of the line is the MFJ-484 keyer. The keyer itself provides, of course, for Iambic operation and has self-completing dots and dashes and dot and dash memories. The message storage capability is 4096 bits total and can store up to twelve 25 character messages plus a 100, 75, 50, or 25 character message. A great deal of versatility is built into this keyer in that the various memories can be split or combined, reset on command, and messages repeated

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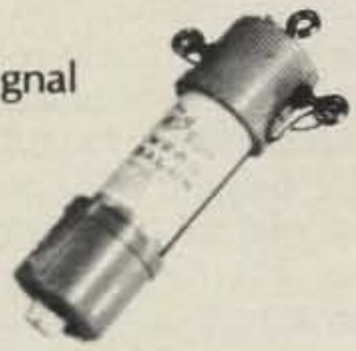

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continuously with or without a variable delay of 0–2 minutes between repeats. All possible controls are on the front panels of the keyer to include speed, weight, monitor tone and volume, repeat delay and memory select, plus a series of push-buttons and LED's dealing with memory storage/address functions. The other two keyers in the line, the MFJ-482 and MFJ-481, are basically variations of the MFJ-484, but they have somewhat less versatility and memory storage plus fewer front panel controls. The MFJ-482, which was tested by the author, is described below in more detail. One would have to study the specifications of each keyer to decide which one is the most suitable for one's operating requirements. For instance, the occasional operator would not have the requirement for extensive message storage capability that an avid contest operator might find a necessity.

The MFJ-482 keyer is housed in an attractive Ten-Tec Cabinet measuring 6 × 6 × 2 inches. It can be powered using a supplied wall plug transformer or any 12 to 15 v.d.c. source. Two keying outputs provided for positive or negative voltage keying are self protected, so one can try whichever one works best with a given transmitter. A simple lever key or squeeze lever key for Iambic operation can be used. A tune position is provided on the function switch for transmitter keying during tune-up.

The circuit of the keyer is a rather complex arrangement of some 13 IC's in all. All are conventional CMOS IC's with U8, a 2102, being a RAM providing for 1024 bits of memory. All of the IC's are run from an internally regulated +5 volt line, so the supply voltage is not critical. The entire circuitry is very neatly assembled on a double-sided PC board. All IC's are socketed for easy replacement in the unusual event one should fail. Bypassing is used where necessary to provide for r.f. protection. No difficulty with r.f. was ever encountered in operation.

One might first separate the features of the keyer into those which strictly have to do with the unit as a keyer and those which have to do with memory operation. The keyer circuitry provides for self-completing dots and dashes and dot and dash memories. Dot and dash insertion is provided, so when using a squeeze key, Iambic operation is possible. Both speed and weight controls are provided, the weight control being mounted on the rear panel. A built-in sidetone oscillator and speaker are provided. Volume and pitch are adjustable with the tone control being rear-panel mounted. As a keyer, the unit performed very well. "Start-up" was instant, and the range of all the controls seemed to satisfy all operating needs (the speed range is 8 to 50 w.p.m., but it can easily be modified if one would like an expanded lower range). Once a satisfactory weight adjustment was found, this control was no longer used, so its location on the back panel was no disadvantage. However, it must be admitted that it would have been nice to have the tone control front-panel mounted. It does get tiring to listen to the same pitch tone for extended periods. As long as the rest of the features of the keyer satisfied one's needs, it would not be difficult, of course, to mount a tone control potentiometer in some corner on the front panel. In fact, it could replace the "reset" push-button on the front panel, since, as discussed later, a tap on the keyer paddle also performs the reset function.

As a memory keyer, the MFJ-482 provides for the storage of up to four 25 character messages. However, by means of a pull switch on the speed control, the first two 25 character message memories can be combined, so one ends up with one 50 character memory and two 25 character memories. To record a message, the selector switch is set to "record," one presses one of the memory address buttons (A, B, C, or D or only A if memories A and B are combined), and one starts sending. A memory LED lights up when the memory address button is depressed and will extinguish when the memory is full. One has to roughly synchronize one's sending with the setting of the speed control during recording. This is no real problem, since before recording one normally practices the message to be recorded anyway and thus automatically sets the speed control. Another way to approach the recording of a message is to set the keyer at its slowest speed. Then, one 25 character memory will run for about 37 seconds, so one can look at a watch while recording. Once recorded, the message can be played back at any faster speed. The capacity of one 25 character memory will provide for a message such as three times CQ followed by "DE" and a two times repeat of most calls. The 50 character combined A and B memories provide for a fairly long CQ call. For casual operating, one might program memories A and B for a CQ call, memory C for a short QRZ call, and perhaps memory D for a test call.

To playback a message, the selector switch is set at "send" and the desired memory address button depressed. The message will be sent once. If the selector switch is set at "repeat," the message will be repeated continuously. In either case, if one taps on the key at any time

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HEATH SB104A See "Ham Radio", April 1981
KENWOOD TS820 See "CQ", March 1981

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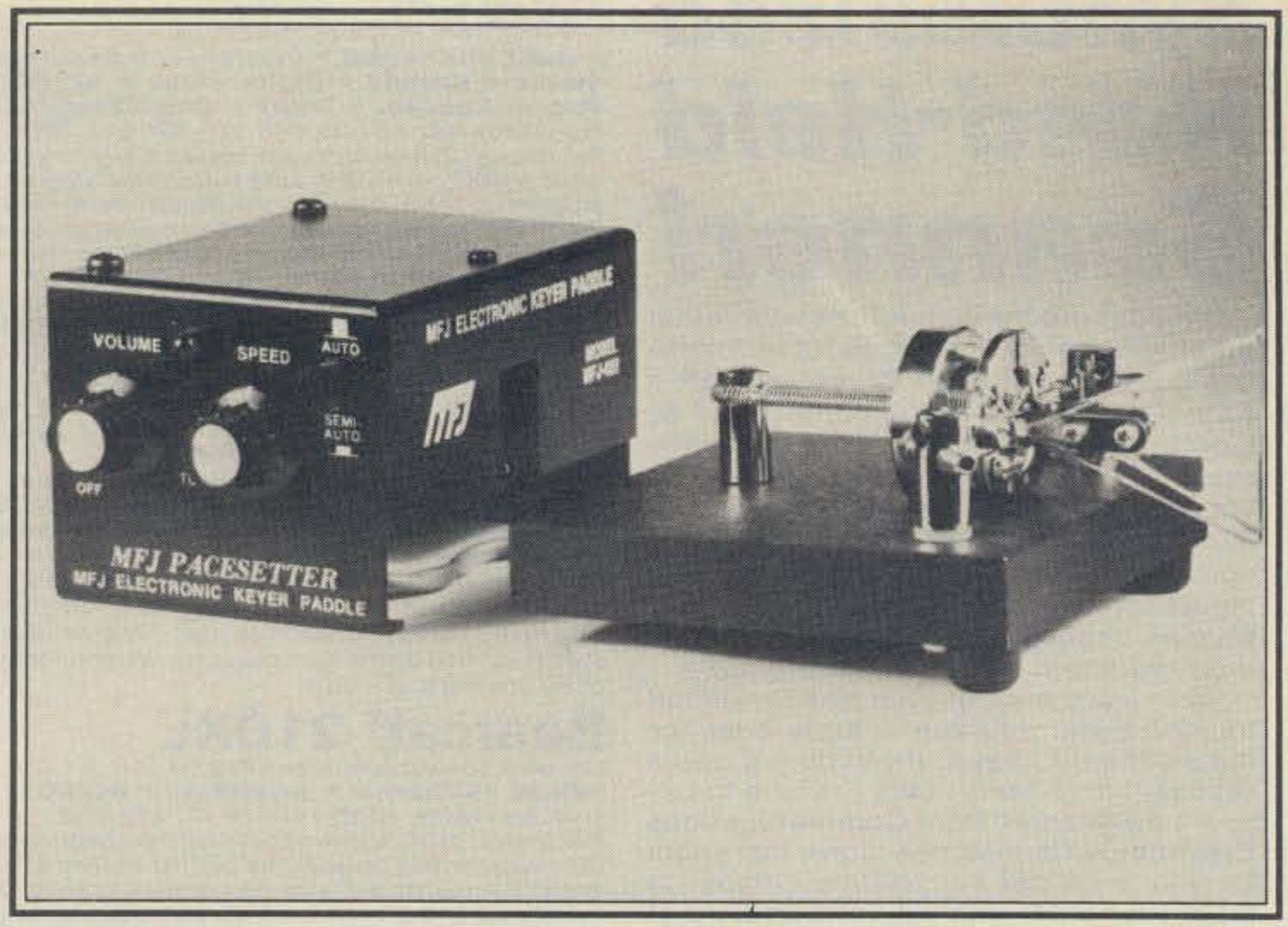

The MFJ-422 differs from the other MFJ keyers described in that it is constructed around a Curtis 8044 IC. The construction is quite compact, and it is meant to mount directly on top of the Bencher paddle to form an integrated unit.

during the playback, memory playback will stop, and one can end or continue the transmission by manual keying. The same action results from pressing the "reset" button, which resets all memory addresses to the beginning. One does have to practice a bit to learn all the versatile operations possible with the memory functions. In any case, all the memory functions performed perfectly without any r.f. or other problems. The instruction pamphlet provided with the MFJ-482 provides quite complete instructions as to both operation of the keyer and memory functions.

If one hasn't used a memory keyer before, one is in for a pleasant surprise as to the handiness of such a device. However, as mentioned before, before acquiring such a keyer one should analyze how much memory is needed. The MFJ-482 probably provides a good compromise for most operators, while the MFJ-484 contains just about everything an avid contest/DX operator needs, and the MFJ-481 gives one a good keyer with a memory capability for one long CQ call or a short CQ call and a QRZ call.

In all the keyers, memory retention is provided by a 9 volt battery, if desired. The battery will save the messages in memory if the a.c. power is lost or if one is transporting the keyer. A battery will last about 8 hours. However, the battery is turned off when the on/off switch on the volume control is turned off. In normal home station operation, if one wishes to retain the memories, it is easiest to leave the unit turned on all the time (the primary of the plug transformer is across the a.c. line all the time anyway). The d.c. power consumption under standby conditions was measured as only 0.36 watt.

For those who do not need memory functions and want a compact Bencher paddle/keyer combination, the MFJ-422 keyer is a good bet. The keyer is available with or without the paddle. It is specifically designed to mate with the Bencher paddle as shown in the photograph. The keyer slips over the paddle and is attached to it by a single screw (the same one that holds the rear rubber foot on the paddle base). The whole combination, including the paddle, measures only about 4 × 2½ × 5½ inches. It can be powered either by a 9 volt battery or by an optional plug transformer.

Unlike the previously described keyers, the MFJ-422 uses basically just a single IC—the well-known Curtis 8044. A bit of extra circuitry provides for the same negative or positive voltage universal keying possibilities as with the other MFJ keyers. Otherwise, the 8044 IC is complete in itself with self-completing dot/dashes, dot/dash memories, sidetone, etc. The MFJ-422 provides side panel controls for speed and monitor volume. Internal controls provide for adjustable weight and monitor tone. The auto/semi-auto pushbutton switch provides for a tune function in the semi-auto position. The reliability and r.f.-proof qualities of the Curtis chips have been well demonstrated, so there is no need to go over them. All in all, the MFJ-422 is a very neat and compact packaging of a keyer based on the Curtis 8044 with about as many features as one could desire except for memory keying. It should be ideal for home station or portable operation.

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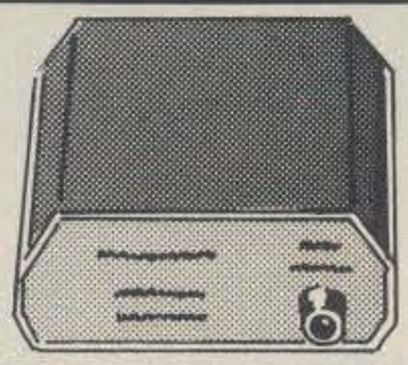

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Other features include search, priority channel, digital clock, count, scan delay, dual scan speed, dual level display, backlighted keyboard, and LED indicators for the direct access channels. Price is $499.95. For more information, contact Regency Electronics, Inc., 7707 Records Street, Indianapolis, IN 46226, or circle number 101 on the reader service card.

DYMA Line Surge Protectors

DYMA Engineering's new line of power line surge protectors offer different line voltage values of the firm's model 3AC line surge protector with an improved series filter. The new models were developed to serve the specialized requirements of various computer, terminal, and communications uses. The protector is series filter combined with an over-voltage protector. The series filter eliminates noise and high-speed transients from the incoming power line.

The new models are the 1AC, which is a hard-wired unit designed for internal installation in the protected equipment. Also introduced is a 220v, 30 amp unit, also hard-wired and designed for the protection of groups of loads and permanent installation in a steel device box. For more information, contact DYMA Engineering, Inc., P.O. Box 1697, 213 Pueblo del Sur, Taos, NM 87571, or circle number 104 on the reader service card.

Daiwa Infrared Mobile Microphone System

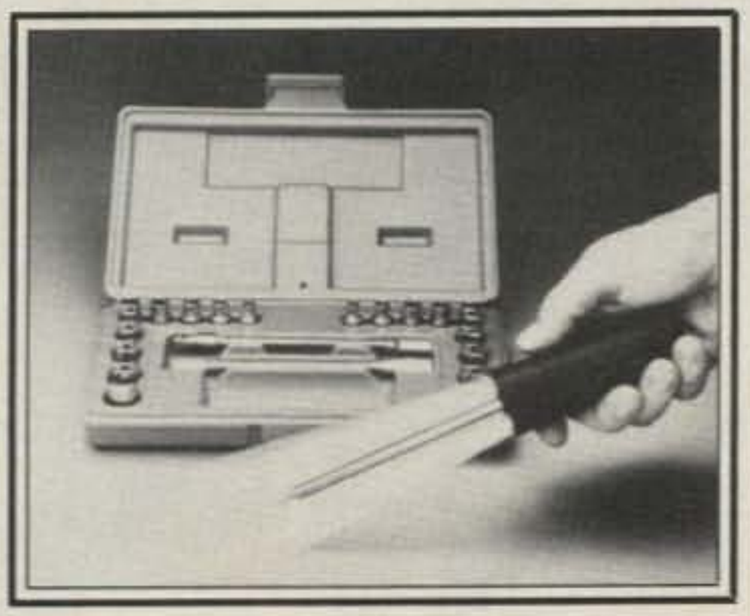
Daiwa's RM-940 Infrared Mobile Microphone System offers cordless operation with a lightweight, compact microphone that transfers all audio and transmit/receive switching on a safe infrared beam. The RM-940 system comes complete with a microphone, infrared sensor, and control/charger unit. The electret condenser microphone can be hung around the neck (cord supplied) or clipped to a shirt pocket. A latching push-button switch activates the infrared transmitters on the microphone. Audio and transmit/receive switching are then transfered via infrared beam to a sensor mounted near the sun visor or the rearview mirror. Maximum usable distance is 3.5 feet. An additional sensor can be added for broader coverage.

Microphone plugs compatible with most Kenwood, Yaesu, and Icom rigs are available, plus other plugs can be installed. Also available are optional microphone wind screens. For more information, contact MCM Communications, 858 E. Congress Park Dr., Centerville, OH 45459, or circle number 106 on the reader service card.

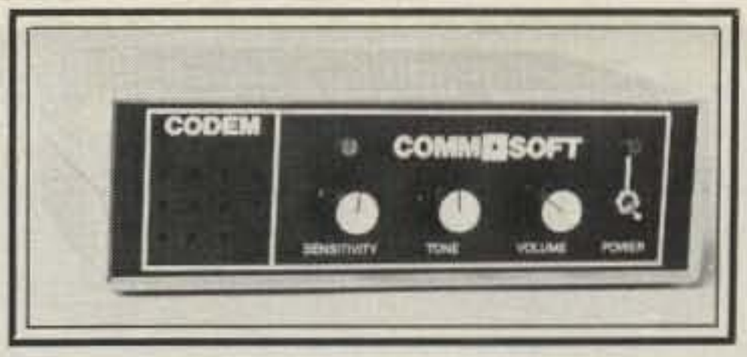
Katzden Day-Nite Tool Kit

The Katzden Day-Nite Tool Kit is a portable 23 piece screwdriver and socket set featuring a patented twin-lighted power torque handle. It puts needed light on

hard-to-see jobs anywhere screws, nut, or bolts are worked with. The Day-Nite power torque handle is made of rugged ABS plastic and has twin lights built into the handle to shine on the area being worked on. Two AAA batteries are included with the set.



The set includes 18 sockets to fit almost any nut or bolt (9 standard and 9 metric sizes), plus a socket adapter with ¼" drive, a 3/16" standard screwdriver blade, and a No. 2 Phillips blade. Blades are chrome vanadium steel, torque tested to 80 lbs. psi. The set comes in a sturdy polyethylene case with a custom fitted tray. Price of the kit is $29.95 plus $3.60 postage and handling. For more information, contact Katzden Gallery, Dept. LA-27, Box 906, 14911 Gwenchris Court, Paramount, CA 90723, or circle number 105 on the reader service card.



Commsoft Codem CW Interface

The Commsoft Codem is a universal interface for personal computers. It provides a way to get Morse code software on the air. Converting received c.w. audio to RS-232 or TTL signal levels and RS-232 or TTL signal levels to transmitter keying, the Codem doubles as a code practice oscillator and c.w. regenerator. A sharp 800 Hz bandpass filter, a.m. detector, and low pass filter are designed into the Codem to provide noise and QRM rejection. C.w. can be monitored using an internal 2" speaker or with an external high impedance earphone. Front panel sensitivity, tone, and volume controls are provided. Manual is included, and price is $124.95. The 9VDC power supply is $9.95.

Also available is the CW89 software package which includes split screen display, 4-99 wpm operation, receive autotrack, a 1000 character pretype buffer, and more. Price of the software package is $99.95. For more information, contact Commsoft, 665 Maybell Ave., Palo Alto, CA 94306, or circle number 107 on the reader service card.

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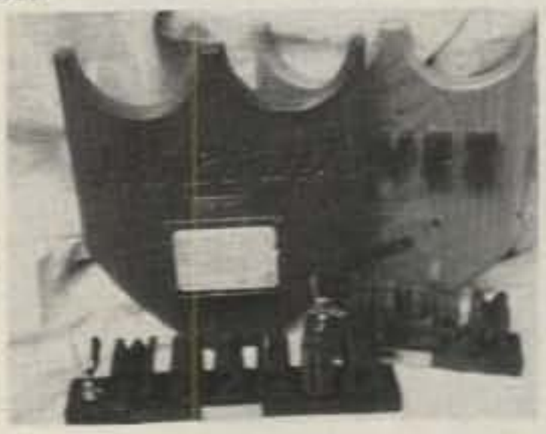

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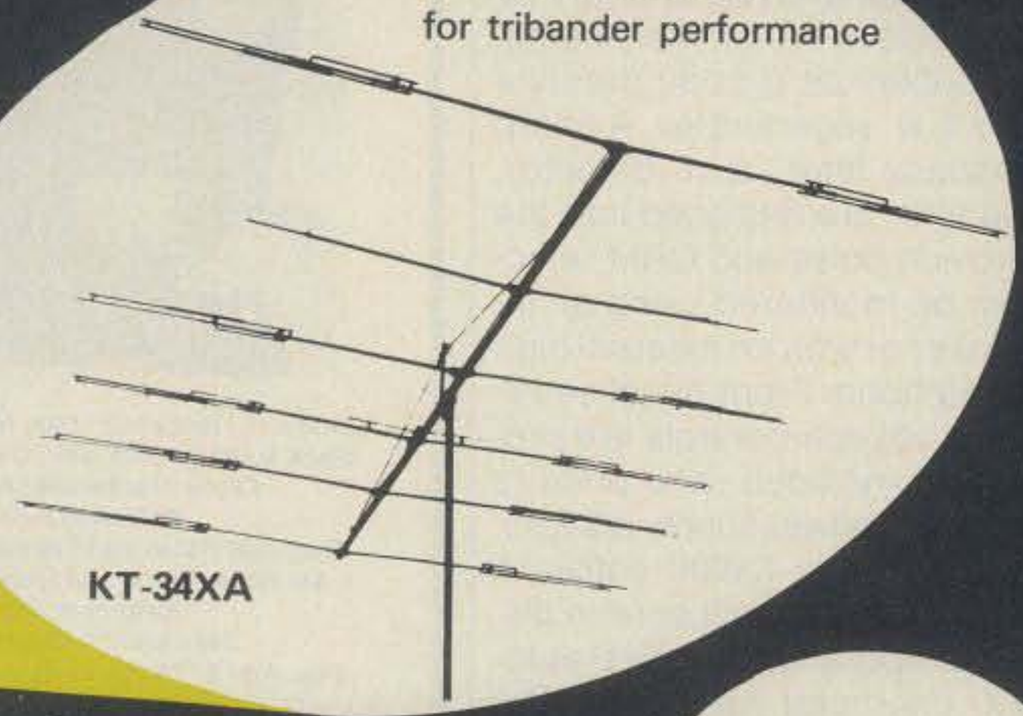

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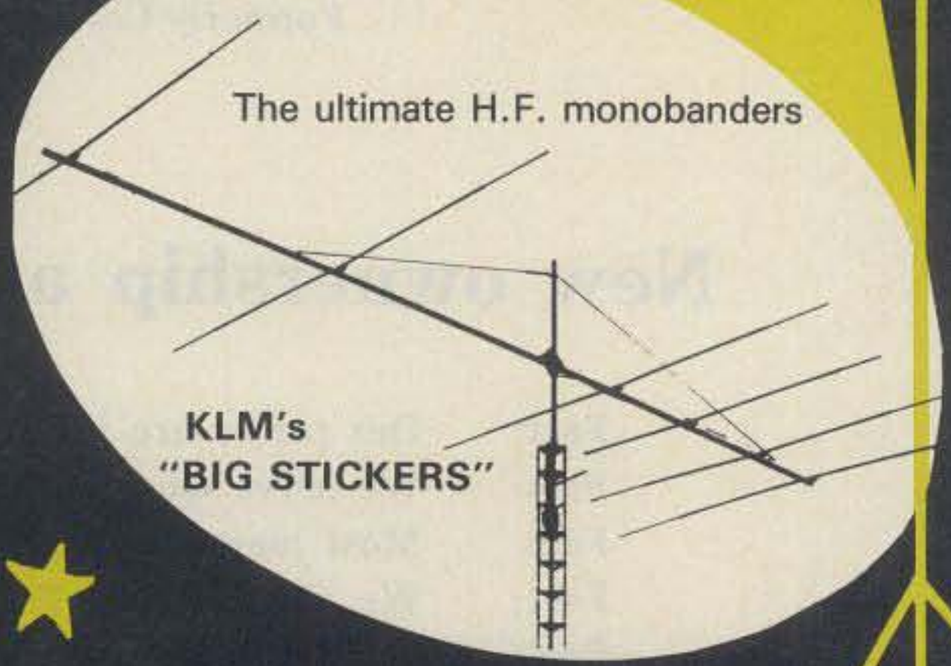

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CIRCLE 67 ON READER SERVICE CARD

W4DQU would have us change our perspective on how long is long when it comes to wire antennas.

Who Says You Don't Have The Room To Put Up A Long Wire Antenna? Of Course You Do!

BY RICHARD E. JAMES, JR.*, W4DQU

I seldom get on 80 or 40 meters without someone telling me he is using a dipole or inverted Vee antenna because he does not have room for a long-wire-type antenna. I believe part of the problem is in the terminology. Most amateurs think of a long-wire antenna as a single, end-fed, long wire. This is not one of the antennas I have in mind, because it has to be extremely long to achieve much gain, and it is unidirectional.

The antennas I have in mind are Vee-beams and rhombics. both of these antennas are bidirectional as long as you do not use terminating resistors in them to make them unidirectional. Both of these antennas are also all-band antennas. The antennas in fig. 1 will work 160 meters and up and neither requires a lot longer than that required for an 80 meter dipole. A balanced antenna should be at least approximately one-half wavelength on the lowest frequency band for efficient operation on that band.

In these two antennas, for a given length in feet, the higher you go in frequency, the more gain you get. Of course, there is an optimum angle for each band for each length, but any given antenna will be usable on all bands and will give some gain on each band as long as the apex angle is between 32 degrees and 90 degrees. A short Vee-beam or rhombic will be closer to optimum on the higher bands if the angle is small and closer to optimum on the lower bands if the apex angle is large. A chart of gain and optimum apex angles is shown in Table I.

I have put up many of these antennas, using available trees in most cases. I do not worry too much about the apex angle. The antenna is still a usable antenna and a much better performer than a dipole or inverted Vee.

Yes, these antennas require the use of a tuner and open wire line, but you get some advantages:

1. All band operation.
2. Low feed line loss.
3. Due to higher impedance at the antenna feed point, on most bands, the r.f. voltage is higher and the amperage lower. This allows the use of light, inexpensive antenna wire and feed lines. I use Saxton Number 18 gauge Copperweld (steel core) antenna wire (Saxton Wire Company, Congers, New York) Number 5300, Saxton Number 18 gauge (spaced one inch) 450 ohms open wire feed line Saxton Number 2500, and usually a short piece of Saxton Number 1562 insulated open wire line as lead-in between window and windowsill.
4. An extremely good ground system is not needed as in the case with a vertical antenna.
5. The antenna is cheap.
6. The antenna is so light that it can be pulled up to tree-top height with a nylon string thrown over a tree limb.
7. Two antennas can work the world, especially if one is oriented northeast and southwest and the other northwest and southeast. The first orientation will probably work 75 percent of the amateurs in the world from the continental U.S.A.
8. Separate antennas for high and low bands are not needed.

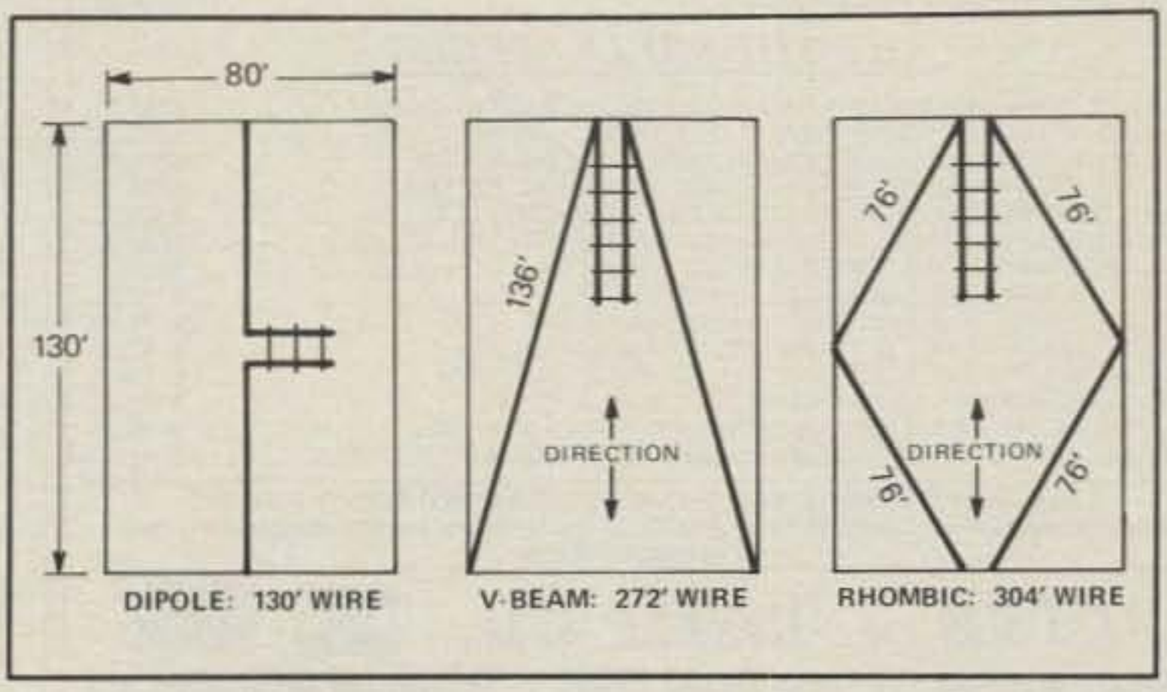

Fig. 1– Wire antennas placed on a typical small city lot. Of course, dimensions will vary.

Leg Length in Wavelengths	Gain	Optimum Apex Angle
1	3.0 dB	90°
2	4.5 dB	70°
3	5.5 dB	57°
4	6.5 dB	47°
5	7.5 dB	43°
6	8.5 dB	37°
7	9.3 dB	34°
8	10.0 dB	32°

Table I– A chart of gain and optimum apex angles.

In summing up, it is hard to understand why two such antennas have largely been overlooked.

The Vee-beam is almost as easy to put up as a dipole. The rhombic is a little more trouble because it requires four supports and all four in about the right places. However, the rhombic does have slightly more gain for a given amount of wire and sometimes it is the more desirable on a narrow lot because the apex angle will be twice as large as on a Vee-beam erected on the same lot.

Try one of these antennas. You will like it. Remember, the longer it is, the more gain you get. But even if the antenna is short, it will do better than a dipole or an inverted Vee installed on the same length lot because it will have twice as much wire in it, more gain, and more space diversity.

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Air Scan, The Directory of VHF Aero Band Scanner Frequencies. By Tom Kneitel, K2AES, this is the all new third edition in a new 5¼" × 8½" format with 80 pages. The book offers some 30,000 plus frequency listings covering topics such as control towers, ground control, Unicoms, test pilots, airline "company" operations, and more. It covers the U.S. and Canada and Mexico. New sections include aviation weather communications, HF/SSB airline route frequencies, and more. The new third edition is $7.95 per copy and is available from CQ's Book Shop.

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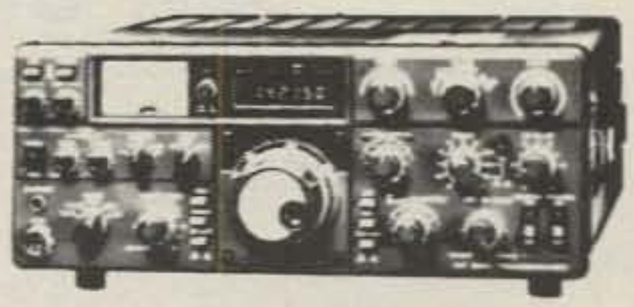

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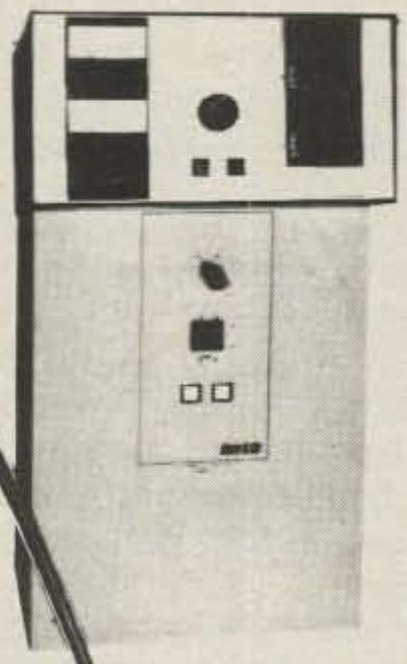

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QSK Operation

All Solid State T/R Switching For Linear Operation

BY NICK LEFOR*, W1DB

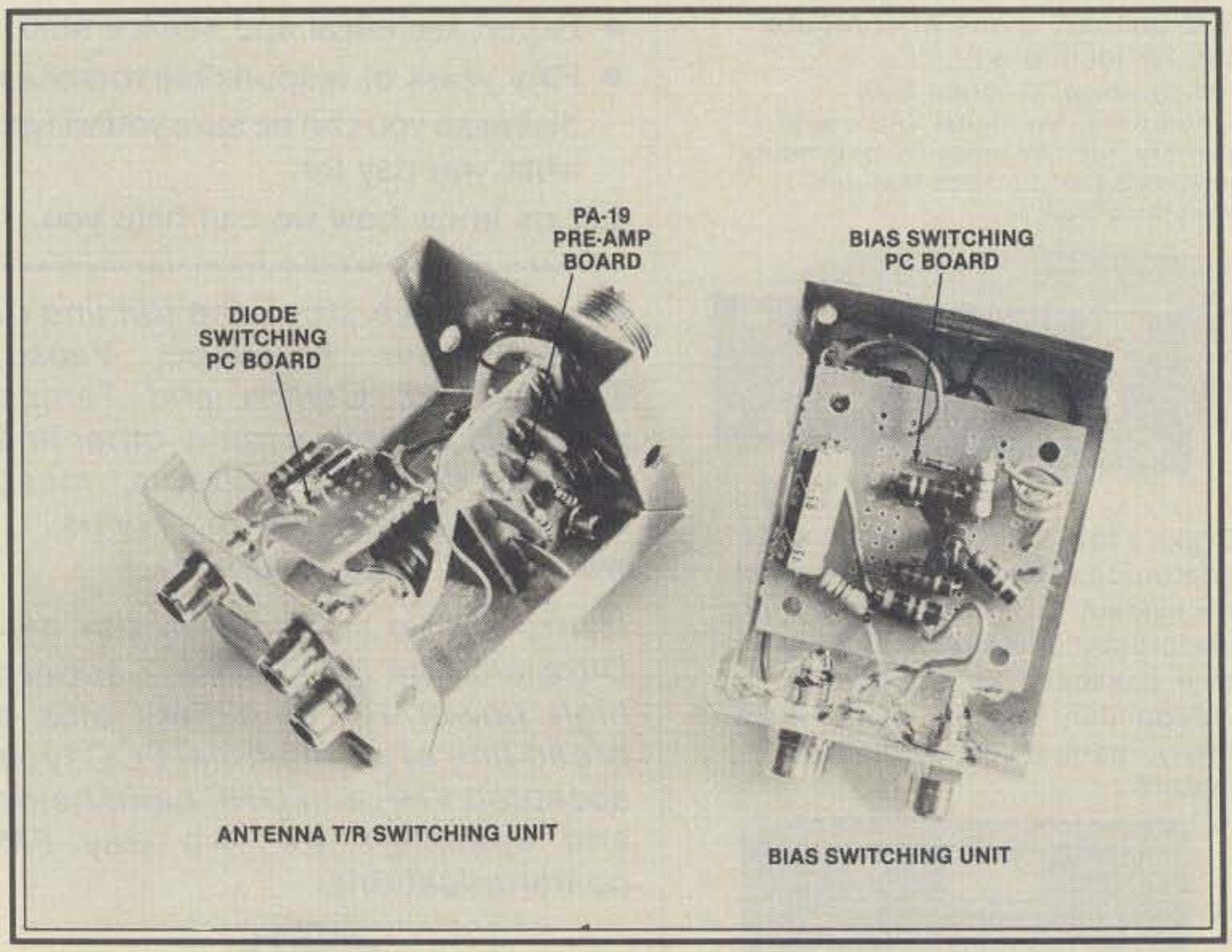
Since my original article on the subject, "Quieting Amplifiers for Fast C.W. Break-In"[1], I have gone through several generations and improvements on the T/R relay unit, the ultimate goal being elimination of the electro-mechanical relay used for bias and antenna transfer functions.

