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The Suitcase Antenna Tuner

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THE RADIO AMATEUR'S JOURNAL

KENWOOD

...pacesetter in Amateur Radio

All-mode tri-bander!

Warp Drive!

TS-790A

Satellite Transceiver

The new Kenwood TS-790A VHF/UHF all-mode tri-band transceiver is designed for the VHF/UHF and satellite "power user." The new TS-790A is an all-mode 144/450/1200 MHz transceiver with many special enhancements such as automatic uplink/downlink tracking. Other features include dual receive, automatic mode selection, automatic repeater offset selection for FM repeater use, VFO or quick step channel tuning, direct keyboard frequency entry, 59 memory channels (10 channels for separate receive and transmit frequency storage), multiple scanning and multiple scan stop modes. The Automatic Lock Tuning (ALT) on 1200 MHz eliminates frequency drift. Power output is 45 watts on 144 MHz, 40 watts on 450 MHz, and 10 watts on 1200 MHz. (The 1200 MHz section is an optional module.)

- **High stability VFO.** The dual digital VFOs feature rock-stable TCXO (temperature compensated crystal oscillator) circuitry, with frequency stability of ±3 ppm.
- **Operates on 13.8 VDC.** Perfect for mountain-top DXpeditions!
- **The mode switches confirm USB, LSB, CW, or FM selection with Morse Code.**
- **Dual Watch allows reception of two bands at the same time.**
- **Automatic mode and automatic repeater offset selection.**
- **Direct keyboard frequency entry.**
- **59 multi-function memory channels.** Store frequency, mode, tone information, offset, and quick step function. Ten memory channels for "odd split."
- **CTCSS encoder built-in.** Optional TSU-5 enables sub-tone decode.
- **Memory scroll function.** This feature allows you to check memory contents without changing the VFO frequency.
- **Multiple scanning functions.** Memory channel lock-out is also provided.
- **ALT—Automatic Lock Tuning—on 1200 MHz eliminates drift!**
- **500 Hz CW filter built-in.**
- **Packet radio connector.**
- **Interference reduction controls:** 10 dB RF attenuator on 2m, noise blanker, IF shift, selectable AGC, all mode squelch.
- **Other useful controls:** RF power output control, speech processor, dual muting, frequency lock switch, RIT.
- **Voice synthesizer option.**
- **Computer control option.**

Optional Accessories:

• **PS-31** Power supply • **SP-31** External speaker • **UT-10** 1200 MHz module • **VS-2** Voice synthesizer unit • **TSU-5** Programmable CTCSS decoder • **IF-232C** Computer interface • **MC-60A/MC-80/MC-85** Desk mics • **HS-5/HS-6** Headphones • **MC-43S** Hand mic • **PG-2S** Extra DC cable

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

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COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 E. Dominguez Street
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KENWOOD ELECTRONICS CANADA INC.
P.O. BOX 1075, 959 Gana Court
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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.
- **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.)
- **Built-in automatic antenna tuner (optional).** Covers 80–10 meters.
- **5 IF filter functions**
- **VOX, full or semi break-in CW**
- **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.
- **AMTOR compatible**
- **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)**
- **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**

Optional accessories:

- AT-440 internal auto. antenna tuner (80 m – 10 m)
- AT-250 external auto. tuner (160 – 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-3D 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-4/5/6/7 headphones
- SP-41/50/50 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 (no pan display)
- VS-1 voice synthesizer
- TU-8 CTCSS tone unit
- PG-2C extra DC cable.

Kenwood takes you from HF to OSCAR!

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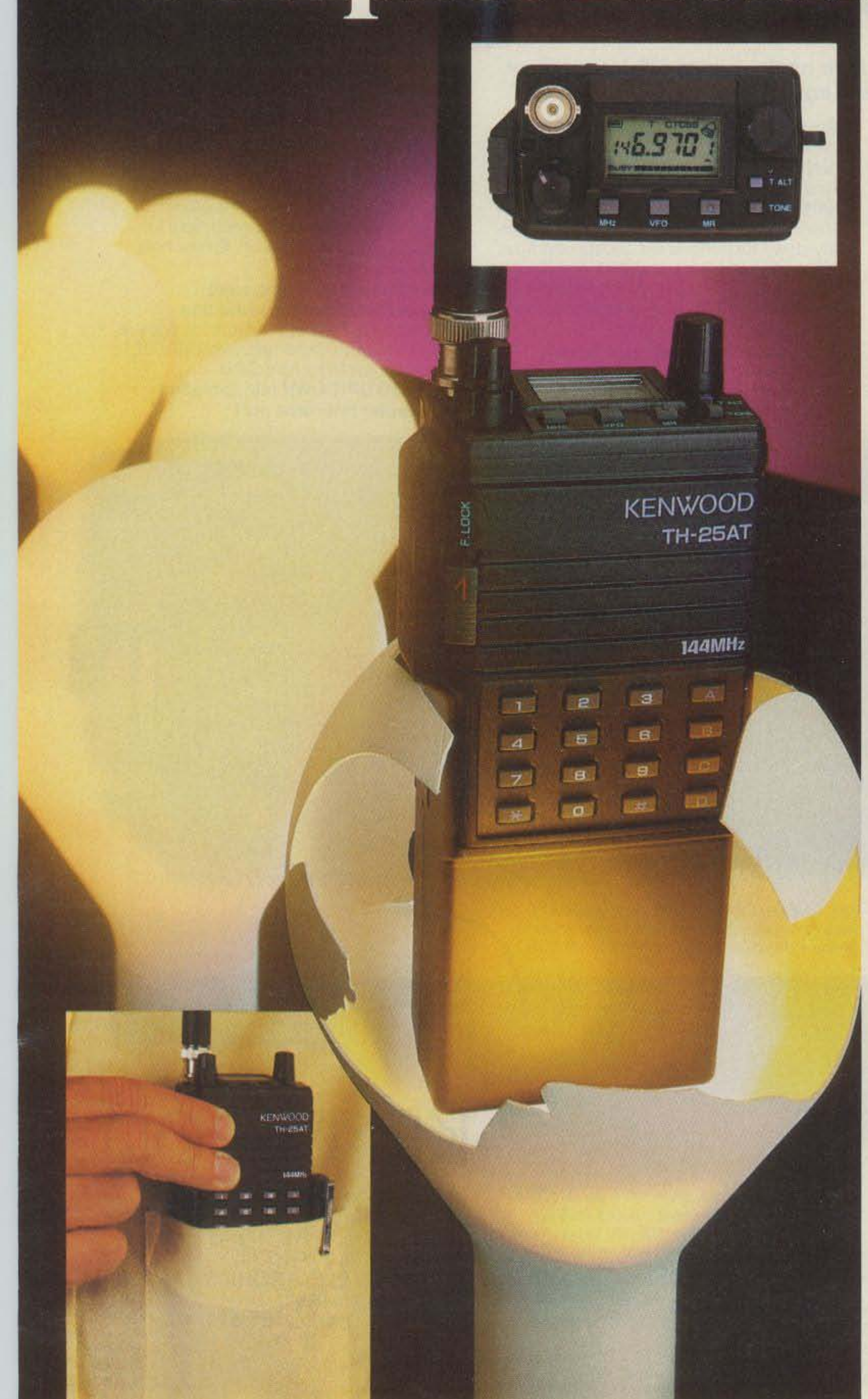

TH-25AT/45AT

New Pocket Portable Transceivers

The all-new TH-25 Series of pocket transceivers is here! Wide-band frequency coverage, LCD display, 5 watt option, plus...

- Frequency coverage: **TH-25AT:** 141-163 MHz (Rx); 144-148 MHz (Tx). (Modifiable for MARS/CAP. Permits required.)
  TH-45AT: 438-450 MHz.
- Automatic Power Control (APC) circuit for reliable RF output and final protection.
- 14 memories; two for **any** "odd split" (5 kHz steps).
- Automatic offset selection (TH-25AT).
- 5 Watts from 12 VDC or PB-8 battery pack.
- Large multi-function LCD display.
- Rotary dial selects memory, frequency, CTCSS and scan direction.
- T-ALERT for quiet monitoring. Tone Alert beeps when squelch is opened.
- Band scan and memory scan.
- Automatic "power off" circuit.
- Water resistant.
- CTCSS encoder/decoder optional (TSU-6).
- **Supplied accessories:** StubbyDuk, PB-6 battery pack for 2.5 watts output, wall charger, belt hook, wrist strap, water resistant dust caps.

Optional accessories:

• **PB-5** 7.2 V, 200 mAh NiCd pack for 2.5 W output • **PB-6** 7.2 V, 600 mAh NiCd pack • **PB-7** 7.2 V, 1100 mAh NiCd pack • **PB-8** 12 V, 600 mAh NiCd for 5 W output • **PB-9** 7.2 V, 600 mAh NiCd with built-in charger • **BC-10** Compact charger • **BC-11** Rapid charger • **BT-6** AAA battery case • **DC-1/PG-2V** DC adapter • **HMC-2** Headset with VOX and PTT • **SC-14, 15, 16** Soft cases • **SMC-30/31** Speaker mics. • **TSU-6** CTCSS decode unit • **WR-1** Water resistant bag

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

The Radio Amateur's Journal

AUGUST 1989 **VOL. 45, NO. 8**

ON THE COVER: Carl Cook, AI6V, of Nevada City, CA is shown busy at work on his antenna system. Evidently Carl doesn't believe in waiting for snow or blizzard conditions to do antenna work. Photo by Larry Mulvehill, WB2ZPI.

FEATURES

DEPARTMENTS

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Postmaster: Please send change of address to CQ Magazine, 76 North Broadway, Hicksville, NY 11801.

Zero Bias AN EDITORIAL

I was talking to Dave Ingram a few weeks ago, and he was excited over a recent "find" in his ongoing search for "classic keys." Dave is an inveterate collector of old telegraph keys, and several times a year he devotes his column to the subject. He lovingly describes the keys and shows pictures not only from his collection, but from other collections as well, including mine. Regardless of your feelings toward CW, these artifacts of a bygone era are truly marvelous to look at and examine. It's a slice of history—not only amateur radio history, but the history of communications—that you can hold in your hand.

What was Dave's "find"? Well, somehow he heard about a company that has a small quantity of *brand new* J.H. Bunnell & Co. double-speed keys. Yes, he said, brand-new, never-used keys that were maintained as inventory, and what's more, they also have other stuff that Bunnell manufactured. Dave said that he had ordered one and was calling me to see if I was interested. Serendipity or a hoax? Well, as it turned out, the company that is disposing of the Bunnell material is located about 20 minutes from the *CQ* office, so I called and arranged to meet someone there a day or two later.

No, it wasn't a hoax, and the stuff is real. I met Joe Jacobs, who told me his family-owned company, INSO, had purchased all of the Bunnell assets many years ago and had manufactured some of the products along with their own. He said that they are getting rid of the building and are selling off all of the old inventory, which includes the keys and spare parts, hardware, etc., for other Bunnell models plus a raft of documentation from the 100-year-old company. What I saw and picked through looked like it had recently come off the assembly line—sounders, resonator boxes, key parts, etc.—but Joe did emphasize that this is not a series of reproductions. He added that what I was seeing, although not 100 years old, was still being manufactured up to 30 or 40 years ago.

Although this stuff is not by any means cheap, it is for the most part pristine and just the way you probably could have bought it from a distributor many years ago. Joe has been selling the inventory a bit at a time to railroad telegrapher groups and a few amateurs via word of mouth. He has three sets of inventory sheets describing all of the material. If you're interested in filling out your collection or even starting one, you can reach Joe at his home: Mr. J.H. Jacobs, 60 Seaview Terrace, Northport, NY 11768 (516-261-1576).

Travels With CQ

The National in Dallas, HAM-COM 1989, had just about its largest turnout ever. People came from all over to have a good time and meet old friends. The commercial exhibit area was totally crowded for the entire weekend including Sunday, which for most hamfests is a relatively quiet day. A lot of people came up to me and asked how the food was, and I told them to eat at home. I did try the barbeque sandwich and can report that there was a microtome sampling of color on a hamburger bun and an infinitesimal residue of taste (not too bad) for just under four bucks. The amount of barbeque on the sandwich can be compared to the amount of vermouth in a perfectly dry martini.

On the brighter side, when returning to the hotel room Friday evening I found a platter of freshly sliced fruit and cheese waiting there with a note from Mr. Tim Laska, the Director of Sales & Marketing for the hotel, hoping that I'd enjoy my stay. The next day I went to thank John Fleet, head of HAM-COM, and said it was a nice thing to have done for the exhibitors. John said (it would be nice if it were true, but I'm not too sure) that the reason I got the special treatment was that he had showed Mr. Laska my food reviews and asked him how he'd like the hotel remembered in print. Thank you, Mr. Laska, for whatever the reason. The fruit and cheese were quite good.

Antenna Special

Most of us go out of our way to put up the antennas we have. As soon as they're up, we hate them and begin to think in terms of what would be better. If only we could get another few elements on that beam, raise it only a few more feet, say 100 feet or so, then life would most definitely be sweeter and the DX would come rolling in.

Maybe it's just a little more wire judiciously placed around the yard, house, or even apartment that will do the trick. How about the nth degree in cover and concealment, enough to make any commando group envious of your style, as you hide your giant loop antenna in a rotatable ferris wheel.

Well, antennas are our favorite topic on and off the air, and the one area where we seem to be willing to be adventurous and try out things. Our two antenna specials each year generate a lot of reader mail from those who have built and used some of the antennas described. They have also been food for thought, as some have taken a basic idea and elaborated on it. Occasionally we will also get a letter or two on an antenna article stating that it can't possibly work and that it is theoretically impossible. Maybe so, but empirically it does work, and the author and others have logbooks full of exotic calls using that antenna.

It's these anomalies that keep a lot of us busy trying different antenna configurations and dreaming up new ones. It's part of the excitement and challenge of amateur radio. Picture a newcomer planning his first antenna and imagining the world opening up to him, and the seasoned veteran of a thousand pile-ups with eyes glazed over as he contemplates a multi-element 80 meter beam just to complete 5-Band WAZ. It's the same thrill of anticipation. It's the world to be and yet to come, the spirit of the hunt and the hunter and a sense of competition if only among ourselves.

Reader Mail

I am still getting a tremendous amount of reader mail on the No-Code issue. Most of you seem to be in favor of the idea. Most of you see the need for change and growth as the only (not most viable, but only) means of survival. We may differ on how this is to be accomplished, and we certainly feel uncomfortable about any changes to our tradition, but most of us realize that something has to be done because the system is bogging down.

We all got into amateur radio for various reasons and with our own expectations. We all were certain of one thing, though: No matter what was going on in the real world, amateur radio could be structured within its own world and with its own rules and therefore was a rock of constancy. The real world could have its wars and famines, and job, family, and social problems could keep us up to our hips in antacid tablets, but amateur radio was the locus and the base which never changed and created order and importance in our lives.

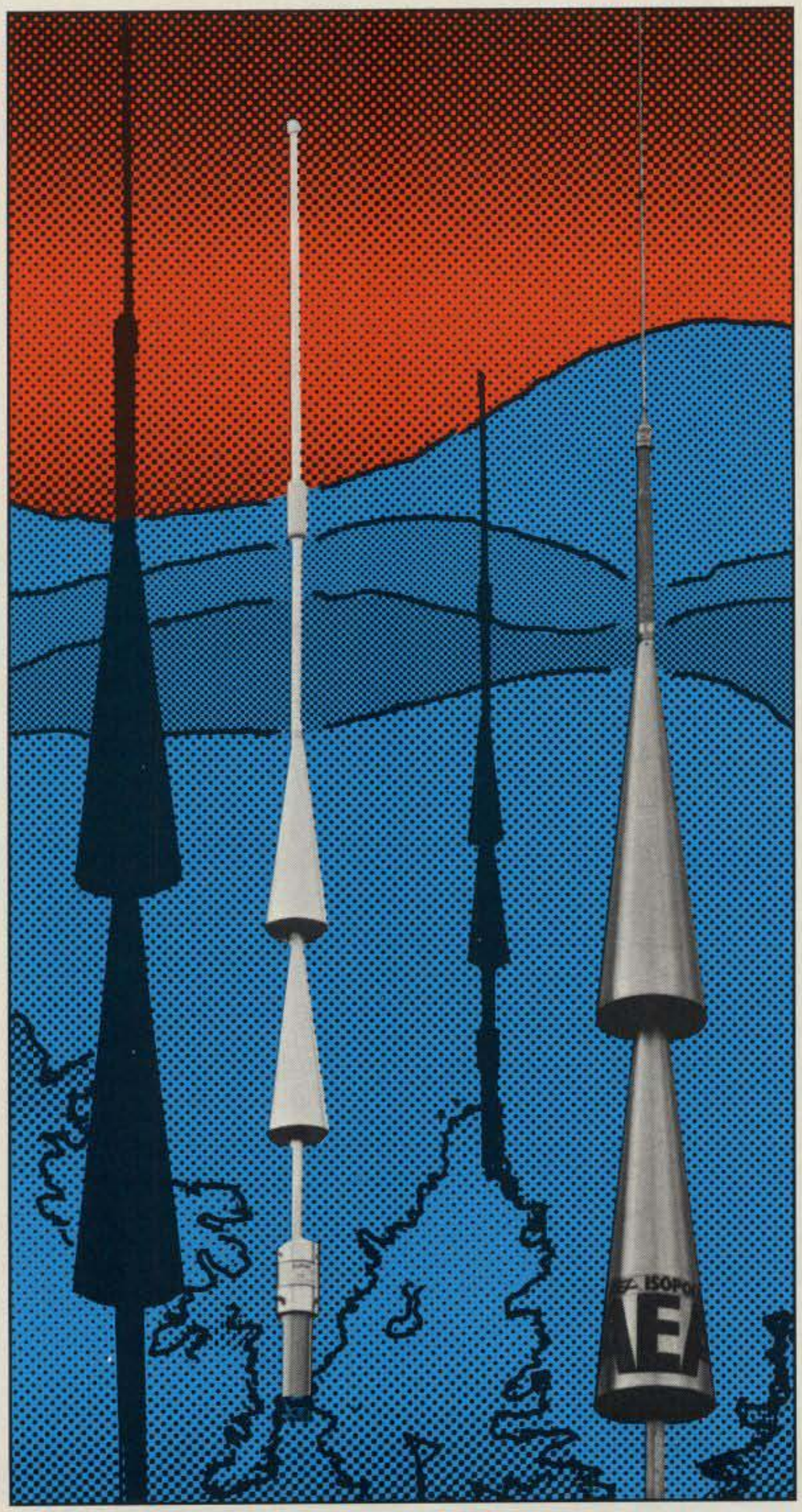
In reality, though, amateur radio has been changing throughout the years. Look at the furor that went on in the pre-SSB days when the anger was directed at those "Donald Duck" sounding signals that loused up the bands. It wasn't that long ago when 2 meter AM was traded in for 2 meter FM, or any magazine that dared to publish material on computers was a traitor to amateur radio. Change in technology or thought has always been viewed by some as merely a monetary plot that will upset and ruin the hobby. The good old days that some of us want to return to and stick with are the bane of those who came before that time.

In all of my experience with amateur radio, there has always been some sort of friction over anything new or different. Before CB gave some amateurs a group on which to blame everything, there were Novices who were ruining amateur radio. I don't know who came before Novices, but there are those of you out there who can probably tell me what group at the time was causing the trouble and fomenting the financial takeover plot to sell the poor lowly amateur things he didn't need.

Ever since the first amateur sent out the first QSL card, amateurs have been collecting them with a passion. Perhaps that first amateur was also in the shoe business, as amateurs have traditionally stored their QSL cards in cardboard shoeboxes, and so in some nefarious, paranoid way QSLing could all be a plot to sell amateurs more shoes.

73, Alan, K2EEK

Improve VHF/UHF Performance with the Isopole™ Antennas



Advanced Electronic Applications offers you outstanding mechanical and electrical design with the IsoPole, the only logical choice for a VHF base station antenna. All IsoPole antennas yield the maximum gain attainable for their respective lengths and a zero degree angle of radiation. Exceptional decoupling results in simple tuning and a significant reduction in TVI potential. Cones offer great efficiency over obsolete radials which radiate in the horizontal plane and present an unsightly birds roost with an inevitable "fallout zone" below. 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 transceivers. Typical SWR is 1.4 to 1 or better across the entire band!

For VHF versions, a standard 50 Ohm SO-239 connector is recessed within the base sleeve (fully weather protected). With the IsoPole, you will not experience the aggravating deviation in SWR with changes in weather. The impedance matching network is designed for maximum legal power and even compensates for the impedance lump introduced by the SO-239 connector used in VHF models.

The insulating material offers superb strength and dielectric properties plus excellent long-term ultra-violet resistance. All mounting hardware is stainless steel. The decoupling cones and radiating elements are made of corrosion resistant aluminum alloys. The aerodynamic cones are the only appreciable wind load and are attached directly to the support (a standard TV mast which is not supplied).

For additional information, please contact ADVANCED ELECTRONIC APPLICATIONS, INC., P.O. Box C-2160, Lynnwood, WA. 98036. 206-775-7373

Isopole 144 & 220

AEA Retail $69.95 Amateur Net $59.95

Isopole 440

AEA Retail $104.95 Amateur Net $89.95

CIRCLE 154 ON READER SERVICE CARD

Announcing

• **BARC Packet Radio Symposium Cancelled** – The BARC Packet Radio Symposium scheduled for September 16 in Barrie, Ontario, Canada has been cancelled. (Info via VE3EP.)

• **MAMARC 1990 Special Event** – The Major Armstrong Memorial ARC will sponsor special events in 1990 to commemorate the 100th birthday of Major Edwin Howard Armstrong, a pioneer responsible for the creation of wideband FM radio and the inventor of the superheterodyne receiver. The club is seeking other amateur radio ops around the world who are willing to research the accomplishments of Armstrong and become official MAMARC special event stations. These stations will be sent special QSLs bearing Armstrong's call, W2XMN, to be distributed to those worked around the world. For more information, contact Barry Groupp, N2HDW, MAMARC, c/o 100th Birthday Committee, P.O. Box 581, Alpine, NJ 07620. Send SASE and your name, call, address, license class, current operating bands, and bands your equipment will operate in FM mode.

• **Amateur Exams in Wellesley, Massachusetts** – Saturday, Aug. 26 at 10 AM. Call Vern, ND1Z (508-533-6822) by Aug. 20 to book a spot. New and prospective amateurs welcome.

• **Glasnost Bowl Special Event** – On September 2 the football teams of Illinois and USC will meet in Moscow's Dynamo Stadium to play the "Glasnost Bowl," the first American college football game ever played in the Soviet Union. There will be two or three special event stations operating simultaneously for 48 hours from USC, the University of Illinois, and, hopefully, Moscow University (calls to be WB6JHC (USC), W9YH (Illinois), and UZ3AZO (?). Certificates will be available. For more information, contact Twin City ARC, Jim Kouzmanoff, N9AVP, 4 Pine Circle, Urbana, IL 61801.

• **The following Special Events will take place during Aug.:**

WA1UMA, from Assumption Parish Picnic, Bellingham, MA; 1500-2200Z Aug. 20; 40, 15, 10, 2 meters. For QSL send SASE to WA1UMA, 31 Saddleback Hill Rd., Bellingham, MA 02019.

WA1RJI, from Stratford, CT; Greater Bridgeport ARC; Aug. 5-6 from 9 AM until bands drop, on both days; 10 meters 28.350 and 20 meters 14.300. For certificate send QSL and SASE to Mildred Blotney, KA1QOW, 11 Pearl Hill St., Milford, CT 06460.

W1GB, from Paul Newman's "Hole in the Wall Gang" camp for children, CT; Southcentral Connecticut ARA; all day Aug. 12-13; General portion of 80-15 and Novice portion of 10 meters. For QSL send QSL and SASE to Bill DeBenedetto, K1PVT, 55 Thompson St. 13E, East Haven, CT 06513.

WC2ADK, from 4-H Fair, Bridgewater, CT; Somerset County Office of Emergency Management; 1400-0100Z Aug. 16- 18; lower 25 kHz of General 80-10 meters and 10 meter Novice, 145.320 simplex. Send QSL and SASE to Somerset County OEM/4-H, P.O. Box 3000, Somerville, NJ 08876.

K2BSA, from National Boy Scout Jamboree, Fort A.P. Hill, VA; Aug. 2-8; CW 3.590, 7.030, 14.070, 21.140, 28.190, SSB 3.740, 3.940, 7.090 (outside US), 7.290 (in US), 14.290, 28.350, 28.990. Special QSLs available. Contact Rosalie White, WA1STO, ARRL, 225 Main St., Newington, CT 06111.

NI3D, from Mt. Davis, PA; Somerset County ARC; 1800Z Aug. 12 to 1800Z Aug. 13; lower 50 kHz of Novice 10 meter band and General bands. For certificate send QSL and SASE to NI3D, RD 2 Box 71, Somerset, PA 15501.

KW3Z, from Smith Island, MD; Nanticoke ARC; 1600Z Aug. 11 to 1600Z Aug. 13; lower portions of the Advanced bands, CW and SSB, 80-10 meters. (Will count for IOTA award, zone NA-83.) QSL via Patrick Ryan, KW3Z, 905 Short Lane, Seaford, DE 19973.

K3HWL, from Titusville, PA; Oil Creek Valley Radio Society; 1400-2300Z Aug. 5 and 6; CW 3.710, 3.675, 7.110, SSB 7.250, 14.275, 28.350 MHz. For QSL send QSL and no. 10 SASE to Robert E. Myers, K3HWL, RD 1 Box 143-G, Titusville, PA 16354.

W6VIO, from Pasadena, CA, to commemorate Voyager 2 encounter with Neptune; Jet Propulsion Laboratory ARC; 0000Z Aug. 19 to 2359Z Sept. 3; primary SSB and SSTV freq. will be 14.235, but also SSB on 28.485, 21.335, 7.235, 3.865, and CW 14.035, 7.035, plus OSCAR 13 and FM in the Los Angeles area on 146.52, 223.5, 224.04. For QSL send QSL and SASE to W6VIO Callbook address. DX stations QSL via buro.

W8AL, from Pro-Football Hall of Fame, Canton, OH; Canton ARC; 2200-0200Z July 31

(continued on page 103)

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Select your own HF beam antenna up to the value designated for each package. Only one antenna may be selected. The value of the antenna is the suggested amateur net price published by Telex/Hy-Gain — see box below.*

Order your tower/rotator package and selected HF beam antenna from your authorized Hy-Gain dealer. The entire package will be shipped, freight prepaid, directly from the factory to you.

PACKAGE NO. 1

HG 37SS Tower
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FREE One HF Beam
Antenna of your choice
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HG 54HD Tower
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Thrust bearing (1)
Mast (1)
T²X or HAM IV or HDR 300 rotator
FREE One HF Beam
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up to a maximum value of **$766.00***

PACKAGE NO. 4

HG 70HD Tower
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Thrust bearing (1)
Mast (1)
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FREE One HF Beam
Antenna of your choice
up to a maximum value of **$891.00***

Contact your dealer for package pricing.

***Suggested Amateur Net Price of HF Beam Antennas**

MODEL	TRIBAND BEAM	AMATEUR NET
391S	TH7DXS Thunderbird, 7 elements	$891.00
393S	TH5MK2S Thunderbird, 5 elements	766.00
395S	Explorer 14 Broad Band	606.50
221S-1	TH3JRS Thunderbird, 750W PEP	383.00
390S	TH2MKS Thunderbird, 2 elements	360.00
396S	30/40 Meter Kit for Exp. 14	154.00

MODEL	MONOBAND BEAMS	AMATEUR NET
239S-1	103BAS 3 element 10 meter	$134.00
236S	153BAS 3 element 15 meter	190.00
226S	203BAS 3 element 20 meter	309.00
375S	105BAS Long John 5 element 10 meter	264.00
376S	155BAS Long John 5 element 15 meter	398.50
377S	205BAS Long John 5 element 20 meter	678.50
394S	204BAS 4 element 20 meter	513.00
371S	Discoverer 7-1 Rotary dipole 30/40 meter	280.00
372S	Discoverer 7-2 2 element 40 meter	630.00
373S	Discoverer 7-3 Director Kit for 7-2	396.00

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Our Readers Say

Only 55 Years To Go

Editor, *CQ*:

The frustration expressed by KB2BXH ("The Vanishing QSL," *CQ* March 1989) is all too familiar. However, I have QSL cards from all four of the states he mentions. The *really* tough states are Mississippi, West Virginia, and Wyoming. (*Callbook* listings not withstanding, all the hams in Mississippi have moved to Oklahoma.)

If he thinks WAS is tough, he should try a *real* challenge—US-CA. My license does not allow SSB on 20 metres, so the CH net is out. I operate SSB on 10 metres, and CW on 15 through 80. In 10½ years I have confirmed 468 countries. At that rate I will be finished in about 55 years, and my age will be 96. I wonder what new challenge will await me then?

Garry Cameron, VE7ACM
Port Alberni, B.C., Canada

Digitize The "Lunchbox"?

Editor, *CQ*:

CQ, April 1989, "Our Reader Say," "A Boat Anchor Edition." I want to *second* the idea that was in the above-mentioned letter written by Joe Adinolf, WB6ZWS.

What a refreshing thought! If this caught on, think what it would do for hamfests. Instead of nothing but high-tech stuff, hams would again bring goodies to place on the tables—ark-5s, dynamotors, tubes, and as Joe mentioned, Swans, Drakes, "S"-line, and, yes, the "lunchbox." Joe, you can never tell! There's a ham out there somewhere who will attempt to digitize the "lunchbox."

My acknowledgement to Chadwick Johnson, W5DBA, for speaking out on the same subject.

Jim Wisdom, K4HCG
Raleigh, NC

From OSOVIAKHIM to DOSAAF

Editor, *CQ*:

In reference to H.B. Mutter's article "Glasnost, Perestrika, and QSLs" in the March 1989 issue, I would like to point out that in the USSR there is no such organization as DOSAFF. The proper name is DOSAAF, which stands for "Dobrovolnoye ob'yedinenie sodeisviya armii, aviatsii i flotu," which in English stands for "voluntary association to assist the army, air force, and navy." DOSAAF covers a multitude of activities, from ham radio to parachuting, target shooting, and flying. Prior to WW II it was called OSOVIAKHIM.

Ivan I. Bezugloff, Jr.
Cleveland, OH

14.313—What's Going On?

Editor, *CQ*:

To my fellow amateurs who try to help others and to those who make it difficult. When I was underway with the US Navy, the nets on 14.313 were God-sends to help boost the morale of my 6,300 shipmates during those long periods when we were not within a thousand miles of a landline. You all know the story of good and bad news from the phone patches. So what has happened? I tuned into the net after a year's absence from HF, and all I hear are a bunch of clowns trying to be some sort of law enforcers on the band; this was not just one time but a couple of weeks running.

Hey, guys, if someone is doing something wrong, do not disrupt the whole net. Send him a letter or card letting him know of his or her violation and let the FCC know. Do not hose up a beautiful thing such as the nets on '313. This is the kind of *stupid* behavior that killed the CB band. Remember, what goes around, comes around. I have more, but . . .

Gregory A. Pioppi, KB2ANG
FPO New York, NY

No-Code Apprentice License

Editor, *CQ*:

We should congratulate The Space Coast Amateur Technical Group for the simple and pragmatic petition for rule-making that they have submitted to the FCC. Their suggestion for a no-code Apprentice Class license is outstanding! By comparison, the efforts of the erudite group that makes up the ARRL "No-Code" Committee seem complicated and less reasonable.

I encourage you, your contributors, and *CQ* magazine to support the petition filed by William E. Newkirk, WB9IVR.

Walter F. Wernsing, K2ZJF
Hendersonville, NC

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W1ICP presents a primer on the use of coaxial cable as a tuned transmission line. The term "tuned" refers to the use of a Transmatch or antenna tuner at the transceiver end of the antenna system.

Coax As Tuned Feeders Is It Practical?

BY LEW McCOY*, W1ICP

Over the years I have written many articles about tuned feeders and multiband antennas, and I have made recommendations about such feeders. Without exception, I have tried hard to convince amateurs never to use coax as a tuned line, simply because of the losses involved. However, I recently did an article in *CQ* about an RV antenna, and with it I used a short length of tuned coax to feed the antenna. By short, I am speaking of only 5 feet or so. Using this piece of tuned coax line got me thinking about the practicality of actually tuning coax—when it is useful and what its limits are. This article will treat the subject.

The neophyte amateur looks at a transmission line as simply some metal conductors with insulation on them. Without some background and understanding, these neophytes just go ahead and use whichever line they think they want. Unfortunately, life isn't that simple, as we will see.

I know I would lose most of my readers if I really went deeply into transmission-line formulas, but fortunately, with computers to do the work for us, the mathematics of transmission lines can be converted to simple-to-read charts which shouldn't scare away anyone. This article therefore is primarily about using coax as a tuned transmission line. By tuned, I mean using a Transmatch at the transceiver.

There are a few basics that should be set down when discussing transmission lines. Regardless of the type of line, coax or open-wire, the inherent losses in a line depend basically on three factors: the actual conductor losses or resistance, the losses introduced by the resistance of the dielectric material used to separate or support the conductors, and last, the frequency used. This last element is very important, because as we go higher in frequency the losses increase, sometimes dramatically. Dielectric losses of course are most pronounced in coaxial feed lines. In this case, the inner conductor is separated from the outer conductor by a sheath of dielectric material, and the outer conductor has an outer sheath for weather and insulation protection. It is the inner sheath that gives coax its high loss factor.

Open-wire line and the popular 450 ohm ladder line don't have anywhere near the dielectric losses of coax, and most important, for all practical purposes open-wire line is lossless from 160 through 10 meters, as we shall see. For the moment, however, let's get back to coax.

Another factor we must add is the greater the mismatch at the antenna, the higher the standing-wave ratio on the line. And as the SWR goes higher, so do the losses in the line. In radio these losses are expressed in decibels, but for many amateurs it is much easier to understand if the dBs are actually converted to watts. That is what I am going to do here. Keep in mind the following facts:

The losses in coax can be attributed to:

a. The dielectric material used to separate conductors.

b. The size or inherent ohmic resistance in the wire.

c. The frequency in use—the higher the frequency, the greater the loss.

d. The losses because of standing-wave ratio.

How Bad Can It Get?

Probably the best illustration is what could be called a "worst case" situation. Let's suppose we are using a half-wavelength dipole on 80 meters, 130 feet or so overall, either horizontal or inverted Vee, and fed with 50 ohm coax. Also, let's assume we are using a Transmatch that can be adjusted to compensate for *any* mismatch, regardless of how high the SWR is. This 80 meter half-wave antenna, depending on its height and configuration, will have an impedance (or feedpoint load) of anywhere from about 30 to 100 ohms and will provide reasonable match for the 50 ohm line. In other words, the SWR should not be much greater than 2 to 1.

But let's assume we now use this same antenna on 40 meters. Instead of a center-fed half-wavelength, it is now a center-fed *full*-wavelength, and the feedpoint impedance goes extremely high—somewhere near 4000 ohms. This means a standing-wave ratio of about 80 to 1 using 50 ohm coax! (We divide the impedance of the line into the impedance of the antenna to arrive at the SWR.) So on 80 meters we have an SWR of less than 2 to 1, and when using 40 meters we have 80 to 1. In addition, this becomes essentially a high-voltage fed system, and without good grounding, you could end up with RF all over the shack. There are methods of using such systems and keeping them "cool," but we won't go into that in this article.

This same 80 meter antenna, depending on where it is resonant on 80, can be horrendous on 20 meters. The SWR is actually 86 to 1. However, a computer antenna modeling program does show this antenna to have as much as 3 dB gain in certain directions on 20 (and at certain angles). The point is, it might be worthwhile to consider such antennas when used on different bands. But of course, coax would be impractical as a feed line with an inverted Vee. Also keep in mind that a trap dipole, with 80 meters as the lowest frequency, would not be a gain antenna on 20.

RG8 has a very insignificant loss factor on 80 meters—only .25 decibels per 100 feet of coax and approximately .35 at 40 meters. With 100 watts going into the line from the transmitter, .25 dB loss is almost impossible to measure with ordinary amateur test equipment. However, when we go to 40 meters with its 80 to 1 mismatch,

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

the additional losses because of high SWR rise to an astronomical figure. With our 100 watt power and 100 feet of line, only a very small fraction of the power will reach the antenna. Also, we must factor in one more problem when we use coax that is badly mismatched. it can be dangerous to run high power when coax has a high SWR on the line. The line can heat or actually puncture because of high RF voltages, causing a line breakdown.

The example we have just given is a worst-case condition, but there is an answer to such a problem. In fact, there are several answers. Open-wire feeders are for all practical purposes lossless as a transmission line. For this reason one can tolerate extremely high standing-wave ratios without losses and without problems. The 80 to 1 mismatch using, say, a 2 or 4 inch open-wire line would not be worth thinking about. Keep in mind that if a transmission line is lossless, the power *has* to go to the antenna and be radiated—without any loss. But this article is not about using open-wire lines. It is about using coax as tuned lines.

When Don't We Need to Tune Coax?

First let's discuss when it isn't necessary to tune coax—or, better yet, when we don't need to match coax. In recent years, with the advent of solid-state transceivers and in some cases even with tube-type transceivers, the transmitter amplifiers were designed so that they could not be operated if the SWR was more than 2 or 3 to 1. The latest transceivers even have protective devices to shut them off if the SWR exceeds 2 to 1. So here is one of our first guidelines: If the SWR is 2 to 1 or less, then it isn't necessary to "tune" or match the coax. Let's make an SWR of 2 to 1 our limit. If the ratio is that or less, then we don't need a Transmatch or tuner.

But do we? Often if you live near a broadcast station, the broadcast signal is so strong that it drives the receiver portion of your transceiver completely wild and you get an awful lot of noise in the form of birdies and false signals. Keep in mind that a Transmatch provides additional selectivity to your receiver and can eliminate such extraneous signals.

Probably the next important question is how to keep that 2 to 1 SWR with a multiband antenna system, 160 through 10 meters. The answer is we can't, unless we use a resistor as part of the antenna, and I am not in favor of using transmitted watts to heat a resistor. The main problem will be with 80 and 10 meters. These bands are too wide to provide complete coverage with low SWR. If we elect to stay on a narrow band of frequencies, particularly on 80, we can come up with a coax-fed system with an SWR of 2 to 1. That satisfies the requirements of our 2 to 1 limit on the transceiver, but limits us in many other obvious ways.

	Inner Cond. wire size	Max. Current (in amps)	Max. Voltage (in volts)
RG-58/U	No. 20	7.5	1900
RG8 types	7/21 or No. 10	33	5000

Table I– Maximum ratings for voltage and current for the two popular coaxial transmission lines.

So let's assume that we are going to jump around the bands, and experiment with antennas that are a far match from 50 ohms. We are going to be dealing with SWRs of, say, 10 or 20 to 1 on our coax. In that case we are going to have to tune the antenna system, the antenna system being the antenna *and the coax feed line.* Here we will correct a mistaken assumption on the part of many new amateurs: Simply because we use 50 ohm coax *does not mean* we have a 50 ohm load at the transceiver. Without getting too technical, keep in mind that the feed impedance of an antenna will depend on many, many factors—its frequency, its length, its proximity to nearby objects, and so on. If by some strange chance the impedance is 50 ohms, then our 50 ohm cable will be a perfect match and we will have an SWR of 1 to 1. But more than likely we won't be that lucky.

So back to our subject. How bad can the mismatch be and still tune the coax line? Earlier I stated the factors governing the losses in coax. Now is the time to look at the practical problems.

The standing-wave ratio is the ratio between the maximum voltage and minimum voltage at any given point on the transmission line, or the ratio of maximum to minimum current. I am going to throw in the simplest of math here. In our 100 watts output case, using 50 ohm cable and a perfectly matched line, the current will be 1.4 amperes (approximately).

The math is simple. By Ohm's Law, the current squared times the resistance equals the power—or, 1.4 times 1.4 equals 1.96, which multiplied by 50 ohms equals 98 watts (close enough). By the same token, the voltage equals the square root of the power times the resistance, or 70 volts. Table I shows the maximum ratings for voltage and current for the two popular coaxial transmission lines. The power is based on 100 watts leaving the antenna.

Let's go back to our worst case, 80 to 1 SWR. This would produce a voltage or current loop of roughly nine or ten times what it would be in a matched condition. In the case of the voltage, 9 times 70 volts is 630, or a lot less than the maximum. However, the wire table rates No. 20 at 7.5 amps, so our current loop at 80 to 1 would exceed this figure by several amps. This would cause line heating and,

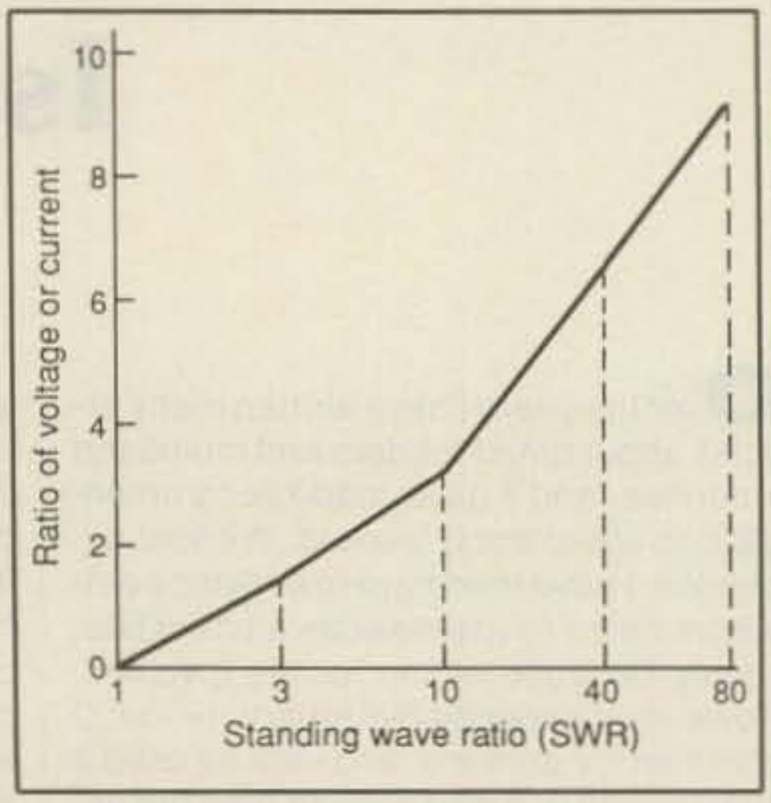

Fig. 1– This chart provides the information of the current or voltage ratio because of SWR.

of course, losses, which is why I said earlier the losses could be prohibitive in such a case.

Now let's look at the legal limit, 1500 watts. In our matched load of 1 to 1 we have a current of 5.5 amps and a voltage of slightly more than 270. Fig. 1 shows the increase in maximum value of voltage or current because of SWR. The 5000 volt rating would become marginal under our worst-case condition. As to the current, the heavier-duty types of RG8 (using No. 10 solid inner conductor, which is rated at about 30 amps) would in all likelihood exceed that rating by a good margin.

The above will give you an idea of the beginning of the problem when tuning a coax line. But we still have the problem of the power losses in line both in its matched and unmatched state.

Let's take another worst-case condition and examine it. RG58/U has a loss of approximately 2.5 decibels per 100 feet at 10 meters. Assume we are feeding a beam with 100 feet of RG58 and the beam is matched at the Novice end of the band. Let's also assume we are running 100 watts out of the transmitter. In such a case, the power loss in the 100 foot run would be 45 watts, leaving 55 watts (approximately) to reach the antenna. It doesn't make very good sense to buy a 100 watt rig and then burn up half the power in the line simply because of an in-

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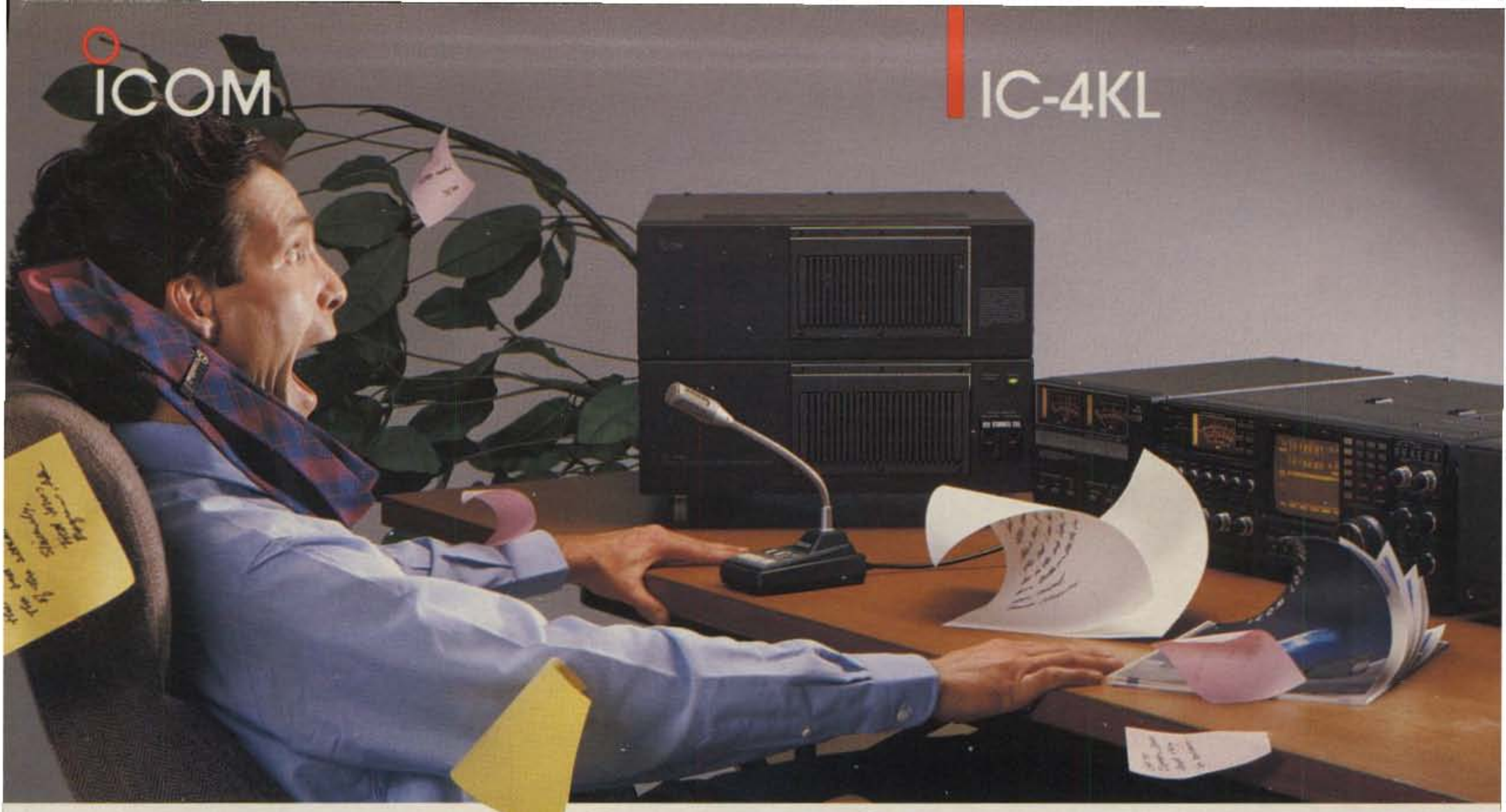

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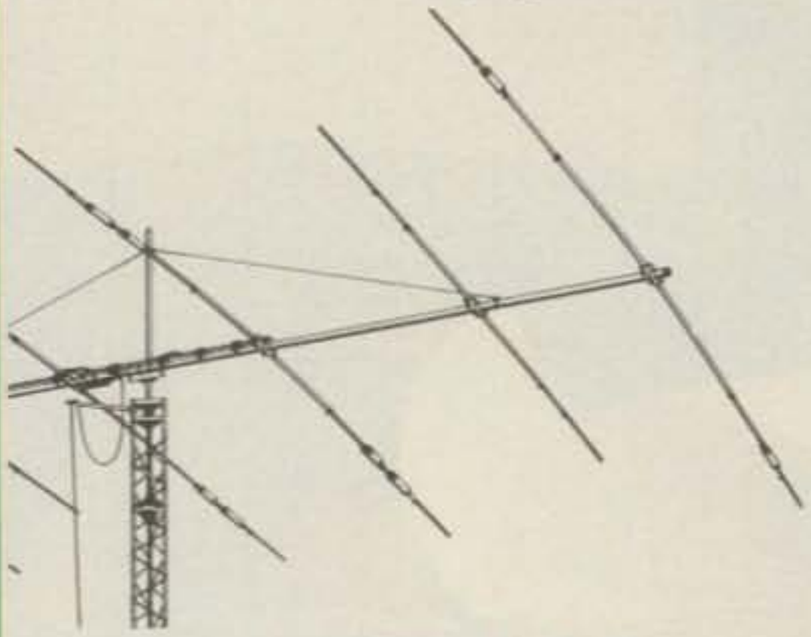

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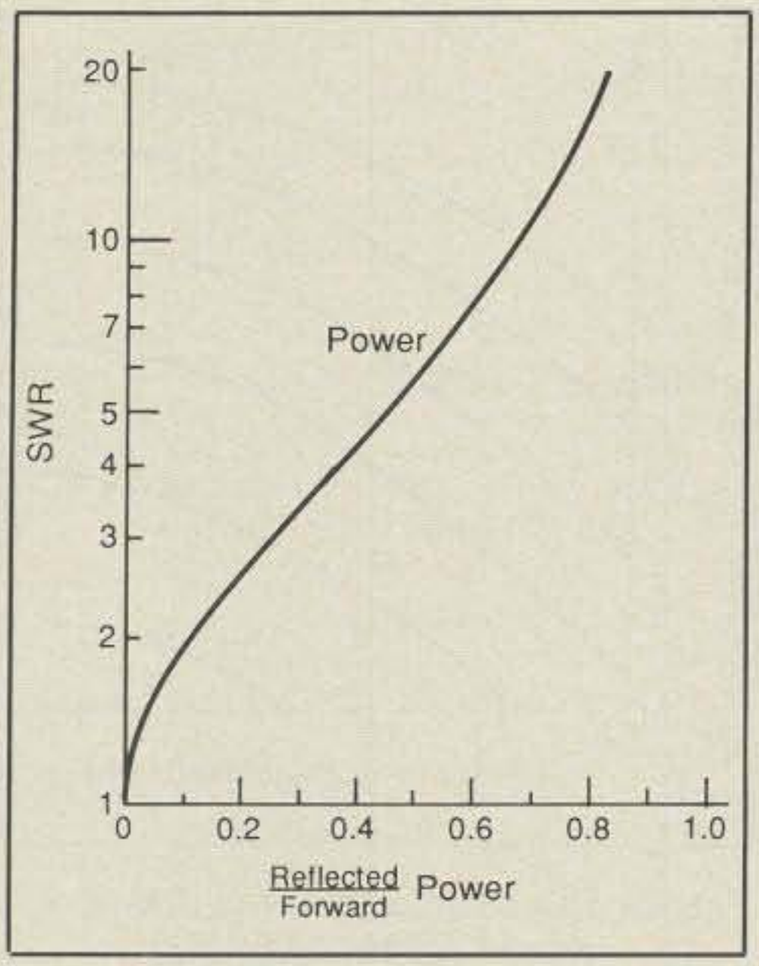

Fig. 2– Chart for determining the SWR when the forward and reflected powers are known.

efficient feed line. Two meters is much, much worse. I see so many new amateurs get their Technician license and end up using the cheapest coax. The loss in 100 feet of RG58 on 2 meters is just about 6 dB, or a loss ratio of about 4 to 1. With a 40 watt rig, only 10 watts would get to the antenna!

Let's digress a moment and talk about decibels. You can study decibel conversion charts in the handbooks, but once learned, some numbers are easy to remember. A power gain or loss of 3 dB is almost exactly a ratio of 2:1, so a gain of 3 dB means twice the power and a loss of 3 dB means half the power. Six dB is a ratio of 4:1, or four times the gain or loss. Ten dB seems to be popular because it comes out to ten times the power (or loss). Usually old timers related a kilowatt to a 100 watt rig, and many still do. In other words, going from 100 watts to a kilowatt was a gain of 10 dB. Likewise, a good four-element beam would have a gain of approximately 10 dB, so the radiated power could be effectively increased 10 times with the use of such an antenna. Getting back to our 2 meter example, it would be downright stupid to use RG58 for a feed line—even for short lengths.

By now you must realize that it is impossible to make a blanket statement that it is always possible to use coax as a tuned line. We have to put many provisos into the statement. As outlined above, you have to look at all the contingencies, including one I haven't mentioned. I talked about SWRs of 20 to 1 or even 80 to 1, but to be honest I would be hard put to find an SWR indicator that would accurately show such mismatches. I am sure that I have examined as many SWR indicators as anyone, and I have found very few that could be depended upon to give an accurate reading when encountering a high SWR. In fact, many of them stop at 3 to 1 and just leave a blank scale above that. However, there is a method that will give somewhat reasonable readings.

Keep in mind that at this point I am discussing tuning coax that has a high SWR, and we want to know what is happening. Fig. 3 shows a setup whereby we can use an SWR indicator in conjunction with a power-reading bridge (these are commonly available devices). First we have the transmitter, then an SWR indicator which is followed by a Transmatch, and then a power bridge in the line to the antenna. The SWR indicator is strictly to show when the Transmatch is adjusted to a 1 to 1 match. We have to do this in order to get the power out of the modern transceiver. Don't forget that if the SWR is more than 2 to 1, the doggone thing will shut down on us.

I did exactly the test described above. I have one SWR indicator that is fairly accurate up to 10 to 1, so I used the setup above on a coax-fed antenna that I knew had a very high SWR. There are a couple of points you should be aware of when doing such a test. The power measurements you'll be making are not *real* power, but rather are the voltage relationships. As a matter of fact, just making these tests will open your eyes to "power readings" on power bridges.

Getting back to my test, I have a rig capable of 100 watts output. I adjusted the Transmatch for a match, with output of the rig down so I could get a good, accurate match. Once matched, and observing the power bridge, I increased the drive. The power bridge had a full-scale reading of 200 watts, and I quickly reached that with the drive control. (I had also done one more thing. I had the SWR indi-

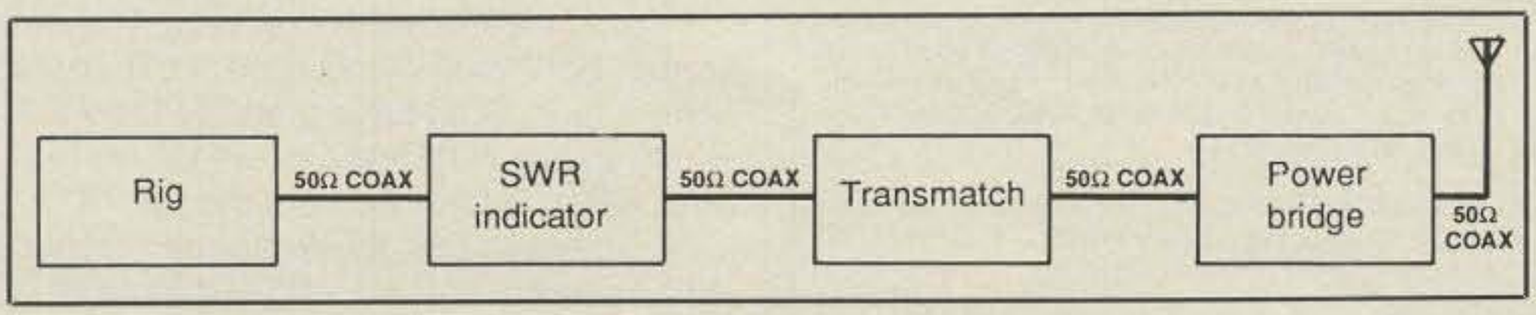

Fig. 3– This is the setup as described in the text. The SWR indicator is used to determine when the Transmatch is correctly adjusted. As always, use the lowest possible power that provides an indication when adjusting a Transmatch.

cator, which reads fairly accurately up to 10 to 1, also at that point in the coax line.) Interestingly enough, the SWR read 10 to 1. Some power bridges can be switched to read the reflected power. Mine couldn't, so I took it out and reversed it in the line.

The reflected power reading, leaving all transmitter settings the same, was 130 watts. Therefore, I had 200 watts forward and 130 watts reflected. Rather interesting, isn't it, for a 100 watt rig (a total of 330 watts). Of course, the *real* power was the difference between the two, or 70 watts. Fortunately, there is a simple chart available (fig. 2) which provides the information we seek. If we divide the forward power into the reflected power, we are provided with a ratio—in this case—200 into 130, or a ratio of .65. Looking at our chart, a ratio of .65 gives us an SWR of 10 to 1! My actual tests came out the same as the chart.

In my case the coax-fed antenna was on 10 meters with about 150 feet of feed line. Actually, the antenna is matched on the very low end, and I tested it at the high end where I knew the SWR was high. In any case, I am using RG8/U—rather old, I might add—and when new, it had a loss of 1 dB per 100 feet at 10 meters. So I had a matched loss of 1.5 dB plus another 4 dB because of the SWR of 10 to 1. Very prohibitive, to say the least—a power loss ratio well over 4 to 1. Incidentally, the chart in fig. 4 shows the *additional* loss because of SWR versus a matched condition.

Getting back to our basic premise, can we use coax as a tuned line? The answer is yes and no. You study the losses and decide what to accept. Aside from actually burning up line, running high power, and so on, you can tune coax.

One of the more popular multiband antennas is a wire trap dipole that covers 80 through 10 meters. It doesn't take long to find out that antenna system is a poor match for a transceiver on many frequencies. In this case, we usually would not be dealing with SWRs of more than 10 to 1 under worst conditions, so I would recommend using a Transmatch. The same is true of many of the trap verticals. However, knowing what we discussed above—the excessive voltages or currents that can exist—you should carefully check the specs on the traps used. I have heard of many blown traps from excessive SWR. By the same token, many balun manufacturers will not guarantee their baluns if the SWR is more than 2 or 3 to 1 (which actually means the balun wasn't designed to take high voltages or currents!). Just be aware of this problem.

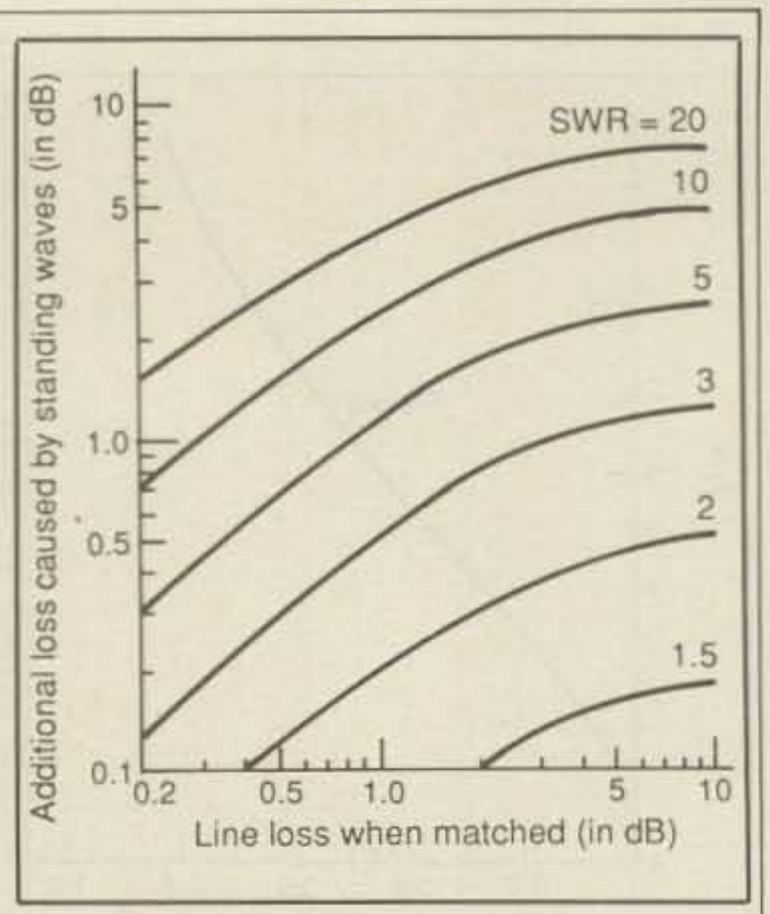

Fig. 4– This chart shows the additional losses caused by SWR.

