Amateur Radio

SERVING AMATEUR RADIO SINCE 1945
JANUARY 1997

CQ

W7XR
WAX
THE EAST COAST
10
15
20
40
80
160

In This Issue:

- Build The Box Antenna, A 2-el. Low-Band Vertical Array
- Big Changes Coming to the 13 cm Ham Band
- Lew McCoy Takes Another Look At Feedlines
- Doug DeMaw Builds A Tunable BFO for Collins Filters
- Hams In The Serb Republic

On the cover:
John Allyn, W7XR
Stanwood, WA

CQ Reviews:

- JPS NIR-12 Noise/Interference Reducer
- M. QRP Transceiver
- 1996 Version Bug and Paddle
- k Probe-Style Oscilloscope

U.S. $

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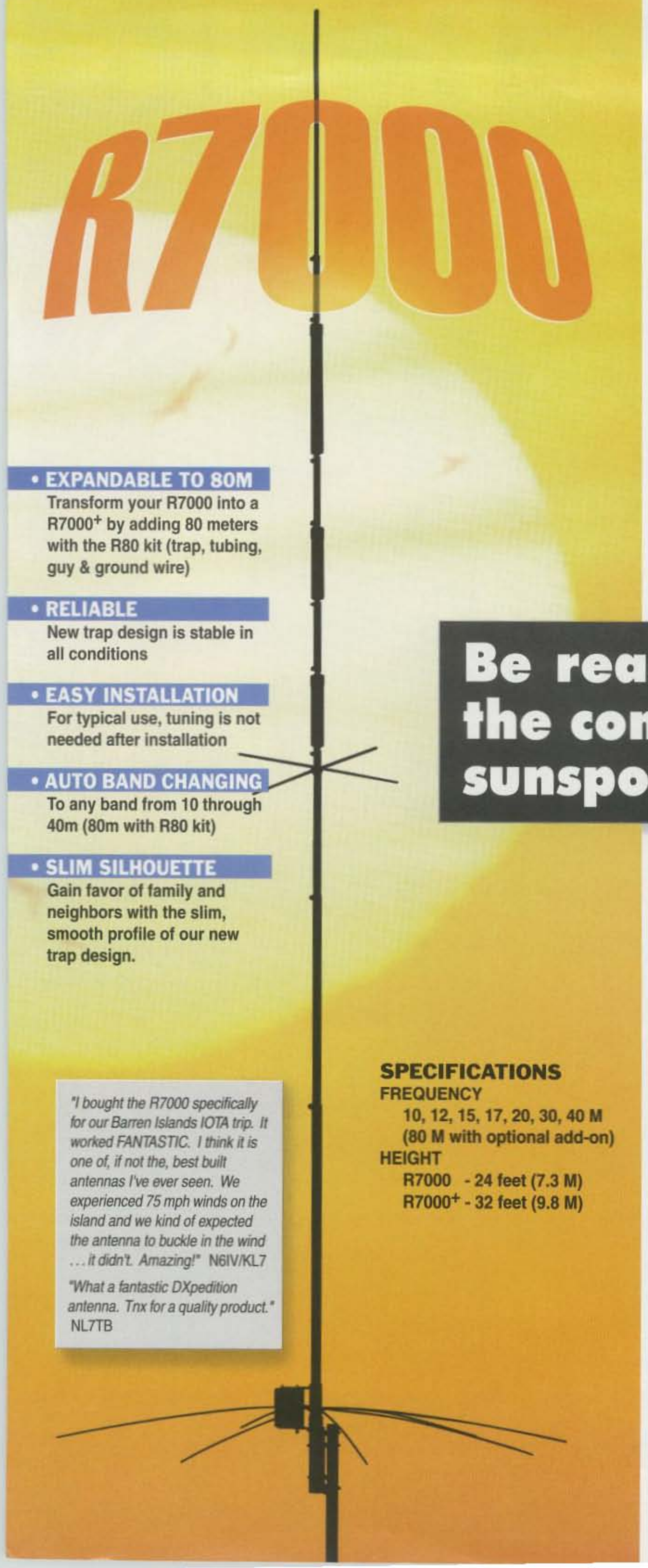
THE RADIO AMATEUR'S JOURNAL

R7000



- **EXPANDABLE TO 80M**
  Transform your R7000 into a R7000+ by adding 80 meters with the R80 kit (trap, tubing, guy & ground wire)
- **RELIABLE**
  New trap design is stable in all conditions
- **EASY INSTALLATION**
  For typical use, tuning is not needed after installation
- **AUTO BAND CHANGING**
  To any band from 10 through 40m (80m with R80 kit)
- **SLIM SILHOUETTE**
  Gain favor of family and neighbors with the slim, smooth profile of our new trap design.

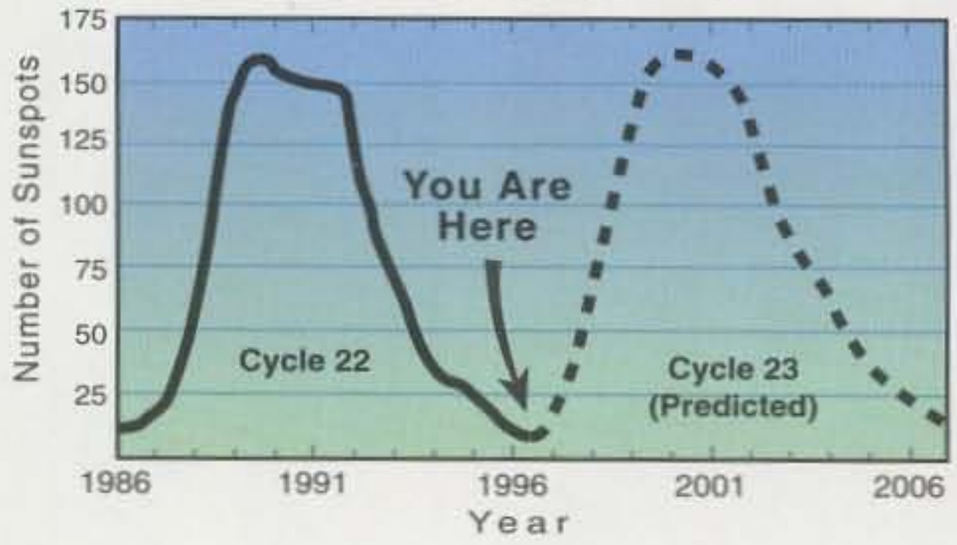
"I bought the R7000 specifically for our Barren Islands IOTA trip. It worked FANTASTIC. I think it is one of, if not the, best built antennas I've ever seen. We experienced 75 mph winds on the island and we kind of expected the antenna to buckle in the wind . . . it didn't. Amazing!" N6IV/KL7

"What a fantastic DXpedition antenna. Tnx for a quality product." NL7TB

10, 12, 15, 17, 20, 30, 40 Meter

The cold winter of low sunspots is thawing. The solar flux will soon begin it's steady climb. Cycle 23 begins Now - and Now is the time to start your station upgrades. As each month passes, DX will find it's way from 20 to 17 to 15 to 12 to 10 meters. Don't miss the action. The best operating conditions are just ahead.

SOLAR CYCLES 22 AND 23



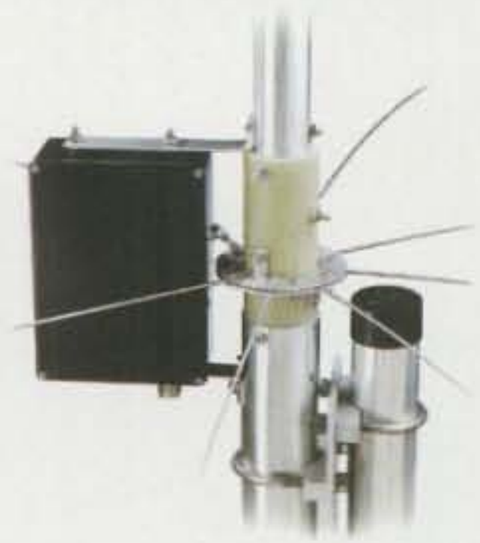
AL6063 Cover Design
The cover completes the LC circuit of the trap. The beauty is in the simplicity; these elegant trap covers make stable capacitance and higher power handling possible.

Controlled Inductance Traps
Cushcraft holds the trap inductance within close tolerance so there's less tuning and outstanding in-weather performance.

Be ready for the coming sunspot cycle!

All Materials
are either stainless steel, aluminum, or high impact plastic.

Double Wall Tubing
makes up the lower three sections. This 0.116 inches of wall insures top performance in winds up to 80 mph.



Mounting Hardware
is extra rugged and makes installation easy on any 1-3/4" to 2-1/8" OD mast.

SPECIFICATIONS

FREQUENCY
10, 12, 15, 17, 20, 30, 40 M
(80 M with optional add-on)
HEIGHT
R7000 - 24 feet (7.3 M)
R7000+ - 32 feet (9.8 M)

If you'd like to know more about the R7000 and R7000+, check it out at http://www.cushcraft.com. We'll even show you what's inside the black box and tell you how it works. Or get an R7000 brochure from your dealer anywhere in the world, hamsales@cushcraft.com, or by contacting our ham sales department.

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CORPORATION

P.O. Box 4680, Manchester, NH 03108
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Looking for value in Amateur Radio?

THIS IS HOW IT'S DONE.

ALINCO DX-70 HF+6 METER MOBILE/BASE/PORTABLE ALL MODE

NOW 100 WATTS OUTPUT ON 6M AND HF!

- 160 - 6 meters, all modes. Includes CTCSS for 6 and 10 meter FM repeaters.
- Detachable head for convenient remote mounting
- 100 memories, each capable of recording split, mode, filter and more
- Speech compressor and narrow band filter included at no extra cost
- Full QSK, semi or automatic break in
- Multi-function control simplifies operation– an Alinco exclusive
- Excellent price – superior value. You get more for less from Alinco!

ALINCO DM-1350 REGULATED DC POWER SUPPLY

- 35A (max), 30A Continuous
- Power HF, VHF/UHF Mobile, HT, laptop computer, cell phone and more
- Front panel variable voltage output (1-14V DC)
- Three different output terminals including cigar-lighter port
- Quiet internal cooling fan
- Built-in circuit protection and convenient front-panel fuse
- Meters included at no extra cost
- 110V and 220V AC input models available
- Great for bench testing and repair shop use
- Perfect for builders and experimenters

ALINCO AUTOMATIC ANTENNA TUNER EDX-2 NOW AVAILABLE!

Equip your DX-70 (or other HF Radio) with the Alinco EDX-2 Automatic Antenna Tuner. Quickly tunes any antenna from 8 to 80 feet, for any band from 10 through 160 meters (minimum 40 foot wire antenna required for 160 meter use). Perfect for base, mobile or marine use. Control cable plugs directly into the popular Alinco DX-70 mobile/base HF radio; usable with other HF units. Be sure to check the low price at your favorite dealer.

You don't have to pay more for great performance!

Simple ▪ Clean ▪ Dependable

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Specifications are subject to change without notice or obligation. Performance specifications only apply to amateur bands. Permits required for MARS/CAP use.

CQ Amateur Radio

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Features

Departments

ON THE COVER: Up in Stanwood, Washington, John Allyn, W7XR, and Ham's best friend, Tailor (an Australian shepherd with no tail), take a break from operating to pose for our roving photographer. Now as East-Coasters, your *CQ* staff could easily bristle at John's "WAX the East Coast" poster fanning the flames of coastal rivalries. The fact of the matter is, however, that's pretty much what he does with about a ton of assorted aluminum hanging from four towers ranging from 140 ft. to 190 ft. The QTH sits atop a 350 ft. bluff overlooking Puget Sound. Band-by-band, the antennas are 7/7/7 on 10, 5/5/5/5 on 15, 6/6/6 on 20, 3-el. and 4-el. on 40, and several smart wires on 80 and 160, plus a 3/8-wave vertical on 160 and remote receiving verticals down near the river. He's loud; we're jealous! (Photo by Larry Mulvehill, WB2ZPI)

Affordable DSP You Can Take Everywhere

NEW!

Kenwood introduces affordable Digital Signal Processing technology to everyone with the all-new TS-570D. Imagine a DSP radio that you can operate in the shack, the car, or on a remote DX island. The TS-570D is the first DSP rig that meets the needs of today's HF operator within a budget. From the first moment that you hear the incredibly clear and powerful audio and operate the new, common-sense ergonomic design, you will realize the TS-570D is the HF rig built for you.

The TS-570D offers the world's first CW AUTO TUNE feature which eliminates VFO adjustments during CW operation. The RCP2 Radio Control Program also allows the HF operator to design and program multiple radios with custom settings while conveniently saving them to a PC file for future use. Advanced Kenwood design and features coupled with traditional Kenwood HF performance make the TS-570D a masterpiece that you can proudly operate. If you have been waiting for a new DSP HF radio with performance at an affordable price, wait no more.

Large LCD display features a 4-stage dimmer while the 7-digit alphanumeric sub-display provides menu mode guidance, split frequency display and digital filter selection options. Easy-to-read S/PWR/COMP/SWR/ALC meters and an operating guidance feature helps to greatly simplify operation.

16-bit DSP technology delivers superb audio quality on both transmit and receive. Noise reduction (line enhancer method and SPAC), audio equalization (voice/transmit equalizer and speech processor), slope tuning and IF filter bandwidth selections can be operated with a touch of a button.

Power output can be set between 5 ~ 100 watts in 5 watt increments. 5 watt setting is ideal for QRP operation.

Preset auto antenna tuner

10-key direct frequency entry

World's first CW Auto Tune eliminates VFO adjustments during CW operation.

Quick memory provides five channels for on-the-fly frequency control: M.IN stores data, MR recalls it.

Electronic keyer provides speed settings of between 0 and 100 wpm and dual key inputs on the back – one for the paddle and one for the key.

Menu system offers 46 types of functions to assist novice thru extra class operators.

A wealth of scanning capabilities enhance operability. Scan speed is variable and can be set for time-based or carrier-based resume. Scanning can work across channels, groups of 10 channels, all except locked out channels, or it can be programmed to scan a frequency range between two channels.

• Mobile/fixed station size (10-5/8 x 3-3/4 x 10-11/16 in) • Heavy-duty design • CW message memories
• CW reverse mode • Full break-in and semi break-in • High-speed 57600 bps PC control • Dedicated packet port

TS-570D
HF Transceiver

With a half century of engineering and design experience to draw upon, Kenwood is changing the future of HF communications technology. High quality TX-RX audio reproduction with extremely effective DSP interference reduction delivers pleasing performance to your ear and over the air. A large, easy-to-read LCD display with a built-in on-screen operator guidance system for simple operation. Features like 10-key direct frequency entry with new "soft-touch" keys, auto-antenna tuner, 100 to 5 watt for QRP operation, variable scanning speed, built-in CW keyer, ANT 1-ANT 2 ports, IF shift control, RS-232C com-port, 100 memory channels, CW reverse, optional VS-3 voice synthesizer and DRU-3A digital recording unit makes the TS-570D the radio for you.

ISO 9002
Meets ISO Manufacturing Quality System

With RCP2 software, build different radios on screen and save all your functions and settings to a file for future use.

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Customer Support/Brochures (310) 639-5300
KENWOOD ELECTRONICS CANADA INC.
6070 Kestrel Road, Mississauga, Ontario, Canada L5T 1S8

ZERO BIAS

AN EDITORIAL

It's time to write 1997 now, and many of us will slip and put down 1996 for a while until the change really sinks in. The new year is more than simply turning or ripping a page in the calendar. It comes with built-in tradition and customs. We're supposed to make resolutions, especially positive ones that we know deep down will not be kept or met. Maybe a few minor ones slip through each year and over time will add up to a positive change. This doesn't mean that things in general are negative or bad. It's just that for the short period around New Year's Eve we are conditioned to think in terms of change, improvement, and our future goals. This prompts a lot of feelings of nostalgia, of things gone by, and a sense of time either spent well or rued. It's where we've been and where we're going with whatever time is left to us. If we've been lucky, or if we're completely truthful, there have been a lot of good times with good memories in years past. Sometimes we simply just have to remind ourselves.

Not long ago, while I was working on my great outdoor project to clean up the rat's nest of cables coming into the shack, I was feeling a bit smug in thinking that I had all the right tools in my shop to execute my super plan. Many of you who have known me for a long time are aware that I've been a tool junky most of my life. Somehow I always need something else to finish what I'm working on. These days it's more of an impulse than a need, but the feeling is still there. So there I was in my shop gathering the tools I would need to work on this project and even looking for some that had been stored away for a long time. No big deal.

A little more than halfway through the project, as I was looking at what I was working on, it dawned on me that a lot of these tools had something in common. They all somehow involved the subway. Here I was bending metal to fabricate some parts using a bending-break that as a youth I had dragged home on the subway (and two buses). It had come from Lafayette Radio & Wire (in those days you said the full name) and cost about $20—an enormous sum. I was also using an assortment of Greenlee chassis punches carefully purchased one at a time from places such as Harrison Radio, Terminal Radio, Arrow Electronics, and a number of other stores now remanded to history. I had—and have—all the popular sizes for just about any tube socket, Amphenol connector, and even the little square job for Cinch-Jones fittings. The little tabletop drill press I was using, a Rockwell (from Pittsburgh, not Cedar Rapids), is still very heavy (no plastic parts in those days), and I remembered the trip to Auslander's Hardware Store near Cortlandt Street to buy it. It was a fortune to me at the time and seemed to take forever to get home.

There were other tools and other memories evoked—all of the stuff I had made over the years, some of which worked and others that just sat there never doing anything. A lot of those memories involved the subway and buses, as I was too young to drive. They also involved my saving allowance, getting odd jobs, and finding part-time work around the neighborhood in order to make the money which was oh so carefully spent. It was the anticipation of things to come that made it all worthwhile and great.

While I still have most of the tools and all of the memories, those early projects are long since gone. New projects have always come up, such as the one I've been working on lately. Granted, I can afford more parts and tools now at my age than I could at 16 or 17, but my projects have become far more utilitarian. Maybe they're just as grandiose as the projects of my youth, but from this perspective, they're utilitarian. One thing is certain, though: Nostalgia shifts during various periods of your life, and these are the days I'll be talking about in years to come. Another difference now is that I tend to take pictures of things I'm working on. All of these things are little clues to remind us of the continuity of our lives, where we've been and where we are.

One peculiar phenomenon of nostalgia that I've noticed, especially among amateurs, is that it's highly selective technically. The *CQ* calendar that features vintage gear is very popular. People love to tell stories about some of the gear they may have had or coveted from those days. Maybe it's enough to see the picture to remind us of all the wonderful things that could be done, the stations worked, and a number of anecdotes about individual rigs and their peculiar design flaws. We all enjoy hearing these stories and relating ours. The gear has a life of its own.

Somehow the above doesn't hold true for all of the computers that may have passed through our shacks. No one seems too sentimental about those good old days, or wistfully imagines restoring any of it to use today. Certainly enough years have gone by to create genuine antiques and collectibles in the computer world, but the mystique and the life force symbolized by amateur gear has not been transferred to computers. They are just things to be used and discarded with no emotional attachment, much like a telephone.

Perhaps in some way that's where our nostalgia and sentiment are heading in the next century. While our typical transceivers are "shaped" in a recognizable transceiver form, more and more of them are computer driven and configured strictly by software. The individual charm and quirks will have to be programmed in to create brand differences. Maybe a subtle awareness of these changes helps to feed our love for a grounding in tradition whether or not we understand the rationale behind the tradition. We don't have to adjust the output manually, or tweak too many controls, or even throw too many switches anymore. That sense of control over the rig has been reduced to pushing a few buttons which activate another microprocessor. The rig also "knows" when we screw up and protects itself against our machinations by shutting down. It "knows" when we don't.

Perhaps the only other thing I can think of at the moment that can create the same reverie as vintage amateur gear is vintage automobiles. Maybe it's just vintage, or maybe it brings back the days of character, individuality, and a personal hands-on involvement with smooth operation of the machine or rig. Most of us can remember not only our first rig, but also our first car, and both memories have been vastly modified by time, even as to how much oil the automobile really burned.

So as we enter the new year and experience all the new things that will impinge on our senses, it's somehow comforting to look temporarily at what we've left behind. What we have now and what we're likely to get in the years ahead is infinitely better in performance, durability, design, and versatility. It's also far cheaper now in terms of today's dollars and yesterday's dollars. If during the course of 1997 we feel the need for a quick nostalgia fix in amateur radio, we simply can read through any of the license manuals, General or above. We can read about theory and circuitry and work on simple problems. To get out of the nostalgia mode, simply open up your transceiver and try to point to all the sections you just read about. (It's not fair to consult the service manual.) Next try to make all the measurements you just calculated. This, of course, teaches us all the concept of humility. That's why the present license exams and requirements are very important. They satisfy our day-to-day need for nostalgia and sentiment, giving us the illusion of control and expertise. I think that most of us can agree in principle that this doesn't really have to extend to performing our own repairs, as we know we could if we had to.

As I completed my outdoor project and stored away my bending-break, I thought again about the 17 tube AM transmitter I had built for 6 meters. It was capable of producing a whopping 25 watts and weighed about 100 pounds. It was beautiful—and big. So much for nostalgia. I turned out the light in the shop, went upstairs to my shack, and looked at what is available to me today, equipment that I probably can't fix or modify that easily. I wouldn't change a thing, but more would be nice.

73, Alan, K2EEK

NEW Xplorer

It's a receiver

a counter, a recorder, a decoder...

•Two-Line LCD display, first line displays frequency. Second line switches between either CTCSS, DCS, DTMF, Signal Strength, or Numerical Deviation.

The New Xplorer Test Receiver. Ideal for any two-way communications testing or monitoring. The Xplorer is a value packed performer integrating the functions of a CTCSS, DCS, and DTMF Decoder, Frequency Recorder, Nearfield Receiver and more into one hand-held unit. No more guessing when programming a frequency for monitoring-the Xplorer captures nearfield frequencies off the air from 30MHz - 2GHz in less than 1 second. The New Xplorer; providing the power of handheld portability with state of the art functionality and performance.

NMEA-0183 GPS Interface,-Connect your GPS to the Xplorer for Mapping applications.
(GPS and Mapping Software not included)

•Built-in Speaker. All frequencies received are demodulated for instant monitoring.

...and the last instrument you will ever NEED.

Features & Specifications

•Easy touch control pad. F1 & F2 keys control all Xplorer functions. Hold, Skip, Store and Lockout all enabled through the keypad.

- •Frequency Lock Out, Manual Skip, and Auto or Manual Hold
- •Internal Speaker, Audio Earphone/Headphone Jack
- •Built-in PC Interface, PC Connection Cable and Download Software included
- •Relative ten segment Signal Strength Bargraph
- •Optimum Maximized Sensitivity for increased nearfield distance reception
- •Tape Control Output with Tape Recorder Pause control relay and DTMF Encoder for audio data recording
- •High speed FM Communications Nearfield Receiver, sweeps 30MHz - 2GHz in less than 1 second
- •Two line LCD displays Frequency and either CTCSS, DCS, DTMF, Deviation or Signal Strength
- •NMEA-0183 GPS Interface provides tagging data with location for mapping applications
- •Frequency Recording Memory Register logs 500 frequencies with Time, Date, Number of Hits and Latitude/Longitude. *(Latitude & Longitude coordinates are only displayed in memory when used with GPS)*
- •Real-Time Clock/Calendar with lithium battery back-up
- •Built-in Rapid Charge NiCad Batteries with 5 hour discharge time and Power Supply included
- •Numerical Deviation Display with 1-10kHz and 10-100kHz ranges
- •Telescoping Whip full range Antenna included

Introductory Price **$899**

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ANNOUNCEMENTS

• **FAR Scholarships for 1997** – The Foundation for Amateur Radio, Inc. plans to administer 60 scholarships for the academic year 1997–98 to assist licensed radio amateurs. Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college, or technical school. The awards range from $500 to $2500 with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Clubs, especially those in Delaware, Florida, Maine, Maryland, New Jersey, Ohio, Pennsylvania, Texas, Virginia, and Wisconsin are encouraged to announce these opportunities. Additional information and an application form may be requested by letter or QSL card, postmarked prior to April 30, 1997 from FAR Scholarships, 6903 Rhode Island Ave., College Park, MD 20740.

• **Central Texas HF Society Special Event** – The Central Texas HF Society will operate from Waco, Texas from 0000Z January 7 to 2400Z January 12 to commemorate the 127th anniversary of the Waco Suspension Bridge on phone and CW, 160–15 meters, Novice 10 meter subband, and 146.58 FM. For a certificate send your QSL and two stamps to Larry Merritt, KC5BFM, P.O. Box 3501, Waco, TX 76707.

• The following hamfests, etc., are slated for January:

Jan. 4, **LARC Hamfest & Computer Fair**, Lakeway ARC, Talley Ward Recreation Center, Morristown, Tennessee. Contact Perry Hensley, KS4QK, 423-828-4848, or mail to LARC Hamfest, P.O. Box 895, Talbott, TN 37877-0895. (Exams.)

Jan. 4–5, **Southwest Florida Hamfest & Computer Show**, Ft. Myers ARC, Cape Coral American Legion and Power Squadron, Cape Coral, Florida. Contact Jackie Kampfert, KQ4MZ, P.O. Box 61183, Ft. Myers, FL 33906 (941-542-6675).

Jan. 11, **NCARC Winter Superfest**, Larimer County Fairgrounds, Fort Collins, Colorado. Fotr table information contact Jeanene Gage, NØYHY, at 970-351-7327; or for general information call 970-352-5304. (Exams.)

Jan. 11, **Amateur Radio Council of Arizona and ThunderBird ARC WestFest**, Glendale Community College North Parking Lot, Glendale, Arizona. Contact Mark Fellhauer, KC7BXS, 4730 West Northern, Glendale, AZ 85301-8016 (602-931-1204).

Jan. 12, **WARAC Swapfest**, West Allis RAC, Waukesha Co. Expo Center, Waukesha, Wisconsin. Contact The WARAC Swapfest, P.O. Box 1072, Milwaukee, WI 53201. (Exams.)

Jan. 18, **Northwest Missouri Winter Hamfest**, Missouri Valley, Green-Hills, and Ray-Clay ARCs; Ramada Inn, St. Joseph, Missouri. For tables, preregistration, and more information, contact Northwest Missouri Winter Hamfest, c/o Gaylen Pearson, WBØW, 1210 Midyett Rd., St. Joseph, MO 64506.

Jan. 19, **Richmond, Virginia Frostfest '97**, The Showplace, Mechanicsville Tpk., Chester, Virginia. Advance tables and tickets by Jan. 4, contact Craig Spain, 804-526-9838 evenings. General info call 804-739-2269 ext FEST. Internet <http://frostfest.rats.net>.

Jan. 19, **Winter Ham Radio Fair**, Union County ARC, Hwy 347, Broadway, Ohio. Contact Union County ARC, Gene Moore, N8YRF, 24461 Claibourne Road, Marysville, OH 43040 (937-246-5943).

Jan. 19, **Metro 70cm Network Giant Electronic Fleamarket**, Lincoln High School, Yonkers, New York. For table and general information contact Otto Supliski, WB2SLQ, 914-969-1053. (Exams.)

Jan. 25, **Tennessee Valley Amateur radio Network Hamfest**, Gallatin Civic Center, Gallatin, Tennessee. Contact Bill Ferrell, 1253 Woodvale Drive, Gallatin, TN 37066 (615-230-7923, leave message). (Exams by preregistration only. Send 610 form, copy of license or certificate of successful completion, and SASE to Ronnie Gilley, 512 Hillside Drive, Gallatin, TN 37066.)

Jan. 26, **Tusco ARC Hamfest**, Ohio National Guard Armory, Dover, Ohio. Contact Howard Blind, KD8KF, 6288 Echo Lake Road NE, New Philadelphia, OH 44663 (330-364-5258).

Jan. 28, **Maryland Mobileers ARC Post Holiday Swapfest & Fleamarket**, the Odenton Volunteer Fire Dept. Hall, Odenton, Maryland. Contact Bill Ziegler, KA6TYY, 1307 Ashburton Drive, Millersville, MD 21108 (phone 410-987-2384 evenings). (Exams, for preregistration information contact Jerry Gavin, NU3D, 410-761-1423.)

2m/70cm Mobiles **FT-2500M/FT-7400H**

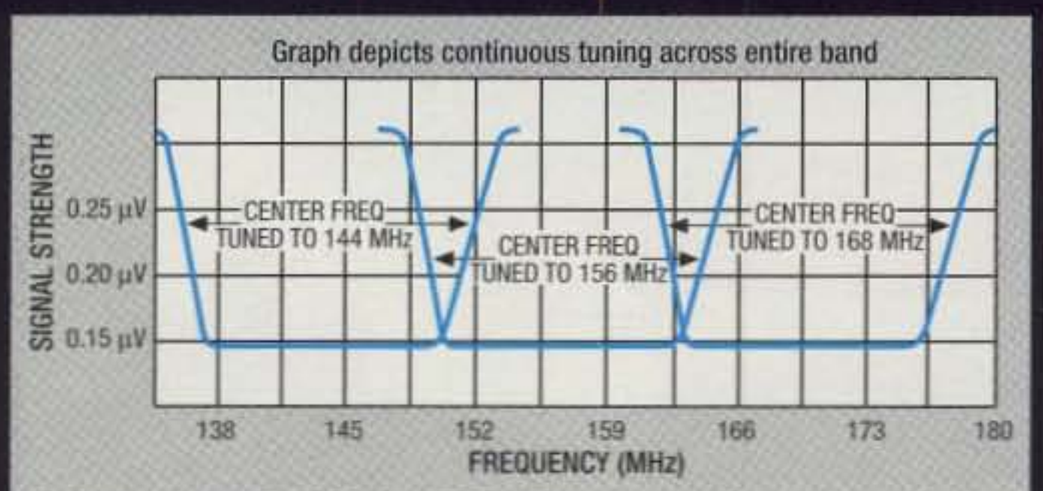
Advanced Track Tuning, Mil Spec, true FM. All in one radio!

Outside, you can easily see why the FT-2500M stands up to the shock and vibration like no other. We engineered the first mobile radio to meet the rigid standards set by the U.S. Military back in the '80s, and that same critical design is in the FT-2500M. From the simplified front panel, rubber coated knobs, durable pebbled finish coating, and huge Omni-Glow™ display to the one-piece die-cast chassis, the FT-2500M can take whatever you throw at it!

Inside, the electrical circuitry meets standards so uncompromising the FT-2500M can respond like no other radio. Built-in 3-Stage Advance Track Tuning (ATT), automatically retunes from 140 to 174 MHz permitting consistent receiver sensitivity across the entire band.

But there's more. Like alpha-numeric display capability! Lets you program a frequency or a 4-character name on any of the 31 memories. With three selectable power output levels and up to 50 watt power output, the FT-2500M extra large heat sink means forced air cooling is not necessary. And, as a bonus, Yaesu's exclusive backlit DTMF mic comes with every FT-2500M.

Experts say the FT-2500M is the only commercial-grade amateur radio available. So, for tough manufacturing standards, inside and out, with true FM clarity, and outstanding performance, the FT-2500M is your mobile.



3-Stage Advance Track Tuning (ATT) – The exclusive 3-Stage Advance Track tuning front end automatically adjusts band width sensitivity across the entire receiver range, while maintaining selectivity specifications. ATT significantly reduces interference from inter-modulation and front end overload.

Specifications

- **Frequency Coverage:**
  FT-2500M
  RX: 140-174 MHz
  TX: 144-148 MHz
  FT-7400H
  RX/TX: 430-450 MHz
- Rugged Military Spec Design
- Advanced Track Tuning (ATT)
- Selectable Alpha-Numeric Display
- Omni-Glow™ Display, largest available
- Power Output:
  FT-2500M 50/20/5 Watts
  FT-7400H 35/15/5 Watts
- Flip Up Front Control Panel hides seldom used buttons
- Backlit DTMF Mic
- 31 Memory Channels
- CTCSS Encode Built-in
- Automatic Power Off (APO)*
- Time-Out Timer (TOT)*
- Manual* or Automatic Backlighting Adjustment
- **Accessories:**

FP-800	20 Amp HD Power Supply w/ Front Mounted Speaker
FRC-6	DTMF Paging Unit
FTS-17A	CTCSS Decode Unit
SP-4	External Mobile Speaker w/ Audio Filters

*FT-2500M

YAESU

Performance without compromise.℠

"Just look inside. Military spec really means something to Yaesu!"

"A QST review says 'the FT-2500M exhibited superior 10 MHz offset IMD dynamic range of 103 db!' "

"This Advanced Track Tuning practically eliminates intermod!"

"Yaesu did it again."

US MILITARY APPROVED MIL-SPEC 810

FT-3000M

High-Powered 2-m FM Transceiver
Feature-rich, 70 full watts of TX power, and built to the tough performance standards you've come to expect from Yaesu.
FEATURES • Frequency Coverage Wide Band Receive-- RX:110-180 MHz, 300-520 MHz, 800-999 MHz* TX:144-148 MHz • AM Aircraft Receive • MIL-STD 810 Rating • Interactive Programming • High Power Output: 70 Watts, plus 50, 25 and 10 Watts • Quick-Touch™ Dual Concentric Control Knob • Twin Cooling Fans • ADMS-2 Windows™ Programmable • Digital Coded Squelch (DCS) • 81 Memory Channels • Auto Range Transpond System™ (ARTS™) • 1200/9600 Baud Packet Compatible • Smart-Search™ • Alphanumeric Display • Dual Watch • Full line of accessories
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The Box Antenna

A New High-Gain, Two-Element, Vertical Parasitic Array For The Low Bands

BY TIMOTHY P. HULICK*, PH.D., W9QQ

In March of 1995 the solution for a two element parasitic vertical array (radiator and reflector) for 75 meters was derived using the Antenna Optimizer software available from K6STI. The computer solution showed that without ground loss the gain over a dipole at a height of 40 feet was 10 dB!

When the antenna was constructed in the same month, a careful ground loss measurement was made with only the radiator in place and was found to be 10 ohms. The measured feedpoint resistance without any matching section was 22 ohms, while the lossless model indicated that it should be 12 ohms. It was decided that 10 ohms of ground loss was acceptable from a practical point of view, still providing 6 dB of gain over the dipole at a height of 40 feet. A full description of the antenna was presented in the December 1995 issue of *QST* on pp. 38–41.

After more than a year of use, the conclusion is that the antenna is indeed a pile-up buster, getting answers on the second or third call on rare occasions. The rule has been that the first call gets the answer. In spite of this performance, I've always felt that there was still room for improvement, since after all, loading coils were used and they tend to be lossy no matter what. Ground loss is one thing that may be overcome by using more and more radials. Coils or inductors, however, are just mediocre at best, and if possible should not be used in an antenna where there is a practical way to eliminate them.