The first approach to this goal was to modify the relay bias switching circuit to solid state switching with r.f. sensing. There have been a number of excellent articles describing this type of modification; however, they are too numerous to list. Therefore, I will confine my discussion to modifications of the equipment in use at this station.

Equipment in use here is the Dentron MLA-1200 r.f. Amplifier and a Ten-Tec Model 540 (Triton), a transceiver which lends itself readily adaptable to QSK operation.

Referring to fig. 1, the block diagram indicates the three units discussed:

(A) R.f. sensing unit
(B) Bias switching unit
(C) Antenna T/R switching unit



The antenna T/R switching unit on the left with the bias switching unit on the right.

R.F. Sensing Unit

Fig. 2, the r.f. sensing unit diagram, is straightforward. Components of this unit are mounted on a small etched PC board (Radio Shack 276-151). This PC board is trimmed down to approximately 1.6 × 2.2 cm (⅝" × ⅞"). The board is mounted on the underside of the r.f. amplifier chassis, and its output (which keys the bias switching) is taken out of the r.f. amplifier cabinet with an RCA phono-type receptacle.

Bias Switching Unit

Fig. 3, the bias switching unit diagram, is a modification from several articles that have appeared in various publications. Components identified in this diagram are also mounted on a PC board with the exception of the bias keying transistor, Q3, which is mounted on the top of the mini-box which houses the bias switching unit. The bias switching unit consists of a small aluminum utility box, approximately 7.6 × 7.6 × 5.1 cm (3 × 3 × 2 inches) (Radio Shack 275-206), phono connectors, and a power transistor socket (Radio Shack 276-029) for transistor Q3. Lack of space within the cabinet of the linear amplifier dictated that this unit be constructed and mounted externally. This may be an advantage to the experimenter, if one does not wish to modify or alter commercial gear.

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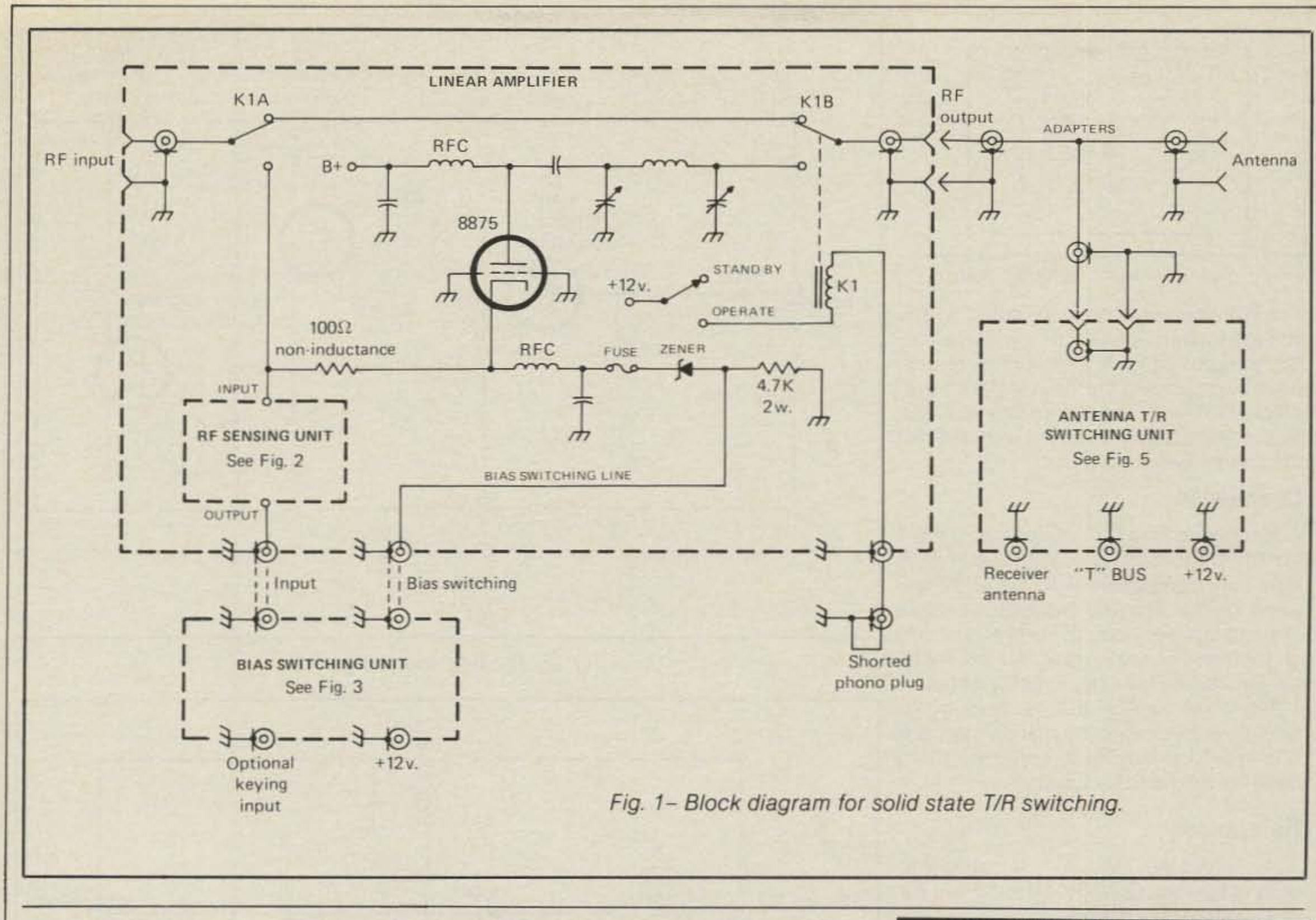

Fig. 1– Block diagram for solid state T/R switching.

To recover this loss, it was assumed that an r.f. preamplifier assembly, similar to the Ameco Model PLF-2 or the Palomar Engineers Model P-310X, inserted between the T/R receiver antenna phono jack and the receiver antenna input, would indeed be satisfactory. However, the addition of another unit to the station precluded their installation.

The answer to the foregoing problems was the PA-19 wideband preamplifier manufactured by Digitrex Electronics.[4] This preamplifier is ideal mechanically, a 2.5 × 2.5 cm (1″ × 1″) PC assembly, and ideal electrically with a frequency range of 2 to 200 MHz with ample gain to offset the insertion loss mentioned earlier. The preamplifier schematic is shown within fig. 5, with components identified for reference only. *Note:* Price of the PA-19 preamplifier is approximately $10.

Fig. 5 shows the final circuitry now in use in the antenna T/R switching unit. This unit is housed in an aluminum utility box similar to the bias switching unit. V.h.f. and phono connectors permit external connections. The photograph indicates mounting of the diode switching PC board and the preamplifier PC board. Note that this unit is mounted to the linear amplifier as shown in fig. 1 of my earlier article.[1]

T/R switching function of this unit is performed by application of the 'T' voltage (approximately + 10v) from the Ten-

Connection to the associated units is made through the use of color-coded phono cables (Radio Shack 42-2309). Note that in fig. 3 an optional keying input is provided for use where r.f. sense keying (approximately + 5v) may not be desired.

Alternate transistor types are also given. These transistors, identified at Q3, have voltage ratings of 1500v to 800v, and sufficient current rating for the intended use.

Antenna T/R Switching Unit

In developing the antenna T/R switching unit, several articles were consulted, including Frey's article "How to Modify Linear Amplifiers for Full Break-In Operation."[2] The electronic T/R switch described by Frey in his article appeared excellent; however, I was concerned with entering the r.f. amplifier and the presence of high voltages. In addition, space within the r.f. amplifier was limited, plus the required band switching for the resonant tuned circuits was not desired in this case. The approach taken was to use an external T/R assembly with forward biased diode switching as shown in fig. 4. In testing this assembly, it was found to have approximately 20 dB insertion loss on receiving. This loss might be explained by "suck-out" as described in the ARRL *Handbook*.[3]

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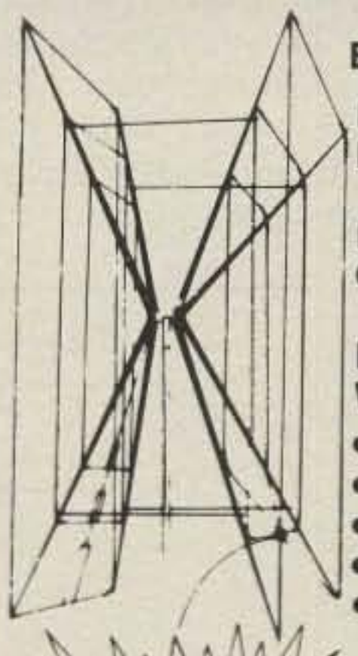

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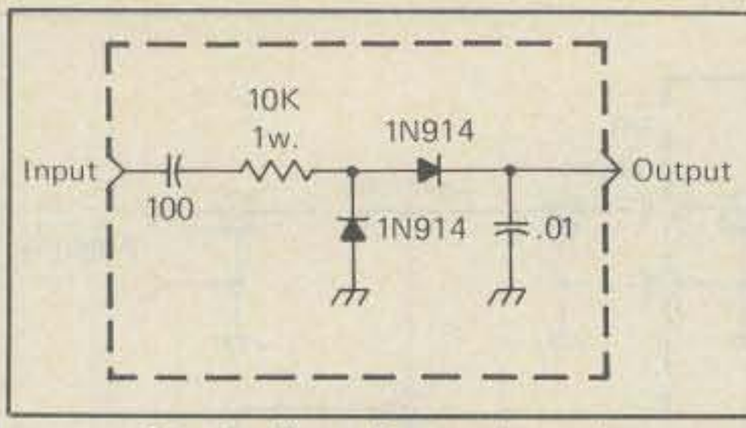


Fig. 2– The r.f. sensing unit.

Tec Transceiver to point 'A' in fig. 5. This voltage forward biases CR1, which effectively places point 'X' at ground potential, thereby grounding the input to the r.f. preamplifier. The 'T' voltage is obtained from the accessory socket on the rear panel of the transceiver.

Conclusion

Response time (T/R switching) of the 1 kw r.f. amplifier in use at this station is now fully compatible with the QSK features of the Ten-Tec transceiver. Note that the auxilliary output control contacts on the Ten-Tec are no longer used, thereby eliminating the built-in delay circuit.

Needless to say, the features of full QSK have been extolled many times, and it is indeed gratifying to enjoy the many benefits provided by full QSK.

References

1. Nick Lefor, W1DB, "Quieting Amplifiers for Fast C.W. Break-In," *Ham Radio*, January 1979, page 46.

2. Dick Frey, K4XU, "How to Modify Linear Amplifiers For Full Break-In Operation," *Ham Radio*, April 1978, page 38.

3. *"The Radio Amateur's Handbook,"* ARRL, Newington, Connecticut, 1981 ed., pages 11–13.

4. Digitrex Electronics, 4412 Fernlee, Royal Oak, Michigan 48073.

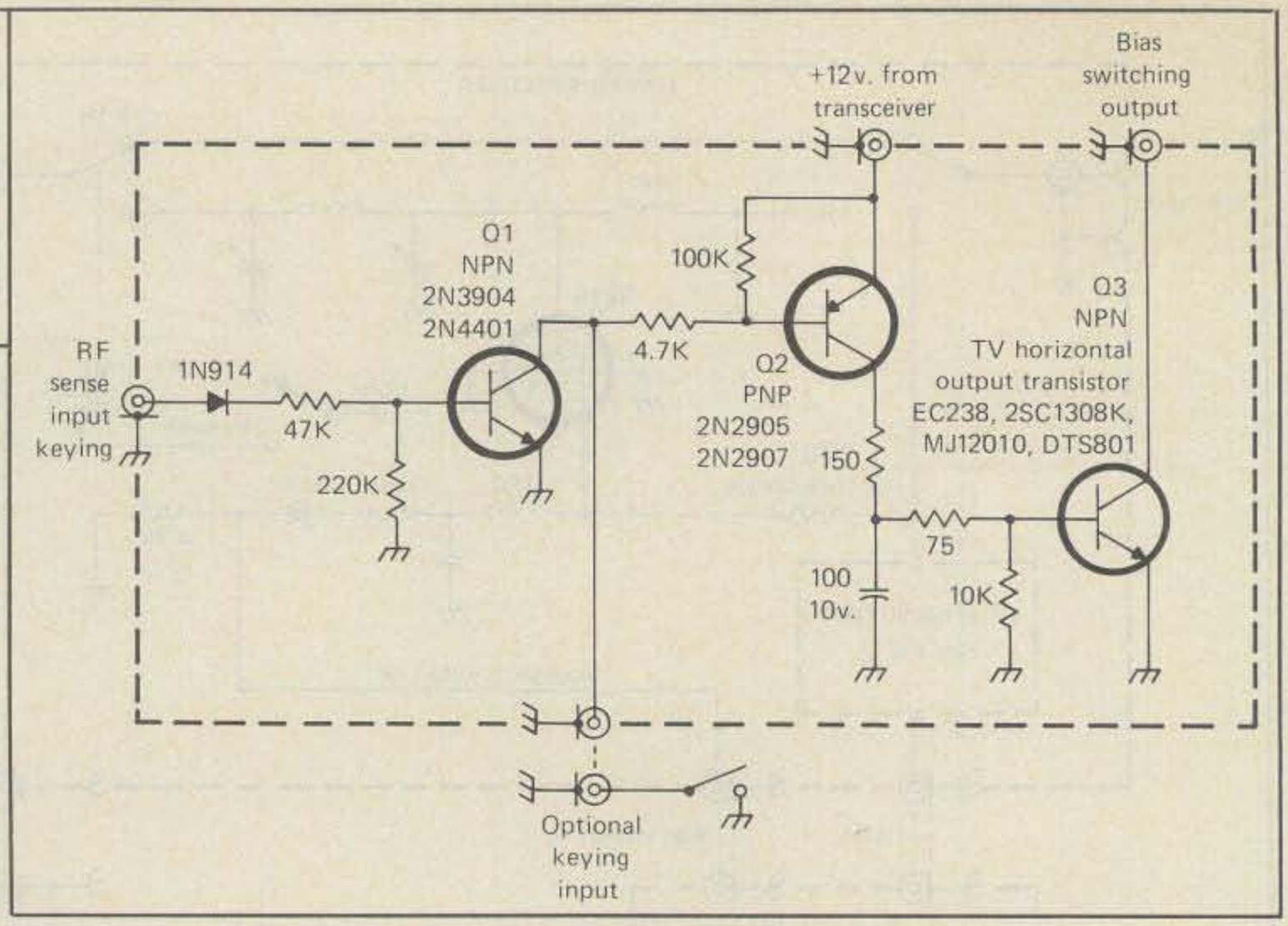


Fig. 3– The bias switching unit.

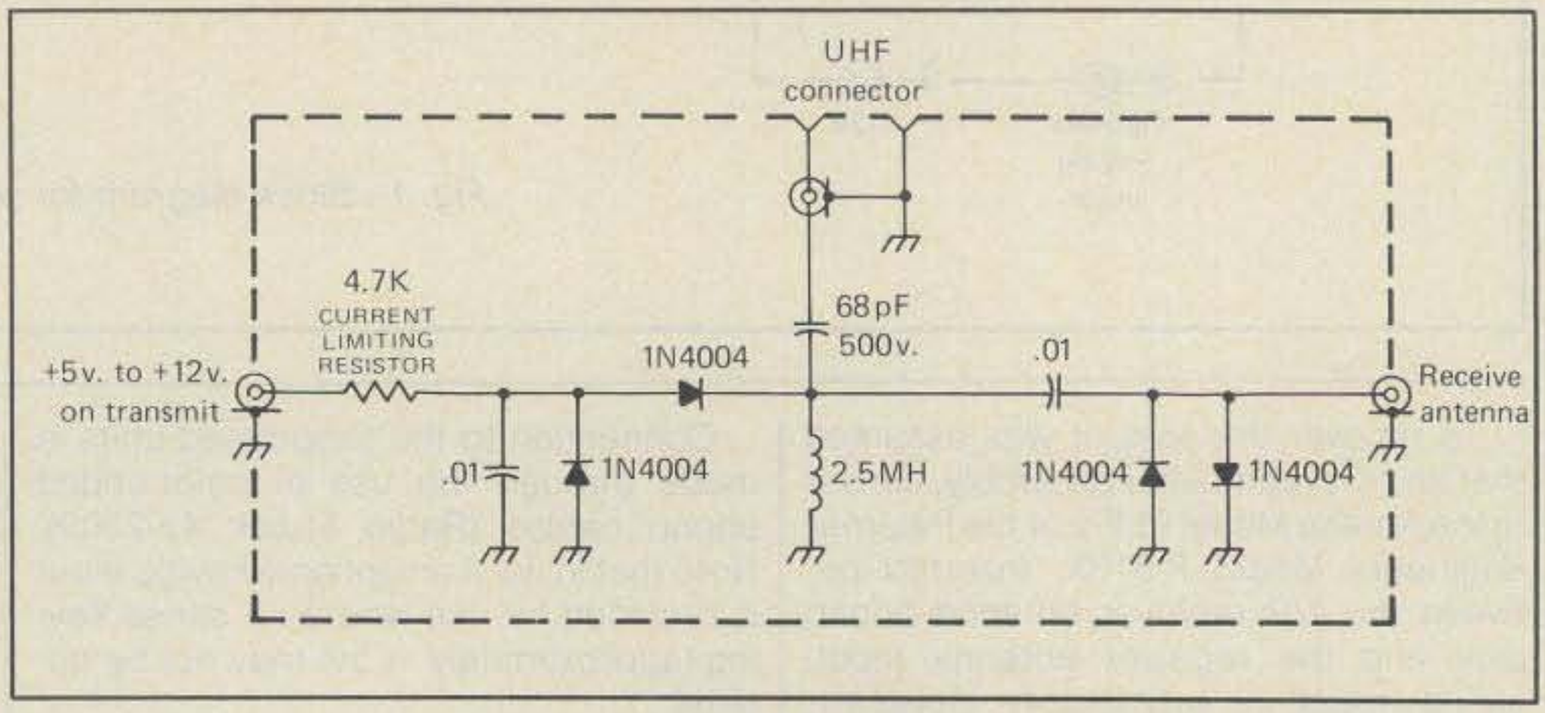
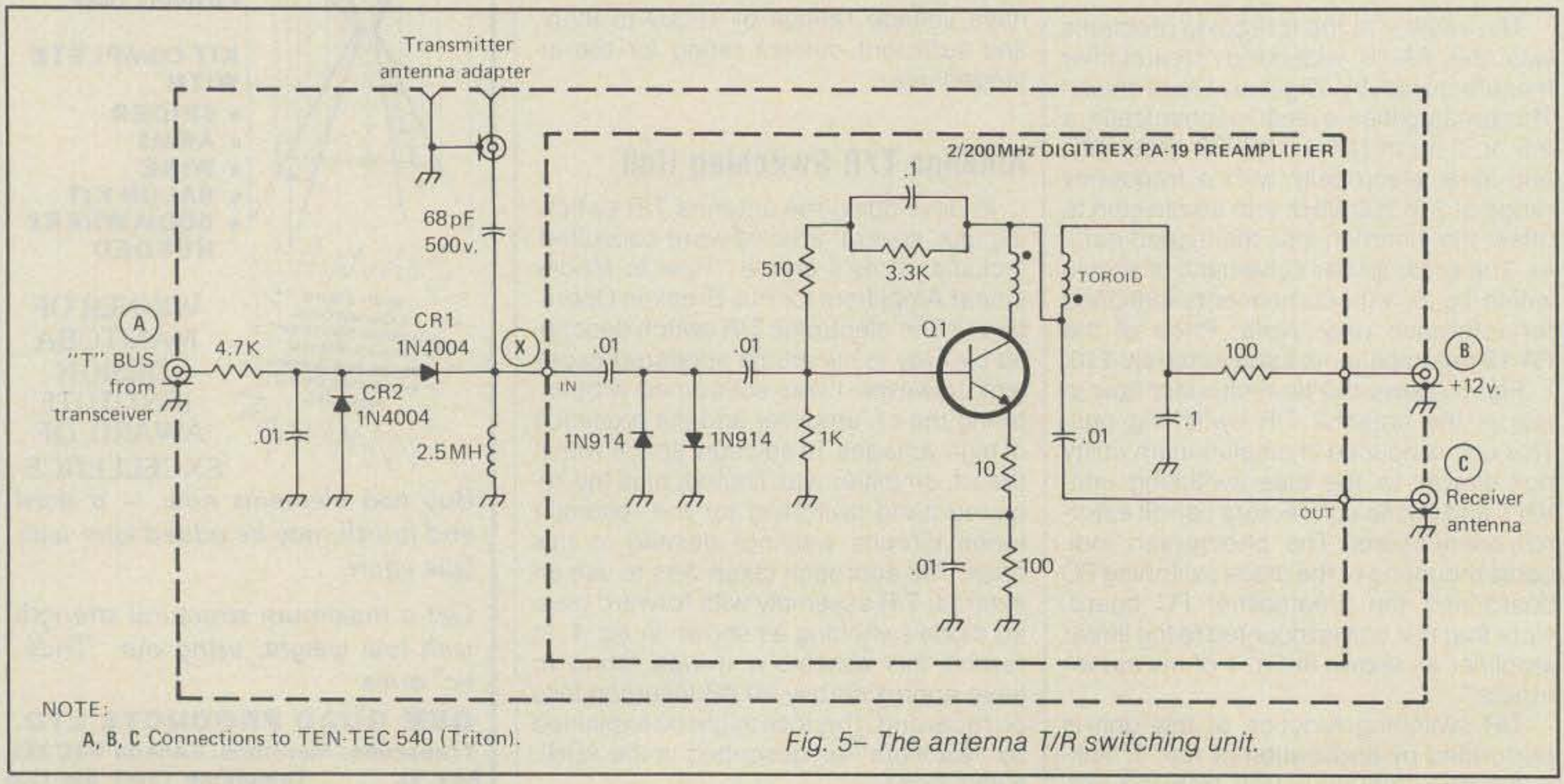


Fig. 4– The T/R switching unit (forward biased diode).



NOTE:
A, B, C Connections to TEN-TEC 540 (Triton).

Fig. 5– The antenna T/R switching unit.

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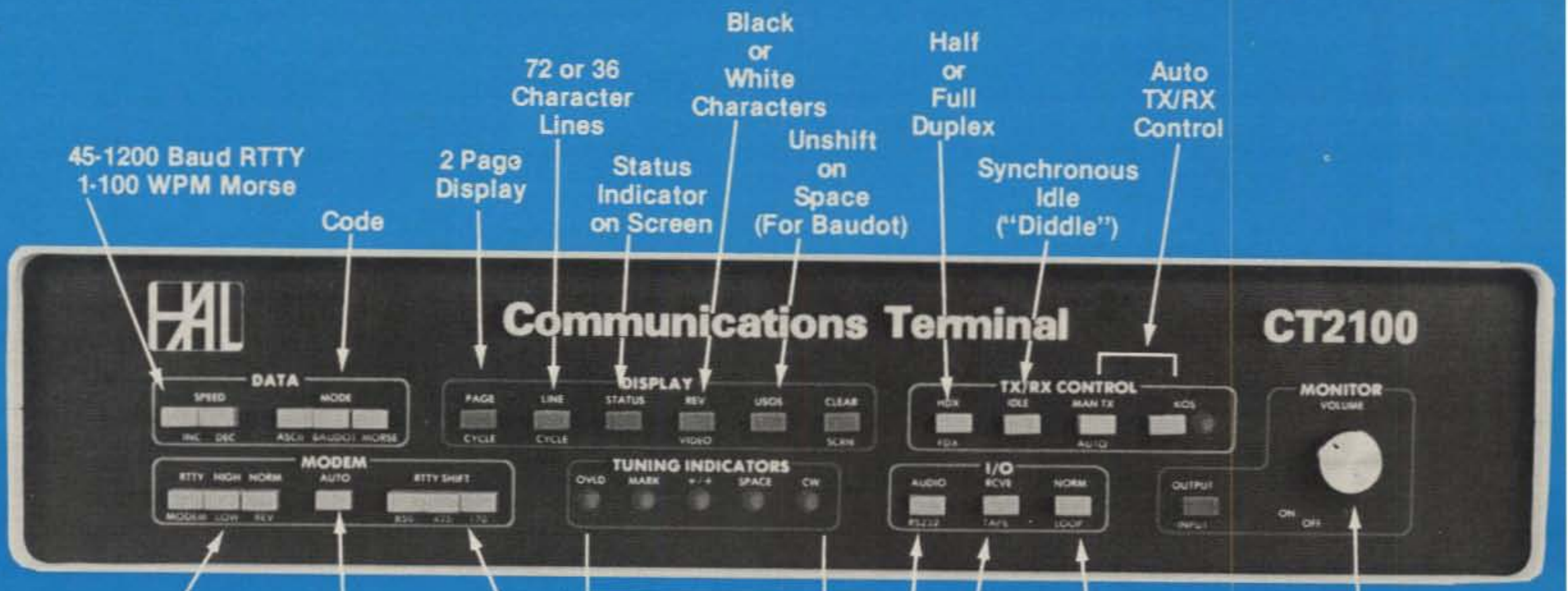

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Built-in Modulator	No (add $45.00)	✓	External add-on ($79.95)
Built-in Scan	No	✓	Not available
Built-in Metering	No	✓	Not available
Video Polarity Shift	No	✓	Not available
Features Remote Control	Yes	✓ Plugs in add-on $38.95	Not available
AFC Performance	Good	Excellent	Poor
Picture Quality	Very good	Very good (true disc)	Good (tears)
Variable Sound Tuning	Good	Good	Poor
Active Clamping Circuit	Diode clamp	True clamp	Diode clamp
External Video	✓	✓	✓
External Audio	✓	✓	✓
AFC Indicator	No	✓	Not available
Appearance	Fair	Very good	Fair
LNA Power Down Coax	Yes, not switchable	Switchable	Set on
Quality of Inside Assembly	Fair	Very good	Fair
*Pricing based on single unit.	**$740.00 (kit)**	**$787.95* (assembled)**	**$974.95* (assembled)**

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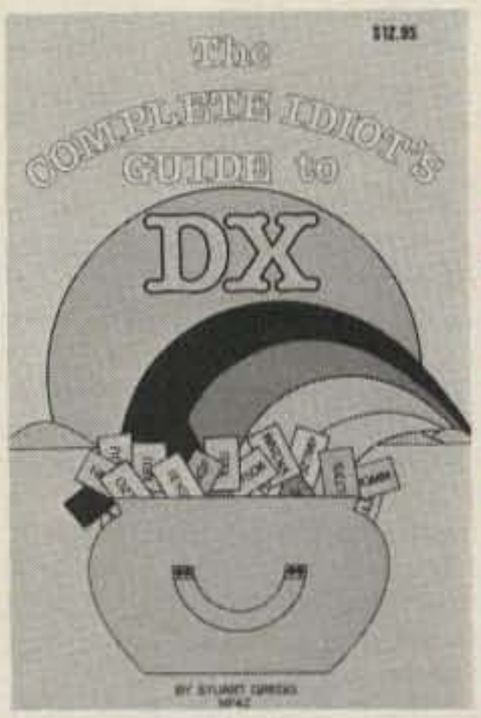
Special Holiday DX Book package features the outstanding "DX IS!", the best of the West Coast DX Bulletin, a 188 page compilation of knowing DX commentary by Hugh "Cass" Cassidy, WA6AUD. Nowhere else will you find such thoroughly entertaining views and commentary on the DX subculture. Meet The Local QRPer, The Old Timer, Slim, Red-Eyed Louis and his cousin Sunspot Louis, The True Blue DXer and other fictional creations grown from Cass' fertile imagination. A "must" on every DXer's bookshelf.

Now, by no stretch of the imagination is this next part of our Holiday DX book package intended to demean the intelligence of either The Local QRPer or The True Blue DXer, but it's called "The Complete Idiot's Guide to DX" and it's written by Stuart Gregg, NF4Z. This entertaining and informative guide is laced with some solid information on the practical aspects of DXing: revelations to the newcomer, confirmation for the experienced DX hound . . . entertaining to all.



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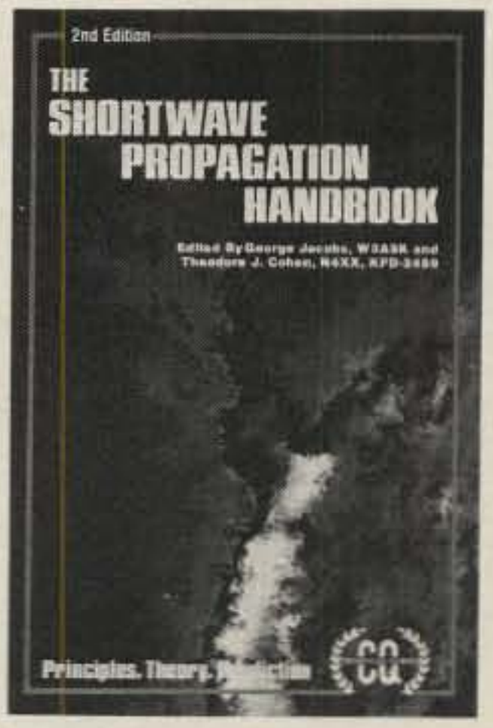

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CQ Reviews:

The Radio Shack LCD DMM

BY ROBERT B. GROVE*, WA4PYQ

Radio Shack has released its top-of-the-line digital multimeter, a substantial improvement over earlier models.

The 22-196 features autoranging and a large (⅜"), contrasty 3½ digit liquid crystal display.

Ranges include 2-20-200-2000 volts a.c. or d.c., 200 ma d.c. current, and 2-20-200-2000 kilohms resistance.

Accuracy on all d.c. voltage ranges is 0.8% of reading or 0.2% of full scale (± 1 digit). A.c. voltage accuracy is 1% of reading or 0.5% of full scale (± 1 digit). D.c. current and resistance scale accuracy is 1.5% of reading or 0.2% of full scale (± 1 digit).

The DMM boasts an input impedance of 10 megohms, making it virtually invisible as a load on any circuit undergoing measurement. Automatic polarity is another plus feature on this little workhorse; awkward lead-switching during a critical measurement is a thing of the past. Other features include range hold, over-range indication, and full overload and transient protection on all ranges.

A standard 9-volt battery provides long-life portable operation, or an optional a.c. adapter will allow the unit constant bench service.

The Radio Shack Auto-Range DMM.

Our Test

In actual service, we found the Radio Shack DMM to be very straightforward, extremely simple to use, and quite accurate. With automatic zero adjust, we never had to consider calibration as with old analog meters.

Settling-down time, the number of seconds required for the display to stabilize, varied considerably with the circuit being measured. For high resistances the display settled down after 15–20 seconds.

The manual which accompanied the DMM is adequate, although not lavish in its instructions and applications. A complete circuit schematic is included, although miniscule in size—typical of offshore printing.

At $99.50, the Radio Shack Auto-Range digital multimeter should provide formidable competition in the home test equipment market.

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CIRCLE 146 ON READER SERVICE CARD

a regular feature by
THEODORE J. COHEN, N4XX

dateline... Washington, D.C.

THE INS AND OUTS OF THE WASHINGTON SCENE

FCC Releases Working Paper on Amateur Radio Deregulation

As part of a continuing series of papers on matters of interest to the telecommunications community, the FCC recently released Working Paper No. 6: "Deregulating Personal and Amateur Radio." *This paper, like others in the series, is intended to stimulate discussion and critical comment on contemporary policy, and does not necessarily reflect the views of the Federal Communications Commission.* The paper's unifying theme, according to its authors (Alex D. Felker and James A. Brown, Jr., both of the FCC's Office of Plans and Policy), "is a general call for much greater flexibility than now exists in the regulation of personal radio."

In presenting their views, the authors point to several FCC regulations which inhibit the achievement of personal radio's goals. Based on their analysis, the authors suggest deregulation or liberalization of the following:

- restrictions that inhibit new technologies, such as spread-spectrum modulation and trunking;
- certain restrictions on amateur repeater operations;
- certain restrictions on amateur third-party messages.

They also suggest that the Commission give consideration to:

- studying means of strengthening amateur radio's technological orientation;
- considering the issuance of a code-free v.h.f. amateur license for technically qualified applicants;
- expanding privileges for Technician Class amateurs to include h.f. privileges;
- allowing some amateur operations on the 27 MHz and proposed 900 MHz Personal Radio Service (PRS) bands.

Finally, Felker and Brown recommend that recreational and hobby uses for personal radio be given explicit recognition in the FCC's Rules.

8603 Conover Place, Alexandria, VA 22308

Again, the material presented in the Working Paper Series is of a preliminary nature and is intended to stimulate discussion. Readers are encouraged to go "back to basics" and to think through the relationships between personal radio's goals (implicit and explicit) and the current regulatory regime. In no sense are the suggestions and comments presented meant to be the "last word" on any subject.

Copies of the Office of Plans and Policy Working Paper Series may be obtained from: Office of Public Affairs, Federal Communications Commission, Room 207, 1919 M Street, N.W., Washington, D.C. 20554.

FCC Continues Inquiry on R.F.I.

On 14 November 1978, the Commission issued a Notice of Inquiry (NOI) on radio-frequency interference (r.f.i.) to electronic equipment. This Inquiry was instituted in response to the large number of complaints received each year about r.f.i. to electronic home entertainment equipment.

In response to the inquiry on r.f.i., the Commission received a comprehensive staff report on r.f.i. which summarized the comments received on the NOI, explained the r.f.i. problem, determined the total interference environment, detailed the television front-end overload problem, and offered policy options for so-called "television interference (t.v.i.)" and the more general r.f.i. problem.

One interference mechanism was singled out as the predominant source of complaints received by the Commission: television receiver overload caused by the operation of a Citizens Band (CB) transmitter. As such, the Commission's staff identified five specific policy *alternatives* which could be used to reduce r.f.i. related to CB operations:

- mandatory performance standards for television receivers;
- voluntary standards for television receivers;
- shared liability between transmitter and receiver;
- strict transmitter liability;
- a Commission-sponsored labeling program for electronic home entertainment equipment.

As a result of the staff report, the FCC in a Further Notice of Inquiry, requested comments on these alternatives, specifically asking for information on the costs associated with implementation of each policy. And while only CB-related t.v.i. is being addressed, the continued mention of amateur radio in the staff report suggests that decisions rendered as a result of the latest Inquiry could affect *both* CB and amateur operations. Consequently, amateurs are encouraged to remain abreast of the Commission's activities in the area of r.f.i. lest "remedies" for t.v.i. be imposed which are burdensome to the amateur service.

Little Support Received For Plain Language Rules

There is a good possibility that by the time this issue goes to press, plain language Rules for the amateur service will be a "dead" issue. The reason for this is that the proposed rewrite of the rules has little support within the Commission and the amateur community. According to James McKinney, Chief, Private Radio Bureau, FCC, "We are receiving more complaints about the proposed plain language Rules than on any other matter before the Bureau."

