Amateur Radio

CQ

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Season's Greetings

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THE RADIO AMATEUR'S JOURNAL

KENWOOD

...pacesetter in Amateur radio

All New Compact HF!

"DX-citing!"

TS-440S Compact high performance HF transceiver with general coverage receiver

Kenwood's advanced digital know-how brings Amateurs world-wide "big-rig" performance in a compact package. We call it "Digital DX-citement"—that special feeling you get every time you turn the power on!

- **Covers All Amateur bands**
  General coverage receiver tunes from 100 kHz—30 MHz. Easily modified for HF MARS operation.
- **Direct keyboard entry of frequency**
- **All modes built-in**
  USB, LSB, CW, AM, FM, and AFSK. Mode selection is verified in Morse Code.
- **Built-in automatic antenna tuner (optional)**
  Covers 80-10 meters.
- **VS-1 voice synthesizer (optional)**
- **Superior receiver dynamic range**
  Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m)
- **100% duty cycle transmitter**
  Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB, 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)

- **Adjustable dial torque**
- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
- **TU-8 CTCSS unit (optional)**
  Subtone is memorized when TU-8 is installed.
- **Superb interference reduction**
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM.
- **MC-43S UP/DOWN mic. included**
- **Computer interface port**
- **5 IF filter functions**
- **Dual SSB IF filtering**
  A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **VOX, full or semi break-in CW**
- **AMTOR compatible**

Optional accessories:

- AT-440 internal auto. antenna tuner (80 m—10 m)
- AT-250 external auto. tuner (160 m—10 m)
- AT-130 compact mobile antenna tuner (160 m—10 m)
- IF-232C/IC-10 level translator and modem IC kit
- PS-50 heavy duty power supply
- PS-430/PS-30 DC power supply
- SP-430 external speaker
- MB-430 mobile mounting bracket
- YK-88C/88CN 500 Hz/270 Hz CW filters
- YK-88S/88SN 2.4 kHz/1.8 kHz SSB filters
- MC-60A/80/85 desk microphones
- MC-55 (8P) mobile microphone
- HS-5/6/7 headphones
- SP-40/50B mobile speakers
- MA-5/VP-1 HF 5 band mobile helical antenna and bumper mount
- TL-922A 2 kw PEP linear amplifier
- SM-220 station monitor
- VS-1 voice synthesizer
- SW-100A/200A/2000 SWR/power meters
- TU-8 CTCSS tone unit
- PG-2S extra DC cable.

Kenwood takes you from HF to OSCAR!

KENWOOD

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

TRIO-KENWOOD COMMUNICATIONS
1111 West Walnut Street
Compton, California 90220

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HF Superiority!

TS-930S All band transceiver with general coverage receiver

Throughout the contest and DX world, the TS-930S is recognized as THE HF rig to own—with the most outstanding performance per dollar ratio!

- Easily modified for HF MARS and CAP operation
- IF notch filter
- Excellent receiver dynamic range
- All solid state, 28 volt final amplifier for lowest inter-modulation distortion
- Power input rated at 250 watts on SSB, CW, FSK, and 80 watts on AM
- Full break-in or semi-break-in CW
- SSB slope tuning—Another Kenwood First!
- CW VBT and pitch controls
- Tunable audio filter built in
- Dual mode noise blanker ("pulse" or "woodpecker") with threshold control
- Eight memory channels
- RF speech processor
- High stability, dual digital VFOs
- AC power supply built in
- Fluorescent tube digital display
- One year limited warranty on parts and labor
- A complete line of accessories is available

TS-430S Compact all band transceiver with general coverage receiver

Kenwood engineering brings you "Digital DXterity"—QSY from band to band, mode-to-mode, and frequency-to-frequency with ease!

- Easily modified for MARS operation
- Superb interference reduction
- Programmable scanning
- 8 memories store mode, frequency, band. Each channel may be used as a separate VFO
- Superior solid state design
- VOX, semi break-in CW with sidetone
- Dual digital VFOs
- A complete line of accessories is available

10 Hz display shown (see operating manual)

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.
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NEW!

This HT has it all!

TH-215A

Full-featured 2m Hand-held Transceiver

Kenwood brings you the greatest hand-held transceiver ever! More than just "big rig performance," the new TH-215A packs the most features and the best performance in a handy size. You will want to keep this HT "close at hand" all of the time. And our full line of accessories will let you go from hamshack to portable to mobile with the greatest of ease!

- **Wide receiver frequency range.** Receives from 141-163 MHz. Includes the weather channels! Transmit from 144-148 MHz. Modifiable to cover 141-151 MHz (MARS or CAP permit required).
- **5, 2.5, or 1.5 W output, depending on the power source.** Supplied battery pack (PB-2) provides 2.5 W output. Optional NiCd packs for extended operation or higher RF output available.
- **CTCSS encoder built-in.** TSU-4 CTCSS **decoder** optional.
- **10 memory channels store any offset.** Each memory channel can store frequency, frequency step, offset, **reverse switch position,** and CTCSS frequency.
- **Nine types of scanning!** Including new **"seek scan"**— A Kenwood exclusive!
- **Intelligent 2-way battery saver circuit extends battery life.** Two battery-saver modes to choose, with power save ratio selection.
- **Easy memory recall.** Simply press the channel number!
- **12 VDC input terminal for direct mobile or base station supply operation.** When 12 volts is applied, RF output is 5 W!
- **New Twist-Lok Positive-Connect™ locking battery case.**
- **Frequency entry by keyboard or UP/DWN keys.**
- **Priority alert function.**
- **Monitor switch to defeat squelch.** Used to check the frequency when CTCSS encode/decode is used or when squelch is on.
- **Large, easy-to-read multi-function LCD display with night light.**
- **Audible beeper to confirm key-pad operation.** The beeper has a unique tone for each key. DTMF monitor also included.
- **Supplied accessories:** Belt hook, rubber flex antenna, PB-2 standard NiCd battery pack (for 2.5 W operation), wall charger, dust caps.

Optional Accessories:

• PB-1: 12 V, 800 mAH NiCd pack for 5 W output • PB-2: 8.4 V, 500 mAH NiCd pack (2.5 W output) • PB-3: 7.2 V, 800 mAH NiCd pack (1.5 W output) • PB-4: 7.2 V, 1600 mAH NiCd pack (1.5 W output) • BT-5 AA cell manganese/alkaline battery case • BC-7 rapid charger for PB-1, 2, 3, or 4 • BC-8 charger for PB-1, 3, or 4 • SMC-30 speaker microphone • SC-12, 13 soft cases • RA-3, 5 telescoping antennas • RA-8B StubbyDuk antenna • TSU-4 CTCSS decode unit • VB-2530: 2m, 25 W amplifier • LH-4, 5 leather cases • MB-4 mobile bracket • BH-5 swivel mount • PG-2V DC cable • PG-3C cigarette lighter cord with filter

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Offices: 76 North Broadway, Hicksville, NY 11801. Telephone: 516 681-2922. CQ (ISSN 0007-893X) is published monthly by CQ Publishing Inc. Second Class postage paid at Hicksville, NY and additional offices. Subscription prices: Domestic—one year $18.00, two years $35.00, three years $52.00; Canada/Mexico—one year $20.00, two years $37.00, three years $54.00; Foreign—one year $22.00, two years $43.00, three years $64.00; Foreign Air Mail—one year $75.00, two years $149.00, three years $223.00.

Allow six weeks for change of address. Printed in the United States of America.
Postmaster: Please send change of address to CQ Magazine, 76 North Broadway, Hicksville, NY 11801.

CQ The Radio Amateur's Journal

ON THE COVER: Sam and Sandy, two of Santa's helpers at Santa's Workshop, North Pole, NY, are wrapping the new Yaesu FT-767GX for some lucky amateur. Will it be under your tree this year? Photo by Larry Mulvehill, WB2ZPI, with the help of Santa's Workshop, North Pole, NY.

DECEMBER 1986 **VOL. 42, NO. 12**

FEATURES

DEPARTMENTS

Zero Bias

AN EDITORIAL

The long awaited *Archie's Ham Radio Adventure* comic book is out and most definitely worth the wait. We had a chance recently to action test the book at the Houston Hamfest. Arnie, KA2TYA, and I manned the *CQ* booth hoping to catch sight of some junior or future amateurs. We had packed a small quantity of the comic books to give out. Diligence pays off. Among all those people we actually spotted about six or seven young people. With one exception, they all seemed to welcome the comic book and started to read it at once. The only exception was a somber young man of nine or ten who took the book when assured it was free, reflected a moment, then returned the book saying seriously, "No thank you, I don't read very much." Even though you may disagree, you do have to respect a man of conviction.

The comic book, as many of you know by now, was a joint effort by the Amateur Radio Industry and the ARRL. It was produced by Archie Comic Publications, Inc. and designed to appeal to junior high school students. Junior high school teachers are being urged to take an active part in distributing the comic book among their students. The books are free and can be obtained from the ARRL, Archie Program, 225 Main St., Newington, CT 06111. Please don't write to the ARRL just to request a copy for your collection of amateur radio memorabilia. These comic books have a job to do, and they can't do that sitting in your basement.

The comic book is one basic approach to create interest in amateur radio among prospective amateurs, and especially young people. It took about 18 months and a lot of work to create one of the most professional recruitment efforts for amateur radio. The cost was extremely modest when you consider the total effort and the 100,000 copies that were produced. However modest the cost, the funds were extremely arduous to raise, and this still represents only one effort, and only one of many ideas. The money needed for follow-up to the comic book, a much smaller amount, still has to be raised, and that too will be arduous. This one singular experiment in recruiting young people is still unfolding, and it will take some time to see how well it will work. Funding a second idea is another problem we'll face down the road. However, it is interesting to note that the cost of one museum could fund over 100 such ideas in total, and all at the same time.

On A Lighter Note

As we enter a holiday season with a new year approaching, it is sometimes important to contemplate fanciful thoughts of "what if?" and "how about?" It's sort of like creating a super gift list for Christmas or Hanukkah presents. Reality says you're not going to get them, but your mind plays a game as if you will get them and what it will be like. Well, I thought about what it would be like to hire one of those super Madison Avenue ad agencies (one with a lot of names) and have them create a series of advertisements for amateur radio that would run on TV and in large-circulation general-interest magazines.

Can you picture a "pop up" ad such as appeared in *Time* magazine a few months ago? Along with the interesting and captivating text, a little tower and antenna unfolds and pops up in one corner, and an operating desk and equipment pop up in another. Another thought is the ads impregnated with a scent, or "scratch and sniff" ads. We've all seen or been exposed to the magazines that have them. In fact, you can generally smell them before you see them. What about distinctive amateur radio scents?

Can you also picture a nostalgic ad featuring surplus equipment? What if you had something that actually smelled like an old surplus store or loft? Whether it was the mixture of dust, cosmoline, wax, oil-filled capacitors or whatever, it would have a characteristic scent. You could also consider calling the scent by a French name (Surplus, pronounced *Suhr-ploo*) and bottling it as a perfume or after-shave.

I'll spare you some of the other ideas that cropped up. I'm sure you all can add a few of your own. The basic principle, though, is easy to get caught up in: "What could you do with unlimited resources?" Well, the basic product is good, everyone involved with amateur radio seems to like it, and most of us have stuck with it for a long time. Perhaps 1987 will be the year in which we figure out several ways to make more people aware of amateur radio and the tremendous benefits we all will derive from their participation.

As the year draws to a close, we still have one hamfest to go to before the official end of our traveling year. This year saw a few good shows get better and a few get progressively worse. The ones that are on that short slide to oblivion all suffer from the same root cause—lack of organization. Traditionally, a small core of people run hamfests, and they do it well for many years. For the most part, there is no second tier of management either because we'd all prefer someone else to do the work or the people in charge want to keep it all to themselves. The former is generally closer to the truth. After a few years people tend to burn out and want out of a heavy workload. Sometimes they move away, and sometimes they just want to go to a hamfest and enjoy it without having to work 12 hour days to put it on. So, as a result, a few of the older hamfests show signs of fading away.

One of the hopes for 1987 is for more club members to take an active part in their clubs' functions, not just to pay dues. Another hope is that clubs form a legal or para-legal committee to study local zoning ordinances with regard to amateur radio. These committees could produce guidelines on how to apply for permits, how to work within the system, and how to work within the "political" system that always exists. It seems that most of us get in trouble by acting first and in haste, and then demanding what we deem as our rights. Perhaps if we first went to our local village or city hall and found out what the zoning code called for we might be able to avoid trouble by trying to comply with existing regulations. PRB 1 is not a blanket guarantee or exemption from existing law. It is possible to get that desired permit by being politic and using politics.

The Novice Enhancement program will be everyone's holiday gift for 1987, and it can be an important step in amateur radio growth. If we can encourage more amateurs to share their knowledge and experiences with Novices and prospective Novices, then we most certainly can flourish.

As of this writing, nothing has been decided as to what phone privileges will be added to the Novice license. Speculation still abounds. In the next several years as the sunpot cycle improves to the point where Novice activity can witness greater DX potential, the continued battle over CW will still be with us.

This year, though, will be marked as a year of possibilities. The VEC program made it easier to take amateur exams. More and more clubs offered license training programs. The first united effort at amateur radio promotion was brought to fruition. In spite of economic uncertainties, there is a positive glimmer of hope as we round out this year and head into the next. Perhaps the concept of a new year, a new beginning, brings out the optimist in some of us. Well, it's a positive attitude that does make things happen.

We at *CQ* would like to wish each of you a happy and joyous holiday season, and we encourage each of you to take that positive view and act on it in the new year.

73, Alan, K2EEK

Or This Inexpensive

It Really Shouldn't Be This Easy

Remember just a few years ago, how it took a roomful of equipment just to work RTTY. And if you wanted more than one mode it took a dedicated computer system costing thousands of dollars. The new AEA Pakratts are proving it doesn't take lots of equipment or money to enjoy working all bands in five different modes.

First, A Good Idea

The idea behind the Pakratt is very simple. One controller that does Morse, Baudot, ASCII, AMTOR, and Packet, and works both HF and VHF bands. Of course the decoding, protocol, and signal processing software must be included in the unit, and connection to the computer and transceiver have to be easy. The unit also has to be small and require only 12 volts, so it will work both in the shack and on the road.

Second, Computer Compatible

It doesn't matter what kind of computer you have, we have a Pakratt for you. The PK-64 works with the popular Commodore 64 or 128, and the PK-232 works with any other computer or terminal that has an RS-232 serial port. The PK-64 doesn't require any additional programs. Simply connect to the computer and transceiver and you're on the air. The PK-232 needs a terminal or modem program for your computer. The one you're using with your telephone modem will work just fine.

PAKRATT™ Model PK-64

PAKRATT™ Model PK-232

Third, Performance and Features

The real measure of any data controller is what kind of on-air performance it gives. While the PK-64 and PK-232 use different types of modems, both give excellent performance on VHF. The optional HF modem of the PK-64 uses independent four-pole Chebyshev filters for both Mark and Space tones, and A.M. detection. The HF option can be factory or field installed.

The PK-232 uses an eight-pole bandpass filter followed by a limiter discriminator with automatic threshold correction. The internal modem automatically selects the filter parameters, CW Fc = 800 Hz, BW = 200 Hz; HF Fc = 2210 Hz, BW = 450 Hz; VHF Fc = 1700 Hz, BW = 2600 Hz.

The PK-64 uses on screen indicators to show status, mode, and DCD (Data Carrier Detect) while the PK-232 uses front panel indicators. Both units use discriminator style tuning for HF operation. And that's just the tip of the iceberg. Features like multiple connects on packet, hardware HDLC, CW speed tracking, and other standard AEA software features are included in both the PK-64 and PK-232.

Fourth, AEA Quality and Price

Not many manufacturers like to discuss quality and price at the same time. AEA thinks you want high quality and low price in any product you buy, so that's what you get with the Pakratts. Ask any friend who owns AEA gear about our quality. The people who buy our products are our best salespeople. As for price, the PK-64 costs $219.95, or $319.95 with the HF option. The PK-64A, an enhanced software unit with a longer flexible computer cable, costs $269.95 or $369.95 with the HF option. The PK-232 costs $319.95 with the HF modem included. All prices are Amateur Net and available from your favorite amateur radio dealer. For more information contact your local dealer or AEA.

Prices and specifications subject to change without notice or obligation.

AEA

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Our Readers Say:

A Sign From Heaven

Editor, *CQ*:

Hats off to Dave Ingram, K4TWJ, for his efforts in restoring romance to amateur radio ("Classic Amateur Gear Revisited," September *CQ*).

In 1968 and '69, I used to run with the big boys: W4BPD on DXpedition, W4KFC in contests—in fact, my attempt was to reach a 100K score in *3* hours in the ARRL CD parties because Vic had once done it in 4! I'll never forget the 15 meter pileup that I pulled VR6TC out of in the middle of the afternoon.

But so what? None of that was even *half* as adventurous or exhilarating as working New Zealand at 5:00 AM on 40 meter CW with an ancient transmitter, military surplus receiver, and droopng dipole antenna. The greatest moment of my life was the one that got away: ZL5AA in Antarctica, whose signal faded into oblivion as the sun came up, much as a vampire cloak begins to smoke as the creature desperately heads for its coffin before the dawn breaks! To this day, I can still hear ZL5AA calling QRZ to my frantic, emotional pleas on CW. Alas, the old rig just couldn't pull that one off. But that made it even *more* fun. And romantic.

Eighteen years went by after that (with *no* ham radio), and, having enough money now to purchase 50 SSB transceivers, somehow I got interested again, and finally I got the "dream" rig that I could *never* afford at age 12: and ICOM SSB transceiver, KW amplifier, etc.

It was a total drag. *Everything* had become extremely technical, proficient, and *easy*! I hated it, and knew then why I had left amateur radio and taken up tennis: At least Becker and Lendl sweat! I sold the entire station immediately. But somehow, ZL5AA haunted me. Two years later I got hold of your September *CQ*, and there it was! Dave's article was staring me straight in the face—a sign from heaven! Sweat, romance, art, adventure, and *pride of accomplishment* were back!

Now I am excited: a 1925 super-regenerative receiver, a WW II Luftwaffe hand key, a homebrew crystal-controlled CW transmitter (1948 tube style), and—yes—a drooping dipole antenna for either 40 or 30 meters, the entire station set on top of old, wooden orange crates in a closet corner! Can you imagine the thrill of tacking up the first ZL QSL card on *that* wall?

I'm not old-fashioned at all, but I do side with John Houseman on doing something the *right* way (in amateur radio)—by *earning* it. We need more Dave Ingrams to help us rediscover this value. Well done, Dave! Give us more.

John Hagey, WB4GTI/6
Pasadena, CA

Thanks, CQ

Editor, *CQ*:

On behalf of The Frankford Radio Club, I would like to thank you for sponsoring the plaque we just received for the highest total club score in the 1984 *CQ* World-Wide DX Contest. Our club works very hard to compete in the club competition. I think a great percentage of the members push themselves not for individual honors, but for the club.

Our members enjoy your contest, the way it is administered, and the way it is presented in your magazine. As a matter of fact, I could not offer any suggestions! Thank you again from each of us.

John T. Salyer W3MA
Past President
Frankford Radio Club

Haste Makes Waste

Editor, *CQ*:

In the spring I sent a letter to you which was published in the September issue. This was written in the spring not long after I moved to Oklahoma. This was written in haste, and we all know that haste makes waste. I did not know everything that was going on, and therefore should not have written such a letter. Therefore, I am sorry for any discontent that may have been caused.

On the 18th of August 1986 I upgraded to Technician. Since then I traded my HF rig for a UHF handy and a 2 meter mobile rig. I have been quite active on 2 meters since, also. Just the other day I sold my computer, traded my UHF handy for a TS-130S, and joined a local club. Since I have also joined MARS and been accepted I am trying to get my code speed up so I can get my General ticket. I am now looking forward to that and also looking forward to working HF again.

I have no intention of selling out at this time. In fact, I have gone to a few of my friends' houses who are still into CB. I found out that it is a nice place to visit, but I would not want to live there! As soon as I get back to work and can, I want to get a better computer so I can run Packet, EME, RTTY, and CW.

Tony E. Byrum, KAØVFN
Oklahoma City, OK

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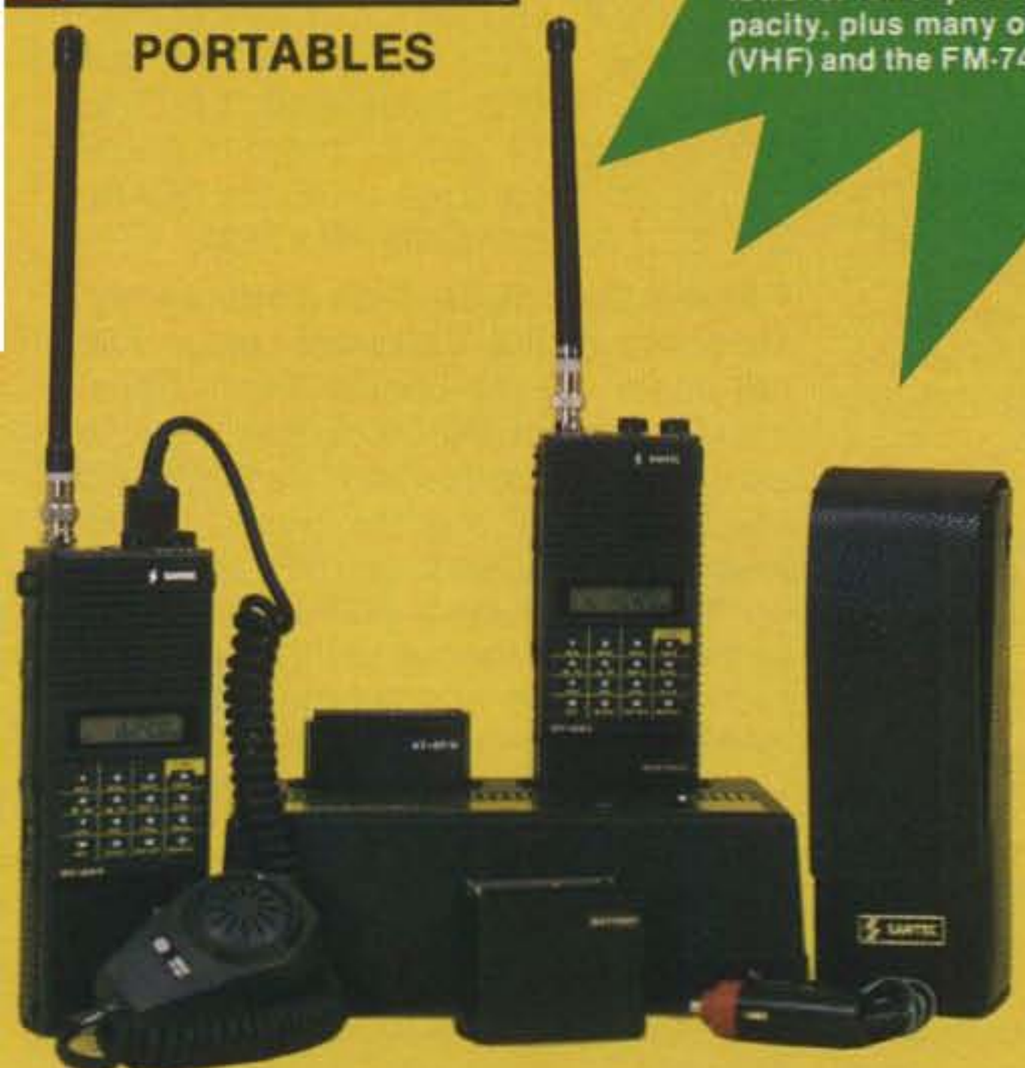

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Announcing

• **Chicago Area Chaverim** - A Chicagoland chapter of "Chaverim," the organization of Jewish amateur radio operators, has been formed and is holding regular on-the-air meetings. The organization welcomes all Chicago-area licensed amateurs. A weekly 2 meter Chaverim net is held on Tuesday evenings at 9:00 PM, and amateurs are invited to sign in on 147.315/147.915 MHz, the repeater of the Metro Amateur Radio Club. Eyeball meetings are planned in coming months.

• **W5AC During 1986 Bonfire** - The Texas A & M University MSC Amateur Radio Committee will be operating the club station, W5AC, during the 1986 Bonfire. They will be operating on November 26 from about 0100Z until the bonfire falls. *(We hope this info reaches readers in time—ed.)* Frequencies: phone 7240, 3900 kHz; SSTV, CW to be announced. For special QSL, send SASE to MSC Amateur Radio Committee, Box J-1, College Station, TX 77844.

• **Hen House Gang Special Event** - W1FHP, the Hen House Gang from Bethlehem, Connecticut, is sponsoring a special Santa Award all the month of December on 10, 20, 40 meters, and by sked. Work four different Bethlehems around the world. QSL to the Callbook W1FHP. Send only a first-class stamp. W1FHP will also take Santa letters from children.

• **Courage Center Handi-Ham Hamfest** - The annual Courage Center Handi-Ham Winter Hamfest will be held Saturday, December 6 at the Eagles Club in Faribault, Minnesota starting with registration at 9 AM. There will be a Handi-Ham equipment auction, dinner at noon, and program. Talk-in on 19/79. For more information, contact Don Franz, WØFIT, 1114 Frank Avenue, Albert Lea, MN 56007.

• **W7UQ Alumni Reunion** - The University of Idaho ARC, W7UQ, will hold its second annual Alumni Reunion on the air from 2000Z December 6 to 0400Z December 7. Frequencies are around 14.230 (2000–0100), 7.230 (0000–0400Z), 3.930 (0000–0400Z), 14.030 (2000–0100Z) and 7.130 (0000–0400). All amateurs, especially U of I alumni, are invited to participate. Listen for "CQ Reunion." QSL available by sending SASE via Callbook address. For more information, contact W7UQ via Callbook.

• **Hazel Park ARC Swap & Shop** - The Hazel Park ARC will hold its 21st annual Swap & Shop on December 7 at the Hazel Park High School. General admission $2.00 in advance, $3.00 at the door. Children under 11 free. Tables $1.00 per foot. Talk-in from the 9-Mile & I-75 area on 146.52 simplex. For tickets and table reservations, mail to HPARC, P.O. Box 368, Hazel Park, MI 48030.

• **AA4UM From Lynchburg, VA** - The Piedmont ARA will conduct Special Event station AA4UM on December 13 from8 AM to 12 noon SSB 3.855 and 12 noon to 8 PM on SSB 14.302 to celebrate the 200th birthday of Lynchburg, Virginia. For certificate send QSL with 9 × 12 SASE for certificate to Piedmont ARA, POB 11362, Lynchburg, VA 24506.

• **W9WWI/9 From Bethlehem, IN** - The Clark County ARC will operate W9WWI/9 from 1700Z to 0300Z December 13, and 1300Z to 2000Z December 14. Freq. 3.905, 7.240, 14.290, 21.365, 146.25/.85. Certificate for a large SASE via CCARC, Box 532, Jeffersonville, IN 47131.

• **Special Event Station From Christmas City** - Members of the Delaware-Lehigh ARC will again run the Special Event Christmas City Station W3OK on December 20 and 21, from Bethlehem, Pennsylvania. The station will operate around the following frequencies from 1600–2200 UTC on 3900, 7200, and 14250 kHz. Certificates will be awarded to those who contact the station and submit a QSL and SASE #10 size to W3OK, The Delaware-Lehigh Amateur Radio Club, Greystone Building, Nazareth, PA 18064.

• **WQ5S "Christmas Toy Test"** - The Plano, Texas, Amateur Radio Klub will operate Special Event Station WQ5S "Christmas Toy Test" from 1600 UTC on 27 December until 24 hours later on the following bands: the center of the Novice bands ± QRM; the lower 25 kHz of the General phone bands ± QRM; and will monitor and respond to calls on 146.52 MHz, 52.525 MHz, and 29.600 MHz FM along with 144.200 SSB. QSL via WQ5S, Brad Fuller, Rt. 11, Box 24, McKinney, TX 75069. The idea behind this event is to give "New Christmas Toy" owners an opportunity to try out their rigs/accessories.

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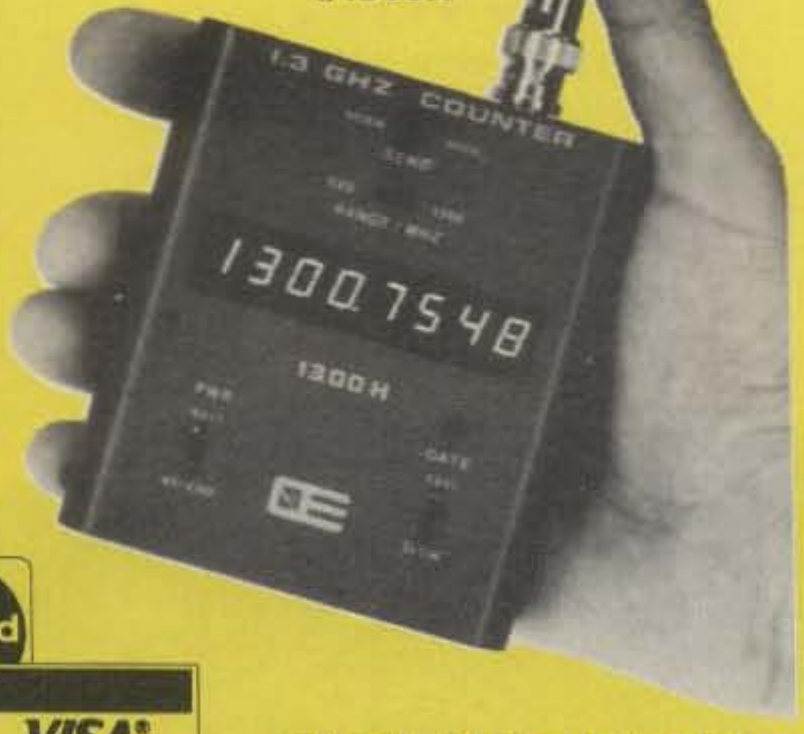

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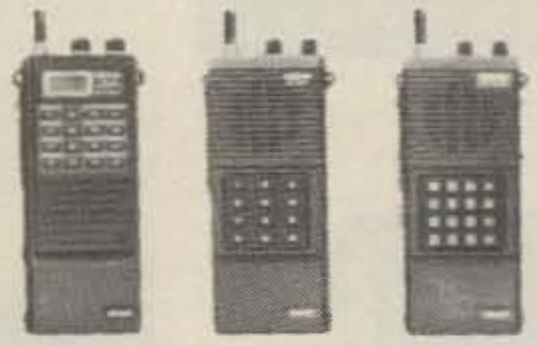

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Here's another work-horse amplifier you can build from junk-box or fleamarket parts. K9ARZ has done a neat job of constructing this amplifier using the venerable 813s.

How To Build A Homebrew 813 Amplifier

BY LAWRENCE W. STARK*, K9ARZ

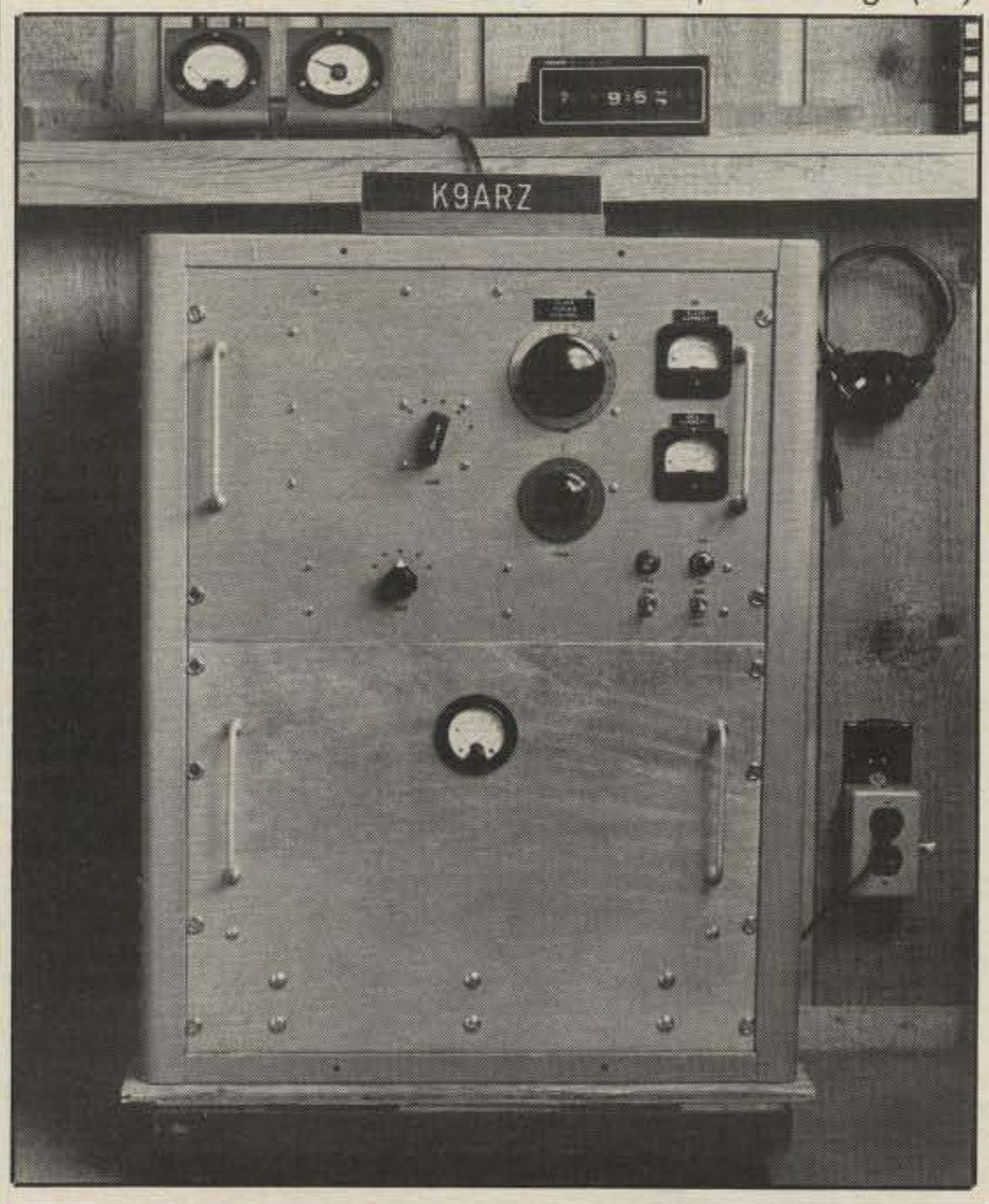
If I were the amateur reading this article instead of the person writing it, I would probably be asking, "Why another linear amplifier circuit using 813 tubes?" The circuit could be designed around the T160L/572B tube. It is an excellent tube for grounded grid service and a bit more up to date than an old pentode like the 813. If one really wanted to get with the state of the art, there is a newer family of triodes available from Eimac that will provide a higher plate dissipation and require less drive. Even the surplus market has more modern tubes, such as 4-400As and the like, that could be used.

*1320 Fox Glade Ct., St. Charles, IL 60185

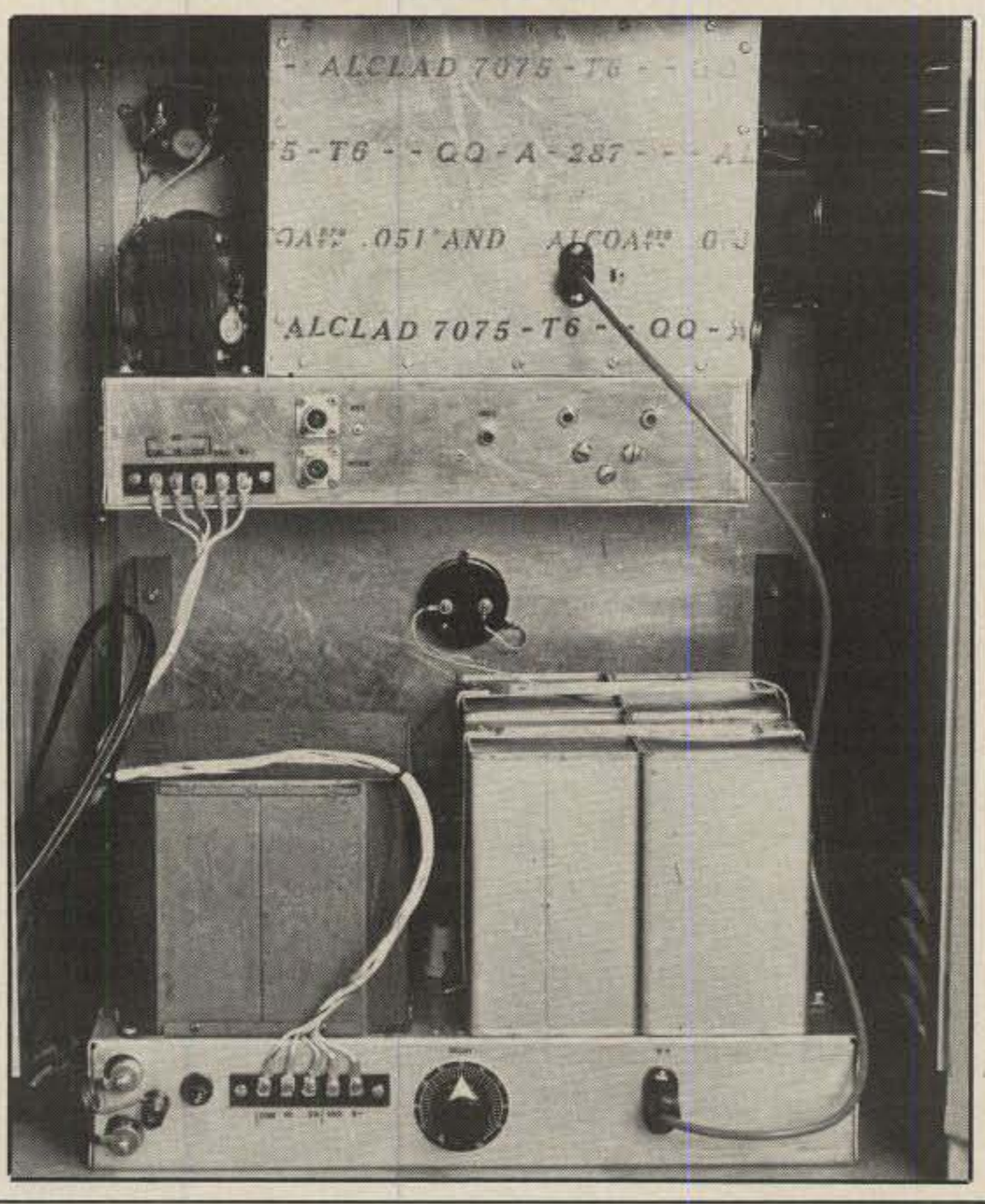
I designed around 813s because I just like the old tubes. They remind me of my mentor and "Elmer," the late William Nolan, W9TQL, who used a pair of 813s in a Class-C grid-driven circuit that purred like a kitten (and those weren't parasitics either). Even his QSL cards were permanently imprinted with "Pair 813s—800 Watts." Well, to say the least, this young neophyte of 15 years was impressed. Once Bill even did the unthinkable: with key down, he pulled an arc off the plates with a **(definitely not recommended)**, which left me (and fortunately not him) speechless.

Since that time I've designed amplifiers around a number of different tubes such as 811As, 4E27As, 4-400s, 4X250Bs, PL6580s, and even the *king* of tubes, the 4-1000A. But for some

Front view of the pair 813s amplifier rack. Despite its archaic appearance, an advantage of the "dolly mounted" cabinet is the amplifier does not take up desk space and can be easily accessed. Meter on the lower deck monitors plate voltage (EP).



Rear view of the rack cabinet which shows the attention given to adequate shielding of RF circuitry. Relatively light-gauge wire is used for interconnection because none of the lines carry "high current." The adjustment on the rear panel of the power supply sets the time delay for the inrush current protection circuit.



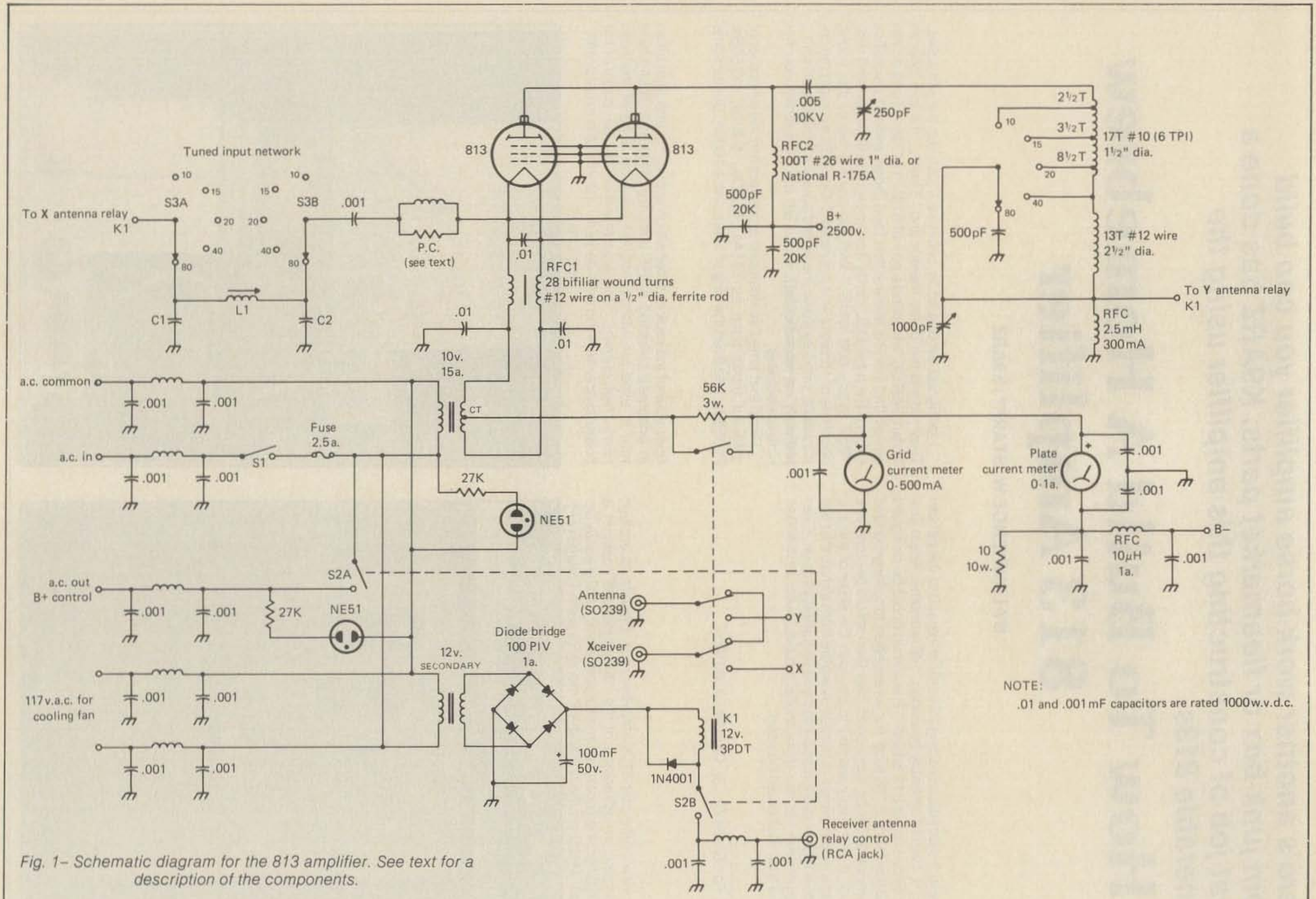


Fig. 1– Schematic diagram for the 813 amplifier. See text for a description of the components.

NOTE:
.01 and .001 mF capacitors are rated 1000 w.v.d.c.

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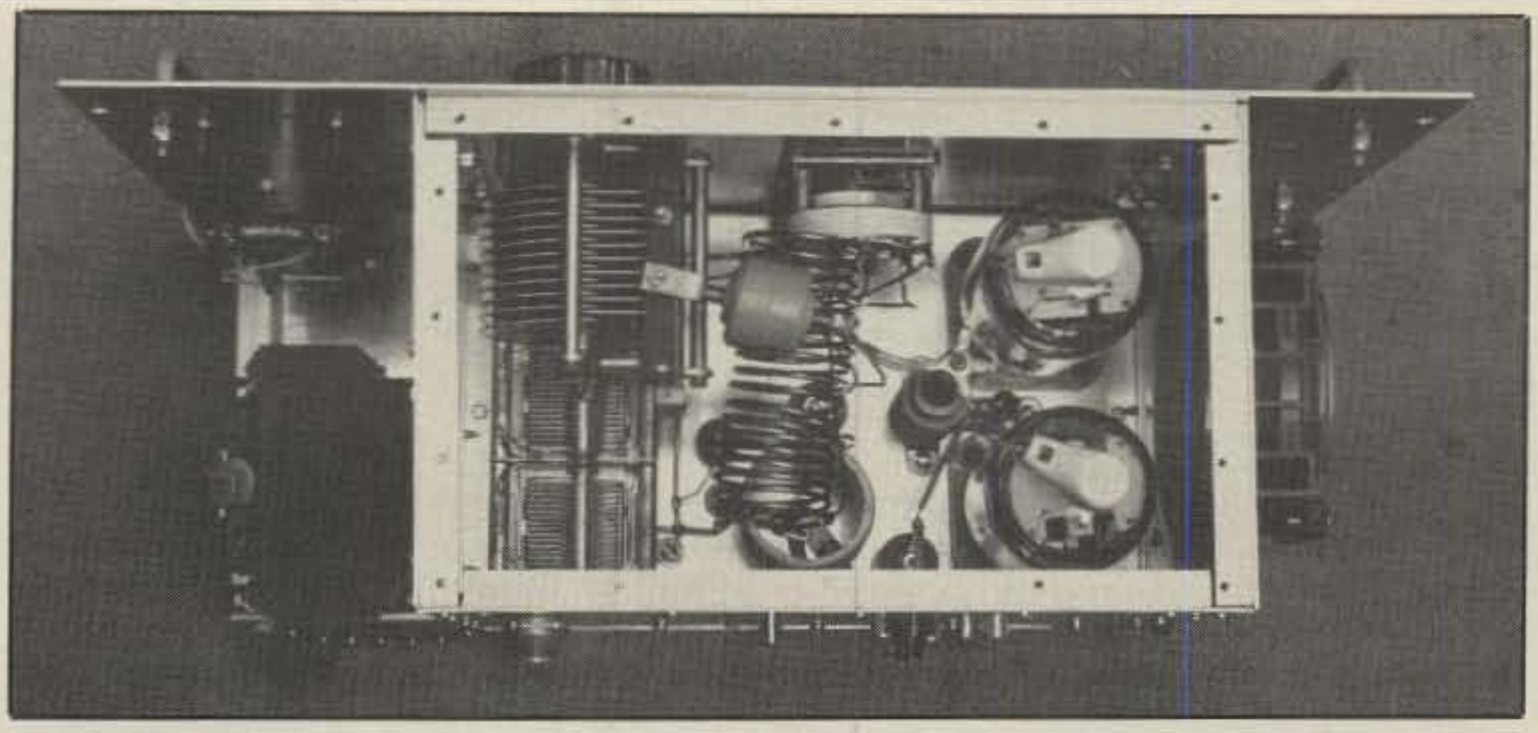


Inside view of the RF deck. Note the positioning of components to provide for short lead lengths in the output circuit. The filament transformer and meters are placed outside the RF enclosure to preclude the need for additional shielding of these components (connecting leads are filtered and by-passed).

strange reason I keep coming back to the 813. The tube has an interesting history. It was the JAN 813 that helped to win the war (WW II). The 813s were used in the Army-Air Force ART-13 (built by Collins Radio), commonly found in the B-17 bomber. They also used 813s in Navy shipboard transmitters such as the venerable GO-9. The 813 is a rugged tube; you can run the graphite anodes cherry red and they just keep on working. And one of the greatest features of the tube is that you can still find them at fleamarkets for a couple of dollars each. Even if you buy them brand new (a few companies such as Phillips of Holland still make them), they'll cost less than $50.00 each.

The Circuit

There is nothing new or exotic about the circuit design. It is a basic zero-bias grounded grid circuit which is cathode driven, using the 813 with its grids tied together to configure as a triode. A 3 watt carbon resistor is wired in series with the cathode (DC) return to B –, to bias the tube to cutoff (zero idling current) during standby. An auxiliary set of switch contacts on the antenna relay is used to short out the biasing resistor during the transmit mode.

The operating parameters were gleaned from Bill Orr's *Radio Handbook* (see notes). The operating conditions are as follows:

Plate Voltage: 2000–2500 VDC
Plate Current: 200 ma
Fil Voltage: 10 volts at 5 amps
Input Impedance: 270 ohms
Drive Power: 11 watts
Grid Current: 50 ma
Output Power: 270–350 watts
Plate Impedance: 5000–7000 ohms (depending on Ep).
The design parameters are for a single tube in grounded grid configuration and would have to be adjusted for paralleling of tubes.

The Output Tank Circuit

The plate tank circuit was also designed with the help of the *Radio Handbook*. With a design plate voltage of approximately 2500 and a pair of 813s, the plate impedance should fall in somewhere around 3500 ohms. Using Orr's charts, a 3.5–4K plate impedance would require the following plate tank circuit values:

Band	Plate Tune C	Load C	Induct. L
80 m	130 pF	580 pF	17 uH
40 m	64 pF	290 pF	8.5 uH
20 m	32 pF	145 pF	4.2 uH
15 m	21 pF	97 pF	2.8 uH
10 m	16 pF	72 pF	2.1 uH

If you are adept at working the formulas, you can design your own inductors in a band-switched arrangement, or simply use a B&W 850A commercially manufactured tank coil unit. The plate tuning capacitor can be an air variable such as a pull-out from a surplus BC-375 Tuning Unit (some of the values go up to 160 pF and will handle up to 3 kv). If you can find one cheap, a 250 pF vacuum variable would be preferred because its minimum capacity is usually lower than air variables and presents a better LC ratio at 10 meters. I've used both types successfully.

Tuned or Untuned Input

If you plan to use the amplifier with an older tube-type exciter or transceiver, you may opt to leave out the tuned input network. Of course, by doing so you would sacrifice the ability to reduce input waveform distortion. Should you decide to eliminate the tuned input, make sure that you leave the series blocking (coupling) capacitor between the input parasitic choke and point '**X**'.

Keeping the tuned input network in the circuit will allow for a lowered SWR between the exciter and the amplifier (important when the exciter has solid-state finals), it will provide more drive to the 813s, and as mentioned before, it will reduce input waveform distortion. The tuned input network was borrowed from an amplifier circuit in the *Radio Handbook* called the "KW-1." Although the KW-1 uses a single 8875, the input circuit worked well with the 813s and is similar to the tuned input used in Heathkit's SB200. The circuit is a simple Pi or L network designed for each of the five most popularly used bands. The values are as follows (the input coils are wound on ⅜" diameter slug tuned coil forms):

Band	C1	L1	C2
80 m	none	24T#16 ena.	470 pF
40 m	510 pF	17T#16 ena.	310 pF
20 m	360 pF	9½T#18	200 pF
15 m	none	4½T#18	75 pF
10 m	none	3½T#18	68 pF

Some adjustment of slugs and/or capacity values may be necessary to achieve resonance or minimum SWR between the exciter and the amplifier. Ideally, 1000 WVDC mica capacitors should be used in the input circuit, but I used 600 WVDC disc-ceramics without encountering any problems.

The input parasitic choke (P.C.) is made by winding about 7 turns of the #16 enamelled wire over a 100 ohm, 3 watt carbon resistor. With this P.C. in series with the input line, no parasitics have been encountered, even though no parasitic chokes are used in series with the plate leads.

The plate RF choke is not especially critical. In one of the prototype amplifiers a National R-175 choke was used and worked quite well. When building the second amplifier, I wound my own using an epoxy cylinder about 1 inch in diameter and about 5½ inches long wound with about 100 turns of #26 enamelled wire.

Other Values

In order to achieve good harmonic suppression, most below-chassis leads were run with tinned-copper braid covered teflon wire with .001 mFd disc ceramic capacitors at each end. This is especially important for leads that exit the shielded sections of the amplifier. The shielding of the leads should be grounded to the chassis as often as possible. AC and other leads running in and out of the RF deck pass through Pi-filters composed of a

.001 mFd capacitor at each end of an inductor wound with 17 turns of #16 enamelled wire approximately ¼ inch in diameter. The #16 wire is sufficient, because no high-current AC passes through the filters.

Plate by-pass capacitors as well as the 80 meter auxiliary loading capacitor (switched in by the band switch) are 500 pF, 20 kv television-type doorknob capacitors. The plate blocking capacitor is a 5000 pF (.005 mFd) 10 kv type which I located at a fleamarket.

If difficulty is encountered in obtaining a suitable 10 volt filament transformer for the 813s, do not give up; it is possible to wire the tube filaments in series without any other changes in the circuit. The first amplifier circuit I constructed used three 813s with their filaments wired in series and powered by a 30 VCT 6 amp transformer that I salvaged from a defunct battery charger. The center tap of the 30 volt transformer was connected through the metering circuit to the B– line as with the 10 volt system. Looking through some of the popular surplus catalogues, I ran across several transformers with secondary values of 22 and 32 volts (ideal considering the voltage drop across the filament choke).

The Power Supply Circuit

The power supply is not very critical. Any supply capable of from 2200 and 3000 volts dc at 500 ma will work well with the 813s. If you do not plan on carrying on marathon QSOs or rigorous contest operation, a transformer with a lesser current rating could be used. With intermittent SSB and CW operation, a 50% duty-cycle design is reasonable.

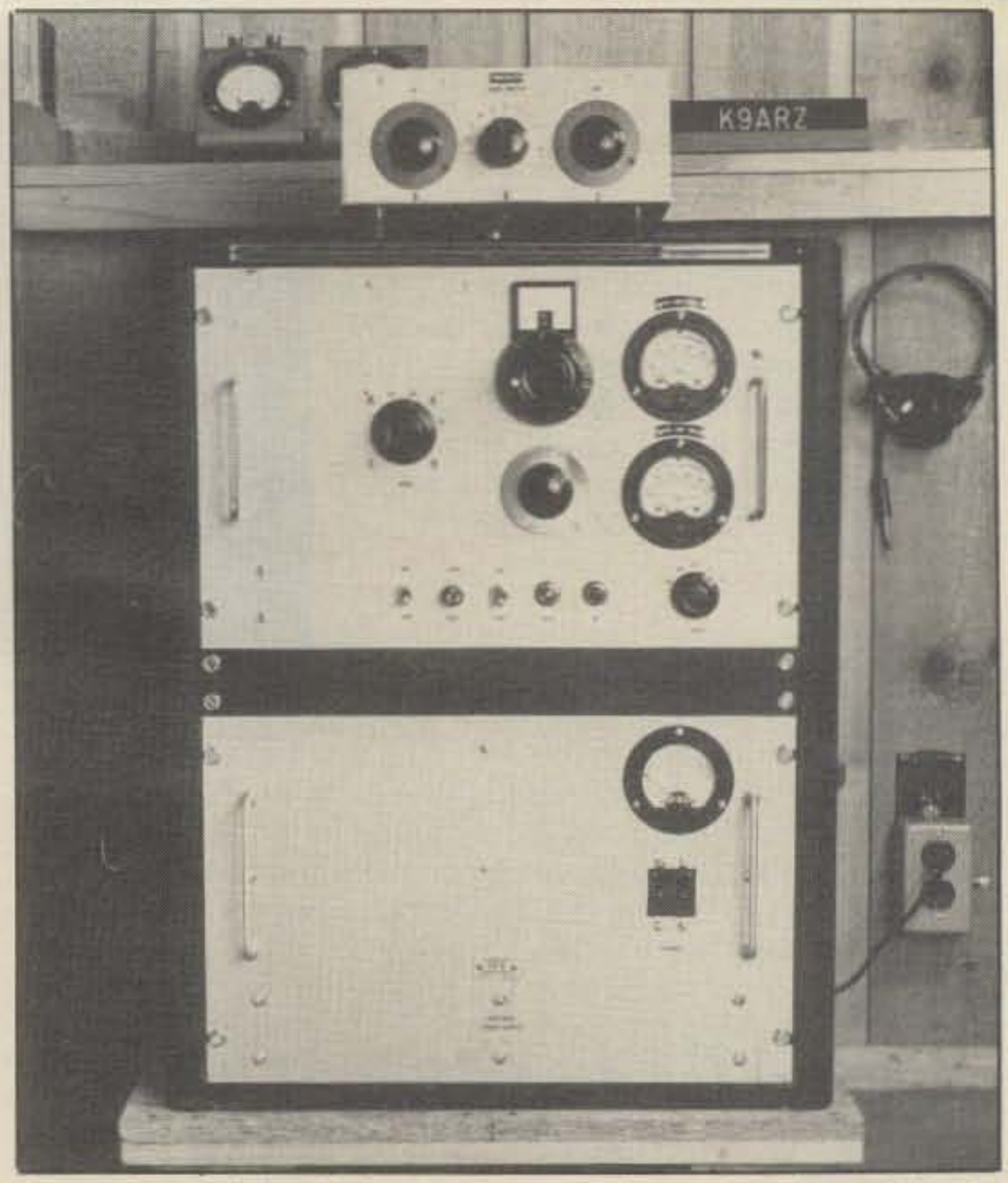
There is a myraid of suitable power transformers available on the surplus market, but I would suggest the following secondary voltage values for optimum performance:

1. For a full-wave center-tap design look for a secondary voltage of 4400 volts RMS at 500 ma with a center tap (2200-0-2200).

2. For a full-wave bridge-rectifier design 2200 volts at 800 ma RMS will be more than adequate. (A center tap is not necessary.)

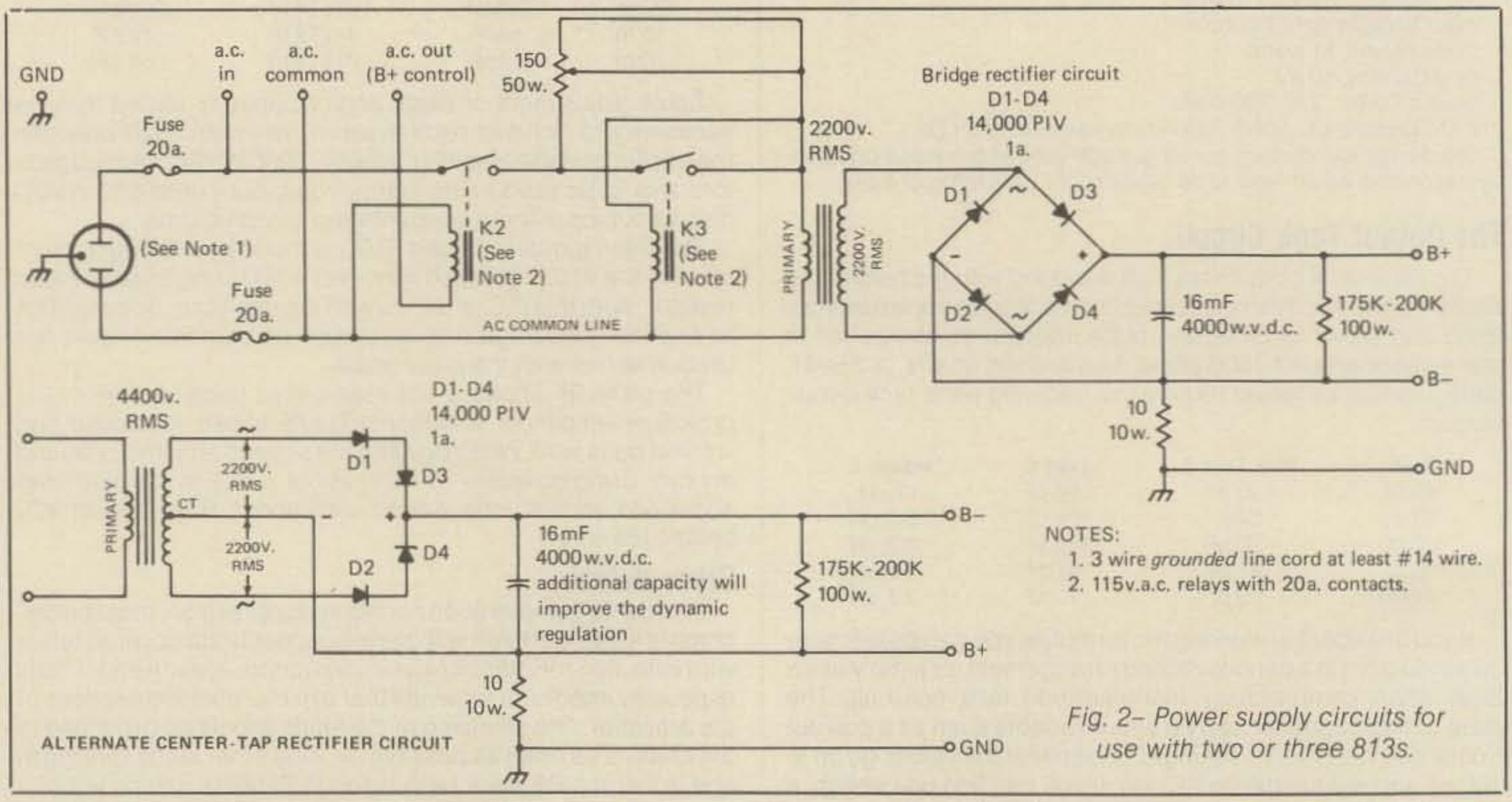
It is possible to "get by" with transformers without as high a current rating, as mentioned previously, but under stress they may fail or run *very* warm.

The diode rectifiers used in the prototype amplifier power supplies were large solid state silicon types such as those advertised in many of the amateur publications. Ideally, a PIV (Peak Inverse Voltage) rating of 14 kv at 1 ampere should be used.



Front view of the higher power version using three 813s in grounded grid. The turns counter is used in conjunction with a Jennings vacuum variable plate tuning capacitor. The turns-counter dial assembly is available from R.H. Bauman Sales, P.O. Box 122, Itaska, IL 60143.

The sample power-supply circuits provided include a provision for inrush current protection for the silicon diodes. This is accomplished by placing a relay in series with the primary of the high-voltage transformer. A variable resistance in the form of a 150 ohm 50 watt rheostat is wired across the relay con-



NOTES:
1. 3 wire *grounded* line cord at least #14 wire.
2. 115v.a.c. relays with 20a. contacts.

Fig. 2– Power supply circuits for use with two or three 813s.

tacts, and the relay field coil is wired in parallel with the high-voltage transformer primary. The rheostat is adjusted for a suitable time delay to allow the filter capacitors of the power supply to charge prior to full application of primary voltage. Another relay is used in series with the primary line to allow for remote control of B + switching when the amplifier in-out switch (S2) is activated. Both relays should have 115 VAC coils and contacts rated at 20 amps. **Remember that when working with any high-voltage power supply, THEY CAN BE LETHAL. All the necessary precautions should be taken to avoid contact with the high-voltage circuitry.**

Shielding

You may have noticed while studying the schematic that great care was taken in providing for adequate by-passing and filtering of all leads exciting the RF deck. If the filtering measures are to be of any value, it will be necessary to properly enclose the amplifier section with an RF-tight enclosure. If you have never built an amplifier or high-powered transmitter, you would be wise to read the sections of the *Radio Handbook* that deal with RF shielding. In both of the prototype amplifiers, the meters were placed *outside* the RF enclosure and were wired to the circuit with shielded leads with by-pass capacitors at each end. This eliminates the need to shield the meters. If you use a muffin fan (recommended) to cool the tubes, be sure to shield the opening with a good RF-tight material which will not impede the air flow, such as copper or aluminum window screening. The screening should be bonded to the RF enclosure with plated machine screws, washers, and nuts as least every 1½ inches.

Alignment

After checking all circuitry for possible short-circuits, a dummy load and a good ground should be connected to the amplifier. With an exciter connected (typical 100 watt transmitter or transceiver), test the antenna relay circuit by keying the microphone of the exciter with **NO** drive applied (make sure that you have first connected the MOX control line to the external control relay contacts of your exciter). Then with drive applied, try resonating the plate circuit on each of the bands. This will be indicated by maximum RF output into the dummy load through the wattmeter. If you do not obtain resonance, it may be necessary to adjust the coil taps a turn one way or the other. Once you have the proper settings, you should see an output of approximately 500–600 watts for two 813s or 900–1000 watts if you use three 813s.