In the first vertical parasitic array a self-imposed height limit for the antenna was set at 30 feet. This is about half of the required height for a quarter-wave vertical antenna. The logical way to substitute for height is with a center loading inductor, even though the inductors (one for each element) represented about 1.4 dB of loss compared to the impractical full-length antenna. This loss has been overcome by a new design only five feet higher than the original version.

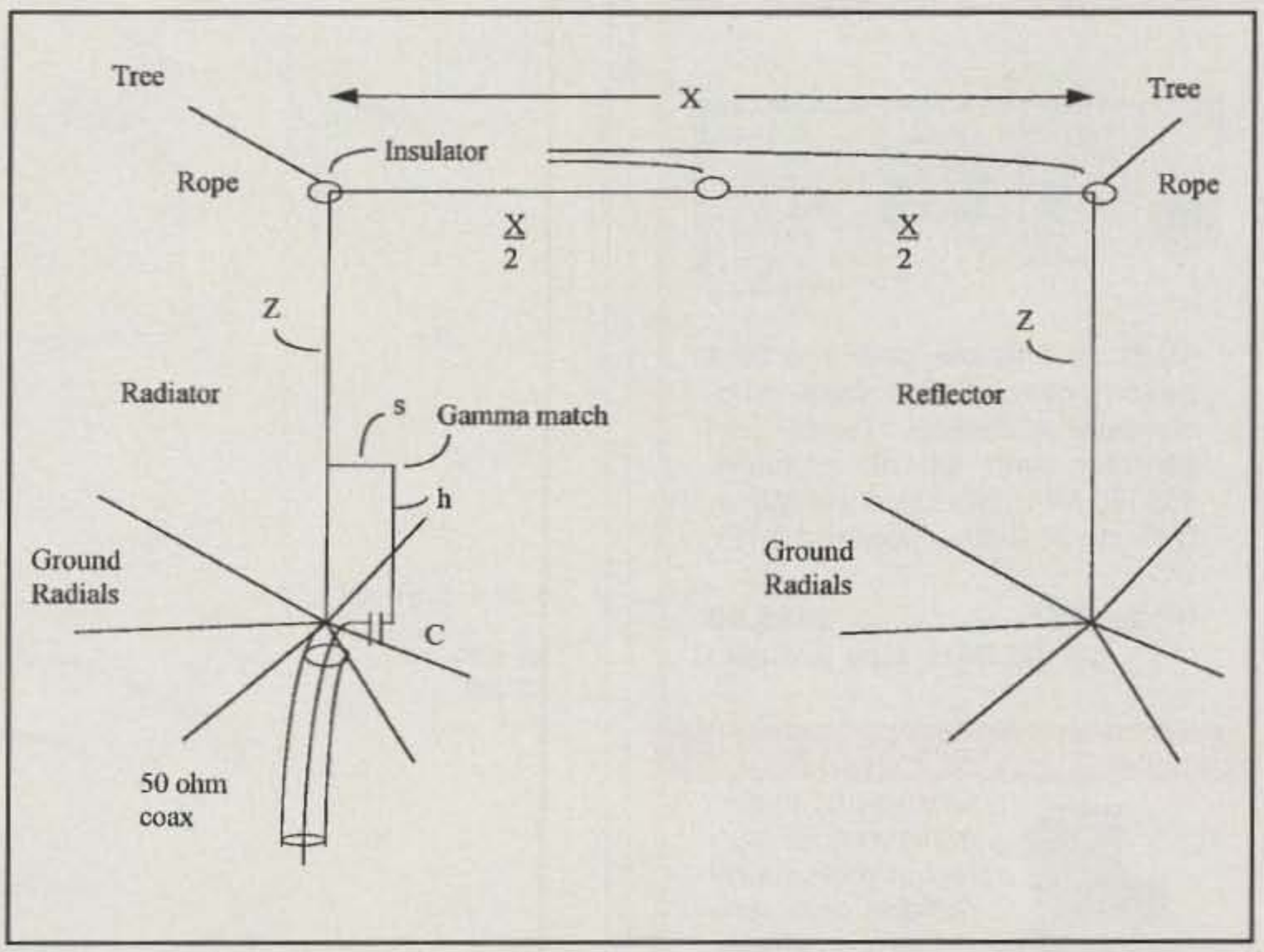

Fig. 1– The box antenna is shown here in general terms. The actual dimensions are presented in Table I.

Because the material to be presented is the result of an evolutionary process, reading the article in the December 1995 issue of *QST* is strongly suggested. It serves as background and should be understood first.

An Abridged Review

Before fully describing the new antenna, your review of the article from the December issue of *QST* should lead to most of the following ten observations about the two-element vertical parasitic array:

1. With 10 ohms of measured ground loss, gain over a dipole at 40 feet is 6 dB at a radiation angle of 5 degrees. This is a very respectable number and served as the inspiration for writing the December *QST* article.

2. The front-to-back ratio is only one or two dB at the same radiation angle.

3. The height of both elements is slightly under 30 feet. To be no more than 30 feet was a design goal.

4. Element spacing is 48 feet.

5. The fed element is the radiator, while the parasitic element is the reflector. Although not brought out in the article,

**886 Brandon Lane, Schwenksville, PA 19473-2102 <e-mail: dxyiwta@aol.com>*

Center Frequency	X	Z	s	h	C	ATC Part Number
1810	128.0	70.0	2.0	14.0	750	100E751JCA2500X
3525	67.4	35.0	2.0	6.5	390	100E391JCA2500X
3600	64.8	35.0	2.0	6.5	390	100E391JCA2500X
3795	58.0	35.0	2.0	6.5	330	100E331JCA2500X

Note: The chip capacitor, C, made by American Technical Ceramics may be obtained in single quantities from: M. Lader Co., 1495 Alan Wood Road, Conshohocken, PA 19428 (phone 610-825-3177 from 9–12 and 1–5 Eastern Time; ask for Chris Zielke).

Table I– The physical dimensions of the box antenna are given as a function of three choices of center operating frequencies in the 80/75 meter band and one in the 160 meter band. Units are kHz, feet, and pF. The dimensions are to be used in fig.1.

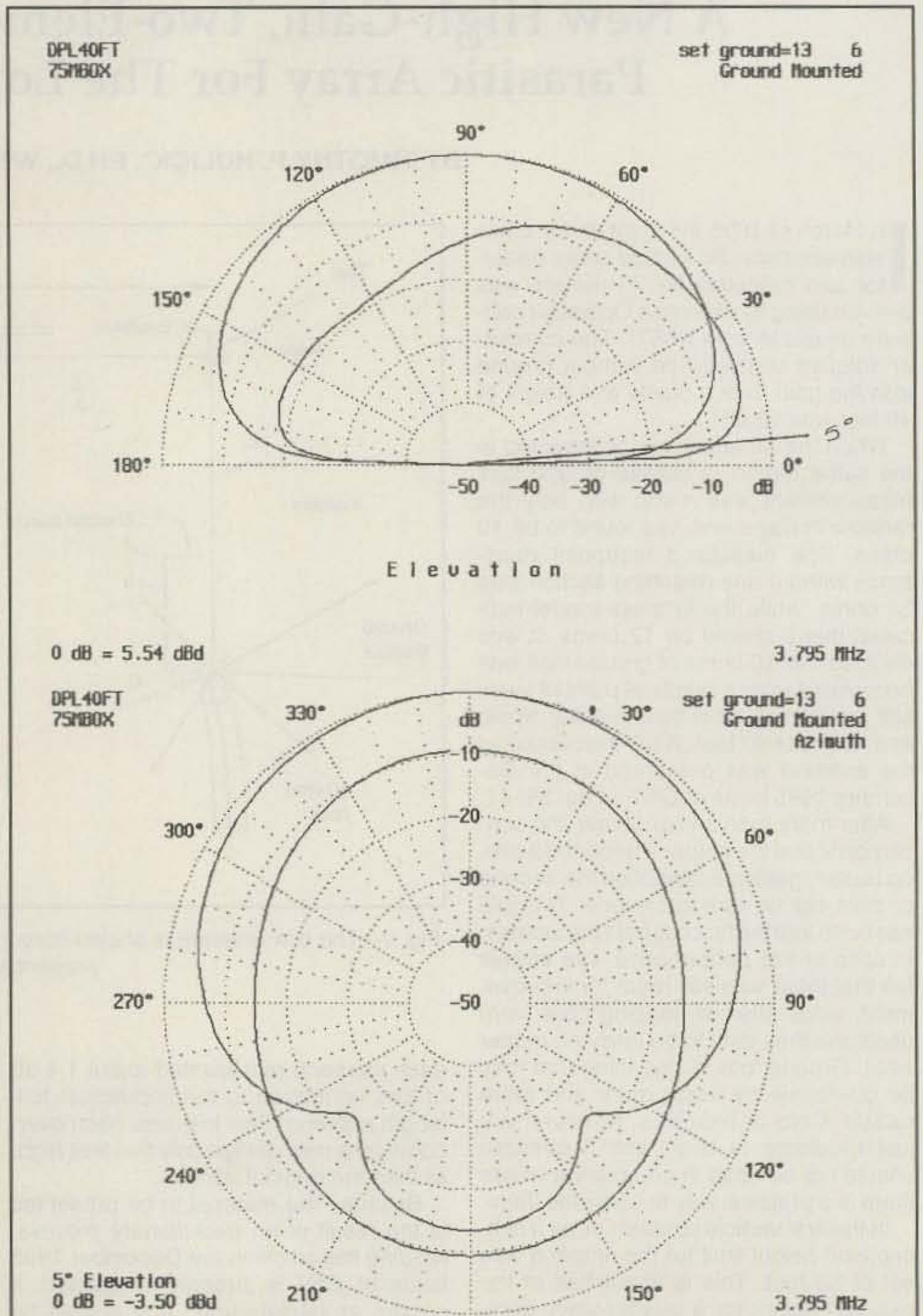

Fig. 2– In the vertical plot at 3795 kHz for a radiation angle of 5 degrees, the gain is seen to be just under 10 dB compared to a dipole at a height of 40 feet. This performance includes the actual ground loss of 10 ohms in the box antenna ground system. The azimuthal plot at the bottom shows deep nulls at the "port and starboard quarters." The front-to-back ratio at a radiation angle of 5 degrees is more than 13 dB at 3795 kHz. The new box antenna has gain over the dipole for 132 degrees of azimuth.

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Freq. in kHz	VSWR	Gain over Dipole (dB)	F/B (dB)	Gain over ver. array (dB)
3500	3.73	6.38	1.18	-
3525	3.47	6.61	1.45	-
3550	3.23	6.88	1.79	-
3600	2.77	7.53	2.74	-
3650	2.31	8.18	4.12	-
3700	1.85	8.77	6.13	-
3725	1.65	8.98	7.47	-
3750	1.45	9.14	9.13	-
3760	1.38	9.18	9.88	-
3770	1.32	9.28	10.76	-
3780	1.26	9.29	11.73	VSWR>1.5
3790	1.20	9.29	12.78	3.66
3795	1.18	9.29	13.37	3.65
3800	1.16	9.27	13.91	3.69
3805	1.13	9.26	14.59	3.78
3810	1.11	9.25	15.30	VSWR>1.5
3820	1.08	9.21	16.93	-
3830	1.05	9.16	18.82	-
3840	1.03	9.10	21.29	-
3850	1.04	9.04	24.47	-
3900	1.13	8.61	22.04	-
3950	1.14	8.16	14.55	-
4000	1.09	7.75	11.18	-

Table II– Comparing the gain of the new box antenna optimized at 3795 kHz with the dipole at 40 feet and the two-element vertical array presented in the December 1995 issue of QST.

changing the design so that the parasitic element is a director provides performance insignificantly better than the radiator alone. Therefore, it was never considered as an alternative, but many readers have asked the question.

6. The 1.5:1 VSWR bandwidth of the antenna is from 3785 to 3800 kHz—only 15 kHz.

7. The antenna is easy and inexpensive to build on a city lot with trees.

8. Two loading inductors are used, resulting in 1.4 dB of loss compared to the theoretical (not constructed) unloaded quarter-wavelength version.

9. The gamma match is used with a series 330 pF chip capacitor.

10. Feedback from fellow 75 meter DX-ers indicated that obtaining the 330 pF chip capacitor used in the gamma match was nearly impossible. This problem has been fixed and it is now readily available (see footnote in Table I). Read on!

Although the original antenna is great in the pile-ups, items 6 and 8 are negatives and are very important areas that require improvement. Item 2 may also be considered a negative, but this depends on expected use of the antenna. If working Europe is your primary objective and you still want the ability to work the VKs and ZLs off of the back, then front-to-back ratio should be small. On the other hand, if QRM off the back prevents you from easily working in the direction of gain, then more front to back is needed.

The New Box Antenna

When first observing the shape of the newly evolved antenna, the term *box* immediately came to mind. There are still two elements, and the parasitic element is a reflector (a director provides almost no desirable effect). The geometry of the new configuration is shown in fig. 1. It

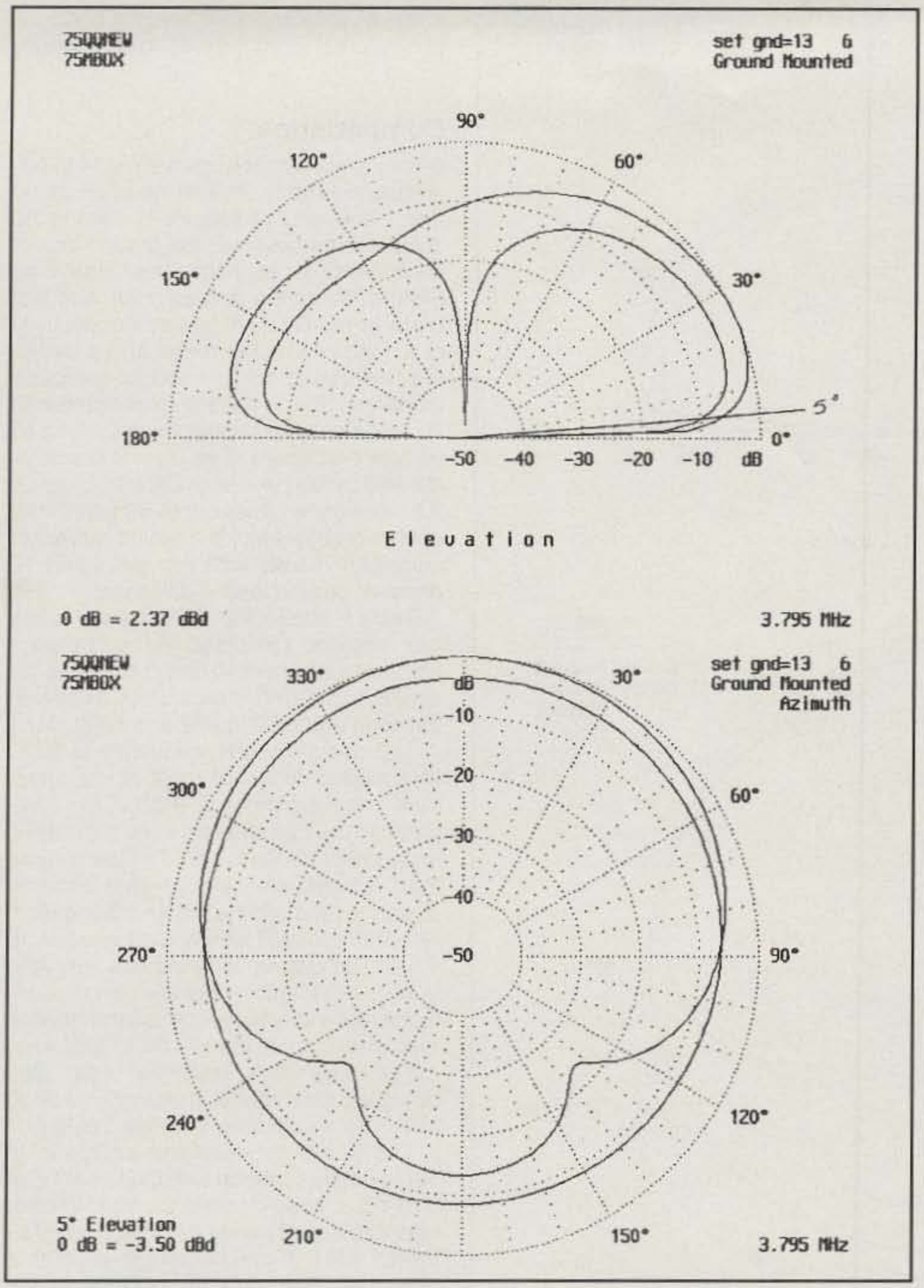

Fig. 3– The gain and front-to-back ratio of the box antenna on 3795 kHz are compared to the original design presented in the December 1995 issue of QST beginning on page 38. Gain is more than 3.6 dB higher for the box antenna at a 5 degree radiation angle, while the front-to-back ratio is improved by more than 5 dB at this frequency. Deep nulls occur with the box antenna at 134 and 226 degrees relative to the direction of maximum gain. The new box antenna has gain over the original parasitic array for nearly 180 degrees of azimuth.

should be studied with the dimensional values given in Table I for useful operating center frequencies of 3795, 3600, 3525, and 1810 kHz.

The first thing you will observe about the box antenna is that it appears to consist of a pair of inverted Ls with the ends of the horizontal sections coming together, but not connecting. Examination of the overall length of the vertical and horizontal sections indicates that this is true, since each is about a quarter wavelength long. However, the positions of the horizontal sections are crucial to the antenna's gain and front-to-back ratio. In the inverted L, the intended use of the horizontal section is for top loading; it really doesn't contribute much to the radiation pattern of the antenna, although some front-to-back ratio is realized.

In the box antenna the orientation of the horizontal sections greatly contributes to the radiation pattern, gain, and front-to-back ratio. With the two horizontal sec-

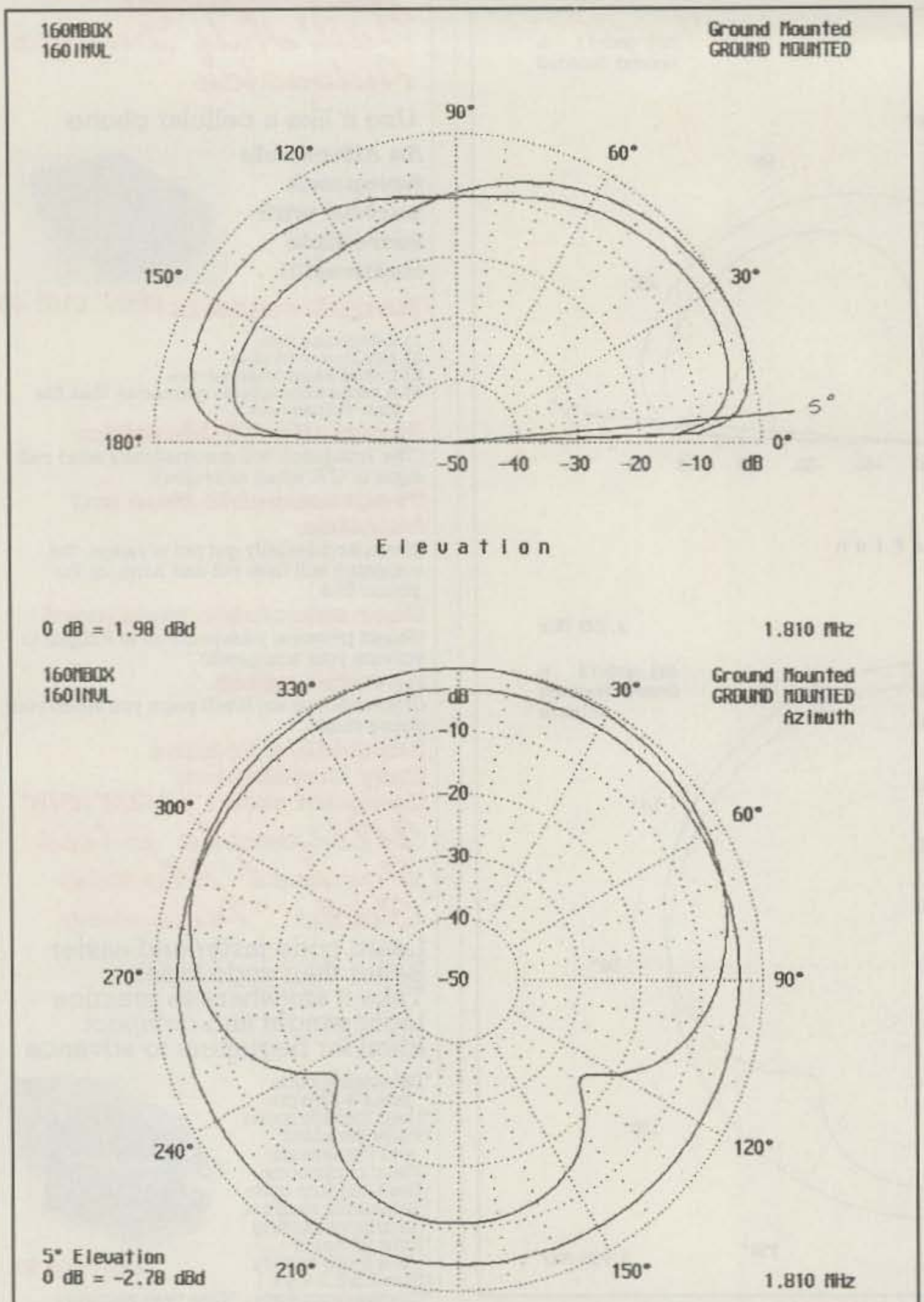

Fig. 4– Even on 160 meters the box antenna shows more than 3 dB gain on 1810 kHz compared to the inverted L antenna at a radiation angle of 5 degrees. The front-to-back ratio of the box antenna is more than 11 dB at this frequency, while the inverted L with no help shows a front-to-back ratio of nearly 5 dB due to the orientation of the horizontal loading section. The new box antenna has gain over the inverted L for about 140 degrees of azimuth.

tions pointed toward each other, gain and front-to-back ratio are optimized, but not on the same frequency. Also, the antenna is easier to construct than two inverted Ls oriented identically. Construction requires only two high supports, and from the ground appears to be continuous as one piece—up, over, and back down.

Notice also that the height of the antenna and the dimensions of the gamma match remain the same from a center frequency of 3525 to 3795 kHz. However, spacing of the vertical elements consequently changes the dimension X. The value of capacitor, C, is 390 pF at 3525 and 3600 kHz, and is 330 pF at 3795 kHz. On 160 the value of C is 750 pF. Although the original height restriction of 30 feet on 75/80 is violated here, it is felt that 35 feet is not impossible and is worth the sacrifice. It turns out to be absolutely necessary, since the performance of the antenna collapses rather quickly if any attempt is made to make it shorter. Do not try to trade off vertical height here for additional horizontal length. It just doesn't work!

Comparisons

Before any comparisons are made to reference antennas, it must be understood that 10 ohms of resistance is used in the computer modeling at the ground end of each vertical section. This simulates ground loss of the radial system and real earth at my QTH. A ground conductivity of 6 millisiemens per meter and a dielectric constant of 13 are used for computer modeling. This is the loss measured with 20 #18 insulated copper wires as long as 60 feet and as short as 20 feet (complemented by 500 feet of old RG-11/U cut up into various lengths) out to 60 feet under each element. Also, the tables represent computer results with the simulated 10 ohms of ground loss in all cases.

Table II shows the performance of the box antenna compared to the reference dipole at a height of 40 feet. It indicates the useful 1.5:1 VSWR bandwidth to stretch between about 3730 kHz and 4000 kHz.

The design center frequency is 3795 kHz. Gain throughout most of this spectrum is on the order of 9 dB. Gain compared to the two-element vertical parasitic array presented in the *QST* article is more than 3.5 dB even though that antenna is only useful over a 15 kHz bandwidth where the VSWR is less than or equal to 1.5:1. The original antenna has very little front-to-back ratio, while the new box antenna has a very respectable front-to-back ratio of up to more than 24 dB at 3850 kHz.

The new box antenna was also designed for a center frequency of 3600 kHz. The results are shown in Table III.

The same comparisons as made in Table II may be made with gain peaking at 9.31 dB at 3600 kHz and the front-to-back ratio peaking at nearly 27 dB at 3700 kHz. Useful 1.5:1 VSWR bandwidth is 3530 to 3950 kHz. Gain over the original version with the loading inductors is slightly more than 2 dB, whereas the original is useful over a much narrower bandwidth.

The new box antenna centered at 3525 kHz has results given in Table IV. Most of the 80/75 meter band is usable with a 1.5:1 VSWR bandwidth from 3500 to about 3870 kHz. Gain over a dipole peaks at 9.31 dB at 3525 kHz ,and the front-to-back ratio peaks at more than 23 dB at 3600 kHz. It also has about 1.5 dB more gain than the original antenna.

For 160 meters, comparison is made to the popular inverted L antenna, since it is felt that this is a more realistic competitor. Ten ohms of ground loss is also assumed even though this measurement was made at 3795 kHz. The presumption is made that the same number and wire size radials are used as at 3795 kHz, but they are twice as long. Unlike 80/75 meters, where

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3500	1.83	8.75	5.34	-
3510	1.71	8.86	5.76	-
3520	1.59	8.96	6.24	-
3525	1.54	9.00	6.48	-
3530	1.49	9.01	6.75	-
3540	1.39	9.08	7.29	-
3550	1.30	9.19	7.88	-
3600	1.06	9.31	11.84	-
3650	1.30	9.08	19.36	-
3700	1.41	8.63	26.92	-
3725	1.41	8.37	19.82	-
3750	1.39	8.12	15.97	-
3760	1.37	8.02	14.86	-
3770	1.35	7.97	13.86	-
3780	1.33	7.86	13.00	-
3790	1.31	7.78	12.26	VSWR>1.5
3795	1.30	7.73	11.92	2.09
3800	1.28	7.69	11.65	2.11
3805	1.27	7.65	11.32	2.17
3810	1.26	7.60	11.04	2.18
3820	1.24	7.51	10.50	VSWR>1.5
3830	1.22	7.43	10.01	-
3840	1.21	7.35	9.55	-
3850	1.20	7.27	9.15	-
3900	1.27	6.92	7.48	-
3950	1.51	6.63	6.37	-
4000	1.87	6.38	5.56	-

Table III– Comparing the gain of the new box antenna optimized at 3600 kHz with the dipole at 40 feet and the two-element vertical array presented in the December 1995 issue of QST.

the dipole is more popular, the inverted L seems to be the antenna of choice. The presentation given in Table V shows that the box antenna provides more than 3 dB of gain from 1800 to 1850 kHz as compared to the inverted L. This is not too surprising, since the box antenna is two inverted Ls with the ends of the horizontal sections meeting but not touching. Front-to-back peaks out at more than 28 dB at 1850 kHz.

Gain plots are shown in fig. 2 with the box antenna compared to the dipole at a height of 40 feet on 3795 kHz. They confirm the performance listed in Table II for a radiation angle of 5 degrees. Notice the rather deep nulls at the starboard and port quarters of the azimuth plot. This may or may not be desirable.

Fig. 3 is a plot of performance of the box antenna compared to the loaded two-element, vertical parasitic array presented in the December issue of *QST*.

The vertical plot shows the deep null

Freq. in kHz	VSWR	Gain over Dipole (dB)	F/B (dB)	Gain over ver. array (dB)
3500	1.15	9.27	8.79	-
3510	1.10	9.30	9.51	-
3520	1.06	9.31	10.37	-
3525	1.06	9.31	10.78	-
3530	1.07	9.31	11.27	-
3540	1.10	9.20	12.28	-
3550	1.14	8.97	13.45	-
3600	1.30	8.94	23.32	-
3650	1.34	8.42	21.69	-
3700	1.26	7.89	13.97	-
3750	1.15	7.41	10.49	VSWR>1.5
3790	1.13	7.13	8.71	1.50
3795	1.14	7.10	8.53	1.46
3800	1.16	7.06	8.38	1.48
3810	1.19	6.99	8.04	1.57
3820	1.22	6.91	7.73	VSWR>1.5
3850	1.36	6.73	6.95	-
3900	1.67	6.45	5.88	-
3950	2.08	6.21	5.14	-
4000	2.61	6.01	4.58	-

Table IV– Comparing the gain of the new box antenna optimized at 3525 kHz with the dipole at 40 feet and the two-element vertical array presented in the December 1995 issue of QST.

straight up and off the vertical end of the antenna, while the box antenna does not, due to the active horizontal sections of the box. The azimuth plot with the radiation angle at 5 degrees shows gain over the loaded vertical for 3795 kHz to be in agreement with thet figure in the last column in Table II.

Fig. 4 compares the box antenna with the inverted L antenna on 160 meters. The azimuth plot is for a radiation angle of 5 degrees. Deep nulls are also apparent at the starboard and port quarters.

Freq. in kHz	VSWR	Gain over inverted L (dB)	F/B (dB)
1800	1.37	3.52	9.55
1805	1.29	3.54	10.49
1810	1.22	3.56	11.48
1815	1.16	3.54	12.67
1820	1.11	3.52	14.05
1825	1.08	3.48	15.54
1830	1.08	3.44	17.41
1835	1.10	3.36	19.65
1840	1.13	3.29	22.48
1845	1.15	3.20	26.05
1850	1.18	3.06	28.69
1900	1.21	2.11	11.85
1950	1.09	1.38	7.47
2000	1.52	0.84	5.35

Table V– Comparing the gain of the new box antenna optimized at 1810 kHz with the inverted L reference antenna.

Construction

Building this antenna for any of the center frequencies presented is as easy as or easier than putting up a dipole or inverted L. In addition to the usual wire, etc, all that is needed are two suitable skyhooks; if they are useful for other antenna types, then they certainly are useful for the box. No. 12 bare copper antenna wire is used for the antenna and gamma match. In fact, the gamma match is constructed in precisely the same manner as described in my article in the December issue of *QST*.

The two corner insulators and the center insulator in the horizontal run are ordinary glass or porcelain wire antenna insulators. All lengths should be measured carefully and not approximated by pacing on the ground. The corner insulators must be connected to the wire so that ithe wire cannot slip, but maintains the same vertical and horizontal lengths even when the wind blows.

A system of pulleys and counterweights must be used to allow the trees to sway even in mild wind. The weights will go up and down, but your antenna will not. The ends of both vertical runs connect to ground at the convergence point of each set of ground radials. Generally, clamped or otherwise unsoldered connections do not hold up to the weather, so it is imperative that all radials are soldered together at the point of connection to the vertical sections. Run the radials on top of the ground—i.e., do not bury them. Do not strip the coax cable radials, so that the copper braid remains like new for best conduction. Only the braid serves as the radial. The center conductor is not used, but may be soldered to the braid at the convergence point.

Conclusions

Although four frequency versions of the same antenna have been presented, only one actually has been built. Since the original antenna was constructed for 3795 kHz, this was the frequency of choice for the box antenna. Unfortunately, both cannot be in position at the same time, so a completely objective comparison was not possible. Also, since the original antenna worked so well, a good comparison is fur-

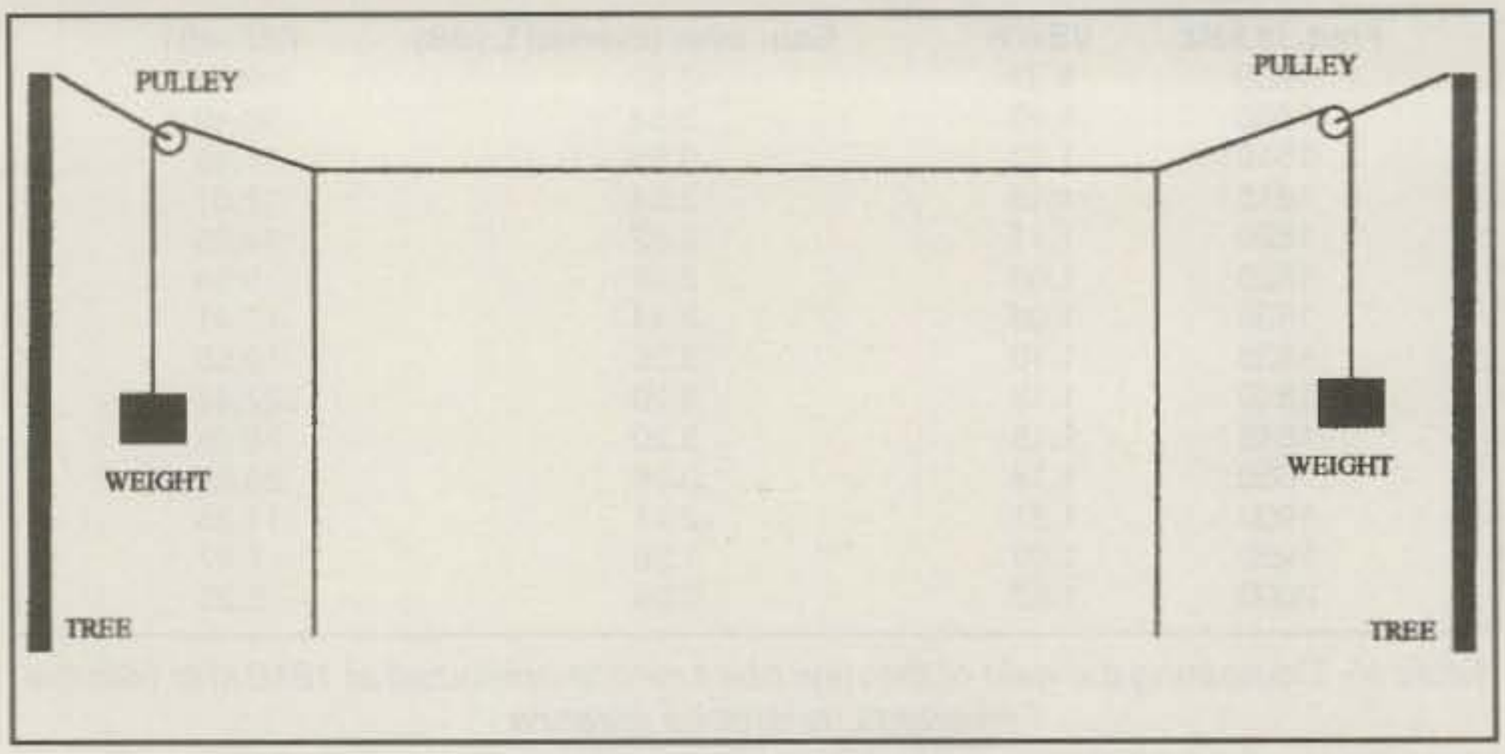


Fig. 5– The box antenna may be held in place between two trees shown here as simple poles. The ground ends of the vertical runs must be securely anchored to the ground by means of a heavy weight, screw-anchor, or ground rod of some type. The weights should be no heavier than that necessary to allow the antenna to retain its box shape without pulling on the ground anchors any more than necessary. Use proper rope size to fit the pulleys so that it cannot jump the wheel and get caught between the wheel and the wheel pin.

ther confounded. Stateside stations off the back of the antenna are definitely weaker on average, and the much wider projected 1.5:1 VSWR bandwidth is also evident as predicted. No tuning of the gamma match is needed, nor did the chip capacitor need to be changed to a different value than that predicted by modeling. The 160 meter version has not been built, but there is no reason to think that it will not work as predicted. That will be a summertime exercise before the next 160 meter DX season.