At this time, the proposed plain language Rules must either be modified or abandoned by Commission action. Our analysis suggests that the Commission will take the latter course of action.

Shortage Seen for Electronic And Computer Grads

According to an article published in *Electronic Engineering Times*, ". . . the number of new (electronic and computer) graduates the industry will need each year through 1985 is about three times

Say You Saw It In CQ

the number to be graduated in the U.S. This projection, made by Pat Hill Hubbard, American Electronics Association (AEA) manager of Technology Training and Careers, shows that through 1985, only 69,000 U.S. graduates will be available to fill 198,000 positions. While this type of analysis is difficult to make, Hubbard maintained that her assumptions were reasonable. She assumed, for example, that the annual compound growth rate for the industry would be 14.9 percent, while the annual rate of promotion within the industry of technical people into management was assumed to be 4.9 percent.

There is a possibility that the projected shortfall in electronic and computer graduates may actually understate the shortage. The projections do not take into account recent decreases in enrollments because of shortages in faculty, space, and equipment. Furthermore, Hubbard's study did not reflect the fact that other "engineering-intensive industries" have demands for engineers with degrees in electronics and computer science.

Connecticut Court Bars Seizure of Radar Detectors

As a result of a Connecticut Superior Court's recent decision, state police will no longer be able to confiscate drivers' radar detectors under a law which addresses "unauthorized reception of police radar signals." Writing in *Electronic Engineering Times*, reporter Richard Doherty noted that in the Court's decision, the police actions were ruled inappropriate because possession of the devices, by and of itself, was not illegal. The decision overruled a dictim of the state's Commissioner of Motor Vehicles which forbid "the use or installation of radar detectors." The matter of amateurs who use microwave equipment in their cars was not, however, resolved.

The article quoted Robin Boyer, an engineer with Microwave Devices in Houston, as saying, "We've been in touch with several hams who've been using our gear on X-band, at 10.525 GHz, who've had trouble with over-zealous officers." Continued Boyer, "Microwave Devices' products are recognized by the FCC as legal transmitters, even though they have been known to interfere with police radars. After all, they do share the same frequency of operation—as do most microwave doppler security alarms."

It should be noted that the 10 GHz amateur band extends from 10.0 to 10.5 GHz, and operation by amateurs of devices such as those produced by Microwave Devices on 10.525 GHz is illegal.

IEEE Publishes Review of WARC-79

Students of frequency management and telecommunications policy will find the *IEE Transactions on Communications* for August 1981 of special interest. This issue (also published as the *IEEE Transactions on Electromagnetic Compatibility*, Vol. EMC-23, No. 3) treats all aspects of the recent World Administrative Radio Conference (WARC), and includes a paper on WARC-79 decisions which affect the amateur and amateur-satellite services. The latter, prepared by Dave Sumner, K1ZZ, of the ARRL, is a comprehensive summary of significant Conference results which will affect our services through the remainder of this century. Other papers of interest to amateurs include:

- Regulatory Procedures and WARC-70 (by J.J. Kelleher);
- Provisions for High Frequency Future Use (by H.A. Feigleson);
- Spectrum Allocations Above 40 GHz (by W.F. Katzenstein, R.P. Moore, and H.G. Kimball).

Atmospheric Radiation Peaks Amateurs' Interests

Richard W. Ferbus, W9DTW, recently published a paper in the *AMRAD Newsletter* (Amateur Research and Development Corporation) which described "Real Time Analysis of Atmospheric Radiation from Weather Fronts." The paper, first presented at the 1981 National Computer Conference, describes a microprocessor-based system which analyzes the electromagnetic radiation from weather systems. The system makes use of the observation that electrical activity from storm fronts is related to the severity of the front. Such radiation, called "sferics," may offer a way to monitor activity associated with severe weather and to predict the occurrence of storm-related phenomena such as tornadoes. Sferics

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CIRCLE 66 ON READER SERVICE CARD

Announcing:

The 1982 CQ World Wide 160 DX Contest

C.W.: January 29–31
Starts: 2200 GMT Fri.

S.S.B.: February 26–28
Ends: 1600 GMT Sun.

With the changes made by the FCC last summer, operating in the 160 meter band will now follow a different pattern. After we have experienced a couple of Top Band contests, we will have a better idea of what to expect and recommend.

Dave Summer, K1ZZ's article "160 Meters Lives Again" in the August issue of *QST* covered the subject thoroughly, and it is recommended reading for all Top Band activists.

The phasing out of all U.S. Loran-A stations has now removed the power restrictions in the 1800–1900 kHz segment of the band. However, the eastern Canadian Loran is still being used on 1950 kHz, so the power restrictions are still in effect in the 1900–2000 kHz segment of the band.

Keeping the "DX Window," 1825–1830 kHz, free of U.S. and VE activity should still be observed. The addition of another "DX Window," 1850–1855 kHz, as suggested by K1ZZ, might also be desirable, now that some overseas stations have been given restricted operating privileges above 1850 kHz.

For the time being, however, it's a wait-and-see policy. We see no reason to make any changes in the basic rules that have been used in the past.

Exchange: RS(T) plus a three figure contact number starting with 001. U.S. stations should include their state, and Canadians their province. DX stations will be identified by their call.

Scoring: *For W/VE/VO stations*—Two points per QSO with other W/VE/VO stations. DX contacts are worth 10 points.

For DX Countries—Two points per QSO with stations in the same country, 5 points with stations in other countries. QSO's with W/VE/VO stations are worth 10 points.

Multiplier: *For All Stations*—One point for each U.S. state, VE province, and DX country worked (KH6 and KL7 are considered DX). there are three VE1 provinces: New Brunswick, Nova Scotia, and Prince Edward Island.

Final Score: Total QSO points times the sum of the multipliers.

Penalties: Three additional contacts will be deleted from the score for each duplicate, false, or unverifiable contact removed from the log.

A second multiplier will also be removed for each one lost by the above action.

Disqualification: Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, violation of the rules of the contest, unsportsmanlike conduct, or taking credit for excessive duplicate contacts or multipliers will be deemed sufficient cause for disqualification.

Disqualified stations or operators may be barred from competing in *CQ* contests for a period of up to three years.

Awards: Certificates to the top scorers in each U.S. state, VE province, and DX country. Additional awards if the score or returns warrant.

In addition, there are two plaques being awarded by the West Gulf A.R.C., both for single operators. One is for the highest scoring U.S. station, and the other is for Europe. The World Champion in the contest will receive the John Doremus, WØAW Memorial plaque from "Friends of WØAW."

The above plaques may be won once only by the same station within a three year period. Winner of the World Plaque will not also be considered for a sub-area award. That award goes to the runner-up in that area.

Sample log and summary sheets may be obtained from *CQ* by sending a large s.a.s.e. with sufficient postage to cover your request. It is not necessary to use the official form. You can make up your own, 40 contacts to the page, time in GMT, number sent and received, and separate column for QSO points and multipliers. Indicate the multiplier only the first time it is worked.

Mailing deadline for c.w. entries is February 28th, and March 31st for the s.s.b. logs.

Logs can be sent directly to the 160 Contest Director, Don McClenon, N4IN, 3075 Florida Avenue, Melbourne, FL 32901 USA. They can also be sent to CQ, 160 Meter Contest, 76 North Broadway, Hicksville, NY 11801 USA. *(Please indicate c.w. or s.s.b. on the envelope.)*

occur as pulses and have been monitored at frequencies from the v.l.f. through the u.h.f. bands. The timing between pulses appears to be a function of the storm's stage of development, with the time between bursts decreasing as the storm intensifies. Low frequency sferics can be monitored at distances of over 1000 miles, and so, Fergus employs a system that monitors the 10 kHz component of the frequency spectrum. Together with others who are building similar systems, Fergus hopes that someday a number of manned and unmanned stations with data links to a central processing station will be used to assess the severe weather conditions which often plague the mid-continent area.

Amateurs interested in this project and in other experimental efforts of AMRAD are invited to write to Mr. Paul Rinaldo, President, AMRAD, 1524 Springvale Avenue, McLean, VA 22101.

FCC Fills All Seven Commissioner Seats

With the swearing in of Henry Rivera, all seven seats on the Commission have been filled. Confirmed by the Senate on 31 July 1981, Mr. Rivera had been a member of the Albuquerque, New Mexico law firm of Sutin, Thayer & Browne, in which he practiced corporate and commercial law.

In a related matter, James Quello was sworn in for a second FCC term. Mr. Quello had previously served as an executive with Detroit radio station WJR, where he held the posts of general manager and vice-president.

Consumer Agency Pushes Safety Guidelines For CB Antennas

According to *The Washington Post*, the Consumer Product Safety Commission is proposing to require safety standards for outdoor CB antennas. The Commission's concern centers on some of the 45-foot backyard vertical models which may come in contact with overhead power lines during installation. According to the CPSC, about 50 people are electrocuted each year in this manner. Voluntary safety guidelines could be used instead of the proposed mandatory safety standards, depending on how the antenna industry responds to the Commission's proposal.

Amateur Awarded Citation By Radio Club Of America

The 1981 Sarnoff Citation was awarded to Jerry S. Stover, W5AE, one of the founders of Communications Industries in Dallas, Texas. Jerry has served as a Director of the Radio Club of America, and currently lectures at Southern Methodist University. He also serves as a communications consultant. The Sarnoff Citation is awarded for "significant contributions to the advancement of electronic communications."

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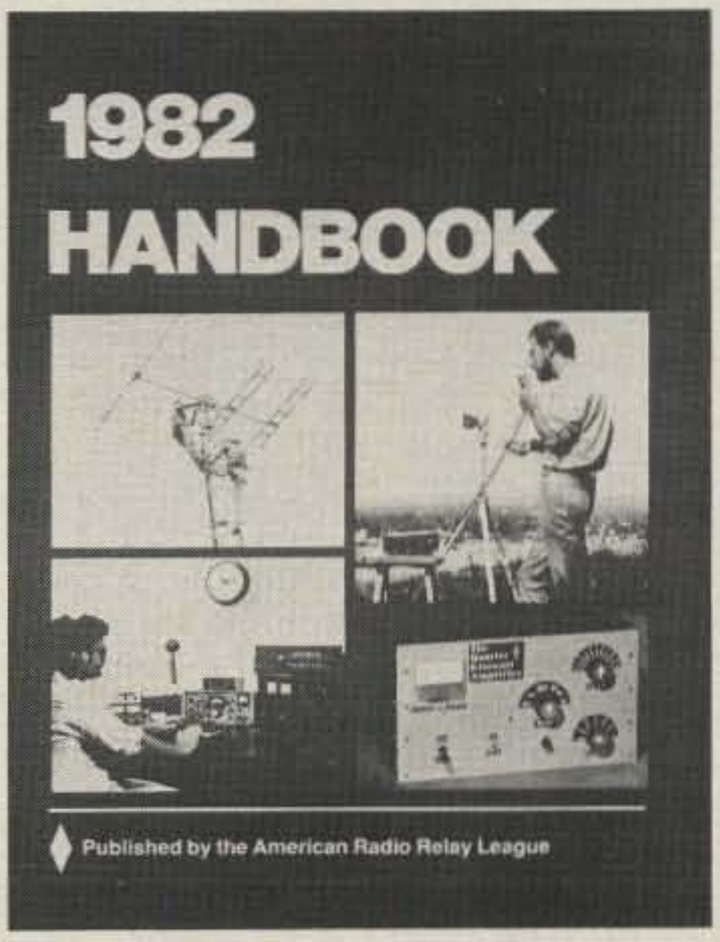

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If you're thinking of submitting "creative" logs for a CQ Contest, perhaps you'd better think twice. Remember, the only prize we have for fiction is a DQ notice.

Gotcha!

BY DOUGLAS ZWIEBEL*, WB2VYA

Let's see, 5 minutes to go and the CQ WW contest will begin. I've looked at those scores from last year, and they don't seem so big. I know three or four of the top place op's, and I don't think they're so much better than I am. Last year I was only about 30 or 40 QSO's down from them after the first 3 hours, and I wasn't even really trying. Yep, this year I'll show my true colors and wow 'em all. I'll make the big effort. Just one minute left to go. Guess I'll fill in the cover sheet—call sign . . . KA1QSD, single op . . . single transmitter . . . all band, there. Oh boy, here we go!

Quick, gotta find a CQ'er to answer. There's one; I'll nail him. Try again. What? Well one more time. Boy, this guy needs a receiver. I'll give him another shot. Two minutes into the contest and still no QSO's. I'll put him in the log anyway. Just because he's a jerk isn't my fault. Okay, my first QSO, CHARGE! There's another guy. Listen to him work the boys! One quick call should do it. Sure enough, got him! Now what's his suffix? I'll wait for the next exchange. Boy, he sure sends fast. Still can't get it. Well, it's a DL0, so it's probably DL0AA. That must be it.

. . . Oh, there's Tom; let's see how he's doing. Zowie, listen to that pileup. Wait a minute, the DX is calling Tom! Oh, I get it. *He's* calling CQ and they answer him. Simple! Okay, just gotta find a clear spot. No, that's in use; so is that one. This sounds like a good spot. "CQ TEST CQ TEST DE KA1QSD K." Wow, a million stations. There, an F3 something. Let's see, "F3?? UR 59905 BK." Gee, that's funny, nothing. Oh, there he is. "K1AR DE F3TV 59914 BK." Dumb European got my call wrong. Oh well, I know he means me. "QRZ TEST DE KA1QSD K." Ahh. UQ2GDQ, great. "UQ2GDQ UR 59905 BK." Silence? Oh, there he is. Guess he has a manually operated antenna changeover switch. That's funny; he got my call as K1AR also. I'd better listen off frequency a little. Ahah! There's K1AR. He's trying to steal my QSO's. I'll fix him, the nobody.

. . . I can't believe it, 30 QSO's and that K1AR still thinks he is working my QSO's. Bet he's just a newcomer. I'll QSY a bit. Listen to that noise. Wonder what it's all about. HZ1HZ, wow, a double multiplier. Quick, give my call. "DE KA1QSD K" . . . "QRZ K1 DE HZ1HZ." He heard me! He heard me! "HZ1HZ DE KA1QSD UR 59905 BK" . . . "1KI DE HZ1HZ 59921 TU QRZ DE HZ1HZ." Hmmm? Guess that was me. My score is really growing. Guess I will have worked out the band soon. I'll try 40 meters; there must be plenty of good stuff there.

. . . Darn, 30 minutes on 40 and only 6 QSO's. What's wrong? I know, all those other guys have "shorty fortys" or even more. There's N2AA. They run hard line heliax! How can you compete with that? Maybe I'll overcome the lack of antenna gain with a little *filament* gain. Just ease up the variac a bit . . . and a bit . . . and maybe a bit more. Gee whiz! This pair of 4-1000's really puts out the soup on 40. Look at the W-4 slam against the peg! Doesn't even bounce off between dits! Bet this will even things up some. Here we go; look out! KA1QSD QRZing with stacked Eimacs. "KA1QSD DE G3VZT K." That was fast. There's nothing like a little "antenna" gain to help out the signal.

. . . Hey, wait a minute; where are all the big multi-multi's? Why don't I hear

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them? Just better take a quick look around and . . . gotcha! There they are: 7001, 7002, 7003. And listen to the multipliers. I could really boost my score if I could work them! But only a General Class ticket. Well, maybe a loss of sight of the VFO. Just an "honest" mistake. Whoops, hit the dial; there's a big pileup. 5T5CJ, hoo boy, another double multiplier! Better add a few more "elements" to the dipole, just to be sure. And . . . see that, first call! You know, I really am *good!* Down to 80.

. . . Must be thunderstorm in the area; this noise is 20 over 9. How can anyone work anything here? But I need the multipliers if I want to at least have a top ten score. Those guys with the beverages must be kidding; they can't really be hearing anything. I know! I'll bet the 80 meter scores are really all made up. Everyone does it, so I guess the CQ WW Committee looks the other way. It's probably just an accepted fact of life. I'll just listen to some of the stateside fakers and put down the calls that they're obviously making up. Guess the boys weren't kidding when they say there's more to contesting than just making QSO's. Ha ha ha, I get the idea. This is easy.

. . . Saturday afternoon and 15 isn't open to Europe so hot. The signals are real punk, but why is there so much QRM? Better take a sampling of the technique the boys use up here. So! That's it. They make believe that they run Japan. Well, the least I can do is turn my antenna north at JA to sorta go along with it. Holy tomatoes, there *is* an opening to Japan! In the afternoon? Guess it's sporadic E or something. Listen to K2SS run those JA's. I can barely even tell anything is there. How can he be getting any calls? Guess this is a modified 80 meter technique. I can do this just as good as the next guy can. Guess a 100 per hour is a good starting rate. Yep, nothing to it.

. . . I'm beat, my back hurts, my head hurts, my ears are ringing from so much c.w. I'm tired of looking for QSO's. Better take a break, relax a bit. Take off the headphones, feet up, flip on the ole 2 meter rig and listen to the gang. "OY7 on 21.073" . . . "ZS3AM on 28001" . . . "VK9XI around 14003" . . . "Hey found a good one, P29NRV on 28110" Say what !? Listen to that! A zillion new multipliers. I must really be slow. How easy can this get? There's the P29; that's a *hugh* pileup. Better check the VK9. That's even worse! Hey wait a minute. I'll call up Fred across town. He only works the contest for new countries, and he has a bigger antenna and a much bigger amp! Maybe he'll work a few for me while I call this P29. Hello Fred . . . you'll do it . . . great . . . see you after the contest . . . yeah, if I hear one you need I'll work it for you, too . . . thanks.

. . . Boy, this is something. Just look at that last hour. Sixty QSO's and 45 of 'em new multipliers! This will prove I'm hot stuff to any skeptics who dare doubt my true ability. Only 3 hours left. Not much doin anywhere. Gotta hustle. Lemme grab the Callbook and I'll "run" some VE's on 40 and 80. I know all the big multi-multi's do that. I'll just borrow their know-how. Guess 30 an hour is a feasible rate.

. . . 3 . . . 2 . . . 1 . . . FINISHED! Man, what a contest. Let's figure up my score here. These are 3 points, those are two each. That's a *dupe* . . . aahhh, eerrrr, can't have too many dupes. I remember who I worked in my head. I'll just leave in the dupes and take out a few QSO's, mark 'em as dupes, and they'll never know the difference. There, that looks real professional. What's this? I missed zone 40 on 20 meters! Impossible, I heard TF3IRA all over the place. Can't be. Guess I forgot to log him. I'll just erase this DJ call and put in TF3IRA and *there*! Zone 40. Add my signature to the declaration and . . . all set. A beautiful contest effort.

. . . "KA1QSD this is the DX-Contest net, 3830 on your dial. Welcome aboard today Joe. Hey Joe, I see you got disqualified in last year's world-wide. What happened?" . . . "Yeah, can you believe that? Guess I didn't subscribe to their magazine or something so they gave me the DQ. Boy, who do they think they are?" . . . "Yeah, Joe, know what you mean. You don't cheat . . . do ya?"

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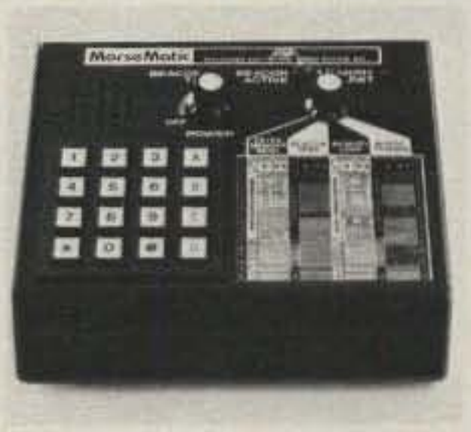

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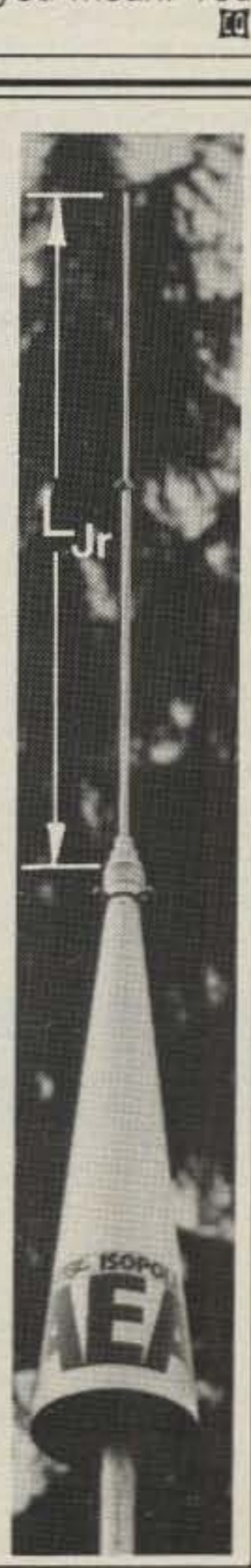

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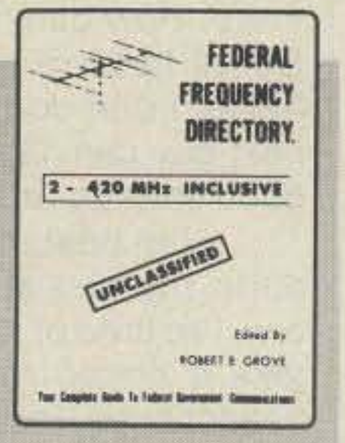

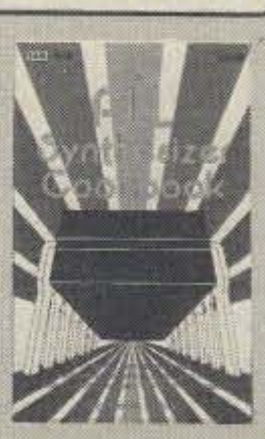

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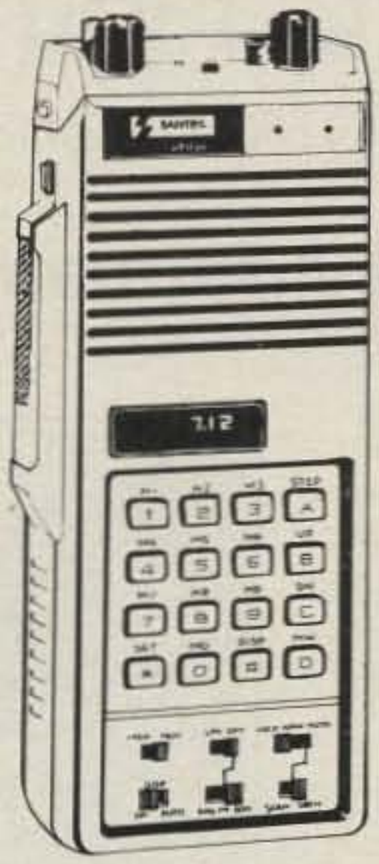

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CIRCLE 90 ON READER SERVICE CARD

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

Antennas

DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

More Information For Scanner Buffs

This month we pick up our discussion of scanner equipment with some thought on mobile scanner antennas. Scanners and s.w.l. topics have become very popular among non-amateurs and amateurs alike. It seems that we all like to listen in and eavesdrop on what's going on.

Mobile Scanner Antennas

The same considerations hold true for selecting and installing a mobile antenna as apply to the base station antenna. An important question is, shall I use an existing a.m./f.m. antenna, or install a special monitor antenna?

The separate monitor antenna will work best in almost all cases, particularly if a "standard" a.m./f.m. antenna is used—that is, one with no special provisions for simultaneous use as a monitor antenna. For close-range, strong signal reception, use of the car's existing a.m./f.m. antenna will probably be satisfactory if it is of the kind whose radiating element is not grounded, and if a special signal splitter is used to electronically feed the separate receivers and minimize interaction between their antenna circuitry, or if a BC/monitor coax switch is used. Bear in mind that automotive antennas are often fed with special coax that may not be suitable for v.h.f./u.h.f. work, and that may result in high signal attenuation. It's worthwhile, too, to play with the antenna's length, if it's adjustable. For v.h.f.-lo reception, the whip should be extended to full length, whereas for high-band reception, the whip is telescoped down to about 18 inches or so. A v.h.f./u.h.f. antenna cut for an adjacent amateur band will usually give a good account of itself.

A simple quarter-wave 18-inch whip can be used for mobile v.h.f.-hi monitoring, while a small 6-inch whip should do the trick for u.h.f. reception. A 49-inch ⅝-wavelength v.h.f.-hi antenna will provide about 3 dB of signal gain; much higher gains are possible on the u.h.f. bands using collinear and other complex designs.

317 Poplar Drive, Millbrook, AL 36054

Designed primarily for amateur 2- and 1¼-meter operation, the AEA Isopole can be used to good effect as a scanner monitor antenna. Two-meter unit shown works as a monitor antenna from about 110–174 MHz, since the 5/8-wave decoupling sections are in-phase at all frequencies. A smaller antenna, which uses but a single decoupling cone, and is known as the Isopole Jr., can also be used as a general-purpose v.h.f. monitor.

There are a number of possible mounting locations. The best spot is the one that's as high as possible, which is the center of the vehicle's top. This location also provides the best ground plane for omnidirectional reception. Two other good locations, from an effectiveness standpoint, are the trunk lip and fender cowl, although the latter may expose the antenna to undue ignition noise. Bumper mounting is least preferred, due to the distorted ground plane configuration and low height. Permanent-type or magnetic mounting are best, while gutter clip and other temporary lash-ups are inefficient and should be avoided.

From a practical standpoint, probably the most desirable all-around mobile antenna for the multiband scanner is the combination v.h.f.-lo/hi/u.h.f. triband whip mounted on the car's trunk lid. A number of manufacturers, including Radio Shack and Antenna Specialists, make a variety of such antennas in trunk-lip and magnetic-mount models.

In most instances, the scanner is installed in the car in the same fashion and at the same place as it would be in any other rig—under the dash or on the transmission hump. Normally, the coax feeding the antenna (typically about 17 feet of RG-58/U) as furnished by the manufacturer has a very small and acceptable loss—typically under 1 dB on the v.h.f.-lo band, 1 dB on v.h.f.-hi, and about 3 dB on u.h.f. bands. These losses are normally not sufficient to worry about in a receiving installation.

The multiband antenna can be connected to the single antenna jack which most scanners now use. If separate (dual) antenna jacks are provided on the scanner, a special antenna combiner may be used to properly split and route the signals from the single antenna. Alternately, if separate v.h.f and u.h.f. monitor antennas are used, a combiner may be used to accept the signals from the separate antennas and electronically combine them into a single scanner input, as in base station installations.

Although almost all public service monitoring uses f.m., with its inherent noise-free reception, ignition noise may still present a problem, particularly on the v.h.f.-lo band (30–50 MHz), and less so on the higher ranges. Noise may be particularly troublesome with forward-cowl monitor antennas, or if the standard cowl-mounted a.m./f.m. antenna is used for monitoring. A noise suppression kit may be required—one designed specifically for v.h.f. mobile use, since suppressors designed for the a.m. broadcast band are not normally effective at v.h.f.

A final point: Be sure to check with your local authorities before installing a scanner rig in your vehicle. Many states and municipal jurisdictions have laws or ordinances prohibiting the use of a mobile receiver that can receive police calls. Al-

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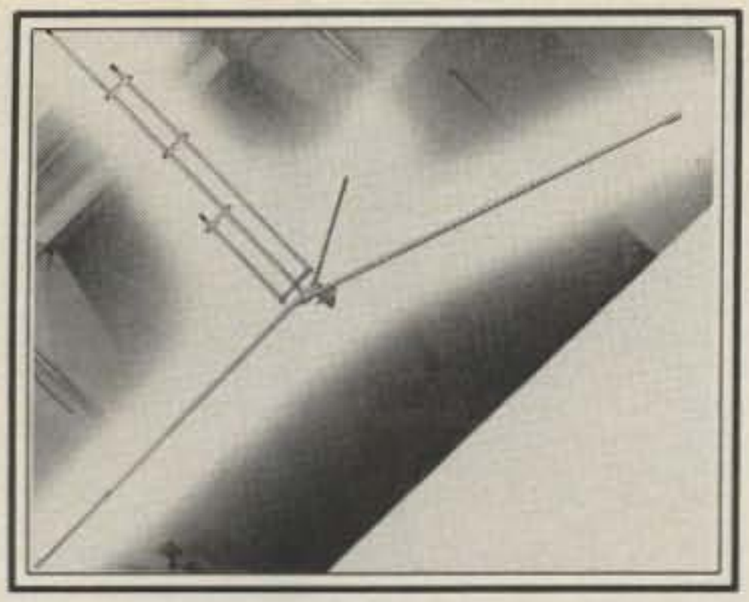

Radio Shack multiband scanner antenna is a simple design that enables 3-band (v.h.f.-lo, v.h.f.-hi, and u.h.f.) reception with a single antenna. Unit consists of three separate whips optimized for reception on each of the 3 bands and 3 radials. (Photo courtesy Radio Shack)

Hustler "Discone" Model DCX antenna is designed for extremely wideband reception over the range 40–700 MHz. Thus, a single antenna can be used with multiband scanner monitors with little performance compromise from band-to-band. (Photo courtesy Hustler, Inc.)

though the laws may be of questionable merit, check them out first!

Special Clubs and Publications

With the recent surge in public service band monitoring, there has been a corresponding upswing in interest in organizations devoted to promoting scanning as a serious hobby.

One of the best known of such specialized radio clubs is the **Radio Communications Monitoring Association (RCMA)**, P.O. Box 4563, Anaheim, CA 92803. RCMA is for persons interested in listening to two-way communications in the v.h.f./u.h.f. public service bands as a hobby, primarily in the 30–50, 118–174, 225–400, 406–

For the sophisticated s.w.l. who wants to roam the higher frequency ranges, the Bearcat 220, shown here, allows monitoring of all the public service ranges plus the a.m. aircraft band. Up to 20 frequencies may be scanned at the same time. In addition to "normal" scanner functions, where frequency limits are set and the scanner searches between programmed parameters, it also searches marine or aircraft frequencies by depressing a single button. These frequencies are stored in memory, so no reprogramming is required. Other state-of-the-art features include priority channel and dual scanning speeds. (Photo courtesy Electra Co., div. of Masco Corp. of Indiana)

420, and 450–513 MHz ranges. The club was formed in May 1975 in order to share ideas and pool information of common interest. RCMA differs from most other listening-type groups since its focus is on *non-skip* reception of local radio systems, with emphasis on message content. A member organization of the **Association of North American Radio Clubs (ANARC)**, a confederation of the best-established hobby-listening clubs, RCMA is probably the oldest group of organized monitor radio listeners in the world. It draws its membership from a wide cross-section of enthusiasts, including amateurs, engineers, law enforcement officers, firefighters, and pilots. The group publishes a bulletin, the *RCMA Newsletter*, a sample copy of which is available for $1. The club has more than 1300 members in 49 states and 8 foreign countries. At this time, U.S. dues are $10.50.

A newer club, the **Scanner Association of North America (SCAN)**, was formed several years ago with a tie-in to the Electra Company, manufacturer of the well-known Bearcat line of scanners, and REACT, the CB public service organization. The club's charter states that SCAN is "dedicated to the advancement of scanner monitoring and to the mutual understanding between citizens, public safety officials, and government." The organization, which boasts more than 30,000

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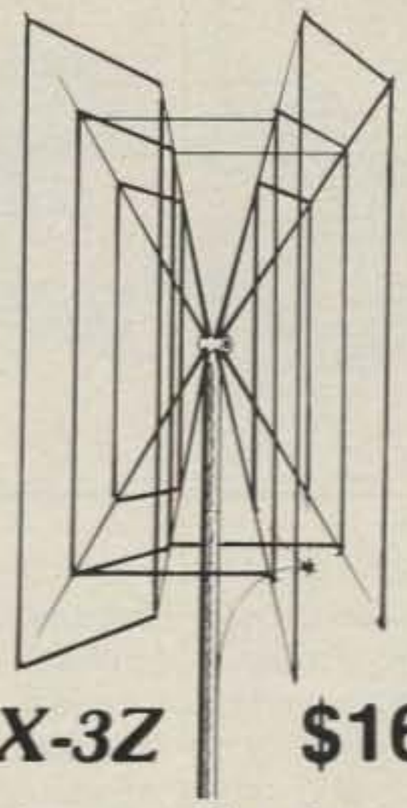

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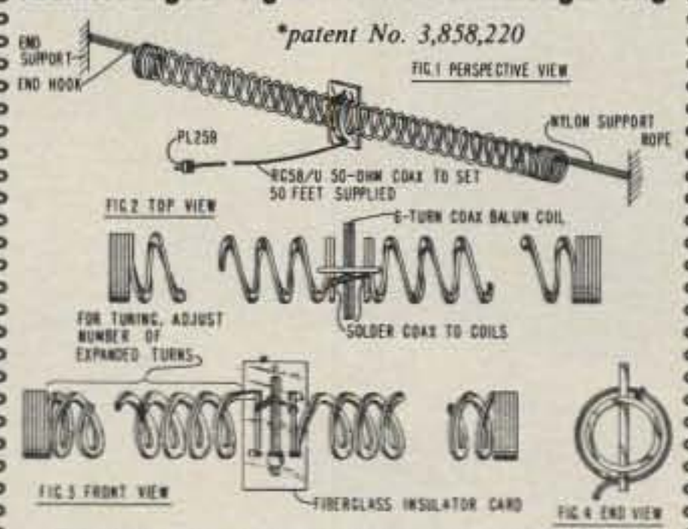

• This electrically small 80/75, 40, & 20 meter antenna operates at any length from 24 to 70 feet • no extra balun or transmatch needed • portable — erects & stores in minutes • small enough to fit in attic or apartment • full legal power • low SWR over complete 80/75, 40, & 20 meter bands • much lower atmospheric noise pickup than a vertical and needs no radials • kit includes a pair of specially-made 4-inch dia. by 4-inch long coils, containing 335 feet of radiating conductor, balun form, 50 ft. RG58/U coax, PL259 connector, UG-175/U adaptor, 100 ft. nylon rope and instructions • now in use by US Dept. of State, US Army, radio schools, plus thousands of hams the world over

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The transmission line should be selected with the same care as the antenna. The best is expensive, but usually well worth the added investment. Losses in the line depend primarily on the cable's conductor sizes and types of insulation. Top-quality cables have polyfoam insulation, 100% braid shielding, and non-contaminating construction. RG-8/U and RG-11/U cables are "standard" in amateur use, although new, high-quality small diameter cables such as RG-8X are becoming popular and are about the same size as the RG-58/U shown here. (Photo courtesy Radio Shack)

Broadband monitor antenna covers three major scanner bands: v.h.f.-lo, v.h.f.-hi, and u.h.f. On the lowest band the 22-inch long design is an inductively shortened ¼-wave; on the mid-range, the radiator is a standard ¼-wave; and on the highest range, the whip acts as a ¾-wave collinear. Avanti AV-808 antenna shown here includes a trunk mount; the whip-and-coil assembly is also sold separately. (Photo courtesy Avanti Communications, Inc.)

members, issues a quarterly magazine, *Scanning Today*, and sponsors a frequency information service to provide members with lists of frequencies for their particular area. It also promotes a technical advisor service, which uses volunteer SCAN member technical experts to help fellow members solve problems or answer questions at the local level. SCAN also sponsors a buyer's co-op service as well as a free classified ad service. More information can be obtained by writing to SCAN at Suite 1212, 111 E. Wacker Drive, Chicago, IL 60601.