Frankly, this is why I have always been so "high" on using open-wire, tuned feeders—no traps, no baluns—but that is another article (if you want me to write one).

I enjoyed writing this article because I hope it clears up some questions. If you want more such articles let me know. And now I will relate one last funny story about tuned coax that happened to me.

Many years ago—in the early 1950s, to be exact—I was working at the ARRL and was asked to give a talk at a local club on the subject of feed lines. As above, I mentioned my worst-case condition about using a coax-fed 80 meter antenna on 40 meters and the horrendous 80 to 1 SWR. A young amateur in the audience raised his hand with a question.

"Lew, I have exactly the setup you describe, but I didn't know the SWR could be that high. But I have managed to work all 48 states with the system on 40 meters. What do you recommend I do?"

Needless to say, the audience seemed to hang on my answer, and at that point in my career I coined McCoy's Rule. I said, "In that case, use McCoy's Rule: If the damned thing works, don't change it!" CQ

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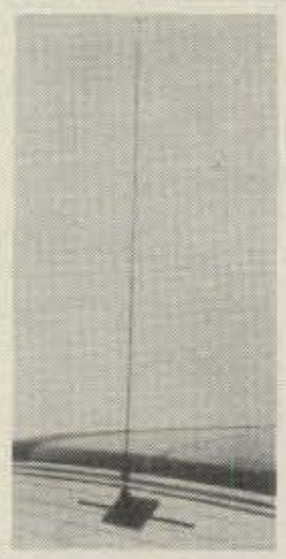

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The Perfect Cube

An Easy-To-Build Quad Antenna

BY DAVID K. SHORTESS*, W5PQL

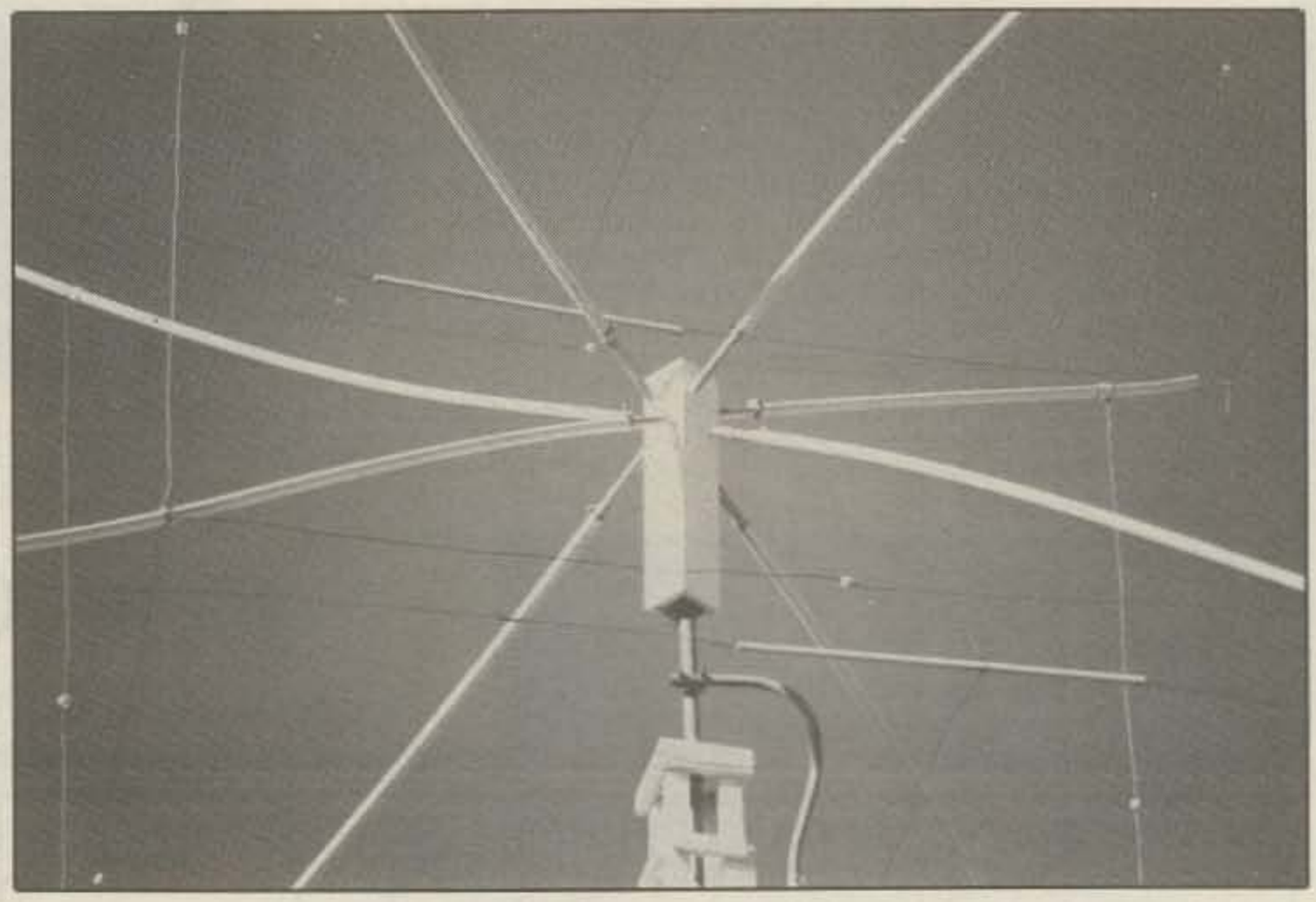
Have you ever considered building a beam antenna? If so, the first thing that you will have to determine is the type. While the Yagi is probably the most popular beam used by amateurs, the quad has certain distinct advantages. It has more gain per element. A three-element quad has as much gain as a four-element Yagi.[1] Along with the increased gain comes increased capture area, so reception may be measurably improved. Also, the quad has a much smaller turning radius, and a boomless, spider quad may be somewhat lighter in weight than its Yagi equivalent.

The disadvantages of the quad stem largely from its shape. Because the quad is a three-dimensional structure as opposed to the two-dimensional Yagi, it is generally more susceptible to storm and wind damage and handling is more difficult. For the home-brewer, the quad has suffered from several additional shortcomings. Bamboo poles for spreaders are no longer available from carpet stores, and fiberglass spreaders are expensive. The supporting members are often complex and difficult to make. It is no wonder that the antenna home-brewer has often dismissed the quad as being too impractical.

With all of this in mind, I decided to try to design and build a quad antenna expressly for the home-brewer. I established several design criteria. The antenna had to be made from readily available, fairly inexpensive materials. The construction had to be limited to the use of simple tools with no welded or machined parts. It had to be strong enough to withstand our gusty New Mexico winds, but lightweight enough to be handled by one person. Finally, these constraints should have no detrimental effect on the performance. I feel that the antenna described here meets all of these demands.

Electrically there is nothing new about this antenna. The element dimensions and spacings were all taken from the literature.[2] Its unique features are its structural design and the materials and methods used in its fabrication.

*1209 Vista Drive, Socorro, NM 87801



The completed 15 meter, three-element quad.

The General Design

The antenna is a 15 meter, three-element quad supported by a boomless spider (fig. 1). The spacings from the driven element are 0.13 wavelength for the reflector and 0.12 wavelength for the director, producing a near optimum combination of desirable gain and a good front-to-back ratio.[2] Thus, the distance from the reflector to the director is 0.25 wavelength, or just under 12 feet, very close to the length of each of the four sides of the two parasitic elements. This gives the antenna an almost perfect cubical shape, with a turning radius of about 8½ feet.

The advantage of the cubical shape lies in the fact that the antenna is completely symmetrical from all directions. Each of the eight spreaders is opposite to, and exactly in line with, one of the other spreaders. In other words, instead of eight spreaders, it can be thought of as having four long spreaders crossing each other at the central support point and extending to the eight corners of the cube.

The twelve edges of the cube include the four sides of the reflector and the four sides of the director. The four remaining edges are guys running from each corner of the reflector to the corresponding corner of the director. The driven element is suspended from these guys.

The Center Support

The spreader supports are made of four 2½ foot long pieces of ¾ inch thin-walled steel electrical conduit cut from one 10 foot piece. Each piece provides support for two spreaders, one on each end. However, they all cannot intersect at exactly the same point at the center of the structure without cutting and welding or splicing the pieces in some way. I solved this intersection problem by offsetting each of the four pieces horizontally by about an inch from the true center. This allowed the four pieces to be nested around each other, all almost touching each other and all completely intact.

The four pieces of conduit are mounted

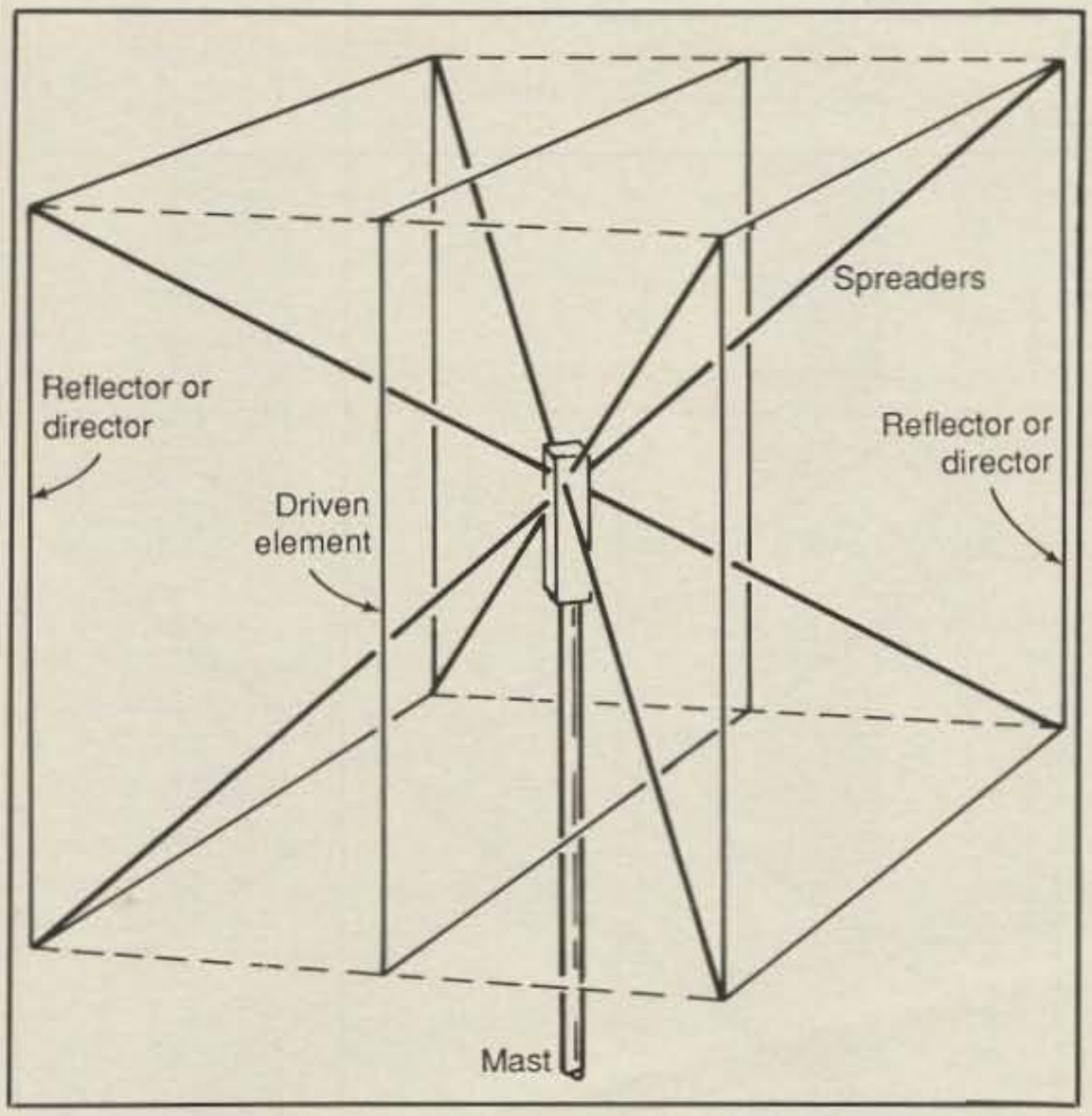


Fig. 1– The overall plan of the three-element quad. The internal guy wires are not shown, and the external guys are shown as dashed lines.

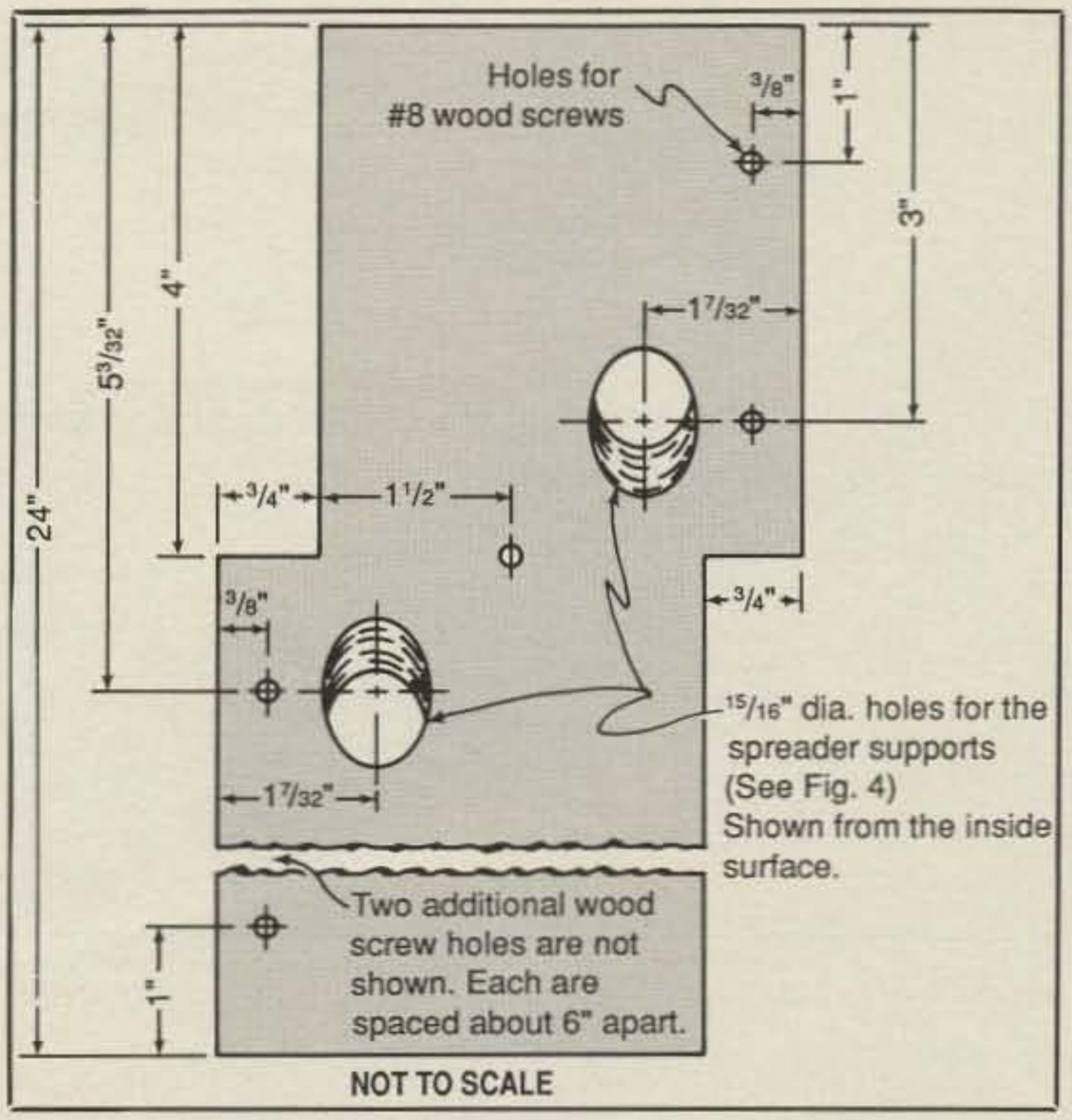


Fig. 2– A cutting and drilling guide for one of the four sides of the center support. The U-bolt holes are drilled in only one of the four pieces.

in a rectangular structure made of four virtually identical pieces of ¾ inch exterior-grade plywood. They are glued and screwed together, edge to side, in a sort of dovetail fashion. The pieces of conduit are mounted in holes drilled at 35° from horizontal. The dimensions of the four plywood pieces are given in fig. 2. The offsets on the sides of each piece are such that the conduit holes are ¾ inch from the edge of the piece. This makes the structure stronger and the drilling easier.

All four pieces of plywood are cut and drilled before they are assembled. Since the location and angles of the conduit holes are rather critical, the drilling of these holes should be done with great care. If it is available, a drill press or a drilling guide should be used. A simple jig made the drilling of these holes with a hand drill much easier. The details of the setup are shown in fig. 3.

The only side of the support that differs from the others is the one to which the mast is attached. The mast extends up inside the structure, and the U-bolts which secure it are fastened to one side. It is important to insert those two U-bolts into the plywood side before the four pieces are glued together. There is no way to get them in after the support is assembled. Also, if the inside of the support is to be painted, that too should be done prior to assembly.

After the wood pieces are glued and screwed together, additional support is provided by eight 5″ × ¼-20 carriage bolts placed in the structure just above and below the U-bolts. Each piece of conduit is inserted through two holes which line up diagonally on opposite sides of the support. It rests against the inner surface of a third side, and is held in place by a 1¼″ × ¼″ sheet metal screw through the wood and into the center of the piece of conduit. The conduit holes in the plywood may have to be filed out a little with a rat-tail rasp in order to get the pieces of conduit in, but a tight fit is desirable.

Finally, a cap of wood is screwed and glued to the top. The eye bolt inserted in its center is useful for attaching a hoisting rope. Fig. 4 shows the relative placement of the various components of the center support. All cracks are thoroughly caulked and sealed. Finally, the entire wooden part of the support is given several coats of good-quality exterior paint.

2 feet × 2 feet of ¾ inch exterior-grade plywood	200 feet of number 14 solid copper-clad steel antenna wire
One 10 foot length of ¾ inch steel electrical conduit	150 feet of 2 inch wide fiberglass fabric
One 10 foot length of ½ inch steel electrical conduit	One quart of fiberglass resin with hardener
Eight 10 foot lengths of ¾ inch 125 psi cold-water PVC pipe	Two heavy-duty U-bolts, center support mount
One 10 foot length of ½ inch 100 psi hot/cold-water PVC pipe	One lightweight U-bolt, balun support mount
Four ¾ inch PVC pipe couplers	12 small compression-type egg insulators
15 inches of ⅞ inch diameter wood dowel (broom handle)	Eight 2 inch tension insulators
100 feet of aluminum TV-antenna guy wire	Eight 1 inch hose clamps
	Twenty 2 inch × # 8 flat-head wood screws
	Four 1¼ inch × # 14 sheet-metal screws
	Eight 2½ inch × ¼-20 carriage bolts
	Eight 5 inch × ¼-20 carriage bolts
	One ¼-20 eye bolt

Table I– materials list.

The Spreaders

The eight spreaders are 10 foot long pieces of ¾ inch, 125 psi, polyvinyl-chloride (PVC) cold-water pipe covered with fiberglass and resin. The fiberglass and resin not only provide additional strength and rigidity to the pipe, but they also protect the PVC from the destructive effects of ultraviolet radiation from the sun. The pipes come in 10 or 20 foot lengths, so there is no waste. If the builder were considering a 17 meter quad of this design, it would require spreaders about 11 feet

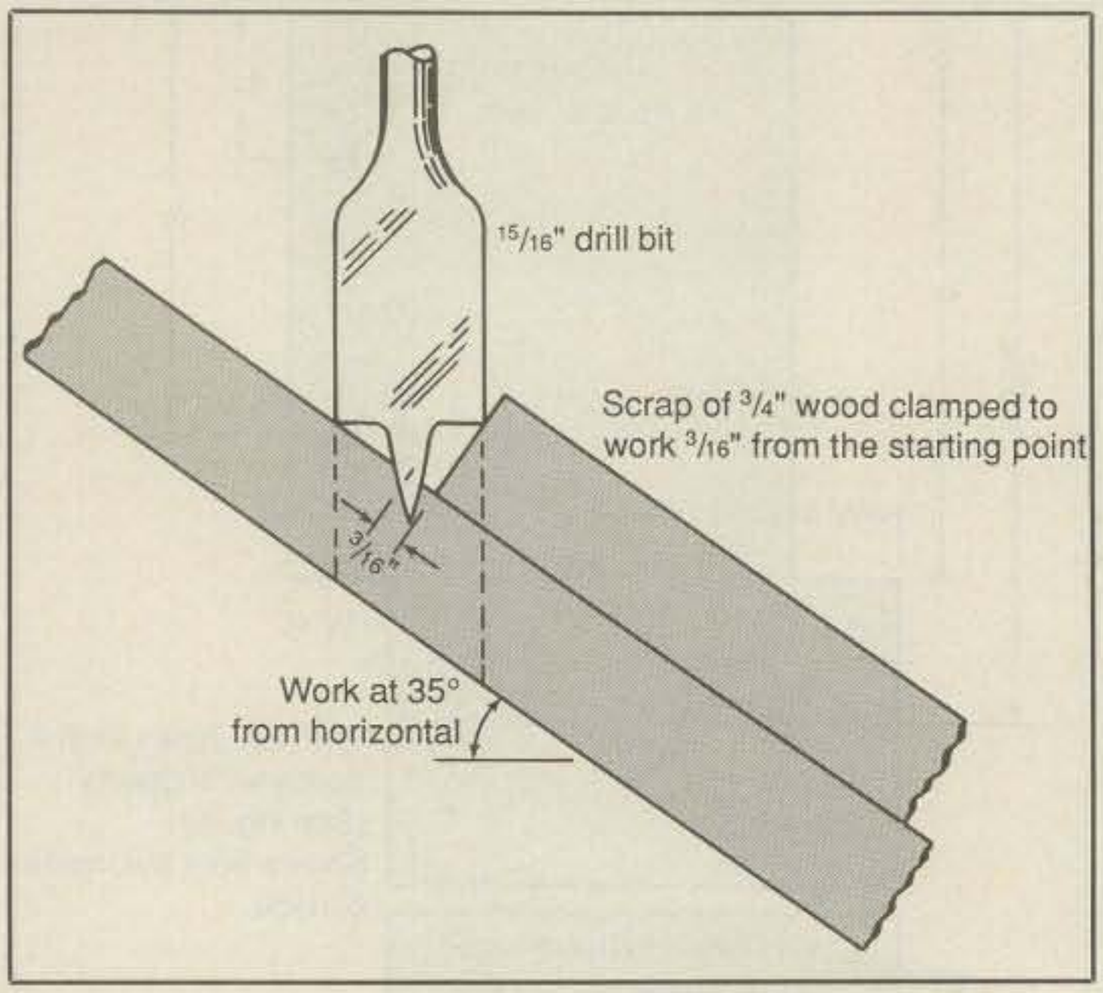


Fig. 3– A jig to aid in the drilling of the conduit holes in the center support pieces.

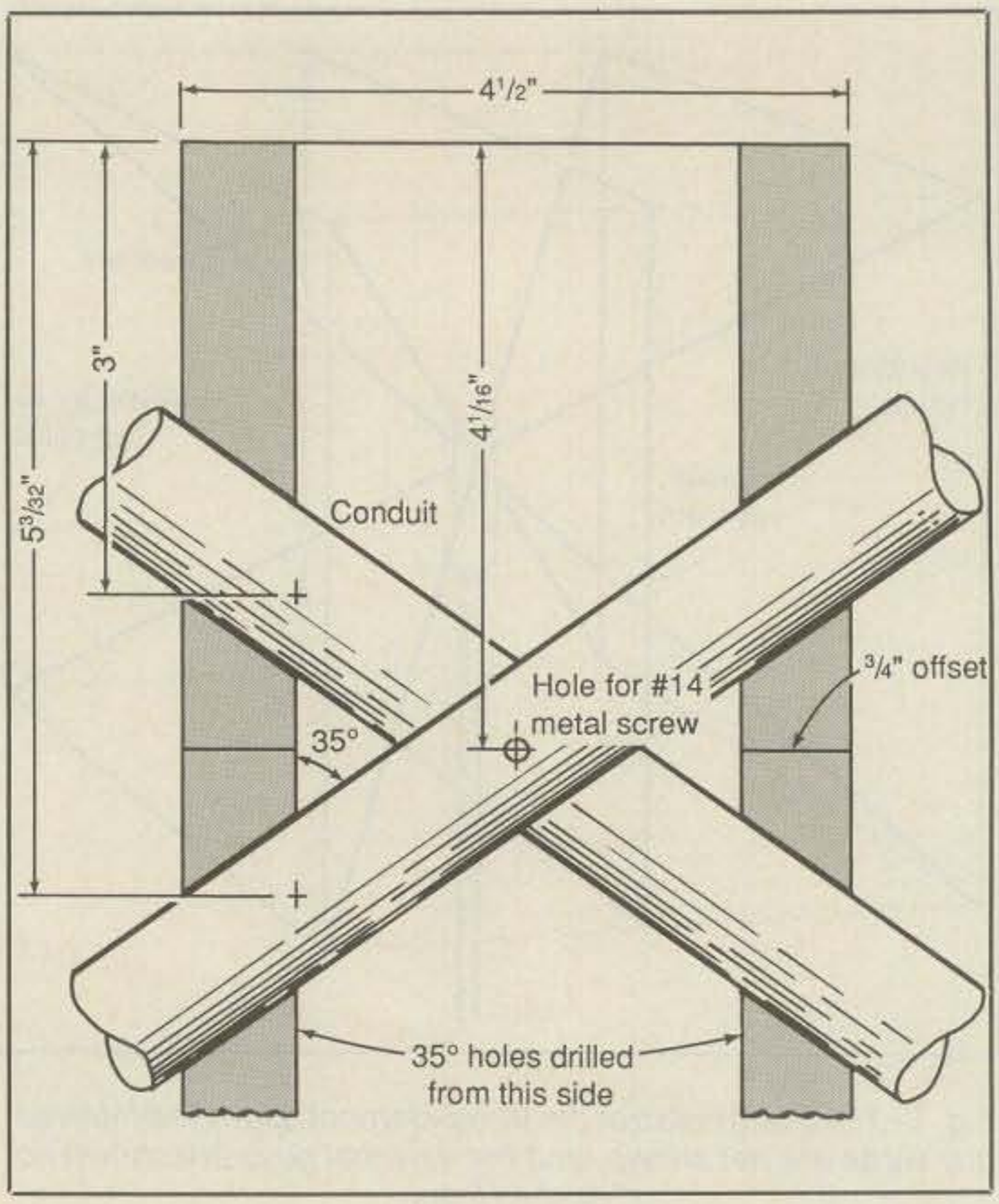


Fig. 4– The center support assembly. Only two of the four spreader supports are shown. The other two would be at right angles to those shown.

long. A 20 meter quad would require 13 foot spreaders.

The ends of the PVC pipes are plugged with pieces of wood dowel 1¾ inches long and 15/16 inch in diameter. An old broom handle was just the right diameter. Fasten a 2½" × ¼-20 carriage bolt lengthwise in each plug, and then glue it in place in the pipe with PVC cement so that the threaded end of the bolt sticks out (fig. 5). All wires are attached to these bolts by loops in the ends of the wires and are held in place by washers and nuts.

Before the fiberglass is applied, the PVC is roughened with a piece of coarse sandpaper. The fiberglass, which comes 2 inches wide on a roll, is tightly spiraled onto the PVC pipe with about a ¼ inch overlap on each turn. Two coasts of pigmented epoxy resin are applied over the fiberglass. The fiberglass and resin cover the plug in the end of the spreader, leaving the threaded portion of the bolt exposed.

A set of internal guy wires is attached to each of the eight spreaders 3 feet from the outer end (see below). The point of attachment is a ring of PVC about ½ inch wide and cut from a ¾ inch PVC pipe coupler. A single cut is made in the ring, and it is glued to the finished spreader.

Finally, a slit 6 inches long is cut with a hacksaw in one side of the base of each of the PVC pipes. It turns out that the inside diameter of the PVC pipes is almost the same as the outside diameter of the steel conduit supports. Thus, with the slit, the PVC pipes can easily slide over the supports.

Assembly

The entire antenna is assembled on a short temporary mast extending about 6 feet above the ground. How this is erected depends on the situation. In my case I assembled the antenna on the flat roof of my house, so I stuck the temporary mast into one of the vent pipes on the roof. If the antenna is to be assembled on the ground, the mast could be driven directly into the ground or inserted into a larger diameter pipe in the ground. It is convenient to be able to rotate the antenna as you work on it.

Internal Guying

Twelve internal guy wires are placed within the structure, 3 feet from the ends of each of the spreaders, to provide additional rigidity. The wires, made of standard aluminum TV guy wire, form their own smaller cube within the larger one. The overall length of each guy is about 8 feet, 6 inches and is broken in the middle with a small compression-type egg insulator. Each one is looped around the spreader on the outer side of the attachment ring and twisted (fig. 6). The positions of the rings and the dimensions of guy wires were selected with the idea of substituting a 10 meter quad for the guy wires if desired. The spacings of the three elements, in terms of wavelengths, would be the same as those of the 15 meter quad.

The Reflector and Director

The lengths of each side of the three elements are calculated, in feet, from the target frequency according to the following formulas, modified from published values:[2]

Reflector: 258/frequency in MHz
Driven element: 252/frequency in MHz
Director: 244/frequency in MHz

No stub or other matching device is used on the parasitic elements. Both are continuous square loops of number 14 solid copper-clad steel antenna wire. The reflector is suspended from 2 inch long ceramic insulators attached to the bolts at the ends of the spreaders by small loops of wire. The director is also suspended from 2 inch long insulators, but because it is smaller, the insulators are connected to the bolts by 6 inch long pieces of wire. *A reminder*: Since the antenna is nearly 12 feet tall, a step ladder or other supporting device at least 8 feet tall is required for the builder to reach the top of the structure.

The driven element is suspended from the long guy wires that run from the corners of the director to the corresponding corners of the reflector. I used number 14 copper-clad steel wire for both those guy wires and the driven element. However, a lighter weight wire should be acceptable

for the driven element, since there is less tension on this element than on the parasitic elements. Again, loops in the ends of the guy wires slip over the bolts in the ends of the spreaders.

In order to avoid interaction between the driven element and the guy wires which support it, an insulator made of a 30 inch long piece of ½ inch hot/cold PVC pipe is inserted in the middle of each guy wire. Again, the length allows four pieces to be cut from a 10 foot length of pipe. Holes are drilled in the PVC, and the driven element is threaded through those holes and secured by short pieces of wire twisted around the antenna wire. Initially, the length of the guy wires with their insulators is about 11½ feet. The actual lengths of the guys are adjusted so that there is enough tension on the system to support the driven element, but not so much that the spreaders are excessively bowed.

It turns out that because of the small offset of the spreader supports and the presence of the internal guy wires, there is a small natural bowing of the spreaders that cannot be avoided. Too much tension on the guys simply increases that bowing. It is interesting that in spite of the bowing of the spreaders, the alignment of the three elements is virtually perfect.

Because there is very little tension on the wires of the driven element, it is important that each leg of that element be as straight as possible. After all of the elements are assembled, some pains should be taken to straighten any bends or curves in the wires of the driven element. The springiness of the antenna wire makes this a bit difficult, but once the wires are straight, they stay that way. Actually, small variations from a true, straight-sided square appear to have no adverse effect on the performance.

The Prototype

Since the antenna has an estimated impedence of around 50 ohms, I fed the driven element of the prototype in the middle of the lower horizontal leg with 50 ohm coaxial cable, both with and without a 1:1 balun. Both arrangements gave similar SWR readings of 1.5:1 or less across the entire phone portion of the band. Both a commercial ferrite core balun and a home-made tri-filar air core balun were used with similar results. In order to reduce the possibility of spurious radiations and TVI, I did incorporate a balun in the final prototype.

If the antenna were to be mounted on a mast extending at least 6 feet above the top of the tower, the balun or the coaxial cable connector could be secured to the mast at the point where the mast intersects the driven element. However, in order to provide greater stability for the structure, I mounted the center support

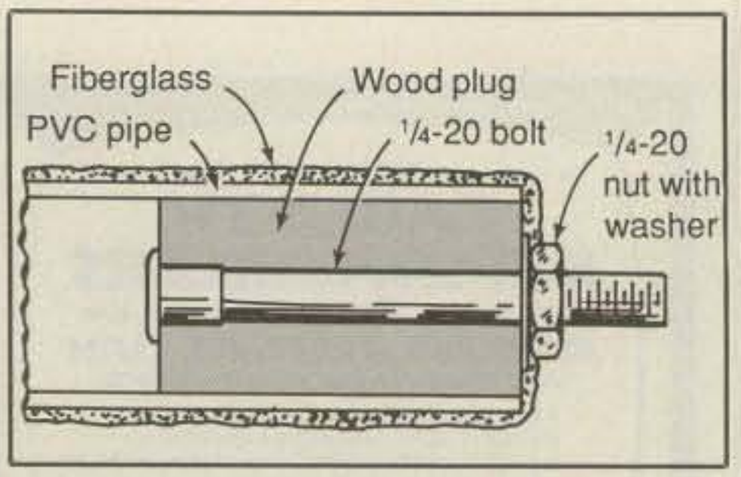


Fig. 5– The end of the spreader, with its wooden plug and bolt.

only about a foot above the top of the tower. This placed the feed point well below the top of the tower. Since the feed point had to rotate along with the rest of the antenna, I hung it from a piece of ½ inch electrical conduit bent to a 90° angle. The pipe was clamped to the mast with a U-bolt just above the top of the tower. It hangs down along the side, just clearing the tower as the antenna rotates.

The complete antenna, without the balun and balun support, weighs 35 pounds, light enough to be carried about or hoisted by one person. Since my wood lattice tower doesn't tilt over, I had to haul the quad to the top. I used a 6 foot gin pole with a pulley. The upper and lower director and internal guy wires were temporarily removed from the spreaders on one side, and the antenna was placed on the ground with the center support next to the tower. The wires were replaced, thus placing the antenna "around" the tower. A rope was run from the eye bolt in the top of the center support, up to the gin pole, and back down to the base of the tower. One person on the ground pulled the rope, while a second person climbed up the tower to guide the antenna.

The light weight of the antenna also made it possible to use a light-duty antenna rotator. I have used a TV antenna rotator with it for all of its five years on the tower. When the wind blows hard, the whole structure waves around quite a little, but there has been no damage to either the rotator or the antenna.

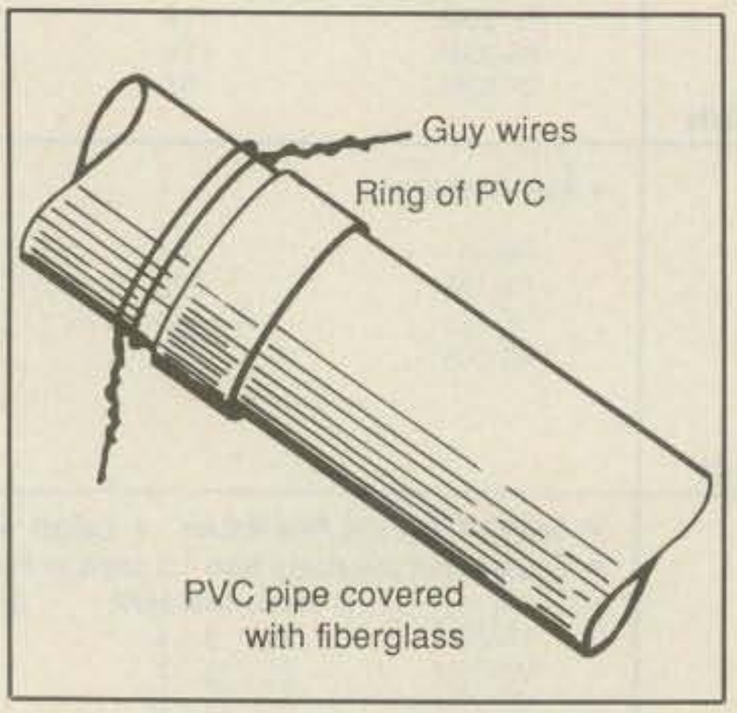


Fig. 6– The ring glued to the spreader for securing the internal guy wires.

A materials list is given in Table I. All of the parts used to build the antenna except the copper-clad steel wire were purchased locally. The wire was ordered from a *CQ* advertiser. The total cost at current prices should run between $75 and $85. The most expensive items are the fiberglass and resin at about $30, obtained from a plastics supply company. The cost of the individual spreaders comes to about $5 or $6 each.

Additional Construction Notes

Ceramic insulators are becoming increasingly difficult to find. It should be possible to make both the compression and the tension insulators out of short pieces of ½ inch wood dowel or hot/cold PVC pipe of the appropriate lengths. Also, the feed-point support could be made of PVC pipe. Two pieces joined by a 90° elbow should do the job.

Although nothing about the construction of this antenna should affect its performance, it turned out that the guy wires which support the driven element did have a slight effect on the resonant frequency, causing it to be a little higher than expected. Experimentation revealed that the shorter the insulators in the guys, the greater the effect. The element lengths given above have been adjusted to compensate for this effect, using the 30 inch long insulators specified.

Performance

This antenna has been in operation at my QTH for nearly five years and has performed admirably. I operate with about 100 watts PEP output, and my tower is 40 feet tall. I have gotten very good signal reports from all parts of the world, standing my ground in pile-ups against much more powerful rigs and/or higher Yagis with more elements. An indication of the front-to-back ratio was obtained from a station on the east coast. He gave me a 10 dB over S9 report with the antenna pointed in his direction, and S5 off of the sides, and an S7 off of the back.

This is not a weekend project. However, in these days of integrated circuits and other sorts of purchased black boxes, it is a project which gives the amateur a chance to do what we were once famous for—building our own equipment from scratch.

References

1. Thurber, Jr., K.T., "The Quad Revisited," *CQ*, December 1988, p. 78.

2. Orr, W.I. and S.D. Cowan, *All About Cubical Quad Antennas*, third ed., Wilton, CT, Radio Publications, Inc. 1982.

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450 MHz	< 3 mv	< 5 mv	< 3 mv	< 1 mv	< 5 mv
850 MHz	< 3 mv	< 20 mv	< 5 mv	NA	< 5 mv
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No, it's not a tower, but it is free-standing, self-supporting, and does increase in height by itself.

Build A Tree-Mounted Antenna Bracket

BY JOHN R. SOMERS*, KC3YB

Let's face it. Not every amateur has an unlimited budget and all of the state-of-the-art equipment advertised in this magazine. At least I don't think that I am the only one with a rig half as old as I am. While a tribander on a 70 foot tower is in my plans, it is not on my lot. Until then I will have to make do with what I have and what I can conveniently come up with. The rest will have to wait.

What I do have, however, are trees. At any given time several are doing duty as support structures for one antenna or another. For dipoles, verticals, and my current Windom, they are unsurpassed—for the money, anyway.

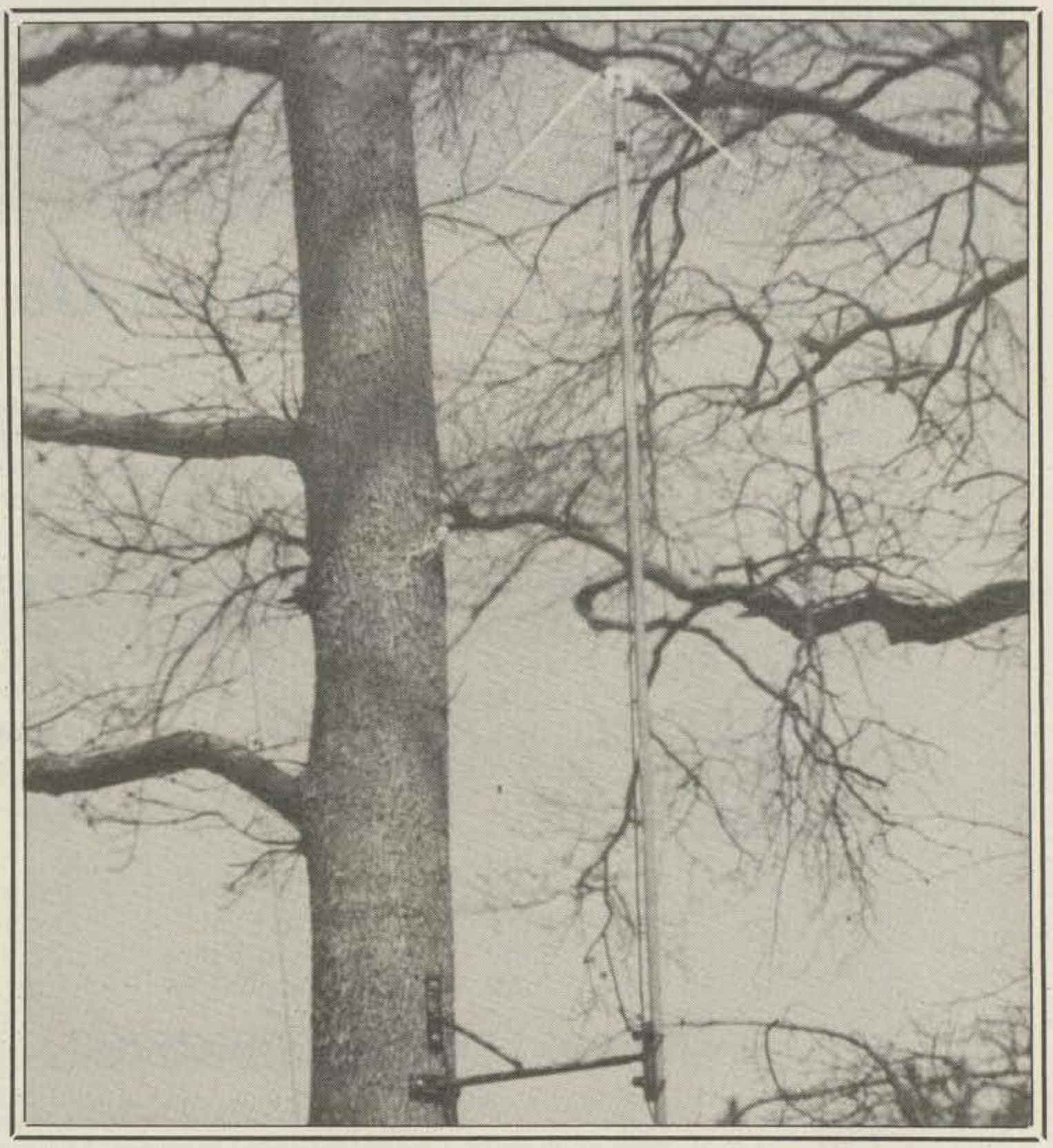
I recently took note of a 65 foot gum tree located near my shack and thought how great it would be if I could get my 2 meter vertical at least part way up that tree. I knew I could never get it all the way to the top, but I could take advantage of the lack of branches for the majority of its height by fabricating a stand-off bracket.

For about $9.00 I bought a heavy-duty galvanized antenna mast. I hacksawed it into three sections—measuring 1, 3, and 6 feet—and welded them together as shown in the diagram. I then took two pieces of 1½″ × 12″ flat stock, bored one hole in each end, and welded them to the tree side of the bracket as shown.

In order to prevent rust where the welding burned away the zinc coating, I sandblasted the joints, primed them, and painted the whole affair with several coats of enamel.

In order to get the bracket to its desired location 'way up the tree, a weighted line was thrown over a stout branch and a heavy nylon rope was pulled over. The bracket was slung at its balance point. I secured the bracket to the tree with ⅜″ × 6″ lag bolts, and the antenna/mast combination was pulled up by the same method. All hands should be kept as clear as possible and you should *without fail* wear a hard hat during this operation.

A critic could find much wrong with this project. For one thing, the tree will keep growing around the bracket mounts, making it difficult to remove in the future.



The completed antenna bracket is versatile, gets your antenna high in the air, and doesn't cost an arm and a leg.

*93-25 Beechwood Place, Crisfield, MD 21817

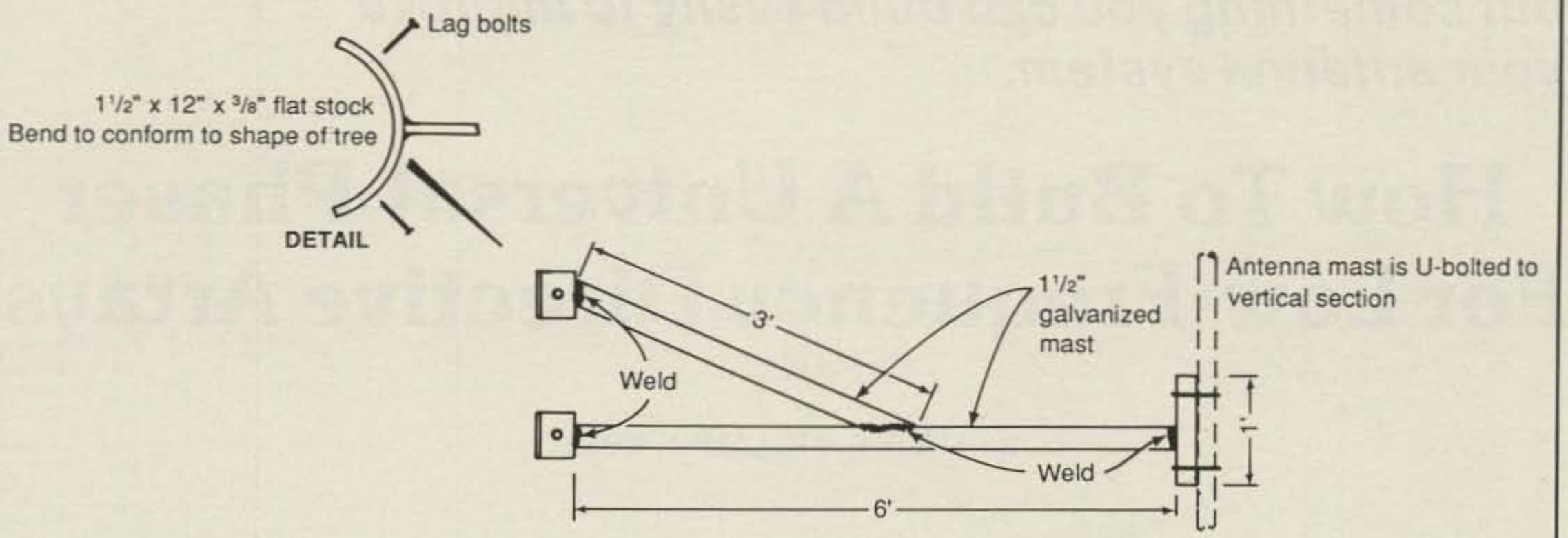


Fig. 1– Side view of the antenna mounting bracket.

Likewise, a staple driven into the tree to secure your coax will sooner or later pinch it in half. Thirdly, access to the antenna and coax is somewhat more difficult than it would be if mounted on a tower.

On the other hand, it is cheap and versatile. Although I presently have only one antenna mounted on my bracket, it is easily strong enough to support more. As my station requirements grow, I expect that I will add one or two.

If this project looks as though it may fill a need at your station, don't necessarily be bound by what I did at mine. Use your imagination. Just think of your tree as sort of a biological tower that grows every year, and soon you will be sporting antennas from your ol' gum tree. CQ

This phaser is not something out of "Startrek," but something you can build easily to improve your antenna system.

How To Build A Universal Phaser For Low-Frequency Directive Arrays

BY THEO. E. BELLAMY*, NU5A

Phasing two antennas to obtain directivity and gain is becoming increasingly popular on the amateur bands. The device described in this article is a universal phaser that can be used to phase two matched antennas for more than one band. It is useful for experimentation because it is completely variable, both in phase shift and impedance matching. It is very simple to build, and can be used with any type of antenna system. While there are other more accurate and elegant methods of phasing two antennas, this device can be used over a wide frequency range, and may be swapped from one antenna system to another as the need arises.

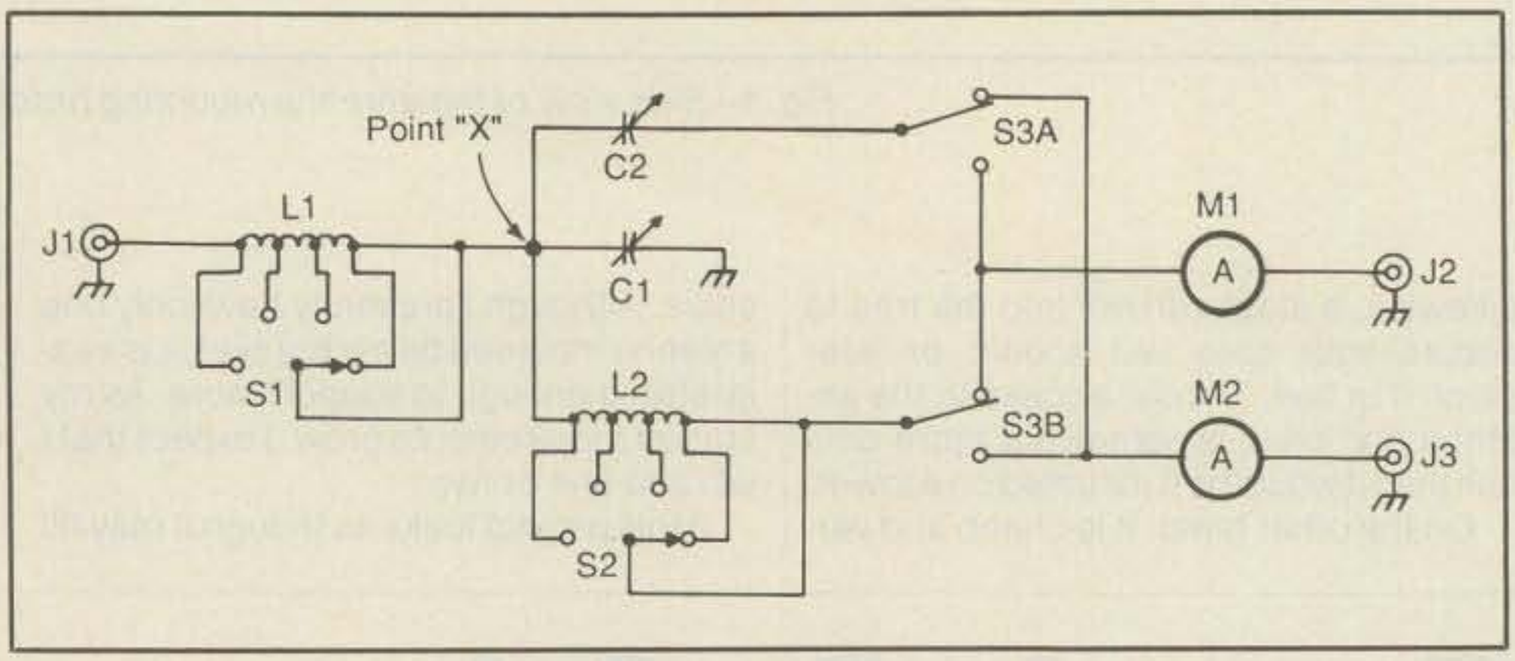


Fig. 1– This is the schematic of the basic phaser. More deluxe versions would have roller inductors instead of S1 and S2, and S3 would be replaced by a DPDT ceramic or vacuum relay.

The Theory, In A Nut Shell

Multi-element phased-array antenna systems obtain their directive characteristics from the phase relationship of the RF currents being fed to the elements. The array will exhibit directivity in the direction of the element receiving the lagging current. Stated another way, the lagging element is the front of the array, and the leading element is the back of the array.

One method of generating this phase difference is to feed the elements with different length feed lines. However, the method we will use in the universal phaser will be to feed the elements with the same length feed lines, while inducing the phase shift by inserting capacitive reactance in one element's feed line and inductive reactance in the other. Since a leading phase angle is caused by capacitive reactance, and a lagging phase angle is caused by inductive reactance, the array will be directive toward the element with inductance in its feed line.

Now I know what you are thinking. You are thinking that the phase shift across a capacitor or inductor alone is always 90 degrees. However, once you factor in resistance, which is always present to some degree, along with stray capacitance in the inductor side and stray inductance in the capacitor side, the situation becomes more complex. Now you can see that by making the capacitor and inductor variable, a wide range of phase angles can be selected.

Fig. 1 shows the schematic of the phaser. C1 and L1 form an L network to match the impedance of point X to the feed line from the transmitter. C2 and L2 provide the phase shift and are adjusted to keep the current balanced while providing the proper phase shift. In the phasing circuits used in commercial broadcast directive arrays, great care must be taken in the adjustment of phase angle and current distribution because the array has to be designed to exhibit a specific pattern. In amateur use this is not a requirement, so the pattern can be adjusted to fit whatever the situation dictates by using variable components without being overly concerned about exact phase angles, currents, or protected coverage areas. Meters M1 and M2 are RF ammeters used to measure the RF currents being fed to each element. They may be omitted, or relative power indication meters may be substituted, as shown in the schematic in fig. 2. More on tuning the phaser later.

Building The Phaser

Construction of this device is very simple. No parts are of critical value, and great latitude is available in their selection. While the coils may be fixed and tapped with an alligator clip, or switched with a multi-position rotary switch, roller inductors are used most often. The capacitors may be broadcast variables of close spacing. Any capacitor in the 800 pF range will work. They are in high-current/low-voltage points, and flashing over is not a real concern.

Direction switching can be accomplished with either a double-pole double-throw relay or ceramic rotary switch. Component placement is not critical except for one consideration. For maximum front to back on receive, L2 and C2 should be shielded from one another. This makes only a subtle difference in

*Rt. 5, Box 6400, Benton, AR 72015

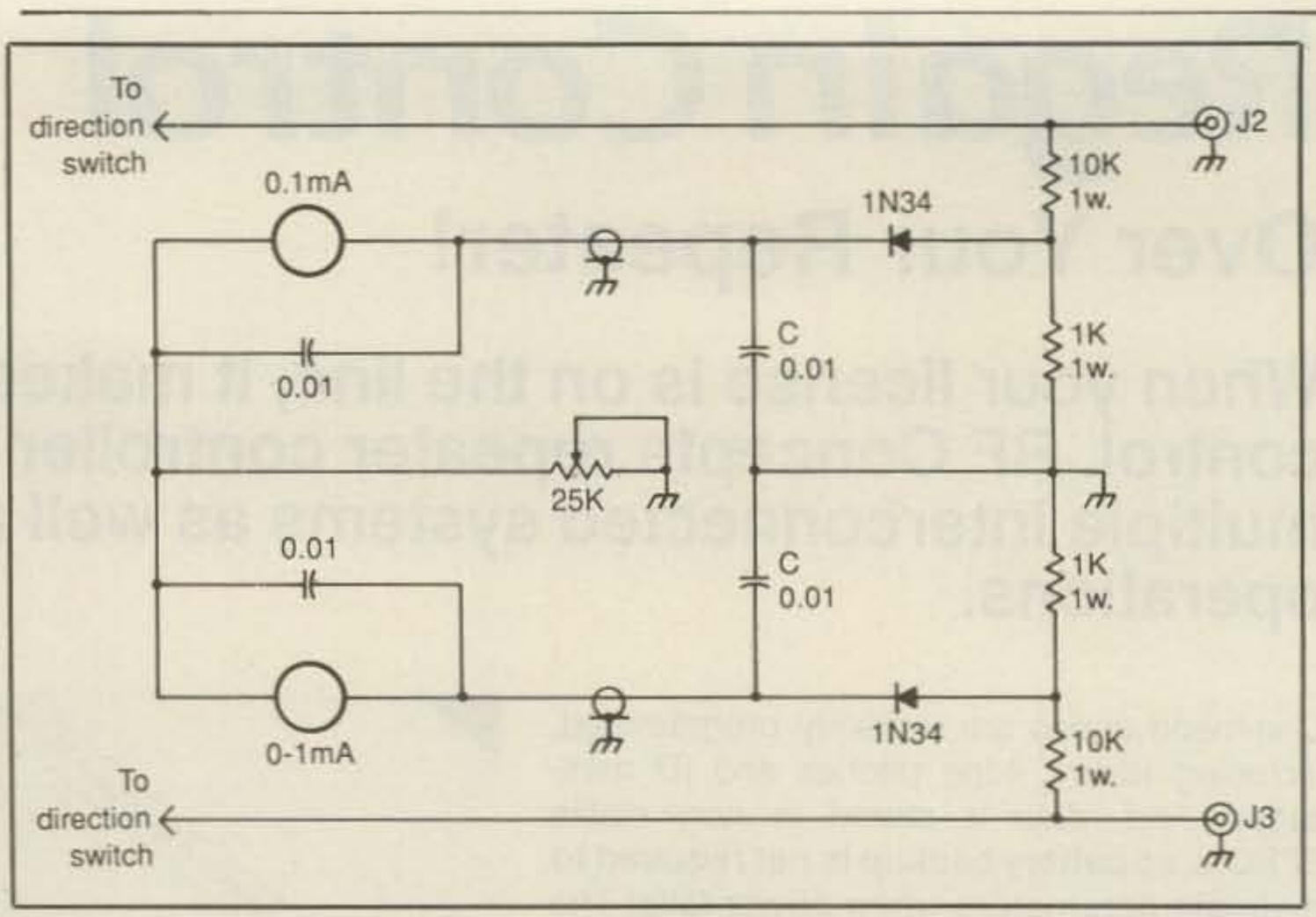


Fig. 2– This is the schematic of the relative output indicators for use in the deluxe phaser. Note that the sensitivity is set with a common variable resistor in the ground return for the meters.

performance, however. A quick game of "chassis chess" with the components and a little common sense should yield a suitable layout in short order. Obviously, the entire assembly should be well shielded.

Fig. 3 shows photos of the simplest version. It uses cheap little broadcast variable capacitors, chunks of miniductor stock with rotary switches, and a double-pole two-position rotary switch to change directions. This rig looks a little wimpy, but it has handled the legal limit with no detected heating. No metering was included, so tuning is strictly done by the S-meter and SWR meter.

The control shaft for C2 must be insulated. In the basic phaser shown in fig. 3, the plastic knob served nicely. C1 does not need to have its shaft insulated because one side of it goes to ground anyway. With most roller inductors an insulator will be required for L1 and L2. If you use a rotary switch or an alligator clip, then you won't have to worry about it. Just remember that if you decide to go the alligator-clip route for experimentation, turn your VOX off before making any adjustments with the alligator clip. If you trip your VOX with your fingers on the clip, you will say something that you might not want to be transmitted. Then you will burn your fingers a second time and say it again.