The Challenge

With the new box antenna exhibiting nearly 10 dB of gain and 25 dB or so of front-to-back ratio over a dipole on 80/75 meters even with 10 ohms of ground loss, and the 160 meter version showing 3+ dB of gain and 25 dB of front-to-back ratio over the inverted L, the next big step is to figure out how to rotate them! ■

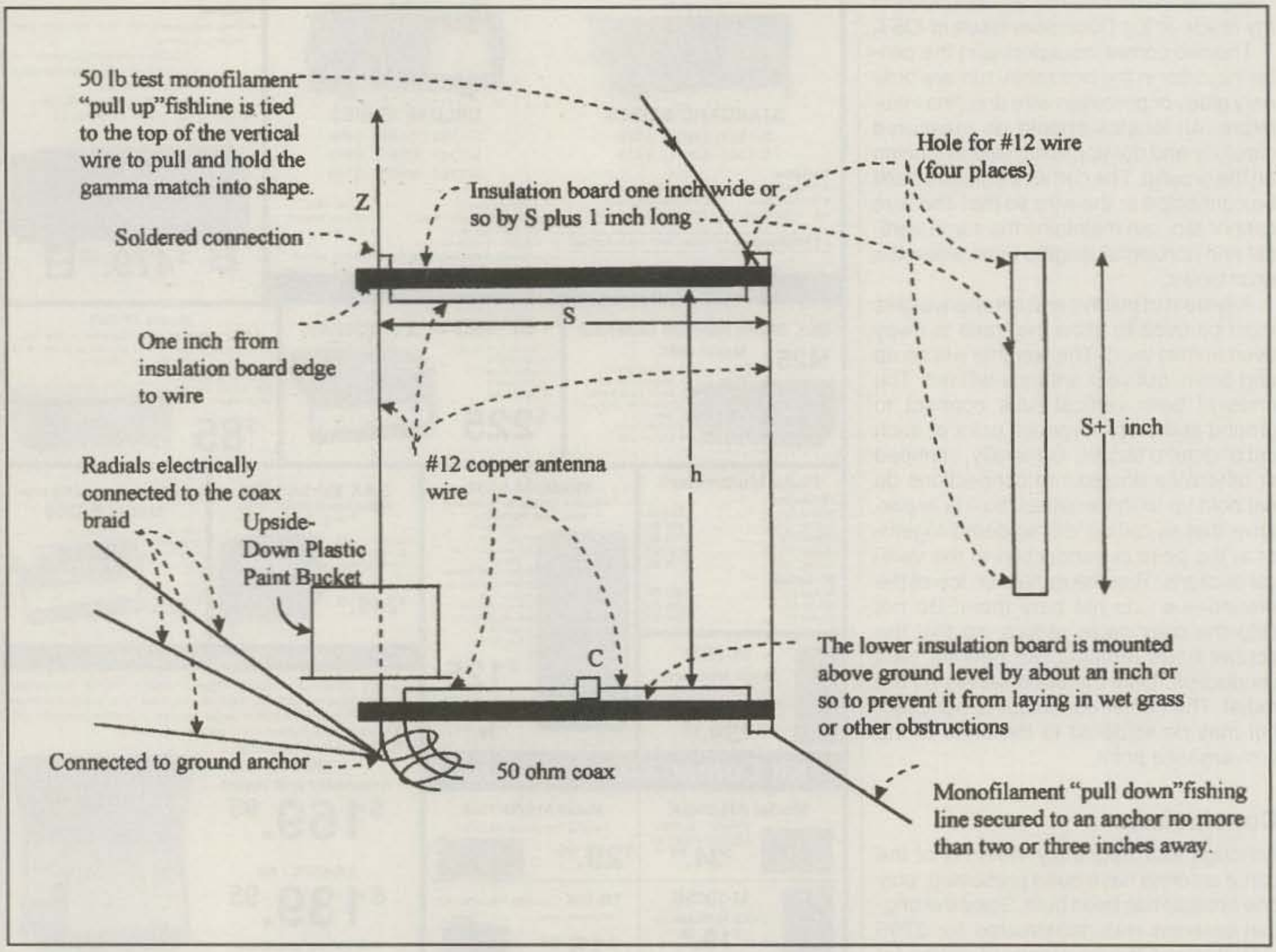


Fig. 6– An exaggerated view of the gamma match. Wire actually runs on the surface of the insulation board. The insulation board may be PVC, plate plastic, or any other rigid insulating material that will maintain horizontal runs of the gamma match horizontal. The holes near the ends of the insulation board allow the wire to weave through and catch on the hole edges, preventing it from slipping away from the rectangular geometry. The thickness of the board is assumed to be thin compared to dimension h. C is soldered to the wires at its ends, weather sealed with silicone rubber and double taped.

MFJ TUNERS

MFJ's world famous 3 KW Antenna Tuner

If you won't settle for less . . . here is the finest 3 KW tuner money can buy!

The MFJ-989C is not for everyone.

However, if you make the investment, you'll get the finest 3 KW antenna tuner money can buy.

Here's why . . .

The rugged MFJ-989C handles 3 KW PEP SSB and covers 1.8 to 30 MHz, including all MARS and WARC bands.

You can match dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave -- nearly any antenna. Use coax or balanced lines.

$349.95

MFJ-989C

MFJ AirCore™ Roller Inductor

MFJ's *exclusive super heavy duty AirCore™* Roller Inductor has an air core that *can't* burn up!

You get high-Q, low loss and exact inductance control for absolute minimum SWR.

MFJ's exclusive *Self-Resonance Killer™* removes damaging self-resonances.

Massive Transmitting Capacitors

The MFJ-989C's two *massive* 250 pf transmitting variable capacitors have extra wide 0.27 inch spaced stator plates.

They handle 6000 volts and amps of RF current for arc-free operation.

Super Antenna Switch

The MFJ-989C *super heavy duty* antenna switch is made of two individual ceramic wafers wired in parallel. Wide spaced, heavy duty contacts handle extreme voltages and currents. *We've never burned one up!*

3 KW Current Balun

MFJ's *super heavy duty current balun* has *two* giant 2½inch toroid cores with *Teflon®* wire connected to ceramic feedthrough insulators.

Use balanced lines without core saturation or voltage breakdown.

Built-In Dummy Load

A *full-size* 300 watt non inductive 50 ohm dummy load is built-in.

Lighted Cross-Needle Meter

Read SWR, forward, reflected power *simultaneously*. Read peak and average power in two ranges.

Superior Cabinet

The MFJ-989C premium, low-profile all-aluminum cabinet has a sub-chassis that adds strength and RFI protection. Has convenient flip-stand. 10¾x4½x15 inches.

No Matter What™ Warranty

Your MFJ-989C is protected by MFJ's famous one year *No Matter What™* unconditional warranty.

In Stock at all Ham Dealers!

More hams use MFJ tuners than all other tuners in the world!

MFJ's Deluxe 300 Watt Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

MFJ-949E **$149.95**

Why? The world's leading antenna tuner has years of proven reliability and can match nearly any antenna! Plus, it has MFJ's famous *No Matter What™* one year warranty!

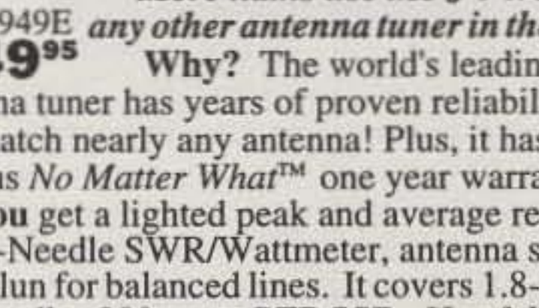
You get a lighted peak and average reading Cross-Needle SWR/Wattmeter, antenna switch, 4:1 balun for balanced lines. It covers 1.8-30 MHz and handles 300 watts PEP SSB. Has *full size* dummy load that easily handles abusive tune-ups.

New 8 position antenna switch lets you select two coax fed antennas, random wire/balanced line or built-in dummy load. You can also pre-tune into the built-in dummy load to minimize QRM.

The custom inductor switch is built to withstand extremely high RF voltages and currents.

Each MFJ-949E cabinet is chemically treated and has a new tough scratch-proof vinyl cladding -- not paint that can scratch or chip off. You won't find a tougher, longer lasting finish anywhere.

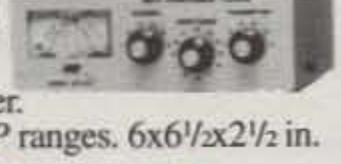
MFJ's versatile 1.5 KW Tuner



MFJ-962C **$249.95**

Use your barefoot rig now and have the capacity to add a 1.5 KW PEP amplifier later! Lighted Cross-Needle SWR/Wattmeter. *6* position antenna switch, *Teflon®* wound balun, ceramic feedthru insulators for balanced lines. 1.8-30 MHz. 10¾x4½x14⅞ in.

MFJ's portable/QRP Tuner



MFJ-971 **$89.95**

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, *30/300 or 6 watt QRP* ranges. 6x6½x2½ in.

MFJ's super value Tuner

MFJ-941E **$109.95**

The new MFJ-941E gives you a 300 watt PEP tuner with *lighted* Cross-Needle Meter. Covers 1.8-30 MHz.

Antenna switch selects 2 coax lines (direct or thru tuner), random wire, balanced line or external dummy load. 4:1 balun. 1000 volt capacitors.

Free MFJ Catalog

Nearest dealer/Free Catalog . . . 800-647-1800

2 Knob Differential-T™ Tuner

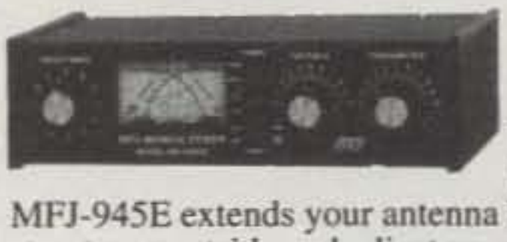
The MFJ-986 Differential-T™ 2 knob tuner uses a differential capacitor to make tuning foolproof and easier than ever. It ends constant re-tuning with broadband coverage and gives you minimum SWR at only one best setting. 3 KW PEP. 1.8-30 MHz.

MFJ-986 **$299.95**

Roller inductor makes tuning smooth and easy. Turns counter lets you quickly re-tune to frequency.

Lighted Cross-Needle Meter reads SWR/forward /reflected/*peak*/average power in 2 ranges. Current balun reduces feedline radiation and forces equal currents into unbalanced antennas.

MFJ's mobile Tuner



MFJ-945E **$99.95**

Don't leave home without this mobile tuner! The MFJ-945E extends your antenna bandwidth -- don't stop to go outside and adjust your mobile whip.

New MFJ-945E now includes 6-Meter operation and has tuner bypass switch. Small 8x2x6 inches uses little room. Lighted Cross-Needle SWR/Wattmeter with lamp switch. 1.8-60 MHz. 300 watts PEP SSB. **Mobile mount**, MFJ-20, $4.95.

MFJ's 6 Meter Tuners

MFJ-903 **$49.95**

MFJ-906 **$79.95**

The MFJ-906 has lighted cross-needle SWR/Wattmeter, bypass switch. Handles 100W FM, 200W SSB. For coax fed antennas. MFJ- 903, same as MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ's smallest Versa Tuner

MFJ-901B **$69.95**

The MFJ-901B is our smallest --5x2x6 inches --(and most affordable) 200 watt PEP tuner --when both your space and your budget is limited. Great for matching solid state rigs to linear amps.

MFJ's random wire Tuner

MFJ-16010 **$39.95**

Operate all bands anywhere with any transceiver with the MFJ-16010. It lets you turn a random wire into a transmitting antenna. 1.8-30 MHz. 200 watts PEP. Ultra small 2x3x4 inches.

MFJ's VHF or UHF Tuners

MFJ-921 or MFJ-924 **$69.95**

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x2½x3 in. Simple 2-knob tuning for mobile or base.

MFJ's artificial RF Ground

MFJ-931 **$79.95**

Creates artificial RF ground. Eliminates or reduces RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Also electrically places a far away RF ground directly at your rig by tuning out reactance of connecting wire.

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CIRCLE 135 ON READER SERVICE CARD

The JPS Communications NIR-12 Noise and Interference Reducer

BY PAUL CARR*, N4PC

Ahhh . . . for the "good old days"? Hardly! I can remember when I became an amateur in the 1950s. One of my first receivers was a BC-455. The sensitivity was adequate, but the selectivity was nonexistent—or so it seemed. The lack of selectivity was due to the IF strip operating at 2.83 MHz. With a single frequency setting, it seemed that signals from the entire 40 meter Novice band occupied the headphones. I could not imagine what it would be like to hear only the station I was in contact with. That thought was only a dream. Many log entries were followed by the comment "lost him in the QRM." I have heard many old timers say that those experiences built character, but I think they only added scar tissue.

Our objective today is the same as our dream of yesterday—interference-free communications. I am happy to report the objective is coming closer to reality.

The JPS Communications NIR-12 is a comprehensive signal processing unit. It is designed to take an audio signal, convert it into a digital signal, enhance the intelligibility, convert the signal back to an analog signal, and route the audio to headphones or speaker. Perhaps you can get a better idea of the unit's versatility if I cover the functions individually.

Notch Filter

When the notch-filter switch is activated, the NIR-12 will automatically find and eliminate multiple tones or whistles from the audio spectrum. If there are four or fewer tones present, the unit will provide 50 dB of attenuation of each unwanted tone. If there are more than four tones present, all tones will be eliminated, but the level of attenuation will be less. I have never heard four or more unwanted tones on a voice signal, but for the sake of the test I was able to create three heterodynes, and they all were eliminated.

*97 West Point Road, Jacksonville, AL 36265

The tones are eliminated about as soon as they happen. The attack time for the notch filter is only 5 milliseconds. The Notch function can be used in conjunction with all other functions, but it must be turned off when receiving CW or data, since the desired signal will be eliminated.

Bandpass Filter

The audio bandpass filter of the NIR-12 is very steep skirted. The bandwidth is adjustable in 100 Hz steps between 50 Hz and 3400 Hz. The center frequency is adjustable between 200 Hz and 3400 Hz in 50 Hz increments. The ultimate out-of-band attenuation is greater than 60 dB, and the filter shape factor is typically 1.18:1 at voice passbands. These are very good filter characteristics.

The frequency control establishes the center frequency of the filter, and the bandwidth control sets the passband. There are recommended settings for voice, CW, data, and SSTV. The nice thing about this format is that you do not have to accept the recommended settings. These functions are determined totally by the user.

The NIR Mode

The NIR mode automatically enhances voice signal intelligibility by recognizing speech and reducing the amplitude of all signals that are not part of the desired speech information. The detected speech frequencies are allowed to pass, while non-speech frequencies may be reduced by using the front-panel NIR control. Because of their syllabic nature, CW and data signals are allowed to pass with minimum degradation. This mode is especially effective for the removal of automobile ignition noise, power-line noise, computer noise, and static. If the NIR control is advanced too far, intelligibility may be lost. However, it is easy to find the best compromise between noise reduction and non-distorted audio. This mode may be used in conjunction with other functions of the unit.

The Dynamic Peaking Mode

The Dynamic Peaking mode (activated by depressing the DYNPEAK switch) provides good reduction of white atmospheric noise when receiving voice, CW, or data. It forms a dynamic bandpass around the desired frequencies such as the fundamental and harmonics of speech, CW notes, and data tones. This method is less effective with impulse noise than the NIR mode, but both techniques may be used together, if desired. There is a three-position switch located on the back panel which allows the operator to adjust the aggressiveness of this function. The noise reduction is greater with higher settings, but the best-sounding audio occurs at the lowest level.

Instruction Manual

The instruction manual is well written. There is a step-by-step procedure for the initial implementation of the unit to include preliminary settings of the controls. This will get you up and going with minimum effort. After your initial operating experience, the instruction book clearly explains all the functions in detail. There is also a chart that shows suggested control for various band conditions you may encounter.

The instruction manual also covers some features that I did not test. For example, there is a diagram that shows the unit's use for transmit audio processing.

Miscellaneous

The input to the unit is either 22 ohms or 47k ohms, internally selectable with a jumper through an RCA-type phono plug. There are three outputs available. There is a headphone output for 8 ohm and higher phones, and a speaker output jack for an 8 ohm speaker. Total audio output is 2 watts at 10% distortion. There is a third output which is intended for a modem. This output is unaffected by the volume setting of the internal audio gain control.

The unit is very ruggedly built. It measures 1.8"H×8.8"W×7.2"D, and weighs 3.8 pounds. The power requirement is 11 to 16 volts DC at 1 amp peak current (supply available from the manufacturer).

The equipment is covered by a limited one-year warranty. If it fails during normal use, JPS Communications will repair or replace (at their option) the equipment at their factory. They will pay shipping charges on the returned item.

The NIR-12 is available at an introductory price of $349.95 from JPS Communications, Inc., P.O. Box 97757, Raleigh, NC 27624 (order line 800-533-3819). ■

The JPS NIR-12 noise and interference reducer.

MIRAGE...160 Watts on 2 Meters!

Turn your mobile, base or handheld into 160 Watt powerhouses and talk further, longer, clearer . . . All modes: FM, SSB, CW . . . Superb GaAsFET preamp . . . Overdrive, high SWR, Over-temperature protection . . . Remote controllable . . .

B-5016-G
$299
Suggested Retail

Power Curve -- typical B-5016-G output power								
Watts Out	*130*	*135*	*140*	*145*	*150*	*155*	*160*	*165*
Watts In	*20*	*25*	*30*	*35*	*40*	*45*	*50*	*55*

The MIRAGE B-5016-G gives you 160 watts of brute power for 50 watts input on all modes -- FM, SSB or CW!

Ideal for 20 to 60 watt 2 Meter mobile or base. *Power Curve* chart shows typical output power.

Hear weak signals -- low noise GaAsFET preamp gives you excellent 0.6 dB noise figure. Select 15 or 20 dB gain.

B-5016-G has legendary ruggedness. *We know of one that has been in constant use since 1979!*

Heavy-duty heatsink spans entire length of cabinet -- prevents overheating. Power transistors protected by MIRAGE's *Therm-O-Guard*™.

Fully protected from high SWR and excessive input power. Has warning LED.

Has smooth adjustable Transmit/Receive switching with remote external keying.

RC-1B, $45, Remote Control. On/Off, preamp On/Off, selects SSB/FM. With 18-ft cable.

Draws 17-22 amps at 13.8 VDC. 12x3x5½ in.

More 160 Watt, 2 Meter Amplifiers . . .

B-2516-G, $299. For 10 to 35 watt mobile or base stations. 160 watts out for 25 watts in.

B-1016-G, $379. MIRAGE's most popular *dual purpose* HT *or* mobile/base amplifier. 160 watts out/10 W in. For 0.2-15 watt transceivers.

B-1016-G Great for ICOM IC-706!

B-215-G, $379. MIRAGE's most popular *handheld* amp. 150 watts out/2 watts in; 160 watts out/3½ W in. For 0.25 to 5 watt handhelds.

100 Watts for 2 Meter HTs

B-310-G
$199
Suggested Retail
MIRAGE RUGGED!

Power Curve -- typical B-310-G output power							
Watts Out	*25*	*50*	*75*	*95*	*100*	*100+*	*100+*
Watts In	*¼*	*½*	*1*	*2*	*4*	*6*	*8*

- *100 Watts out with all handhelds up to 8 watts*
- *All modes: FM, SSB, CW*
- *Great for ICOM IC-706*
- *15 dB low noise GaAsFET preamp*
- *Reverse polarity protection/SWR Protection*
- *FREE mobile bracket* • *Auto T/R switch*
- *FREE handheld BNC to B-310-G cable*
- *Ultra-compact 4¾x1¾x7¾ inches, 2½ pounds*
- *One year MIRAGE warranty*

***Boost** your 2 Meter handheld to 100 Watts!* Ultra-compact all mode B-310-G amp is perfect for *all* handhelds up to 8 watts and multimode SSB/CW FM 2 Meter rigs. *Great for ICOM IC-706!*

35 Watts for 2 Meter HTs

B-34-G
$99
Suggested Retail

Power Curve -- typical B-34-G output power								
Watts Out	*18*	*30*	*33*	*35+*	*35+*	*35+*	*35+*	*35+*
Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*

- *35 Watts Output on 2 Meters*
- *All modes: FM, SSB, CW*
- *18 dB GaAsFET preamp*
- *Reverse polarity protection*
- *Includes mobile bracket*
- *Auto RF sense T/R switch*
- *Custom heatsink, runs cool*
- *Works with handhelds up to 8 watts*
- *One year MIRAGE warranty*

MIRAGE RUGGED!

35 watts, FM only . . . $79

B-34, $79. 35 watts out for 2 watts in. Like B-34-G, FM only, less preamp, mobile bracket. 3⅛x1¾x4¼ inches.

MIRAGE Dual Band 144/440 MHz Amp

BD-35
$199
Suggested Retail

MIRAGE RUGGED!

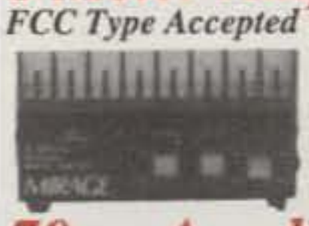
Power Curve -- typical BD-35 output power							
Watts Out (2Meters)	*30*	*40*	*45*	*45+*	*45+*	*45+*	*45+*
Watts Out (440 MHz)	*16*	*26*	*32*	*35+*	*35+*	*35+*	*35+*
Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*

- *45 Watts on 2 Meters/35W on 440 MHz*
- *Auto Band Selection* • *Auto T/R switch*
- *Full Duplex Operation* • *5x1¾x5 inches*
- *FREE mobile bracket* • *"On Air" LEDs*
- *Single Connector for dual band radios and antennas*
- *Reverse polarity protection*
- *Works with all FM handhelds to 7 watts*
- *One year MIRAGE warranty*

Add this Mirage *dual band* amp and boost your handheld to a *powerful* mobile or base -- 45 watts on 2 Meters or 35 watts on 440 MHz! **Mirage's** exclusive *FullDuplexAmp*™ lets you talk on one band and listen on the other band at the same time -- *just like a telephone conversation.* (Requires compatible HT).

6 Meter Amplifier (50-54 MHz)

FCC Type Accepted



The A-1015-G, $389, is the *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 watts out for 10 in. For 1 to 15 watt transceivers.

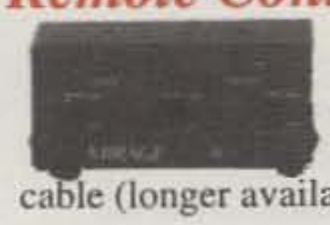
70cm Amplifiers (420-450 MHz)

D-3010-N, $365, -- 100 W out/30 in. For 5 to 45 watt *mobile/base*. **D-1010-N, $395**, 100 W out/10 in. *Dual purpose* -- for handhelds or mobile/base. **D-26-N, $269**, 60 W out/2 in, for *handhelds*.

Amateur TV Amps

Industry standard ATV amps -- **D-1010-ATVN, $414**, 82 watts PEP out / 10 in. **D-100-ATVN, $414**, 82 watts PEP out/2 in. (without sync compression).

Remote Control Head for Amps



RC-1, $45, remote controls most MIRAGE amps. Power On/Off, preamp On/Off, switch for SSB/FM. 18 foot cable (longer available). 1¾x3¾x2½ inches.

Repeater Amps

11 models -- continuous duty all modeFM/SSB/CW repeater amps for 6, 2, 1 1/4 Meters, 70cm, 450 MHz ATV.

Low noise GaAsFET preamps

KP-1

KP-2

High gain *ultra low noise* GaAsFET preamps for receiving weak signals. Selectable gain prevents receiver intermod. 15 to 22 dB gain. Less than 0.8 dB noise figure. Automatic RF switching up to 160 Watts. **Choose** In-*Shack* model or *Mast-Mount* (includes remote control) model to reduce loss. Rugged die-cast enclosure.

Frequency (MHz)	*In Shack $139*	*Mast Mount $195*
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

1¼ Meter Amps (223-225 MHz)

Choose from 10 models -- 20 to 220 watts out for 2 to 50 watts in, $129 to $655.

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Once again WB2AQC, camera in hand, travels to and visits with amateurs in different lands.

Amateur Radio Operators In The Serb Republic

BY GEORGE PATAKI*, WB2AQC

In recent years there has been extensive coverage of the civil war in the former Yugoslavia, and we all have seen television programs that show some of the atrocities committed during this conflict. In any war, acts of extreme violence are practiced by all belligerent sides, and the common, everyday people of all sides pay the price.

The purpose of this article is not to analyze the circumstances that created this civil war or to place blame on those who committed criminal acts. Most of the material published so far illustrates the suffering of the Muslims living in Bosnia-Herzegovina, with very little written about the Christian Serbs. This article is about Serbian radio amateurs and their situation. As they were the only ones whom I met during my trip to this divided land, I can only tell of their experiences.

As far as most official reports are concerned, this war seems different from other wars. With most armed conflicts, each side boasts and exaggerates about their own successes, reporting only minor losses for their side. In the Bosnian-Serbian conflict, however, each side is reporting that the "enemy" killed very large numbers of their "innocent men, women, and children," while they barely touched anybody on the other side. As is usual, there are three sides to each of these stories—one as told by one side, the other side's version, and finally the true story.

The amateurs of Bosnia-Herzegovina, when they were part of Yugoslavia, used the YU4 prefix for their call letters. Now in independent Bosnia, they are using the T9 prefix. The Serbian part of Bosnia-Herzegovina is not recognized as a separate and independent country. Therefore, it does not have, nor can it be assigned, an official amateur radio prefix. The government of this land, advised by a consulting firm, took the "X5" prefix for use by their local amateurs. The government took this step with full knowledge that the prefix was not officially assigned nor internationally recognized. Why exactly "X5"? Simply because it was available as an unassigned prefix.

My short visit to the "Serb Republic" occurred during a six week tour of Hungary and Yugoslavia, where I met and photographed amateurs for a series of articles. I was attending a large gathering of Yugoslavian amateurs in the city of Kraljevo, where I met Dusan, a science teacher from Bijeljina, located on the Serbian side of the now divided Bosnia-Herzegovina. Dusan, who is nicknamed Dule, is the president of the Radio Amateur Association of the Serb Republic (the Bosnian Serbs) and is using X5AA as his call.

*84-47 Kendrick Place, Jamaica, NY 11432

Dusan, X5AA, president of the Radio Amateur Association of the Serb Republic.

Miodrag, X5MK, president of the radio club in Zvornik, at the club station, X5EZK.

Dusan invited me to visit with the amateurs of his land, and we left Kraljevo that evening by car. At 2 AM we arrived at the border between Yugoslavia and the Serb Republic. As I was traveling with an American passport, I had to obtain a visa at the border, which costs 45 German marks. While the official currency in Yugoslavia and the Serb Republic is the dinar, due to inflation many transactions are done in German marks. From the border it didn't take too long to get to Bijeljina, where Dusan lives. According to Dusan, before the war the city had a population of about 35,000. Since the war that number has doubled due to refugees and military personnel.

There are 94 amateurs now using the "X5" prefix. Some are long-time residents and others are refugees from the Muslim side of Bosnia. There is even a foreign amateur living there—Andy, X5/LA2HFA, who is temporarily working there as a kind of observer. The amateurs who moved out of this area to Yugoslavia and wanted to continue their activities received YU1, YT1, YZ1, or 4N1 prefixes in Serbia; YU6 or YT6 in Montenegro; YU7, YT7, or 4N7 in Voivodina; and YU8 or YT8 in Kosovo.

The club station of the Amateur Radio Association of the Serb Republic uses as its callsign X5S. There are several radio club stations, such as X5BYZ in Banja Luka, established in 1947 as YU4BYZ; X5EBL in the same city; X5DOP in Bijeljina; X5EVG in Visegrad; X5EPV in Prnjavor; X5ETB in Trebinje; X5ACL in Gradiska; X5FTU in Derventa; X5GNO in Srbac; and X5EZK in Zvornik. There are active amateurs spread out in many cities. Their equipment is modest, but they can be heard occasionally. Their QSLs, however, are not accepted for DXCC.

Dusan, X5AA, and I went to the city of Zvornik near the Drina river, about 25 miles south of Bijeljina, to visit the local radio club and their station, X5EZK. We met Miodrag, X5MK, the club president, and several members. We met Milan, X5MS (ex-YU4MS and 4N4MS); Dragan, X5DQ; and Nedeljko, X5II. One of the amateurs there did have QSL cards; another said that he had just run out of them; and a third just admitted that he hadn't had any printed. They all are sensitive to the final outcome of the X5 prefix. The club, however, does have its own QSL cards.

We also visited Slobodan, X5EOL, in Vlasenica, about 15 miles southwest of Zvornic. Slobodan, a refugee from the Muslim side of Bosnia, is an elementary school teacher, as is his wife. He used to be YU4EOL, and was first licensed in 1966. They live in a small apartment with their daughter. Slobodan mentioned that when they took refuge, they had to leave almost all of their possessions behind, and now a Muslim family lives in their former house. When I asked him who had lived in this apartment before them, he said it was a Muslim family who went to the other side as refugees. Both sides have their victims.

Some Bosnian Serb amateurs are trying to get around the X5 prefix problem by using "4O" prefixes, which also are used occasionally by Yugoslavian amateurs. For example, the radio club in the city of Doboj is using 4O4D and 4O4FDE calls, and they even have QSL cards printed with those calls.

For the last stop on my tour Dusan took me to Pale, the seat of local government. I was surprised to see that Pale is a village east of Sara-

Slobodan, X5EOL, is also ex-YU4EOL. He and his family are refugees from Bosnia.

Here are some of the members of the radio club in Zvornik who came to the club station, X5EZK, for our visit. From left to right: Nedeljko, X5II; Dragan, X5DQ; Milan, an operator without a personal call; Miodrag, X5MK; and Dusan, X5AA.

jevo (former capital of Bosnia-Herzegovina), which according to the Dayton Agreement is now part of Muslim Bosnia. It's all quite strange. We did get to meet several members of the government, especially the Deputy Minister of Telecommunications, who was interested in ways to legitimize their amateur radio prefixes. Although the government gives strong moral support to their amateurs, there is little they can do financially. The Deputy Minister showed me a set of rules and regulations governing amateur radio activities, which he was about to submit to their Parliament for acceptance. These rules were "prepared" by a consulting firm (probably the same one who came up with X5) and were intended not only to regulate amateur radio activities, but also to show the ITU that they were ready to be accepted by the international amateur radio fraternity. I read a few pages and quickly noticed that these "rules" were in fact copied from our FCC Part 97 rules, including and maintaining the same paragraph numbers. It doesn't make too much sunse to start out a new set of rules with paragraph 97, but that's what they did.

I don't know how they will solve their basic problems, which are numerous, difficult, and complicated. So far, governments of several countries have tried to work out equitable solutions, but except for stopping the wholesale killings, very little progress can be seen. As far as legitimizing their amateur radio prefixes, this is a miniscule problem compared to the ones these people must face in their daily lives. While people and governments work toward resolving these problems, the X5 situation remains very difficult. ■

The Ramsey SX Series Sidebander 20 Meter QRP Transceiver

BY PAUL CARR*, N4PC

Since the beginning of my amateur radio career I have always had an interest in QRP operation. I keep a sharp eye on the advertisements to find what's new on the horizon. The entrance of Ramsey Electronics into the QRP sideband market piqued my interest, and I was eager to get my hands on the transceiver for evaluation.

Transceiver Overview

The SX Sidebander is a single band QRP transceiver that covers the 20 meter band. The receiver covers 14.0–14.5 MHz, while the transmitter covers 14.0–14.35 MHz. Additionally, there are provisions for WWV reception on 15.0 MHz. The unit operates on SSB and CW.

There are two digitally synthesized VFOs. These are selected by a switch on the front panel. The minimum frequency resolution is 10 Hz. You may think that it would take forever to "cruise the band" at this tuning rate, and you're right. To provide ease of excursion about the band, there are two additional tuning speeds of 1 kHz and 100 Hz. The resulting frequency is displayed on a large, seven-place LED display. There is no doubt where you are on the band.

In the upper corner of the front panel there is a series of eight LEDs. These provide a strength indication on receive and an RF output indication on transmit. Other controls on the front panel include microphone gain, volume, dial lock, keyer speed, and RIT.

The Ramsey Electronics SX Sidebander 20 meter QRP transceiver.

The Receiver Section

Let me take a few minutes to give you an overview of the receiver section. From the antenna connector, the signal is routed through a four-section bandpass filter which provides excellent out-of-band rejection of unwanted signals. Prior to the receive mixer, there is a switch-selectable 20 dB attenuator which provides the means to control strong local signals. The signal is then routed to an NE602A, where the receive signal is mixed with an 8 MHz signal from the VFO.

The resulting six MHz is amplified and applied to a six-pole crystal lattice filter. The IF signal is amplified again and applied to a second NE602A which is used as a product detector. The signal is mixed with a BFO signal, and the recovered audio signal is amplified and routed to the audio output stage. The audio output is greater than 2 watts, and there is a built-in 3 inch speaker.

The gain on the two IF amplifiers is controlled by an audio-derived automatic gain control which has two time constants. Some people may like a slow time constant for SSB and a faster time constant for CW. The gain control is smooth. No undesired popping or overshoot was noted.

The receiver is very sensitive. In fact, I heard many signals on the band when I was using only a short clip lead for an antenna. If there is a signal on the band, you will hear it with a good antenna.

The Transmitter Section

The signal from the microphone is amplified and routed to an MC1496 balanced modulator. The audio signal is mixed with a 6 MHz reference signal. After the reference carrier is suppressed, the resulting double-sideband signal is amplified and routed to the six-pole lattice filter where one of the sidebands is suppressed. The resulting SSB signal is routed to another NE602A which is used as a transmit mixer. The low-level SSB signal goes through a series of bandpass filters to the final amplifier stage. The final amplifier output is 10 watts PEP. Harmonic attenuation is provided by a three-section PI network filter before applying it to the antenna. The CW signal employs a similar route except for the microphone amplifier circuit.

*97 West Point Rd., Jacksonville, AL 36265

If You Choose The Kit

Kit building can be very rewarding if you enjoy constructing your own equipment. There are a few things you need to know beforehand, however. You will need the necessary soldering equipment and skills to use the equipment properly. Most of the "dead" kits that I have brought to life in past years normally have one or more soldering mistakes.

Additional test equipment needed consists of a frequency counter, a VOM, a 0 to 1 amp current meter, and the normal hand tools (pliers, diagonal cutters, etc.). You will find the kit takes many hours to build, and you should be prepared to dedicate the necessary time for wiring and alignment.