The new "smart," synthesized scanners make searching for unknown or unpublicized frequencies fairly simple. Still, it's helpful to have some idea of the local frequencies likely to be heavily "trafficked" to avoid searching in the blind for signals of interest. Several publications are available for this purpose and are essential for those using crystal controlled scanners, which require that target frequencies be known.

Bearcat publishes a comprehensive set of frequency directories. These volumes are published in two versions: one for the eastern time zone, and another for the central and western time zones. Area-wide listings make it easy to locate frequencies of interest among police, fire, emergency, aircraft, railroad, and other services, which are conveniently grouped by listening area. A reference section, fold-out FCC frequency allocation chart, 10-code chart, legal responsibilities section, and log book are included. Current price of each edition is about $13 at this writing.

Another valuable reference source for scanner buffs, s.w.l.'s, and professional communications agencies is the *Federal Frequency Directory*, a massive book containing 100,000 frequencies, agencies, and locations of active U.S. Federal Government communications assignments in the 2–420 MHz spectrum. The book, which provides authoritative listings, is available for about $15 from CQ's Book Shop.

The "Police Call" frequency directories, costing about $6 each and containing about 10,000 listings apiece, are available in nine state groupings and are distributed by Radio Shack. In addition, a number of specialized scanner directories covering government, aeronautical, and energy and environmental users are available from Gilfer Shortwave, Box 239, Park Ridge, NJ 07656.

There are also a series of scanner frequency guides put out by CRB Research, each designed for a particular area of interest. These, too, are available from CQ's Book Shop.

We should like to caution, again, that although scanner monitoring is good fun for all and a serious hobby for many, listeners are reminded to observe the restrictions of the 1934 Communications Act, which forbids the disclosure of, or

Bearcat "ThinScan" 4-band, 6-channel pocket portable scanner is representative of advanced monitor technology. Unit shown here allows reception on any mix of 6 channels in 4 bands (v.h.f.-lo, v.h.f.-hi, u.h.f., and u.h.f.-"T" bands). It scans the six crystal-controlled channels at the rate of 15 channels per-second and has a built-in scan delay. Another scanner in the pocket-portable line allows dual reception of both v.h.f.-a.m. aircraft and u.h.f.-f.m. channels on the same unit. (Photo courtesy Electra Bearcat div. of Masco Corp. of Indiana)

personal benefit derived from, the interception of a radio transmission not intended for them to hear.

Summary

In this series, we have covered the wide range of scanning equipment available to the casual and serious listener alike—with special emphasis on the new-breed models with their attendant sophistication but more demanding antenna requirements. We have shown that the choices of monitor antennas are many, and run the gamut from the small indoor antennas furnished with most units, to complex, multiple-resonant verticals and wideband discones. Hopefully, this sampling of information will provide you with some insight into scanner receiver and antenna interface applications and considerations.

Next month, we will discuss a subject that's dear to the DXer's heart, one that's even synonymous with "antennas" to many: the *Yagi*. See you then.

73, Karl, W8FX

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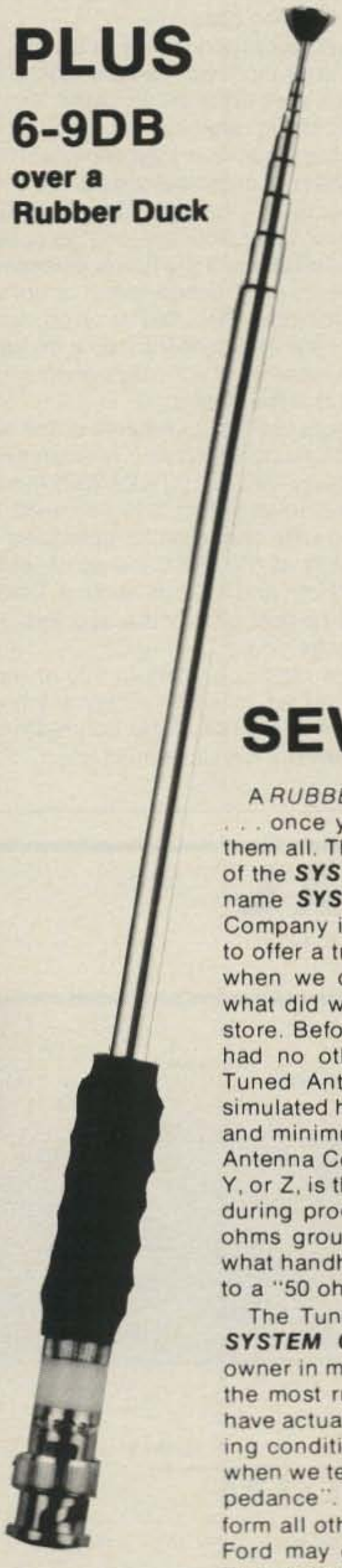

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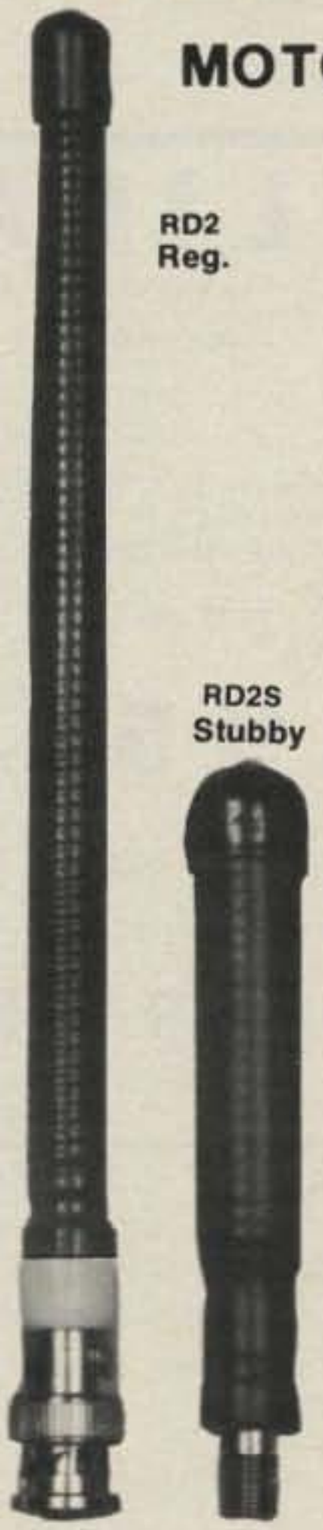
The Tuned Antenna Company has designed the ***SYSTEM ONE*** antennas with you, the handheld owner in mind. Not only will our product stand-up to the most rugged treatment you will give it, but we have actually taken the time to determine the operating conditions of a hand held radio, and believe us when we tell you it is not "50 ohms ground plane impedance". If your Tuned Antenna does not out-perform all other brands, send it back for a full refund. Ford may or may not have a better idea, but the Tuned Antenna Company definitely has a better *RUBBER DUCK*. We are putting our reputation on the line and our money where our mouth is. Don't settle for anything less than ***SYSTEM ONE*** Tuned Antenna Company's *RUBBER DUCK*. Ask your dealer for a Tuned Antenna today.



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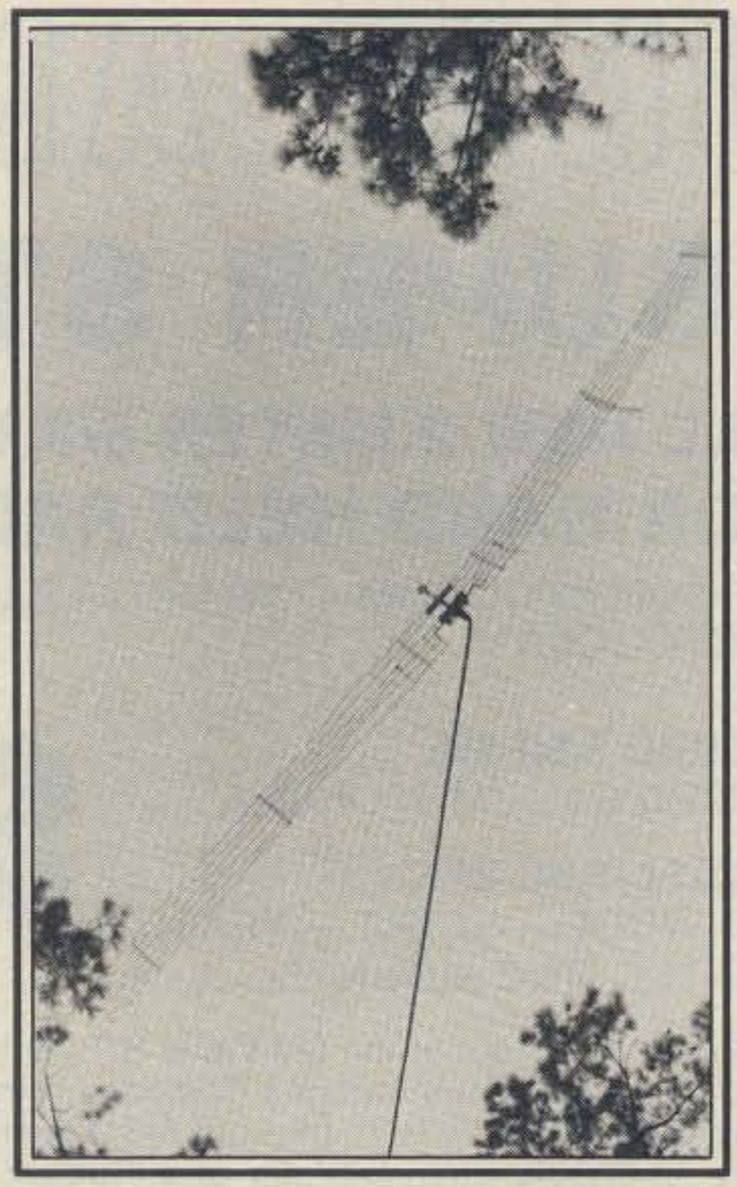
Antenna Of The Month
The Mor-Gain Multiband H.F. Communications Antennas

The Mor-Gain series of multiband dipole antennas represents an unusual approach to the problem of obtaining efficient and effective operation on several h.f. bands. Using no traps, loading coils, or tuning networks, the antennas—available in about a dozen versions—are one-half the length of conventional dipoles, are designed for low-s.w.r. feed with a single coaxial feedline, and handle 2.5 kw c.w. or PEP s.s.b.

In production for amateur and commercial use for more than 15 years, more than 20,000 of the antennas have been made to date. The amateur "HD" dipoles are of commercial/industrial grade, originally designed for s.s.b. point-to-point applications, and are re-engineered versions of the commercial counterparts. Of the same quality and reliability as the commercial models, they feature unbreakable insulators and stainless steel hardware.

The "HD" antenna design is of a patented, proprietary origin. It's based on the combination of a number of "wrap-around" dipoles that are paralleled, or combined, into one so that only two or three (for inverted Vee operation) suspension points are required; a single feedline is employed. Little in the way of tuning is required, although resonant frequencies can be altered by adjusting various "U" tabs or shorting bars.



Mor-Gain "half-size" h.f. multiband dipole as installed at the author's station. Five-band antenna shown here is 66 feet long and is fed directly with 75-ohm coax. A single feedline is used for operation on all bands.

A number of models are available, allowing operation on various combinations of bands from 80 through 10 meters, including specialized models for Novice band operation. An important feature is that the antennas are half-size; for example, an 80- through 10-meter "HD" is between 66 and 69 feet long, as opposed to up to 135 feet for a full-size dipole on 80 meters. An antenna tuner is not required for operation, but may be desirable to help transmitter loading on band edges, where the s.w.r. may become a bit ragged in some cases.

Perhaps the most versatile of the series, and the one which your Antennas Editor uses, is the 75-10 HD/A (SP) model. This particular antenna is designed for 75–10 meter operation, is optimized on 75 meters at the mid-band point (about 3800 kHz), and comes with a built-in SO-239 coaxial connector, supplied at a slight extra cost.

Prices range up to about $85 or more for the larger antennas. They are available from Mor-Gain, 2200 South 4th St., Leavenworth, Kansas 66048.

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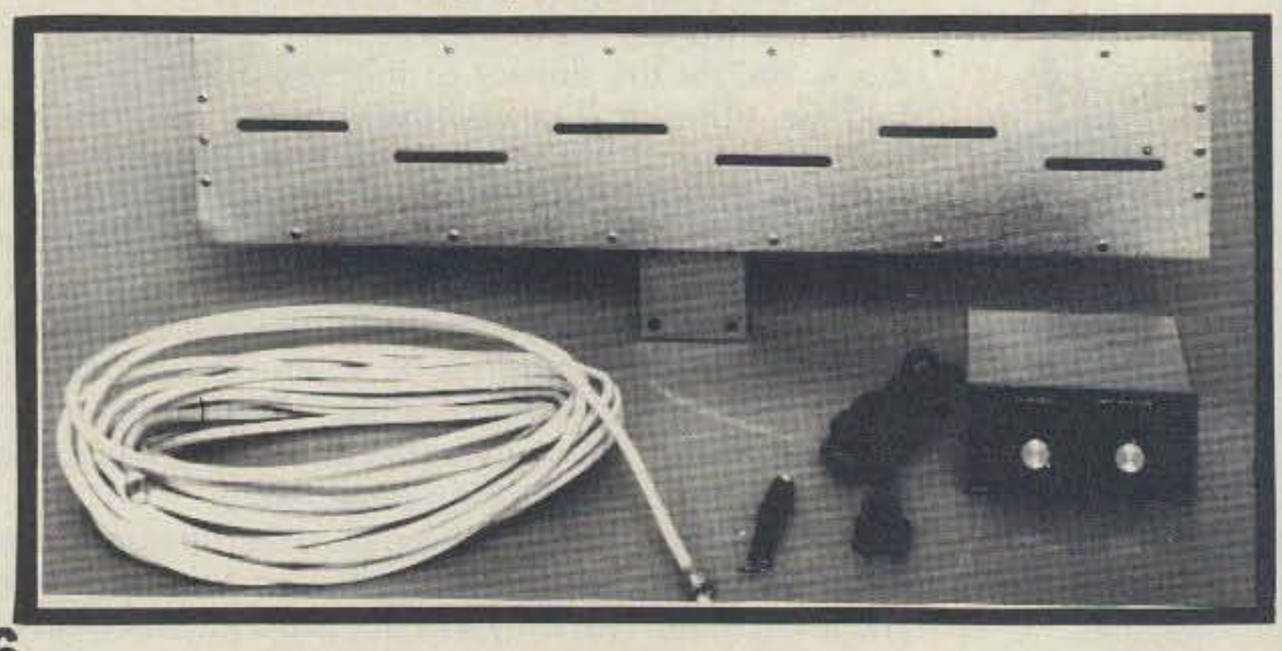

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Run up to 300 watts RF power output.

SWR and dual range wattmeter (300 & 30 watts full scale, forward/reflected power). Sensitive meter measures SWR to 5 watts.

Flexible antenna switch selects 2 coax lines, direct or through tuner, random wire/balanced line, or tuner bypass for dummy load.

12 position efficient airwound inductor for lower losses, more watts out.

Built-in 4:1 balun for balanced lines. 1000V capacitor spacing.

Works with all solid state or tube rigs.

Easy to use, anywhere. Measures 8x2x6", has SO-239 connectors, 5-way binding posts, finished in eggshell white with walnut-grained sides.

4 Other 300W Models: MFJ-940B, $79.95 (+$4), like 941C less balun. **MFJ-945, $79.95** (+$4), like 941C less antenna switch. **MFJ-944, $79.95** (+$4), like 945, less SWR/Wattmeter, **MFJ-943, $69.95** (+$4), like 944, less antenna switch. Optional mobile bracket for 941C, 940B, 945, 944, $3.00.

MFJ-900 VERSA TUNER

MFJ-900

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Matches coax, random wires 1.8-30 MHz.

Handles up to 200 watts output; efficient air-wound inductor gives more watts out. 5x2x6".

Use any transceiver, solid-state or tube.

Operate all bands with one antenna.

2 OTHER 200W MODELS:

MFJ-901, $54.95 (+$4), like 900 but includes 4:1 balun for use with balanced lines.

MFJ-16010, $34.95 (+$4), for random wires only. Great for apartment, motel, camping, operation. Tunes 1.8-30 MHz.

MFJ-949B VERSA TUNER II

MFJ-949B

$139.95 (+$4)

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Tunes out SWR on dipoles, vees, long wires, verticals, whips, beams, quads.

Built-in 4:1 balun. 300W, 50-ohm dummy load, SWR meter and 2-range wattmeter (300W & 30W).

6 position antenna switch on front panel, 12 position air-wound inductor; coax connectors, binding posts, black and beige case 10x3x7"

MFJ-962 VERSA TUNER III

MFJ-962

$199.95 (+$4)

Run up to 1.5 KW PEP, match any feed line from 1.8-30 MHz.

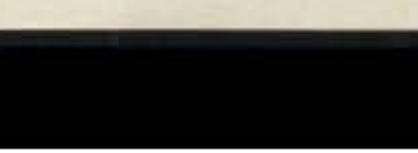
Built-in SWR/Wattmeter has 2000 and 200 watt ranges, forward and reflected.

6 position antenna switch handles 2 coax lines, direct or through tuner, plus wire and balanced lines.

4:1 balun. 250 pf 6KV cap. 12 pos. inductor. Ceramic switches. Black cabinet, panel.

ANOTHER 1.5 KW MODEL: MFJ-961, $179.95 (+$10), similar but less SWR/Wattmeter.

MFJ-984 VERSA TUNER IV



MFJ-984

$299.95 (+$10)

Up to 3 KW PEP and it matches any feedline, 1.8-30 MHz, coax, balanced or random.

10 amp RF ammeter assures max. power at min. SWR. SWR/Wattmeter, for./ref., 2000/200W.

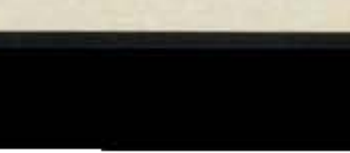
18 position dual inductor, ceramic switch.

7 pos. ant. switch. 250 pf 6KV cap. 5x14x14".

300 watt dummy load. 4:1 ferrite balun.

3 MORE 3 KW MODELS: MFJ-981, $209.95 (+$10), like 984 less ant. switch, ammeter. **MFJ-982, $209.95** (+$10), like 984 less ammeter, SWR/Wattmeter. **MFJ-980, $179.95** (+$10), like 982 less ant. switch.

MFJ-989 VERSA TUNER V



MFJ-989

$319.95 (+$10)

New smaller size matches new smaller rigs — only 10-3/4Wx4-1/2Hx14-7/8D".

3 KW PEP. 250 pf-6KV caps. Matches coax, balanced lines, random wires 1.8-30 MHz.

Roller inductor, 3-digit turns counter plus spinner knob for precise inductance control to get that SWR down.

Built-in 300 watt, 50 ohm dummy load.

Built-in 4:1 ferrite balun.

Built-in lighted 2% meter reads SWR plus forward/reflected power. 2 ranges (200 & 2000W).

6 position ant. switch. Al. cabinet. Tilt bail.

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a monthly feature by
IRWIN MATH, WA2NDM

Math's Notes

A LOOK AT THE TECHNICAL SIDE OF THINGS

For the last two months we have been working on the various microwave distribution services and amateur radio systems in the 2300 MHz region of the electromagnetic spectrum. This month, we will conclude the series with a description of the 4000 MHz region, which is employed primarily for satellite-to-earth transmission.

Between the range of 3700 MHz and 4200 MHz there are a number of stationary communications satellites orbiting the earth that are used to transmit commercial television signals to the various cable-TV distribution services around the United States and Canada. These signals contain entertainment channels as well as educational programming, stock market information, network "pre-feed" signals, etc. Since the satellites are essentially fixed in position at heights on the order of 25,000 miles, coverage is line-of-sight to most of North America. Receiving these signals with a single down-converter such as described for the MDS service is not quite as simple, however. The frequency range is very high, making the semiconductors expensive, the circuitry even more critical, and the signal levels quite low, meaning that a very high-gain parabolic-type antenna is a must. Furthermore, some specialized signal processing is required to extract the video signal from the transmitted signal. Unlike the MDS service, the satellite signal consists of f.m. modulated video (at the carrier in the 3700–4200 MHz range) with audio further frequency modulated as a sub-carrier.

5 Melville Lane, Great Neck, NY 11023

Fig. 1 is a block diagram of a typical TVRO for a TV Receive Only system as it is called. A high-gain parabolic or circular "dish"-type antenna at least 10 feet in diameter is coupled to a low noise amplifier. This amplifier usually exhibits noise figures of 1–2 dB (at 4000 MHz) and is fabricated of expensive bipolar or GaAs-FET transistors expressly designed for the job. Following the LNA is a low noise mixer, usually employing another GaAs-FET transistor, driven by a stable voltage-controlled local oscillator. The tuning of this oscillator is what determines the overall received frequency. Output from the mixer is at 70 MHz.

As you will imagine, the 4000 MHz stages are rather critical to design both from a standpoint of stability and low noise, and although amateurs do build their own, commercial versions already "tuned-up" are available for $300 to $400.

Once the signal is in the 70 MHz range, the problems become much easier to handle. Following the mixer is a high-gain 70 MHz conventional i.f. amplifier which drives the video and audio demodulators. These stages convert the f.m. signals to standard NTSC signals which are then fed to an r.f. modulator or channel 3 or 4 where they are displayed on a standard TV set. Signal quality is excellent, and with a properly designed station, it is the best that can be obtained outside of a studio.

If all of the foregoing does not worry you, and you have the space available for a 12–20 foot diameter antenna, you have a couple of options. At this writing (June 1981) we have seen complete receiving packages for as little as $4000 including antenna. Alternately, many of the components are available in tested, fully aligned "modules." For about $300 to $400 you can buy the LNA, for example. Another $300 to $750 will purchase the antenna, depending on how much work you wish to do. Finally, for $1000 to $1500 you can obtain the complete 70 MHz to channel 3 or 4 receiver.

If you choose to build, however, these

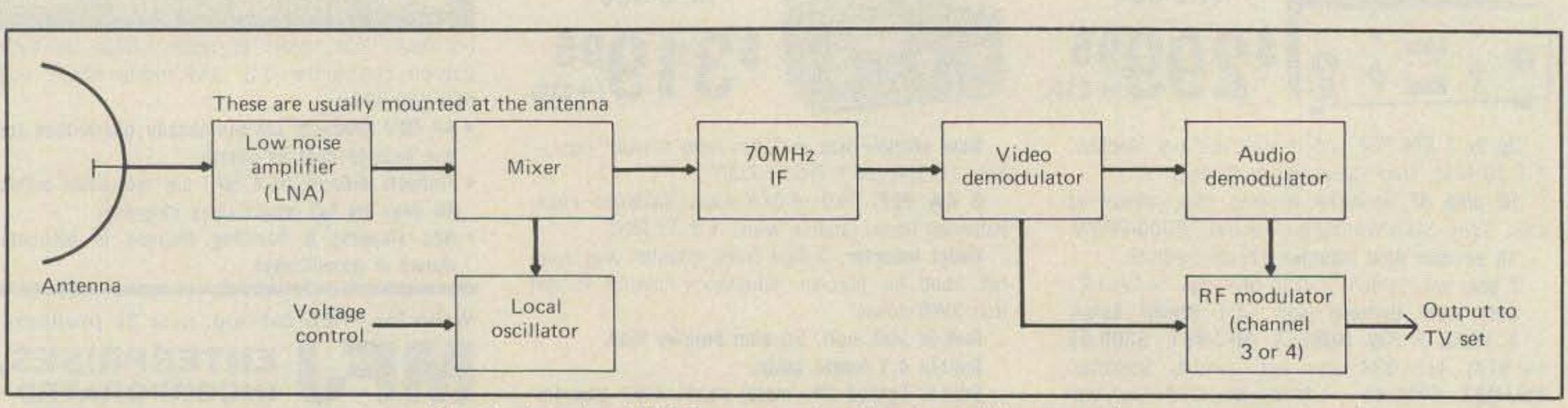

Fig. 1– A typical TVRO system for direct satellite reception.

Say You Saw It In CQ

costs can be reduced quite significantly. At least one manufacturer has complete printed circuit boards available, as well as microwave semiconductors, for all parts of the system. Final cost for this approach will depend on how well stocked your "junk box" is. Furthermore, you could build the antenna, and if it were made larger than necessary, you could tolerate a fair amount of deviation from the ideal parabolic, thereby lowering costs even further. The total cost, by the way, for a knowledgeable experimenter with a good supply of surplus components and reasonable mechanical ability could be well under $1000, which, considering the final outcome (not to mention the experience), might not be all that bad.

As in the case of the MDS services, there is a legal aspect of receiving of the signals, however, and for that reason we cannot go into much more detail. If you check the advertisements in *CQ* and the other amateur magazines, you will quickly discover the various companies offering literature and hardware pertaining to all of the services we have been discussing. A letter or card to any or all of those will usually bring enough information to allow you to decide whether to build, buy, or pass up the "opportunity" altogether. If you did decide to experiment in the 2300 MHz (and higher) amateur bands, however, you would find that it isn't quite as hard as you might have believed.

73, Irwin, WA2NDM

MY COMPETITION KNOWS ME. . . YOU SHOULD TOO!!!

HAL'S SHOPPER'S GUIDE

FREQUENCY COUNTERS

COMPLETE KITS: CONSISTING OF EVERY ESSENTIAL PART NEEDED TO MAKE YOUR COUNTER COMPLETE. **HAL-600A** 7-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 600 MHz. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY AND ONE FOR HIGH FREQUENCY; AUTOMATIC ZERO SUPPRESSION. TIME BASE IS 1.0 SEC OR .1 SEC GATE WITH OPTIONAL 10 SEC GATE AVAILABLE. ACCURACY ± .001%, UTILIZES 10-MHz CRYSTAL 5 PPM. **COMPLETE KIT.....$129**

HAL-300A 7-DIGIT COUNTER (SIMILAR TO HAL-600A) WITH FREQUENCY RANGE OF ZERO TO 300 MHz. **COMPLETE KIT.....$109**

HAL-50A 8-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 50 MHz OR BETTER. AUTOMATIC DECIMAL POINT, ZERO SUPPRESSION UPON DEMAND. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY INPUT, AND ONE ON PANEL FOR USE WITH ANY INTERNALLY MOUNTED HALTRONIX PRE-SCALER FOR WHICH PROVISIONS HAVE ALREADY BEEN MADE. 1.0 SEC AND .1 SEC TIME GATES. ACCURACY ± .001%. UTILIZES 10-MHz CRYSTAL 5 PPM. **COMPLETE KIT.....$109**

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Plus A **FREE** In-Line RF Probe.

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HAL 300 PRE.....$14.95
(Pre-drilled G10 board and all components)

HAL 300 A/PRE.....$24.95
(Same as above with preamp)

HAL 600 PRE.....$29.95
(Pre-drilled G10 board and all components)

HAL 600 A/PRE.....$39.95
(Same as above but with preamp)

NEW! **HAL 1 GHz PRE-SCALER** VHF & UHF INPUT AND OUTPUT DIVIDES BY 1000. OPERATES ON A SINGLE 5V SUPPLY PRE-BUILT & TESTED $79.95

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ACCUKEYER (KIT) THIS ACCUKEYER IS A REVISED VERSION OF THE VERY POPULAR WB4VVF ACCUKEYER ORIGINALLY DESCRIBED BY JAMES GARRETT, IN QST MAGAZINE AND THE 1975 RADIO AMATEURS HANDBOOK. **$16.95**

ACCUKEYER—MEMORY OPTION KIT THIS ACCUKEYER MEMORY KIT PROVIDES A SIMPLE, LOW COST METHOD OF ADDING MEMORY CAPABILITY TO THE WB4VVF ACCUKEYER. WHILE DESIGNED FOR DIRECT ATTACHMENT TO THE ABOVE ACCUKEYER, IT CAN ALSO BE ATTACHED TO ANY STANDARD ACCUKEYER BOARD WITH LITTLE DIFFICULTY. **$16.95**

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NEW! HAL 2304 MHz Down Converters
(freq. range 2000MHz/2500MHz)

2304 model #2 kit (with pre-amp).....$59.95
2304 model #3 kit (with High Gain Pre-Amp).....$69.95
All above models with Coax fittings In & Out and with Weather Proofed Die Cast Housings
Factory Wired & Tested.....$50.00 additional
Power supply kit for above.....$24.95/built $34.95

CLOCK KIT

NEW! **HAL 79 FOUR-DIGIT SPECIAL—$7.95.** OPERATES ON 12-VOLT AC (NOT SUPPLIED). PROVISIONS FOR DC AND ALARM OPERATION

6-DIGIT CLOCK • 12/24 HOUR

COMPLETE KIT CONSISTING OF 2 PC G10 PRE-DRILLED PC BOARDS, 1 CLOCK CHIP, 6 FND READOUTS, 13 TRANSISTORS, 3 CAPS, 9 RESISTORS, 5 DIODES, 3 PUSH-BUTTON SWITCHES, POWER TRANSFORMER AND INSTRUCTIONS.
DON'T BE FOOLED BY PARTIAL KITS WHERE YOU HAVE TO BUY EVERYTHING EXTRA.
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CLOCK CASE Available and will fit any one of the above clocks. Regular Price. . .$6.50 **But Only $4.50 when bought with clock**

SIX-DIGIT ALARM CLOCK KIT for home, camper, RV, or field-day use. Operates on 12-volt AC or DC, and has its own 60-Hz time base on the board. Complete with all electronic components and two-piece, predrilled PC boards. Board size 4" × 3". Complete with speaker and switches. If operated on DC, there is nothing more to buy.*
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Twelve-volt AC line cord for those who wish to operate the clock from 110-volt AC. $2.95

*Fits clock case advertised above.

TOUCH TONE DECODER KIT

HIGHLY STABLE DECODER KIT. COMES WITH 2 SIDED, PLATED THRU AND SOLDER FLOWED G-10 PC BOARD, 7-567's, 2-7402, AND ALL ELECTRONIC COMPONENTS. BOARD MEASURES 3½ × 5½ INCHES. HAS 12 LINES OUT. ONLY **$39.95**

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For those who wish to mount the encoder in a hand-held unit, the PC board measures only 9/16" × 1¾". This partial kit with PC board, crystal, chip and components.
PRICED AT.....$14.95

HAL 567-12 single line in, 12 lines out, complete with 2-sided plated-through G-10 board and all components. Uses seven 567's and three 7402's. **PRICED AT.....$39.95**

HAL 567-16 single line in, 16 lines out, complete with 2-sided plated-through G-10 board and all components; includes 22-pin edge connector. Uses eight 567's and four 7402's. (See construction article in April 1981 Radio & Electronics for complete writeup.) **PRICED AT.....$69.95**

"HAL" HAROLD C. NOWLAND W8ZXH

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CIRCLE 38 ON READER SERVICE CARD

a monthly feature by
A. EDWARD HOPPER, W2GT

Awards

NEWS OF CERTIFICATE AND AWARD COLLECTING

The December "Story of The Month" as told by Bill is:

E. H. (Bill) Irwin, WA3ZMY
All Counties #301, 9-26-80

"After serving with the 37th Field Artillery Battalion attached to the 2nd Infantry Division, where I was introduced to radio, I considered getting a ham ticket. Unfortunately, I never found time for it (yes, I'm still kicking myself).

"After 35 years of association with radio on other frequencies, in May 1975, through the Prince Georges Wireless Association, I finally got around to getting a ticket. Around May of 1975, I finally got on the air with a borrowed rig. It had a built-in s.w.r. of 8:1, and the learning experiences started right there. After a self-imposed Novice career of about 18 months, the upgrade opened many new doors. I feel that an extended Novice career is a great boon for future operations.

"After the usual sundry accomplishments, such as RCC, WAS, WAC, WPNX, etc., the sophistication surfaced. Thoughts like 76-WAS and WAC all one band came into the operation. Somehow, somewhere around May 1976, a Kenwood TS-520 was added to the operation. Better equipment was a big help.

Several times a year I go portable to put Delaware on the air. During one of these trips in 1977, I lucked out and got First Place in the Novice Round-Up.

"The up-grade came in March of 1977, and it took another two months to finish 5BWAS. Following that I discovered the organized nets for different purposes on the air. What to do? Which way to go? Tried traffic-handling, phone-patching, contact-type nets, DXing to get the needed 4 for DXCC, and then tried to make a decision.

"Somehow, like most other hams, I had heard about "Counties." I had put Counties on the air for the operation, but hadn't really considered chasing them.

P.O. Box 73, Rochelle Park, NJ 07662

The MO-2 of WA3ZMY with 40-20-15 resonators and 5/8 colinear for 2 meters.

Bill, W3ZMY, inside that MO-2 with his TS-120S and other equipment.

Well, needing something to shoot for, I looked into it. I went back through all the QSLs on hand and came up with 687 Counties confirmed. Well, why not? On January 17, 1979 I launched the operation, and by September 26, 1980 the 'U.S. Box Crushing Service' *(He lost one box of QSLs in the mail.—Ed)* managed to get the required 3074 County confirmations in to qualify for All Counties #301. This was also a relief to the rest of the family.

"A lot of this was done with the TS-120-S that went into use after I fried the 520 during Field Day of 1979.

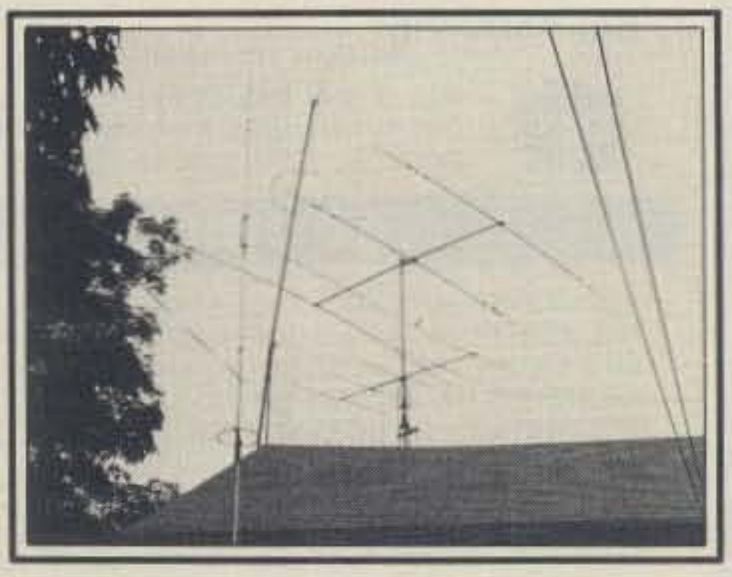
"After the concentrated study of radiation, propagation, antennas, operating techniques, and operators habits broadcast on 14.336 MHz, I feel I've learned more about these subjects in a year and a half than I would have in 5 years of freelance operating.