If you have insufficient drive, place an SWR bridge between the exciter and amplifier and adjust the input coils for MINIMUM SWR and MAXIMUM DRIVE as indicated on the plate and grid current meters. If using two 813s optimum efficiency should be realized when the key-down (CW) plate current reads about 400 ma (on the 0–1 A plate meter), and the grid current reads about 100 ma (on the 0–500 ma grid meter). If the grid current reads too high, slightly raise the antenna loading control (without re-dipping the plate), and the grid current should drop to its optimum value. If you do not keep the grid current *low*, undesirable harmonics and waveform distortion may result.

The prototype amplifier with three 813s has been in operation at my QTH for over two years, and I have yet to experience a problem with it. It was cheap to build, and I am now near completion on another. And as Lew McCoy, W1ICP, once said, ". . . the watts out (from a homebrew amplifier) are just as useful as the most expensive amplifier you can buy."

Notes

McCoy, Lew, W1ICP, "The Junker Amplifier," *Q*. October 1970, pp. 25–28.

Orr, William, W6SAI, *Radio Handbook*, 20th Edition, Editors and Engineers (Pub1.), Indianapolis, 1975, pp. 7.23, 11.33, and 22.13–18.

Photos by Glenn A. Hansen Photography, 311 Fairview Avenue, West Chicago, IL 60185 (1-312-293-5042). CQ

Although CW is like poetry to some amateurs, you don't have to be a poet to understand how to use iambic keying. W9KNI takes us through iambic and non-iambic techniques with a paddle and keyer.

Paddle and Keyer Notes On Current Amateur CW Technique

BY BOB LOCHER*, W9KNI

The most widely utilized method of forming Morse CW characters on the amateur bands today is undoubtedly the combination of the paddle and the keyer. The ease, speed, and accuracy of this combination make it, for most amateurs, the ideal vehicle for hand-formed CW. Properly used, the paddle and keyer help the operator send perfect CW smoothly and at speeds not possible with any other method of hand-sent CW.

In spite of worldwide usage of the paddle-keyer combination, there is little standardization on methods of interconnection, little on hooking up the equipment, and virtually nothing in the way of literature selection or proper usage.

Although there is no absolute standard, most operators hook up a paddle so that the thumb sends dots and the fingers send dashes. The wire between the paddle and the keyer is usually a shielded, two-conductor cable, and the shield is used for the ground return, providing some shielding from transmitted RF. A quarter inch stereo plug is generally used to plug the paddle into the keyer, and the tip of the stereo plug usually carries the dot side.

Two types of paddles are used today—iambic and non-iambic. Iambic paddles are also sometimes called twin-lever or dual-lever paddles, while non-iambic paddles are referred to as single-lever paddles. Though these two types of paddles often closely resemble each other, depending on the design, usage and technique can be very different, and those operators using one type often find it difficult or impossible to use the other.

In a single-lever, non-iambic paddle dots are formed by moving the paddle to one side, while dashes are formed by moving the paddle to the other side. Since the paddle is a single-lever type, it is impossible to close both the dot and dash circuit at the same time.

In the iambic style of paddles one lever or side is pressed to send dots, while the other side is pressed to send dashes. However, it is possible and practical to close both the dot and dash circuits at the same time. This feature, when used with a keyer designed to take advantage of the ability of the paddle to close both circuits simultaneously, allows the operator to form some characters with significantly less wrist and hand motion. This added feature makes iambic keying desirable for those who learn the techniques.

Thanks to the low cost of modern microcircuit components, virtually every keyer offered today is fully iambic and can be used equally with iambic and non-iambic paddles. The features of an iambic keyer are of value to both iambic and non-iambic users alike.

For the non-iambic user, the dot-memory that is a necessary component of iambic keying offers enlarged timing tolerances, making the non-iambic operator's CW more accurate. For example, the letter "K" in Morse, dah-dit-dah, is formed on a single-lever paddle by closing first the dash side, then the dot side, then the dash side. However, for the character to be properly formed by a keyer lacking dot memory, the dot must be initiated by the operator during the space following the dash, and held until the dot actually starts forming. To do this properly requires rather accurate timing, more difficult at higher speeds.

If the keyer has dot memory, the timing tolerance for closing the dot circuit is greatly enlarged. Now at any time during the actual transmission of the dash or the following space the operator can close the dot circuit momentarily. The keyer will hold a dot instruction in dot memory until the dash and the space following are completed. Then the keyer will send the dot, regardless of whether the paddle is closing the dash circuit or is at rest.

The advantage of the iambic technique, as mentioned before, is the reduced motion needed to send many characters, particularly the so-called iambic seven, which are the letters "C," "F," "K," "L," "Q," "R," and "Y."

The classic example of the advantage of iambic techniques in sending is the two letters "C" and "Q." In conventional single-lever paddle usage the operator hits the dash contact, then moves the lever to the dot side, back to the dash side and again to the dot side, pauses for the letter space, then goes to the dash side, waits for two dashes, then hits the dot side and returns to the dash side.

The iambic operator, on the other hand, squeezes the two paddles, being sure that he closes the dash side first. The keyer thus starts with a dash, and, as long as both paddles are held closed, automatically sends dashes interspersed with dots until the operator releases the paddle. Therefore, at the start of the second dot the operator releases the paddle, the "C" is completed, and the operator waits a letter space before starting the letter "Q."

The "Q" is started by holding the dash side of the iambic paddle closed, and once the second dash has started, just flicking the dot paddle closed momentarily, while continuing to keep the dash circuit closed. After the end of the second

*1445 Northwoods Circle, Deerfield, IL 60015

dash, the dot memory of the keyer generates the dot, and then the dashes resume. The operator must release the paddle after the dash starts, allowing the "Q" to be completed.

Notice, then, that to send a "CQ" iambically requires only a properly timed and started squeeze for the "C," and holding down the dash paddle with a kiss of the dot circuit for the "Q." Compared to the back and forth movements needed on the single-lever paddle, one can see how much more economical of motion by the operator the iambic paddle is, and this leads to more comfortable and faster keying and often better accuracy.

Many operators who have had experience using bugs find the conversion from single-lever paddles to iambic paddles and iambic techniques very difficult due to habits picked up using bugs that are incompatible with iambic techniques. This is especially true of operators trying to quickly learn to key iambically. I went through just such an experience, and it was months before the conversion was complete.

For the operator wishing to convert from a single-lever paddle to a double-lever paddle a few tips might be helpful. First, once you have made the decision, stick with it. Unhook the old paddle, put it away, and do not use it again. The techniques of iambic keying are incompatible with it, and going back and forth between paddles will make for an impossible situation.

Then, with the new paddle hooked up, do *not* try to learn iambic techniques; just concentrate on sending CW. The first day or two may be difficult, and practice should be confined to the monitor of the keyer, not on the air, until you begin to be comfortable with the new paddle. Once you are able to send CW without excessive mistakes, return to normal operating. But do not try to use iambic techniques; given a bit of time they will come naturally.

One day your subconscious will realize that sending a CQ the old way is silly with iambic techniques available, and you will start slipping into the iambic mode. Then you will probably go through a stage in which you try to send everything iambically, including letters for which the technique is inappropriate. Once you have that habit under control, the conversion will be complete.

Is the pain of the conversion worth it? For me it certainly was. Keying is easier, more fluid, and faster. But for some people who have been using single-lever paddles for years, it may not be. And after all, amateur radio is a hobby; the conversion will only be worth it if it gives dividends in operating pleasure. If it won't, then don't try it. If you never go over 20 or 25 words per minute and have no desire to do so, then the conversion likely will be of little value to you. However, if you aspire to 40 or 45 words per minute, iambic sending will make your goal more achievable.

The term *iambic* puzzles many amateurs. A look into most dictionaries does nothing to dispell the confusion. In fact, the term *iambic* is derived from poetic meter, or rhythm. In poetry an iambus is a pair of syllables, the first unaccented, the second accented. The iambus is equated to a foot in poetic meter, and is the basic unit of poetic rhythm and timing. Different forms of structured poetic verse use different rules of timing, with a common form being, for example, iambic pentameter.

Iambic pentameter calls for lines of poetry each five poetic feet long, and would be expressed by a poetry teacher interested in demonstrating it as "dit-dah dit-dah dit-dah dit-dah dit-dah" with inflections on various of the couplets to emphasize his or her timing. This sounds remarkably like a ham's idea of five "A's" being expressed in Morse code, and in fact is similar to what comes out of an iambic keyer when both paddles are closed: dit-dah-dit-dah-dit-dah, etc. That, then, is how iambic keyers and iambic paddles acquired the name.

If you are a recent newcomer to CW, or if you have never used a bug or a single-lever paddle, by all means start with an iambic paddle and keyer. You will have no habits to unlearn, and you will find iambic techniques easy to learn and satisfying.

For those operators using iambic techniques, there is one other choice which must be made, between, as Curtis Electro Devices puts it, type "A" and type "B" timing. The difference is subtle but very real, and operators used to "A" timing cannot send properly on a keyer with "B" timing, and vice versa.

Commercially, only keyers using the Curtis 8043 or 8044 chip are available with the "A" timing pattern, but the 8044 chip is also now offered with a "B" timing pattern. Although either pattern is perfectly valid, the author recommends "B" timing if an initial purchase is being contemplated, as there are far more keyers, including all current programmable memory keyers, using the "B" pattern. In any case, the problem only exists for operators who actually use iambic keying techniques.

If you use iambic techniques and wonder how to tell the difference, try sending a "CQ" on the keyer in question. If you get it without error, the timing is the same as you are used to. If you are a type "B" operator, and the keyer is a type "A," you will get a "KG" or possibly a "KQ." If you are a type "A" operator, you will get an extra dash at the end of your CQ.

Modern paddles and keyers add a great deal of pleasure to CW operating for those who know how to use them. I hope that this article will help others find out how pleasant CW can be. CQ

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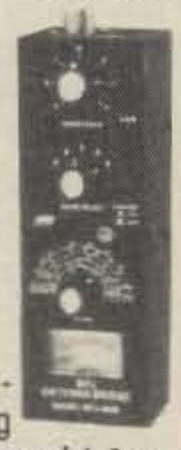

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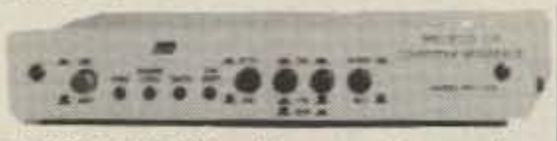

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CIRCLE 31 ON READER SERVICE CARD

Lou, W2ZZ/CT3 (left), and Martti, OH2BH/CT3BZ. Their stations jammed each other, and in the very best Top Band Ham Spirit, Lou dropped out so Martti could become world-high scorer.

Crew of world-high CW multi-op station GW3YDX. (L-R) G3WPF, G4OBK, and GW3YDX holding baby Alice. Theirs was the second highest world-wide score. Teamed up with G3RTE, GW3YDX was third world-high multi-op on phone.

This nice Caribbean J73D CW multiplier was on far too briefly.

SP7AW at CW multi-op SP7KTE. This was the highest scoring station in Poland.

His first try gets ND4Y the Kentucky CW contest certificate.

Results of the 1986 CQ 160 Meter CW and Phone DX Contests

BY DONALD MCCLENON*, N4IN

Conditions were about normal for the CW contest, and were well below normal for phone, especially the second night, with very high QRN in the southeast U.S. The big CW scores ran higher than last year, and the big phone scores were lower. There were less total stations active in both modes, or our system of weeding out DUDs and phonies has improved. There were 4905 valid CW participants and 5556 on phone. Many of these either improved their stations or put in more time to produce so many good scores. We received 628 CW and 308 phone logs.

Last year's lecture on getting calls correct did not produce any improvement. Almost any logical combination of numbers and letters may now be assigned to someone, so if you switch one character, you still have a callbook-listed call, but one not worked by anyone else in the contest, and usually not in the state you recorded. Most contestants have no idea how bad some logs can be. A lot of detective work, judgment, patience, and *time* is required to be fair to all.

CW Contest—January

All 50 states, 11 provinces, and 108 countries were active. No valid VO2 or VE8 stations were reported. PEI, VY, and perhaps SD were among the rarest. Any of the following active prefixes were good catches for W/VE: all Russians, CO, CX, EA6, EA8, EA9, FP, GD, GJ, GU, HL, IS, IT, J3, J7, JW0, KH2, KP4, LA, LX, OH0, OY, P29, PZ, T7, TF, TK, VS6, XX9, ZB, ZS, 4U1I, 5B4, 9H1, 9L1, 9M2, 9Y4. There were 15 more countries on than last year.

The following number of active stations were reported from each country having over ten:

Country	Stations	Country	Stations
W	2196	SP	23
OK	302	F	21
JA	301	Y	19
UA	297	UC	18
DL	274	SM	16
G	266	UQ	16
UB	225	EA	15
VE	120	OE	15
UA9	115	VK	14
YU	53	LA	13
I	40	LZ	12
PA	40	OZ	12
GM	28	UL	12
OH	27	UP	12
UR	27	GW	11
HB	25	Others	340
		Total	4905

*3075 Florida Ave., Melbourne, FL 32904

KJ0H wins the first-place Iowa CW certificate with 100 watts to a dipole.

Single operator Martti Laine, OH2BH, operating CT3BZ, set a new record world-high score of 732,354 points. No one could beat an excellent op in an excellent location, where most of his QSOs were 10-pointers. Second world high was multi-op GW3YDX at 552,126, far above his last year top-spot score. Also above last year's top were single ops W1CF (WA2SPL Op.) 486,591; G3SZA 439,461; K5NA 423,600; AA1K 414,953; VE3BVD 390,780; KT3M 388,833; and W1BIH/PJ2 377,225. Single VE6OU/VE3 320,489; multi YU1EXY 306,852; and single W3BGN 303,042 complete the list of over 300K scores. Top 10 scores in the W/VE Single Operator, DX Single Operator, and World-wide Multi-Operator categories are shown in the score boxes.

QSO leaders were AA1K 998, W1CF (WA2SPL Op) 987, KT3M 925, K5NA 917, VE3BVD 864, GW3YDX 846, N9MM 843, W8JI 800, K9RS 795, N5RZ 793, W0AIH 773. Outside W/VE QSO leaders were GW3YDX 846, CT3BZ 694, G3SZA 629, YU1EXY 579, YT2R 511, I2UBI 505. High contact totals outside N.A./EU were CT3BZ 694, W1BIH/PJ2 482, KH6RS 383, HK1AMW 322, UG6GAW 315, UL7MAN 312, EA9EU 311, 4X4NJ 279, UL7OB 278, UA9CBO 246.

Multiplier leaders were K5NA 120; AA1K, W1CF 119; KT3M 113; CT3BZ 106; VE1ZZ 105; K3ND, K3ZO, N4IN 103; W3BGN, GW3YDX 102; N4PN 100. Last year's top was 102. DX multiplier leaders not shown above were YU1EXY 84; EA3VY 80; W1BIH/PJ2 79; GM3IGW, YT2R 77; 4X4NJ, G3XTT 74; OK1KSO, YU3EA 73.

Countries worked leaders were GW3YDX 70; CT3BZ, K5NA 65; AA1K, G3SZA 63; W1CF 62; KT3M 58; YU1EXY 57; UR1RWX, UZ6LWZ 56; OK1KSO, UP1BWR 55. With Franz Josef Land being such a rare and exotic multiplier, a special tribute goes to VE5UF for confirmed QSOs with *two* of them!

We are fortunate to have many new plaque sponsors this year. Sponsors and trophy winners for both modes are shown in the special plaques box. Single and multi-op winners in each state, province, and country will receive *CQ* certificates.

Phone Contest—February

Just the opposite of last year, most found the first night much better than the second, but it was not a very good DX weekend. Not many worked all states, but there were a number of active stations in all of them. KL7 and KH6 were usually the toughest. PEI, VE6, and VY1 were on but not worked by many. No valid VO2 or VE8 was recorded. From a W/VE standpoint the following would be good catches from the 94 active countries: all Russian prefixes, C31, EA6, EA8, EA9, EI, GD, GU, HC, HH, HK0, IS, IT, J3, KP4, KX6, LU, LX, PJ2, PJ7, SV5, SV9, T7, VU, YK, ZP, ZS, 5B4, 9H1.

The following numbers of active stations were recorded from each country having 10 or more participants:

Country	Stations	Country	Stations
W	2560	UQ	21
UB	742	HB	19
UA	700	SP	18
G	400	PA	17
VE	187	SV	16
UA9	131	GM	15
I	91	UI	14
DL	54	HK	13
OK	54	OH	13
UP	41	UF	13
UL	38	UM	12
UC	35	LZ	12
YU	27	UO	11
OE	26	UR	10
EA	23	Others	238
GW	22	Total	5556

Poor conditions kept the big scores well below those of last year. Single operator Wally Stefanoff, LZ2CJ, has the world-high score of 279,258. The next 11 were as follows, with asterisks denoting multi-op stations: VE3MFA 210,648, K1ZM 209,757, W3BGN* 200,070, KC8MK* 199,342, WB9HAD 196,575, GW3YDX* 194,432, OK3KFO* 167,895, K1NG* 164,794, K9UWA 157,157, W0CEM* 155,960, VP9AD* 153,420. Top 10 scores in the W/VE single operator, DX single operator, and world-wide multi-operator categories are shown in the score boxes.

World-high QSO leader WB9HAD with 1171 was the only one to top last year's 1060 record. Following him were KC8MK* 1048, K1ZM 1012, W0CEM* 1007, K0HA 944, W3BGN* 930, K1NG* 893, K9UWA 887, LZ2CJ 832, W8RA* 825, WB3GCG 819, W0ZV 800. Again, multi-ops are starred. Outside W/VE, high QSO totals were LZ2CJ 832, OK3KFO* 708, GW3YDX* 569, UP1BWB* 510, VP9AD* 507, LZ2KPD* 451, LZ1KOZ 410. Outside N.A./EU, high contact totals were: UA9AKO 205, UA9MA 195, 4X4NJ 127, YV2IF 121.

Four less countries were on, and top multiplier leader W3BGN with 90 was 10 below last year's leader. Others with high multipliers were K1ZM 87; KC8MK 82; K1NG 79; K9UWA 77; AA1K, AA4MM 76; WB3GCG, WB9HAD 75; K3ND, N4IN, W0ZV 72. DX multiplier leaders were GW3YDX 64, YV2IF 63, LZ2CJ 61, VP9AD 60, XE1VIC 57, VP5Z 55, YU1AAO 51.

LZ2CJ with 55 countries was the only one to beat last year's 53 record. Following him were GW3YDX 48; YT2R 47; YU1AAO 46; IV4PRK 45; OK3KFO 45; PA3DFT 43; EA3CCN, I8CZW 42; LZ1KOZ 41. Best W/VE totals were W3BGN 35, AA4MM 32, K1ZM 31, KC8MK 27, K9UWA 26, AA1K 25, K1NG 24, WB3GCG 22. All are far below last year's levels.

Sponsors and winners for the old and several new trophies are shown in the plaques box.

Club Competition

Frankford Radio Club's 2.6 million point score was well ahead of all the others, up from second place last year. Yankee Clipper Contest Club was second with about half the leader's score. Potomac Valley Radio Club wasn't too far behind in third place. These were the only seven-figure scores. There were 66 reporting clubs, down from 78 last year.

Next Time

The CW Contest will be held the last full weekend of January 1987 (Jan. 23–25), and the Phone Contest will be held the last full weekend of February (Feb. 20–22). Send your large SASE to *CQ* with enough postage for the log and summary sheets you plan to use. You can make up your own logs with Universal or GMT, info sent and received, sequentially numbered multipliers as each is first worked, and claimed points. Indicate all your no-point dupes before sending in the log. There then is no penalty for them.

Include a summary sheet with your entry showing scoring and other essential information, and a declaration that all rules and regulations were observed. CW mailing deadline is Feb. 28, and March 31 for Phone. For best service, send logs to 160 Meter Contest Director Don McClenon, N4IN, 3075 Florida Ave., Melbourne, FL 32904 USA. They may also be sent to *CQ* 160 Meter Contest, 76 North Broadway, Hicksville, NY 11801 USA. Indicate CW or Phone on the envelope. Send good photos of your setup and/or operators. Photos can be sent well after log deadlines.

Enjoy the 1987 contests!

73, Don, N4IN

Soapbox W/VE CW

After losing three balloons, the wire made a good receiving antenna lying on the entire block of houses . . . *K8UNP*. Saturday night it sounded like a W4-only window . . . *KB5UL*. Didn't know chasing states would be so much fun . . . *WB5YOT*. Operation stopped when had to rush W6JTA to hospital with respiratory attack . . . *W6JU*. Exciting to have Franz Josef Land UA1OT call us, and to be called by a JA pileup . . . *W7XR*. Maybe some Pacific and Caribbean islands are too small for 160 meter antennas . . . *KS7T*. Appreciation for giving out WY multiplier makes it all worthwhile . . . *KB8KW/7*. Couldn't decide if band or chili was hotter; both were great . . . *K8AQM*. Heat in our

Plaques

Single Operator

CW

World by K5AAD. Winner: **CT3BZ,** operated by Martti Laine, OH2BH.

USA by N4PN (W0AW Memorial). Winner: **W1CF** operated by Joseph B. Krone, WA2SPL.

Europe by K4SB. Winner: **G3SZA,** Dave R. Wilson.

Asia by WD4RCO. Winner: **4X4NJ,** Riki Kline.

Phone

World by K5AAD. Winner: **LZ2CJ,** Wally Stefanoff.

USA by K4JRB. Winner: **K1ZM,** Jeffrey T. Briggs.

Europe by N4IN. Winner: **LZ1KOZ,** Plamen Nikolaev Ivanov.

Oceania by Dixie DXers. No entrant.

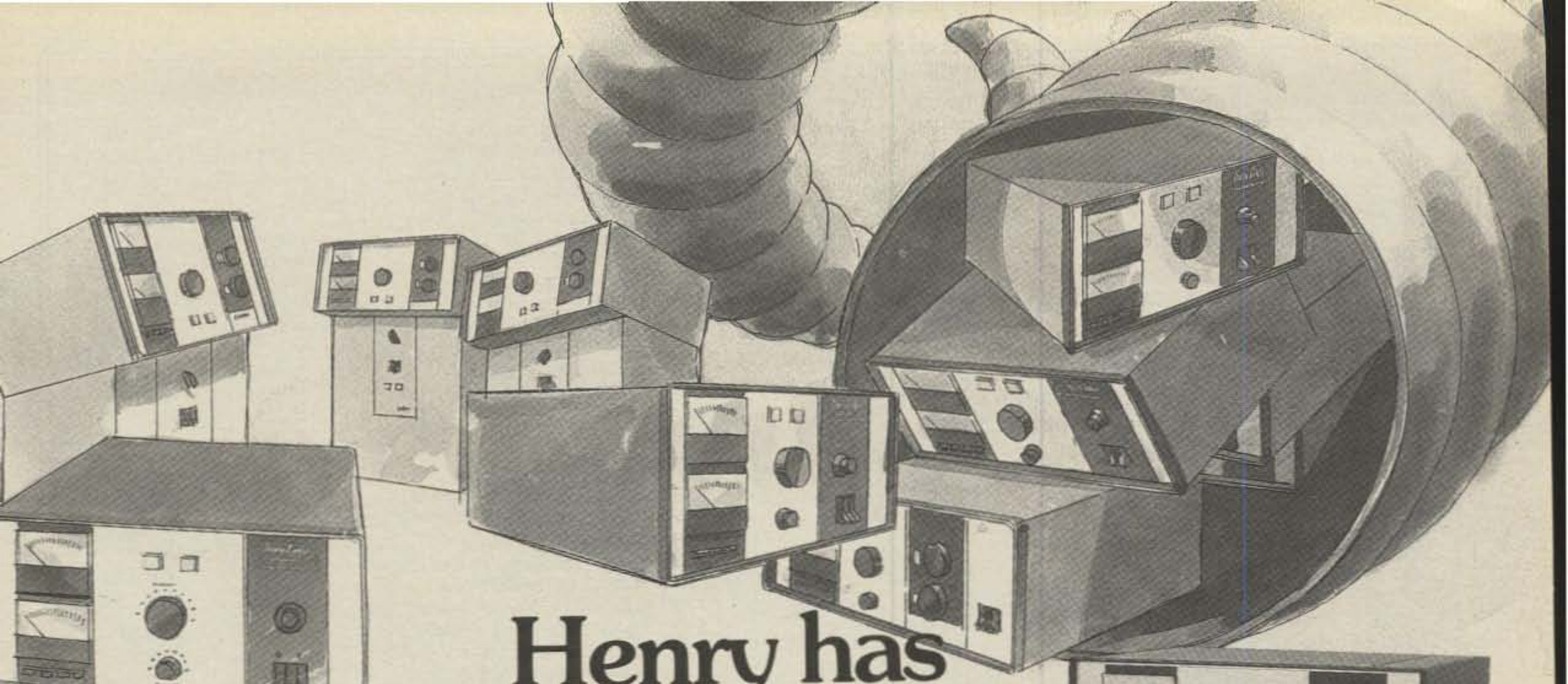
Multi-Operator

CW

World by N4RJ. Winner: **GW3YDX,** Ron G.D. Stone.

Phone

World by S.E. DX Club. Winner: **W3BGN,** Steven Sussman.



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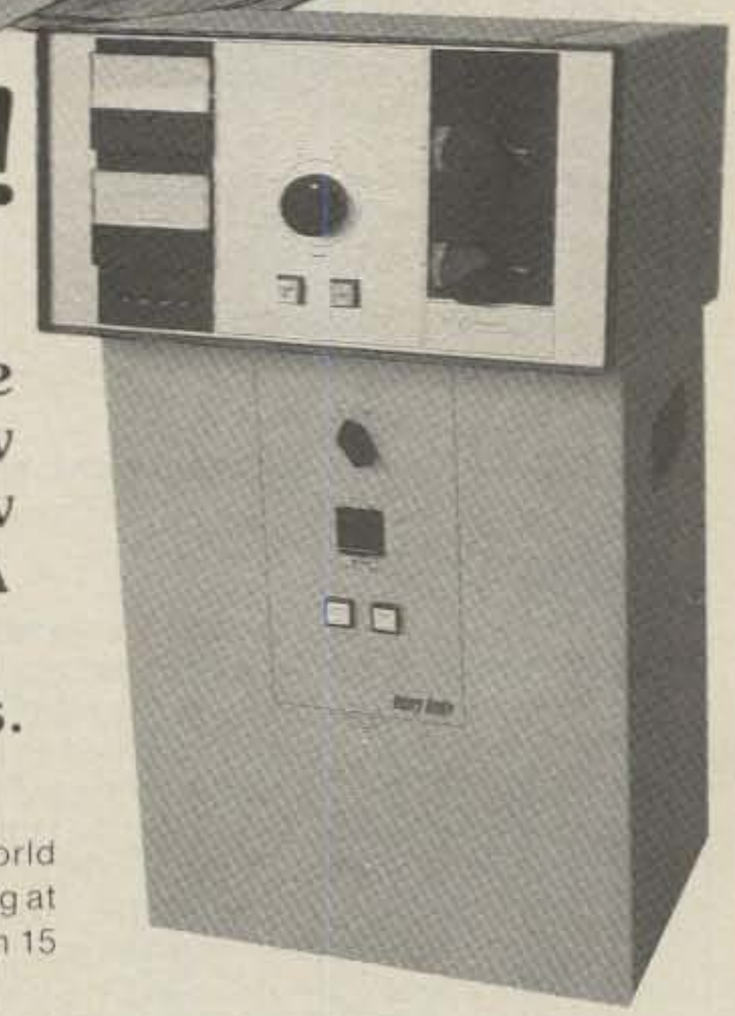

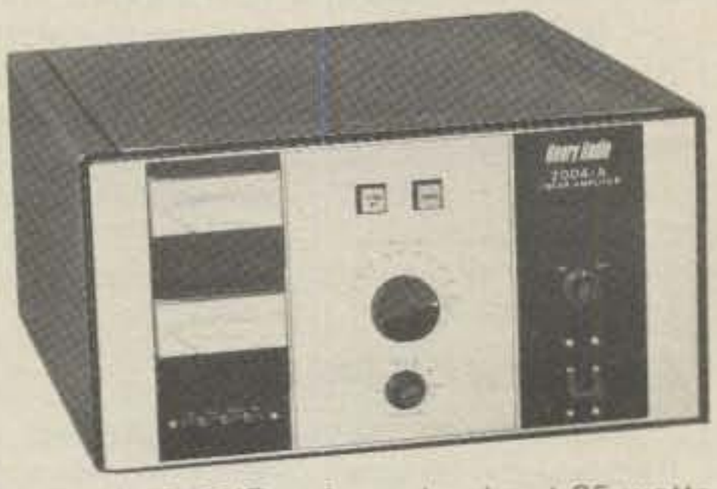

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Aggregate CW and Phone Club Scores

Total Score	Club Name	Top CW	Top Phone
2,624,799	Frankford Radio Club	AA1K	VP9AD
1,388,495	Yankee Clipper Contest Club	K5NA	K1ZM
1,236,484	Potomac Valley Radio Club	K3ZO	KC3EK
805,221	Southeastern DX Club	N4PN	N4NX
738,714	Downhill Contest Team	CT3BZ	—
677,361	Society of Midwest Contesters	K9RS	WB9JKI
666,970	Rubber Circle Contest Club	W7XR	K7QQ
512,286	Grand Mesa Contesters	KI0G	W0GOR
431,142	Northern Ohio Amateur Radio Society	W8JI	KC8MK
336,293	SP Top Band Club	SP7KTE	SP5INQ
325,680	Mile High DX Assoc.	W0ZV	W0ZV
315,078	Kankakee Amateur Radio Assoc.	W9AZ	WB9HAD
305,346	Radio Club RTV Zagreb	YT2R	YT2R
276,557	Dixie DXers	KN4B	KN4B
276,446	North Texas Contest Club	KC5DX	K5WXZ
219,055	Bavarian Contest Club	DL6RAI	DL7MAE
211,848	R. C. C. C.	KH6RS	—
210,633	Hoosier Contest Club	W9RE	W9RE
201,964	Kansas City DX Club	WA0TKJ	WA0TKJ
201,924	Mad River Radio Club	KS8S	N8ET
192,080	Lithuanian Contest Group	UP1BWR	—
184,204	Radio Club Omega	OK3KFF	—
176,535	Radioclub OV-Zvazarmu	OK3KFO	OK3KFO
156,804	Radioclub ZJF	OK1KSO	—
129,076	Radio Club Ivan Cankar	YT3T	—
123,965	North Alabama DX Club	AA4NU	AA4NU
123,251	Radio Club Senta	YU7JDE	—
108,843	Minnesota Wireless Assoc.	W0HW	W0HW
103,984	Central Arizona DX Assoc.	K7OX	—
102,663	Lakeway Amateur Radio Club	—	N4FNB
91,250	Radio Club Liaz	OK1KQJ	—
89,257	Bulgarian Contest Group	—	LZ1KOZ
84,759	San Diego DX Club	N6AW	—
81,260	Far Out Radio Club	W8IMZ	—
79,200	Central Arkansas DX Club	—	KB5DN
70,990	Eastern Iowa DX Assoc.	KJ0H	K0GVB/C6A
68,238	Radio Club Kolubara	—	YU1AAO
64,701	Fraser Valley DX Club	—	KA7AUH
63,910	Mississippi Valley DX Club	W0HBH	W0HBH
62,823	Viimsi Radio Club	UR2RHF	—
62,112	Radio Club OK1KKS	OK1KKS	—
56,891	Southern California DX Club	W6BA	—
41,972	Texas DX Society	K5GN	—
34,054	Petaluma Exprimenters	WB6EGE	WB6EGE
32,175	Radio Club Venezolano	YV1OB	—
31,800	Central Florida DX Club	N6AR	—
31,527	Kaunas Poly Inst. Radio Club	UP3BO	—
30,312	Knights of the Laid Table	IO2UIY	—
30,140	Radioklub DDR	Y24IB	Y28AL
23,424	Carolina DX Assoc.	—	AA4V
22,740	Riga Radio Club	UQ2GIP	—
22,644	Radio Club OK1KZD	OK1KZD	—
22,365	Gower Gulch Gang	—	N6LL
19,476	West Texas DX Assoc.	WF5E	WF5E
19,410	Utica Amateur Radio Club	NA2Q	—
19,025	Nagoya Univ. Radio Club	JA2YKA	—
17,745	University of Tokyo Contest Club	JA1YWX	—
16,695	Redwood Empire DX Assoc.	—	K6ANP
16,100	Stockport Radio Society	—	G4OBK
15,456	Northern California DX Club	W6BIP	—
14,320	Albany Amateur Radio Assoc.	K2QF	—
12,050	Radio Club OK2KHF	OK2KHF	—
9,018	Radio Club SZTM	OK5MVT	—
8,700	Radio Club Liptal	OK2KPS	—
6,132	Western Washington DX Club	W7IEU	—
990	Wilamette Valley DX Club	KA7FEF	—
370	Kettle Moraine Amateurs	N9KS	—

barn location was partly from the chili cauldron and partly from the rig . . . *W9AZ*.

Soapbox DX CW

Thanks to all who QSY'd from other bands to give us 2 points . . . *JA1YWX*. Changed outside loop transistors 7 times during icy night . . . *DF0THW*. K1ZM dropped in and shared operation. Made WAC in a little over 2 hours. First one took 20 years . . . *ZL3GQ*. This is the time of hard work and no sleep each year . . . *OK1KPU*. Strange conditions and nice people make a good contest, but hope HF reopens soon, so wierdos can go back home . . . *G3SZA*. Big honor to be first non-Finn to hold a top-band permit. It sounds a lot different from this end . . . *K8MN/OH2*. As a newcomer, enjoyed this band. Now working on 6-band DXCC . . . *RA6AR*. Best DX and good luck from Franz Josef Land . . . *UA1OT*. Can't work JA because of non-stop talking UB5 and UA3 SSB here . . . *UB5LCV*. Fun operating with computer support . . . *YU3EA*.

Soapbox W/VE Phone

Short-lived thrill to be called by KL7HIR, but then find out he was in Penna . . . *WB3GCG*. Twenty-nine Europeans Friday nite . . . *AA4MM*. Had a ball first time in this contest. Won't invite Murphy next time . . . *NW5E*. Line noise makes sure I don't need a dupe sheet . . . *WB5YOT*. Thirty inches of rain before contest ensured a good ground . . . *WB6EGE*. This got me hooked on 160 . . . *WA0LRJ*. The east coast doesn't seem to stay up for us. The winner may be the one with the worst case of insomnia . . . *KS7T*. Computer logging is the only way to go . . . *N9AKE*. Laryngitis caused several ops to address me (Margaret) as "OM" . . . *W0GOQ*. Condx so poor, couldn't even hear WWV to find out how bad . . . *VE5UF*.

Soapbox DX Phone

Forty knot wind broke the antenna . . . *EA6TC*. Our band only 3 kHz wide, but we had good company together there . . . *DL7MAE*. Cooling fans quit when line voltage dropped to 95 . . . *VP5Z*. Called many midwest USA but only W0EJ answered . . . *GW3YDX*.

OK3CZM relaxes after he and OK3CMZ piloted OK3KFO to fourth world-high multi-op phone.

W0CEM phone crew. Standing (L-R) WB0WHB, W0CEM. Seated (L-R) K0WA, AB0S. They and three others were the only ones to top the 1000 QSO mark.

CW Multi-Op Station Crews

KY1H & K1RQ, KB1W, KS1N, W1BS, WB1EYL. **AK1L** & KA1X. **W1OP:** K1HGC, KZ1K, N1AKO, N1BBM, WA1JHV, WA1TAQ. **W2CXM:** AG1M, NC2T, WB2LJK. **K3ND** & W3GM. **W3GU** & K3CY. **W3FV** & Net. **K3UA** & W3FSB. **K3WW** & Net. **N4RJ** & Net. **N4XM** & KD4U. **N4SF:** AA4NC, K4NYV, N4EL, N4TN, NW4B. **AA4V** & WB4SJG. **KB5DN** & AF5M. **KE5BC** & WB9CIF. **WA5POK** & KA5GRP. **K6XV** & K6PJY. **WB6EGE:** KA6GBC, KA6OPN, N6MQ, N6QC, WB6WPO. **W6JU** & W6JTA. **AI7B** & W7EJ. **W7XR** & N7UA, W7TJ. **KE7V** & KA7WIA, N7TT. **W7WA** & K7QO, WA7UQV. **K7LXC** & K7HBN, W7AWA. **KT7G** & KG7D. **K8AQM** & KB2XD, KC8KQ, KN8P, NI8L, WB8ATA, W8WVU, KA8POW, WD9INF. **WA8BSF** & AC8W, K8OD, N8CQA. **W8JI** & KB8MU, KC8MK, KD8V, N8ATR, WA8DXG. **KS8S** & AD8P. **N8ET** & W8ZV, Net. **K9RS** & K9KM, K9VV, NA9D. **W9AZ:** AK9F, K9NR, K9IFO, K9ZO, WB9HAD, WD9CSA. **N9MM** & KM9D, N9NC, W9ZRX, WB9POH. **W9RE** & WA8YVR. **W0AIH/9** & K0FVF, KM0O, N0BG. **KI0G** & KA0LRW, ND0E, W0KEA.

K0UK & K0CL. **WA0TKJ** & AB0S, K0UR, WB0DRL. **W0UCE** & KA0NBS. **JA2YKA:** JA9SSY, JE2VYM, JF2DQJ, JF2UTL, JG2VTD. **JA1YWX:** JF2IWL, JI2GUT, JM1MCF, JA6-9330. **JA9YBA:** JA9LNJ, JA9VDA, JH7UJR. **JA7TQK** & A.K., H.K. **JA4YPE:** JF3MOK, Agou, Kodama. **RW9HZZ:** RW9IM, UA0-103,803, UL7-023-442. **UD7DWZ:** Sakhov, Kurmak, Apanas. **RL8PYL:** RL8PY, UL7PAE, UL7PCZ. **LZ2KPD:** Georgiev, Nenov. **OK1KSO:** OK1JCW, OK1JJB, OK1JKT. **OK3KFF:** OK3CQA, OK3CQW, OK3CWZ. **OK1DFP** & OK1FEW, OK1FMB, OK1FQL. **OK1KQJ:** OK1DXA, OK1DXS, OK1ICM, OK1IMR. **OK1KKS:** OK1ACF et al. **OK1KZD:** OK1DHJ et al. **OK1KQH:** Jarakov et al. **OK2KHF:** OK2BMU et al. **OK5MVT:** Not given. **OK2KPS:** Not given. **OK3KFO:** OK3CMZ et al. **G3FVA:** G3PFZ, G3ZDM, G4TFU. **DJ1BZ/A** & DL5TT, DL5TV, DL3SAS, DL3SAU, DL3SAV, DL3SAZ.

DL6RAI & DJ0ND. **DL9YX** & DF4XG. **DF0THW:** DF2PI, DF7PN, DK7PE. **DF2RG** & DL7MAE. **DL0FJ:** DF7LF, DJ2EA, DK4VP, DK8LN.

PA3DQW & PA3DGM. **SP7KTE:** SP7AW, SP7IIT, SP7LFT, SP-0046-KI. **SP5PBE:** SP5ELA et al. **GM3IGW:** G3IGW, G3BBD, G3YPE, G4MH. **EA3VY** & EA3AIR, EA3AVV, EA3FER, EA3FNN. **UR1RWX:** UR2RJ, UR2RDJ, UR2RNA, UR2RNJ, UR2RRR. **UR1RYY:** UR2RE, UR2RQ, Neil. **UZ6LWZ:** UA6-150-1070, UA6-150-1103. **UZ6LWU:** Kantor, Sawelyev, Nazarowa. **UZ3AYR:** RA3AUU, UA3-170-4811, UA3-170-4921. **UZ3DXX:** RA3DJL, UW3GU, UA3-142-461. **UZ4WWB:** Blinov, Vasiliev. **UQ1GWW:** UQ2-037-83, UQ2-037-116. **UQ1GWY:** Wlasow, Zviedris, Kalninsch. **UP1BWR:** UP2BIL, UP3BF. **GW3YDX** & G3WPF, G4OBK. **YU1EXY:** Vel, Slavko. **YT2R:** YU2OG, YU2OH, YU2AW, YU2MM, YU2MY. **YT2B:** YU2NK, YU2VR. **YU7JDE:** YU7BW, YU7CM, YU7MCG, YU7ZZ, Ati. **KH6RS:** AH6AZ, AH6V, AH6GP, K7SS, KH6UU, NH6EV, et al. **ZL3GQ** & K1ZM.

Phone Multi-Op Station Crews

AK1L & KA1X. **K1NG** & KI1G. **N2MM** & Net. **WV2Z0W** & WB2TIX. **KC3EK** & KA3EJJ. **W3BGN** & KM3T. **K3ND** & W3GM. **W3FV** & Net. **K3YTL:** KA3ILD & WB3FAA. **K3UA** & W3FSB. **N4NX** & Net. **N4RJ** & Net. **WB4GNT** & Net. **AA4V** & WB4SJG. **N4FNB** & KF4CB, KQ4C, KA4UEU, KB4LSX. **KB5DN** & KB5RF, KD5ZM, AF5M, W9BN. **KE5BB** & KE5BC, KB5CX, K5MS, KA5UVO, WB9CIF, KA5PEL, WB8TCT. **W5MPX** & NQ5B, N5GCQ, WD0CEN. **N6LL** & WA6DVG, WA6CDR, K6PVC, N6XL. **WB6EGE:** N6MQ, N6QC, KA6OPN, WB6WPO. **NK7U** & NI7T. **K7IDX** & Net. **W8RA** & N8CXX, NF8C. **KA8POW** & WB8ATA, WD9INF, KA8SEW, K8AQM, KC8KQ, KD8SF, KA8JJF, WD8CRY. **KC8MK** & KB8MU, KV8M, KW8N, N8ATR, N8DCJ, N8GVW, W8CAR, W8JI, WA8DXG. **KB8AC** & WD8LLR. **K0GAS** & KJ0G. **W0CEM** & AB0S, K0WA, WB0WHB. **KD0OZ** & KA0UPF. **VP9AD** & W3MA. **VE3KRP** & VE3NNR. **OE3WQB** & OE1OPW, OE3RTC. **LZ2KPD:** Kolarov, Stojadinov, Georgiev. **OK3KFO:** OK3CMZ, OK3CZM. **I8CZW** & IK8DOI. **UP1BWB:** UP2BLU, UP2BPY, UP2-038-728, UP2-038-1209, UP2-038-1220. **UP1BYT:** UP2-038-1757, UP2-038-1758. **GW3YDX** & G3RTE. **YT2R:** YU2OG, YU2OH, YU2DQ, YU2AW, YU2UU. **YU1AA0:** YU1PKB, Vel.

Top 10 Scores

Top 10 W/VE Single Op. CW		Top 10 W/VE Single Op. Phone	
W1CF	486,591	VE3MFA	210,648
(WA2SPL Op.)		K1ZM	209,757
K5NA	423,600	WB9HAD	196,575
AA1K	414,953	K9UWA	157,157
VE3BVD	390,780	K0HA	147,980
KT3M	388,833	WB3GCG	138,525
VE6OU/VE3	320,489	W0ZV	132,480
W3BGN	303,042	AA1K	108,832
K3ZO	262,341	VE3PN	98,637
VE1ZZ	219,240	WB8SCD	83,662
KM3T	208,492		

Top 10 DX Single Op. CW		Top 10 DX Single Op. Phone	
CT3BZ	732,354	LZ2CJ	279,258
(OH2BH Op.)		LZ1KOZ	89,257
G3SZA	439,461	YV2IF	71,820
W1BIH/PJ2	377,225	XE1VIC	66,462
HK1AMW	225,709	UC2IDC	53,618
EA9EU	207,365	4X4NJ	50,266
I2UBI	200,531	PA3DFT	48,117
4X4NJ	198,098	VP5Z	45,375
YU3EA	188,340	IV4PRK	42,615
UG6GAW	171,216	OE1DH	40,280
YU3EF	167,418		

Top 10 Multi-Op. CW		Top 10 Multi-Op. Phone	
GW3YDX	552,126	W3BGN	200,070
YU1EXY	306,852	KC8MK	199,342
EA3VY	252,560	GW3YDX	194,432
YT2R	236,082	OK3KFO	167,895
GM3IGW	228,998	K1NG	164,794
W8JI	226,670	W0CEM	155,960
N9MM	222,754	VP9AD	153,420
K3ND	218,463	W8RA	126,820
KH6RS	211,848	VE3KRP	107,240
W9RE	197,880	N4FNB	102,663

Number groups after calls denote score, total QSOs, multiplier, and countries worked. Multi-op scores follow single-op listings. State, province, and country certificate winners are shown in boldface.

CW SCORES
SINGLE OPERATORS
NORTH AMERICA
United States

Connecticut				
W1WY	**50,094**	**265**	**66**	**20**
W1WEF	45,000	250	60	15
KA1LZR	22,317	227	43	6
K8HVT	20,492	188	47	8
K1KI	17,020	150	46	6
KB1H	10,240	107	40	6
W1AB	5,280	26	24	24
Maine				
AD1G	**48,212**	**228**	**68**	**23**
Massachusetts				
W1CF	**486,591**	**987**	**119**	**62**
	(WA2SPL Op.)			
W1KM	130,376	334	86	40
KA1DWX	60,634	272	71	24
W1IS	48,498	256	59	19
K1XM	24,640	114	55	17
W1HT	18,144	63	32	29
KR1R	15,170	181	37	2
KQ1F	14,564	120	44	10
K5ZD/1	9,805	102	37	7
K1MEM	3,211	21	19	18
New Hampshire				
N1ACH	**116,493**	**431**	**87**	**36**
Rhode Island				
K2MN	**7,975**	**120**	**29**	**4**
Vermont				
W3SOH	**4,114**	**80**	**22**	**3**
New Jersey				
KT3M	**388,833**	**925**	**113**	**58**
W2FJ	162,425	523	89	37
K2FL	63,602	255	77	29
W2BHK	57,882	297	66	22
W2CVW	29,116	197	58	11
KY2P	8,835	129	31	3
N2IN	8,618	124	31	2
NF2C	4,488	86	24	2
WA2ASQ	4,050	63	27	3
W2LPV	1,008	30	16	2
New York				
K5NA	**423,600**	**917**	**120**	**65**
K2UU	49,490	130	70	42
NA2Q	19,412	182	46	7
W2DW	16,309	127	47	11
K2QF	14,320	141	40	9
NA2M	13,545	126	43	9
W2GKZ	11,322	126	37	6
KW2J	10,220	127	35	4
KU2A	9,684	109	36	5
W2KTF	2,835	60	21	2
N2RT	420	7	7	7
Delaware				
AA1K	**414,953**	**998**	**119**	**63**
W3NX	42,084	200	63	21
Maryland				
K3ZO	**262,341**	**750**	**103**	**51**
KM3T	208,492	673	94	42
WB3AVN	163,760	557	92	40
W3GG	57,480	382	60	18
W3ARK	8,064	108	32	4
W3GN	3,925	71	25	2
W3FQE	1,566	39	18	2
W3PEV	658	22	14	2
Pennsylvania				
W3BGN	**303,042**	**687**	**102**	**52**
W3UM	161,980	564	91	40
W3TS	91,962	446	78	26
WB3CAC	77,484	419	66	20
W3QM	70,280	406	70	20
W3AP	48,837	223	73	28
N6CQ/3	44,086	249	67	19
W3CV	23,544	163	54	12
KB3A	18,440	197	40	4
KN3S	18,240	159	48	6
N3BNA	17,934	150	49	7
W3KV	13,938	97	46	15
N3ARK	11,410	138	35	5
WB3LFZ	10,585	166	29	3
K3OO	9,835	105	35	8
W3EVW	8,066	90	37	7
K3NZ	5,850	80	30	6
WA3IMY	1,596	39	19	2
Florida				
N4IN	**175,409**	**490**	**103**	**50**
N4WW	126,630	358	90	42
W4OO	46,060	199	70	29
K8UNP	32,330	193	61	21
N6AR	31,800	177	60	22
N4EJW	29,341	176	61	20
W4BAA	21,660	94	60	23
W4WKQ	12,768	143	42	3
Georgia				
N4PN	**197,700**	**710**	**100**	**45**
KN4B	102,068	533	79	25
N4NX	55,451	301	71	22
W8ZF/4	34,905	186	65	23
N4UZ	25,965	269	45	3
W4DJD	11,440	119	40	8
NQ4I	10,406	84	43	10
K4PI	2,538	25	18	11
Kentucky				
ND4Y	**62,046**	**516**	**54**	**8**
North Carolina				
N4ZC	**121,828**	**641**	**76**	**25**
	(WA8MAZ Op.)			
W4TMR	85,400	526	70	16
K4PB	58,980	425	60	11
South Carolina				
K4CNW	**67,817**	**338**	**73**	**26**
Tennessee				
AA4NU	**44,541**	**285**	**63**	**17**
K4XO	40,430	244	65	16
Virginia				
K4GKD	**50,820**	**321**	**60**	**15**
W4XD	50,344	361	58	11
K4POL	34,633	206	59	18
N7FMB	31,920	224	57	11
N7HJM/4	28,350	210	54	10
K4OD	16,335	159	45	4
W4KMS	12,848	120	44	7
NJ8Z	2,415	51	23	2
Mississippi				
W5XX	**85,044**	**457**	**76**	**21**
New Mexico				
WD5T	**19,500**	**172**	**50**	**5**
Texas				
N5RZ	**205,108**	**793**	**94**	**39**
N5DU	195,272	676	88	34
KC5DX	109,865	632	73	20
K5WXZ	53,802	367	63	13
KB5UL	44,072	363	56	5
WB5YOT	40,264	323	56	8
N5UA	24,304	164	56	14
WF5E	13,588	141	43	6
KN5H	12,936	131	44	6
W5QF	11,172	121	42	3
W5IRP	2,938	55	26	2
N5AFV	2,576	53	23	2
California				
N6ND	**117,068**	**518**	**74**	**24**
N6AW	83,727	398	63	15
N6RZ	70,242	374	69	17
N6GG	66,464	356	62	13
AG6D	48,455	328	55	10
KI6O	47,270	254	58	10
W6BA	35,828	222	52	8
K6MO	32,538	188	51	9
W6ISQ	24,672	169	48	6
N6PE	22,560	183	48	10
N6VR	21,063	142	51	8
WB6JMS	17,232	145	48	6
W6BIP	15,456	161	42	5
K6TS	12,920	140	38	6
N6JM	10,868	118	38	4
AA6T	10,656	128	37	3
W6OUL	8,280	98	36	3
KE6US	4,026	58	33	2
K6NY	1,740	58	15	1
AA4M	1,032	43	12	1
W6OKK	850	41	10	2
Arizona				
K7OX	**103,984**	**567**	**67**	**14**
W7YS	22,246	200	49	5
NG7S	9,694	125	37	2
NF7E	1,020	34	15	1
Idaho				
KA7T	**35,934**	**266**	**53**	**8**
N7SU	26,775	231	51	7
Nevada				
N7NV	**3,633**	**74**	**21**	**3**
W7ABX	2,898	66	21	2
Oregon				
K5MM/7	**123,624**	**576**	**72**	**20**
KA7FEF	990	42	11	2
Utah				
N5CT/7	**58,920**	**435**	**60**	**9**
K7CU	3,960	53	33	3
Washington				
K7IDX	**10,906**	**101**	**38**	**9**
K7UU	7,232	100	32	4
W7IEU	6,132	91	28	3
W7BYK	2,603	60	19	3
K7WA	870	38	10	3
WA7DRA/7	100	11	4	2
NG7N	60	10	3	1
Wyoming				
KB8KW/7	**8,352**	**107**	**36**	**2**
W7HLA	6,771	84	37	2
Michigan				
W8UVZ	**79,875**	**426**	**75**	**20**
N8EA	44,520	299	60	16
K8OOK	17,820	180	45	2
W8VSK	17,415	173	45	5
NK8Q	8,060	118	31	3
Ohio				
W8IMZ	**81,260**	**502**	**68**	**17**
	(WB8MRU Op.)			
NE8V	61,566	431	62	11
KA8HFO	59,685	342	69	19
K8SVT	11,868	111	46	3
WA8RCN	8,283	112	33	2
N8FXL	7,992	99	36	3
K8HF	5,130	75	30	2
K8MR	2,000	44	20	2
West Virginia				
K8OQL	**64,386**	**335**	**73**	**24**
Illinois				
W9YYG	**82,857**	**483**	**71**	**17**
KM9L	39,680	259	62	13
WB9JKI	39,494	262	62	12
W9LNQ	34,925	278	55	10
W9RW	32,648	241	56	11
N9BBM	10,767	132	37	2
W9HOT	5,536	79	32	2
W9CA	5,312	77	32	2
NB9Y	2,940	51	28	2
Indiana				
KB8AC	**8,246**	**98**	**38**	**2**
Wisconsin				
W9XT	**53,159**	**404**	**59**	**7**
WA1UJU	48,297	439	51	3
W9WAQ	40,260	280	61	12
WB9HRO	31,641	265	53	8
K9RR	26,977	218	53	7
W9MQZ	21,120	180	48	8
WZ4F/9	8,874	116	34	4
W9KHH	6,766	92	34	2
K9EC	4,455	69	27	3
N9CWR	1,425	36	19	2
N9KS	370	17	10	2
Colorado				
W0ZV	**193,200**	**748**	**84**	**30**
KV0Q	126,450	645	75	21
KY0A	72,312	365	69	19
N0ZA	50,740	385	59	9
KJ0G	47,731	347	59	10
W0GOR	31,620	216	60	12
K0ZX	12,696	110	46	7
K9MWM	330	15	11	1
Iowa				
KJ0H	**56,290**	**368**	**65**	**11**
N0BB	39,960	286	60	10
KD0QA	2,645	47	23	3
Kansas				
W0AWP	**15,030**	**145**	**45**	**4**
Minnesota				
W0HW	**67,648**	**454**	**64**	**13**
WB0HCH	60,822	423	62	10
W0HBH	36,540	266	58	11
W0RXL	18,576	170	48	5
Missouri				
K4VX	**178,020**	**748**	**92**	**38**
		(KM9P Op.)		
Alaska				
KL7Y	**12,029**	**83**	**23**	**9**
Antigua				
V2ACW	**80,850**	**233**	**66**	**22**
Bermuda				
VP9LB	**49,966**	**233**	**43**	**4**

Canada

Newfoundland				
VO1MP	**157,716**	**308**	**78**	**39**
VO1QU	19,869	81	37	16
New Brunswick				
VE1TE	**21,941**	**127**	**37**	**3**
Nova Scotia				
VE1ZZ	**219,240**	**276**	**105**	**67**
Quebec				
VE2DVI	**23,522**	**127**	**38**	**4**
Ontario				
VE3BVD	**390,780**	**864**	**90**	**35**

No-29-30

VE6OU/3	320,489	718	89	34
VE3INQ	140,379	386	73	23
VE3KP	138,970	437	65	15
VE3OME	127,286	418	62	15
VE3LSK	55,284	221	51	8
VE3CWE	24,219	129	39	4
VE3ST	9,632	60	32	4
VE3HCT	1,428	21	14	2
Saskatchewan				
VE5UF	**109,440**	**345**	**64**	**14**
VE5RA	90,960	315	60	9
Alberta				
VE6CB	**6,125**	**52**	**25**	**2**
British Columbia				
VE7BS	**35,280**	**162**	**40**	**9**
VE7DXU	8,980	94	20	2
Dominica				
J73D	**4,680**	**34**	**26**	**12**
Dominican Republic				
HI8LC	**13,650**	**75**	**35**	**11**
Mexico				
XE1MD	**20,265**	**116**	**35**	**4**

AFRICA

Ceuta				
EA9EU	**207,365**	**311**	**67**	**48**
Madeira				
CT3BZ	**732,354**	**694**	**106**	**65**
		(OH2BH Op.)		
CT3ET	5,368	27	22	18

ASIA

Hong Kong				
VS6DO	**23,688**	**146**	**24**	**20**
Israel				
4X4NJ	**198,098**	**279**	**74**	**54**
Japan				
JA7NI	**23,240**	**137**	**28**	**20**
JF1NZW	21,775	108	25	12
JA5BJC	20,709	129	27	20
JE1SPY	12,320	112	20	12
JA7JWF	5,625	66	15	10
JA7DLE	5,316	113	12	7
JR6LJO	4,976	42	16	12
JA3BCT	2,915	33	11	7
JA1PIG	2,880	26	12	7
JE1ARQ	2,310	27	11	8
JA4IGW	1,242	23	9	5
JA4ESR	920	12	8	3
JH5NBW/1	840	25	8	5
JA7UMT/1	714	40	6	5
JA6GGD	399	8	7	6
JA2LA	335	21	5	4
JA8SW	305	17	5	5
JH7AJD	156	19	3	3
JA2BP	132	30	2	2
JH2XTV	80	16	2	2
JR4ISK	28	4	2	2
Malaysia				
9M2AX	**9,700**	**69**	**20**	**18**

U.S.S.R. ASIA

Armenia				
UG6GAW	**171,216**	**315**	**58**	**52**
Asiatic S.S.R.				
UA9CBO	**98,145**	**246**	**45**	**45**
UA9AO	76,456	223	38	38
UA9MR	62,946	193	39	39
UA9MS	55,186	155	41	41
RA9FC	47,027	162	31	31
UA9FM	42,842	146	31	31
UA9AJX	35,836	130	34	34
UA9CBR	34,068	117	34	34
UA9KBY	17,550	93	25	25
UA9XS	8,415	54	17	17
UAØZBP	8,162	108	11	8
UAØAG	8,143	61	17	17
UAØAFA	5,292	61	14	14
UAØZBW	4,030	70	10	6
RAØFA	3,195	63	9	6
UAØQEJ	1,728	60	6	6
Azerbaijan				
UD6DKW	**8,007**	**55**	**17**	**17**
Georgia				
RF6FHA	**17,200**	**93**	**20**	**20**
Kazakh				
UL7MAN	**123,438**	**312**	**42**	**42**
UL7OB	102,705	278	41	39
RL7PAB	2	1	1	1
Kirghiz				
UM8MBA	**31,473**	**93**	**39**	**39**
UM8MFB	3,624	42	12	12
Tadzhik				
RT5UL/UJ	**7,140**	**52**	**17**	**17**
Uzbek				
RT5UY/UI	**68,508**	**176**	**44**	**44**

EUROPE

Balearic Is.				
EA6ET	**105,780**	**319**	**60**	**51**
Bulgaria				
LZ2DF	**46,440**	**185**	**45**	**39**
LZ1TR	24,486	141	33	33
LZ2VP	15,040	78	32	31
Czechoslovakia				
OK3CZM	**139,963**	**410**	**67**	**53**
OK1KPU	116,424	351	66	49
		(OK1JDX Op.)		
OK2BCI	110,936	406	56	48
OK3CSQ	81,597	259	59	48
OK1DFF	80,640	266	56	46
OK3CWQ	74,032	278	56	48
OL8CQF	69,384	296	49	42
OK2FD	61,204	217	52	44
OK1MCW	55,264	281	44	43
OL8COS	53,251	236	47	43
OK1AJN	51,660	281	41	40
OLØCRG	51,534	271	42	41
OK2BVG	47,616	195	48	44
OK1DRU/P	47,080	243	44	42
OK1KLX	44,321	240	41	41
OL7BLO	38,220	209	39	39
OL8COJ	36,036	218	39	39
OL9CPG	33,657	187	39	36
OK1DOZ	32,970	224	35	35
OK3CAL	31,536	202	36	36
OL1BIC	27,921	156	41	37
OL1BLN	27,744	203	32	32
OK1DWC	25,970	187	35	35
OK2BEJ	21,300	180	30	30
OK2PAZ	21,052	123	38	37
OL1BGA	17,853	124	33	33
OK1DXW	15,689	136	29	29
OK2BCZ	13,328	116	28	28
OK3KEU	13,000	129	25	25
OK2PZZ	12,068	108	28	28
OK1FA	10,511	115	23	23
OK2SRA	10,296	111	24	24
OL1BKO	9,453	105	23	23
OK2BMA	9,288	79	27	27
OK1DVK	9,048	41	39	38
OK3TAE	8,993	101	23	23
OL6BNW	8,250	96	22	22
OK2BHQ	7,306	61	26	26
OK1DMA	6,380	73	22	22
OK1MNI	6,314	73	22	22
OK1MSB	5,918	63	22	22
OK1FBH	5,824	47	26	26
OL8CTA	5,253	81	17	17
OK1DWG	5,208	58	21	21
OK2PAW	4,446	63	19	19
OK1KHG	4,248	67	18	18
OL6BNO	4,176	65	18	18
OL6BMH	4,000	59	16	16
OK2KHD	3,500	33	20	18
		(OK2PFV Op.)		
OK1AIA	3,440	38	20	20
OK1KZ	3,204	44	18	18
OK1MZO	3,162	45	17	17
OK2PKL	2,736	39	16	16
OK2ABU	2,652	42	17	17
OK2BDR	2,604	42	14	14
OK1DZD	2,384	37	16	16
OK3KUV/P	1,331	32	11	11
OK3CTO	1,248	22	12	12
OK1DUT	972	21	12	12
OK2EC	790	11	10	8
OK1KCF	576	14	9	9
OK1FRR	408	22	6	6
Denmark				
OZ1LO	**25,272**	**120**	**36**	**30**
OZ8RO	19,240	96	37	37
England				
G3SZA	**439,461**	**629**	**99**	**63**
G4WQN	166,566	411	69	49
G3XTT	132,386	265	74	52
G4BYG	110,200	337	58	44
G4ARI	19,985	119	35	32
G3TXF	19,642	72	46	41
G4ODV	11,948	91	29	29
G2CIL	6,555	62	23	23
Finland				
K8MN/OH2	**71,668**	**291**	**46**	**45**
OH3JR	64,766	257	47	44
OH2LP	36,288	196	36	36
OH9NV	8,866	71	26	26
OH6YF	7,860	80	20	20
France				
F3AT	**24,477**	**104**	**41**	**36**
F6BEE	13,949	66	37	31
FD1JDG	2,580	35	15	15
Germany (FRG)				
DK6AS	**125,622**	**357**	**63**	**49**
DK3KD	60,528	215	52	43
DL6NB	49,735	192	49	40
DL1JF	45,990	200	45	41
DL8CM	26,359	120	43	41
DL4GCR	15,036	123	28	28
DF3CB	8,165	80	23	23
DL1AM	4,224	38	22	22
DK2OY	3,536	47	17	17
DF5RA	2,739	54	11	11
DA2ER	650	13	10	10
Germany (GDR)				
Y24IB	**5,140**	**52**	**20**	**20**
Y24AK	4,592	58	16	16
Y25FH	1,342	25	11	11
Greece				
SVØAA	**27,588**	**105**	**44**	**38**
Guernsey				
GU3HFN	**49,950**	**261**	**37**	**37**
		(GU3MBS Op.)		
Ireland				
EI9J	**42,480**	**151**	**48**	**38**
Italy				
I2UBI	**200,531**	**505**	**67**	**50**
I4EAT	115,320	312	62	48
IO2UIY	30,312	165	36	33
Luxembourg				
LX9BV	**3,285**	**43**	**15**	**15**
Malta				
9H1CG	**61,869**	**293**	**41**	**38**
Netherlands				
PA3DFT	**108,619**	**341**	**59**	**50**
PAØLOU	50,736	186	48	38
PA3BNT	1,428	25	12	12
Norway				
LA2GV	**151,512**	**469**	**59**	**51**
Poland				
SP5EXA	**63,683**	**280**	**43**	**43**
SP5INQ	57,820	217	49	45
SP5AD	47,902	208	43	42
SP9GDB	35,298	188	37	37
SP4EAK	19,108	108	34	34
SP9DH	17,487	118	29	29
SP6LTF	11,914	106	23	23
SP9AKD	7,854	71	22	22
SP5GH	7,208	36	34	34
SP9BRP	4,811	59	17	17
San Marino				
T77C	**107,085**	**366**	**55**	**50**
Scotland				
GM3YOR	**57,240**	**153**	**60**	**45**
Spain				
EA7AIN	**24,358**	**99**	**38**	**28**
EA3DBO	7,722	57	26	26
EA2CR	4,180	40	20	20
Switzerland				
HB9AGA	**86,940**	**299**	**54**	**44**
HB9APJ	12,609	93	27	27