The construction booklet is well written, and includes history and theory supplements to enhance your education. The booklet also schedules breaks so that you will not spend too much time during a single construction session. If you follow the instructions carefully, and have a reasonable amount of experience in building, success is sure to follow.

On The Air

After construction, alignment, and initial tests, I was eager to put the transceiver on the air. I chose the CW portion of the band for my initial test. My first contact was with a station in Oregon. The antenna was a simple 80 meter Windom at a height of about 60 feet. Keying was smooth, and the rig did everything I asked of it. I have not spent as much time on phone, since CW is my preferred mode of operation. However, results on phone have been very satisfactory. I'm sure the rig will provide many hours of great operating pleasure in the future.

Power Requirements

There is lots of circuitry inside the rig. The power requirements are 500 ma on receive and 5 amps on transmit. The unit is housed in a cabinet that measures 9.5"W × 3.7"H × 9.0"D. The weight is 5 pounds.

Availability

The unit is available from Ramsey Electronics, Inc., 793 Canning Parkway, Victor, NY 14564-8924 (716-924-4560). The price is $299.95 for the kit; $369.95 for the unit wired and tested. ■

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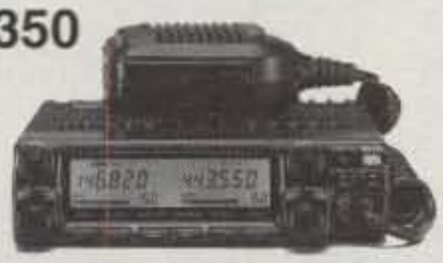

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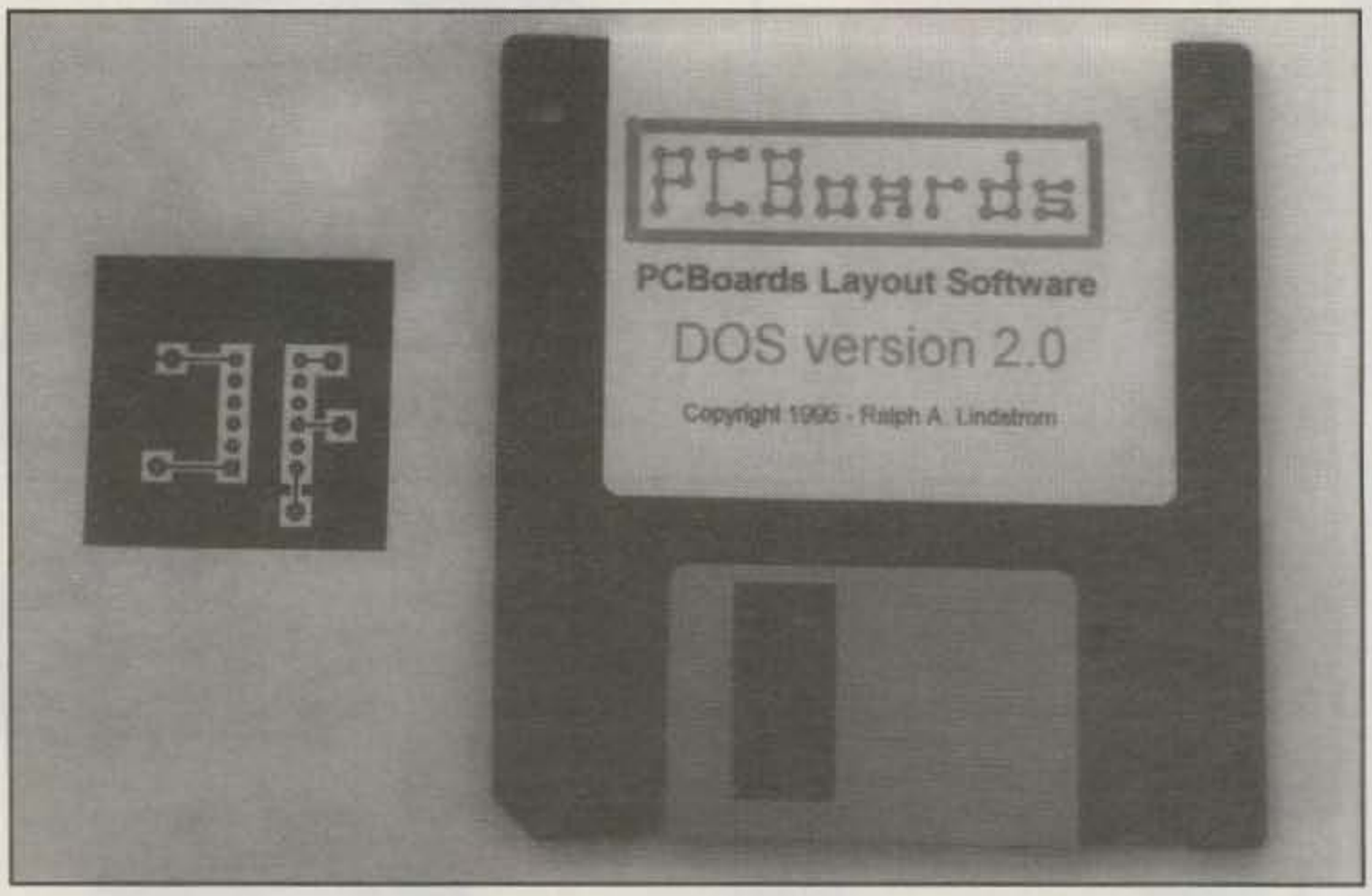
PCBoards Software

BY DOUG DeMAW*, W1FB

There are several pieces of computer-aided design (CAD) software available for laying out PC boards, but some of them are too costly for casual amateur design work. I grew weary of doing my layouts with donut pads and tape on clear plastic, but was unwilling to fork over $300 or more for the software I needed to make quality circuit-board patterns with my computer.

PCBoards in Birmingham, Alabama solved my problem with its excellent low-cost program called PCBoards. It was written by Ralph A. Lindstrom. Fig. 1 shows a board pattern I created with this software. The board is being used as the foundation for a small receiver I built.

The program comes on a 3.5 inch diskette and is designed to work with IBM-compatible PCs that have a memory minimum of 512K. Required also is an EGA, VGA, Super VGA, or IBM 8514/A graphics system. The computer must be equipped with DOS 3.0 or later. Printing requirements are an HP Laser Jet or equivalent (for laser output). I use a Panasonic KX-P4410 laser printer that is programmed to operate as an HP Laser Jet. PCBoards can be run also with an IBM graphics-compatible dot-matrix printer, or an HP or Houston Instruments pen plotter. The software is written in Microsoft Quick Basic 4.5 and Assembly Language.



PCBoards is a low-cost circuit board design software that works on IBM-compatible computers with a memory minimum of 512K.

Software Features

There are two types of PC board design software on today's market. One is called "autorouter," or some similar name. With the autorouter feature the designer simply places the PC board pads, IC, or other component sites where he or she wants them, then tells the computer to join the appropriate conductors. The system bypasses existing conductors and finds a route between the two points that will be joined. Although this technique eliminates a lot of nail biting when developing a layout, it is not necessarily the best method to use for boards that will contain critical VHF or UHF circuits. Long, random routes often introduce unwanted inductive reactances that can reduce the circuit gain, complicate matching, or cause instability. PCBoards sells autorouter PC design software, should that be the user's preference.

PCBoards produces right-angle connections between circuit pads, as seen in fig. 1. Note that some of the pads in the example are larger than others. These are called "fat pads." The designer must first make standard small pads on the screen, then draw a line around each small pad to enlarge it, as shown.

The parts menu, or bank, contains pads, DIP patterns for ICs, SIP layout, standard resistor layouts from 1/8 to 5 watts, capacitors from small silver mica to electrolytic size, and diodes. Included also are headers, pLcc packages, and sEmi packages. There is a USER function that can be employed to allow placement of user-generated components.

The Layout Screen

The maximum layout area occupies most of the monitor screen. This work area is composed of dots. The arrow keys or mouse moves the cursor from dot to dot during layout. Each dot on the grid represents 1/20 inch. An absolute counter appears at the lower right of the screen for keeping track of distances between components or pads. It monitors both the X and Y movements. A viewport function provides a small window in the 6.05" × 13" work space. This is where the layout work for small PC boards takes place.

The user can view the top or bottom layers of the PC board at any time. The + and – keys select the desired layer.

Solid-copper areas are provided by means of the FILL command. This is done in 50 mil blocks by placing the cursor at the desired point on the pattern and pressing F1. Filled areas can be removed by press-

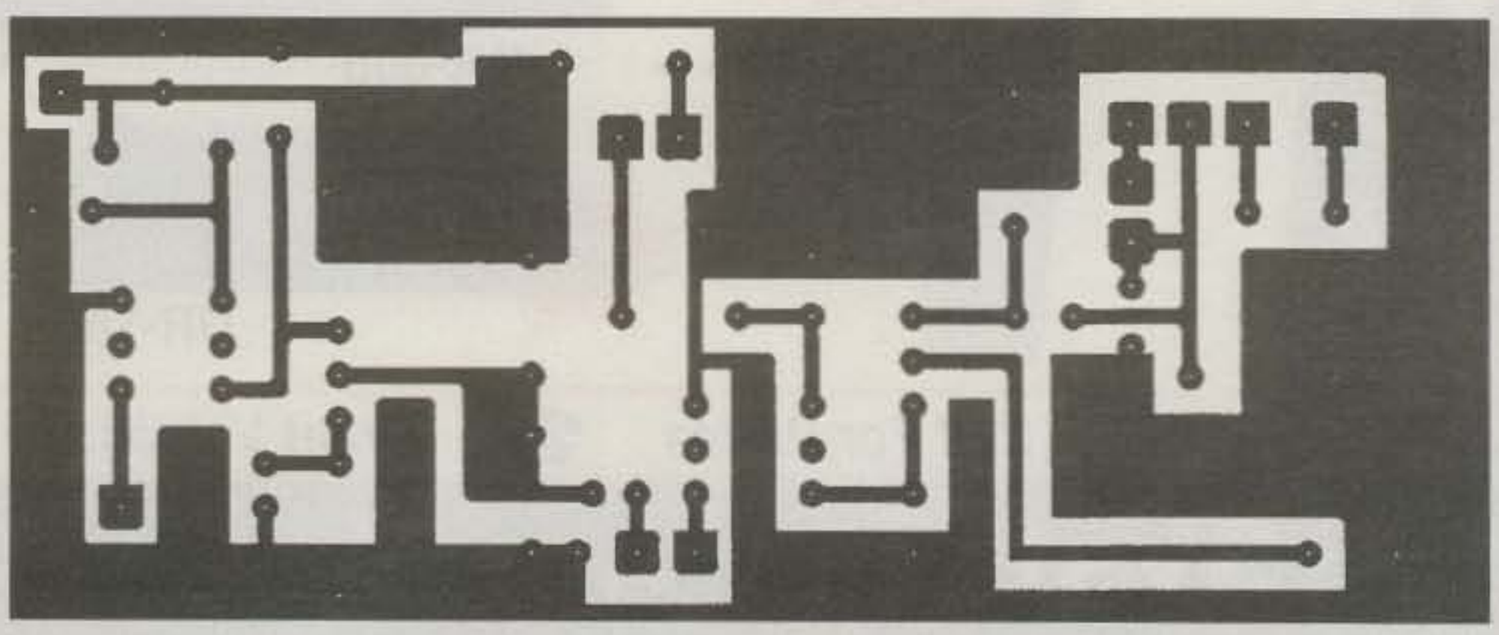


Fig. 1– An example of a receiver PC board pattern created with PCBoards on a Panasonic laser printer at W1FB.

*P.O. Box 250, Luther, MI 49656

ing F2. Rotation of all components can be done in 90 degree increments.

Other Considerations

It is wise to invoke the SAVE command periodically during the design procedure. This requires naming the work for file identification. Saving is essential at the end of the work in order to call up the file and print it. The user can select the etched side or its mirror image for printing. Selection of the mirror image is beneficial for those who use TEC-200 or Press-N-Peel etch-resist film. This compensates for the image reversal that occurs when photocopying the pattern onto the etch-resist film.

A preliminary rough layout for the PC boards can be sketched on quadrille pad paper. The pads with the smallest grids have 1/10 inch squares. Hence, two movements of the cursor on the layout screen (two dots) equals one square on the quadrille paper. A rough pencil layout makes it easier to do the final layout with the computer.

PCBoards comes with an easy-to-follow instruction manual. Even a rank beginner should be able to master this program after a few trial runs. The supplier also sells software for creating schematic diagrams. Free demo samples of the three software programs are available on 5 1/4 inch floppy disks upon request. PCBoards' price class is $99. They can be ordered from PCBoards, 2110 14th Ave., Birmingham, AL 35205. ■

Announcing:

The 40th Annual CQ World-Wide WPX Contest

SSB: March 29–30, 1997
CW: May 24–25, 1997

Starts: 0000 GMT Saturday Ends: 2400 GMT Sunday

I. Contest Period: Only 36 hours of the 48 hour contest period permitted for Single Operator stations. **Off periods must be a minimum of 60 minutes in length and clearly marked in the log.** Multi-Operator stations may operate the full 48 hours.

II. Objective: Object of the contest is for amateurs around the world to contact as many amateurs in other parts of the world as possible during the contest period.

III. Bands: The 1.8, 3.5, 7, 14, 21, and 28 MHz bands may be used. No WARC bands.

IV. Types of Competition:

1. Single Operator (Single band and All band)

(a) Single Operator stations are those at which one person performs all of the operating, logging, and spotting functions. **Only one transmitted signal is allowed at any time.**

(b) **Low Power:** Same as 1(a) except that **output power shall not exceed 100 watts.** Stations in this category will compete with other low power stations only.

(c) **QRP/p:** Same as 1(a) except that **output power shall not exceed 5 watts.** Stations in this category will compete with other QRP/p stations only.

(d) **Assisted:** Same as 1(a) except the **passive use (no self-spotting) of DX spotting nets or other forms of DX alerting are permitted.** Stations in this category will compete with other Assisted stations only.

(e) **Tribander/Single Element (TS):** Tribander (any type) with a single feedline from the transmitter to the antenna and single element (TS) category. During the contest, an entrant shall use only one (1) tribander for 10, 15, 20 meters and single-element antennas on 40, 80, and 160 meters.

(f) **Band Restricted (BR):** An eligible entrant must hold a license restricting operation to less than the six (6) contest bands (160, 80, 40, 20, 15, 10) on both modes. Examples of such licenses are: Novice, Technician, 4 class license, etc. Since frequency privileges differ from country to country, competition is within one's own country.

(g) **Rookie (R):** An entrant in this category shall have been licensed as a radio amateur three (3) years or less.

2. Multi-Operator (All band operation only)

(a) **Single Transmitter:** Only one transmitter and one band permitted during the same time period (defined as 10 minutes).

(b) **Multi-Transmitter:** No limit to transmitters, but only one signal and running station allowed per band. *Note:* All transmitters and receivers must be located within a 500 meter diameter area or within the property limits of the station licensee, whichever is greater. **All operation must take place from the same operating site.** All antennas must physically be connected by wires to transmitters and receivers.

V. Exchange: RS(T) report plus a progressive contact three-digit contact number starting with 001 for the first contact. (Continue to four digits if past 999.) Multi-transmitter stations use separate serial numbers for each band.

VI. Points:

(a) Contacts between stations on different continents are worth three (3) points on 28, 21, and 14 MHz and six (6) points on 7, 3.5, and 1.8 MHz.

(b) Contacts between stations on the same continent, but different countries, are worth one (1) point on 28, 21, and 14 MHz and two (2) points on 7, 3.5, and 1.8 MHz. **Exception: For North American stations only—contacts between stations in different countries within the North American boundaries are worth two (2) points on 28, 21, and 14 MHz and four (4) points on 7, 3.5, and 1.8 MHz.**

(c) Contacts between stations in the same country are permitted for multiplier credit but are worth zero (0) points.

VII. Multiplier: The multiplier is the number of "**valid**" prefixes worked. A PREFIX is counted only once regardless of the number of times the same prefix is worked.

(a) A PREFIX is the letter/numeral combination which forms the first part of the amateur callsign. Examples: N8, W8, WD8, HG1, HG19, KC2, OE2, OE25, etc. Any difference in the numbering, lettering, or order of same shall constitute a separate prefix. A station operating from a DXCC country different from that indicated by its callsign is required to sign portable. The portable prefix must be an authorized prefix of the country/call area of operation. In cases of portable operation, the portable designator will then become the prefix. Example: N8BJQ operating from Wake Island would sign N8BJQ/KH9 or N8BJQ/NH9. KH6XXX operating from Ohio must use an authorized prefix for the US 8th district (W8, K8, etc.). Portable designators without numbers will be assigned a zero (0) after the second letter of the portable designator to form the prefix. Example: N8BJQ/PA would become PAØ. All calls without numbers will be assigned a zero (0) after the first two letters to form the prefix. Example: XEFTJW would count as XEØ. Maritime mobile, mobile, /A, /E, /J, /P, or interim license class identifiers do not count as prefixes.

(b) Special event, commemorative, and other unique prefix stations are encouraged to participate.

VII. Scoring

1. Single Operator: (a) All Band score = total QSO points from all bands multiplied by the number of different prefixes worked (prefixes are counted only once). (b) Single band score = total QSO points on the band multiplied by the number of different prefixes worked.

2. Multi-Operator: Scoring is the same as Single Operator, All Band.

3. A station may be worked once on each band for QSO point credit. **Prefix credit can be taken only once.**

IX. QRP/p Section: Single Operator only. Output power must not exceed 5 watts for all claimed contacts. Results will be listed in a separate QRP/p section and certificates will be awarded to each top-scoring QRP/p station in the order indicated in Section XI.

X. Low Power Section: Single Operator only. Output power must not exceed 100 watts. **You must indicate low power on the summary sheet and state the actual maximum output power used for all claimed contacts.** Results will be listed in a separate low power section and certificates will be awarded to each top-scoring low power station in the order indicated in Section XI.

XI. Awards: Certificates will be awarded to the highest scoring station in each category listed under Section IV—

1. In every participating country;

2. In each call area of the United States, Canada, Australia, and Asiatic Russia.

All scores will be published. To be eligible for an award, a Single Operator station must show a minimum of 12 hours of operation, and multi-operator stations must show a minimum of 24 hours of operation.

A single band log will be eligible for a single band award only. If a log contains more than one band, it will be judged as an all band entry unless specified otherwise.

In countries or sections where entries justify, second- and third-place awards will be made.

XII. Trophies, Plaques, and Donors:

SSB

Single Operator, All Band

WORLD—Stanley Cohen, WD8QDQ
USA—Atilano de Oms, PY5EG
EUROPE—Jim Hoffman, N5FA
SOUTH AMERICA—Ron Moorefield, W8ILC
OCEANIA—Phillip Fraizer, K6ZM Memorial
AFRICA—Peter Sprengel, PY5CC
*JAPAN—The DX Family Foundation
CANADA Low Power—Amateur Radio League of Alberta
WORLD QRP/p—Dayton Amateur Radio Assn.
USA QRP/p—Doug Zwiebel, KR2Q

Single Operator, Single Band

WORLD—John N. Reichert, N4RV
WORLD Low Power—Verne Fowler, W8BLA
WORLD 7 MHz—William D. Johnson, KVØQ
OCEANIA—D. Craig Boyer, AH9B
USA 28 MHz Novice/Tech—Jon Engelhardt, KAØZFX
USA 21 MHz—Bernie Welch, W8IMZ Memorial
USA 3.7 MHz—Lance Johnson Digital Graphics

Multi-Operator, Single Transmitter

USA—D. Craig Boyer, AH9B

Multi-Operator, Multi-Transmitter

N. AMERICA—Burt Curwen, KL7IRT Memorial
USA—Glenn Tracey, KC3EK

Contest Expedition

WORLD—Kansas City DX Club

CW

Single Operator, All Band

WORLD—Steve Bolia, N8BJQ
USA—Steve Bolia, N8BJQ
EUROPE—Ivo Bezer, 5B4ADA
OCEANIA—Tom Morton, KT6V
CANADA—Radio Amateurs of Canada (RAC)
*JAPAN—The DX Family Foundation
CANADA Low Power—Amateur Radio League of Alberta
USA QRP/p—Richard Arland, K7YHA

Single Operator, Single Band

WORLD—Pedro Piza, Sr., KP4ES Memorial
WORLD 7 MHz—William D. Johnson, KVØQ
WORLD 3.5 MHz—Lance Johnson Digital Graphics
OCEANIA—D. Craig Boyer, AH9B
USA—Kansas City DX Club
USA 28 MHz—Bernie Welch, W8IMZ Memorial
USA 21 MHz—Wayne Carroll, W4MPY

Multi-Operator, Single Transmitter

WORLD—Ron Blake, N4KE
USA—Austin Regal, N4WW

Contest Expedition

WORLD—Ed Roller, K4IA

Combined SSB/CW

Single Operator, All Band

WORLD—Al Slater, G3FXB Memorial
EUROPE—Les Nouvelles DX Group
USA—D. Craig Boyer, AH9B

Club (SSB & CW)

WORLD—*CQ* Magazine
USA—Oklahoma DX Association

**Donor is responsible for this trophy.*

A station winning a World trophy will not be considered for a sub-area award. That trophy will be awarded to the runner-up for that area if the returns justify the award.

XIII. Club Competition: A trophy will be awarded each year to the club or group that has the highest aggregate scores from logs submitted by members. The club must be a local group and not a national organization. Participation is limited to members operating within a local geographical area **(exception: DXpeditions especially organized for operation in the contest and manned by members)**. Indicate your club affiliation on the summary sheet. To be eligible for an award, a minimum of three logs must be received from a club.

XIV. Log Instructions:

(a) All times must be in GMT. All breaks must be clearly marked. Single operator and multi-single logs must be submitted in chronological order. Multi-multi logs must be submitted chronologically by band.

(b) All sent and received exchanges are to be logged.

(c) Prefix multipliers should be entered only the FIRST TIME they are worked.

(d) Logs must be checked for duplicate contacts, correct QSO points, and prefix multipliers. Duplicate contacts must be clearly shown. Computerized logs must be checked for typing accuracy. Original logs may be requested if further cross-checking is required.

(e) **An alpha/numeric check list of claimed PREFIX multipliers must be submitted with your log.**

(f) Each entry must be accompanied by a summary sheet listing all scoring information, the category of competition, and the entrant's name and mailing address in BLOCK LETTERS. Also submit a signed declaration that all contest rules and regulations for amateur radio in the country of operation have been observed.

(g) Official log and summary sheets are available from *CQ* for an SASE with sufficient postage. If official forms are not available, you may make your own.

(h) Disk submission of logs is encouraged. CT's *.BIN file or *.ALL file, N6TR's *.DAT file, NA's *.QDF file, or *.DBF files are preferred. An ASCII file containing all required information is also acceptable. Disk files must be in chronological order for single operator and multi-single stations and chronological by band for multi-multi stations. Please label your disks and name your files with the call used (example: N8BJQ.BIN or N8BJQ.DAT). Disks will be **required** from top-scoring stations if requested.

(i) Logs may be submitted via e-mail to <SDB@AG9V.AMPR.ORG> or <N8BJQ@ERINET.COM>. Binary files may be sent, providing they are in MIME or UUENCODE format. Internet submissions will also require a summary sheet and prefix multiplier sheet. Logs received via e-mail will be confirmed via e-mail upon receipt.

XV. Disqualification: Violation of amateur radio regulations in the country of the contestant, violation of the rules of the contest, unsportsmanlike conduct, taking credit for excessive duplicate contacts, or unverifiable QSOs or multipliers will be deemed sufficient cause for disqualification. An entrant whose log is deemed by the WPX Contest Committee to contain a large number of discrepancies may be disqualified as a participant operator or station for a period of one year. If within a five-year period the operator is disqualified a second time, he or she will be ineligible for any *CQ* contest awards for three years.

The use of non-amateur means such as telephones, telegrams, etc., to elicit contacts or multipliers **during** a contest is unsportsmanlike and the entry is subject to disqualification. Actions and decisions of the WPX Contest Committee are official and final.

XIII. Deadline:

(a) All entries must be postmarked NO LATER than May 10, 1997 for the SSB section and July 10, 1997 for the CW section. E-mail logs are also subject to these deadlines. **Indicate SSB or CW on your envelope.** One extension of up to 30 days, for legitimate reasons, may be granted if requested from the contest director, N8BJQ. Logs postmarked after the deadline, or extension deadline, if granted, may be listed in the results, but will be ineligible for any awards.

All logs go to: CQ Magazine, WPX Contest, 76 N. Broadway, Hicksville, NY 11801 USA. Questions pertaining to the WPX Contest can be sent to WPX Contest Director, Steve Bolia, N8BJQ, 4121 Gardenview Drive, Beavercreek, OH 45431 USA, or via e-mail to <N8BJQ@ERINET.COM>.

Please remember to send in early for WPX contest log and summary sheets.

The Vibroplex 1996 Version Bug and Paddle

BY DAVE INGRAM*, K4TWJ

When the new owner of Vibroplex, Mitch, WA4OSR, said he was sending me a new 1996 version "Original" bug for critiqueing and review, my first thoughts were a mix of excitement, curiosity, and reservation. Could the improvements to this world-famous semi-automatic key actually make it better, would they downplay its classic design, and would that unique "tactile feedback" found only in a bug disappear? What about speed control and dot weighting? I have found some bugs are good for fast rather than slow CW, some are good for slow rather than fast CW, but few are really good (great!) for both.

The new "Original" arrived a day later. Itt exceeded my expectations, and I fell in love with it after only one evening's on-the-air use. Yes, the improvements are terrific; yes, the classic beauty is retained; and yes, that special feel from the vibrating pendulum nudging the tip of your thumb while sending dots is still there. This is one bug that everyone will enjoy catching!

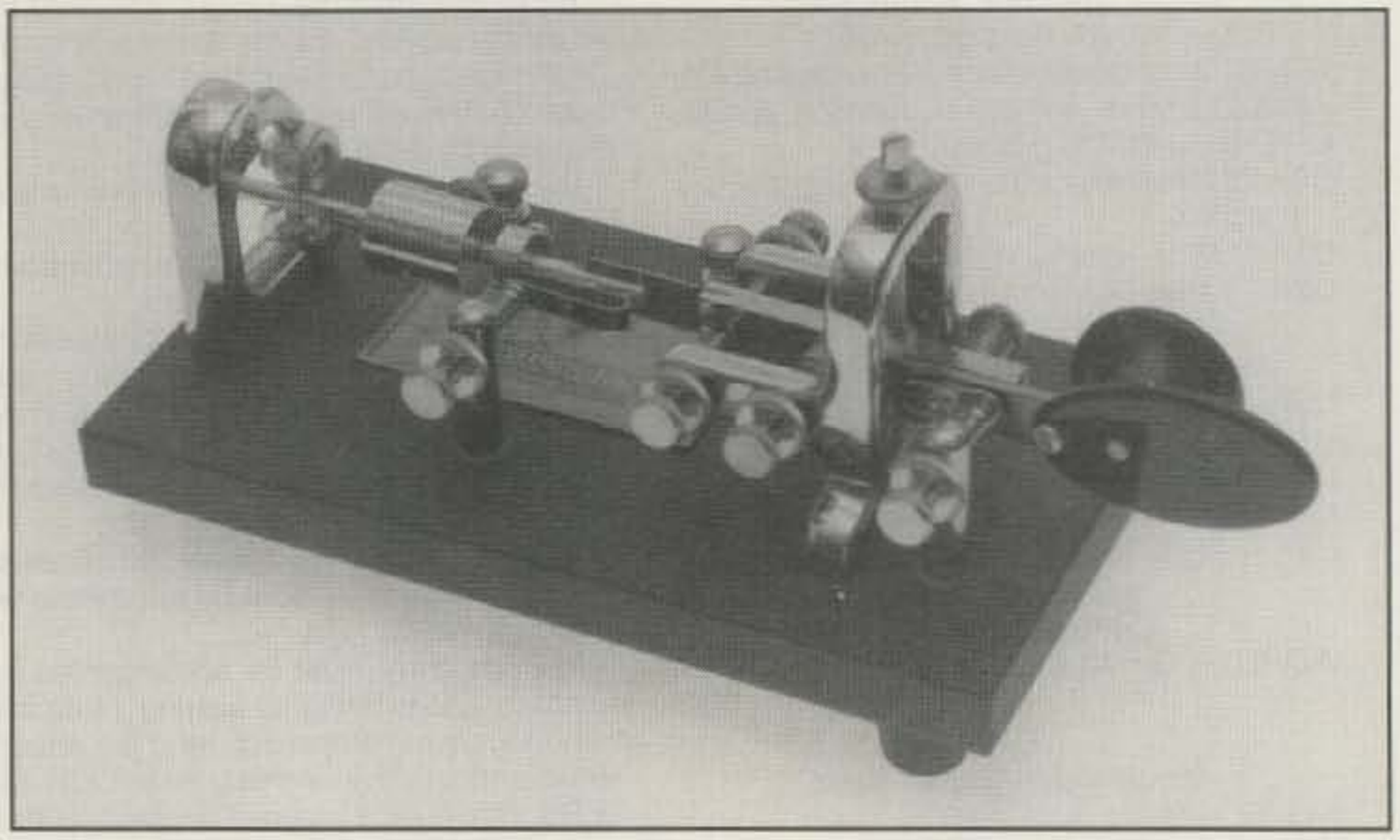
So how does this 1996 semi-automatic key differ from Horace G. Martin's Original 1904 craze-starting Vibroplex? First, the standard model's (painted) gray base (used between the 1940s and 1994) has been changed back to classic black like the Vibroplexes of the 1920s and '30s. Modern-style powder coating that will not chip, flake, or peel is used. Rounded rather than sharp base edges have also returned.

Second, the complete upper mechanism is now triple chrome plated and fully polished—even inside the main yoke and all of the rear damper assembly. The result of this all-out chrome plating and polishing is a spectacular-looking bug. Herein lies an interesting perplexion: Should one purchase a standard black base "Original" for its classic amateur radio beauty or go for a glitzy all-chrome deluxe "Original"? A challenging decision indeed!

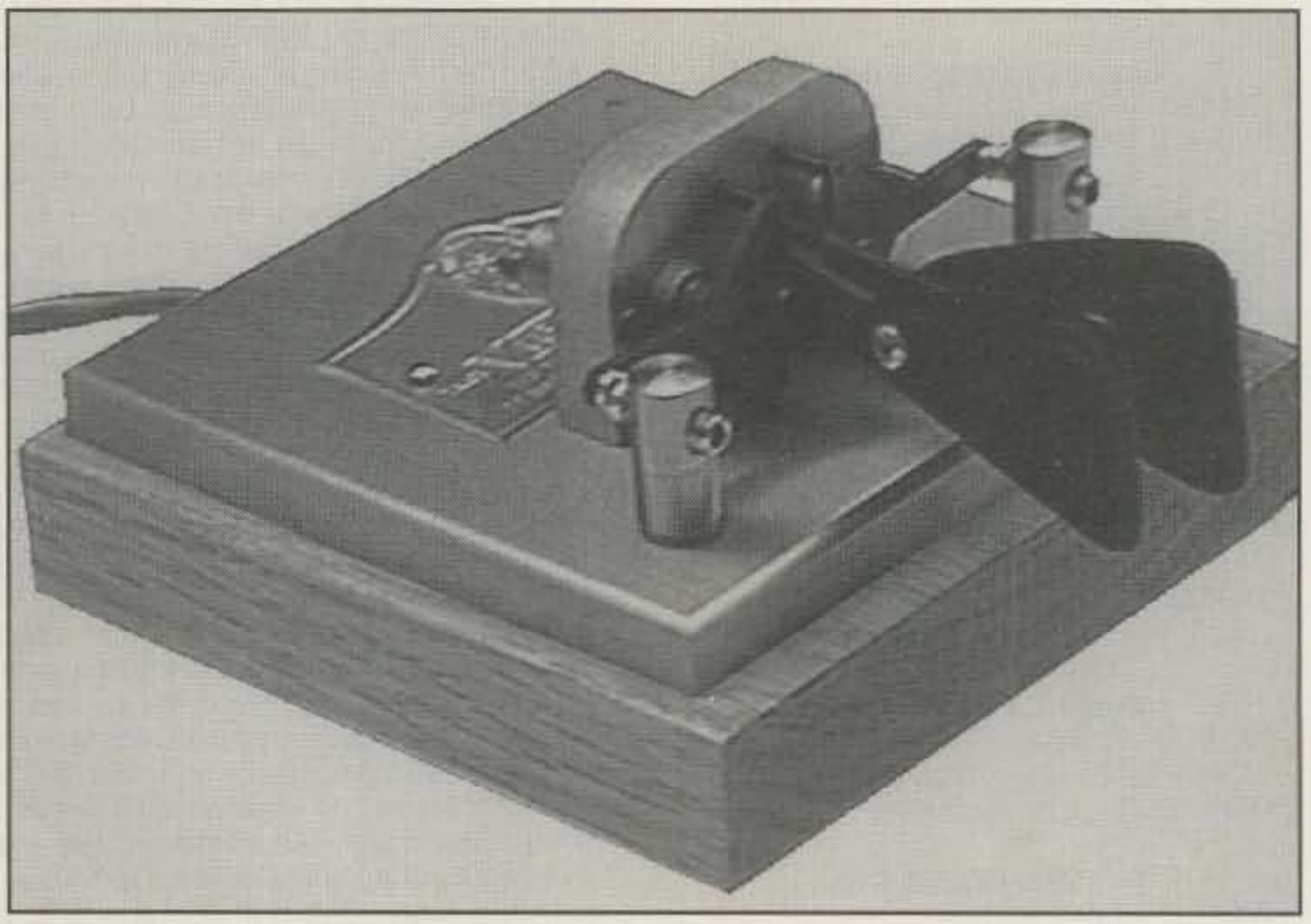
Third, the mechanism on all four models of the "Original" (standard/black base, deluxe/all-hrome, gold Original/chrome mechanism with entire base 24kt. gold plated and Original Presentation/24kt. gold plate atop its chrome base) are now being made to more precise and exact standards than ever before.

True bug lovers might initially presume that more exacting production standards would result in a "tight feeling" and high-speed-favoring key, but I did not find such the case. Unnecessary looseness and slightly misaligned dot contacts are gone, but the ability to be reset for fast or slow dots is still there. Neat! In my

*4941 Scenic View Dr., Birmingham, AL 35210



The new Vibroplex 1996 "Original" bug. This smart-looking item is available in black base, chrome base, full 24 kt. gold base, and 24 kt. gold plate atop chrome base versions. All have more precise and triple-shrome-plated mechanisms. Their "feel" is superb.



Also new for 1996 is this square-based Vibroplex Brass Racer magnetically tensioned paddle. It has dual levers with independent travel/tension adjustments, stays put on an operating desk, and handles very well.

opinion, Vibroplex's new "Original" combines '30s styling with '90s production accuracies in perfect proportions.