Fig. 4 shows photos of the most deluxe version. It uses internal shielding, roller inductor for phase shift, and dual metering. This unit was designed for an array of two double bazooka antennas for 75 meters spaced ⅛ wavelength apart. Relative

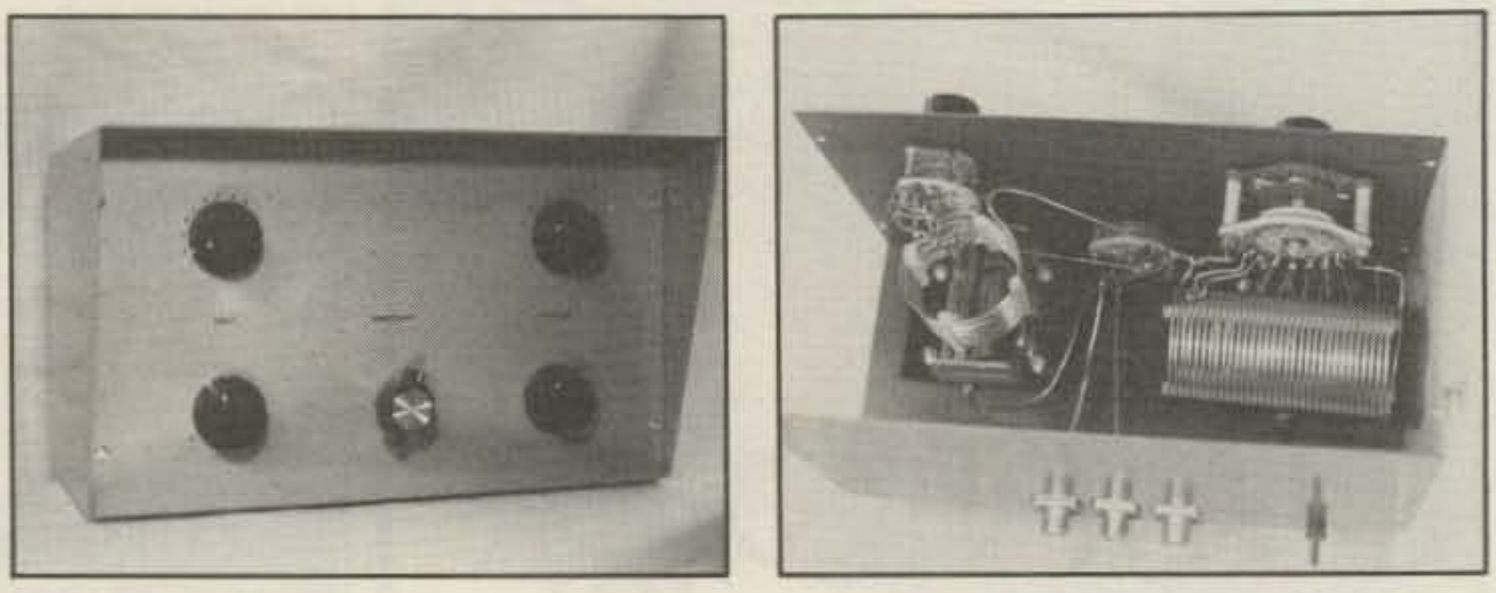
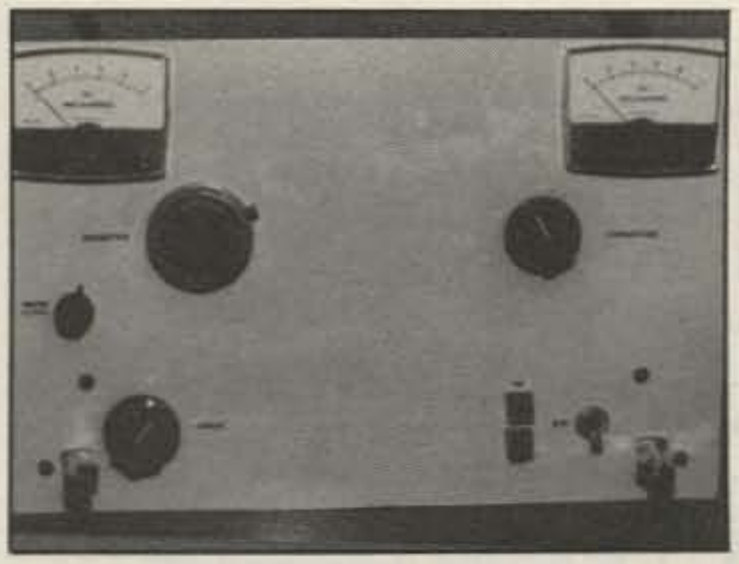


Fig. 3– (A) This is a photo of the basic phaser. Controls for phase shifting are on the left, while the L-network controls are on the right. Direction switching is done with the rotary switch in the center. (B) This is the internal view of the basic phaser. The use of a rotary switch for direction switching eliminates the need for relay power wiring and power supply.



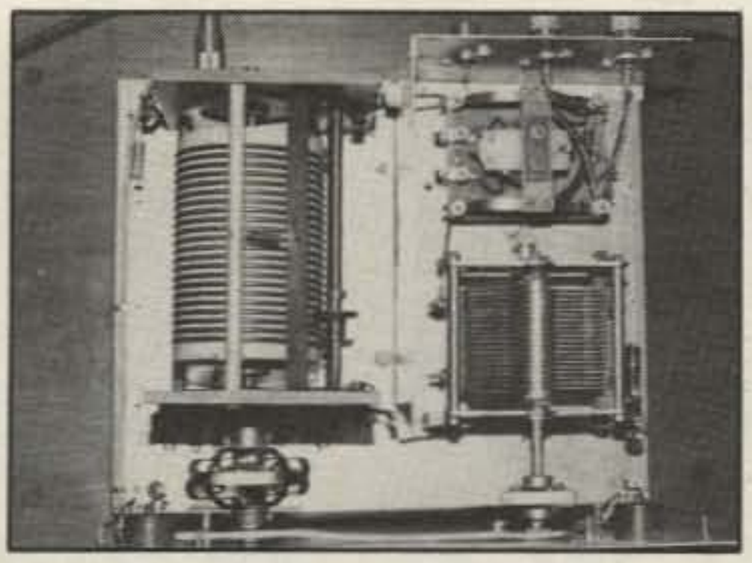


Fig. 4–(A) This is the front of the deluxe phaser built by Tom McLees, WF5I, for use on an array of double bazookas at eighth-wave spacing on 75 meters. L1 in this unit is not variable, as it will tune the whole band by a small adjustment of C1, which is the knob labeled "Input." L2 and C2 are the knobs near the meters. Notice the indicator lights in the lower right labeled NE and SW, next to the toggle switch that activates the direction relay. (B) This is the top view of the deluxe phaser showing the roller inductor for L2 and the Cardwell transmitting capacitor for C2. The direction relay is behind C2. L1 and C1 are under the chassis. Notice the shielding between L2 and C2, and the shaft insulators on the variable components.

output indicators were used to aid in tuning. For spacings other than eighth wave, RF ammeters may be a better aid. This is due to the way the feedpoint impedance changes at different phase angles and different spacings. At eighth-wave spacing the feedpoint impedances of each element are a complex impedance with the same resistive component. Furthermore, the lead element is the same amount positive J that the lag element is negative J. Therefore, equal power will be the same as equal current, and relative power indicators will work quite well. This may not be the case at other spacings.

Set Up and Tuning

Tuning the phaser can be a bit tricky until you get the hang of it. First of all, the antennas must be matched as closely as possible so that they provide the same impedance to the outputs of the phaser. There are lots of really scientific ways to do this, but I have found that the easiest (and probably the most pedestrian) way to accomplish this is to put the feedline from each element on an antenna switch and vary the antenna feedpoint adjustments for minimum SWR, or 50 ohms with a noise bridge. The way you go about this will vary with the type of antenna. Just make sure the feedlines are exactly the same length, or an undesirable phase shift will be introduced that will not be the same when the direction is switched. After you get the elements where they show the same low SWR when you switch between them, you are ready to try out the phaser.

Unless you have built RF ammeters into your phaser, or have an external meter you can use, the only way to adjust the phaser is to tune in a station that you know is broadside to your array and twist the phasing knobs while switching directions until a good front to back is obtained. Then you can feed a little power to the phaser and adjust the input knobs for minimum SWR, or you can use a noise bridge if you have one. With a bit of fiddling you will find a setting that gives good F/B and a low SWR in both directions. However, this may not be the optimum setting if you have no way to check the current to each element. Therefore, try to find a setting of the phase controls that uses both capacitance and inductance. It is possible to obtain F/B with only capacitance providing phase shift, but then all the current will be fed to one element and gain will suffer a little.

Spacing between the elements may be anywhere from ⅛ wavelength to ¼ wavelength. If you must compromise in element placement, closer or wider spacing will work. However, the performance may suffer due to side lobes in the case of wider spacing, or from losses due to low radiation resistance in the case of closer spacing. Try to make the elements as identical to one another as possible.

Summary

This universal phaser will work with virtually any type of antenna. I have used the same phaser with a pair of loops at eighth-wave spacing on 75 meters, and a pair of verticals at quarter-wave spacing on 75 meters. I have a friend who uses a phaser like this with a pair of verticals at eighth-wave spacing on 75 meters. He can change the feed system on the verticals so they work as half-wavelength verticals on 40 meters at quarter-wave spacing, and feed them with the same phaser by just retuning it. Other systems now in use are two inverted Vees, two half squares, two bob-tailed curtains, a pair of double bazookas, and assorted loops. This setup would be ideal for a pair of Butternut 80/40 meter verticals spaced at 31 feet, where they would be eighth-wave spaced on 80 meters and quarter-wave spaced on 40 meters.

It's really great to be able to direct your signal where you want it to go at double the ERP of a single element. It's even more helpful to be able to knock down the QRM and QRN by 20 dB or so. Plus, the variable nature of the device enables you to swing the null off the back and skew the pattern to selectively reduce the amplitude of undesired signals. CQ

CQ REVIEWS:

The MN and YO Software Programs For Antenna Analysis

BY LEW McCOY*, W1ICP

Every once in a while a product comes along which really excites me. The MN and YO software programs are just such products, and you will quickly see why they are exciting.

For years when I worked in the Technical Department at the ARRL, I spent a good deal of my time answering what was called TIS (Technical Information Service) mail. Probably the most often asked question went something like this: "I have just put up a long-wire antenna. My shack is in the basement, and my antenna goes straight up 4 feet to a window, and from there due south for 40 feet, up to 25 feet in a tree, from there 65 feet east to the lot line. What radiation pattern can I expect?" Of course, there was no simple answer. My policy was to tell such amateurs to try the antenna and see where the pattern was best.

MN software, believe it or not, will give an accurate—in fact, a very accurate—answer to any such question about an antenna! This software was derived from an extremely complex program, and, I might add, a very expensive antenna plotting and calculating program, that was designed for the U.S. Government. The classic program is called MININEC.

Brian Beezley, K6STI, has taken the MININEC program, worked it to make it usable for amateurs, and made it possible to run the program on IBM-PC computers (and clones). All you have to do is enter the antenna to be analyzed into a small file, listing the frequency, element or wire lengths, desired height (free space or height above ground), and a few other pieces of information, and then call up MN. Depending on whether or not your computer has a math coprocessor, the program starts to work and completes the analysis. The time it takes to complete an antenna analysis will depend on the complexity of an antenna.

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

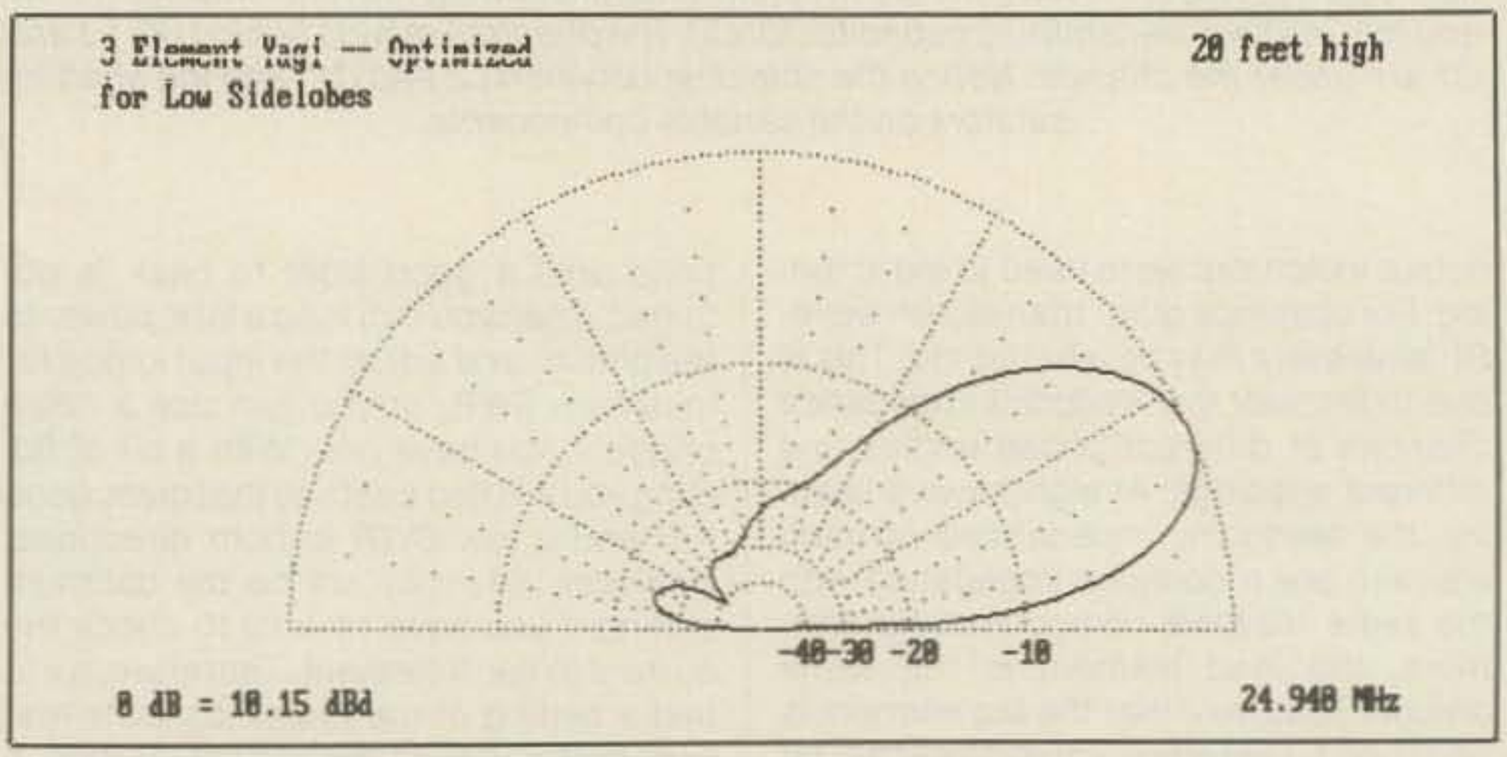


Fig. 1– Printout of a three-element Yagi, vertical radiation pattern, optimized for low side lobes and gain.

MN will compute forward gain, F/B, beamwidth, side lobes, current, impedance, SWR, near fields, and far fields in free space or over realistically modeled earth. It can also compute the interaction of nearby antennas.

MN along with another provided program, MNPLOT, will turn out all the vital statistics on the antenna. These are in a single package. Another antenna program, YO (Yagi Optimizer), is separate software, and more on that item later. The printout shown in fig. 1 is the analysis of a three-element Yagi. The vertical radiation patterns are given in this instance. Note the gain figure at the particular angle of maximum gain.

Included in the MN software program is the already completed analysis of many popular beam designs, plus K6STI's very pertinent comments about each antenna. The MN program is simple to use once you understand how to place the X, Y, and Z coordinates of the antenna to be tested. Either a free-space pattern can be derived or a pattern over real earth (any kind of earth), or even ground planes. The antenna pattern is computed in both the vertical and horizontal planes, with any degree from one on up.

Over the years I have thought of many antenna designs, but in most cases I never made working models. I literally have been having a ball running some of the designs, and one or two, particularly a beam with quarter-wave elements, look very promising. I also found that several of my designs were real dogs. This is a truly marvelous program because it is extremely accurate, and I might add MN does a truthful job in analyzing antennas. It certainly opens your eyes when some of the popular antennas are analyzed. It becomes obvious that many antenna designers who think they have created really great antennas would be in for a real shock if they ran the program on their creations (both commercial and otherwise). I also have to admire Beezley's file comments on the various antennas he has tested. Take the G5RV antenna, for example, which I for one have never been excited about because when all is said and done, it boils down to a simple shortened dipole with tuned feeders.

Here is what K6STI has to say, and I

```
Bowtie Dipole
Free space
27 MHz
7 wires, inches
6  0,-1,0      0,-60,36     #12
6  0,-60,36    0,-60,-36    #12
6  0,-60,-36   0,-1,0       #12
6  0,1,0       0,60,36      #12
6  0,60,36     0,60,-36     #12
6  0,60,-36    0,1,0        #12
2  0,1,0       0,-1,0       #12
1 source
38,224,0
0 loads

This antenna doesn't seem as broadband as expected.

G - Gain , F/B , Impedance      U - View Antenna File      F - Change Frequency
P - Plot Directive Pattern      E - Edit Antenna File      S - Change Sources
D - Save Directive Pattern      A - New  Antenna File      L - Change Loads
N - Save Near Fields            Q - Quit to DOS

                                                           Command:
```

Fig. 2– This is the menu readout provided by MN. I happened to bring this up with a file on the Bowtie which will give the reader another look at a file.

might add, this is what an antenna file looks like:

G5RV Multiband Antenna
Free Space
14.200 MHz
1 wire, feet
20 0 −51 0 0 51 0 #12
1 source
10,100,0
0 loads

"Even using the recommended 34 foot open-wire matching section, the designer states that an antenna tuner is necessary for all-band operation, and MN confirms some pretty wild input impedances. The radiation pattern on each band is just what you would expect for a center-fed wire of this length: dipole-like on the lower bands, cloverleaf-shaped on the higher ones. All in all, this popular antenna does not seem to possess any special properties, operating like any ordinary random-length center-fed wire."

If you examine the above file, you will note the name of the antenna, where it is to be modeled (free space in this instance), and the frequency. The frequency can be given, and in this case the G5RV is a multiband antenna so the antenna is plotted for 14,200 kHz. The next line gives the information that it is a wire antenna and will be calculated in feet. The program works in feet, inches, decimal equivalents, and so on. It follows the X, Y, and Z coordinates. More on those in a moment. The first number "20" is the number of pulses into which the antenna is divided for the purpose of analysis. The number 51 is, of course, one half the G5RV flat-top dimension, and the last number, #12, is the wire dimension.

The documentation for the program is excellent, and I will quote the explanation of the source, segments, and so on.

Coordinate System

X and Y are in the horizontal plane and Z is height. In MN, if +X is North then +Y is West. MN maintains the original MININEC azimuth angle convention, which is counterclockwise and is reversed from normal compass bearings: 0 degrees azimuth angle is along the +X direction, and 90 degrees azimuth is along the +Y direction. +Z is up. The forward horizon is at 0 degrees elevation angle, 90 degrees is overhead, and 180 degrees is the rear horizon. The 180 to 360 degree positive angles can also be referenced by −180 to 0 degree negative angles. Unidirectional antennas are assumed to be aimed in the +X direction by the subroutine that computes gain, F/B, maximum side-lobe level, and beamwidth. The Z coordinate can be set to 0 if only free-space modeling is performed.

To gain a mental picture of the geometry involved, imagine facing a 3-element beam 5 feet off the ground and aimed at you. Assume that the center of the driven element has been put at X=0, Y=0, Z=5. The main lobe of the beam points directly at you, in the +X direction. The elements extend in the −Y direction to your left, and in the +Y direction to your right. The director has a +X coordinate, while the reflector is in −X territory. Positive azimuth angle is to your right (counterclockwise when viewed from above), and positive elevation angle is above your head.

Wires, Segments, and Pulses

A wire is always straight in MN. A bent wire is modeled by connecting two straight wires. Two or more wires are considered connected if they share the same XYZ coordinates at an endpoint, and current will be allowed to flow between the wires as if they were soldered together. For example, each loop of a cubical quad antenna is described by four separate wires whose endpoints lie at four points. A two-element quad is thus modeled by eight wires in MN, even though a real antenna would actually have only two wires strung around the spreaders. A Yagi element having tapered sections of telescoping tubing may be modeled by using several connected wires having different diameters (element tapering can greatly affect antenna performance and should always be accurately modeled).

MN allows you to specify into how many segments each wire is divided for analysis purposes. Generally, the more segments used, the higher the accuracy, but the longer the analysis takes. The number of segments required depends on the geometry of the antenna being analyzed and the accuracy required. For example, 5 to 25 segments are generally used for dipole elements, and 15 to 100 for full-wave loop elements. Many segments are required for antennas having very closely-spaced wires, such as folded dipoles. To be sure that you are using enough segments, you should always increase the number of segments and try a new run to see if the results change significantly. This is very important.

MN uses the segmentation to divide the current in the wire into sections called pulses. The current is uniform within each pulse. Each pulse is centered on a segment boundary. No pulses are placed at wire ends, where the current is always zero, but a pulse is placed at every wire junction and overlaps onto all wires making up the junction. The number of segments (not pulses) for each wire is specified in the antenna file. MN will allocate pulses after unscrambling all the wire connections. The number of wires is limited to 50, the number of pulses to 126, and the number of segments to 176.

Sources

A source of energy (feed point) is permitted at any pulse. You must have the feed symmetry in mind when you divide the driven wires into segments. In the Yagi example above, the driven element uses an even number of segments (10).

This results in an odd number of pulses between the segments (9), and thus a centrally located pulse at the feedpoint (pulse #14, including the 9 pulses in the reflector wire which was specified first). Specifying an odd number of segments for the driven element would result in an off-center feed point. The first time MN is run with a new antenna file, the **.RUN** output file generated by MN should be examined to verify that the pulses have been distributed and numbered the way you intended. In fact, the easiest way to figure out which pulse number to specify as the feed point is by making an initial guess, loading the antenna file, quitting, and then examining the antenna geometry section of the **.RUN** file to see how the pulses really were allocated.

If an antenna has only one source, and you are not interested in the magnitude of the antenna currents, then the voltage can be any non-zero value and the phase can be set to 0. For two or more sources the relative magnitudes and phases of the sources will directly influence the antenna characteristics.

Loads

You may specify up to 50 lumped loads for an antenna. Typical amateur antennas using lumped loads are triband beams, trap dipoles and verticals, and shortened dipoles and whips. Loads are always located at pulses. There are two different load models—impedance loads and Laplace Transform loads. An antenna may not mix the two kinds.

Some Further Thoughts

As I stated, the documentation is excellent—and extensive. I'll admit it took me a while to actually start plotting antenna files, but once you get the hang of it, it's easy.

I use a hard disk, with dual floppies, IBM compatible, and I have an Epson LQ-800 high-quality printer. In addition, I have gone whole hog, so to speak, and have VGA, with NEC Multisync II display. The antenna patterns displayed in this article were produced from this system. The software is equipped to handle the simplest of display methods, up through EGA.

When MN is installed and an antenna file called, a menu (fig. 2) is displayed. After the choice is made, the program goes to work grinding out the analysis. The length of time depends on the complexities of the antenna, ground conditions (yes, you can set ground conditions), and so on. The longest program I ran took over two hours, but as Beezley points out, if you have a coprocessor in your computer, the time needed is much, much less. (Since writing this, I purchased a coprocessor for my computer and the program really "flies.")

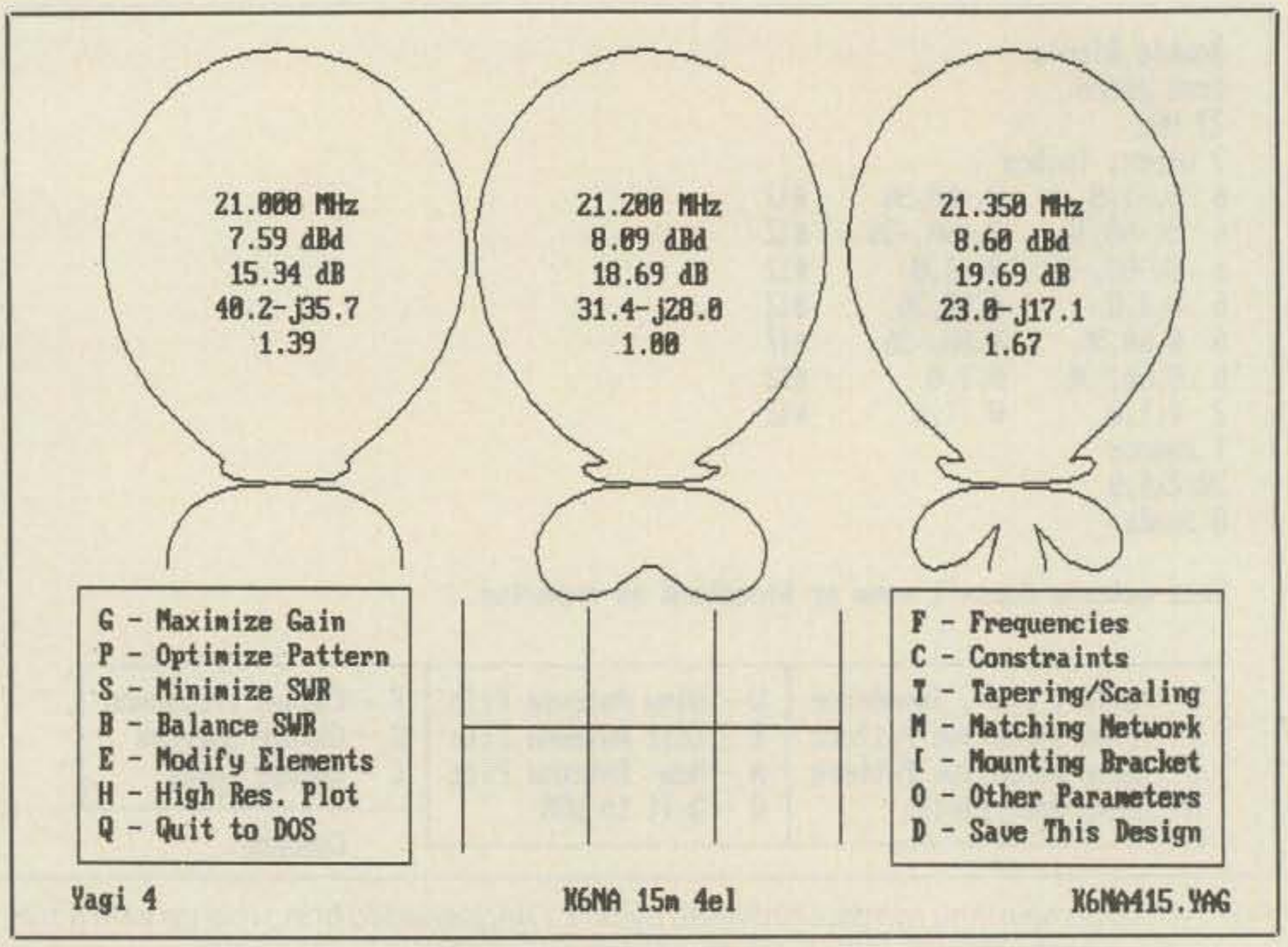


Fig. 3– This is a printout from the very marvelous Yagi Optimizer program. In this case it happens to be a four-element beam of K6NA. The first line is, of course, frequency, next gain, then F/B, then impedance, including the reactance. Note the menu that is provided; I would say that it is more than complete. Also, this program will optimize any type of Yagi. (For obvious reasons I have not shown any commercial beams.) Not surprisingly, some are very good.

MNPLOT is included, and when files are completed with MN, MNPLOT can be brought up. MNPLOT provides comparison modes between antennas by simply tapping the space bar on the keyboard. I have long argued that for the same boom height, a quad has a lower angle of radiation than a Yagi. In the comparison mode, the meat of the radiation angle for the quad was 2 to 4 degrees lower than a Yagi. Some amateurs may argue that 2 or 4 degrees isn't worth debating about.

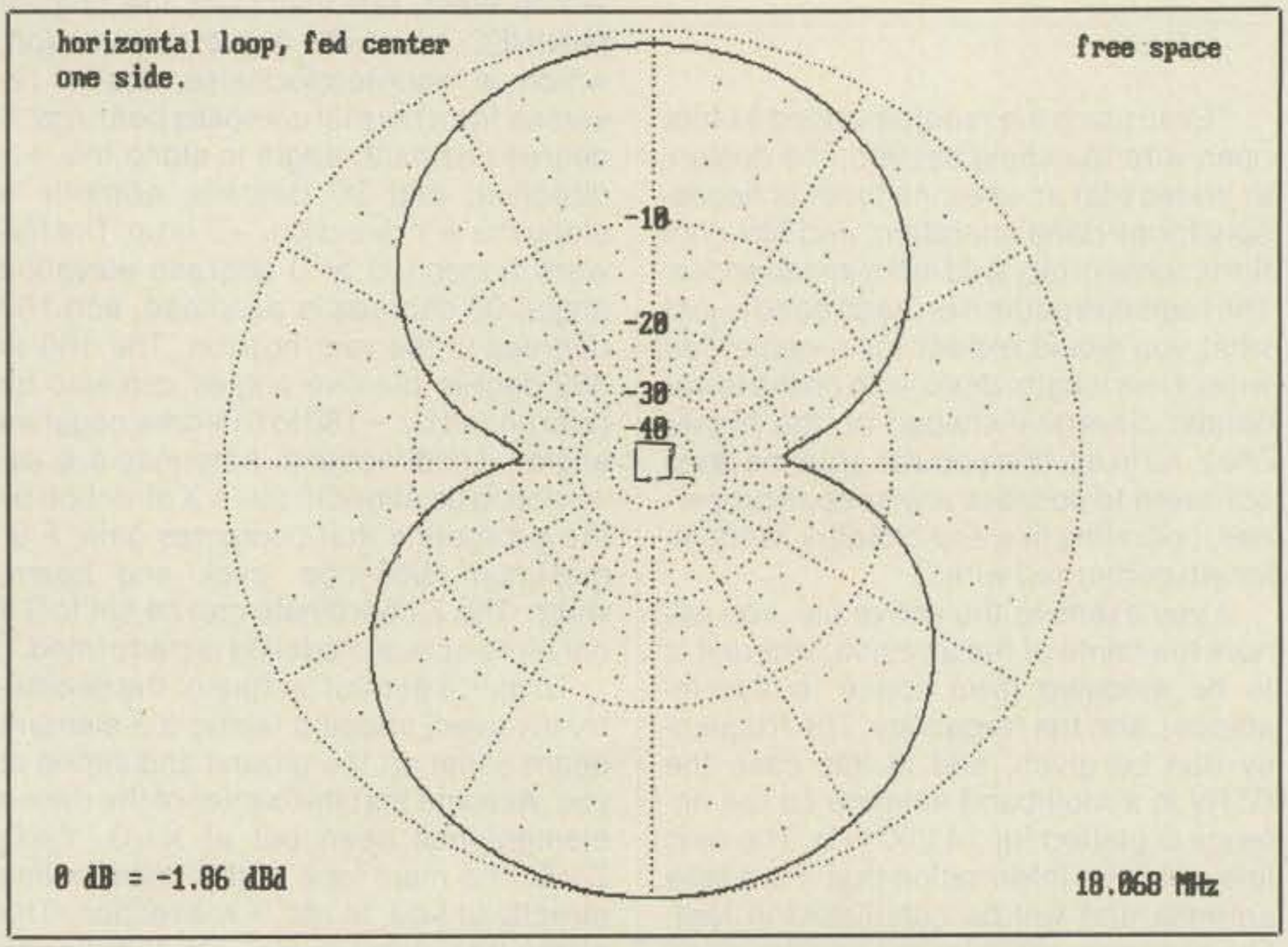


Fig. 4– This is the horizontal free-space pattern of a horizontal loop. For the neophyte, visualize yourself as being in space, looking down at an RF section taken through the radiation pattern. The loop would be at the center, as shown.

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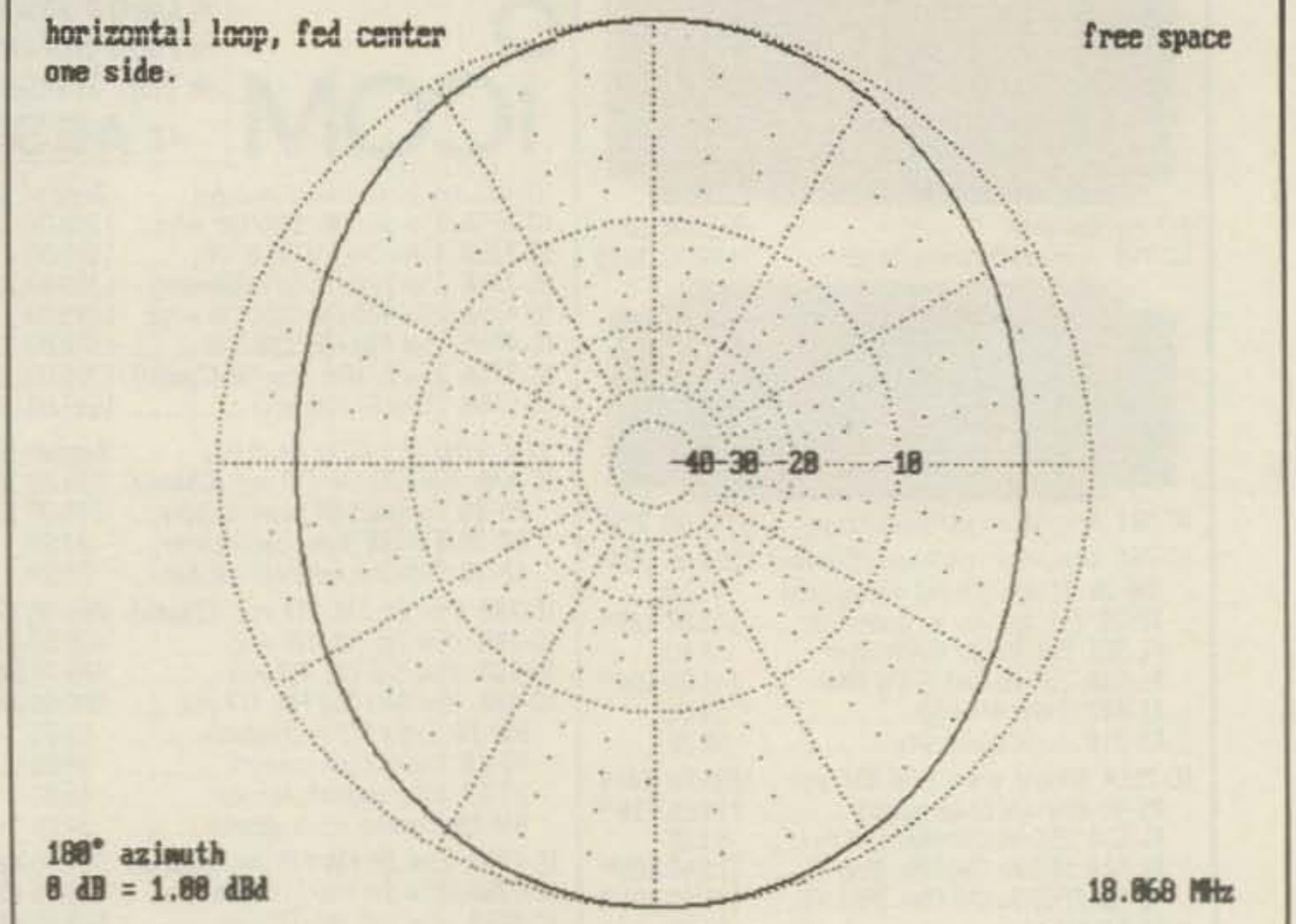


Fig. 5– This is the vertical free-space pattern. In this case we would be looking at the loop edge on. One can ignore the bottom half of the pattern. It is also true that the presence of real earth would modify the pattern, depending on how high the loop was. However, note that most of the radiation is straight up. In fact, the majority of the power would be above the critical angle of radiation for any return from the ionosphere. It does appear to be a more or less omnidirectional antenna—in the horizontal plane, but certainly not as good as a vertically positioned loop.

However, my answer to that is to actually calculate the ionosphere hops for long DX. I am sure you'll be surprised.

Actually, to do a really good review on this program would take a lot more pages than I am allowed, so I had better talk a little about YO.

Yagi Optimizer

Over the years I have argued, quite strenuously at times, that ours is a hobby of competition. You and your buddy ham may be great friends, but if he gets consistently better reports than you, you may tell me that you don't mind, but all I've got to say is—horse puckey.

YO is a completely independent software program marketed by Brian Beezley that quite simply will optimize any Yagi antenna. You put the information into your antenna file—element size, spacing, element taper—and then you tell YO that you want maximum gain, or more front-to-back, or more bandwidth, and YO goes to work and provides a readout as shown in fig. 3. If you aren't happy, change your request and you'll get an answer. Needless to say—and I don't want to get into arguments with antenna manufacturers—the program will, of course, tell you how to improve your commercial antenna. So if you are competitive, and who isn't, this program will do the job for you.

More Details

YO.EXE is a Yagi-Uda antenna analysis and optimization program for IBM-PC and compatible computers. YO will analyze a Yagi hundreds of times faster than general-purpose antenna modeling programs such as MININEC or MN. A fast Yagi model is implemented with high accuracy for forward gain and overall pattern, and good accuracy for F/B and input impedance. The Yagi model used in YO is significantly more complex than the well-known W2PV Yagi model. YO includes an algorithm for automatically optimizing the forward gain, radiation pattern, and input impedance of a Yagi. This algorithm simultaneously adjusts all element lengths and spacings to repeatedly converge an antenna design to an optimal set of dimensions, using performance criteria and objectives which you specify.

The Yagi analysis algorithm used in YO employs a method-of-moments solution for element currents. It includes correction factors to prevent convergence to supergain geometries, and to more closely match the YO-computed gain and pattern to those obtained with MN. Com-

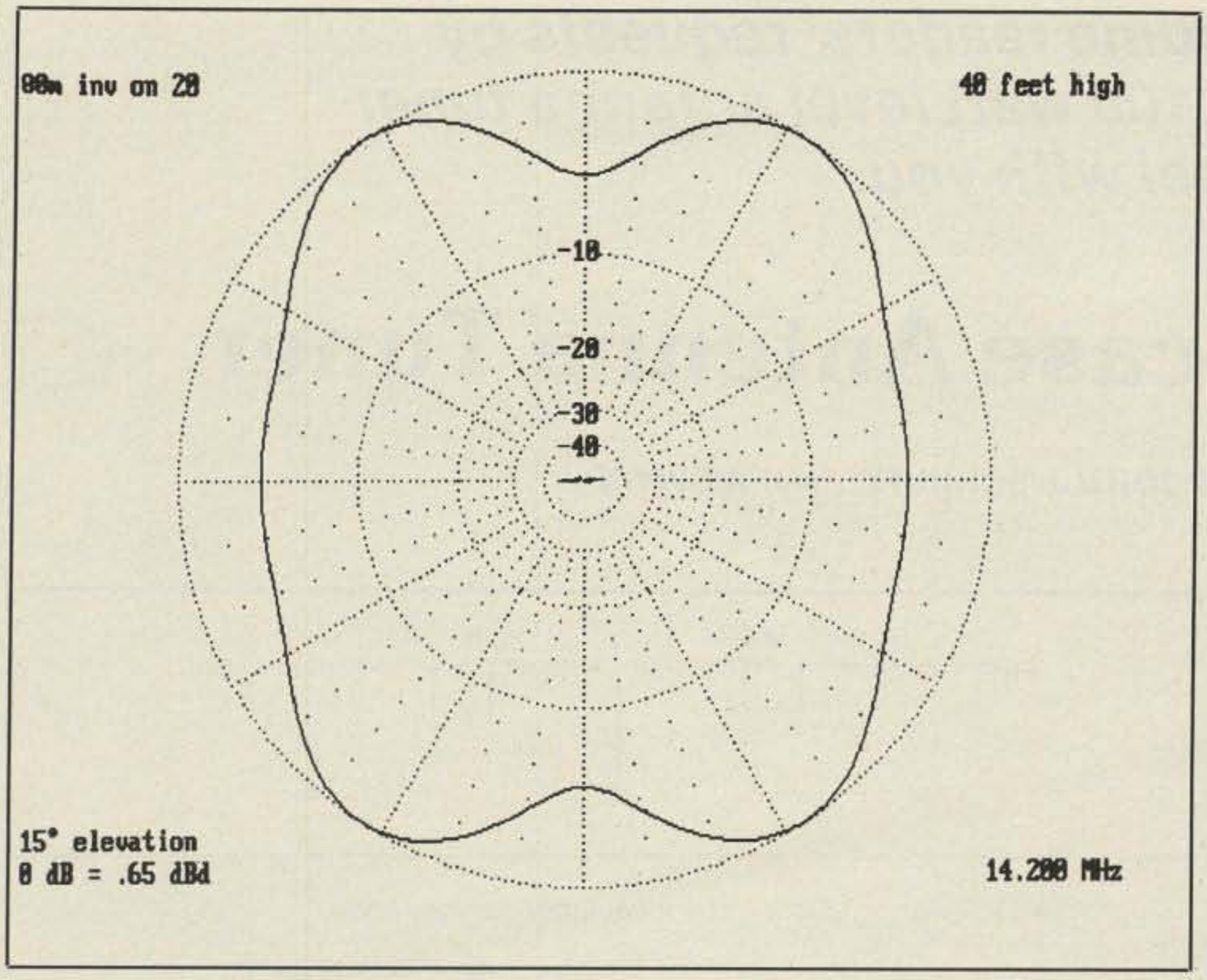


Fig. 6– Probably the most popular antenna used is an inverted-Vee cut for 80 meters (probably because of the single support needed). As I stated, I plan to do an article showing all the patterns for all bands using MN. This is the horizontal pattern of an 80 meter half-wave used on 15. This pattern is taken at 15 degrees above the earth and gives you an idea of the four major lobes. However, see fig. 7 for the maximum gain of these lobes.

pared to MN, the accurate arbitrary-geometry antenna modeling program based on MININEC, YO is typically within 0.1 dB for forward gain, within a few dB for F/B, and within a couple of ohms for input impedance. Patterns produced by YO and MN for the same Yagi usually appear nearly identical. Occasionally, F/B differences of 10 dB or more will occur for unusual Yagis which YO computes as having all back lobes more than −30 dB down.

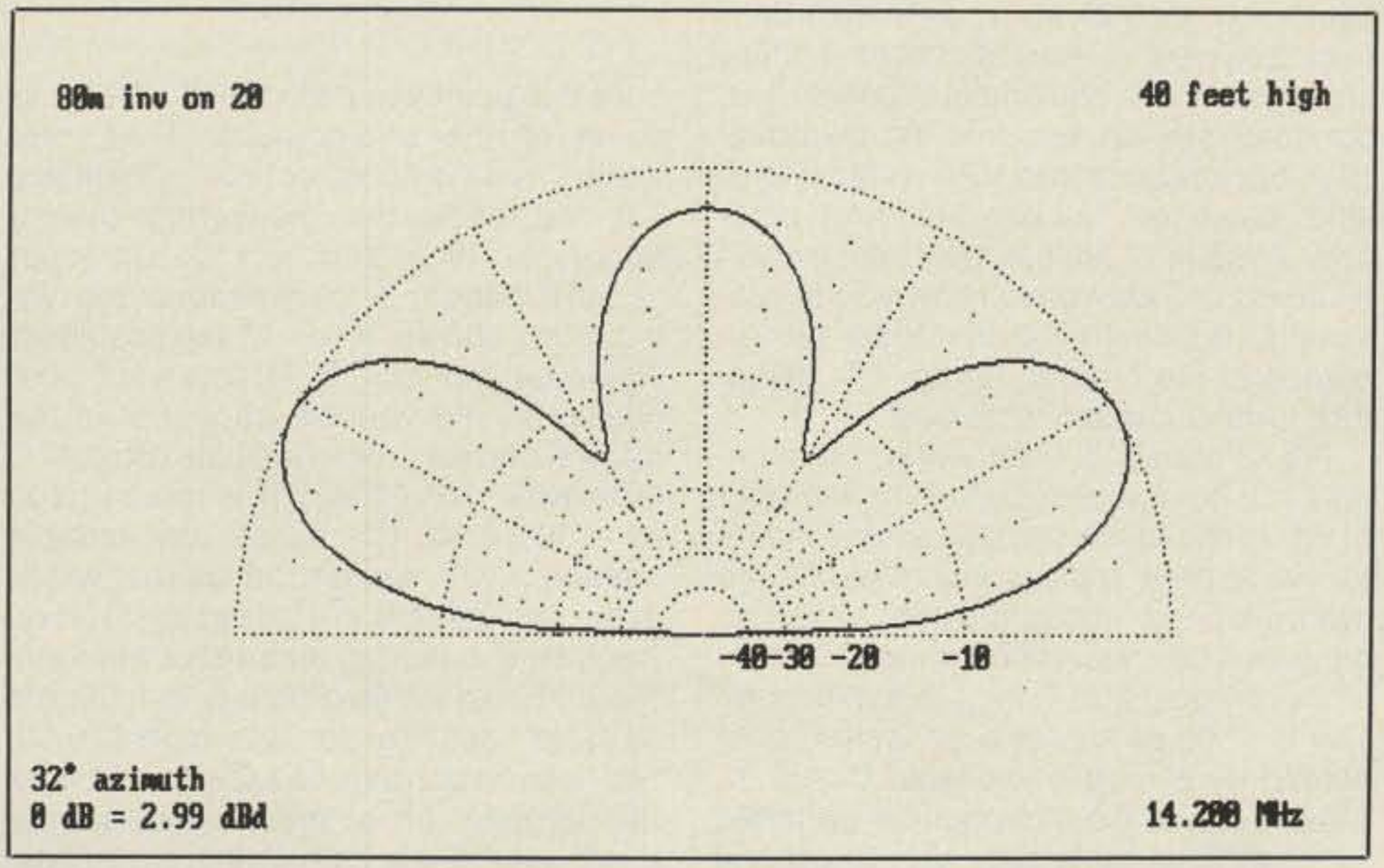


Fig. 7– Vertical pattern of the inverted-Vee. Note that maximum gain occurs just below the 30 degree line. For the neophyte, you are viewing the inverted-Vee edge on, the plane of the antenna running through the center of the drawing.

The speed of the YO Yagi analysis algorithm permits several Yagi repetitions per second to be performed for small Yagis (8 MHz XT with 8087). Using YO a small beam can be completely optimized for gain, pattern, and SWR over a frequency band in just a few minutes. For antennas having many elements, such as long-boom VHF Yagis, the optimizer may be run unattended with constraints to automatically find the best antenna—while you sleep, if necessary. Yagis having up to 50 elements can be modeled. YO will analyze a Yagi at a spot frequency or at the low, middle, and high frequencies of a band of interest. It will update plots on your screen of the far-field radiation patterns at each frequency while it repeats the Yagi dimensions, and will continuously display the forward gain, F/B, input impedance, and SWR. This running graphics/alphanumeric display lets you interactively direct the optimization. You may interrupt the optimization at any time to save the current design or to change optimization strategy.

It is very fascinating to watch the computer screen as YO analyzes an antenna, changing the gain, F/B, and so on. If you are an antenna buff, this program is also a must.

By the way, getting back to MN, I have received many requests over the years for information about full-wave, horizontal loops. What I mean here is an antenna that is the same as a quad element but laid on its side, then elevated, usually fed with tuned feeders. I never got excited about the antenna simply because so much of the radiation is straight up, thereby losing a lot of power. (Straight-up radiation is great for working space ships, but not much else.) In any case, I used MN to run the program on such a loop. The pattern shows exactly how bad and how much power is lost. However, I know amateurs, and I know a lot of amateurs will swear by the antenna. Always remember, 99 percent of all antennas will work someone—somewhere—and even poor antennas can occasionally produce good reports. However, for the horizontal loop see fig. 4, horizontal pattern, and see fig. 5 for the vertical pattern.

I couldn't resist modeling probably the most popular antenna in use, an inverted-Vee. In fact, I want to do an article showing the patterns on all bands of this antenna. What I am referring to is a center-fed, 80 meter half-wave, with tuned feeders and a Transmatch, with the feedpoint up 40 feet. I have already done the patterns. Now I just have to write the article. In any case, I couldn't resist showing you the 20 meter pattern for this antenna (see figs. 6 and 7).

The MN program is $75 and the Yagi Optimizer, YO, is $90. They are available from Brian Beezley, K6STI, 507½ Taylor, Vista, CA 92084.

W4FA responds to some readers' requests by describing a unique 100 watt level antenna tuner small enough to travel with you.

The Suitcase Antenna Tuner

BY JOHN J. SCHULTZ*, W4FA/SV0DX

After my article on a suitcase station appeared in the Febraury 1989 issue of *CQ*, I received various inquiries about specific components that comprise the station. Many of the inquiries had to do with the "mini" antenna tuner used with the station setup.

I mentioned in the "suitcase" article that the antenna tuner used was similar to previous small antenna tuner designs I have described in various *CQ* articles. That statement is true enough. However, the final suitcase tuner design I now use in the suitcase station contains various improvements over previously published tuner designs. I incorporated the use of some components which could easily be "field serviced" almost anywhere in the world. A greater inductance (and hence matching) range was achieved by using iron-powder toroidal cores for the inductors, etc.

Before you rush away thinking that I'm about to describe some exotic design requiring complex construction, let me assure you that quite the opposite is true. All of the components used in the improved suitcase tuner are readily available from U.S. suppliers. Many of the parts can be obtained from local Radio Shack stores, while other parts can be obtained from mail-order houses such as Amidon and Radiokit which specialize in low-quantity hobbyist purchases. You might also be interested to learn how easy and relatively inexpensive it is to construct inductors using toroidal cores, whether such inductors are used for tuners, in RF filters, or for other RF applications.

Constructing a mini-tuner means that there has to be some marriage of minimum tuner size with the ability to match a wide range of unknown antenna load impedances over as wide a frequency range as possible. Also, the total cost has to be quite reasonable. My own vote for such an ideal tuner design, as far as its electrical layout is concerned, is shown in fig. 1. Ideally, the two inductors would be continuously variable roller inductors,

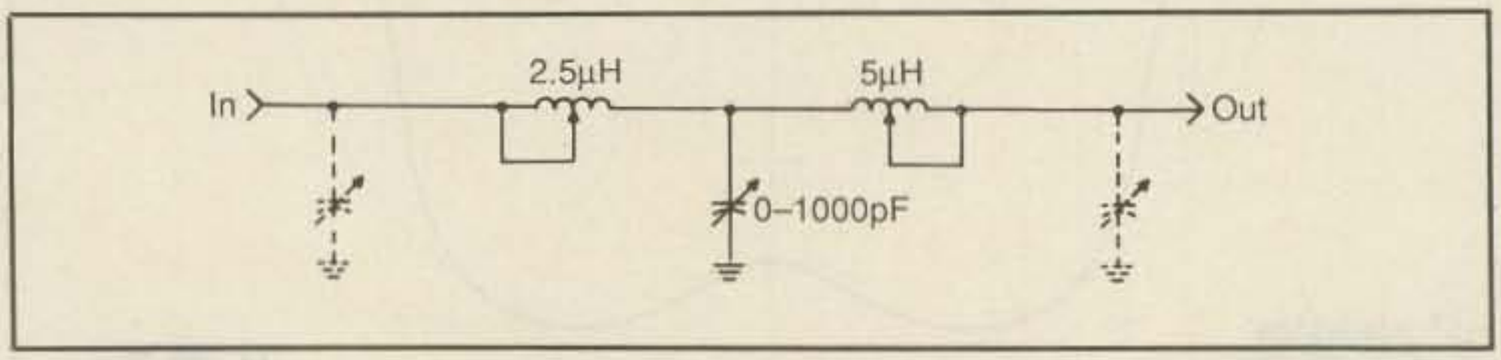
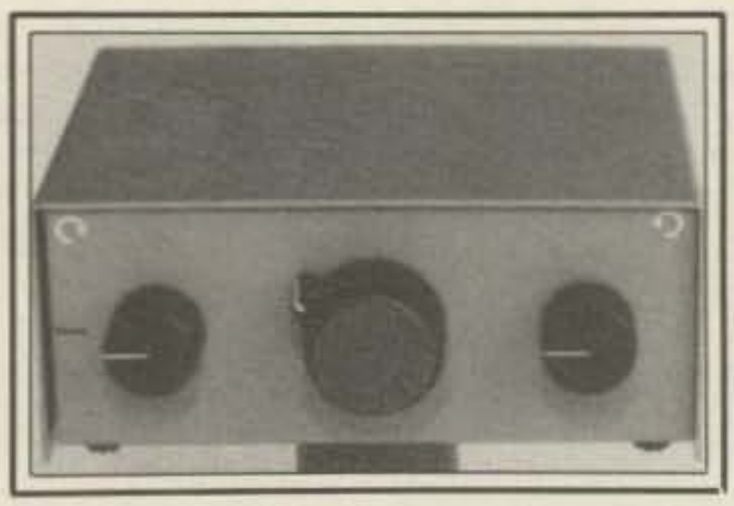


Fig. 1– The ideal tuner configuration.

and the 0–1000 pF variable capacitor shown would normally be connected at the center junction of the inductors to form a T-network. By suitable switching, the capacitor should also be capable of being switched into either of the dashed-in positions shown, thus forming either a CL or LC network tuner. The matching range of such a tuner design, if you want to go through some theoretical Smith chart exercises, is enormous over the entire 80 through 10 meter range.

Unfortunately, the cost aspect of constructing such an ideal tuner is also enormous unless you have access to a custom machine shop. Miniature roller inductors (1 inch or so in diameter) date back 30 years or more as far as military communications equipment is concerned, but they are an extreme rarity today. High-capacitance, medium-voltage, variable capacitors fall into the same category. In spite of all that, the "real world" situation of today does allow you to reasonably duplicate the electrical performance of the circuitry of fig. 1 in miniature form at a reasonable cost.

Fig. 2 shows a "real world," reasonably low-cost duplication of the circuitry of fig. 1. The continuously variable inductors have been replaced by toroidal-core switch-tapped inductors in order to achieve the inductance range desired while physical size is kept to a minimum. The 0–1000 pF variable capacitor is replaced by a readily available 0–300 pF capacitor and fixed capacitors switched across the variable capacitor to expand its range. A simple switching arrangement is employed so either an LCL T-network arrangement or a CL or LC network arrangement can be achieved.



The front of the tuner is quite plain in appearance. It could, of course, be dressed up a bit with lettering or decals. The tuner is shown balanced on a film container.

At this point you might wish to refer to some of the photographs. The "real world" tuner is constructed in a standard Ten-Tec enclosure measuring overall about 4¾"W × 2"H × 4"D. The input (2.5 uH) inductor is the smaller of the two inductors shown. It has 11 tap positions. The larger inductor (5 uH) also has 11 tap positions. The variable capacitor in the middle comes from Radiokit (Box 411, Greenville, NH 03048). It is rated at 300 pF, 1000 volts. Of course, any variable capacitor with similar ratings that will fit in the enclosure is perfectly satisfactory. If you start exploring the surplus markets, there should be no difficulty in finding a suitable capacitor for less than $10.00. Still less expensive capacitors such as the surplus "air padder" types can be used, but there is then an increased possibility that an arc-over might take place between the plates of the capacitor when running 100 watts output into a high-impedance antenna load.