"As in-plant maintenance management, I have a bit of advantage in that I have a machine shop available for construction, as well as sundry electrical and plumbing supplies at reasonable cost. If an antenna gets broken or an idea surfaces, repair or construction is fairly convenient.

"Personally, my feelings are that the County Hunting operation is representative of all of amateur radio in that there is nothing that can be accomplished without a fantastic group of people on the other side of the transmitter.

"Good Hunting and CU on frequency."

The assortment of equipment and Plaques/Awards at WA3ZMY.



The antennas at WA3ZMY include a 4 element tribander, 5 band vertical, 40 meter double bazooker, 80 meter double bazooker, 5 element 6 meter beam, 10 meter G/P, and 2 meter Ringo-Ranger.

Say You Saw It In CQ

Special Honor Roll
All Counties

#336 Ted Ruso, W9VPE 8-10-81.
#337 George H. Martens, AC8F 8-29-81.
#338 Robert C. Young, K1NWE 9-4-81.

Awards Issued

Ted Rusco, W9VPE, waited until he had them All and then claimed USA-CA-500 through All Counties endorsed All S.S.B., All Mobiles.

George Martens, AC8F (ex WB8JIX), also waited until he had them All and then requested USA-CA-500 through USA-CA-3000 endorsed All S.S.B., All Mobiles; and All Counties Mixed.

Bob Young, K1NWE, who got USA-CA-500 back in June 1965, finally decided to do the necessary paperwork to receive USA-CA-1000 through USA-CA-2500 endorsed All S.S.B., All 20; USA-CA-3000 endorsed All S.S.B.; and All Counties endorsed Mixed.

Clifford McCoy, WB9ELH, added to his fine collection USA-CA-2500 and 3000 endorsed All S.S.B., and he needs but two to have them All.

Fred Zurbriggen, WB9YZE, added USA-CA-1500, 2000, 2500, and 3000 endorsed Mixed to make a nice collection, and he needs just a very few for All Counties.

Les Laabs, N9ATA, was awarded USA-CA-500 through USA-CA-2500 endorsed Mixed.

Jerry Burkhead, N6QA, requested USA-CA-2000 endorsed All 2XC.W.

James Grandinetti, WA2SRM, added USA-CA-2000 endorsed All S.S.B. to his nice collection.

Charlie Jacobsson, SMØCHA, sent for USA-CA-1500 endorsed All S.S.B.

Roger Hansen, KL7HFQ (ex WA7FHY), applied for USA-CA-500 (#4 to Alaska), USA-CA-1000, and 1500 (#2 to Alaska) all endorsed Mixed.

Aloysius Polaneczky, W3EFY, earned USA-CA-1000 endorsed All A-1.

Bill Hudzik, WA2UDT, picked up USA-CA-1000 endorsed Mixed.

USA-CA-500 Certificates, endorsed Mixed, went to:

Ben Murray, W5CJV (ex WN5CJV, OA2BH, OA4CCN, TI2CJV).

Henry Kiernan, KF2O (ex WA2AUB, WV2AUB, WM2ITU).

David Jorgensen, WD5COV.

USA-CA-500 Certificates, endorsed All S.S.B., were issued to:

Don Smith, WB5RXV, also endorsed All 40.

Victor Enrique Carugati, ZP5CVE (#1 to Paraguay).

George Wosika, KAØGTA, also endorsed All Mobiles, All 20.

Alfredo Erjautz Zocher, OA2CD, qualified for USA-CA-500 endorsed All C.W. #2 to Peru.

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- Lets your antenna radiate—not your coax
- Helps fight TVI—no ferrite core to saturate or reradiate
- Rated 5 KW peak—accepts substantial mismatch at legal limit
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New Heavy threaded brass contact posts

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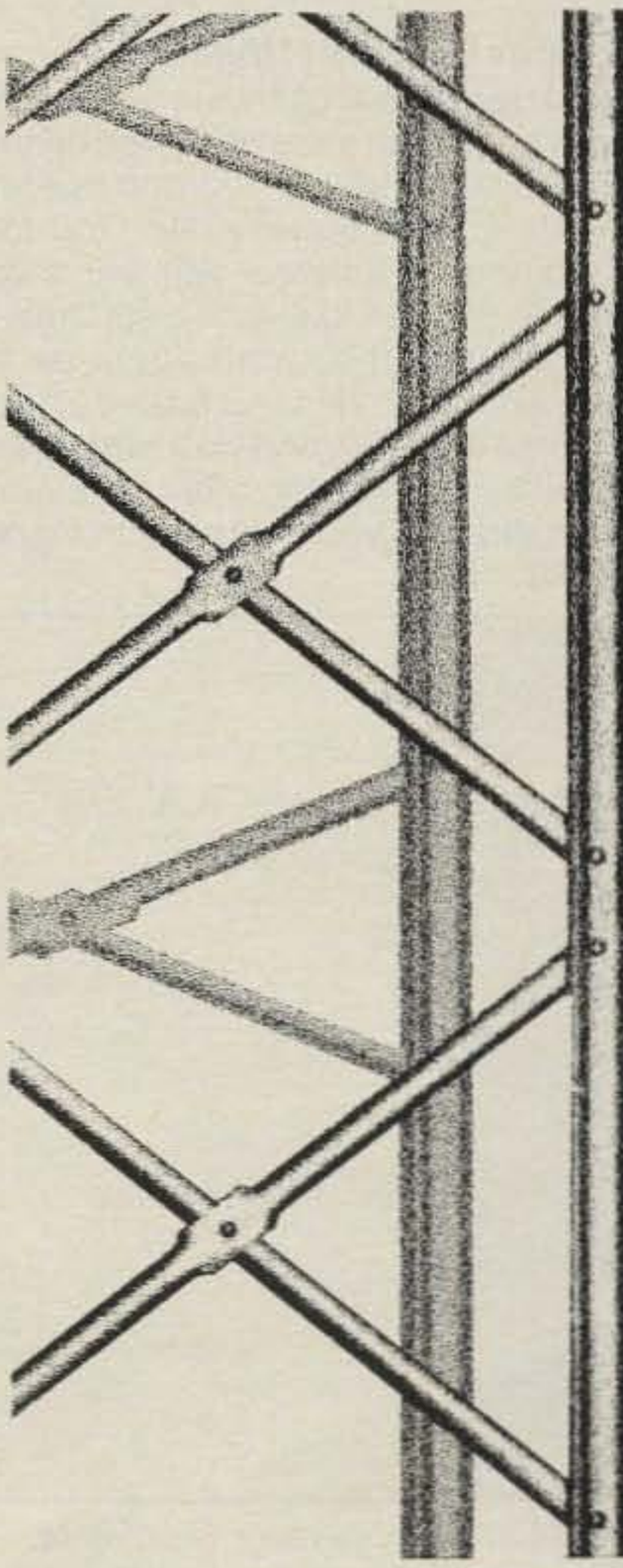

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- ☐ Up to 18 sq. ft. antenna capacity.
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- ☐ All riveted construction — no welds.
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- ☐ All steel — galvanized for added life.
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CIRCLE 63 ON READER SERVICE CARD

USA-CA Honor Roll

3000		N6QA	483	W3EFY	685
W9VPE	362	WA2SRM	484	WA2UDT	686
WB9ELH	363	AC8F	485	KL7HFQ	687
AC8F	364	K1NWE	486	AC8F	688
K1NWE	365	WB9YZE	487	K1NWE	689
WB9YZE	366				
		1500		500	
2500		W9VPE	540	W9VPE	1640
W9VPE	425	N9ATA	541	N9ATA	1641
N9ATA	426	KL7HFQ	542	W5CJV	1642
WB9ELH	427	AC8F	543	KF2O	1643
AC8F	428	SM@CHA	544	KL7HFQ	1644
K1NWE	429	K1NWE	545	WB5RXV	1645
WB9YZE	430	WB9YZE	546	OA2CD	1646
				KA@GTA	1647
2000		1000		ZP5CVE	1648
W9VPE	481	W9VPE	683	AC8F	1649
N9ATA	482	N9ATA	684	WD5COV	1650

Awards

The International Amateur Radio Society, Inc. Awards Program: Rules for their Awards are as follows.

1. All awards are issued to both amateur radio operators and s.w.l.s (heard).

2. Request for endorsements of mode, band, QRP, etc., must be made at time of original application and must be so indicated in the log extract.

3. A verified log in lieu of QSL cards will be accepted. Have your log certified by a local club official, two licensed amateurs, a notary public, or Xerox copies of QSL cards will be accepted. *All entries should list the country in order of prefix.*

4. If QSLs are sent in place of the above, sufficient funds for their return by registered mail or other specified route must be included in addition to any other funds.

5. If amateurs outside the U.S. require special consideration, please contact the Awards Manager: Scott R. Douglas, Jr., KB7SB, P.O. Box 46032, Los Angeles, California 90046, U.S.A.

The IARS Work The Pacific Award.

Work The Pacific (WTP): The basic award is issued for confirmed contact with at least 30 countries in the Pacific area as set forth by the WTP countries list. Endorsement Seals can be applied for in increments of 5 over the original application. A Plaque is available (but not required) when the Gold Seal level of 50 confirmed countries is attained.

Award Application Fee: $3.50 U.S., or 18 IRCs.

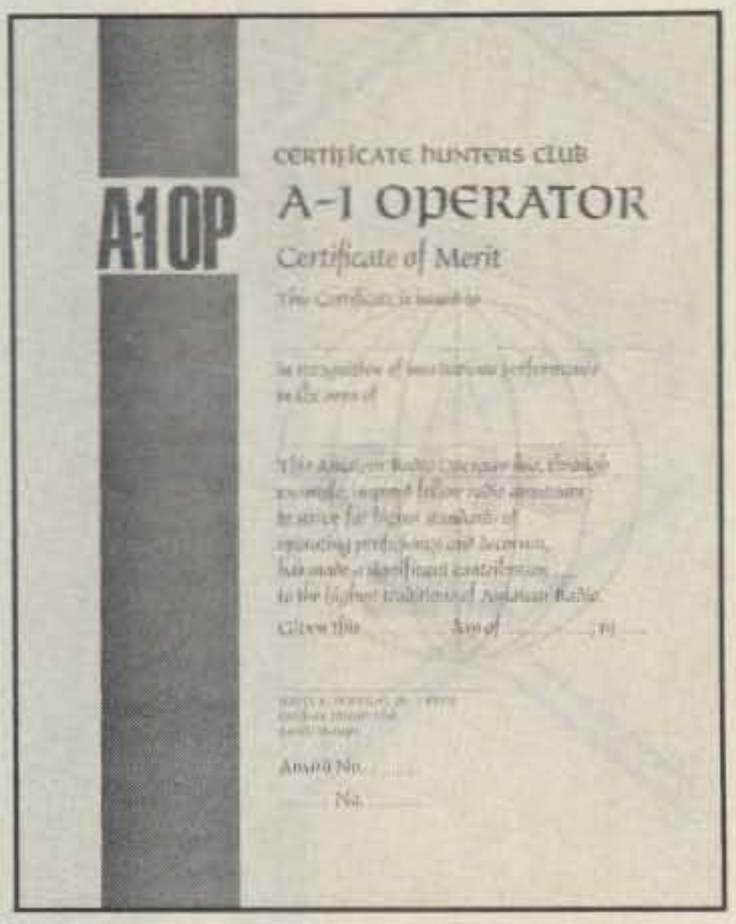
Gold Seal Plaque (if desired): $18.00 U.S.

Endorsement Seals applied for after original application: $1.00 or 5 IRCs.

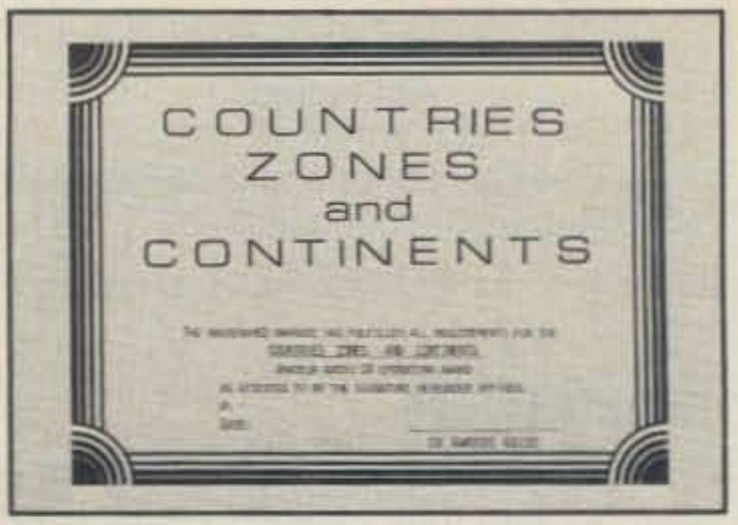
Work The Caribbean (WTC): The basic award is issued for confirmed contact with at least 20 countries in the Caribbean area as set forth by the WTC countries list. Endorsement Seals can be applied for in increments of 5 over the original application. A Plaque is available (but not required) when the Gold Seal level of 30 confirmed countries is attained. All application fees and other costs are the same as for the WTP Award. For a list of the WTP and/or WTC countries list, send s.a.s.e. to Awards Manager, KB7SB. *Note:* In my June and November '81 columns I had data on their *Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington,* and *Wyoming* Counties Awards. If you do not have copies of the June and November *CQ's*, write to KB7SB for details. Their cost is now $3.50, not $3.00.

The IARS Work The Caribbean Award.

A-1 Operators Certificate Of Merit: This Award is issued free of charge by the sponsor to amateur radio operators observed on the bands exhibiting above average operating practice and courtesy, etc. *You too* can nominate an amateur you feel is deserving. All that is required is a statement of why you wish the certificate to be issued, to whom you desire it issued, a processing fee of $3.50, and your statement cosigned by at least two other amateurs who can attest to your statements. Apply to KB7SB.



The IARS A-1 Operator Certificate.



The Countries–Zones–Continents Award.

Countries-Zones-Continents Award: Sponsored by the DX Awards Guide, Charles J. Ellis, P.O. Box 1136 Welch Station, Ames, Iowa 50010. Rules are as follows:

1. Applicant must work 30 countries from the DXCC list (*QST*, ARRL), 30 zones from the WAZ list (*CQ*), and 6 continents from the WTW (*73 Magazine*) list, 66 stations minimum. All Countries, Zones, and Continents must have been current at the time of claimed contact. At least four contacts per continent are required for each category.

2. Only one station per continent or zone, regardless of band used, will be allowed.

3. No mode or band restrictions except repeater and satellite contacts will not be allowed.

4. Stations contacted in one category listed in #1 above may not be claimed in another category.

5. Endorsements are available for single modes or bands, but only if requested with application.

6. No contact with a station in the country where applicant operated while making any claimed contact will be allowed.

7. Credit will not be allowed for contacts made as a participant in any national or international amateur radio contest.

8. All contacts must have been made within a 25 mile radius of the location from which the earliest claimed contact was made.

9. All contacts must be verified by sponsor, and only send confirmations to DX Awards Guide accompanied by funds (U.S. stamps or IRCs) sufficient to pay in full for certified (return receipt requested) return airmail. While in the possession of the sponsor, all reasonable care will be exerted to protect them. Nevertheless, all applicants by submission hereof agree to hold DX Awards Guide, its publisher, officers, and employees blameless for any damage to or loss of these confirmations.

10. All contacts must have been made 1 January 1979 or later and within two years of the earliest claimed contact.

11. A photo of applicant and the station used must accompany the application. One or two photos will be acceptable, but a substantial portion of the equipment used must show in either case.

12. Ten IRCs to offset handling and mailing costs are required.

13. Use of this form/rules is mandatory, and applicant must sign certification.

Notes

To prove that c.w. County Hunting is *not* dead, the accompanying list was kindly submitted by George, WBØODS. The list is as of 1/1/81, unless there is another date after the score. Sorry to take so long to find room for this.

C.W. County Hunters Confirmed Two-Way C.W. County Contacts

W8RSW	All	N6QA	1593
W2MEI	All	WAØNZA	1541
W1JTD	3068	KØDEQ	1527 (76)
W9VEN	3022 (80)	W5VGF	1517
W3HQU	3019	WA9OQE	1515 (73)
W3ARK	3014	WB2CBK	1486
N2RT	3004	K4AIZ	1432 (73)
WB4CCK	3000 (80)	W8RYP	1432 (80)
K1ZFQ	2993 (80)	W2EZ	1420
KA5A	2984	N6UH	1378
WA9WIF	2918	N9AG	1242
W1AQE	2872	K9UIY	1209 (74)
K8NQP	2864 (76)	W3ZUH	1421 (74)
W2RPZ	2855	W1TEE	1421
W9WR	2822 (80)	WB2ZOW	1183 (73)
WBØODS	2790	K7EQ	1164
WA4EBE	2776	DL7CS	1158
W1SBU	2555	WA5EEM	1121 (73)
WØFBB	2510	W3QQR	1105
K9WA	2477	N9TN	1100 (80)
W9MSE	2469 (76)	W7JHA	1096 (74)
W3BT	2468 (80)	WB2LYS	1076 (73)
K3DEJ	2461	WB9JKP	1070 (80)
W7GHT	2450	KAØCLS	1021
WA1KMP	2404 (76)	K2LFG	1000 (73)
K6CR	2401	W4ZRJ	871 (76)
W8WVU	2394	WA3QNT	853 (76)
W8YL	2386	WA2EYA	811
K3ZMI	2368	K9HVL	775 (73)
W2CUE	2248	W8JAQ	750 (73)
W4POA	2215	W4OMW	750 (76)
N5QQ	2100	N4NV	750 (76)
VE1AHG	2015 (80)	AGØA	730 (76)
K3LK	2010 (80)	W3EFY	679 (76)
W7JYW	1986 (76)	W5VZU	665 (73)
W1ICA	1941 (74)	W4DGX	650 (80)
N9DR	1908	KA1HB	623
WB4QGN	1901 (76)	WB9SMU	601
K9BG	1839 (76)	K4AVX	569
K2TE	1820 (73)	WB5MBS	536 (76)
K1ITU	1768 (73)	WD6CQP	456
W5XX	1732 (75)	WB9ONA	410 (76)
W2NCG	1644 (76)	K1PQV	320 (73)
W3PYZ	1629	N2CW	282 (74)

As this is being written (September), *CQ* has exhausted their supply of USA-CA Record Books. New, up-to-date books are being printed and will be available *long* before you read this—cost same $1.25 direct from *CQ*, 76 North Broadway, Hicksville, NY 11801.

The new custodian for *CQ*'s Prefix Awards—WPX, VPX, WPNX—is Norman Koch, K6ZDL, P.O. Box 1351, Torrance, California 90505.

Custodians for other *CQ* Awards are:

Worked All Zones (WAZ) is Leo Haijsman, W4KA, 1044 Southwest 43rd Street, Cape Coral, Florida 33904.

CQ DX Award is Billy Williams, Jr., N4UF, P.O. Box 9673, Jacksonville, Florida 32211.

United States of America Counties Award (USA-CA) is Ed Hopper, W2GT, P.O. Box 73, Rochelle Park, New Jersey 07662.

Hope you all remember that all *CQ* Awards as of 1 March 1981 cost non-subscribers $10.00. The cost to subscribers is $4.00, and they must enclose the mailing label (or a copy) from a recent copy of *CQ*.

Sad to report that a check with the FCC indicates that WB2HTX has never upgraded his Novice license. Thus, his operations on the 14336 Net are *not* legal; of course, this leaves him open to serious penalties from the FCC. Also, W9HAT apparently permitted his license to expire some time ago. WB5WOE was caught apparently giving out a "nearby" county while at home. WB6CKU was found to be giving out counties he never visited. The calls W6NV, W6VK, and KL7NV were pirated by Bill Shannon while Mobiling and on DXpeditions. The calls were genuine, but *not* his. Apparently at one time Bill did have a Novice license.

So do not submit applications for USA-CA using those calls. I'm sorry that such things happen, but don't take your anger out on me. I did not operate illegally; *they* did.

Hope you all have wonderful holidays.

73, Ed, W2GT

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No - 87-88

Here's a good all-around power supply that will power your 200 watt PEP h.f. transceiver for about 10¢ per watt.

A Bargain Priced Transceiver Power Supply

BY JOHN J. SCHULTZ*, W4FA

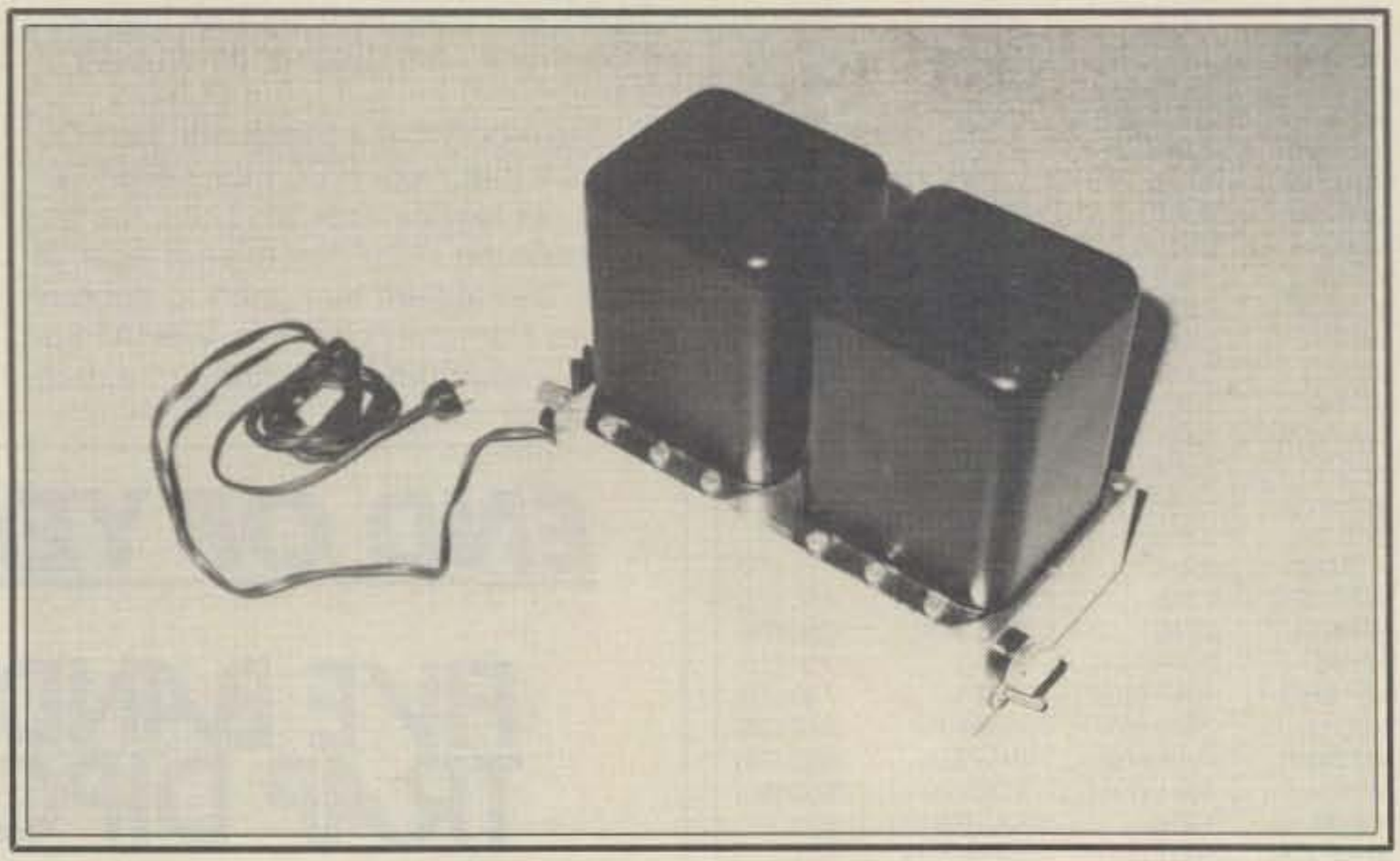
How about an a.c. supply for a solid-state, 200 watt PEP transceiver for less than $20? Such supplies can be built quite economically if one takes time to find the necessary components at reasonable prices and avoids circuit frills. This article illustrates one such supply, but many variations on the same theme can be developed depending upon what components are available.

If one is going to build an economical a.c. supply, it is necessary to first define the features that are needed. Does one really need, for instance, a supply that will produce precisely 13.8 volts and have regulation to a fraction of a volt over a 0–20 ampere load current range? Also, is it necessary to have ripple specification down to a few millivolts? In reality, none of these features are absolutely necessary. Most solid-state transceivers are designed to be used in a mobile as well as a fixed station environment. In the mobile situation the transceiver must be designed to accommodate itself to one of the worst "power supplies" possible in terms of regulation—the battery. Therefore, almost all transceivers have a wealth of internal voltage regulating circuits and filtering so they will retain stability and produce a clean signal. The gist of the matter is that although a super regulated and filtered a.c. supply is a nice thing to have, it is a bit of a luxury. A reasonably well-filtered a.c. supply without regulation, except perhaps in the sense that "stiff" transformers are desirable, will work fine in almost all cases.

The diagram of the supply described in this article is shown in fig. 1. As one can see, it is a totally conventional full-wave bridge rectifier circuit. In this case, two transformers are used, each of which has a 7.5 v.c.t./25 ampere secondary. Only half of one secondary is used to develop an a.c. voltage of about 11 volts, which produces a peak d.c. voltage of about 15 volts. With the 42,000 mf filter capacitor and the particular transformers used, the d.c. output voltage dips to about 12.5 volts under a 15 ampere load.

The photos show how the supply is constructed on a small chassis which was chosen just to be large enough to accommodate the transformers. The six individual filter capacitors are each 6800 mfd, 25 volt units. They are held by cable ties to the bottom cover of the chassis. The bridge rectifier (rated at 200 volts PIV and 30 amperes) is mounted on a small heat sink. The heat sink is a necessary item in a high amperage power supply, although many builders tend to overlook the point. Even though the voltage drop across the diodes in the bridge may be less than a volt, when 15–20 amperes pass through the diodes, several watts have to be dissipated. Depending on the duty cycle, it may suffice to just tightly clamp the rectifier bridge housing to the chassis and have the latter act as a heat sink. But, at the relatively inexpensive cost of a proper heat sink, construction techniques using such a component are highly recommended. One can then draw 15–20 amperes continuously from such a supply if desired without worry about any component overheating.

Well, what did the cost figures add up to for the power supply shown? Roughly they went something like this:



In most cases the basic supply can be built on any chassis which is just large enough to accommodate the transformers used.

*c/o CQ Magazine

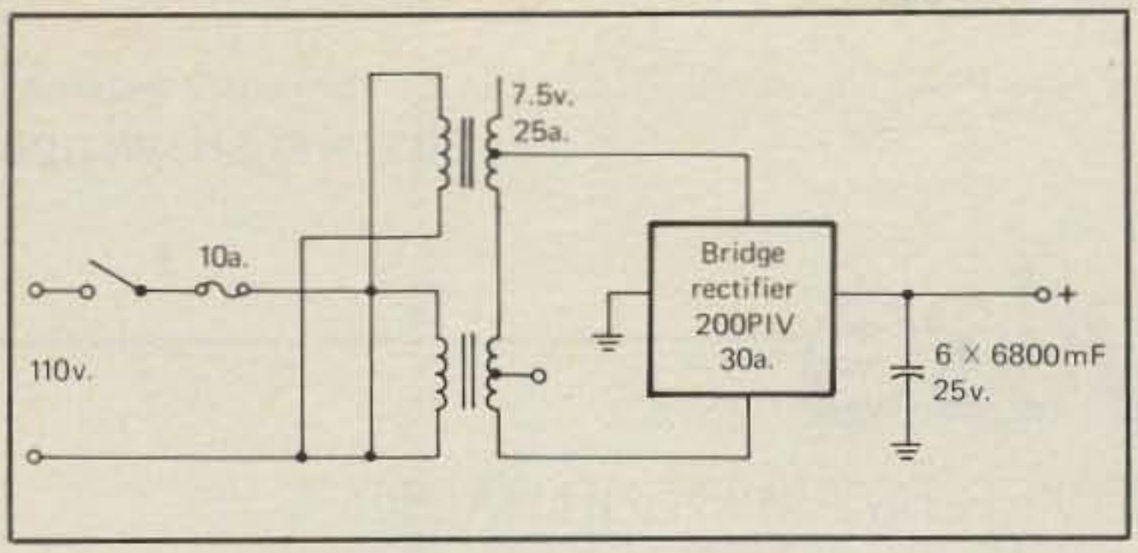


Fig. 1– The wiring diagram of the basic power supply.

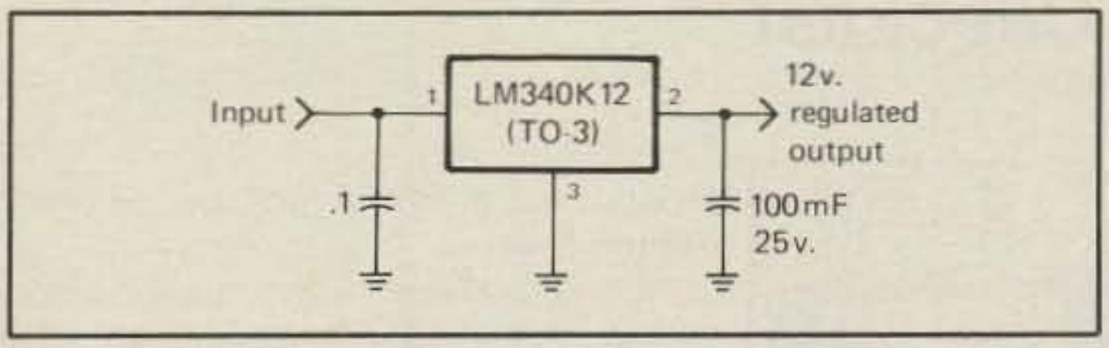


Fig. 2– A simple 12 volt regulator good for about 1 ampere can be added to the basic power supply for transceiver receive-only purposes as noted in the text.

The six paralleled filter capacitors are held with tough plastic cable ties to the inside bottom plate of the power supply chassis.

Two surplus transformers at 4.95 each	$ 9.90
Bridge rectifier	2.00
Filter capacitors	6.00
Chassis, switch, fuse, etc.	5.00
	$22.90

Actually, the out-of-pocket expenses involved were less than $20 since all of the items, except the transformers and chassis, came via the junk box route. The entire assembly, by the way, was later painted with flat black spray paint and may not look like a chrome-plated marvel, but it is not an eyesore by any means.

As was mentioned before, the key to building such a supply economically lies in finding the parts at the right prices. Fortunately, this is not difficult to do. Many dealers have loads of transformers with "odd-ball" voltage or current ratings that they are glad to sell practically by the pound. The 7.5 v.c.t. transformers used are an example. But, here is a listing of some other types that were found by quickly scanning some current sales flyers (all with 110 volt primaries):

13 V/8 amperes	$7.95
5 VCT/10 amperes	4.95
6.6 V/18 amperes	4.95
6.3 V/30 amperes	5.95

It doesn't take much imagination to see how these or similarly rated transformers can have their secondaries wired in series or parallel, as necessary, to create just about any secondary voltage or current capability desired. Generally, transformers of the same manufacture can be wired in parallel for a higher current capability. However, this should not be done with transformers of different manufacture, since only very slightly different secondary voltages or winding resistances will cause a wasted current to circulate between the secondary windings when they are paralleled. If the size and price are right, it is also advantageous to use transformers with high current ratings, even though the capability is not needed, since the load voltage regulation will be better. Often there is only a dollar or two difference in price between surplus transformers with, for instance, a 20 ampere or 30 ampere rating. Finally, remember that the peak d.c. voltage is 1.4 times the a.c. secondary. Start with secondary taps, when possible, so the unloaded d.c. output voltage of a supply does not exceed 15–16 volts.

Several sources had 40,000 mf/20 v.d.c. computer grade capacitors in the $2 to $3 range. Some of these sources for both transformers and capacitors are:

Fair Radio Sales
P.O. Box 1105
Lima, OH 45802

Technical Electronics
P.O. Box 2361
Woburn, MA 01888

Delta Electronics
176 Second Ave.
Waltham, MA 02154

There are, of course, many other sources for parts. It is just a question of sending for enough catalogs or flyers to locate the currently available bargains.

The supply described worked well with several solid-state transceivers. There are some transceivers, however, notably the former Atlas series, which have separate d.c. inputs for the receiver and transmit circuitry, although both still have to be tied together for mobile operation. But, in fixed station operation there may be some slight advantage to having the d.c. input for the receive circuitry regulated. Since usually less than an ampere is drawn, this is simple to do by adding a 12 volt regulator IC circuit as shown in fig. 2.

One can, of course, go on to embellish the basic supply in many ways. Put the supply in a suitable enclosure, and one can add a speaker so the unit also functions as the station loudspeaker. Add a digital clock module to the enclosure, and it really will look like a professional unit (the Radio Shack 277-1005 module is particularly well suited since its LCD display requires only a 1.5 volt battery for continuous operation). In any case, with a bit of imagination one can develop a very functional and cost-effective power supply.

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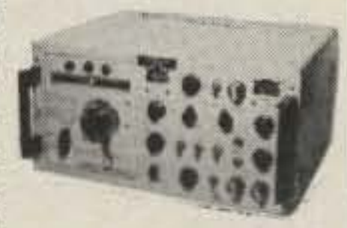

R-388/URR - 0.5-30.5 Mhz in 30 bands; rackmount. Mil-Collins 51J3; 10½x19x13", 55 lbs. Used, checked: . . . . . **$400.** Manual, partial repro: . . . . . **$10.**

HAMMARLUND SP-600JX - 0.54-54 Mhz AM-CW in seven bands; rackmount. 10½x19x17", 85 lbs. Used, checked: **$285** Manual, partial repro: **$10.**

R-648/ARR-41 - 190-550 Khz and 2-25 Mhz AM-CW in 25 bands; mechanical digital tuning. Requires 24 VDC 4 amps; 7½x16x13¼", 35 lbs. Used, checked: **$205.** Manual, partial repro: . . . . . **$15.**

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CIRCLE 39 ON READER SERVICE CARD

a monthly feature by
BILL WELSH, W6DDB

Novice

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Fire Safety Checklist

Most amateurs attend conventions once in a while. The information in the following checklist is an expanded version of the "Fire Safety Checklist" published by Successful Meetings and printed here with their consent. You are urged to bring a copy of this list with you whenever you will be staying at a hotel. After you have used this list a few times, you should know what to watch for in each hotel and what to do if an emergency arises. Please share this important information with your relatives and acquaintances.

Hotel Familiarity

Do hallways have automatic sprinklers?

Do hallways and stairwells have automatic emergency lighting?

Do hallways and meeting rooms have smoke detectors?

Are maximum capacity figures adhered to in meeting rooms, display areas, and elevators?

Are fire and safety exit doors unlocked from the hallway side?

Are fire doors left closed, rather than being left propped open? They should be closed.

Where are the closest fire extinguishers to your room?