I am quite impressed with the new "Original's" wide speed range and smooth overall "feel." I can move the dot weight to the pendulum's rear, adjust contact spacing and arm stops for wide travel, get wrist action going, and send computer-readable code from 10 to 20 wpm. Changes between 10 and 20 wpm can be handled by resetting only the weight. If I reset the contacts and arm stops for less travel and move the weight closer to the pendulum's flat mainspring (between pendulum and arm), the "perfect copy" speed ranges from 18 to 40 or 45 wpm (a blast for contests!). I also found the bug handles so well that I can switch between using my right hand and left hand (southpaw style, palm curled over the main yoke so my index finger makes dashes) without losing rhythm. Now this is when bugs and CW really become fun to use!

Although I thoroughly enjoy using a good bug (would you ever guess!), some operators say semi-automatic keys are difficult to master. That may indeed be true, especially if you cannot get a good wrist action going, or are using an old bug with deteriorated springs or one with high-voltage-pitted contacts. Maybe it is time to gear up with a new bug and save the old one as a collectible. (Don't you dare throw an old bug in the trash or junk box!)

Now some good news for those of you who have completely given up on mastering the art and joy of bug use: Check out Vibroplex's new '96 version "Vibrokeyer" single -ever paddle. It too has a new-style black base and triple-chromed upper assembly, and you can send perfect code with it while even wearing gloves!

Prefer an economically priced dual lever/ iambic paddle with 1996-style flair? Take a close look at the new Vibroplex square-based Brass Racer. It has a brushed and polished brass mechanism mounted on an attractive oak wood base, and a nameplate that really grabs your attention: it is glazed brass and includes the bright red bug logo plus Vibroplex's new Mobile address. Since the address on Vibroplex's nameplates has proven historically significant, Mitch has reserved a large number of consecutive serial number plates for the new square-based Racer (Vibroplex fans and collectors, take note).

I test-operated one of the Racer gems and found its snappy magnetic action quite enjoyable—particularly at higher speeds. I also liked the separate tension and gap adjustments for each lever and noticed the new square-based Racer was more surefooted on the desk than earlier (triangular-based) Racers. That is probably due to the extra weight of one third more brass being used in the larger base. It is a lot of paddle for the money.

Finally, I encourage everyone to practice improving their CW fist and start working more CW. It is fun, a skill to be proud of, and much more effective for DXing than screaming along with the multitudes in SSB pileups.

The Vibroplex 1996 "Original" bug is priced at $139.95 (standard model), and the Square Brass Racer is priced at $129.95. For more information on Vibroplex bugs, paddles, and super CW "extras," telephone The Vibroplex Company at 1-800-840-8873, or write to them at 11 Midtown Park E., Mobile, Alabama 36606.

1996 CQ WPX CW Contest High-Claimed Scores

SINGLE OPERATOR ALL BAND USA

KE2PF 6,817,581
K3ZO 4,710,325
KQ2M 4,606,271
KT3Y.....4,351,344
KF3P.....4,115,584
KM9ØØP 3,833,696
AA3B 2,512,281
K4ØØPI 2,466,170
AB6FO.....2,141,737
N4ZR 1,890,800
NB6U 1,764,135
W9LT 1,633,280
K5ZD 1,420,184
K9LJN.....1,358,370
K5YAA 1,211,800
NU4Y 1,208,765
WBØO.....1,114,344
WR3O.....985,581
K1VWL 890,292
KW2J 777,777

28 MHz

N4BP 19,257
W2HG.....984

21 MHz

W6BSY 27,537

14 MHz

K8GL 2,296,386
N7TT.....1,192,240
W5FO 1,152,944
KB5WWA.....980,826
KY2P 881,136
WA7FAB.....713,416

7 MHz

KI1G 2,629,610
N6MU 1,031,490
W3GH.....930,528
K2XA 130,848
W8AEF 86,190

3.5 MHz

W3BGN 289,960

1.8 MHz

WA3WJD 6,240

LOW POWER ALL BAND

N2BA 2,014,740
AC1O.....1,719,354
WA1LNP.....1,129,101
WD5K 668,044
N2LSK 587,904
AE6Y 475,888
K96BAI 404,736
WV5S 355,576
K2UF 351,000
W8UPH.....309,964

28 MHz

N5NMX 5,394

21 MHz

WA1FCN 31,974
KN4Y 14,700

14 MHz

KK9W 308,250
WS8O 225,330
N8II 204,325
K2AW 140,436
W7HS 139,250
NJ3K.....125,550

7 MHz

AA2SZ 238,896
KX7L.....76,930
KE3VV 20,600
N9ENA.....15,480
WB2DVU 13,328

1.8 MHz

AA9AX 192

DX ALL BAND

3V8BB 11,775,568
WP2AHW 10,533,756
HH2PK.....9,519,495
VE3EJ.....6,420,724
S59AA 5,160,400
GIØKOW.....5,026,413
OM8A 4,958,865
TM4US 4,626,360
OM7DX.....3,980,325
RN6BY.....3,802,205
OM5A 3,512,928
EA2IA 3,394,390
PA3DZN 3,241,422
UR8QX 3,185,868
YL8M 3,015,183
EX2M.....2,988,768
3DAØNX 2,851,200
OI6YF 2,848,278
VD3IY/7 2,651,360
RA3AUU 2,603,900

28 MHz

9H1EL.....670,500
S51AY 113,953
UT5UGR.....96,992
G4IFB 66,248
LZ2KRU.....57,996

21 MHz

PR5W 1,723,868
F6BKP 550,638
S5ØD 437,864
UA4LM.....279,321

14 MHz

OHØNSJ 3,567,906
VP5Z.....3,448,068
YM2ZW.....3,302,023
RZ9UA.....2,964,240
YT1BB 2,809,352
TMØX.....2,563,636
9AØCW 2,477,820
LY5A.....2,221,956
VD7NTT.....2,090,088
YU1IG.....1,980,800

7 MHz

LU1IV.....7,174,620
XQ1IDM.....5,754,716
YW1A 5,046,174
UA6LAM 3,870,592
S5ØA.....3,568,824
S5ØC 3,418,170
OT6T 3,337,208
CY7A 3,326,400
SP7GIQ 3,280,800
PYØFF 2,881,100

3.5 MHz

EA8/OH2KI 1,358,852
LY2BTA 967,974
4N1A.....905,256
P4ØA.....889,080
UU1J.....806,124

1.8 MHz

4X4NJ.....259,420
S5ØU 175,440
OH1EH/OHØ.....167,424
9A4D.....149,362
LY3BU 120,328

LOW POWER ALL BAND

N2WCQ/6W1 ...3,201,763
RAØFU.....2,369,088
ED3CA.....1,945,125
RA9AE.....1,893,800
YU7CB.....1,366,728
9U5DX.....1,240,566
EA5FV 1,200,991
IU2E.....1,152,242
DL3HRJ 1,076,758
YO3FRI.....1,042,783

28 MHz

9A5I 124,425
T99T 91,800
F5PGP.....77,952
IT9ORA.....60,368
SV2BOH 48,840

21 MHz

LU7FJ 1,552,485
YV6AZC.....901,600
LU5VC 432,653
S57J 183,106
S59D.....124,844

14 MHz

VK2APK.....1,374,728
7M1MCT 1,371,681
IU9AF 1,315,608
IQ2A 1,237,104
HA8RH 1,174,104

7 MHz

EA8CN.....1,513,332
ZL3CW 1,416,768
PA3AAV.....1,133,860
IU3V.....1,109,372
S54A.....1,000,500

3.5 MHz

ED3ALN.....678,536
HA6OY 477,280
9A24OB 387,612
9A24ØB.....387,612
OK1JOC 361,950

1.8 MHz

HA8BE.....137,592
OI1MLB 86,800
OK1NG.....64,680
OK1HGM 17,172

ASSISTED ALL BAND USA

WF3T 2,116,884
AB2E 1,341,680
WK2G 1,291,077
N6ZZ.....678,300
N1CC.....552,520

14 MHz

K3ANS.....505,932
W6TKF 196,087
KB8NTY.....74,907
WA2TIF 46,872
K9OSH 21,960

7 MHz

AA8UH.....137,710

LOW POWER ALL BAND

WS1E 655,557
AA3OC 208,278

DX ALL BAND

DL1IAO.....1,982,766
S53R.....819,280
JH3AIU 673,072
JF1SEK 285,616

14 MHz

IQ7A 883,500

7 MHz

S57AL.....1,457,340

3.5 MHz

DL1FDV.....334,642

LOW POWER ALL BAND

HAØHW 212,344
K1EFI/VP9.....122,578
F5TCN.....82,904
VE3ZTH.....42,896

QRP/p

RA3CW.....A.....657,696
KA1CZF.....A.....362,796
SMØTHU....A.....143,835
EA7AAW....A.....113,452

MULTI-OPERATOR SINGLE TRANSMITTER USA

NB1B 6,264,274
K1ZZ.....5,148,760
NJ4F 4,231,385
KVØQ.....3,845,786
WC4E 3,639,510
KC7V 2,044,464
KN5H 1,615,350

DX

8R3ØK 12,360,600
P42V.....11,636,394
IH9/OK1CW...10,483,262
LZ9A 7,389,976
LZ8A 5,510,484
HG3O 5,326,202
RU1A.....5,018,972
OH2IW.....5,007,905
GB6WW.....4,935,238
JH5ZJS.....4,849,525
OI8LQ.....4,626,020
II2K 4,625,860
OI4OC 4,562,096
DL1AUZ.....4,298,976
GX3PRC.....4,231,810
DK2OY 4,225,300
OL3A 4,184,518
OI2JNX.....4,177,444
RZ3Q 4,152,016
IQ4T.....4,119,120

MULTI-OPERATOR MULTI-TRANSMITTER USA

WZ1R 5,736,461
WD8LLD 3,673,141
AA9OC 2,878,143

DX

9A1A.....16,268,490
YTØW 14,550,580
EM2I 12,410,685
OT6A 10,243,140
AL3/N7DF.....9,939,909
RW2F 9,684,220
PA6WPX.....8,072,976
9H3TY 8,000,064
ED4ML.....6,373,344
LY7A.....5,834,928
JA1YXP 4,268,192
OI1W 2,657,367
HG8U.....2,050,924
EA3CKX 1,067,710

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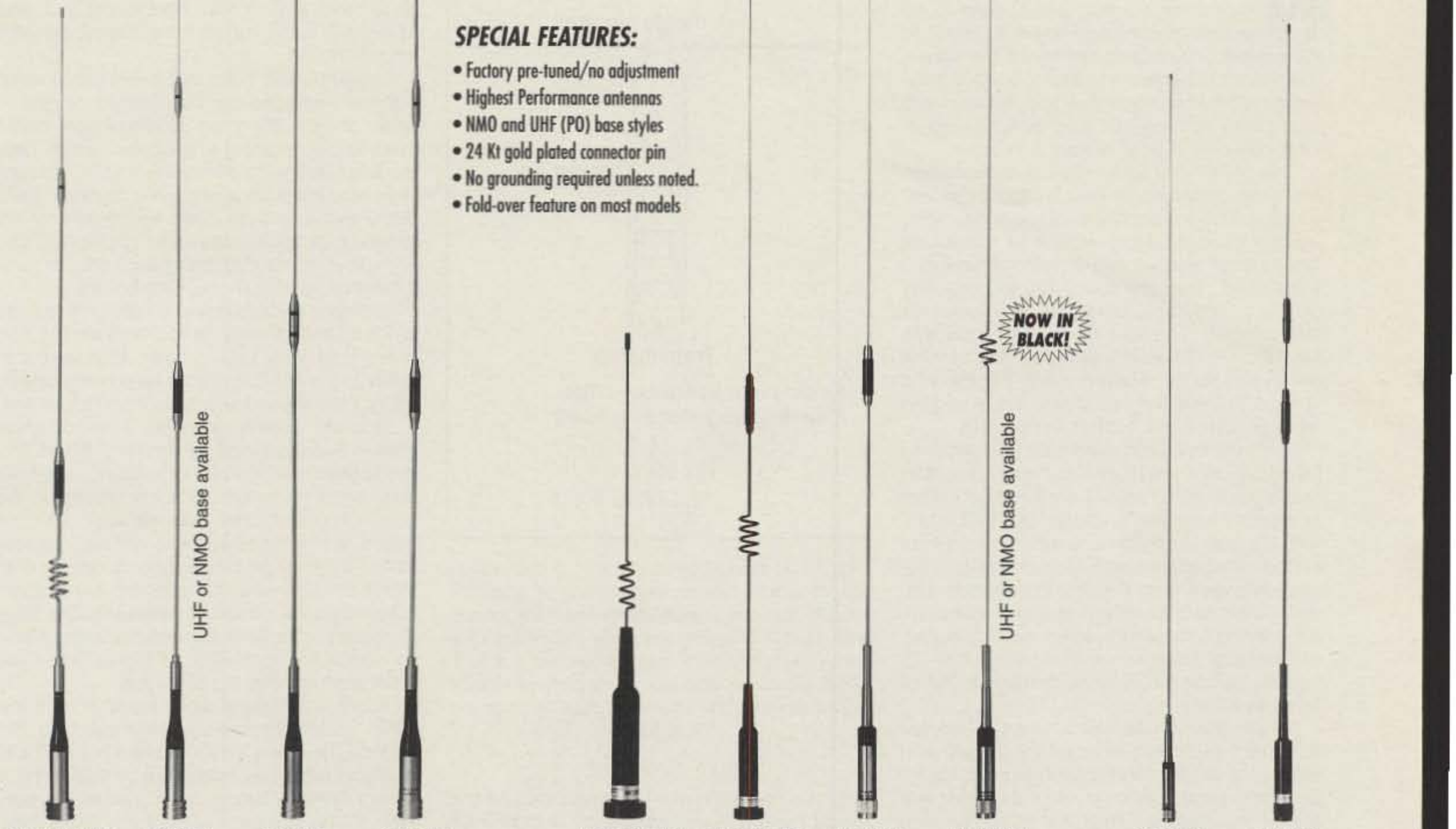

SG7200NMO | SG7500 SG7500NMO | SG2000 | SG7900 | NR72BNMO | NR73BNMO | NR770R | NR770H NR770HB | CR214S | CR320A

MODEL	BAND	GAIN (dBd.)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
NR72BNMO[6]	2m/70cm	2.15	100	NMO	13.8	1/4λ, 1/2λ
NR73BNMO	2m/70cm	2.15/5.3	100	NMO	33.5	1/2λ, 1-5/8λ
NR770SA[6]	2m/70cm	2.15/2.15	100	UHF	16.9	1/4λ, 1/2λ
NR770HA[7]	2m/70cm	3.0/5.5	200	UHF	40.2	1/2λ, 2-5/8λ
NR770HNMO[8]	2m/70cm	3.0/5.5	200	NMO	38.2	1/2λ, 2-5/8λ
NR770RA	2m/70cm	3.0/5.5	200	UHF	38.6	1/2λ, 2-5/8λ
NR790A*	2m/70cm	4.5/7.2	120	UHF	57.5	6/8λ, 3-5/8λ
SG7000[6]	2m/70cm	2.15/3.8	100	UHF	18.5	1/4λ, 6/8λ
SG7200NMO	2m/70cm	3.2/5.7	150	NMO	36.6	1/2λ, 2-5/8λ
SG7500A	2m/70cm	3.5/6.0	150	UHF	40.6	1/2λ, 2-5/8λ
SG7500NMO	2m/70cm	3.5/6.0	150	NMO	41.0	1/2λ, 2-5/8λ

1/4λ antennas rated in dBi.

MODEL	BAND	GAIN (dBd.)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
SG7900*	2m/70cm	5.0/7.6	150	UHF	62.2	7/8λ, 3-5/8λ
SG2000*	2m	5.2	150	UHF	62.6	7/8λ
SG6000NMO[6,9]	6m	2.1	150	NMO	39	1/4λ
NR140A	1-1/4m	3.8	100	UHF	36.2	5/8λ
NR124	23cm	8.4	100	N	25	4-5/8λ
CR214S[6]	2m/1-1/4m	2.15/3.4	120	UHF	37	1/2λ, 5/8λ
CR224A*[6]	2m/1-1/4m	5.0/6.0	150	UHF	68.5	7/8λ, 2-5/8λ
CR320A[6]	2m/1-1/4m/ 70cm	2.15/3.8/ 5.5	200/ 200/100	UHF	37.4	1/4λ, 1/2λ, 2-5/8λ
CR627B[6,9] CR627BNMO[6,9]	6m/2m/ 70cm	2.1/4.5/ 5.5	120 200/100	UHF NMO	60	1/4λ, 1/2+1/4λ/ 2-5/8λ
NR2000NA	2m/70cm/ 23cm	3.15/6.3/ 9.7	100	N	39	1/2λ, 2-5/8λ 5-5/8λ

* Not recommended for Magnet Mount
[6] Grounding required.
[7] NR770HB same specifications but in black finish.
[8] NR770HBNMO same specifications but in black finish.
[9] 50MHz antennas adjustable

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(Not available on NR72BNMO, NR73BNMO or NR770SA.)

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Clean your glasses. It's time for a sharp, clear look at amateur radio's workhorse—feed line.

Another Look At Feed Lines

BY LEW McCOY*, W1ICP

New amateurs, and some who have been around for a while, still appear to be somewhat confused when it comes to the subject of coax and open-wire (or ladder) line. Here I will attempt to break down the differences between these two popular lines and show their advantages and disadvantages. First, however, a bit of history is in order.

One of the very early types of transmission line used by amateurs was known as "open" wire line. This line consisted of two conductors, equally spaced, using what was known as "spreaders." Various line-spacing dimensions were used. Two and four inch spacing was common, and some amateurs even used six inch spacing. The wire most often used was No. 12 or No. 14 solid copper, and the spreaders were usually situated along the line and spaced to keep the two wires nearly as perfectly parallel to each other as possible.

One point to bear in mind is that all feed lines have loss. Just how much loss depends on several factors, which we will discuss later. What is important here is to understand that open-wire line such as that mentioned (two, four, or six inch spacing) has an extremely low-loss figure, while coax does not. The impedance of an open-wire line is based on the size of wire used, the spacing between the wires, and the dielectric material used to separate the wires. Of course, air was the common material between open-wire lines.

Shortly after World War II, when TV started to come into its own, we saw the introduction of plastics to electronic manufacturing. Manufacturers quickly came up with the use of plastics to separate twin lines, the most common being 300 ohm television twinlead. The 300 ohm number is the designator for the ohmic impedance of the line. The impedance of open-wire line or parallel-spaced conductors is determined by the size of the wire used, the spacing between the lines, and the dielectric material used (if there is any), such as plastic, to hold the lines in place. Naturally, the two, four, and six inch spaced open-wire lines are separated by air, which is just about the best dielectric there is (a pure vacuum would be best).

Amateurs were quick to utilize the 300 ohm *twinlead,* as the TV feed line was called. It was cheap, it could handle fair amounts of power (as much as 1000 watts in some cases), and it was easy to use. In fact, the folded dipole is still a very good and popular antenna. This antennas was a natural for 300 ohm twinlead. I will show such an antenna a little later.

It wasn't very long before transmission-line manufacturers realized that there was a market for a line that would be more rugged and would handle more power than the common twinlead. This led to what we now call ladder line. These lines are made with much heavier wire, have greater separation (usually on the order of one inch), and the phenolic or material is cut out in symmetrical sections, making the line look like a ladder. Less loss is achieved by removing about half of the phenolic insulation. The inherent losses in this type of line are not as low as with regular open-wire line, but for amateur applications ladder line is very good.

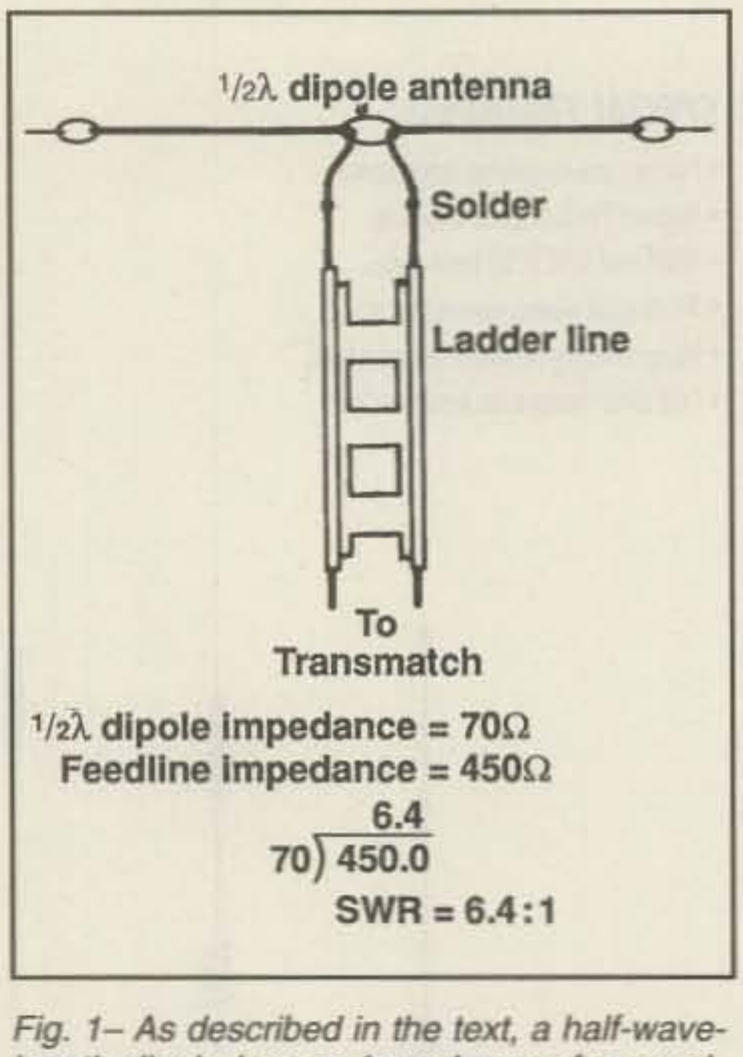

Fig. 1– As described in the text, a half-wavelength dipole has an impedance of approximately 70 ohms. If fed at its resonant frequency with ladder line, the resulting mismatch (but with practically zero loss!) would be 6.4 to 1 SWR. However, with a wide-range tuner or with a Transmatch, the antenna could be used on any band.

The normal impedance of ladder line is on the order of 450 ohms. The current types now available in 450 ohm line will easily handle the amateur legal limit. I have used 300 ohm twinlead at 1000 watts, but in some instances (with poor quality line) the phenolic material melted!

As an aside, years ago I used 300 ohm twinlead to feed a 160 meter antenna. My shack was on the upper floor, and one night my wife came up to the shack and said, "You had better look out the back window." I shut off the rig and went to look out at my dipole. The twinlead had caught fire and was slowly burning, the fire coming back towards the shack. It took some quick action on my part to keep the fire out of the shack. That would not have happened with modern 450 ohm ladder line, and of course could never have happened with open-wire line.

One important point that bears mentioning: 300 ohm twinlead can be affected by rain or snow, and the effect can be appreciable in that it will cause detuning of your transmitter. Ladder line can also be affected by rain or moisture in that the impedance of the line changes. Also, 300 ohm line, or even ladder line, should not run parallel to or tightly along metal, such as a tower. My rule of thumb is to mount such lines at least 12 inches away from metal structures.

We need to digress a little here and discuss SWR (standing-wave ratio). The main function of any feed line is to carry power from the transmitter to the antenna, and to do so without radiating. If the line radiates, then it isn't a feed line; it becomes another antenna. Standing-wave ratio, a bugaboo to all amateurs, is the ratio of the maximum RF current or voltage in one feed line conductor to the current or voltage in the other conductor. The ideal situation, in most cases, is to have as low an SWR ratio as possible—in other words, a ratio of one to one. Why? Simply because you obtain the greatest efficiency. Line losses will increase as the SWR increases, so unless you use a lossless line—for example, open-wire or ladder line—you must work to keep the SWR low.

There are other reasons to strive for a low SWR, and I'll discuss some of those later. But for now, here is a very important point. For all practical purposes, open-wire or ladder line is a very low loss line, and this means that very high SWRs can exist without any really measureable losses taking place. In your amateur career you probably will hear that a high SWR will cause a feed line to radiate. That is not so. Regardless of the SWR, the current or voltages in the two conductors are supposed to cancel each other's radiation. However, there is a condition in which a feed line can radiate, and I will discuss that a little further on, when we discuss coaxial line.

Let's get a little practical at this point and discuss the actual use of open-wire line. Most of us know, or should know, that the impedance of a half-wavelength dipole is on the order of 70 ohms, depending on the antenna's height and the ground conditions below the antenna. Suppose we feed this dipole with open-wire line, one side of the line going to one side of the dipole and the other side of the line to the other side of the dipole, as in fig. 1. The SWR on the line is determined easily because we can divide the 70 ohm antenna impedance into the 450 line impedance, giving us a ratio of 6.4 to 1. This is a high SWR, and in fact, with modern transceivers with solid-state finals, we would not be able to feed any power into the

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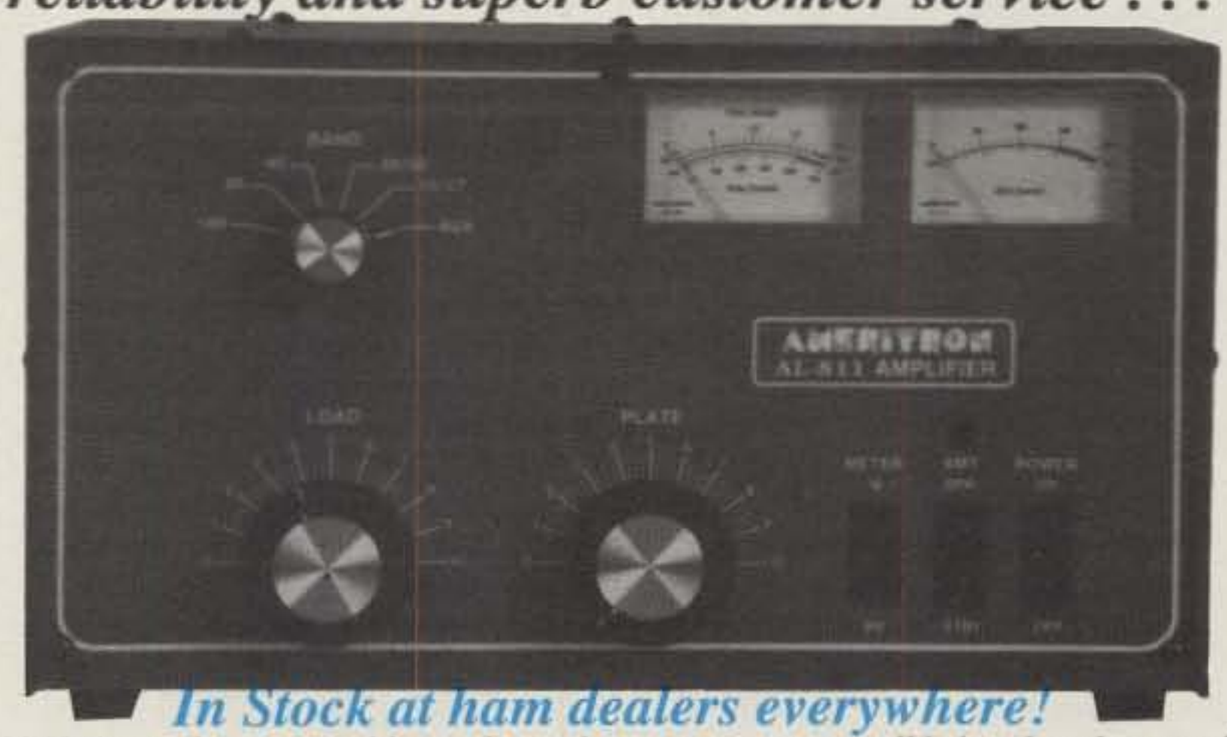

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A *quiet* blower pressurizes the cabinet with a large volume of air flow. It keeps the 811A tube temperature *well below* the tube manufacturer's rating -- even with a key down carrier at 400 watts output -- without the *overwhelming* noise of oversized fans.

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Two illuminated meters give you a clear picture of your AL-811 operating conditions so you can tell right away if something is wrong.

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Too high line voltage stresses components and causes them to wear out and fail. Too low line voltage causes a "soft-tube" effect -- low output and signal distortion.

Ameritron's exclusive *Adapt-A-Volt™* power transformer has a special buck-boost winding that lets you compensate for stressful high line voltage and performance robbing low line voltage.

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Shielded RF compartment. One year limited warranty. Compact 16" D x 13¾" W X 8" H. 30 pounds. UPS shippable. Shipped with transformer installed and wired for 120 VAC. Draws 8 amps at 120 VAC. Export model AL-811X wired for 240 VAC and includes 10 and 12 meters.

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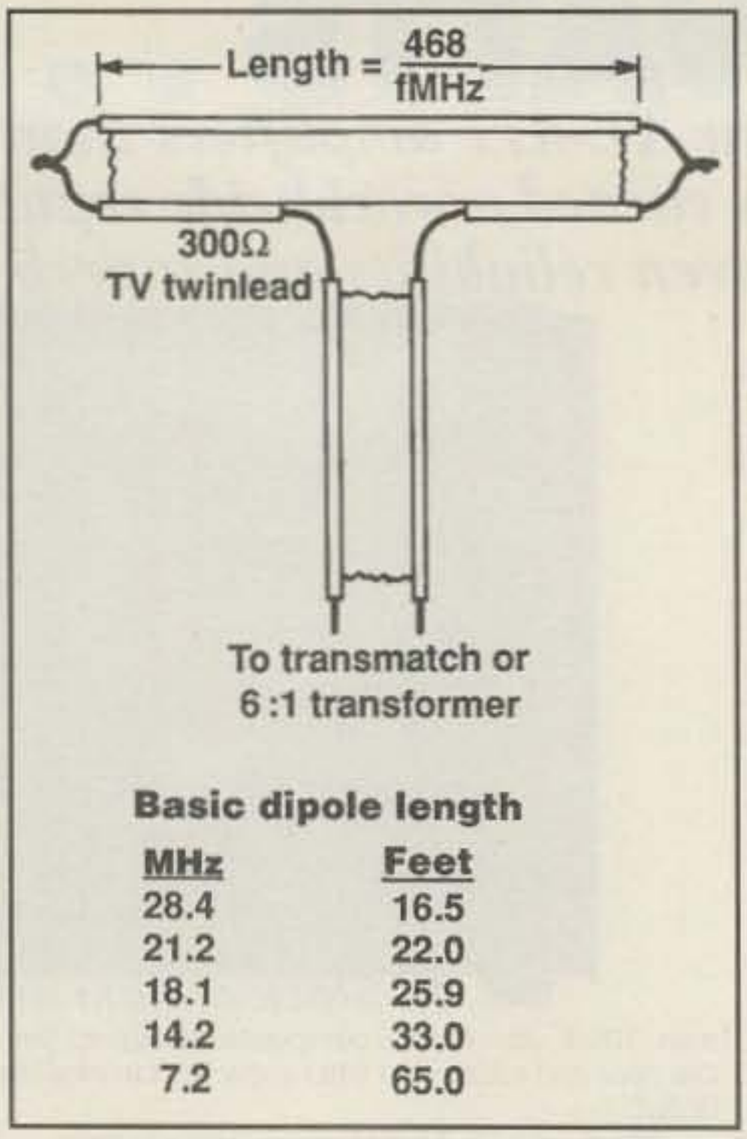

Basic dipole length

MHz	Feet
28.4	16.5
21.2	22.0
18.1	25.9
14.2	33.0
7.2	65.0

Fig. 2– This diagram gives information on the at one time very popular folded dipole. The folded dipole gives slightly greater bandwidth than an ordinary dipole. There is some amateur radio "mystique" to a folded dipole, as users have reported unusual results with it. Dimensions are given for many of the popular bands.

line at the transceiver. The transceiver would self-protect and shut down at 6 to 1. We must transform that 6 to 1 SWR mismatch to a 1 to 1 load for the rig to put out power. That's simple with a Transmatch or antenna tuning device.

However, and this is important, the open-wire line loss feeding a dipole, and having an SWR of 6 or 7 to 1, is not worth worrying about. The line loss because of standing-wave ratio is less than one decibel, even on 10 meters. (As an example, an SWR of as much as 10 to 1 with open-wire or ladder line is still less than one decibel—not even a measurable loss.) Our problem would still exist, though, in that we would have to transform the SWR mismatch to match the 50 ohm output of our rig. We would have to use a Transmatch to transform the impedance of the 450 ohm line down to 50 ohms. This is a very simple process, but necessary in order to have our transceiver working properly.

When we look at an antenna fed with open-wire line, the system should be viewed as a "package." To explain, let's assume we have enough room to put up a dipole that is 160 feet long—in other words, two 80 foot lengths of wire fed at the center with 450 ohm ladder line. To further confuse our problem, we plan to use this antenna on all bands—say, 160 meters clear down through 10 meters. The impedance of that antenna is going to vary all over the map. It can go from below 50 ohms to well over 4000 ohms, depending on which band we are on. We bring the end of our 450 ohm line into the shack and connect it to the Transmatch. What is this load that we have attached to the Transmatch? It certainly isn't 450 ohms. (It could be on one frequency, somewhere, but that's highly unlikely.) This load, which the Transmatch sees, is very complex. Our Transmatch has the job of transforming this varying load into a constant 50 ohm load to match the output of the transceiver. We put an SWR bridge in the line from the rig to the Transmatch, and then by observing the SWR bridge meter, we adjust the Transmatch so that we have a 1 to 1 SWR showing. This means that the Transmatch is converting the *unknown load* to a perfect 50 ohm load. Think of the Transmatch or antenna tuner in the same manner as a transformer. In fact, that's what it is. It transforms the unknown antenna system load into a 50 ohm, pure resistive load. The Transmatch takes the unknown antenna system load, and whatever that load is, high or low impedance, with reactance in it, converts the whole thing to a perfect 50 ohm resonant load.

We know for sure that there is almost certainly going to be an SWR of greater than 2 or 3 to 1 on the ladder line. However, we also don't care what the SWR is because we are using a practically lossless line. The line cannot radiate, so our power is going to go to our antenna and be radiated. What is more important, though, is our simple dipole antenna of 160 feet length is a very good antenna.

As you think about what you have just read, ask yourself, "Is the overall length of the dipole that important, and must it be a half wave long or longer?" The answer to those two items is important in understanding this system.

Always keep in mind that you are using an essentially lossless line. It should become apparent that theoretically you can use an antenna of any length for multiband operation. There are some limits as to how small—or rather how short—you can make the antenna, however. Always remember that bigger as well as higher is better in antenna construction. But most of us are strapped for antenna space, so let's be practical. I would recommend an antenna that is at least a quarter wavelength long overall. In other words, a 65 foot dipole will work on 80 (even 160), and when you tune the system to a higher band, that antenna will exhibit gain in some directions. You can use an inverted-V type of dipole; you can even fold the ends at 90 degrees to increase the overall length. You can make your own G5RV antenna simply by making the dipole 102 feet, center fed. In the case of our 160 foot dipole example, longer is always better. With a Transmatch you can use end-fed antennas or just long-wire antennas, although from experience, I prefer center-fed dipoles.