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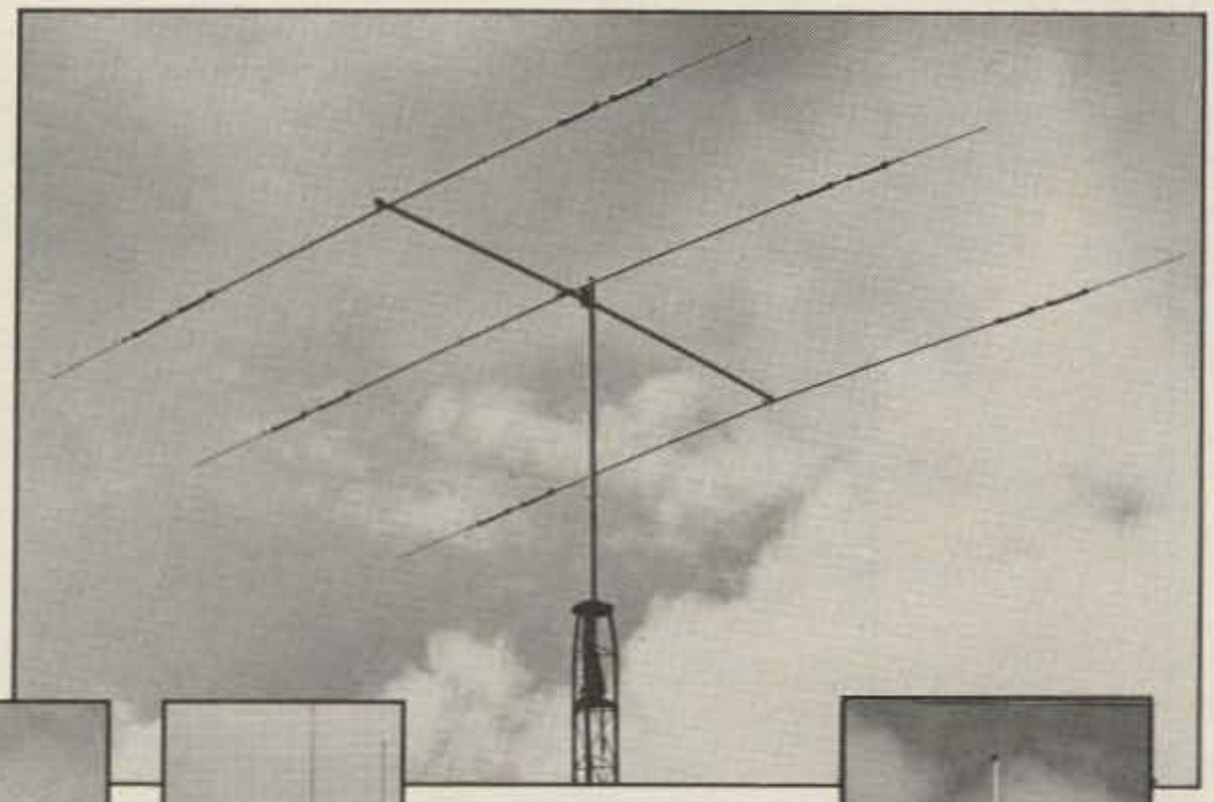

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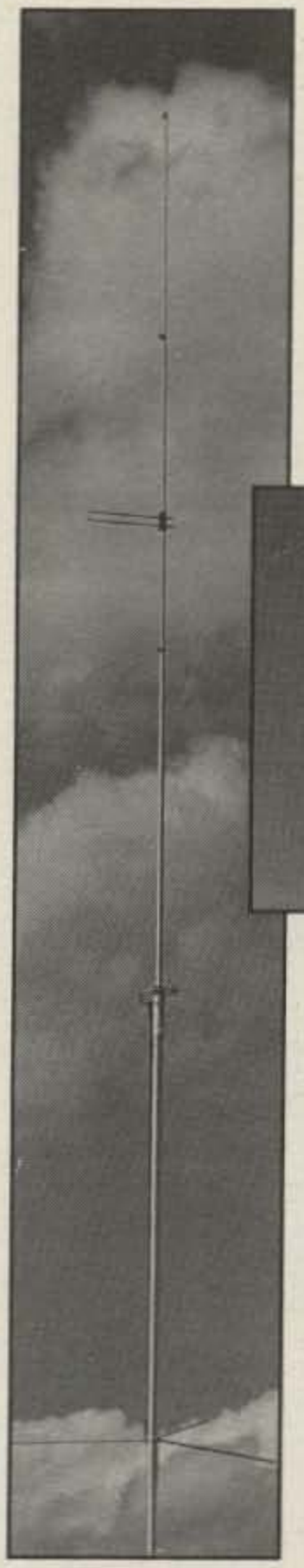

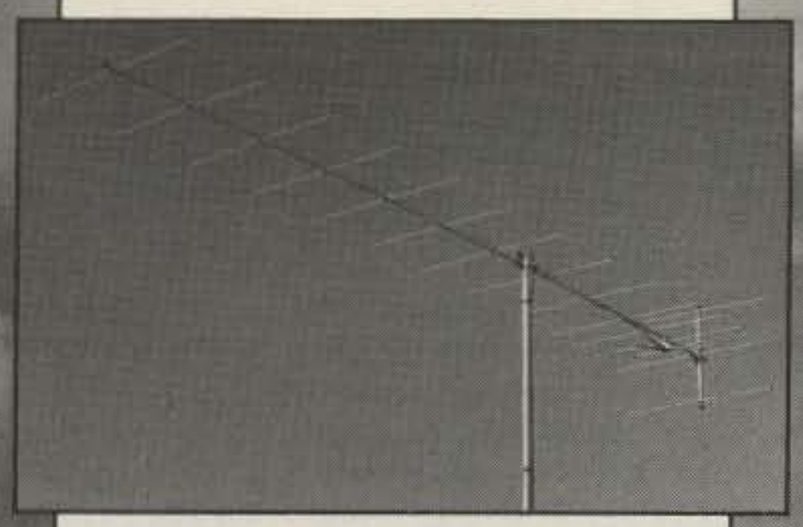

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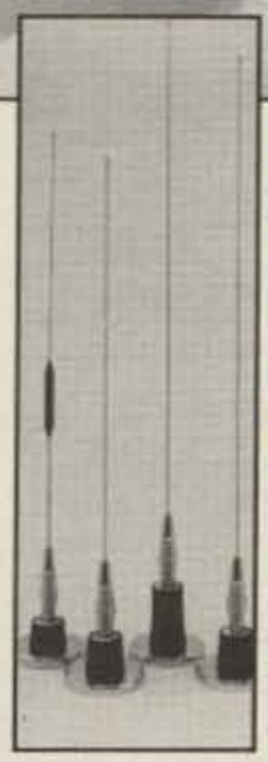

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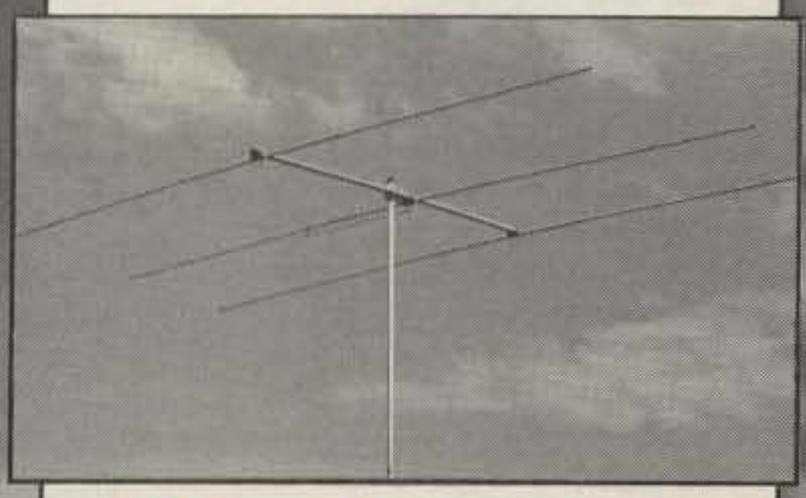

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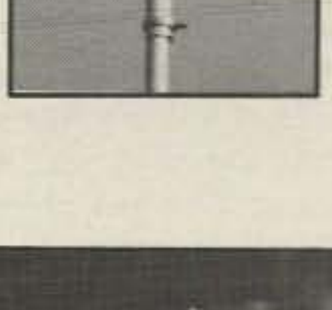

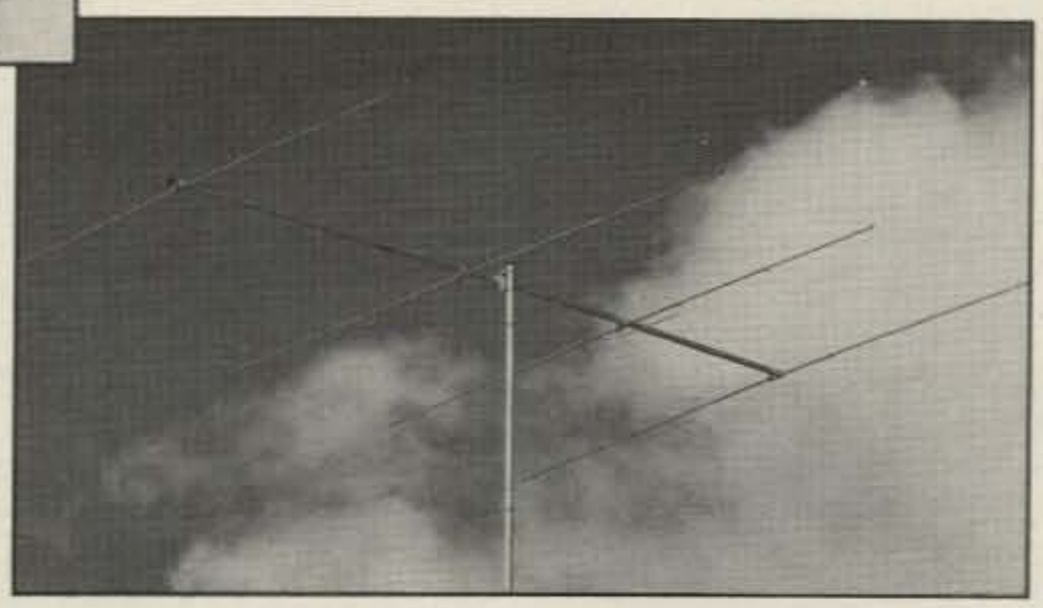

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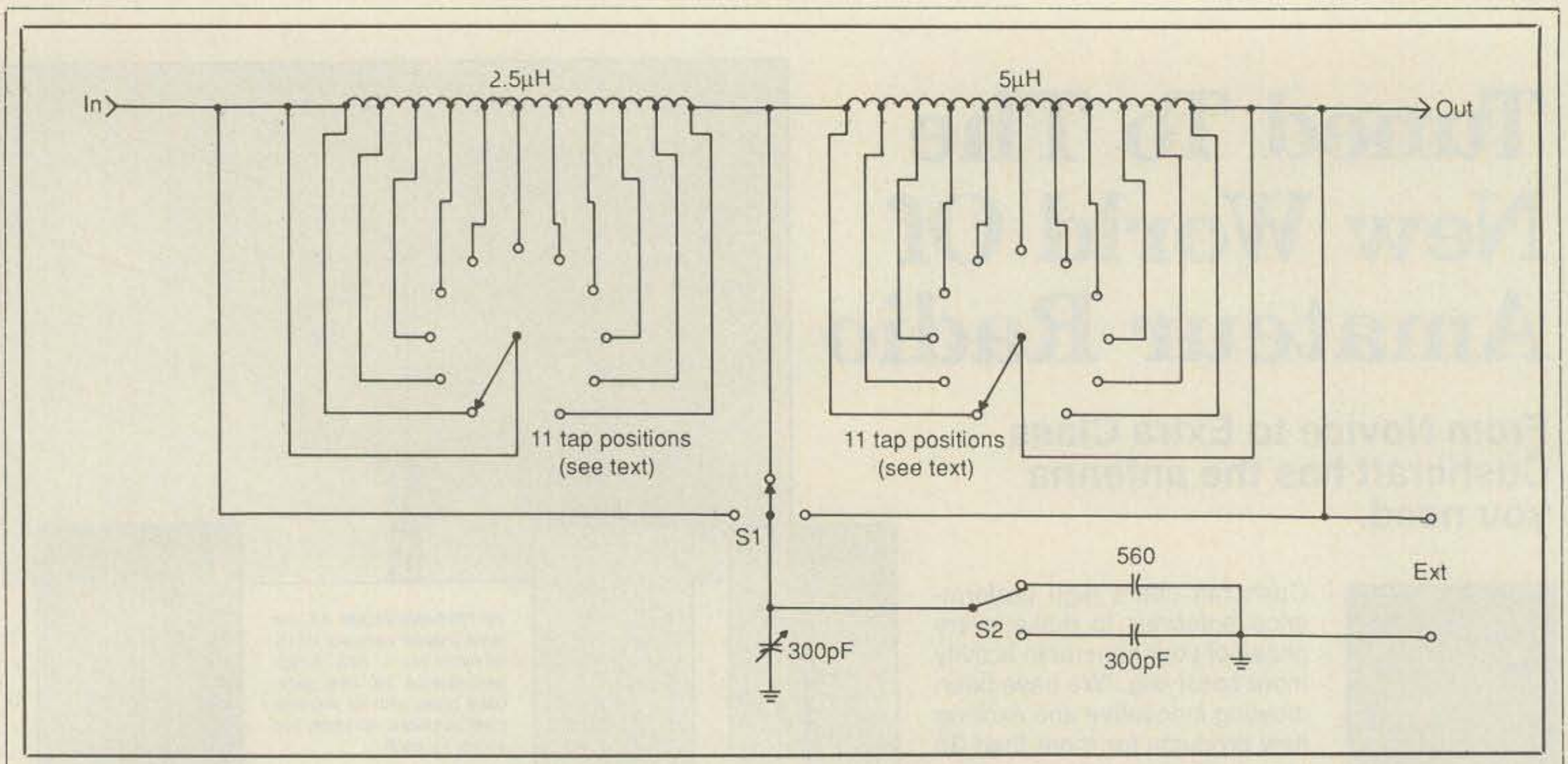
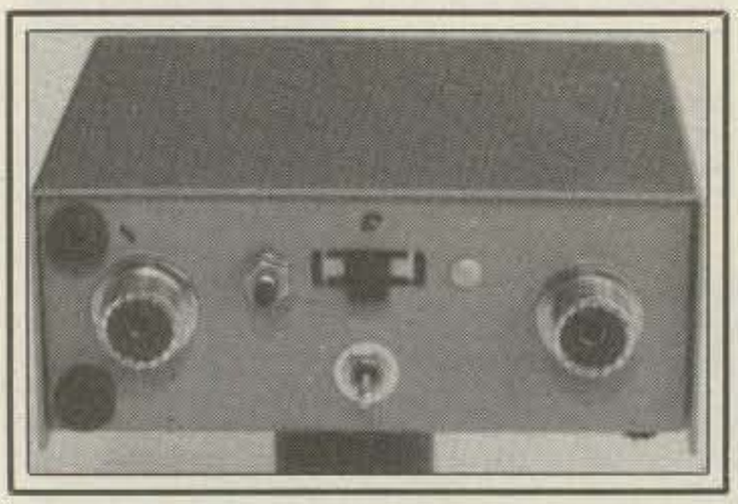
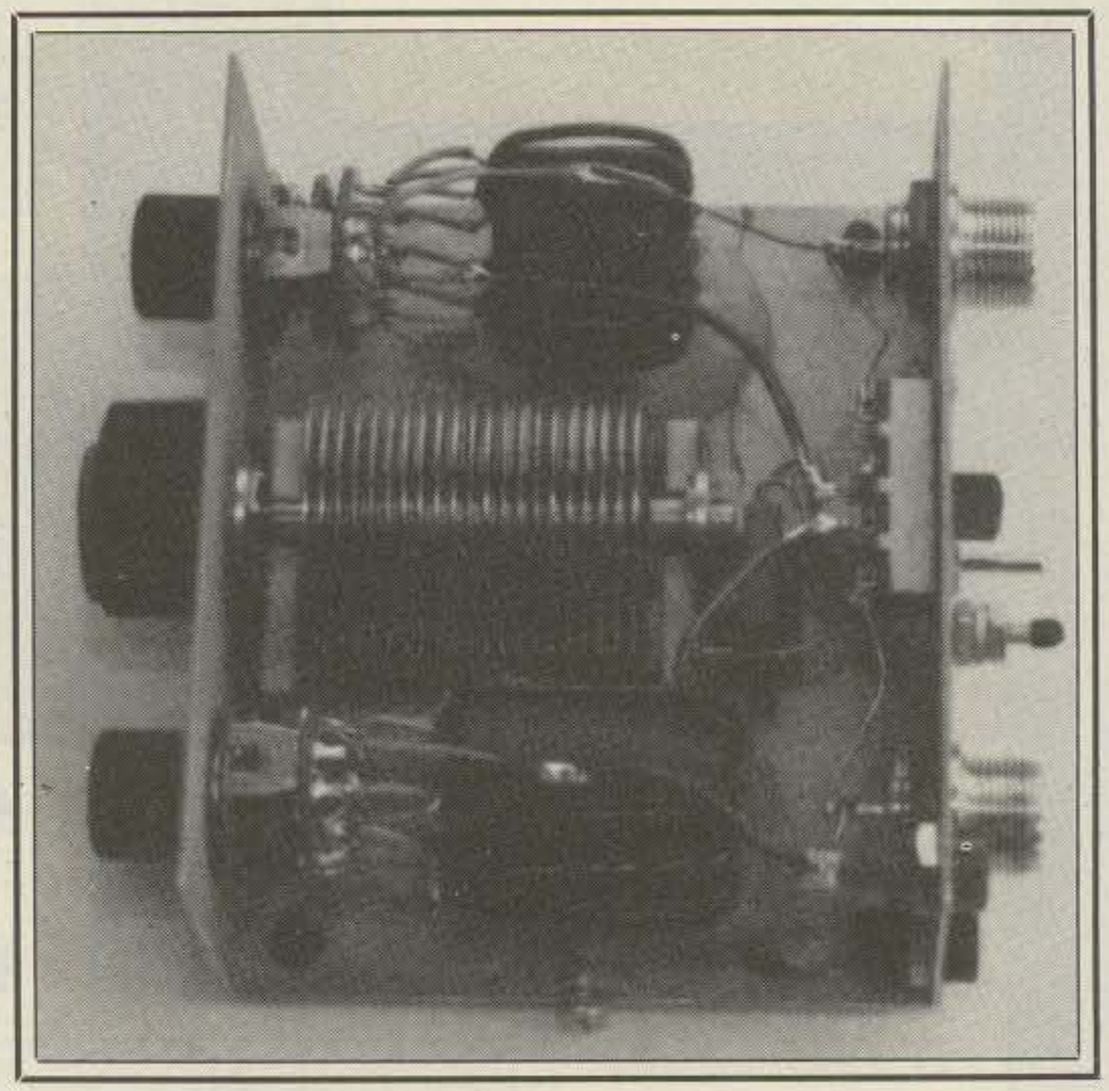


Fig. 2– A practical tuner design which pretty much achieves the same matching range as the ideal tuner of fig. 1.



The rear of the tuner contains the usual in/out coaxial connectors, a slide switch for network configuration, and a toggle switch for fixed capacitor switching. There is also a ground lug and two jacks for a balun.



The text explains the component's assemblies inside the tuner. You can, however, at least see here the two switched inductors and the variable capacitor between them.

The two fixed capacitors that can be paralleled with the variable capacitor are standard silver-mica types rated at 1000 volts. Less expensive and more readily available ceramic-disc types rated at 1000 volts should also be satisfactory for this relatively low-power tuner. Radiokit has the silver-mica types at about $1.00 each. The switch used to control the two fixed capacitors is a standard mini-toggle type, DPDT with a center-off action.

The slide switch shown on the rear panel of the tuner places the variable/fixed capacitors combination either between the two inductors or at the input or outside side of the tuner, as shown in fig. 2. I preferred a slide switch for this application because by just feeling for it on the rear panel, you can tell which network is being formed. The slide switch used was a garden-variety DP-three-position type. It may not be immediately clear how you should wire such a switch. Fig. 3 provides some clarification. Of course, a simple rotary switch can also be used, or even two toggles switches of the type used to switch the fixed capacitors. By feeling the position of the switches you can tell which tuner network is in use.

The most interesting aspect of the tuner is the inductors. There would be no reasonable way to get the inductance values desired (capable of handling 100 watts) in the space available without using toroidal cores for the inductors. Many handbooks describe how to use and calculate the inductance for toroidal core coils. Amidon (12033 Otsego St., W. Hollywood, CA 91607) provides a free application sheet/catalog which pulls together in one place about all the information that is needed. The only thing that most literature fails to emphasize is the great flexibility that is possible when you stack the cores. For instance, suppose for a given power level you felt #14 wire had to be used. Also, you wanted a certain value of inductance. For the value desired, you might calculate

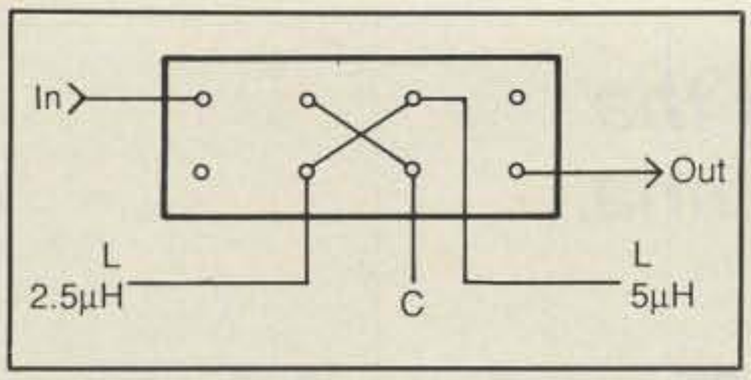


Fig. 3– If a heavy-duty DPDT slide switch with a center off position is used, this is how the terminals on the back of the switch can be wired to achieve the switching action of S1 in fig. 2.

that 10 turns on a T-200 core (2 inch outer diameter) would do fine. But what if the 2 inch core is too large for an enclosure? Well, you just can't take two 1 inch cores (each of the same height as the 2 inch core), stack them together, use the same number of turns, and come up with the same inductance. It can be done, however, by adjusting the number of turns on the stacked cores. If you're going to stack cores, double the **AL** value given in the literature for a single core when stacking two cores, triple it for three cores, etc. The **AL** value is used in a simple formula, given in the literature, for calculating the number of turns needed to achieve a given inductance.

The nominal 2.5 uH coil used in the tuner uses two stacked T-106-2 cores which are about 1 inch in outside diameter. The nominal 5.0 uH coil uses three stacked T-106-2 cores. Each coil has about 11 turns of #14 enameled wire. It just worked out that the use of the cores as described resulted in reasonably small-size coils and the number of turns corresponded roughly to the number of positions on each coil switch, so it was easy to wire the coils to the switches. The stacked cores also provide that the coils won't saturate at the 100 watt level. The cores are stacked by lightly gluing them together and then placing heat-shrink tubing over them. The heated tubing tightly binds the cores together.

Each coil tap is connected to a switch position by roughly a ½ inch length of hook-up wire. The switches used are a single-pole 12-position type (Radio Shack 275-1385). Actually, the switches are very inexpensive types which can be found at 50 cents each or less from some outlets. They have been mass produced for entertainment electronics and can be found in almost any corner of the world. And any switch of this type which can be obtained and which has all of the switch positions filled in (e.g., 2P6T through 6P2T) can be readily converted to a 1P12T switch! I won't go into how to do it, but it's obvious once you take one apart. No special tools are needed, just a long-nose plier. So although these switches are not of any great quality, I figured that if anything did "burn-up" in the tuner, it would be switch contacts. Therefore, why not use a switch type which is almost universally available at low cost? You can even pack a few spare switch wafers inside the tuner enclosure, if desired.

Actually, in field use I've never burned up any switch contacts. The switches are of the "shorting" type. If you do substitute another switch type, be sure it is of the "shorting" type. Non-shorting types can readily arc-over when you are rapidly experimenting with switch positions to match an unknown antenna load. It is interesting to note that a typical non-shorting switch might be able to "hot" switch only 100 ma or so, while the same switch can carry several amperes through its contacts in a resting mode.

Finally, let me note the purpose of the two optional banana jacks across the coaxial output connector. They can be used to quickly plug in an external balun assembly or an external capacitor for difficult matching encounters on the lower frequency bands.

The suitcase tuner packs the greatest matching range I've been able to achieve into a unit of its size. It's easy to construct if you take it step by step, and cost is what you make of it in tracking down the required components. CQ

The hunt continues as AB0X fills us in on the illusive quest for a perfect receiving antenna.

The Search For The Perfect Low-Band Receiving Antenna

BY MICHAEL CRABTREE*, AB0X

In a never-ending search for truth, justice, and the perfect low-band receiving antenna, over the last few years I have experimented with dozens of different antennas that will fit on a city lot.[1] Unfortunately, most of the antennas have ended up wound up in an ugly ball on the garage floor. Now, finally, I have discovered an antenna that seems to show some real promise.

Actually, the antenna design is not new. Just the way it has been erected is new! In fact, the loop antenna has been one of the most documented designs in the amateur journals over the last few years. The article by Dick Genaille, W4UW, in the December 1987 issue of *CQ* served as a basis for my experiments.[2] Fig. 1 shows the wiring details for the loop. It is a shielded coupling link constructed from coaxial cable.

Having no tall vertical supports like Genaille, however, I first tried the loop of 184 feet in a rectangular shape on the ground. It didn't take long to evaluate the performance of this arrangement. Even though I had heard others on 160 brag about this "grounded" version of the loop, I quickly determined that it was next to useless. The noise was down on the loop, but so were the signals. The signal-to-noise ratio was not much different than the vertical used for transmitting. Even when used with a preamp, it just didn't receive worth a darn! NX0I, a low-band DX partner, tried the same antenna a few feet in the air supported by his wooden fence for even a longer period than I did, and his final conclusion was the same as mine.

However, I didn't give up on the loop antenna. I was reminded of the success of the full-size horizontal loop used by several 160 DXers as a low-noise receiving antenna. Therefore, my next approach was to drag the loop that had been lying on the ground up the ladder to the roof of my house. When stretched out around the perimeter of the roof, the loop suddenly came alive with signals! The signal-to-noise ratio had dramatically improved as well!

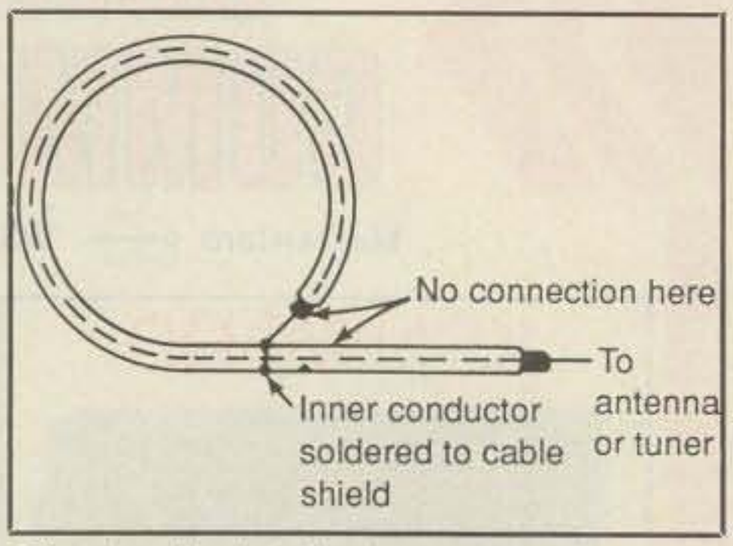


Fig. 1– A shielded coupling link constructed from coaxial cable.

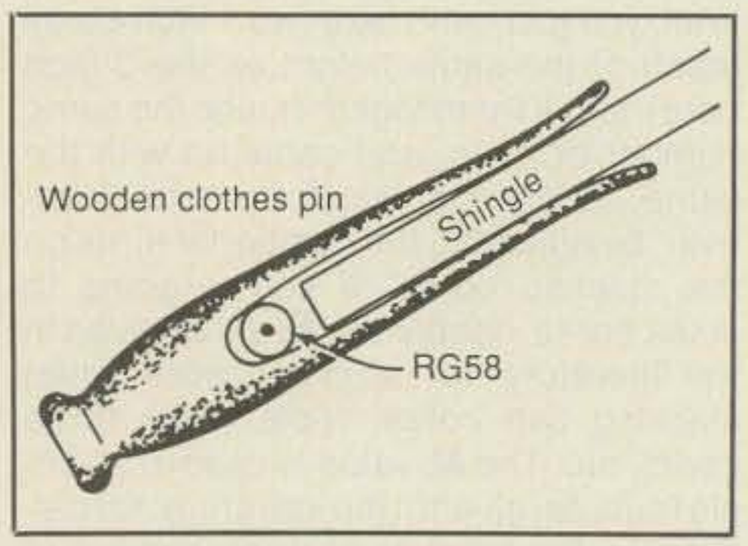


Fig. 2– A side view of a wooden clothes pin used to anchor the coaxial cable to the roof shingle.

After carefully analyzing the situation, I'm convinced that the loop was useless on or near the ground because noise was being reradiated by the numerous radials that I, like any good low-band DXer worth his salt, had buried in the backyard. Of course, this is a subjective evaluation, but I think it is quite logical.

Construction and Deployment Of The Loop

RG58U was used in the construction of the loop, as I had large quantities left from my low-power days. However, RG8X or even RG59 could be used. One-piece construction as shown in fig. 2 is recommended. My roof would not accommodate the full 184 foot loop Genaille suggested, so the loop was shortened to 176 feet. Logically, it seems that the length and the shape of the loop are probably not critical as long as the loop remains in a flat plane.

The coax was stretched out around the perimeter of my roof about a foot from the edge to avoid the metal gutters and to make it easier to work with—primarily to keep the OM from falling off the roof! At the four corners of the roof I lifted the shingles a little and slipped the coax underneath. It was then drawn tight as I stretched it toward the next corner. The cable was suprisingly secure under the shingles. At the point where the loop is closed, as shown in fig. 1, two old-fashioned split-pronged wooden clothes pins were used to make the coax lie flat on the roof at the feedpoint. With the RG58U inside the split of the clothes pin, it is pushed up onto a shingle (see fig. 2). It is recommended that clothes pins be spaced about every 10 feet or so on the roof to guarantee the coax from slipping or blowing away in a storm. However, if you can pull the coax tight enough around each corner, it may not be absolutely necessary to use the clothes pins. On the other hand, it is better to be safe than sorry!

Fig. 3 shows the overall layout of the loop on the roof. The loop is in a flat plane about 18 feet above ground on the roof. Coax-Seal® or some other sealant is recommended at the point where the loop is closed.

Performance

The loop was erected to help receiving conditions on the low bands. However, I was pleasantly surprised to find that the loop receives quite well on all bands from 10 through 160. The loop appears to be omnidirectional on most bands and often

*7871 Webster, Kansas City, KS 66109

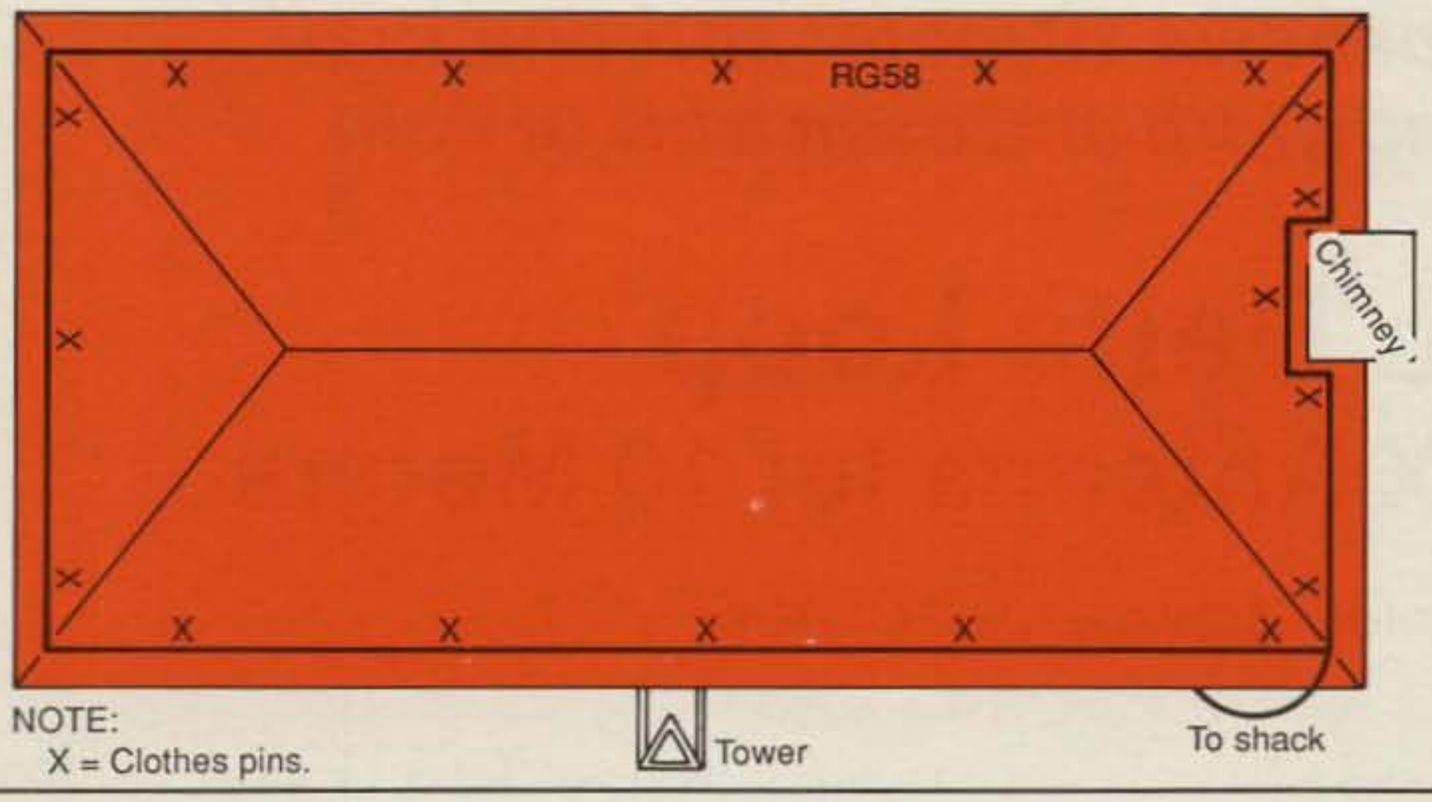


Fig. 3–A top view of the author's home showing the general pattern of the low-band receiving antenna.

compares quite favorably with my tribander on 10–20 meters. The loop is fed to the rig through a Palomar preamp which is usually used on 40–160 meters.

During the 3W8CW operation from Vietnam I had trouble hearing the station on 40 meter CW with my phased verticals. The noise was often louder than the 3W8. However, when I switched to the loop I had 100% copy. The phased verticals worked great on transmit, and I soon had Vietnam in the log on 40. It would not have been possible without the help of my new loop receiving antenna!

The loop seems to work best on 80 meters. As you might expect from such an antenna, the signals are not as strong on the loop as with other antennas, but the noise almost disappears with the loop. Used with the preamp, numerous times the loop has been superior on receive to my other 80 meter antennas. This is a significant statement, as this antenna system, a shunt-fed tower vertical and a sloper, has been used to confirm 201 countries on 80 so far. During an ARRL Phone DX Contest the QRN on the vertical and the sloper covered all DX signals in the window from 3790 to 3800 kHz except for one very loud JA. Switching over to the loop I found four more DX stations in the window that were completely inaudible with the other antennas.

On 160 the loop does not seem to perform quite as well as it does on 80, but I have found it helpful on several occasions when used with a preamp.

The loop was not tested extensively on transmit, as I have excellent transmitting antennas at my QTH. Genaille and many others have reported that the loop works pretty well when hung from high vertical supports. Turning the loop horizontally as I have described would certainly hamper its transmitting capabilities primarily because of lowering the antenna to an average height of only 18–20 feet. Also, the loop in his configuration would produce a high angle of radiation. Simple tests on transmit indicate that the SWR is below 2 to 1 from 28.0 MHz to 21.4 MHz. However, from 20 meters on down in frequency to 160 the SWR jumps up to about 4 to 1. Changing the length of the loop would be the first obvious adjustment with which to experiment if you were serious about using the loop on transmit.

To evaluate the effectiveness of the horizontal loop on transmit requires much more experimentation than I have done. It would certainly be something that readers could research further if they have a special need for a restricted-space antenna. Also, it could be of value to readers who live in an area where antenna concealment is a necessity. I found out after the fact that the loop of standard RG58U is practically invisible on my roof of black shingles. The white outer jacket of several brands of the RG8X mini-cable would probably be difficult to spot on a light-colored roof.

The horizontal loop on the roof has only been in place for about four months, but the overall performance of the antenna on receive has been very encouraging. I believe a little more time is needed to fully evaluate it. However, it has already outperformed low-band specials such as the "snake," vertical, or inverted L at this QTH. It's cheap and easy to install. Of course, keep in mind that the loop on the roof is a compromise antenna. It certainly can't compare with a full-size Beverage, but it's the best low-noise antenna I have ever used that will fit on a city lot!

References

1. Crabtree, Mike, "Some Thoughts on 160 Meter Receiving Antennas for City Lots," *CQ*, January 1988.

2. Genaille, Richard A., "Low Noise, Coaxial Link Antennas for HF Receiving," *CQ*, December 1987.

Here is a simple, inexpensive 10 meter antenna that provides excellent bandwidth and even a bit of gain.

The Delta Loop
A Classic DX Antenna for 10 Meters

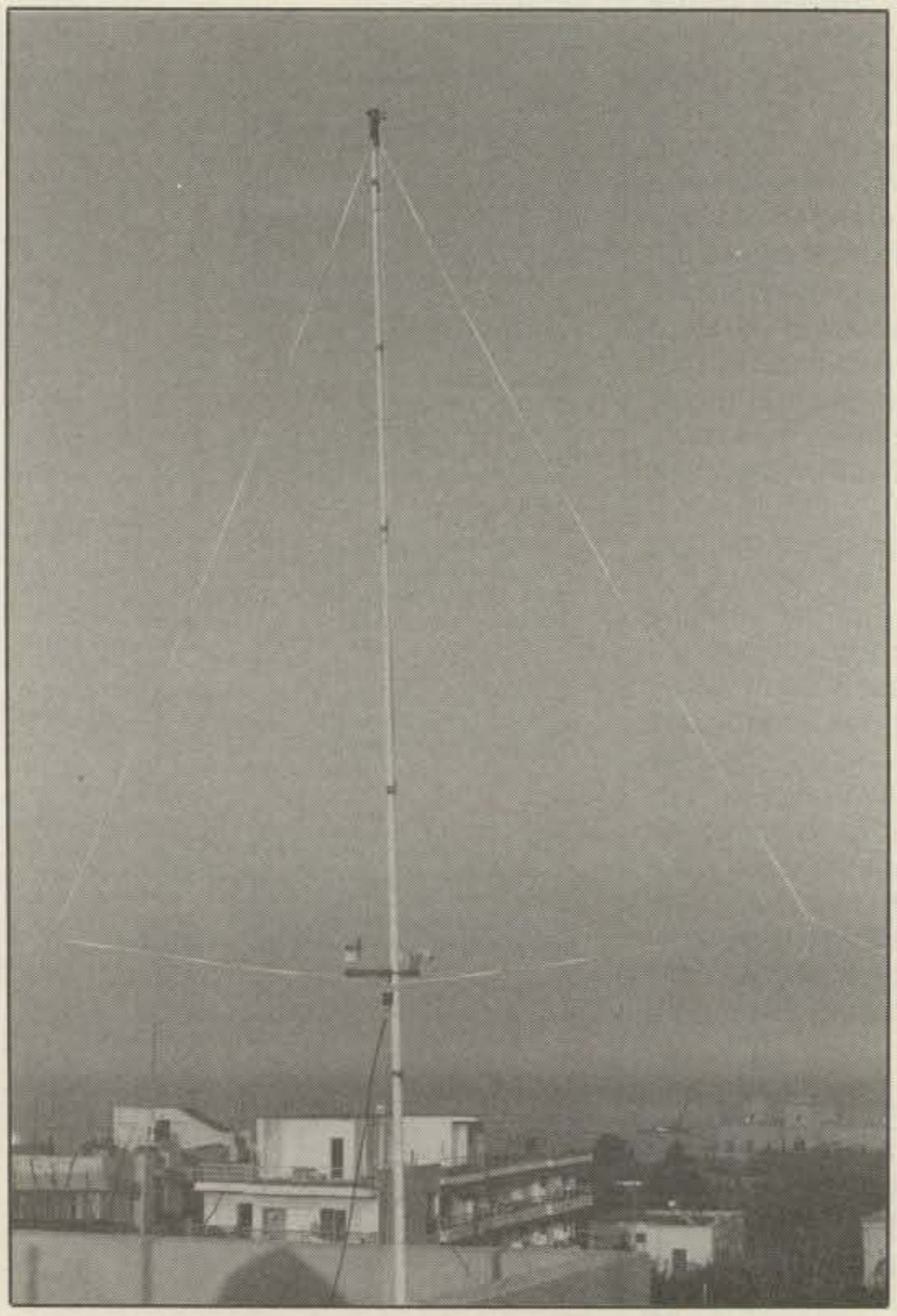
BY JOHN J. SCHULTZ*, W4FA/SV0DX

Even though it is pretty much true that almost any antenna will net you some DX on 10 meters when the band is "open," it doesn't hurt to have something more than a dipole when possible. The delta loop antenna is another one of those simple wire antennas, like the extended Double-Zepp, which provides a bit of gain over a dipole but doesn't quite approach the performance of a full-size two-element beam. However, unlike a beam antenna, the basic delta loop can be constructed out of simple wire and does not require any tuning adjustments. And, in contrast to a horizontal dipole antenna, the delta loop antenna requires only one elevated central support point.

The delta loop antenna is just a form of loop antenna in which the total circumference is a full wavelength. Taking the full-wavelength-loop idea and converting it into a three-sided triangular form of antenna is generally attributed to W6DL. He proposed various forms of delta loop antennas where the three sides of the antenna might be of equal length, or two sides might be of equal length and the third side shorter. Depending upon how the antenna was configured and at what point a transmission line was connected to it, either horizontal or vertical polarization could be obtained. Many amateurs have experimented with delta loop antennas and made some valuable contributions to the field of knowledge about them. For instance, it is generally accepted that making the side lengths somewhat unequal and feeding it at a corner (rather than in the middle of a side) will somewhat enhance low-angle radiation from the antenna.

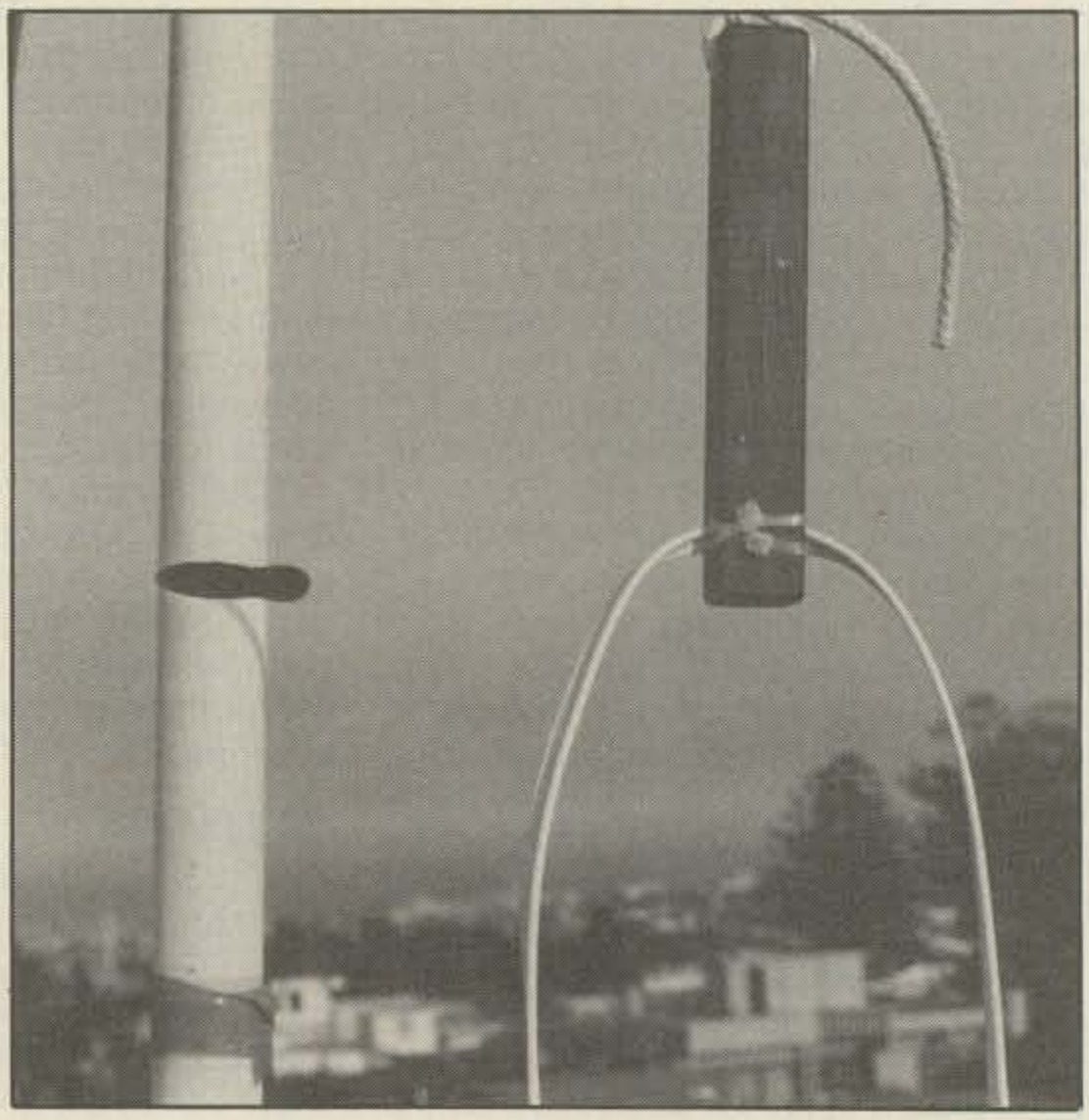
I decided to experiment with a delta

*c/o CQ magazine



Here's the delta loop antenna on a rooftop in Rhodes, Greece. The center support is a fiberglass rod about 16 feet long.

The top apex of the antenna utilizes a plastic insulator about 4 inches long and ¾ square. The twinlead passes through a hole at one end and is held in place by plastic cable ties. A hole at the other end is for a small-size nylon support rope.



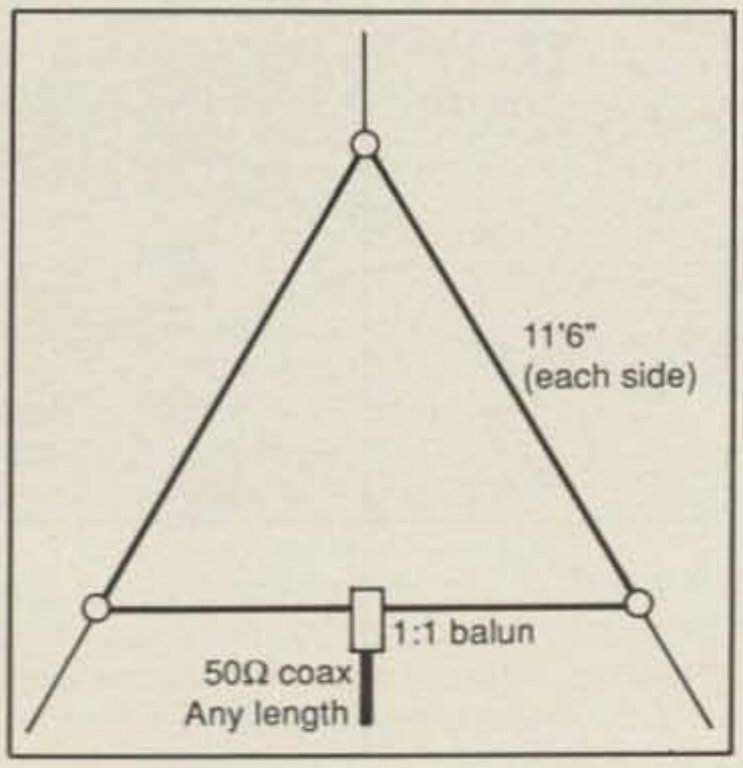


Fig. 1– Simple delta loop antenna for 10 meters. Erected in this manner, only one elevated support point is required. The dashed lines indicate nylon support ropes.

loop antenna for 10 meters in its simplest form, since I thought that form would appeal to most amateurs as a very simple, easy-to-construct antenna idea. Fig. 1 presents the form and dimensions of the 10 meter delta loop. The form of delta loop shown requires only a single, central elevated support point. Many proponents of delta loop antennas will argue that the antenna should be erected as shown in fig. 2 such that the antenna is turned "upside down." I don't disagree with such proponents. However, I simply think that in most *practical* antenna installation situations the delta loop form of fig. 1 is easier to erect, and you have a better chance to get the apex of the antenna at maximum elevation. The latter is important, since a current (radiation) maximum takes place at the apex of the antenna. The antenna form of either fig. 1 or 2 provides a horizonatally polarized signal.

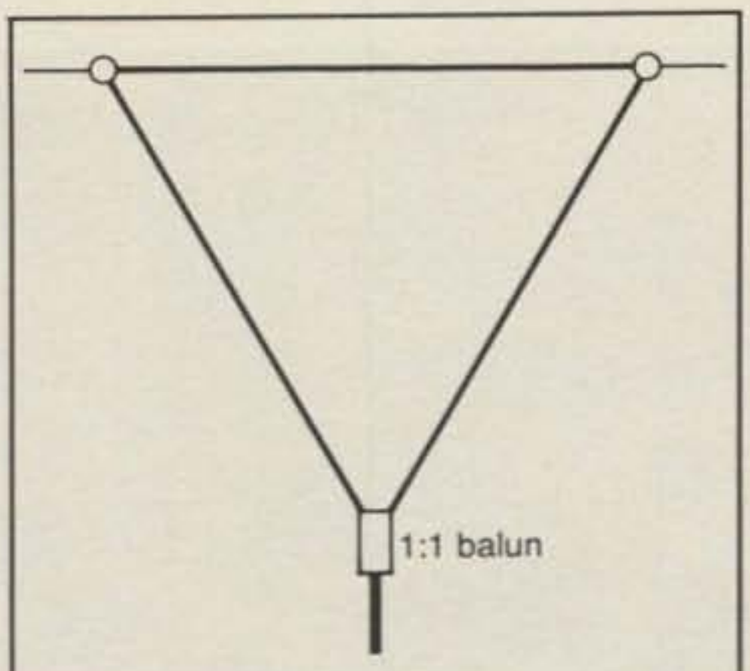


Fig. 2– Experience has shown that the delta loop, erected in this fashion, provides somewhat better DX performance. Obviously, however, two elevated support points are required. Dimensions, etc., remain the same as in fig. 1.

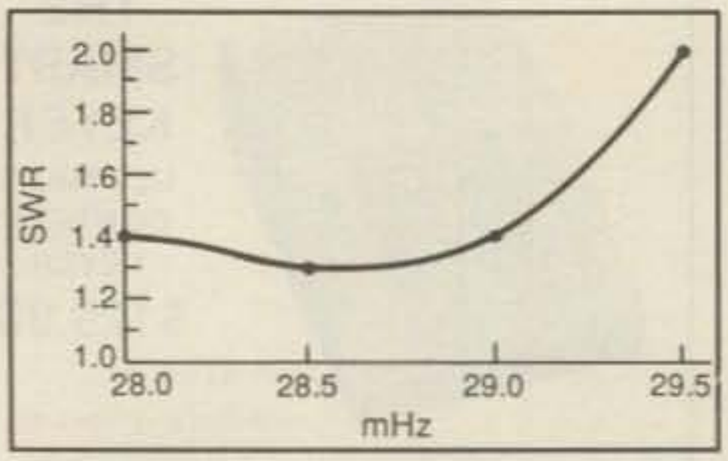
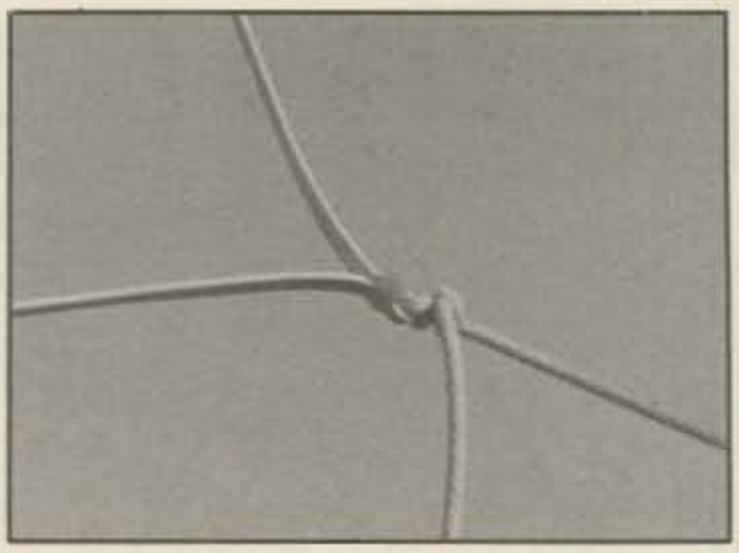


Fig. 3–SWR results obtained for the delta loop. Of course, such results will vary depending upon a specific installation. If you want to favor the upper end of 10 meters more, the loop should be made a few inches shorter on each side.

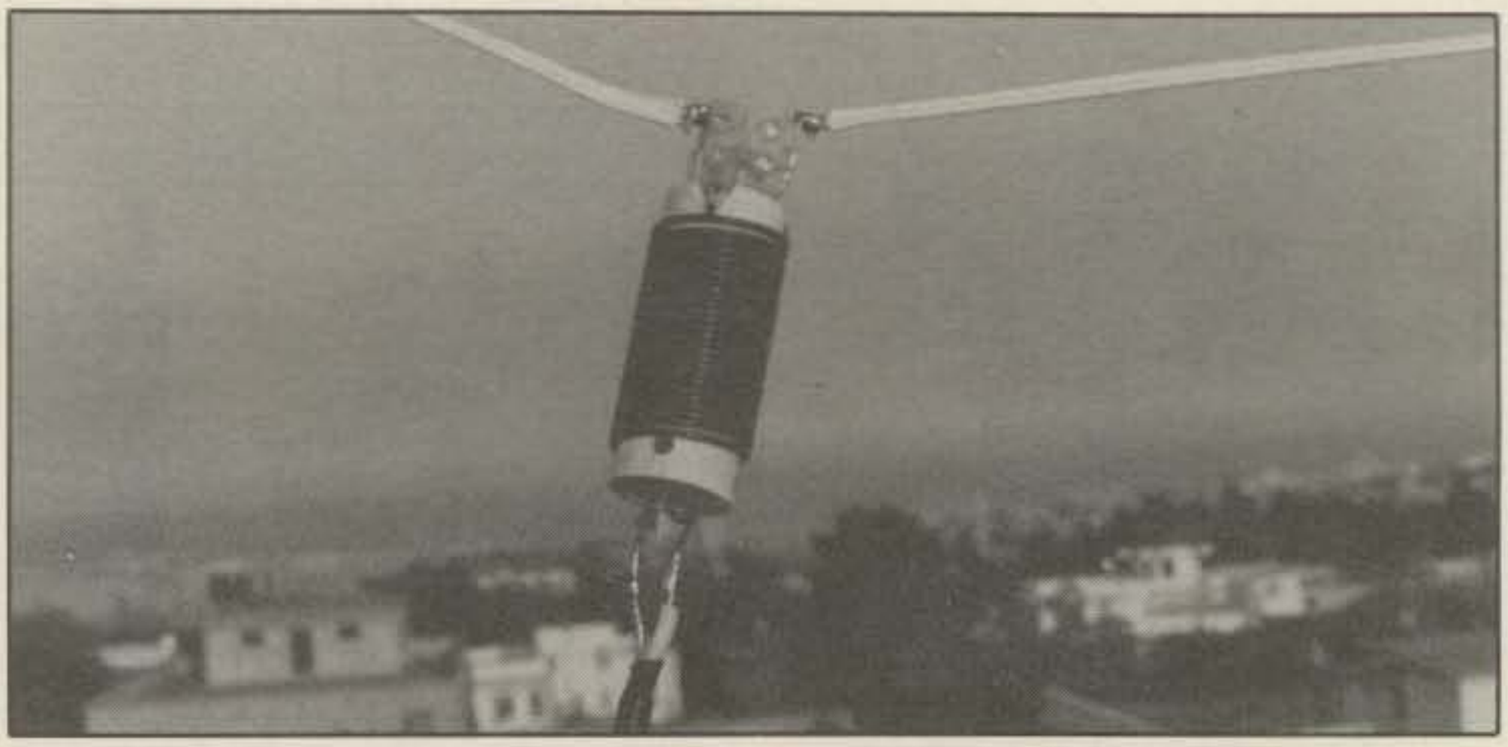


The bottom corners of the antenna are formed by "pinching" the twinlead (using a plastic cable tie) around the corner support ropes, which are then knotted.

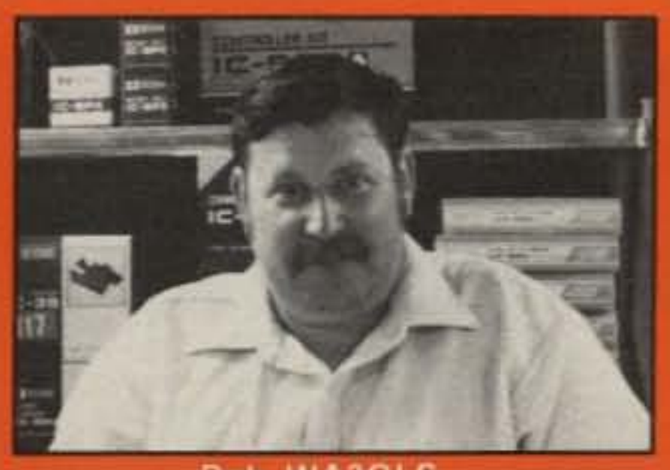
Most delta loop antennas are constructed from regular #14 AWG antenna wire, and such construction does result in a very sturdy antenna structure. However, I had quite a bit of good-quality 300 ohm TV twinlead on hand. I therefore constructed the delta loop using that line with the thought that the two-conductor line (ends connected together) would act as sort of a "thick" conductor and provide increased SWR bandwidth. I can't claim to have discovered anything new regarding the construction of a delta loop by using twinlead line, but I was impressed by the SWR bandwidth I obtained as shown in fig. 3. The antenna had an effectively "flat" response for well over 1 MHz of bandwidth. As can be seen from some of the photographs in this article, the antenna was erected fairly well "in the clear" with a fiberglass rod as the central support. The SWR response is bound to vary dependent upon specific installation conditions. As usual, however, the name of the game is to get the apex point of the antenna as high as possible in order to enhance effective low-angle radiation for DX.

Most of the construction details for the antenna are shown by the various photographs. There are few details concerning construction of the antenna about which you have to be careful. The side lengths of the loop are not critical (within plus or minus a few inches). The 1:1 balun shown in fig. 1 is recommended to ensure a symmetrical radiation pattern, but it is not absolutely necessary if you are considering the delta loop form of antenna for a temporary installation.

Performance-wise, the delta loop theoretically provides about 2 dB gain over a horizontal dipole erected at the same mean height. The 2 dB of gain doesn't sound like a lot, but it provides a slight signal increase at practically no cost except for another ½ λ length of wire. Low-angle radiation seems to be enhanced compared to a conventional ½ λ dipole, and the side signal rejection seems to be about 6 to 10 dB better. Those factors combined with the fact that the delta loop requires only a single elevated support point and that it provides extremely good bandwidth distinguish it as a very viable antenna form for 10 meters. CQ



The 1:1 balun used at the base of the antenna is a completely standard handbook design. It's shown here exposed, but it was later put in a plastic enclosure. In this case, the balun consists of three trifilar windings (10 turns) of #14 enameled wire on a 1 inch (outside diameter) by 3 inch long PVC form. It will handle a KW easily.



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Kurt, KA3OQR

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1989 CQ WPX SSB Contest High-Claimed Scores

The following scores are early-bird high-claimed scores as of June 6, 1989. These are raw scores subject to verification.