U.S.S.R. European

Byelorussia				
UC2AA	**65,764**	**285**	**41**	**41**
UC2WO	47,760	206	40	39
UC2SLX	24,853	155	29	29
UC2IDZ	24,099	157	29	29
UC2WBP	15,528	122	24	24
Estonia				
RR2RU	**125,874**	**422**	**54**	**51**
UR2RCU	72,981	248	53	50
UR2RHF	62,823	277	43	43
RR2RW	8,843	40	37	37
UR2RCO	5,700	60	19	19
European S.S.R.				
RA3DX	**91,545**	**337**	**51**	**50**
UA3RAR	83,385	359	45	45
RA6AOS	78,364	294	52	51
RV6AZ	49,686	230	42	42
UA4LDN	42,476	216	37	37
UA4PO	28,866	162	34	34
UA4CLV	26,826	138	34	34
UA4WEJ	25,560	160	30	30
RA6AR	24,732	135	36	36
UA6LIT	24,584	164	28	28
UA3ATV	19,924	101	34	34
RA3AOD	17,856	102	31	31
UA3LAR	16,833	101	31	31
UA3DRR	13,547	115	23	23
UV3QNO	9,600	74	25	25
UW3GL	9,108	76	23	23
UA3PLS	5,480	49	20	20
UV6AGF	5,274	54	18	18
UA3PNN	3,768	65	12	12
RZ6AWP	210	6	6	6
Franz Josef Land				
UA1OT	**4,600**	**35**	**20**	**20**
UV1OO	60	3	3	3
Kaliningrad				
UA2EC	**35,796**	**180**	**38**	**38**
Latvia				
UQ2PQ	**120,224**	**429**	**52**	**48**
UQ2GKL	67,206	274	46	44
UQ2GMB	43,337	204	41	39
UQ2GD	38,036	193	37	37
UQ2GIP	22,740	139	30	30
UQ2GNL	16,510	129	26	26
UQ2GII	8,228	78	22	22
UQ2GLW	6,138	66	18	18
Lithuania				
UP2BCW	**107,301**	**431**	**47**	**43**
UP3BO	31,527	201	31	31
RP2BIL	12,912	108	24	24
Moldavia				
UO5ONT	**14,760**	**119**	**24**	**24**
UO5OLW	10,120	91	22	22
Ukraine				
UB5WF	**111,540**	**389**	**55**	**50**
UB5ZAL	98,560	332	55	50
RB5WW	62,934	242	51	47
UB5LCV	60,802	271	43	43
UB5UKH	56,115	234	45	43
UB5ZFE	49,412	209	44	44
UB5WCQ	47,902	214	43	43
UB5FAN	40,915	228	35	35
RB5GW	36,816	130	48	47
UT5UGR	34,850	202	34	34
UB5IJA	29,640	184	30	30
UB5EPV	27,931	181	31	31
UB5VKW	24,490	160	31	31
RB5IJ	24,242	129	34	34
UB5UEG	21,624	121	34	34
UB5TN	20,700	109	36	36
UY5TE	15,886	124	26	26
UB5WFG	11,726	107	22	22
UB4JCV	11,388	88	26	26
UY5VA	10,322	74	26	26
UB5EF	9,729	91	23	23
UB5EIT	7,920	70	22	22
UB5VK	3,485	41	17	17
UB5EFA	3,344	34	19	19
RT4UA	2,679	24	19	19
UB5YGQ	2,240	52	10	10
Wales				
GW3JI	**60,804**	**205**	**54**	**45**
Yugoslavia				
YU3EA	**188,340**	**439**	**73**	**54**
YU3EF	167,418	391	71	48
YT3T	129,076	390	61	49
		(YU3BQ Op.)		
YU7SF	144	15	3	3
YU7MGU	26	5	2	2

Oceania

Hawaii				
KH6IJ	**8,316**	**47**	**18**	**6**
Marshall Is.				
KX6DX	**25,740**	**101**	**26**	**10**
Papua N.G.				
P29PR	**11,628**	**73**	**18**	**12**

SOUTH AMERICA

Brazil				
PY1BVY	**2,478**	**19**	**14**	**4**
Colombia				
HK1AMW	**225,709**	**322**	**71**	**28**
Netherland Antilles				
W1BIH/PJ2	**377,225**	**482**	**79**	**29**
Peru				
OA4ZV	**113,110**	**197**	**58**	**19**
Venezuela				
YV10B	**32,175**	**73**	**45**	**22**

MULTI-OPERATOR
NORTH AMERICA

United States

Massachusetts				
KY1H	**151,710**	**629**	**78**	**30**
New Hampshire				
AK1L	**65,636**	**436**	**61**	**13**
Rhode Island				
W1OP	**33,300**	**286**	**50**	**8**
New York				
W2CXM	**33,152**	**230**	**56**	**15**
Pennsylvania				
K3ND	**218,463**	**647**	**103**	**50**
W3GU	133,988	501	86	35
W3FV	131,824	502	88	36
K3UA	68,968	317	74	27
K3WW	53,105	310	65	22
Georgia				
N4RJ	**168,295**	**632**	**97**	**44**
Kentucky				
N4XM	**104,566**	**525**	**77**	**23**
North Carolina				
N4SF	**170,335**	**639**	**95**	**41**
South Carolina				
AA4V	**43,014**	**232**	**67**	**21**
Arkansas				
KB5DN	**64,976**	**465**	**62**	**11**
Louisiana				
KE5BC	**12,341**	**129**	**43**	**4**
Texas				
WA5POK	**18,471**	**159**	**47**	**10**
California				
K6XV	**115,559**	**471**	**73**	**19**
WB6EGE	28,840	198	56	12
W6JU	8,160	112	32	4
Oregon				
AI7B	**125,195**	**559**	**73**	**21**
Washington				
W7XR	**153,525**	**534**	**75**	**22**
KE7V	87,561	415	69	18
W7WA	85,559	438	67	16
K7LXC	77,553	413	63	15
KT7G	52,628	321	59	10
Michigan				
K8AQM	**98,700**	**600**	**70**	**17**
WA8BSF	51,246	423	54	5
Ohio				
W8JI	**226,670**	**800**	**95**	**40**
KS8S	175,266	697	91	37
N8ET	131,280	676	80	28
Illinois				
K9RS	**156,206**	**795**	**83**	**28**
W9AZ	118,503	631	77	25
Indiana				
N9MM	**222,754**	**843**	**98**	**42**
W9RE	197,880	759	97	42
Wisconsin				
WØAIH/9	**159,460**	**773**	**85**	**30**
Colorado				
KIØG	**131,118**	**590**	**78**	**26**
KØUK	120,750	554	75	23
Kansas				
WAØTKJ	**135,722**	**709**	**79**	**24**
Minnesota				
WØUCE	**54,752**	**425**	**58**	**7**

ASIA

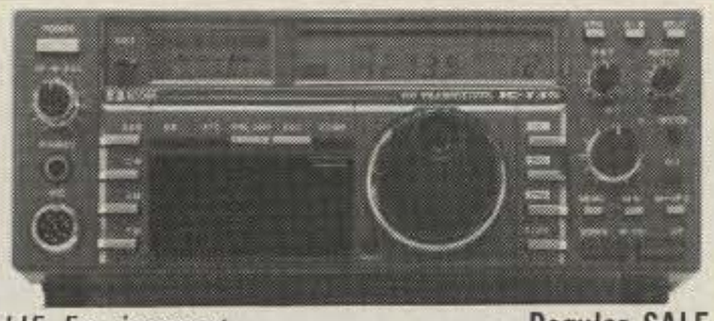
Japan				
JA2YKA	**19,025**	**137**	**25**	**16**
JA1YWX	17,745	175	21	14
JA9YBA	16,675	134	23	14
JA7TQK	9,920	111	20	15
JA4YPE	1,280	39	8	6

U.S.S.R. Asia

Asiatic S.S.R.				
RW9HZZ	**32,970**	**146**	**30**	**30**
UZ9AWH	12,012	64	21	21
Azerbaijan				
UD7DWZ	**2,607**	**29**	**11**	**11**
Kazakh				
RL8PYL	**98,384**	**249**	**43**	**43**

EUROPE

Bulgaria				
LZ2KPD	**44,352**	**194**	**42**	**38**
Czechoslovakia				
OK1KSO	**156,804**	**394**	**73**	**55**
OK3KFF	148,204	422	67	50
OK1DFP	94,655	347	55	46
OK1KQJ	91,250	383	50	44
OK1KKS	62,112	263	48	41
OK1KZD	22,644	159	34	34
OK1KQH	18,340	163	28	28
OK2KHF	12,050	117	25	25
OK5MVT	9,018	80	27	27
OK2KPS	8,700	105	20	20
OK3KFO	8,640	74	27	27



HF Equipment	Regular	SALE
IC-735 HF transceiver/SW rcvr/mic	999.00	**849.95**
PS-55 External power supply	199.00	**179.95**
AT-150 Automatic antenna tuner	445.00	**359.95**
FL-32 500 Hz CW filter	66.50	
EX-243 Electronic keyer unit	56.00	
UT-30 Tone encoder	17.50	

IC-745 9-band xcvr w/.1-30 MHz rcvr	1049.00	**899.95**
PS-35 Internal power supply	199.00	**179.95**
EX-241 Marker unit	22.50	
EX-242 FM unit	44.00	
EX-243 Electronic keyer unit	56.00	
FL-45 500 Hz CW filter (1st IF)	66.50	
FL-54 270 Hz CW filter (1st IF)	53.00	
FL-52A 500 Hz CW filter (2nd IF)	108.00	**99.95**
FL-53A 250 Hz CW filter (2nd IF)	108.00	**99.95**
FL-44A SSB filter (2nd IF)	178.00	**159.95**

IC-751 9-band xcvr/.1-30 MHz rcvr	1399.00	**999.00**
IC-751A 9-band xcvr/.1-30 MHz rcvr	1649.00	**1399**
PS-35 Internal power supply	199.00	**179.95**
FL-32 500 Hz CW filter (1st IF)	66.50	
FL-63 250 Hz CW filter (1st IF)	54.50	
FL-52A 500 Hz CW filter (2nd IF)	108.00	**99.95**
FL-53A 250 Hz CW filter (2nd IF)	108.00	**99.95**
FL-33 AM filter	35.25	
FL-70 2.8 kHz wide SSB filter	52.00	
RC-10 External frequency controller	39.25	

Other Accessories:	Regular	SALE
IC-2KL 160-15m solid state amp w/ps	1999.00	**1699**
PS-15 20A external power supply	169.00	**154.95**
PS-30 Systems p/s w/cord, 6-pin plug	299.00	**269.95**
OPC Opt. cord, specify 2, 4 or 6-pin	10.00	
MB Mobile mount, 735/745/751A	24.50	
SP-3 External speaker	61.00	
SP-7 Small external speaker	49.00	
CR-64 High stab. ref. xtal (745/751)	63.00	
PP-1 Speaker/patch	159.25	**149.95**
SM-6 Desk microphone	44.95	
SM-8 Desk mic - two cables, Scan	78.50	
SM-10 Compressor/graph EQ, 8 pin mic	136.25	**124.95**
AT-100 100W 8-band auto. antenna tuner	445.00	**389.95**
AT-500 500W 9-band auto. antenna tuner	559.00	**489.95**
OPC-118 Adapts AT-100/500 to IC-735	16.00	
AH-2 8-band tuner w/mount & whip	625.00	**549.95**
AH-2A Antenna tuner system, only	495.00	**429.95**
OPC-137 Adapts AH-2/2A to IC-751/745	16.00	

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Other Accessories - continued:	Regular	SALE
GC-4 World Clock **(Closeout)**	99.95	**59.95**
GC-5 World clock	91.95	

6-meter VHF Portable	Regular	SALE
IC-505 3/10W 6m SSB/CW portable	549.00	**489.95**
BP-15 AC charger	14.00	
EX-248 FM unit	55.50	
LC-10 Leather case	39.50	

VHF/UHF base multi-modes	Regular	SALE
IC-551D 80W 6-meter SSB/CW	799.00	**699.95**
EX-106 FM option	140.00	**126.95**
BC-10A Memory back-up	9.50	
IC-271A 25W 2m FM/SSB/CW	859.00	**759.95**
AG-20 Internal preamplifier	64.00	
IC-271H 100W 2m FM/SSB/CW	1099.00	**969.95**
AG-25 Mast mounted preamplifier	95.00	
IC-471A 25W 430-450 SSB/CW/FM xcvr	979.00	**869.95**
AG-1 Mast mounted preamplifier	99.50	
IC-471H 75W 430-450 SSB/CW/FM	1399.00	**1169**
AG-35 Mast mounted preamplifier	95.00	

Accessories common to 271A/H and 471A/H		
PS-25 Internal power supply for (A)	115.00	**104.95**
PS-35 Internal power supply for (H)	199.00	**179.95**
SM-6 Desk microphone	44.95	
EX-310 Voice synthesizer	46.00	
TS-32 CommSpec encode/decoder	59.95	
UT-15 Encoder/decoder interface	14.00	
UT-15S UT-15S w/TS-32 installed	92.00	

VHF/UHF mobile multi-modes	Regular	SALE
IC-290H 25W 2m SSB/FM, TTP mic	639.00	**569.95**
IC-490A 10W 430-440 SSB/FM/CW	699.00	**599.95**

VHF/UHF/1.2 GHz FM	Regular	SALE
IC-27A Compact 25W 2m FM w/TTP mic	429.00	**379.95**
IC-27H Compact 45W 2m FM w/TTP mic	459.00	**399.95**
IC-37A Compact 25W 220 FM, TTP mic	499.00	**439.95**
IC-47A Compact 25W 440 FM, TTP mic	549.00	**489.95**
PS-45 Compact 8A power supply	139.00	**129.95**
UT-16/EX-388 Voice synthesizer	34.99	
SP-10 Slim-line external speaker	35.99	
IC-28A 25W 2m FM, UP/DN mic	429.00	**379.95**
IC-28H 45W 2m FM, UP/DN mic	459.00	**399.95**
IC-38A 25W 220 FM	459.00	**399.95**
IC-48A 25W 440-450 FM	459.00	**399.95**
HM-14 TTP microphone	55.50	
UT-28 Digital code squelch	37.50	
UT-29 Tone squelch decoder	43.00	
HM-16 Speaker/microphone	34.00	
IC-3200A 25W 2m/440 FM w/TTP	599.00	**499.95**
UT-23 Voice synthesizer	34.99	
AH-32 2m/440 Dual Band antenna	37.00	
AHB-32 Trunk-lip mount	34.00	
Larsen PO-K Roof mount	20.00	
Larsen PO-TLM Trunk-lip mount	20.18	
Larsen PO-MM Magnetic mount	19.63	
RP-3010 440 MHz, 10W FM, xtal cont.	1229.00	**1099**
IC-120 1W 1.2 GHz FM Mobile	579.00	**499.95**
ML-12 1.2 GHz 10W amplifier	379.00	**339.95**
IC-1271A 10W 1.2 GHz SSB/CW Base	1229.00	**1079**
AG-1200 Mast mounted preamplifier	105.00	
PS-25 Internal power supply	115.00	**104.95**
EX-310 Voice synthesizer	46.00	
TV-1200 ATV interface unit	129.00	**119.95**
UT-15S CTCSS encoder/decoder	92.00	
RP-1210 1.2 GHz, 10W FM, 99 ch. synth	1479.00	**1299**

Hand-helds	Regular	SALE
IC-2A 2-meters	279.00	**249.95**
IC-2AT with TTP	299.00	**259.95**
IC-3AT 220 MHz, TTP	339.00	**299.95**
IC-4AT 440 MHz, TTP	339.00	**299.95**
IC-02AT 2-meters	399.00	**339.95**
IC-03AT for 220 MHz	449.00	**399.95**
IC-04AT for 440 MHz	449.00	**389.95**
IC-u2A 2-meters	299.00	**269.95**
IC-u2AT with TTP	329.00	**289.95**
IC-12AT 1W 1.2GHz FM HT/batt/cgr/TTP	459.00	**399.95**
A-2 5W PEP synth. aircraft HT	599.00	**499.95**

Accessories for IC series	Regular
BP-7 425mah/13.2V Nicad Pak - use BC-35	74.25
BP-8 800mah/8.4V Nicad Pak - use BC-35	74.25
BC-35 Drop in desk charger for all batteries	74.95
BC-16U Wall charger for BP7/BP8	20.25
LC-11 Vinyl case for Dlx using BP-3	20.50
LC-14 Vinyl case for Dlx using BP-7/8	20.50
LC-02AT Leather case for Dlx models w/BP-7/8	54.50

Accessories for IC and IC-O series	Regular
BP-2 425mah/7.2V Nicad Pak - use BC35	47.00
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	37.50
BP-4 Alkaline battery case	15.25
BP-5 425mah/10.8V Nicad Pak - use BC35	58.50
CA-5 5/8-wave telescoping 2m antenna	18.00
FA-2 Extra 2m flexible antenna	11.50
CP-1 Cig. lighter plug/cord for BP3 or Dlx	13.00
CP-10 Battery separation cable w/clip	22.50
DC-1 DC operation pak for standard models	23.25
EX-390 Bottom slide cap	5.50
MB-16D Mobile mtg. bkt for all HTs	21.99
LC-2AT Leather case for standard models	54.50
RB-1 Vinyl waterproof radio bag	31.50
HH-SS Handheld shoulder strap	16.95
HM-9 Speaker microphone	47.00
HS-10 Boom microphone/headset	23.25
HS-10SA Vox unit for HS-10 & Deluxe only	23.25
HS-10SB PTT unit for HS-10	23.25
ML-1 2m 2.3w in/10w out amplifier	**SALE 99.95**
SS-32M Commspec 32-tone encoder	29.95

Receivers	Regular	SALE
R-71A 100 kHz-30 MHz, 117V AC	$949.00	**799.95**
RC-11 Infrared remote controller	67.25	
FL-32 500 Hz CW filter	66.50	
FL-63 250 Hz CW filter (1st IF)	54.50	
FL-44A SSB filter (2nd IF)	178.00	**159.95**
EX-257 FM unit	42.50	
EX-310 Voice synthesizer	46.00	
CR-64 High stability oscillator xtal	63.00	
SP-3 External speaker	61.00	
CK-70 (EX-299) 12V DC option	12.25	
MB-12 Mobile mount	24.50	
R-7000 25 MHz-2 gHz scanning rcvr	1099.00	**969.95**
RC-12 Infrared remote controller	67.25	
EX-310 Voice synthesizer	46.00	
AH-7000 Radiating antenna	89.95	

11

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Bert, DF2PI (left), and Rudi, DK7PE, two of the DFØTHW CW operators in action during the contest.

DL6NB probably got no help from either the dog or the mike during the CW contest.

PT7CB braved his summertime static to produce the second highest South American phone score.

PHONE SCORES
SINGLE OPERATORS
NORTH AMERICA
UNITED STATES

Connecticut

K8HVT	35,560	276	56	9
W1WEF	19,906	235	37	5
W1WY	13,186	157	38	6

Maine

N1CTD	33,580	313	46	6
KA1ZX	5,301	78	31	4

Massachusetts

KY1H	77,287	552	61	18
K5ZD/1	26,004	273	44	6
K1MEM	3,944	41	34	9

New Hampshire

N1ACH	42,771	346	53	11
KA1BAM	24,702	239	46	6
AF1T	7,130	100	31	4

Vermont

W3SOH	1,957	47	19	4

New Jersey

W2FCR	58,032	503	52	10
K2FL	19,536	200	44	7
W2PHW	10,044	129	36	4
W2SDO	9,789	109	39	6
W2CVW	4,408	70	29	4
KY2P	1,224	33	17	2

New York

K1ZM	209,757	1012	87	31
NA2M	17,958	198	41	5
W2GKZ	8,806	113	37	2
W2DW	2,928	55	24	4

Delaware

AA1K	108,832	583	76	25
W3NX	21,804	213	46	7

Maryland

K3ZO	35,500	317	50	10
W3GN	11,084	151	34	4

Pennsylvania

W3TS	79,254	561	63	11
W3GU	49,147	362	59	14
W3UM	44,712	368	54	10
WA3SPJ	28,675	353	37	5
W3AP	25,333	236	49	5
N3BNA	23,220	209	36	5
W3UHP	18,662	202	43	5
KA3AVB	10,080	135	35	4
KY3N	10,030	137	34	5
AD3Z	9,207	129	33	4
W3AJS	7,626	111	31	4
WA3IMY	6,976	100	32	5
WA3YON	6,650	80	38	4
KC1U	5,886	100	27	3
N3CWP	5,320	61	38	4
W3DHM	5,250	80	30	4
N3ARK	4,758	87	26	3
K3WW	4,602	81	26	3
W3EVW	2,712	52	24	3
K3OO	2,652	45	26	5
W3KV	795	22	15	3

Alabama

N4JF	9,583	125	37	4

Florida

AA4MM	77,596	338	76	32
N4IN	60,552	342	72	20
W4WKQ	10,222	130	38	4
WB4VQO	3,450	53	30	4

Georgia

WI4K	63,396	551	54	10
KN4B	54,346	433	58	12
WA4VDE	42,498	359	54	11
K4DLI	42,123	338	57	10
K4PI	35,365	296	55	9
WI4R	34,927	304	53	9
N4HH	33,402	265	57	12
K4EZ	15,136	164	43	7
KX4R	12,956	143	41	4
K4TEA	12,768	143	42	6
KC4GR	6,902	97	34	3
W4OTX	5,888	51	46	8
W4UYC	4,588	68	31	5
NQ4I	2,450	43	25	4

Kentucky

WB4OSS	49,539	474	49	5

North Carolina

WB3GCG	138,525	819	75	22
W4TMR	79,230	639	57	8
N4UH	36,608	315	52	11
KF4HK	33,201	300	51	6
KA2CDJ/4	5,270	70	34	4
W4HVU	4,205	71	29	2

Tennessee

AA4NU	79,424	516	68	17
W4UWC	28,329	215	57	13
N4BSN	4,950	72	33	3

Virginia

W4TMN	35,819	385	43	4
N7FMB	20,320	239	40	5
W4KMS	8,738	121	34	3
N7HJM/4	5,332	77	31	5
W4YE	4,088	67	28	3
N3RC	3,125	58	25	3

Arkansas

WA5NFC	44,388	387	54	7

New Mexico

WD5T	4,960	77	31	2
K5TVC	2,064	40	24	3

Texas

NW5E	79,608	590	62	10
K5WXZ	49,973	391	59	9
N5UA	38,502	265	62	14
WB5YOT	19,182	194	46	6
KD5VU	14,916	156	44	4
K7CW/5	12,012	126	44	6
WF5E	5,888	85	32	4
N5AFV	2,541	59	21	2

California

K6HNZ	74,432	484	64	12
KI6O	39,786	281	57	10
K6ANP	16,695	146	45	7
WB6JMS	16,674	169	42	7
N6OJ	9,135	143	29	4
W6OUL	4,991	100	23	4
W6PFE	3,872	81	22	3
N6JM	3,504	60	24	4
N6PE	2,664	54	24	2
W6ISQ	1,462	36	17	3
N6NF	640	33	8	4
K6MO	405	21	9	2
W6OKK	336	24	7	1

Arizona

KR7Y	75,520	513	64	14
K7SP	23,376	219	48	8
NF7E	9,660	129	35	3

Idaho

N7SU	13,376	148	38	4
KA7T	11,940	177	30	4

Montana

KS7T	17,262	189	42	4

Nevada

W7ABX	1,836	51	17	3
N7NV	1,300	43	13	3

Washington

KA7AUH	64,701	415	63	12
K7QQ	58,056	404	59	10
KE7V	41,040	286	57	12
W7AWA	36,685	268	55	10
NK7V	2,100	45	20	3
K7WA	104	13	4	1

Wyoming

WA8LRJ	21,160	215	46	3
KB8KW/7	7,770	102	35	3
NQ7Q	1,843	47	19	2

Michigan

W8UVZ	23,613	208	51	6
K8SVT	17,280	201	40	4
W8QOI	12,285	112	35	3

Ohio

N8ET	48,308	412	52	8
AD8C	16,882	170	46	6
N8FXL	13,115	142	43	5
NA8W	3,690	60	30	2
NM8K	2,619	47	27	2
K8MR	1,764	36	21	3

West Virginia

WB8SCD	83,662	667	59	10
NJ8N	57,230	439	59	12
K8OQL	41,150	374	50	7
W8VEN	11,248	136	38	5
W8TN	5,644	77	34	4

Illinois

WB9HAD	196,575	1171	75	20
WB9JKI	63,630	455	63	12
KM9L	49,471	367	61	11
KR9G	41,528	320	58	9
N9AKE	23,220	247	45	2
KG9D	8,820	115	36	2
W9HOT	6,501	94	33	2
W9YYG	2,871	45	29	4
W9CA	1,278	34	18	2

Indiana

K9UWA	157,157	887	77	26
NI8L	14,008	197	34	2
W9RE	12,753	150	39	6

Wisconsin

WA1UJU	56,628	516	52	4
WB9HRO	19,943	184	49	6
W9MQZ	12,650	124	46	5
W9XT	8,015	110	35	2
W9KHH	3,164	55	28	2

Colorado

WØZV	132,480	800	72	19
WØGOR	50,103	399	57	7
WØGOQ	26,394	215	53	8
WØKEA	18,260	194	44	3
NØZA	3,312	66	23	2

Kansas

WAØTKJ	31,683	222	59	11
ABØX	29,568	287	48	5

Minnesota

WØHW	41,195	334	55	7
WØRXL	2,068	44	22	2

Missouri

WØHBH	27,370	272	46	6

Nebraska

KØHA	147,980	944	70	16

Bahamas

KØGVB/C6A	14,700	84	35	5

CANADA

Newfoundland

VO1MP	11,761	50	33	9

Quebec

VE2DTI	11,222	73	31	4
VE2QO	4,641	46	21	2

Ontario

VE3MFA	210,648	654	67	15
VE3PN	98,637	419	49	8
VE3CWE	14,065	100	29	2
VE3NBE	9,480	65	30	3
VE3ST	2,793	30	19	2

Manitoba

VE4SK	675	15	9	1

Saskatchewan

VE5RA	35,203	156	47	5
VE5UF	16,164	94	36	5

Alberta

VE6CB	3,200	43	16	2

British Columbia

VE7ERY	22,838	124	38	4

Mexico

XE1VIC	66,462	230	57	14

Turks & Caicos

VP5Z	45,375	163	55	15
		(KC2RS Op.)		

ASIA

Israel

4X4NJ	50,266	127	41	36

U.S.S.R. Asia

Asiatic Russia

UA9AKO	39,627	205	21	21
UA9MA	39,078	195	26	26
UW9WK	14,975	68	25	25
UA9MR	9,792	63	18	18

Georgia

RF6FHA	14,808	66	24	24

EUROPE

Andorra

C31OF	21,312	109	36	34

Austria

OE1DH	40,280	210	38	38

Balearic Is.

EA6TC	10,281	87	23	23

Bulgaria

LZ2CJ	279,258	832	61	55
LZ1KOZ	89,257	410	41	41
LZ1KKZ	2,016	21	18	18

Czechoslovakia

OK1JDX	25,878	138	38	38
OK1AJN	16,184	101	34	34
OK1DWC	13,950	99	30	30
OK1DWG	5,832	53	24	24
OK1JOE	3,762	49	18	18
OK2QX	3,078	34	19	19
OK1DKS	2,640	39	15	15
OK2BHQ	1,482	27	13	13
OK1AXB	1,248	21	13	13
OK2ABU	780	18	10	10

England

G4OBK	16,100	83	35	32
G3BDQ	7,650	70	25	25
G4YWG	994	16	14	14

England

G3FVA/P	16,380	107	30	29

Germany (FRG)

DJ1BZ/A	117,960	350	60	45
DL6RAI	105,896	375	56	48
DL9YX	92,288	315	56	47
DFØTHW	59,262	232	51	43
DF2RG	58,240	231	52	47
DLØFJ	47,772	276	36	34

Netherlands

PA3DQW	153,526	489	58	46

Poland

SP7KTE	121,472	433	52	46
SP5PBE	35,872	215	32	32

Scotland

GM3IGW	228,998	490	77	54

Spain

EA3VY	252,560	487	80	50

U.S.S.R. European

Estonia

UR1RWX	172,670	508	62	56
UR1RYY	96,390	346	51	46

European S.S.R.

UZ6LWZ	118,950	362	61	56
UZ6LWU	50,920	247	40	40
UZ3AYR	37,582	193	38	38
UZ3DXX	30,876	198	31	31
UZ4WWB	28,140	145	35	35

Latvia

UQ1GWW	32,718	158	38	38
UQ1GWY	14,605	127	23	23

Lithuania

UP1BWR	192,080	480	70	55

Wales

GW3YDX	552,126	846	102	70

Yugoslavia

YU1EXY	306,852	579	84	57
YT2R	236,082	511	77	53
YT2B	137,592	389	63	47
YU7JDE	123,251	376	59	48

OCEANIA

Hawaii

KH6RS	211,848	383	56	11

New Zealand

ZL3GQ	142,506	235	63	22

Check logs are gratefully acknowledged from the following: NOØV, OH1XX, OK1DQT, OK1DRQ, OK1DWJ, OK3CQD, OK3CWL, OY7ML, OZ2E, RA1AO, RA1WA, RA3VO, RA9YG, RB4IVG, RB5CU, SP4JWR, UA3DMY, UA3IAK, UA3PDW, UA3PFN, UA3XBB, UA4LCH, UA6HOF, UA6PCH, UA9CAQ, UA9FZ, UAØQO, UB4XWB, UB5JLJ, UB5VAA, UG6GDS, UQ2MU, UWØCN, Y41TA, LA7SI.

Definition: DUD—someone you did not work in the contest, but was in your log. Someone who is deceased, not on the air, no such call issued, or you are not in his log. Often created by copying errors.

Disqualified for excessive DUDS: WB3FIZ, DF9ZP (DL6FBL Op.), JR1CFG, SV1PL.
Disqualified for excessive dupes: UT4UW.
Disqualified for dupes and DUDS: OK1KFQ, Y34K.

A few lucky W/VE's got the Andorra phone multiplier from Antonio, C31OF.

Finland				
OH6YF	**620**	**13**	**10**	**10**
Germany (FRG)				
DL7MAE	**28,910**	**175**	**35**	**35**
DJ8UJ	7,128	65	22	22
DL1MAJ	7,128	59	24	24
DL8PC	4,368	43	21	21
DK2OY	624	18	8	8
DL6RAI	532	17	7	7
Germany (GDR)				
Y28AL	**14,674**	**99**	**29**	**29**
Y24MB	4,392	50	18	18
Italy				
IV3PRK	**42,615**	**181**	**45**	**45**
I4CSP	7,425	64	25	25
IV3PVD	1,568	26	14	14
Luxembourg				
LX1GQ	**5,943**	**58**	**21**	**21**
Netherlands				
PA3DFT	**48,117**	**217**	**43**	**43**
Poland				
SP5INQ	**30,438**	**151**	**38**	**38**
SP5PBE	9,646	71	26	26
SP9MAL	8,275	70	25	25
SP9GDB	6,003	52	23	23
SP9MZS	3,961	49	17	17
SP6DVP	222	8	6	6
Portugal				
CT1AFN	**4,085**	**41**	**19**	**19**
CT1TM	155	7	5	5
Spain				
EA3CCN	**35,145**	**149**	**45**	**42**
EA1AW	2,261	27	17	17

U.S.S.R. EUROPEAN

Byelorussia				
UC2IDC	**53,618**	**295**	**34**	**34**
European S.S.R.				
UA6LIT	**9,594**	**72**	**26**	**26**
RA6LNG	7,320	58	24	24
UA4CLV	5,562	58	18	18
UA6RB	3,608	32	22	22
RA3DKE	1,440	23	12	12
RA3DAD	1,358	20	14	14
UA4CQJ	20	2	2	2
Latvia				
UQ2GM	**12,100**	**90**	**25**	**25**
UQ2GLW	5,340	53	20	20
Lithuania				
RP2BJF	**1,236**	**23**	**12**	**12**
Moldavia				
UO5ONQ	**21,998**	**122**	**34**	**34**
UO5ONA	13,442	93	26	26
Ukraine				
UB5SDE	**21,855**	**129**	**31**	**31**
RB5WW	16,523	100	31	31
RB5MW	13,572	84	29	29
Yugoslavia				
YU3EA	**22,860**	**120**	**36**	**35**
YU7SF	5	1	1	1

SOUTH AMERICA

Argentina				
LU8DPM	**720**	**9**	**2**	**2**
Brazil				
PT7CB	**13,919**	**47**	**31**	**14**
Colombia				
HK6JTR	**1,428**	**19**	**12**	**10**
Venezuela				
YV2IF	**71,820**	**121**	**63**	**35**

MULTI-OPERATORS NORTH AMERICA

UNITED STATES

New Hampshire				
AK1L	**60,579**	**495**	**53**	**10**
Rhode Island				
K1NG	**164,794**	**893**	**79**	**24**
New Jersey				
N2MM	**52,896**	**400**	**57**	**12**
WV2ZOW	8,670	114	34	4
Maryland				
KC3EK	**73,332**	**611**	**54**	**12**
Pennsylvania				
W3BGN	**200,070**	**930**	**90**	**35**
K3ND	90,504	531	72	21
W3FV	47,152	365	56	11
K3YTL	43,164	446	44	6
K3UA	39,930	315	55	11
Georgia				
N4NX	75,010	522	65	15
N4RJ	41,850	278	62	15
WB4GNT	21,945	169	57	13
South Carolina				
AA4V	**23,424**	**223**	**48**	**10**
Tennessee				
N4FNB	**102,663**	**779**	**61**	**10**
Arkansas				
KB5DN	**79,200**	**611**	**60**	**10**
Louisiana				
KE5BB	**51,720**	**400**	**60**	**10**
Texas				
W5MPX	**4,988**	**80**	**29**	**3**
California				
N6LL	**22,365**	**212**	**45**	**7**
WB6EGE	5,214	103	22	4
Oregon				
NK7U	**90,916**	**568**	**68**	**15**
Washington				
K7IDX	**55,251**	**344**	**63**	**12**
Michigan				
W8RA	**126,820**	**825**	**68**	**16**
KA8POW	62,694	530	54	7
Ohio				
KC8MK	**199,342**	**1048**	**82**	**27**
Indiana				
KB8AC	**16,155**	**166**	**45**	**5**
Colorado				
K8GAS	**31,928**	**271**	**52**	**5**
Kansas				
W8CEM	**155,960**	**1007**	**70**	**16**
Minnesota				
KD8OZ	**59,736**	**485**	**57**	**6**
Bermuda				
VP9AD	**153,420**	**507**	**60**	**17**

CANADA

Ontario				
VE3KRP	**107,240**	**398**	**56**	**6**

EUROPE

Austria				
OE3WQB	**45,080**	**230**	**40**	**40**
Bulgaria				
LZ2KPD	**96,642**	**451**	**39**	**39**
Czechoslovakia				
OK3KFO	**167,895**	**708**	**45**	**45**
Italy				
I8CZW	**42,300**	**189**	**45**	**42**

U.S.S.R. European

Lithuania				
UP1BWB	**66,950**	**510**	**25**	**25**
UP1BYT	2,484	41	12	12
Wales				
GW3YDX	**194,432**	**569**	**64**	**48**
Yugoslavia				
YT2R	**69,264**	**276**	**48**	**47**
YU1AAO	68,238	245	51	46

Check logs are gratefully acknowledged from the following: C31LD, KL7Y, OH1XX, OH2FQ, PP7HS, PT7BZ, RA4NAI, RB5DX, SP7KTE, SP8BVJ, UA6JDQ, UV3QIP, UZ6AWX, VE1CBF, ZL3GQ.

Disqualified for excessive Dupes and DUDS: I4ZNU, Y34K.

CQ REVIEWS: BY LEW MCCOY*, W1ICP

The OPTOelectronics Model 1300H Frequency Counter

OPTOelectronics of Ft. Lauderdale, Florida has come out with a frequency counter that is very unusual in many respects. First, it is very small, measuring 4 inches high by 3½ inches wide by only 1 inch deep, so it is small enough to fit into a shirt pocket. It is completely self-powered with its own internal nickel-cadmium battery pack. This is an awful lot of test equipment in a very small package, and it really works!

I always like to see companies run by hams with their equipment designed by hams, simply because such people keep our needs in mind. OPTOelectronics is owned by Fred Huff, W4PLM, and I have known Fred for many years. He is an active amateur who has been designing and building frequency counters for a long time, and the Model 1300 is one of his latest creations.

Some Details

The Model 1300-H has a frequency range that should satisfy any experimenter, the range going from 1 MHz to 1.3 GHz in two steps, up to 500 MHz and then to 1.3 GHz. I checked the sensitivity by using a 450 MHz handheld with 100 milliwatts output. At a distance of 10 to 12 feet from the 1300-H I could get an accurate frequency reading. This indicated excellent sensitivity to me. The rated sensitivity of the unit is 5 to 15 mV in the 150 to 500 MHz range and 10 to 35 mV in the 500 to 1000 MHz range.

There is a sensitivity switch that reads **High** or **Normal.** In the high position there will usually be a display of random count because of self-oscillation of the ultra-high-gain amplifier. As soon as a signal is detected, the self-oscillation is overridden. If the random display is found to be objectionable, the normal position can be used.

The gate switch is used to select a fast (short) signal time or a longer time. Fast is .25 seconds sample time and slow is 2.5 seconds.

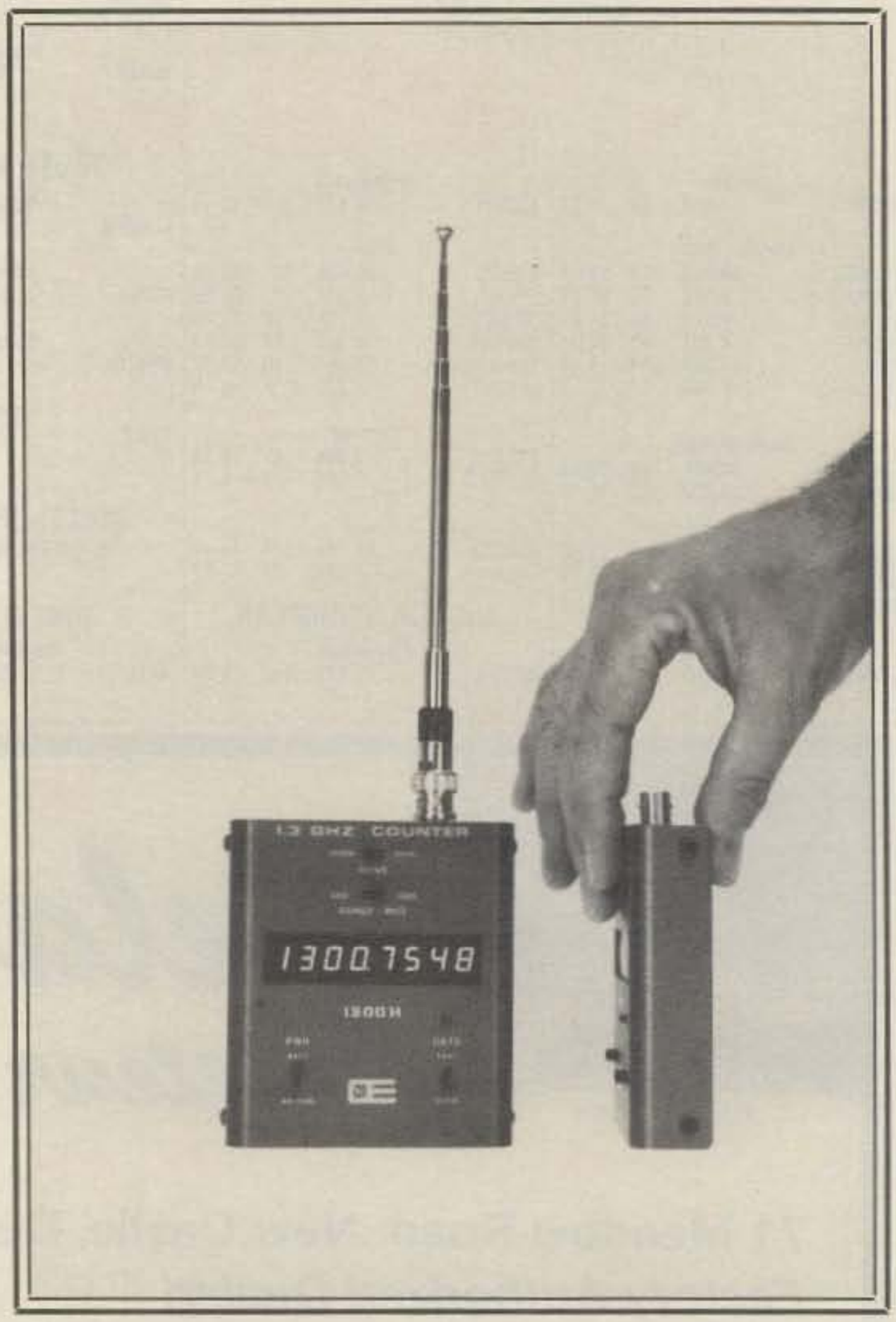
Accuracy

The accuracy is also very good. I tested the counter at 146.000 MHz and found that as close as I could tell, the instrument was accurate to within 100 cycles. This was checked against WWV. There is a front-panel hole that has an adjustment screw. This adjustment will provide plus or minus 15 parts per million range.

The counter can operate 2 to 3 hours on the internal battery pack before the batteries need to be recharged. The counter is on and usable when the AC adapter/charger is plugged in.

The readout has eight red LED digits. The probe connector is a BNC-type fitting, and a telescoping antenna is available. This input is common to both 500 MHz and 1.3 GHz.

I do a lot of antenna work in which I use a grid-dip meter for measurements. Usually I have to lug a receiver out to where I am working and use the receiver to check the accuracy of the grip-dipper. However, it really makes the job easy using the pocket frequency counter along with the dipper.



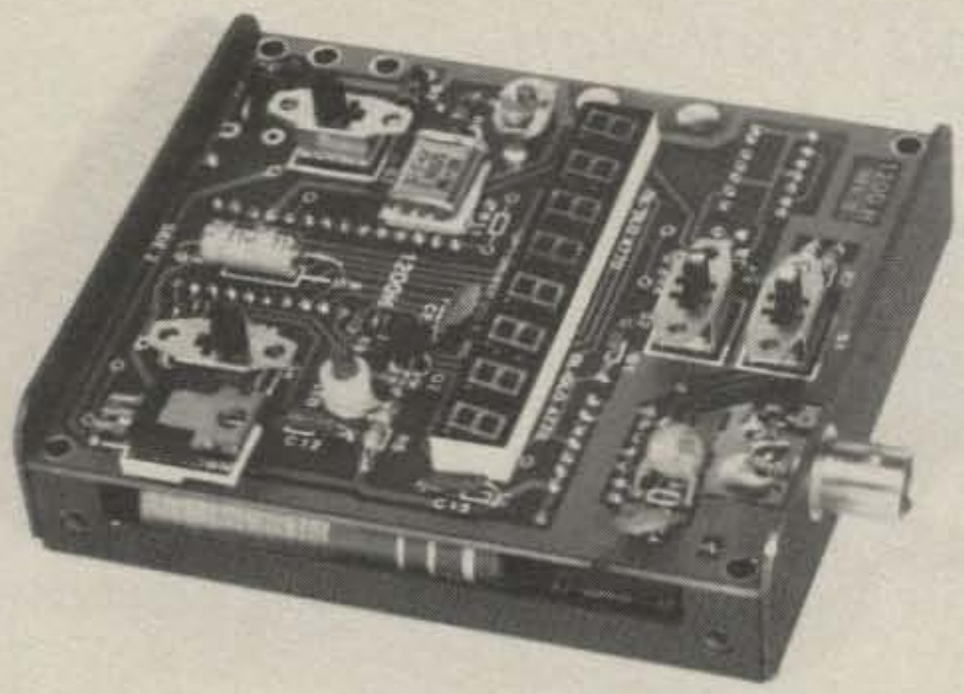
This front-and side-view photo gives one a very good idea of the size of the counter. One can quickly see that the Model 1300-H is quite small.

Many Uses

Some of the other uses for the 1300-H include checking any transmitter frequencies and oscillators in such. It is also used in counter-surveillance to detect hidden "bug" transmitters. Also, it will measure clock frequencies in computers or other digital equipment.

Obviously, I am impressed by the performance of the unit. I

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



Here is a view with the cover removed.

told my wife it would make an excellent Christmas present (for me, of course).

The list price is $150.00, which includes the Ni-Cad battery pack, the AC adapter, and charger. Other accessories include a telescoping antenna, $12.00, and direct probe connection of 50 ohms, $18.00. The unit is manufactured by OPTOelectronics Inc., 5821 N.E. 14th Ave., Ft. Lauderdale, Florida 33334 (305-771-2050). CQ

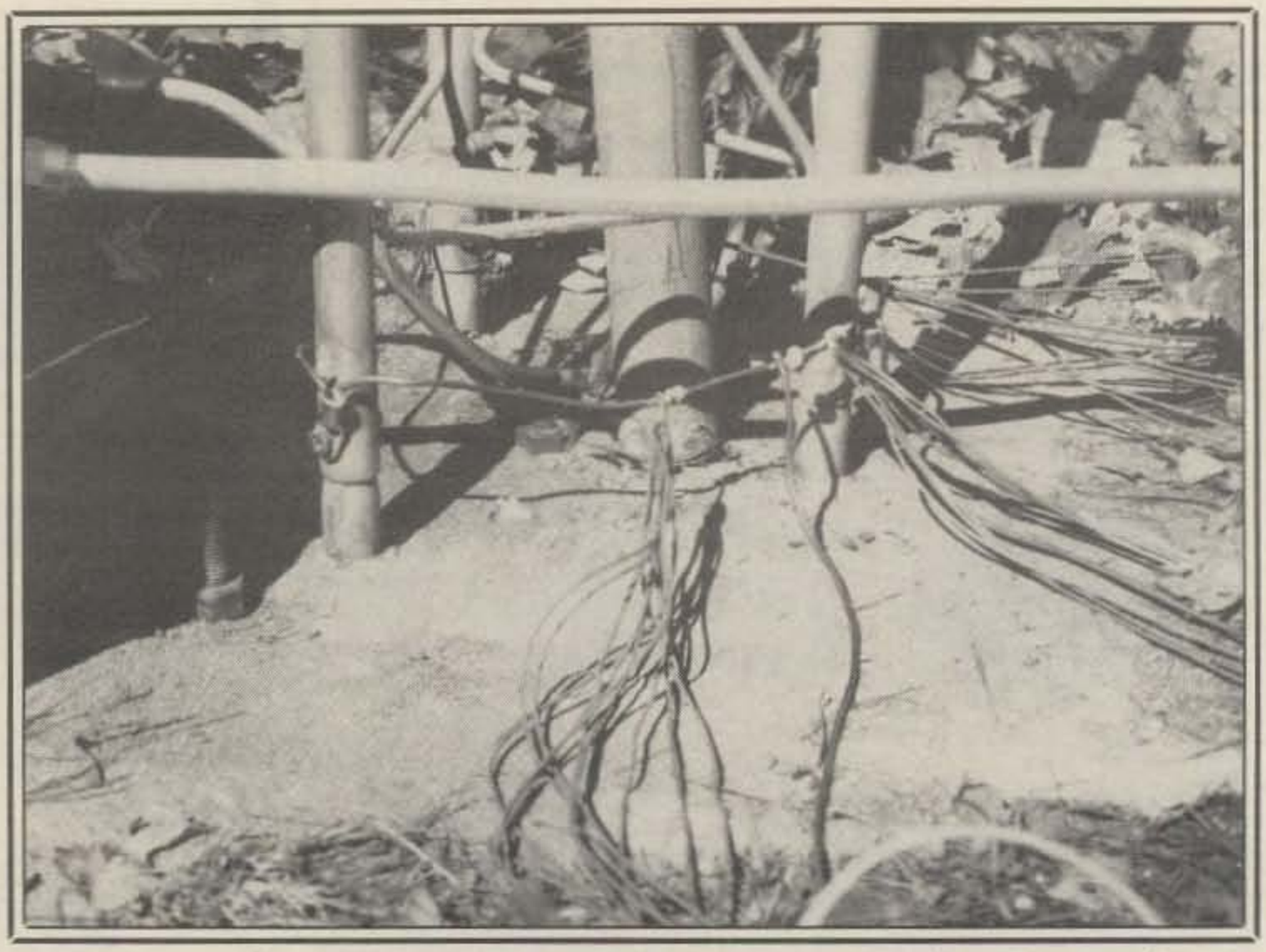
It's not supposed to work, it really shouldn't work, and you can't make it work. KM1H shows us that in spite of the above it really does work and work well.

Build A High-Performance, Extended Bandwidth, Shunt Fed, 160 Meter Vertical

BY CARL HUETHER*, KM1H

After listening during the winter of 1984-85 to the 160 meter action being reported on the local DX repeater, I finally decided to try the band. My 100 foot guyed tower already supported homebrew, 4-element monoband Yagis for 10, 15, and 20 meters, plus an assortment of delta loops and slopers for 40 and 80 meters. Considerable time had been spent minimizing, or emphasizing as required, interaction between the various antennas. One more antenna hanging from the tower would probably cause the whole thing to quit working, to say nothing of my long-suffering wife and neighbors.

Some of the repeater gang had reported excellent DX results with verticals on 160, so I decided to have a go at shunt feeding the tower. Since the upper two sets of guy wires are Phillystran[1], adding insulators was only required to the bottom set of guys. Adding insulators to an existing guyed tower is readily accomplished, even if all levels must be converted.



The grounding ring and the radials. The cable running horizontally at the tower base is the CATV hardline.

Facts, Myths, and Sea Stories

Published information in amateur radio journals about shunt feeding towers has been very sparce indeed. Most articles seemed to perpetuate the myth that the antenna has to be resonant in order to work. The commercial services have been using grounded nonresonant towers for years. There is a catch, however. The nonresonant tower does exhibit a narrower bandwidth, primarily due to the restrictions of the matching device(s)/feed system. Those towers whose electrical height is substantially less than a quarter wavelength are especially prone to this malady. This article will attempt to show a method to reduce the effect of those restrictions and provide an extremely attractive solution to working DX on 160 meters. It should satisfy the numerous requests for details that I have received over the air and through correspondence. There is also a very positive benefit to this method of feed. Since the tower still appears nonresonant to the various wire antennas, there has been no measurable effect on their performance. This is of major concern to those who have labored many hours to fine-tune directional sloper and delta loop arrays for 80 and 40 meters. Should the electrical height of the tower equal an odd quarter wavelength on those bands, simply add a horizontal extender wire to eliminate the effect. Remember a grounded radiator exhibits resonance at odd multiples of a quarter wavelength. This effect has been burned into my memory due to an experience I had while in the Navy.

One of the shipboard transceivers fed a 36 foot vertical with a remote tuner at

*54 Hobbs Rd., Pelham, NH 03076

[1]*Phillystran is the registered trademark of Philadelphia Resins, Inc.*

the base, mounted to the side of the stack (exhaust pipe for you landlubbers). This system had worked flawlessly for many months until suddenly on one of our primary operating frequencies it ceased to function. As senior Electronics Technician, I detailed one of my group to repair duty. After many hours he reported there was nothing wrong with the transceiver. We could hear fine, but we could not be heard. After much grumbling about the mental abilities of my technician, I decided to go to the radio room and see for myself. Four hours later we were no closer to a solution. With 600 watts output we were barely heard a mile away. Other frequencies worked fine. A quick trip up to the 40 meter amateur band, several hundred kHz away, generated excellent reports. (Illegal as heck, since the Navy had yet to give /MM permission to amateurs. I only had 3 months service left anyway). By now half of the officers on the ship were crammed around the radio room asking exasperating questions as only offices are trained to do. Suddenly one of the deck Chief Petty Officers came in to report a frying sound at one of the guy wires supporting the stack. A quick investigation solved the mystery. Earlier that day the guy wire was given a fresh coat of white lead (used to minimize salt-spray corrosion). The guy was insulated, but the white lead was completely covering the insulator. The total length of the guy including the shorted section measured exactly a quarter wavelength at our problem frequency! Although there was no direct connection between the antenna and guy, it was absorbing and shunting all of the RF to ground. After the insulator was cleaned, performance returned to normal. I have never heard or read of such an extreme case to this date and would be interested in hearing of other similar experiences.

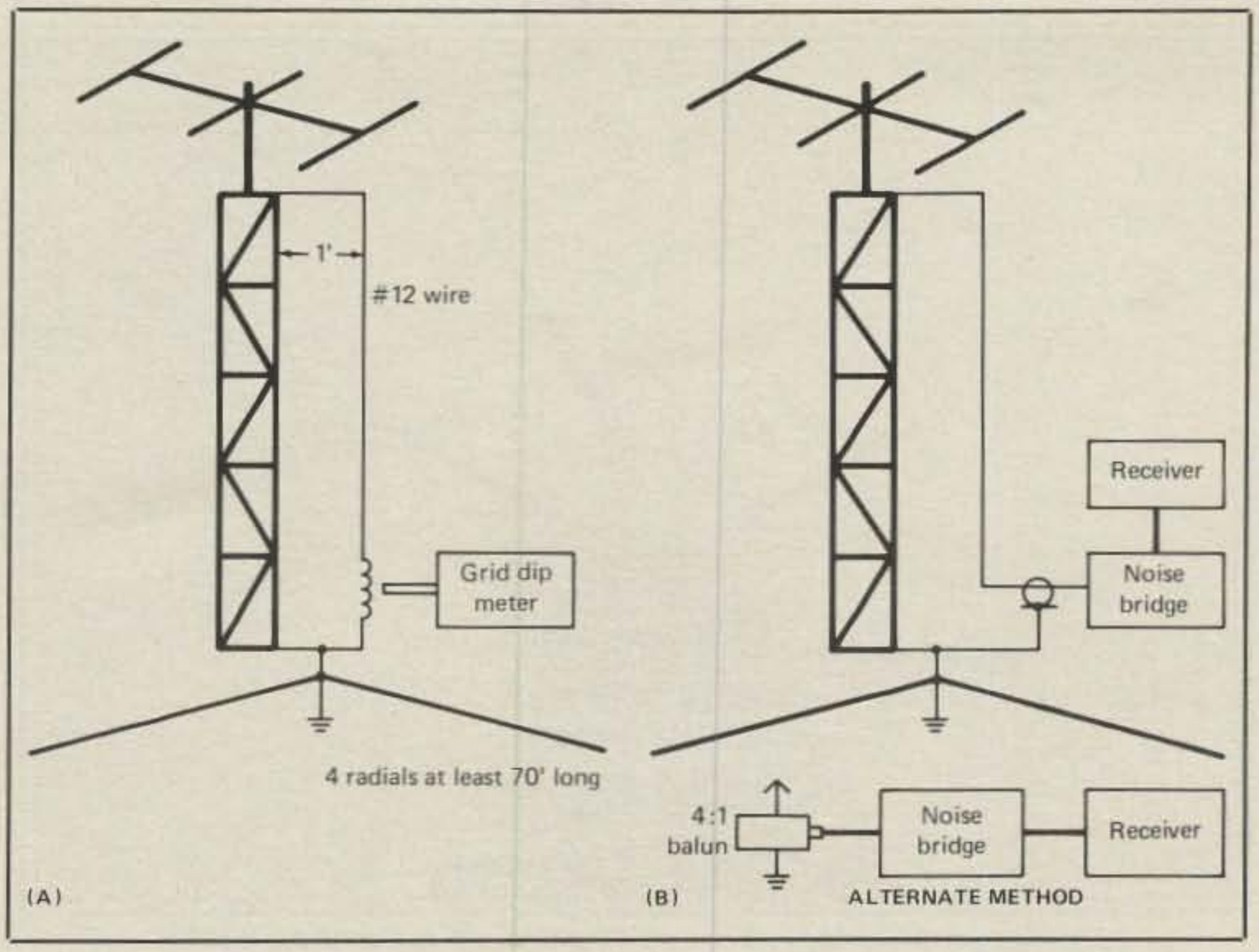


Fig. 1- Two methods of determining resonant frequency of a tower.

Getting Started

The top-loading effect of the mast (16 feet) and Yagis yielded a measured quarter-wave resonant frequency of 1400 kHz. This translates to an *electrical* height of 175 feet, a pretty impressive height by any standard. The true electrical height may be measured many ways, but two methods are easily employed by the average amateur without access to an R&D lab. Option one is to attach a #12 wire to the top of the tower and spaced about a foot away. At ground level, couple a two-turn loop to a grid-dip meter and read the resonant frequency, fig. 1(A). A disadvantage is that many grid-dip meters do not go below 3 MHz. Another method is to use a noise bridge and a general-coverage receiver. Use the same #12 wire as above, but connect directly to the center pin input of the bridge, ground the case to the base of the tower, fig. 1(B). Some bridges will require a 4:1 balun at the input. For all of the above methods, the base of the tower must be grounded, and in most cases at least 4 radials will be necessary. Once the true electrical height is known, the chart depicted in Table I may be used for selecting the series capacitor (Cs) and the gamma rod length. The shunt capacitor (Cp) requires a bit of experimentation, but it is typically in the 1500 to 2500 pF range.

Phase 1

A #12 wire was spaced 12 inches from and attached to the 65 foot level of the tower. An Omega match (fig. 2) quickly yielded a 1:1 match at 1835 kHz with a 2:1

(A)

Physical Height (ft.)	Electrical Height (ft.)
40	85
50	95
60	105
70	115
80	125
90	135
100	140
110	150
120	155
130	160

(B)

Electrical Height (ft.)	Gamma Rod (ft.)	Cs (pf)
80	70	200
90	60	225
100	50	250
110	40	400
120	35	750
130	30	1000
140	35	700
150	55	500
160	60	400
170	65	350
180	70	300
190	75	275
200	80	250

Table I- (A) Approximate electrical height versus physical height of Rohn 25G tower, or similar, with typical triband Yagi (TH7, KT34, A4, etc.). (B) Gamma rod length and approximate Cs for various electrical heights.

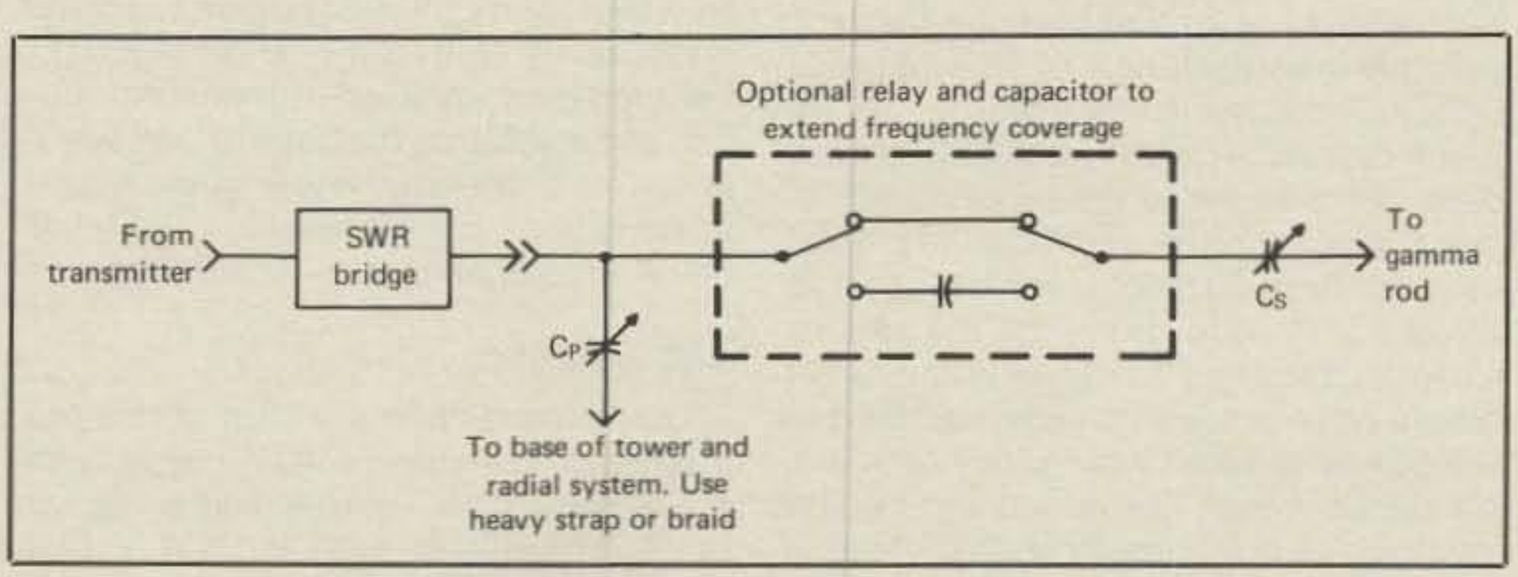
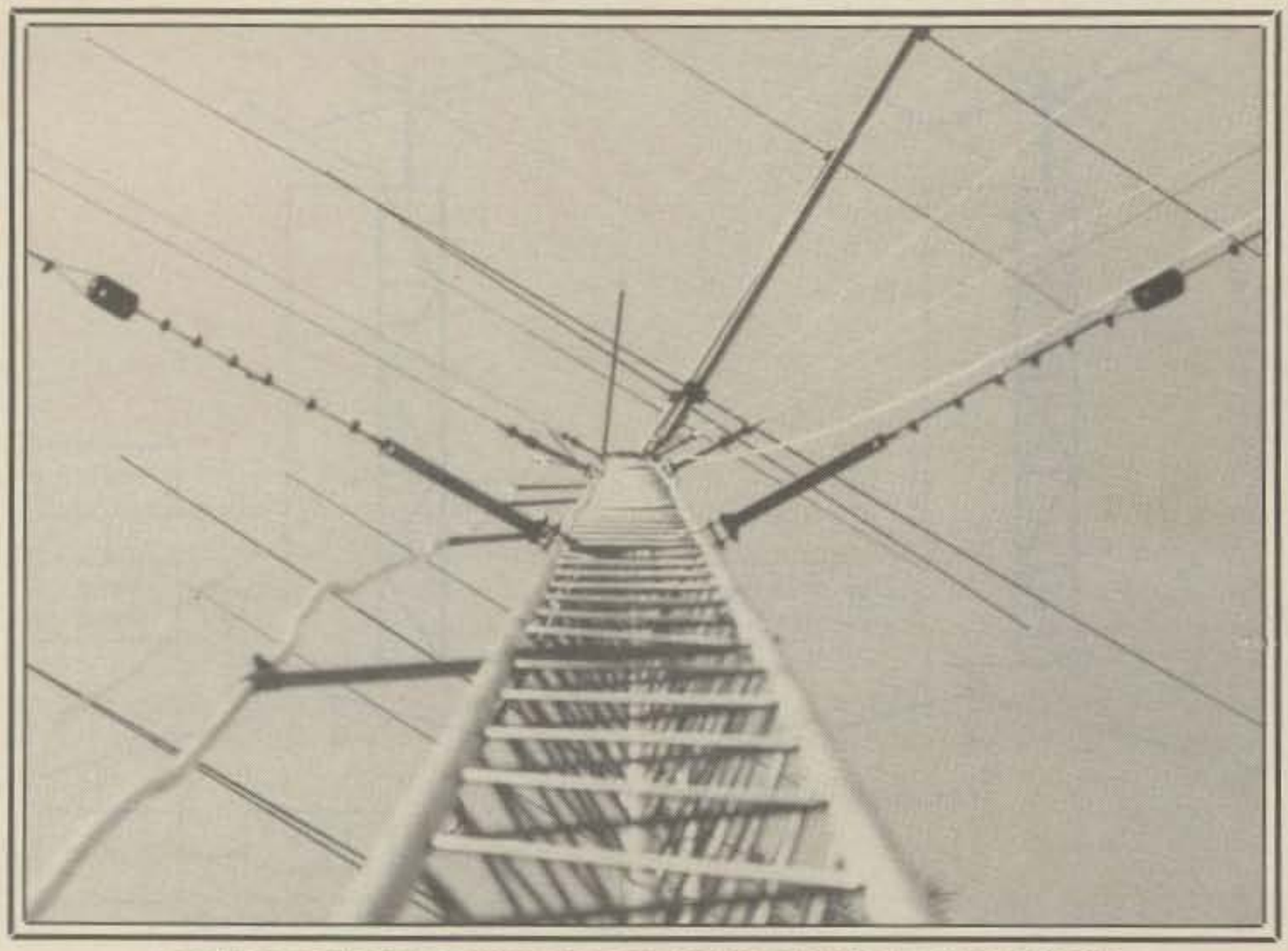
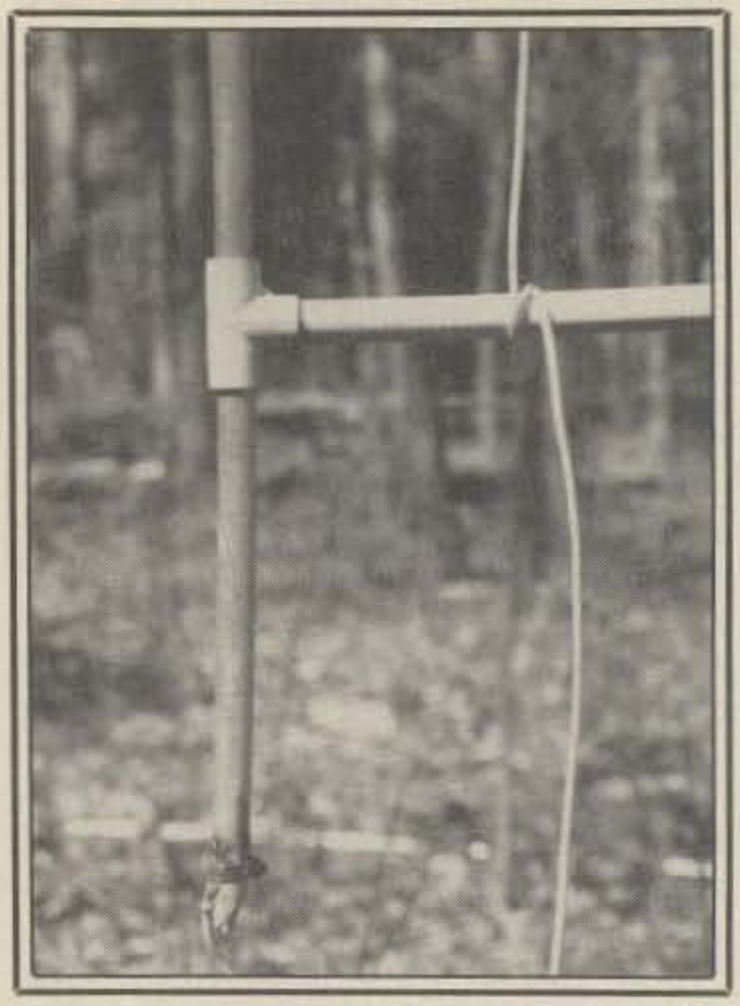


Fig. 2- The Omega match. For values of Cs see Table I. Cp is 1500-2500 pF.