Are the fire hoses in good condition? Dacron (and similar) hoses last better than cotton or linen hoses.

Are there fog-stream nozzles on the fire hoses? They are more effective for knocking down fires.

How many floors in the building?

How many floors between your room and the top of the building? Remember that helicopters do a great job of rescuing people from the tops of buildings, and people are very visible on rooftops.

How many floors between your room and the street level?

Study the emergency data posted in your room.

Walk each possible emergency escape route (from each room you use) to become familiar with each of them.

2814 Empire Ave., Burbank, CA 91504

Leon Fletcher, who lives in Monterey, California, is not yet an amateur, but he expects to be one soon and he advises that the June through August 1979 (Code) and November 1977 through March 1978 (Amateur Radio Station Installation Tips) Novice columns helped him get a good start towards being an amateur. Leon kiddingly states that his "station" consists of a Heath 1416 code practice oscillator (cpo) powered by a Duracell 9-volt alkaline battery and actuated with a Nye 114-310-002 telegraph key. He also has a Realistic CTR-39 cassette tape recorder which he uses daily with the Heath 3701 Novice license program. His extremely low power "station" is mounted on an S-F STD-36 radio desk, leaving more than 90% of the shelf space still unoccupied. He is about ready to pass the FCC Novice license exam, and he has ordered a Heath SB-104A transceiver with the matching SB-604 speaker and PS-1144 power supply. Leon operates as WL5138 from his yacht, Safari. He has already worked a lot of eyeball DX (long distance) contacts; he has visited all 58 California counties, 45 states, and 52 countries. He is a former college teacher and administrator and he is now a freelance writer living partially off royalties from "How to Design & Deliver a Speech," a college textbook he wrote.

Do not enter an elevator if an emergency occurs, because you may become trapped in it if power is lost. If power is not lost, the elevator car automatically stops at the floor that is on fire, which is where you do not want to be.

Remember that most hotels are fireproof or are built and furnished to resist (retard) fires.

Help is requested as soon as an emergency is known. Panic, smoke, and fumes cause more deaths in fire situations than flames and/or heat.

Send a written note to advise the hotel manager (and the home office, if it is a hotel chain) of fire safety hazards you find. They should want to know about locked exit doors, lack of sprinklers, fire doors propped open, and other fire hazards.

Room Familiarity

Keep the room key one place and know where it is at all times. It is advisable to keep the room key in your coat pocket and to put your coat on before leaving the room.

If you have a flashlight, leave it in a known place within reach from the bed.

Study room layout and then move around it with your eyes shut to become familiar enough to do so in the dark.

If windows open, open them to become familiar with the procedure and fasteners.

Make sure window and door latches function correctly.

Is there a ledge outside windows?

Are there obstructions below windows?

Is there a ventilation fan in the bathroom and, if so, does it work?

Emergency Exit Familiarity

Know where each possible escape exit is in relationship to your room.

Count and remember how many doors exist between your door and each emergency exit near your room.

Know which direction each emergency exit is from each door in your room/suite.

Become familiar with vending machines, ash tray stands, chairs, and similar obstacles that may be between your room and nearby emergency exits.

Look inside the fire exit doorway (make sure that you do not open a security alarm door) to find out if it opens directly into a stairwell.

Say You Saw It In CQ

Edwin F. Zambrano, DU1EFZ, a Class C (Novice) amateur, lives in Quezon City, Philippines. He is 30 years old, married, the father of a 2-year-old son, and Vice President of the Broadway Centrum Condominium Corporation. His station includes a Kenwood TS-830S Transceiver that has been modified to run less power output, plus a Nagara Denshi TA-351 5 element triband (10, 15, 20 meters) Yagi-Uda about 15 meters (50 feet) above ground level. He has contacted 47 states and 75 countries, and he is an award hunter. He would like to contact American Novices, but his 10 and 15 meter bands are different than the U.S.A. Novice bands. His 10 meter band is 28.55 to 28.65 MHz, and his 15 meter band is 21.25 to 21.31 MHz. However, he hopes to have upgraded to the Class B license by the time this picture is printed, and that will give him the additional frequencies he wants to use.

Without closing the fire exit door, look around the stairwell area to become familiar with it.

Remember that stair doors are usually spring locked. If the door closes behind you, you just have a choice between going all the way to the bottom (lobby) or top (roof).

Check doors at the top and bottom to find out if they are locked or unlocked, but do not let your room floor door lock behind you and possibly trap you in the stairwell area.

Know escape routes well enough to be able to crawl them in absolute darkness.

Emergency Situations

Promptly investigate unusual odors, smoke, or strange noises.

If you suspect something is wrong, let the front desk personnel know about it.

Either stay in your room awaiting help or exit the building via an emergency escape route if you become convinced that an emergency exists.

If the telephone system is functioning, it should be used to alert others of the danger. Otherwise, it may be necessary to pound on doors (if the hallway is not filled with smoke, fumes, or flame).

Do not run, because you may not be able to get up and escape if you fall and get hurt.

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CIRCLE 135 ON READER SERVICE CARD

If Your Room Door Is Hot When A Fire Exists:

It is probably safer to stay in the room than to try to exit the building.

If the telephone is working, let the desk clerk know you are remaining in your room, and tell him how many people are in your room.

If you decide to leave the room, follow instructions detailed next if your room door is not hot.

Fill the bathtub with water and soak sheets, towels, clothing, and blankets.

Do not expect to be protected by immersing yourself in a bathtub filled with water; you may boil.

Do not worry about damaging the room.

Stuff wet sheets, towels, blankets, and clothing around cracks in doors and transoms to minimize smoke and fumes entering the room.

If smoke and/or fumes are entering the room through the heating/cooling system, block outlets as effectively as possible. Gasses from scorched non-flammable materials can kill you.

Use ice bucket, drinking glasses, and similar containers to throw water on hot doors and walls.

Turn ventilation fans (if any) on to help keep the room clear of smoke and fumes.

If there are flames outside windows, pull down adjacent draperies and curtains.

If there is no smoke or fumes in the room, leave the windows closed.

If there is smoke or fumes in the room, open the windows. If the windows cannot be opened, use a chair (or some similar object) to smash them without endangering yourself.

Use a wet handkerchief (or small towel) to cover your mouth and nose to protect yourself from smoke and fumes.

Lie on the floor near a window to have the best chance of getting good air to breathe.

If you need to hang out a window to get breathable air, do not hang out so far that you are in danger of falling out the window if you pass out.

Do not go out on a ledge except as a last resort.

Do not jump from a second or third story except as a last resort. Realize that the chance of survival is very poor if one jumps from any floor above the third story of a building.

If firemen are on the scene with ladders and/or nets, follow their instructions.

Do not panic; you must use your brain to save your life.

If Your Room Door Is Not Hot When A Fire Exists:

If the telephone is working, let the desk clerk know how many of you are leaving the room and which emergency escape route you intend to use.

Use a wet handkerchief (or small towel) to cover your mouth and nose to protect you from smoke and fumes you may encounter.

Do not stop to pack your belongings.

Take the room key with you, and (if you have one) keep your flashlight in your hand.

Open the door slowly and just enough to find out if the hallway is clear of smoke, fumes, and fire. Flash fires can roar down a fireproof hall and kill people without singeing the hallway.

If the smoke or fumes are noticeable, stay low (crawl) to get the best available air.

Close/lock the room door behind you to minimize smoke damage and possible thievery.

If the hallway seems okay, crawl to the nearest emergency exit, or another one if the closest one is unsafe.

Stay close to the wall on the same side of the hallway as the exit is located.

Count doors as you crawl past them so that you will know where the door to your room is located.

Be ready to retreat back into your room if all emergency exit routes are blocked.

When you have crawled to the fire exit door, open it cautiously to make sure it is safe to step into the stairwell.

If the stairwell area appears to be safe, step into it and descend the stairs slowly and carefully, making use of the handrails.

If your room is on a lower floor, it is usually best to walk down to the ground/lobby floor. If your room is on an upper floor, it is usually best to walk up to the roof.

Walk (do not run or jump) to the roof or lobby. Do not let anyone panic you into hurrying. You must stay on your feet to avoid the possibility of being trampled by other people.

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CIRCLE 48 ON READER SERVICE CARD

This is Marsha and Victor Rivera. Victor operates ZK1CG from Raratonga in the South Cook Islands. His station includes an Icom IC-701 Transceiver, 80 and 40 meter dipoles, 5 element 10 and 15 meter monoband Yagi-Uda beams, and a Hy-Gain TH6DXX triband Yagi-Uda beam. He is on 21,160 (plus-or-minus 5) kilo-Hertz most of the time. Victor will shift to 10, 40, or 80 meters (when they are open) to work Novices on those bands. If you work him and are anxious to get his QSL, it is best to mail your QSL directly to him at P.O. Box 38. I advise you to enclose 3 International Reply Coupons (IRC's, green stamps) to allow him to airmail a card back to you. It takes about 5 months for cards to arrive via surface mail and about 10 months via the DX QSL bureau. Work him; he is listening for you and he likes to ragchew (chat).

stairs until you reach the roof or ground level, unless you encounter heavy smoke.

If you encounter heavy smoke, do not try to walk through it; reverse your direction and walk to the opposite point (roof or lobby).

If you have to retreat to the roof, prop the door open to vent smoke and fumes out of the stairwell for others.

Smoke plumes bend away from the area that is burning.

When you are safe, let the authorities know who you are and that you have escaped.

Amateur Radio Calendar

Large wall calendars are now scarce. Consequently, an amateur radio club has purchased a supply of 13.5 by 19.5 inch calendars which have room to write events of personal importance, such as contests and club meetings. Amateur radio (nothing else) is printed in large lettering on the top half of each sheet. If you want a calendar, send a self-addressed mailing label and $3.25 to W6LS, 2814 Empire, Burbank, CA 91504. Payment may be in the form of U.S.A. cash/postage, 16 IRC's, money order, or check made payable to W6LS. The price includes U.S.A. shipping. Calendars are mailed individually in sealed wrappers. They are a useful addition to the shack.

73, Bill, W6DDB

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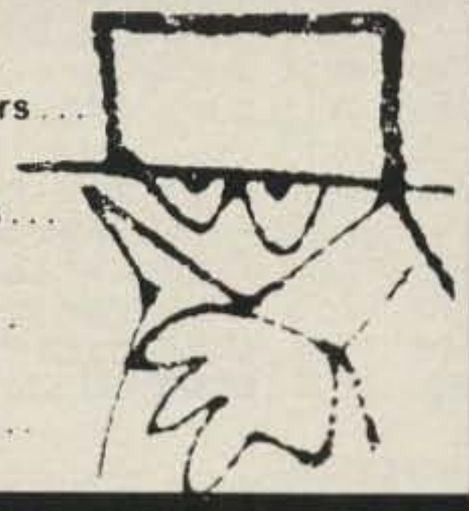

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CIRCLE 46 ON READER SERVICE CARD

a monthly feature by
FRANK ANZALONE, W1WY

Contest Calendar

NEWS/VIEWS OF ON-THE-AIR COMPETITION

Now that I have had a little more time to digest Rod Linkous, W7OM's DX Column in the September issue, in which he referred to guest operators at a DX contest station as "hired guns," I cannot accept his suggestion that this type of operation should be classified as multi-operator. Unless the licensee of the station is also directly involved in the operation of the station, I see no justification to classify it as a multi-operator station.

Giving the guy at the mic or key an occasional cup of coffee or sharpening his pencils are the same chores that are performed by the XYL at your home station. Does that put you in the multi class? No way.

True, the call identifies the operation, and the station probably gets the credit, but when the results are finally published, the call of the "hired gun" is also indicated. And if he is lucky enough to be a winner, his name is also included on the certificate or plaque. The award, however, goes to the licensee. (Arrangements can be made for a duplicate if it is so requested.)

While on the subject of guest operators, sometimes one who is operating at a station that might be considered a rare spot has been credited as being a Contest Expedition. I definitely do not consider this as meeting the requirements of an expedition. Going to an established station, parking your duff in a comfortable chair, and doing your thing may provide a lot of additional contacts from that rare spot, but you are still only a guest operator, a "hired gun."

When I hear the term DXpedition, I visualize packing your equipment, making a journey to a given area, and setting up a station. But most important is that the operation is with a call that has been officially assigned to you for that operation, and *not* with a call that has been licensed by a station already there.

14 Sherwood Road, Stamford, CT 06905

Calendar of Events

	Nov.	**28-29**	**CQ WW DX CW Contest**
	Dec.	4-6	ARRL 160 M. C.W. Contest
	Dec.	4-6	"Santa Claus" Operation
†	Dec.	5-6	Spanish Phone Contest
	Dec.	5-7	Connecticut QSO Party
	Dec.	5-7	Telco Pioneers QSO Party
	Dec.	12-13	Spanish C.W. Contest
†	Dec.	12-13	Hungarian CW Contest
	Dec.	12-13	ARRL 10 Meter Contest
	Dec.	27	Canada Contest
	Jan.	2-4	ZERO District QSO Party
	Jan.	9-10	Hunting Lions Party
	Jan.	9-10	"73" 40 & 80 M. Phone Contest
	Jan.	16-17	"73" 160 M. Phone Contest
†	Jan.	16-17	AGCW-DL QRP CW Contest
	Jan.	23-24	White Rose SWL LF Contest
	Jan.	23-24	North Dakota QSO Party
	Jan.	**29-31**	**CQ WW 160 M. C.W. Contest**
	Jan.	30-31	French C.W. Contest
	Feb.	6-7	RSGB 7 MHz Phone Contest
	Feb.	13-14	QCWA C.W. QSO Party
	Feb.	13-14	YL-OM Phone Contest
	Feb.	13-14	Dutch "PACC" Contest
	Feb.	13-15	Two Land QSO Party
	Feb.	**26-28**	**CQ WW 160 M. Phone Contest**
	Feb.	27-28	French Phone Contest
	Feb.	27-28	YL-OM C.W. Contest
	Feb.	27-28	RSGB 7 MHz C.W. Contest
	Mar.	13-14	QCWA Phone QSO Party
	Mar.	**27-28**	**CQ WW WPX SSB Contest**

† Not Official

In addition, picking a Contest Expedition station winner is not to be determined by the size of the score, but by the location of the station and the contribution it made to the contest.

A reminder: your Phone logs should have been mailed by December 1st, and the C.W. entries are due to be mailed by January 15th. We give you two additional weeks for the C.W. due to the heavy Christmas mail. An extension will be given if you have a legitimate reason, but the request must be made in writing to one of the Directors.

Sending your logs to the respective Directors is acceptable even though the rules announcement indicated that this year they should go directly to the CQ office, 76 North Broadway, Hicksville, NY 11801. The Phone logs can be sent to Larry Brockman, N6AR, 7164 Rock Ridge Terrace, Canoga Park, CA 91307. The C.W. go to Bob Cox, K3EST, 6548 Spring Valley Drive, Alexandria, VA 22312. Whichever address you use, make sure you identify Phone or C.W. on the envelope.

All the best wishes for a most joyful Holiday Season and for the coming year.

73 for now, Frank, W1WY

Connecticut QSO Party

Starts: 2000Z Sat. December 5
Ends: 0200Z Mon. December 7
Off Period: 0500-1200Z Sun. Dec. 6

The Candlewood A.R.C. is again sponsoring this party. Their club station, W1QI, will be on the air operating c.w. on odd hours and s.s.b. on even hours.

The same station may be worked on each band and mode for QSO points, mobiles in each county change. Oscar contacts are considered a separate mode.

Novices should identify by /N as part of their call. Mobiles should also identify their county of operation.

Exchange: QSO no., RS(T), and QTH. County for Conn. stations, ARRL section for others.

Scoring: One point per QSO, 2 points if it's with a Novice, 3 points for Oscar contacts, and 5 points if it's with W1QI.

Multiplier: ARRL sections for Conn. Out-of-state stations use Conn. counties (max. of 8).

Final Score: Total QSO points times ARRL sections worked for Conn., and Conn. counties for others.

DX stations may be worked for QSO points but counted only *once* for a multiplier.

Frequencies: C.W.—40 kHz up from bottom of each band. S.S.B.—3927, 7250, 14295, 21370, 28540. Novice—3725, 7125, 21125, 28125.

Awards: Certificates to top scorers in each Conn. county and each ARRL section. Also the "Worked All Connecticut

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A-743, 30-40m Kit (A-3)	$ 54.00
A-744, 30-40m Kit (A-4)	$ 54.00
20-4CD, 4 el. 20 mtr. Mono	$235.00
20-3CD, 3 el. 20 mtr. Mono	$160.00
15-4CD, 4 el. 15 mtr. Mono	$ 96.00
15-3CD, 3 el. 15 mtr. Mono	$ 89.00
10-4CD, 4 el. 10 mtr. Mono	$ 82.00
10-3CD, 3 el. 10 mtr. Mono	$ 69.00
32-19, 2m SSB Boomer	$ 75.00
214B, 2m SSB Jr Boomer	$ 61.00
214FB, 2m FM Jr Boomer	$ 61.00
ARX-2B, 2m Ringo Ranger II	$ 38.00

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25G Section	$ 38.50
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HG-54HD 54 ft. self supporting. 16 sq. ft. at 60 mph. Nested height: 21 ft.	$1513.00
HG-70HD 70 ft. self supporting. 16 sq. ft. at 60 mph. Nested height: 23 ft.	$2187.00

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RG-213/U, 50 Ohm Coax	$ .29/ft
8 Cond. Rotor (2 #18, 6 #22)	$ .18/ft
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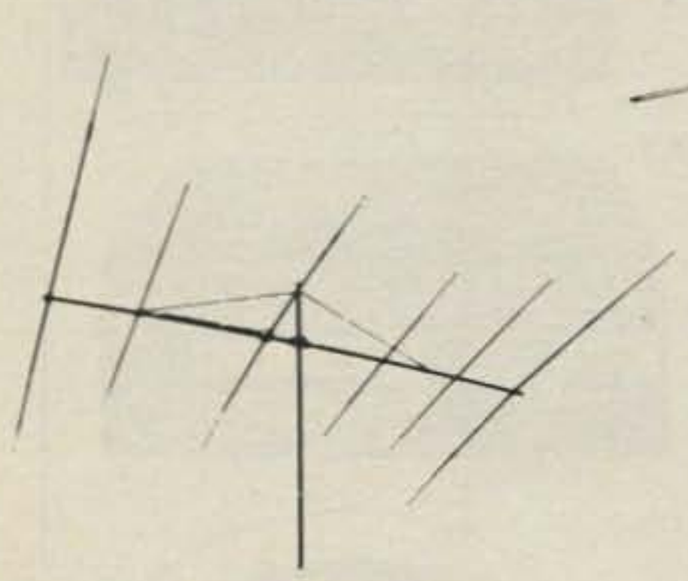

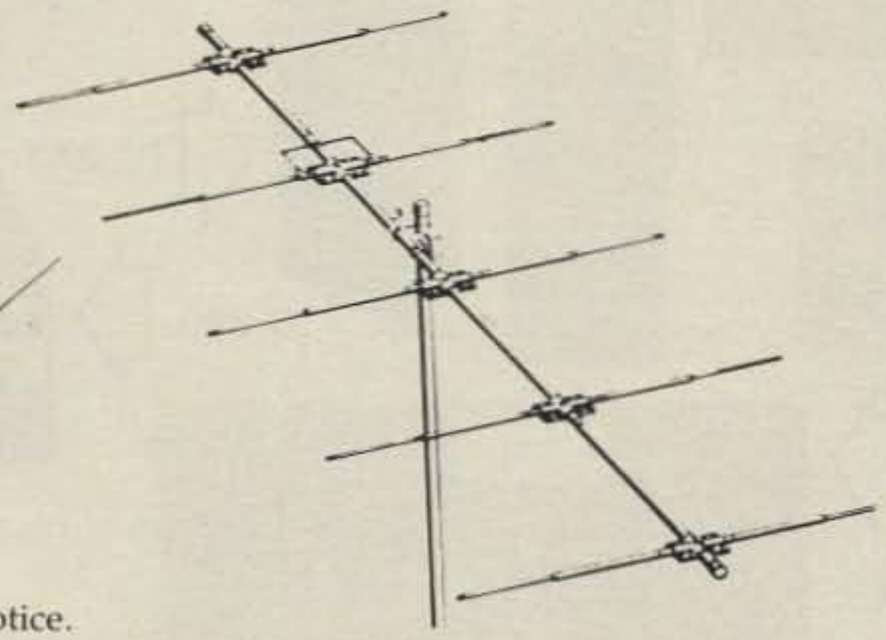

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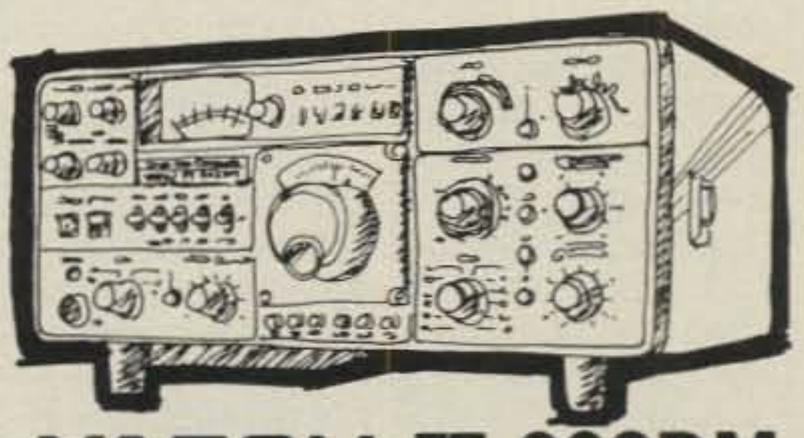

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Include a large s.a.s.e. for a copy of the results and mail your log by January 2nd to CARA, Att: Steve Grouse, KA1ECL, 3 Queens Court, Danbury, CT 06810.

ARRL 160 C.W. Contest

Starts: 2200 GMT Fri. December 4
Ends: 1600 GMT Sun. December 6

This is the 12th year for this activity organized by the ARRL. Activity will be between stateside stations, VE's, and also DX. DX to DX, however, does not count.

Exchange: RST and your ARRL section or country if it's a DX station.

Scoring: Contacts between stations in ARRL sections count 2 points, with other areas 5 points. The multiplier is determined by the number of ARRL sections worked (74 possible) plus VE8 and each DX country.

Awards: Certificates to top scorers in each section and each DX country.

Please keep the DX Window (1825–1830) clear of stateside and VE operation. That's where you will find the DX stations calling. They will be listening 1800–1805 or on a frequency they specify.

Recent changes by the FCC have modified 160 operation. It is suggested that W/VE stations transmit only in the segments 1800–1825 and 1830–1850 kHz in conformance with the ARRL band plan. (Check *QST* for more details.)

The usual grounds for disqualification—violation of rules, excessive duplicate contacts, etc.—will prevail. A large s.a.s.e. to ARRL will get you the necessary forms to make log keeping easier.

All entries must be postmarked no later than Jan. 5th and go to: ARRL Communications Dept., 160 Contest, 225 Main St., Newington, CT 06111.

"Santa Claus" Activity

0000Z Fri. to 2300Z Sun., Dec. 4–6

The Pike County A.R.C. of Winslow, Indiana and the Old Post A.R.S. of Vincennes, Indiana will operate a special events station, W9CZH, from Santa Claus, Indiana.

A special QSL card postmarked from the Santa Claus post office will be sent to all who contact W9CZH upon the receipt of an s.a.s.e.

Judging from the list of operating frequencies, activity will be confined to s.s.b. and RTTY. (*Is c.w. becoming a lost art?—ed.*)

Suggested frequencies: 3925, 7270, 14305, 21410 on s.s.b., 14090–14100 on RTTY, and 146.52 f.m.

Send your QSL and request to: "Santa Claus," P.O. Box 111, Ireland, IN 47545.

Telco. Pioneers QSO Party

Starts: 1900Z Sat., December 5
Ends: 0500Z Sun., December 7

This is the 17th annual party organized by the Telephone Pioneers of the U.S. and Canada. This year's party marks the 70th anniversary of Pioneering, and it is again being sponsored by the John D. Burlie Chapter #89 of Columbus, Ohio.

Members may be contacted on each band and each mode if they are in different chapters, but only one contact is permitted between stations in the same chapter.

Exchange: QSO no., and chapter name and number (ITPA chapters, name only).

Scoring: One point per QSO and one multiplier for each chapter worked. Chapters count once only (max. of 97 TPA and 5 ITPA chapters).

Frequencies: Phone—3965, 7275, 14295, 21365, 28675, 50.1–50.25, 144.275–145.5, 146.52. C.W.—3565, 7065, 14065, 21065, 28065. Novice/Tech.—3725, 7125, 21125, 28125. Plus or minus 10 MHz.

Awards: Certificates to the highest scoring chapter, top scoring Pioneer Club station, and individual Pioneers and Pioneer Life Member.

Mailing deadline for all entries is Jan. 15th. Log sheets may be obtained from your Radio Club Coordinator or Adminis-

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CIRCLE 27 ON READER SERVICE CARD

Say You Saw It In CQ

trator. Logs go to: John D. Burlie Chapter #89, Att: Ted Phelps, W8TP, c/o Western Electric Dept. 45150, 6200 East Broad Street, Columbus, OH 43213.

Spanish DX Contest

Phone: Dec. 5–6 C.W.: Dec. 12–13
Starts: 2000 GMT Saturday
Ends: 2000 GMT Sunday

It's the world working the Espanoles, with separate weekends for phone and c.w. Only single operator operation is permitted, all bands 3.5 through 28 MHz.

Exchange: RS(T) plus a three figure QSO number starting with 001.

Scoring: Contacts between EA stations and the following prefixes are worth 3 points: DU, CE, CM/CO, CP, CX, HC, HI, HK, HP, HR, KP4, LU, OA, PY, TG, TI, XE, YN, YS, YV, ZP, or equivalent prefixes.

Between EA and all other non-Hispano and non-European countries, 2 points.

Between EA and Europeans, 1 point (WAE boundaries).

Multiplier: For EA, each DXCC country worked on each band. All others use EA call districts worked on each band.

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

Awards: Gold, Silver, and Bronze medals to the first 3 places, phone and c.w., in Spain and to overseas winners. Certificates to first place winners in each country. A minimum of 100 points required to qualify.

Include a summary sheet with your log showing the scoring and other pertinent information, the usual signed declaration that rules and regulations have been observed, and your name and address in Block Letters.

Your entry must be postmarked no later than February 15th to: U.R.E. International Contest, P.O. Box 220, Madrid, Spain.

Hungarian C.W. Contest

Starts: 1600 GMT Sat. December 12
Ends: 1600 GMT Sun. December 13

It's the world working the HA's on all bands 3.5 through 28 MHz on c.w. only.

Operation will be in three classes: Single operator, single band and all band, and multi-operator all band. (Club stations are considered as multi-operator.)

Exchange: RST plus a contact number starting with 001. In addition, the HA's will send two letters to identify their county. (BA, BP, BE, BO, CS, FE, GY, HA, HE, KO, NO, PE, SA, SO, SZ, TO, VA, VE, ZA. Total of 20 on each band.)

Scoring: One point for each HA contact, and a multiplier of one for each different county worked on each band. (Same station may be worked once on each band for QSO and multiplier credit.)

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

Awards: Certificates to the first place winners in each class in each country.

Include a summary sheet with your entry including the usual signed declaration. Send within six weeks from the end of the contest to: Radio Amateur League of Budapest, P.O. Box 2, H-1553, Budapest, Hungary.

ARRL 10 Meter Contest

Starts: 0000 GMT Sat. December 12
Ends: 2359 GMT Sun. December 13

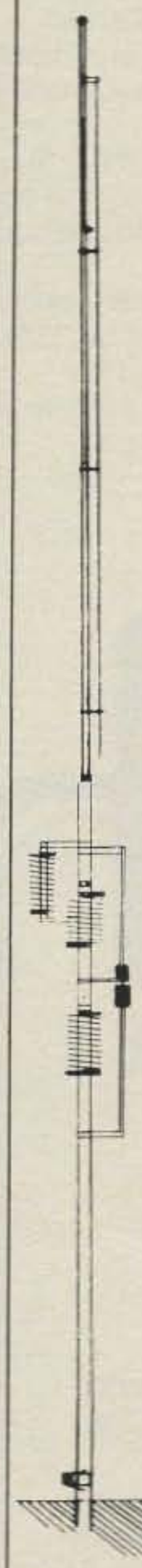
This the 9th annual 10 meter contest organized by the ARRL has become very popular especially with the improvement in propagation.

It's a worldwide activity in which DX stations are permitted to work other DX. You are *not* limited to working W/Ks and VEs only.

The same station may be worked once on phone and again on c.w. No cross mode, however. A maximum of 36 hours operating time is permitted out of the 48 hour contest period.

Exchange: Stations in the 50 U.S. states

Still More Usable Antenna For Your Money...
PLUS 30 Meters!



That's right, Butternut's new Model HF6V offers you more active radiator on more bands than any other vertical of comparable height at any price. The HF6V's exclusive Differential Reactance Tuning™ circuitry lets the entire 26-foot antenna work for you on 80/75, 40, 30, 20 and 10 meters, and a loss-free linear decoupler provides full quarter-wave unloaded performance on 15 meters. Better still, the HF6V can be modified—without surgery—for the remaining WARC bands when the time comes. Here are just a few of the features that make the HF6V the ideal WARC antenna for your new WARC station:

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For complete information concerning the HF6V and other Butternut products, contact your dealer or write for our free catalog.

Suggested amateur net prices:

Model HF6V (automatic bandswitching 80-10 meters)	$159.00
Model TBR-160 (160 meter base resonator)	39.50
Model 30MCK (30 meter conversion kit for HF5V-II/HF5V-III	29.50
Model RMK-II (roof mounting kit with multiband radials)	41.50

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Please send all reader inquiries directly

and Canada send RS(T) and their state or province. Others (including KP4, KV4, etc.) will send RS(T) and a consecutive contact number starting with 001. Stations not land-based will send RS(T) and their ITU region.

Scoring: Each completed QSO is worth 2 points, 4 points if it's with a Novice or Technician. The multiplier is determined by the US states, VE call areas, DXCC countries, and ITU regions worked (as sent by non-land-based stations). (U.S. and Canada not counted as a country.)

Activity will take place in the portion of the 10 meter band normally used for c.w. and for phone operation. Oscar contacts also permitted.

Awards: Certificates to the highest scoring single operator station in each ARRL section, VE call area, and DX country. Multi-operator, Novice, and Tech. awards will be issued depending on entries received from respective areas, also for non-land-based stations.

As for all ARRL activities, it is recommended that you send a large s.a.s.e. for appropriate log forms and instruction sheets.

Mailing deadline for logs is Jan. 15th to: ARRL Communications Dept., 10 Meter Contest, 225 Main St., Newington, CT 06111.

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CIRCLE 81 ON READER SERVICE CARD

Canada Contest

0001 to 2359Z Sun., December 27

Again sponsored by the Canadian Amateur Radio Federation, this contest follows the same pattern as the Canada Day Contest last July.

Activity will be on all bands, 2 through 160 meters, phone and c.w. Single operator, single and all band, multi-operator all band only.

The same station may be worked on each band and each mode for QSO and multiplier credit.

Exchange: RS(T) and QSO number starting with 001.

Scoring: 10 points for each contact with Canada, 1 point if with others, and 10 bonus points for each contact with any CARF official news station using the suffix TCA or VCA.

Multiplier: Number of VE provinces/territories worked on each band and each mode (12 prov./terr. × 8 bands × 2 modes for a maximum of 192 possible.)

Contacts with stations outside of Canada count for QSO points but no multiplier; VE1's are requested to identify their province.

Frequencies: Phone—1810, 3770, 3900, 7070, 7230, 14150, 14300, 21200, 21400, 28500, 50100, 146520. C.W.—1810, 3525, 7025, 14025, 21025, 28025, 50100, 144100. Try phone on even hours, c.w. on odd hours.

Awards: A Trophy to the overall single operator winner. Certificates to the top scorers in each category, in each VE province/territory, U.S. call area, and DX country, and also to the highest score from a Canadian non-Advanced amateur.

Include a summary sheet showing the scoring and also a dupe sheet with your log. Mailing deadline is February 1st to: Canadian A.R.F., P.O. Box 2172, Stn. D, Ottawa, Ont. K1P 5W4, Canada. Non-members may include an s.a.s.e. for copy of results (do not attach stamps).

ZERO District QSO Party

Starts: 2000Z Sat., January 2
Ends: 0200Z Mon., January 4

This year's party is again being sponsored by the Mississippi Valley Radio Club. The Zero district covers a lot of territory, so a lot of activity can be expected, hopefully from some of the rare counties.

Stations outside the Zero District may work Zero stations only, but ZEROs may work both in and out of district stations. The same station may be worked once on each band and mode, and mobiles in each county change.

Exchange: RS(T) and QTH. ARRL section and county for Zeros, ARRL section only for others.

Scoring: *For Zeros*—Total QSOs multiplied by (Zero counties + ARRL sections + DX countries) worked.

For others—Total QSOs multiplied by (Zero ARRL sections + Zero counties) worked.

Frequencies: C.W.—3560, 7060, 14060, 21060, 28060. S.S.B.—3900, 7270, 14300, 21370, 28570. Novice—3725, 7125, 21125, 28125.

Awards: Certificates will be issued to all entrants who submit a log and include an s.a.s.e. Endorsements will be given for high score in each ARRL section, DX country, Novice/Tech. class, and Special Mobile Class.

Mailing deadline is February 15th to: Mississippi Valley Radio Club, WØSI, 3518 W. Columbia, Davenport, Iowa 52804. Log forms and a copy of the results are available for s.a.s.e.'s.

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CIRCLE 79 ON READER SERVICE CARD

a monthly feature by

GEORGE JACOBS, W3ASK

Propagation

THE SCIENCE OF PREDICTING RADIO CONDITIONS

December ionospheric propagation conditions are typical of the winter season in the northern hemisphere. Although the hours of daylight are shorter than at any other time, the earth is closest to the sun during December and the density of the ionosphere is expected to increase more rapidly after sunrise than during other seasons. The level of solar activity is expected to remain relatively high, further assuring generally good ionospheric propagation conditions, at appropriate times, on all amateur bands from *6* through *160* meters.

Atmospheric noise and static levels should be at seasonally low values during December, and signal levels are expected to be exceptionally high during many band openings.

December Band Openings

Excellent *daytime* DX openings to all areas of the world should be possible on the *10*, *15*, and *20* meter bands. Also expect *6* meter DX openings to many areas of the world during the daylight hours, particularly when conditions are expected to be High or Above Normal.

From *sundown* to *Midnight*, expect DX openings towards the south and west on both *15* and *20* meters, and towards the east and the south on *40* and *80* meters. Fairly good DX openings should also be possible on the *160* meter band from the eastern half of the country towards the north, east, and south.

From *Midnight* to *sunrise* check both *40* and *80* meters for openings to most areas of the world. Openings to many areas of the world, particularly towards the west and the south, should also be possible on *20* meters, often with strong signal levels. Some fairly good openings should also be possible on *160* meters, mainly towards the south and the west.