UNITED STATES SINGLE OPERATOR ALL BAND

W9RE	5,071,776
W4NT	4,750,750
K3ZO	3,661,893
K6HNZ	3,062,315
KY2J	3,034,584
NN7L	2,812,518
WG5J	2,682,603
AI2C/4	2,428,884
WE0A	2,097,106
KA5W	1,745,199
KI6CG	1,675,493
K0CS	1,658,503
K1AR	1,564,384
WW2/JA2EZD	1,416,426
KF2O	1,391,580
K6EID	1,376,326
KB0C/9	1,097,996
N0ZA	1,060,697
KB2SE	1,013,688
KS2M	959,610

28 MHz

WM5G	4,213,127
N5RZ	3,749,265
NA7P	3,089,690
WO5G	2,986,137
K5ZD/3	2,066,540
W0AIH/9	1,932,987
KE7EQ	1,634,425
WJ7S	1,567,704
WA3LFY	1,528,604
WA4QMQ	1,522,560
KW6J	1,376,125
KA1JJR/T	1,162,096
AG8W	1,045,836
AB6R	1,008,272

21 MHz

K2VV	3,403,451
N4ZZ	2,235,798
N9AG/8	1,745,207
KH6DW/KS6	1,368,054
W7FP	1,254,693
AG9S	868,756
WB2YQH	408,289

14 MHz

N8BJQ	1,064,244
WB1DXD	948,002
WF5E	754,290
NI7T	684,760
N4MO	522,240
W1BWS	498,048
W4CYC	174,632

7 MHz

WQ5W	537,200
KC7KU/2	99,246
W3BGN	88,486
KD8B	67,728
WD8PAQ	35,464
KK4RV	34,596

3.7 MHz

K1ZM	497,168
NJ1F	319,930
KM2P	232,954
KQ3V	204,568
NQ2D	118,146
KM5R	94,432
KC3EK	94,080
KN5/JA1XAF	65,816

1.8 MHz

WA2IUO	22,220

QRP/p

N1AFC	A	332,605
KD8JN	A	227,592
KB4GID	A	163,296
WB6JMS	A	153,780
WA2UUK	28	248,792
W6CN	28	140,384
KB4IOS	28	79,001
W4DEC	21	81,900
KH6CP/WW1	21	16,610
K9OSH	14	3,042
WB2OHD/6	14	1,408

MULTI-OPERATOR SINGLE TRANSMITTER

WC4E	10,759,242
WO0G	7,909,322
KI1G	6,794,256
NA6A	4,684,057
KI6VC	4,365,352
NM9H	3,800,608
N7TT	3,336,432
AB4CQ	3,104,981
KS3F	3,073,329
KA9TNZ	2,915,545
WC5C	2,387,028
NN5W	1,982,001
KE0YO	1,937,616
NT0P	1,800,381
WB3KKX/8	1,378,120
AA6BB/7	1,308,391

MULTI-OPERATOR MULTI-TRANSMITTER

WR6R	3,685,825

DX SINGLE OPERATOR ALL BAND

KP2A	13,185,900
P40V	13,010,319
GB8FX	7,049,694
KG6DX	7,042,464
N7NR/NH6	6,227,270
HK1LDG	6,007,354
GW4BLE	6,005,588
D44BC	5,905,711
OK1ALW	5,367,320
HA0MM	4,577,304
DA2JV	4,398,120
VE1GJ	3,731,712
OH1AF	3,695,797
6W7OG	3,689,280
FM4EB	3,538,140
WL7E/WH6	3,512,845
YB3ASQ	3,152,310
OH6YF	3,011,435
KC6WV	2,783,625
SO7TN	2,718,029
HA8XX	2,468,040
FE6AOJ	2,406,924
DU1NH	2,338,185
OH2PM	2,312,063
CX8CG	2,280,000

28 MHz

ZP0Y	10,538,360
9H1EL	5,882,825
JH1AJT	4,848,480
4Z8UX	4,006,891
I1ZEU	3,764,128
IO8KPV	2,952,541
UL7ACI	2,919,910
4N1W	2,908,542
8P6SH	2,867,670
YU3C	2,818,400
OA4ZV	2,799,087
CE3DNP	2,797,632
F2XT	2,552,704
NL7GP	2,452,040
KX6GL	2,345,189
JE8XRF	2,281,708
JF1SEK	2,130,557
NP4P	2,127,792
XE1JEO	2,099,146

21 MHz

HD1OT	6,849,747
FM5DN	6,643,164
XL7SV	6,248,682
NY6M/KH2	6,122,620
YZ1EXY	4,733,904
OH6RM	3,690,778
4N3E	3,374,882
HA0NNN	2,862,600
HA8JV	2,673,596
HB9BUN	2,668,580
OK1DXS	2,183,442

14 MHz

L2M	3,529,658
VE1CYL	3,265,422
CE6EZ	2,773,670
TF3CW	2,733,872
DL1YAW	2,641,940
YU7AV	2,290,520
YT3M	1,892,898
KH6FKG	1,884,458
OH6RM	1,508,277
RO5OC	1,425,162
YU1JW	1,304,160
EA3AAY	1,164,328
JA7YAB	1,079,036
CE6NOT	1,000,080

7 MHz

TE1L	4,491,144
CQ3DL	2,291,930
KL7U	1,095,822
YU1KQ	810,264
F6EZV	655,200
HB9DCQ	284,760
JA2BAY	278,202
YO9HT	179,858
PA2SWL	160,344
JA1YAD	90,852

3.5 MHz

FP5DX	521,280
IV3WMP	170,976
SP4MPO	124,628
HA9BVK	119,000
CT3BD	108,324
OK3YCL	84,512
HA6NA	73,080
DL8QS	70,716
LZ1KZM	56,320
YO9IAB	31,620

1.8 MHz

VP9AD	82,810
YU3MM	47,520
LZ1KOZ	26,320
YV1QEW	1,620

QRP/p

4X6IF	A	920,822
YU2TY	A	768,660
F1BEG	A	499,728
JI1DQS	A	287,742
YU4YA	A	265,016
ZL1AXB	28	522,032
JH8DEH	28	210,600
JI1JVG	28	208,886
OK1JCH	21	441,945
JA8RJE	21	216,821
YC2OK	21	135,744
JA2JSF	14	84,162
YO2CMI	14	33,796
JG7LBN	7	2
OK3TEI	3.7	23,800
RB5EKI	1.8	9,690

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ZX5C	22,561,715
IR4VEQ	13,180,734
HG5A	11,587,220
HG1S	11,562,894
FV9NDX	11,342,448
5H1HK	11,262,108
HG7B	8,556,920
P33ES	8,525,594
OR0TT	8,385,339
VE7ON	7,800,594
YT3T	7,739,096
FO5IW	7,204,593
CF1IDX	6,942,950
HA5KKC	5,701,432
OG3AA	5,618,456
HG0D	5,467,744
VE5GF	4,811,324
FF1LFG	4,793,539
JA1YXP	4,786,518
JG3ZDK	4,685,712

MULTI-OPERATOR MULTI-TRANSMITTER

KL7RA	23,762,466

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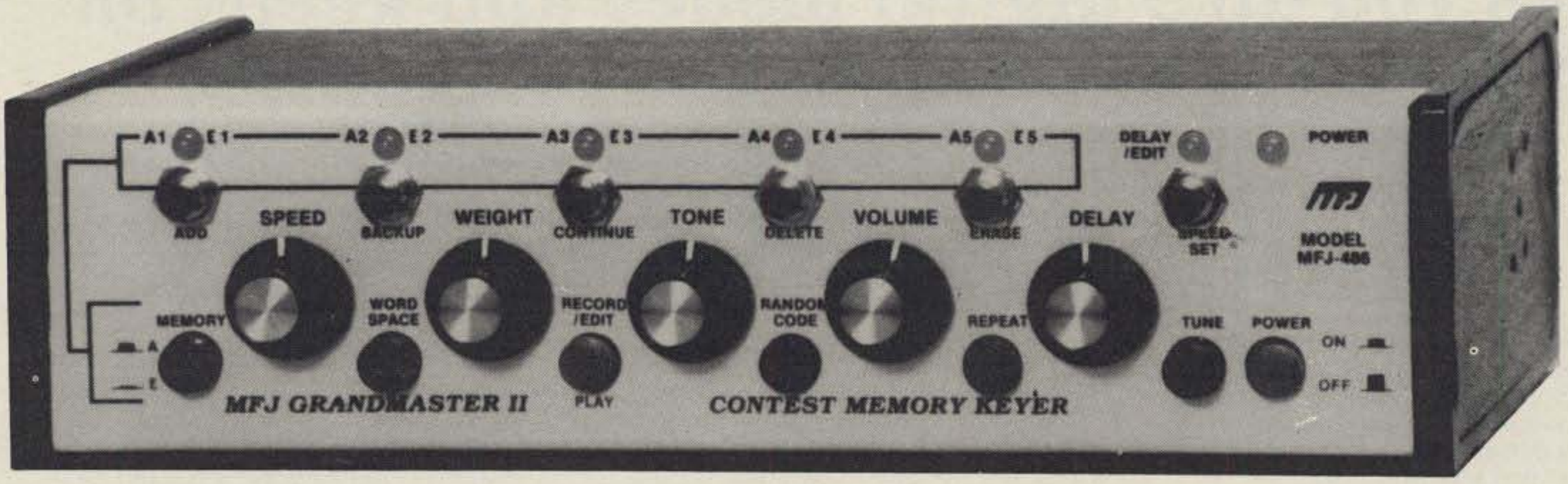

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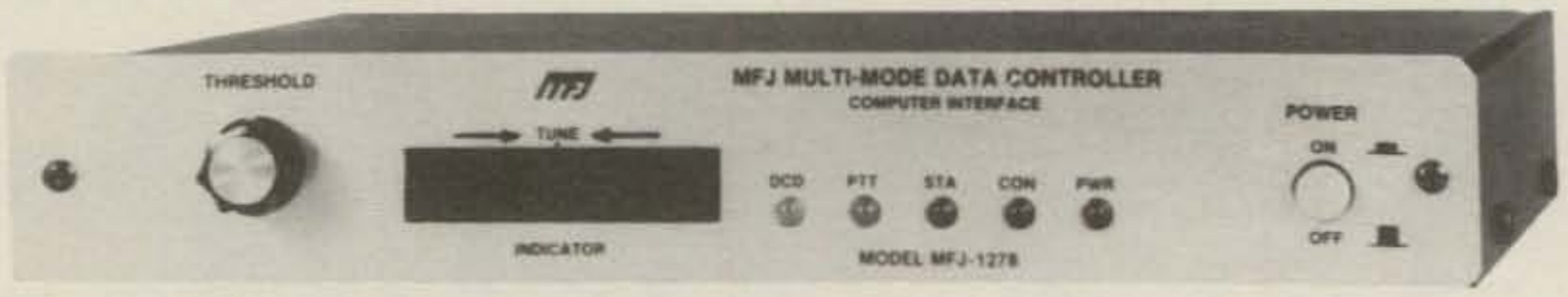

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You get tons of features other multi-modes just don't have.

Only MFJ gives you all 9 modes

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MFJ's unequaled tuning indicator makes it really easy to work HF packet stations.

And unlike others, you use it *exactly the same* way for *all* modes -- not differently for each mode.

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MFJ's new *Anti-Collision* technology gets packets through faster, more reliably.

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You'll enjoy natural looking pictures that only multiple gray levels can give you.

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You can double your fun by operating VHF *and* HF packet because you get **high performance** switchable VHF/HF modems.

You get the **Easy Mail**™ Personal Mailbox with soft-partitioned memory so you and your ham buddies can leave messages for each other 24 hours a day.

In MFJ's new WeFAX mode you can print full fledged weather maps to screen or printer and save to disk using an IBM compatible or Macintosh computer with an MFJ Starter Pack.

A new **KISS** interface lets you run **TCP/IP.** They also come **NET ROM** compatible -- *no modification needed!*

You also get 32K RAM, one year *unconditional* guarantee and a *free* 110 VAC power supply (or use 12 VDC).

For dependable HF packet tuning, the MFJ-1274 gives you a high resolution tuning indicator that's accurate to within 10 Hz -- and it's only $20.00 more.

MFJ Video Digitizer

Here's an actual print-out of Aimee from the MFJ Order Desk. She was digitized with the MFJ-1292 and the result was printed on a 9-pin Epson compatible printer. We reduced the size to fit the ad.

Create fascinating digitized snapshots you can transmit with your MFJ-1278 of *anything* you can point your camcorder at!

The MFJ-1292 "Picture Perfect" Video Digitizer connects your video camera to your IBM compatible computer so you can capture digitized video snapshots on disks.

Your MFJ-1292 package includes a plug-in card for your computer, software and complete instructions for ... **$199.95.**

As an added bonus you get a handy Contrast and Brightness Control unit that you can conveniently place near your keyboard for fine tuning your pictures.

Packet Pictures

Transmit and receive high resolution VGA, EGA and CGA color pictures via packet with MFJ picture passing software.

Beautiful color pictures are automatically received, saved to disk and "painted" to screen.

Pictures are compressed as they are transmitted - so you get true high speed picture passing.

You can save to disk any CGA picture you can see on your screen.

You can set up your own picture bulletin board and exchange pictures with others - even if you're not there.

Let's help spread picture passing throughout the world and create a new world standard. Get this ***powerful*** new software for only ... **$9.95.**

MFJ-1288 works with virtually any packet radio controller and IBM compatible computer. It's included *free* in the MFJ-1284 IBM Starter Pack.

MFJ ENTERPRISES, INC.
P.O. Box 494, Mississippi State MS 39762
601-323-5869; TELEX: 534590 MFJSTKV
Nearest Dealer/Orders: 800-647-1800
Include shipping and handling

MFJ ... making quality affordable

CIRCLE 49 ON READER SERVICE CARD

MFJ's *Deluxe* 300 Watt Tuner

... *gives you* ***full*** 1.8-30 MHz coverage, a ***peak reading*** (and average) Cross-Needle meter, built-in ***dummy load,*** antenna switch and balun ... all covered by a ***full one year unconditional guarantee*** ... for only $149.95

MFJ-949D

$149.95

Made in U.S.A.

- ***Peak reading meter***
- ***Built-in dummy load***
- ***Covers 1.8 to 30 MHz***
- ***1 full year guarantee***

You won't find all these useful features in *any* other 300 watt tuner -- not even at twice the price.

New peak reading meter

The new ***peak*** and average reading Cross-Needle meter in the MFJ-949D shows you SWR, forward and reflected power -- all in a single glance.

Without a ***peak reading*** wattmeter you just won't be able to tell if your rig is putting out all the peak SSB power it's designed for. Don't be without one if you want top performance.

Built-in dummy load

A built-in 300 watt 50 ohm dummy load makes tuning up your rig soooo easy. How do you tune up your rig without one?

An external dummy load will cost you about $30 more -- plus it takes up valuable space at your operating position and requires another cable.

Full 1.8 to 30 MHz coverage

The MFJ-949D gives you **full** 1.8-30 MHz coverage.

Make sure the tuner you're considering covers *all* the HF bands.

Don't get a tuner that keeps you from operating all the frequencies you've worked for -- now or in the future.

Plus more . . .

You get a versatile 6-position antenna switch and a 4:1 balun for balanced lines.

You can run up to 300 watts PEP and tune out SWR on coax, balanced lines or random wires.

Unconditional Guarantee

You get a *full one year unconditional guarantee.* That means we will repair or replace your MFJ tuner (at our option) *no matter what* for a full year.

Others give you a 90 day *limited* warranty. What do you do *after* 90 days? Or *before* 90 days when they say, "Sorry, it's your fault"?

What's really important? *precise* control for minimum SWR

What's really important is your tuner's ability to get your SWR down to a minimum -- and the MFJ-949D gives you more precise control over SWR than *any* tuner that uses two tapped inductors.

Why? Because the two *continuously* variable capacitors in the MFJ-949D give you *infinitely* more positions than the *limited* number on two switched coils.

This gives you the precise control you need to get minimum SWR and maximum power into your antenna.

After all, isn't that why you need a tuner?

High efficiency *and* a compact size: *performance* is most important

The MFJ-949D uses a *single* airwound coil. Using only one inductor takes up a minimum of space and there's no mutual coupling problems.

The excellent form factor of the short fat coil gives you highest Q. Plus you get plenty of inductance that gives you a much wider matching range than other designs.

This results in a highly efficient tuner that puts maximum power into your antenna *and* a compact 10 x 3 x 7 inch size that complements your rig and fits right into your station.

Competing tuners using *two* tapped coils *require* a large cabinet -- not just to house the coils but also to help reduce detrimental coupling between the inductors. The result? *A tuner that's* ***bigger*** *than your radio.*

Your very best value

The MFJ-949D gives you your very best value, first-rate performance, proven reliability and the best guarantee in ham radio . . . all from the *most trusted* name in antenna tuners. Don't settle for less. Get yours today!

MFJ's 1500 Watt Tuner

MFJ-962C

$229.95

For a *few* extra dollars the MFJ-962C lets you use your barefoot rig now and have the capacity to add a 1.5 KW PEP linear amplifier later. It covers 1.8 to 30 MHz.

You get MFJ's *new* ***peak*** and average reading Cross-Needle SWR/Wattmeter.

You also get a 6-position antenna switch and a teflon wound balun with ceramic feed-thru insulators for balanced lines. Measures just 10¾x4½x14 7/8 inches.

How can an American manufacturer like MFJ give you more tuner for your money than clearing houses for foreign competition?

MFJ tuners are made in America.

Here's how MFJ gives you more tuner for your money than *any* clearing house for foreign competition.

MFJ builds every tuner cabinet from scratch using the latest high-speed computer controlled punch presses.

MFJ manufactures, assembles and tests every PC board that goes into MFJ tuners.

Instruction manuals and other materials are printed in MFJ's print shop.

MFJ tuners go directly from our factory to your dealer. We're not just an importer adding profits, tariffs and import charges.

With MFJ's efficient in-house manufacturing and straight to your dealer distribution you get the most tuner for your money.

WHY CHOOSE AN MFJ TUNER?

Hard-earned Reputation: There's just no shortcut. *MFJ is a name you can trust* -- more hams trust MFJ tuners throughout the world than all other tuners combined.

Proven Reliability: *MFJ has made more tuners for more years than anyone else* -- with MFJ tuners you get a highly-developed product with proven reliability.

First-rate Performance: MFJ tuners have earned their reputation for being able to match just about anything -- *anywhere.*

One full year *unconditional* guarantee: That means we will repair or replace your tuner (at our option) *no matter what* for a full year.

Continuing Service: MFJ Customer Service Technicians are available to help you keep your MFJ tuner performing flawlessly -- no matter how long you have it -- just call 601-323-5869.

Your very best *value:* MFJ tuners give you the most for your money. Not only do you get a *proven* tuner at the lowest cost -- you also get a one year *unconditional* guarantee and *continuing* service. That's how MFJ became the world's leading tuner manufacturer -- by giving *you* your very best *value.*

Choose your MFJ tuner with confidence! You're getting proven performance and reliability from the most trusted name in antenna tuners. Don't settle for less.

Call or write for a *free* full-line MFJ catalog with all 10 of our tuners and tons of ham radio accessories!

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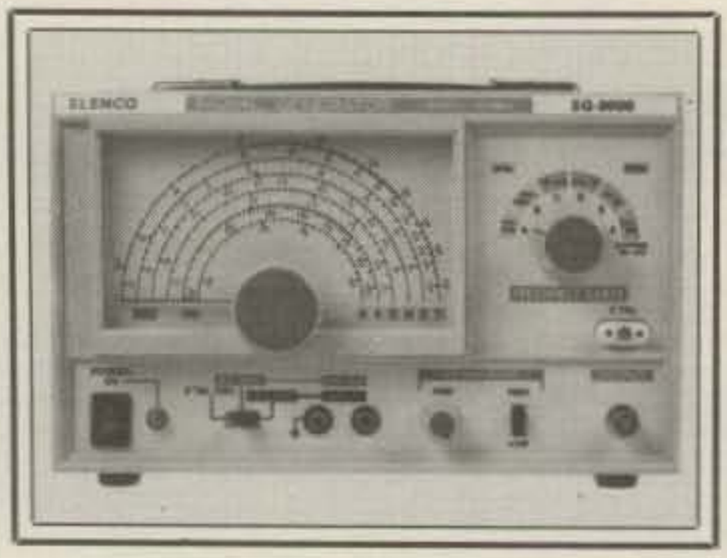
P.O. Box 494, Mississippi State MS 39762
601-323-5869; TELEX: 534590 MFJSTKV
Nearest Dealer/Orders: 800-647-1800
Include shipping and handling

MFJ ... making quality affordable

CIRCLE 50 ON READER SERVICE CARD

CQ Showcase

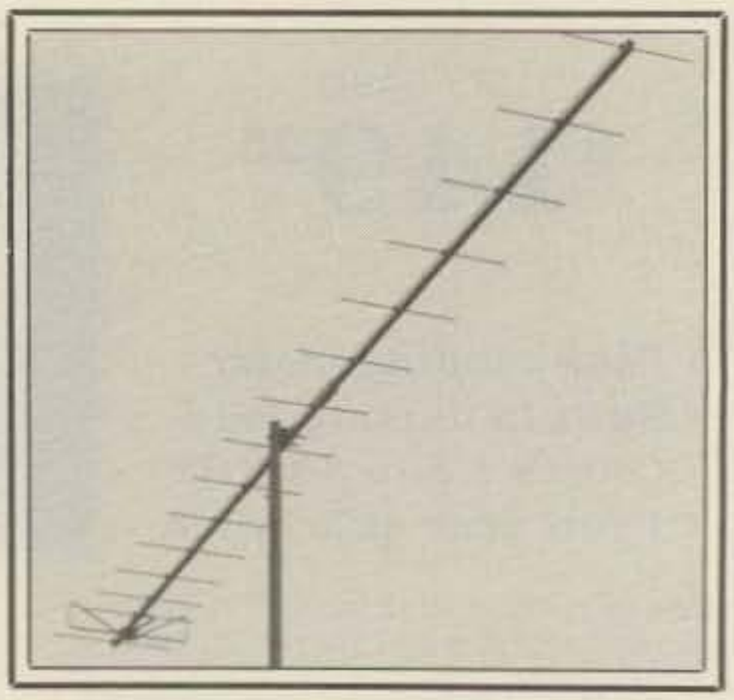


The Elenco Signal Generator

The Elenco SG-9000 is a high-frequency signal generator capable of AM modulation. It incorporates a stable RF oscillator with frequency range of 100 kHz to 150 MHz and has an easy-to-read dial. Frequencies of 455 kHz, 4.5 MHz, and 10.7 MHz are specially noted for easy setting. An internal audio frequency of 1 kHz is available for AM or external use. External crystals may be used to lock the oscillator to, say, frequency between 1–15 MHz. The RF output voltage is variable and has a 20 dB attenuator switch, and the unit comes with instruction manual with circuit description, block diagram, and schematic. Cost of the SG-9000 is $195.95. For more information, contact Elenco Electronics, 150 W. Carpenter Avenue, Wheeling, IL 60090, or circle number 112 on the reader service card.

NCG's CM-1200 SWR/Power Meter

The CM-1200 ultra-compact SWR/Power Meter is now available and features a frequency range of 1225–1325 MHz, SWR 1.1:1.5, insertion loss 0.25 dB, maximum power 60 watts, power range 10–60 watts, impedance 50 ohms, and N-type connectors. Dimensions of the unit are 2.25″ × 2.55″ × 1.1″, and weight is 5.25 ounces. For more information, contact NCG Co., 1275 N. Grove St., Anaheim, CA 92806, or circle number 105 on the reader service card.



AEA 430-16 Yagi

AEA has announced the 430-16 Yagi antenna for 430 MHz. The 430-16 is a high-performance, computer-optimized Yagi specifically designed for ATV operation. With frequency coverage from 420–440 MHz, it can also be used for DX chasing on 432 MHz and satellite transmit/receive action on 435.9 MHz or as a companion for the AEA fast-scan TV unit, the FSTV-430.

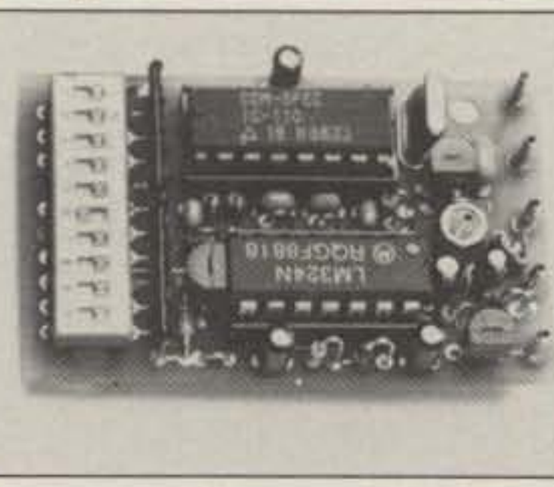
Additional features include 250 watts power capacity, butterfly dipole driven element, two- and four-day stacking systems available, E-28 and H-32 degree beamwidth, 14.3 dB gain over a dipole, and 16 elements. The 430-16 Yagi sells for $139.95. For more information, contact Advanced Electronic Applications, Inc., P.O. Box C-2160, Lynnwood, WA 98036, or circle number 101 on the reader service card.

Hustler HF Mobile Mast

Hustler, Inc. has introduced an HF mobile mast for use with their line of mobile resonators and accessories. Model MO-4 is a 22 inch all-stainless-steel mast which

will allow the user a number of mounting options previously unavailable to the HF mobile operator. Suited for use on RVs, trucks, vans, and cars with plastic bumpers, the MO-4 can be mounted on trunk lips, mirrors, roof racks, and ladders. When used in conjunction with standard Hustler resonators, the MO-4 can also be installed on a high-quality magnetic mount. A shortened dipole can be formed by using two MO-4 masts and a matching pair of resonators. A tri-band dipole can be assembled with the addition of two Hustler VP-1 tri-band adapters and two each of the desired resonators, of interest to those in condos, apartments, and other areas with antenna restrictions.

The MO-4 is supplied with three 30 inch tip rods for use with 10, 15, and 20 meter resonators. These extra rods are used in place of the tip rods normally used on the aforementioned resonators. No tip rod changes are necessary when used on 40, 75, or 80 meters. The MO-4 has a suggested retail price of $19.95. For more information contact Hustler, Inc., One Newtronics Place, Mineral Wells, TX 76067, or circle number 103 on the reader service card.



Communications Specialists Two-Tone Sequential Encoder

Communications Specialists' PE-2P DIP-switch programmable two-tone sequential encoder is designed to be mounted inside a radio or other housing, and allows the operator to send a single two-tone sequential paging call. With standard 1–3 second timing, the PE-2P is compatible with Communications Specialists SD-1000 two-tone decoder and other systems such as Motorola Quick-Call II, 1 + 1, and GE Type 99. The timing may also be changed to match additional two-tone formats. Both tone A and tone B are DIP-switch programmed from a 32-tone memory base that is specified when ordering. This allows over 1000 possible combinations from a single PE-2P. With some additional circuitry, the PE-2P may be wired to send multiple calls.

The PE-2P measures 1.25″ × 2.0″ × 0.4″ to allow installation into most mobile radios, and is powered by + 10–16 VDC. The selected call is activated by a momentary ground. A 150 ma output is provided to key PTT. The PE-2P is priced at $54.95. For more information, contact Communications Specialists, Inc., 426 West Taft Avenue, Orange, CA 92665-4296, or circle number 106 on the reader service card.

ICOM IC-2SA 2 Meter Handheld

The new IC-2SA 2 meter micro-sized handheld transceiver features 5 watt power output, 48 memory channels and one call channel, power-saver function with high-speed switching, multi-scanning function, auto power off timer function, priority watch, built-in clock with timer function, dial select function, dial select function, and 9 controls with a handy reference chart located on the back of the radio. Suggested retail price is $419.00. For more information, contact ICOM America, Inc., 2380 116th Ave. NE, Bellevue, WA 98009-9029, or circle number 104 on the reader service card.

Certified Communications FLEXI 4XLIIA

All of the previous coax of this type has had a 9.5-gauge solid center conductor that would, upon continual flexing such as that around a rotor or on a crank-up tower, migrate off center, causing a change in impedance and radically shortening its useful life. The solution until now has been the use of a jumper of RG213 or the like around the rotor that protects the "poor man's hardline" and extends its life to as much as 10 to 15 years instead of as few as 12 months. FLEXI 4XLIIA provides a new alternative in all installations—that of continuous runs at the lowest possible loss with full flexibility. An exclusive engineering concept provides the flexibility of a multi-stranded center conductor without sacrificing the super low-loss characteristics. It consists of 95% coverage tinned copper braid and premium non-contaminating jacket.

For further information on this and the company's other wire and cable products contact Certified Communications, 261 Pittman Road, Landrum, SC 29356, or circle number 111 on the reader service card.

Bill's Basics

a monthly feature by
BILL WELSH, W6DDB

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Antennas—Conclusion

This is the concluding segment of a two-part article. The first segment covers previous articles, antenna fundamentals, RF ground, height, impedance, SWR, polarization, traps, dipole antennas, random/long-wire antennas, verticals and ground planes, directional antennas, and textbooks.

Baluns

Jim Thompson, W4THU, gave me permission to reprint the following article, which appears in the current issue of The Radio Works catalog. His complete catalog is available for $2.00. Requests should be mailed to Box 6159, Portsmouth, VA 23703.

Current Baluns Versus Voltage Baluns

Much is taken for granted when selecting and using baluns. Typically, a user will choose the least expensive object that carries a "balun" label and is marked with a ratio. Some will even choose a balun by its size or weight, neglecting that fact that weight and size indicate core size and mass, not to mention power handling capability. In truth, a balun is a complex device, and its use in antenna systems is often misunderstood. Generally, most manufacturers claim that their balun will reduce TVI or improve the antenna's radiation pattern. In reality, common baluns do not live up to their promise, and this is one reason for the myths that surround balun use. In fact, many baluns do not seem to make any difference when added to an antenna system. They can't; they are not properly designed.

The reason for poor results is that nearly all popular balun designs, including the ones used with my tribanders, are "Voltage-Type (C)" baluns. "Voltage-Type (C)" baluns produce "equal and opposite VOLTAGES at the balanced port, regardless of load impedances." Since low impedance antennas are current fed, a device that "causes equal and opposite CURRENTS on the conductors at both ports for any load impedance" is desirable. "There is nothing gained by forcing the voltages of the two antenna halves, whether balanced or not, to be equal and opposite relative to the cold side of the balun input (usually connected to the shield of the coax feedline), since the antenna field is proportional to the CURRENTS in elements, not the voltages at the feed point."

It is evident that the conventional baluns we have been using for years are not suitable for antenna applications and, in fact, may well contribute to the very problems that they are supposed to solve.

"Current-Type (C)" baluns have no adverse effects on the transmission line or antenna matching system. On the other hand, "a less than perfect voltage balun can have a profound effect on the impedance seen at its input because of the tertiary winding." This is just a very brief summary of the difference between "Voltage-Type (C)" and "Current-Type (C)" baluns. It is clear that (for antenna applications) only "Current-Type (C)" baluns are suitable if maximum performance of the antenna is to be obtained. Simultaneously, the "Current-Type (C)" balun will provide a high order of feedline isolation, excellent balance, and outstanding electrical characteristics. It can do this over a very wide bandwidth and under less than ideal load conditions. Thus, the "Current-Type (C)" balun provides decreased pattern distortion (due to feedline radiation and poor balance), reduced TVI and RFI, and reduced RF in the shack. These are exactly the problems the "Voltage-Type (C)" balun are supposed to clear up, but fail to do in practice.

The Radio Works has always built "Current-Type (C)" baluns. The C1-2K, C75-4K, B1-2K, B1-4K, B4-2KX, 4K-LI, and the "Remotebalun" are all "Current-Type (C)" baluns.

If you wish to learn more about current and voltage baluns, read the article by Roy W. Lewallen, W7EL, on page 157 of "The ARRL Antenna Compendium." All quotations in this article are from that reference.

45527 Third Street East, Lancaster, CA 93535-1802

Raymond Colvin, KB4UCR, started as a CB operator and moved up to an Extra class license within three months. His station includes Kenwood TS-430 and TS-940 transceivers, a Yaesu FT-757-GX transceiver, the Drake B-line twins, an inverted-Vee, a Hy-Gain Explorer 14, and a Dentron Clipperton L linear amplifier. Raymond lives in Fort Deposit, Alabama. His wife (Dot, KC4EFT) holds a Technician license. Raymond is an ordained elder in the Seventh Day Adventist Church.

Antenna Support Rope

The February 1989 issue of *CQ* magazine contains my article about long-wire antenna support material. That article advises readers to use black Dacron® /polyester double-braided antenna rope produced by Synthetic Textiles, Inc. (2472 Eastman Avenue, Building 21-22, Ventura, CA 93003). Their rope has excellent resistance to abrasion and aging. This rope is easy to tie and untie, and it does not snarl or kink. It also does not shrink or stretch. Due to its high resistance to being damaged by ultraviolet light, it has a very long service life. This special antenna support rope was developed a decade ago; it was developed in response to the constant urging of Richard L. Measures, AG6K.

Lauren Ridley (of Synthetic Textiles) advised me that all three sizes (3/32, 3/16, and 5/16 inch) are sold in 1000 foot reels. She stated that prices include handling and shipping charges, for prepaid orders. The 5/16 inch diameter rope may also be purchased in two 500 foot spools.

If you would like to receive a free sample piece (2 to 3 inches) of the 3/16-inch diameter rope, send your request for it to my California address, along with a self-addressed, stamped envelope. This rope is the best antenna support I have ever used. If you are going to erect an antenna that will require rope support, I strongly advise you to use this material. Whenever your existing rope supports need to be replaced, replace them with this excellent support rope.

The 3/32 (0.9375) inch diameter rope is rated at a strength of about 260 pounds, and it sells for $30 per 1000 foot spool. The 3/16 (0.1875) inch rope is rated at about 770 pounds, and it sells for $65 per 1000 foot spool. The 5/16 (0.3125) inch rope is rated at approximately 1790 pounds, and it sells for $100 per 1000 feet. Handling, application, and other factors significantly affect the actual strength of every rope. Individual amateurs are allowed to order directly from the manufacturer. This appears to be an excellent item for clubs to purchase for resale to their members.

Antennas West (Jim Stevens, KK7C, 2996 Cherokee Lane, Provo, UT 84604)

includes a 200 foot tube of this 3/32 inch rope with their antenna installation kit. The price of one 200 foot spool of this rope is $11.95, postpaid; two spools costs $19.95, postpaid.

The Radio Works (Jim Thompson, W4THU, 3207 Dogwood, Portsmouth, VA 23703) sells various lengths of this rope at approximately 5, 10, and 15 cents per foot for 3/32, 3/16, and 5/16 inch ropes, respectively. It appears on page 35 of Jim's current catalog, which is well worth its $1.00 cost.

The Radio Works sells a 3/16 (0.1875) inch diameter single solid braid line that is rated at 700 pounds. This rope provides good opposition to damage by fungus, ultraviolet light, and fire. This Dacron® line sells at five cents per foot, plus shipping costs. It can be purchased in as short a length as 100 feet.

M² Enterprises (Mike Staal, K6MYC, 1600 Decker Avenue, San Martin, CA 95046) uses this antenna rope as boom supports in its long boom Yagi-Uda antennas and H-frame structures. Mike sells spools of this rope in all three sizes. The price is 5, 10, and 15 cents per foot for 3/32, 3/16, and 5/16 inch diameter ropes, respectively, in 100 foot lengths. Longer lengths are available. Their other address is 360 West Bedford, Fresno, CA 93711.

W9INN Antennas (Bill Franckbonner, 811 Cathy Lane, Mt. Prospect, IL 60056) uses 3/32 inch Dacron® /polyester double-braid rope in his excellent antennas.

Another source of antenna support rope is Rope-Rope-Rope, Box 6601, Portsmouth, VA 23703. This outfit sells 200 foot lengths of Dacron® rope at $12.45, including shipping charges.

Wire Antennas

I know two sources of excellent wire antennas. These are Antennas West and The Radio Works.

Jim Stevens, KK7C, of Antennas West offers several wire antennas that are completely fabricated and ready to install. Jim also markets a very useful wire antenna installation system, which I use. He calls it the QRV-QL Quick Launch Wire Antenna Installation System, and it sells for about $30. This kit allows one to erect wire antennas easily, safely, and with minimum effort. Every club should have one of these kits for use by their members. Let them get accustomed to using it during Field Day. Jim's address is P.O. Box 50062, Provo, UT 84605.

Jim Thompson, W4THU, of The Radio Works offers a 56-page catalog ($2.00) which lists an extensive assortment of antennas, antenna accessories, support ropes, connectors, insulators, and other amateur radio products. Jim added the Carolina Windom/2 to his product line at my request. I told him that I have helped many ex-students erect antennas, and I know that very few of them have enough space to install 160 or 80 meter half-wavelength antennas. I recently moved to a location in the Mojave Desert, and it will be a long time before I get my antenna system installed completely. I erected a Carolina Windom/2 and experienced excellent results the following weekend during a DX contest. I worked about 250 DX stations in a total of 53 countries, including several 40 meter contacts. The Carolina Windom/2 will remain part of my final antenna system. (The Radio Works, Box 6159, Portsmouth, VA 23703.)

These are top-notch outfits with a lot to offer all amateurs, and their products are particularly useful to new amateurs.

Magnetic Loop Antennas

Tony Johnston, G4OGP, has introduced a line of magnetic loop antennas which provide excellent performance in very limited space. The model AMA3 antenna covers 13.9 to 30 MHz at 200 watts PEP maximum; its diameter is 80 centimeters (31½ inches). The model AMA4 antenna covers 1.8 to 4.2 MHz at 100 watts PEP maximum; its diameter is 3.4 meters (11 feet, 2 inches). The model AMA5 covers 3.5 to 11 MHz at 150 watts PEP maximum; its diameter is 1.7 meters (5 feet, 7 inches).

These antennas are expensive, and their present usage appears to be limited to embassies and other government agencies. The SWR does not exceed 1.4 to 1 in proper installations, which are free of large metallic objects. These antennas have a nominal impedance of about 50 ohms, making them suitable to be fed with standard coaxial cables, such as RG-213/U.

The address is Cap. Co. Electronics,

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- **100% Duty Cycle**
- **40 Memory Channels**

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TS-711A **TS-811A**
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TM 2550A (45W) **TM231A (50W)**
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TH215A
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TH-25AT, TH-45AT, TH-205AT
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- Built-in Power Supply and Automatic Antenna Tuner
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- Built-In Automatic Antenna Tuner & Power Supply
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- General Coverage Receiver
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IC-735 Ultra Compact XCVR
With General Coverage Receiver
CALL FOR SPECIAL PRICE!

IC-725 Ultra Compact HF XCVR
- 26 Memories w/Band Stacking Registers
- USB/LSB/CW, AM Receive Optional Module for AM Transmit and FM TX/RX
- 160-10M Operation • 100W Output
- Receive 30 kHz-33 MHz

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2 meter HT
RX 138-174 MHz
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- Stores Standard & Odd Offsets

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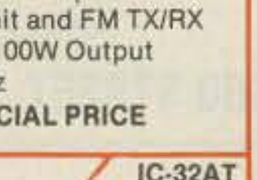
- M-Series with Meter A-Series Without Meter



Model	Cont. Amps	ICS Amps	Price
RS4A	3	4	$49
RS7A	5	7	59
RS12A	9	12	79
RS20A	16	20	99
RS20M	16	20	119
RS35A	25	35	159
RS35M	25	35	179
RS50A	37	50	229
RS50M	37	50	249

YAESU

FT 767 GX HF/VHF/UHF
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FT-736R
New All Mode Base Transceiver
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SAVE $$$!

FT-411 NEW
2 meter HT
- 49 Memories
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- DTMF Autodialer
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AMERITRON

AL80A

	LIST		LIST
AL80A	$985.00	ATR15	380.00
AL84	479.00	RCS4	134.50
AL1200	1825.00	RCS8V	134.50
AL1500	2370.00		

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rfc 2-317 2M
30W in = 170W out
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Model	Band	In-Out	List Price
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2-217	2M	2-170W	$299.00
2-117	2M	10-170W	$299.00
2-417	2M	45-170W	$299.00
3-22	220	2-20W	$112.00
3-211	220	2-110W	$299.00
3-312	220	30-120W	$264.00

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PARAGON
General Coverage HF Transceiver
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New HF Transceiver, Ham Band Optimized for Reduced Phase Noise and Dynamic Range, Dual VFO's, Scannable Memories & More.

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144 MHz Isopole	CALL
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Other AEA products also in stock call!!!

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KAM All Mode Terminal Unit	$289.95
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NEW Model MFJ-986 3KW Tuner
Only $239.95

1278 Multi Mode TNC	$239.95
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Check these features:
- All steel construction
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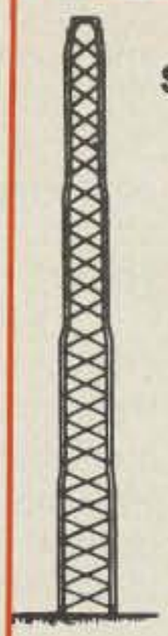
- Complete with base and rotor plate
- Totally self-supporting—no guys needed

Model	Height	Load	Sale Price
HG37SS	37 ft	9 sq ft	$CALL
HG52SS	52 ft	9 sq ft	$CALL
HG54HD	54 ft	16 sq ft	$CALL
HG70HD	70 ft	16 sq ft	$CALL

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



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- America's Best Tower Buy—Compare Save $
- Complete With Base and Rotor Plate
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Model	Height	Ant Load*	Weight	Delivered Price*
HBX40	40 ft	10 sq ft	228	$449
HBX48	48 ft	10 sq ft	303	$589
HBX56	56 ft	10 sq ft	385	$699
HDBX40	40 ft	18 sq ft	281	$569
HDBX48	48 ft	18 sq ft	363	$689

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

ROHN

Guyed Tower Packages

- World Famous Rohn Quality and Dependability
- Rugged high wind survival provides safe installation
- Multi purpose towers satisfy a wide range of needs
- Complete packages include: guy hardware, turnbuckles, guy assemblies, concrete base, rotor plate and top section per manufacturers specs.

Packages shown below are rated for 70 mph wind zone. 90 mph wind zone packages slightly higher. All tower packages shipped freight collect from our Plano, TX warehouse, in stock for prompt delivery.

	Model 25G	Model 45G	Model 55G
50'	$839	$1499	$1939
60'	929	1679	2169
70'	1129	1879	2399
80'	1199	2199	2799
90'	1279	2369	2999
100'	1529	2569	3239
110'	1629	2979	3449
120'	1699	3149	3699

US TOWER CORPORATION

These rugged crankup towers and masts now available from Texas Towers!

Check these features:
- All steel construction
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- No guys needed

Coax arms, Thrustbearings Masts, Motor drives, Remote controls, Hinged bases, Rotor bases, & Raising fixtures also in stock-

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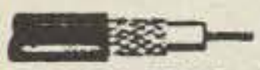
Model	Min.Ht.	Max.Ht.	Ant.load*	Sale price
MA40 mast	21'	40'	10 sq ft	$629
MA550 mast	22'	50'	10 sq ft	999
TX438	22'	38'	18 sq ft	919
TX455	22'	55'	18 sq ft	1385
TX472	23'	72'	18 sq ft	2279
HDX555	22'	55'	30 sq ft	2079
HDX572	23'	72'	30 sq ft	3559

Note-US Towers Shipped Freight Collect From Visalia, CA Factory

Note-towers rated at 50 mph to EIA specifications

RG-213U



$.39/ft $379/1000 ft. Up to 600 ft via UPS

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

RG-8X

$.22/ft $209/1000 ft.

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

9086

$.45/ft $439/1000 ft.

- Same Specs as Belden 9913
- Lower loss than RG8U
- 100% shielded-braid & foil

HARDLINE/HELIAX®

Lowest Loss for VHF/UHF!

½" Alum. w/poly Jacket ..... $.79/ft.
½" LDF4-50 Andrew Heliax® ..... $1.99/ft.
⅞" LDF5-50 Andrew Heliax® ..... $4.99/ft.
select connectors below

Heliax® is a Registered Trademark of the Andrew Corp.

Coaxial Cable Loss Characteristics (DB/100 ft)

Cable Type	Imped.	10MHz	30MHz	150MHz	450MHz
RG-213/U	50	.6	.9	2.3	5.2
RG8X	52	.8	1.2	3.5	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

HELIAX® CONNECTORS

Cable Type	UHF FML	UHF MALE	N FML	N MALE
½" Heliax®	$29	$29	$29	$29
⅞" Heliax®	$55	$55	$55	$55

COAX CONNECTORS

Amphenol Silver PL259 ..... $1.50
UG21B N Male $3.50
9086/9913 N Male Connector $4.95

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Stranded Copper 14ga ..... $.10/ft.
¼ mile 18ga copper-clad steel wire $30
Dog bone end insulator ..... $.79 ea.

Van Gordon

1:1 Balun ..... $15 Center Insulator $8
Dipole Kits D80 $31.95/D40 $28.95
Short Dipole Kits SD80 $35.95/SD40 $33.95
All-band Dipole w/ladder line $29.95
G5RV all band antenna $49.95

ALPHA DELTA

DX-A 160-80-40 Sloper $49

CUSHCRAFT

A3 3-el Tribander .....
A4S 4-el Tribander Beam w/S.S. Hdwre. ....
A743 & A744, 30/40 mtr KIT for the A3 & A4 .
R4 20-10 mtr Vertical .....
AP8 80-10 mtr Vertical .....
AV5 80-10 mtr Vertical .....
D40 40 mtr Dipole .....
40-2CD 2-el 40 mtr Beam .....
A50-5 5-el 6 mtr Beam .....
215 WB NEW 15-el 2 mtr Beam .....
230 WB NEW 30-el 2 mtr Beam .....
4218 XL 18-el 2 mtr Beam .....
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ARX2B 2 mtr Vertical .....

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TH5MK2S Broad Band 5-el Triband Beam .
TH7DXS 7-el Triband Beam .....
TH3JRS 3-el Triband Beam .....
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 .....
2BDQ 80/40 mtr Trap Dipole .....
5BDQ 80-10 mtr Trap Dipole .....
BN86 80-10 mtr KW Balun W/Coax Seal ...

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6BTV 80-10 mtr Vert $149 5BTV 80-10 mtr Vert $129
4BTV 40-10 mtr Vert $99 G7-144 2-mtr Base $129
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Mobile Resonators	10m	15m	20m	40m	75m
400W Standard	$16	$17	$19	$22	$26
2KW Super	$20	$22	$25	$29	$39

Bumper Mounts - Springs - Folding Masts in Stock!

BUTTERNUT ELECTRONICS CO

HF6VX 80-10m Vertical $159.95 Delivered
- Full Legal Power
- Highest Q Tuning Circuits

HF2V 80-40m Vertical $149.95 Delivered
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- Automatic Band Switching

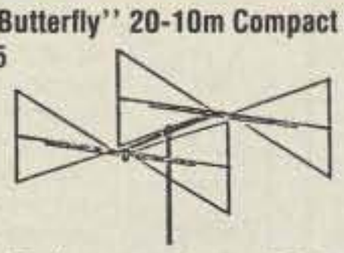
Accessories:

RMK II Roof Mtg. Kit $59.95
STR II Stub-Tuned Radials $39.95
TBR160 160m Coil Kit $59.95
30m Add-on Kit $39.95
17/12m Add-on Kit $39.95

HF6V HF2V

FREE UPS on ACCESSORIES when purchased with antenna

HF5B "Butterfly" 20-10m Compact Beam $259.95



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KT34XA 6-el Broad Band Triband Beam $619

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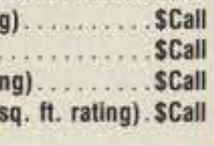
Alliance HD73 (10.7 sq. ft. rating) $129.95
Alliance U110 (3 sq. ft. rating) $49
Telex CD 4511 (8.5 sq. ft. rating) ..... $Call
Telex HAM 4 (15 sq. ft. rating) ..... $Call
Telex Tailtwister (20 sq. ft. rating) ..... $Call
Telex HDR300 Heavy Duty (25 sq. ft. rating) . $Call

ROTOR CABLE

Standard 8 cord cables $.25/ft. (vinyl jacket 2-#18 & 6-#22 ga)
Heavy Duty 8 Cond cable $.45/ft (vinyl jacket 2-#16 & 6-#18 ga)



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10 FT. STACKED SECTIONS

20G ..... $54.50 45G $153.50
25G ..... $65.50 55G $197.50

ALL ACCESSORIES IN STOCK—CALL

ROHN FOLDOVER TOWERS

Model	Height	Ant. Load*	Price
FK2548	48 ft.	15.4 sq. ft.	CALL FOR PRICES
FK2558	58 ft.	13.3 sq. ft.	
FK2568	68 ft.	11.7 sq. ft.	
FK4544	44 ft.	34.8 sq. ft.	
FK4554	54 ft.	29.1 sq. ft.	
FK4564	64 ft.	28.4 sq. ft.	

25G Double Guy Kit ..... $299.
45G Double Guy Kit ..... $319.

*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.

TOWER/GUY HARDWARE

3/16 EHS Guywire (3990 lb rating)	$.15/ft
1/4 EHS Guywire (6650 lb rating)	$.18/ft
5/16 EHS Guywire (11,200 lb rating)	$.29/ft
5/32 7×7 Aircraft Cable (2700 lb rating)	$.15/ft
3/16 CCM Cable Clamp (3/16" or 5/32")	$.45
1/4 CCM Cable Clamp (1/4" Cable)	$.55
1/4 TH Thimble (fits all sizes)	$.45
3/8EE (3/8" Eye & Eye Turnbuckle)	$6.95
3/8EJ (3/8" Eye & Jaw Turnbuckle)	$7.95
1/2 × 9EE (1/2"×9" Eye to Eye Turnbuckle)	$9.95
1/2 × 9EJ (1/2"×9" Eye & Jaw Turnbuckle)	$10.95
1/2 × 12EE (1/2"×12" Eye & Eye Turnbuckle)	$12.95
1/2 × 12EJ (1/2"×12" Eye & Jaw Turnbuckle)	$13.95
5/8 × 12EJ (5/8"×12" Eye & Jaw Turnbuckle)	$16.95
3/16" Preformed Guy Grip	$2.49
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6" Diam - 4 ft Long Earth Screw Anchor	$19.95
500 D Guy insulator (5/32" or 3/16" Cable)	$1.69
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PHILLYSTRAN GUY CABLE

HPTG2100 Guy Cable (2100 lb rating)	$.32/ft
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9901LD Cable End (for 2100/4000 cable)	$9.95
9902LD Cable End (for 6700 cable)	$11.95
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GALVANIZED STEEL MASTS

Heavy Duty Steel Masts 2 in OD - Galvanized Finish

Length	5 FT	10 FT	15 FT	20 FT
.12 in Wall	$29	$49	$69	$89
.18 in Wall	$49	$89	$129	$149
.25 in Wall	$69	$129	$189	$249

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CIRCLE 85 ON READER SERVICE CARD

Ltd., Unit 6, Peel Road Industrial Centre, Peel Road, West Pimbo, Skelmersdale, Lancashire, WN8 9PT, England. Delivered prices appear to be in the $600 to $1000 range. These magnetic loop antennas work well just a few feet off the ground.

Ted Hart, W5QJR, has a book available about magnetic loop antennas. The title is *Small High Efficiency Antennas* and the price is $11.95, plus shipping. The address is P.O. Box 334, Melbourne, FL 32902-0334.

False Southeast Asia M.I.A. Reports

During October 1988 two American amateurs heard 10 meter code transmissions which were supposedly made by one of 700 U.S. Marines being held captive near Hanoi. Direction finding disclosed a bearing that did not come close to Vietnam. However, the bearing line passed through Geneva, which is where it is believed the false transmissions originated. This hoax prompted Colonel Joseph A. Schlatter, K4FPT, to write a letter wherein he detailed the steps you should follow if you hear a transmission that allegedly concerns Americans missing in Southeast Asia. His 17 January 1989 letter recommends following these steps:

A. Tape record the transmission.

B. Note the date, time, frequency, and mode of the received transmission.

C. If possible, obtain a beam heading.

D. If possible, notify a nearby FCC field operations office of the transmission, and request that they determine a bearing. Listing is under U.S. Government.

E. If it is a code transmission, copy the entire transmission. If it is a voice transmission, make notes of major points, if you are not tape recording it.

F. Call Joe Schlatter collect at 202-694-4708 or 202-695-0501 to report the transmission. If Joe is not immediately available, speak to one of the analysts in the Defense Intelligence Agency (D.I.A.) Special Office for Prisoner of War/Missing in Action (PW/MIA).

G. Supplement the telephoned verbal report with a written report sent to the D.I.A., Special Office for PW/MIA, Room 2E230, The Pentagon, Washington, DC 20340-5390.

H. Monitor the same frequency (plus and minus a few kiloHertz) several days and follow the same procedure if a similar transmission is heard.

Printed Aids

Previous Novice columns contain information that is useful to new and aspiring amateurs. Many of these items have been reprinted for distribution to students of licensing courses I instruct. For ease of use, these printed aids have been separated into six categories. These categories are introduction, code, theory, station, operating, and miscellaneous. Outdated items are continually replaced with newer material. Fifteen dollars brings a complete set of current printed aids, including shipping costs. A list of these printed aids will be sent to anyone who requests it and sends a business-size (#10) self-addressed and stamped envelope to my California address. Licensing course instructors are welcome to revise and/or duplicate these items to suit their requirements.

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 an 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.

73, Bill, W6DDB

CIRCLE 177 ON READER SERVICE CARD

CIRCLE 129 ON READER SERVICE CARD

CIRCLE 179 ON READER SERVICE CARD

The Packet User's Notebook

a feature by
BUCK ROGERS,
K4ABT

CONNECTING YOU AND PACKET RADIO IN THE REAL WORLD

A Look At Our Beginnings

It all started with a click and a clack, a long and a short space, and later it became known as a mark and a space. Now it is called packet radio.

There was a time when I would climb out of bed in the wee hours of the morning, remove the bank of ashes in the fireplace, and stoke the firedogs with another log. I would stand there for a few minutes to warm my body before I made the dash for the little hamshack out by the old, faded, oil and red-lead painted barn.

In those next few moments, while standing by the fireplace, I would wonder which State I would contact that morning. Just maybe there would be more than one. On some of those winter mornings I would hear a Canadian or some remote Caribbean Island station.

My old Hallicrafters "Sky Buddy" receiver was about to get another early morning workout. In 1949 that old receiver was a small cut above a Tuned RF (TRF) or super-regenerative type. In addition, it had an analog dial and a bandspread (both about the same vernier sweep) and an IF that was as broad as that old red barn's door.

The other half of the "dynamic duo" was my 7 watt CW home-brew transmitter. This work of art was the remains of my grandfather's Atwater-Kent all-wave radio. I had removed most of the pencil-size "stick resistors" and the foil-over-paper condensers. (In 1949 we called a capacitor a condenser if its value was below .5 MFD.)

Coupled to my 130 foot long Windom antenna, suspended between two pine sapling poles (which also supported the gourds for the martins, a bird that kept the hawks away from the chickens), this 7 watt wonder was my access to the world of (however crude) "digital" communications then and now. If you recall, CW was the forerunner of RTTY, ASCII, and now packet. It was a beginning for all of us who moved up the scale to this point in time in a continually evolving analog-to-digital world.

CW will never die. It will only change "states." I will hold CW as my first love in amateur radio communications, but I won't try to impose it as a required ritual or tradition that must be followed just because I enjoyed the use of it.

506 Pheasant Ridge Drive, Warner Robins, GA 31088

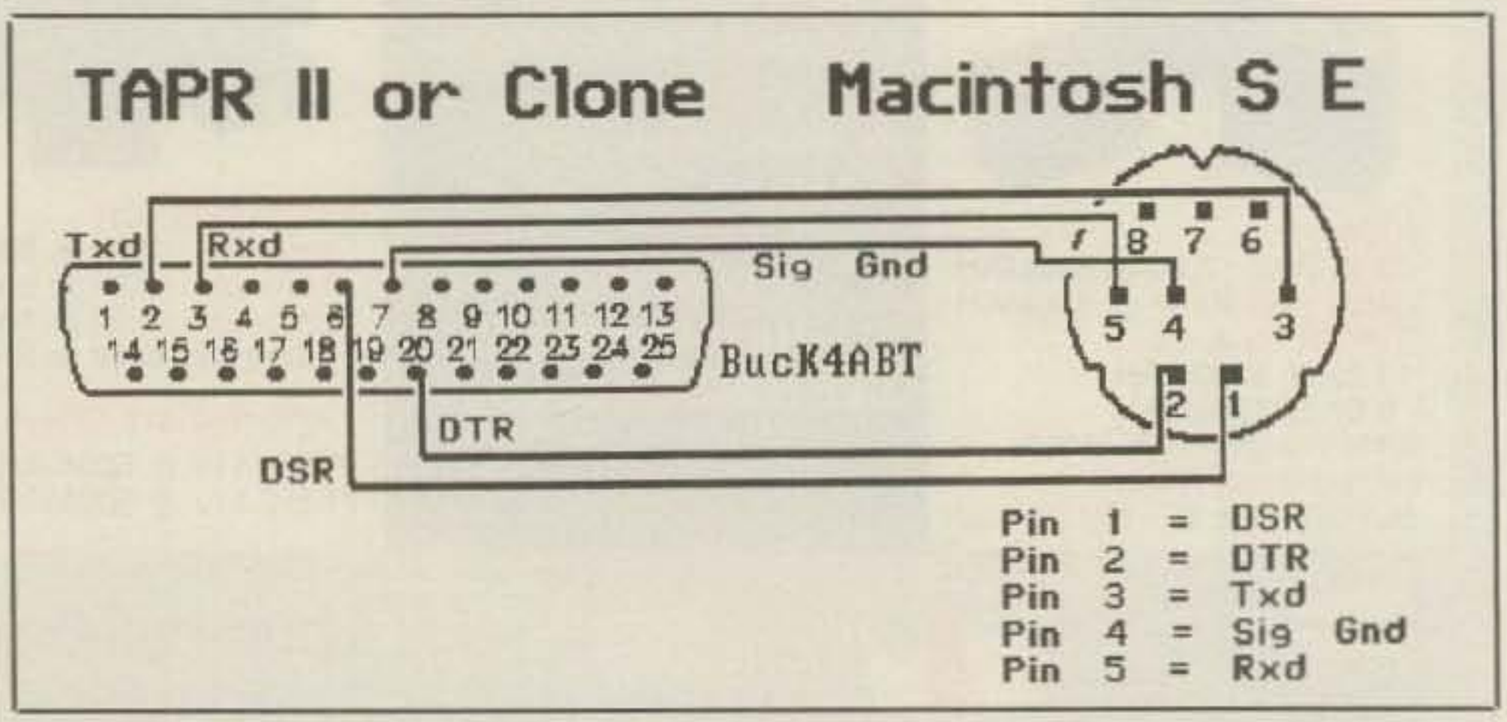


Fig. 1 - For the notebook, this illustration shows the Macintosh SE interfaced to the TAPR II clone.

A Matter of Personal Preference

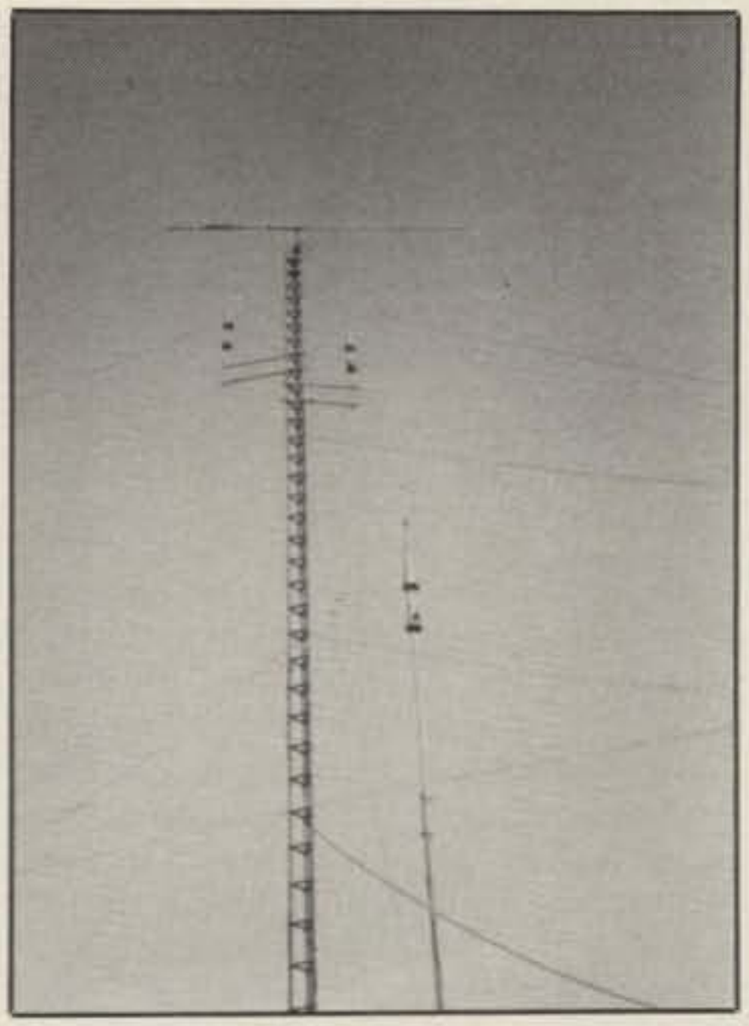
There are those who will argue that CW is not, or was not, the digital beginning, but look at the trends that have lead us to our present "non-voice" communications medium. In one form or another the index will somehow rotate like the needle of a compass and point to CW as the beginning. The key to the index is, of course, *"non-voice."*

In 1959 I held a code proficiency certificate for receiving 35 words per minute and for three years running. Those days are long gone as we move to yet another plateau in the world of digital communications. We now call it AX.25 packet radio!

Building on a Solid Foundation

Let's look at the building blocks of digital communications in ascending order.

Shown here is part of the impressive shack at K4ABT.



Here is a closer look at the antenna setup at K4ABT's "packet ridge."

Although some are a bit primitive, nevertheless they were part of our packet heritage.

- Smoke signals.
- Hollow logs.
- Drums/tom-toms (animal skins, stretched tightly over the open end of a hollow log).
- Early railroad rails polarized as telegraph lines.
- Later via telegraph lines reaching from coast to coast.
- Relays with long and short spaces between clicks and clacks.
- Spark-gap transmitters with keyed, on and off AC primaries that resembled the Russian Woodpeckers, with signals from one end of the RF spectrum to the other, including UHF.
- Then came the electron coupled oscillators that gave us the beginning of true.CW.

Since that time no single force has had more impact on our society than the communications industry. The reality that looms ahead is the knowledge that it will evolve even further. In retrospect, we used every form of ingenuity to add to or improve those communications systems of yesteryear. In a very determined sense, we seem to be driven to improve our communications mediums. This drive in some way appears to be connected to a "want" or need to reach out farther and farther. We may someday use the same store-and-forward techniques to bridge vast expanses of space, and in relation to the speed of light, we will bridge time.

For the moment let's continue with the background and rise to the present level of development in the digital staircase. Every conceivable kind of device was added to the telegraph relays of that era in an effort to make the sound of the clickety clack louder.

At the L & N railroad station in Attalla, Alabama, I remember Haley Williams, a wonderful gentleman who used a Prince Albert tobacco can attached to the railroad's communications relay. The lid was removed to raise the level of the relay contact clicks another 10 dB (more or less). I used to marvel at the way Mr. Williams could copy telegraph with a pencil in his right hand, while he relayed the same message up the line with his left hand, and at 15 to 20 wpm and using a hand key. He gave me my first exposure to code.

I learned CW from the masters. I can still hear the mark and spaces. Yes, I said "mark and spaces." I relate to CW as the beginning of the electronics digital era for me. Although the protocol was different, the long and short spaces were there, even if it was much slower.