Looking up the tower you can see the gamma rod on the left side.



Closeup of the standoff construction. The white wire is a temporary experiment to shunt feed the tower on 80 meters.

bandwidth of 90 kHz. With 45 watts output from a tired T4XC, I made a number of contacts throughout the Gulf Coast and the Caribbean, but only when no one else was competing. In my initial rush to get on the band, only the four radials used to measure the resonant frequency were installed. Apparently, the ground losses more than overcame any benefits of the almost three-eighths wavelength radiator. **Get that RF ground resistance as low as possible**. I then used #6 solid copper wire (CATV scrap), soldered into heavy-duty lugs, to tie the three tower legs together at the base. The copper wire ring makes an ideal attachment point for the radials. Install at least one 8 foot ground rod a minimum of 2 feet from the concrete base of the tower for lightning protection, IF YOU HAVE NOT ALREADY DONE SO!! More radials were installed, and the extensive ground system from an unused 80 meter cage vertical was spliced in. Eventually, 13,000+ feet of radials were in the network. Permit me to state here that the radial system follows no particular pattern. The hub of the 80 meter radials is about 70 feet from the tower; it was tied in with a length of #6 wire going directly from the tower base to the 80 meter hub. New radials were run from the base of the tower to the property limits. Depending upon the direction, they range in length from 60 to 220 feet and use #18 through #22 wire. Some of the radials were tied together with a perimeter wire; others were not. Some were soldered to the 80 meter wires where they crossed; others were not. The reasoning behind this lack of consistency is that there is general disagreement as to the proper way to install radials. I figured that by violating all schools of thought an effective compromise would result; let the engineers argue forever, I want to work DX! The Omega match required retuning after every substantial change to the ground system, indicating that "something good" was happening. The DX coverage area also kept expanding. If a noise bridge is available, the actual improvements may be observed and recorded.

Woops!

One night I decided to operate above 1860 kHz and get started on 160 meter WAS. The transmitter would not load! Reduction of those ground losses had raised the Q of the antenna and reduced the 2:1 VSWR bandwidth to 20 kHz! The problem was compounded by trying to match the tower with #12 wire; the d1 to d2 ratios were all wrong. My first thought was to change the gamma feed to a wire cage of from 3 to 4 inches in diameter. From a purely operational viewpoint, the cage would have worked very well and yielded a bandwidth of about 75 kHz. However, as mentioned earlier, the tower was already cluttered, and the mechanical problems involved in mounting, tuning, and stabilizing the cage in high winds and other unfriendly New England weather conditions quickly negated the benefits. A simpler solution was required.

The Solution

Coincidental with the start of this project, cable television (CATV) came to my town. Soon after establishing a "brown bottle" friendship with the CATV construction manager, the storage area behind the garage was filled with reel ends of guy wire and 75 ohm hardline of various diameters. A few quick calculations confirmed that a gamma rod constructed from .750 inch hardline would yield a considerable improvement over the #12. The diameter ratios are not ideal, but is considerably more manageable and lighter than the cage. Should the hardline not be available from the CATV contractor, it can be found in scrap-metal yards. Call the CATV engineer in your community, or in surrounding towns, and ask who buys their scrap. The engineer may even be a ham, but in any case will likely be more helpful than a front-office paper pusher. No matter what the source, CATV cable is a genuine bargain.

The actual construction of the hardline gamma rod turned out to be the ultimate in simplicity. The material list is:

75 feet .750 inch CATV hardline
10 feet ¾ inch PVC water pipe
Five ¾ inch PVC plumbing T fittings
Three stainless steel hose clamps
15 inches aluminum tubing; ¾ inch through 1 inch satisfactory
One tube Anti-oxidant

Unreel the hardline on the ground and get it as straight as possible. Ream out the through leg of the T fittings so the cable fits snugly; if you have access to .625 inch hardline, this step may be eliminated. (Should .875 inch or even 1.000 inch cable be available, so much the better. Simply use the next largest diameter pipe fittings and build up the cable diameter with tape, etc.) Cut the ¾ inch pipe into 5 equal lengths, cement into the T fittings, and slide onto the cable in roughly equidistant positions. Hoist the cable into po-

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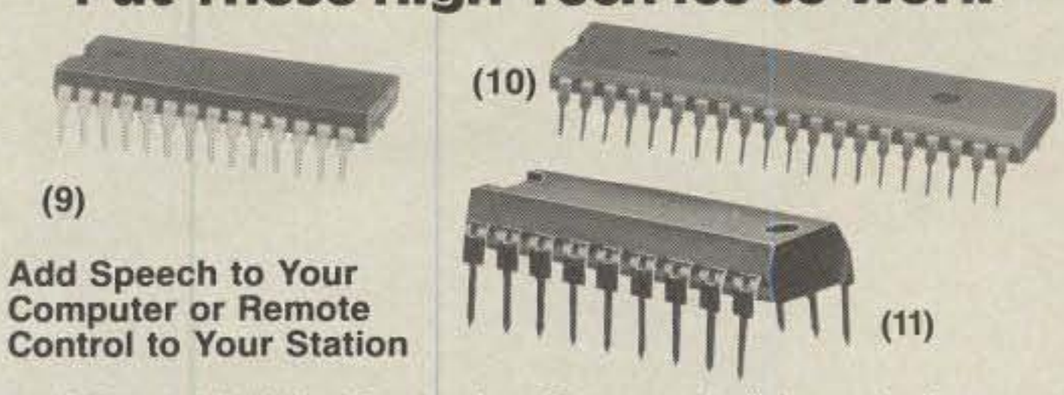

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58/U	52	66%	50 MHz, 4.0 dB 200 MHz, 8.0 dB	100 MHz, 5.3 dB 400 MHz, 12.0 dB	278-1326	.16
59/U	75	75%	50 MHz, 1.8 dB 200 MHz, 3.9 dB	100 MHz, 2.8 dB 500 MHz, 7.5 dB	278-1327	.16

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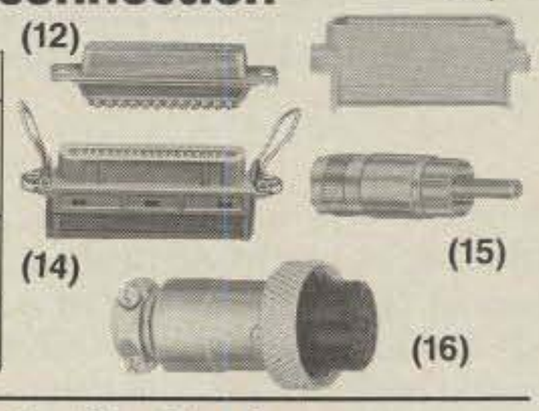

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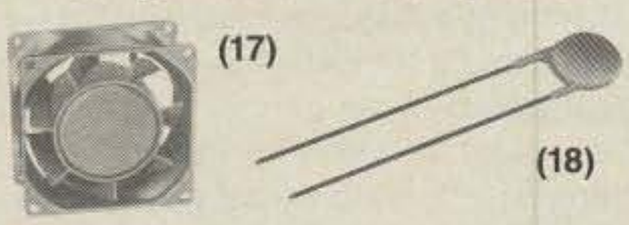

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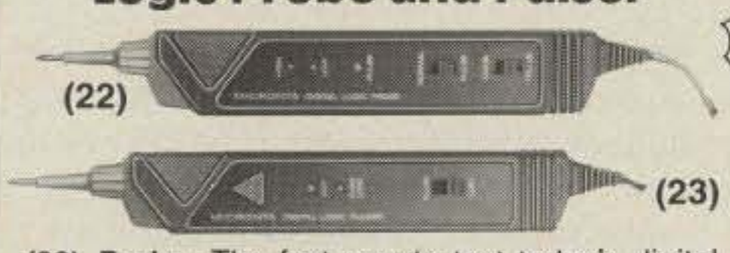

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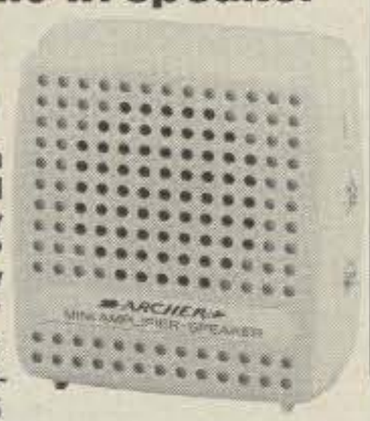

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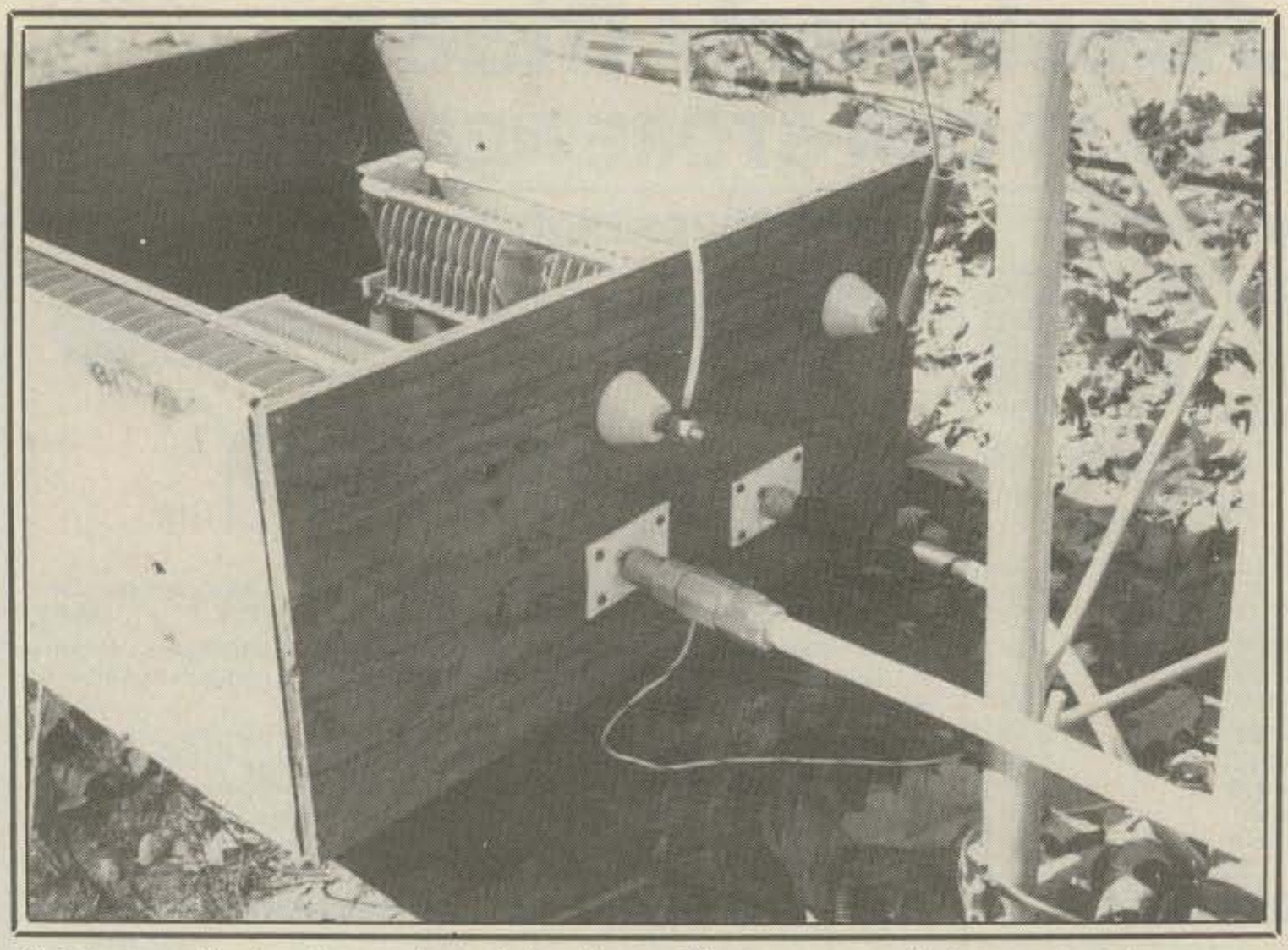


Cables terminate at tower base into a tuner. The box normally has a plexiglass cover.

sition and tie the PVC pipe onto the applicable horizontal tower braces; space the gamma rod 12 inches from a tower leg (fig. 3). Don't be too fussy about getting the rod absolutely straight; mine wanders around in a sine wave of about 3 inches. (Who knows, it might even improve the bandwidth.) With the rod positioned opposite the vertical leg and a few inches from the guy torque arms, it does not interfere with climbing the tower. Flatten both ends of the 15 inch length of tubing for a distance of 1.5 inches and bend the ends down at right angles. This piece may now be attached to the gamma rod and a tower leg with the hose clamps and acts as a sliding short. Finally, attach a length of #10 or #12 stranded wire to the bottom of the gamma rod with the remaining hose clamp; the other end will attach to the series capacitor of the Omega network. Fan the strands and tin the wire so that maximum contact area is made with the rod and clamp; apply a liberal amount of anti-oxidant to all mating surfaces (available at electrical supply houses and great for use on telescoping beam elements, tower legs, etc.) CATV cable is made from a very soft aluminum; self tapping screws do not hold very well. I also wanted to use only the outer jacket of the cable.

The beauty of the Omega match and the sliding short is that it is no longer necessary to be concerned about the gamma rod spacing from the tower. Set it once and forget it. This most certainly makes tune up a cinch! Simply place a 50 or 75 ohm VSWR bridge at the input to the tuning network and adjust both capacitors for minimum reflected power. Adjust the position of the short a foot at a time, and the capacitors, until a perfect match is achieved. Optimum gamma rod spacing appears to be in the 12 inch region with the rod facing a tower leg. Having the rod directly facing the 12 inch tower cross section instead might very well degrade the coupling efficiency. Many reports of poor performance with shunt feed have been analyzed and a pattern has emerged. Spacing in the 2 to 3 feet region can be matched to the transmission line, but energy transfer from the rod to the tower is minimal. The rod is doing most of the radiating. There appears to be a practical limit of diameter and spacing ratios that can be tolerated. Those amateurs who have followed my suggestions have reported a marked improvement in *operating* performance. I'm waiting for the first person to report using 6 inch diameter irrigation tubing for the rod!

With the short set at the 70 foot level on my tower, the parallel capacitor required 2300 pF, comprised of a fixed 1800 pF transmitting mica and a 1000 pF variable. Approximately 300 pF was needed for the series capacitor to resonate at 1835 kHz. This consisted of an antique 100-100 pF dual-section variable and a 200 pF transmitting mica of equal antiquity. Slight readjustments of the series capacitor permits coverage of the complete 160 meter band with zero reflected power indicated at resonance on my 75 ohm Bird wattmeter. Once set, the shunt capacitor does not need readjustment when QSYing. At the 100 watt level, broadcast variable spacing has proven adequate. At the 1500 watt level a minimum of 3500 V spacing for Cs and 1500 V for Cp should be sufficient, as long as the VSWR is kept reasonable. If using fixed capacitors, make sure they can handle a peak RF current of at least 7 amps. Bandwidth is now an acceptable 55 kHz between the 2:1 points. Once the final position for the short has been decided, apply anti-oxidant to all mating surfaces and tighten securely. Weatherproof the top of the gamma rod. Cable boots can be found in CATV staging areas, since they are only used to

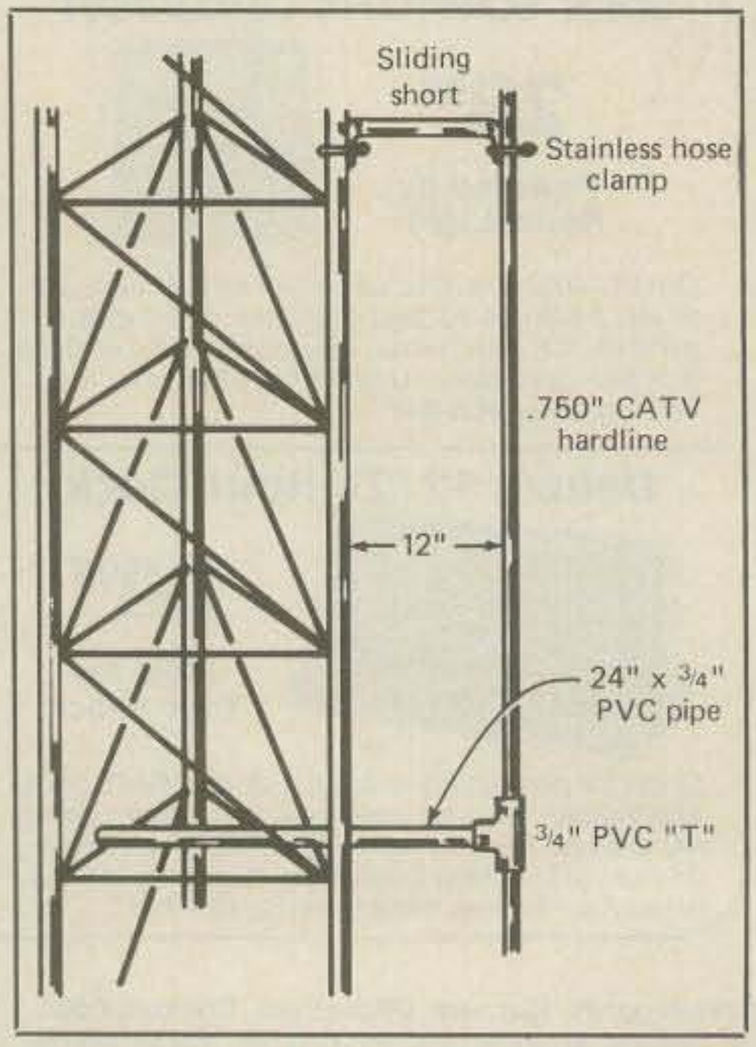


Fig. 3- Support system for the gamma rod and the sliding short.

protect the cable while in transit or storage. An alternative would be chair leg protectors available at hardware stores. The feedline is 150 feet of .500 inch CATV hardline. Feedlines and control cables from the other antennas on the tower are tie-wrapped to tower legs and run down to ground level. They then run for 75 feet through the woods, on the ground, and then under the lawn, through 75 feet of 4 inch PVC sewer pipe into the house. Interaction has been nonexistent.

Options

The matching network ideally lends itself to remote control. At last, a use for those surplus selysns. Alternatively, a DPDT relay can be used to switch in a *series* capacitor at the input side of Cs (fig. 2). Switching in the capacitor will *raise* the reasonant frequency. A typical result would be 1800-1850 kHz in the de-energized position and 1850-1900 kHz when energized. A series capacitor was selected because the input is a high current point and the switching may be handled by an ordinary power relay. Switching a parallel capacitor would exceed the abilities of most relays available to us mere mortals.

Brag Section

Performance, which is what really counts, has exceeded expectations. With new finals in the transmitter, 54 countries were worked barefoot during the summer static season without the benefit of low-noise receiving antennas. Adding 160 meters to my old NCL-2000 amplifier, plus a few good Beverages for receive, has brought the country total up to 134 through March 1986 (11 months), plus WAS. Included in that total is the first W1 to Japan QSO (with QSL) with legal power—in fact, at 600 watts output, about 4 dB below legal power. As a sidenote, do not be concerned if you cannot get quarter-wave radials in some directions. In the direction of Europe and Africa, my radials are only 60 to 90 feet long, yet performance in those directions has been excellent.

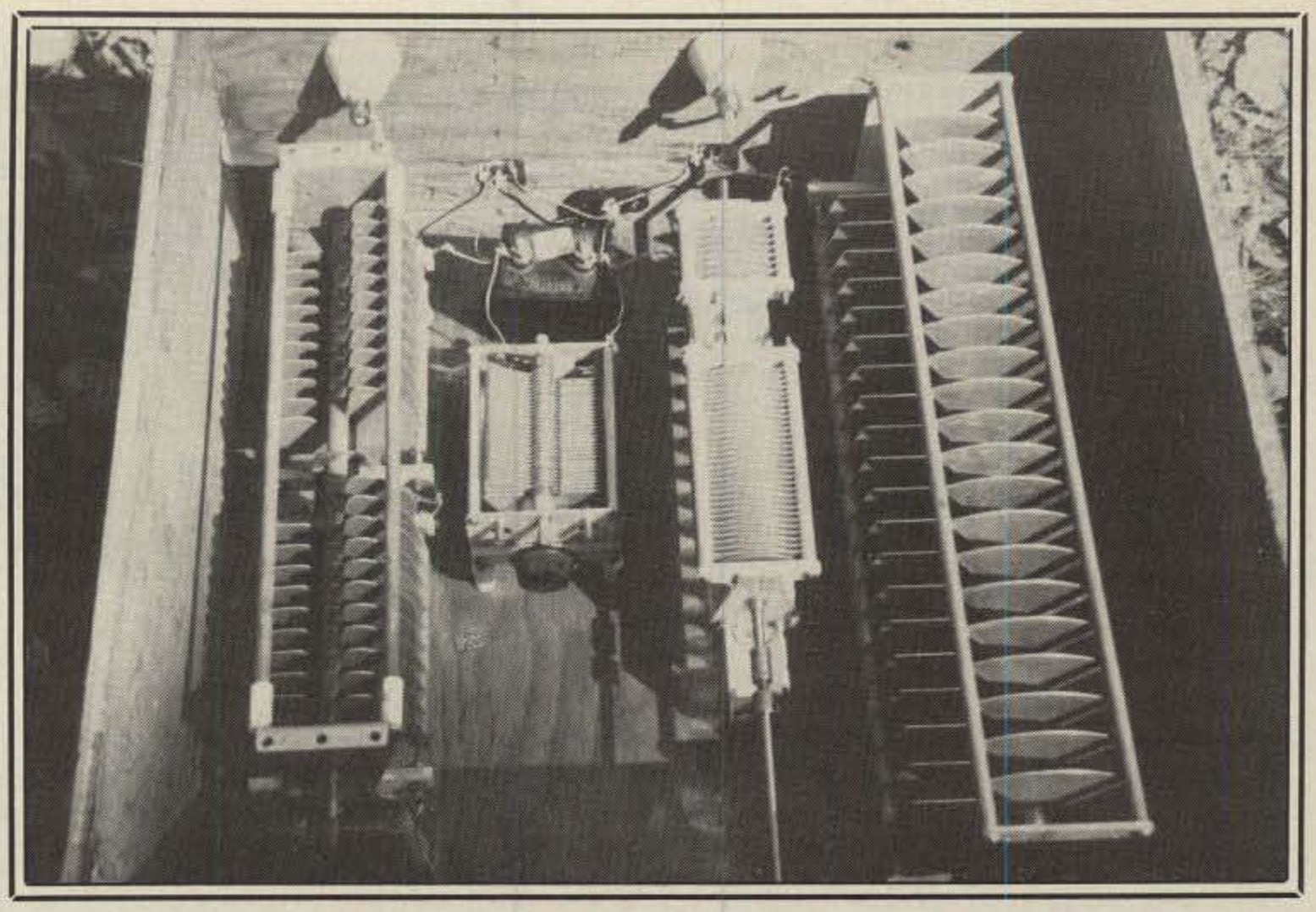
Summary and Final Comments

Towers as short as 50 feet physical height can be efficient performers on 160. A typical triband Yagi, mast, and 2 meter beam adds 40 to 60 feet to the electrical height. Getting the ground resistance down is extremely important with short towers.

The total electrical height of the structure *does not* have to be resonant in order to maintain adequate bandwidth and may be advantageous.

The radiated field strength drops quite rapidly past the 2:1 VSWR points.

The same tower can be fed on other bands. Just make sure that the electrical height on the new band does not cause the radiated energy to be a cloud warmer.



Inside the tuner box is the Omega match. The left side is for 160 meters, and the right side is for 80 meters.

Five-eighths wavelength is the practical limit unless you wish to use decoupling sleeves and go the collinear route.

If the electrical continuity of the joints between tower sections is suspect, particularly on older towers, jumper them with heavy strap or braid. As suggested previously, use anti-oxidant. Use anti-oxidant on any new tower even if it will not be used as an antenna; it makes for easier disassembly.

Above all, do not get discouraged if the antenna does not appear to work at first. Give yourself a few weeks to properly evaluate performance. One-sixty meters exhibits highly variable propagation conditions. Some nights are strictly "Horizontal Nights." Other times, only verticals seem to get through. There is one-way propagation. There will also be nights that you cannot "buy" a contact, but stations only a hundred miles away are getting through in fine shape. The vertical still holds the DXCC and most of the contest records on 160.

Thanks to Andy Deskur, KA1M, for the excellent photography.

Does anyone know how to convert all those fleamarket bargain 50 ohm Bird elements to 75 ohms?

Is your antenna working for you or against you? How much power should you be running? KB1N takes a look at some of the common problems facing new amateurs in the mystical world of antennas.

Novice Antenna Hangups

BY PETER O'DELL*, KB1N

Back when I worked at the ARRL, I got a call from a new Novice one day. He said he had been calling CQ and answering CQs for over a week. So far, as best he could tell, no one had heard him. Certainly no one had answered him.

He went on to say that he had a wattmeter that he was using with his new station. The wattmeter indicated that his transmitter was putting out about 5 watts, which was what it was supposed to. So why wasn't anyone answering him?

As the conversation proceeded, I found out that he lived in an apartment complex in New York City. As it happened, my mother-in-law had lived in that complex when I first met my wife, Sally. Everything about the buildings spelled out the proverbial *brick outhouse* approach to construction, including, I'm sure, the steel superstructure.

As he described his indoor 40 meter dipole that ran up and down his hallway ceiling, I had a mental picture of most of the RF his transmitter put out being swallowed up by the steel monster. Only a few stray milliwatts were escaping from its clutches. It was an amateur radio nightmare equivalent to the goriest scenes from "The Monster that Devoured Cleveland."

To my way of thinking, the new Novice needs every break he (or she) can get. Running low power is challenging (it's called operating QRP), and it is fun for the skillful operator. Most new Novices aren't *yet* skillful operators, or they wouldn't still be Novices. So my first piece of advice for him was to borrow another rig that would bring him up to the average power level until he had a few contacts under his belt. (Most Novices are running transceivers with about 100 watts output power capability.)

But even that wasn't going to solve the problem. He needed to get an antenna outside of the steel cage—i.e., the steel girders of the building. Since he was near the top of the building, I suggested that he simply tie a small rubber ball to a long piece of thin wire. When he wanted to operate, all he would need to do was to lower the ball and wire out one of his windows. He would need some sort of matching network (transmatch) to match his transmitter to a random-length wire.

At this point he interrupted with a question. Since the wire was pointed downward, wouldn't it act like a ground instead of an antenna? All the pictures he'd ever seen of vertical antennas showed the feed point at the bottom, not the top. As I told him, it really doesn't make any difference in which direction the wire points. If it is outside a steel-girder-type building, it's going to work better than if it is inside. (And this is true, also, of a wooden house covered with aluminum siding!)

I suggested that it would probably work even better if he could make it hang a couple of feet away from the building. One way of doing that would be to loop the wire over the end of a broom stick (or some other convenient nonconducting rod). Then wedge the other end of the broomstick into the window.

He called back a few days later to tell me that the outside antenna and higher-powered transmitter had done the trick. Now other stations seemed to hear him more times than not. When you are new to the game and having difficulty, it is usually a good idea to turn to someone with more experience.

My friend Clark, W8TN, tells the story of another Novice who had an antenna that was definitely working against him. Bill called Clark one evening in a state of despair. Bill had been on 15 meters all day long answering CQs with no response. Fortunately, he had the presence of mind (and the opportunity) to turn to an experienced amateur for help.

When Clark drove up in front of Bill's house, he saw no sign of the antenna. Bill led him to the basement, where the station was located. Behind the transmitter was a gray piece of coax cable that ran partway up the wall and terminated in a ball of electrical tape. A black piece of coax emerged from the tape ball and ran up the wall and across the floor joist to the beam that ran the length of the house.

When Clark asked where the antenna was, Bill answered that it was stapled to the floor beam. (Believe me, that's not what we mean when we talk about "beam" antennas!) Now for the $64 question: What exactly was the purpose of the ball of electrical tape?

Well, Bill had spent all his money on the transceiver. To cut back on any additional expenses, he had used some coax that he had in his "junk box" (a mythical container invented by amateurs to explain their magical ability to find almost any electronic item imaginable lurking in one of the stacks of technological refuse in their basement or garage). No single piece was long enough to reach from the antenna to the transmitter, so Bill had very creatively spliced them together.

Bill had feared he would upset the neighbors, so he had resorted to the indoor, subterranean antenna to minimize any potential conflict with them. To save money, he had spliced together two pieces of coax by twisting the ends together and wrapping with tape. Although his intentions may have been laudable, his efforts to make radio contact were totally futile.

At Clark's home they found enough wire to make a 15 meter dipole and enough new coax to run from the basement to a convenient outside mount. Clark helped Bill string the antenna from the peak of his ranch-style home to a small fruit tree in the backyard. At no point was the antenna more than 20 feet off the ground, yet Bill was able to work 20 states within the next week. None of the neighbors seemed to notice the presence of this unobtrusive "sky hook."

Coaxial cable is somewhat like a water pipe. Just imagine the mess you would have if you spliced together two water pipes by twisting the ends together. If it is absolutely necessary to join two pieces together, it should be done with the proper connectors. Otherwise, you run the risk of losing all the RF at the connection. Typically, you would use regular male plugs (e.g., PL-259s) on the ends of the

*7 Brian Road, South Windsor, CT 06074

two cables and a double female connector (PL-258).

Antennas suitable for the amateur radio service (and everything else except a few arcane military needs) work much better above ground than below. The rule of thumb is "the higher, the better." By the way, Bill (not his real name) has gone on to become a well-respected and moderately famous DXer and DXpeditioner. He didn't let a few mistakes as a Novice stand in his way.

As a Novice, I settled for a trap-vertical antenna. It was inexpensive and one of the few aerials that I could install on the roof of the small townhouse we lived in in New York City. The instructions called for the use of four quarter-wavelength radials for each band. Using the vertical with the radials on the roof, I had little trouble making contacts.

Later on we moved to Michigan, where we bought a house on a small city lot. I erected the vertical in the backyard. For a ground mount, the manufacturer's instructions said there was no need for radials. The instructions assured me that I would get *a low SWR* without the radials. That I did get, but I didn't make any contacts. I wasn't sure why the antenna didn't work very well. Eventually, I put up dipoles for all bands and used them exclusively. Sometime later I learned that in spite of the manufacturer's instructions, verticals frequently need radials for a ground mount as well as a roof-top mount.

A few years passed, and I found myself answering technical questions at the ARRL. One call came in from a newly upgraded General who was able to make contacts on 10, 15, and 20, but no one seemed to hear him on 40 and 80. He was using a trap vertical mounted on the ground without radials. His SWR meter indicated an almost perfect match for 40 and 80. He's even measured the power arriving at the base of the antenna. Everything seemed perfect, except no one could hear him.

I told him about my experience with radials and suggested that he try it. He called back to tell me that he had measured the temperature of the ground near the base of the vertical before transmitting. Next, he transmitted on 80 meters for about 10 minutes. When he rechecked the temperature, he found that it had gone up several degrees near the base of the antenna.

Then he installed radials for 80 meters. Two things happened. First, the ground stopped heating up. Second, he started making contacts. When I last heard from him, he was busy adding more radials to his backyard. He was burying them about an inch underground to avoid any problems with the lawn mower. He was sure that it was going to improve things, even on the bands where the antenna had seemed to work before.

So you see, having a low SWR is not necessarily the most significant thing where your antenna is concerned. If your antenna is locked inside a metallic cage or below ground level, the RF will probably never make it out of your domicile. If you are using a vertical without a set of radials (four for each band is a good compromise), most of your RF is likely to be doing little more than heating the soil around the base of your antenna.

When you are first starting out as a new operator, you need all the breaks you can get. Operating QRP can be a lot of fun, but it can also be very frustrating in the crowded Novice bands, particularly if you are attempting to make your first few contacts. Most people on the Novice bands are using transceivers with approximately 100 watts output power. You probably should be, too.

Whether you are using a dipole or random wire, the advice is the same. It should be outside and as high up as possible. Verticals seem (to me) to work better when they are mounted above ground. You will certainly not go wrong adding radials to your vertical, no matter where you've mounted it. If SWR is the only criteria by which you judge your antenna, then you might as well follow McCoy's tongue-in-cheek advice and hang a dummy load in an inverted-Vee shaped tree. That's an antenna that's sure to give you hangups. CQ

CQ REVIEWS:

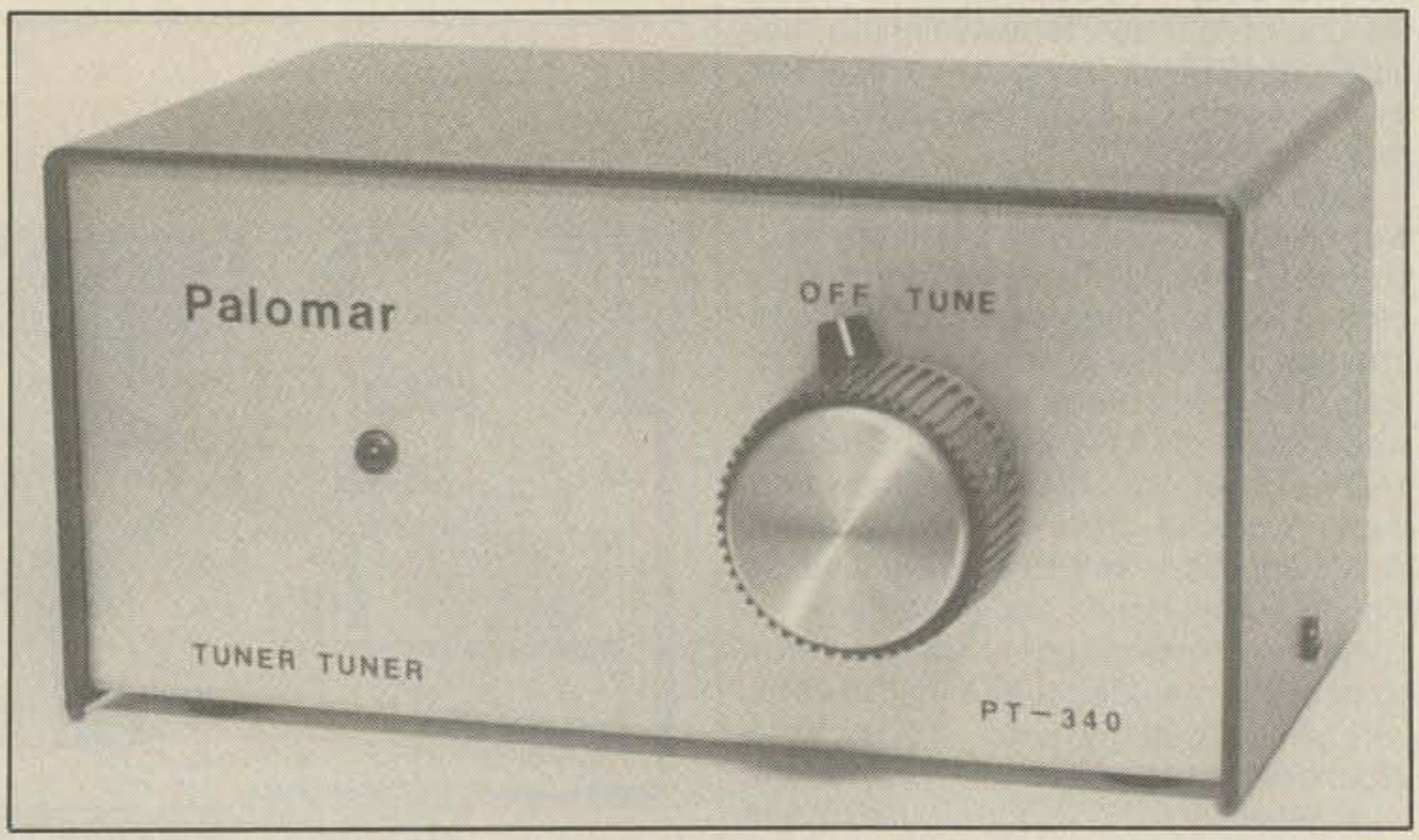
Palomar Engineers PT-340 "Tuner-Tuner"

BY JOHN J. SCHULTZ*, W4FA/SV0DX

Now and then an accessory item comes on the market which is based on a simple concept but which also is extremely useful. I would say that Palomar Engineers' "Tuner-Tuner" falls in that category. Of course, I may be a bit prejudiced since I have been writing about and advocating the use of noise bridges for years.

The "Tuner-Tuner" is an operating aid which allows one to adjust an antenna tuner without actually putting a carrier on the air. I won't go into the theory of how it all operates, but the basic idea is shown in fig. 1. Fig. 1(A) shows a noise bridge as it is normally used as a test instrument. It usually has a variable capacitor and resistor calibrated for reactance and resistance. One connects an antenna with unknown characteristics to it as well as a receiver. The receiver is set to the frequency of interest for the antenna. One then adjusts the controls on the noise bridge until a noise dip is heard in the receiver and then reads from the dials on the noise bridge the impedance (resistive/reactive values) of the antenna load. However, let's say that the controls on the noise bridge were not variable but were internally set for a pure 50 ohm resistive value (no reactance). Then, the modified noise bridge can be used as shown in fig. 1(B). With the switch shown set so the modified noise bridge is connected to a transceiver (in the receive mode) and to an antenna tuner/antenna system, a noise dip will only be heard when the antenna tuner is adjusted such that is presents a pure 50 ohm load to the transceiver's terminals. If the switch is used to bypass the modified noise bridge and direct connection of the tuner made to the transceiver, one can immediately transmit/receive. The modified noise bridge plus the bypass switch constitute the "Tuner-Tuner." It's absolutely ideal for use with solid state transceivers since as soon as the transceiver sees a 50 ohm load, it is ready to operate.

The "Tuner-Tuner" can also be used with transceivers which have tube-type finals, but then some means, such as a dummy load, has to be used to preset the plate tuning and load controls on the transceiver for a 50 ohm load at the desired operating frequency. The great beauty of the system, no matter which type of transceiver is being used, is that one does not radiate any carrier signal during the tuning process. One can play around all day long, if it need be, to get an antenna tuner/antenna system to present a pure 50 ohm load at the only ex-



It does a lot, but that's all there is to the front of the PT-340—a switch and an LED.

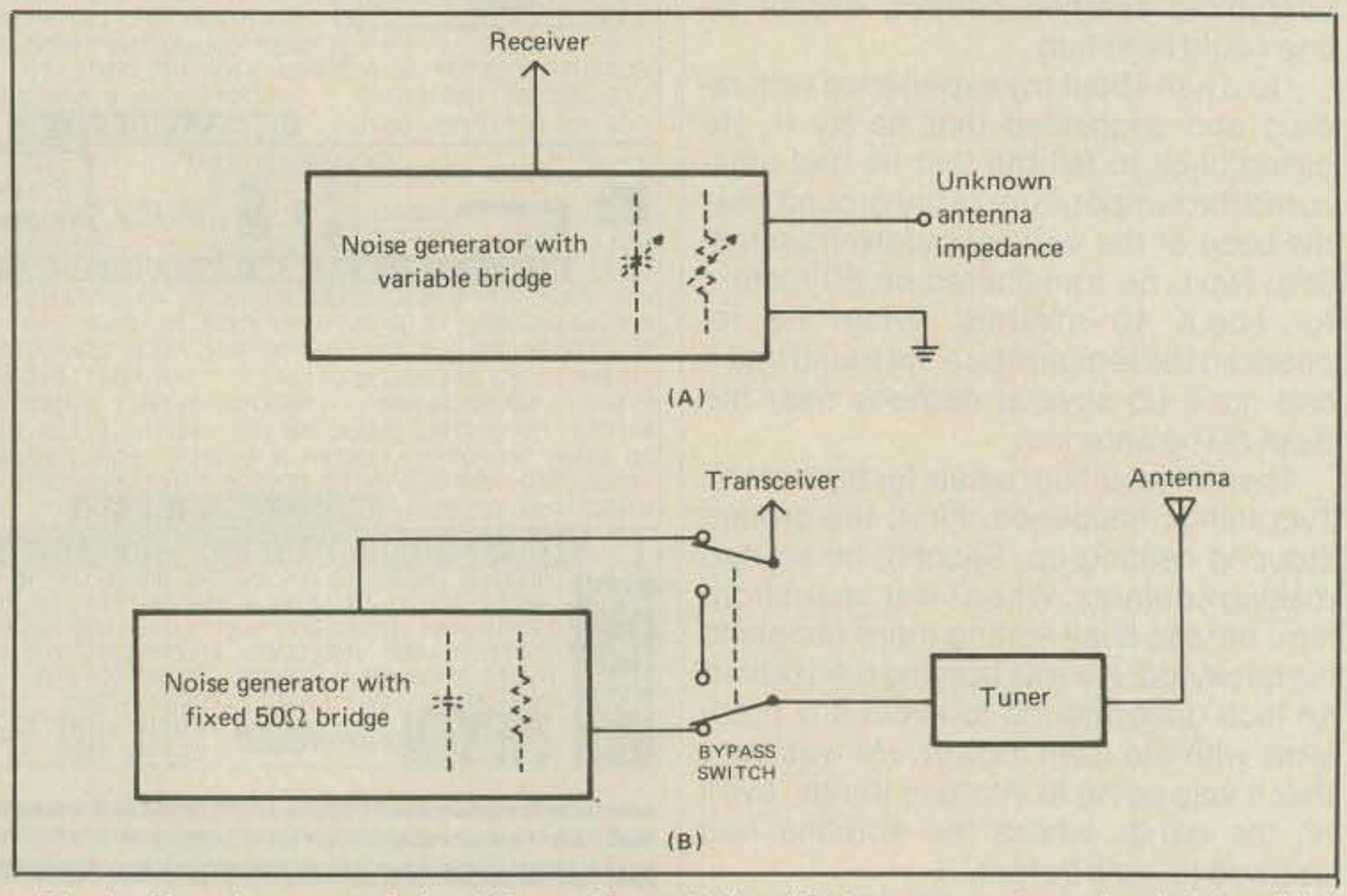


Fig. 1– Development of the "Tuner-Tuner" idea (B) from a regular noise bridge (A).

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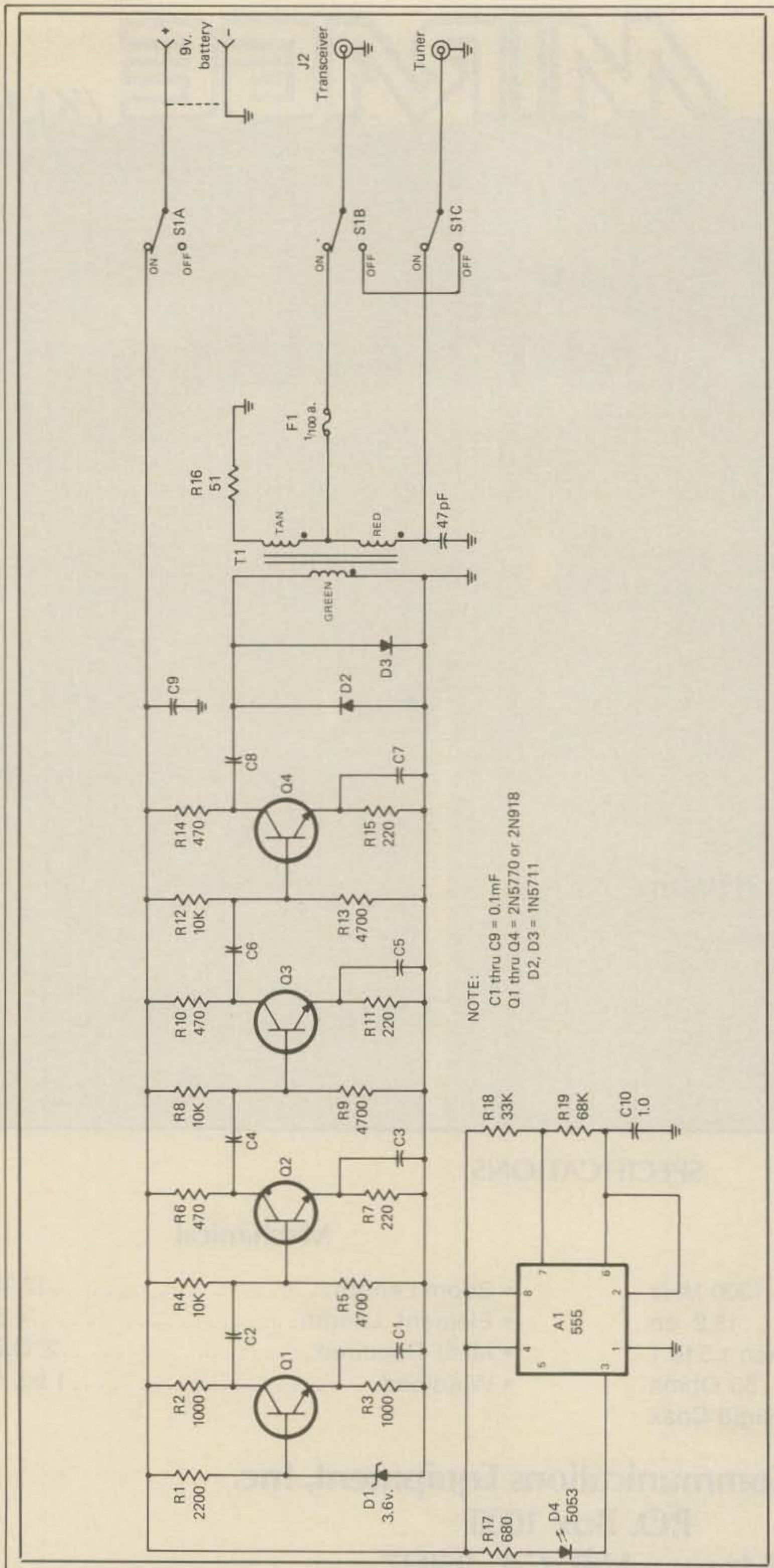

Fig. 2– Schematic of Palomar's PT-340. Current drain is about 35 ma.

PT-340 Specifications:

Frequency Range: 1.7–30 MHz
Operating Impedance: 50 ohms
Controls: On-Off
Panel Indicator: Flashing red LEd when "On"
Connectors: SO-239
Power Pass Capability: 3000 watts when "Off"
Power Required: 9 VDC @35 ma. Connector and holder for #1604 battery (battery not supplied)
Size: 15 × 12 × 7 cm (6" × 5" × 3")
Weight: 400 g. (14 oz.)
Cabinet: Brushed aluminum panel; black vinyl cover

Table I– Specifications of the Palomar Engineers PT-340 "Tuner-Tuner."

pense of eventually running down the battery in the "Tuner-Tuner."

Details

Table I lists the specifications for the Model PT-340 "Tuner-Tuner." One can see from the table the size of the unit, type of battery required, power-handling capability when bypassed, and various other details.

Fig. 2 shows the electrical diagram of the unit. The actual noise generating source is the diode D1. The broadband noise it produces is amplified by the chain of Q1 to Q4. T1 converts the output to a balanced form so a bridge arrangement can be developed. The fixed 51 ohm resistor and 47 pF capacitor on the secondary of T1 set the bridge so it is fixed for a 50 ohm, nonreactive response. Note that in the **on** position of the switch a 1/100 amp fuse is in line with the transceiver input. So, if one should transmit without placing the switch in its bypass position, the fuse will go instead of the secondary windings on T1. The NE555 IC at the lower left is used to blink the LED D4 a few times a second when power is on.

Construction

The "Tuner-Tuner" presents a very neat appearance both inside and outside. All of the components except the switch and connectors are mounted on a single PC board. The switch used is a true, rotary RF type with steatite insulation. The inside layout is well dimensioned, and yet there is some extra room in case one wants to add something extra. The fuse used is clip mounted to facilitate replacement, and a spare fuse is included with the unit. I would suggest taping the spare fuse inside the unit. It is very unlikely that one would ever put power in the unit by accident since the front-panel blinking LED is a very attention-getting reminder that the unit is not in the bypass mode. However, if one *does* use up one fuse, I'd suggest searching for another spare as soon as possible; 1/100 amp fuses are not particularly expensive, but they can be a bit difficult to find. Most parts stores

only stock fuses down to 1/10 amp. The battery for the unit is held by a clip on the outside of the rear panel so one does not have to remove the top to replace it.

Operating Notes

Once hooked up and turned on, the "Tuner-Tuner" will produce a healthy S9 to 30 dB over S9 noise signal on all bands from 160 through 10 meters. The noise signal is somewhat modulated by the IC which blinks the LED to give it a sort of chug-chug sound. It is an advantage since it gives the noise signal a distinct sound so one can recognize it immediately. When an antenna tuner is correctly adjusted, the noise will dip down to a very clear S0 (along with a clear audible null, so one doesn't have to necessarily look at the S meter).

The "Tuner-Tuner" method of adjusting an antenna tuner is far superior to using the SWR-meter method. Not only is no signal radiated, but one does not have to place a number of switches on a transceiver in a tune-up mode and then reset them for an operating mode. Think for a moment how many controls on a transceiver have to be manipulated for normal tune-up. Depending on the make of transceiver used, you might have to change modes, run down the output power, key the transmitter, and then do everything in reverse when tuned up on a new frequency. With the "Tuner-Tuner" one just turns its switch on and starts tuning.

Regardless of the fact that the "Tuner-Tuner" method does not radiate power, I couldn't resist trying to compare how accurately it works compared to SWR meter tune-up. The "Tuner-Tuner" method produced just as fine a match as any SWR meter method when the SWR meter built into a transceiver was used as the point of comparison. And, of course, that is the most important point since it represents the SWR that the transceiver's output stage actually "sees." When comparing the "Tuner-Tuner" method to the SWR-meter method whereby an external SWR meter is used between a transceiver and an antenna tuner, the "Tuner-Tuner" method always produced a perfect null on the transceiver's internal SWR meter, while in the other case the external SWR meter might read 1:1 while the internal SWR in the transceiver might show anywhere from a 1:1 to 1:2 SWR.

When using the "Tuner-Tuner" for frequency excursions within an amateur band, nothing has to be touched on a transceiver. However, I did find that when experimenting with an antenna tuner for the first time with a random load, it was advantageous to set the transceiver's AGC to fast. Since the transceiver's S meter can be used as the indicator for the "Tuner-Tuner," it becomes more quickly responsive with fast AGC when one is just randomly turning the controls on an antenna tuner while trying to find a match.

Other Uses

I found that even when a perfect null was obtained on a transceiver's S meter using the "Tuner-Tuner," there was still some barely discernible noise to be heard. This arises because an absolutely perfect balance cannot be achieved. However, the remaining noise could possibly be used as a quick check that a transceiver's sensitivity is still up to par. It could not be used for any sort of measurement, but it could serve to resolve the old question "Is it the band or my equipment?" when one encounters a completely dead band.

Although the unit is ideally suited to its intended application, one also could turn it into a regular noise bridge. The fixed resistor and capacitor in the bridge circuit could be made variable elements. However, then one would have to have available a reasonable means of calibrating rotation.

Summary

The PT-340 "Tuner-Tuner" is an extremely useful aid if a station setup requires the adjustment of an antenna tuner. It performed exactly as claimed. It represents one of those simple but clever ideas whose time has come. The PT-340 retails for $99.95 plus $4.00 shipping/handling from Palomar Engineers, Box 455, Escondido, CA 92025.

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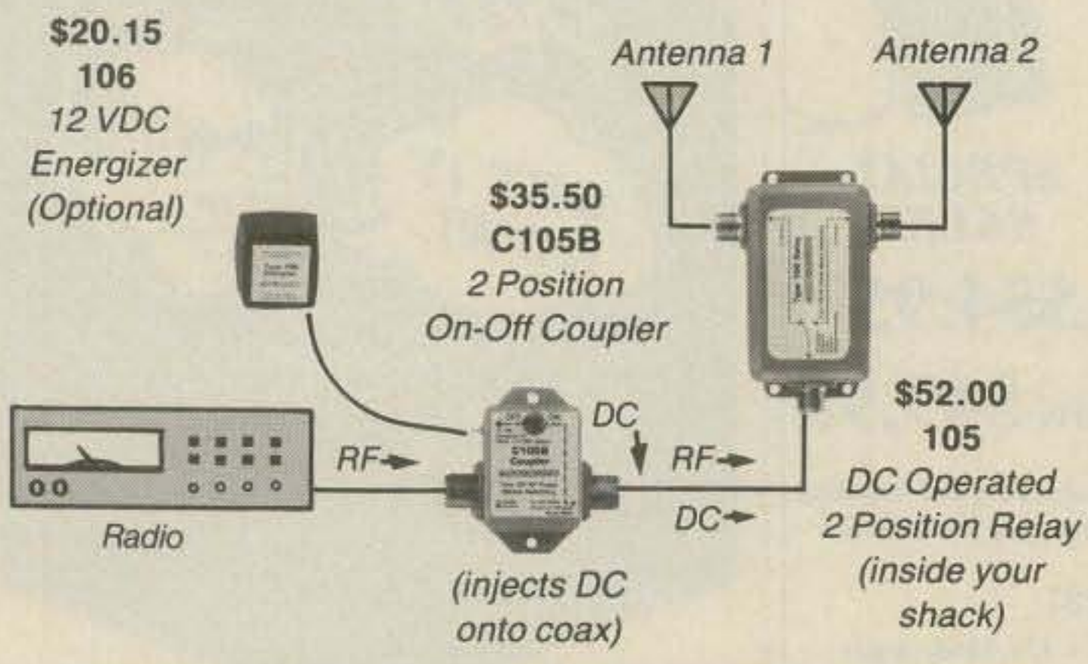

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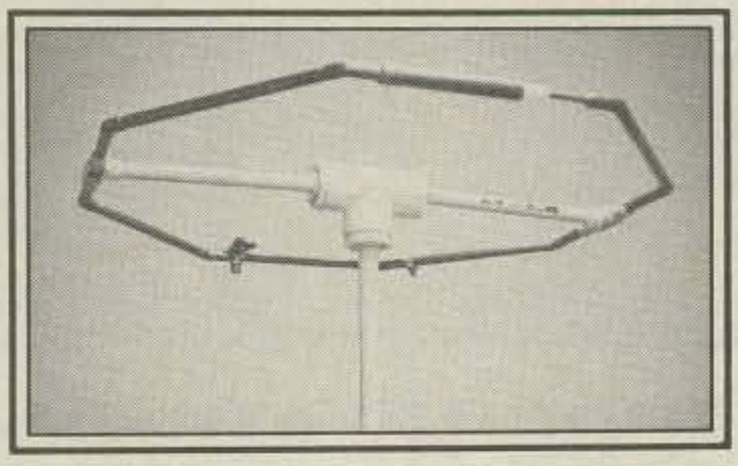
Contact your local amateur radio dealer or Nel-Tech Labs at 28 Devonshire Lane, Londonderry, NH 03053, or circle number 101 on the reader service card.

Advanced Design Networks MICROLOOP Antennas

Advanced Design Networks, Inc. has announced a new generation of compact monoband antennas—MICROLOOP. Across-the-loop dimensions vary from 27 inches for 10 meters to 104 inches for 40 meters. Performance of the MICROLOOP is approximately equivalent to a full-sized dipole in a much smaller space. A comprehensive overview of the MICROLOOP is available to all amateurs on request. For more information, contact Advanced Design Networks, 8601 66th Street North, Pinellas Park, FL 33565, or circle number 102 on the reader service card.



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In our second part of this series, KR3T takes us through a discussion of Terminal Node Controllers and how packet signals are transmitted.

An Amateur Packet Radio Primer
Part II—Packet Radio Equipment

BY JONATHAN L. MAYO*, KR3T

This is the second of a four-part article series designed to provide a complete introduction to amateur packet radio. Last month's article provided an introduction to packet radio's capabilities and digital communications in general. If you haven't read last month's article, I suggest you do so before proceeding.

This month's topic is the **TNC** (**T**erminal **N**ode **C**ontroller) and other components of a packet station. If you have been following amateur packet radio at all, you have probably run across the term *TNC*. This article explains what a TNC is, what a TNC does, and finally, how to integrate a TNC into your amateur radio station for packet operation.

Portions of the articles have been excerpted from my book *The Packet Radio Handbook* to be published by TAB Books, Inc. in January 1987. The book is featured in TAB's current trade catalog, and the cost is $14.95. For more information, write to TAB at P.O. Box 40, Blue Ridge Summit, PA 17214.

Assorted TNCs. Clockwise from the bottom: the original VADCG TNC, the Pac-Comm TNC-200, the Kantronics KPC-2, the AEA PKT-1, the Heathkit HD-4040, and the VADCG TNC+. The disk contains the Richcraft AX.25 TNC software system.

TNC

The TNC (Terminal Node Controller) is the "heart" of a packet station. The TNC serves as an interface between a user's terminal and the packet radio network. The TNC is also known as a packet controller, a **PAD** (**P**acket **A**ssembler/**D**isassembler), and a **FAD** (**F**rame **A**ssembler/**D**isassembler). The TNC is responsible for organizing and controlling the transmission and reception of data across a packet radio network. As you may recall from the first article, there are two kinds of TNCs: software and hardware based. Some TNCs are a mixture of the two, with some of the functions being handled by hardware and others by software. Today, however, the name TNC usually applies to only a hardware system. A collection of various TNCs is shown in the photo.

Hardware-Based TNCs

Hardware-based TNCs are the mainstay of the packet marketplace. Many manufacturers have jumped on the packet bandwagon, and now there are numerous hardware-based TNCs available that vary in price and performance. However, two TNCs have established themselves as the de facto standards: the TAPR TNC-1 and TNC-2. TAPR (Tucson Amateur Packet Radio) had a fundamental role in the development of packet radio in the United States and worldwide. Until the TNC-1 was discontinued by TAPR, over 2,500 units were sold, and for the past few years they have set the standard of TNC performance. The TNC-1 and TNC-2 have been licensed by TAPR and are now manufactured by a variety of companies.

Hardware TNC Components

A hardware-based TNC is actually a microcomputer system. As you will soon see, it contains the same basic components as a microcomputer. While different ICs (Integrated Circuits) may be used in different designs, the basic functions remain the same. No matter how many extras are added on, a TNC must have several standard capabilities in order to function properly.

Terminal I/O

All hardware TNCs must contain some sort of **I**nput/**O**utput (**I/O**) capabilities for terminal communications. This is usually in the form of a serial communications port conforming to the RS-232 standard. Other forms of I/O in use are the current loop for use with mechanical teleprinters, **TTL** (**T**ransistor **T**ransistor **L**ogic), and parallel communications ports. Through the I/O port(s), the TNC accepts data and commands and sends received data and status messages.

Each form of I/O has its advantages and disadvantages. The RS-232 serial I/O port has become the standard for most peripheral communications. A peripheral is any component that is added on to a computer system, such as printers, modems, and, of course, TNCs. In serial I/O the information in the form of bits is transferred serially one bit at a time over a data line (see fig. 1). In asynchronous I/O, a "start bit" is sent at the beginning of each bit group (character), and a "stop bit" is sent at the end. Other lines are usually included for control and to carry status information. Almost all microcomputers and terminals provide for RS-232 communications. When connecting a peripheral (such as a hardware TNC) to a terminal or computer using an RS-232 interface, a 25-wire ribbon cable is usually used for runs under 50 feet. The ribbon cable is usually terminated on each end with a DB-25 connector, which is the standard connector in RS-232.

Parallel I/O is also used for connecting peripherals to computer equipment. Today it is used almost exclusively for connecting printers. In parallel I/O the information bits that make up each piece of data are sent at the same time

*1817 Saratoga Court, Allentown, PA 18104

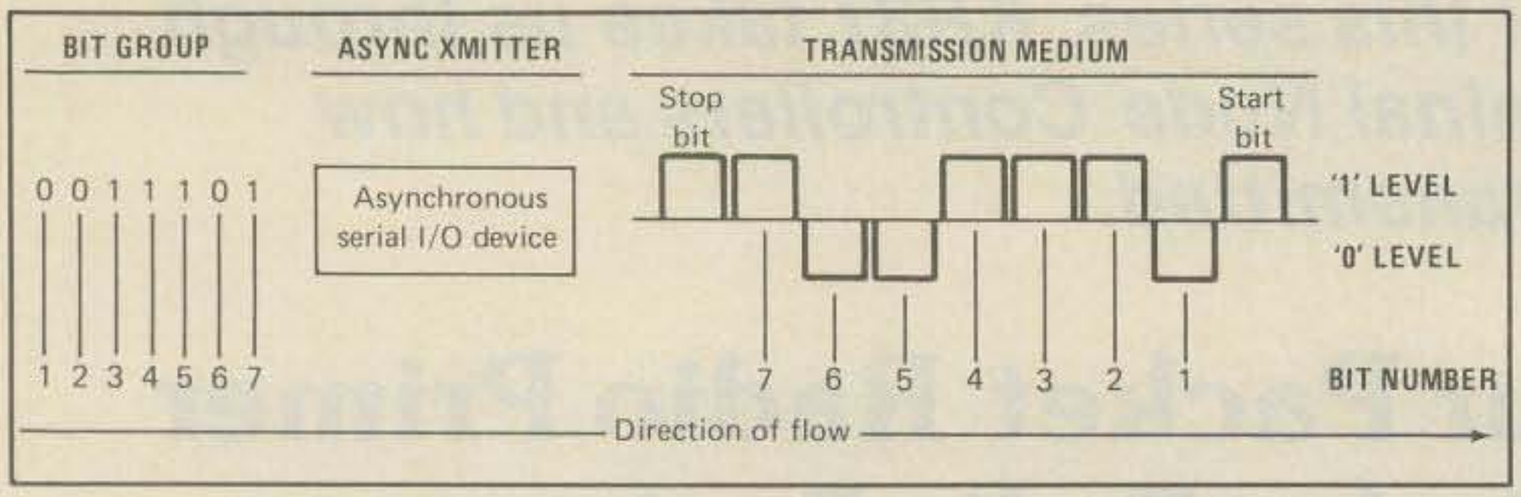

Fig. 1– A diagram showing asynchronous serial data transmission.

over individual wires (see fig. 2). For example, if each piece of data is represented by one byte (8 bits), then 8 separate wires would be used. There are other wires added for carrying control and status information between the computer and the peripheral. Parallel I/O is not used in most TNC designs.