Also keep in mind that when your Transmatch is tuned to match the unknown antenna system load to the transmitter, you have set up the maximum transfer of power. Another advantage is that your transceiver is in all likelihood designed to have a 50 ohm input for the receiver. You therefore also improve your reception by matching the antenna system to the receiver. In addition, if you happen to be bothered by cross-modulation or other types of interference from a nearby broadcast station, the Transmatch provides more selectivity for your receiver and will give you better protection. Frequently I have been asked whether I use a Transmatch with all my antennas, including my beam, which has a 50 ohm feed. The answer is simple: I always use the Transmatch merely because I want my equipment always to work into its design impedance, which is 50 ohms.

I mentioned the 300 ohm twinlead folded dipole. This antenna has been around for many, many years and is an excellent performer. It is unlike the ordinary dipole because the antenna is folded back on itself. Fig. 2 shows the

antenna and its 300 ohm twinlead feed. It is also slightly more broadband than an ordinary dipole. Of course, from what I have just shown you, you can see that the impedance of the system is 300 ohms, the same as the impedance of the line. You'll still need a Transmatch or a 6 to 1 ratio balun to get down to 50 ohms. The common 4 to 1 balun should work okay. Jerry Sevick's book *Building and Using Baluns and Ununs* gives details on making 6 to 1 (or practically any other value) transformers. (The book is available from *CQ*.)

The formula for figuring out the length of a folded dipole is 468 divided by the frequency to be used. A Novice 10 meter folded dipole would be 468 divided by 28.5, giving a length of 16.47 feet. One of the very first antennas I made was a folded dipole for 10 meters. I taped the dipole to a length of bamboo and hand-rotated it. I worked well over 100 countries with that antenna, and it cost less than ten dollars.

If you go to yard sales, you might look for 8 foot long, non-metal fishing poles. Two of these will be long enough to tape to them a 10 meter folded dipole made from twinlead or ladder line. It shouldn't be any problem to make up a simple rotating system using a TV rotator, and you then will have one very fine rotatable, directional antenna. Ten meters will be coming back into its own within the next few years. If you want to make your own open-wire feeders, you may find it tough to find the necessary spreaders. However, women's plastic hair curlers are cheap, and there are many types available. If you can find plastic or poly dowel rods, they can be cut to the desired length and used.

Coaxial Feed Lines

Coax feed line is without a doubt today's most popular transmission line in use by amateurs. Coaxial line consists of (usually) two conductors—an inner conductor and an outer conductor, which also serves as a shield. A protective jacket usually made from a poly material surrounds the outer conductor. The material used in this outer covering can be a type that is impervious to weather. In fact, with some coax the lines actually can be buried underground without affecting their performance. However, compared to open-wire line, coax suffers as to efficiency. Because of the close spacing of the conductors and the dielectric material used to surround the inner conductor, losses can be quite high. This, of course, will depend on how well the coax is designed and manufactured.

A simple example explains this problem. One hundred feet of RG58/U feeding an antenna on 2 meters will have very high losses. Assume 100 watts is being fed from the transmitter. Just about 70 watts will never reach the antenna, but will be dissipated as heat. That's what I call inefficiency! This loss occurs when the coax's impedance (50 ohms) is matched to a 50 ohm antenna. If we have a mismatch, the losses will rise.

There are some facets of SWR that are very important. First, and of course most important, is the design of your transceiver. Nearly all solid-state transceivers are designed so that they simply cannot tolerate an SWR of more than 2 to 1. Simply put, when the SWR exceeds this value, the transmitter final amplifier turns itself off. If the load were to exceed 3 to 1, the voltages and currents could go so high that they would destroy the final transmitter transistors.

Therefore, there are circuits built into the rig to protect the final stage against this condition.

There are a couple of answers to this problem. First, you can match your antenna system to your feed line and also match the feed-line load to the transceiver. This can be a fixed adjustment that never needs changing. Unfortunately, it also means that your system likely will be confined to a single frequency or a very narrow bandwidth. When you QSY, the values all change, so you would require more flexible adjustments.

The next answer is the use of a Transmatch with your transceiver. Today, many transceivers have built-in Transmatches—or if you will, antenna tuners. Unfortunately, most of these have very limited matching ranges; usually they will handle no more than a 3 to 1 SWR. Remember, a 450 ohm ladder feed line connected to a halfwave dipole will have a 6 to 1 SWR. The obvious answer, therefore, is to use a wide-range Transmatch. In my system I use a commercial Transmatch which handles either coax or open-wire line, or even single-wire feed. This following statement may shock you, but I can easily match SWRs of 40 to 1 or higher on my ladder-line feed.

I mentioned earlier that RG58/U had that horrendous loss at 2 meters in a 100 foot run. One problem with having a high SWR is the increase in losses in the line as the SWR rises. How much the losses increase is very important. The statement that has been used is "additional losses due to SWR." Here is a very important point in this discussion. For all practical purposes, open-wire or ladder line is lossless up to 30 MHz. In fact, ladder line has a loss of only 0.3 decibels per 100 feet at 50 MHz. My SWR of 40 to 1 would mean no additional losses worth considering up to and through 10 meters. Another popular coax is RG8X. This is a relatively small diameter coax. Its loss on 10 meters is about 1.5 decibels (that can be appreciable).

It is important to know how RF energy flows in coax. The RF flows on the outside of the inner conductor and the inside on the outer shield. There should be no flow of energy on the outside of the outer shield. If RF flows on the outside, then the coax acts as an antenna and radiates. This is very undesired radiation if you are using a directional antenna, as it can either destroy or degrade the desired beam pattern.

The coaxial line with which we all are familiar is simply a tubular feed line with an inner conductor surrounded by a metal sheath. The inner conductor can be a solid or stranded wire, the stranded wire providing slightly more flexibility of the line. It is customary to enclose the inner conductor in a sheath of poly material and then surround the poly material with a copper or aluminum shield which is also the second conductor. This outer shield can be made from stranded copper wires or a solid shield. The solid shield is more expensive than the stranded, but does provide better shielding. One of the important factors of coax line is that it is a shielded transmission line in that all of the RF flowing on the line should be enclosed within the shield. In theory, there should be no radiation from the coaxial line when it is carrying RF energy, but that is in theory. In amateur practice it sometimes is difficult to keep the coax from radiating.

The impedance of a coaxial line is determined by the size of the conductors and the spacing between the inner conductor and the outer shield. Before WW II coax was not in common use by amateurs simply because it was hard to find and very expensive. However, after the war coax was readily available on the surplus market and was cheap. Amateurs were quick to use the line because it offered many advantages over the then-used open-wire line. Coax could be strapped to a metal tower, buried underground, and even run under water. Of course, all these features were a big advantage over the lines amateurs were accustomed to using. The commonly available impedance of the coax line then was either 50 or 75 ohms, but gradually amateurs came to accept 50 ohms as the standard.

This relatively low impedance completely changed transmitter and receiver design so that all modern equipment is designed to work into 50 ohm impedances. That, and the advent of television and the need to prevent TVI, hastened the use of coax. All of this may sound as though coaxial feed lines are the answer to all amateurs' prayers, but unfortunately that isn't so.

It is important to keep in mind that losses also occur on the receiving path. Weak signals coming into your antenna may never reach your receiver! I know amateurs still like to use RG58 coax on 2 meters when doing mobile installations, but it is so easy to lose a lot of your power with it, that it just isn't worth using it. In addition, we found out many years ago that if an absolutely perfect job isn't done when installing coax fittings on RG58 or RG8X, it is possible to lose as much as 10 decibels just in the fitting. Get the details for installing fittings from one of the handbooks and do a good job, not a sloppy one.

If you are planning a new antenna installation and you would like to consider burying your feed line (coax), do some homework first. There are several feed-line manufacturers and dealers who advertise on the pages of *CQ*. Write to them and ask for the coax types they have available and their prices. Study the jacket material and the recommendations for use. Also the loss characteristics are very important. For example, a commonly used designation is RG8 coax, which is about 1/2 inch in diameter. However, there are many different types of this line which amateurs commonly refer to as RG8 coax. For VHF and UHF you want the lowest possible loss coax within your price range.

I mentioned earlier that some amateurs prefer to use coax to come into their shack and to keep open-wire line outside. I normally don't like to recommend using lengths of coax to go outside and then connect to ladder line or open-wire line via a transformer. A problem exists in that very high voltages and currents could exist on that short coax line from the rig out to the open-wire line. If you are running high power, the SWR on that length of coaxial line can get so high it will puncture the line. Be aware that high power in such an installation could be a serious and dangerous problem.

The above should help motivate you to think about one of the least appreciated aspects of your station. If you're a new amateur just starting out during this cycle's rise, then you have plenty of time to do it right the first time. If you're an old timer who's been around for a while, it's likely that your coax is old enough to vote and drink in all 50 states, and maybe it's time to get in step with some modern products. ■

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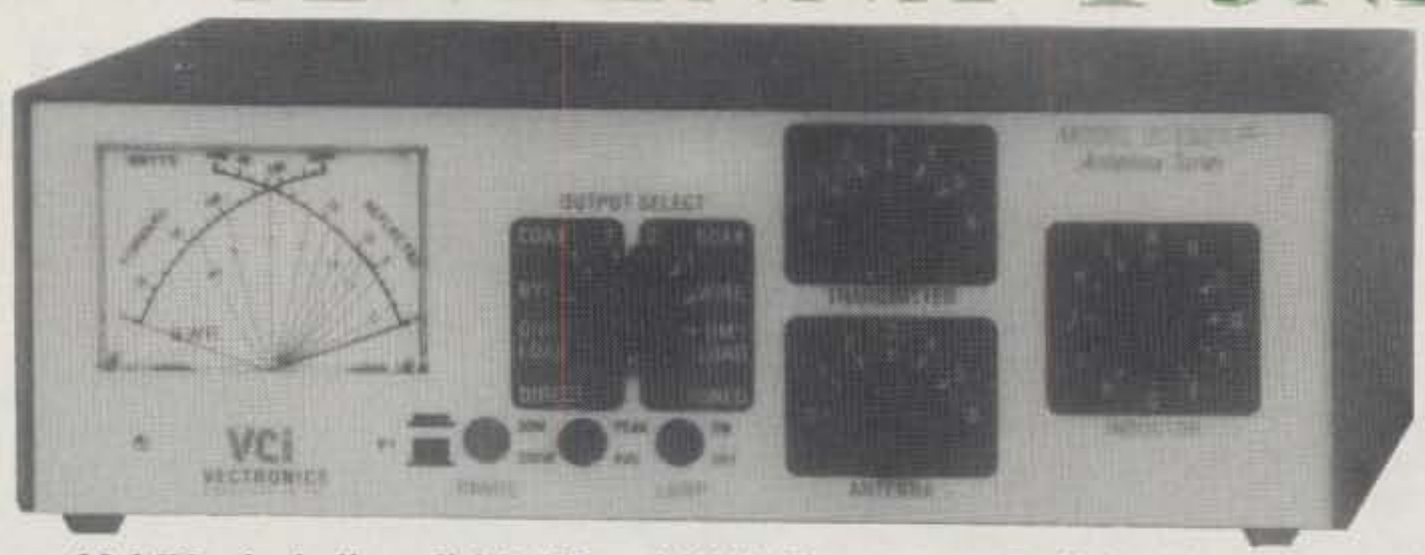

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The VC-300DLP eight position antenna switch lets you select two coax fed antennas, random wire/balanced line or built-in dummy load for use through your tuner or direct to your transceiver. Bypass position bypasses your tuner but keeps your SWR Power meter in line.

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A built-in 50 Ohm dummy load makes tuning up your rig easy! Use it for testing and repairing your rig, setting power level, adjusting your mic gain and more.

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Backlit dual movement meter simultaneously monitors Power and SWR. Covers 1.8-30 MHz. Handles 300 Watts SSB PEP, 200 Watts continuous, (150 Watts on 1.8 MHz.). 7.25x8.75x3.6 in. Weighs 3.4 lbs.

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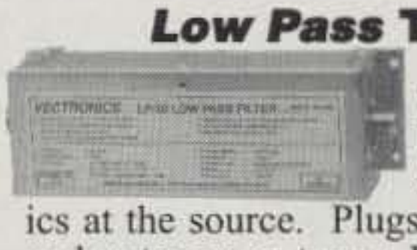
DL-650M, $64.95. Handles 100 watts continuous, 1500 Watts for 10 seconds to 650 MHz. Ceramic resistor. SWR < 1.3. SO-239 connector. **DL-650MN, $69.95** has N connector.

Low Pass TVI Filter



LP-30, $69.95. Eliminates TVI by attenuating harmonics at the source. Plugs between transmitter and antenna or tuner. Handles 1500 watts.

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CIRCLE 157 ON READER SERVICE CARD

The Radio Shack Probe-Style Oscilloscope

BY BUCK ROGERS*, K4ABT

Look! It's not a bird! It's not a plane! It's an "osziFOX©"! Anyone who knows Buck Rogers very well also knows what a high-tech "gadget" hound I am. When I heard about the gadget I'm about to describe here, I knew I was about to get another "gadget fix." It's a new high-tech idea from Radio Shack™, and it's worth the "C-note" in every respect.

This device is a miniature oscilloscope with a small screen built into the side of it. The screen measures approximately one inch diagonally. It's light weight and slightly larger than a shirt-pocket-size flashlight.

To talk about this handheld oscilloscope is one thing. However, when you hold it in your hand, you begin to realize that it's more than you first thought. This "Probe-Style" oscilloscope comes with a bundle of PC-compatible software that is supported in the Windows™, Windows 95™, and DOS environments. When reality sets in . . . POW! You realize you have a handful of high-tech dynamite!

The day I received the Radio Shack (catalog No. 22-310) osziFOX software and oscilloscope, I went through the compact manual in about an hour. When I had some difficulty with the first pass, I read it again. After reading over the manual twice, I proceeded to install the osziFOX software, which makes the Probe-Style oscilloscope into an even more powerful test instrument.

If I had read the manual once and then installed the software, I would have fared better. The software is easier to understand than the manual. Actually, the on-screen "help" feature of the osziFOX does more justice to the Radio Shack micro "o-scope" than does the manual. I'm not saying you should omit the manual. I'm merely saying the software will ease your mind as you proceed with the use of the osziFOX.

The Radio Shack Probe Style oscilloscope comes with a full set of interface cables for the serial port of your computer, the test leads to connect to device(s) under test, and power connector cable.

Introduction

Let me put my enthusiasm in check for a moment while I give this test instrument a more formal introduction. The osziFOX is a microprocessor-controlled oscilloscope and digital voltmeter housed in a small probe with a backlit mini liquid crystal display (LCD). All oscilloscope parameters are menu driven, either on the miniature screen of the handheld scope or on the screen of your PC. The command menu and selections are chosen by pressing one of two push buttons on the handheld probe.

You can quickly and single-handedly set all parameters while looking at the point of measurement, the probe's controls, and the display. This eliminates the need for any head move-

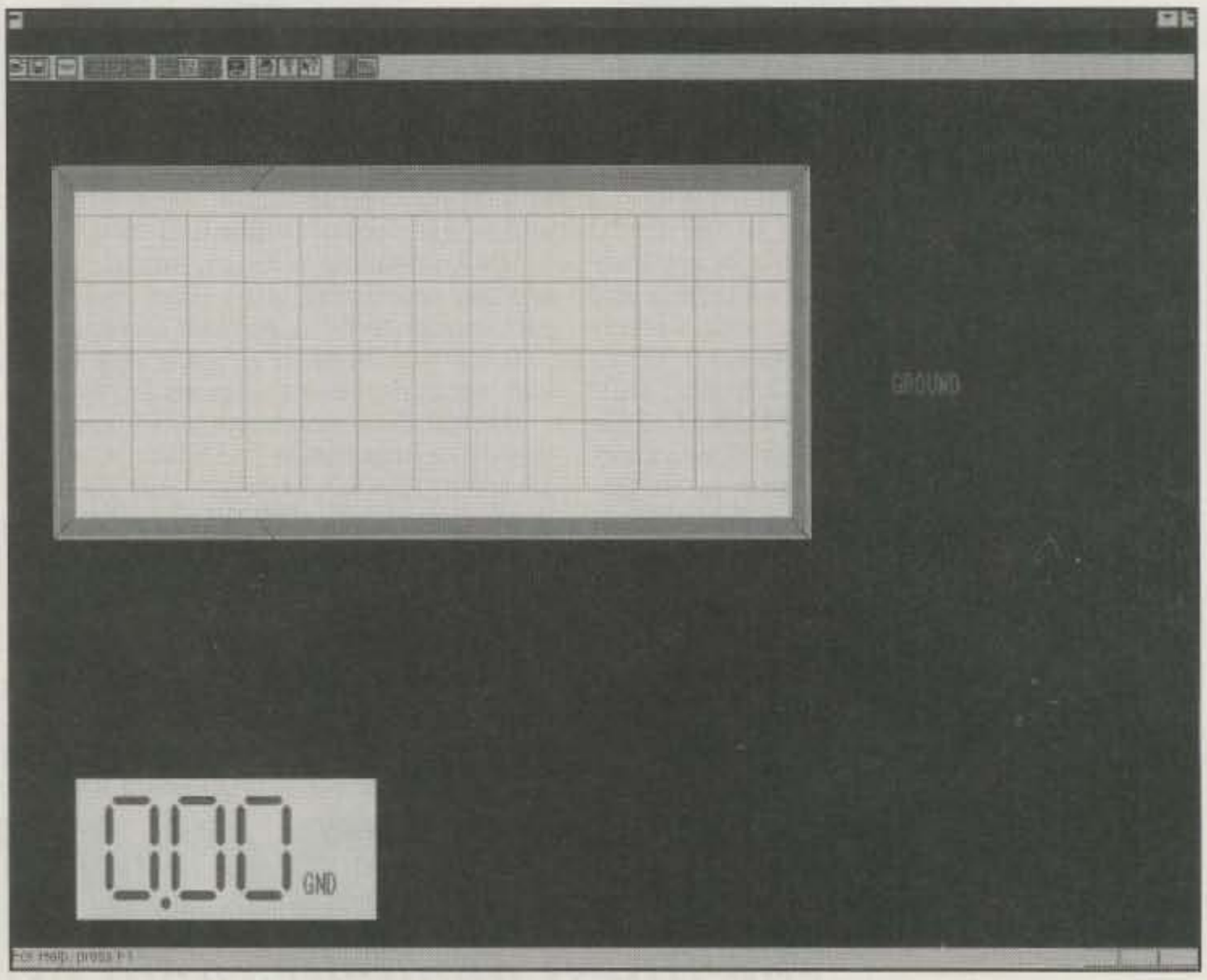

Fig. 1– The opening screen of the osziFOX software package supplied with the Radio Shack Probe Style oscilloscope.

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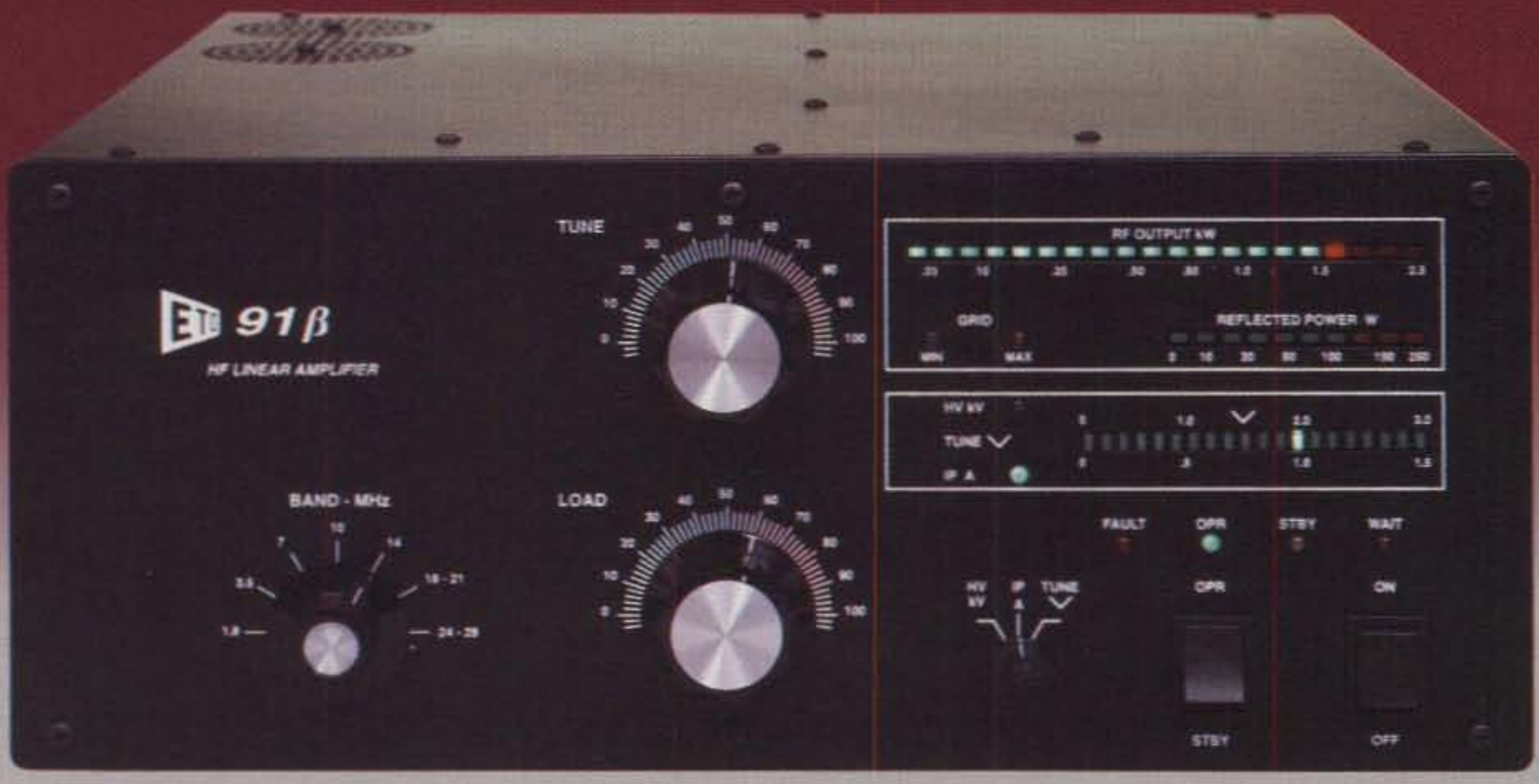

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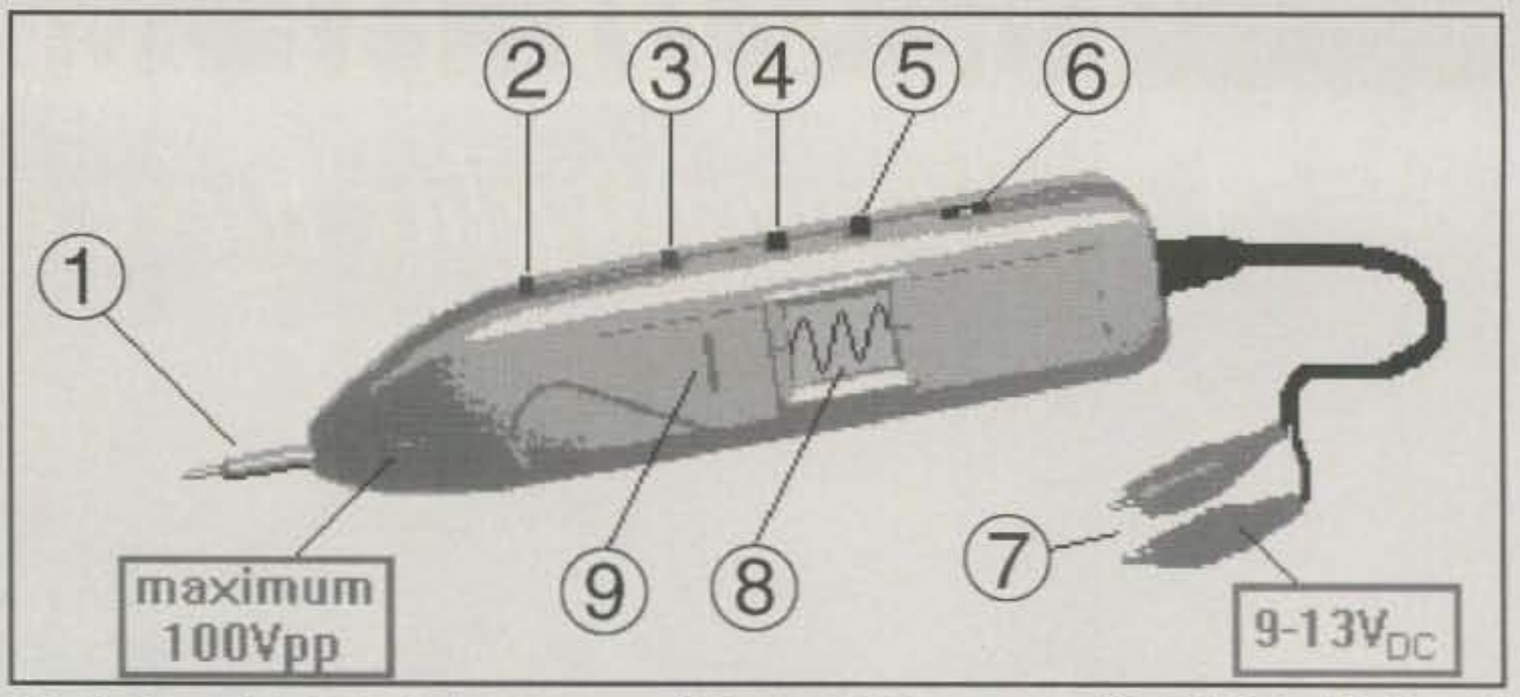


Fig. 2– The points indicated above are as followes: (1) Measurement Tip, (2) Select Button, (3) Menu Button, (4) Input Coupling Switch, (5) Input Voltage Switch, (6) Serial Line Connector, (7) Power Cable, (8) osziFOX Software, (9) Zero Line Adjustment.

ment, making the osziFOX the easiest to use measurement tool available.

It Operates "Stand-Alone" Or With Your PC

The osziFOX operates as a stand-alone device or with the PC serial interface and accompanying software (supplied). Here are some of the osziFOX features:

Sample rate = 1 ms – 50 ns (20 MHz)
Multiple trigger sources:
- AUTO
- +/–EXTERN
- +/–INTERN
- SINGLE/RUN

Six selectable trigger levels
Selectable input voltage ranges:
- 1 VACpp (1 volt AC peak-to-peak) or 1 VDC
- 10 VACpp (10 volt AC peak-to-peak) or 10 VDC
- 100 VACpp (100 volt AC peak-to-peak) or 100 VDC

Selectable input coupling:
- AC
- DC
- Ground

There is an extra ground line to reference the incoming signal and a second connector to plug in an external trigger source.

When using the oscilloscope with the osziFOX software or in conjunction with a PC, you not only have the screen display to work with, you have many features such as save to disk, print to hardcopy (printer), and comment and save.

Features

Signal Screen. The opening screen (fig. 1) of the PC software signal screen displays all incoming signals you measure with the osziFOX. Every record has 128 values to shape the waveform. The curve is shown in the default color—bright green. The colors of the curve and background can be changed and saved as the default screen colors at startup.

To move the scope's horizontal or vertical cursors, click on a scope cursor and continue to press the left mouse button while moving the mouse from one location to another. When the scope cursor is at the desired location, release the button.

Ground Connector. To establish an incoming signal, you need to attach one of the supplied test wires to the osziFOX's ground reference. The ground reference for the incoming signal is the Ground (0 volt) jack. A full complement of controls and connections is shown in fig. 2.

Select Button. The Select button is used to select functions and modes. When using the recording screen with the trigger set to **Run** or **Auto**, the Select button rapidly changes the timebase. When using the recording screen with the trigger set to **Single**, the Select button arms the trigger.

Menu Button. This button is used to sequence through the osziFOX software menus on the display.

Input Coupling Switch. This switch is used to select the AC, DC, or GND (Ground) input coupling. When set to **GND**, the trigger automatically resets to **Auto**. The switch setting options are shown on the osziFOX's back label. The computer displays the actual setting.

Input Voltage Switch. The Input Voltage switch is used to select a maximum AC input voltage of 1 volt pp, 10 volts pp, or 100 volts pp, or a maximum DC input voltage of 1 volt, 10 volts, or 100 volts. *Note:* Never exceed a voltage of 100 VACpp (volt peak-to-peak) or 100 VDC between the measurement tip and ground. The switch setting options are shown on the Probe Scope's back label. The computer displays the actual setting.

Serial Line Connector. Connect the oszi-

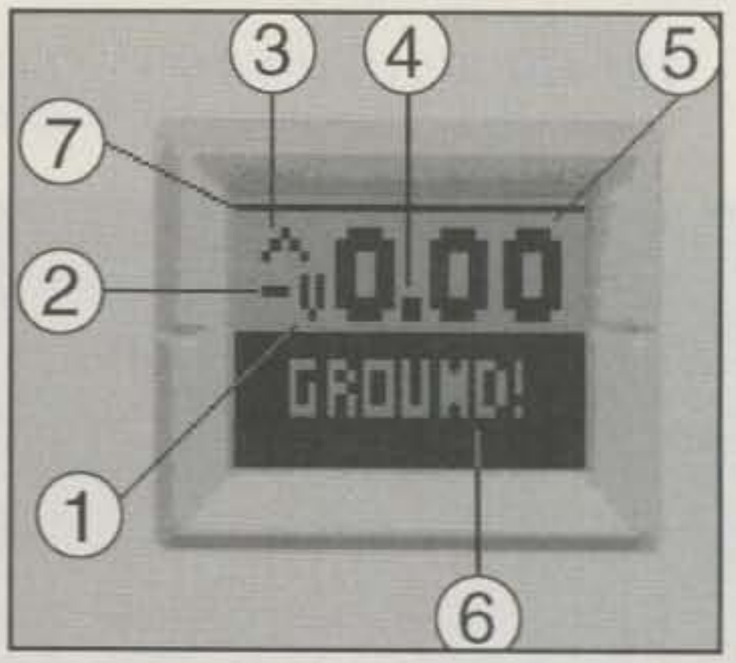
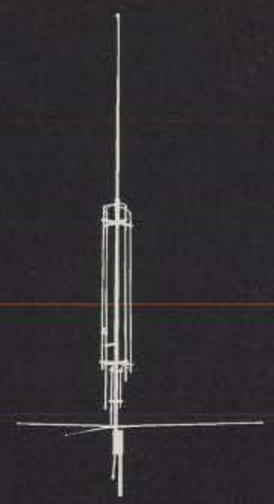


Fig. 3– Did I mention that the osziFOX is also a digital voltmeter (DVM)? The digital voltmeter (DVM) window displays the readings for the mode and value being measured.

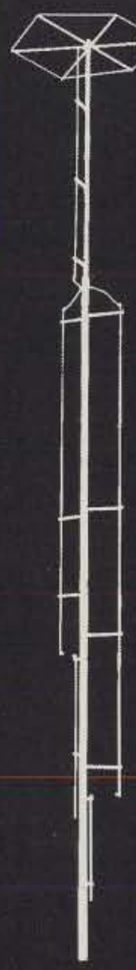
GAP: THE PERFECT ANTENNA

We at GAP realize there isn't a perfect antenna. No singular antenna will scream DX on 80 and be the best for local nets on 10. If anyone tells you there is, beware! The perfect antenna does not exist, but the right one for you may. If you want something to bust the pile on the low bands, then consider the Voyager. Just starting out in ham radio and need a great general coverage antenna, the Challenger is easy to assemble and for little effort will yield superior performance, especially on DX. Maybe you knowingly or unknowingly moved into one of those "restricted areas" where the Eagle's limited visibility, but unlimited ability is desired.



Eagle DX

Challenger DX



Voyager DX

This chart helps you select the right GAP antenna. When comparing GAPs, bandwidth is not a concern. With few exceptions, a GAP yields continuous coverage under 2:1 for the **ENTIRE BAND**.

All antennas utilize a GAP elevated asymmetric feed. A major benefit is the virtual elimination of the earth loss, so more RF radiates into the air instead of the ground. This feed is why a GAP requires **NO RADIALS**. Just as elevating a GAP offers no significant improvement to its performance, adding radials won't either, making set up a breeze.

A GAP antenna has no traps, coils or transformers. This is important. The greatest sources of failure in multiband antennas are these devices. Perhaps you heard someone discuss a trap that had melted, arced or became full of water. Improvements to these inherent problems are the focus of the antenna manufacturer, while the basic design of the antenna remains unchanged. **GAP improved the trap by eliminating it!** Removing these devices means they don't have to be tuned and, more importantly, won't be detuned by the first ice or rain. The absence of these devices improves antenna reliability, stability and increases bandwidth.

Another major advantage to a GAP antenna is its NO tune feature. Screws are simply inserted into predrilled holes with a supplied nutdriver.

The secret is out and people in the know say:

CQ–"The GAP consistently outperformed base-fed antennas. .and was quieter."

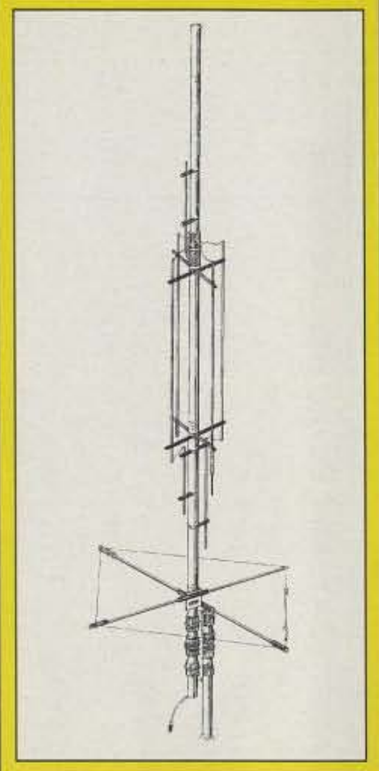
73–"This is a real DX antenna, much quieter than other verticals."

RF–"To say this antenna is effective would be a real understatement. Switching back and forth on 40m between another multiband HF vertical and the GAP, there was no comparison. Signals were always stronger on the GAP, sometimes by S units, not just DB's."

Worldradio – "These guys have solved the problem associated with verticals. That is, an awful lot of RF is wallowing around and dropping into the dirt instead of going outward bound. A half-wave vertical does need radials if it is end fed (at the bottom). But the same half-wave vertical does not (as much, hardly at all) if is fed in the center."