From the clack (long hold, dash) to the click (short hold, dot) to the signal on, signal off via wireless methods of CW, we

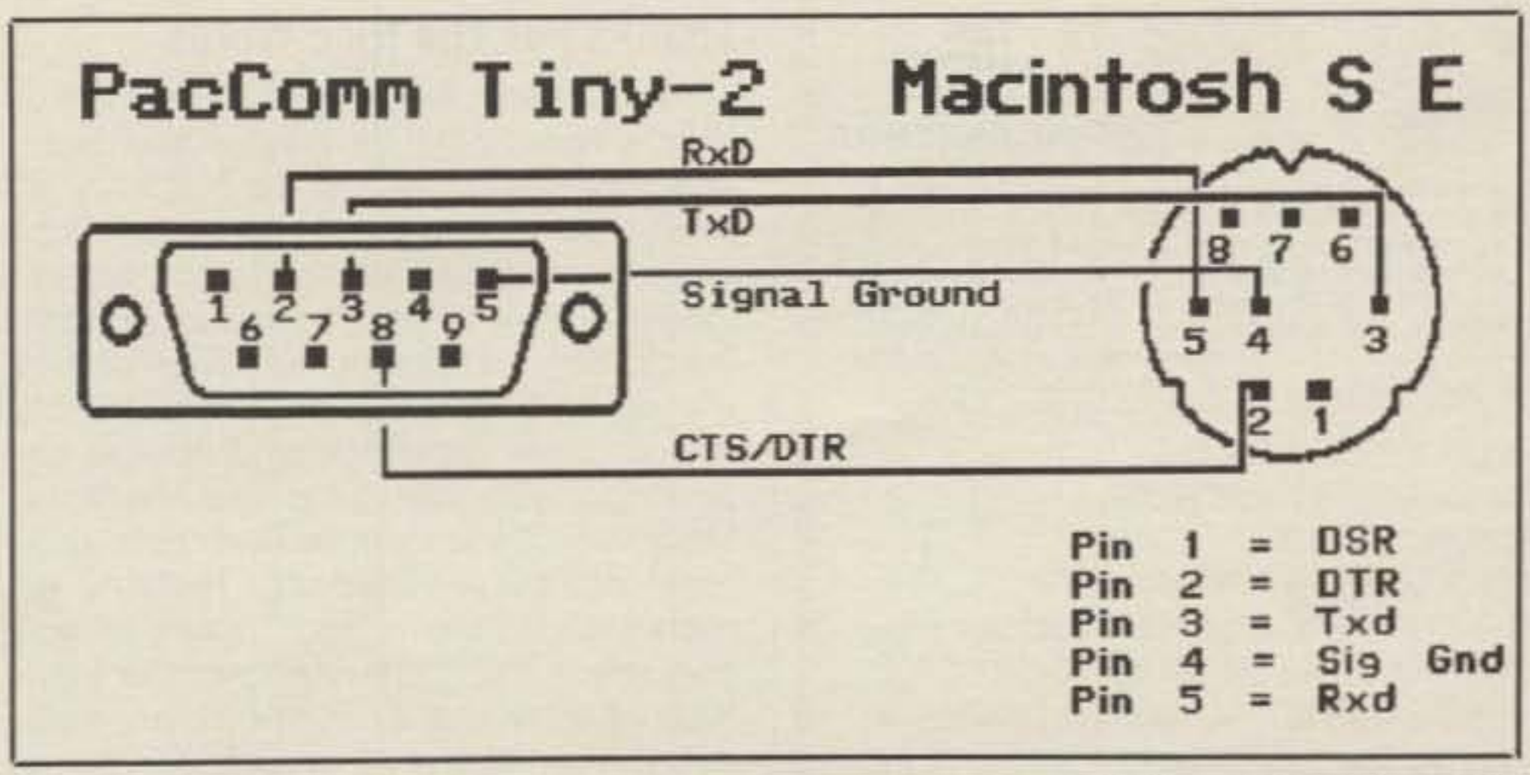


Fig. 2- Also for the notebook, here are the PACCOMM Tiny-2 TNC and Macintosh SE. Note: DTR is used similar to CTS for hardware handshaking.

have somehow made the transition to the high technology of the now-popular error-free AX.25 protocol.

Between these two worlds of communications lie the vast amounts of trial and retrial, test and retest, experiment and more experiment. Slowly we progressed with each step from telegraph to teletype (called TTY in the early days). The print mark and space were controlled by a current-on/current-off loop. The wireless adaptation of TTY was known as radioteletype, or RTTY.

In those days 60 wpm was the industry standard for RTTY, and AFSK was then as now 2125 Hz and 2295 Hz with the 170 Hz shift.

The demands for greater speeds and better methods of data transmission have caused a need for greater shifts between the mark and space, although it would seem the reverse, for speed reasons. The larger shift is necessary for the modulating and demodulating circuits to detect the change in tone and shift as the speed increases. In this manner the analog tones can be converted to digital pulses, and in similar fashion converted to seven- or eight-bit characters.

Back To The Future and The Real World

Having covered the building blocks to the present state of digital communications, I can now give a brief discussion of how we are able to create letters and symbols using the many methods of developing "marks" and "spaces."

To begin with, here is a simplified approach to why we have 170 shift for RTTY 60 and 100 wpm, 200 Hz shift for 300 baud, and 1000 Hz shift for 1200 baud.

Now my next slip of the typing finger may really put your brain into high gear. It just so happens that it doesn't really matter which tone is used for mark and which for space in packet. The packet method of returning ones and zeros is accomplished in a slightly different manner. A change from one tone to the other renders a "zero," while no change in tone signal gives a "one." This is called NRZI, or Non Return to Zero Inverted, meaning *a form of bit coding in which a zero bit causes a change in state, and a one bit will render no change.*

The standards vary, but for the most part we will use these for reference purposes:

- RTTY 2125 Hz mark and 2295 Hz space (170 Hz shift).
- 300 baud 1600 Hz mark and 1800 Hz space (200 Hz shift).
- 1200 baud 1200 Hz mark and 2200 Hz space (1000 Hz shift).

Now what, and where, are we in this complex region of communications called packet? Why have I given you all this background to digital communications? Well, I really want the newcomers to packet radio to love it and enjoy it as much as I do. Moreover, I think the brief history of this wonderful mode of communications that we have just covered will enhance your appreciation for this rapidly expanding "hobby" of packet radio.

A Moment for The HF Packeteer

Don't feel that VHF packet is the end of the line for you. Although there is lots of fun and plenty of BBSes on VHF, there is an even larger packet world on HF.

Look over this list of HF packet frequencies. It is rapidly expanding.

3630 kHz (some evening activity)
3642 kHz (some evening activity)
7093 kHz (most active 40 meter freq.)
7097 kHz
10147 kHz
10149 kHz
14101 kHz
14103 kHz (very active, almost 24 hrs.)
14105 kHz (good QSO frequency)
14107 kHz (all the BBSes you will ever need)
14109 kHz (BBS traffic forwarding, full time)
14111 kHz (STA and experimental use)
28103 kHz (Novice and Tech, 300 baud frequency)
28105 kHz (most used 10 meter packet 300 baud frequency)
28195 kHz (1200 baud packet "LSB")
28205 kHz (1200 baud packet "LSB" with some BBS activity)

With 10 meters open almost every day, and the expanding of packet to all parts of the world, the DXer will find an abundance of packet in every part of the globe. I have already worked many ZLs, in New Zealand, and I just today worked a ZS in South Africa. The story goes on and on, so confiscate the kids' computer and attach it to the TNC (that you just bought, explaining to the XYL that it is a very inexpensive modem) and go for the gold.

Meanwhile, be aware of the requirements and pitfalls revolving around digipeating through another station to a country which is not part of the FCC third-party agreements. Refrain from using your fellow packeteer's station as a digipeater on HF unless you are sure the station that you are calling is listed for third-party communications. QSO, yes. Third-party traffic, *no*. Following is a list that I have available, alphabetical by prefix: CE Chile, CO Cuba, CP Bolivia, CX Uruguay, C5 Gambia, EL Liberia, GB United Kingdom, HC Ecuador, HH Haiti, HI Dominican Republic, HK Columbia, HL9 Korea, HP Panama, HR Honduras, JY Jordan, J3 Grenada, J6 St. Lucia, J7 Dominica, J8 St. Vincent, LU Argentina, OA Peru, PY Brazil, TG Guatemala, TI Costa Rica, VE Canada, VK Australia, VR6 Pitcairn Island, V2 Antigua and Barbuda, V3 Belize, V4 St. Christopher/Nevis, XE Mexico, YN Nicaragua, YS El Salvador, YV Venezuela, ZP Paraguay, 3D6 Swaziland, 4U1ITU ITU Geneva, 4U1VIC VIC Geneva, 4X Israel, 6Y Jamaica, 8R Guyana, 9G Ghana, 9Y Trinidad and Tobago.

Thanks For The Nice Words

I met many readers of "The Packet User's Notebook" at Dayton this year, and I was warmed by the sincerity of those of you who expressed how much you enjoy my column. I want to say thanks to each one of you who stopped by the *CQ* booth. I hope to hear from more of you, and I'm looking forward to seeing you at other hamfests such as the upcoming Shelby, North Carolina and Stone Mountain/Lawrenceville Hamfests (just north of Atlanta, Georgia). The kind remarks and constructive dialogue you give me in your letters and at the hamfests help me make future columns even better. I am sincerely grateful to you for your support. Until next month, happy packeting!

73, de BucK4ABT

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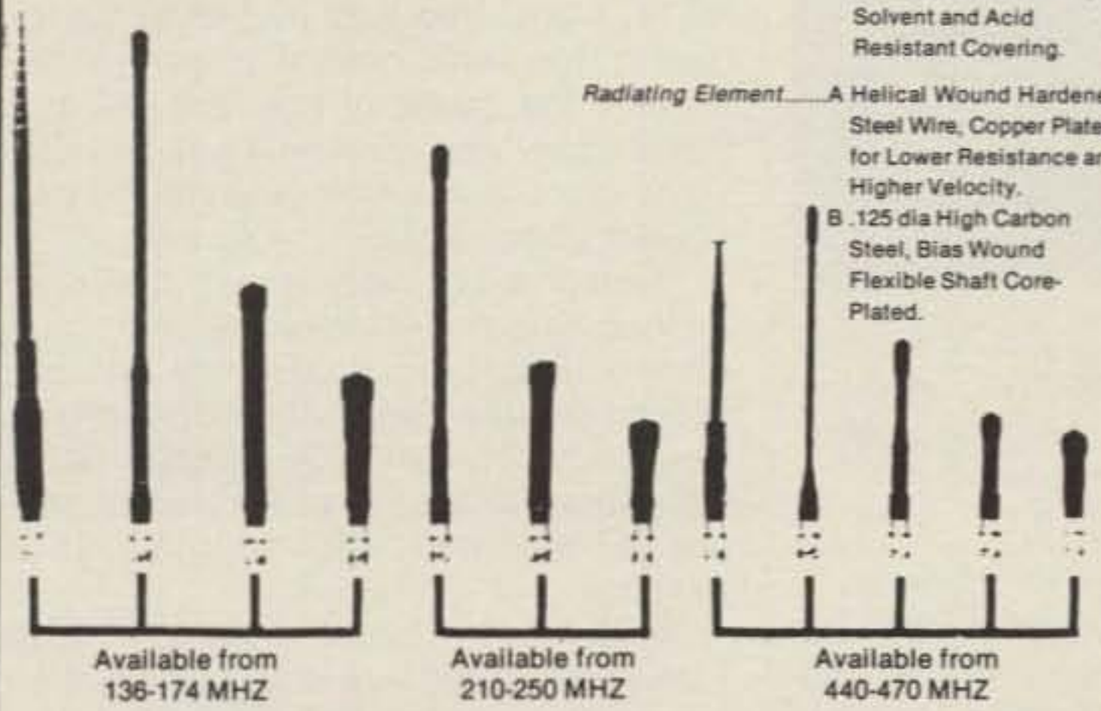

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Awards

a monthly feature by
DOROTHY JOHNSON, WB9RCY

NEWS OF CERTIFICATE AND AWARD COLLECTING

The Story of the Month for August is:

Clarence Willis, Jr., KJ4EJ
USA-CA All Counties #599, Mixed, 12-15-88

"I was very pleased to receive USA-CA All Counties #599 on December 15, 1988. It was a great Christmas present from all the many, many friends I have acquired since entering this fascinating hobby of amateur radio. It was also a great pleasure to give my brother, KC3YT, his very last county in Rockingham County, North Carolina at the same time he gave me my last county, which turned out to be Rockingham County, North Carolina. He was awarded USA-CA All Counties #600 on December 16, 1988.

"It was only 'right' that Bill should be the one to give me my last county to complete USA-CA, for it was mostly his encouragement that got me into ham radio in the first place.

"Unlike Bill, who had been a ham for many years, I did not enter the hobby until after I retired on January 4, 1984. I always used the excuse that I was too busy with my work and other hobbies to take the time to seek a ham license.

"I was born in Wilmington, Delaware in 1928, so you can now do a little math and learn that I was in my late fifties when I first obtained a license. I lived in Delaware until 1976. In 1953 I was appointed Postmaster of Laurel, Delaware, and in 1973 I was promoted to a position within the newly created U.S. Postal Service as Manager of the Budget and a Cost Analyst at the Wilmington, Delaware Management Facility. I also owned a small business buying and selling rare coins and currency, a business which had been created mostly for the purpose of supporting my personal collections. Numismatics and syngraphics were my serious hobbies in those days. Radio never entered the picture, unless I was visiting KC3YT, where I had to listen to all the 'chatter' from his radio to have a conversation with him. After my transfer to Wilmington, where Bill lived, my visits to his home increased and my interest in radio began to blossom.

"In 1976 I was transfered again, this time to Harrisburg, Pennsylvania, where I was appointed Director, Finance Division of the Harrisburg Management Area, and again amateur radio was put on the back burner. While serving in this position, I was detailed to head a Revenue Protection Team responsible for protection of revenue through verification of optional bulk mailing and acceptance procedures. This position required extensive travel to the large mailing firms across the state of Pennsylvania and left little time for my hobbies.

Willis, KJ4EJ, USA-CA All Counties #599 (left) with brother Bill, KC3YT, enjoying festivities at MARAC convention in Manchester, Tennessee.

"In the summer months of 1981 and 1982 I was detailed to Postal Headquarters in Washington, DC to assist in the writing of a Manual on Budgeting, for use by the Management Sectional Centers.

"In the summer of 1983 my wife, Sue, and I moved to Florida. I retired in January 1984 from government service. My new neighbor turned out to be AA4HL, Chet, an avid CW operator, also retired and formerly from Massachusetts. Chet again sparked my interest in amateur radio.

"With two 'hams' now encouraging me to get a license, I finally decided that perhaps I was not 'too old' to learn the code and perhaps I could pass the theory tests. My daughter Nancy was now living in Utah, and a planned auto trip to visit her and her husband provided me with an opportunity to study while enroute. I took a few letters of the code each day and began the process of memorizing them. After about the third day I was beginning to spell out, in code, the signs along the highways. By the time I arrived back in Florida I felt confident I could pass the code test. I took the test and was on my way. I obtained the call KB4LXI, later advanced to N4LOU, and finally became KJ4EJ. Perhaps I can attempt Extra class now that the USA-CA All Counties number is behind me!

"In early 1985 I found the County Hunters and was immediately addicted. Joe, W5UJO, was net control and gave me my first information about county hunting. My logs indicate that my first contact on the net frequency was with KB8KW, now NS7Z, Mike, who was mobile in Carter County, Montana. I was attempting to determine the cause of this 'pile up' and threw in my call thinking I was working some rare DX. Joe later gave me the particulars about the USA-CA Award.

"I am proud of every entry in my County Record Book, but I am especially proud of my entry for Maricopa County, Arizona, which was obtained while working off net frequency, from K7UGA, Senator Barry Goldwater. This is one of the few non-mobile contacts that I allowed to remain in the book.

"In June 1988 I left Florida on a trip to Idaho with a little less than 100 counties to go. Later, after 11,848 miles, 35 states, and thousands of mobile contacts, I arrived home with only 33 to go. KC3YT had about 70 to go, but in a short time he had caught up with me. When we were both down to about ten counties or so to go, we compared notes and found that we both needed several of the same counties in North Carolina. This eventually dropped to only one, Rockingham County. It was then we began to realize that just perhaps we could finish together. Bill, KC3YT, drove to a few that I needed in Ohio and Tennessee on the way to the Manchester, Tennessee convention of MARAC, and I had driven to a few that he had not worked. As it turned out, John, KØIFL, drove over a hundred miles to get me my next to last, which was in Illinois.

"KC3YT was now also down to just one to go. I drove north and Bill drove south to Rockingham County, North Carolina, where we made contact on the net, giving each other his last county from positions about 4 or 5 miles apart.

"I have not totalled the number of different persons who gave me a county, but it certainly is in the hundreds. Someone asked me what county was the hardest to get. I told him that it was the one you didn't have. My last five or six were counties that were not 'isolated' or in sparsely populated areas as you might expect. Several were actually on interstate highways. So when you start thanking the many hams who helped you finish up, believe me each and every county contact is equally valuable. Thanks for every one is extended at this time!

"What will I do now? Well! I have finished four states now toward the Master

---

333 South Lincoln Ave., Mundelein, IL 60060

USA-CA Special Honor Roll

Ed Tynan, W7HRD
All Counties #614, All SSB Mobiles
4-5-89

Victor Brosnan, ZL2ACP
All Counties #615, Mixed, 4-6-89

Bill Fourt, NF9A
All Counties #616, Mixed, 4-27-89

USA-CA Honor Roll

3000		1500	
W7HRD	645	W7HRD	876
ZL2ACP	646	4Z4DX	877
NF9A	647	W0AWP	878
2500		**1000**	
W7HRD	720	W7HRD	1062
WA1UDH	721	UP1BZO	1063
DL9YC	722	I0AOF	1064
NF9A	723	W0AWP	1065
2000		**500**	
W7HRD	787	J87CD	2323
NF9A	788	F6BFI	2324
		W7HRD	2325
		UP1BZO	2326
		W0AWP	2327

The total number of counties for credit for the United States of America County Award is 3076. The basic award fee for subscribers to *CQ* is $4.00. For nonsubscribers it is $10.00. Initial application must be submitted in the USA-CA Record Book, which may be obtained from CQ Communications, 76 North Broadway, Hicksville, NY 11801, U.S.A. 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 Dorothy Johnson, WB9RCY, USA-CA Custodian, 333 South Lincoln Avenue, Mundelein, IL 60060, U.S.A. DX stations must include extra postage for airmail reply.

County Hunter Award, and have also finished my first state for the second time around, working KC3YT on one of his trips through Delaware's three counties. Looks like it's 'Let's Do It Again.' This time, if I get it all done, hopefully some ham will be surprised when I tell him, 'That was my last county for the whole ball of wax.' I know of no better way to keep in touch with the many friends made during the past several years in attaining this goal. It's my turn to put out some more counties on the air for others.

"Thanks to all who have given me counties over the past several years or assisted in any way. Special thanks go to the most tolerant of all, my wife, Sue, who did so much of the logging and never complained (too much) when we departed off course to get that one county that had not been run recently. 73's and Good Hunting!—Willis."

Awards Issued

Ed Tynan, W7HRD, was awarded a fully endorsed certificate when he filed his good application for USA-CA All Counties #614, USA-CA 3000 #645, USA-CA 2500 #720, USA-CA 2000 #787, USA-CA 1500 #876, USA-CA 1000 #1062, and USA-CA 500 #2325, All SSB Mobiles, dated 4-5-89.

Elemer Bielik, HA9RE, and daughter, who no doubt helped him become the first amateur operator in HA-land to reach the USA-CA 1000 and 1500 levels.

Victor Brosnan, ZL2ACP, completed the collection of his confirmations and received USA-CA All Counties #615, and USA-CA 3000 #646, Mixed, dated 4-6-89.

Bill Fourt, NF9A, completed his paperwork and claimed USA-CA All Counties #616, USA-CA 3000 #647, USA-CA 2500 #723, Mixed; and USA-CA 2000 #788, All Mobiles, all dated 4-27-89.

Stephen E. Press, WA1UDH, received USA-CA 2500 #721, Mixed, dated 4-7-89.

Werner F. Brill, DL9YC, added a gold seal to his USA-CA certificate by claiming USA-CA 2500 #722, Mixed, dated 4-10-89.

Dov Gavish, 4Z4DX, received his gold seal for USA-CA 1500 #877, Mixed, dated 4-18-89.

Alvin B. Unruh, W0AWP, made a big step by claiming USA-CA 1500 #878, USA-CA 1000 #1065, and USA-CA 500 #2327, All CW, dated 4-27-89.

Headquarters Station of KPI Radio Club, UP1BZO, received USA-CA 1000 #1063, and USA-CA 500 #2326, Mixed, dated 4-8-89.

Giuseppe Loreti, I0AOF, added a gold seal to his unique record by claiming USA-CA 1000 #1064, All RTTY, #1 RTTY, dated 4-24-89.

USA-CA 500 certificates went to:

Sue Richardson, J87CD, USA-CA 500 #2323, Mixed, 4-1-89.

Jean-Jacques Roche, F6BFI, USA-CA 500 #2324, All SSB, 4-4-89.

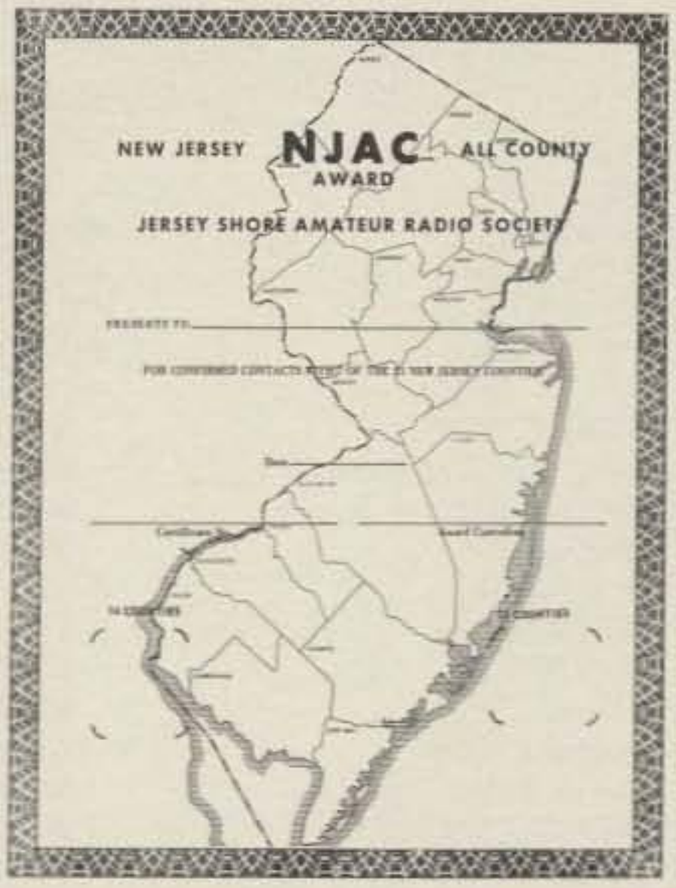
Ed Tynan, W7HRD, USA-CA 500 #2325, All SSB Mobiles, 4-5-89.

HQ Station of KPI Radio Club, UP1BZO, USA-CA 500 #2326, Mixed, 4-8-89.

Alvin B. Unruh, W0AWP, USA-CA 500 #2327, All CW, 4-27-89.

Awards Available

New Jersey All County Award. The Jersey Shore Amateur Radio Society sponsors the NJAC Award for working all New Jersey Counties. Required is an alphabetical list of the counties, with station worked, date of contact, frequency, and mode. The list is to be attested to and signed by two licensed amateurs and accompanied by $1.00 (or 3 IRCs for DX stations) to cover handling and postage.



New Jersey All County Award offered by the Jersey Shore Amateur Radio Society.

Application may be made (and the certificate will be sent) with a verified list of 7 of the 21 counties, and at a later date seals may be added for 14 and 21 counties. Alternatively, all 21 counties may be listed at one time and the certificate will be sent with both seals attached. Applications may be sent to Jersey Shore Amateur Radio Society, P.O. Box 295, Toms River, NJ 08754-0295, or directly to William B. Kelly, N2GOI, JSARS Awards Chairman, 733 Princeton Avenue, Brick, NJ 08724.

Punto Fijo DX Club Award. The Punto Fijo DX Club offers this award for working club members. The award is free. To qualify, work three stations from Punto Fijo and send GCR list with $2.00 or 6 IRCs

Punto Fijo DX Club Award available from the club in Venezuela.

CW County Hunters Honor Roll

Following is the annual listing of CW County Hunters showing confirmed CW contacts as of January 1, 1989. The list is courtesy of Buster Boatman, N0CKC.

#1 W8RSW
#2 W2MEI
#3 KA5A
#4 W1JTD
#5 W3HQU
#6 W3ARK
#7 NG0T
#8 WB0ODS
#9 N2RT
#10 W1AQE
#11 N5QQ
#12 WA6VJP
#13 K3LK
#14 W3HQU (2nd)
#15 K7EQ
#16 K8MW
#17 W6NNV
#18 N0CKC

W7GHT 3075
WA6VJP 3075 (2nd)
W7IEU 3071
W2EZ 3071
W0FBB 3071
N6QA 3066
K8KIR 3066
W7HZL 3061
W2RPZ 3059
NF0X 3056
N2CWG 3047
W3IIF 3040
W9MYY 3033
N0CYB 3022
KA1HB 2990
W3EYF 2989
WC5D 2968
W1TEE 2959
W5VGF 2956
W2FXA 2955
WA4KER 2946
WB1EIL 2942
N7TT 2927
KN4Y 2925
K4MF 2908
WB2ABD 2894
K7GJZ 2840
W8WVU 2818
AK2H 2807
W8YL 2802
W3HQU 2795 (3rd)
VE3IR 2793
WD9BCG 2793
WD4SIG 2773
KS7T 2769
W6TZD 2748
W9CRN 2745
N9DR 2636
W2CUE 2622
W6ISQ 2500
VE3KZE 2246
KA1CLV 2235
W3XE 2175
W1APU 2132
W6CF 2104
W3DYA 1803
W0AWP 1799
W0IZV 1734
K2PF 1727
WA3QNT 1670
W5OBT 1258
WA8YWK 1214
W4HSA 1194
NN7A 936
G4KFT/W3 933
N2FKE 841
W6NNV 311 (2nd)

YV9 Award offered by the Radio Club Venezolano.

to cover postage. Separate awards will be issued for bands, modes, or SWL. Send applications to Cedric Puchalski, YV1CP, Punto Fijo DX Club Award Manager, Apartado Postal # 3, Punto Fijo, 4102A, Falcon, Venezuela, SA.

Radio Club Venezolano Awards. The Radio Club Venezolano offers the three following awards. All applications must be sent to Radio Club Venezolano, Comision de Diplomas, Apartado Postal # 2285, Caracas - 1010A - D.F.,Venezuela, S.A. The awards are free; a fee is levied to cover postage.

YV9 Award: Work nine of the ten call areas of Venezuela. Send GCR list with $5.00 or 40 IRCs for postage to the address above. Separate awards will be issued for mode or SWL, regardless of band.

YV100, YV200, YV300: Work 100, 200, or 300 YV stations. The same station may be worked on different bands, but the contacts must be on different days. Send GCR list with $5.00 or 40 IRCs for postage to the address above. Separate awards

YV100 Award offered by the Radio Club Venezolano.

will be issued for mode or SWL, regardless of band.

DX100, DX200, DX300: Work 100, 200, or 300 different countries. If you have the DXCC Award, you may send a photocopy of that award in lieu of a certified list, or send GCR list, along with $5.00 or 40 IRCs for postage, to the address above. Separate awards will be issued for mode or SWL, regardless of band.

Hameenlinna 350 Years Award Competition. Hameelinnan Radioamatoorit ry. is sponsoring an award competition to celebrate the 350th anniversary of Hameenlinna City. The award is available to all licensed amateurs and SWLs.

To qualify for the award, amateurs must work stations from Hameenlinna in the period 1 January 1989 through 31 December 1989 sufficient to accumulate at least 350 points. Hameenlinna stations are identified as OH County 309 (in CW, OHC 309). Scoring is as follows:

Station/Points	DX-MPL	Frequency MPL
OG3AA/100	OH-1	HF 1
OH3AA/50	EU-2	VHF 2 (OH 1)
OH3/25 (OHC 309)	DX-3	

The special callsign OG3AA was used in the period March 20 through April 2, 1989, and will be used again in the period September 11 through September 24, 1989.

A station may be worked only once per band. QSOs via repeaters are not acceptable, except for QSOs via satellites.

Applications must be mailed before 31 December 1990 and must show exact information for each contact as follows: Station worked, date, time (UTC), report sent and received. Send application with fee of 10 IRCs or $5.00 U.S. to Hameenlinnan Radioamatoorit ry., PL 7, SF-13101 Hameenlinna, Finland.

Notes

Oops! My mistake. In the April column we credited Pedro J. Allina, HK1JJH, with USA-CA 1000 #1046 and USA-CA 500 #2296. Pedro's call is HK3JJH, *not* HK1JJH. Excuse me, Pedro.

73, Dorothy, WB9RCY

BOB HANSON
MAY WELL HAVE HAD 200,000 FRIENDS.
NOW HE NEEDS THEM ALL . . .

The world of communications has lost a great friend and devoted public servant. On Wednesday, May 8, 1989 Bob Hanson, W9AIF, passed away on the operating table during a delicate and enormously costly liver transplant operation.

Bob will be mourned by literally hundreds of thousands of individuals whose lives he touched throughout the world as a noted columnist . . . public service association executive (SCAN, REACT, Community Watch) . . . communications industry advertising and marketing manager . . . and active radio amateur.

But mourning alone cannot pay adequate tribute to Bob's total dedication to serving others—including his wife of 23 years, Marilyn, and two teenage sons, Peter and Andrew.

Since liver transplants are regarded by some as "experimental surgery," not one dime of the expense—estimated in excess of $200,000—was covered by insurance. We simply cannot allow Bob's wonderful family to live with that impossible burden.

Your help is desperately needed. Immediately. Please, please send your contribution today. Make checks payable to: **Organ Transplant Fund Inc./Robert Hanson** a legally constituted non-profit organization. Any funds collected in excess of those required to pay actual medical expenses will be used to relieve similar transplant victims.

The Robert Hanson Fund.
A Living Memorial.

Organ Transplant Fund Inc./Robert Hanson
P.O. Box 766 • Morris, IL 60450-0766

1989 CQ 160 Meter Contest High-Claimed Scores

Following are the high-claimed scores as of June 1, 1989. An asterisk after the call denotes multi-operator.

Phone

VP9AD*	384,714
VE6OU/3	311,712
WB9Z	203,472
K3KG	161,433
KI1G*	148,555
UZ6AXE*	148,005
K5NA*	145,200
KR9S*	116,608
KD9SV	114,944
W3TS	105,235
NQ4I	102,075
NU8Z*	97,650
K4YT/3	90,830
WB4NMA	90,785
WB8K*	90,660
WØCEM*	90,240
RF6FKF	78,900
LZ9A*	77,589
KDØOZ*	73,254
K8MJZ*	71,874
AA1K	71,742
AA4MM	71,604
KY1H*	70,281
W3BGN	68,915
K4ODL	66,690
K5QBG	65,534
KB4WQO	64,960
RB5IOV	61,500
N1CTD	61,490
OK5TOP*	60,844
YU4BR	60,333
N4IN	60,166
K4LLQ	58,290
KH6CC	57,749
RB5DX	56,298
PJ9JT	55,920
WB8PHI*	55,832
WA5NFC	54,972
WC7S	54,560
UB4QWW*	51,425
K6HNZ	48,660
K5WXZ	47,731
KJØB	47,008
OK1DXS	46,863
KF4HK	46,693
KØLIR*	46,436
K4JRB	45,762
WA1UJU/9	44,885
VE5UF	44,010
WB4ZNH	43,561
KØGAS	42,168
W6UE	42,009
	(KA6SAR Op.)
WB2P	41,616
AA4VG	40,896
KR9G*	39,672
N5KDA*	39,326
IV3PRK	38,663
W2FCR	37,804
K3NZ	37,688
HB9CXZ	37,160
KM4HH	36,261
WD9INF	36,140
KA7AUH*	35,623
VE7WJ	33,616
K4PI	33,385
KX4R	31,396
K9OSH	31,262
N7BHC*	31,161
KS3F	31,050
LZ2JE	28,934

CW

GW3YDX	399,432
KP2A	356,669
	(K4TEA Op.)
YT2R*	316,290
PJ9JT	308,535
PA3DQW*	300,810
I4EAT*	275,473
OK5TOP*	265,598
VE6OU/3	233,640
GM3IGW*	202,300
UR1RWX*	201,748
W2GD*	196,830
K5NA	194,287
OK3KAP*	193,446
IB8A	189,782
W3LPL	183,204
	(WA8MAZ Op.)
HB9CIP*	180,096
N4RJ*	177,928
AA1K	172,838
YV1OB	170,520
UP1BWR*	169,940
N2NU*	168,171
W9AZ*	167,195
OK1KQJ*	159,929
G4OBK	159,918
DLØKF*	159,092
UR2RGN	159,030
K1ZM	156,262
VE3DO	155,547
G4BYG	154,895
UZ9CWA*	154,530
PA3AUC*	153,660
CT1AOZ	150,526
DK8ZB	147,374
KH6CC	145,805
G3XTT	145,210
WOØG*	140,640
HA8DZ	136,604
YU2TW	135,180
K3ZO	121,425
W3BGN	119,775
OHØAM*	118,800
LZ9A*	117,978
KY1H*	113,529
AA4S	112,000
WØAIH/9*	111,370
K5MM/7	109,296
RB5BA	109,228
VE3KP	109,040
UT4UXW*	108,560
UL7MU	107,337
DL6RAI*	106,800
KX6DC	106,692
	(NZ8B Op.)
UA1DZ	105,340
WØZV	101,400
N4XM*	100,602
NØTT	98,274
DKØTU	98,136
	(DL4EBY Op.)
WX4G	97,483
4N2D*	96,336
I3VHO	95,840
WØUN*	95,676
K7QQ*	95,565
K2SG	94,323
RQ2GN	93,368
UP2BTA	92,496
AA4V*	92,208
W7XR*	91,791

Antennas & Accessories

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

A LOOK AT THE SHACK FROM BOTH ENDS OF THE COAX

Random Headings—Part III

This month we continue our "Random Headings" with some G5RV antenna talk straight from the antenna's designer, Louis Varney, and we'll share some sage words on coaxial cable from supplier Pres Jones, N8UG. We'll also save room for some antenna notebook items and discussion of several new software products.

G5RV Notes de G5RV

We've mentioned the G5RV antenna, originally designed by Louis Varney, G5RV, many times in the column, promoting it as a very popular, practical, and easy-to-feed multiband HF antenna. To recall, the antenna flattop is 102 feet in length, and it is typically fed using a matching section to coaxial cable to the transmitter or transceiver, as shown in fig. 1. Alternate designs include one making use of a similar matching section but also using a balun transformer to make the transition to the coax feedline; another variation uses ladderline or openwire line all the way to the hamshack. Use of an antenna tuner is recommended with all versions of the G5RV.

Pull out your February issue, and note the variety of comments on the G5RV made by several amateurs in Part III of our reader forum. After considering these comments, Louis decided to offer his own two cents, and sent us a very lengthy letter that lack of space prevents us from reprinting in its entirety. But sharing portions of Louis's letter should help set the record straight.

Misconceptions on the Half-Size G5RV. Louis never intended or suggested that the full-size G5RV be reduced to half-size, especially for the purpose of resonating on 28 MHz. The half-size G5RV simply was suggested for those amateurs who had insufficient space in which to erect the full-size version. Tests had shown that the half-size G5RV was capable of very satisfactory results on all bands from 40 through 10 meters with the bonus of working as a ½-wavelength antenna on 10 meters.

Use of a Transmatch. It was never Louis's intention to use the antenna without a transmatch or antenna tuner, except possibly on 20 meters with the full-size version or on 10 meters with the half-size version. In his opinion, efforts to find a "magic length" of feeder to produce an acceptable match on all bands *without* the use of a transmatch are doomed to failure.

Use of a Balun. Writes Louis, "Any attempt to use a balun with the G5RV antenna is a mistake . . . There exists, unfortunately, great misunderstanding of the properties and function of a balun in amateur radio circles. In brief, a balun is specifically designed to work into a non-reactive load. It cannot replace a tuned circuit (transmatch) where it is necessary to satisfy the conditions of a reactive load, as occurs on all bands except 14 and 24 MHz with the full-size G5RV and all bands except 28 MHz with the half-size version."

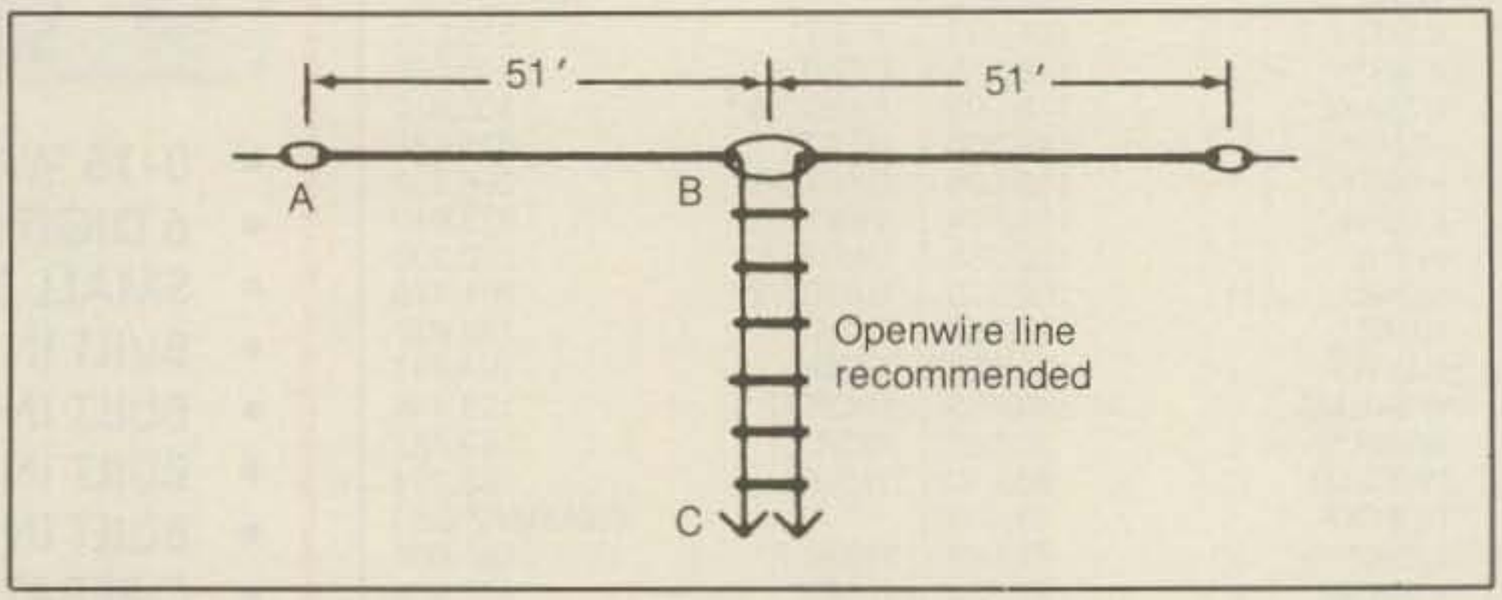


Fig. 1 - A popular version of the G5RV antenna uses a 102 foot flattop with a 33 foot matching section of openwire line or ladderline, from point B to point C. At point C a length of coax is connected for the run to the hamshack. (Some readers have reported matching problems with this arrangement, or one which uses a balun at the connection point, and instead use openwire line or ladderline all of the way to the antenna tuner in the hamshack.)

160 Meter Operation. Louis took exception to the philosophy of 160 meter operation expressed by one reader in the February column who preferred to adapt the G5RV to 160 by increasing the flattop to 238 feet. Louis responded to this suggestion by stating, "Extending the flattop for 160 meter operation is much better than using the G5RV with the feeder shorted at the station end to enable its use as a top-loaded vertical (or as a Marconi T antenna). But [the reader] has lost sight of the main object of the design of the G5RV antenna, which is to enable amateurs who only have very limited garden space at their disposal to be able to radiate very effective signals on all eight HF bands and *at least* be able to radiate a signal on the 160 meter band."

The Matching or "Make-Up" Section. The classic G5RV design envisions a 33 foot matching section of ladderline or openwire line between the flattop and the coax feeder. According to Louis, his term "matching or make-up section" was perhaps a poor choice, in light of the apparent misunderstanding of its true function:

"It functions as a 1:1 impedance transformer on 14 and 24 MHz, presenting a non-reactive load impedance of about 90 ohms at its base, to which any convenient length of 80 or 75 ohm coax may be connected." Low-SWR matching conditions exist, but only on 14 and 24 MHz with the full-size G5RV antenna. On the other bands, the impedance at the base of this make-up section is reactive and strongly suggests the use of a transmatch at the transmitter or transceiver. For various reasons, Louis also suggests making up a simple coaxial RF choke consisting of 6-10 turns of coax about 6 inches in diameter, taped together at the point of connection of the coax to the matching section.

The "Odd 1/16- to 1/8-Wavelength" Effect. Louis writes, "As in any combined antenna/feeder system which is required to be resonant at any given frequency band, it may be found that a G5RV antenna and its associated feeder (of whatever type and length) will load up the transmitter satisfactorily, via the transmatch, on all but one HF band. This is due to the fact that, in any resonant antenna/feeder system, if the whole system resonates at one particular frequency so as to present to the transmatch tuned circuit the complex reactive impedance —characteristic of such a condition, which cannot be satisfied by either a parallel tuned circuit or a series tuned circuit—then the simple solution . . . is to add on or cut off a few feet of feeder until the unwanted effect disappears. It is very unlikely that the effect will reappear on any of the other bands."

Straight Talk on Coax de N8UG

Pres Jones, N8UG, "the Wire Man," operates Certified Communications out of Landrum, South Carolina, and has become a major supplier of antenna wire, accessories, and coaxial cable. About two years ago Pres embarked on his "Certified Quality" program to help ensure uniformly high quality in the cables he and other dealers sell. The program involves working closely with manufacturers to produce cable made to his specifications. In the interests of high quality, these items are manufactured in small lots demanding strict quality control, and they are subject to sampling, testing, inspection, and approval before being accepted.

Some time ago Pres wrote us that he is constantly besieged with requests for more infor-

317 Poplar Drive, Millbrook, AL 36054

mation concerning the proper amateur application of wire and cable. Pres believes that the average amateur often doesn't really know exactly what type of cable he wants, but he does *want* to know. Pres devotes a good portion of each of his catalogs to wire and cable background information that he's taken pains to update, and he's asked us to disseminate this information to our readers.

With that in mind, a tip of the hat to Pres for the work he's done and for encouraging us to reprint it here in an edited form. Hopefully, the following should help you make some informed choices:

Coax Military Designations. These designators really don't mean a great deal these days; RG/U nomenclature is taken from federal military specifications, and is a convenient means of getting close to what you want. But you have to be careful, as the terminology isn't always specific. For example, "RG8/U" doesn't pin down size, capacity, shielding, stranding, dielectric, plating, metal, or jacketing—only that it's a cable with a nominal 50 ohm characteristic impedance. *You* have to specify everything else!

Also be careful in interpreting "Mil Spec." Top-quality cable is made to military specifications or better, but unless it is made to satisfy QPL (Qualified Product Listing) requirements, it won't qualify for federal inspection and acceptance. QPL products cost at least 50% more than non-QPL products.

RG8/U and RG213/U. The fact that the RG8/U designator doesn't pin down much has recently made RG213/U a "first choice" for a variety of applications. RG213/U is .405 inches in outside diameter, is jacketed with class IIA PVC (a non-contaminating material), has 97% shielding with bare copper braid and a solid polyethylene dielectric, and has a 13 AWG stranded bare copper center conductor. Its characteristic impedance is 50 ohms, with a signal loss of less than 0.5 dB/100 feet at HF. It's a very flexible and durable cable, good for 10-15 years of normal use.

It's important to note that the non-contaminating jacket extends the life of the cable by at least 50%, and although it's really not designed to be buried, it will outlast Class I PVC-jacketed cable by a long shot. RG213/U will handle 3500 watts at 10 meters and a kilowatt at 2 meters. While RG8/U that can do all of these things *can* be found, if you don't specify so as to know exactly what you're getting, you can miss the performance mark by a mile. Legitimate RG213/U will do it all.

"Poor Man's Hardline." This type of low-loss cable is growing in popularity. Typically, it is RG8-sized, jacketed with Class I PVC, and has a sheath of 100% aluminum polyester plus 95+% tinned copper braid shield, a semi-solid polyethylene dielectric, and a 9.5 AWG solid bare copper center conductor. The cable's characteristic impedance is 50 ohms, and signal loss is about 1 dB less per 100 feet that that of RG8/U or RG213/U at VHF, or less than 3 dB/100 feet at 450 MHz. Used properly, it can last six to ten years, but it isn't designed to run around a rotor or to be used in a tip-down or telescoping tower situation. In such situations, a jumper length of RG213/U or the like is indicated. UHF or low-loss "N"-type connectors work well with this type of cable. Pres also offers what he calls a "4XL" (Low Loss Long Life) version of "poor man's hardline" that has a Class II PVC jacket that makes for a 10-15 year cable if properly used.

RG8X. Increasingly popular, "Mini-8" is used extensively as a convenient, low-cost alternative to RG8 where relatively lower power-handing capability is no problem. Its main claim to fame is having about half the loss of RG58 types at about the same price. RG8X is .242 in outside diameter and jacketed with a Class I PVC, has 95% shielding with bare copper braid and foamed polyethylene dielectric, and has a 16 AWG stranded bare copper center conductor. Its characteristic impedance is 50 ohms. Signal loss is about 1 dB/100 feet at 10 meters, or 3 dB at 2 meters. Cable heating can damage a foamed poly dielectric cable very quickly, so take care where you place it and how you work with it. Useful life is 5 to 10 years.

New versions of RG8X with Class II PVC non-contaminating jackets are now available at slightly higher prices that will almost double cable life; there's also an MG8X of different design that's specifically intended for marine use.

Foamed Polyethylene Dielectric. This type of material is popular because of its light weight, low loss characteristics, and flexibility. However, the material is subject to moisture absorption and has a low melting point. It has to be sealed well at both ends and kept at moderate temperatures; it won't stand a lot of heat from any source, including heat from a "hot tin roof" or from an exhaust pipe. Tight bends and crushing should be avoided. At the bottom line, these cables are generally better inside the hamshack rather than outdoors, at least for long-term installations.

450 Ohm Ladderline. Many consider ladderline to be the best buy, lowest-cost, easiest-to-use HF transmission line of them all. It is made in a flat configuration, ⅞ inches in width; the jacket is polyethylene into which "windows" are cut. Conductors are solid 18 AWG copperweld (40% copper over steel). Ladderline should be installed no less than twice its width from any metal surface, and the line should be given a half-twist every 2 feet to minimize flapping in the wind. It will handle 1000 watts easily at HF. Used with a tuner equipped for balanced feed, it's highly competitive with coax at HF, and works great with various types of multiband antennas.

Pres also has a few things to say about station grounding wire. He recommends that one use half-inch or larger new or used soft copper tubing from the ground rod(s) to a point at the rear of the operating area, at which point the

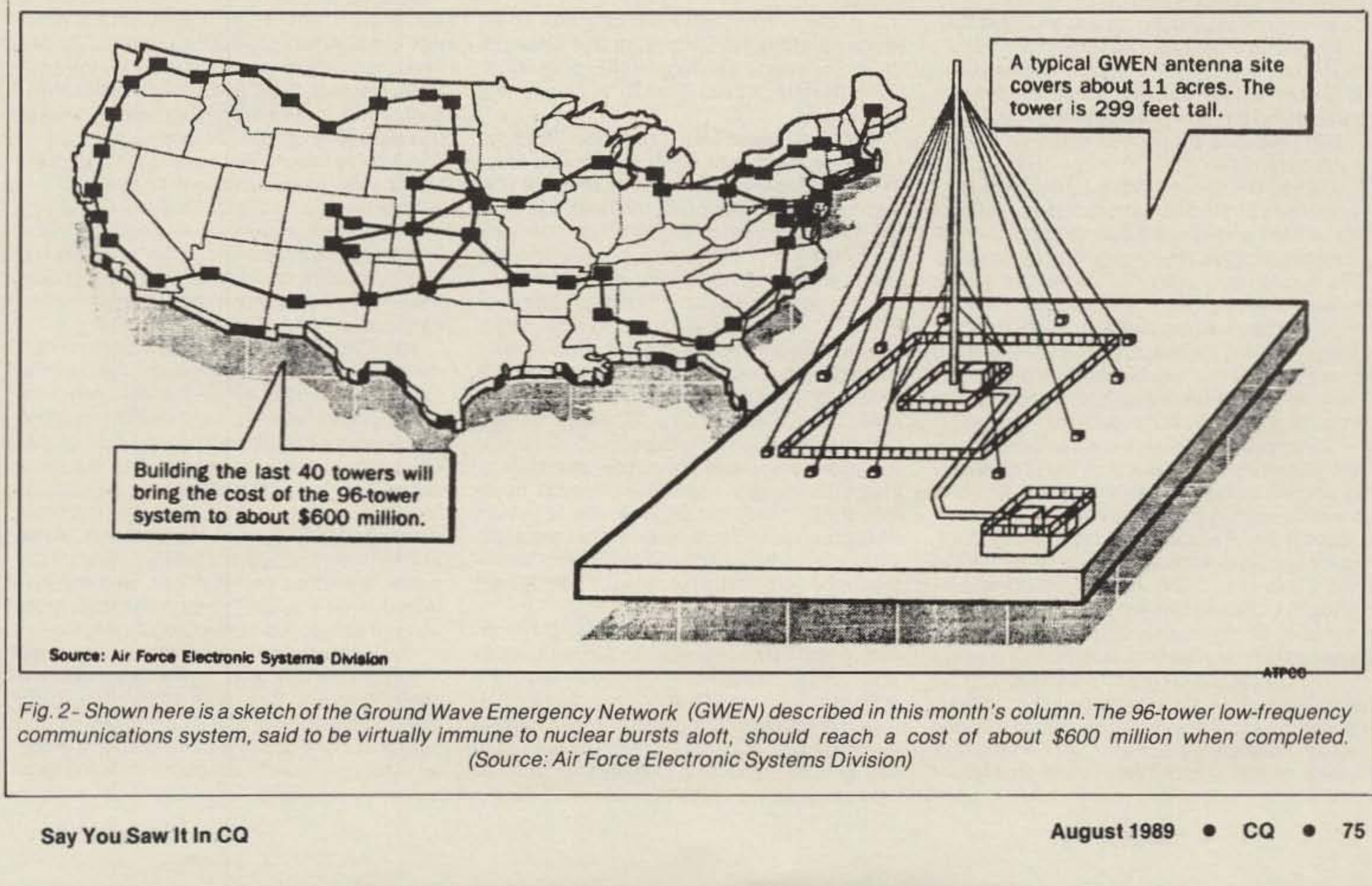


Fig. 2- Shown here is a sketch of the Ground Wave Emergency Network (GWEN) described in this month's column. The 96-tower low-frequency communications system, said to be virtually immune to nuclear bursts aloft, should reach a cost of about $600 million when completed. (Source: Air Force Electronic Systems Division)

tubing should be bolted to the center of a bus bar of convenient length. From this bar, 1 to 3 foot lengths of ½ inch or larger flexible braid can be run in ray fashion, symmetrically, to each device in the shack's RF chain. The braid can be prepared and its shape set by pushing it back on itself, forcing a hole through it with a sharp pencil, and flooding the area with solder.

As this column went to print, Pres told us that he has added several unique types of coax to his product line, beyond the ones we described here. We anticipate covering them in a future column.

For a current wire and cable catalog, contact Certified Communications, 261 Pittman Road, Landrum, SC 29356.

From the Antenna Notebook

VectorFinder. The Radio Engineers have introduced a line of VHF direction-finding systems. Somewhat resembling sophisticated video cameras bristling with antennas and a compass on top, three different models are available covering 144 to 300 MHz in various ranges and frequency combinations. The devices incorporate two collapsible vertical phase sensing antennas mounted in a handheld package which includes the various controls, battery, and compass.

The equipment is connected to any FM receiver or transceiver using 50 ohm cable. A tone is superimposed upon the received signal and becomes inaudible at the receiver when the handheld unit is oriented to the line-of-sight of the incoming signal. The compass is then read for the line-of-sight heading.

The VectorFinders are priced from about $125. Another product, the 2MQ Portaquad, a high-gain 2 meter portable quad antenna, is also available from the firm. Contact The Radio Engineers, 3941 Mt. Brundage Ave., San Diego, CA 92111.

Say Hello to GWEN. Unless the latest round of federal budget cuts extracts its toll on the program, in a few years the country will be girded by a network of LF radio towers and sites that complete an emergency communications network that helps ensure that in nuclear war, U.S. commanders can talk to their forces even through the barrage of electromagnetic pulse (EMP) produced by nuclear bursts in the atmosphere.

GWEN, the Ground-Wave Emergency Network, uses LF signals that are mostly unaffected by EMP and which follow the curvature of the earth, to give the signals very long range. The system would be used to overcome EMP effects, relaying teletype messages and linking strategic alerting sensors such as long-range warning radars. GWEN is designed to make sure that nuclear blasts don't prevent attack warning messages from reaching the President or obstruct his ability to retaliate.

The planned 40 towers and 11 towerless radio terminals are phase 3 of the GWEN program, which began with the construction of seven towers in the Midwest in 1983 as a test to see if the LF system worked. In phase 2, additional towers were built; these were dubbed the "Thin Line." The 40 new towers should bring the total GWEN system to 96 towers in a network which roughly forms a lazy figure-eight pattern across the country.

The typical GWEN antenna site (fig. 2) is on an 11 acre plot and contains the tower, fences, and three small shelters that hold an antenna tuner, radio/data processor, and emergency power supply. About 1 foot below ground is a large "wheel" of copper wire radiating from the base of the antenna. The 2 kw to 3 kw stations operate on frequencies between 150 and 175 kHz.

```
                        MINIPROP
                      05-01-1989
          Sunspot Number : 150.0   Solar Flux : 190.0
          Mininum Radiation Angle : 1.5 deg

TERMINAL A : Millbrook AL          TERMINAL B : Jordan
  Latitude :  32.50 N                Latitude :  31.50 N
 Longitude :  86.30 W               Longitude :  36.50 E

   Sunrise : 1103 UTC                 Sunrise : 0253 UTC
 Gray line : 342/162 deg            Gray line : 342/162 deg

    Sunset : 0022 UTC                  Sunset : 1609 UTC
 Gray line : 18/198 deg             Gray line : 18/198 deg

  SHORT-PATH  Bearing from A to B :  46.1 deg
              Bearing from B to A : 314.5 deg
              Path Length : 10694 km    6645 mi (U.S.)

  LONG-PATH   Bearing from A to B : 226.1 deg
  (Polar)     Bearing from B to A : 134.5 deg
              Path Length : 29306 km   18211 mi (U.S.)

Computing short-path MUF.....
```

Fig. 3- Shown here is the screen display which the MINIPROP propagation prediction program produces after the sunspot number and solar flux are entered. The new Version 3.0 sports a number of very sophisticated features, including a new "mode searching" capability as discussed in this month's column.

10 Meter Loop from N4MMI. Joseph S. Ciardi, N4MMI, sent us construction details on a fine full-wave 10 meter loop antenna, based originally on a 40 meter design found in the *ARRL Antenna Book*. He says the antenna is very easy to build and offers surprisingly good performance that at times outperforms his beam, depending on the type of propagation experienced.

Joe has worked up a construction sheet which he offers for a standard business-size SASE. For a copy, send your SASE to Joseph S. Ciardi, N4MMI, 17402 Brian Drive, Jupiter, FL 33478.

Wall Feed-Through Trick. Jack Sobel, WØSVM, sent us a short note describing a wall feed-through device that he says is cheaper and less expensive than other methods. He says the method works great for either openwire line or ladderline. He's been using the trick for years, and says it dates from around 1945.

He simply makes use of two short pieces of RG8 or RG58 coax, drilling holes for the coax in the wall with appropriate spacing. He suggests using caulking material around the coax where it passes through the wall for a weathertight seal. Total cost is about 32 cents for two pieces of coax at 16 cents per foot.

Incidentally, Radio Shack now also sells inexpensive coaxial cable feed-through bushings that protect the cable where it passes through a wall. Two different sizes are available, one for RG59 and one for RG8U size cables. A package of two of these critters will set you back all of 49 cents.

Transmission Line Notes de N5KSD. David N. Floyd, N5KSD, wrote us with some observations on his experiences in converting from openwire line to twin lead to feed his wire flattops. He told us that his feedline of choice is openwire line, but he reluctantly converted to 450 ohm and 300 ohm twin lead because of problems with the openwire line caused by tree branches damaging the uninsulated feeder.

Dave indicates that changing to the solid dielectric cables hasn't caused any significant changes in the way in which his inverted Vee and G5RV load. However, he noticed an increase in line SWR caused by moisture on the 300 ohm section. This problem was minimized by coating the line with silicon grease.

Software Topix

MINIPROP Version 3. Shel Shallon, W6EL, is well-known for MINIPROP™, a very competent propagation prediction program, earlier versions of which we've written up in the April 1986, October 1987, and April 1988 columns. Shel tells us that Version 2 was used by the National Oceanic and Atmospheric Administration (NOAA) to schedule comms with its ozone hole measurement team in the Antarctic.

Shel sent us a copy of his latest opus, Version 3, which like previous programs provides information about the strength of received signals in addition to providing maximum usable frequency (MUF) predictions. The new version has some nice new bells and whistles.

MINIPROP Version 3 uses a unique, new method for searching through the several ionospheric modes to find the right combination of E and F hops that yields the strongest received signal at each half hour on each of seven user-selected frequencies. This results in signal-level predictions that are more accurate than earlier versions. For the strongest mode, MINIPROP reports predicted signal strength, the radiation or takeoff angle for the mode, the mode configuration, and the predicted mode availability (the percentage probability that the predicted mode actually exists).

The program also predicts maximum usable frequency (MUF), and in addition tells you beam headings from both ends of the path, path length, sunrise and sunset times for the path terminals, grayline directions, and more. All of this information, for both short- and long-

paths, is displayed on your computer's screen, and you can print out the signal strength and MUF predictions.

In addition, there's a handy "DX Compass" feature that helps you determine what bands are open in 12 directions from your QTH at any time of day. You can store your own QTH in a disk file, and the program includes an on-disk atlas of latitudes and longitudes of all DXCC countries. The program includes utilities that let you add, modify, or delete atlas entries and print a customized table of beam headings to all locations in the atlas.

Propagation predictions can take some time to run, so Version 3 supports the optional 8087, 80287, and 80387 math coprocessors. The program runs on the IBM PC, XT, AT, PS/2, and compatibles with at least 320K RAM. A detailed, printed manual is included. The price is $49.95 postpaid from Sheldon C. Shallon, W6EL Software, 11058 Queensland St., Los Angeles, CA 90034-3029.

Fig. 3 shows the display that appears after the sunspot number or solar flux is entered, while fig. 4 is a graphic screen display of predicted MUF over a given path.

Pizazz Plus. In the March 1988 column we briefly described an interesting graphics utility program for the IBM PC that lets you take just about any image which you can display on your computer's screen, graphics or text, from practically any application program, and print it out better than you might think possible. Essentially, if you can put something on your computer's screen, you can capture it with Pizazz.