Parallel transfer is used internally in most computer systems (and TNCs) to transfer information between its components. For example, information is transferred between the processing unit and memory in parallel. Thus, a means of converting from parallel to serial and back again is needed to communicate with the outside world through a serial port. This is accomplished by the use of a **U**niversal **A**synchronous **R**eceiver and **T**ransmitter (**UART**).

The UART takes information fed to it in parallel format and sends the information out in serial format. In reverse, the UART accepts serial data and converts it to parallel format. UARTs are found in almost all serial communication I/O circuits.

Memory

Memory is another component that all TNCs share. **RAM** (**R**andom **A**ccess **M**emory) is used for storage of short-term information such as variable parameters and as a buffer for received and sending frames. Since RAM loses its contents when power is removed from it (volatile memory), some form of backup is usually provided in the form of a small battery cell on the circuit board to maintain power to the RAM at all times. Other methods of backing up the RAM include saving its contents to disk, or as in the case of the TNC-1, using a special kind of non-volatile RAM for storage of valuable information. Most TNCs come equipped with a minimum of 8K (about 8,192 bytes or 65,536 bits of information) of RAM.

ROM (**R**ead **O**nly **M**emory) is another form of memory found on most all TNCs. The ROM is actually **PROM** (**P**rogrammable **R**ead **O**nly **M**emory) which is programmed, or "burned in," with the permanent programs needed to run the TNC. These programs consist of the user interface, the protocol(s), the calibration routines, and any other programs necessary to use the features of the TNC. Some TNC manufacturers put user information such as callsign and VADCG number (the VADCG number is only used with the VADCG protocol) in ROM. Communications with the TNC is through the user interface. It accepts commands and displays status information.

The protocol(s) implementation programs which are contained in ROM usually consist of the AX.25 protocol and the VADCG protocol. The protocol contains the rules to keep track of each frame and controls the transmission of frames.

The amount of ROM that comes with a hardware TNC varies depending on the number and complexity of programs included, but it is usually 8K to 32K. ROM is an ideal medium for storing long-term information, and it can be easily removed for upgrading should a new version come out.

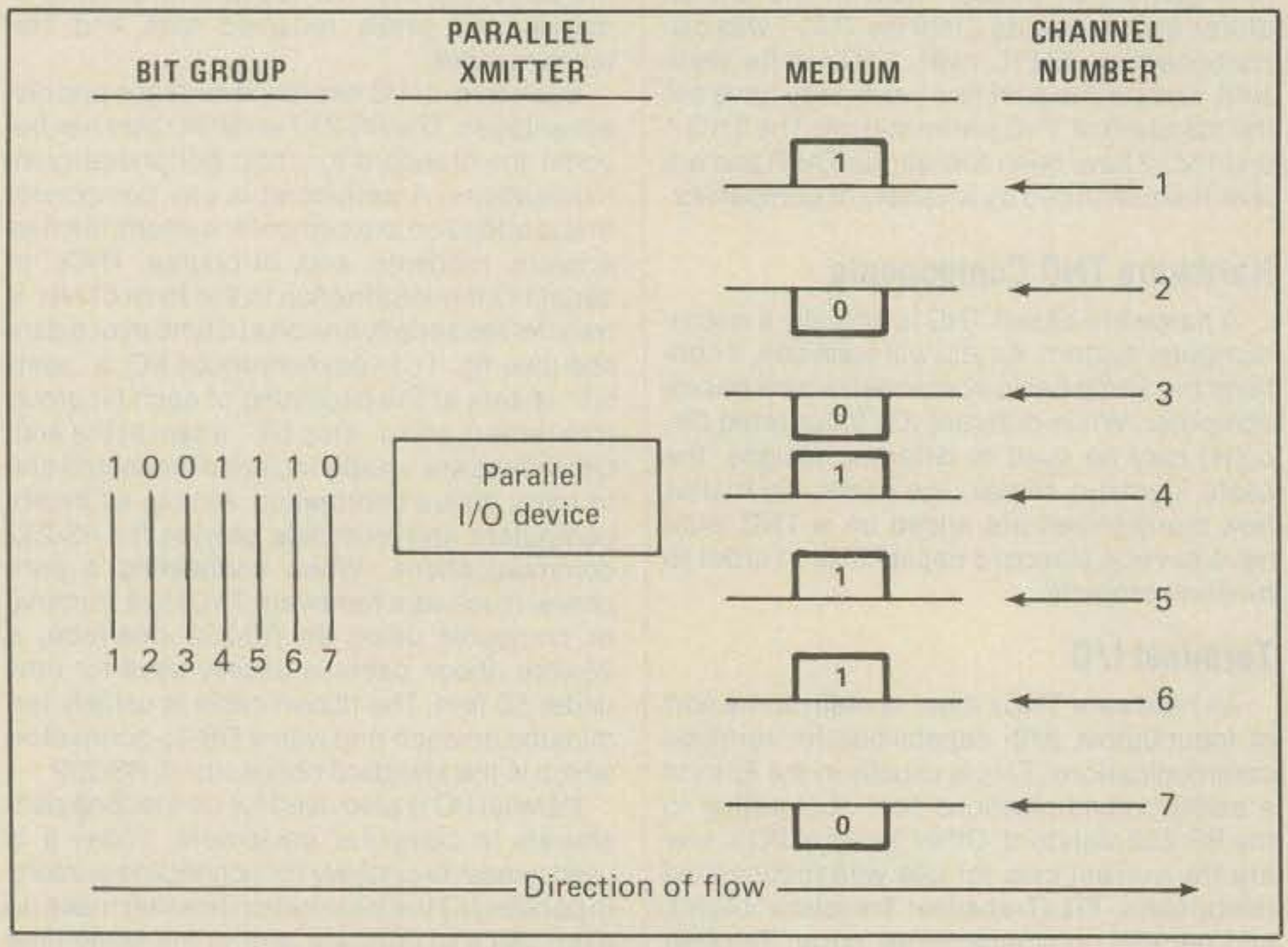

Fig. 2– A diagram showing parallel data transmission.

HDLC

So far you know that the information or data to be transmitted comes from the I/O port and that the program that controls the transmission of the frames is contained in ROM. But where does the information that is inputted into the TNC via the I/O port for transmission get put into frames and actually sent? This is the job of the **HDLC**. HDLC stands for **H**igh Level **D**ata **L**ink **C**ontrol, and one of its functions is to format data into frames for transmission. It generates the **F**rame **C**heck **S**equence (**FCS**) of outgoing frames. If you recall from the first article, the FCS is the root of packet's error checking. The HDLC also disassembles and checks the FCS of received frames. Some TNCs handle the HDLC functions in software, while others use a separate IC designed especially for HDLC functions.

CPU

Just as the TNC is the heart of the packet station, the **CPU** (**C**entral **P**rocessing **U**nit) is the heart of the TNC. It manages the operation of all other components and serves as a clearinghouse for all data transferred between components. The CPU follows the instructions programmed in ROM.

The speed with which the CPU performs its tasks is controlled by the system clock. The system clock generates all timing signals for the CPU and other components. Along with the capabilities of the components, the system clock puts an upper limit on how fast the TNC can work.

Modem

After the HDLC has assembled a frame for transmission, it is sent to the modem. The modem circuit is usually, but not always, included on the TNC circuit board. If it is not included on the board, an I/O connector is provided on the TNC to interface with a modem. TNCs with on-board modems should have an external modem connector or some way to bypass the on-board modem should it be necessary to add on an external modem. This feature is desirable to accommodate greater filtering if needed or a change in the standard modem specifications used for packet radio.

TNCs with on-board modems usually include a calibration program, so it is easy to calibrate the modem without extra equipment. An on-board modem is a great convenience; however, a TNC without a way to easily bypass the on-board modem can cause problems *if* the modem standards change significantly.

While information is usually inputted to the TNC in asynchronous format from the terminal, the information in frame form is sent to the modem in synchronous format. In synchronous communications there are no start and stop elements surrounding each bit group. Rather, the bit groups are combined into one long "bit stream" and sent as a whole (see fig. 3). Because the sending speed and length of bit groups are predefined, the receiving station is able to identify the individual bit groups without the use of start and stop elements. However, the receiving station must know when the bit stream starts and when it ends. Thus, a

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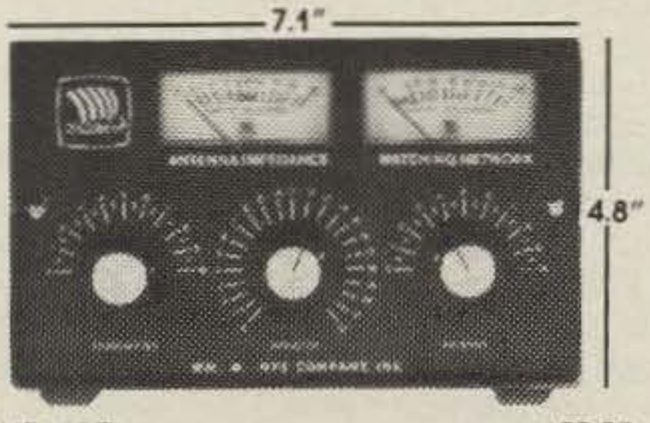

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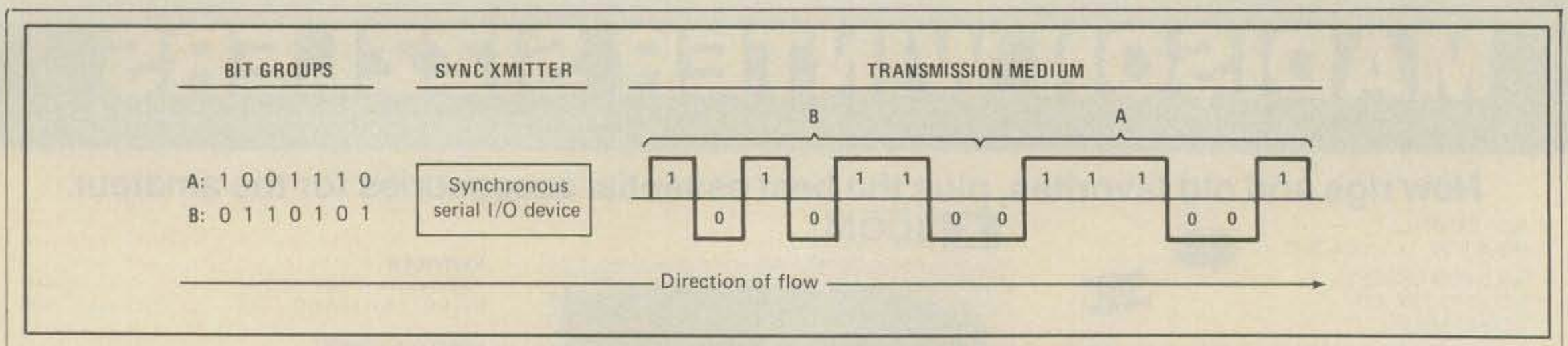


Fig. 3– A diagram showing synchronous serial data transmission.

special character (called a **flag**) is usually put at the beginning and end of each bit stream.

Power Requirements

The power requirements of hardware-based TNCs vary from a present-day low of 25 ma to 1 amp and up at 9 to 12 VDC. If you are planning to operate portable packet, current drain is an important criteria to keep in mind. Sometimes the power consumption of a TNC can be reduced by replacing regular **MOS** (**M**etal **O**xide **S**emiconductor) chips with their **CMOS** (**C**ompli-mentary **MOS**) equivalents where possible. CMOS chips draw much less power. Unlike the original TAPR TNC-1 which included an AC power system, most TNCs today run from 12 VDC.

TNC System Trace

Now let's do a trace of a hardware TNC based on the knowledge we have of its components. Assume that a terminal of some sort is connected to the I/O port, that a transceiver is connected to the modem, and that the modem is either on-board or interfaced in some way to the board (see fig. 4).

The information to be transmitted to the receiving station is typed on the keyboard of the terminal. The information goes through the I/O port into the TNC and is directed by the CPU to a RAM buffer as controlled by the software in ROM. Once the maximum length of the information is reached (usually 128 to 256 characters), or a send frame command is received from the terminal, the information is sent to the HDLC along with other control data. The HDLC combines the control data and the information into a frame and then computes the FCS (Frame Check Sequence). The FCS is added to the end of the frame.

The completed frame is then sent to the modem where the individual bits from the HDLC modulate the signal sent to the transmitter. The transmitter then transmits the modulated frame to the receiving station (usually in less than a second, provided the link between the two stations is clear and reliable).

The receiver at the receiving station receives the modulated frame and sends it to the modem. The modem demodulates the frame and sends the bits to the HDLC. The HDLC then disassembles the frame into its component parts (control data and information), provided the FCS check is good. The information is then routed to the terminal I/O port or RAM if the port is busy, as directed by the CPU following the program in ROM. The information is sent through the I/O port to the terminal where the information is displayed exactly as it was sent.

Each frame is sent this way. Whether you are transmitting a short note to your friend down the street or a large file across town, it all goes one frame at a time.

Modulation Schemes

Now that you have a better idea of how

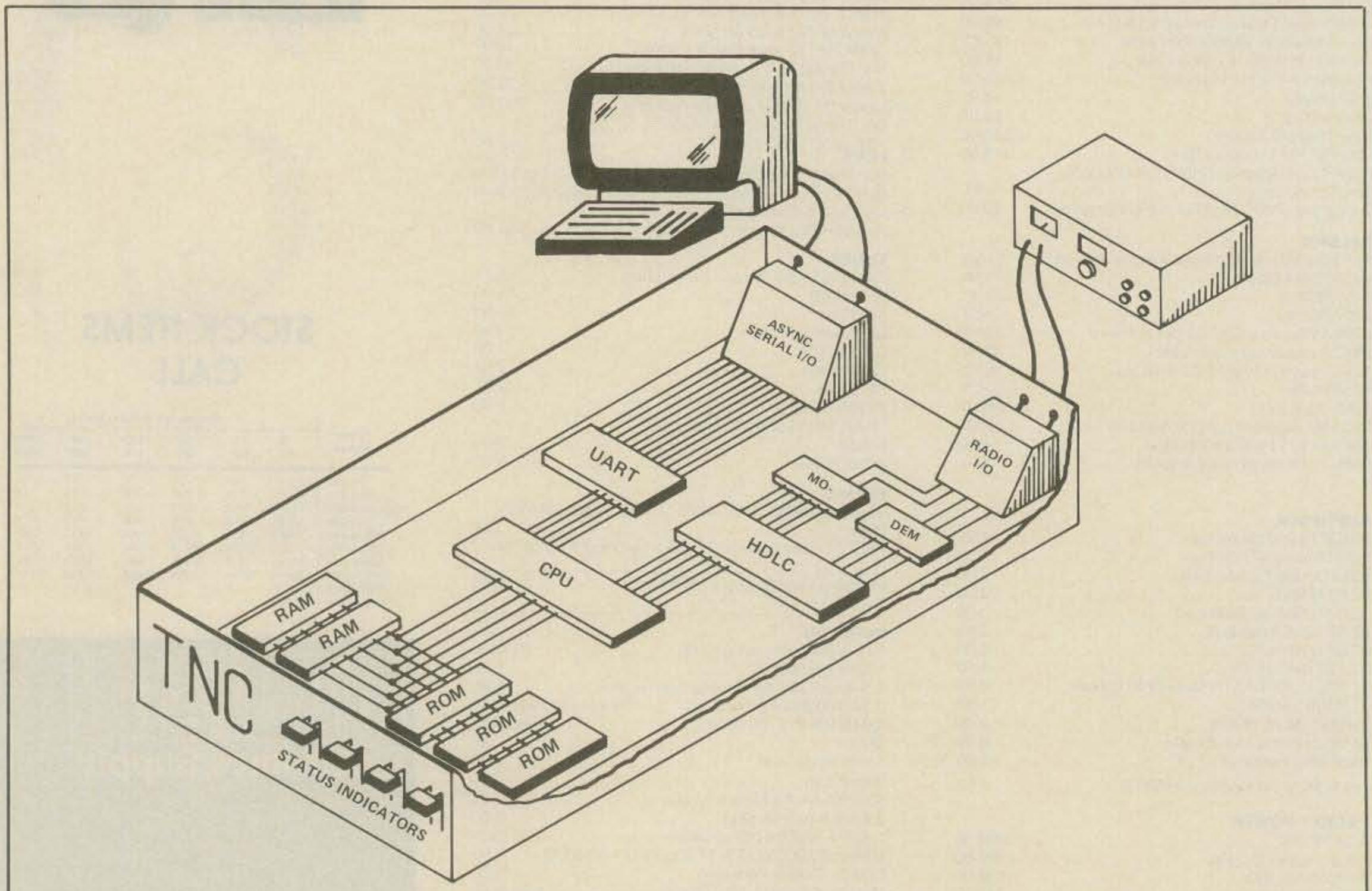


Fig. 4– A "blowout" of a hardware TNC illustrating the various components.

packet radio operates, we can discuss the modem standards in use today on packet radio. There are presently two different standards—one for VHF operation and one for HF operation. Soon a third and even fourth standard may emerge for use on VHF and UHF. But before we get too far ahead of ourselves, let's regress a little.

In the early days of amateur packet radio in the late 1970s and early 80s, early packet experimenters were looking for modems for use with their systems. They had to be cheap, reliable, and plentiful. The modems also had to be simple; they were having enough problems with the TNCs alone. The modems had to have a fairly high baud rate and be easy to interface with the rest of the system. They chose the Bell 202 standard because it met all the above requirements.

Bell 202 modems are still found as surplus items and at hamfests for very low prices. The Bell 202 standard uses a 1000 Hz shift with mark and space tones at 1200 Hz and 2200 Hz. They can handle the standard 1200 baud rate of VHF packet radio and are easy to calibrate and use.

The Bell 202 modem was implemented in packet radio for use with 2 meter FM transceivers. The modulation method used is **AFSK** (**A**udio **F**requency **S**hift **K**eying) at 1200 baud. Bell 202 modems are the type found on most on-board TNC modems. The Bell 202 modem usually uses a **P**hase **L**ock **L**oop (**PLL** demodulator.

A Phase Lock Loop demodulator works by utilizing a phase detector along with a **V**oltage-**C**ontrolled **O**scillator (**VCO**) in a feedback circuit. A Direct Current feedback voltage is generated proportional to the difference in frequency between the received audio and the VCO. This voltage will change as needed to adjust the VCO to the same frequency as that which was received. Therefore, the voltage will vary as the input audio frequency alternates between mark and space conditions. This varying voltage is then filtered and amplified to produce the required mark and space signals.

There are several disadvantages to using a PLL demodulator. One is that they tend to lock onto the strongest signal in their lock range, often ignoring the weaker signals that you might be trying to copy. Another disadvantage is that a PLL has no variable tuning indicator, so it must be tuned by ear in conjunction with a single LED which lights when a signal is tuned in. However, these disadvantages are not too important on VHF and UHF packet radio. The fact that the PLL tends to lock in on the stronger signal is useful if two stations transmit at the same time. The stronger signal might be received correctly, thus avoiding a complete collision. And since most packet activity on VHF and UHF takes place on pre-assigned fixed frequencies, tuning is not a major issue.

For HF operation, shift-filter-based modems are usually used. The filters are tuned for particular shift frequencies and come in two different flavors: passive and active. A passive filter is a simple LC resonant circuit whose band-pass is pre-adjusted to pass the necessary frequency pairs. An active filter system (either transistors or ICs) may utilize feedback filters or switched capacitor filters to provide the desired band-pass characteristics.

There is an increasing amount of packet activity on the HF bands. The 10, 20, 30, 40, and 80 meter bands are being used for transcontinental and DX communications. There are HF Gateway stations which allow for input on VHF

using the Bell 202 standard and output on HF. Thus, a modest station or one without room for an HF antenna can take advantage of the increased range of HF.

Because of the characteristics of HF operation, different modem configurations have been developed for packet transmission. Three-hundred baud (A)FSK with a 200 Hz shift is usually standard. If AFSK is being used, the **LSB** (Lower Sideband) is chosen. On 10 meters, the Bell 202 standard is sometimes used.

While Bell 202 on VHF is the mainstay of packet activity and HF is being increasingly utilized, other forms of modulation have been under development and will see increasing usage in the future due to their obvious advantages. For amateur satellite activity 400 baud FSK is being used. For high-speed linking, 9600 baud **PSK** (Phase Shift Keying) and FSK is under development and very-high-speed (56,000 **BPS**—Bits Per Second) radio modems are under development for real-time digitizing of voice and video along with higher speed linking.

Radios

In order for a transceiver to work well on packet radio it must meet several requirements. A fast turn-around time from transmit to receive (T/R) and vice versa is important for efficient packet operation. A slow T/R time will reduce the throughput of the packet network. A T/R time of 50 milliseconds is fine and up to 100 ms is tolerable. Radios with T/R times from 5 to 15 ms are ideal. Since the transceiver will most probably be left on for long periods of time, good stability is a necessity. Most modern rigs do not have a problem in this area.

The transceiver's bandwidth must be capable of passing the audio tones used in modulation. Low distortion is another desirable feature. The relative amplitude of modem tones should not be altered significantly by the radio. Changes in phase are tolerable as long as the change is linear (all frequencies are shifted the same amount).

Don't let these requirements worry you too much. Most any recent transceiver is adequate for packet operation. On VHF FM a handie-talkie will do. HF operation is somewhat more critical of transceiver performance; a modern synthesized rig is recommended.

Terminal

While most any terminal will "work" with the TNC, when selecting a terminal there are many options open that need to be considered in order to achieve maximum flexibility from your packet station. Terminals come in many different configurations, and understanding what features are available from each can help you pick a terminal that best suits your operating style.

There are two main types of terminals—dedicated terminals and terminal emulators. A dedicated terminal is a device the sole purpose of which is to convert digital codes into recognizable symbols. Terminals of both types come in a variety of forms and configurations.

Rather than use a dedicated terminal, most packet operators utilize a terminal emulator for communicating with their TNCs. A terminal emulator is a software program which runs on a microcomputer and allows the microcomputer to function as a terminal. The terminal emulator concept is very popular for several reasons. It is cost effective because there is no additional equipment to buy beyond the computer system, and the computer may be used for other purposes. A computer can be used for a wide variety of functions by changing software, while a dedicated terminal can only be used as a terminal.

Computer-based terminals also allow for much greater flexibility in handling the information obtained through the terminal. With a dedicated terminal, received information can only be printed out, or, with some video terminals, temporarily stored. But with a computer-based terminal emulator, the information can be permanently saved to disk or cassette, formatted and printed using word processing software, or processed using data-base or spreadsheet software.

Some terminal emulation software is written especially for packet operation. This software is usually designed for use with a specific TNC and contains features which enhance its use. However, it is not necessary to have a terminal program exclusively for packet operation.

Most any ASCII telecommunications software package will work. These are the same programs used with telephone-based modems to access remote computer systems. There are a great number of terminal programs with an equally great diversity in features and capabilities. Most all microcomputer systems with communications capabilities have terminal software available for them.

Conclusion

In this article we have taken a look at the many variables that go into setting up a packet station. The cost of setting up a packet station varies widely depending on what equipment you already have and what kind of station you *want* to have. Take a look at what you have and what you need. Research the available equipment for items that meet your needs. Try to visit a local packet operator to get some more ideas and learn more about your local packet operating conditions.

If you have any questions, comments, or suggestions regarding the article series, my packet book, or packet radio in general, please contact me. You can write to me at the address listed. However, if you would like a quicker response, leave me a message on CompuServe. My ID is 72276,2276. Also, while you're on CompuServe, visit the HamNet forum. HamNet is dedicated to most all aspects of amateur radio, including packet. To get to HamNet, use the "GO HAMNET" command. I have an online column dedicated to packet radio in the HamNet Online Section (GO HAM-1) which I invite you to access. The column is called Packet Radio Online.

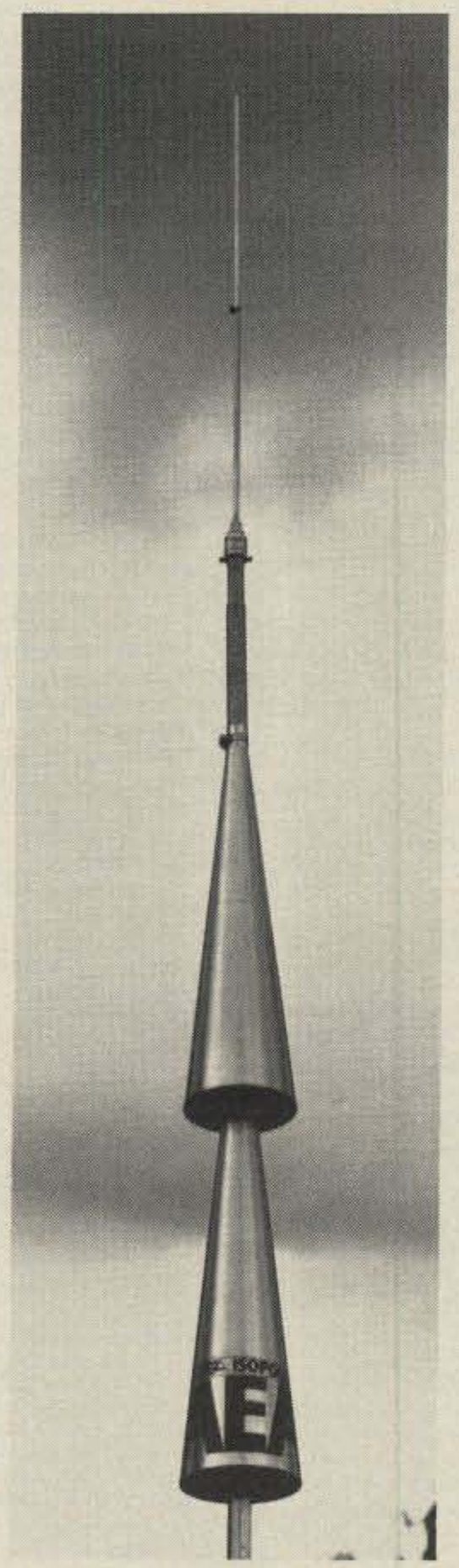
Next month, I'll discuss the particulars involved in operating packet radio.

(To Be Continued)

Put More Punch in Your Packet

Outstanding mechanical design makes the IsoPole the only logical choice for a VHF base station, especially for Packet operation. All Isopole antennas yield the **maximum gain attainable** for their respective lengths and a maximum signal on the horizon. Exceptional decoupling from the feed line results in simple tuning and a significant reduction in TVI potential. The IsoPole antennas are all impedance matched in the factory so that no field tuning is required. The IsoPoles have the broadest frequency coverage of any comparable VHF base station antenna. This means no loss of power output from one end of the band to the other, when used with SWR protected solid state tranceivers. **Typical SWR is 1.4 to 1 or better across the entire band.**

A standard 50 Ohm SO-239 connector is recessed within the base sleeve (fully weather protected). With the IsoPole you will not experience aggravating deviation in SWR with changes in weather. The impedance matching network is weather sealed and designed for maximum legal power. The aerodynamic cones are the only appreciable wind load and are attached directly to the support (a standard TV mast which is not supplied).



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The Hot Rod antenna can be expected to make the same improvement to hand-held communications that the IsoPole antennas have made to base station operation. **Achieve 1 or 2 db gain** over ANY 5/8 wave two meter telescopic antenna. The factory tuned HR-1 is 20% shorter, lighter and places far less stress on your hand-held connector and case. It will easily handle over 25 watts of power, making it an excellent emergency base or mobile antenna. In the collapsed position, the Hot Rod antenna will perform like a helical quarter wave. Three Hot Rods are available; HR-1 1/2 wave 2M Ant., HR-2 for 220 Mhz, and HR-4 for 440 Mhz. Amateur Net Price on all Hot Rods is $19.95.

For either base station or hand-held operation AEA has the perfect VHF/UHF antenna. Put more punch in your Packet station with an AEA IsoPole or Hot Rod antenna. To order your new antenna contact your favorite Amateur Radio Distributor. For more information contact Advanced Electronic Applications, P.O. Box C-2160, Lynnwood, WA 98036, or call 206-775-7373.

IsoPole Specifications

Model	144	220	440
Freq. Coverage (Mhz)	135-160	210-230	415-465
2.1 VSWR bandwidth	›12Mhz @ 146Mhz	›15Mhz @ 220Mhz	›22Mhz @ 435Mhz
Power Rating	1 kw	1 kw	1 kw
Gain**	3 dbd	3 dbd	3 dbd
Radiating Element Length	125.5" (3.2m)	79.25" (2m)	46" (1.2m)
Amateur Net Price	$49.95	$49.95	$69.95

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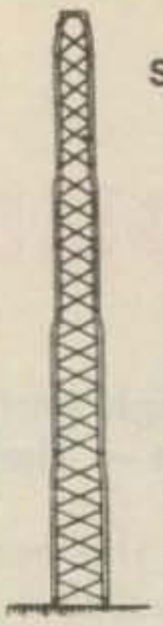

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60'	639	1209	1609
70'	689	1329	1759
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100'	989	1899	2259
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120'	1259	2179	2819

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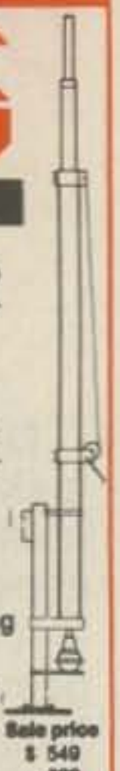

Model	Min. Ht.	Max. Ht.	Ant. load*	Sale price
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TX472	23'	72'	18 sq ft	2059
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Note - US Towers Shipped Freight Collect From Visalia, CA Factory

**Note-towers rated at 50 mph to EIA specifications*

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Up to 600 ft via UPS

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- Our RG-213/U uses virgin materials.
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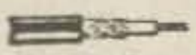

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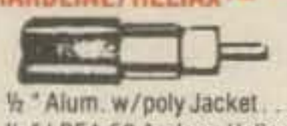

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Cable Type	Imped.	10MHz	30MHz	150MHz	450MHz
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RG8X	52	.8	1.2	3.5	5.8
9086	50	.4	.64	1.7	3.1
½" Alum	50	.3	.5	1.2	2.2
½" Heliax	50	.2	.4	.9	1.6
⅞" Heliax	50	.1	.2	.5	.9

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TH7DXS 7-el Triband Beam	
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205BAS 5-el 20-mtr Beam	
155BAS 5-el 15-mtr Beam	
105BAS 5-el 10-mtr Beam	
204BAS 4-el 20-mtr Beam	
64BS 4-el 6-mtr Beam	
12 AVQ 20-10 mtr vertical	
14 AVQ 40-10 mtr vertical	
18 AVT/WB 80-10mtr Vertical	
18HTS 80-10 mtr Hy-Tower Vertical	
23BS 3-el 2 mtr Beam	
25BS 5-el 2 mtr Beam	
28BS 8-el 2 mtr Beam	
214BS 14-el 2-mtr Beam	
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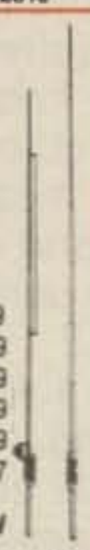

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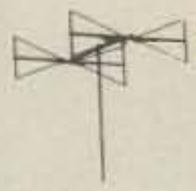

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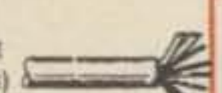

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FK2568	68 ft.	11.7 sq. ft.	$ 999.
FK4544	44 ft.	34.8 sq. ft.	$1199.
FK4554	54 ft.	29.1 sq. ft.	$1299.
FK4564	64 ft.	28.4 sq. ft.	$1399.

25G Double Guy Kit	$249.
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*Above antenna loads for 70 mph winds w/guys at hinge and apex. All foldover towers shipped freight prepaid in 48 states. Prices 10% higher west of Rockies.

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3/16 CCM Cable Clamp (3/16" or 5/32")	$.45
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CIRCLE 43 ON READER SERVICE CARD

Twelve meter mobile? Why not? N5BHU shows us that building a 12 meter mobile antenna isn't really that hard to do.

QED On 12 Meters

BY JAY HARRISON*, N5BHU

To most people, *QED*, from the Latin *quod erat demonstrandum*, signifies that which is to be demonstrated. However, in this case it means Quick, Easy, and Dirty. And it has been shown to work.

With the upswing in the sunspot cycle in our favor, activity on the new 12 meter band (24.890–24.990 MHz) has picked up considerably, and I wanted an antenna to let me work the band from my car. I also wanted one to approximate the performance of my Butternut HF4B Butterfly beam on 12 meters.

Unfortunately, no commercially made 12 meter mobile antenna was available. I have had good success with a 4 foot high 20 meter mobile antenna, and I wanted a 12 meter version of similar size. It had to be something which would unscrew quickly from the mount to be replaced by one for another band, or to be tucked behind the front seat of my car as I drive into a parking garage with a low ceiling. (Ever notice how the ceilings of parking garages get closer to the pavement each year? Or is that a phenomenon peculiar to Texas?)

I decided to try my hand at modifying a 4 foot high citizens band antenna I found at Radio Shack (Model 21-934A) for about $11. My junk box had about 15 to 18 inches of No. 12 insulated, solid copper wire and some tape, so I was in business.

Simple as this project is, it requires careful pruning and adjusting to get it to play properly. Patience is a must in this project, but once the SWR readings are down to an acceptable level, the QED plays like a song.

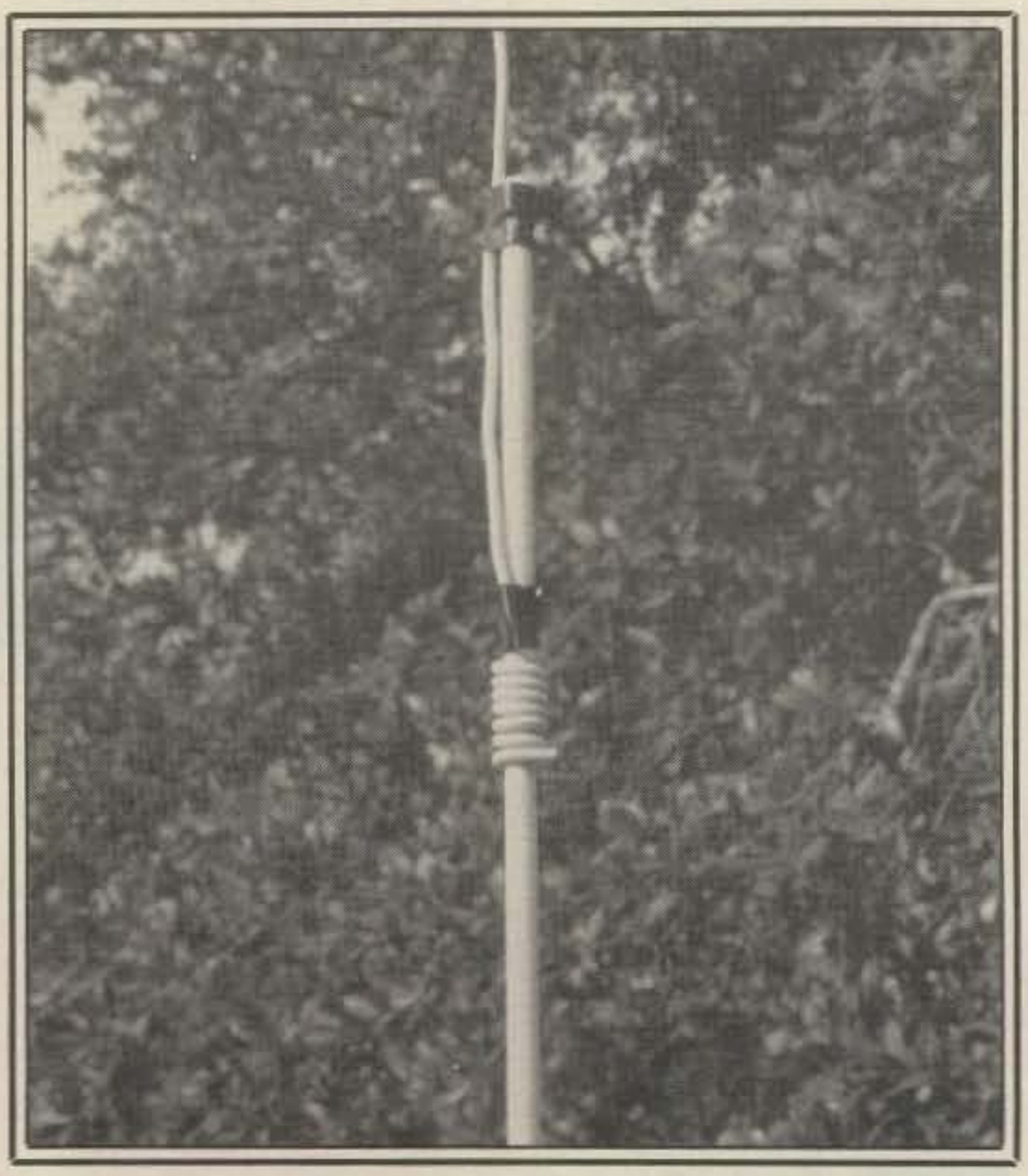
Arbitrarily, I picked a point about midway in the top loading coil of the CB antenna (about 5⅝ inches from the cap) and wound seven turns of the insulated wire over it. (See fig. 1.) I then extended the remainder of the wire parallel to the coil and above the top of the antenna several inches. I temporarily taped things in place and began tuning and pruning.

When I first tried it, the modified antenna showed 35 watts out and 35 watts reflected—not a good beginning. I therefore began to prune the wire in quarter- or half-inch pieces while I also gradually moved the pickup coil up or down the CB antenna loading coil. I even experimented with varying the spacing between the turns of the pickup coil, but the success came from positioning the pickup coil and trimming the top of the wire.

To say the position of the pickup loop is critical is an understatement. I moved the coil a quarter-inch at one point, and the whole thing suddenly went from not work-

*2500 Timberline Dr., Austin, TX 78746

N5BHU examines the results of his handiwork in converting a CB antenna for 12 meter amateur use.



A close-up view shows the ease with which the Radio Shack CB antenna was modified to work on 12 meters.

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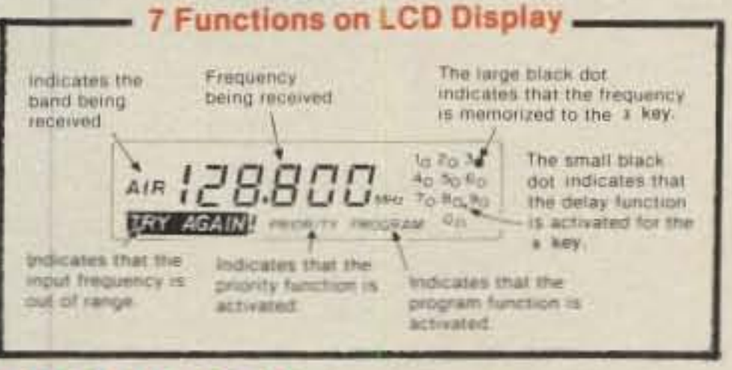

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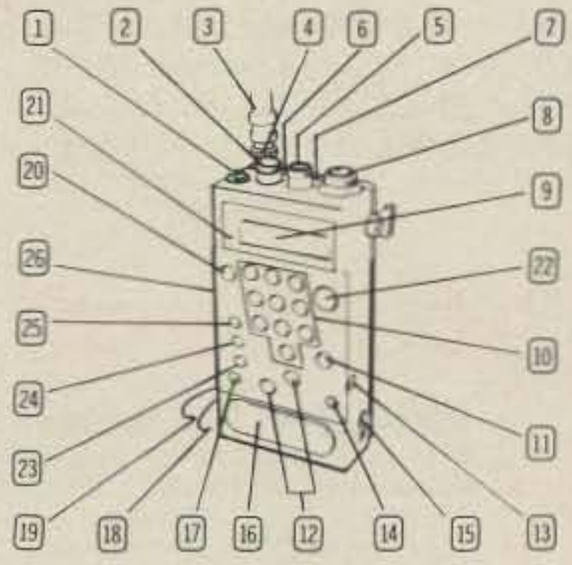

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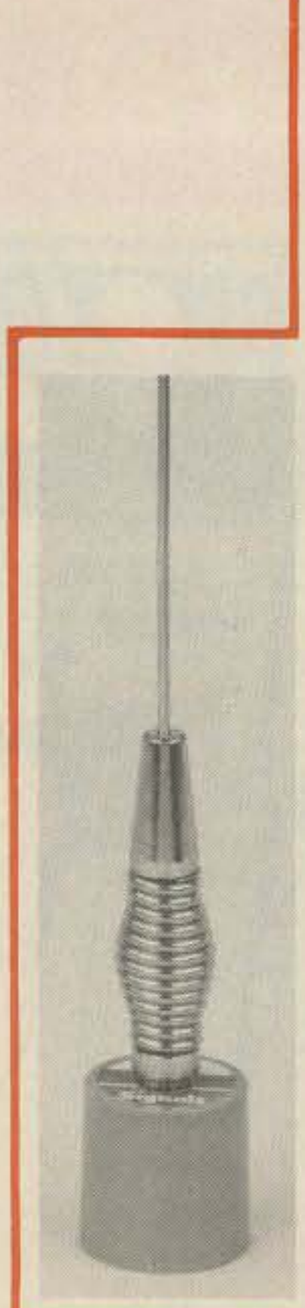

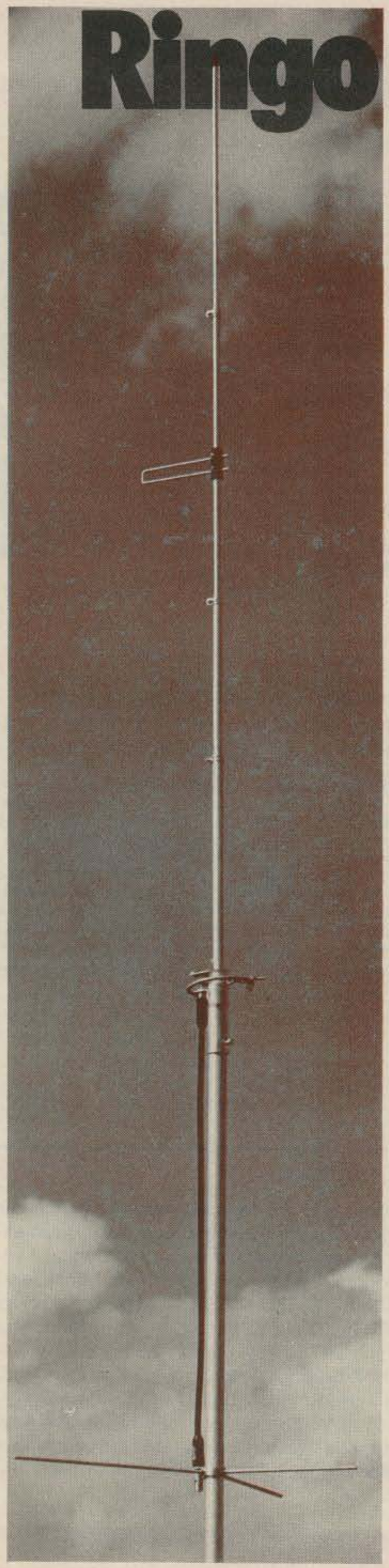

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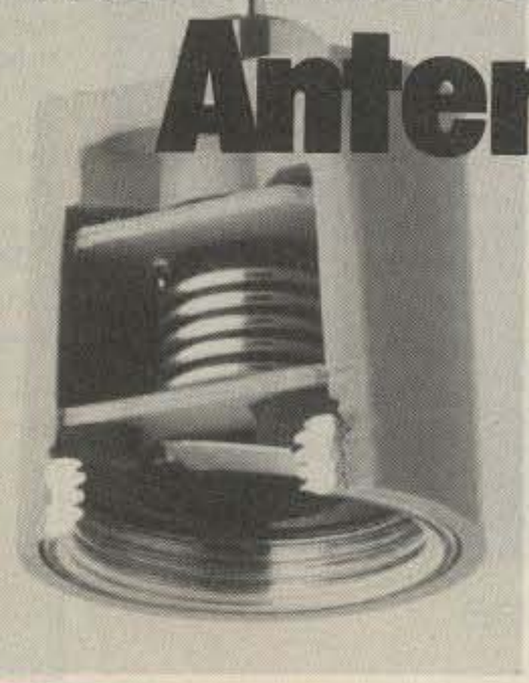

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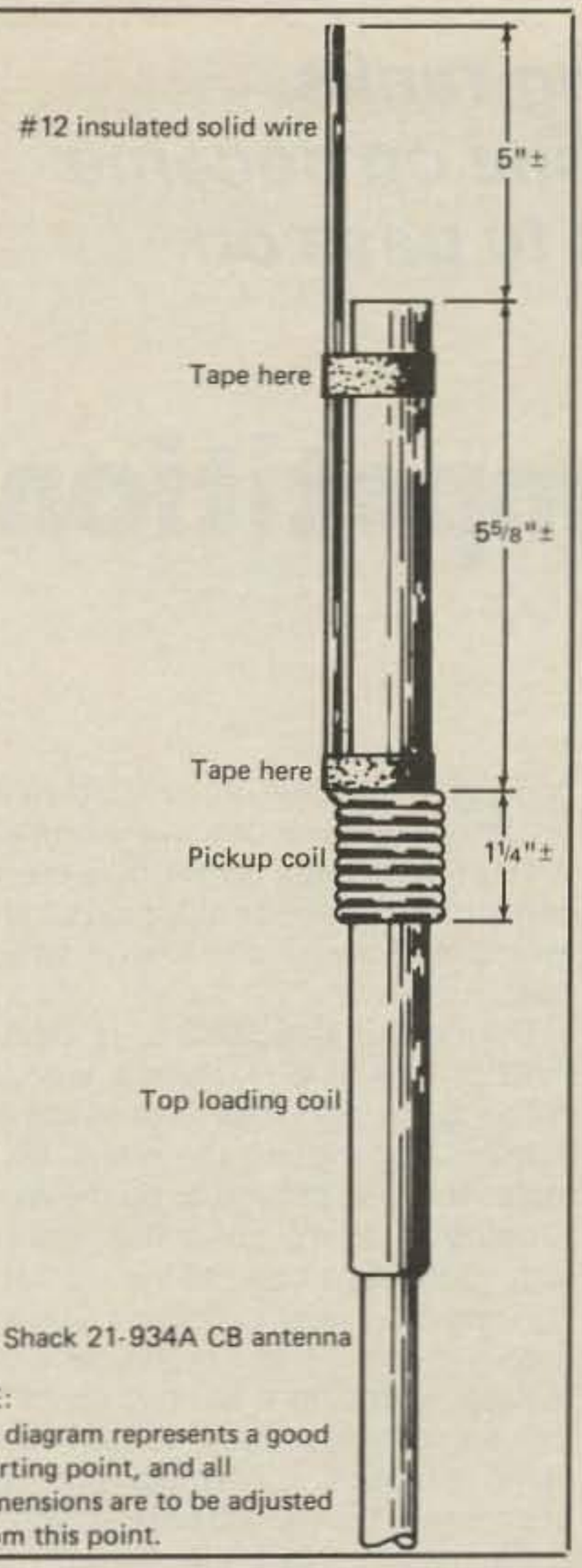

Fig. 1– The basic construction of a 12 meter mobile antenna. This diagram represents a good starting point, and all dimensions are to be adjusted from this point.

ing to working. I had 110 watts out and none reflected. And the antenna was flat for the full 100 kHz of the band.

I then taped everything firmly in place, taking care not to move the pickup coil. Some builders might want to slip some heat-shrink tubing over the whole thing once it's tuned.

The advantage of the flexible wire at the top of the QED is that if some low-hanging object is hit, the wire will bend and can be straightened easily. The antenna will not play with the wire tip in the horizontal position, however, so straighten it promptly.

Reports from the 12 meter gang have been surprisingly good, and I have been quizzed extensively about the QED. There were some skeptics out there in radioland when I said it was a modified CB antenna only 4 feet tall. My first mobile contact was with WBØNHD in Minneapolis, and he thought I was still at the home station and on the beam.

Like I said, the whole thing is quick, easy, and dirty—and cheap. CQ

"Wanted: Young ops to join the contesting ranks. Experience not necessary." Here's how one op became hooked on contesting, and why he wants to pass on the enthusiasm to others.

What's Happened To Competition?

BY LEW GORDON*, K4VX

The first time I entered a DX contest was at the age of 18. My good friend Norm, W9JMJ, had saved his pennies for a year and had just purchased a new Collins 75A receiver. This represented the finest receiver ever built up to that time, and I was itching to try it out. Norm's antennas were not as good as mine, so I suggested that if he would bring over his 75A, we could use my push-pull 807's to put Indianapolis on the contest map.

A brand new contest had been created that year by *CQ* magazine which they called a "World-Wide" contest. The ARRL DX Contest had long been considered the premier of world-wide activities, but this new contest looked interesting, especially with the concept of zones entering into the scoring system. In addition, there was no "quota" on DX QSOs, which had always relegated DX to second-class citizenship in the ARRL contest.

As neither of our parents owned a car and both Norm and I were in college, precontest preparation consisted of calling a taxi to bring Norm's 75A to my place. We had thought about taking it on the trolley system, but it would have required transferring trolleys in midtown, which we wanted to avoid. I had just installed an 8JK wire beam for 10 and 20 meters in the attic (there was no 15 meter band), and we had a folded dipole for 20 meters. For 40 meters I tied the two 20 meter folded dipole twinlead feedline wires together and tuned my *Handbook* tuner for maximum glow on the reliable neon bulb output power meter. At that time 40 meters was CW only over the entire band, and occasionally one could even hear DX, so I wanted to be sure we could work any DX that might show up down there.

Norm had spent one year in the Army stationed in Korea, where he had held the call J8AAS, so he was experienced in working a pileup. He was to start the contest as operator and I would help with the logging chores. We set our clock to WWV, and that Friday night in November 1948 W9APY was ready!

Well, we thought we were ready. However, our conversion from central standard time to GMT was off by one hour, so we gave the rest of the world a one hour handicap. Our first QSO was on 20 meters with KL7PJ at 0132 GMT when Norm sent his first 57904. We were 55901, which probably explains why it took so long for our first contact. Sixteen minutes later we worked TI2RU with a 55907. The dipole was working! Through dedication and effort we were able to keep up that QSO rate throughout the entire contest so that when our last QSO with VE8NY was made we had a grand total of 105 QSOs, 21 zones, 41 countries for almost 18,000 points. The only DX we heard on 40 meters was J9AAO on Okinawa (whom we could not raise). In addition, we couldn't keep the tuner from arcing on 10 meters, so in reality we were in the multi-operator single band category. Now *CQ* had provided a lot of contest categories, but M/S Single Band was not one of them!

That weekend had an enduring effect upon my life. The thrill of competition became one of the major rewarding activities of amateur radio in my case. I was never able to enjoy the thrill of victory from Indianapolis, but several years later as W9APY/5 in Mississippi, I was able to actually place reasonably high in the ARRL DX Contest, winning the Delta Division. Several section first-place finishes in the Sweepstakes from Mississippi and later Indiana provided all the impetus needed to set a goal of eventually having a first-class multi-tower antenna system that was competitive with anyone anywhere.

Family and work commitments through my middle years prevented me from constructing my ultimate station, but the goal was there, nonetheless. The 15 years we lived in northern Virginia near Washington provided the opportunity for real contest competition for the first time. With the help of my friend Lennie Chertok, W3GRF, and other established contesters from the Potomac Valley Radio Club, I was able to build a fairly competitive station near Manassas, Virginia. A few single operator appearances in the top ten as W4ZCY and later as K4VX were forthcoming, but time was catching up, and as in any endeavor, one knows when his peak is passing.

During the late 1970's, to best help PVRC in the club standings, we started entering the multi-operator single transmitter categories in the major DX contests. This has proved to be the most rewarding of all my contesting career efforts. Building a competitive contest station, training new operators young and not-so-young in some of the skills of contesting, watching a team grow to really function as a team, and sometimes even being number one in a major competition are some of the rewards of multi-operator contesting. Before I retired and moved to Missouri in 1980, our team had several #1 USA finishes in the M/S category in both *CQ* World-Wide and ARRL DX Contests. Since then my Virginia operators have continued contesting, and a couple are considered world class.

Moving to Missouri has provided the biggest challenge of them all. Being competitive from the propagation black hole of the midwest is a formidable task. First, you "make" propagation, you don't just "use" it! This translates to BIG antennas. I was fortunate to have been able to acquire old surplus military Trylon towers for the cost of hauling them away. (This resource has just about dried up, but for anyone who is patient there are still some tower bargains out there.)

Back in 1981, to recruit some operators, I placed advertisements in both *CQ* and *QST*. While I was not overwhelmed by volume, I did receive several calls. One cocky youngster of 16 called and simply stated "I'm your operator!" This proved to be more than true. That young man (KRØY) finished in the top ten in Sweepstakes last year in both modes from K4VX/Ø. Several times he has been near the top in the *CQ* WPX Contest using his own call. As Jeff is a senior this year in EE at the University of Missouri, I may lose him to W1, W5, W6, or wherever the job market takes him. I'm not sure how

*P.O. Box 105, Hannibal, MO 63401

we can replace him. Too bad we don't have an operator "draft" system like the NFL where the team with the poorest record receives the first draft choice from the available talent!

How can a contest station attract new operators? Another advertisement such as I placed several years ago might work: "OPPORTUNITY—Contest station centrally located with shots to Europe and Japan seeks young operators to share propagation opportunities. Experience not a requirement."

There are many other competitive contest stations located all over the country plagued by the lack of operators. Too few young teenagers entering ham radio today are being attracted to join the contesting ranks. Established contesters who are members of social-type ham clubs have an opportunity to give presentations on what contesting is all about. Those who have access to video cameras could tape actual contest operations for showing at future club meetings.

Field Day is an excellent opportunity to encourage the competitive side of ham radio. Encourage Field Day participation by your club. Help with antennas, equipment, and advice. Show the young operators how to make a "rate" with minimal equipment. Last summer, for example, operating at the Hannibal Radio Club's Field Day setup, I made 230 QSO's in 4 hours using a TS-130 and a trap vertical with no radials. Someone younger would have probably made 300+!

Invite your local newspaper to write a feature article describing amateur radio. A mention of contesting could do no harm. Photos of you at your contest operating position with a caption that you are talking to BY1PK in Peking during a recent DX contest, for instance, could be interesting to an aspiring ham.

Invite prospective contesters to visit during a contest, or even better, invite them to help with some of the less demanding contesting chores such as punching calls into the computer for duping. During the bottom of the sunspot cycle they can search and pounce on 10 meters for short periods. Who knows? After a few LUs and CEs they might like contesting!

I make no attempt to try to convert the contest haters with their verbal assaults on all contests and contesters. I'm sure in their minds their babble about cousin George's hernia or their weekly QRU net is far more sensible than an international competition. The Sunday driver and the grand prix racing driver are about as far apart in goals.

I have to believe that somewhere out there are future Vic Clarks and Katashi Noses waiting for an opportunity to become contesting legends. Let's give them a chance to participate in something which can have an enduring effect upon their lives.

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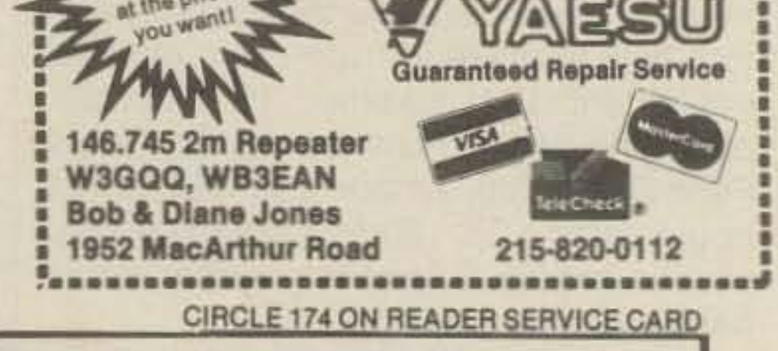

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Antennas & Accessories

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

A LOOK AT THE SHACK FROM BOTH ENDS OF THE COAX

Hamshack Computers: Part V

W8FX concludes his examination of hamshack PCs with Part V. In the first four installments he looked into computer selection, installation, operation, and maintenance. This time it's the software to make it all happen. We think that you'll find his suggestions timely and useful.
—K2EEK

Last time we got together we continued our examination of the hamshack personal computer (PC) with a discussion of PC care and maintenance. This followed our coverage of selection, installation, and operation. This month we'll peer into computer software selection, with the view to helping you to obtain your best dollar value in amateur radio and other types of software. Following that, we'll take a peek at some new hamshack software, look at some antenna products, and fetch some new reading matter from the library shelf. Let's first address software, updating and amplifying the discussion contained in our article "Software Tips for Amateurs," which appeared in the September 1985 issue of *CQ*.

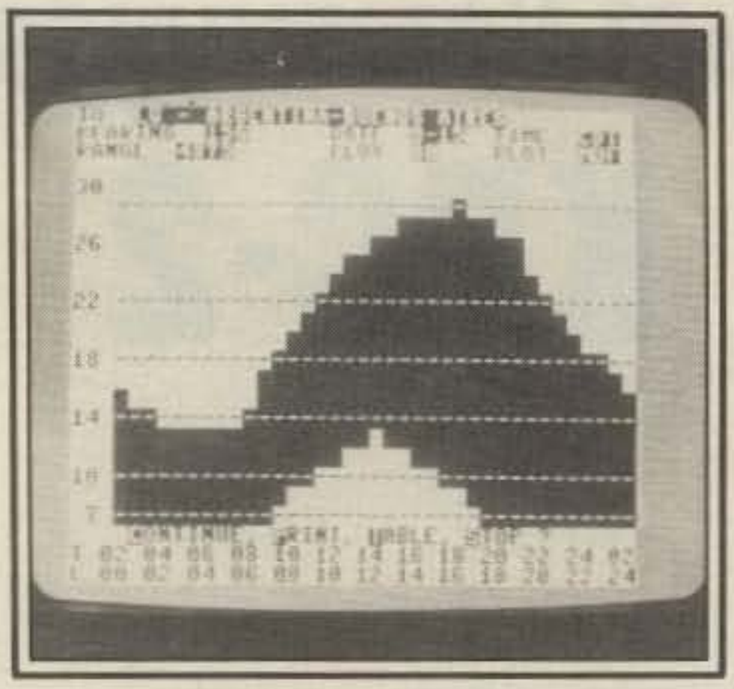
Hamshack Computer Software

Making an intelligent decision when purchasing computer software is no easy task, and the consequences of poor choices can be costly and frustrating. Just about everyone who has turned the cover of a computer magazine, or who has used a personal computer, "knows" that well-known, highly rated commercial software packages such as Visi-Calc, Word Star, and dBase II™ do bangup jobs when used for their intended purposes: financial spreadsheeting, wordprocessing, and data management, respectively.

However, it's a different story with other software, especially that for relatively small, specialized markets, including amateur radio. For example, will that new whiz-bang Maximus Mark V packet interface by Sometime Software Systems really enable the best packet connection for your computer and transceiver? Whose logging programs will keep the best running tabs on your quest for WAZ? And which satellite tracking program is simplest to use, yet produces easy-to-use data printouts that are "on the nose"?

We can't claim that we have all of the answers to questions such as these. But, having had our own personal "trial by fire" in purchasing a variety of computer software over the past few years, we have developed some checklist questions which you should find useful in making the "hard" software selection decisions for your hamshack or home. Let's look at some of these.

1. Is the software you're considering designed for your specific hardware configuration? This should include all major components and peripheral devices: video display, printer, disk drive, operating system, and any interfaces. The watchword is compatibility of all elements of the system with the software that's to run on it.



A good example of the kinds of applications well-suited for hamshack computing is the MUFPLOT™ propagation prediction program offered by Base 2 Systems. The screen display shown here is of a path from the United States to Argentina. (W8FX photo)

2. Is the software written in a fast assembly or compiled language, or is it written in a relatively slow, high-level language such as BASIC? Speedy operation is especially important in data-handling programs which must search for and sort data, as well as in various real-time, on-the-air applications.

3. Is the software's documentation complete, well-organized, clearly written, and legibly printed? Can you understand it? And is it indexed? Unlike a book, you can often size up a software package fairly well by its "cover."

4. What kind of storage medium is required—cassette or disk? Some programs require the use of two cassette or disk units for effective operation. Note that the most sophisticated programs are usually available on disk rather than on tape cassette these days due to the many inherent limitations of the latter media. Many sophisticated programs require a "hard" disk drive for proper, fast performance.

5. Is the manufacturer service oriented, with solid follow-up support after purchase? What do other purchasers say about the service rendered? There's some informal user-group, ham club, and on-the-air sources of information and scuttlebut for popular hamshack software on this score.

6. Are there magazine reviews or users' group critiques available which rate the software? A trip to the local library and to a local ham club or users' group meeting may be a wise move in order to obtain a "second opinion."

7. Does the manufacturer have a regular program to offer enhancements, such as new features, updates, and "fixes" in the future? These may not be free, however, especially after expiration of the warranty. However, the prices charged for program updates and upgrades should be reasonable.

8. Is the software written so that you can make backups for your own use to guard against accidental damage to a tape or disk? If not, will the manufacturer sell you a backup, and under what conditions and at what cost?

9. Is the program simple to learn and use, with easy-to-remember control codes, commands, and formats? Any minor annoyances on first use of the software will likely grow over time and may reach intolerable levels.

10. Is the package menu-driven and self-prompting, or is it command oriented? To use it effectively, must constant reference be made to the user's manual? Is a command overlay or "cheat sheet" available for the package?

11. What form does the software take: ROM "firmware," disk, or cassette tape? Are the capabilities and limitations of each clearly understood? Ham/computer interfaces generally require the computer to be "tied up" for on-the-air work. Keep this in mind if you want to task your hamshack computer with multiple jobs, especially ones that involve other family members.

12. How much random access memory (RAM) is required for the program? Can your computer handle the RAM requirement, yet have adequate working space left for the files that may be created?

13. Can you see the software demonstrated before purchase?

This isn't always possible, but is highly recommended. Even a "quickie" demo may reveal that the software is too difficult to use, or that it just won't do the job you had in mind for it.

14. Is the program set up with convenient, easy-to-remember, and logically chosen "default" values for editing, searching, printing, and the like?

15. Can necessary disk "housekeeping" operations be performed from within the program without any loss of program data? This is very nearly a "must," in my view.

16. Is the program well error-trapped so as to be as nearly "crash proof" as possible? Woe unto the program that, upon the occurrence of certain errors, seizes control of your computer and refuses to relinquish it, causing you to lose all of your contest QSO data!

17. Are set-up templates or comprehensive program or file examples provided for your assistance in getting started with the software? Is a tutorial available, either on disk or in the user's manual?

18. Is the program designed for easy, file-compatible interface with other software? In the hamshack an interface between a log or database program and a QSL-printing program might be important; in business applications such interfaces are rapidly becoming "must haves."

19. Is the package flexible so that you can design custom input and output displays if necessary to suit your own needs and preferences?