DX propagation conditions on the *160* meter band generally peak during December. Expect the band to open towards Europe and in an easterly direction beginning at about 8 p.m. in all North American time zones, and continuing until about 3 a.m. in the AST and EST zones, 1 a.m. in CST, Midnight in MST, and 11 p.m. in the PST zone. These *160* meter openings would favor transmitter locations in the eastern half of the USA. Openings towards the south, particularly to Central America, the Caribbean area and the northern countries of South America, should be possible from about 10 p.m. to 3 a.m. in all time zones. Openings towards the Pacific, Australasia, and the Far East will favor stations in the western half of the country, but it should be worth the time to check for these openings in other areas as well. Conditions should peak between 4 a.m. and local sunrise.

In looking for DX openings on *40*, *80*, and *160* meters, keep in mind that optimum conditions occur just as the sun begins to *rise* at the *eastern* terminal of the path.

For those interested in *short-skip* conditions on the h.f. bands during December, try *40* and *80* meters during the day for openings less than 250 miles, and *80* and *160* meters for this same distance at night. For openings between 250 and 750 miles, *40* meters looks best during the day, and both *80* and *160* meters look best at night. Between 750 and 1300 miles, try *20* meters during the day, *40* or *80* meters from sunset to Midnight, and *80* meters from Midnight until sunrise. Try *40* meters again for about an hour or so after sunrise. For openings between 1300 and 2300 miles, try either *15* or *20* meters during the day, *20* and *40* meters from sundown to Midnight, and *40* and *80* meters until sunrise. Check *40* meters again for an hour or so after sunrise.

This month's column contains *DX Propagation Charts* valid through mid-February 1982. *Short-Skip Propagation Charts* for December appeared in last month's column.

Solar Cycle Progress

While declining slowly but steadily since January 1980, the present sunspot cycle took a small turn upward at last reading. The Royal Observatory of Belgium, the official keeper of the world's sunspot records, reports a monthly mean sunspot number of 158.2 for August 1981. This results in a provisional smoothed sunspot number of 141.4 centered on February 1981. Solar activity is measured by the level of smoothed sunspot number. The result for February is just over a point *higher* than the smoothed sunspot number recorded for January 1981. Such fluctuations in a solar cycle are not unusual, but this recent spurt upward will help prolong the period of relatively high solar activity and the associated good ionospheric propagation conditions. A smoothed sunspot number of 120 is forecast for December 1981.

V.h.f. Ionospheric Openings

With the continuing level of relatively high solar activity, some worldwide DX openings on the *6* meter band should be possible during December. Peak conditions are likely towards Europe, Africa, and in a generally easterly direction an hour or two before Noon, towards Central and South America and the Caribbean area from an hour to two before, to about

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for December 1981

	Expected Signal Quality			
Propagation Index	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 4, 15, 22, 31	**A**	**A**	**B**	**C**
High Normal: 3, 6, 8, 14, 19, 21, 23-24, 30	**A**	**B**	**C**	**C-D**
Low Normal: 1-2, 5, 7, 9, 13, 16-18, 20, 25, 28-29	**A-B**	**B-C**	**C-D**	**D-E**
Below Normal: 10, 12, 26-27	**B-C**	**C-D**	**D-E**	**E**
Disturbed: 11	**C-E**	**D-E**	**E**	**E**

Where expected signal quality is: **A—Excellent opening, exceptionally strong, steady signals greater than S9 + 30 dB.**

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

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

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. **Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.**
2. **With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be good-to-fair (C) on Dec. 1st and 2nd, good (B) on the 3rd, excellent (A) on the 4th, good-to-fair (B-C) on the 5th, etc.**

For updated information, subscribe to bi-weekly MAIL-A-PROP, David D. Meisel, Editor, 54 Westview Crescent, Geneseo, NY 14454.

11307 Clara St., Silver Spring, MD 20902

an hour after, Noon, and towards the Pacific, Australasia, and the Far East during the later afternoon and into the sunset period. Don't expect 6 meter DX openings every day, and it is likely that there will be considerably fewer openings compared to the two previous winters when solar activity was higher. Best days to check for DX openings are when conditions are expected to be High Normal or Above Normal. Short-skip F-2 layer openings on 6 meters should be possible on some days for distances as short as 1300 miles. Shorter distance openings may be possible from time-to-time as a result of an expected seasonal increase in sporadic-E ionization.

December should be a good month for meteor-scatter ionospheric propagation on the v.h.f. bands. The *Geminids*, a major meteor shower which should reach its peak on December 13–14, should provide between 60–70 meteors into the earth's atmosphere each hour. The *Ursids*, a less intense shower, is expected to peak December 22–23 with a meteor rate of approximately 15 an hour.

Although December is not optimum for trans-equatorial openings on the 6 meter band, some should be possible, particularly from the southern tier states deep into South America. The best time to check for TE openings is during the evening hours between 8 and 11 p.m., local time.

Auroral displays often occur more frequently in December. They are more likely to occur when h.f. conditions are expected to be Below Normal or Disturbed. During Auroral displays, short-skip ionospheric propagaton may be possible on the v.h.f. bands for distances up to approximately 1,000 miles.

The DX Edge

Do-it-yourself predictions of band openings depend to a great degree on being able to determine what regions of the world are in daylight, in darkness, and where the day-night terminator, or *Gray Line*, is located. There are complex computer and other graphical programs available for determining these, but they are expensive and not in the do-it-yourself category. Now comes the *DX Edge*, which provides this data simply, immediately, and at a cost most radio amateurs can afford.

The *DX Edge* is the brainstorm of Tony Japna, N2UN. It is a slide-rule-type device, consisting of a plastic carrier (11¾" × 4¾") imprinted with a unique double map of the world. It shows the 40 *CQ* zones of the world and many country prefixes. In addition, there are 12 transparent plastic slides (6¼" × 4¾"), one for each month, which slide into the carrier. Each slide shows the Gray Line and areas of daylight and darkness. By sliding the insert through the carrier, you can easily determine for your location the area of the world that is in daylight, parts that are in darkness, and the Gray Line at any given time. The inserts can also be used for determining sunrise and sunset times for any location.

Jens Frost, a recent, distinguished visitor to W3ASK's shack from Denmark. Jens is Editor of the prestigious World Radio TV Handbook. *The* WRTVH *is considered the "bible" for facts and figures, general information, and operating schedules for every a.m., f.m., TV, and shortwave broadcast station in the world.*

The *DX Edge* is well fabricated, never outdated, requires no calculations or additional data, can be used anywhere without modification, and supplies data instantly. It truly opens new horizons for do-it-yourself propagation predictions for the h.f. amateur bands. It is an aid that no DXer should be without!

The DX Edge can be obtained for $14.95, postpaid in US, Canada, and Mexico (other countries add $2.00 for surface or $4.00 for air delivery) from The DX Edge, P.O. Box 834, Madison Sq. Station, New York, NY 10159.

The *DX Edge* makes an ideal companion to the *Shortwave Propagation Handbook*, by George Jacobs, W3ASK, and Theodore J. Cohen, N4XX. The *Handbook* stresses do-it-yourself forecasting and literally contains propagation "road maps" to worldwide shortwave propagation conditions that eliminate much of the mystery and complexity usually encountered in making such determinations.

The Editor of this column would like to take this opportunity to extend his warmest wishes to readers everywhere for a very Merry Christmas and a Happy New Year and holiday season.

73, George, W3ASK

December 15, 1981–February 15, 1982
Time Zone: EST (24-Hour Time)
EASTERN USA TO:

	10/6 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	07-08 (1) 08-09 (2) 09-13 (4) 13-14 (2) 14-15 (1) 09-11 (1)**	06-07 (1) 07-08 (2) 08-14 (4) 14-15 (2) 15-16 (1)	03-06 (2) 06-07 (3) 07-09 (4) 09-10 (3) 10-12 (2) 12-13 (3) 13-16 (4) 16-18 (3) 18-21 (2) 21-23 (1) 23-01 (2) 01-03 (3)	14-16 (1) 16-17 (2) 17-19 (3) 19-02 (4) 02-03 (3) 03-04 (2) 04-05 (1) 17-19 (1)* 19-20 (2)* 20-02 (3)* 02-03 (2)* 03-04 (1)*

HOW TO USE THE DX PROPAGATION CHARTS

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

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. An * indicates the best time to listen for 160 meter openings.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:

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

4. Time shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M., 13 is 1 P.M. etc. Appropriate *standard* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate chart 8 hours in PST Zone, 7 hours in MST Zone, 6 hours in CST Zone, and 5 hours in EST Zone. For example, 13 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 04 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts c.w., or 1 kw. p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength 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.

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

Northern Europe & European USSR	07-08 (1) 08-09 (3) 09-10 (4) 10-11 (2) 11-12 (1) 08-10 (1)**	06-07 (1) 07-08 (2) 08-09 (3) 09-11 (4) 11-12 (3) 12-13 (2) 13-14 (1)	04-06 (1) 06-07 (2) 07-09 (3) 09-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-23 (2) 23-02 (1)	17-19 (1) 19-01 (2) 01-03 (1) 19-02 (1)*
Eastern Mediterranean & Middle East	07-08 (1) 08-09 (3) 09-11 (4) 11-12 (3) 12-13 (2) 13-14 (1) 09-11 (1)**	07-08 (1) 08-09 (2) 09-11 (4) 11-14 (3) 14-15 (2) 15-16 (1)	07-10 (1) 10-13 (2) 13-16 (3) 16-18 (4) 18-22 (3) 22-01 (2) 01-03 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-01 (2) 01-02 (1) 20-00 (1)*
Western Africa	07-08 (1) 08-09 (2) 09-12 (3) 12-16 (4) 16-17 (3) 17-18 (2) 18-19 (1) 08-10 (1)**	05-06 (1) 06-08 (2) 08-14 (3) 14-19 (4) 19-20 (3) 20-22 (2) 22-23 (1)	03-04 (3) 04-06 (2) 06-13 (1) 13-15 (2) 15-17 (3) 17-00 (4) 00-01 (3) 01-03 (2)	18-20 (1) 20-23 (2) 23-01 (3) 01-03 (2) 03-04 (1) 22-03 (1)*
Eastern & Central Africa	08-09 (1) 09-11 (2) 11-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1) 08-10 (1)**	06-08 (1) 08-12 (2) 12-14 (3) 14-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	01-04 (2) 04-06 (1) 06-08 (2) 08-14 (1) 14-16 (2) 16-17 (3) 17-23 (4) 23-01 (3)	18-21 (1) 21-23 (2) 23-01 (1) 21-00 (1)*
Southern Africa	07-08 (1) 08-11 (3) 11-14 (4) 14-15 (3) 15-16 (2) 16-17 (1) 08-10 (1)**	06-08 (1) 08-11 (2) 11-13 (3) 13-16 (4) 16-18 (3) 18-19 (2) 19-20 (1)	06-08 (1) 12-14 (1) 14-15 (2) 15-17 (3) 17-20 (4) 20-00 (3) 00-02 (2) 02-04 (1)	18-19 (1) 19-22 (2) 22-00 (1) 19-22 (1)*
Central & South Asia	08-09 (1) 09-10 (2) 10-11 (1) 17-19 (1)	07-08 (1) 08-10 (2) 10-11 (1) 17-19 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-11 (1) 17-19 (1) 22-23 (1) 23-00 (2) 00-01 (1)	06-08 (1) 18-20 (1)
Southeast Asia	09-11 (1) 11-14 (2) 14-15 (1) 18-19 (1) 19-20 (2) 20-21 (1)	09-10 (1) 10-12 (2) 12-13 (1) 18-19 (1) 19-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-21 (2) 21-23 (1)	05-07 (1) 17-19 (1)

Indicates best times to listen for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a Propagation Index of (2), or higher.

**Indicates best times to listen for F-2 layer openings on 6 Meters.

Say You Saw It In CQ

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

Time Zones: CST & MST (24-Hour Time) CENTRAL USA TO:

	10/6 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	07-08 (1) 08-09 (3) 09-11 (4) 11-12)2) 12-13 (1) 08-10 (1)**	06-07 (1) 07-08 (2) 08-12 (4) 12-13 (2) 13-14 (1)	02-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-13 (3) 13-15 (4) 15-17 (3) 17-19 (2) 19-23 (1) 23-02 (2)	15-17 (1) 17-18 (1) 18-01 (3) 01-02 (2) 02-03 (1) 17-20 (1)* 20-01 (2)* 01-02 (1)*
Northern & Central Europe & European USSR	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (2) 11-12 (1)	06-07 (1) 07-08 (2) 08-10 (4) 10-11 (3) 11-12 (2) 12-13 (1)	04-07 (1) 07-09 (3) 09-13 (2) 13-15 (3) 15-16 (4) 16-18 (3) 18-20 (2) 20-22 (1) 22-01 (2) 01-02 (1)	17-19 (1) 19-22 (2) 22-01 (1) 19-00 (1)*
Eastern Mediter-ranean & Middle East	08-09 (1) 09-10 (2) 10-11 (3) 11-12 (2) 12-13 (1)	07-08 (1) 08-10 (3) 10-11 (4) 11-12 (2) 12-13 (1)	07-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-21 (1) 21-23 (2) 23-01 (1)	18-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
Western Africa	07-08 (1) 08-09 (2) 09-11 (3) 11-14 (4) 14-16 (3) 15-17 (2) 17-18 (1) 09-11 (1)*	06-08 (1) 08-10 (2) 10-14 (3) 14-17 (4) 17-18 (3) 18-20 (2) 20-21 (1)	06-13 (1) 13-15 (2) 15-17 (3) 17-21 (4) 21-23 (3) 23-01 (2) 01-03 (1) 03-06 (2)	18-20 (1) 20-23 (2) 23-02 (1) 20-23 (1)*
Eastern & Central Africa	07-08 (1) 08-09 (2) 09-13 (3) 13-14 (4) 14-15 (3) 15-16 (2) 16-17 (1) 10-12 (1)**	06-08 (1) 08-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	07-14 (1) 14-16 (2) 16-17 (3) 17-20 (4) 20-22 (3) 22-00 (2) 00-02 (1)	19-00 (1) 20-22 (1)*
Southern Africa	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (4) 13-14 (3) 14-15 (2) 15-16 (1) 08-10 (1)**	07-09 (1) 09-11 (2) 11-12 (3) 12-15 (4) 15-17 (3) 17-18 (2) 18-19 (1)	06-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-22 (3) 22-01 (2) 01-03 (1)	18-19 (1) 19-21 (2) 21-22 (1) 19-21 (1)*
Central & South Asia	08-09 (1) 09-10 (2) 10-11 (1) 18-19 (1) 19-20 (2) 20-21 (1)	07-08 (1) 08-10 (2) 10-11 (1) 18-19 (1) 19-21 (2) 21-22 (1)	04-06 (1) 06-07 (2) 07-09 (3) 09-10 (2) 10-11 (1) 17-18 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-02 (1)	06-08 (1) 18-20 (1)
Southeast Asia	09-10 (1) 10-13 (2) 13-14 (1) 16-17 (1) 17-19 (3) 19-20 (2) 20-21 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-13 (2) 13-14 (1) 16-18 (1) 18-20 (3) 20-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-10 (3) 10-12 (2) 12-14 (1) 16-18 (1) 18-20 (3) 20-21 (3) 21-22 (2) 22-23 (1)	04-07 (1) 17-19 (1)
Far East	15-16 (1) 16-17 (2) 17-19 (4) 19-20 (2) 20-21 (1) 17-19 (1)*	08-10 (1) 15-16 (1) 16-17 (2) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	02-03 (2) 03-06 (1) 06-07 (2) 07-09 (3) 09-10 (2) 10-11 (1) 15-18 (1) 18-20 (2) 20-22 (3)	02-03 (1) 03-07 (2) 07-09 (1) 03-07 (1)*
South Pacific & New Zealand	09-11 (1) 11-14 (2) 14-15 (3) 15-18 (4) 18-19 (3) 19-20 (2) 20-21 (1) 16-18 (1)**	07-09 (1) 09-11 (2) 11-13 (3) 13-16 (2) 16-17 (3) 17-19 (4) 19-21 (3) 21-22 (2) 22-23 (1)	10-17 (1) 17-19 (2) 19-20 (3) 20-00 (4) 00-04 (3) 04-06 (2) 06-07 (3) 07-08 (4) 08-09 (3) 09-10 (2)	23-01 (1) 01-02 (2) 02-07 (3) 07-08 (2) 08-09 (1) 00-02 (1)* 02-07 (2)* 07-08 (1)*
Australasia	08-09 (1) 09-11 (2) 11-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1) 17-19 (1)**	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (2) 11-13 (1) 13-17 (2) 17-19 (3) 19-21 (4) 21-22 (2) 22-23 (1)	04-07 (2) 07-09 (4) 09-10 (3) 10-11 (2) 11-15 (1) 15-17 (2) 17-20 (1) 20-23 (2) 23-04 (3)	02-04 (1) 04-07 (2) 07-09 (1) 03-06 (1)*
Caribbean, Central America & Northern Countries of South America	07-08 (1) 08-09 (3) 09-11 (4) 11-13 (3) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1) 09-11 (1)**	06-07 (1) 07-08 (3) 08-11 (4) 11-13 (3) 13-18 (4) 18-19 (3) 19-21 (2) 21-22 (1)	06-07 (3) 07-09 (4) 09-11 (3) 11-14 (2) 14-16 (3) 16-23 (4) 23-02 (3) 02-06 (2)	17-18 (1) 18-19 (2) 19-21 (3) 21-04 (4) 04-05 (2) 05-07 (1) 19-20 (1)* 20-22 (2)* 22-01 (3)* 01-02 (2)* 02-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	06-07 (1) 07-08 (2) 08-10 (4) 10-11 (3) 11-13 (2) 13-14 (3) 14-17 (4) 17-18 (3) 18-19 (2) 19-20 (1) 09-11 (1)**	06-07 (1) 07-08 (3) 08-10 (4) 10-— (3) 11-13 (2) 13-15 (3) 15-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	02-06 (2) 06-07 (3) 07-08 (2) 08-14 (1) 14-16 (2) 16-18 (3) 18-00 (4) 00-02 (3)	19-21 (1) 21-04 (2) 04-06 (1) 21-05 (1)*
McMurdo Sound, Antarctica	08-10 (1)	06-08 (1) 08-10 (2) 10-12 (1) 15-17 (1) 17-18 (2) 18-22 (3) 22-23 (2) 23-00 (1)	16-18 (1) 18-20 (2) 20-02 (3) 02-04 (2) 04-06 (1) 06-08 (2) 08-09 (1)	23-05 (1)

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

	10/6 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1)	06-07 (1) 07-08 (2) 08-09 (3) 09-11 (4) 11-12 (2) 12-13 (1)	05-06 (1) 06-09 (2) 09-12 (3) 12-14 (4) 14-15 (3) 15-17 (2) 17-19 (1) 22-01 (2)	18-20 (1) 21-00 (2) 00-01 (1) 19-23 (1)*
Central & Northern Europe & European USSR	07-08 (1) 08-10 (2) 10-11 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1)	05-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-14 (1) 14-16 (3) 16-18 (2) 18-21 (1) 21-00 (2)	18-20 (1) 20-23 (2) 23-00 (1) 19-22 (1)*
Eastern Mediter-ranean & Middle East	07-08 (1) 08-10 (2) 10-11 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1)	06-07 (1) 07-10 (2) 10-14 (1) 14-16 (3) 16-17 (2) 17-20 (1) 20-23 (2)	07-09 (1) 18-22 (1)
Western Africa	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (4) 13-15 (3) 15-16 (2) 16-17 (1) 09-11 (1)**	06-07 (1) 07-08 (2) 08-13 (3) 13-16 (4) 16-17 (3) 17-18 (2, 18-19 (1)	05-12 (1) 12-14 (2) 14-16 (3) 16-19 (4) 19-22 (3) 22-00 (2) 00-02 (1)	18-19 (1) 19-21 (2) 21-22 (1) 19-21 (1)*
Eastern & Central Africa	07-08 (1) 08-10 (2) 10-13 (3) 13-14 (2) 14-15 (1) 09-11 (1)**	06-08 (1) 08-12 (2) 12-15 (3) 15-17 (2) 17-18 (1)	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (2) 16-21 (3) 21-23 (2) 23-00 (1)	18-22 (1) 07-09 (1)
Southern Africa	07-08 (1) 08-10 (3) 10-12 (4) 12-13 (3) 13-14 (2) 14-15 (1) 08-10 (1)**	07-09 (1) 09-12 (2) 12-13 (3) 13-15 (4) 15-17 (2) 17-18 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-00 (2) 00-02 (1)	18-19 (1) 19-20 (2) 20-21 (1) 18-19 (1)*
Central & South Asia	06-09 (1) 17-18 (1) 18-19 (3) 19-20 (1)	06-09 (1) 16-17 (1) 17-19 (3) 19-20 (2) 20-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-17 (1) 17-18 (2) 18-19 (3) 19-21 (2) 21-23 (1)	04-09 (1) 17-19 (1)
Southeast Asia	08-09 (1) 09-11 (2) 11-12 (1) 14-15 (1) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1) 15-17 (1)**	07-08 (1) 08-10 (3) 10-11 (2) 11-14 (1) 14-15 (2) 15-18 (3) 18-20 (2) 20-21 (3) 21-22 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1) 15-17 (1) 19-20 (1) 20-22 (2) 22-00 (1)	02-04 (1) 04-07 (2) 07-08 (1) 04-06 (1)*
Far East	13-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1) 15-18 (1)**	12-14 (1) 14-15 (3) 15-17 (2) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	00-06 (2) 06-08 (3) 08-09 (2) 09-12 (1) 12-18 (2) 18-21 (4) 21-22 (3) 22-00 (2)	00-01 (1) 01-04 (2) 04-07 (3) 07-08 (1) 01-05 (1)* 05-06 (2)* 06-07 (1)*
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Australasia	10-13 (1) 13-15 (2) 15-16 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1) 17-19 (1)**	08-09 (1) 09-11 (3) 11-12 (2) 12-14 (3) 14-15 (2) 15-17 (1) 17-19 (2) 19-21 (4) 21-22 (2) 22-23 (1)	06-07 (3) 07-09 (4) 09-10 (3) 10-12 (2) 12-14 (1) 18-20 (1) 20-21 (2) 21-23 (3) 23-01 (4) 01-03 (3) 03-04 (2) 04-06 (1)	01-03 (1) 03-04 (2) 04-07 (3) 07-08 (1) 03-04 (1)* 04-06 (2)* 06-07 (1)*
Carribbean, Central America & Northern Countries of South America	07-08 (1) 08-09 (3) 09-10 (4) 10-12 (3) 12-15 (4) 15-16 (3) 16-17 (2) 17-18 (1) 08-10 (1)**	06-07 (1) 07-08 (3) 08-10 (4) 10-13 (3) 13-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	06-08 (4) 08-10 (3) 10-13 (2) 13-15 (3) 15-22 (4) 22-00 (3) 00-06 (2)	17-18 (1) 18-19 (2) 19-20 (3) 20-04 (4) 04-05 (2) 05-06 (1) 19-20 (1)* 20-22 (2)* 22-00 (3)* 00-03 (2)* 03-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	06-07 (1) 07-08 (2) 08-09 (4) 09-10 (3) 10-12 (2) 12-13 (3) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1) 08-11 (1)**	06-07 (1) 07-08 (3) 08-09 (4) 09-11 (3) 11-13 (2) 13-15 (3) 15-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	05-06 (2) 06-07 (3) 07-08 (2) 08-14 (1) 14-16 (2) 16-18 (3) 18-00 (4) 00-01 (3) 01-03 (2) 03-05 (1)	19-20 (1) 20-22 (2) 22-00 (1) 00-04 (2) 04-05 (1) 20-03 (1)*
McMurdo Sound, Antarctica	07-08 (1) 08-09 (2) 09-10 (1) 19-20 (1) 20-21)2) 21-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-20 (2) 20-22 (3) 22-01 (2) 01-02 (2)	16-18 (1) 18-20 (2) 20-03 (3) 03-04 (2) 04-05 (1) 06-07 (1) 07-08 (2) 08-10 (1)	00-05 (1)

CQ DX Tip

—In any pile-up, give your call twice, then listen. —*W4MB*

This month by
ROD LINKOUS, W7OM

DX

NEWS OF COMMUNICATIONS AROUND THE WORLD

There are many things that DXers have in common. Get two or more in a room or in a round table and the conversation shifts to that interest which makes DXers unique. Then again, there are some items about which there is no real agreement. One of these is the DX net.

DX Nets

The real proof of the DX pudding is working the DX. Many prefer to go the Lone Ranger route: hear them, work them, and disappear into the noise. It is hard to believe how aggressive these quick ones can be until the rare country comes on for the first time. And many times it doesn't have to be the first time or a DXpedition to be in a super rare spot.

With the advent of reasonably priced equipment and antennas, the DX community grew almost overnight. This was a welcomed change, especially when the new DXers were in the sparsely populated countries. The emergence of the third world countries brought prosperity to some and the desire to enter into what had been a rich man's hobby.

In earlier years only those willing to build their own gear or pay large sums to the very few suppliers could get into the thick of chasing DX. Even with World War II surplus gear, entry into DXing took some electronic talent.

The new wave of DXers brought new vitality to this great hobby. However, the shear numbers brought problems, too. One such real problem was figuring out how the many newcomers could work as many countries as possible with the least amount of trouble and still work. DX contesting answered much of the demand for the more common countries. DXpeditions got a few more to the young and hungry. Contesting and DXpeditions weren't the answer for everybody, nor were they for all year around.

Like with every problem, eventually new solutions evolve. To the phone DXer, the pileups became awesome. The band often became a battle ground. Then came the DX net and list operations. Lists are probably the oldest form of gang DXing. I remember many from the a.m. days in the early fifties. The DX net became a dominant DX scheme in the seventies.

*5632 47th Ave. S.W., Seattle, WA 98136

DX Nets

Time (UTC)	Day (Radio)	Name	Freq.	Remarks
0000	daily	The Family Hour	21345	Check 30 minutes earlier
0000	daily	The Family Hour	28575	Winter months
0100	week day	Brown Sugar Net	14310	
0200	Sunday	40 Meter DX Net	7080	
0200	daily	CHC DX Net	14298	
0300	weekends	Brown Sugar Net	14310	Winter months
0500	Friday	Arabian Nights	14250	JY3ZH NCS
0600	Tuesday–Friday	Pacific DX Net	14265	VK3PA NCS
0630	Saturday–Sunday	80 Meter DX Net	3795	
0630	daily	P29JS Net	14220	VK2BKD, VK5MQ, VK9NS
1400	daily	The Family Hour	14225	
1500	Sunday	Foreign Service	21416	
1600	Sunday	Arabian Nights	28616	
1600	Sunday	VE DX Info Net	21355	Winter months
1800	daily	YL ISSB System	14332	
1800	daily	Afrikaaner Net	21355	Winter months
1900	daily	Safari Net	21292	
2300	daily	The Family Hour	14225	

Table I– The above listing of DX nets was provided by the Totem Tabloid, *edited by Jack Bock, K7ZR. Unfortunately, it may not be complete. Also, the times may shift with propagation changes with the seasons. The frequencies may vary plus or minus QRM. If you know of well-organized and reliable DX nets not listed, drop me a line and we'll share it with all.*

The Family Hour

Two of the better known DX nets are the Afrikaaner and The Family Hour. In my very first DX column in *CQ* many years ago, I ran an item on the founder of The Family Hour—Bill Bennet, W7PHO. It really didn't start out as a DX net on 14225 MHz. It was more or less a handy watering hole for Asian and Pacific DX stations to chat with Bill. He gave the Americans overseas a chance to talk to home and get the latest news. Bill provided consistancy, as he was on 14225 almost every day without fail.

Bill's other hobby is sports. He never really got over his early school teaching days as a coach, so the DX stations in Asia and the Pacific knew where to find out what was happening in the sports world.

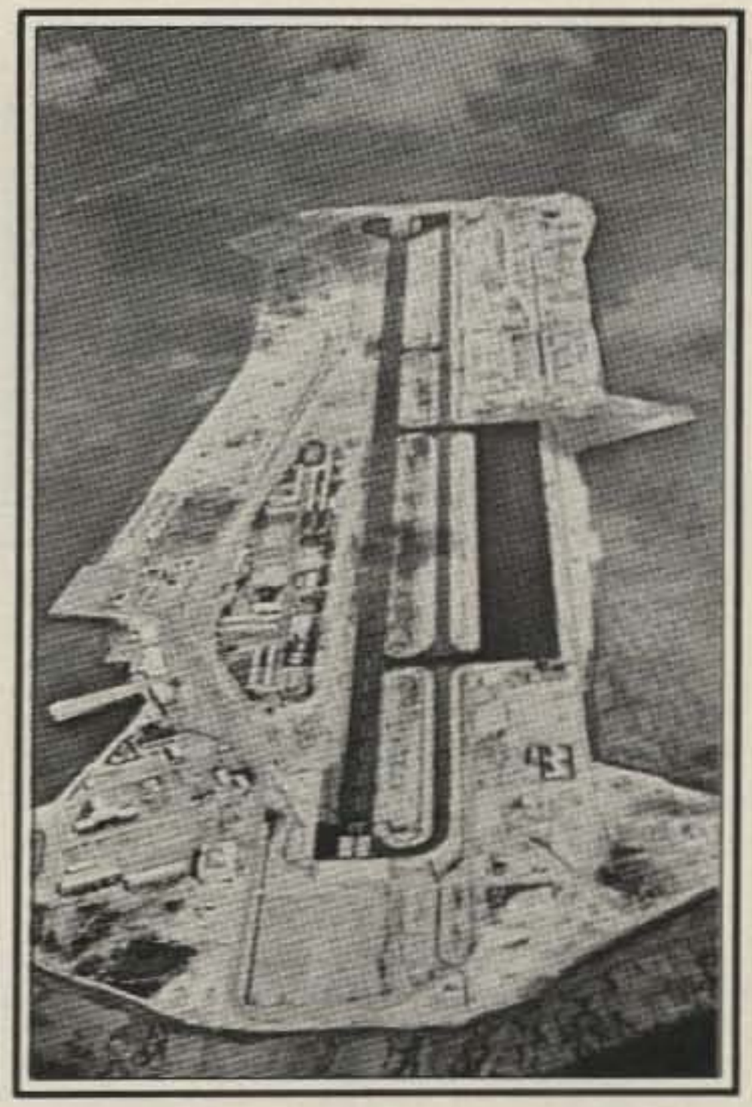
Bill, the coach, also brought another dimension to the 14225 gathering—discipline. As most know, he is an iron-fisted no-nonsense emcee. It also allowed the multitude to participate in his number one hobby—DXing.

Soon the word got around. Others joined the initial local W7s in a quick QSO with the rarer Asian and Pacific countries. Then Bill got the DX stations to bring along a friend. Then came along even more rare countries. So, over the years others joined in as participants and substitute emcees.

Today, The Family Hour is on three bands daily. Others took up running the daily shows. See the table for current times and frequencies. The times may shift with the seasonal effects on propagation. Except on 10 meters, you need an Advanced or higher license to join in the net. Yet many of the DX stations move up with an emcee into the high end of the band.

The operating format varies with propagation and the rarity of the DX station. Usually the "last letter" scheme is used. If not too many need the country, they use the shotgun approach. Then anyone

Say You Saw It In CQ



To most pilots, airdromes like the one pictured here are considered aircraft carriers. This one doesn't move or pitch, because it is the home (temporarily) of Bob Bryan, WH3AAB. It is known as Johnston Island. Supplementing each other, WH3AAB and KH3AB have almost taken KH3 off the top 100 most-needed countries list.

can get on at first by identifying to the control station with the last letter of their call. If it is a rare DX station being run (controlled) by the emcee, they may take a few from each call area. It is standard to run one DX station at a time. If a rare station comes on regularly, he will be asked to wait until the less frequent attenders and sometimes less rare station is worked. Sometimes they will spin off a DX station with a stateside station as an emcee.

The statement "only those who need him for a new country come with the last letter of your call" has special meaning. It means don't work him for the umpteenth time. But if you need him for a new band-country or zone-country, join in with those who need him for the very first time.

Discipline is a hard thing to understand. If a bad acting (can't follow instructions) DXer is identified, he will have to wait for another day to work DX on The Family Hour. Breakers from a call area may get the area put on the end of the list, or put off until tomorrow. Thus, the area sometimes polices its own. Patience is the key, as almost everyone gets a chance eventually.

The Afrikaaner Net

This winter month DX net is probably the best known of all. This is largely due to the DX using the net and its order. Principally, this net provides the best chance to work the rarer African countries. However, many other rare countries show daily. They, too, like to work the Africans.

The Afrikaaner group has a very orderly and disciplined system. The order of rotation through the USA call areas starts in the area determined by the day of the month. For example, on the 23rd day of the month, they start with the 3rd call area. Canadian and other DX areas are interspersed between the USA areas. They take a specific number from each call area to keep rotating through the sequence. This is a very organized and productive DXing spot.

The 21355 MHz channel makes this an all-hands bash. Thanks to very seasoned emcees or control stations, this is a great source for a new country or two. Before and after the net, DX QSL information is available for the asking.

They usually have an east and west coast control station. This ensures that an area called gets a chance to hear the net control.

The CHC DX Net

The Certificate Hunters Club (CHC) has revitalized their net activity. When Clif Evans, K6BX, became a silent key, the daily CHC gatherings waned. Under new leadership, the CHC DX net provides a good chance for the General Class DX-er to work those DX stations with 20 meter only ability.

They, too, use the east-west system. This late night gathering affords a large variety of DX. As they get established, this could become a very large group.

The YL International SSB System

This is probably the largest continuous net for DX. This net is both *inter*national and *intra*national in scope and format. Normally, call areas are covered in this sequence: 1, 4, 7, Ø, 3, 6, 9, 2, 5, 8, 1, etc. This unique order allows the DX stations a chance at a variety in a short period, versus the normal regional approach of the normal numerical sequence.