The Pizazz program in effect takes the place of the plain-Jane screen print program that comes with your computer's DOS, acting to

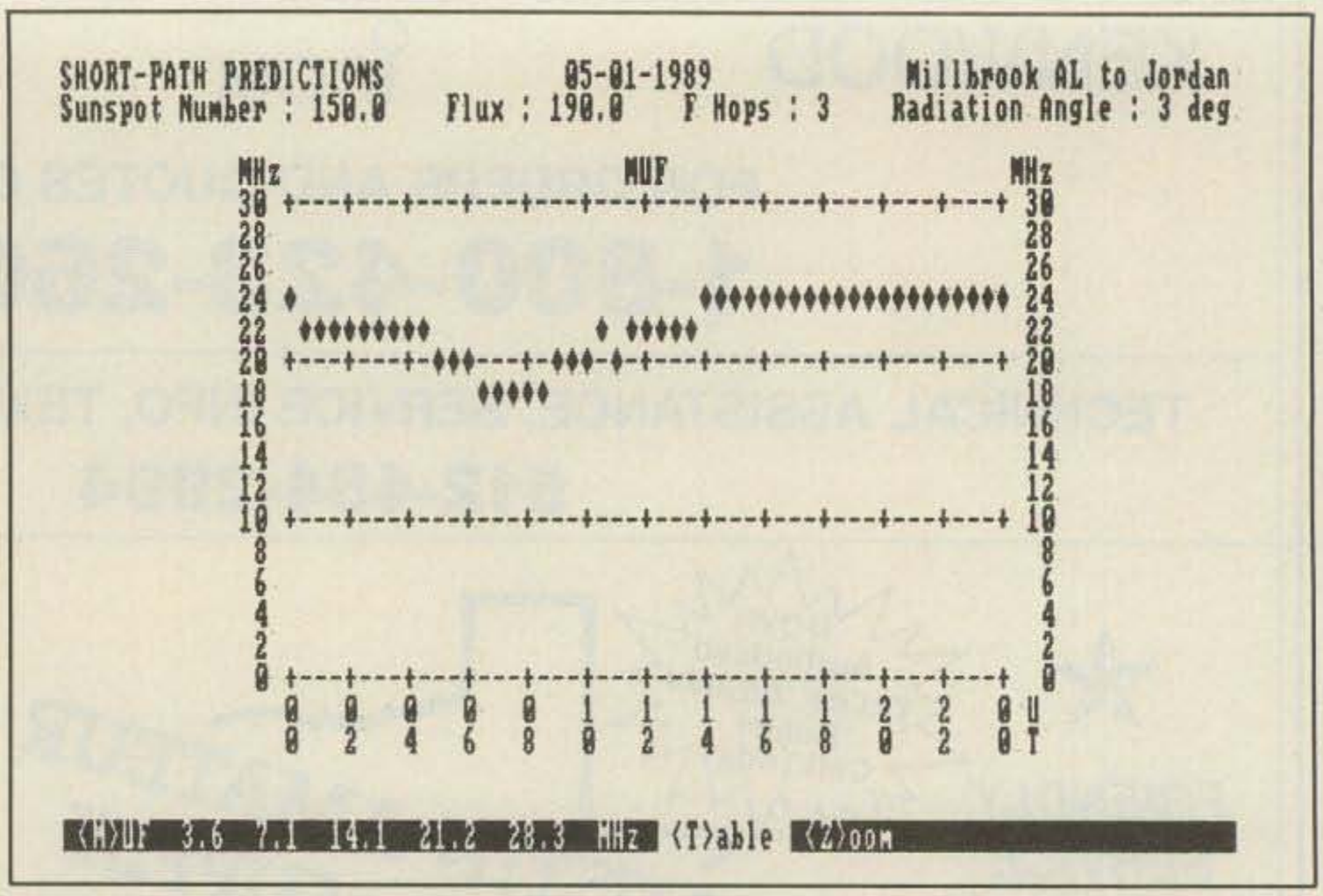


Fig. 4 - MINIPROP graphic display of predicted MUF. A glance at the screen display shown here allows you to get a good picture of propagation conditions between any two points on the earth's surface over a 24-hour period. This display depicts a predicted path from the author's Alabama QTH to Jordan.

"supercharge" the computer's PrtSc (print screen) key. The RAM-resident printing utility lets you capture color or monochrome graphics, manipulate the images in various ways, and print them out or send them to a disk file.

The folks at Applications Techniques were kind enough to send me their latest update, Pizazz Plus, a greatly enhanced version of Pizazz. The new version does everything the original program did, and it also handles over 25 graphics adapter cards, a wide variety of file formats, and over 220 printers. The program is specially designed to faithfully translate color RGB screen images into halftone gray-scaled prints, and to take full advantage of the capabilities of each printer it supports.

I frequently use the program to produce some of the "screen dump" illustrations from applications programs which I cover in the column. Slow Scan TV (SSTV) and Fast Scan TV (FSTV) enthusiasts might find some application for the program in their hamshacks.

About the only fault I find in the program is its new price, which has crept up to $149, and which may price it out of reach of most amateur users. Nevertheless, it's worth your examination if you can use its many sophisticated print capabilities.

For more information, contact Application Techniques, Inc., 10 Lomar Park Dr., Pepperell, MA 01463.

Short Bursts

Software Swap. A short note from Don Trayes, WB4CVH, indicates that he's interested in trading public-domain amateur radio software for the Commodore 64 and 128. Don says that over the past couple of years he's picked up hundreds of amateur programs for Commodore computers and is looking to expand his library and at the same time help others get started.

If you want to swap software, contact Donald S. Trayes, WB4CVH, U.S. Navy Section, U.S. Military Training Mission, Detachment Jubail, APO New York 09298-5006.

Software Sources. Gert Andersen, OZ2GZ, wrote in response to a note in one of our 1984 columns in which I mentioned some sources of amateur- and SWL-oriented software. Gert had trouble contacting some of the firms I listed.

Unfortunately, many amateur radio software outfits are part-time, mom-and-pop, shoestring operations that tend to go full tilt for a couple of years, but close down when sales and profits don't reach expectations or the computer they support starts to slide in popularity. Many of the firms that were heavily into Commodore 64 software in 1984 have either made the transition to the IBM PC or are flat out of business.

Gert mentions that he now has an IBM PC and is particularly interested in acquiring propagation-prediction, satellite-tracking, and antenna-design software. We can make some suggestions in those directions.

In addition to keeping up with our column, where we try to keep abreast of the latest in useful hamshack software, you might investigate propagation-prediction programs such as MufMap and BandAid which are available from Base (2) Systems, 2534 Nebraska, Saginaw, MI 48601. The DX Edge program is sold by The DX Edge, P.O. Box 834, Madison Square Station, New York, NY 10159.

If your taste runs to satellite programs, a large library of such programs is maintained by the AMSAT Software Exchange, P.O. Box 27, Washington, DC 20044. Excellent antenna design programs are offered by Brian Beezley, K6STI, 507½ Taylor St., Vista, CA 92084, and by Epsilon Co., P.O. Box 715, Trumbull, CT 06611.

Wrapping It Up

That's all the room we're allowed this time, guys and gals. Next month, more Antennas & Accessories topics of current interest.

Overheard: Reasons that sound good don't always prove to be good, sound reasons.

73, Karl, W8FX

MIRAGE/KLM

The Next Generation

The amplifiers you have been waiting for are available for shipment NOW!

New protection circuitry automatically shuts off the output power to prevent damage to output transistors and provides shutdown for high VSWR as well.

New GaAs-FET pre-amp designs provide gain of over 22 dB and a noise figure of *less* than .6 dB!

144 MHz Amplifiers		220 MHz Amplifiers	
B-1016-G	10W in = 160W out	C-1012-G	10W in = 120W out
B-3016-G	30W in = 160W out	C-3012-G	30W in = 120W out
B-215-G	2W in = 150W out	C-211-G	2W in = 110W out

Each of the following amplifiers provide . . . Bullet-proof, thermal shutdown . . . VSWR shutdown . . . over-current shutdown . . .

144-MHz Amplifier

Finally, a ruggedized high-speed RF switching relay that takes the punishment SSB-op's demand . . . 5mS or less typical switch-time . . . Dual-gate GaAs MES-FET pre-amp . . . greater than 22 dB typical gain . . . Wide, dynamic range for overload protection . . . 1 dB compression > +4 dBm

B-3030-G
30W in = 300W out

(Linear curve: 1W - 30W, 45W max.)
13.8 vDC **32 amps max.**
440 watts (DC) **68% efficiency**

H-F Amplifier All Solid State (Awaiting FCC Type-Acceptance)

The Band-Pass filter allows wideband performance while meeting FCC specifications . . . 1.8 - 25 MHz (Domestic). Typical harmonic - 50 dB . . . attenuator for reduction of pre-amplifier power should your radio experience intermodulation . . . gain out back to 14-15 dB.

120% ICAS duty cycle . . . air cooled . . . fan hood available . . . active cooling kit available for 100% key-down duty cycle.

HF-5080
50W in = 800W out

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CIRCLE 78 ON READER SERVICE CARD

Contest Calendar

a monthly feature by
JOHN DORR, K1AR

NEWS/VIEWS OF ON-THE-AIR COMPETITION

Contest Operating Ethics

The topic of contest operating ethics has always been a source of debate among our fellow contest operators. For the most part, I believe that the vast majority of us operate with the highest level of integrity. This is especially true when it comes to the more obvious issues of logging correct callsigns/exchanges, removing duplicates, and so on. In simple terms, the average contest operator knows when he has crossed the line between strict rule interpretation and judgmental liberty. Or does he? It's when we explore the "gray area" that our interpretation begins to vary.

This month I want to explore this aspect of contesting by polling ourselves through an ethics questionnaire. You will find a survey in this column that has been designed to discover two facets of contest operating ethics: (1) Gray area scenarios that solicit the way you would react, and (2) specific operating practices that you may have used in the past.

The process for this survey has been designed to be completely anonymous, so your frank responses are encouraged. *CQ* magazine has offered to collect the completed questionnaires and forward them to me for tabulation (minus the postmarks). You will notice the survey ends with a comments section. If I receive an adequate number of responses to this section, I will publish your comments in a "soapbox" format, which should prove to be very interesting.

In addition to your own response, I encourage you to photocopy the survey and use it at club meetings, local gatherings, or in other ways to increase the total sample. A few years ago I used a similar approach at a local meeting and collected results that yielded a very spirited discussion. In any event, my goal is to receive a statistically significant response rate that you can look for in the November column.

CQ WW Rule Changes

As I mentioned in last month's column, the *CQ* WW Contest Committee had the opportunity to gather as a group at this year's Dayton Hamvention. These occurrences, although rare, give us the chance to discuss and often resolve many complex issues. To this end, you will find important changes in the 1989 *CQ* WW rules (to be published next month). First, in response to the growing number of packet radio/2 meter FM networks worldwide, we will be creating a new *Single Operator Unlimited* category for the *CQ* WW Contest. Although a more complete explanation will be available in next month's contest announcement, this category will permit single operator stations to legally use external spotting technology (e.g., packet radio, 2 meter FM, etc.) and eliminate the unnecessary burden of the 10-minute rule. Put a different way, entrants in this category will now be able to compete among themselves, not with the large multi-multi efforts as in the past.

Second, the *CQ* WW Committee has voted to eliminate the two-year rule for trophy awards. This rule has been a long-standing policy of the *CQ* WW Contest and was developed years ago to encourage participants to try other categories at a time when a small number of stations dominated a limited number of awards. Clearly with over 80 available trophies, it was time to reevaluate this policy and suggest change. To keep my already bulging mailbox under control, this rule will not be retroactive.

2 Baldwin Street, Windham, NH 03087

Calendar of Events

July	29-30	Florida QSO Party
July	29-30	Venezuela CW Contest
July	29-31	County Hunters CW Contest
Aug.	5	YLRL YL/OM SSB Sprint
Aug.	5-6	ARRL UHF Contest
Aug.	5-6	New York State QSO Party
Aug.	12-13	European CW Contest
Aug.	12-13	New Mexico QSO Party
Aug.	13	ARCI QRP SSB Sprint
Aug.	19-20	SEANET 1989 SSB Contest
Aug.	19-20	New Jersey QSO Party
Aug.	19-21	Missouri QSO Party
Aug.	26-27	All Asian CW Contest
Sept.	6-8	YLRL "Howdy" Days
Sept.	9-10	European SSB Contest
Sept.	9-10	ARRL VHF QSO Party
Sept.	10	North American CW Sprint
Sept.	16-17	Scandinavian CW Contest
Sept.	17	North American SSB Sprint
Sept.	23-24	Scandinavian SSB Contest
Sept.	**23-24**	**CQ WW DX RTTY Contest**
Sept.	23-24	Classic Homebrew Exchange
Oct.	7-8	Pennsylvania QSO Party
Oct.	7-8	VK/ZL Oceania CW Contest
Oct.	8	RSGB 21/28 MHz SSB Contest
Oct.	15	RSGB 21 MHz CW Contest
Oct.	**28-29**	**CQ WW DX SSB Contest**
Nov.	10-12	Japan Intern'l. DX Contest
Nov.	11-12	European RTTY Contest
Nov.	**25-26**	**CQ WW DX CW Contest**

August Contest Column

The August contest agenda is dominated by two significant events: Worked All Europe—CW and All Asia—CW. These long-running contests are special favorites of mine and can generate a great deal of excitement and competition during the doldrums of summer. Both offer a great opportunity to test those 10 meter stacks you put up in July. In addition, there are several State QSO Parties, including the 30th consecutive running of the New Jersey QSO Party, as well as other events that will keep your operating skills tuned during the summer months.

Next Month's Column

It only seems fitting that I take a look back at the history of the *CQ* WW Contest during the months we publish this year's results. Next month will bring Part I of an in-depth analysis of past *CQ* WW Contests including previous winners, scoring, QSO and multiplier trends, etc. In addition, I will include a special interview with a winner from 25 years ago as he shares his experiences. Stay tuned. There just may be a few other surprises as well.

While we are on the subject, I am in the final planning stages of adding a monthly contester spotlight section to the column. In particular, I would like to provide a brief profile of one of our fellow contesters each month, complete with photographs. If you would like to participate, please drop me a line and I'll be glad to provide you with the details.

Hopefully, most of you are near completion on those summer antenna projects as we gear up for an exciting fall contest season. If you're like me, however, you may have only gotten as far as drawing a few pictures. Remember, the *CQ* WW SSB Contest is less than 100 days away (put another way, just 12 weekends). As always, the deadline for the November issue is September 1st.

73, John, K1AR

Contest Operating Ethics Survey

Your Call Area/Province/Country (optional): _____

Years of Contest Experience (optional):_____

1. In general, do you think leading contest operators use operating ethics similar to those of the "small guns"?

   YES_____ NO_____

2. XU1SS calls you in the last 10 minutes of the *CQ* WW Contest for a double multiplier. You give him his report and he doesn't reply. Would you log him anyway?

   YES_____ NO_____

3. 4U1ITU is running Europe on 7045. Would you say to him "Listen for Stateside" on his transmit frequency?

   YES_____ NO_____

4. You have been on 14276 for 3 minutes and someone comes on your frequency and says, "You are QRMing the Chernobyl Family Hour Net . . . Please QSY!" Would you:
   a) QSY from the frequency
   b) Zerobeat the net
   c) Tell the guy to move in a less than friendly manner (hi)

5. You have just finished duping your log and find that you are 1,109 points below a new category record. Would you add a few QSOs into the log to increase your score past the old record?

   YES_____ NO_____

6. You have been calling BY4AA for 10 minutes and can't work him. Would you "push the upper button" on the amplifier just this one time?

   YES_____ NO_____

7. You have just discovered 9M8ZZ on 14133. Would you work him assuming no one will notice you that far out of the band?

   YES_____ NO_____

8. WB7XYZ, in Wyoming, just called you for a "clean sweep" in the ARRL SS contest with only 4 minutes to go. Unfortunately, you copied everything but his check. Would you write in something in your log to keep the QSO?

   YES_____ NO_____

9. Would you knowingly take over someone else's frequency (e.g., a weak backscatter signal on the band edge that has a slower rate than you could generate)?

   YES_____ NO_____

10. Have you ever used packet radio spotting and still claimed single operator?

    YES_____ NO_____

11. You are tuning the bands and hear your friend running Europeans. Would you stop and ask him, "Hey, Joe, are there any good multipliers on the band?" or "What frequency is he on?"

    YES_____ NO_____

12. Would you allow a friend to hold your frequency while you run up the band to chase a new multiplier?

    YES_____ NO_____

13. You just passed 9Q5XX to 20 meters for a new multiplier. All you hear are a few mumbles that sound like him. Would you log him?

    YES_____ NO_____

14. You are in the process of analyzing your Multi-Single log for 10-minute rule violations and find one that results in a lost multiplier. Would you change the time in your log to allow the contact to count?

    YES_____ NO_____

15. Have you written in a few calls in your log during a big run, assuming that no one will be able to find them?

    YES_____ NO_____

16. HA1XYZ just calls you on 20 meters for the fifth time. Would you change his call into a valid QSO out of frustration?

    YES_____ NO_____

17. 5Z4XX works someone with a very similar callsign to yours. Just as you figure out what he is doing, he moves on to the next call area. Would you log him?

    YES_____ NO_____

18. Would you look at a friend's log after the contest to find callsigns or other log information that you can correct in your own log after the contest?

    YES_____ NO_____

19. Have you ever changed a callsign in your log to cover a duplicate contact?

    YES_____ NO_____

20. Have you ever changed the time in your log to extend your operating time limit?

    YES_____ NO_____

Comments._____

_____

_____

(use additional sheet if necessary)

Deadline: October 1, 1989

Return survey to: CQ Magazine
Contest Column Survey
76 North Broadway
Hicksville, NY 11801

ARRL UHF Contest

1800Z Sat. to 1800Z Sun., Aug. 5–6

Activity on this one starts at 220 MHz and goes all the way up to 2.3 GHz and higher.

Exchange: Grid square locator.

Points: Three for 220 or 432 MHz contacts. Six for 902 or 1296 MHz. And 12 for 2.3 GHz or higher.

Multiplier: Total number of different grid squares worked on each band.

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

Detailed rules were published in the July issue of *QST*. It is suggested you send a large SASE to the ARRL for official log and summary sheets.

Send to ARRL UHF Contest, 225 Main Street, Newington, CT 06111.

New York State QSO Party

1600Z Sat. to 1600Z Sun., Aug. 5–6

This is the sixth annual QSO Party sponsored by the Salt City DX Association. They specifically encourage portable and mobile operation from rare New York State counties during the peak camping and vacation season.

The same station may be worked on each band and each mode, and NY stations can make in-state contacts for QSO and multiplier credit. Mobiles in each county change.

Exchange: RS(T) and QTH. County for NY stations; state, VE province, or country for DX.

Scoring: One point for SSB contacts, 2 points for CW.

New York stations multiply total QSO points by (NY counties + states + VE provinces + DX countries) worked for their final score.

Others multiply total NY QSO points by the number of NY counties worked (maximum of 62).

Frequencies: 1815 and 40 kHz up from bottom of all other bands on CW. And 1880, 3880, 7280, 14280, 21380, and 28580 on SSB. (No WARC bands.)

Awards: Certificates to the top scoring stations in NY State, U.S., Canada, and DX entrants. Special awards for the highest scoring single operator, NY State club group operating from a rare NY county and NYS mobile.

Mailing deadline is September 26th to: George Hippisley, K2KIR, RD #1 Box 27A, Verona, NY 13478.

European DX Contest

CW: Aug. 12–13 SSB: Sept. 9–10
1200Z Saturday to 2400Z Sunday

This is the 34th annual contest sponsored by the DARC. The activity will be between European countries and the rest of the world on all five bands, 3.5–28 MHz. (IARU Region I regulation of frequencies for contest operation.) This year's event features important rule changes. These include a new multi-multi category and the addition of club competition.

Only 30 hours of operating time out of the 36-hour contest period are permitted for single operator stations. The 6-hour off times may be taken in one, but not more than three, periods any time during the contest and must be indicated in the log.

Classes: (a) Single operator, all band. (b) Single operator, high bands, 14, 21, and 28 MHz. (c) Multi-operator, single transmitter. Only one signal on any band at the same time. (d) Multi-operator, multi-transmitter. All transmitters must be located within a 500 meter diameter and within the property limits of the station licensee's address. (e) SWL.

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

Points: One point per QSO and 1 point for each QTC reported.

Multiplier: The multiplier for non-Europeans is determined by the number of European countries worked on each band (see WAE country list).

Europeans will use the ARRL country list of non-European countries. A quick band change to work a new multiplier is permitted. However, activity on the originating band must not be interrupted for at least 15 minutes.

Bonus Multiplier: Multiply your multiplier on 80 meters by 4, on 40 by 3, and on 10/15/20 by 2.

Final Score: Total QSO points plus QTC points times the sum total multiplier from all bands.

SWL: Only (a) single operator, all-band class may be used. The same call sign, European or non-European, may only be logged once per band. The log must contain both call signs and at least one of the control numbers. Each QSO logged counts 2 points, each complete QTC 1 point (maximum of 10 per station). Multiplier is determined by the DXCC and WAE country lists.

QTC Traffic: Additional point credit may be earned by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that took place earlier in the contest and was later sent back to a European station. It can only be sent by a non-European station back to a European. The general idea is that after a number of Europeans have been worked, a list of these stations can be reported back during a QSO with another station. An additional, one point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported (i.e., 1300/DL2DN/134, which means that at 1300Z you worked DL2DN and received #134).

A QSO can be reported only once and not back to the originating station.

A maximum of 10 QTCs to a station is allowed. The same station may be worked several times to complete this quota. Only the original contact, however, has QSO value.

Keep a uniform list of QTCs sent; 3/7 indicates that this is the third series of QTCs sent and that 7 are being reported.

If more than 100 QTCs are claimed, a check list must show that the maximum quota of 10 per station is not exceeded.

Club Competition: This new rule requires the club to be a local group and not a national organization. Eligible club members must operate within a 500 km diameter. Entries must clearly indicate their club name on the summary sheet. A special trophy will be awarded by the DARC to the winning clubs from Europe and non-Europe.

Awards: Certificates to the top scorers in each class in each country. Each participant with at least half the score of the continental leader will also receive a certificate. Plaques will go to continental winners in the single- and multi-operator classes.

Disqualification: Violation of the rules of the contest, or taking credit for excessive duplicate contacts, will be deemed cause for disqualification. Each duplicate QSO or QTC will result in a penalty of 3 QSO/QTC points.

Logs: It is suggested that you use the official DARC or equivalent log form. Figure 40 contacts to the page and use a separate sheet for each band. Submit a dupe sheet for each band with 200 or more contacts. A summary sheet showing the scoring and a signed declaration are also required. (Sample log forms are available—SASE or IRCs.)

WAE Country List: C31, CT1, CU, EA, EA6, EI, F, G, GD, GI, GJ, GM, GM Shetland, GU, GW, HA, HB, HB0, HV, I, IS, IT, JW Bear, JW Spitsbergen, JX, LA, LX, LZ, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, SP, SV, SV5 Rhodes, SV9 Crete, SY Athos, T7, TA1, TF, TK, UA1346, UA2/UZ2F, UA1 Franz-Josef-Land, UB, UC, UN/UA1N/UZ1N, UO, UP, UQ, UR, Y2, YO, YU, ZA, ZB2, 1A0, 3A, 4U1 Geneva, 4U1 Vienna, 9H1.

Mailing deadline is September 15th for CW entries and October 15th for SSB to: WAEDC Contest Committee, P.O. Box 1328, D-8950 Kaufbeuren, Fed. Rep. of Germany.

New Mexico QSO Party

1800Z Sat. to 1800Z Sun., Aug. 12–13

This annual event is sponsored again by the Albuquerque DX Association. The object is for New Mexico and non-New Mexico stations (including DX) to QSO each other on as many bands as possible. Note that New Mexico mobile stations

can be worked from more than one county.

Classes: New Mexico portable/mobile stations, New Mexico fixed stations, and non-New Mexico stations. All bands are encouraged (excluding WARC bands). SSB—1880, 3945, 7280, 14280, 21380, 28480; and CW—1810, 3555, 7055, 14055, 21055, 28055.

Exchange: New Mexico stations send RS(T) and county. Stations outside New Mexico send RS(T) and state/province/country.

Scoring: Count 2 points for SSB and 3 points for CW QSOs. Multipliers are U.S. states, Canadian provinces, and DXCC countries (KH6 and KL7 are states) worked per band. Final score is computed by QSO points times multiplier or QSO points times multiplier times number of counties operated from for New Mexico mobile/portable stations. Stations may only be worked once per band/mode.

Awards: Certificates will be issued to the highest scoring portable/mobile and fixed stations in each New Mexico county and each state/province/country. Plaques will be awarded to the highest scoring portable/mobile and fixed New Mexico entry and the highest scoring entry outside of New Mexico.

Stations making 200 or more contacts must include dupe sheets. Logs must be postmarked by September 30th and sent to: Richard Stump, KD5VV, P.O. Box 11021, Albuquerque, NM 87192. Include an SASE for a copy of the final results.

ARCI QRP SSB Sprint

2000Z to 2400Z Sunday, August 13

Here is another shorty by the ARCI QRP, the "Summer Daze Sprint."

Exchange: RS and state, province, or country. Members will include their membership number, non-members their power output.

Points: Contacts with a member 5 points, non-members same continent 2 points, but 4 points if on a different continent.

Multiplier: Total states, provinces, and countries worked on each band. (Same station may be worked on each band for QSO and multiplier credit.)

Power Multiplier:
4 to 5 watts output—×2
3 to 4 watts output—×4
2 to 3 watts output—×6
1 to 2 watts output—×8
Less than 1 watt out—×10
Over 5 watts out—check log.

Power Supply Multiplier: 1.5 if using battery; 2 if using solar/natural supply, or battery charged by solar/natural supply.

Final Score: Total QSO points × QTH × power × power supply if any.

Frequencies: 1810, 3985, 7285, 14285, 21285, 28385, 28885, and 50385.

Awards: Certificates to the top three scorers overall and to the top score in each state, province, and country in which two or more entries are received.

Use a separate log sheet for each and a summary sheet showing the scoring and other essential information. Sample log forms are available from K5VOL. Include a large SASE with your request, also if you desire results of the contest.

This year logs go to: Red Reynolds, K5VOL, 835 Surryse Road, Lake Zurich, IL 60047 USA.

SARTG RTTY Contest

Three Periods GMT
0000–0800 & 1600–2400 Sat., Aug. 19
0800–1600 Sun., Aug. 20

This is the 19th annual contest sponsored by the Scandinavian Amateur Radio Teleprinter Group. Use all bands 3.5 through 28 MHz. The same station may be worked on each band for QSO and multiplier credit.

Classes: Single operator all band, single

operator single band, multi-operator single transmitter, and SWL.

Exchange: RST and QSO no.

Points: QSOs with own country, 5 points. With other countries on same continent, 10 points. With other continents, 15 points.

Multiplier: Each DXCC country and each W/K, VE/VO, and VK call area.

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

SWLs use same scoring but based on sum of stations and messages copied.

Awards: Certificates to the top-scoring stations in each class in each country and each call area of the U.S., Canada, and Australia.

Use a separate sheet for each band, and include a summary sheet showing the scoring, comments, and other essential information, and your name and address in block letters.

Logs must be received by October 10th and go to: SARTG Contest Manager, Bo Ohlsson, SM4CMG, Skulsta 1258, S-710 41 Fellingsbro, Sweden.

Missouri QSO Party

2100Z Sat. to 0000Z Mon., Aug. 19-21

The Northwest St. Louis ARC, KØAXU, invites all amateurs to participate in the 1989 Missouri QSO Party. There are no time limit or power restrictions, and the same station may be worked on more than one band, phone or CW, for additional credits. Mobiles may be worked from more than one county.

Exchange: QSO number, RS/RST, and QTH. Missouri stations send county; stations outside Missouri send state, province, or country.

Scoring: For Missouri stations, count one point per contact for fixed or portable stations; two points for Missouri mobile contacts. Multiply total contacts by the number of states, provinces, and countries.

Out-of-state stations count two points for each Missouri contact; three points for Missouri mobile contacts. Multiply by the number of different Missouri ounties worked (possible: 115).

Awards: A certificate will be awarded to the highest scorer in each state, Canadian province, and foreign country *(minimum of 10 contacts)*. The top three single operator stations in Missouri will receive awards.

Frequencies: CW 3540, 7040, 14040, 21040, and 28040 kHz. Phone 3940, 7240, 14280, 21340, and 28480 kHz. VHF operators are welcome.

Logs must be mailed by September 30, 1989. They go to: Rich Zysk, KØGSV, 3457A Humphrey St., St. Louis, MO 63118. All QSLs for club station KØAXU should be sent to KØGSV. Be sure to send an SASE (business size) for a copy of the results.

New Jersey QSO Party

2000Z Sat. to 0700Z Sun. Aug. 19–20
1300Z Sun. to 0200Z Mon. Aug. 20–21

This is the 30th annual party sponsored by the Englewood ARA. Phone and CW are part of the same contest, the same station may be worked on each band and mode, and NJ stations may contact in-state stations for QSO and multiplier credit.

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

Scoring: NJ stations score 1 point for W/K and VE/VO contacts, and 3 points for DX. Multiply total by ARRL sections worked (maximum of 74). KP4, KL7, KH6, etc., are 3-point contacts and section multipliers.

Out-of-state stations multiply total NJ QSOs by number of NJ counties worked (maximum of 21).

Frequencies: 1810, 3535, 3950, 7035, 7135, 7235, 14035, 14285, 21100, 21355, 28100, 28400, 50–50.5, and 144–146. Suggest phone on even hours, 15/10 meters on odd hours, and 160 at 0500Z.

Awards: Certificates to the top scorers in each NJ county, ARRL section, and DX country. Second-place awards if four or more logs are received from that section. Also Novice/Tech. and mobile awards. There are four plaques donated by the section managers for NNJ and SNJ to the winning stations in those sections.

Use UTC time, indicate the multiplier only the first time it is worked, include a QSO check sheet, and include a summary sheet showing the scoring, etc. Send a large SASE if you wish a copy of the results.

Stations planning activity in NJ are requested to advise the EARA by August 1st so that coverage of all counties may be planned.

Logs must be received no later than Sept. 16th and go to: Englewood ARA, P.O. Box 528, Englewood, NJ 07631-0528.

All Asian CW Contest

0000Z Sat. to 2400Z Sun., Aug. 26–27

The same rules as for the Phone Contest on June 17–18 apply here. See June Contest Calendar for complete rules. Logs for this one must be in the hands of the committee no later than September 30th. They go to: JARL, P.O. Box 377, Tokyo Central, Japan.

DX

a monthly feature by
CHOD HARRIS, VP2ML

NEWS OF COMMUNICATION AROUND THE WORLD

DX Forums, New DXCC Countries, and More

Among the best-attended activities at major DX gatherings are the DX forums. These meetings usually feature members of the ARRL's DX Advisory Committee (DXAC), prominent DXers and DXpeditioners, and representatives from the ARRL DXCC desk. The attraction of these meetings is that individual DXers can learn first-hand what is happening *now* in the world of DX. What new countries or changes in the DXCC rules are under consideration? What is happening at the DXCC desk? Further, the DXers present can ask questions about current DX events, and express their opinions to those who make major DX decisions. The DX forums at the Visalia International DX Convention and the Dayton Hamvention in April were typical of such meetings.

New DXCC Countries

The major topic of the two forums was the pending applications for six new DXCC countries. At Dayton Rick Roderick, K5UR, chairman of the DXAC, explained why there was a sudden flood of such applications. "The DXAC anticipated handling more applications under the new DXCC rules," Rick said. The rewritten DXCC country criteria Rule 2 concerning island nations has produced the most interest. "There was historical inconsistency in the application of the old Rule 2(a) and 2(b)," Rick continued. "The rule was ambiguous and discriminated against island nations. The new rule is more precise and can be applied more consistently."

The change in the DXCC rule governing the addition of islands to the DXCC list produced six applications for new DXCC countries in the first 18 months after the rule change. Rotuma was the first such application and was soon added to the DXCC list. Five more applications were pending at the DXAC as of the Dayton Hamvention at the end of April: Conway Reef off Fiji, Ocean or Banaba Island off Kiribati, the Marquesas and Astral Islands off French Polynesia, and Frederick Reef off Australia. Rick briefly discussed each application.

"Conway Reef is 281 miles from the nearest point of Fiji, and 658 miles from Rotuma, and thus appears to meet both Rules 2(a) and 2(b)," he explained. Since the question of whether Fiji was a DXCC country by reason of government, an essential point in the new DXCC rule, had already been determined in the case of Rotuma, only the mileages had to be checked to approve the application.

From the left, front: Humberto, CX3AN/CX0XY, and Tony, VP8BRR. Rear: Juan Carlos, CX4CB/CX0XY, Alberto, CX4HS/CX6BBY, and Mick, VP8BRT.

The application for Ocean Island was not as clean, as the new rule requires such entities to be not only 225 miles from the "parent" DXCC country, but also 500 miles from the nearest additional DXCC island in the same "country." Since Kiribati already consists of three DXCC countries—West, Central, and East Kiribati—there was some question about the application.

The application for the Marquesas and Astral Islands hinges on whether French Polynesia is a DXCC country by reason of government, or because of distance from the "parent" DXCC country of France. Rick pointed out that French Polynesia fails to meet three of the four criteria spelled out in the new DXCC rules for determination of a country by reason of government. French Polynesia is not a member of the United Nations, nor the International Telecommunications Union (ITU). It does not have its own ITU-assigned prefix. And it doesn't handle its own treaties or foreign affairs. In favor of its "independence" is that fact that it does issue its own stamps.

Finally, on the application for Frederick Reef, Rick pointed out that some maps show an island called Swain Reef between Frederick Reef and the mainland of Australia. If the existence of this reef is confirmed, Frederick will not be 225 miles from "any part of the parent DXCC country," and thus will not qualify as a new DXCC entity.

Rick also mentioned that the Basilica del Santo in Italy was under consideration as a potential new DXCC country, based on the separation of the Basilica from the parent country of the Vatican, in Rome. Rick said more information was necessary to make a decision on the Basilica.

Other Topics

Potential new DXCC countries were not the only topics of the DX forums. Rick mentioned that the DXAC likes to receive input from the DX community on DXAC issues. Of the 150 to 200 pieces of mail that the DXAC receives each year, nearly 60% of it is generated internally by members of the DXAC. Another 11% comes from the ARRL. Only 30% comes from outside DXers, and a mere 1% comes from the many DX clubs around the country. Rick said that individual DXers and clubs can express their opinion of DX matters to the DXAC by sending a letter to the DXAC, in care of the ARRL Headquarters.

Don Search, W3AZD, the DXCC administrator at ARRL Headquarters, discussed some of the controversy surrounding the aborted 4W0PA operation from Yemen. "We have received lots of reports, but we don't know the whole story," Don explained. The only documents submitted to the DXCC desk for possible accreditation are copies of the entrance and exit stamps in the passport, and the visa. No operating permission for amateur radio has been sent to the DXCC desk, and accreditation will hinge on such permission. On the role of an Austrian doctor in the expulsion of Hans, 4W0PA, out of Yemen, Don said that the DXCC desk had received many complaints, but the Austrian denies interfering with the 4W0PA operation. A supposed Telex from the Yemen PTT to the ITU denying any amateur radio operation in Yemen could not be confirmed at the ITU; no record of the Telex exists in Geneva.

In other matters, Don said that the 5R8VT documents had been received, and accreditation was imminent. The DXCC desk continues to reject QSL cards

P.O. Box 50, Fulton, CA 95439

The WPX Program

Mixed

1394	W0TIV	1397	YU3NU
1395	K3QAP	1398	KD2BW
1396	IK6BOB		

SSB

2060	KD2UC	2065	JH4DVJ
2061	IK5IIU	2066	KI6PG
2062	DE0DAQ	2067	LU2FYU
2063	IK6BOB	2068	SP4CLX
2064	JH1FTS	2069	IK6FHG

CW

2573	DL5XAS	2577	JE1WBA
2574	WJ7H	2578	FE1JUD
2575	SM0BSB	2579	YU2CUV
2576	IK6BOB	2580	I2XHJ

WPNX

246	KA2RSJ	247	KB4BSO

Endorsements

Mixed: 450 W0TIV, IK6BOB, KD2BW. 500 W0TIV, IK6BOB, KD2BW, ONL-2169. 550 W0TIV, G3DCC, IK6BOB. 600 W0TIV, IK6BOB. 650 IK6BOB. 700 IK6BOB. 750 IK6BOB. 750 IK6BOB. 800 IK6BOB, AB5C, K5IID. 850 IK6BOB. 900 IK6BOB, LA9SN. 950 IK6BOB, LA9SN. 1000 I2EAY, IK6BOB, LA9SN. 1050 5H3RB, IK6BOB. 1100 5H3RB, IK6BOB, SM4-3434, ONL-4003. 1150 W9IL, DF6EX, ONL-4003. 1200 W9IL, ONL-4003. 1250 ONL-4003. 1300 ONL-4003. 1350 ONL-4003. 1400 SM6CST. 1450 WE2L. 1900 SM3EVR.

SSB: 350 DE0DAQ, IK6BOB, LU2FYU. 400 N0ISL, DE0DAQ, IK6BOB. 450 IK6BOB, K5IID. 500 IK6BOB, WB4FOT, SM0MIW, K5IID. 550 IK6BOB, WB4FOT, K5IID. 600 IK6BOB, WB4FOT, K5IID. 650 IK6BOB. 700 W0GOQ, IK6BOB. 750 W0GOQ, IK6BOB. 800 W0GOQ, IK2DUU, IK6BOB, I6CCI. 850 W0COQ, IK2DUU, IK6BOB, I6CCI. 900 W0COG, IK2DUU, IK6BOB, I6CCI. 950 W0GOQ, IK8GCS, IK6BOB, I6CCI. 1000 W0GOQ, I6CCI. 1050 I6CCI. 1100 KE6KT, I2TZK, I6CCI, KD9OT, AC3T. 1150 KE6KT, I2TZK, I6CCI,, KD90T, I2DMK. 1200 I2TZK, I2EOW, I6CCI. 1250 I2EOW. 1350 WE2L, K5RPC. 1400 WE2L, K5RPC. 1450 K5RPC. 1800 I6ZJC. 1850 I6ZJC. 1900 I6ZJC. 1950 I6ZJC. 2000 I6ZJC. 2050 I6ZJC. 2100 I6ZJC.

CW: 350 SM0BSB, JE3CYH, FE1JUD, YU2CUV. 400 LA3GI, SM0BSB, FE1JUD, YU2CUV, JE3CYH. 450 KJ6NR, G3DCC, SM0BSB, FE1JUD. 500 KJ6NR, G3DCC, SM0BSB, WB4FOT, FE1JUD. 550 WB4FOT. 600 NS2H, WB4FOT. 950 G4SSH. 1300 SM6CST. 1350 JH3CXL. 1400 JH3CXL. 1450 JH3CXL. 1500 JH3CXL. 1600 N4YB. 1650 N4YB. 1650 N4YB. 1700 N4YB.

10 Meters:	IK6BOB, K5IID, WB4UBD
15 Meters:	IK8GCS, TF5BW, IK6BOB, KD9OT, K5IID
20 Meters:	KJ6NR, IK6BOB, K5IID, OH2-612
40 Meters:	IK6BOB
80 Meters:	KD2UC, IK6BOB, YU3NU, K6IID, OH2-612
160 Meters:	SM4-3434

Asia:	IK6BOB, YU3NU, OH2-612
Africa:	IK6BOB, OH2-612
No. America:	KD2UC, IK6BOB
So. America:	KC8YM
Europe:	DL5XAS, IK6BOB, YU3NU, OH2-612, SP4CLX, IK6FHG
Oceania:	IK6BOB, OH2-612

Award of Excellence: N6JV, W2HG, ONL-4003

Award of Excellence with 160 Meter Endorsement: PY2DBU

Award of Excellence Plaque Holders: W1BWS, G4BUE, N3ED, LU3YL/W4, NN4Q, KA3A, VE7WJ, VE7IG, N2AC, W9NUF, N4NX, SM0DJZ, DK5AD, WD9IIC, W3ARK, LA7JO, VK4SS, K6JG, N4MM, I8YRK, W4CRW, SM0AJU, K5UR, K6XP, N5TV, K2VV, VE3XN, W6OUL, DL1MD, DJ7CX, DL3RK, WB4SIJ, SM6DHU, N4KE. I2UIY, DL7AA, ON4QX, WA8YTM, YU2DX, OK3EA, I4EAT, OK1MP, N4NO, ZL3GQ, VK9NS, DE0DXM, DK4SY, UR2**, AB90, FM5WD, I2DMK, W4BQY, I0JX, SM6CST, VE1NG, I1JQJ, WA1JMP, PY2DBU, HI8LC, KA5W, K0JN, W4VQ, KF2O, K3UA, HA8UB, W8CNL, K7LJ, W1JR, F9RM, W5UR, WB8ZRL, SM3EVR, CT1FL, K2SHZ, UP1BZZ, W8RSW, WA4QMQ, EA7OH, K2POF, DJ4XA, IT9TQH, W8ILC, K2POA, N6JV, W2HG, ONL-4003, VE7DP, K9BG.

Award of Excellence Plaque Holders with 160 Meter Endorsement: W4BQY, W5UR, N4NO, W8RSW, N4KE, I2UIY, W8ILC, W1BWS, NN4Q, G4GUE, LU3YL/W4, I4EAT, VE7WJ, W9NUF, N4NX, VK9NS, DE0DXM, VE7IG, K9BG, AB9O, FM5WD, SM0DJZ, DK5AD, SM6CST, I1JQJ, W3ARK, HI8LC, KA5W, UR2**, VE3XN, K6XP, LA7JO, W4VQ, K6JG, K3UA, HA8UB, W4CRW, N4MM, K7LJ, SM0AJU, KF2O, SM3EVR, K5UR, UP1BZZ, OK1MP, N5TV, K2POF, W8CNL, DJ4XA, IT9TQH, DL9RK, N6JV, ONL-4003, W1JR, W6OUL.

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.

from Walvis Bay, pending an elected government in Namibia, and a clear indication of the control of Walvis Bay by South Africa. Finally, Don explained that both the Iran amateur radio society and the Iranian government confirmed that amateur radio is illegal in Iran, and thus cards from the currently active EP stations do not count for DXCC.

At the Visalia convention, DX forum leader Jim Maxwell, W6CF, discussed some of the additional questions the DXAC might consider in the future. These included DXCC credit for contacts on the WARC bands, pending new country applications from the Council of Europe TP2CE and the Vienna International Centre 4U1VIC, the basis and purpose of the DXCC program, and QSLing practices. The latter question was raised when several members of the Clipperton DX Club in France asked the ARRL to stop accepting cards handled by QSL manager Antoine Baldeck, F6FNU, for DXCC credit. The French amateur radio society, the REF, has already stopped accepting cards from F6FNU for credit for the REF award program.

The subject of QSL practices is a hot one, as more and more DX stations and QSL managers are adopting controversial QSL procedures, such as requiring separate return envelopes for each callsign, not answering cards via the QSL bureau system, etc. In an effort to establish some guidelines for QSL managers, the April issue of *The DX Magazine* contained an editorial about ethics for QSL managers. The editorial is reprinted here.

"QSL Manager Ethics"

"QSLs are to be sent by FedEx Overnight mail to arrive on a Sunday morning (multiple cards to arrive on separate but successive and contiguous weekends), enclosing Amex, Diners, Visa or Mastercard details, Krugerrands or US bonds. Preference will be given to pretty, pastel, carefully color coordinated cards and those depicting an autumnal rural scene whilst most accurately reflecting the impact of list operations upon Judeo-Christian ethics.

From the left: OH2BU (op. at XF4L); wife of OH1RY; and Peter, OH1RY. (SM0COP photo)

"Others will be rigorously processed for a year or two, thence returned collect by the same route; enclosed will be half of your cards Magic-Markered 'No Longer In Log.' Any enclosures will be safely retained in a Swiss CD whilst personal research whether the cards are to be printed in Japan, Indonesia, Sudan or the copy shop next door is undertaken."

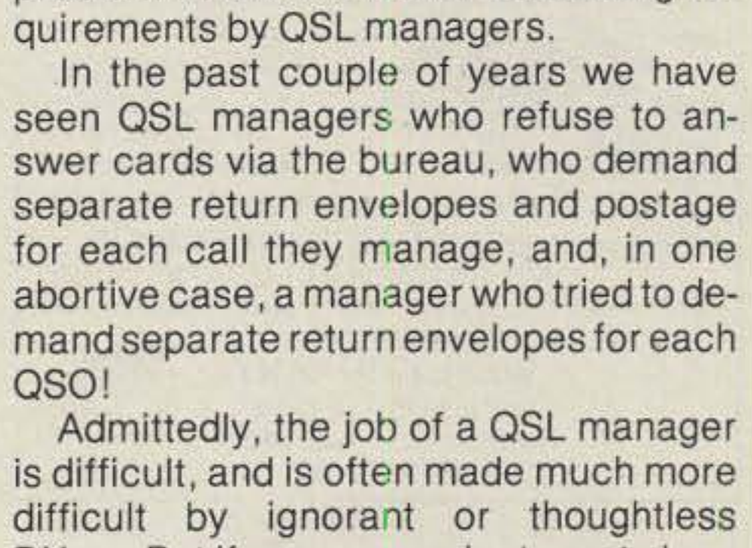
So reads Steve Dove, NM2Y's QSLing instructions.

Although Steve's demands are tongue-in-cheek, his letter illustrates a growing problem in the DX world: escalating requirements by QSL managers.

In the past couple of years we have seen QSL managers who refuse to answer cards via the bureau, who demand separate return envelopes and postage for each call they manage, and, in one abortive case, a manager who tried to demand separate return envelopes for each QSO!

Admittedly, the job of a QSL manager is difficult, and is often made much more difficult by ignorant or thoughtless DXers. But if someone volunteers to be a QSL manager, that person should adhere to certain minimum standards.

These standards are based on an extensive survey of QSL managers and QSL managing practices. Dozens of manag-



Kevin, 9M2ZZ, operates out of this very well-equipped station in Kuala Lumpur, Malaysia.

The WAZ Program

10 Meter Phone

328	NY2E	329	YU2AA

15 Meter Phone

274	JE4MWR	276	N4OM
275	JL3VWI	277	YU2AA

20 Meter Phone

736	N6CCL	741	VE7EW
737	K9APW	742	SP4CLX
738	IK2BTI	743	UA6JD
739	VE5AEC	744	WA3IMN
740	NY6M/KH2	745	YU2AA

40 Meter Phone

52	YU2AA

80 Meter Phone

50	YU2AA

10 Meter CW

65	NY2E	66	YU2AA

15 Meter CW

146	KØQQ	148	F3TH
147	W6JTI	149	YU2AA

20 Meter CW

324	WA8YTM	326	YU2AA
325	F3TH		

40 Meter CW

101	YU2AA

80 Meter CW

21	KØZZ	23	YU2AA
22	N4WJ		

All Band WAZ

SSB

3326	JY9LC	3336	IK6BOB
3327	HZ1AB	3337	IC8JAH
3328	SM5BBS	3338	KA5TQF
3329	I4GAS	3339	OH6SU
3330	N6CCL	3340	WI2J
3331	I3VKW	3341	WE8Q
3332	KC8MK	3342	IK2EKP
3333	IK2BTI	3343	IK5EXV
3334	I5ZTC	3344	YC2GHE
3335	KA1RRL		

Phone/CW

6522	4X6UO	6534	AA5BT
6523	PY4WS	6535	W8NDO
6524	W8WLU	6536	KV3J
6525	N7BSA	6537	KA2OOG
6526	WG7A	6538	K7WK
6527	JA1WJ	6539	KA5TQF
6528	IK4DCS	6540	KA5TQF (CW)
6529	OH3YR	6541	SM7GCZ
6530	JK3HGS	6542	G4DYO
6531	WC4B	6543	NJ1T
6532	IK6BUB	6544	JS1LPG
6533	IK6BUB (CW)		

Applications and reprints of the latest rules may be obtained by sending a self-addressed stamped envelope (65 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.

5 Band WAZ

As of May 1, 1989, 222 stations have attained the 200 zone level.

New recipients of 5 Band WAZ with all 200 Zones worked:

K8EJ
HG19HB
UA6JD
YU2AA

The top 16 contenders for 5 Band WAZ are:

1. N4WW, 199
2. WØJLC, 199
3. SP9PT, 199
4. K6YRA, 199
5. K8EJ, 199
6. K9GX, 199
7. AA4V, 199
8. SP6JCY, 199
9. K2UU, 199
10. HA8XX, 198
11. NS7Z, 198
12. K7UR, 198
13. KBØU, 198
14. PY7ZZ, 198
15. K6SIK, 198
16. VE8DX, 198

555 Stations have attained the 150 Zone level, as of May 1, 1989.

Applications and reprints of the latest rules may be obtained by sending a self-addressed stamped envelope (65 cents) size 4½ × 9½ to the W A Z Manager, Leo Haijsman, W4KA, 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants should include sufficient postage for safe return of their QSL cards. The processing fee for all CQ awards is $4.00 for subscribers and $10 for non-subscribers. In order to qualify for the subscriber rate, please enclose your latest *CQ* mailing label with your application.

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ers who handle cards for hundreds of DX stations responded to our survey.

The only reason for the existence of a QSL manager is to facilitate the return of valid confirmations. The manager serves the DX station and the DX world at large. A good QSL manager will do the following:

1. Understand that the manager will not make money by managing, and may actually incur some out-of-pocket costs.

2. Accept and answer QSLs via the worldwide bureau system. This often means maintaining membership in the national amateur radio society, as the QSL bureaus of many countries don't handle cards for non-members. QSLing via the bureau is not free for the manager, who has to pay postage from the bureau to his or her home, buy the cards, and pay postage to return the cards into the bureau system. However, a well-organized manager will make enough money on IRCs and those DXers considerate enough to include donations over and above postage to cover the costs of handling cards via the bureau.

3. The manager will return cards direct by airmail if sufficient postage or funds are provided. If the DXer includes appropriate airmail stamps, or enough IRCs for airmail return, the card should be returned by air, not by surface or other means.

4. A manager must not insist on a donation over and above the postage cards. This is not meant to exclude a manager from requesting a donation, but the cards should be returned properly even if no donation is included.

5. The manager should answer SWL cards. In some countries a prospective amateur needs to collect cards to earn a license to transmit. In any case, an SWL has as much right to a return card as a licensed amateur.

6. A manager will answer QSL re-

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FT-212RH/-712RH
Compact VHF/UHF FM Mobile

FT-736R All Mode Multi-Band
VHF/UHF Full Duplex Base

YAESU

FT-4700RH Dual-Band (VHF/UHF)

FT-767GX HF/VHF/UHF All Mode Base

FT-757GXII HF All Mode Base/Mobile

FT-747GX Lightweight HF All Mode Mobile/Base

CIRCLE 72 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

3656	YU2AA	2128	SM7TV	1639	N6AW	1254	N8BJQ	981	I2EAY
3519	F9RM	2122	N6CW	1638	K8LJG	1241	K7CU	950	F1HWB
3181	K2VV	2102	YT7DX	1601	KL7AF	1214	AI8S	947	YU2GIJ
2931	W2NC	2077	W9NUF	1601	SM0AJU	1205	K5DB	929	VE3NUP
2794	K6JG	2061	PA0SNG	1567	I1POR	1203	YU1GR	911	I5ZTC
2750	VE3XN	2008	YU7SF	1538	IT9TQH	1201	W9IL	899	K1BAZ/DV1
2655	YU2YW	1999	K5UR	1538	HA8XX	1195	JA6GCW	884	WA4WIN
2635	W4BQY	1981	K9BG	1535	W4UW	1190	DF6EZ	859	OE1KJW
2561	K6XP	1964	DJ4XA	1524	K2POF	1173	KC8CC	847	YU7RU
2511	N4NO	1931	IN3ANE	1509	W6OUL	1161	YU7DR	841	W9IAL
2507	N6JV	1918	PY4OD	1494	YU2CQ	1146	AI6Z	840	YU3PG
2499	W9DWQ	1910	W0SFU	1470	NN4Q	1143	I0AOF	830	YU1PJ
2480	N4MM	1908	SM3EVR	1467	DK5AD	1141	WD9IIC	802	W5ASP
2430	PY1APS	1841	I2MQP	1460	WE2L	1140	NE6I	773	KS3L
2403	K0BLT	1836	HA0DU	1435	YU1SZ	1127	PY2DBU	750	KI8B
2388	EA2IA	1829	4X4FU	1416	K2OLG	1120	JA1WJ	750	KC7EM
2380	WA8YTM	1810	IT9QDS	1415	N2AIF	1109	YU3NU	748	IK2BHX
2300	YU1AB	1806	YU2NA	1407	SM6CST	1102	KS0Z	742	K5IC
2290	YU7BCD	1801	KF2O	1403	AB9O	1098	5H3RB	729	W4WKQ
2252	N9AF	1758	KA5W	1400	AC2J	1096	G4OBK	719	KY3V
2251	I2PJA	1743	SM6DHU	1380	YT7WW	1081	K3UA	710	W6LC
2242	I8YRK	1736	YT3AA	1334	WB8ZRL	1008	W0JIE	696	N3KR
2161	YU7BPQ	1695	N5TV	1334	W7CB	999	SP5AA	678	RB5MP
2134	N2AC	1654	I1EEW	1311	YU2TY	998	NV9S	641	JE2GMO
2131	I6SF	1650	IS0LYN	1302	4N7ZZ	986	G4SDJ	618	IK2ECN

SSB

3444	F9RM	1741	EA2IA	1371	N5TV	1050	K8LJG	801	N6CGB
3118	I0ZV	1738	WF4V	1307	I1POR	1035	W0ULU	797	NK2H
2746	K2VV	1725	ZP5JCY	1301	KL7AF	1023	CT1AHU	794	NE6I
2697	ZL3NS	1701	K5UR	1298	CT1BY	1021	WA2FKF	787	KC2FC
2569	K2POA	1635	W9NUF	1291	IT9TQN	993	KS0Z	783	K3UA
2505	K6JG	1615	W3ARK	1290	PY4OD	985	XE1XF	757	KB0C
2440	CT1UA	1583	WA4QMQ	1283	IK5ACO	983	G4SDJ	757	IK7DBB
2300	I0AMU	1558	G4CHP	1277	EA4KK	982	IK8GCS	745	AI6Z
2298	VE1YX	1556	CT1FL	1273	W2NC	981	DK5WQ	744	IK0EIM
2264	K6JG	1528	KF2O	1270	KD9OT	960	HK6BER	711	VO1AW
2250	I2PJA	1525	KC8YM	1241	I2EOW	950	F1HWB	699	I7UNX
2247	N4MM	1515	DJ4XA	1231	SM6DHU	947	I2WZX	683	YC7DF
2208	WD8MGQ	1496	I6EEW	1218	SM0AJU	917	IK2DUU	675	DJ0AF
2182	W8YDB	1482	W4UW	1217	I2TZK	911	W6OUL	674	KB4HU
2092	I4ZSQ	1480	G4CHP	1200	AB9O	909	YB3CEV	666	G4OBK
2091	CT4NH	1450	XE1OX	1196	N6FX	908	N2AIF	661	K0PVI
2077	I6ZJC	1437	K5RPC	1176	N2AC	902	K3IXD	657	W5AWT
2002	W4BQY	1433	EA8AKN	1170	N2AC	860	CX6BZ	650	WM5G
1965	I8YRK	1418	EA3AQC	1163	NN4Q	860	WN5MBS	641	CT1CIR
1913	OZ5EV	1414	YU2NA	1158	PY4VX	859	K8ZZU	639	KA0ZFX
1906	N4NO	1405	I8KCI	1141	KC8CC	854	KK5P	636	LU1DWN
1900	WA8YTM	1404	CT4UW	1141	KE6KT	854	IT9ONV	635	EA7DHK
1846	I2MQP	1396	WE2L	1114	I8WYD	832	I3ZSX	633	SM6CST
1846	YU7BCD	1394	AC2J	1110	LU8ESU	827	LU1VK	618	CT1DIZ
1816	W9DWQ	1394	HA8XX	1102	AG2K	805	W5ILR	613	NM5Y
1805	I4CSP	1390	I5ZJK	1083	I8LEL	803	G4KHF	607	K5HT
1802	PA0SNG	1386	KA5W	1082	WB8ZRL	803	IT9JKY	600	IT9CUE
1755	NJ0C								

CW

2748	K2VV	1673	N4MM	1198	KA5W	1024	NN4Q	799	EA5AR
2688	W2NC	1639	PY4OD	1190	W1WAI	1019	HA5LZ	798	G4OBK
2543	WA2HZR	1619	W9NUF	1188	KF2O	1006	KN7K	790	NE6I
2485	N6JV	1612	VO1AW	1146	N2AIF	1000	DL2HBX	781	G4UOL
2405	ON4QX	1596	4X4FU	1144	F6HKD	988	OK1CZ	763	OE1KJW
2223	VE7CNE	1583	K5UR	1143	SM0AJU	969	G4FAM	761	WB8ZRL
2191	N4NO	1538	DJ4XA	1138	W9PWM	957	VE4CE	750	W0JIE
2128	W3ARK	1534	N4YB	1138	I2UIY	956	G3VQO	749	G4MVA
2083	K6JG	1507	JH3CXL	1138	YU2NA	952	G4SSH	731	YU3PG
2074	W9DWQ	1459	IT9VDQ	1134	EA7OH	919	AI6Z	726	K1BAZ/DV1
2037	G2GM	1456	KA7T	1134	K8LJG	915	SM5DAC	708	JA2GCW
2025	W4BQY	1455	I2DMK	1129	YU2CQ	914	NF5Z	701	KA1CLV
1923	K6XP	1398	N5TV	1112	YU3NU	898	OZ5UR	684	W5AWT
1922	YU7SF	1300	N6FX	1106	IT9TQH	891	HA8XX	657	AC5K
1900	N2AC	1285	SM6CST	1106	LA9XG	868	K3UA	642	IS0FIC
1874	EA2IA	1261	SM6DHU	1097	AK2H	865	EA1AK	639	KU0S
1867	I6SF	1251	KL7AF	1095	DJ1YH	849	CT1LN	619	PY4WS
1852	YU7BCD	1219	K2POF	1085	W6OUL	848	I2EAY	611	WE2P
1779	OZ5EV	1215	VE1ACK	1069	TI4SU	838	JJ1FSK	609	W9IAL
1757	I1YRL	1212	I7PXV	1051	OH3TQ	837	YU2GIJ	602	4X6DK
1745	WA8YTM	1205	I8YRK	1033	I2IWM	823	KQ3S	600	K7DBV
1731	LZ1XL								

quests for more than one callsign with a single return envelope. A manager can request a separate envelope per callsign, but not refuse to answer such requests. (On the other hand, a considerate DXer will provide separate envelopes and will expect a considerable delay if not.)

5 Band WAZ #75

When you are in that big contest and you hear someone endlessly chanting "CQ DX," what do you think? If you are Mico Avramovic, you might think that you are being called, YU7DX being his callsign.

Mico Avramovic, YU7DX, at the operating desk with one of his daughters. Mico works a lot of DX and often is out in front in the competition. A few of the large number of trophies he has won can be seen. Forty meters was the hardest for him to fill out. Mico has gained 5 Band WAZ #75.

Mico not only hears them, but he works them. He has gained 5 Band #75 to add to his 5BDXCC, 6BWAC, and items such as those. Mico is an electrician, 45 years old with an XYL and two children. He works both SSB and CW using a horizontal delta loop for 80, a vertical delta loop for 40, and a TH6DXX. He also has a vertical for 40 to 10 meters. Mico started out with homebrew gear, but after getting into things a bit he upgraded the home station.

In gathering the necessary cards for the WAZ Award, Mico found 40 meters the toughest to fill out. Mico has been licensed since 1962. He is a member of the local radio club, Heroj Pinki, in downtown Novi Sad. The club has about 80 members.

Mico jumps in during contest periods at times, but mostly he operates single-handed. However, when something needed is on a DX net, there is no objection to going with that flow.

CQ DX Awards Program

SSB

1684	FR5ZN	1686	DU1DZA
1685	TI2LTA	1687	N8HUR

CW

749	WA6HYB	751	NU7V
750	WA8YWK		

SSB Endorsements

320	VE1YX/321	310	K2JLA/313
320	ZL3NS/320	310	WA4WTG/311
310	N7RO/319	300	K8CMO/308
310	K9MM/319	300	KC8EU/306
310	ZL1AGO/319	300	W0ULU/303
310	W0SFU/319	300	KS0Z/303
310	I0ZV/319	275	TI2LTA/281
310	I4LCK/318	200	VE2ANE/224
310	K5OVC/317	200	FR5ZN/217
310	N6AHU/316	28 MHz	N8HUR
310	K3UA/314	3.5/7 MHz	KA9TNZ

CW Endorsements

320	K9MM/320	275	KA2DIV/279
310	W0IZ/312	250	K2JLA/255
310	K3UA/310		

Total number of active countries is 320. 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 SASE 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.