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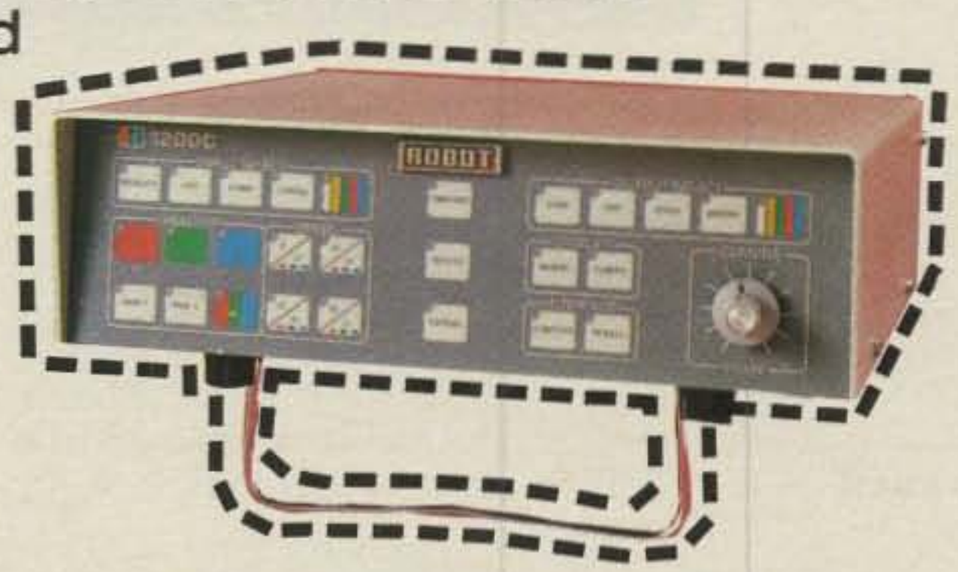

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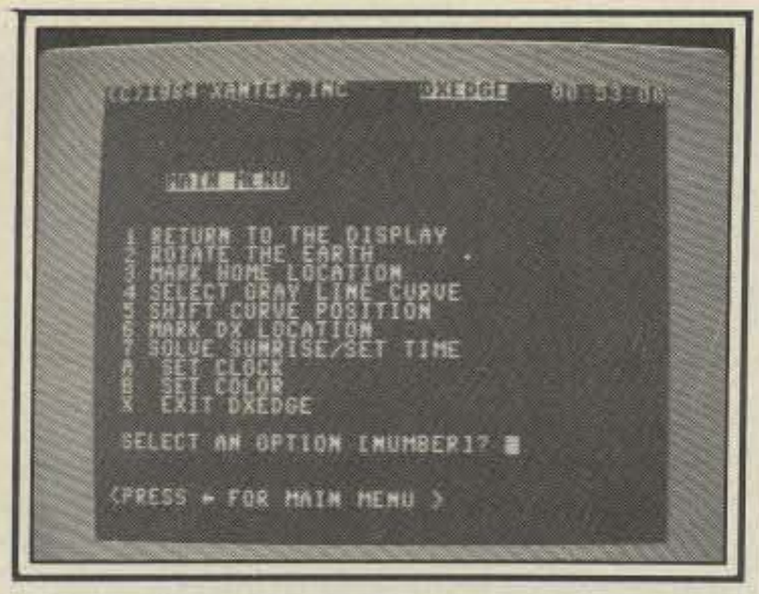


Screen photo of the Computerized DX Edge™ showing the main menu. This program is a good representation of the many fine hamshack applications software packages available for the popular Commodore 64 computer. (Photo courtesy Xantek, Inc.)

Can video screen colors be modified to suit your own tastes and your particular monitor?

20. What is the manufacturer's overall reputation? If he's known for products other than computer software, would you buy these from him?

21. What is the return and restocking policy? Customarily, software by its very nature is nonreturnable, though some firms are more lenient in this respect than others and have a short trial return period. Be sure before you buy!

22. If the software is to be used on a computer that is to be operated in an RF environment, will the hardware be adversely affected by the presence of strong RF fields? And does the computer generate too much receiver hash? These can be real problems in ham/computer interface packages.

We've mostly considered commercial, off-the-shelf software here. In addition to commercial software, there are other program sources, too. Such sources include the numerous amateur radio and computer-oriented magazines published today. Many of these contain program listings each month, some of which may be useful to you in home and hamshack applications. Needless to say, these programs are of widely varying quality, and rarely will such programs represent the "last word" in sophistication. Note that some magazines include a list of in-print back issues near the rear of the current issue, so you can see what software programs may have been published in previous issues. Too, some magazines publish conversions of previously published programs for other computers. Again, a jaunt to the local library may be productive.

Additionally, most computer systems that have been around for a few years—including several no-longer-produced orphan computers—have built a stalwart following so that users' group program exchanges have developed around them. These exchanges, which specialize in public-domain programs, can help you to effectively cope with the high cost of software. To locate users'-group/public-domain sources applicable to your computer, browse through the specialized magazines which have sprouted up to support your PC. Many of these magazines list such groups and sources regularly and may even have columns devoted to them. Bear in mind that public-domain software quality varies all over the lot, with much of it in the "rough draft" stage. Often, it's up to you, the user, to do some fine-tuning and bug-swatting.

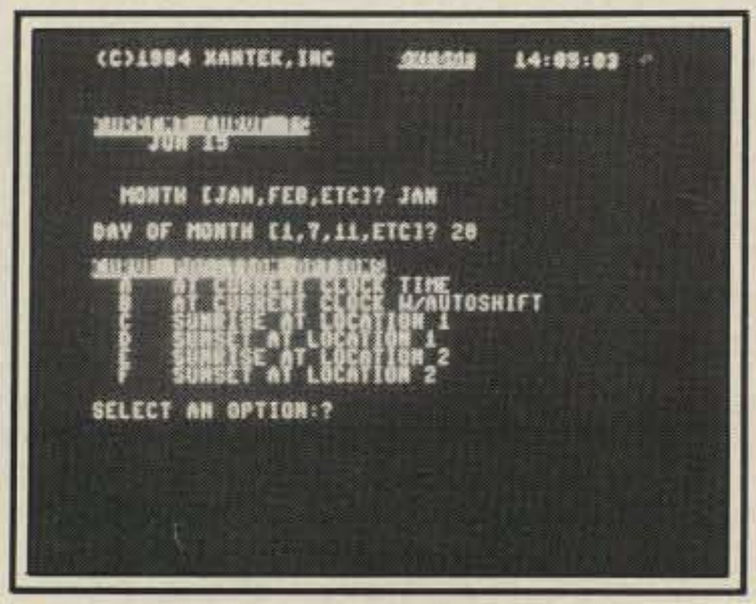
Some general suggestions: Carefully consider just what you want the software to do before purchasing it. Do you, for example, just need a computer program to work out beam headings for you, or do you want a more sophisticated program that will also calculate MUF (Maximum Usable Frequency) and sunrise/sunset data? Survey the various programs competing for your dollar investment; you'll be surprised at the variations in capability, price, and overall quality between them. Consider special-purpose as well as general-purpose programs with add-ons. While most hams purchase special-purpose application programs, it's also possible to perform many tasks, such as logging, with a general-purpose database program with an appropriate customization template.

Survey sources. While you should consider price in software selection, you should not shop on price alone. Often the least expensive software translates into the shoddiest performance. Realize, too, that software pricing is extremely flexible, doesn't seem to follow any set rules, and is often geared to the computer it's to run on. For example, IBM-PC owners will usually pay much more for a comparable program than will their Commodore 128 friends. At the bottom line: Keep up with what's new; be and stay informed!

A point we should touch on is the question of customer support. Most hamshack software is written by active amateurs who are not only trying to make a buck, but are also trying to fill a real need they have identified in publishing their product. As such, they are usually willing to help you get your program running right. When you're asking for help, whether calling or writing, take time to run through the problem or problems you're having carefully and critically; often the answer lies in a little-used and never-read portion of the user's manual. Check the manual carefully. Look for any "help" or "read me" type files on your program disk. Ask yourself if the problem occurred before, and if so, were the conditions the same as now. And check to see if you've added any new equipment to your system or otherwise changed your setup to possibly introduce a hardware incompatibility that impacts on the software.

Be sure, too, that you've returned your warranty registration card, without which few software manufacturers will respond to your request for help. When calling or writing for assistance, clearly identify your computer system, program name and version number, and specific peripheral equipment you are using. If calling, have your user's manual handy.

Several excellent books are available to help you become informed, to make the right



Screen photo shows a menu from the Xantek DX Edge™. The Commodore 64 program is used to draw "grayline" propagation curves used in seeking sunrise/sunset DX. (W8FX photo)

Computer operation in the hamshack is nicely detailed by these two gentlemen in their book Computer Programs for Amateur Radio *. In the foreground is Jim Steffen, KC6A, and Wayne Overbeck, N6NB, is in the back—the gent with the beard, now shaved off. Their 328-page Hayden book represents an excellent computer tutorial and collection of BASIC-language amateur radio computer programs. Their book is published at $16.95 by Hayden Books, 10 Mulholland Drive, Hasbrouck Heights, NJ 07604. It's available from most dealers who sell amateur radio publications, along with disks of the software programs contained in the book for several of the more popular hamshack PCs. (Photo courtesy N6NB)*

software decisions. Although written without specific reference to the hamshack, a computer software book by Alfred Glossbrenner is a near "must." It is *How to Buy Software*. I suggest its purchase for anyone who will make any serious use of the computer in the hamshack.

Glossbrenner's book (ISBN 0-312-39551-5) is billed as "the master guide to picking the right program." Indeed, it is. The 648-page book is chock full of information needed to buy software with confidence. Included is information on computer operating systems and programming languages; how to read between the lines of software ads, reviews, and catalogs; how to evaluate programs before buying; interpreting sales and documentation jargon; where to buy software and what to do if your programs "crash"; and many other topics. Specific selection criteria are provided for most major types of programs, including communications, wordprocessing, spreadsheets, databases, and integrated software packages.

While this is a general-purpose book with little of specific amateur application, the principles he espouses are good ones to go by, regardless of the software you're buying. His book is generally available in well-stocked bookstores. If not, contact St. Martin's Press, 175 Fifth Avenue, New York, NY 10010. It is priced at $14.95.

We've promoted the PC for a variety of hamshack applications—from antenna design, to logging, to propagation prediction—in our *CQ* articles and monthly columns. But it took Wayne Overbeck, N6NB, and James Steffen, KC6A, to "put it all together" in a comprehensive volume, *Computer Programs for Amateur Radio*. This 328-page book is published at $16.95 by Hayden Books, 10 Mulholland Drive, Hasbrouck Heights, NJ 07604.

Overbeck and Steffen's book is both a computer tutorial and a collection of BASIC language amateur radio computer programs. It shows you how to use your PC for contest and general-purpose logging, VHF operating, antenna design and improvement, moonbounce, database management, awards tracking, and the like. The emphasis is on the practical applications, with a view to cutting down on the time spent in keeping records, performing mathematical calculations, and other "overhead" chores. No specialized knowledge is required to get the programs up and running. As long as you have a disk-drive-equipped Apple II, IBM-PC, TRS-80, Commodore 64/128, or most any computer that runs CP/M and Microsoft BASIC, you should be able to use the programs in the book. Commodore Vic-20 and Timex-Sinclair computer owners can run a number of the programs, too.

For the user who doesn't enjoy the typing-in of lengthy programs, a package of software, which includes some 20 programs, is available on disk for the Commodore, TRS-80 Model III, and IBM-PC, as well as in several CP/M formats. The disks are available from some dealers, or directly from co-author James Steffen (his address is found later in the column).

You obviously won't be able to apply all of the software selection suggestions we've provided all of the time. Sometimes, for example, it just isn't possible to get a "hands on" program demonstration prior to purchase. You may find that the program is a new one with scant information available, and so you purchase it on faith and hope, trusting the ham callsign you saw associated with the ad for a new offering to prevent you from being ripped off. But we hope these tips have taken some of the mystery out of the software selection process. Above all, apply the same logical buying criteria that you would otherwise apply in making any substantial household or hobby purchase. Good shopping and good luck!

Software of Note

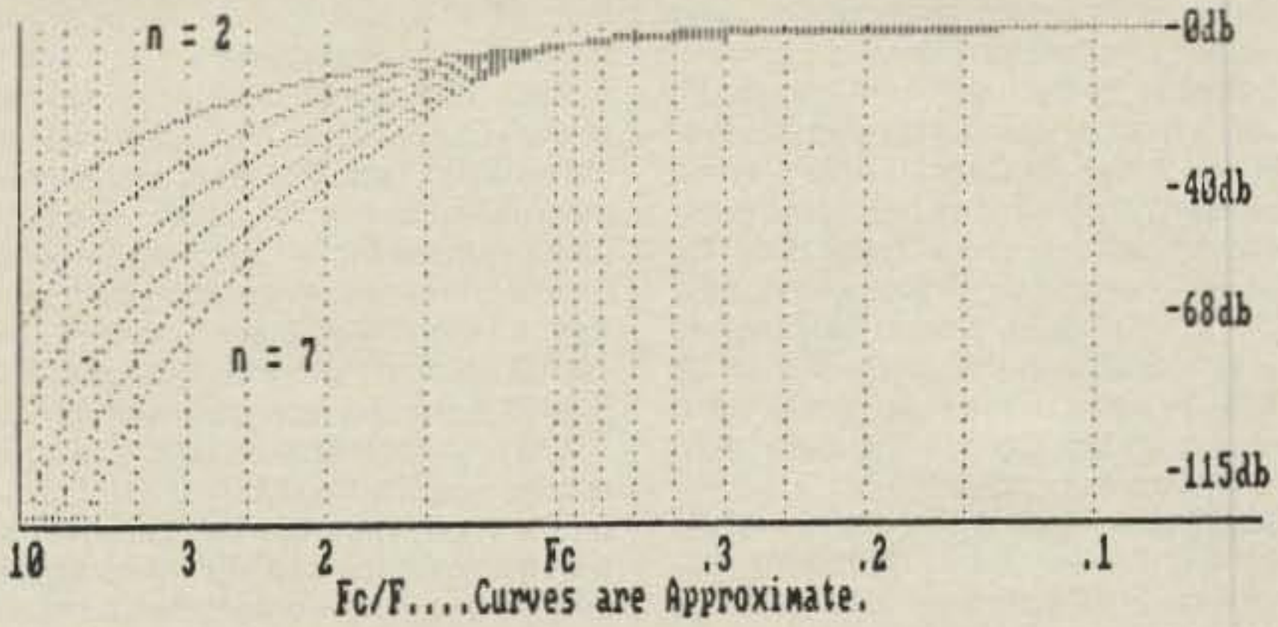
Etron RF Design Aids. We've been in communication with John Simmons, W6MDI, a consultant engineer and proprietor of Etron RF Enterprises, a small RF consulting firm that has been operating in and around the Los Angeles area for some 14 years. Two years ago John's firm acquired an IBM-PC to "help keep things straight." As they became familiar with the machine's capabilities, they put to it many of the generic, recurring design problems that were in the firm's electronic "note books," reducing the various written formulas and procedures to program format. As these programs grew in number and complexity, they were reorganized into a series of "Radio Frequency Notes" programs.

The subject matter of the three current Note Book series programs starts with very basic design topics and graduates into more sophisticated subjects, mostly in the RF engineering realm. The programs in the series are designed to yield useful results that allow the circuit designer to move directly from the computer to the workbench with useful information, without the need to translate the computer results into workable circuitry. Thus, the programs in the Note Book series are designed to be powerful, everyday working aids and tools for the RF designer.

RF Notes No. 1 is a menu-driven collection of eight RF engineering design programs for the Commodore 64/128 and IBM-PC. The programs perform many useful functions including various voltage, current, and power conversions; VSWR calculations; passive filter construction; resonant circuit design; basic micro strip and strip line design; and cross products. Most of the programs produce a graphic reference sketch, either in schematic diagram or mechanical drawing form. While primarily intended for RF applications, the programs may in most cases be used down to audio frequencies. I've had the opportunity to use the C-64 version, and consider it to be a very professional product. The IBM version is priced at $57 and the C-64 version at $65.

RF Notes 2 is only for the IBM-PC and compatibles at this time. This is a sophisticated four-program package that performs various calculations relating to RF attenuator pads, inductors, capacitors, and impedance matching networks. All of the programs in this series have graphics. The package is priced at $60.

RF Notes 3, also for the IBM-PC, consists of specialized programs to be marketed in particular "Volumes." Right now, Vol. 1 is available; it is dedicated to the design of Butterworth response filters. The program designs lowpass, hipass, bandpass, and band-reject filters based on input/output impedance ratios and user-defined input parameters. Outputs are in schematic form with circuit constants being presented. Helpfully, each of the four programs in the package includes an input tutorial in graphical form, which details the inputs necessary to describe the filter type selected. Typical input tutorial and schematic output pages are reproduced in fig. 1. This package is priced at $85.

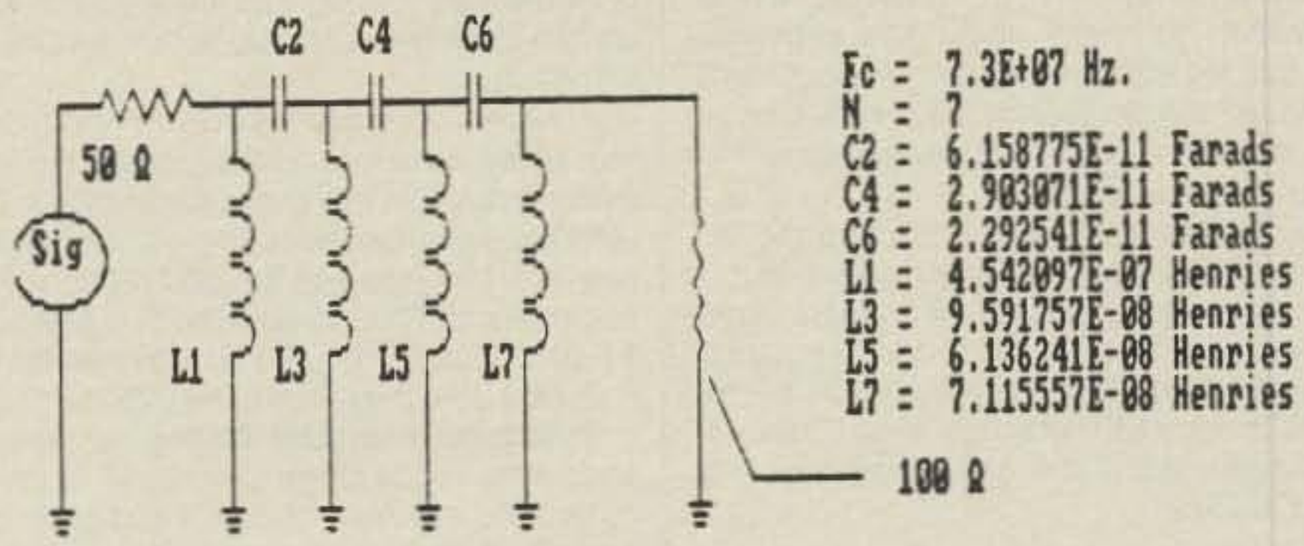


Note that Fc = -3db cutoff frequency. You must first specify a cutoff frequency, then choose a frequency [(Fc x M = Fa) where M = any number) 1] and specify a attenuation at that frequency (Attenuation = __db at Fa). Alternately, you may simply specify Fc and n.

Press any key to Continue

High Pass input Tutorial Page

Butterworth High Pass, 7th Order



Fc = 7.3E+07 Hz.
N = 7
C2 = 6.158775E-11 Farads
C4 = 2.903071E-11 Farads
C6 = 2.292541E-11 Farads
L1 = 4.542097E-07 Henries
L3 = 9.591757E-08 Henries
L5 = 6.136241E-08 Henries
L7 = 7.115557E-08 Henries

Press any key to plot response Esc to Escape

Typical High Pass Schematic Output Page
N = 7, Rs = 50, RL = 100

Fig. 1– Typical Etron RF Notes 3 graphic display (Butterworth high-pass filter).

For more insight into these programs, contact Etron RF Enterprises, P.O. Box 4042, Diamond Bar, CA 91765.

Canned Ham. Sporting a novel name for his product is Charles Kelly, NP2BP. He's come up with a comprehensive, test-oriented code training program for beginners designed to be run on the IBM-PC. It is prepared from the perspective of a beginner to ham radio—an "outsider." The primary purpose of Canned Ham is to raise your Morse Code receiving rate quickly to 13–15 wpm, in order to allow you to pass the General and Advanced code tests. The program will also help you if you are learning the code from scratch as an absolute beginner, though in this case it's recommended that a beginner's 5 wpm audio cassette tape be used in the initial stages.

In Canned Ham no visual cues or memory aids are used. The program claims great strength in its ability to increase the efficiency of practice hours. This is achieved by allowing you to concentrate practice in the weak areas, rather than in random drills or simulated QSOs, which can rapidly become stale through memorization. According to the program's author, he has tested Canned Ham on a number of volunteers, and all have achieved their amateur radio "ticket" in 13 sittings or less, a typical sitting being of 60 to 90 minutes' duration. Some features are drills in which you can stipulate certain symbols and characters

for emphasis; use of actual words in various categories; callsigns and Q-signals; three-word-phrase drills; simulated QSOs; and smooth speed progression from 5–16 wpm.

The package comes with a 42-page, indexed user's manual which is divided into four chapters that cover the Canned Ham method and philosophy; program disk preparation; detailed user instructions; and a "battle plan" for using Canned Ham to "crush your way up past the Magic 13," in Charles' words. The program is priced at $33.95 with the user's manual on disk, or $39.95 with a printed user's manual. It is available from The Gordon Company, P.O. Box 505, Williamsburg, VA 23187.

Notes from Wayne, N6NB. We've mentioned the Overbeck and Steffen book, *Computer Programs for Amateur Radio*, several times in our column, most recently in this month's discussion of software buying guidelines. Wayne has corresponded with us several times to update us on his activities, particularly with respect to problems in running programs drawn from the book on particular computers. He has indicated some problems with the C-64/1541 disk drive combination, particularly relating to datafile reliability. This has occurred despite using the program syntax recommended by Commodore, with resultant data errors and program crashes on some 1541 disk drives. He and co-author Jim Steffen, KC6A, have been working hard to correct these problems, and have sent an errata sheet to C-64 users who have written to them about the problem. Wayne suspects that many more users have experienced the datafile problems than have written in, and so asks that we publicize the problem and its solutions.

Space prevents us from reprinting the errata sheet which Jim forwarded to us. But if you're a legal owner of the C-64 amateur radio software program disk for their book, I suggest that you send an SASE to co-author KC6A requesting a copy of the errata sheet. His address: Jim Steffen, KC6A, 6831 Espanita, Long Beach, CA 90815.

New Products

Enough "computer stuff" for now. Let's look at some antenna-related products you're likely to find interesting.

Aluminum Brazing Rod. William A. Yaeger, W9OCS, writes to advise that he's discovered and now markets an aluminum brazing rod that is highly useful in working with beam and vertical antennas using aluminum conduit. He indicates that in constructing antennas you can eliminate high-resistance joints and the need for clamps by welding the joints. The brazing rod can also be used to repair damaged or bent antennas by straightening the elements and filling in kinked or cracked areas by the welding process.

The aluminum brazing rods he markets, "M.S.S. Wonder Rods," have a low melting point (732 degrees), and they are suitable for use with an ordinary propane torch and a wire brush. Necessary flux is built into the rod, which is similar to brazing rods used by industry to repair motor-boat propellers. Other uses for the rods include welding copper to aluminum (as in matching networks), repair or plugging of holes in aluminum panels or chassis, and alternator repair. In addition to aluminum and copper, brass and galvanized or "white" metals can generally be welded using the product.

For details, contact Medford Specialized Service, N3401 Castle Road, Medford, WI 54451.

Dacron Antenna Rope. Word comes to us from Debbie L. Livingston of Synthetic Textiles, Inc., of a line of special Dacron® antenna rope, which is available in 3/32", 3/16", and 5/16" diameters. This special double braided rope was manufactured by the firm at the urging of a local amateur radio operator, and they are now marketing the line nationally. The braid cuts neatly with the firm's "Hot Knife" and is said to tie and untie easily even after years of use. DuPont's colorsealed black Dacron® polyester yarn is used on the braided jacket to afford additional protection from ultraviolet light damage.

The product is sold on 1000 foot spools and ranges in price from $30 to $100, depending on the rope diameter. Each spool is shipped with the electric Hot Knife for cutting. For further information, contact Synthetic Textiles, Inc., 2472 Eastman Ave., Building 21, Ventura, CA 93003.

From the Bookshelf

Receiver Rating Guide. SWLs looking to upgrade their receiving equipment should take note of Rainer Lichte's book, *Radio Receiver—Chance or Choice*. In this book Lichte has assembled detailed information on a wide array of communications receivers, spanning the past dozen years or so, from most of the major manufacturers. Each receiver rated was subjected to a series of lab-type tests. Lichte presents the results of these tests and his summary of the sets' strong and weak points, based on his objective and subjective involvement with them.

In such a book one may quibble with the author's performance criteria, comparisons, and assessments. In any case, the book is a useful reference source and buying guide intended to help the reader to pick the best receiver for his or her needs. The 256-page book is $18.50 plus $1.50 postage from Gilfer Associates, Inc., P.O. Box 239, Park Ridge, NJ 07656.

Propagation Publishing Catalog. An excellent source for a wide range of amateur radio, computer, and electronics books and other publications is Propagation Publishing, P.O. Box 5255, Morton, IL 61550-5255. Operated by James R. Jones, NG9E, the firm indicates that it wants to be a one-stop source for all published products in amateur radio: books, tapes, computer programs, operating aids, and the like. Perusing Jim's catalog, I note offerings in the areas of general amateur radio, antennas, computer technology, software, SWL items, power supplies, electronic projects, learning aids, reference handbooks, satellite television, video electronics, and more. Catalogs and supplements are issued regularly.

Short Bursts

In the Antenna Manufacturers Directory on page 75 of last May's issue, we misspelled a firm's name. Spi-Ro Manufacturing, Inc., is the correct name of the firm which we referred to as "Spi-Pro Distributors." Their address is P.O. Box 1538, Hendersonville, NC 28793. Thanks to R. L. Williams for bringing this oversight to our attention.

Wrapping It Up

We've concluded the Hamshack Computing series with what are, hopefully, some useful software selection guidelines and suggestions. We hope you've enjoyed this series as much as we have enjoyed presenting it; we've learned a lot in preparing it. Next month: more topics of timely antennas and accessories interest. See you then. 73, Karl, W8FX

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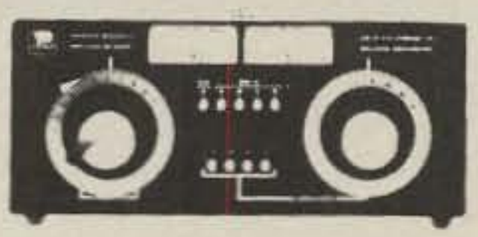

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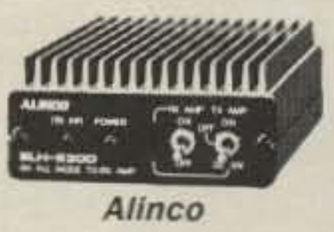
FT-1903/1123	IC-03/04AT	Icom IC-M12 (Marine) M700
	IC-A2/U16	Tempo M-1



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Awards

a monthly feature by
DOROTHY JOHNSON, WB9RCY

NEWS OF CERTIFICATE AND AWARD COLLECTING

William J. Webb, KX1A, USA-CA All Counties #513, 6-2-86, at home in Wethersfield, Connecticut. Second op is son Chris.

Lt. William J. Webb, KX1A, at work with the Hartford, CT Fire Department.

Santa Claus (aka Bill Webb) at the operating position of ARS KX1A.

The Story of the Month for December is:

William J. Webb, KX1A (ex: WB1GOO) USA-CA All Counties #513, 6-2-86

" 'Are you coming in for coffee?' 'No, I think I'll just sit here and play with the rig . . . . Say, what's this?' 'Is there a mobile out there that would like to put out his county for the county hunters? Please call VK4VU.'

"Well, needless to say, I ended up putting out Worcester County, Massachusetts that morning, May 18, 1979, during a coffee break on the way to a local hamfest. I began to listen on the County Hunters Net from time to time and finally got hooked.

"First licensed on February 28, 1978 as WB1GOO, I found myself fascinated with DX, so much so that I've spent the last 5½ years working part time as an aide for the ARRL DXCC Award administered by Don Search, W3AZD.

"I make my living as a lieutenant with the Hartford City Fire Department. I've been with them for 17 years. My wife, Lori, has been employed by the United States Government for 19 years. We have two children, Chris 8 years old and Anne five months old. I am the only ham in the family.

"It was almost seven years to the day when I finally made a contact with KF5DE/m for my very last county, Gloucester, Virginia. It was May 17, 1986. I was acting NCS and NG9L was assistant. When it came time for KF5DE to run, I couldn't hear him. Fortunately, before he finished the run I was able to hear him well enough to give him a 3/3 report. Arnie, K9DCJ, remarked later that I seemed awfully calm while I was getting my last county. Of course, Arnie couldn't hear what was being said with the mic key up when the mobile was eight minutes into his run and I couldn't hear him!

"It is really a thrill to get the last counties. Thanks to MARAC (The Mobile Amateur Radio Awards Club) there is even an award to send to the mobile operator to show appreciation for his help. Equally appreciated are those who, without the incentive of an award, run out there for that third or fourth from the last county. They may not get much credit, but they are much appreciated just the same.

"I've yet to decide whether to pursue the counties 'a second time around.' I certainly have no intention of becoming a stranger to the many good friends I have made through county hunting. These are friendships I cherish and wish to preserve. Catch you all on the bands. 73, Bill Webb, KX1A"

333 South Lincoln Ave., Mundelein, IL 60060

USA-CA Special Honor Roll
C. Bayard Smack, Jr., W3NB
All Counties #519, 8-18-86

USA-CA Honor Roll

3000		**1500**	
W3NB	551	KE5GF	763
2500		**1000**	
W3NB	617	KE5GF	935
2000		**500**	
NK7B	677	KE5GF	2124
		JA1UQP	2125

The total number of counties for credit for the United States of America Award is 3076. The basic award fee for subscribers to CQ is $4.00. For non-subscribers, it is $10.00. Initial application must be submitted in the USA-CA record book which may be obtained from CQ Publishing Company, 76 North Broadway, Hicksville, NY 11801, for $1.25. To qualify for the special subscriber rate please send a recent CQ mailing label with your application. To be eligible for the USA-CA, applicants must comply with the rules of the program as set forth in the revised USA-CA Rules and Program dated April 2, 1985. A complete copy of the rules may be obtained by sending an SASE to the USA-CA Custodian, 333 South Lincoln Avenue, Mundelein, IL 60060, U.S.A. DX stations must include extra postage for airmail reply.

Awards Issued

C. Bayard Smack, Jr., W3NB (ex: W3AYS), finished them all and sent for USA-CA 2500 #617, USA-CA 3000 #551, and USA-CA All Counties #519, 8-18-86, Mixed.

Norm Friedman, NK7B, continues to add gold seals to his certificate and has qualified for USA-CA 2000 #677, 8-7-86, Mixed.

Rex Cromwell, KE5GF, claimed USA-CA 500 #2124, USA-CA 1000 #935, and USA-CA 1500 #763, 8-5-86, Mixed.

USA-CA 500 certificates went to:

Rex Cromwell, KE5GF, USA-CA 500 #2124, 8-5-86, Mixed.

Masami Yamada, JA1UQP, USA-CA 500 #2125, 8-22-86, Mixed.

Awards Available

ZP Award Program. The Radio Club of Paraguay issues the following awards to any amateur or SWL.

The AMCA Award. The All Mediterranean Countries Award is given for confirmed contacts with Mediterranean countries (inland) as follows: Class A 41 countries, Class B 30 countries, Class C 20 countries. A ZP contact is obligatory in any class. Countries: A2, A5, AC3, C31, CP, HA, HB, HBO, HV, JT, LX, OE, OK, TL, TT, TZ, UC2, UD6, UG6, UH8, UI8, UJ8,

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- 7910 single-chip modem
- 300 and 1200 bauds
- Enhanced command set
- Multi-color status LED's
- Supports RS-232 and TTL computers
- Active HF bandpass filter
- Tuning indicator option
- 12 volt DC operation
- Premium quality case
- 6" w x 2" h x 7" d

The TNC-220 has the familiar TAPR command set and AX.25 Level 2 Version 2 protocol running on a Z-80 processor with 32k bytes of EPROM and 16k bytes of battery-backed RAM. A Zilog 8530 SCC performs all packet HDLC in hardware. The terminal port can select either RS-232 or TTL for your C-64/128, VIC-20 or other TTL computer. Five large, color-coded LED's clearly indicate status at a glance. The power switch is now located on the front panel. The TNC-220 is enclosed in a rugged extruded aluminum cabinet with an attractive two-tone blue front panel. All indicators and controls have large, clear labels.

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The TCCA Award. The Tropics of Cancer and Capricorn Award is given for confirmed contacts with countries touched by the Tropics of Cancer and Capricorn as follows: Class A 28 countries, Class B 20 countries, Class C 12 countries. A ZP contact is obligatory in any class. Countries valid for this award: Tropic of Cancer S2/3, BV, BY, EA9 (Sahara), KH6, A4, A6, SU, TZ, C6, VU, XE, XZ2, 5A, 5T5, 5U7, 7X, 7Z. Tropic of Capricorn A2, CE, C9, LU, PY, VK, ZP, ZS, ZS3, 5R8.

The AZ 11 PX Award. The All Zone 11 Prefixes Award is given for confirmed contacts with prefixes in CQ WAZ Zone 11 as follows: Class A 30 prefixes, Class B 19 prefixes, Class C 12 prefixes. Prefixes list: ZP1 to ZP9, PY1 to PY0, and the special prefixes issued for WPX contests.

The DSA Award. The Diploma Sud-America Award is given for confirmed contacts with countries located in ITU zones 12, 13, 14, 15, 16, and 73 as follows: Class A 33 countries and 6 ITU zones, Class B 25 countries and 6 ITU zones, Class C 19 countries and 5 ITU zones. A ZP contact is obligatory in all cases.

Countries as follows. Zone 12: FY, HC, HC8, HK, HKO (Malpelo I.), OA, PZ, 8R, YV, CP1/8/9. Zone 13: PY6/7/8, PY0 (Fernando de Noronha), PY0 (St. Peter and St. Paul). Zone 14: CE1/2/3/4/5, CE0X, CE0Z, CP2/3/4/5/6/7, ZP, CX, LU,-A/U/Y. Zone 15: PY1/2/3/4/5/9; PY0 (Trindade I.). Zone 16: CE6/7/8, VP8 (Falkland), LU-V-W/X. Zone 73: KC4USP (Palmer Station), LU-Z CE9AA/AM, VP8 (Graham Land), VP8 (So. Georgia), VP8 (So. Orkney), VP8 (So. Sandwich), VP8 (So. Shetland).

The DP Award. The Diploma Paraguay is given for confirmed contacts with 5 different ZP stations. South American stations need to contact 15 ZP stations.

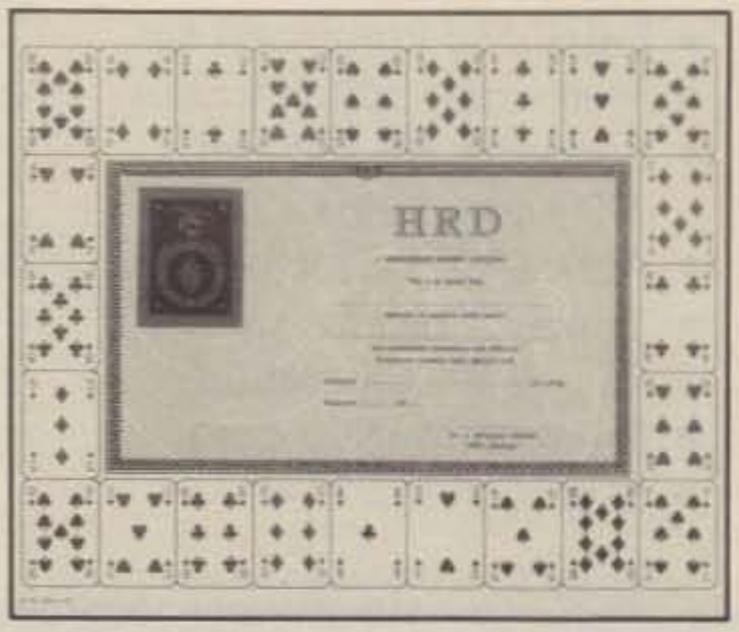
The WAZP Award. The Worked All ZP is given for confirmed contacts with one station in each of the nine call areas.

The CRCP Award. The Certificado Radio Club Paragueyo is given for confirmed contacts with 15 different ZP stations. South American stations need to contact 50 ZP stations. The ZP 100, ZP 150, and ZP 200 Awards are given for confirmed contacts with 100, 150, and 200 different ZP stations.

The ZP3 Award. The ZP3 Award is given for confirmed contacts as follows. ZP stations need to contact 10 different ZP3 stations. CE, CP, CX, LU, PY stations need to contact 5 different ZP3 stations. The rest of the world needs to contact 2 different ZP3 stations.

The DDP Award. The Diploma Departmentos del Paraguay is given for confirmed contacts with the capital of Paraguay and different Departments into which Paraguay is divided as follows: Class A 20 contacts, Class B 16 contacts, Class C 12 contacts. Departments by prefixes are as follows: ZP1—Boqueron, Chaco, Nueva Asuncion; ZP2—Alto Paraguay, Pte. Hayes; ZP3—Amambay, Concepcion; ZP4—Canendiyu, San Pedro; ZP5—Asuncion (Nation's Capital); ZP6—Central, Cordilleras, Paraguari; ZP7—Caaguazu, Caazapa, Guaire; ZP8—Misiones, Neembucu; ZP9—Alto Parana, Itapua.

For all ZP Awards contacts must be made after May 15, 1952. Certified list (no QSL's) of contacts with a fee of 10 IRC's for each award should be sent to: Radio Club Paraguayo, Award Manager, P.O. Box 512, Asuncion, Paraguay.



The Hungarian Rummy Diploma (HRD) offered by the Hungarian Radioamateur Society.

The Hungarian Rummy Diploma (HRD). The Radioamateur Society of Somogy county issues the HRD awards. The applicant must submit proof of contacts made on or after September 1, 1972. The HRD award is issued in three degrees. Bronze: "Hand rummy," contacting 14 cards in accordance with the rules of the game. Silver: Full collection of one of the four series plus one Joker of the same color. For example: diamond 2 . . . A, plus red Joker (14 cards). Gold: Full pack, containing 54 cards.

HRD-108 Award. Two packs of cards from 108 different stations are necessary for this award.

The Hungarian Canasta Diploma (HCD). Three canastas (21 cards) have to be confirmed in accordance with the rules of the game. The canasta contains 7 cards of the same figure, and 2 of them can be equivalent (for example: 7 cards of figure 5, 7 cards of figure 8, and 7 cards of Kings). Not more than 3 cards can be substituted by the 4 Jokers and the "little jokers" (figure 2) in one canasta.

Note: Contacts on or after April 4, 1980 are valid for HRD-108 and HCD.

Amateur stations belonging to radio club "Tivadar Puskas" can send any kind of HRD cards for the QSO's. These stations are: HA, HG3, GA, GB, GD, GH, GL, GM, GR, GW, HD, HF, HH, HM, HS, HV, HX, HY, KGC, KGL, KGR, KGU, KHC, KHJ.

Allocation of the HRD cards is as follows:

HA/HG call areas	Pique Spade	Coeur Hearts	Caro Diamond	Treff Club
	R/a		R/b	
1	A		J	
2	2		J	
3	3		J	
4	4		J	
5	5		Q	
6	6		Q	
7	7		K	
8	8		K	
9	9		K	
0	10		K	

??? Red and black Joker = Y = .

Application should include callsign/s, name, and QTH of the applicant as well as the following information: station worked/heard, date, time UT, band, mode, received report. (SWL's should indicate the station being worked by the heard stations.) Each list must be accompanied by a statement from the applicant's national society or from any two amateurs other than the applicant that the QSL cards of the contacts/receptions listed are in the possession of the applicant and that the items of the cards are correctly listed.

Send application and fee of 5 IRC's to: Dr. Janos Mihalyfy, HA3GA, P.O. Box 173, Kaposvar, Hungary H-7401.

Videoton Award. The Videoton Radioclub issues this award. The applicant must submit proof (GCR) of contacts made on or after January 1, 1969. Only HA4 and HG4 QSL's are valid.

There are three groups of cards, 3–4–3 different cards illustrating BC receiver, TV receiver, and computer sets, respectively. The Videoton Award is issued in three degrees: Bronze—complete set of any group; Silver—complete set of any three groups; Gold—all of the ten cards.

The Videoton Award from the Hungarian Radioamateur Society.

Send application with fee of 2 IRC's for the bronze award, 3 IRC's for the silver award, and/or 5 IRC's for the gold award to: Award Manager, Halmi Belane, HA4XP, Berkes F.ltp.40, Szekesfehervar, Hungary, H-8000.

USATV Membership Certificate. Paid members who join the USATVS organization with a subscription to the SPEC-COM Journal (or the former A5 publication) are

The membership certificate for members of The United States ATV Society.

mailed an 8″ × 10″ framable, parchment paper membership certificate for display in the shack. (If you are a member and subscriber and did not get a certificate in the initial bulk mailing, send a note and 58 cents for postage to: Spec-Com, Amateur Radio Specialized Communication Journal, P.O. Box H, Lowden, Iowa 52255.

USATVS Specialized Communicator General Award Certificate. This certificate is awarded to all entrants in organization-sponsored annual contests on FSTV, SSTV, FAX, or RTTY. Also awarded for that "FIRST" successful two-way, HF Amateur Shortwave band Facsimile (FAX) contact, verified (QSL required) reception or transmission of an international FAX or SSTV signal through an OSCAR Satellite, Worked All 50 (U.S.) States or DXCC (100 Countries) on SSTV. Send GCR to USATVS/SPEC-COM Achievement Awards, c/o Membership Services Department, P.O. Box H, Lowden, Iowa 52255.

Of Special Interest To County Hunters

Richard Brocaw, K5VYT, USA-CA All Counties #112, has almost completed a very comprehensive computerized USA-CA tracking system for county hunters.

Specialized Communicator Award Certificate offered by the Amateur Television Society.

Dick's program contains a complete county database (approximately 200,000 bytes) along with utilities to allow adding or deleting counties; a database of state names that will recognize all normal state abbreviations; a configuration program that will allow the user to tailor the program to his liking, including such items as screen colors, logging levels, additional bands, callsign, default bands, and modes, etc.; an editor that allows entry of all QSO and QSL data; and a report generator which will produce a large quantity of reports for general record keeping and award submission.

This system uses menus and function keys for control and is very user friendly. It has so far been checked out on IBM XT, Zenith 148, AT&T 6300. Dick will be testing it with the Radio Shack 1000, 1200, and 2000. For further information send an SASE to: Richard Brocaw, K5VYT, 1850 Pearl Loop, Bosque Farms, New Mexico 87068, U.S.A.

Notes

Once more the end of a calendar year is coming around. However you celebrate these holidays, I hope you are also celebrating the end of a happy, productive year and are looking forward to the New Year with pleasure.

73, Dorothy, WB9RCY

World of Ideas

a monthly feature by
DAVE INGRAM, K4TWJ

A LOOK AT THE WORLD AROUND US

Chats, Notes, and Hopes

Please pardon our recent sporadic appearance in this *CQ* column, gang. We're presently pursuing a large number of absolutely fascinating amateur radio related projects and there aren't enough hours in a day to get everything in. Life's special pleasures seem to run in cycles (better known as things too good to be true that usually aren't permanent), however, so we'll probably soon return on a dependable monthly basis. Meanwhile, a brief "pre-column" chat . . .

I'm presently writing the last few words in a new and fully illustrated book on Packet Radio. Howard W. Sams is standing by to publish immediately. If you're reading this during late November and if you're a Packeteer, zip us a black-and-white photo of you at your setup. We'll include it in the Packet book, give you worldwide recognition, and you'll become a celebrity. I've room for seven more, so hurry.

Past World of Ideas columns with a nostalgic air have been tremendous hits, but the September 1986 column, "Classic Gear," was a blowout! Thanks! We're now collecting (and soliciting) more photos and stories from folks like you, and will do it again soon. Send photos and keep watching this column. Some *choice* schematics are also planned.

OSCAR satellites are another hot area we'll be revisiting soon. It's phenomenal what today's amateurs have done with our "damaged" OSCAR 10. Furthermore, revolutionary plans in future satellites are rapidly becoming reality.

Remember my "QRP-30" transceiver in June 1983 *CQ*? I've now completed the promised second version and have contacted several countries with it. The rig runs 2 watts; has internal rechargeable battery, selectable frequency control, and full QSK; and is smaller than a pack of cigarettes. Yes, we're now trying to find time to write its full story. Meanwhile, a third (micro) version is going together—same features but *one third* the size. Honest!

You'll be hearing about or enjoying the results of our other endeavors from time to time. Meanwhile, let's all pull together to rekindle amateur radio's original glamor and popularity. Comments? I'm still frequenting 14,180 to 14,190 kHz Sundays around 2230 GMT, and really would like to talk with you. Happy Holidays!

Eastwood Village No. 1201 So., Rt. 11, Box 499, Birmingham, AL 35210

1987: The Year of the Novice

During previous holiday seasons I've traditionally featured a variety of new and/or unique amateur radio related gifts in this diverse *CQ* column. This year, however, I'm shifting that focus somewhat to highlight a single, vitally important gift we as an amateur radio community can give ourselves. I'm referring to the presently evolving Novice Enhancement program.

This desperately needed opportunity for ensuring our world of personal communications and perpetuating its existence for future generations has some serious roots. It can no longer be shunned or ignored merely because we're too busy in our endeavors to consider amateur radio's future. Indeed, our long-term enjoyment of amateur radio's many fascinating pursuits has caused us to fall short in the public-relations areas.

Suddenly, the facts became all too clear. Like the American Indian, the buffalo, or the retiring Catholic Nuns recently featured on national TV's "1986" program, we're rapidly becoming an endangered species. We're aging ourselves out of existence. The average age of today's U.S. amateur presently hovers between 49 and 52 years, and it's climbing. What merit will our longtime endeavors and amateur radio related achievements make if there isn't a continuing generation to realize and appreciate them? How can awards programs and contests be meaningful with fewer and fewer competitors? What purpose will amateur radio museums serve without visitors? Will industry continue to provide products for our declining market?

Looking around us, we can see how others such as the Japanese handled their situation and emerged as a leading figure in the amateur world. That small nation's amateur population almost exceeds that of the U.S., their average age is below 30, their enthusiasm is extremely high, and the kaleidoscope of Japanese manufactured gear is a world envy. Are we willing to passively accept those facts without even attempting to better our own situation? Surely not. We must regain our proud stronghold and continue showing the world what amateur radio means!

Our prospect of breathing new life into our ranks via glamorized Novice privileges is encouraging in every sense of the word. There's power in numbers—enough power to regain our foothold as a leading body, to retain our frequency allocations, and to convince American manufacturers we're a viable market rather than a risky investment. Visualize the fascinating variety of new equipment we could enjoy if our ranks were doubled, and you'll understand that point. We must expand or recede. There's no standing still in today's society.

Factually, our present Novice program(?) is more discouraging than exciting to newcomers. One must be unbelievably devoted (gung ho ho!) to survive existing Novice allocations and consider upgrading. Eighty meters offers little DX-citement, 40 is overrun with foreign broadcasts, and upper frequency bands require good equipment for communicating when they're open. Being unsure what the amateur world is actually like, however, newcomers understandably begin with less expensive and/or older gear for "testing the waters." They're also presently restricted to CW, a mode many of us have moved away from in today's era of SSB, RTTY, Packet, and OSCAR satellites. Heck, a large number of today's "aged" amateurs (myself included) were at least allowed to experience phone operations on 2 meters as a Novice. I walked on air for a week after making my first 2 meter AM QSO. Then *CQ* published an article describing a modulator for my newly acquired AT-1. I couldn't afford a better rig, but upgrading to General didn't cost a penny. I was hooked for life! I was so nervous and excited during that code test and my arms and knees shook so hard that the guys around me complained about the racket. After the code run, I regained use of my hands, scribbled 13 words straight, and passed. Whew! Sound familiar?

A couple of weeks ago I switched over to Novice band operations to refresh my memory and visualize what it's like today. A one-word summary would be "purgatory" (and this is our glamorous "welcoming door" to newcomers?). The variable bandwidth control, notch filter, audio peaker, and noise blanker in my TS-930 still couldn't remove all the grunge. The chaps I contacted used less elaborate rigs (Heath receivers and Globe Scout transmitters, for example), but they copied me almost solid. Most of them had some quite interesting stories to tell, and their gear tales resembled a

stroll down memory lane. I would still like to talk one guy into trading his Harvey Wells transmitter.

History often indicates that each evolving generation is slightly less "standard" than its predecessor, but today's Novices make me wonder about that. Copying through the howls, screams, and static of 40 meters reminds me of some old-time sparkers' tales. A clever operator kept a jar full of wilderness-picked and hand-tested galena "rocks" for his detector. He could copy 25-plus words per minute on a rolling ship using only his ears to filter signals according to their tones. A nearby "rock cruncher" would unexpectedly fire up, literally blowing the earphones off our hero and destroying his galena's detection point. That operator could quickly grab another galena, swap it in the holder, reset the cat whisker, and not miss a full word of copy. That's where the term "radio operator" acquired its true meaning!

Our upcoming enhanced Novice program will still require the traditional Morse code proficiency, but it will include phone operations in portions of the 28, 220, and 1260 MHz bands. That means Novices can enjoy SSB, DXing, mobiling, UHFing, and handheld-talkie activities. It also increases our "clout" to industry and government. This fresh new look will once again get excitement booming and raise morale.

"Grandfathered Technician" licensees can also acquire their first stand-alone use of HF—an experience guaranteed to inspire further involvement and upgrading. Watch for some exciting 10/6/2 meter gear to address that market—maybe tiny FM mobile-size SSB transceivers, pocket 10 meter SSB talkies with snap-on mobile amplifiers, or infrared remote-controlled SSB/CW/FM rigs. The Technician license will cease to be a dead-end street.

Will our present HF bands support the proposed new activities? Sure . . . no problem, especially in the 28.100 to 28.500 MHz range. Since propagation on the 220 MHz and 1.2 GHz bands is line of sight, they can essentially be "reused" every 200 miles. I've recently heard several old timers mentioning our (higher class allocated) HF CW bands are less crowded today than they were during the 1930s (the heydays of amateur radio). On the other hand, today's technology is moving in another direction—VHF, UHF, and microwaves. Within the next decade or two, HF communications could be a nostalgic pursuit, riding the variable waves of ether while fully predictable communications are conducted on UHF and microwaves. How? Via interlinked satellites, space located translators, multilinked repeaters, Packetized voice (and video)—the list is endless. Fantasyland? Packeteers presently interlink digipeaters along eastern and western seaboards. W3IWI bounced Packets off the moon. At least one high eliptical orbiting OSCAR satellite capable of one-third world coverage for several hours each day is slated for a 1989 launch. A triple launch of similar world interlinkable satellites is planned for soon thereafter. Encourage a large number of enthusiastic Novices to pioneer an overlooked area such as 1.2 GHz, give them access to super rigs and talkies, and watch it become a fascinating new area. Why, I'll bet we'll all be buying 1.2 GHz rigs to join the fun.

Each of us can contribute something of merit to the rebirth of amateur radio popularity and the enhanced Novice program. We each can act as a true "Helping Elmer" encouraging and supporting budding Novices while telling them true tales of amateur radio's proud past to pass on to future Novices. We can check back with them from time to time, study their progress, and demonstrate the "amateur spirit" of which we're so proud. Our ideal achievement would be favorable national recognition not once on nationwide TV, but often. A massive "save the radio amateur" campaign is definitely in order.

Do you have some good ideas for reestablishing our proud place in society? Speak now. We want to hear from you. Let's expand the Novice enhancement program into a full rebirth of amateur radio popularity program. Our world's the best, but we can't continue keeping it a secret.

73, Dave, K4TWJ

DX

This month by
JOHN A. ATTAWAY, K4IIF

NEWS OF COMMUNICATION AROUND THE WORLD

WAZ On 160 Meters—Is It Possible?

The *CQ* DX Department and *CQ* Editors have frequently discussed the possibility of an amateur station working each of the 40 zones on the 160 meter (1.8–2.0 MHz) band. For many years we were advised by top band enthusiasts that it probably was impossible for two major reasons. First of all, 160 is a uniquely difficult band for DX operation. Propagation is infinitely more restrictive even than 80 meters, and the band is frequently subject to static crashes, electrical interference, and any other form of QRN the mind of Mother Nature can conceive. Secondly, not all countries allow 160 meter privileges to their amateurs, and consequently, some zones might be impossible to work simply because no one is active on the band.

However, during the low part of the present sunspot cycle, interest in 160 meters as a DX band has substantially increased and we understand that there are several stations who have worked over 30 zones and perhaps 2 or more stations who have worked 38 or 39 zones. We now feel that while WAZ on 160 meters will be exceedingly difficult, perhaps even comparable in difficulty to 5-Band WAZ, *it is possible*, and stations who add 160 to their WAZ attainments should be adequately recognized. Therefore, we take great pleasure in

Announcing 160 Meter WAZ

effective immediately, with contacts acceptable which were made anytime on or after *January 1, 1975*. This date was picked to approximate the beginning of the last sunspot cycle. It was felt by the editors that making a new start on January 1, 1987, which was discussed early in the planning phase, would negate the work of those who have labored hard in the 160 meter vineyard for many years. In addition, the 1975 start acknowledges those who fought the top band battle in the years before full power was permitted.

The first five applicants who succeed in presenting proof of contact with the 40 zones of the world on 160 meters will receive an engraved plaque commemorating their achievement. Later applicants will receive a special certificate, or may purchase a plaque at our cost.

To make 160 Meter WAZ more interesting for the amateur without special antennas for 1.8 MHz, those with simple dipoles or trap-loaded verticals, we plan to have a two-tiered system with a certificate offered for working 30 of the 40 zones on top band. This will be followed by endorsement stickers for 35, 36, 37, 38, and 39 zones, as each zone will be a distinct challenge as a DXer approaches the ultimate number 40. *All cards must be submitted to the WAZ Award Manager, Leo Haijsman, W4KA*, 1044 Southeast 43rd St., Cape Coral, FL 33904.

P.O. Box 205, Winter Haven, FL 33882

Left to right are Pat, F6EYS, President of the Clipperton DX Club, and Francis, F6FQK, Station Director, operating from the Council of Europe station, TP2CE, in Strasbourg, France. June 27, 28, and 29 culminated a 3-year effort to establish an amateur station at the Council of Europe. Many hams and organizations contributed to equipping the station. Battima Electronics donated the beams, the Clipperton DX Club the coax, and the Northern California DX Foundation printed the 4-color QSL cards. Antennas were installed by F6FQK, F6EYS, and F6HIX. The first 40 hours of operation yielded 3500 QSOs, 1668 SSB and 1832 CW, with interruptions for visits from newspapermen and Council executives, including the Secretary General. QSL SSB contacts to F6FQK and CW contacts to F6EYS. The next major operation from TP2CE is scheduled for December 5, 6, and 7, 1986. DARC has added Council of Europe to its WAE program and a submission has been made to the ARRL asking for separate country status comparable to 4U1ITU.

One-Sixty Meter WAZ will be offered for any combination of CW, SSB, or phone contacts. Separate awards will *not* be offered for the different modes. The following overall rules apply:

1. The official CQ WAZ Zone Map and printed rule list will be used in determining the zone in which a station is located. Copies of the map and rule list may be obtained by sending a self-addressed, stamped envelope to the WAZ Award Manager or to *CQ* magazine.

2. Confirmation must be accompanied by a list of claimed zones showing the call letters of the station contacted within each zone. The list should also show clearly the applicant's name, call letters, and complete mailing address. *CQ* Form 1479 is preferred.

3. All QSLs must show 2-way contacts with licensed, *land-based*, amateur stations operating in the 160 meter, 1.8–2.0 MHz, band.

4. All contacts submitted by an applicant must have been made *from* within the same country.

5. Any altered or forged confirmations will result in permanent disqualification of the applicant.

6. Include with the application a $5.00 processing fee plus a self-addressed envelope with sufficient postage stamps or international reply coupons (IRCs, present value 37¢ each) to return the QSL cards by the class of mail service desired and indicated, U.S. postage certified $1.65 or overseas airmail $2.50. (The $5.00 fee applies to both *CQ* subscribers and nonsubscribers. This is a special exception. Ten dollars is still required when nonsubscribers apply for regular WAZ and Single Band WAZ awards.)

7. Applications for 35, 36, 37, 38, and 39 zone stickers should be accompanied by a $2.00 sticker fee, a self-addressed, stamped envelope, or self-addressed envelope and IRCs and mailed directly to the WAZ Award Manager.

8. Decisions of the *CQ* DX Awards Advisory Committee on any matter pertaining to the administration of this award will be final.

Paul Zapfe, DJ3ND, earned 20 Meter SSB. Single Band WAZ #556 using a Kenwood TS-820, Collins 30L-1, and a Hy-Gain TH6DXX beam. His most difficult zone was zone 23. Paul is 39 years old and a technician/engineer by profession.

In recognition of the extraordinary efforts made by Stewart S. Perry, W1BB, to promote DXing on 160 meters, this new award is dedicated in his honor.

50th Anniversary WAZ Award

Through September 1, 1986 the following stations have met all the requirements for the

50th Anniversary WAZ Award, commemorating the Golden Anniversary of *CQ's* premier DX award. For complete rules see the February 1986 issue of *CQ*, page 56.

Certificate Number	Awarded To:
1.	Jerry Fiore, N4JF
2.	Albert Hix, W8AH
3.	W. Gibbons, K2TQC
4.	Todor Dikor, LZ1HA
5.	Bob Farkay, K9RHY
6.	George McKercher, WØMLY
7.	Franz Langner, DJ9ZB
8.	David C. Norton, AB9O
9.	James Sansoterra, K8JRK
10.	Naoji (Nab) Hasagawa, JA2BL
11.	Toshiro Ogino, JI1QPU
12.	Hiroyuki Ogawa, JA8DNZ
13.	David Ornee, KQ9W
14.	Anton Irlawan, YB5QZ

Rare Prefixes and Special-Event Stations

A4XOS: This station operated August 8–31, 1986 to celebrate the 17th Arabic Scouts Camp, "A4X Oman Scouts." A special award is available from the ROARS, P.O. Box 981, Sultanate of Oman.

AMØEEE: This special callsign was used by Spanish amateurs operating from various European capitals to celebrate the entry of Spain into the European Economic Community. Special awards are available from Radio EEE, P.O. Box 2071, CP-50080, Zaragosa, Spain.

FK25: To commemorate the 25th anniversary of the Amateur Radio Association of New Caledonia, all ARANC members are using the prefix FK25 through December 31, 1986. Complete rules for an FK25 certificate may be obtained from the Award Manager, P.O. Box 3956, Noumea, New Caledonia.

GB2TV: Marked the 50th anniversary of high-definition TV—November 2, 1936.

GB2WED: Last July 23 only, celebrated the Royal Wedding. QSL to G4IVJ.

GB6RW (Royal Wedding): Also was active for the wedding. QSL to G4KIU.

GB6NP: Celebrated 25 years of nuclear power. QSL to Box 73, Ipswich, England.

GB60C: Operated as part of the effort by the city of Birmingham, England to host the 1992 Olympic Games.

GB8CG: This station was active July 24 to August 2, 1986 to commemorate the Commonwealth Games.

GB9DB: Commemorated the 900th Anniversary of the Domesday Book. This is the first time the GB9 prefix was used. QSL to G4AYM.

HI60: HI60RCD was active throughout 1986 to commemorate the 60th Anniversary of the Radio Club Dominicano.

LZ6: Bulgarian stations are using the LZ6 prefix from July 1 to December 31 to celebrate the 60th anniversary of the founding of the first Bulgarian amateur radio club in Sofia in 1926. An LZ60 Jubilee Award is being issued by the Bulgarian Federation of Radio Amateurs, P.O. Box 830, Sofia, Bulgaria.

LZ92S: This was a special station operated by the City Student's Radio Club in Sofia as part of an effort to attract the 1992 Olympic Games to Sofia, Bulgaria.

PA6VHS (Very High Speed): Active July to October 1986 to celebrate the 25th anniversary of the Very High Speed Radio Club. QSL to PAØDIN.

SO: This prefix is issued to visitors in Poland.

SX1: SX1MBA, "Memorial Battleship Averoff," operated June 27 to July 7, 1986 from the radio room of the battleship *George Averoff* to commemorate Greek Navy Week.

UP9: UP9A was on the air during the first two weeks of July 1986 to celebrate the 750th anniversary of the city of Siauliai, Lithuania.

V31 & V32: In Belize, V31 indicates a Grade 1 license and V32 a Grade 2 license. Specific geographical locations within the country are indicated by the suffix.

YB18AR: This special callsign marked the 18th anniversary of the Radio Society of Indonesia. QSL to YBØDPZ.

3G3: 3G3DX is a Chilean station using the relatively new 3G prefix for Chile.

4C1: 4C1AGP was a special station in Mexico celebrating the International Peace Year.

The WPX Program

Mixed

1232	4X4JJ	1233	AB9O

S.S.B.

1840	DJØAF	1842	YC2AFP
1841	AB9O	1843	G4POF

CW

2397	F6EFY	2399	KB4GID
2398	KO2HE/OA4	2400	JE2JML

Endorsements

Mixed: 450 4X4JJ, AB9O, N4OM. 500 4X4JJ, AB9O, N4OM. 550 4X4JJ, AB9O, N4OM. 600 AB9O, N4OM. 700 N4OM. 750 N4OM. 800 I2QMU, N4OM. 850 I2QMU, EA3CTI, N4OM. 900 I2QMU, EA3CTI, N4OM. 950 I2QMU, EA3CTI. 1000 I2QMU, EA3CTI. 1050 HA8UB, EA3CTI. 1100 HA8UB. 1150 N4IB, HA8UB. 1500 I2MDK. 1550 WA4QMQ. 2000 N2AC. 2350 W4BQY.

S.S.B.: 350 NK2H, AB9O, YC2AFP, G4POF. 400 DJØAF, NK2H, AB9O, YC2AFP. 450 NK2H, HA8UB, AB9O, YC2AFP, KD9OT. 500 WA4PMF, NK2H, HA8UB, AB9O, WØCON. 550 NK2H, HA8UB, AB9O, YC2AFP. 600 NK2H, HA8UB, AB9O, YC2AFP. 700 AC3T. 850 TI2KD. 950 N4IB, W7KWI. 1000 I2DMK. 1250 W3ARK, EA2IA. 1300 W3ARK. 1500 WA4QMQ. 1700 W4BQY. 2350 ZL3NS.

C.W.: 500 NS2H. 550 OK3FON. 600 OK3FON. 650 OK3FON. 700 OK3FON. 750 OK3FON, LA9XG. 800 OK3FON, WA4QMQ, LA9XG. 850 OK3FON, W9PWM. 900 OK3FON. 1050 HA8UB. 1100 HA8UB. 1200 I2DMK. 1400 EA2IA. 1450 W3TVB. 1800 N2AC. 1900 W4BQY. 2050 WA2HZR.

10 meters:	TI2KD.
15 meters:	N4OM.
20 meters:	AC3T, TI2KD, AB9O, N4OM.
40 meters:	G4CHP, JA3ARM.
80 meters:	G4CHP, AB9O.
160 meters:	AB9O, NN4Q.
Asia:	N2CIC, N4OM.
Africa:	N4OM.
No. America:	WA4PMF, DL3GK, AB9O, N4OM.
So. America:	G4CHP, HA8UB.
Europe:	DL3GK, IK2AEQ, N4OM.
Oceania:	W4UW, N4OM.

Award of Excellence: 160 Meter Endorsement NN4Q.

Award of Excellence Holders: YU2DX, OK3EA, OK1MP, N4NO, ZL3GQ, W4BQY, IØJX, WA1JMP, KØJN, W4VQ, KF2O, W8CNL, W1JR, F9RM, W5UR, CT1FL, W8RSW, WA4QMQ, W8ILC, VE7DP, K9BG, W1BWS, G4BUE, N3ED, LU3YL/W4, NN4Q, KA3A, VE7WJ, VE7IG, N2AC, W9NUF, N4NX, SMØDJZ, DK5AD, WD9IIC, W3ARK, LA7JO, VK4SS, K6JG, N4MM, I8YRK, W4CRW, SMØAJU, K5UR, K6XP, N5TV, K2VV, VE3XN, W6OUL, DL1MD, DJ7CX, DL3RK, WB4SIJ, SM6DHU, N4KE, I2UIY, DL7AA, ON4QX.