Another great feature from a DX station's point of view is the ability to find almost every state for WAS on each day. And they QSL! The large group of

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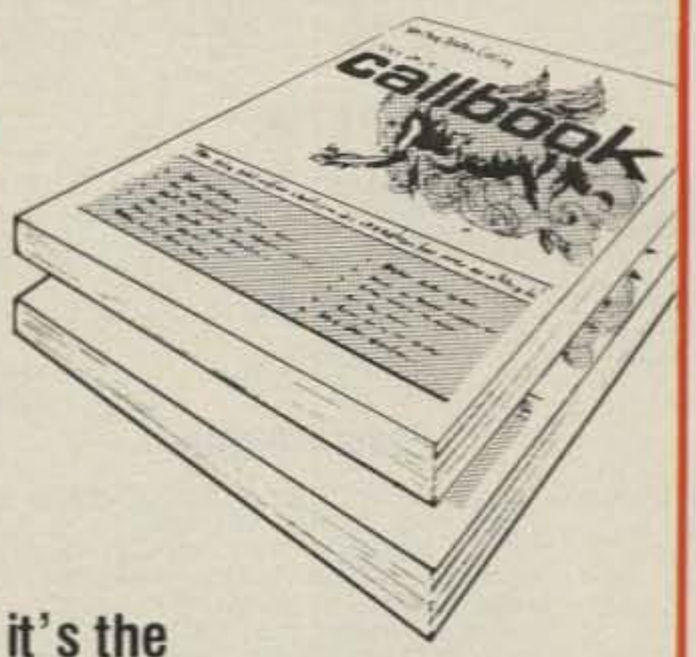

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1420	EA5ANR	1424	WD8IIA
1421	WD9FOE	1425	SP3HTZ
1422	PY2JSF	1426	IV3IOX
		1427	WB7TAZ

C. W.

2094	JH3JYS	2098	SP8GSC
2095	WA7NXL	2099	JH2QAY
2096	WA2CNF	2100	KØLST
2097	KA8EBG	2101	ZL2AWW

WPNX

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		202	KA8GBB

Endorsements

Mixed: 400 EI1DH, KP4EQF, DL9TD. 450 DL9TD, KE5J. 500 K1RB, DL9TD. 550 K9TI, K7CU, N2AIF, KA5W. 600 JA9FAI, K7CU. 650 ISØMVE, WD9IIC, HAØKW. 700 JA2KVD. 750 W6YMH. 900 I2DMK. 950 KL7AF. 1000 ONL-4003, F6CRT. 1150 WA4QMQ, K9BG. 1500 N9AF, N2AC.

S.S.B: 300 EA3ANR, PY2JSF, SP3HTZ, IV3IOX. 350 JA7MGP, WD9FOE, SP8DYY, WD8IIA, WD5ABG WB7TAZ. 400 NP4CC, WD8IIA. 450 DA1MV. 500 K1RB, W6YMH. 550 WØULU. 600 VK6YL, I2DMK. 650 XE1XF, IØPSB. 700 K4CKS, AC2J. 850 G4CHP. 900 DK2BL. 950 WA1JMP. 1000 I6JZC. 1050 DJ7CX. 1100 WØYDB, WA4QMQ. 1900 IØAMU.

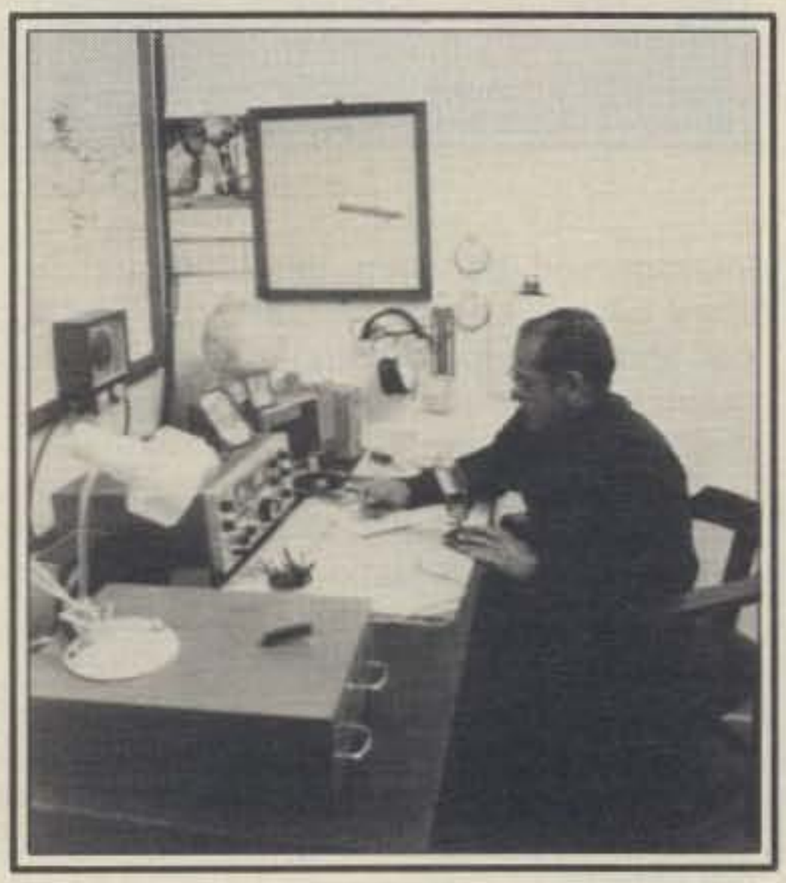
C.W.: 300 WA7NXL, WA2CNF, KA8EBG, KØLST, ZL2AWW. 350 W4DGX, K7CU, KA7AIG, AK9Z, KØLST. 400 JH3JYS, JH2QAY, KØLST. 450 KØLST.500 SP8GSC. 550 WA4QMQ. 750 DJØIE, I2DMK. 900 I3HDH. 950 JE1JKL. 1000 PI1PT. 1050 VE7CNE. 1200 DJ7CX. 1300 K8MFO. 1450 N6JV. 1500 WA2HZR. 1650 W2NC.

10 meters:	JA1KRU.
15 meters:	JA5MG, JA1KRU.
20 meters:	JA5MG, VK6YL, SP3HTZ, WD9DCL.
40 meters:	OE1KJW.
160 meters:	WD9DCL, DJ2UU.
Asia:	I3HDH, JA5MG, VZK6YL, K4CKS, KB8EC, KA3A.
Europe:	DK3EP, OZ2JZ, VK6YL, I3MLD, SP8DYY, WB4UBD, AK9Z.
Oceania:	K7CU.
No. America:	DK2BL, VK6YL, I3MLD.
So. America:	DK2BL.

WPX Award Of Excellence holders to date: K6JG, W4WSF, W4CRW, WA5VDH, W6TCQ (K6XP), WA2EAH, VE3GCO, DL1MD, DJ7CX, DL3RK, WB4SIJ, DL7AA, ON4QX, YU2DX, OK3EA, OK1MP, N4NO, ZL3GQ, W4BQY, IØJX, WA1JMP, KØJN, K4IEX, WA2AUB, W8CNL, W1JR, F9RM.

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.

The consistant signal of Bill, YJ8BG, is temporarily silent waiting for a change of address and call. Bill operated from Vila, Vanuatu until this last summer when he returned to Australia. If you worked him and haven't received a card, be patient and we will let you know of Bill's new call and address.



Antonio L. F. "Lopes" Lopes, 3D6BE, is at his usual position on the bottom of a huge pileup. Lopes handles the multitude with much skill. He has calmly given many a new country from his Mbabane, Swaizland QTH.

ISSBanders makes the probability of the net having adequate control stations very high. However, the tremendous participation makes the sequence through the call areas often longer than some DXers' patience. It's a great way to chase DX and get the QSLing caught up.

Don't become confused by the net's title. The YL ISSB group is composed of both men and women. Although this is the biggest daily gathering of YLs, there are a lot of OMs there, too.

Pros and Cons

I thought I'd cover a few of the main issues for those who might not have been part of the captive audience when the subject came up. It also may capture some of the steam from a couple I've heard.

It goes without saying that the DX net is a great way to work DX in a hurry. It is like fishing in a fish farm. If you want to work DX, go where the DX is, and a sure bet is the DX net. It is reliable and most are welcome.

For the DX station, it provides a harbor or haven from the constant pileups. At least he gets a chance to meet some friend and enjoy a little semi-organization in a normally chaotic medium. If the DX station has a language or experience limitation, it provides a means to slowly gain the ability to cope. One DX station reports that the DX net is the only place where he gets to use more than a 100 word vocabulary.

On the other side of the coin, the most common comment is "It isn't real DXing." Maybe that is true. Maybe. When an emcee or control station gives too much help, he is being a crutch often beyond reason. The DX station turns out to work the emcees over and over, and the DXer does little. Most emcees (controls) try their best to make the two stations do it on their own. The problem is that there is often another impatient guy waiting, who hears both sides and throws in the missing call or signal report. DX accomplishments are a personal thing. If that is accomplishment, an assisted contact, in their log book, so what. Yet the final tally is distorted. But when it gets down to the last fifty or so, it really is a minor item. For if they wait another day, they can repeat the whole episode and make it a real two-way contact.

Some big gun DXers don't like the nets, as they don't give them a chance to show off their muscle except in a positive way—as an augmenting emcee. However, the DX net does stop the umpteenth 59 + 20 both way reports and nothing more.

I got a short note from a little pistol (*QRZ DX* talk) with 100 watts and a vertical. He reported chasing a semi-rare DX station who had been working the pile down at about one to two a minute for a couple of hours. Just about the time he had a chance to work him, along came the big gun. One call, and the long-winded QSO began. It went something like this: "Name's Bob, you're 59 + 20, running kw to 6 elements at 120 feet. Nice to work you again. Our last dozen or so QSOs were short, so I thought I'd say hello. . . ." A half an hour later, the QSO was still going on, and the band dropped out.

Maybe DX nets aren't *the* answer for everybody or for all times. However, they do serve a real need and a purpose. If they are not your thing, avoid them. But don't jam or louse them up, for you can bet the family jewels, *they are here to stay*. So, if you can work the DX but not the control station, hang in there because you'll get another chance if your patience holds out.

Kure Atoll

Loren Wolff, KH6LW, dropped me a short note with the pictures shown in this column. He reported not only a great time, but some interesting tidbits about the small DX country.

Dave Goodwin, WBØICS/KH7, is stationed on Kure with the Coast Guard through July 1982. He is active in running phone patches for the twenty Coast Guard personnel stationed on this isolated duty station. He can usually be found along with his QSL manager, Bart, WB6FBN, on the Brown Sugar net, 14310 at 0400 UTC.

Dave has been very helpful in getting KA6HCL (also a Dave) on the air. He has a Novice license and should soon be providing Novices with a Kure c.w. QSO on 15 meters. Dave Goodwin has been encouraging KA6HCL to become active. It was WBØICS who assisted KA6HCL in his first QSOs on the air from Kure.

Besides providing the world with a

Say You Saw It In CQ

The pair in front of the Kure Island landmark are Loren Wolff, KH6LW/KH7 and Dave Goodwin, WB0ICS/KH7 (right). The occasion was Loren's fifth trip to Kure Atoll shown in the other frame. He was visiting Dave for two weeks running phone patches and whitling down the pileups, thus providing Dave a little breathing room when he gets a chance to get on from this rare spot. (Photos by KH6JEB and WB6FBN)

Kure contact, Dave Goodwin is busy keeping the LORAN station on the air. He hopes to be active on 40 and 80 meters.

Just a bit about Kure: Kure Island, more accurately Kure Atoll, is an oval shaped atoll, 5 miles at its maximum diameter, located 50 miles northwest of Midway at the extreme northwest end of the Hawaiian Archipelago (see the photo). Although it is nearly 1,200 miles from Honolulu, it is part of the state of Hawaii. The LORAN station is situated on Green Island, the only permanent land, and is located at the southern side of a lovely lagoon. Green Island is about 1.5 miles long and almost ½ mile wide. The maximum elevation is 26 feet on one of the higher dunes. Those stationed on Kure are blessed with comfortable weather ranging consistantly between 60° and 80° F. With three sail boats and two Boston Whalers, those interested in water sports are blessed. Lobsters are abundant in the lagoon and are caught regularly by snorkelers and scuba divers.

Kure provides a haven for many Monk seals, an endangered species of seals. Green Island supports breeding colonies of many species of seabirds and serves as a resting point for several species of migratory shorebirds and ducks. Among them are the Gooneys, bosun birds, French Frigate birds, Boobies, and many types of terns.

The WAZ Program

10 Meter Phone

153	W3AP	156	AG9S
154	WA2VUY	157	EA3BIC
155	W0RAO		

80 Meter Phone

13	SM4CAN

All Band WAZ

S.S.B.

2277	HC1HC	2283	I0ICM
2278	K5ANB	2284	DK5XN
2279	I1XXM	2285	DJ7AT
2280	JA4COF	2286	DL1RY
2281	JA4ENL	2287	W6LUR
2282	I0EKM	2288	WB6WKM

C.W. and Phone

5204	KC9AT	5212	DK7RW
5205	JA1HOM	5213	DL1BG
5206	N3MC	5214	EI9CX
5207	OK1AYN	5215	SP8GSC
5208	OK3KJF	5216	K6GXO
5209	I3VYW	5217	DL9OT
5210	W6DH	5218	DK9MC
5211	DL7SI	5219	K4KCS

ALL PHONE

573	DJ9OV

Applications and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (30 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.

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CIRCLE 74 ON READER SERVICE CARD

No – 103 – 104

When is DX not DX?

Usually when it is an illegal operation. The HHØN operation may be more than meets the eye in this case. Navassa Island is the center of a dispute on ownership and control. The Haitian government, thus the HH call, claims the nearby island, too. So if this one is really Haitian territory, scratch another super rare one from the list, as it doesn't meet the distance rule. If it isn't Haitian, scratch HHØN, as it is an unauthorized operation at last report. Hopefully the XZ5A and XZ9A certification will clear this one up.

Also the demonstration of K7LAY/BY from mainland China is another interesting item. The QSOs *may* not count. The most significant thing is that the first olive is out of the bottle. Let's hope the next olive comes easy.

Paulau is listed in most DX logs as the Western Caroline Islands. Yet, they did *not* sign the articles of alignment with the rest of Micronesia. So, from some points of view they are now an independent nation separate and apart from the other islands making up the Western Caroline Islands. Until final disposition of the Trust Territories of the Pacific, this case is out with the jury. Work them; it is a rare DX country regardless of how you count it.

From The Pileup

The stack is down as the bands were good, so most of those who dropped me a note were busy chasing DX. The contributors are given in parentheses.

There is a new "DX Group" with 32 members in Cuba. They are printing a standard QSL for the group's use. The Federacion de Radioaficion de Cuba provides the world with a chance to work the CMs and COs on all bands. The following are active on 75/80: CO2GB, CO2HQ, CO2JA, CO4RCB, and CO5GV. I am active from 40 to 10 meters. (CO2OM) Gavin, VP8AJW, in the South Orkneys meets his QSL manager, KØJW, on Thursdays at 1030 UTC on 14275 MHz. Steve, KØJW, says he won't take a list, but Gavin will stay around a while to work a few. Take it easy on him, as he is an inexperienced operator. (*QRZ DX*)

Sked with Les, 7Q7LW, in the country of Malawi at 2000 UTC on 21282 ± QRM, hopefully every Saturday. (WB8RJX) Good news for all, as the crew change on Crozet, FB8W, this year brings an active ham to the island. He is F2CL. He will be going along to operate as FB8WG. He will be serving several months of duty there and should be QRV by now, if not, shortly. (*QRZ DX*) Cocos Island, VK9NYG, heard often on 21190 transmit while listening around 21290 at 1300 UTC. (*The DXer*) ZL3PO expects to return to Chatham on 14 September for two years. He operated from there some years back. He consistantly is strong and is exceptional at handling the pileup. (*QRZ DX*) South Orkney, VP8ZR, is reported to frequent 21280 from 2100 to 2230 UTC. (*The DXer*) Brian, AH6AT, is now operating as VU2MSG from the American consulate in Calcutta. QSLs go via the American Consulate, Calcutta, Washington, DC 20520. (*QRZ DX*)

T5TI is a new call for Somalia and has been heard. 6OØDX cards are still in limbo. Also G3JKI/5A and 9U5JM cards are not acceptable for DXCC, *yet*. (*The DXer*)

The WPX HONOR ROLL

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with CQ master prefix list. Scores are based on the current prefix total regardless of an operator's all-time count. Honor Roll must be up-dated annually by addition to, or to confirm present total. If no up-date, file will be placed into "inactive" until next up-date. No fee required for additions to Honor Roll totals.

MIXED

2154	F9RM	1622	W9DWQ	1309	SM7TV	1127	K9BG	853	I2MQP
2151	YU2DX	1584	DJ7CX	1269	PA2TMS	1116	SM3EVR	836	LA7JO
1975	K6XP	1575	W2NUT	1240	K6ZDL	1108	KF2O	800	K7AGJ
1942	K6JG	1550	N6CW	1238	K5DB	1050	K8LJG	793	DK2BL
1863	VE3GCO	1538	PAØSNG	1236	YU1AG	1019	PY4OD	775	WB8YQX
1860	W2NC	1506	N6JV	1205	DL1MD	1017	W7CB	764	N4IB
1850	K2VV	1504	N9AF	1190	N6FX	1001	YU3APR	756	WB8ZRL
1762	YU7BCD	1445	N2AC	1181	WØSFU	920	WØIUB	753	N3RL
1760	N4MM	1434	YU2RTW	1180	WA1JMP	914	N6JM	750	KA3A
1713	N4UU	1411	N4NO	1175	IN3ANE	903	KL7AF	750	W6YMH
1693	W3PVZ	1360	YU1ODS	1168	I6SF	902	K6DT	700	NN4Q
1655	W4BQY	1350	KE4I	1155	W8CNL	893	JA1KRU	661	K2QF
1647	W7LLC	1332	W9FD	1151	UK3AAO	865	DA2DC	623	WØJIE
1623	K5UR	1325	N6AV	1148	JH1VRQ	859	UA3FT	618	JA9FAI

S.S.B.

2066	F9RM	1421	YU7BCD	1162	WØYDB	1001	W4BQY	802	I4LCK
1868	IØAMU	1408	I4ZSQ	1150	N2SS	1001	WD8MGQ	770	WA2FKF
1833	IØZV	1375	K5UR	1127	YU7ODS	996	JH1VRQ	743	WB7YQX
1759	K6XP	1300	PAØSNG	1121	DJ6VM	989	OE2EGL	716	EA3KW
1682	K2POA	1285	W9DWQ	1105	WB2NYM	938	N6FX	702	KL7AF
1672	K6JG	1262	N4UU	1072	DL1MD	932	W6YMV	700	AC2J
1543	N4MM	1250	IØMBX	1060	DJ7CX	853	I2MQP	657	I5AFC
1528	K2VV	1234	PA2TMS	1040	I6ZSC	852	CT1UA	654	WB8ZRL
1500	I8YRK	1189	HP1JC	1035	W2CC	850	ZP5RS	629	YU3APR
1484	I8KDB	1181	OZ5EV	1023	WA4QMQ	830	N2AC	619	VK3NDY
1475	ZL3NS	1163	AA4A	1010	N4NO	810	I6NOA	606	VK6YL

C.W.

1653	W8KPL	1415	N4UU	1218	N4MM	964	N6FX	735	DL1MD
1633	W2NC	1333	K2VV	1205	VO1AW	928	I6SF	703	K2FO
1550	ON4QX	1307	G2GM	1108	VK4SS	854	PY4OD	700	K8LJG
1491	WA2HZR	1286	N2AC	1077	K6ZDL	851	KH6HC	679	I1YRL
1471	K6JG	1262	K5UR	1066	YU7ODS	813	YU3APR	651	KL7AF
1467	DL1QT	1261	W4BQY	1002	YU1AG	808	I5IZ	615	KA3A
1466	N6JV	1235	W3ARK	1000	VE7CNE	802	DJ3LR		
1434	K6XP	1234	W9FD	989	LZ1XL	750	JH1VRQ		
1420	YU7BCD	1225	DJ7CX	965	JE1JKL	750	N4YB		

Packed and ready to head for another rare spot is Jerry Kangas, A9XDD. The bag has more than enough for DXCC. Flanked by Willis Propst, K7RS, (left) and Bill Bennett, W7PHO, Jerry passed through on his way to and from Oregon, his home when he is not in the far corners of the globe. Jerry was to be part of the South Yemen, 70 operation in September. Hope it is history now, and I am in the log. (Photo by K7RS)

5 Band WAZ

Standings as of September 1, 1981

All 200 zones worked:

1. ON4UN, John Devoldere (Belgium)
2. K4MQG, Gary Dixon (U.S.A.)
3. SM4CAN, Kent Svensson (Sweden)
4. AA6AA, Steve Orland (U.S.A.)
5. W8AH, Albert Hix (U.S.A.)
6. W6KUT, E. A. Andress (U.S.A.)
7. EA8AK, Fernando Fernande (Spain)
8. LA7JO, Stig Lindblom (Norway)
9. EA3SF, Fernando Blenert (Spain)
10. OH1XX, Hannu Nieminen (Finland)
11. EA8OZ, Julio Rosello (Spain)
12. WØSD, Edward Gray (U.S.A.)
13. KØZZ, Gary Knutson (U.S.A.)
14. ON6OS, P. Michiels (Belgium)
15. OK3TCA, E. Melcer (Czech.)

The top 11 contenders for 5 Band WAZ:

1. K5UR, 199
2. ZL3GQ, 198
3. OK3TCA, 197
4. LA5YJ, 197
5. OZ3PZ, 197
6. DL3RK, 196
7. W8GT, 195
8. N4RR, 192
9. LA9GV, 191
10. N6DX, 191
11. F6DZU, 191

107 Stations have attained the 150 zone level

Say You Saw It In CQ

CQ DX Awards Program

S.S.B.

1046	VK2DPN	1049	VE3IPR
1047	K8VFV	1050	F2RK
1048	EA6GP	1051	K3LUE

C.W.

505	OH2PQ	507	KB8MF
506	KO5D	508	DF3FJ

S.S.B. Endorsements

310	K2FL/317	275	K8VFV/275
300	G4CHP/300	250	WD9IIC/256
300	K5DUT/300	250	I8INW/250
275	W7OM/298	200	AI9F/222
275	WA4LOF/295	200	XE1MDX/212
275	K9UAA/288	200	F2RK/207
275	VE3IPR/287	28 MHz	KB5FU
275	KB5FU/276	28 MHz	VK2DPN
275	KK@C/276	28 MHz	K8VFV

C.W. Endorsements

300	DL3RK/303	150	OH2PQ/155
200	AA6DP/202	Mobile	VK2DPN

The total number of active countries is 318. 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.

Giorgio Giacomin, I3DSE, is at the controls in Vicenza, Italy. The certificates speak well of his DX exploits. (Tnxs—Photo W7IIT)

The XZ5A, XZ9A, and VU7AN cards are getting microscopic treatment at the DXCC desk. (*Totem Tabloid*) Lots of DX Christmas parties. If you are in the area, contact one of the local DXers for details. PVRC in the Washington, DC area and the Western Washington DX Club in the Seattle area have big plans as usual. (QRM) Roy, G3ZQA, does 160 meters the hard way. Imagine the thrill of a long haul 160 meter contact with a home brew QRP rig with less than 1.5 watts. (*SPRAT*) There are so many DXpeditions on from almost every corner of the world, that it is hard to catch slim until long after the QSO and two hours in the pileup. Work them, log them, and then worry. (A ghost of the past . . . WCDXB circa 1975 but more true today.) (QRM) Mike has recovered from the auto accident and is very active using the new A71 prefix with the old XD suffix as A71AD. (*QRZ DX*)

QSL Information

Some have asked about the many QSL managers listed in this column. The mainstay for QSL manager route is the excellent W6GO/K6HHD list. Yet each month *QRZ DX* lists current operations and their QSL routes. To put icing on the list, several of our readers take the time to drop a line with a list of those managers they used with success. I thank the single contributors! Even though you may not get mentioned here, the multitude also thanks you.

A22YV to JA2KLT
A22ZM to ZS5CU
CH2AR to VE2BCC
CH2FOU to VE2BCC
CR9JA to JA1UT
CS@CJC to CT4FU
C31LM to EA3BDW
C31MF to EA1QF
C31NL to PA@OOM
C31NM to PA@GIN
C31NR to DL5KX
C31QD to PA@GIN
C31RV to OE3GBB
C31TI to F6DLD
C31WM to PA@GIN
C31WS to PA@GIN
DJ1NK/ST3 to DF2RG
DJ3TF/HB@ to DJ3TF
ED5EIP to EA5BW
EI9CJ to WA3CEC
EL2AG to WA4VDE
FB8YE to F6BFH
FC@GQQ to DJ6ZM
FW@BN to W9BN
F@GAE/FC to DF6HZ
GB4RWD to G4KIU
GU3TVY to G3TVY
GW4IGQ to WB3AKI
G5DDD/9L1 to DJ@GN
HB@XX to HB9BB
HL9FR to WB9RGA
HL9TN to W3GNM
HL9YL to WB9RGA
HT2JAZ to YN1MAT
I2QEN/5N3 to I6DZB
JG3JLY/JD1 to JG3CKF
JW6MY to LA6MY
JW7XB to LA7XB
JX6BAA to LA7JO
JX7FT to LA5NM
J6LCV to WD4NBX
J6LOV to K2QIE
J87BL to W1JP
KA7HRK/KH8 to ZK1CG
KB7RJ/TI2 to KA7CRX
KC4AAC to W6MAB
KC6SW to K7ZA
KC6ZZ to K7TI
KX6ZY to K7TI
K5VRX/SV5 to W3YY
K5VT/any to K5VT
K7ZZ/HB@ to W1JZ
OH2BR/OH@ to OH2BAD
OY5CD to EI8H
PA2WLE/3A to PA3ARM
PA3AKP/3A to PA3ARM
PJ8JOC to WA2JOC
P29VV to ZL1VV
RK9X to UA9XWU
R2PR to UP2BEB
ST@AL to DK2OC
ST@AS to DK2OC
TG9TU to K4CLA
TL8DC to F6EWM
TN8VT to K5VT
TU4BE to WA6RUJ
T3@DB to G8LGB
UA1PAM to UK3SAB
VE3BVD/ST2 to VE3FRA
VK9NL to VK9NS
VP2KAY to WA2IFZ
VP2MMR to KL7IHP
VP2VGR to GW4FJK
VP8AIC to WA4TWS
VP8AJW to K@JW
VQ9NZ to W1NZZ
VQ9PO to W1HSP
VS6CT to KB9N
VU2WHO to DF2EO
WA1KRR/KH@ to AD1S
WD4REE/KH2 to W1CS
YB1AEG to HB9AJD
ZF2FF to WB3JWJ
ZK1XO to HB9BUX
ZK2TA to OE2DYL
ZL@AAB to VK9NS
3V8DX to G3SVK
3X1Z to W4FRU
4Z4NUT to WB2FTK
5B4KU to SM5ASE
5H3VT to K5VT
5N3ALE to DK2OC
5U7BE to DK2OC
5Z4CI to PA@ADC
7P8BZ to K5VT
7P8CF to JA2KLT
8P6CX to K2QIE
8P6KX to K2QIE
8P6KY to K2QIE
8P6MH to K2QIE
9L1WS to G2MI
9Q5L to WN4DXL
9Q5VT to K5VT
9U5AV to K5VT
9Y4MM to K1MM

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KL2OC to Ulrich Adelung, Klopstockstr. 2, 1000 Berlin 21, W Germany
K5VT to V. Thompson, 4028 Perlita, Apt. 4, Los Angeles, CA 90039
VK9NS to J. Smith, Box 103, Norfolk Island via Australia 2899
WA2JOC to W.W. Dickerson, 352 Crampton Dr., Monroe, MI 48161

QSL Help!

Thanks to those who helped when called upon last time for the clues to the old and elusive QSL routes. Still need clues to YS3JLN, 5A5TH, 5A2TP, and HR1GSO. Thanks for the notes on VP2VEH, but it turned out that he is still moving around, so we need a 1982 address.

Again

Last September's column on DX contesting didn't bring me any mail. Guess everyone understood *correctly* to write to Frank Anzalone, W1WY. The letters I heard about mean you do read the column and that's what it is all about. Thanks for the cards and notes. *See you in the pileups!*

73, Rod, W7OM

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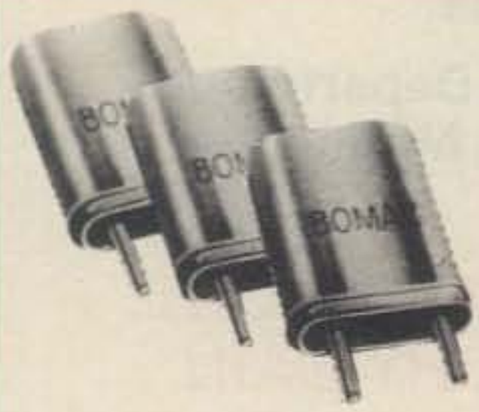

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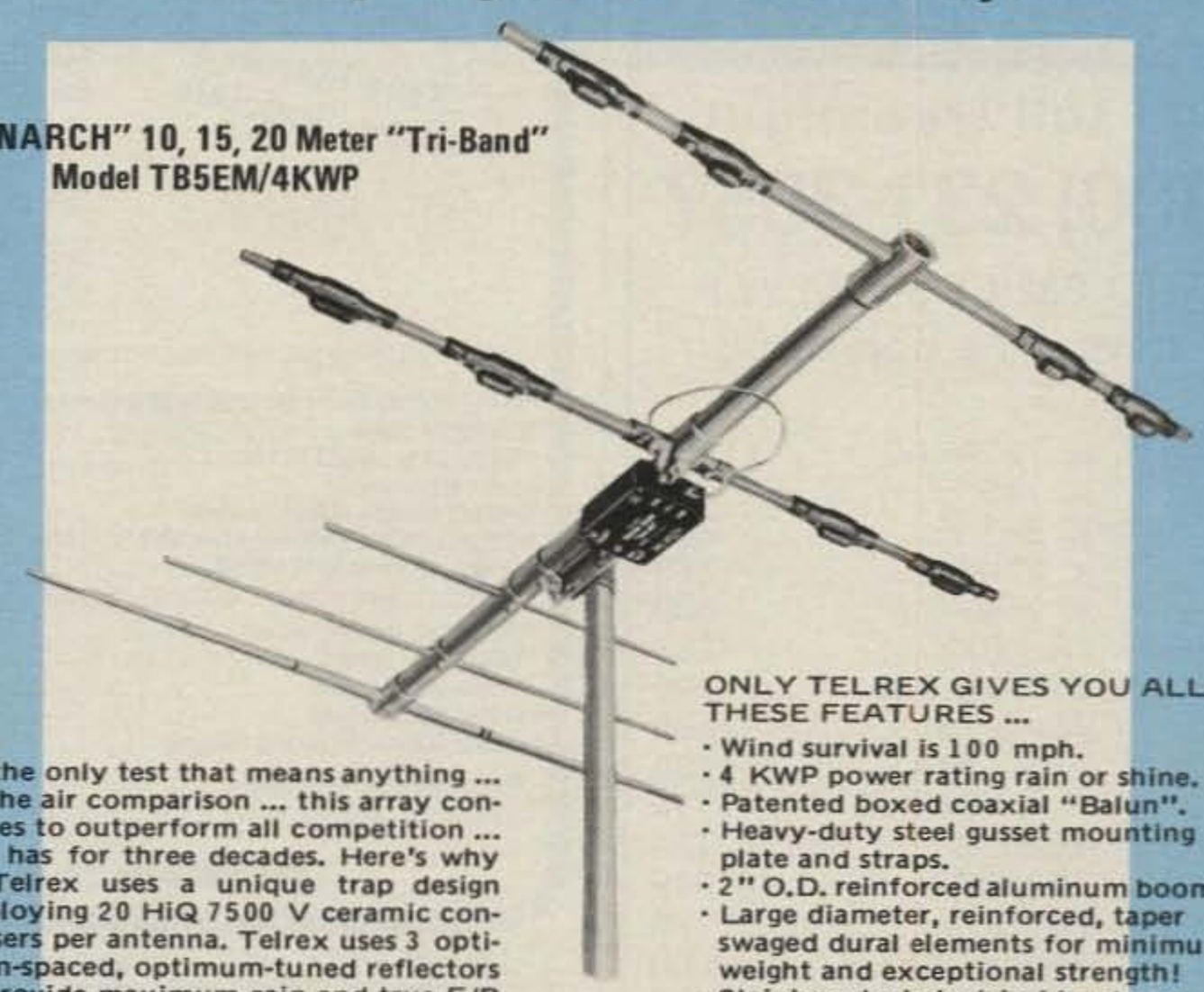

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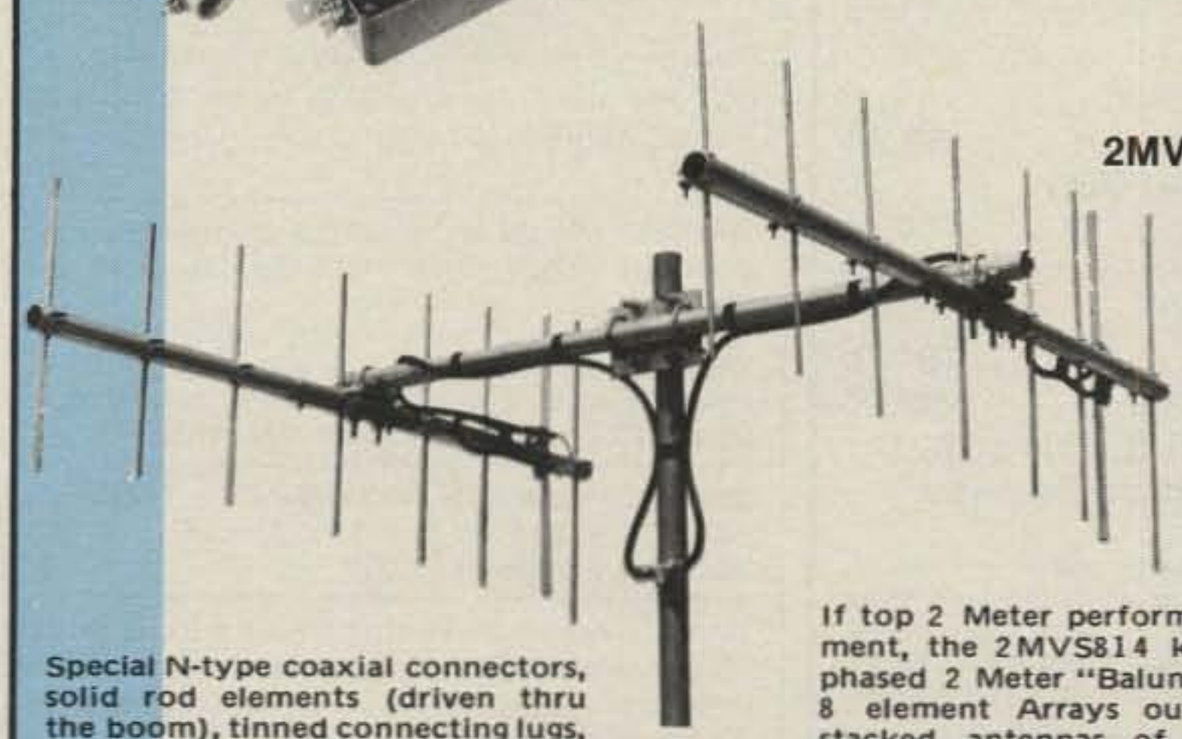

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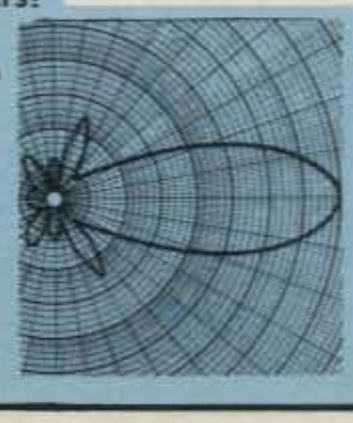

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