IEEE–"Near field and power density analyses show another advantage of this antenna (asymmetric vertical dipole): it decreases the power density close to the ground, and so avoids power dissipation in the soil below it. The input impedance is very stable and almost independent of ground conductivity. This antenna can operate with high radiation efficiency in the MF AM standard broadcast band, without the classical buried ground plane, so as to yield easier installation and maintenance."

Latest Release: **TITAN DX**



This all purpose antenna is designed to operate 10m-80m, WARC bands included. It sits on a 1-1/4" pipe and can be mounted close to the ground or up on a roof. Its bandwidth and no tune feature make it an ideal antenna for the limited space environment as well as a terrific addition to the antenna farm.

MODEL	BANDS OF OPERATION											HT	WT	MOUNT	COUNTER-POISE	COST
	2m	6m	10m	12m	15m	17m	20m	30m	40m	80m	160m					
Challenger DX	■	■	■	■	■		■		■	■		31.5'	21 lbs	Drop In Ground Mount	3 Wires @ 25'	$259
Eagle DX			■	■	■	■	■		■			21.5'	19 lbs	1-1/4" pipe	80" Rigid	$269
Titan DX			■	■	■	■	■	■	■	■		25'	25 lbs	1-1/4" pipe	80" Rigid	$299
Voyager DX							■		■	■	■	45'	39 lbs	Hinged Base	3 Wires @ 57'	$399

GAP

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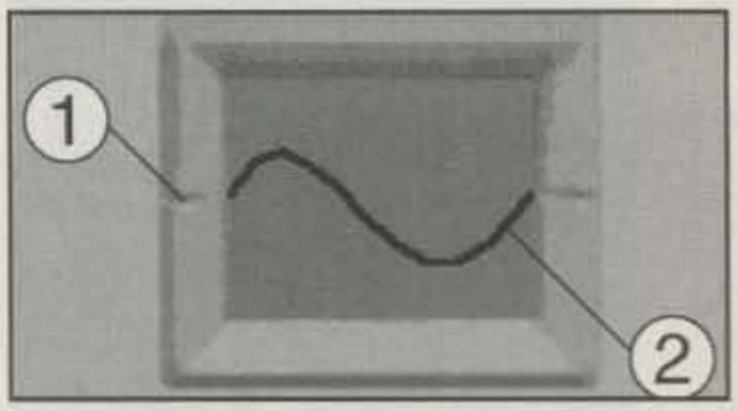

Fig. 4– This is how the osziFOX scope display appears on the probe, a green background with dark trace. (1) Middle Markers; (2) Measured Signal.

Specifications and Power Requirements

Input Voltage at [3]:	9–13 VDC
Duration LCD Backlite off:	approx. 5 hr.
Duration LCD Backlite on:	approx. 15 min.

Hardware Specifications

Sampling Rates:	50 ns, 100 ns, 0.5 µs, 1 µs, 5 µs, 10 µs, 50 µs, 0.1 ms, 0.5 ms, 1 ms
Band Width DC:	DC – 5 MHz
Band Width AC:	100 Hz – 5 MHz
A/D Converter:	6 bit resolution
RAM:	128 bytes
Input Coupling:	AC, DC, GND (Ground)
Input Voltage Ranges:	when AC selected—1 Vpp, 10 Vpp, 100 Vpp when DC selected—1 V, 10 V, 100 V
Trigger Definitions:	Auto, Internal, External
Trigger Levels:	Six
Trigger Modes:	Run and Single Cycle
LC-Display:	16×32 dots resolution, LED backlighted
Serial Line:	19.200 Kbaud, 7 data bits, 1 stop bit, no parity
DVM Accuracy:	±2 to ±5% depending on the parameter settings
Power Supply:	9–13 VDC, red (+ terminal) and black (– terminal) alligator clips
Power Consumption:	backlight OFF => about 12 ma backlight ON => about 85 ma
Dimensions:	165 × 33 × 20 mm
Weight:	about 70 g

FOX to your computer using the supplied serial cable. This plug is the cable's smaller, right-angle barrel plug which connects into the osziFOX's Serial Line jack.

With the computer (PC) off, connect the cable's 9-pin female connector to your computer's serial port. *Note:* Tighten the connector's fastening screws using a small-blade screwdriver.

During start up the software automatically searches for a signal from the osziFOX and configures it for the port to which it is connected. However, you manually can select a serial port from the FILE and COM Port menus. On the osziFOX's serial connector, Pin (1) corresponds to the transmit line and Pin (2) corresponds to the transmit ground line.

Power Cable. Connect a DC power supply to the osziFOX using the supplied power cable. Connect the black alligator clip to 0 volts (ground). If you use a battery, be sure that the black clip is connected to the battery's negative (–) terminal. Connect the red alligator clip to 9–13 VDC. If you use a battery, be sure that the red clip is connected to the battery's positive (+) terminal. The osziFOX draws a maximum current of about 85 ma. ***Caution:*** Never exceed +13 volts DC to the osziFOX.

Timebase Definitions (LCD). Repeatedly press the probe's Menu button until **Timebase** appears. Then press the Select button to select the desired timebase among 10 available set-

tings. When you select the recording screen and set the trigger to **Run** or **Auto**, the Select button rapidly changes the timebase.

Trigger Definitions (LCD). Press the probe's Menu button repeatedly until **Trigger** appears. Then press the Select button to select the desired trigger among the following five settings.

Auto: When you select this option, the oscilloscope continuously triggers and records signals each time a trigger occurs. If you set the input coupling switch to **GND**, the osziFOX automatically sets the trigger to **Auto**.

+INTERN: When you select this option, the oscilloscope records signals only when the defined trigger event occurs. The signal is recorded when the trigger level is equal to the incoming signal and the signal is rising.

–INTERN: When you select this option, the oscilloscope records signals only when the defined trigger event occurs. The signal is recorded when the trigger level is equal to the incoming signal and the signal is falling.

+EXTERN: When you select this option, the oscilloscope records signals only when the defined trigger event occurs. The signal is recorded when the trigger level is equal to the signal present at the external trigger plug and the signal is rising.

–EXTERN: When you select this option, the oscilloscope records signals only when the defined trigger event occurs. The signal is recorded when the trigger level is equal to the signal present at the external trigger plug and the signal is falling.

Backlight Definitions (LCD). Repeatedly press the probe's Menu button until **Backlight** appears. Then press the Select button to toggle between **On** and **Off**. The LCD's backlight draws about 73 ma of current. When you turn off the backlight, the current decreases to its minimum of about 12 ma, an important power-saving consideration when you power your oscilloscope from a battery.

Function Definitions (LCD). The osziFOX works either as an oscilloscope or as a digital voltmeter (see fig. 3). Press the probe's Menu button until **Function** appears. Then press the Select button to toggle between **Scope** (oscilloscope) and **DVM** (digital voltmeter).

Digital Voltmeter Screen (LCD)

In the DVM mode the recorded value is shown as follows:

1. **Display Mode. V** appears when the osziFOX is set to the DVM mode. *Note:* Use the Input Coupling Switch to select AC, DC, or Ground. The probe displays the current selection below the measured voltage indication.

2. **Polarity Mode.** The minus (–) symbol appears when the measured DC voltage is negative with respect to the displayed zero line.

When you set the Input Coupling Switch to AC, all negative half-waves are multiplied by –1 to convert them to positive half-waves. Then all positive half-waves are added with respect to the actual zero line and divided by 128. This average is then multiplied by 0.707 (VRMS). It is necessary to have at least two signal periods to measure AC DVM values.

When the Input Coupling Switch is set to DC, the probe displays an average of 128 recorded values.

3. **Voltage Monitor Mode. /** appears if the osziFOX detects a voltage greater than the selected range.

4. **Voltage Range Mode.** The position of the decimal point (.) indicates the voltage measurement range. Use the Input Voltage Switch to select the desired range.

5. **Measurement Mode.** The display shows measured values as follows:

Voltage Switch with AC Coupling

Range	Voltage Peak-to-Peak
1 V pp	0.00 – 1.00
10 V pp	0.0 – 10.0
100 V pp	1 – 100

Voltage Switch with DC Coupling

Range	Max. Voltage
1 V	0.00 – 1.00
10 V	0.0 – 10.0
100 V	1 – 100

Never try to measure a voltage that exceeds 100 VAC pp/100 VDC.

6. **Input Coupling Mode.** Displays the Input Coupling mode (AC, DC, or Ground).

7. **Zero Line.** A horizontal line appears across the screen to show the actual zero line as set by the Zero Level control on the osziFOX.

Scope Screen (LCD)

Due to the lower dot resolution of the Probe Scope's display, the measured signal (2) is more clearly displayed on a computer's osziFOX software display (see fig. 4).

In the **Scope** mode, the recorded value is shown as follows:

• The probe display's Y-axis has 16 dots.

Each dot represents 1/16th of the actual selected input voltage.

• The probe display's X-axis has 32 dots. Only the first 32 of 128 samples are displayed.

Set the Input Coupling Switch to **GND** (Ground). Then adjust Zero Level to set your reference zero line. The two middle markers (1) correspond to an approximate zero line reference. If the trigger is set to **Single**, use the Select button to arm the trigger.

Trigger Level Definitions (LCD)

To set the Trigger Level Definitions:

1. Repeatedly press the probe's menu switch until **Trigger** appears.
2. Press the Select button to select **+INTERN, –INTERN, +EXTERN,** or **–EXTERN**.
3. Press the probe's menu button again so **Trigger Level** appears.
4. Then press the Select button to select one of six trigger levels.

Note: The level (±0.5, ±0.3, or ±0.1) has to be multiplied by the actual selected Input Voltage. The result corresponds to the trigger level expressed in volts.

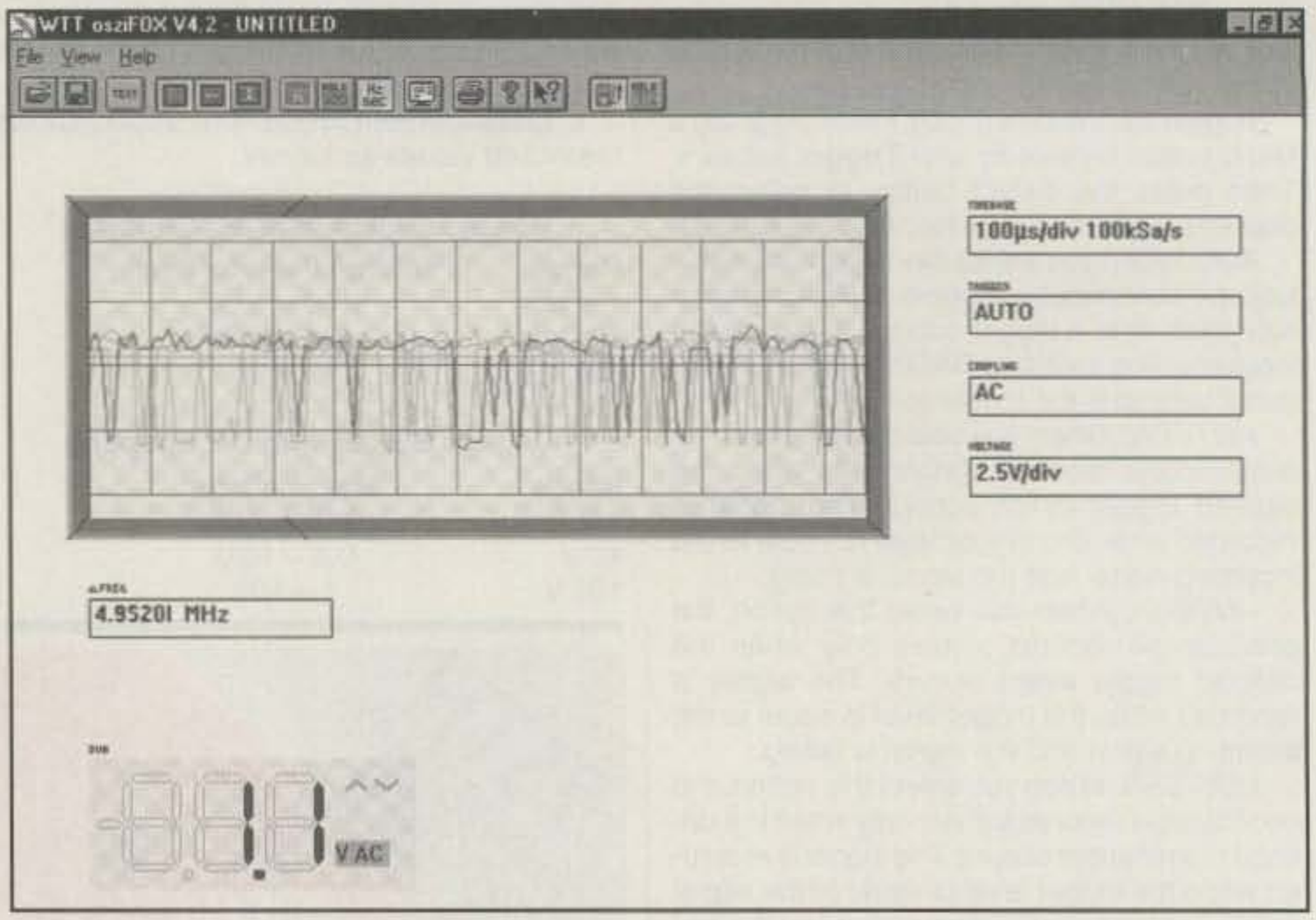

Fig. 5– Each time I use the osziFOX oscilloscope I discover another use for it. I just used it to set the local oscillator in one of my theNET (TNC-2) nodes—yet another application for the system node operator who wants his node to perform with the highest degree of precision.

Summary

I have one final note: Use caution, as the osziFOX oscilloscope measurement tip is very sharp. To prevent injury, handle it with care.

The osziFOX software and oscilloscope package is not a toy. It is a high-tech instrument that you'll find useful in many of today's troubleshooting and electronic project applications. Each time I use the osziFOX oscilloscope I find another use for it. I just used it to set the local oscillator in one of my theNET (TNC-2) nodes (see fig. 5)—yet another application for the system node operator who wants his node to perform with the highest degree of precision.

The Radio Shack (catalog number 22-310, $99.99) osziFOX software and oscilloscope comes as a complete package ready to install and operate. You can find it at your neighborhood Radio Shack store or dealer. ■

DEFY SUNSPOTS . . . ADD AN AMP

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Matched Rectifiers	yes	no

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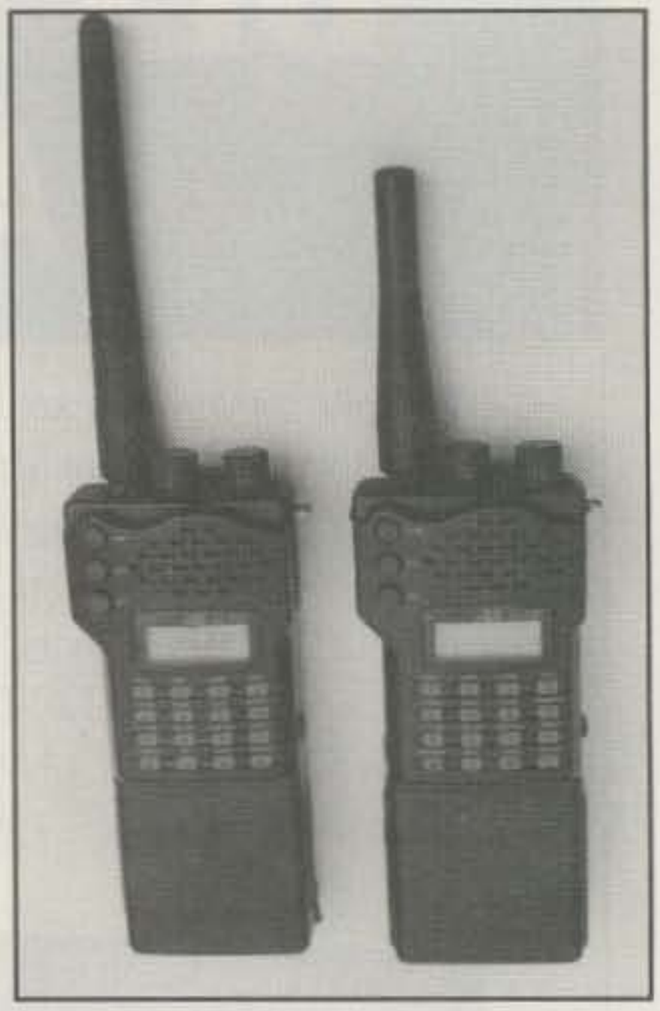
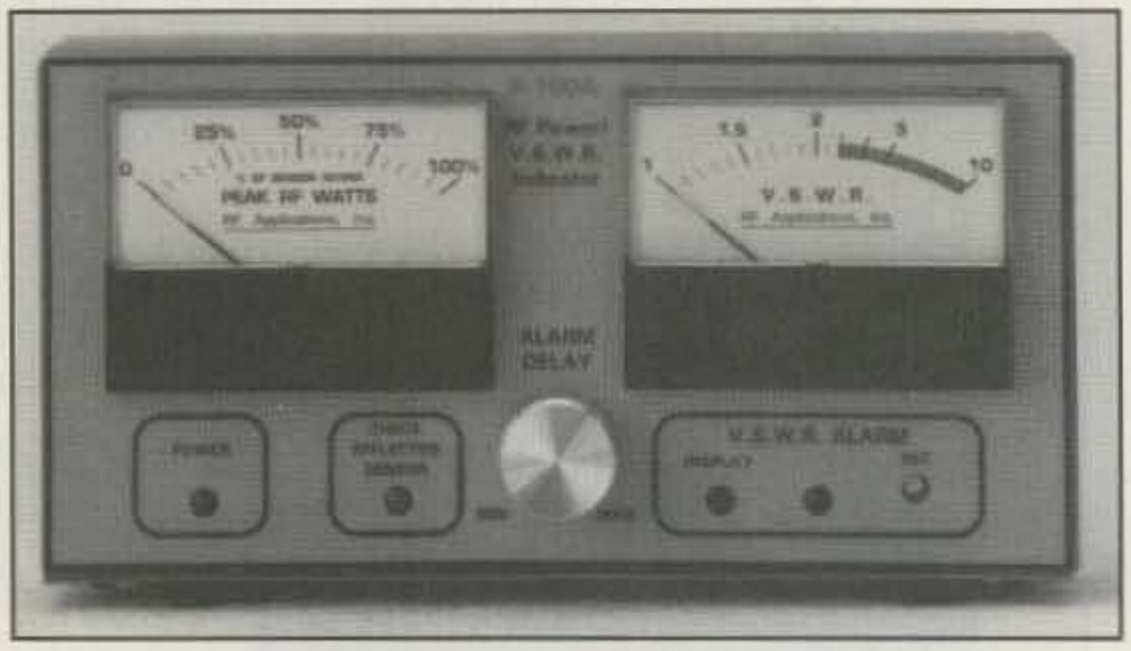


Premier Communications has introduced the ADI AT-200/2-meter and AT-400/70cm FM handheld transceivers. Both models are identical in features and size (5.5"H×2.1"W×1.25"D, with supplied battery pack). The only difference is frequency coverage. The AT-200 operates 144–148 MHz, with extended reception of 130–179 MHz for monitoring NOAA weather, VHF marine, and public services; MARS/CAP capability is also included. The AT-400 operates 430–450 MHz, with extended reception of 400–480 MHz. Both are equipped with an easy-dial VFO, 20 memories, backlit display and DTMF keypad, 4 scan modes, dual watch, and call channel. Power output of the AT-200 and AT-400 is 2.5 watts high and .35 watts low. Five watt versions (AT-200H and AT-400H) equipped with 12 volt battery packs are also available.

Additional features include 38 tone CTCSS encoder, CTCSS decoder (for tone squelch), and DTMF paging. For pricing and more information, contact Premier Communications, 20277 Valley Blvd., Walnut, CA 91789 (phone 1-800-666-2654; fax 909-869-5710), or circle number 100 on the reader service card.



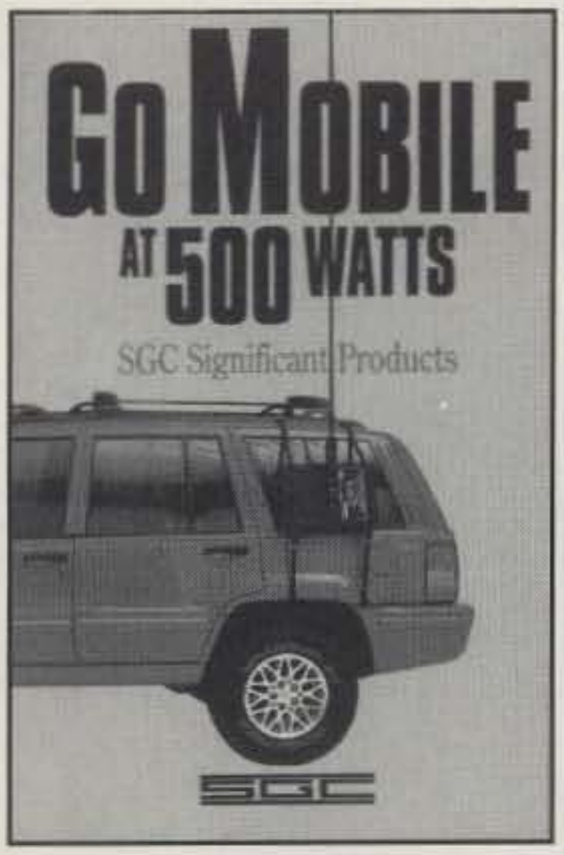
P-100A HF Digital Wattmeter From RF Applications, Inc.

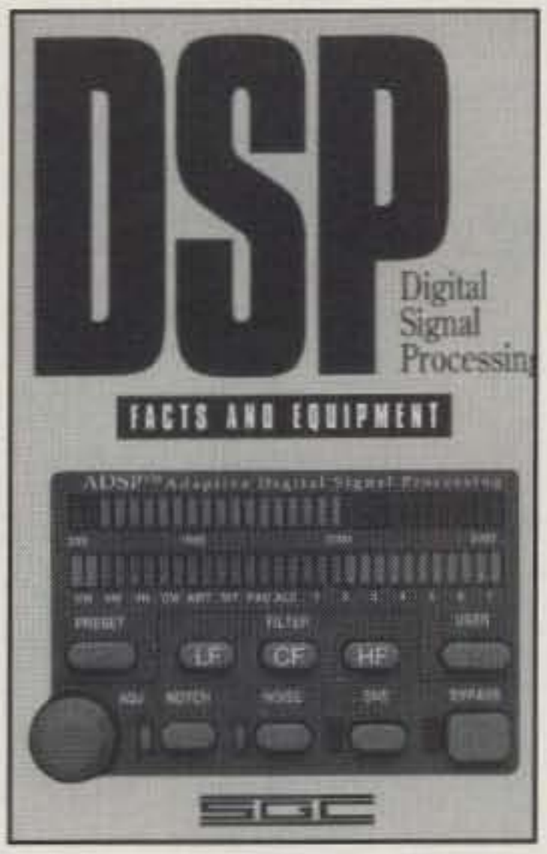
The P-100A HF digital wattmeter provides digitally-driven analog meters for indication of peak RF power and VSWR. Using line sections and elements, the P-100A gives programmable forward/reflected element ratios of 2:1, 4:1, 5:1, and 10:1. The wattmeter can cover HF through UHF frequency ranges. Also included is an adjustable VSWR alarm, including a control relay that can be adjusted via a front-panel control. The alarm can be set from 1.1:1 to 10:1 using a small screwdriver, and the alarm delay time can be adjusted from immediate to approximately ten seconds.

List price of the P-100A is $239.95. For more information, contact RF Applications, Inc., 9310 Little Mountain Rd., Mentor, OH 44060 (phone 1-800-423-7252; international 1-216-974-1961; fax 1-216-974-9506), or circle number 101 on the reader service card.

SGC Inc. HF-SSB Radio Communications Books

SGC Inc. has published two new books relating to HF-SSB radio communications. *Go Mobile at 500 Watts* explains the techniques needed





to install a 500 watt mobile station in one of several automobiles. It has chapters on the basic layout of a mobile system, power for a 500 watt mobile system, antennas and grounds, noise and vibration, and installation tips. *DSP: Facts and Equipment* explains the basic concepts of digital signal processing and compares digital processing to analog processing. Included are chapters describing how sound is recorded and reproduced, the comparison of analog to digital filtering, DSP in high-frequency communications, and the future of DSP.

Both books are available through dealers or directly from SGC, Inc., P.O. Box 35326, Bellevue, WA 98009. For more information, contact the SGC Marketing Department at 1-800-259-7331, or circle number 104 on the reader service card.

C5900DA Mobile Transceiver From Standard Radio

The C5900DA from Standard Radio is a three-band, dual-display FM mobile transceiver with back-lit microphone and display. It offers a wide receive coverage on all bands, and uses a built-in triplexer for one antenna. Power output is 45W on 6 meters, 50W on 2 meters, and 35W on 70 cm, 3W and 10W selectable. The radio comes with 160 memories, 80 each side, and can be upgraded to 400, 200 per side with an accessory memory chip CMU161. Seven Hyper memories are provided, in addition to the normal memories, for quick selection of most- used frequencies. A snap-off front panel permits mounting the radio in the trunk or under the front seat. It is packet ready for 1200–9600 baud. A new feature is the ability to DTMF control the radio from an HT, allowing remote cross-banding, memory and VFO frequency changing. The CTCSS encode/decode board is built-in and DTMF allows auto-dialing with 12 memories, six per side. The C5900DA is equipped with a programmable TX time-out timer and auto power-off. Automatic opposite band mute reduces audio –20 dB when a signal appears on the main band. The unit measures 1.57"H × 5.51"W × 6.81"D, and weighs 2.65 lbs. Suggested retail price is $1049.

Formore information, contact your nearest Standard dealer, or Standard at P.O. Box 48480, Niles, IL 60714 (phone 312-763-0081; fax 312-763-3377; or on the web at <http:// www.stdradio.com>), or circle number 103 on the reader service card.

P.C. Electronics 1 Watt ATV Transmitter

The new TX33-1b 33 cm band (902–928 MHz) 1 watt ATV transmitter comes ready to go in a 7.3" × 4.7" × 2.1" inch die cast aluminum box. The front-panel RCA jacks accept video from most all camcorders, cameras, or VCRs. You can transmit live-action color or black-and- white video. A video monitor jack outputs the camera video while in receive mode to enable setting up the focus and lighting before transmitting, and then presents the actual detected composite video in transmit so you can fine adjust the video gain. There is a low impedance mic jack for mixing with the line audio input to allow voice-over commenting while showing your home video tapes.

The TX33-1b has built-in RF T/R relay so you can connect the companion P.C. Electronics TVC-9G 33 cm down converter through this box to a single antenna for simplex operation. However, many areas use a separate band for full duplex or repeater. The PTL (Push-To-Look) jack is in parallel with the transmit/receive toggle switch. This transmitter is AM, the same as broadcast TV, so all you need to receive is a down converter and a TV set. The down converter output uses a BNC and the common antenna is type N. The TX33-1b comes with one crystal; you must specify its frequency (910.25 MHz is the most common, but others are stocked or can be ordered).

For more information, or to receive a 10-page ATV catalog from P.C. Electronics, write to them at 2522 Paxson Lane, Arcadia, CA 91007 (phone 818-447-4565; or e-mail <toms mb@aol.com>), or circle number 109 on the reader service card..

Palomar's Field Strength Meter

A new field strength meter, Model PFS-1, is available from Palomar Engineers. The PFS-1 features a detector linear over nearly a 30 dB range, an accurate step attenuator with 30 dB range, a 25 dB RF amplifier, high Q tuned circuits to suppress out-of-band local signals, and a panel meter readable to .1 dB. The PFS-1 meter cover 1.8 to 150 MHz and is powered by 9 or 12 volt batteries. Antenna connection is an SO-239 jack on the rear of the aluminum cabinet. The Model PFS-1 is priced at $195.

For more information, contact Palomar Engineers, P.O. Box 462222, Escondido, CA 92046 (619-747-3343; fax 619-747-3346; e-mail <75353.2175@compuserve.com>), or circle number 107 on the reader service card.

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MATH'S NOTES

BY IRWIN MATH, WA2NDM

WHAT'S NEW AND HOW TO USE IT

A Primer on Optical Communications—Part I

First I would like to wish all readers of this column the best for 1997. May this be the year all of your hopes, dreams, and aspirations come true!

I will begin the new year with a series of columns that will introduce most of you to the world of light wave communications. As I stated in December, and previously, there are many new worlds awaiting the experimenter. Hopefully this series will inspire some of you to take a look at one of them. Now to business.

We all are familiar with "The World Above 50 MHz" from articles in this magazine and the other amateur radio publications. We all have come across microwave-related articles on occasion, and some of us have even built, or considered building, 10 GHz (and higher) transmission links using Gunn diodes and the like. In the next several columns, however, we will explore a totally new area—the world above 150,000 GHz, or the world of light wave transmission. We will learn about the various similarities to and differences from lower frequency RF and how to employ this technology in our experimentation. We will learn about optical transmission methods from the transmitter to the receiver, look at "optical antenna equivalents," and finish our discussion by touching on the new technology of fiber optics. Since *CQ* is, after all, an amateur radio journal, and since I fully believe in homebrewing as I have mentioned ad-infinitum, actual circuitry will be given, wherever possible,

c/o CQ magazine

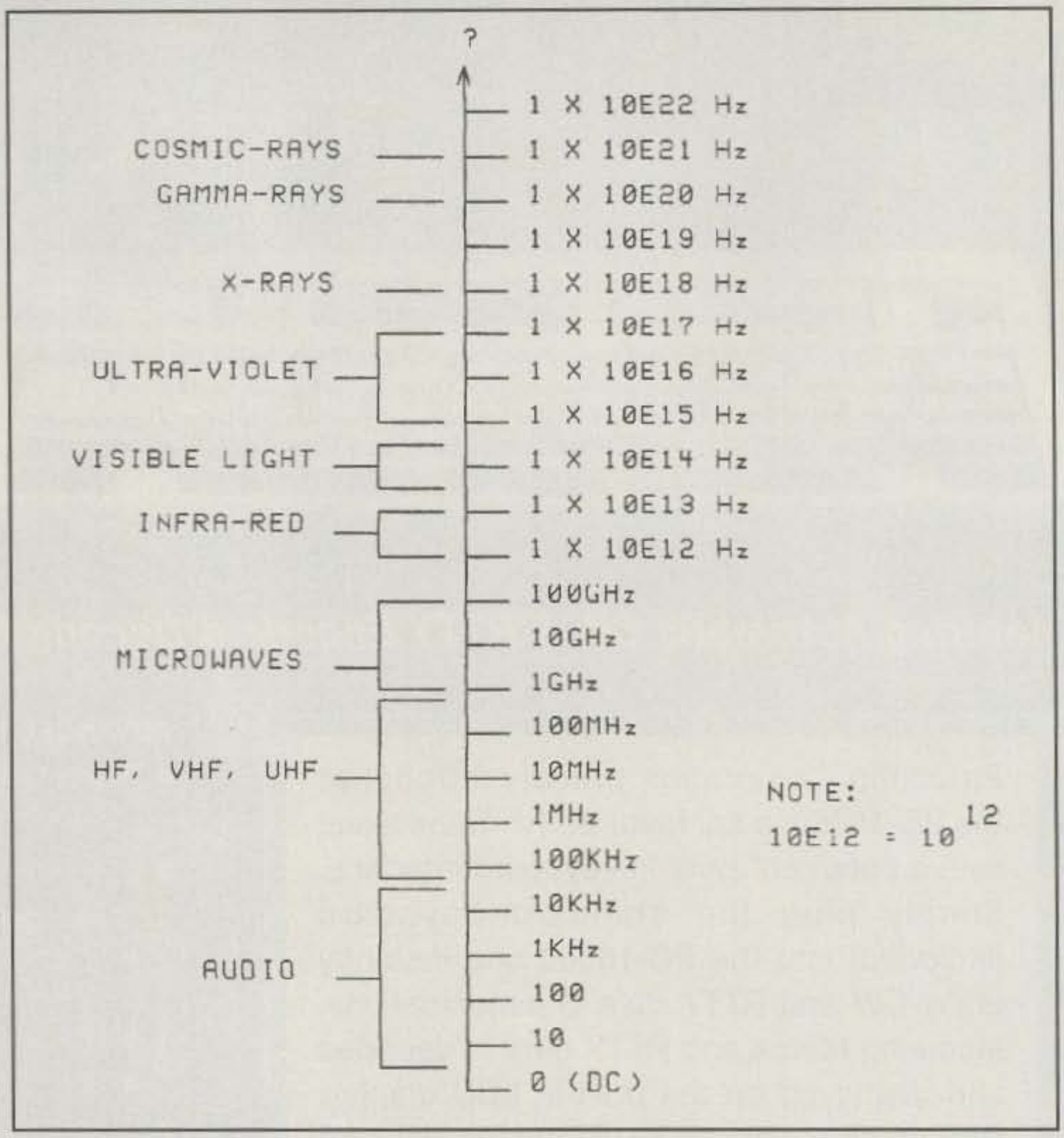

Fig. 1– A rough approximation of the electromagnetic spectrum.

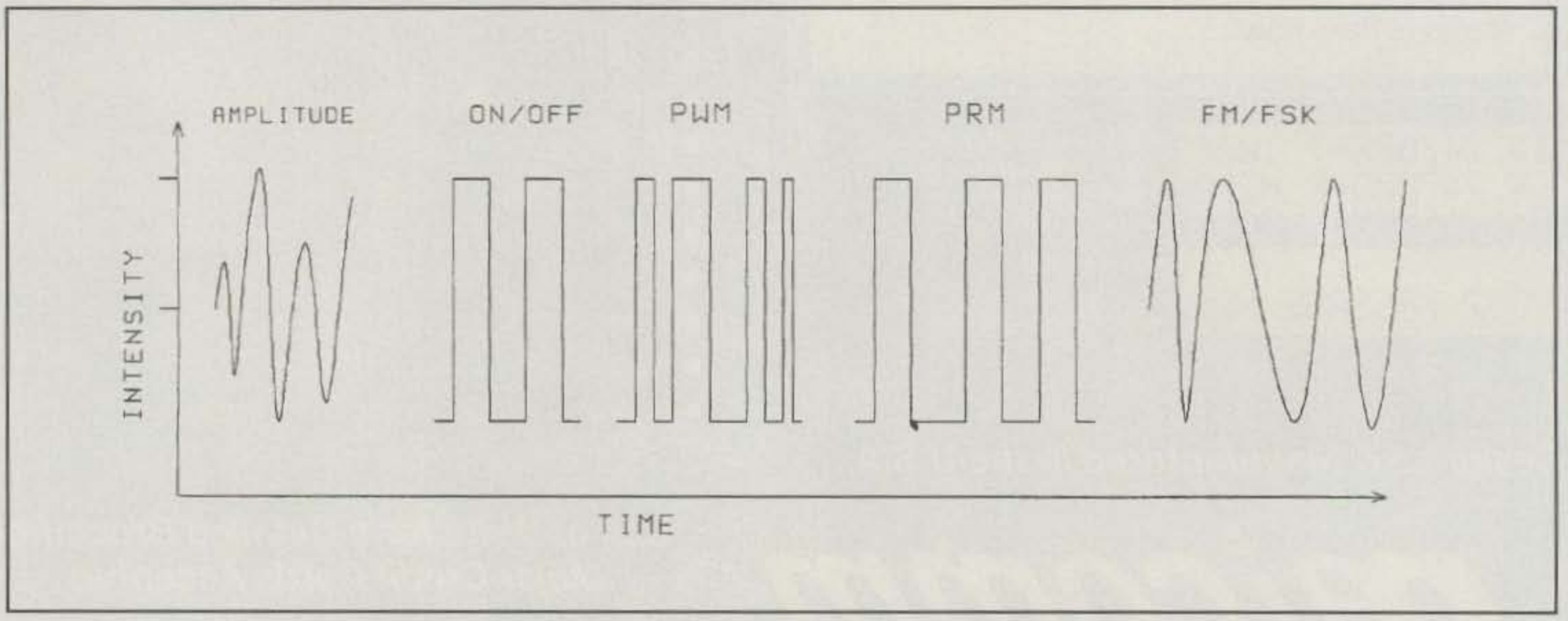

Fig. 2– Some of the ways that an LED can be modulated.

to enable the experimenter to gain real hands-on experience.