Award of Excellence Holders with 160 Meter Endorsement: G4BUE, LU3YL/W4, VE7WJ, W9NUF, N4NX, SMØDJZ, DK5AD, W3ARK, LA7JO, W4VQ, K6JG, W4CRW, N4MM, SMØAJU, KF2O, K5UR, OK1MP, N5TV, W8CNL, W1JR, W6OUL, W4BQY, W5UR, N4NO, W8RSW, N4KE, I2UIY, W8ILC, W1BUS, NN4Q.

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 neat operating position at HB9ALO. Certificates include 10 Meter CW Single Band WAZ #20, 15 Meter CW Single Band WAZ #81, 20 Meter CW Single Band WAZ #181, 40 Meter CW Single Band WAZ #54, and 5-Band WAZ (150 zones) #290.

5I: The station 5IØA operated from Moheli Island in the Mozambique Channel. This island is claimed by Tanzania and *may* meet the requirements for a new amateur radio country.

5K: Columbia amateurs used the 5K prefix during the Pope's 1986 visit to their country.

6K86AG: This station operated from South Korea to celebrate the Asian Games.

7SØTM: This special-event station commemorated the 50th anniversary of the Museum of Science in Stockholm, Sweden. QSL to SKØTM or to the SM Bureau.

8J3JST (Japan Standard Time): 100 years of Japan Standard Time was marked by this station which operated from June 1 to July 24, 1986. QSL to the JARL.

80Ø & 802: These special prefixes for Botswana were used in that country to commemorate the 20th year of their independence.

Club and Association News

European DX Foundation: The European DX Foundation was established to promote the DX interests of amateur radio operators. Interested DXers of all countries are invited to join. Applications may be obtained from Erich Wagner, DL1LD, Flurweg 23, D-4444 Bad Bentheim 1, West Germany.

International DX Association: Bill Rutherford, NB5L, is the new secretary of INDEXA. His address is P.O. Box 363, Richardson, TX 75083.

Northern California DX Foundation: Bob Ferrero, W6RJ, has been elected president of NCDXF, succeeding Jack Troster, W6ISQ, who resigned after 15 years at the helm.

Northern California DX Club: NCDXC officers are Lou Beaudet, K6TMB, President; Ted Algren, KA6W, Vice President; Ron Panton, W6VG, Secretary; "Knock" Knockenhauer, K6ITL, Treasurer; and Directors Hal Godfrey, N6AN, and Bill Fontes, W6TEX. Able new *DXer* Editor is Jim Maxwell, W6CF, who is also a prominent amateur radio historian.

Redwood Empire DX Association: Officers are

The WAZ Program

20 Meter Phone

574 ..... W7LZA
575 ..... WA5IPS
576 ..... N4PB
577 ..... G4RFV
578 ..... W9MP

40 Meter Phone

38 ..... TG9VT

20 Meter CW

274 ..... JA7FS

All Band WAZ
SSB

3052 ..... EA8SH
3053 ..... EA5FCP
3054 ..... ON4WL

Phone/CW

5995 ..... PA3CXC
5996 ..... JH3JYS
5997 ..... JA7FS
5998 ..... WA9RCQ

All Phone

589 ..... W6IHA

Applications and reprints of the latest rules may be obtained by sending a self-addressed stamped envelope (39 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.

Doug Bender, WA0JRB, President; WG6H, Vice President; Chod Harris, VP2ML, Secretary/Treasurer; and Directors Henry Davis, W6DTV, and Bruce Butler, W6OSP.

Southern California DX Club: Officers are Dan Davitt, N6CGB, President; Steve Locks, W6FRZ, Vice President; Russ Mason, KG6IP, Secretary; Edgar Brown, N6OU, Treasurer; and Don Minkoff, NK6A, Bulletin Editor.

International Short Wave League: With regret we report that the International Short Wave League has disbanded. ISWL was a landmark organization in the earlier days of radio. We understand that it closed down last July due to financial problems. With our youth oriented to computers and satellites, perhaps this is a sign of our times.

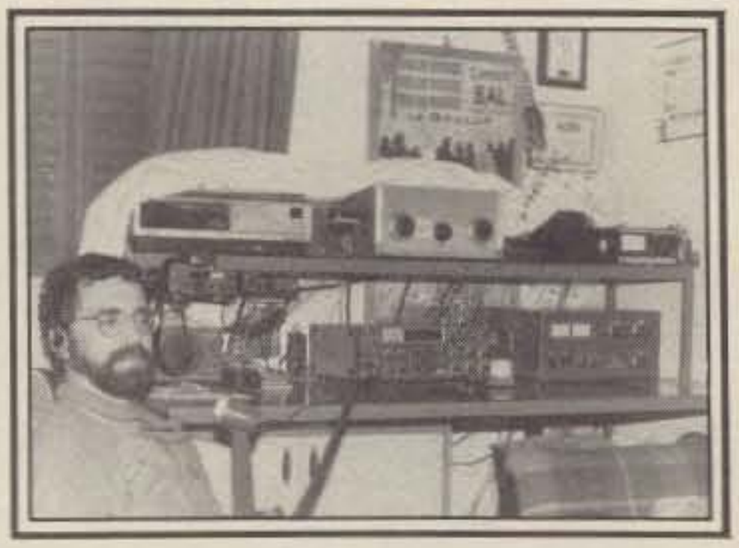
Here and There

Ed Peck, K6AN: The *CQ* DX Department was saddened by the passing of Ed Peck, K6AN/W6LDD, on August 11, 1986. Ed was a member of the first *CQ* DX Awards Advisory Committee back in 1968. Our condolences to Mary and the family.

USSR On 75 Meters: According to *QRZ DX*, it is reported unofficially that Soviet stations with the highest class of license (Class I) are allowed to operate in the 3650–3800 kHz segment during major contest weekends. These contests include the *CQ* Worldwide Phone Contest in October, the *CQ* WPX SSB Contest in April, The ARRL DX Phone Contest, plus the WAE, CQ-M, OK-DX, YO-DX, LZ-DX, VK-ZL, and All Asia Contests. Interested DXers should follow Frank Anzalone's Contest Column in *CQ* for information on these events.

French QSL Bureau: The new address of the French QSL Bureau is R.E.F., Boite Postal 273, 81209 Mazamet Cedex, France.

Heard Island: DXers interested in Heard Island will want to read *Heard Island Odyssey* by Kirsti, VK9NL, who is the XYL of Jim Smith, P29JS. This book is a complete chronicle of the 1983 Heard Island DXpedition. It is available for $12.25 from Ron Pretekin, AB8K, 6741 Oak Field Drive, Dayton, OH 45415.



Dov Gavish, 4Z4DX, has 315 countries confirmed for the CQ SSB DX Honor Roll. Dov has also qualified for 5-Band WAZ #23 and many other difficult DX awards. (Photo courtesy N4JF)

Incoming QSL Service: KIQS, an incoming QSL service for US DXers, is operated by K4CLA. For full details, write to K4CLA at 562 Oak Drive, Lexington, SC 29072.

Chinese Zones for WAZ: In response to many letters received since Chinese amateurs returned to the air, WAZ Manager Leo Haijsman, W4KA, advises that stations with the prefixes BT or BY 1–9 are in Zone 24, while stations with the BT0 or BY0 prefix are in the more rare Zone 23.

DXCC Restructure: The ARRL DX Advisory Committee is scheduled to make its final report to the League Board of Directors at the end of December. If you have thoughts regarding changes in DXCC, send *constructive* comments to the DXAC, c/o ARRL, 225 Main Street, Newington, CT 06111.

The Northern California DX Club

When K4IIF first became DX Editor of *CQ* almost 20 years ago, the first invitation to visit and make a presentation was from the Northern California DX Club. Consequently, this group has always been special to us. The following short history of NCDXC was written by Hal Godfrey, N6AN.

The Northern California DX Club was founded on October 10, 1946 by 11 DX-oriented radio amateurs, and the club has just celebrated its 40th anniversary. Several years later the club received nonprofit corporation status and thus became the first incorporated DX club in the world. A 40-year award is being offered. Contact Hal, N6AN for details.

The NCDXC was formed to promote cooperation, friendship, and a bond among individuals interested in DX communications. Among the club's various activities are monthly meetings, usually held at a local restaurant, where the club's business is conducted. In addition, there are presentations and discussions relating to DXpeditions, DX contests, and operating skills. Guest speakers present subjects related to DX, the technical aspects of radio, and topics of general interest to active radio amateurs. The club also sponsors an annual picnic and Christmas party.

On alternate years, in cooperation with the Southern California DX Club, the NCDXC spon-

Katsuyoshi Shishido, JA4JBZ, has qualified for 40 Meter SSB Single Band WAZ #40, one of the most difficult of the WAZ series of awards. He lacks only zone 2 on 80 meters for 5-Band WAZ and is eagerly listening for a VO2 contact. Katsuyoshi is 38 years old and works for a construction company.

5 Band WAZ

Standings as of September 1, 1986

All 200 zones worked:

1. ON4UN
2. K4MQG
3. SM4CAN
4. AA6AA
5. W8AH
6. W6KUT
7. EA8AK
8. LA7JO
9. EA3SF
10. OH1XX
11. EA8OZ
12. W0SD
13. K0ZZ
14. ON6OS
15. OK3TCA
16. K6SSS
17. ZL3GQ
18. OK3CGP
19. SM0AJU
20. OZ3PZ
21. I3MAU
22. I2ZGC
23. 4Z4DX
24. N4KE
25. K5UR
26. K9AJ
27. SM3EVR
28. LA5YJ
29. DL3RK
30. N4WJ
31. G3MCS
32. SM5AQD
33. W0MLY
34. I0RIZ
35. ON5NT
36. OH6JW
37. OK1AWZ
38. IV3PRK
39. DJ6RX
40. OH3YI
41. I4RYC
42. ZL1BIL
43. I4EAT
44. ZL1BQD
45. TG9NX
46. XE1J
47. F5VU
48. W3AP
49. YO3AC
50. K3TW
51. XE1OX
52. VE7IG
53. OK1ADM
54. CT1FL
55. WA1AER
56. N4RR
57. UW0MF
58. W4DR
59. OK1MP
60. W1NW
61. OE1ZJ
62. HB9AHL
63. HB9AMO
64. LA6OT
65. UR2QD
66. UK2RDX
67. ZS5LB
68. F6DZU
69. DL4YAH
70. LA7ZO
71. W9ZR
72. W1NG
73. VK9NS
74. N4KG
75. YU7DX
76. DL8MAG
77. OK3DG
78. ZL1BOQ
79. EA9IE
80. DL7HZ
81. DJ9RQ
82. EA5SP
83. EA2IA
84. SP3BQD
85. LZ1NG
86. N4JF
87. CT2AK
88. HB9CIP
89. OK1MG
90. CT4BD
91. VK6HD
92. EA6ET
93. VK3QI
94. LZ2DF
95. ON4QX
96. SM0DJZ
97. CT3BM
98. K2TQC
99. EA8XS
100. HA9RE
101. SM4CTT
102. A71AD
103. LZ2CC
104. SM4CLE
105. LZ1HA
106. SM5AKT
107. CT4NH
108. ZL4BO
109. I1BSN
110. DF6CY
111. DK5AD
112. DL6EN
113. SM6CVX
114. LU8DPM
115. SM6DYK
116. DL7XS
117. DF7NM
118. UA3TT
119. OK1DDS
120. YU2TW
121. EA8QL
122. I1APQ
123. G3TJW
124. NW5K
125. AB9O

The top 18 contenders for 5 Band WAZ are:

1. JA1BWA, 199
2. JA3EWU, 199
3. N4WW, 199
4. K5YRA, 199
5. W8UVZ, 199
6. F6BEE, 199
7. JA0CWZ, 199
8. W6GO, 199
9. K4CEB, 199
10. G3GIQ, 199
11. SP6KTE, 199
12. SP5JCY, 199
13. LU6GV, 198
14. W2YY, 198
15. K7UR, 198
16. W3GG, 198
17. K9GX, 198
18. DJ9ZB, 198

383 Stations have attained the 150 zone level.

MIRAGE /KLM

ANTENNA POLARITY SWITCHER MODEL APS-1

The APS-1 is a self-contained control head designed to allow remote polarity switching of circular antennas such as the Mirage/KLM range of crossed yagis.

The APS-1 may be powered by the power adaptor (included) or may alternately be powered from a vehicle or other 13–17 VDC source.

In addition to switchable outputs for two antennas, the APS-1 also contains a 6–13 volt regulated DC power supply. This feature is designed for powering items such as preamplifiers, VHF/UHF converters, etc., but may also be used whenever a low-current stabilized variable voltage source is required.

SPECIFICATIONS:

Power Requirement (AC) .....117V ± 10% AC 50/60 Hz 15 Watt
Power Requirement (DC) .....11–16 VDC 500 mA

Outputs .....Two 12 VDC unregulated, switched (antenna relay supply).
One 6–13 VDC variable regulated auxiliary supply.

Total output current 500 mA with AC transformer that is included, 1 amp with optional high current transformer or external DC supply. This unit has our popular five (5) year warranty.

P.O. BOX 1000 MORGAN HILL, CALIFORNIA 95037 (408) 779-7363

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R 6. Automatic shutoff
E 7. Simple modification to adapt (special adapter for ICOM)
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CIRCLE 19 ON READER SERVICE CARD

NEW DVK-100

ANNOUNCING THE DIGITAL VOICE KEYER

$349.00 Suggested Amateur Net Price

Now for the first time you can enjoy the truly unique operation of a Digital Voice Announcement System, designed specifically for Amateur Radio communications. The DVK-100 represents the latest technology in digital audio processing.

Create your own natural voice contest calls, CQ's, etc. Your voice is stored in digital memory, ready to be played back at the touch of a key. The Digital Voice Keyer is not a tape recorder or robotic sounding synthesizer, but a true full fidelity natural voice record/playback system.

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FEATURES

- **Superior natural voice quality**
- **Micro-processor controlled**
- **32 seconds of message time**
- **PTT/VOX operation**
- **Dynamic/condensor mic input**
- **Selectable monitor amplifier with preset level controls**
- **Selectable audio compressor**
- **Sealed membrane keyboard**
- **4 independent voice memories**
- **Positive/negative keyed PTT**
- **ESD/EMI/RFI shielding**
- **Selectable end of transmission tone generator**

The sound of the future is here today. Contact your local Amateur Radio dealer or NTL for further information.

Dealer Inquiries Invited

NEL-TECH Labs Inc., 28 Devonshire Lane, Londonderry, NH 03053 (603) 434-8234

CIRCLE 8 ON READER SERVICE CARD

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. Lifetime Honor Roll fee $2.00 (U.S.) for each mode, with no fees required for up-dates.

MIXED

3001	YU2DX	1836	I8YRK	1437	N6AW	1169	K2OLG	917	W6YMH
2865	F9RM	1829	K0BLT	1420	EA9IE	1157	K2POF	901	W0JIE
2753	K2VV	1792	YU7BPQ	1415	K8LJG	1141	N4IB	889	I0AOF
2685	W2NC	1782	SM7TV	1414	IT9QDS	1131	YU2CQ	883	WI4K
2532	K6JG	1760	W9NUF	1392	I2MQP	1123	3A2LF	853	K7CU
2416	VE3XN	1752	WA8YTM	1391	IS0LYN	1114	N8BJQ	821	KX1A
2366	W9DWQ	1701	W0SFU	1370	PY1APS	1108	SM0AJU	820	W2XQ
2346	K6XP	1675	I2PHN	1359	KL7AF	1063	KC8CC	800	I2TZK
2269	W4BQY	1668	I6SF	1347	I27IY	1060	WD9IIC	800	AC2J
2224	N4NO	1662	YT7DX	1322	N6JM	1038	YU2CBK	764	I2EAY
2198	YU2TW	1661	K9BG	1322	NN4Q	1028	PY1DFF	762	N2CIC
2174	N4MM	1654	4X4FU	1312	LA7JO	1016	N2AIF	747	OE1KJW
2103	YU7BCD	1644	YU7AW	1305	DK5AD	1012	AI8S	745	VE6VN
2018	N6JV	1597	KF2O	1247	YU7AJD	1007	AI6Z	678	W4WKQ
1985	N9AF	1584	I3ZKD	1247	W5PWG	996	SV1PL	664	G4SDJ
1898	PA0SNG	1564	IN3ANE	1227	W6OUL	995	KC2RS	661	KL7VZ
1895	YU1AB	1525	N5TV	1227	WB8ZRL	973	VE5FX	650	JO1BMV
1890	N2AC	1516	PY4OD	1215	G4FAM	934	WD4RAF	640	N3KR
1869	K5UR	1516	WA1JMP	1194	W7CB	922	VE2PD	633	Y44UI
1863	I2PJA	1512	K7NN	1189	JH1VRQ	917	NE6I	632	K6UXO
1855	N4UU	1490	CT1LN	1181	K2QF				

SSB

2789	F9RM	1479	WF4V	1075	I1POR	935	XE1XF	722	N2CIC
2538	I0ZV	1470	WA4QMQ	1073	N6FX	933	K8LJG	715	I8WYD
2310	K2VV	1451	VE1YX	1071	NN4Q	930	N4IB	714	SM0AJU
2223	K6JG	1413	CT1LN	1060	TG9GI	921	IK5ACO	707	K9BQL
2221	ZL3NS	1377	I2MQP	1048	PP2ZDD	909	I0SGF	699	I2KKL
2108	K2POA	1339	KF2O	1048	I2UIY	902	VE2PD	692	XF4MDX
2089	K6XP	1329	W9NUF	1037	KC4OV	896	PY4VX	686	W6YMH
2070	I0AMU	1312	W3ARK	1035	WB8ZRL	896	WA2FKF	666	JA1XDA
1956	N4MM	1303	CT1FL	1032	KC8CC	888	I5AFC	663	CT1AHU
1950	CT1UA	1249	N5TV	1029	N2AC	878	WI4K	662	VO1AW
1858	W0YDB	1243	AC2J	1017	I4LCK	871	EA4KK	661	KC2FC
1840	I4ZSQ	1234	LA7JO	1012	KC8YM	859	TI2KD	659	I4UFH
1802	WD8MGQ	1219	G4CHP	1008	SM6DHU	850	CT1BY	654	KX1A
1724	YU7BCD	1199	W2NC	996	K5RPC	818	IN3AHO	652	CP8HD
1693	N4NO	1183	XE1OX	992	HI8GB	817	ON6IT	649	AI6Z
1688	OZ5EV	1171	W2CC	989	W4UW	805	EA8AKN	646	OE5BGL
1667	I8YRK	1132	I8KCI	974	I4CSP	795	I2EOW	643	KE6KT
1666	W4BQY	1130	NJ0C	967	LA2TO	792	AG2K	638	AB9O
1661	PA0SNG	1112	KK9L	950	PY4OD	769	KK5P	621	YB3CEV
1642	W9DWQ	1095	KL7AF	945	CT4UW	763	K3IXD	616	NE6I
1599	I8YZP	1083	ZP5JCY	945	EA3AQC	758	WB6SRK	607	YB3CDL
1593	K5UR	1078	ZP5RS	936	W3GXK	744	EA5BCX	606	WA8YTM
1514	CT4NH								

CW

2554	W2NC	1569	YU7SF	1176	KA7T	811	N2AIF	663	LA7JO
2216	K2VV	1501	N4MM	1116	IT9VDQ	800	JH1VRQ	654	W0JIE
2025	WA2HZR	1501	LZ1XL	1000	I7PXV	797	W9PWM	654	KA1CLV
1999	N6JV	1482	K5UR	996	K2POF	788	YU2CQ	647	WB8ZRL
1924	N4NO	1446	VO1AW	990	K8LJG	753	KN7K	646	JA2GCW
1912	ON4QX	1436	I6SF	952	SM6DHU	751	VE1ACK	643	N4IB
1901	K6JG	1357	N4YB	943	KL7AF	748	SM5DAC	642	I2EAY
1878	W9DWQ	1353	W9NUF	922	OH3TQ	725	SM0AJU	641	NE6I
1836	W3ARK	1329	W4WJ	909	DJ1YH	724	VE4AEX	628	W6YMH
1798	W4BQY	1290	K9QVB	904	NN4Q	715	F6HKD	616	WA8YTM
1739	K6XP	1287	PY4OD	901	AK2H	708	TI4BGA	611	W4RHZ
1701	N2AC	1234	I1YRL	899	I2UIY	689	OE1KJW	610	K6UXO
1699	VE6CNE	1233	I2DMK	823	G4FAM	669	ZS6BCR	603	I8YRK
1672	YU7BCD	1200	N5TV	818	AI6Z	667	W2XQ		

sors the famous International DX Convention at either Fresno or Visalia, a large DX-oriented affair attended each year by DXers from all parts of the world.

The NCDXC also participates in the major DX contests, and many of its members travel far and wide on major DXpeditions. Most notable are Lloyd and Iris Colvin, W6KG and W6QL, of YASME fame, the recent Clipperton DXpedition, two Kingman Reef DXpeditions, and many others.

Over the years the club has grown as it has become better organized. A formal set of by-laws has been written, complemented by a procedures manual which minutely details the modus operandi of the club's affairs. The membership is kept informed by the monthly club publication, *The DXer*, which includes the president's report, minutes of club and board meetings, plus DX and technical articles and news items of interest to club members.

The NCDXC owns and operates a 2 meter repeater for the purpose of disseminating DX information on a current basis and for weekly on-the-air club meetings. The latter include officer reports, the latest DX news, contest information, *West Link*, a propagation report, a swap shop, and QSL information. The repeater

Enrique, EA5AD, is very active in the CQ WAZ program and recently qualified for 20 Meter SSB Single Band WAZ #524. His most difficult zones were zone 19 and zone 2. Enrique is 41 years old and has been licensed since May 21, 1977. He is a restaurant manager.

is used during DX contests to report the frequencies and callsigns of DX stations currently active on the bands.

Since the founding of the club, there have been a total of 694 members. Of this number, 75 have become silent keys, 6 of whom were charter members. There are currently 400 members, 64% of whom hold Extra class licenses, 32% Advanced class licenses, and 4% General class licenses. Forty club members are on the DXCC Honor Roll, and 72 members have worked 300 or more countries.

This is what it is like to be a member of NCDXC. What is the story of your DX club? K4IIF would like to know. Write to John at P.O. Box 205, Winter Haven, FL 33882.

Information For The Active DXer

Radio amateurs who are actively pursuing specific DX goals such as WAZ, WPX, the *CQ* DX Country Awards, DXCC, or any other of the many worthwhile DX awards need one or more sources of current information. If you are really into DX, reading a monthly column is not sufficient, as the major magazines go to press so far in advance. For example, these words are being written in early September, but you will not read them until about the first of December. Therefore, you need to take one of the special bulletins which circulate weekly or bi-weekly with up-to-the-minute news. Bulletins put out by the major DX clubs are also very helpful, but are usually restricted to club members.

Here is a sampling of some of the information sources used in compiling this column. This is by no means a complete list, just the publications mailed to us during the past month arranged in alphabetical order.

Carolina DX Association Bulletin, Murf Ratteree, W4WMQ, Editor, 264 Wayland Drive, Rock Hill, SC 29730.

DXer's Magazine, Gus Browning, W4BPD, Editor, P.O. Drawer DX, Cordova, SC 29039.

DX-NL, Walter Geyrhalter, DL3RK, Editor, Box 1328, D-8950 Kaufbeuren, West Germany.

DX-Press, John Fung-Loy, PA3CXC, Editor, Strausslan 4, 2551 NM Den Haag, The Netherlands.

International DX Association Newsletter, John Parrott, W4FRU, Editor, 1902 Jamestown Court, Arlington, TX 76013.

Long Skip, John Sklepkowcyz, VE3IPR, Editor, 300 Deloraine Ave., Toronto, Ontario, Canada, M5M 2B3.

Northern California DX Foundation Newsletter, Kip Edwards, W6SZN, Editor, P.O. Box 2368, Stanford, CA 94305.

CQ DX Awards Program

SSB

1496	DJ0AF	1498	YB0JH
1497	AB9O		

CW

677	YB4FNN	680	KU0S
678	G4SSH	681	K4MF
679	G3DPX		

SSB Endorsements

310	W4DPS/315	275	AB9O/276
310	VE1YX/315	275	N0AMI/276
310	YS1RRD/314	275	KC2FC/275
300	I3OBO/302	250	N2CIC/263
300	NN4Q/301	28 MHz	AB9O
300	K2JLA/300	28 MHz	N2CIC
275	W4UW/288	3.5/7 MHz	AB90

CW Endorsements

300	W9BW/309	275	NN4Q/286
300	I3OBO/301	150	K2JLA/159
275	W0HZ/287		

Total number of active countries is 316. The basic award fee for subscribers to CQ is $4. For non-subscribers, it is $10. In order to qualify for the reduced subscriber rate, please enclose your latest CQ mailing label with your application. Endorsement stickers are $1.00. Updates not involving the issuance of a sticker are made free when an s.a.s.e. is enclosed for confirmation of total. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business size, No. 10 envelope, self-addressed and stamped, to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. DX stations must include extra postage for air-mail reply. Please make all checks payable to the awards manager.

Northern California DX Club DXer, Jim Maxwell, W6CF, Editor, P.O. Box 473, Redwood Estates, CA 95044.

North Florida Amateur Radio Society's Balanced Modulator, Pete Nissen, W4PTT, DX Editor, Billy Williams, N4UF, Editor, P.O. Box 9673, Jacksonville, FL 32208.

QRZ DX, Bob Winn, W5KNE, Editor, P.O. Box 834072, Richardson, TX 75083.

Southern California DX Club Bulletin, Don Minkoff, NK6A, Editor, 12567 Brooklake St., Los Angeles, CA 90066.

The Long Island DX Bulletin, Harvey McCoy, W2IYX, Editor, P.O. Box 173, Huntington, NY 11743-0876.

Totem Tabloid, John Bock, K7ZR, 7317 South Jewett Road, Clifton, WA 98236. (This is the publication of the Western Washington DX Club.)

W6GO/K6HHD QSL Manager's List, P.O. Box 700, Rio Linda, CA 95673-0700.

Most of these publications will send you a sample copy if you provide a self-addressed, stamped envelope with your request. For strictly DX information, exclusive of club news and other articles, North American amateurs should consider *The Long Island DX Bulletin*, *QRZ DX*, or the *DXer's Magazine*. European DXers should try *DX-NL* or *DX-Press*. In addition, there is a publication called *The DX Bulletin*, edited by Chod Harris, VP2ML, which is widely regarded. However, we have not seen a recent issue and do not know the particulars.

Rockall Island

The following article is courtesy Bob Winn, W5KNE, and first appeared in *QRZ DX*.

"According to G4DYO, the callsign GB2RI was issued for use during mid-August from Rockall Island. Could Rockall become a separate country for DXCC? I'll let you be the judge of that.

"Rockall Island is an isolated and uninhabited rock which is located in the northeastern Atlantic Ocean about 289 miles west of the westernmost part of the Scottish mainland and about 300 miles northwest of the Irish Coast. It is 189 miles west-southwest of the St. Kilda Group of islands.

"Rockall's measurements are 65 feet high by 83 feet across, with a circumference of approximately 250 feet. This bit of rock, separated from the European Continental Shelf by a very deep trench, is unique because it is not related to any of the continents as we know them. It is the only visible portion of the Rockall Bank, a fragment of an old continent (Pangea). Located nearby is Hasselwood Rock and Helen's Reef.

"Rockall first accurately appeared on maps in the early part of the 17th century. It is variously called Rockall Island or Rockall Bank, or more commonly just Rockall. The name probably comes from the Gaelic word which means "the spiked rock." Early nautical charts listed the name Rokol, but did not accurately locate the rock.

"In 1955, Great Britain very quietly annexed Rockall. The Admiralty said the annexation was necessary since that sector of the sea was within the area of a guided missile range to be built in the Hebrides. Rockall is said to be administered by Scotland. Evidently, no other country has ever laid claim to Rockall, but it has been involved in a dispute between Ireland and Great Britain concerning the definition of the continental shelf between the two countries.

"As far as the record shows, except for a recent unauthorized operation by an adventurer, no one has ever operated a legitimate amateur radio station from Rockall. During the mid-1960's, a group led by Don Miller, W9WNV, authorized the calls GM5AEW/P and GM5AIA/P for an operation from Rockall, but the operation never took place because Don Miller thought a 'GR' prefix would be required to make the operation from Rockall a new country for DXCC. At least one expedition was reported to have permission to use a GR callsign, but there is no record of the operation ever taking place."

QSL Information

Joe Arcure, Jr., W3HNK, was elected to the DX Hall of Fame in 1979 in recognition of his enormous contributions as a QSL Manager. Joe's work continues. The following is a recent list of stations for which Joe can provide you with a card. SASE to Joe Arcure, Jr., W3HNK, P.O. Box 73, Edgemont, PA 19028. (Thanks W6GO/K6HHD QSL Manager's List.)

AI5P/ to KH6XX
AP2SQ to KL7NA
CN8BG to KP4D
CO5GV to KP4RF
CQ4NH to KV4EN
CQ4UH to KV4EY
CQ6LF to LX1BW
CR0UA to LY4L
CR4NH to NP4A
CS0UA to OD5CS
CS1UA to OX3LV
CS4NH to OY3H
CS4UA to OY5NS
CT1BOH to OY7BD
CT1BT to OY7JD
CT1FL to OY9LV
CT1RM to PJ8UQ
CT1TZ to PJ8YL
CT1UA to PY1CZL
CT1UD to PY1DBE
CT1UE to PY1MO
CT2AK to PY4AKL
CT2SH to PZ1CF
CT3AF to P29BS
CU0UA to SM0CER
CU1UA to SM7CRW
CU2AK to TA3DX/1
CU4NH to TF5BW
CU5UA to TF5EP
CW3BR to TG4VT
CX3BR to TG9VT
CX4CC to TI2JCC
DA2DX/ to TR8BL
EA8AK to TU2HJ
EA8CR to UA1PAM
EA8GZ to UK2FAA
EA8JJ to UX4L
EA8QR to VE1BL/1
EL2BI to VK9BS
EN4L to VP2EUQ
FG0DDB/FS7 to VP2EY
FG0UQ to VP2EYL
FG0YL to VP2KK
FM4DN to VP2VY
FM4DU to VP5D
FM5BH to VP5MF
FM5WD to VP9AD
FM7WD to WP4C
F0AZC to W4GSM/HC8
GW3DZJ to YS1GMV
G5CTB to ZP0PX
HC8GI to ZP5CBL
HD8GI to ZP5CF
HH2WF to ZP5PX
HI8MOG to ZS6WI
HI8XRG to Z24JS
HL1EJ to 5B4AI
HM1EJ to 5U7AG
HP1XLS to 9H4L
HP1XYA to 9L1JT
JT0DKF to 9Y4NP
JT0GM to 9Y5ONP
A71AD & A71XD to 5B4TI, M. Smedal, Box 7121, Nicosia, Cyprus
BV2B to Box 30-547, Taipei, Taiwan Republic of China
C30AAN to DL8OH
CN8EL to W2PD
FR4DN (Reunion Island) to Philip Mondon, CD-16 Avirons, 97425 France
FT8YA to F6DZU
GD3AHD/P to G4CVZ
HL9MM to KA6V
J87CD to P.O. Box 975, St. Vincent, West Indies
JT1BG to W7PHO for QSO's made on Family Hour
KX6ND to JA1ELY
OE3EMN/YK to OE3SFW
TL8KH to W2MZV
TR8SA to F6FNU
VS6CT/KP2 to KA6V
XU1SS to JA1HQG (1986 Callbook address)
YI1BGD to Scientific Center, Box 6100, Baghdad, Iraq
7J1ACH to NG7X

73, John, K4IIF

Dennis, G4UCB, operating from Vatican station HV1CN. Dennis is an active CQ zone chaser and recently qualified for 20 Meter SSB Single Band WAZ #561 using a Yaesu 902, FL-2100, and a Hy-Gain TH3 MK3 beam. Zones 18 and 19 were the most troublesome. Dennis is age 48, married with 3 harmonics, and is a self-employed electrical contractor.

Propagation

a monthly feature by
GEORGE JACOBS, W3ASK

THE SCIENCE OF PREDICTING RADIO CONDITIONS

CQ WW DX CW Contest Bulletin

Since this issue of *CQ* should reach many subscribers before the *CQ* WW DX CW Contest weekend of November 29 and 30, here is a press-time day-to-day forecast for the contest period. Better conditions are expected than were forecast in last month's column. The contest weekend is now expected to skirt a period of radio storminess, and remain mostly at the propagationally normal level. There is, in fact, a very good chance that conditions to many areas of the world will rise to High Normal or better. It looks as if Mother Nature is going to cooperate to make the contest weekend a good one for HF propagation conditions.

Solar Cycle Progress

The Royal Observatory of Belgium reports a monthly mean sunspot number of 7 for August 1986. This results in a 12-month running smoothed sunspot number of 13 centered on February 1986.

Table I shows the progress of sunspot Cycle 21 from its beginning in June 1976 through February 1986. Predicted values for the remainder of the cycle are shown in parentheses.

The solar cycle is measured by the level of *smoothed sunspot number*. This value smooths out fluctuations by averaging monthly mean values over a 12-month period. The latest smoothed sunspot number, therefore, always lags the latest monthly mean value by six months.

The year 1986 began with a solar level approximately 20% *higher* than originally expected. This was caused by the cycle stalling for several months during 1985 at approximately the 17 level.

Table I shows the latest prediction for the end of Cycle 21 as likely to occur sometime during late 1986. This prediction is based on data provided by the National Geophysical Data Center, Boulder, Colorado. At the time of writing this column, early October, it is not yet possible to confirm this prediction. To the contrary, physical evidence on the sun's surface itself suggests that the beginning of a new cycle may yet be several months away, and may not occur until well into 1987.

There are observable patterns on the sun that herald the ending of one cycle and the beginning of a new one. These are the location of spots on the sun's surface, and the polarity of their magnetic fields. Old cycle spots occur mainly near the sun's equator, while new cycle spots break out at high solar latitudes. Old and new cycle spots on the same side of the solar equator have magnetic fields of *opposite* polarity (see fig. 1).

The official end of one cycle and the beginning of a new cycle is taken as the month during which old cycle and new cycle spots are approximately equal in number. While several new cycle spots have already been identified, old spots continue to predominate. This suggests that the beginning of a new cycle may yet be several months off.

While the solar cycle is measured by sunspots, for which data is available over nearly a 300-year span, more accurate measurements of solar activity are now being made. Several observatories throughout the world are monitoring radio frequency radiation from the sun on a daily basis. The level of these radiations, called *solar noise flux*, is measured daily by an official observatory at Ottawa, Ontario. The median value of 10.7 cm (2,800 MHz) solar noise flux for August was 70.1. The levels of solar flux now being recorded also seem to indicate that the end of the present solar cycle may yet be several months away.

December Conditions

Twenty meters should continue to be the best band for worldwide DX during December. The band should open on most days just after sunrise and remain open until an hour or two after sunset. Signals should peak toward Europe and the east about noon; towards Africa during the early afternoon, towards South America during the last afternoon; towards the Pacific area and Australasia during the early evenings; and towards Antarctica a bit later in the evening. When conditions are high or above normal, the band may remain open for DX until as late as midnight. Even though we're near the bottom of the present sunspot cycle, look for some fairly good DX openings on *15* meters when conditions are high or above normal. Check for openings towards Europe, Africa, and the east be-

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for December 1986

	Expected Signal Quality			
Propagation Index.....	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 10, 25	**A**	**A**	**B**	**C**
High Normal: 4, 13, 17, 22-24, 26, 31	**A**	**B**	**C**	**C-D**
Low Normal: 2-3, 5, 8-9, 11-12, 16, 18-20, 29-30	**A-B**	**B-C**	**C-D**	**D-E**
Below Normal: 6-7, 14-15, 21, 27	**B-C**	**C-D**	**D-E**	**E**
Disturbed: 1, 28	**C-E**	**D-E**	**E**	**E**

Where expected signal quality is: **A—Excellent opening, exceptionally strong, steady signals greater than S9.**

B—Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S6, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. **Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.**
2. **With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be poor-to-nil (D-E) on Dec. 1, good-to-fair (B-C) on the 2nd and 3rd, good (B) on the 4th, etc.**

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
1976	15	13	12	13	13	12m	13	14	14	13	14	15	13
1977	17	18	20	22	24	26	29	33	39	46	52	57	32
1978	61	65	70	77	83	89	97	104	108	111	113	118	91
1979	124	131	137	141	147	153	155	155	156	158	162	165M	149
1980	164	163	161	159	156	155	153	150	150	150	148	143	154
1981	140	142	143	143	143	142	140	141	143	142	139	138	141
1982	137	133	129	124	120	117	115	109	101	96	95	95	114
1983	93	90	86	82	71	71	66	66	68	68	67	64	74
1984	60	56	53	50	48	47	44	40	34	29	25	22	42
1985	21	20	19	18	18	18	17	17	17	17	17	15	18
1986	14	13	(12)	(12)	(11)	(10)	(9)	(9)	(9)	(9)	(9)	(9)	(10)
1987	(9)	(9)	(10)	(10)	(11)	(12)	(12)	(13)	(14)	(15)	(16)	(18)	(12)

The letter "m" marks the minimum of sunspot Cycle 21 and "M" marks the maximum.
( ) Predicted values.

Table I– Smoothed observed and predicted sunspot numbers for Cycle 21.

11307 Clara Street, Silver Spring, MD 20902

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart approprate 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. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. 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 10 dB loss, it will lower by one level.

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

December 15, 1986 - February 15, 1987
Time Zone: EST (24-Hour Time)
EASTERN USA TO:

	15 Meters	20 Meters	40 Meters	80 Meters
Western & Central Europe & North Africa	09-11 (1)** 08-09 (1) 09-11 (2) 11-12 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (4) 12-13 (3) 13-14 (2) 14-15 (1)	15-16 (1) 16-17 (2) 17-19 (3) 19-01 (2) 01-03 (3) 03-04 (2) 04-05 (1)	17-19 (1) 19-20 (2) 20-02 (3) 02-03 (2) 03-04 (1) 20-00 (1)* 00-02 (2)* 02-03 (1)*
Northern Europe & European USSR	08-10 (1)	06-07 (1) 07-11 (2) 11-12 (1)	15-17 (1) 17-19 (2) 19-01 (1) 01-02 (2) 02-03 (1)	17-19 (1) 19-01 (2) 01-03 (1) 21-00 (1)*
Eastern Mediterranean & Middle East	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-14 (2) 14-15 (1)	17-19 (1) 19-21 (2) 21-00 (1) 00-01 (2) 01-02 (1)	18-20 (1) 20-22 (2) 22-00 (1) 20-22 (1)*
Western Africa	10-12 (1)** 08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	18-20 (1) 20-23 (2) 23-02 (1) 02-03 (2) 03-04 (1)	19-22 (1) 22-01 (2) 01-03 (1) 22-01 (1)*
Eastern & Central Africa	08-11 (1) 11-13 (2) 13-14 (1)	07-13 (1) 13-16 (2) 16-18 (1)	18-20 (1) 20-23 (2) 23-01 (1)	19-00 (1)
Southern Africa	10-13 (1)** 08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	07-09 (1) 12-14 (1) 14-15 (2) 15-16 (3) 16-17 (2) 17-19 (1)	18-20 (1) 20-22 (1) 22-00 (1) 22-00 (1)	19-22 (1)
Central & South Asia	16-18 (1)	07-10 (1) 19-21 (1)	06-08 (1) 18-22 (1)	06-07 (1) 18-20 (1)
Southeast Asia	16-18 (1)	07-10 (1) 17-20 (1)	06-08 (1) 18-21 (1)	06-07 (1) 18-20 (1)
Far East	16-18 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-17 (1) 17-19 (2) 19-21 (1)	05-08 (1) 17-18 (1)	05-08 (1) 17-18 (1)
South Pacific & New Zealand	13-15 (1)** 12-14 (1) 14-17 (2) 17-18 (1)	05-07 (1) 07-10 (2) 10-18 (1) 18-20 (2) 20-22 (1)	01-02 (1) 02-04 (2) 04-07 (3) 07-08 (2) 08-09 (1)	04-05 (1) 05-07 (2) 07-08 (1) 04-07 (1)*

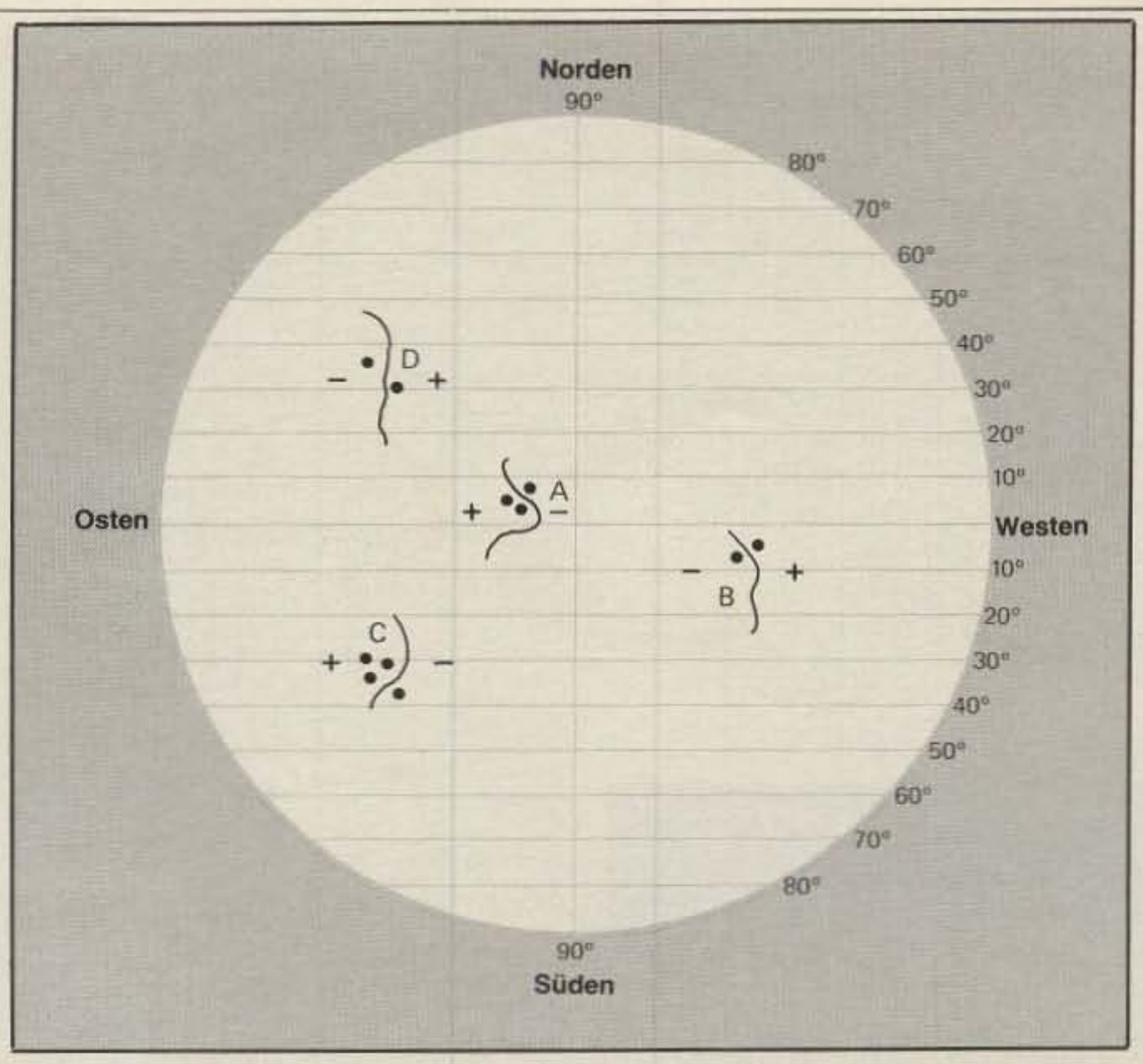

Fig. 1– Positions of sunspots associated with an old solar cycle (A and B) and with the start of a new solar cycle (C and D). Note the opposite polarity of the magnetic fields associated with the old and new spots on a given side of the solar equator.

fore noon; towards South America during the early afternoon; and towards the Pacific and Australasia during the late afternoon. Although not likely to happen very often, look for some *10* meter DX openings when conditions are high or above normal. Best bet is for openings towards South America during the early afternoon, although the band may also open briefly towards Africa from the eastern half of the country and towards the Pacific and Australasia from the western half.

With the hours of darkness at a maximum in the northern hemisphere, and static levels at seasonally low values, a considerable improvement is expected in DX propagation during the hours of darkness on the *40, 80,* and *160* meter bands. *Forty* should open for DX during the early afternoon, with the first signals coming from Europe. After sundown the band should open to Africa and to South America. Signals from the Pacific area, the Far East, and Australasia should peak just before sunrise, but the band may remain open for an hour or two later. Fairly good DX is also expected on *80* meters between sundown and sunrise. Signals from Europe, Africa, and the east should peak before midnight; signals from South America should be in for most of the hours of darkness; signals from Australasia and the Pacific area should peak just before sunrise. There will be many nights during December when *80* meters will be the best band for DX propagation. Check both *40* and *80* meters for long-path openings during sunrise and sunset periods.

December should be an active month for 160 meter DXers, with the ARRL 160

Please send all reader inquiries directly.

Australasia	14-16 (1)** 12-15 (1) 15-17 (2) 17-18 (1)	06-07 (1) 07-10 (2) 10-12 (1) 15-16 (1) 16-19 (2) 19-21 (1)	03-05 (1) 05-08 (2) 08-09 (1) 17-19 (1)	05-06 (1) 06-07 (2) 07-08 (1) 17-18 (1) 05-07 (1)*
Caribbean, Central America & Northern Countries of South America	10-15 (1)** 08-09 (1) 09-12 (2) 12-16 (3) 16-17 (2) 17-18 (1)	06-07 (1) 07-08 (3) 08-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-18 (4) 18-19 (2) 19-20 (1) 01-03 (1)	17-18 (1) 18-19 (2) 19-21 (3) 21-03 (2) 03-06 (3) 06-07 (2) 07-08 (1)	18-20 (1) 20-21 (2) 21-04 (3) 04-06 (2) 06-07 (1) 21-03 (1)* 03-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina and Uruguay	11-15 (1)** 08-09 (1) 09-11 (2) 11-13 (1) 13-14 (2) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-09 (2) 09-10 (1) 12-14 (1) 14-15 (2) 15-16 (3) 16-17 (4) 17-18 (3) 18-19 (2) 19-20 (1) 22-00 (1)	19-21 (1) 21-02 (2) 02-05 (1) 05-06 (2) 06-07 (1)	21-03 (1) 03-05 (2) 05-06 (1) 03-05 (1)*
McMurdo Sound, Antarctica	15-17 (1)	07-09 (1) 17-18 (1) 18-20 (2) 20-22 (1) 22-00 (2) 00-02 (1)	22-00 (1) 00-02 (2) 02-06 (1)	*Nil*

Time Zones: CST & MST (24-Hour Time) CENTRAL USA TO:

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

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

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

*Indicates best time for 160 meter openings.
**Indicates best time for 10 meter openings.

Meter Contest scheduled for December 6–8. Expect fairly good conditions on this band, probably better than they have been during the past 10 years. Conditions on *160* meters are generally at their best during periods of very low solar activity. Look for openings towards Europe and the east as early as 8 p.m. in the EST time zone, with the band remaining open until 2 a.m. Check for European openings in the CST time zone between 8 p.m. and 1 a.m., from 8 p.m. to midnight in the MST zone, and to 11 p.m. in PST zone. Some openings towards the south, especially to the Caribbean area, should be possible from about 10 p.m. to 2 a.m. in all time zones, and possibly right up until local sunrise. Openings towards the Pacific and Australasia favor west coast stations, but it will be worth looking for these openings in all time zones between 4 a.m. and sunrise. A good rule to remember about *160* meter DX openings is that conditions tend to peak about the time that the sun rises at the *easternmost* terminal of a DX path, or during the night-to-day "grayline" period.

VHF Ionospheric Openings

Quite a bit of meteor shower activity is expected during December. *Geminids*, a major meteor shower, should take place between December 3 and 15. It is expected to peak with a meteor rate of about one a minute on December 12. This should permit some fairly good meteor-type openings on *10, 6,* and *2* meters. A second, but less intense shower period is expected later in the month, called *Ursids*. This shower should take place between December 16 and 23, peaking on the 21st with a meteor rate of about 15 an hour.

A secondary seasonal peak in sporadic-*E* propagation usually takes place during December (the major peak is during the summer months). This should result in occasional short-skip openings on *10* and *6* meters as short as a few hundred miles and as long as 1400 miles.

Some auroral-type VHF ionospheric openings are also likely to occur during December, especially when ionospheric conditions on the HF bands are Below Normal or Disturbed. Be sure to check the Last Minute Forecast at the beginning of this column for those days that are forecast to be in these categories during the month.

This month's column contains DX Propagation Charts valid through February 15, 1987. Short-Skip Propagation Charts for use during December appeared in last month's column.

The Editor of this column would like to take this opportunity to extend his warmest wishes to everyone, everywhere during this holiday season, and to herald the good news that solar activity is almost certain to rise again during the New Year.

73, George, W3ASK

ASTRON CORPORATION

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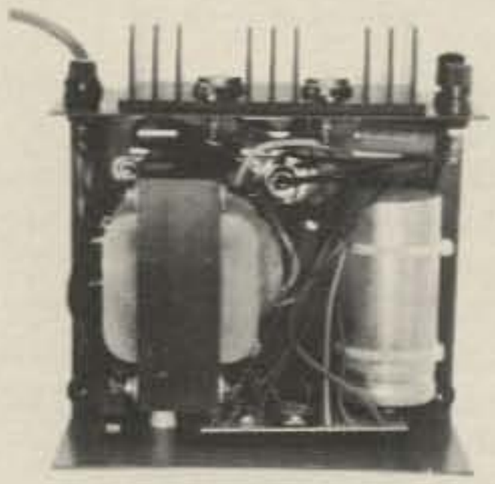


INSIDE VIEW – RS-12A

RS and VS SERIES

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output.
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-4A.
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage.
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105 - 125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE: Less than 5mv peak to peak (full load & low line)

MODEL RS-50A

MODEL RS-50M

MODEL VS-50M

RM-A Series

MODEL RM-35A

19" X 5¼ RACK MOUNT POWER SUPPLIES

Model	Continuous Duty (AMPS)	ICS* (AMPS)	Size (IN) HXWXD	Shipping Wt. (lbs.)
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• SEPARATE VOLT & AMP METERS				
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W X D	Shipping Wt (lbs)
RS-4A	3	4	3¾ x 6½ x 9	5
RS-7A	5	7	3¾ x 6½ x 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

RS-M SERIES

MODEL RS-35M

- Switchable volt and Amp meter

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt (lbs)
RS-12M	9	12	4½ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

VS-M SERIES

MODEL VS-20M

- Seperate Volt and Amp Meters
- Output Voltage adjustable from 2-15 volts
- Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt (lbs)
VS-20M	16	9	4	20	5 x 9 x 10½	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-7S	5	7	4 x 7½ x 10¾	10
RS-10S	7.5	10	4 x 7½ x 10¾	12
RS-10L(For LTR)	7.5	10	4 × 9 × 13	13
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18

CIRCLE 53 ON READER SERVICE CARD

97

Contest Calendar

a monthly feature by
FRANK ANZALONE, W1WY

NEWS/VIEWS OF ON-THE-AIR COMPETITION

We had quite a birthday celebration at K2GL's spacious QTH in Tuxedo Park, New York last September. Over 75 prominent contesters and DXers from all over the country, from coast to coast, border to border, assembled to honor Buzz Reeves on his 80th birthday.

Doug, KR2Q, made sure that past and present members of the K2GL multi crew were there. *CQ* was well represented by Dick, K2MGA; Bob, K3EST/6; Don, N4IN; Freddie, K6SSS, Gene, N2AA; Bob, N1XX; and I wouldn't have missed it for the world. Tom, K1KI, Don, W3AZD, and his XYL, Hope, and Steve, WA2DHF, represented the ARRL, and Yuri, VE3BMV/W2, took care of his *Radiosporting* magazine.

Yes, it was quite a party, especially at the luncheon where we all had a chance to express our feelings and also present Buzz with several awards and trophies.

73 Magazine has saturated the month of January with six single band events entitled "World SSB Championship." Being single band affairs on SSB only, it was not too difficult to space the weekends so there is little or no conflict with other events scheduled for the month of January—a good example of what can be accomplished by a little advanced planning and cooperation between the involved organizations. This is something that should be kept in mind by other organizations, especially State QSO Party groups, when they plan their events. You just don't pick a date out of a hat.

Add another plaque to our World-Wide Contest. The West Jersey DX Group will be sponsoring the U.S.A. Single Operator 14 MHz Phone award for 1986.

Just a reminder, deadline for mailing your phone logs for our World-Wide contest is December 1st, and January 15th for the CW section. Send your logs to the home office, of course, 76 North Broadway, Hicksville, NY 11801.

Before I overlook it, best wishes for the coming holidays this month. They will be here before you know it. In the excitement of preparation and celebration don't forget that the deadline for the March issue is December 15th, and January 15th for the April issue. Use my home address, please.

73 for this time, Frank, W1WY

Calendar of Events

	Nov.	**29-30**	**CQ WW DX CW Contest**
*	Dec.	5-7	ARRL 160 Meter Contest
*	Dec.	6-7	Telco. Pioneers QSO Party
†	Dec.	6-7	TOPS 3.5 MHz CW Contest
*	Dec.	13-14	ARRL 10 Meter Contest
	Dec.	13-14	VU2 Garden City CW
	Dec.	20-21	VU2 Garden City SSB
	Dec.	20-21	EA DX CW Contest
	Dec.	28	Canada Winter Contest
	Jan.	1	AGCW Happy New Year Pty
	Jn.1-	De.31	UBA SWL Competition
	Jan.	3-4	"73" 10 Meter SSB Champ.
	Jan.	10&11	"73" 15 & 20 SSB Champ.
	Jan.	10-11	ARRL VHF Sweepstakes
	Jan.	10-11	European YL-OM Contest
	Jan.	17-18	"73" 160 M SSB Champ.
	Jan.	17-18	AGCW-DL QRP CW Contest
	Jan.	17-18	Crazy 8's HF, VHF, UHF
	Jan.	**23-25**	**CQ WW 160 Meter CW Contest**
	Jan.	24&25	"73" 40 & 75 SSB Champ.
	Jn.31	-Fb.1	YL ISSB CW Contest
	Feb.	7-8	QCWA CW QSO Party
	Feb.	7-8	Vermont QSO Party
	Feb.	14-15	Dutch "PAC" Contest
	Feb.	14-16	YLRL YL-OM Phone Contest
	Feb.	**20-22**	**CQ WW 160 M SSB Contest**
	Feb.	21-22	ARRL DX CW Contest
	Feb.	21-22	YL ISSB Phone Contest
	Fb.28	-Mr.2	YLRL YL-OM CW Contest
	Mar.	7-8	ARRL DX Phone Contest
	Mar.	7-8	QCWA Phone QSO Party
	Mar.	21-23	BARTG Spring RTTY
	Mar.	**28-29**	**CQ WW WPX SSB Contest**

** Covered last month.*
† Not official.

TOPS Activity Contest 3.5 MHz CW

1800Z Sat. to 1800Z Sun., Dec. 6–7

TOPS is an international club for CW enthusiasts founded in Great Britain in 1946. Their objective is to encourage CW operation on the top bands.

Classes: Single operator, multi-operator, and QRP (5 watts or less input).

Single operator stations must take one break of 7 hours during the contest period; multi-operators can operate the full 24 hours.

Exchange: RST plus a three-figure QSO number starting with 001. TOPS members will also include their membership number.

Scoring: QSO's within own country, 1 point, in own continent 2 points, with other continents 6 points. Work a TOPS member and get 2 bonus points (members get 3 points).

Each call area in W, VE, VK, PY, U, and JA will count as a separate country for scoring. The multiplier is determined by prefixes worked (same as *CQ* WPX Contest).

Final Score: Total QSO points times the total number of prefixes worked.

Frequencies: Operation will be between 3500–3585 MHz, with the lowest 12 kHz reserved for out-of-continent DX contacts only. (When sending CQ send TAC, not Test.)

Awards: At least 15 certificates will be awarded based on the top scores in each class.

Logs must be received no later than January 31st and go to: Bertil Arting, SM3VE, Bergesvegen 26, S-823 00 Kilafors, Sweden.

VU2 Garden City Contest

CW: Dec. 13–14 Phone: Dec. 20–21
1200Z Saturday to 1200Z Sunday

It's the world working the VU2's on all five bands, 10 through 80 meters. Only single operator class. The VU2's have their own classification, Grades 1 and 2, but it has no bearing on the scoring.

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

Scoring: VU2's earn 1 point for Asian contacts (including India); 2 points for Europe, Africa, and Australia; and 3 points for North and South America.

DX stations work VU2 stations only. Asian stations earn 1 point per contact; Europe, Africa, and Australia earn 2 points; and North and South America earn 3 points.

There is no multiplier. Just add the QSO points from each band for your final score. The same station may be worked once on each band for QSO credit.

Awards: All contestants submitting valid logs will receive certificates of participation. Winning certificates go to the three top scorers in each group and each class. *(Not clear of the grouping of DX stations.—ed.)*

All entries must be postmarked no later than January 15th 1987 and go to: Garden City Contest, Bangalore Amateur Radio Club, P.O. Box 5053, Bangalore 560001, India.

EA DX CW Contest

1600Z Sat. to 1600Z Sun., Dec. 20–21

The format of this activity has been changed from that used last year. It is still the world working the Espanoles, but the multiplier has been expanded to EA provinces.

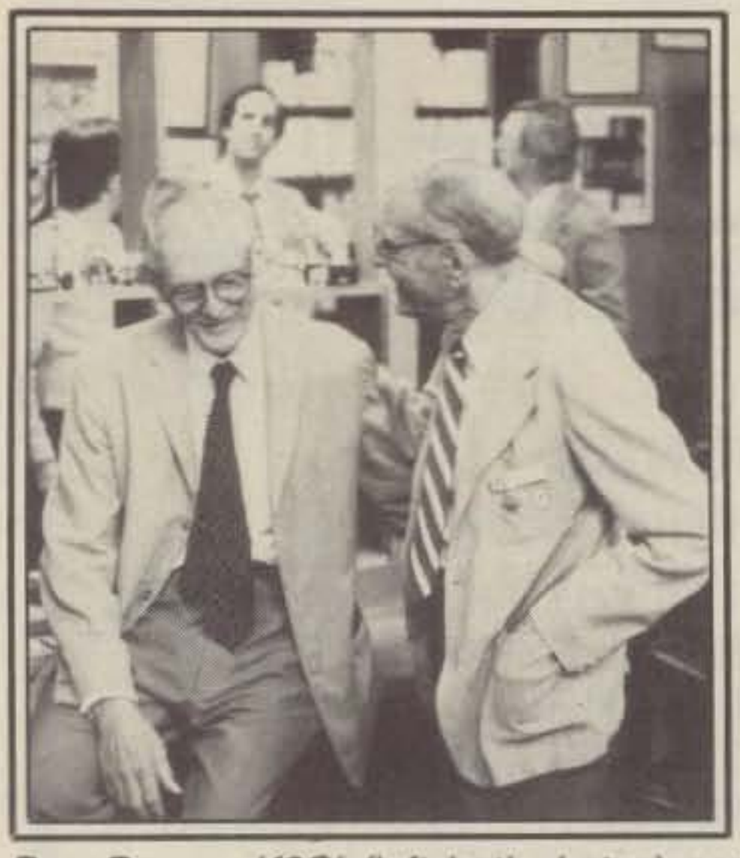
Only contacts with EA stations are valid. The same station may be worked on each band, 10 through 160 meters.

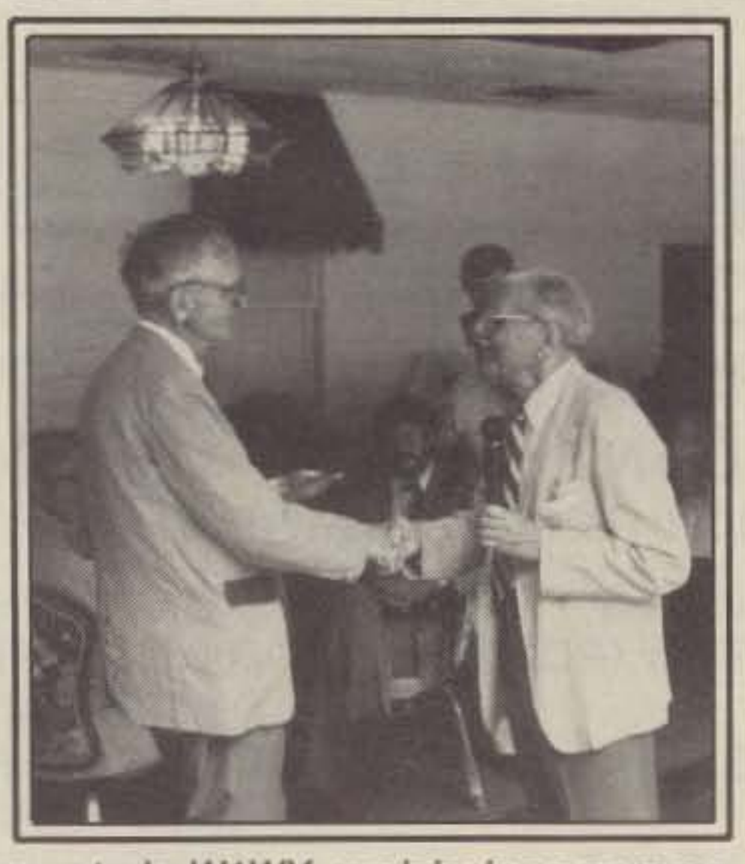
Classes: Single operator and multi-operator, single transmitter.

Exchange: RST plus a three-figure QSO number. EA stations will include their province ID.

Scoring: For Europeans, 1 point for

14 Sherwood Road, Stamford, CT 06905





Buzz Reeves, K2GL (left, both photos), and yours truly, W1WY, reminiscing over some of the past World-Wide Contest events dating back to the early '50s. Buzz was signing W2HJR in those days, a dominant figure in the final results. Nothing has changed except the call. N2AA/K2GL was still the top banana when the final results were posted for the 1985 Contest. He has won more than his share of top U.S.A. and world awards down through the years. At the birthday luncheon I had the pleasure of presenting Buzz with the 1985 U.S.A. Champion Plaque for N2AA/K2GL's Multi-Multi CW victory in our CQ World-Wide Contest. (Photos by N1XX)

each EA contact. DX stations earn 3 points per QSO.

Multiplier: Each EA province worked on each band.

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

Spanish Provinces: *EA1*—AV, BU, C, LE, LO, LU, O, OR, P, PO, S, SA, SG, SO, VA, ZA. *EA2*—BI, HU, NA, SS, TE, VI, Z. *EA3*—B, GE, L, T. *EA4*—BA, CC, CR, CU, GU, M, TO. *EA5*—A, AB, CS, MU, V. *EA6*—PM. *EA7*—AL, CA, CO, GR, H, J, MA, SE. *EA8*—GC, TF. *EA9*—CE, ML.

Awards: Medals and certificates to the worldwide winner and the winner of each continent. Certificates to the winner in each DXCC and WAE country.

A separate log sheet is requested for each band, a summary sheet showing the scoring and other essential information, and the usual signed declaration.

Mailing deadline for logs is January 30, 1987, and they go to: U.R.E. CW Contest, P.O. Box 220, 28080 Madrid, Spain.

Bill Leonard, W2SKE, at K2GL's 80th birthday luncheon.

Canada Winter Contest

0000Z to 2400Z Sun., Dec. 28

Sponsored by the Canadian Amateur Radio Federation, this year's contest has a new set of rules. Activity is not confined to Canada only; everybody works everybody.

Use all seven bands, 1.8 through 50 MHz, both on phone and on CW. The same station can be worked on each band and each mode for QSO and multiplier credit.

Classes: Single operator, single and all band, single and mixed mode. Multi-operator, single and multi-transmitter, all band only.

Exchange: RS(T), and QSO number and province, territory, US state, or country.