7. A QSL manager will make a diligent, thorough search of the log before returning a card marked "not in log." This includes checking a day forward and back, an hour forward and back, checking if the time is local and not UTC, etc. The manager can postpone this search until accurate cards are handled, but a manager should make an honest effort to find a contact before returning a card.

8. A manager should obtain cards and answer QSL requests in a timely manner. Sometimes there will be a delay of a month or so for printing or receipt of logs, but a manager should answer incoming direct QSL requests within a month or two. A good manager will set up an on-the-air sked to eliminate delays associated with mailing logs.

9. A manager should be considerate of DXers who don't know how to QSL properly. Educate these DXers as to proper procedure, rather than insult or ignore them. This will pay off for all managers worldwide.

10. A good manager will communicate well, letting the DX community know if there will be delays due to cards being printed, logs lost, or vacations. A manager should answer in a timely manner all letters that include return postage.

The vast majority of QSL managers worldwide adhere to these guidelines. They have demonstrated that a manager can provide an invaluable service to the DX community, and not go broke doing so. Perhaps it's time to invoke DXCC Rule 12 (ethics) for QSL managers.

QSL Managers

Robert A. Winters, KD7P/NH2, reports that his *Callbook* address is no longer valid. He can now be QSLed via 68 Betel Palm, NCWP, FPO San Francisco, CA 96630-1848.

3C2CR (CW) to DJ9ON
3D2YY to JH4IFF
4X41ID to 4X4HQ
5B4WW to 5B4TI
5H3TW to K3ZO
5N0ELT to G4OHX
5T5CK to DL1HH
5V7SA to WB4LFM
7P5ER to ZS5VF
8S0ITU to SK0CC
9H1IV to VK2FAG
9M6HF to WE2K
9Q5FF to WA9PCI
9X5AA to W4FRU
9X5NH to DJ6EA
A35AA to N5XX
BT1TUS to BY1QH
CN8FC to WA4QMQ
D68JL to AK1E
EL2L to WA8LKS
EM5T to UT4UWV
EO1AQW to UZ1QWW
EO3AWK to UZ3AWW
EO9ACS to UZ9CWW
EU7L to UL8GWW
EV1AN to UZ1NWA
EV4AW to UA4WE
EW0CL to UC1LWA
EW1C to UC2ADX
EW9BJ to UB4JWN
FH/DL7FT to DL7FT
FR4FA/p to F6FNU
FY5EW to F6BFH
HK0BKX to WB9NUL
HL5BDS to HL1ASS
J49/DK6AS to DJ8MT
JA7FTJ/JD1 to JA7BIJ
JT1T to JT1KAA
JX7DFA to LA2KD
JY9SR to W3FYT
KC4AAA to NC6J
LU1ZA to LU2CN
LW1EZK to LU6EF
OH0BDA to OH2BDA
P29SR to WB6IOQ
P40P to N1CIX
P40YL to HB9CUY
PP1ZAH to W8AH
PQ2/PY1GCW to PY1SL
RT0U to UT4UWV
RW3A to UZ4AZM
S79J to K3ERO
S79YA to W6YA
SO1DX to EA3AOC
ST2/PA0GAM to PA0GIN
SX7R to SV4CPQ
T33JS to VK9NS
T5CT to N4CT
T5MF to I2MQP
TA2BK to DJ0UJ
TL8NS to IN5EYY
TL8TG to KC4NC
TP4BCE to F6FGQ
TW0AA to F6EEM
UQ0GZW to UQ2GKL
V21CW to KA2DIV
VK8TD to KG6B
VK9LA to DJ5CQ
VP2EXX to KC8JH
VP8BUB to G4YLO
YB8ATI to KJ4DQ
YB9LC to W3HNK
YJ0AYS to JA1AFP
ZC4WK to WB8JEY
ZD9BV to W4FRU
ZK1XV (89) to VK2BCH
ZS8MI to ZS6PT

No - 91 - 92

Washington Readout

a monthly feature by
FREDERICK O. MAIA, W5YI

REGULATORY HAPPENINGS FROM THE WORLD OF AMATEUR RADIO

FCC Releases Revised Amateur Radio Service Rules

The FCC Commissioners have approved new Part 97 Rules covering the Amateur Radio Service. They were introduced to a standing-room-only crowd at the ARRL National Convention held in Dallas on June 3rd by FCC's Bob McNamara (Chief, Special Services Division) and Johnny Johnston, W3BE (Chief, Personal Radio Branch), both of the Washington, DC office.

The massive revision was necessitated because technological advances and operational changes have made the current Amateur Radio Service rules difficult to apply to modern amateur radio communications. Looking toward the future, the Commission reorganized Part 97 of its rules to create a regulatory environment designed to encourage modern techniques, technology, and uses of amateur radio.

Specifically, the FCC revised and reorganized Part 97 in order to make the amateur service rules easier to understand and to provide a foundation upon which future advancements in communications can be incorporated into the amateur service. The Commission also deleted unnecessary, obsolete, and redundant rule provisions.

The hoped-for 40% reduction in the size of the Amateur Radio Service regulations actually ended up being only a 25% savings as the FCC went back to the drawing board and confronted the many issues dealt with by nearly 200 commenters. Practically every section of their initial rule proposal had to be re-addressed and revised.

Prior to this complete overhaul, Part 97 had not undergone a major restructuring since 1951, when most communications systems in the service were using high-frequency, hand-keyed telegraphy and amplitude-modulated telephony. Since then a number of emerging technologies, such as single-sideband and frequency-modulated telephony, VHF/UHF repeaters, radioteleprinting, satellite transponders, digital communications, television, etc., have become popular with amateur operators. While rules have been modified or added to accommodate these technologies, the result has been a "patchwork quilt" of rules surrounding an antiquated structure that is often confusing, particularly to a prospective licensee.

Part 97 has now been restructured into a format consisting of six subparts and two appendices. These are:

Subpart A: General Provisions, which contains those rules concerned with license and station location requirements.

Subpart B: Station Operation Standards, which is comprised of those standards which apply to all types of amateur station operation.

Subpart C: Special Operations, which contains the requirements that apply to nonstandard operations such as beacons, repeaters, auxiliary operation, remote control of amateur stations and model craft, and AMSAT, the amateur-satellite service.

Subpart D: Technical Standards, containing the remaining technical principles.

Subpart E: Providing Emergency Communications, which contains the rules applicable to operations in distress and disaster situations, along with RACES, the radio amateur civil emergency service.

Subpart F: Qualifying Examination Systems, which contains the requirements for the preparation, administration, and coordination of amateur radio operator examinations—i.e., the Novice and VEC testing programs.

Appendix 1 lists the geographic areas where the amateur service is regulated by the FCC, and

Appendix 2 lists volunteer-examiner coordinator regions.

Subpart E, Providing Emergency Communications, a new subpart, was not originally specified in the FCC's Notice of Proposed Rulemaking released in April 1988. Dropped was the subpart entitled "Fundamental Purposes of the Amateur Service," which was incorporated elsewhere.

The new rules combine the regulations which pertain to an amateur station providing emergency communications with the rules that govern RACES stations. They do not, however, change the basic principles or purpose of the amateur service in the United States.

The FCC's "quiet hours" proposal to simply grant the FCC authority to restrict amateur operations to prevent harmful interference without further stipulations by far drew the most opposition from the amateur community. The Commission decided to keep the current "quiet hours" rule imposing restrictions, as necessary, on the operation of amateur service stations to eliminate interference to home-entertainment equipment. The FCC had initially proposed to:

(1) . . . remove certain specific time periods for the imposition of restrictions against amateur station transmissions;

(2) . . . remove the criteria that consumer receivers must be "of good engineering design, including adequate selectivity characteristics" and;

(3) . . . remove the 97.131 requirement that the alleged interference be investigated by the Commission.

The general prohibition against amateur stations transmitting communications as an alternative to other authorized radio services has been clarified to permit emergency communications to be provided. The new rules also permit the use of amateur stations to provide communications that relate to the public's safe observation and participation in parades, marathons, or similar public events, if the principal beneficiary of such communications is the public and any benefit to the event's sponsor is incidental.

Communications relating to the buying and selling of amateur station apparatus—so-called "swap nets"—is also permitted as an exception to the general prohibition against business communications. The exception expressly forbids such messages by those seeking to profit from such sales or purchases on a regular basis. Another exemption is for communications that assist journalists in filing reports. Such reports, however, must not detract from the efforts of other stations that are actually engaged in providing emergency communications.

With respect to operator license examinations, the Commission included in the rules their policy that a Morse code receiving test alone is adequate proof of

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National Volunteer Examiner Coordinator, P.O. Box 565101, Dallas, TX 75356-5101

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FT411-811
FT-1903/1123
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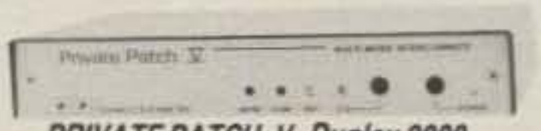

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both sending and receiving ability. The FCC confirmed that knowledge of all telegraphy characters is basic to sending and receiving texts correctly; therefore, the Morse code test message still must contain all alphabet letters, numerals, and specified punctuation and operating prosigns. Test messages may, however, be transmitted for a minimum duration of five minutes rather than exactly five minutes as presently specified in §97.29(c).

The new rules specify the number of questions that must be answered correctly on each written examination, rather than a percentage of correct answers. Administering volunteer examiners (VEs) now have the authorization to require expert verification that an examinee with a physical disability requires a reader or transcriber, other than the one of the administering VEs. By another rule change, a volunteer examiner coordinator is not limited to designated regions in the United States. All VECs may now coordinate examination sessions in every testing region—i.e., every VEC is thus a national VEC.

The new Part 97 rules retain the "Definitions" section. Some terms used in the amateur service rules have been shortened and simplified—for example, *beacon, repeater, earth station,* and *space station.* The Commission also included an exception to the prohibition on international third-party communications. The exception states that the prohibition does not apply to a message for any third party who is eligibile to be a control operator of the station. Traffic may now be sent to amateur operators in countries where third-party communications are not permitted.

Another exception applying to the time limitation for a RACES drill has been incorporated into the new Part 97 where an emergency planning official has specifically approved the drill or test. The good amateur practice requirement has been consolidated with the requirements concerning frequency selection, frequency sharing, and malicious interference. Also, under the new rules a representative of a foreign government is not barred from holding a reciprocal permit.

With respect to repeaters, the new rules deleted the requirement that operation be discontinued within five seconds after cessation of radiocommunications by the user station. Also deleted was the restriction that a repeater cannot transmit on more than one channel from the same location.

Additionally, the Commission clarified the permissible emission types to be used by amateurs, new easy-to-understand designators being adopted. Included or clarified were many other policies concerning amateurs that have evolved over the years as interpretations of existing rules. For example, it included the existing policy concerning state and local regulations governing the height and placement of amateur antenna structures.

An unanticipated and surprising change is the inclusion of PRB-1 in Part 97. PRB-1 is the September 1985 FCC preemptive declaratory ruling that state and local regulation of an amateur station antenna structure must reasonably accommodate those communications and must constitute the minimum practicable regulation to accomplish the state or local authority's legitimate purpose. PRB-1 now progresses from a declaration by a federal agency to a full-fledged government law.

At this writing, the complete text of Part 97 rewrite is not yet available. It is currently in the process of being typeset and will be officially released shortly through the Department of Commerce. This report has been completed based on information obtained from the Commission's press release and other information discussed at the FCC Forum at the ARRL National Convention. The new Part 97 becomes effective September 1, 1989.

It is estimated that about 20% of the questions on Rules contained in the present amateur radio license examination question pools will have to be changed. The Volunteer Examiner Coordinators are in the process of addressing the rule changes and new Part 97 replacement questions are being developed. We plan to have complete low-price Part 97 Manuals available detailing the new Rules. More on this next month.

Special Callsign System Vetoed!

The FCC has decided not to initiate a special amateur radio callsign system administered in the private sector. This was a major announcement, since many amateurs were waiting for a mechanism by which they could obtain a callsign of their choice!

The proceeding began more than three years ago when the FCC received a June 17, 1986 letter from the American Radio Relay League expressing an interest in finding a way by which requests for specific callsigns for amateur stations could be honored through a system administered in the private sector. In response to that letter, and to numerous other requests from the amateur community, the Commission issued a Public Notice (PRB-3) on February 3, 1987 requesting comments and proposals to determine whether an amateur radio callsign system administered by a Special Call Sign Coordinator (SCSC) from the private sector could be implemented without additional costs to the FCC.

The Commission also proposed to completely scrap its present (circa 1978) callsign assignment system whereby amateurs qualify for shorter—and more desirable—callsign formats by upgrading or a different callsign (in the same format) when an amateur changes mailing address to a different region. All new callsigns, regardless of the licensee's operator class, were to have been systematically assigned with a 2×3 format from the NA-NZ prefix block. That block had the capability to provide over 4.5 million callsigns.

The Commission proposed that the actual amateur station licensing function, including the assignment of an "official" [primary] callsign, would continue to be performed by the FCC, consistent with its statutory licensing responsibility. Upon request of an individual licensee, however, an SCSC would then assign one or more supplemental "special" [secondary] callsigns to an authorized station. An administrative cost would be collected by the SCSC for the issuance and maintenance of these callsigns.

These special callsigns could then be used in lieu of the Commission-assigned callsigns during the station identification procedure. The SCSC would then be required to have an "on-line" computer access system whereby the FCC would be able to relate the secondary callsigns to their primarily issued callsign for monitoring and compliance work. Thirteen groups, including The Radio Amateur Callbook, Buckmaster Publishing, Forest Industries, the ARRL, and the Central Alabama and W5YI VECs, did apply to become the Special Call Sign Coordinator.

The ARRL asked for a comment time extension from April to July 1987. Meeting in Atlanta on July 9-10, League Directors supported the issuance of specific callsigns to amateurs but (completely reversing their June 17, 1986 letter) felt this should be a government rather than a private-sector function. The Directors did, however, vote to submit a contingency proposal to be the SCSC providing that no other organization shared the duty with the League and providing the cost of the program was totally recoverable. The ARRL made it clear that it did not wish to participate in another program (such as the VEC System) where other groups cooperate in accomplishing a common goal.

The FCC staff completed their recommendations on the matter in early 1988. The issue remained before the Commissioners for more than a year. They finally ruled on May 31. The fact that the League was reluctant to be the SCSC probably killed the matter. The official release gave a different reason. "After carefully considering the comments, the Commission finally concluded that a special callsign program—even one administered in the private sector—would require the diversion of significant resources that are essential to the timely and efficient processing of applications for new and upgraded amateur licenses. Under these circumstances, the FCC concluded that a special callsign system is not in the public interest. Accordingly, it terminated the proceeding."

Propagation

a monthly feature by
GEORGE JACOBS, W3ASK

THE SCIENCE OF PREDICTING RADIO CONDITIONS

According to worldwide daily sunspot observations collated by the Royal Observatory of Belgium, the median value for April 1989 was 129. Daily values ranged from a high of 185 reported on April 8th to a low of 92 observed on the 13th. The corresponding median level of 10.7 cm solar flux for April, as reported by the Algonquin Radio Observatory in Ottawa, Canada, was 190.

The median level of sunspot activity observed during April increases the 12-month smoothed sunspot number to 125, centered on October 1988. A smoothed sunspot number of 174 is forecast for August 1989 as the present cycle continues toward a record, or near-record, maximum, which is now expected to occur during the first quarter of 1990. A corresponding 10.7 cm solar flux level on the order of 220 is forecast for August.

Figs. 1 and 2 depict the present course of Cycle 22 to date, and predictions through April 1990, as made by the Space Environmental Services Center, NOAA, Boulder, Colorado.

The National Geophysical Data Center, NOAA, also in Boulder, is calling for Cycle 22 to reach its maximum during March 1990 with a smoothed sunspot number of 190 (±42).

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for August 1989

Propagation Index	*Expected Signal Quality* (4)	(3)	(2)	(1)
Above Normal: 1-2, 5, 7, 28-29	A	A	B	C
High Normal: 3-4, 6, 8, 10, 13, 19, 21, 27, 30-31	A	B	C	C-D
Low Normal: 9, 11-12, 17-18, 20, 22, 26	A-B	B-C	C-D	D-E
Below Normal: 14, 16, 23, 25	B-C	C-D	D-E	E
Disturbed: 15, 24	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 S0 and S3, and with considerable fading and noise.

E—No opening expected. 3dB per S-Unit.

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 excellent (A) on August 1st and 2nd, good (B) on the 3rd and 4th, excellent (A) on the 5th, good (B) on the 6th, etc.**

August DX Conditions

Late August and early September are days when DX forecasters usually like to hide! This is the most difficult period for which to make accurate predictions because conditions can change drastically from day to day. On some days conditions on the HF bands will sound much as they did during June and July, typically summertime. On other days they will sound more typically fall-like, with somewhat higher daytime and lower nighttime usable frequencies. Since this is a period of transition, this month's DX Propagation Charts cover only the one-month period from August 15 through September 15, rather than the usual two-month span. Short-Skip Charts for use during August appeared in last month's column.

Good DX openings to most areas of the world should be possible on *three* bands during the daylight hours, *10*, *15*, and *20* meters. *Fifteen* meters is expected to be the best of these bands for most of the daylight hours. Look for optimum DX openings on *20* meters for a window of about an hour or two after sunrise, and again during the late afternoon and early evening hours, although the band should remain open for DX to one area of the world or another just about around the clock on most days. Some fairly good *10* meter openings should be possible, particularly during the afternoon hours.

As September approaches, conditions on all three bands should improve during the daylight hours, but expect the bands to close somewhat earlier as a result of the increasing hours of darkness.

From sundown to midnight expect good DX conditions on *20*, *40*, and *80* meters. It should be a toss-up between *20* and *40* meters for top honors.

From midnight to sunrise the best DX band should be *40* meters. Expect plenty of DX also on *80* meters, and *20* meters should remain open to southern and tropical areas during this time period as well.

By late August it should also be possible to work some DX on *160* meters during the hours of darkness. Conditions on this band, as well as on *40* and *80* meters, tend to peak just as the sun begins to *rise* on the *light*, or eastern side of the path.

VHF Ionospheric Openings

August should be a very active month for meteor showers, with at least five different ones expected to peak during the first three weeks of the month. At least one of these, the *Perseids*, should be an intense shower with a great deal of activity. It is expected to last for five days, with maximum intensity likely to occur during the afternoon of August 12th. Maximum periods for other meteor showers expected during the month are August 5, 12, 18, and 20.

Ionization produced by the thousands of meteors expected to enter the earth's atmosphere during these showers, particularly during periods of maximum in-

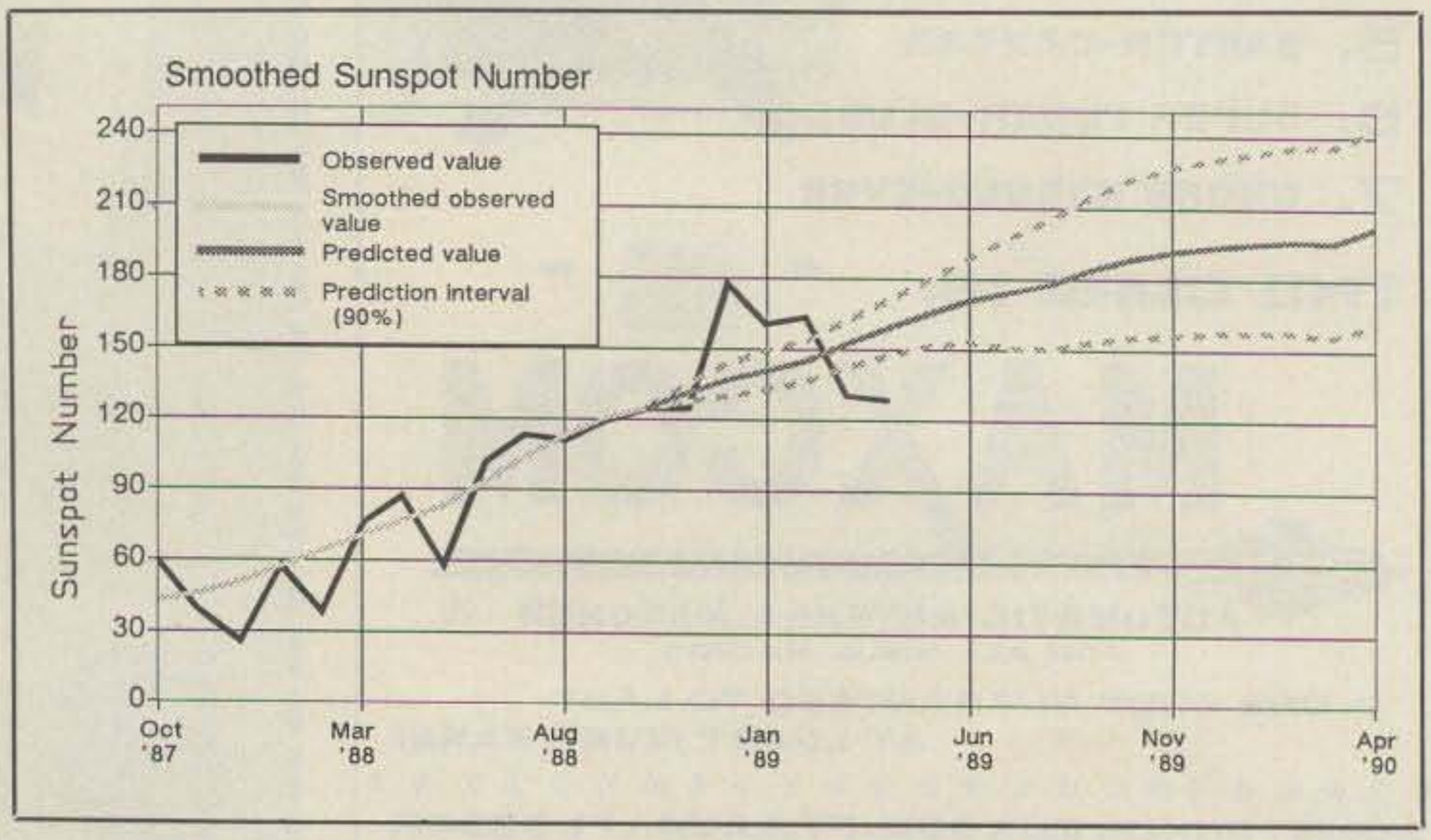

Fig. 1– Cycle 22 progress and prediction (smoothed sunspot numbers).

11307 Clara Street, Silver Springs, MD 20902

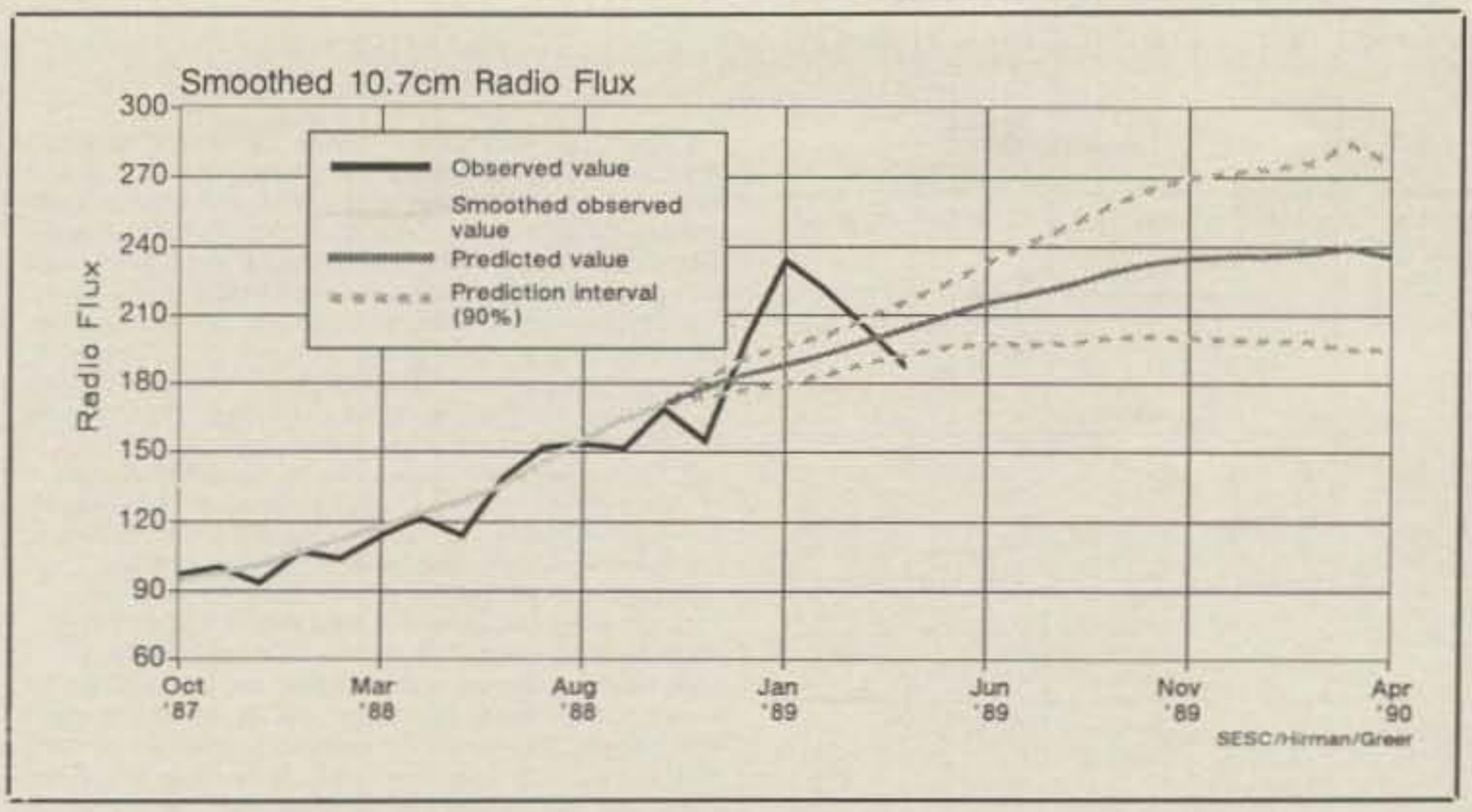

Fig. 2– Cycle 22 progress and prediction (10.7 cm solar flux).

tensity, is expected to make possible numerous meteor-scatter-type openings over several hundreds of miles on the *10*, *6*, and *2* meter bands.

Although on the decrease, fairly frequent sporadic-E ionization is expected to continue during August, resulting in some good short-skip openings on *10* and *6* meters over distances of approximately 600 to 1300 miles. During periods of very intense and widespread sporadic-E ionization, two-hop openings may also be possible up to distances of about 2600 miles. An occasional opening on the *2* meter band may also occur during August, over distances ranging between approximately 1000 and 1400 miles. While this type of short-skip propagation may occur at any time of the day or night during August, there is a tendency for sporadic-E ionization to peak between 8 a.m. and noon and again between 6 and 9 p.m. local daylight time.

Auroral displays produce ionization in the earth's atmosphere which is often capable of reflecting VHF radio signals over distances upwards to 1,000 miles or so. Auroral displays and associated auroral-scatter propagation are most likely to occur during August when HF conditions are Below Normal or Disturbed. Check the Last Minute Forecast appearing at the beginning of this column for those days that are expected to be in these categories during the month.

There is a fairly good chance for some *6* meter transequatorial (TE) openings during late August, with conditions expected to improve considerably by mid-September. The optimum times for TE openings between the U.S. and Latin America should be the early evening hours, shortly before and just after sundown. TE openings favor locations in the southern tier states, although some may be possible to states farther north.

73, George, W3ASK

August 15 to September 15, 1989
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

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

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

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

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

HOW TO USE THE DX PROPAGATION CHARTS

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

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. An * indicates the best time to listen for 160 meter openings.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:
(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days
Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 ia 1 P.M. etc. Appropriate *daylight* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 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 quarter-wavelength above ground on 40 and 20 meters, and a wavelength above ground 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase be one level for each 10dB loss, it will lower by one level.

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

Southern Africa	09-11 (1) 11-13 (2) 13-15 (1)	08-09 (1) 09-11 (2) 11-12 (3) 12-14 (4) 14-15 (3) 15-17 (2) 17-18 (1)	06-08 (2) 08-15 (1) 15-16 (2) 16-19 (3) 19-21 (2) 21-23 (1) 23-03 (2) 03-06 (1)	20-21 (1) 21-23 (2) 23-00 (1) 21-00 (1)*
Central & South Asia	09-11 (1) 19-21 (1)	08-09 (1) 09-10 (2) 10-11 (1) 18-19 (1) 19-21 (2) 21-23 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-11 (1) 17-19 (1) 19-22 (2) 22-02 (1)	05-08 (1) 19-21 (1)
Southeast Asia	12-14 (1) 17-19 (1)	08-09 (1) 09-12 (2) 12-16 (1) 16-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-13 (1) 18-20 (1) 20-23 (2) 23-00 (3) 00-01 (2) 01-02 (1)	05-08 (1)
Far East	16-20 (1)	08-10 (1) 13-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	19-22 (1) 22-23 (2) 23-01 (3) 01-03 (2) 03-06 (1) 06-07 (2) 06-09 (3) 09-11 (2) 11-13 (1)	03-06 (1) 06-07 (2) 07-08 (1) 06-07 (1)*
South Pacific & New Zealand	10-12 (1) 12-17 (2) 17-18 (3) 18-19 4) 19-20 (3) 20-21 (2) 21-22 (1)	07-11 (1) 11-17 (2) 17-19 (3) 19-21 (4) 21-22 (3) 22-00 (2) 00-02 (1)	07-09 (4) 09-10 (3) 10-13 (2) 13-18 (1) 18-20 (2) 20-22 (3) 22-02 (1) 02-04 (3) 04-07 (2)	23-00 (1) 00-01 (2) 01-04 (3) 04-06 (4) 06-07 (2) 07-08 (1) 23-01 (1)* 01-05 (2)* 05-06 (3)* 06-07 (1)*
Australasia	09-11 (1) 15-17 (1) 17-18 (2) 18-19 (3) 19-20 (2) 20-21 (1)	09-11 (2) 14-15 (1) 15-17 (2) 17-19 (1) 19-20 (2) 20-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	07-09 (4) 09-10 (3) 10-13 (2) 13-19 (1) 19-22 (2) 22-00 (3) 00-03 (4) 03-05 (3) 05-07 (2)	02-04 (1) 04-05 (2) 05-07 (3) 07-08 (1) 04-05 (1)* 05-06 (2)* 06-07 (1)*

Time Zone: PDT (24-Hour Time) WESTERN USA TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	11-13 (1)	08-09 (1) 09-12 (2) 12-14 (1) 14-15 (2) 15-16 (1) 22-00 (1)	00-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-19 (3) 19-22 (2) 22-00 (3)	19-21 (1) 21-23 (2) 23-00 (1) 22-23 (1)
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-18 (2) 18-19 (1)	07-08 (1) 08-09 (2) 09-12 (4) 12-14 (3) 14-20 (4) 20-22 (3) 22-23 (2) 23-01 (1)	07-10 (4) 10-12 (3) 12-15 (2) 15-17 (3) 17-01 (4) 01-03 (3) 03-05 (2) 05-07 (3)	19-20 (1) 20-21 (2) 21-23 (3) 23-02 (4) 02-05 (3) 05-06 (2) 06-07 (1) 20-22 (1)* 22-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Urguay	07-08 (1) 08-13 (2) 13-15 (3) 15-18 (4) 18-19 (2) 19-20 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-17 (3) 17-21 (4) 21-23 (3) 23-00 (2) 00-01 (1)	10-15 (1) 15-17 (2) 17-18 (3) 18-01 (4) 01-03 (3) 03-06 (2) 06-08 (3) 08-10 (2)	19-20 (1) 20-21 (2) 21-02 (3) 02-03 (2) 03-05 (1) 20-22 (1)* 22-02 (2)* 02-03 (1)*
McMurdo Sound, Antarctica	11-15 (1) 15-18 (2) 18-19 (1)	10-15 (1) 15-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	16-18 (1) 18-20 (2) 20-02 (3) 02-04 (2) 04-07 (1) 07-09 (2) 09-10 (1)	00-04 (1) 04-06 (2) 06-07 (1)

Time Zone: PDT (24-Hour Time) WESTERN USA TO:				
Central & Northern Europe & European USSR	Nil	07-09 (1) 09-11 (2) 11-13 (1) 13-14 (1) 14-16 (1) 22-00 (1)	12-14 (1) 14-16 (2) 16-17 (3) 17-23 (2) 23-01 (1) 06-08 (2) 08-09 (1)	19-23 (1)
Eastern Mediterranean & Middle East	Nil	07-09 (1) 09-11 (2) 11-13 (1) 13-14 (2) 14-15 (1) 22-00 (1)	12-15 (1) 15-17 (2) 17-19 (3) 19-23 (2) 23-01 (1) 06-08 (1)	20-22 (1)
Western & Central Africa	10-13 (1) 13-16 (2) 16-17 (1)	08-11 (1) 11-13 (2) 13-17 (3) 17-19 (2) 19-20 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-03 (2) 03-08 (1)	21-23 (1)
Eastern Africa	13-16 (1)	09-13 (1) 13-15 (2) 16-17 (3) 17-18)2) 18-19 (1) 00-02 (1)	13-16 (1) 16-18 (2) 18-21 (3) 21-23 (2) 23-00 (1)	Nil
Southern Africa	09-11 (1) 11-13 (2) 13-15 (1)	08-10 (1) 10-12 (2) 12-14 (1) 14-15 (2) 15-16 (3) 16-17 (2) 17-18 (1)	13-15 (1) 15-17 (2) 17-20 (3) 20-22 (2) 22-00 (3) 00-02 (2) 02-06 (1) 06-08 (2) 08-10 (1)	19-21 (1) 21-22 (2) 22-23 (1) 21-22 (1)*
Central & South Asia	17-19 (1)	08-09 (1) 09-11 (2) 11-13 (1) 16-18 (1) 18-21 (2) 21-23 (1)	06-07 (1) 07-09 (3) 09-11 (1) 19-21 (1) 21-23 (2) 23-01 (1)	05-07 (1) 17-19 (1)
Southeast Asia	16-19 (1)	09-10 (1) 10-12 (3) 12-13 (3) 13-16 (1) 16-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	23-01 (1) 01-02 (2) 02-04 (3) 04-07 (2) 07-09 (3) 09-11 (2) 11-14 (1)	03-07 (1)
Far East	12-14 (1) 14-16 (2) 16-18 (1)	09-10 (1) 10-12 (2) 12-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-22 (2) 22-23 (1)	19 21 (1) 21-23 (2) 23-01 (3) 01-04 (4) 04-05 (2) 05-06 (1) 06-08 (2) 08-10 (3) 10-12 (2) 12-14 (1)	01-02 (1) 02-03 (2) 03-05 (3) 05-06 (2) 06-07 (1) 03-06 (1)*
South Pacific & New Zealand	10-13 (1) 13-15 (2) 15-18 (3) 18-20 (4) 20-21 (2) 21-22 (1)	08-10 (1) 10-12 (3) 12-15 (2) 15-18 (3) 18-22 (4) 22-00 (3) 00-02 (2) 02-03 (1)	07-09 (4) 09-11 (3) 11-13 (2) 13-17 (1) 17-19 (2) 19-21 (3) 21-03 (4) 03-05 (3) 05-07 (2)	22-23 (1) 23-00 (2) 00-03 (3) 03-06 (4) 06-07 (3) 07-08 (1) 23-01 (1) 01-06 (2)* 06-07 (1)*
Australasia	13-15 (1) 15-18 (2) 18-20 (3) 20-21 (1) 21-22 (1)	07-08 (1) 08-10 (2) 10-17 (1) 17-19 (2) 19-21 (3) 21-23 (4) 23-00 (3) 00-03 (1)	12-20 (1) 20-22 (2) 22-23 (3) 23-04 (4) 04-06 (3) 06-08 (2) 08-10 (3) 10-12 (2)	23-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 01-03 (1)* 03-05 (2)* 05-06 (1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-12 (2) 12-14 (3) 14-16 (4) 16-17 (2) 17-18 (1)	07-08 (1) 08-09 (2) 09-14 (3) 14-19 (4) 19-20 (3) 20-22 (2) 22-00 (1)	06-08 (4) 08-11 (3) 11-15 (2) 15-18 (3) 18-04 (4) 04-06 (3)	19-21 (1) 21-01 (3) 01-03 (2) 03-05 (3) 05-06 (2) 06-07 (1) 20-22 (1)* 22-04 (2)* 04-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	09-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-16 (3) 16-22 (4) 22-23 (3) 23-00 (2) 00-01 (1)	09-15 (1) 15-17 (2) 17-18 (3) 18-01 (4) 01-02 (3) 02-06 (2) 06-08 (3) 08-09 (2)	20-21 (1) 21-00 (2) 00-02 (1) 02-04 (3) 04-05 (2) 05-06 (1) 22-01 (1)* 01-03 (2)* 03-05 (1)*
McMurdo Sound, Antarctica	13-15 (1) 15-17 (2) 17-19 (1)	12-16 (1) 16-18 (2) 18-20 (3) 20-22 (2) 22-00 (1)	09-11 (1) 17-19 (1) 19-20 (2) 20-01 (3) 01-03 (2) 03-04 (1) 06-08 (2)	22-23 (1) 23-01 (2) 01-04 (1) 04-06 (2) 06-07)1)

Announcing *(from page 6)*

through Aug. 4 and 1700-2300Z Aug. 5-6; SSB 28.350, 21.350, 14.270, 7.270, CW 28.150, 21.060, 14.060, 7.060, plus RTTY (SWLs welcome). For unfolded certificate send QSL and 9 × 12 SASE with 45 cents postage. For QSL or folded certificate send QSL and no. 10 SASE to Randy Phelps, KD8JN, 1226 Delverne Ave. SW, Canton, OH 44710.

K8DAC, from Saginaw, MI; Saginaw Valley ARA; 1400-2300Z Aug. 5; SSB Novice phone portion of 10 meters along with General phone portions of 10, 15, 20 meters. For certificate send QSL and no. 10 SASE (folded) or 9 × 12 SASE (unfolded) to K8DAC, SVARA, P.O. Box 1783, Saginaw, MI 48605.

9-Land, from Colorado's 14,000 foot mountain peaks; Arapahoe Radio Club; 1600-1800Z Aug. 12; CW 14,050-14,060, with participants calling "CQ 14," phone around 14,285 calling "CQ Fourteeners." QSL direct or to K9AY, 7318 S. Birch St., Littleton, CO 80122.

CJ2MO, from World Youth Baseball Championship, Trois-Rivieres, Quebec, Canada; ARC VE2MO; Aug. 10-20; SSB 10, 15, 20 meters. For special QSL send QSL and SASE to P.O. Box 1473, Trois-Rivieres, Quebec, Canada G9A 5L6, or to QSL Mgr. VE2AJD, any Callbook since 1955.

•The following hamfests, etc., are slated for August:

Aug. 5-6, **Cedar Valley ARC Summerfest 89,** Teamsters Hall, Cedar Rapids, IA. Contact Summerfest 89, Cliff Goldsberry, 2926 Shaffer Dr. SW, Cedar Rapids, IA 52404, or call 319-365-8849.

Aug. 5-6, **1989 Greater Jacksonville Amateur Radio and Computer Show,** Prime Osborn Convention Center, Jacksonville, FL. Contact Greater Jacksonville Hamfest Assn., P.O. Box 10623, Jacksonville, FL 32207 (SASE).

Aug. 6, **Greenfield Amateur Repeater Assn. Hamfest,** 4H Fairgrounds, Greenfield, IN. Contact Keith Dalrymple, N9GWK, 2210 Wayne Dr., Greenfield, IN 46140 (317-326-4478).

Aug. 6, **Portage ARC Hamfair,** Portage County Fairgrounds, Randolph, OH. Contact Joanne Solak, KJ3O/8, Portage ARC, 9971 Diagonal Rd., Mantua, OH 44255.

Aug. 6, **Winchester Hamfest,** Clarke County Ruritan Fairgrounds, west of Berryville, VA. Contact Joanne Blaker, WB2CMV, 703-869-4878, or write to SVARC, Box 139, Winchester, VA 22601.

Aug. 12, **Burlington ARC Hamfest,** Essex Junction, VT. Contact Barb Kimball, N1DLE, 1 Sundown Dr., Williston, VT 05495 (802-878-5555).

Aug. 12, **Rhinelander Swapfest,** Rhinelander Ice Arena, Rhinelander, WI. Contact Leonard Bauman, K9RMN, 804 Lincoln St., Rhinelander, WI 54501 (715-369-3296, or 369-5564).

Aug. 12-13, **ARK-LA-TEX Hamfest,** Shreveport Convention Hall, Shreveport, LA. Contact Shreveport ARA, P.O. Box 37632, Shreveport, LA 71133-7632.

Aug. 12-13, **Golden Spread Hamfest,** Amarillo Civic Center Exhibition Hall, Amarillo, TX. Contact Golden Spread Hamfest, P.O. Box 1524, Amarillo, TX 79105-1524.

Aug. 13, **Grant County ARC Swapfest,** Play Acres Park, Fairmount, IN. Contact Dennis Clevenger, KA9JUB, 516 S. Walnut St., Fairmount, IN 46928.

Aug. 13, **St. Cloud ARC Hamfest,** Whitney Senior Center, St. Cloud, MN. Contact SCARC, Box 141, St. Cloud, MN 56302.

Aug. 13, **Northwest Indiana Hamfest and Computer Fair,** Porter County Fairgrounds and Expo Center, east of Valparaiso, IN. Contact Hamfest Committee, PCARC, P.O. Box 1782, Valparaiso, IN 46384.

Aug. 13, **Mid-Atlantic ARC Hamfest,** Bucks County Route 611 Drive-In Theater, Warrington, PA. Contact Al Maslin, W3DZI, 215-446-4936, or write to MARC, P.O. Box 352, Villanova, PA 19085.

Aug. 13, **Central Kentucky ARRL Hamfest,** Scott County High School, Georgetown, KY. Contact Bill DeVore, N4DIT, 112 Brigadoon Parkway, Lexington, KY 40503 (SASE).

Aug. 18-20, **Northcentral Montana Hamfest,** B.N. Campground, south of Havre, in Beaver Creek Park. Contact W7IDK, Hi-Line ARC, 16 Ninth St., Havre, MT 59501.

Aug. 19, **Tri-County ARA Hamfest 89,** Palomares Park Recreation Hall, Pomona, CA. Contact Joe Lyddon, WB6UFX, 6879 Sard St., Alta Loma, CA 91701 (SASE). (VEC exams.)

Aug. 19, **Ramapo Mountain ARC Hamfest and Computer Fleamarket,** American Legion Hall and Grounds, Oakland, NJ. Contact Marc, WA2S, 201-652-1318.

Aug. 19, **Finger Lakes Hamfest,** 4H Acres, north of Ithaca, NY. Contact Bob, KD2IM, 607-347-4444.

Aug. 19-20, **Northwestern Div. Convention and Tacoma Hamfair,** Tacoma, WA. Contact Radio Club of Tacoma, P.O. Box 11188, Tacoma, WA 98411, or call RCT at 206-759-2040.

Aug. 19-20, **Huntsville Hamfest,** Huntsville, AL. Contact David L. Reasoner, N4KTY, 3103 Holly Hill Rd., Huntsville, AL 35802 (205-883-7629). (VE exams.)

Aug. 20, **Tri-States Swapfest,** Eagles Alps Lodge, Quincy, IL. Contact Michael Nowack, NA9Q, c/o WIARC, P.O. Box 3132, Quincy, IL 62301 (217-224-8526).

Aug. 20, **Warren ARA Hamfest,** Trumbull Branch Campus of Kent State University, Warren, OH. Contact Warren ARA Hamfest, P.O. Box 809, Warren, OH 44482.

Aug. 20, **Tippecanoe ARC Hamfest,** Tippecanoe County Fairgrounds, Lafayette, IN. Contact D.C. Roberts, 5124 jackson Highway, West Lafayette, IN 47906.

Aug. 25-27, **ARRL Southwestern Div. Convention,** LA Airport Hilton Hotel, Los Angeles, CA. Contact HAMCON Inc., P.O. Box 18201, Encino, CA 91416-8201.

Aug. 26, **Arctic ARC Hamfest/Swapmeet,** Moose Lodge, Fairbanks, AK. Contact Joan Soutar, N0AJW, P.O. Box 81389, Fairbanks, AK 99708.

Aug. 26-27, **Computerfest 89,** Hara Arena, Dayton, OH. Contact Mark Hanslip, 143 Schloss Lane, Dayton, OH 45418, or call 513-263-FEST.

Aug. 27, **Marysville Hamfest,** fairground, Marysville, OH. Contact Union County ARC, 13613 U.S. 36, Marysville, OH 43040 (513-644-0468, W8BJN).

Aug. 27, **St. Charles ARC Hamfest 89,** Blanchette Park, St. Charles, MO. Contact Mike Nolan, KA0UXQ, 16 Gateswood Dr., St. Peters, MO 63376.

Aug. 27, **Five-County Swap-Shop and Michigan State ARRL Convention,** Saginaw Civic Center, Saginaw, MI. Contact Saginaw Valley ARA, P.O. Box 1783, Saginaw, MI 48605-1783.

Aug. 27, **Lebanon Hamfest,** Cedars of Lebanon State Park, south of Lebanon, TN. Contact Mary Alice Fanning, KA4GSB, 4936 Danby Dr., Nashville, TN 37211 (615-832-3215).

Aug. 27, **Danville Area Hamfest,** UAW no. 579 Civic Center, Danville, IL. Contact John Cunningham, WA9WJG, 1703 E. English, Danville, IL 61832 (217-443-0100).

Ham Shop

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TUBES AND PARTS of all kinds. All are priced very reasonably. SASE for list to Arne, 5725 West Lake St., Minneapolis, MN 55416.

WANTED: 1945–46 issue of *CQ* magazine. Quote Dennis G. Eksten, W9SS, 5006 N. Second St., Loves Park, IL 61111-5809.

FOR SALE: Midland 13-500 Mobile 2 meter rig 144–148, 9 sets of crystals installed, comes with manual and mike, $85. DX300 SW receiver, $150. More info send SASE to P.O. Box 518, Whitehouse, FL 32220.

SELL: Clegg 99er 6 meter transceiver, HP23A Heath power supply, $50 each. KA8SBL, Calcutta, OH, phone 386-5990.

WANTEDVacuum Capacitors, Vacuum Relays, Eimac Power Tubes, Sockets, and Chimneys, Harris-Gates ATL-10A, Collins 208U-10. A. Emerald, 8956 Swallow, Fount. Vly., CA 92708.

NATIONAL RADIO CO equipment manuals and NCL-2000 parts. SASE for lists of either. Maximilian Fuchs, 11 Plymouth Lane, Swampscott, MA 01907.

CQ, QST, HANDBOOKS FOR SALE. SASE for list and prices. W3ICZ, Hemlock Farms, Box 1580, Hawley, PA 18428.

BUY: Amateur Radio Equipment, Good/Bad. For large list/$1 and SASE. Joe Bedlovies, 241 Dover Street, Bridgeport, CT 06610.

WANTED: 90, 150, 300+ mm MODERN view camera lenses. Geonar, Caltar FB. Toyo-Omega 45D lens boards. Reflective Focusing cloth. Riteway 4 × 5 holders. HUGE ball head "Studio Ball." T.N. Colbert, WA8MLV, Burton, Ohio 44021.

FOR SALE: Kenwood TS-820S with DI6. R/O and CW filter, oper. and service manuals, $470. J. Robinette, N8ISU, 6312 Austinburg Rd., Ashtabula, OH 44004.

YOUNG HAMS: 10 Meter Youth Net. Meets on 28.375 every Wednesday at 2100Z. Join us!

WANTED: Hand keys, regular and unusual types. K8LJQ, 2023 Lannen Rd., Howell, MI 48843.

FOR SALE: Amp Supply Linear Amplifier LK800-A with three 3CX-800A7 triodes, like new, 10 hours use. Call (215) 527-7734 evenings.

WANTED: Op and service technical manual for military RTTY audio converter CV-89/URA. Will pay copy costs. D. Testa, Box 9064, Newark, NJ 07104.

JOHNSON MATCHBOX, 10–80 meters, perfect cond., use as is or excellent for parts, $35. W4NXH, 813-581-0749.

WANTED: Eimac AF-68, Globe DSB-100. Alvin Bernard, NI4Q, P.O. Box 690098, Orlando, FL 32869-0098.

FOR SALE: TRS-80 Model III Microcomputer, $50. ROM 116 RTTY-CW Interface (needs repair), $70. Flesher-demodulator TU-470, $75. Hal St-6000 Demodulator, $125. Dentron MT-3000A Antenna tuner, $100. Heathkit HF Wattmeter, $45.* Heathkit VHF Wattmeter, $40.* Hayes Smartmodem 300, $45. Epson FX + NLQ printer, $250.* Cushcraft VHF 2M antenna ARX-2B, $35. Butternut vertical antenna HF6V 80-40-20-15-10 mb., $25. Zenith 4-head VCR w/remote control, $225. Hickok Digital Multimeter LX-304, $45. Sencore transistor tester TF40, $50. RCA DC-power supply AP-704A, $40. RCA T.F. isolation transformer WP26A, $45. RCA Audio/Square-Wave generator 594B/440, $50. Superscope computer cassette recorder C-190, $30. Heathkit Amateur Novice License Program, $15. Heathkit Amateur General Class License Program, $20. Tandy 20 Meg. hard drive card, $100. DSI Frequency Counter 3550, $50. Wilson self-supported 45 foot antenna tower, $100. Mosley CL-33 HF tri-bander antenna, $100. CDE H/1VCD-45 antenna rotor, $100. Tandy model 3000 microcomputer: 10 expansion slots, 2 floppy drives 1.2 meg and 360K, 40 meg hard drive, DDGA, packet radio board, VM3 monochrome monitor, $2675.* Kenwood 7950 2M VHF transceiver, $300.* Larsen LM-150 Mobile antenna, $30. Kenwood TS-940S transceiver (antenna tuner built in), $2350.* A & B interface switch (to computer or printer), $40. Kenwood DC power supply Model KPS-12, $75.* Please call: 201-471-3798, Bill, WB2VJF, Clifton, NJ. PS: The items marked by an asterisk are not for immediate sale.

TELETYPE Model 19 w/2 TDs and nontyping reperf., vy gd cond, $50. Model 15KSR $35, 15RO $25, both gd cond. All three $95. U pick up or will del. 50 mi. $10. N3GPU, Box 1480, Columbia, MD 21061.

WANTED: Amp Supply LK-800A; Hy-Gain 400 Roto-Brake or T2X Tailtwister, 155BAS Beam. Sell: Hy-Gain #51467-10 lower mast support for Ham 4 or T2X, $35. K0MK, 218-865-6541.

SUPER HAM QTH St. Augustine, FL, Anastasia Island. Beautiful 2 bedroom 2 bathroom house on large plot. View intercoastal, walk to Ocean beach. Backyard borders saltwater canal. All appliances including central air. Mint condition only 3 years old. Asking $89,500.00. Call (516) 271-5784 night, (516) 367-8420 daytime. Ask for Fred (N2JCD).

WANT: NCG 10/160 or ICOM 475 HF transceiver. A. Williams, AA5KB, 2902 Whisper View, San Antonio, TX 78230 (512-493-0819).

WANTED: Copy of TDA7000 FM Receiver article in July 1988 *Hands-On Electronics* magazine. Al Bernard, NI4Q, P.O. Box 690098, Orlando, FL 32819 (407-351-5536).

MICROLOG AIR-1 RTTY/CW cartridge for transceiver operation using C-64 computer. Complete w/manual and cables. $100 or trade for any 2 or 6 meter gear/antennas of equal value. N4ATM, 455 Kevin Dr., Orange Park, FL 32073.

APPLE IIE program needed to learn code. Please send info to Nancy, N4SWJ, 56 Rebellion Road, Charleston, SC 29407. Thanx.

WANTED: GOOD HW-101 and HP-23p/s. G. Grove, Twin Valley, MN 56584 (218-584-8237).

KAM, C-64: Does anyone know of any good software, all mode, for this pair other than "KANTERM"? Luke, WB5JAP, 2109 Sandy Ln., Irving, TX 75060.

WANTED: Swan 350 meter: 0–800 on bottom. R. Mollentine, 7139 Hardy, Overland Pk., KS 66204.

TEKTRONIX SCOPE Plug-In, several models, $25 to $50 ea., other ham test equipment. K6KZT, 805-528-3181.

TWO METER COWL MOUNT ¼-wave disguise antenna with 2M/AM-FM splitter $12; Heathkit AM-2 SWR Meter $7. Charles Bright, WE0R, 4115 Buckley Ridge Court, St. Louis, MO 63125 (314-554-5584 after 4 PM Central time).

FOR SALE: World Radio DB-84 80/40M SSB Xcvr. 300W PEP w/115VAC and 12VDC supplies, manuals, very good cond., $95. Paul Elliott, N3GPU, Box 1480, Columbia, MD 21044.

SASE for old Radio Electronic Telegraph Publication List. Dick, 1263 Lakehurst Rd., Livermore, CA 94550-1851.

AUTOMATIC PROGRAM WANTED to convert 3 block to 2 block graphics for print shop for Commodore. Dick Randall, K6ARE, 1263 Lakehurst Rd., Livermore, CA 94550-1851.

FOR SALE: Xerox 16/8 computer, 10 megs HD, (CPM), manuals, $400, U pay shipping. R/S hand-held programmable scanner, 10 channels, $85. More info send SASE P.O. Box 518, Whitehouse, FL 32220.

WANTED: SX-88, SX-28A, HQ-180A, NC-400, NC-183D, RME 45 and 50, and spkrs. SX-71 main tuning knob, receiving tubes. Lee, W0VT, 914 Golden Bear La., Kingwood, TX 77339.

COMMODORE 64C and ComPakrat w/FAX for the PK-232, 9 inch amber monitor, manuals, cables. Perfect, $175, incl. ship. Gerard, N2BFL (212) 873-9659, eves.

WANTED: Drake TR-5 Xcvr, Cushcraft 617-6B 6M Boomer, Heil EQ-300K, Hy-Gain 205BAS, ICOM IC-735, Kenwood TS-430S or TS-530S. Forrest, (218) 865-6541, K0MK.

WANTED!! AEA MM-3 KEYER (The Morse Machine) serial number 43 stolen from DEN-TRONICS's booth at the DALLAS HAMFEST. Unit may be returned to either AEA or DEN-TRONICS no questions asked. If not returned surveillance video tapes will be released to local law enforcement agencies.

WANTED: Old AM Broadcast Radios of the 20s, 30s, 40s, 50s, and earlier. Please write with full description including condition and price. Gerry Skloot, 2923 Mandalay Beach Road, Wantagh, NY 11793 (516-221-3535).

WANTED: DRAKE MN-2700 and signal generator to 400 MHz. I'm also interested in military surplus. Please write to: Dario Siccardi, I1SIH, Via Mendozza 2/B, 16166 GENOVA, ITALY.

WANTED: BC-1016 Undulator Unit and Crossover/Transfer relays/switches w/"N" connectors, C.T. Huth, 229 Melmore St., Tiffin, OH 44883 (419-448-0007).

WANTED: A rationally priced source of aluminum tubing 6061-T6, .058 walls 1–2 inch diameter. WANTED: Round, mint Collins, SS-1R. T.N. Colbert, WA8MLV, Burton, Ohio 44021.

BUY: Amateur radio equipment, good/bad. For large list/$1 and SASE. Joe Bedlovies, 241 Dover Street, Bridgeport, CT 06610.

YAESU FT-980, filters, updates, SP-980P, MD-1, all perfect, $1195. FC-757AT, $250. IC-745, FM board, $695. FOB K1LEC, 802-886-8121.

WANTED: Rohn EF-25 erection fixture (gin pole), Ameritron RCS-8V, Kenwood AT-230, HC-10 clock. Sell: Cushcraft 22SK, A-147-22. K0MK, 218-865-6541.

WANTED: Owner's manual for the Tempo RBF-1 SWR/watt meter. Also want Tempo 20/20 HF, CT 220-TR FM trans, AC power supply/spkr, CT220-40 or CT220-80 amp, ext VFO, CT606-b2 or CT606-02 FM amp, and Tempo HF linear. Owner's manual for the VESTO 44 foot tower and platform. Anyone wishing to part with BLACK Tempo equipment please send list and prices to Wayne Smith, KC41LD, 7040 SW 17th Place, Ocala, FL 32674 (904-237-6351).

FREE: Ham Radio Gospel Tracts. SASE N3FTT, 5133 Gramercy Dr., Clifton Hts., PA 19018.

WANTED: Copy of owner's manual for the Tektronics Type 502 oscilloscope. Please send your info and price to N9GXA, Rte. #1, Box 122, Berne, IN 46711.

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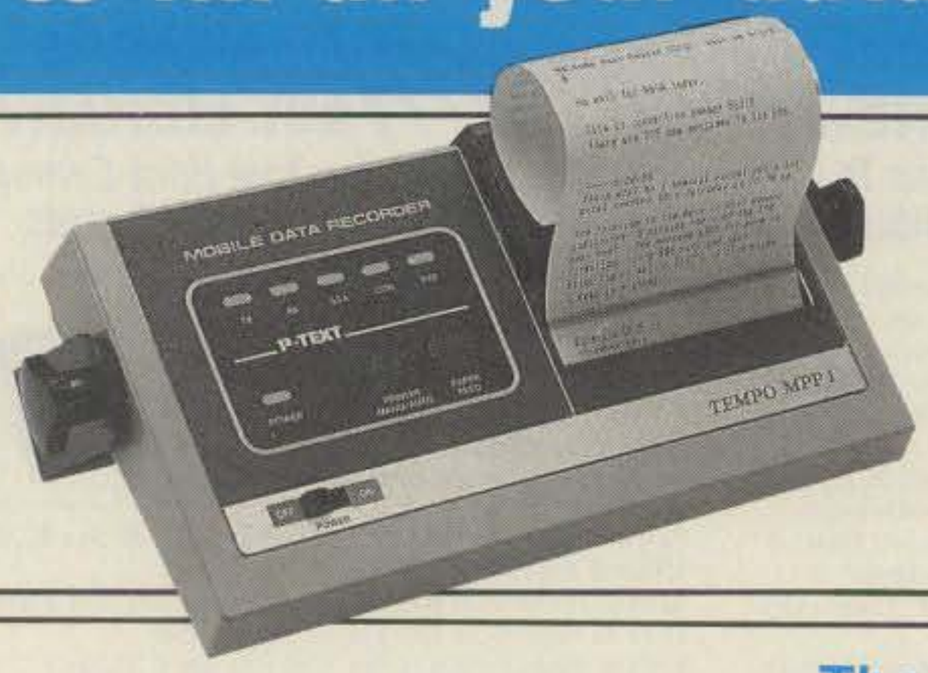

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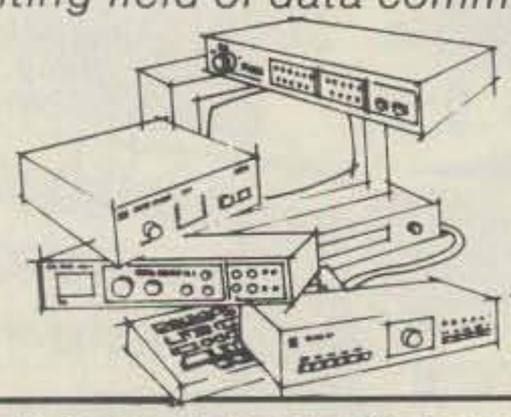

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