Points: Canadian contacts are worth 10 points, contacts outside Canada 4 points, and 20 bonus points for each official station using the VCA or TCA suffix.

Multiplier: Each Canadian area (13) and each band and each mode (14) worked, possible total of 182. *(Suggest you send an SASE to VE6VW for sample log forms. —ed.)*

Frequencies: 1825/75, 3525/3775, 7025/70/7155, 14025/14150, 21025/21250, 28025/28500, 50040/50125 kHz.

Awards: Certificates to top scores in each class in each Canadian area, US call area, and each DX country.

Mail logs within 30 days of end of contest to: Norm Waltho, VE6VW, Box 1890, Morinville, Alberta, Canada T0G 1P0.

AGCW-DL Happy New Year Party

0900Z to 1200Z January 1

This seems to be a European activity only, but will report it here for your information. As the club's name implies, it's a CW affair, single operator only.

Classes: (1) Maximum input of 500 watts. (2) 100 watts. (3) 10 watts. (4) SWL. (Both calls must be reported.)

Exchange: RST plus QSO number. AGCW members will include their membership number.

Scoring: One point per QSO multiplied by the number of AGCW members contacted on each band.

Frequency: Three bands only, 3510–3560, 7010–7040, 14010–14100 kHz.

Send your report by January 31st to: Fritz Bach Jun., DK1OU, Eichendorffstrasse 15, D-4787 Gesenke, West Germany.

U.B.A. SWL Competition

Jan. 1 to Dec. 31, 1987

We often hear from SWL's complaining that very little coverage is given to their hobby. This one should keep them busy for the whole of 1987.

There are four categories: Single operator, phone, CW and RTTY, and all modes for clubs and multi-operator.

Use all 5 bands, 3.5–28 MHz.

There will be certificates and trophies for winners in all categories and areas.

The U.B.A. requires that you use their special log forms. Your requests for more detailed information and log forms should be directed to the Contest Manager, Marc Domen. Include 3 IRC's if in Europe, 4 IRC's for all other areas.

Contest Manager: Marc Domen, ONL 6945, Gebr. Blommestraat 14, Borgerhout, B-2200 Antwerpen, Belgium.

"73" World SSB Championship Contests

A series of six single band contests has been organized by *73 Magazine* to determine the SSB World Champion on each band, 10 through 160 meters.

Rules are the same for each one, and since they are all scheduled for the month of January, we will treat them as a single entry.

10 Meters (48 hours)
0000Z Sat. to 2400Z Sun., Jan. 3–4
15 Meters (24 hours)
0000Z to 2400Z Sat., Jan. 10
20 Meters (24 hours)
0000Z to 2400Z Sun., Jan. 11

160 Meters (48 hours)
0000Z Sat. to 2400Z Sun., Jan. 17–18
40 Meters (24 hours)
0000Z to 2400Z Sat., Jan. 24
75 Meters (24 hours)
0000Z to 2400Z Sun., Jan. 24

Classes: Both single and multi-operator, single transmitter. Stations may operate the full contest period regardless of their classification.

Exchange: RS report and state, province, or territory for the 48 US states and 13 Canadian areas. RS and country for DX stations, including Alaska and Hawaii.

Points: Contacts within own continent, 5 points. Outside own continent, 10 points.

Multiplier: One for each US state, Canadian area, and DXCC country worked (excluding the US and Canada).

Final Score: Total QSO points times the multiplier points.

Awards: Plaques to the World Champion winner on each band (minimum of 500 contacts). Certificates in each class in each US state, Canadian area, and ARRL DXCC country (minimum 100 contacts).

DX Windows: 7.08–7.09, 3.790–3.805, 1.825–1.830, 1.850–1.855, 1.907–1.913 MHz. These frequencies are reserved for split-frequency operation only. DX stations may transmit in the Window but must receive outside the Window frequencies. W/VE's are not permitted to transmit in the Window. *(A bold step. It will be interesting to see how it is observed.—ed.)*

Failure to comply with the DX Window rule could result in disqualification. Taking credit for duplicate contacts in excess of 3% of the total made can also mean disqualification. There is a stiff penalty of 100 QSO points for *each* duplicate contact for which credit has been claimed in the final score.

A summary sheet showing the scoring and other essential information, and a dupe sheet for entries with 100 or QSOs are required.

It is suggested that you send a large SASE to Bill Gosney, KE7C, the Contest Chairman, for official log forms.

Mail separate entries to the individual Contest Directors listed below, postmarked *no later* than February 18, 1987.

Contest Chairman and 160 Meters: Bill Gosney, KE7C, 2665 North Busby Road, Oak Harbor, WA 98277.

10 Meters: Linda Ingram, KG6MO, 44720 N. 11th St. East, Lancaster, CA 93535.

15 Meters: Gary Vest, NW5E, Star Route, Box 34, Holliday, TX 76366.

20 Meters: Chuck Ingram, WA6R, 44720 N. 11th St. East, Lancaster, CA 93535.

40 Meters: Dennis Younker, NE6I, 43261 6th St. East, Lancaster, CA 93535.

75 Meters: Ron Johnson, KC7PA, 68 South 300 West, Brigham City, UT 84302.

Ticket Talk

a monthly feature by
FREDERICK O. MAIA, W5YI

INFO ON AMATEUR RADIO LICENSING

FCC Further Deregulates Amateur Radio Operator Testing!

At an August meeting at the FCC in Washington, DC, Volunteer-Examiner Coordinators were introduced to newly adopted procedures that further deregulated the Commission's amateur radio operator testing program. All major VEC organizations attended, representing some 90% of the amateur radio operator examinations administered worldwide. The FCC's Ray Kowalski, Chief of Special Services, defined the conference objectives. The theme was "Maintaining Questions and Integrity." A VEC acts as the administrative link between the volunteer examiner and the FCC.

A *Report and Order* in *PR Docket 85-196,* adopted just a few days earlier, was released to the public at the VEC conference. In it were new guidelines transferring the responsibility for maintaining the question pools for amateur operator written elements in the VE system from the Commission to the Volunteer-Examiner Coordinators.

The new rules also provided for VE's to design examinations based on test question formulas determined by the VEC and clarified that answers to the questions (without appeal) are part of the VE duty to grade each examination element.

Background of the Proceeding

On September 13, 1982 Public Law 97-259 amended the Communications Act to allow the FCC to accept and employ the voluntary services of amateur operators in the preparation and administration of amateur operator examinations. The Novice license has always been given by a single volunteer examiner.

On December 1, 1983 the Commission implemented a new VEC program for the other four operator classes (Docket 83-27). The system provided for Volunteer examiners (VE's) administering written tests prepared by VEC's using FCC selected questions from an FCC developed question pool. The volunteer testing program was turned over to the amateur community in stages. Eventually VEC's were authorized to design the examinations using a formula provided by the FCC.

National Volunteer Examiner Coordinator, P.O. Box 10101, Dallas, TX 75207

Some 1600 persons each month qualify for the beginner Novice license, while another 4000 persons are examined for the higher licenses in over 300 VEC-coordinated sessions. Twenty-five different VEC's coordinate examination sessions in a total of 75 different regions. Each amateur callsign district is a separate region, as is Alaska, Hawaii, and the Caribbean. (There are actually 14 different regions, since each VEC can also arrange examinations outside of the U.S. and its possessions.)

As part of the 1983 volunteer ham testing implementation, the FCC proposed to further deregulate the program to its next stage after the VE system had been in place three years. Recommended were:

1. Maintenance of the question pool from which written examination questions are drawn be transferred to the VEC beginning January 1, 1987, and . . .

2. VE's (in addition to VEC's) would be authorized to select the specific question sets to be administered to candidates.

In other words, the program would be dropped one level—question pool development transferred to VEC's (a previous FCC function), test design to the VE (a VEC function), with the FCC stepping out of the examining picture completely except for routine supervision.

Comments on the Proposal

Standardization and uniformity of the written examinations was a major concern. The ARRL wanted the FCC to continue to maintain the question pools, since allowing each VEC to have a separate question pool "would be a step away from uniform standards and fairness (and) toward shopping (by an applicant) for the easiest examination." The League said such "forum shopping" would undermine the integrity of the Volunteer Examiner program and thus the service as a whole. "VEC's should not be subjected to accusations of using unfair questions and that the only means of assuring standardization and high-quality question pools is to have the Commission give its stamp of approval to them." The League also questioned transferring the selection of the questions to the VE noting that "VE's are already burdened."

Most commenters supported the proposal noting that "it is unrealistic for the Commission to continue to maintain the question pools in view of budgetary constraints" and "VEC's have the capability of maintaining question pools." Some thought turning the question pools over to the VEC's would cause VEC's to expend more time and effort and increase their costs.

FCC Discussion on the Proposal

The Commission agreed that the matter of amateur radio testing standardization was important and said that strict examination guidelines would be summarized in the rules. The FCC noted that any greater standardization must be achieved through the cooperative effort of the various VEC organizations.

Responding to concerns for the quality of examinations, the FCC said the present questions are worded to permit the use of a variety of answer formats. "Thus, while the majority of VE's elect to use the multiple-choice format, they could also use true-false, fill-in-the-blank, and essay formats. Second, the Commission does not supply the answers to any of the questions. Thus, the potential exists at the present time for examinations to be constructed in such a way as to make the right answers obvious. But this has not occurred. The multiple-choice answers have been of high quality. Moreover, there has been a high degree of standardization in the answers brought about through mutual cooperation of the VEC's. There is no reason to believe that this would change if the responsibility for the root questions also rested with the VEC's."

The FCC said that they do indeed have the statutory authority to allow VE's to prepare examinations due to the broad authority given the Commission to utilize the services of amateur licensees in ways that will be most beneficial in assisting us with the operator examination workload, including maintenance of the question pools by VECs." The enabling legislation "does not imply that the preparation of examinations must be solely a Commission function."

"The burden upon VE's of selecting examination questions is not a compelling reason to continue requiring that only the VEC can select the question sets. The VE's could still use VEC-supplied question sets. Furthermore, they could use suitable prepackaged question sets from a source which used the same (VEC determined) algorithm (test construction

Element 2: At least 20 questions on Novice privileges.
Element 3: At least 50 questions concerning additional privileges of Technician and General class licensees.
Element 4A: At least 50 questions concerning additional privileges of Advanced class licensees.
Element 4B: At least 40 questions concerning additional privileges of amateur extra class licensees.

Table I– New written examinations must contain a question set as shown here.

formula) and standards required of the VE's, as long as concerns for security were met."

Thus, volunteer examiners are not only permitted to design their examinations, but are free to continue obtaining them from their VEC, or even purchase them in the publishing marketplace as long as a system exists precluding disclosure of exact test questions selected from the pool. Such a system might be a random selection scheme on a computer disk containing all test questions.

Question Pools and Test Design

The Commission said that after carefully evaluating the comments, they have concluded that the public interest would be served by transferring maintenance of the question pools for amateur examinations to the VEC's. "We believe that standardization can be achieved through cooperative efforts of the VEC's, through the standards which will be in the rules and by recourse to the question pools that we have maintained."

The January 1, 1987 date that the VE's can begin preparing question sets was moved up from January 1, 1987 *to immediately* upon routine Office of Management and Budget approval of the new procedures. OMB concurrence is necessary, since the new procedures involve an additional paperwork burden on the public.

VEC's were instructed to use the current FCC question pools as their base for the time being. "However, the pools should not remain static, but should track the dynamism in amateur radio technology. We anticipate that VEC's and VE's will be responsive to new development and update the question pools as needed," the FCC said.

The new rules also provide for a new type of volunteer examiner—the *Preparing Volunteer Examiner*. The current VE will now be referred to as an *"Administering VE"*—one of three VEC-accredited amateur operators who administer examinations to candidates for amateur operator licenses. A *Preparing VE* is one who submits questions or prepares written or telegraphy examinations for amateur operator licenses. He need not be VEC accredited, but must hold an amateur operator license of a class higher (if one exists) than the examination being prepared.

A Preparing VE is also permitted to supply (market) prepackaged question sets and telegraphy messages to Administering VE's if they are consistent with the coordinating VEC's published instructions and design formulas. Preparing VE's are not permitted to provide specific test designs to applicants, since Part 97 rules require that these be held secure against disclosure.

The transfer of the question pools to the VEC's has resulted in the deletion of PR Bulletins 1035A, B, C, and D which contain the FCC question pools. A new percentage system was adopted for selecting questions from various topics in the new VEC maintained pools. Provision was made for tests with more questions than is now the case. PR Bulletin 1035—the amateur radio operator license examination study guide (syllabus)—was also eliminated.

New Part 97.27(b) now provides for examinations being prepared by either the VEC or the administering VEs according to instructions from their coordinating VEC.

New Part 97.27(c) specifies that neither the same telegraphy message nor the same question set may be readministered to the same person.

New Part 97.27(d) requires that each VEC and VE must hold telegraphy mes-

Examination Topics:	Elements 2	3	4A	4B
1. FCC Rules, Amateur Radio Service	35%	18%	12%	20%
2. Amateur Station Operating Procedures	5%	12%	2%	10%
3. Radio Wave Propagation	5%	12%	4%	5%
4. Amateur Radio Practices	15%	8%	20%	15%
5. Amateur Radio Electrical Principles	15%	8%	20%	15%
6. Amateur Equipment Circuit Components	5%	6%	12%	10%
7. Amateur Equipment Practical Circuits	5%	4%	20%	10%
8. Transmitted Signals & Emissions	5%	8%	12%	10%
9. Amateur Antennas & Feed Lines	10%	14%	10%	10%

Table II– The topics and percentage of questions in each question set shall be that listed for the appropriate examination element.

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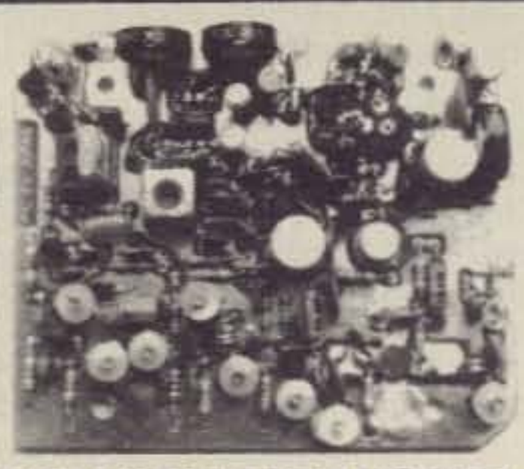

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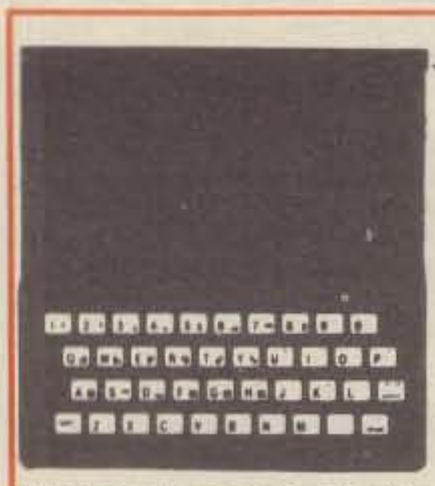

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sages and question sets for current and future examinations in confidence.

New Part 97.29 specifies that the examiners are solely responsible for determining the correctness of the candidate's answers.

New Part 97.517(a) authorizes VEC's to provide VE's with code and written tests.

New Part 97.517(b) specifies that only Extra class amateurs may prepare Element 1B (13 wpm) and 1C (20 wpm) code exams. Element 1A (5 wpm) may be prepared by Extra, Advanced, or General class VE's.

New Part 97.517(c) specifies that only Extra class amateurs may prepare question sets or submit pool questions for Elements 4A and 4B. Advanced and Extras: Element 3. Extra, Advanced, General, or Technician: Element 2.

New Part 97.521 outlines VEC question pool requirements. Each question pool must contain at least ten times the number of questions required for a single examination. No question may be used unless it appears in a published list made available to the public prior to its use for making question sets.

New Part 97.21(b) specifies that a telegraphy examination shall consist of a prepared message containing *all* the letters of the alphabet, numerals 0–9, period, comma, question mark, AR, SK, BT, and DN. Previous Part 97.27(a&b) stated that "The applicant is responsible for knowing, and *may* be tested on . . . etc."

(Note: We submitted a *Petition for Reconsideration* on this. We asked the FCC to permit a "good mix" of characters in code test messages rather than all of them. Most VE's/VEC's use QSO-type code tests, and it is burdensome to include all characters in the same QSO. For example, the SK and AR are difficult to use in the same code message, since SK means "end of contact" and AR means "end of message.")

Grading of Amateur Examinations

The FCC provided a means for volunteer examiners to use other than printed questions and written answers when administering examinations. "In anticipation of more reliance on computer assistance by administering VE's, the rule amendments are sufficiently flexible to accommodate other examination methods such as administering examinations at a computer terminal where the candidate will read a question from the screen, answer the question by stroking an appropriate key, and have it graded and the results recorded immediately," the FCC wrote in their Order. Again it appears that computer-generated tests/grading could be widely marketed and used.

The FCC made it clear that "Our experience to date with volunteer examining indicates to us that VE's are highly competent and dedicated to their tasks. All three VE's have passed the examination they are administering. They have also passed the next higher examination if there is one. While the administering VE's may obtain appropriate answers from the VEC or other sources as an aid in grading the candidates' answers, the responsibility for correctness of an answer given remains with the administering VE's."

1986 VEC Conference

The new rulemaking was discussed at the VEC Conference, and it was unanimously agreed upon by the VEC's that it would be in amateur radio's best interest if one set of pool questions was used by all VEC's. Answers would be provided as a convenience to VE's. Three VEC's in attendance were selected to form a "Committee for Question Pool Maintenance." This consisted of Ray Adams, N4BAQ, of the Western Carolina VEC; Jim Clary, WB9IHH, ARRL-VEC; and Gordon Girton, W6NLG, of the Sunnyvale VEC (California). Although the revisions to the pools will come from many sources, these individuals will form the final pool question evaluation committee. Jim Clary said that his participation would be contingent upon ARRL Director approval.

It was decided that publishers and instructors need a longer implementation period for new examinations. VEC's present voted in favor of a one-year moratorium on revising existing question pools except for "Topic I"—*FCC Rules and Regulations*. Thus, no new question pools will be implemented until after January 1, 1988. The new FCC developed Element 2/ Novice question pool was distributed to each VEC, but will *not* be implemented. The new Extra class pool released in April is being used effective October 1st, however.

The FCC pointed out that not only are VEC pass rates monitored, but so are those of geographical areas. Puerto Rico appears to have a higher pass rate than other areas. A procedure was adopted authorizing FCC supervised retesting of applicants when the retesting is requested by the same VEC as coordinated the original examination session. The FCC will utilize the resources of a different VEC when retesting is necessary.

The 1987 Conference of VEC's is scheduled to be held at the ARRL National Convention in Atlanta next July.

Novice

a monthly feature by
BILL WELSH, W6DDB

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Reciprocal Operating Agreements and Third-Party Traffic Agreements Applicable To USA Amateurs

Our government has two sets of international agreements that are important in regard to operation by US amateurs. These lists were updated 23 July 1986. We have reciprocal operating agreements with 67 countries. We have third-party traffic agreements with 40 countries. We have both reciprocal operating agreements and third-party traffic agreements with 31 countries.

One of these sets of agreements permits US amateurs to operate in foreign countries and permits amateurs of those foreign countries to operate in this country. This is called *reciprocal licensing*. In neither case are amateurs required to pass tests to operate in the other country; all licenses are accepted as proof of qualification. This reciprocal operating system is great for amateurs who visit other countries.

The other set of agreements concerns the exchange of non-commercial (personal) traffic between non-amateurs in different countries via amateur radio, which is greatly appreciated as a person-to-person service. This is the third-party traffic agreements list.

Fifteen-year-old Jason Sickler, NS0H, of Dickenson, North Dakota passed the Novice exam during February 1984. He progressed through the Technician, General, and Advanced tickets within two years. Jason passed the Extra class test in April 1986. His station includes a Kenwood TS-430S transceiver and a B&W inverted-vee antenna. He has contacted amateurs in about 40 states and 8 countries since he became an Extra. Jason is a member of the Theodore Roosevelt Amateur Radio Club. He credits Roger Beyer, N0FBA, with giving him a good start in amateur radio while Jason attended classes at the Trinity School.

2814 Empire Ave., Burbank, CA 91504

Table I shows the countries with which we have agreements, and which permit reciprocal licensing (R) and/or third-party traffic (T) exchange. Foreign country prefixes are included as an added aid. The most commonly used prefix is listed. However, most of these countries have other prefixes which they allow their amateurs to use.

Reciprocal Licensing. The FCC only issues reciprocal operating permits to visiting alien amateur radio operators who are licensed by (and are citizens of) the indicated countries. US citizens are not eligible to receive an FCC-issued reciprocal operating permit.

Any alien amateur may apply for a permit by completing an FCC form 610-A, attaching a copy of his/her valid license, and mailing these two items to the Federal Communications Commission, P.O. Box 1020, Gettysburg, Pennsylvania 17325 USA. Some US missions have this FCC form, and it can also be obtained from the FCC. An FCC-issued reciprocal operating permit is valid for one year, or until the alien's license expires, depending on which comes first.

Operating privileges of a reciprocal permit holder are detailed in 97.311 of the FCC rules and regulations (Part 97) governing the amateur radio service. Basically, the permit holder is limited to the operating privileges that apply to her/his class of license in her/his home country. However, US regulations must be obeyed, and the US Extra class privilege cannot be exceeded by any reciprocal licensee, regardless of the operating privileges that exist in her/his home country. Reciprocal permit holders do not automatically have American Extra class privileges when operating in the US. As an example, if one holds a license equivalent to the US General ticket, the reciprocal operating privileges are those of a US General class licensee.

The exact callsign shown on the permit must be used by the reciprocal operating permit holder. As an example, if the permit shows CP5WDX/W6, it is incorrect to use CP5WD/W6, CP5WDX/6, or any other unapproved identification.

US amateurs who want to obtain a reciprocal operating permit from any of the indicated countries, with which we have agreements, should request the appropriate forms from officials of those countries. US-based embassies and legations may have the required application forms. If not, address such a request to the amateur radio licensing authority in the capital of the country concerned. The ARRL has a reciprocal licensing expert who can probably provide names, addresses, and other data in response to requests.

This is 29-year-old Mark Bills, KA0VHY, of Mystic, Iowa. He was a shortwave listener five years before becoming a Novice. His station includes a Ten-Tec 509 Argonaut transceiver, Kenwood TS-520 transceiver, Yaesu FR-67 receiver, Heath SB-101 transceiver, MFJ Versatuner II antenna tuner, three Realistic receivers, and an assortment of other equipment and accessories. Mark enjoys working code contacts on the Novice bands.

When US amateurs operate in other regions and countries, they must abide by the rules that apply in those areas. As the saying goes, "When in Rome, do as the Romans do."

Third-Party Traffic. Third-party traffic involves at least one person in addition to the operators handling the traffic. Third-party traffic includes message traffic handled directly between amateurs, plus telephone-patch traffic in which non-amateurs speak to each other directly via amateur radio. International radio communications must be in plain language. Third-party traffic must be of a personal nature; business messages are prohibited. No amateur radio operator is allowed to accept money, service, or goods in exchange for handling third-party traffic. Only personal messages are allowed to be handled by amateur radio opera-

R	T	Prefix	Country
	*	VP2A	Antigua & Barbuda
*	*	LU	Argentina
*	*	VK	Australia
*		OE	Austria
*		C5A	the Bahamas
*		8P5	Barbados
*		ON	Belgium
*	*	VP1	Belize
*	*	CP	Bolivia
*		A22	Botswana
*	*	PY	Brazil
(1)	*	VE	Canada
*	*	CE	Chile
*	*	HK	Colombia
*	*	TI	Costa Rica
	*	CO	Cuba
*		OZ	Denmark
	*	J73	Dominica
*	*	HI	Dominican Republic
*	*	HC	Ecuador
*	*	YS	El Salvador
*		3D2	Fiji Islands
*		OH	Finland
(2)		F	France
	*	C53	the Gambia
*		DL	Fed. Rep. W. Germany
	*	9G1	Ghana
*		SV	Greece
*	*	J3	Grenada & Dependencies
*	*	TG	Guatemala
*	*	8R1	Guyana
*	*	HH	Haiti
*	*	HR	Honduras
*		TF	Iceland
*		VU	India
*		YB	Indonesia
*		EI	Republic of Ireland
*	*	4X	Israel
*		I	Italy
*	*	6Y5	Jamaica
*		JA	Japan
*	*	JY	Jordan
*		T3	Kiribati
*		9K2	Kuwait
*	*	EL	Liberia
*		LX	Luxembourg
	*	XE	Mexico
*		3A	Monaco
*		PA	Netherlands
*		PJ2-9	Netherlands Antilles
*		ZL	New Zealand
*	*	YN	Nicaragua
*		LA	Norway
*	*	HP	Panama
*	*	ZP	Paraguay
*	*	OA	Peru
*		DU	Philippines
*		CT1/CT4	Portugal
	*	VP2K	St. Christopher (Kitts) & Nevis Islands
*	*	J6	St. Lucia
	*	VP2S	St. Vincent & the Grenadines
*		S79	Rep. of Seychelles
*		9L1	Sierra Leone
*		H44	Solomon Islands
*		ZS	Republic of South Africa
*		EA, EA5, EA7	Spain
*		PZ	Suriname
	*	3D5	Swaziland
*		SM	Sweden
*	(3)	HB9	Switzerland
*	*	9Y4	Trinidad & Tobago
*		T2	Tuvalu Islands
(4)	(5)	G, GA, GI, GM, GW	United Kingdom
*	*	CX	Uruguay
*	*	YV	Venezuela
*		YU	Yugoslavia

Table I Notes

1. No reciprocal permit is required between Canada and the United States.

2. Reciprocal licensing also applies to French Guiana, French Polynesia (Gambier, Marquesas, Society and Tubual Islands, plus Tuamotu Archipelago), Guadeloupe, Ile Amsterdam, Ile Saint Paul, Iles Crozet, Iles Kerguelen, Martinique, New Caledonia, Reunion, Saint Pierre and Miquelon, plus the Wallis and Futuna Islands.

3. USA/ITU agreement authorizes third-party traffic to be exchanged between the USA and 4U1ITU (only) in Geneva.

4. Reciprocal licensing also applies to Bermuda, British Virgin Islands, Cayman Islands, Falkland Islands, Gibraltar, Hong Kong, Montserrat, Saint Helena, plus Turks and Caicos Islands.

5. Third-party traffic may be exchanged with United Kingdom special-events stations (GB prefix), except GB3 prefixed stations.

Table I– Countries with which we have agreements and which permit reciprocal licensing (R) and/or third-party (T) exchange.

tors. Amateurs are allowed to handle messages on behalf of third parties if the messages are of the character that would not normally be sent by any existing means of electrical communication, or except for an amateur radio station being available.

The callsigns of both the foreign station and the US station must be transmitted to identify transmissions of stations handling international third-party traffic. One's own callsign (alone) does not suffice in this case.

Amateur Radio Population in the United States

June 1986 FCC statistics revealed that 418,279 licenses were valid with USA amateurs. This represented an increase of 9211 (2.25%) licensees over our June 1985 status.

The June 1986 breakdown by class of license is as follows:

Novice	78,942	18.9%
Technician	84,985	20.3%
General	116,606	27.9%
Advanced	97,970	23.4%
Extra	39,776	9.5%

Novice and Technician licensees now comprise 39.2% of our amateurs, a 0.6% increase over one year ago. This 39.2% segment of USA operators shares the use of less than 5% of the high-frequency (3 to 30 megaHertz) spectrum that is available to USA amateurs.

Photographs Wanted

Photographs of Novices in their shacks provide introductions to a few of the newer amateurs. Photograph size is unimportant, but good definition, contrast, and subject matter are important. Color pictures can be used, but black-and-white photographs are preferred. Operating activities and achievements, plus a self-introduction, are needed with each picture. Send SASE if a picture must be returned. A free one-year *CQ* subscription (or renewal) is awarded to the one amateur whose picture I select as the winner for the month. If you are a subscriber, please enclose the mailing label (or copy) from your latest *CQ* issue. One award is made each month, no matter how many photographs are printed. DX amateurs, who frequently work the American Novice bands, are also urged to submit photographs.

Tech Talk from ICOM

ICOM

VHF Mobiles: Going First Class

Two meter and 70cm FM mobile activities are an extremely popular pursuit among today's radio amateurs, and there are some good reasons for that situation. Modern VHF and UHF transceivers boast a dazzling array of operating features, yet they're small enough to fit in the confined space of any auto's interior. Reduced size and unobtrusive VHF and UHF antennas are also easy to assemble and install on modern "bumperless" autos. Modern amateur communications couldn't be easier or more enjoyable!

VHF and UHF band propagation is basically line of sight, however group and club supported repeaters placed atop mountains and tall buildings throughout our great land extend that coverage in an almost overlapping manner. Indeed, it's quite natural for one to travel from coast to coast while chatting with other amateurs via their area's FM repeaters. Many of those repeaters also include local autopatch telephoning capabilities which can be accessed via a transceiver's DTMF keypad.

Meanwhile, the nature of FM's "interference free copy" encourages friendly conversation type QSOs rather than mere exchanges of names and signal levels. It's a grand way to experience the true pleasures of amateur radio communications, and ICOM wants to help you join these activities in high style. We offer five exciting transceivers to fit your personal preferences: The IC-28A, IC-28H, IC-27A, IC-27H and the IC-3200A. Each of these new generation units include all of the flexibilities and luxuries modern technology has to offer, yet each is very easy to understand and operate anywhere or anytime.

ICOM's new IC-28H (45 watts output) or IC-28A (25 watts output) two meter transceivers are ideal traveling companions for the open road. The unit's wide frequency coverage of 138 to 174MHz includes MARS and CAP operations, plus it receives continuously available NOAA weather broadcasts in the popular 162.550MHz range. If you enjoy space age SWLing, you can even listen for Russian space missions reported active in the 143MHz range.

Scanning of the IC-28A/H's 21 memories can be accomplished via its main dial or microphone buttons, or selected memories can be scanned while in the memory scan mode. You can activate or cancel their automatic scanning from the microphone for ultimately convenient mobiling.

The IC-28A/H includes a large LCD readout which can be viewed from any angle, plus an automatic dimmer that reduces its backlight during night use. All popular PL tones are built-in and any "odd repeater split" can be programmed into the IC-28A/H. It's a "do anything unit", yet it's super easy to operate. If your auto's cramped for space, the IC-28A is only 5.25 inches deep. Thinking about Packet? The IC-28A and IC-28H boasts exceptionally fast switching times, and performs like a Packateer's dream.

ICOM's ever popular IC-27H (45 watts output) and IC-27A (25 watts output) transceivers concentrate a glamorous array of operating capabilities into a thin package covering the 140 to 150MHz range. This unit's dual VFOs and nine memories can be tuned via its main dial or microphone buttons as desired. Programmable or full band scanning is available, along with two tuning rates.

Band or memories can be automatically scanned for busy or open channels (convenient for checking active repeaters or availability of heavily used autopatch systems). Scan speed and pausing times are also selectable. A special priority function lets you spot check any VFO or memory channel, all popular PL tones are included, a DTMF keypad is built into the mic, and an optional UT-16 voice synthesizer will announce the unit's operating frequency. This transceiver has everything!

Both two meter and 70cm amateur bands are thriving with FM activity, and ICOM's Dual Band IC-3200A lets you enjoy all of their action in the easiest and most comfortable manner possible. Using only 14 front panel controls, this super compact unit covers 140 to 150MHz plus 440 to 450MHz with any repeater split and popular PL tone readily available and programmable into its ten memories.

Its dual VFOs and memories can be fully or partially scanned from the front panel's button or steptuned from the mic. That mic, incidentally, is ideal for autopatching without "dashboard fumbles". Finally, the IC-3200A's built-in duplexer provides dual band operation using a single coax line. When teamed with ICOM's AH-32 dual band antenna and AHB-32 padded trunk lid mount it's a double winning setup!

Want to enjoy VHF/UHF activity in top style? Think ICOM! ICOM's customers say its transceivers are simply the best, and those opinions ring louder each day!

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- **Packet Compatible**
- **21 Memory Channels**

The IC-28H has all the features you need for carefree 2-meter mobile operation. The only thing it doesn't have is a big price.

45 Watts. The IC-28H provides a full 45 watts of powerful output. The **IC-28A** 25-watt version is also available. Both units have a selectable low power.

Large LCD readout. A wide-view LCD readout can be easily read even in bright sunlight. An automatic dimmer circuit reduces the brightness for evening operation.

CIRCLE 178 ON READER SERVICE CARD

Wideband Coverage. The IC-28H performs from 138–174MHz (specifications guaranteed from 144.00–148MHz) and includes weather channels. Ideal for MARS and CAP operation.

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The IC-27H 45 watt and IC-27A 25 watt ultra compact 2-meter mobiles continue to be available.

21 Memory Channels. Store 21 frequencies into memory, or lock out certain memory channels. All memories are backed up with a lithium battery.

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Available Options. IC-HM14 DTMF mic, PS-45 13.8V 8A power supply, UT-29 tone squelch unit, SP-10 external speaker, IC-HM16 speaker mic and HS-15/HS-15SB flexible boom mic and PTT switchbox.

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VHF

a monthly feature by
STEVE KATZ, WB2WIK

PRINCIPLES, PRACTICES, AND PROJECTS FOR THE VHFER

The NC1I/1 70 cm EME VT Expedition

The following report is from Bob McCormick, KA1KPH, of Feeding Hills, MA. Bob, Frank Potts, NC1I, and Lanny Aldrich, K1LEC, devoted considerable time and effort this past June to putting a rare state (Vermont) and grid square (FN33) on 70 cm with an effective moonbounce station. Passages taken directly from Bob's report are shown within quotation marks.

"The planning stage started in the fall of 1985 and went on for many months. In the spring of 1986, Frank (NC1I) and Bob (KA1KPH) took a drive up to the Springfield, VT area where Bob's parents lived. The search was underway, with the snow still knee deep in some areas! The goal was to find a site with all the luxuries of home, including 220 VAC service at 20 amps, a horizon-to-horizon moon window, minimum RF interference, and preferably located in a new grid square."

Unfortunately, Murphy fouled things up as usual. While an ideal hilltop site with 220 VAC service in a horse barn existed, the owner of the property denied the fellows access. To further complicate matters, it wasn't discovered until the last moment that due to a mixup in published dates for the ARRL June VHF QSO Party, our stalwart group planned their moonbounce expedition for the same weekend as the popular contest. (They intended their operation to be the week *after* the contest to minimize potential QRM from local high-powered contesters.) In their renewed search for a site, they now had to consider shielding their setup from the W1TKZ/1 contest operation on Mt. Equinox, not easily done in southern Vermont. They found an ideal site on the property of Mr. Bob Barlow, whose cooperation was largely responsible for the ultimate success of the expedition.

"On June 8th Frank, Bob, and Bob's son Shawn, NC1B, loaded a truck full with aluminum and headed for Vermont to erect the antenna system. They began work by lashing three sections of Rohn 25G tower to a vertical I-beam using 5/8 inch rope . . . .

"The array consisted of four 24 foot long, 32-element Yagis which were designed, assembled, and provided by Steve Powlishen, K1FO. These antennas were identical to those used by NC1I at his home QTH. A KR500 (Ken-Pro) elevation rotor and HAM-II (Telex) azimuth rotor controlled the array. The phasing lines consisted of sections of (Andrews) LDF4-50A with a KY4Z half-wave power divider which was mounted at the back of the array. The tower-mounted (receive) preamp was a modified A.R.R. P432-VDG, and a piece of LDF4-50 was used on transmit, with Belden 9913 (cable) used for receive."

On the morning of Friday, June 13th (uh oh!) Frank and Bob packed up and transported the station for their three-day expedition. The rig was a Drake "C" line with a Microwave Modules MMT432/28S transverter, a KLM 100 watt solid-state intermediate power amplifier, and a homebrew K1FO final amplifier using an 8938 (tube). Having set up the antenna system and the station, the first order of business was to check for sun noise—a valid indicator for checking the moonbounce worthiness of a station. Their crude measurements indicated only 4 dB of sun noise, which isn't much, but by 2045 UTC Friday the group had made their first EME contact with DL9KR.

Lanny, K1LEC, and Frank, NC1I, lashing a section of Rohn #25 tower to the steel I-beam used for support during the NC1I/1 EME expedition to VT.

"At 2355 UTC the moon became visually trackable, yielding stronger and more consistent signals . . . . Fortunately, the sky was clear for more than 75% of available moon time, allowing the array's alignment to be visually confirmed throughout the rest of the expedition. Frank (NC1I) experienced ample frustration because many stations were calling on the same frequency . . . . At times it seemed like all of Europe was calling, but signals were weak and calls could not be deciphered.

"As soon as the June VHF QSO Party started, the band was inundated with radar signals consistently peaking at 40 dB/S9. The interference forced a shutdown of the operation for some time. Reports indicated that the problem was shared by all 70 cm stations in the northeast . . . ." Boy, can I identify with that one! Is radar interference a universal problem, or are we in the northeast corridor especially plagued by this stuff?

"On more than one occasion the operator's ears were blasted by a local contester who found NC1I/1 down at the low end of the band, on 432.005 MHz. It's funny that someone would sit around for a 2½ minute CQ and then respond! Frank's ears were left ringing for what seemed like hours when one station replied at 0408 UTC, which was midnight local time, as Frank was struggling to work a station on his setting moon. Needless to say, the local contester got his point."

This is a problem for all weak-signal enthusiasts. I wish we could convince our fellow operators to remain silent until the DX contact, be it off the moon or otherwise, has been completed. Nothing is more annoying than being blasted by a local with a 60 over S9 signal when one is struggling to complete a QSO with a station in the noise.

Probably due to less than ideal conditions and a marginal setup, NC1I/1 never heard his own echoes throughout the three-day expedition to VT. As EMEers know, one needn't hear his own signals reflected from the lunar surface in order to make solid contacts. NC1I was pleased with the cooperation and patience of the operators at the stations he worked, for few contacts were routine; many contacts required an hour to complete, at least partly because Faraday rotation was especially bad during the expedition weekend. For the uninitiated, severe Faraday effect greatly reduces the chances for linearly-polarized stations to work each other off the moon.

"The fact that only 6 of the 22 stations that were worked were 'Yagi stations' reinforced the observation of unfavorable conditions. Although the Faraday seemed more favorable during several periods, these were short lived. All contacts were made on random." (Random means no prearranged, scheduled contacts.)

153 Rodman Court, Eatontown, NJ 07724

Lanny Aldrich, K1LEC, makes a final adjustment on the NC1I/1 70 cm EME array.

Stations with the strongest signals received by the NC1I/1 station included DL9KR, K5JL, YU1AW, and I5MSH. Besides the 22 stations worked, NC1I/1 heard K8WW, DL9EBL, and G3SEK, and they believe W1ZX/3 and W7JF were calling (no confirmation of this).

". . . DL9KR and K5JL were by far the best signals of the weekend, with FB RST reports and grid squares exchanged both ways—just like home! It's a good feeling to work someone off the moon and have an "armchair copy" QSO. Usually, this is only accomplished when at least one station involved is using an enormous station.

"The DXpedition ceased operation at 2100 UTC on June 15th. The station was disassembled and packed up for the trip with everyone on the road by 2300 UTC." (That's fast work, fellows.) "The antennas remained behind with plans to return two weeks later for their removal. Upon return, the entire antenna system, including the tower, was completely loaded into the truck in less than two hours." (Ditto.)

The group's biggest disappointment, next to the lousy conditions, remains their poor QSL return rate.

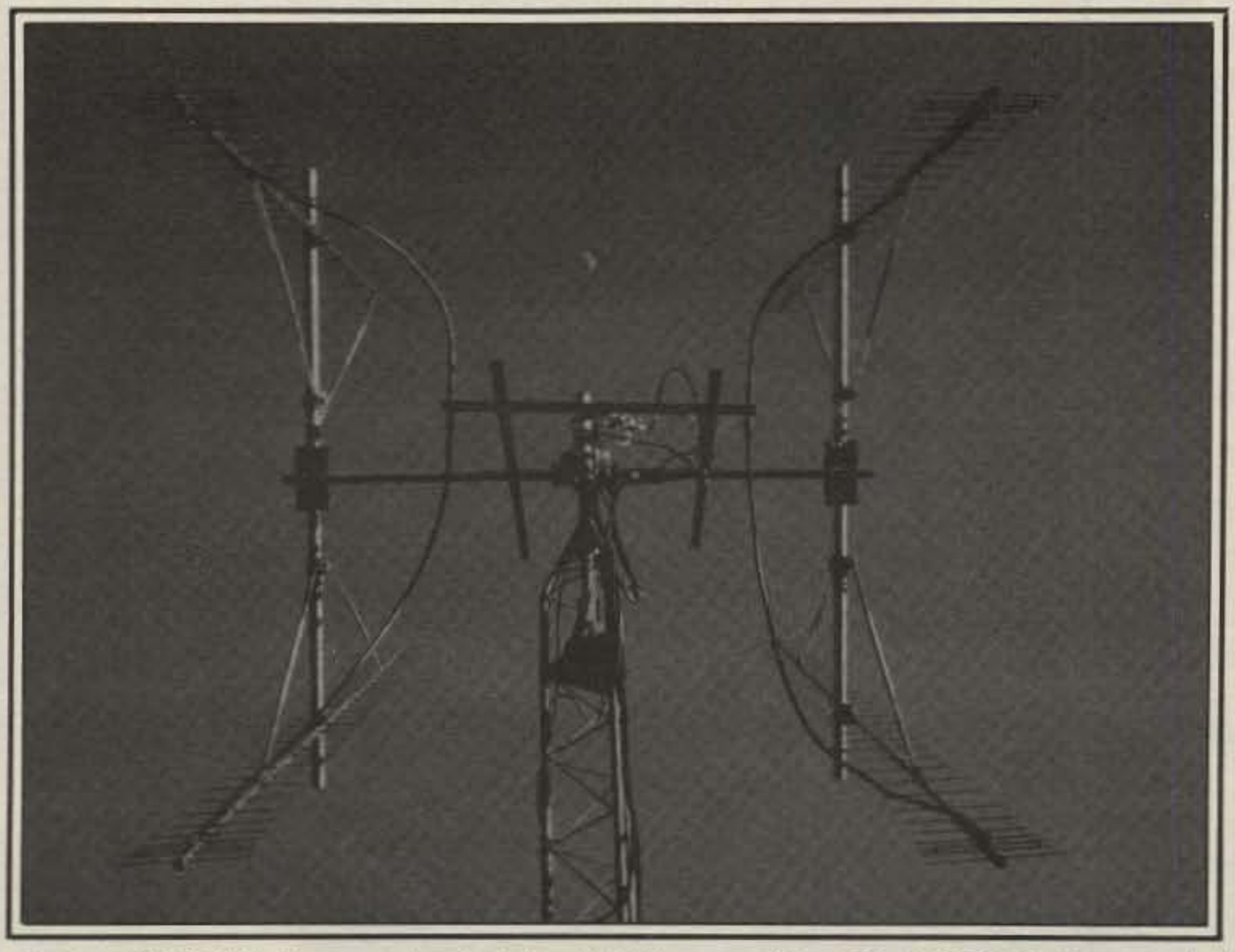
"At the time, all 22 stations worked were mailed a QSL card. Two months after the operation, only four QSL cards had been received. Since then, only two additional cards have been received. Where's the rest of the cards?!

"With all things considered, the DXpedition is viewed as a success. Working more stations would have been nice, but considering the operation took place during a summer weekend with less than optimal conditions and with limited advanced notification, the outcome is better than expected. If no one becomes active on 70 cm EME from Vermont, an encore performance will be staged, perhaps in 1987. Your input is needed!"

Well? If you're on 432 MHz EME and need VT for WAS, or need FN33 for VUCC, drop Bob a note. His address is P.O. Box 17, Feeding Hills, MA 01030-0017.

Bob and Frank offer their thanks to Bob's parents, who provided sleeping quarters and food; Chip, W1AIM, and Lanny, K1LEC, who helped in selecting the operation location; Steve, K1FO, for the antennas and technical support; and Shawn, NC1B, who assisted with the installation and removal of the station and antennas.

The NC1I/1 operation typifies the kind of true amateur radio spirit we all appreciate. If not for this and similar operations—most of which require the expenditure of considerable work, time, and money—the pursuit of VHF operating awards (WAS, VUCC, etc.) would be very frustrating. Similar moonbounce stations have been set up in the past (W3CCX, W5FF, K2UYH, N6NB, K6MYC . . . the list is long), and I hope new faces will continue to light the VHF "DXpedition" scene. Thanks for a fascinating story, Bob.



Ah, there it is! With the moon in sight, the NC1I/1 array of 4 × 32-el K1FO Yagis generated enough signal for 22 QSOs during the weekend of June 14, 1986.

Big News for Users of Belden 9913

And who isn't? I first began using 9913, the ultra low-loss RG-8 style coaxial cable which is brother to heliax but much lower in cost, when it first appeared on the market in early 1984. Since that time I've probably installed a hundred connectors on the stuff. While PL-259 "UHF" connectors fit the 9913 cable like a glove, they are not very usable above 220 MHz, and they are never watertight, so they require careful wrapping with vinyl tape, "Coax-Seal," or something similar.

Standard UG-21B/U "Type N" fittings must be modified to accommodate 9913's extra-large center conductor, and Amphenol (among others) now offers special constant-impedance connectors which fit 9913 but are still less than ideal; after all, 9913 doesn't have 97% braid coverage like the good military cables offer, so there isn't much braid for the standard type-N clamp to grab. This makes for a connection which might work electrically, but is weak mechanically. And although N fittings are weather-resistant, they really aren't watertight.

Gilbert Engineering to the rescue! This Glendale, AZ company manufactures a type-N crimp connector which fits 9913 cable perfectly and can be made totally weatherproof by the simple installation of a section of Alpha FIT21 shrink tubing over its rear end. The type-N male connector's part number is NS-3008-29, and it is very reasonably priced at $2.35 each ($100 minimum order), making it even less costly than a standard type-N (military) clamp connector. The crimp fitting is designed to offer constant impedance through the low microwave region, and is easily installed with Gilbert's GCRT-213 crimp tool ($45.26). The connector manufacturer recommends the use of Alpha FIT21 shrink tubing, suitable shrunk over the rear of the connector and the adjacent cable, to assure a watertight seal. It should be noted that FIT21 contains a plasticizer which remains elastic after shrinkage and is thus better suited for this application than other types of shrink tubing.

You may contact Gilbert Engineering by writing to them at 5310 W. Camelback Rd., Glendale, AZ 85301, or by calling (602) 245-1050. I've already ordered my connectors. The deal sounded too good to beat.

By the way, I've had at least one negative experience with 9913 cable (although in general, I love it). I had a 60 foot long section of 9913 spliced between two sections of "hardline," to extend the feedline of a relocated 2 meter beam. While "UHF" connectors were used on both ends of this cable, the fittings were expertly installed (by me, and I've installed thousands), with all the solder holes properly filled and all solder properly reflowed. Over each connector were several overlapping layers of "Scotch 88" type vinyl tape (which is great stuff) totally sealing the connector and the "barrel" fitting to which it was connected, and the cable itself for about 2 inches past the connector. This was a *really* watertight installation. Or so I thought, until the VSWR on that particular 2 meter beam started to climb.

I blamed the beam and its matching device (this was a Cue Dee Yagi, well-made in Sweden, with a gamma match); then I blamed the

coaxial "splices," which were made with high-quality Amphenol fittings. In fact, I blamed almost everything but the real culprit, which turned out to be the 9913 cable itself.

To determine if the cable was at fault, I removed it from the system entirely and dragged it down the tower. Both terminating connectors were dry (as a bone, so to speak), and the metal plating was still shiny. "No water ever got in here," I mused to myself. I gave the cable to a friend, Luther Quick, WA2DTA, who took it to his microwave lab at work and "swept" the cable for return loss. It was terrible! Using a time-domain reflectometer, Luther was able to quickly pinpoint the trouble, which was a major impedance bump somewhere near the midpoint of the cable. Or was it? Every time he moved the cable, the "bump" point changed location.

At this point, Luther did the reasonable thing and drilled a hole into the cable at the approximate location of the "bump." To quote WA2DTA, "The SWR ran out on the floor!" It was water, and its location in the cable was free to move about at will due to the heliax-like construction of 9913 cable. I never did find out how the water penetrated the cable, seemingly without ever getting past either connector.

I guess this is a word to the wise and wary: Due to the construction of 9913, it is far more prone to water problems than standard RG-type cables with solid or cellular dielectrics. Be certain that your installation is watertight, and assume that if your VSWR suddenly rises, the cable probably contains water!

Notes From Everywhere

Don Ryan, WZ4K, is an active VHFer from Virginia Beach, VA (FM26) who recently changed jobs, antennas, and rigs! Don says he's happy working in avionics for Piedmont Airlines (my favorite carrier for our annual Dayton pilgrimage), and has new antennas for 144 and 432 MHz, plus a mast-mounted preamp for the higher band, new heliax feedlines, the works. He recently installed the muTek front-end in his IC271A and reports that it works "really great."

On my advice, Don obtained an MMT432/28S transverter, but got less than he bargained for. He found a used one at a hamfest, and his "bargain" module turned out to be "a mess." After having the unit repaired by the PX Shack, he thought about modifying his IC-730 for use with the transverter, but opted to go for broke with a brand-new IC-471A and Tokyo Hi-Power Labs HRA-7 preamp. How's that preamp work, Don?

WZ4K asked my advice about cleaning some 28 uH roller inductors in an ultrasonic tank. This doesn't sound like a VHF question (28 uH is an awful lot of inductance for 70 cm!), but I'll address it anyway. My advice with corroded or oxidized copper or silver would be to first hand-polish with a proper slightly abrasive cleaner such as "Twinkle" applied to a damp sponge. Once the metal shines, rinse with deionized water. If all the cleanser isn't removed by a simple rinse, then try an alcohol or fluorocarbon solution in your ultrasonic cleaning tank, followed by a deionized water rinse. After the final rinse, avoid touching the polished metal with your bare hands and fingers. Use cotton gloves until the part is firmly installed in position so that it no longer requires handling.

In my opinion, the deionized water rinse is worth the small amount it costs. Household tap water often contains minerals which accelerate corrosive action.

Thanks for the nice letter, Don. Hope I answered your question.

Harry Searles, KL7JHX. of Roseburg, OR wrote to ask about "minimum station" requirements for scatter and aurora work. I replied to Harry with a personal letter, but will summarize some of my comments here.

First of all, I'd recommend reading this column for January through April 1985 (Holy cow! That was nearly two years ago!), for these tutorials contained several tips on weak-signal-mode VHF operation. Next, I'd say to start out on 6 meters if you can; both meteor scatter and Au are more easily worked on 6 than on the higher bands, so this is a terrific learning ground. Meteor-scatter signals tend to peak in strength at about sunrise each day, and my experience indicates more scatter activity on Sunday mornings than any other day. Therefore, if one wishes to learn about m.s. work, one must be willing to arise very early (at least in the summer—later in the winter) on Sunday mornings!

A minimum station for 50 MHz might be 100 watt transmitter power to a 10 dB antenna system; receiver noise figure at this low a frequency is not an important consideration, although rejection to overload from strong local signals in the band can be extremely important. Such a 1 kw ERP (effective radiated power) station should be capable of working random meteors with some success, although operator prowess will play a major role here. A better-equipped station, such as 1 kw output power to a 13 dB antenna (i.e., 20 kw ERP) will help stack the odds in your favor when trying to work weaker scatter; however, I'd rather have a pro-

ficient operator working on my 100 watt station than a neophyte working my legal-limit equipment.

Six meters produces scatter signals which can be so strong at times that it is construed as E-skip. During these brief periods, stations running real QRP have completed scatter contacts. But I would not recommend low power for m.s. work, as frustration levels will run high and frustrated operators tend to lose interest quickly.

After pruning your operating skills on 6 meters, the transition to 2 meters is easier. Weaker and shorter duration scatter signals are produced on 144 MHz, so stations need to be better equipped. I'd say a typical 2 meter scatter station is 1 kw PEP output to a 16 dB antenna system (40 kw ERP) with enough elevation to have a low-angle shot to a distant horizon. Not that m.s. cannot be worked with a lesser station—it certainly can—but success rate will depend heavily on station performance and operator experience. Also, on 2 meters receiver noise figure becomes more important; not just any receiver will do an adequate job.

Minimum station for Aurora work, when the "buzz" is good and strong, is very modest: perhaps 100 watts ERP and a decent receiver, plus a good ear for fuzzy signals, are all one needs. However, as with any mode, the better the station, the more likely will be your success. And again, like with nearly any mode of operation, the antenna system is the best place to sink the money, as you'll get more return for each dollar invested than you will with expensive station equipment. Six meter amplifiers are easy to assemble and not critical in construction technique. I personally use a homebrewed 4-1000A amp (1500 watts out), and recently built an 8877 amp for 50 MHz (also 1500 watts out), which will be the subject of an upcoming construction article in *CQ*. Anyone with a few hand tools can get a legal-limit amp running on 50 MHz.

Aurora becomes more rare as the distance from the magnetic north pole is increased (this is a point in northern Greenland), so it isn't very popular on the west coast; however, Au has been worked as far south as Los Angeles (on very rare occasions), and I believe it is not uncommon in Vancouver. Obviously, the general Au beam heading is towards geomagnetic north (not towards the north pole), and your "shot" in that direction will largely determine your success with the mode.

Good luck, Harry, and let us know how you're doing.

Mike Eilers, K8OOK, or Grand Rapids, MI, wrote to say he's worked 38 states and 111 grids thus far, using a barefoot IC551 (10 watts) and a 3-element beam at 35 feet on 50 MHz. Mike's been on 6 meters for only four years, so he missed the great F2 openings of the last solar cycle peak (1979-1980). As such, his work is impressive. K8OOK is disappointed in local contest activity, and says after he works the "big guns" in his skip zone, he is "done for the weekend."

My suggestion is, why not build a 50 MHz amplifier and start working some of that early-morning scatter, Mike? A single 4CX250, 8930, 8874, 4-400, or the like will run at least 500 watts output on 6 meters, and such an amplifier can be built from surplus parts for little more than a song. The IC-551 has an adequate receiver for casual scatter work, and maybe you can add a couple of elements to that 3-element Yagi to build up a bit more gain, always useful on transmit and receive. With maybe $100 more invested, you could probably double the number of grid squares worked each contest. I, for one, make about half my 6 meter grids each January Sweepstakes via meteor scatter on Sunday morning, and most of those grids are out your way, Mike!

Speaking of the January contest, it's coming up in just a few weeks. Are you ready? I hope I will be. We've just moved to a new QTH, and tower installations took a back seat to unpacking the essentials. I do have a brand-new W-51 (Tri-Ex crankup), a pile of shiny stainless steel hardware to replace the rusty stuff that had to be hacksawed through when removing the old antennas, lots of new 9913, and most of the essentials for putting a good station back together. Now all I need is the time. Murphy even bit me when I wasn't looking, during our homesite selection in June. It turns out that I'll be in FN20, one of the least rare grids in the east, by virtue of less than one mile. Had we chosen a site just a mile to the east, closer to the beach, I'd be in FN30—a grid which is amazingly rare (especially on the higher bands), considering it contains much of New York City and all of Long Island. Rats!

Looking for new grids on two? WA7VHW is active from DN07 using an 8877 kw to an 11-element W5UN quagi on a 25 foot boom at 50 feet, and Don has been working some excellent m.s. from his new QTH. His report of August 27 included the details of his Perseids (meteor shower) sked with W0KEA in Colorado (DM69). Don was also successful in completing meteor contacts with seven other stations, including two randoms, K6PVS and VE5LY.

WA7VHW is very interested in knowing if any other readers experienced the "blue whizzer" (long meteor trail which makes for strong, steady signals) between 0526 and 0529 UTC on August 13. It was during this period that he and Phil, W0KEA, exchanged not just callsigns and reports, but commented on the weather, their amplifiers, etc., all during one "burn" that produced signals of S9 + 40 dB average. Surely others had similar experiences from this lengthy burn, and Don is anxious to hear of them. By the way, WA7VHW was using an IC-211 with only the MOSFET preamp in his THL 80 watt "brick" amplifier following the loss in his 100 foot feedline for his receiving system during the Perseids shower in August. I'd estimate that receive system to have a noise figure of about 5 dB! Don should have a better receiving system running by now, but this goes to show what can be done with modest equipment under the right conditions.

Another Perseids report came in from Allen, KA3NTX, who operated from his home QTH in PA. Using an IC-260A with an 85 watt amplifier and a single 15-element Cushcraft (model 215WB) beam, Allen worked W8ZZM in EN57, about 750 miles, and heard several stations from WI and MN. He also heard VE3KRP in Thunder Bay, ONT (EN58), but no contact was made. Allen operates during the school year from Michigan Technological University in EN57 using the club station W8YY. Anyone needing this grid is encouraged to write KA3NTX for a sked. His address is 218 D.H.H., Michigan Tech. Univ., Houghton, MI 49933.

A new VHF award is sponsored by "The West Coast VHFer." Called the Worked All California Grid Squares award, this new activity will reward stations who contact a given number of California's grid squares using the frequencies above 50 MHz. The number of grids required will be based on the frequency band, and had not been determined as of the October 1986 newsletter. The sponsor is soliciting comments from VHFers and asks that interested parties write to John Kitchens, NS6X, P.O. Box 939, Camarillo, CA 93010. "The West Coast VHFer" mailing address is P.O. Box 2041, Oxnard, CA 93034. This excellent newsletter is published monthly by Bob Cerasuolo, WA6IJZ. Domestic subscriptions are available for $10 annually.

The Mt. Airy VHF Club held their annual VHF/UHF conference and fleamarket the weekend of October 4–5. I was too busy packing for a move to attend the conference on Saturday, but I dragged myself away from this most fascinating activity to attend the terrific fleamarket Sunday morning. The weather was spectacular and helped produce what I'd guess were record crowds. If you are interested in VHF/UHF, live within a day's drive of the Philadelphia suburb of Warminster, PA, and don't attend this fleamarket, you're really missing something special. The Pack Rats' (members of the MAVHFC) timing is marvelous in that one has time to pick up items at their October fleamarket and get them working in time for the January contest! Bravo for another good show.

I'm still attempting to get four product reviews finished, so please be patient. One of the new products for review is the KLM 44-element 23 cm Yagi, which was being tested at a small "antenna range" in upstate NY as this was written. Wintertime in the northeast is perfect for antenna work, as you tend to move fast before frostbite sets in. Happy Holidays and see you in '87.

73, Steve, WB2WIK

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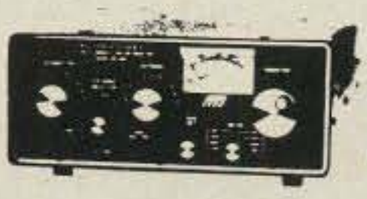

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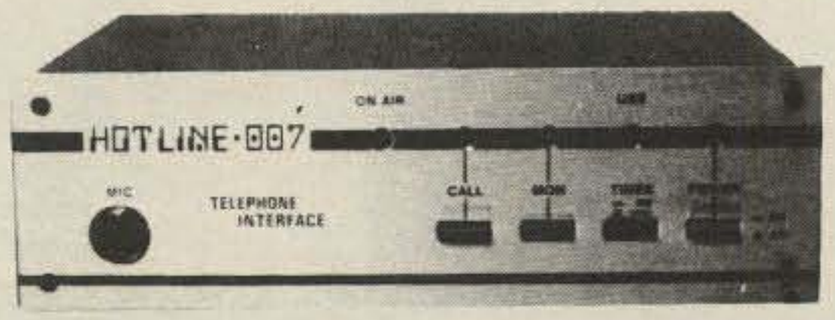

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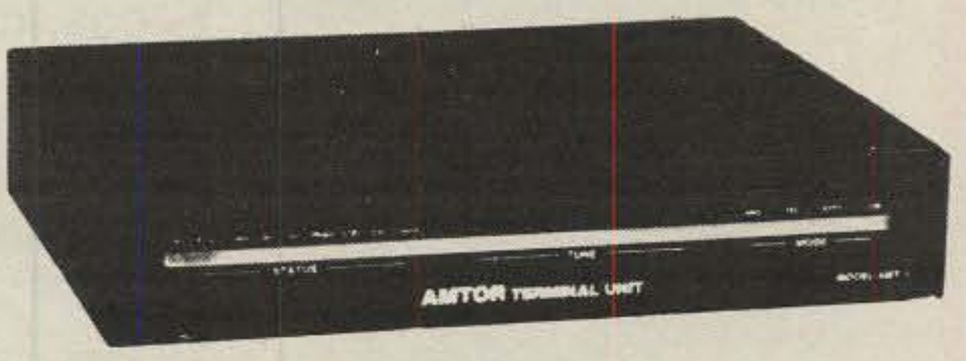

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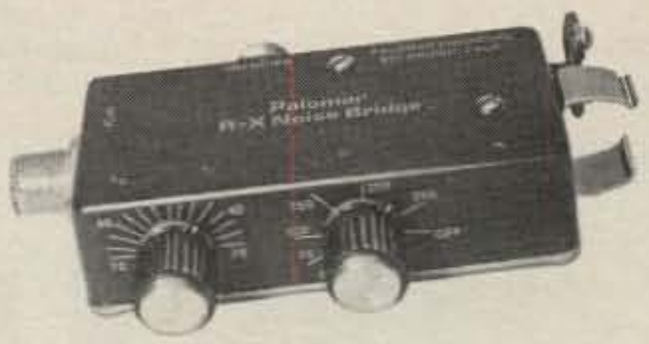

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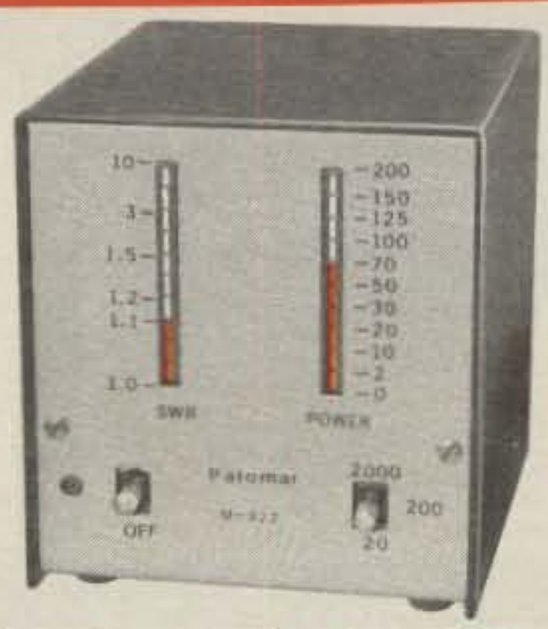

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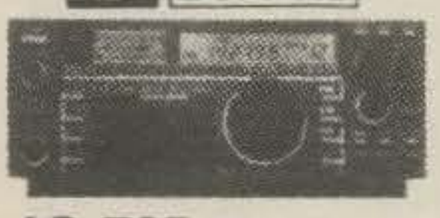

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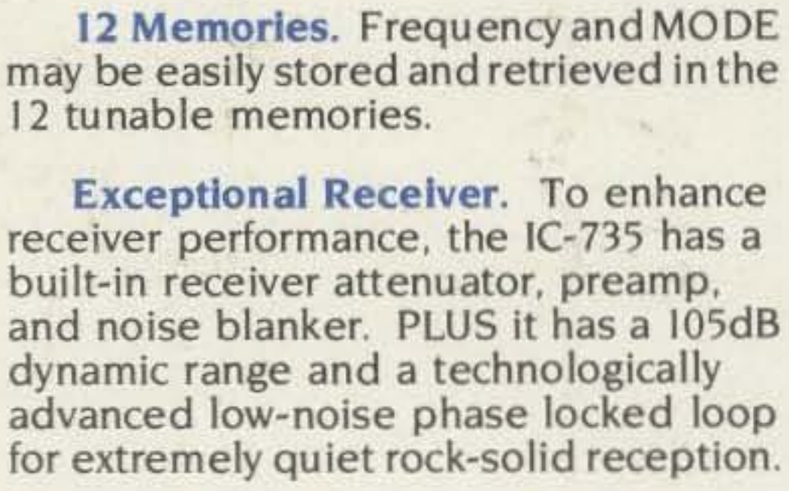

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