When one thinks back to the time in 1912 when amateurs were restricted to the "useless frequencies" below 200 meters (1.5 MHz and above) and the discoveries and contributions they made without extensive laboratories and sophisticated equipment, one can only wonder if these feats can be repeated in the apparently "restricted transmission range" of light wave signals. I believe they can, so perhaps we can "show them all" once again! I certainly hope so.

Fig. 1 is a simple chart showing the relationship of the various electromagnetic frequencies currently known and used by man. As one can see, the light wave frequencies (from 1x10E12 Hz to 1x10E14 Hz) are farther away from the bands we are used to than audio is from 2 meters! Light is, nevertheless, electromagnetic radiation (the same as RF), and as we will see, exhibits similar behavior.

Generating these super-high frequencies is simple. A light bulb, LED, or Laser Diode does it all the time. Amplifying, modulating, and mixing them for transmission purposes is something else, however, but not beyond the capabilities of the average amateur radio operator. Simple point-to-point communications systems can easily be built, so all is certainly not lost. Doing research and developing the art is what "separates the men from the boys," as the expression goes.

In any optical transmission system, as in its RF counterpart, there must be a transmitter and a receiver. In the case of an optical transmitter the source of the carrier is usually an LED or a solid-state Laser Diode. For our initial discussions we will employ LEDs, as they are much lower in cost, safer, and easier to use. We will touch on lasers later.

Fig. 2 shows some of the ways that we can modulate an LED. We can use amplitude modulation (or "intensity modulation," as the field calls it) by varying the brightness of the LED around some quiescent point in the same manner that an AM transmitter varies the amplitude of its carrier. We can use CW by turning the light source on and off, the equivalent of turning an RF carrier on and off. We can even use wide-band or narrow-band "FM" by varying the frequency of a sine or square wave "carrier" that in turn is used to turn the LED on and off. (When a square wave is used in this manner, the modulation scheme is know as "pulse FM.") Keep in mind, however, that in this case the FMing is done on the electrical signal that drives the light source, not on the actual light source itself. To actually vary the frequency of a light source would result in "color modulation," a technique that is experimental at present (but certainly not impossible).

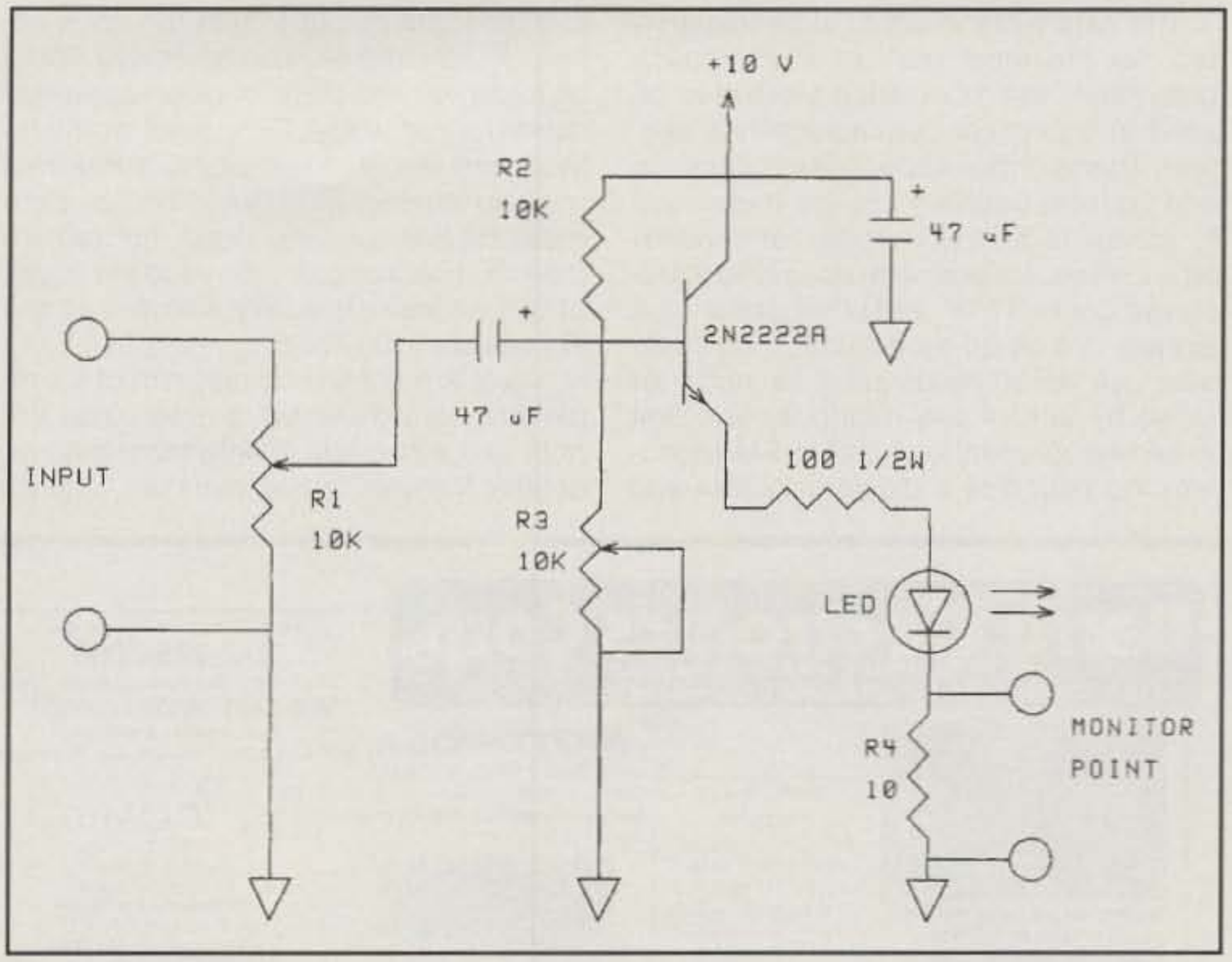

Fig. 3– Simple intensity modulated optical transmitter.

The nature of the signal to be transmitted, for the most part, is what usually determines the modulation method to be used in an optical communications system. This is primarily because only on-off and variable intensity are the easy ways to modulate an LED. Audio- and video-type signals, for example, usually use AM. Morse Code, RTTY, and other digital-type signals use on-off modulation. You could also use on-off modulation for audio or video by one of two methods. The first would be to use the signal to FM modulate the output of a digital oscillator and then use this output to turn the transmitting LED on and off. The other way would be to convert the audio or video into a true digital format with A/D devices, and later reconvert the received digital pulse train back to analog with D/A devices. Both methods are currently used, but require more complex circuitry (beyond the scope of this series) especially with wide-band signals such as video.

Fig. 3 is a schematic diagram of a simple AM light wave transmitter. You will note that it consists of little more than an emitter follower, a few resistors, and an LED. To "get our feet wet," any visible red indicator LED, such as the RadioShack 276-087, may be used. Once the unit is operating, this LED can be changed to a higher power device if desired. You can build the circuit on a piece of perfboard or even in one of the popular experimenter's plug-in breadboards.

After building the circuit, turn R1 to the 0 ohms position (maximum attenuation) and R3 to the 0 ohms position also (no LED bias). Now apply power to the circuit. Connect an oscilloscope (set to 0.1 volts/division, DC coupled) across the 10 ohm monitoring resistor. Each tenth of a volt developed across this resistor corresponds to 10 milliamperes of current flowing through it and the LED in series with it. Slowly adjust R3 for a reading of 0.2 volts DC. This corresponds to 20 ma of current flowing through the LED, which should be on at this point. The 20 ma level is the zero signal quiescent or half-power point, and R3 can be thought of as the power-output or carrier-level control. Since this circuit is capable of providing quiescent current levels of almost 50 ma, be careful. If you try to drive more current through the LED than it can handle, you may damage it.

Now apply a 1 kHz sine wave to the input while observing the monitoring point on the oscilloscope. Set the generator to 1 volt rms (2.8 volts peak-to-peak). Slowly increase R1 (which now becomes the percent of modulation control) until the lower half cycle of the sine wave is almost at 0.05 volt (5 ma) and the upper half cycle of the sine wave just reaches 0.4 volt (40 ma). This is twice the normal level of a 20 ma LED, but since the lower half cycle of the sine wave is at 5 ma, the average LED current is approximately 20 ma and the LED is not overdriven. Later you can experiment with higher drive currents.

Once this is achieved, the transmitter is fully operational and fully modulated. If you try to increase the level of the modulating signal further, you will clip at the lower end when the LED cuts off and possibly damage the LED at the higher end due to excessive current. If you wish to test your transmitter, a simple solar cell connected to a pair of high-impedance earphones will serve as a very simple test receiver. In optical communications circles this type of receiver is the equivalent of the early crystal set. At the moment, however, it will illustrate that the circuit is actually transmitting the sine wave. You may have to orient the solar cell directly over the LED to get a usable signa,l but you should hear the 1 kHz tone.

Now that we have some idea of how to build an optical transmitter, next month we will look at ways of elaborating on it to transmit audio in the form of speech.

73, Irwin, WA2NDM

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CN410M	Mobile	3.5-150MHz	15/150W	UHF
CN460M	Cross Needle	140-450MHz	15/150W	UHF
CN465M	Cross Needle	140-450MHz	15/75W	UHF
CN495M	Cross Needle	880-1300MHz	15/150W	N

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DP830	Digital	1.8-150MHz 140-525MHz	.1-1.5kW 01-150W	UHF & N

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Output Current	Max. *(1)	40 A	30 A	5.2A	20A
	Rating	32 A	24 A	4.2 A	16 A
Voltage Fluctuation		Less than 1% (with rated output)		Less than 2% (with rated output)	
Ripple Voltage		Less than 3 mV (with rated output)			
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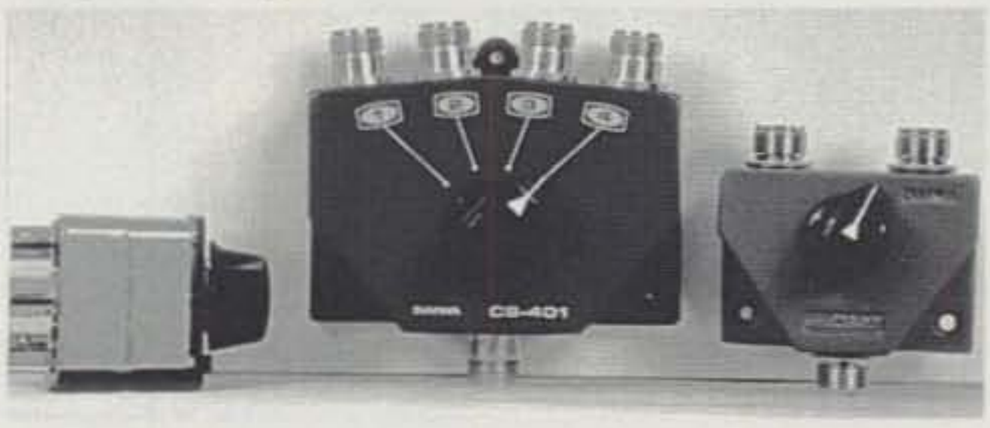
CS401G - 1300MHZ, 1KW, N



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BY KARL T. THURBER, JR., W8FX

ANTENNAS & ACCESSORIES

A LOOK AT THE SHACK FROM BOTH ENDS OF THE COAX

Happy New Year '97!

A very Happy New Year to all our readers! We hope 1997 will be a most happy and prosperous New Year for you and yours. That having being said, in this holiday month we'll continue with our customary antenna column happenings. Are you ready?

Antenna Ramblings

Gladiator Vertical Antennas. Bob Myers, W1XT, offers a line of single-band vertical antennas for 160, 80, 40, 30, and 20 meters, which he calls the Gladiator series. The antennas are available in several configurations, and they're promoted as heavy-duty, efficient, low-angle DX radiators.

For 160, 80, and 40 meters, the low-SWR antennas are electrically shortened and center-loaded; full-size versions are offered for 40, 30, and 20 meters. Full-length as well as inductively loaded short radial systems (the latter for 160 and 80 meters) are available. Also offered are optional matching transformers and a variety of accessories and parts (U-bolt and saddle assemblies, antioxidant lubricant, bulk radial wire, insulators, and clamps).

Designed for single-band operation only, the Gladiator verticals are fully adjustable within a band for optimum performance. They can be ground mounted or use an elevated ground-plane configuration. However, as with all such verticals, a good ground radial system is a must.

The antennas range in height from 16 ft. to 26 ft. tall, and are $189.95 to $299.95, depending on band; radial kits and other accessories are moderately priced. Bob also carries a variety of OSCAR satellite products, including antennas, software, azimuth/elevation rotators, crossbooms, etc.

For further information, contact R. Myers Communications L.L.C., P.O. Box 17108, Fountain Hills, AZ 85269-7108 (602-837-6492). Bob has a catalog showcasing his line of antennas and antenna accessories, along with photos, descriptions, and prices, prominently posted on his Internet web page. It's found at <http://www.primenet.com/~bmyers/>.

SSC Communications Products Catalog. Software Systems Consulting perhaps is best known for its line of GOES satellite, HF weather fax (WEFAX), slow-scan television (SSTV), Telex, and electronic messaging software and hardware. Their latest communications products catalog depicts a variety of high-tech accessories in these realms, including several complete satellite ground receiving stations. These range in price from $529.95 to $1599.

The catalog also includes a variety of specialized VHF/UHF satellite receiving antennas and accessories. Besides several SWL-oriented products, the catalog offers a quadrifilar helix 137 MHz antenna optimized for polar satellites, a 1 meter GOES parabolic receiving dish, a 1692 MHz linear feedhorn, a 1691 MHz loop Yagi, a 137 MHz low noise preamp, a 1691 MHz to 137 MHz downconverter, and accessories.

For a catalog, contact Software Systems Consulting, 615 S. El Camino Real, San Clemente, CA 92672 (714-6498-5784).

RF Applications and "The Watt." We highlighted Bruce R. Knox, N8LXS's RF Applications firm in the May 94 and October 95 columns. We noted the company's mission since its 1992 founding was to be an innovator, marketer, and manufacturer of high-performance, high-quality, and affordable RF power measurement systems. We also described the P-1500 and P-3000 Digital RF Power/VSWR Indicators, microprocessor-based instruments which give fast, accurate power and VSWR readings in real time, with no adjustment or calibration required.

We see that Bruce has expanded his product line and also introduced a quarterly newsletter, "The Watt." New products include two devices that use digitally driven analog meters, a technology that offers true peak detection and display capabilities while not sacrificing the familiar analog meter display.

The P-2000A HF digital wattmeter ($299) is designed for HF applications (1.8 to 30 MHz) and has an adjustable meter response time. The P-100A digital wattmeter ($239.95) is a flexible instrument that uses coaxial line sections and sensor elements from Bird Electronics® and Coaxial Dynamics®. Both instruments sport a pair of high-quality analog meters, one for RF power and the other for VSWR. They also incorporate an adjustable VSWR alarm system that provides both a visual and an electrical indication should the measured VSWR during a transmission exceed a preset value.

Sight-impaired and mobile operators will be interested in the P-2000CW audible HF wattmeter; it uses a remote coupler and covers 1.8 to 30 MHz. By pressing the left button on the unit, you can hear the current or last transmitted peak power in Morse Code. By pressing the right button, VSWR is reported, also in Morse. The device also has a VSWR alarm that sends a series of "V" characters if the VSWR exceeds a preset limit. It's $249.95.

VSWR protection only is provided by The Match Alert™. The $130 device monitors the transmission line and compares the computed VSWR with a preset value; if it exceeds the desired limit, a relay drops out until all RF is removed. You can use the relay to disable a linear amplifier or provide a visual or audible alarm.

The fall 1996 issue of "The Watt" newsletter contains several interesting discussions. To get on the mailing list, contact RF Applications, Inc., 9310 Little Mountain Rd., Kirtland Hills, OH 44060 (telephone 1-800-423-7252; Internet <http://www.rfapps.com>).

Jade Products Update. In previous columns, most recently June 1996, we discussed several Jade Products antennas offered by proprietors Jane, KA1FUN, and Dennis, K1YPP, Blanchard. Now Jade Products has introduced a number of new non-antenna products, many relating to sophisticated and safe battery charging. These include several "smart" battery charging controllers; a "smart" solar controller kit; the Battery Guard, a low-voltage disconnect module; a Curtis keyer kit using the 8044ABM chip; a code-practice oscillator kit based on the one in the ARRL's *Now You're Talking!* beginner book; and a selection of Vibroplex® keys.

For more information or a catalog, contact Jade Products, Inc., P.O. Box 368, East Hampstead, NH 03826-0368 (1-800-523-3776; Internet <djade@hampstead.k12.nh.us>).

KWAD-KITZ Antennas. KWAD-KITZ offers several VHF quad and Yagi antenna kits for the 2 meter, 6 meter, and 220 MHz bands. Among the newest designs are a 5-element, 68 inch PVC-boom quad for 2 meters ($42.95) that claims an 11 dBi gain and tunes the entire band with an SWR of 2:1 or less. It features hardwood spreaders and weighs in at 6 lbs.

Also offered is a 2-element, 6 meter Yagi that weighs in at 6 lbs., 12 oz., has a 4 ft. boom, and boasts a 3¾ ft. turning radius. Claimed gain is 6 dBd; it's $44.95. Also proffered are a 4-element, 220 MHz quad ($41.95); and a 3-element, 6 meter Yagi ($49.95). The KWAD-KITZ antennas feature predrilled and precut materials, as well as color-coded for easy assembly.

Another product is a VHF/UHF discone antenna that provides continuous coverage of 144 MHz through 1296 MHz using a single coax feed. Other novel antennas include a "ZL Special" 2 meter direction-finding (DF) antenna, a 6 meter through 440 MHz discone, and a piggyback 440 MHz/2 meter quad. Available accessories include a collapsible 15 ft. mast, portable antenna carrying cases, and boom-to-mast brackets. Also offered is Ken Neubeck, WB2AMU's book, *Six Meters, The Magic Band.*

For more information, contact KWAD-KITZ, P.O. Box 1643, Sheboygan, WI 53082-1643 (1-800-531-3100; Internet <aa9bj@excel.net>).

Postscript: This is a good time to mention that the competition between Yagi and quad enthusiasts is one which probably will never be settled amicably. Element for element, and dollar for dollar, the quad arguably offers somewhat more gain and generally better overall performance than does a comparable Yagi. However, the quad can be a bulky and cumbersome antenna, at least on HF, although many of the problems "go away" with the smaller size of VHF and UHF quads. Refer to the sidebar in this column for a summary of the relative merits of the two antennas.

AMECO Dummy Loads. AMECO is an old-line amateur radio supplier that today focuses primarily on technical books, license exam and Morse code instruction materials, transceiver preamplifiers, telegraph keys, and the like. I recall successfully using AMECO's 78 RPM Morse code phonograph training records when I went for my Novice exam in 1954!

Recently AMECO branched out to offer a series of high-performance RF dry loads covering the range from DC to 650 MHz. The 1.5

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Quad versus Yagi —Some Observations

By way of review, there are several reasons why quads are so popular today, despite occasional mechanical problems that sometimes are associated with them. Quads typically have broader bandwidths than do conventional Yagis, they have greater signal capture area when compared with most other antennas, polarization is quickly and easily changed, they're nearly immune to rain static and corona discharge, and they require smaller space than do conventional Yagi-style beams for the same frequency bands. Also, quads can easily be designed to be directly fed with coax without the use of elaborate matching devices.

Both basic types of antennas offer considerable gain over the simple dipole, with good front-to-back (F/B) ratios. Of the two types, the Yagi still is the more popular antenna, while the quad is slightly better than the Yagi for DX, if considered on an element-for-element basis. Today many more amateurs are trying quads for the first time on the VHF and UHF bands, since at VHF and UHF, most of the mechanical problems associated with traditional HF quads are minimized.

Here are some observations and notes I've collected over the years regarding comparisons between the two antennas—not taking sides, mind you, just presenting "the facts" as I see them.

1. The quad is about equivalent in power gain to a Yagi having one additional element. The quad also exhibits somewhat more gain than does the Yagi for a given boom length, size, and turning radius.

2. The quad is a relatively inexpensive antenna if made of "natural" materials such as bamboo, although it can become more expensive than the Yagi if specially fabricated spreaders, aluminum spiders, and other custom fixtures are used in construction.

3. The Yagi is less susceptible to damage from strong winds and ice storms than is the quad. Its on-the-tower appearance also is considered more aesthetically pleasing than that of the quad, at least in the public's mind.

4. The quad is less popular overall than is the Yagi, largely because it requires additional effort to install and maintain. A rather boxy-appearing antenna, the quad is bulky and fragile to handle and to hoist into position when compared with the Yagi.

5. The quad is easier to adjust for proper performance than is the Yagi, since there is less interaction between the elements, element spacing is less critical, and there are no traps to tune. However, feeding schemes can become complex in multiband quads.

6. The quad is more broadband and less critical of exact tuning than is the Yagi, being a low-Q closed loop. End effects, prevalent with the Yagi's dipole-like elements, are reduced in the quad.

7. The quad is somewhat less vulnerable to lightning strikes and static discharges than is the Yagi, as it has no sharp end points.

8. Many of the more objectionable physical attributes and characteristics of the quad on HF are ameliorated when smaller quads are used on the VHF and UHF bands.

At the bottom line, there's little noticeable on-the-air difference between comparable Yagis and quads—say, between the three-element Yagi and the two-element cubical quad. The choice resolves to a personal one, one which should be based at least partially on practical assembly, construction, installation, and tune-up considerations rather than on the narrow differences in expected performance between the two types of antenna.

KW dummy load is available in two versions. The Model DL1500 is an air-cooled unit that handles 1.5 KW average power for up to 15 seconds, and 150 watts continuously.

The Model DL1500-F is a forced-air-cooled dummy load. It handles an average of 1.5 KW for a full 30 seconds, while handling 300 watts continuously. The latter unit has a low-noise fan that helps keep the noninductive load element cool. Both units are furnished in a strong, lightweight aluminum case perforated to enhance cooling. The SWR for both models is stated as 1.1:1 from 160 to 2 meters, or 1.5:1 to 70 cm.

For pricing and more information, contact Donna L. Bates, Customer Service, AMECO Corporation, 224 East Second St., Mineola, NY 11501 (516-741-5030).

Tower Tech Supplies and Services. Steve Morris, K7LXC, is the "Up the Tower" contributing editor for sister publication *CQ Contest*. He writes a fact-filled column each month that does an excellent job of covering all aspects of tower safety and construction, while offering a number of excellent tips.

Steve operates Tower Tech, a new specialty amateur retailer that brings to bear his considerable experience by focusing specifically on towers. Items offered include a wide variety of rigging gear, including custom "buckets," tool bags, and other accessories; UV-resistant Dacron® rope; a variety of safety belts and harnesses; lanyards; and weatherproofing materials.

Expected to be available by the time you read this is Steve's tower construction book, *Up the Tower*. It promises to be an A-to-Z treatment for practically anyone planning a tower and antenna system, or one who has some experience but wants to pick up additional tips and knowledge about tower projects.

Also available are several tower-related article reprints. These include "The Ten Most Common Tower Building Mistakes"; "Building a One Tower Station"; "Grounding"; "Up the Tower" (copies of Steve's *CQ Contest* magazine columns); and "ARP Ranks the Top 10 Tribanders in Five Distinct Categories" (a mid-80s article from *Amateur Radio Profiles,* a now-defunct publication, that compares a variety of HF beams). Steve says that the first article is free for an SASE; additional reprints are $1.

Steve also notes that he has set up a free "Internet mail reflector" mailing list called Towertalk, which is devoted to tower and antenna topics. If you have online capabilities and would like to subscribe, send an e-mail message with the word "subscribe" in the text to <towertalk-request@akorn.net>.

For more info or reprints, contact Tower Tech, Box 572, Woodinville, WA 98072 (1-800-TOWERS8; Internet <UpTheTower@aol.com>).

Olde Antenna Lab Update. In February 1992 we described the antenna design and manufacturing activities of David A. Clingerman, W6OAL, who operates the Olde Antenna

Lab (OAL) of Denver. Dave's a retired Navy Aviation Electronics Technician who also has worked as a radio frequency (RF) engineer, RF manager, and electronics engineer in government and civilian contexts.

According to Dave, OAL has been in operation in the Denver area since 1990. His goal is to provide low-cost RF components, such as antennas and RF hardware, that are similar in application and equal in quality to, but much lower in price than, comparable commercially available products.

In his Denver lab Dave produces a number of different VHF, UHF, and microwave antennas, many of which are quite unusual and innovative. His current offerings include several omnidirectional "wheel" series antennas; 6, 10, and 15-element Helixes for 33 cm up; 1×2 wavelength, dipole-fed, truncated corner reflectors for 33 cm up; and an omnidirectional, horizontally polarized "folded halo" for 144–148 MHz and 222–224 MHz.

Also available are the OAL Mobile Six, a horizontally polarized, 6 meter mobile and fixed station halo antenna of classic design, similar to the old Hi-Par Saturn VI; and a variety of components and accessories. These include power splitters, parabolic dish feeds for 70 cm up, bandpass filters, and Z-verters (used to adapt 75 ohm hardline for 50 ohm use).

One of the most popular of Dave's "wheel" antennas is the 70 cm Little Wheel. It consists of three broadband, quarterwave elements in parallel, arranged in a cloverleaf pattern. Dave found that the Little Wheel worked so well that he created "wheels" for other bands from 144 MHz to 13 cm. The largest wheel antenna is the Big Wheel for 144–148 MHz; the smallest is the Micro Wheel for 2300–2450 MHz (13 cm).

Other antennas in the series include the 222 (for 222–224 MHz); the Nano Wheel (33 cm); and the Mini Wheel (23 cm). The antennas also can be configured as mobile "magwheels" with the addition of a magnet mount; two-band, two- and four-bay wheel arrays can be fabricated using accessory stacking harnesses.

For an interesting catalog, contact The Olde Antenna Lab of Denver, 6224 S. Prince St., Littleton, CO 80120 (303-798-5926).

P.C. Electronics ATV Antenna Notes. We've noted in previous columns that it's not all that difficult to communicate using "real" amateur TV—that is, fast scan TV, or FSTV. Getting on FSTV isn't a great deal different from voice modes, except that you use your camcorder to provide the video signal input to your transmitter. You also use your TV set to receive the picture; an FSTV signal looks much like a commercial TV signal.

You won't find FSTV on HF. Rather, it's on UHF, mostly on the 70 cm band because of the spectrum space required. There also are many UHF FSTV repeaters scattered across the country. For best results, ATV antennas need a broad bandwidth in addition to desirable low SWR and high gain; relatively few antennas work well at both 421 and 439 MHz, largely where activity is focused.

Tom O'Hara, W6ORG, notes that your station's antenna, coax, and tower height are the most important facets of your ATV system. They therefore deserve special care and attention. He says that he has extensively tested commercial 70 cm antennas for suitability to broadband ATV work. In his P.C. Electronics ATV catalog, which displays a full range of FSTV equipment, he notes several antennas offered by KLM, Rutland Arrays, AEA, and Diamond that nicely fill the bill, in his estimation.

Not to say that there aren't other suitable antennas, but his list of ATV beams includes the KLM 440-6X (8.9 dBd gain); KLM 440-10X (11.2 dBd gain); KLM 440-16X (14.2 dBd gain); and the Rutland FO22-ATV (15.8 dBd gain). Among omnidirectional antennas, he suggests the AEA IsoPole™ 440, a 3.5 ft. long, 3 dBd gain antenna; and the Diamond F718 series 15 ft., 9.3 dBd omni antennas. All of these antennas are available from P.C. Electronics.

Contact P.C. Electronics at 2522 Paxson Lane, Arcadia, CA 91007-8537 (818-447-4565; Internet <tomsmb@aol.com>).

Software Ramblings

CTS Serial Port Utilities™. Anyone who has tried to use multiple PC peripherals hooked to a PC's serial port knows the frustration of trying to get peripherals (or multiple communications devices such as modems, TNCs, and radio interfaces) up and running. Getting them all to work just right (especially simultaneously) requires some technical knowledge of how ports and interrupts (particularly hardware interrupts) work, as well as some industrial-strength diagnostic tools.

The CTS Serial Port Utilities (SPU) are a collection of PC diagnostic and control programs that can analyze and fix all kinds of serial port problems. Many communications glitches are caused by faulty setups. The port address or IRQ (interrupt request) may not be set properly for applications using the port. Another common problem is failure of the PC's BIOS to detect all ports properly. Some problems are more difficult: port address or IRQ complications may result in a conflict that causes intermittent operation or complete failure of the port.

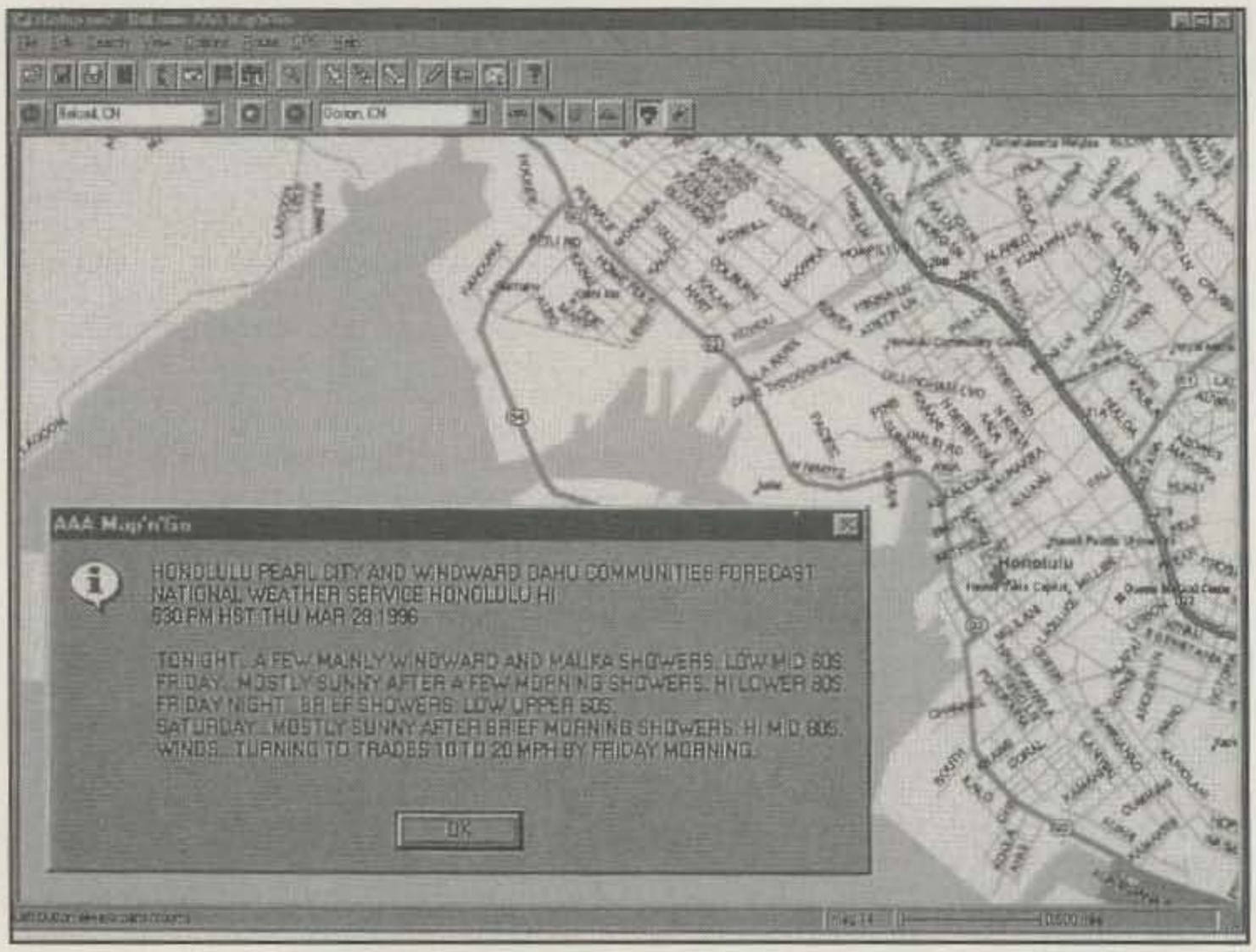
What makes the SPU package different from some other diagnostic port utilities is that it *actually tests* the serial ports. Many other communications utilities don't really test the serial ports, but merely report that ports exist and show the standard IRQ used by the ports (which may be wrong), while SPU thoroughly checks for addressing and IRQ problems. At the heart of the SPU package is a program called PortInfo, which tests the PC's serial ports, performs an exhaustive test of interrupt generation to identify any problems, and checks various Windows setup files for proper port configuration.

The personal edition of PortInfo and the SPU documentation is $20. Also available are several other options, including the Personal Plus, Professional, and Professional Plus editions. The latter edition ($79) includes a variety of additional diagnostic and other serial port utilities.

In addition, two separate Interrupt Mapping utilities—IRQInfo™ and IRQInfo Pro™—are available for even more detailed port analysis. These utilities include tests for serial and parallel ports, sound cards, scanners, mice, hard and floppy drives, network cards, SCSI devices, and anything else that uses an IRQ. IRQInfo is $24 and IRQInfo Pro is $35.

Contact Computer Telecommunication Systems, Inc., 3847 Foxwood Road, Suite 1000, Duluth, GA 30136-6100 (1-800-380-2666; Internet <sales@comminfo.com> or <http://www.comminfo.com>).

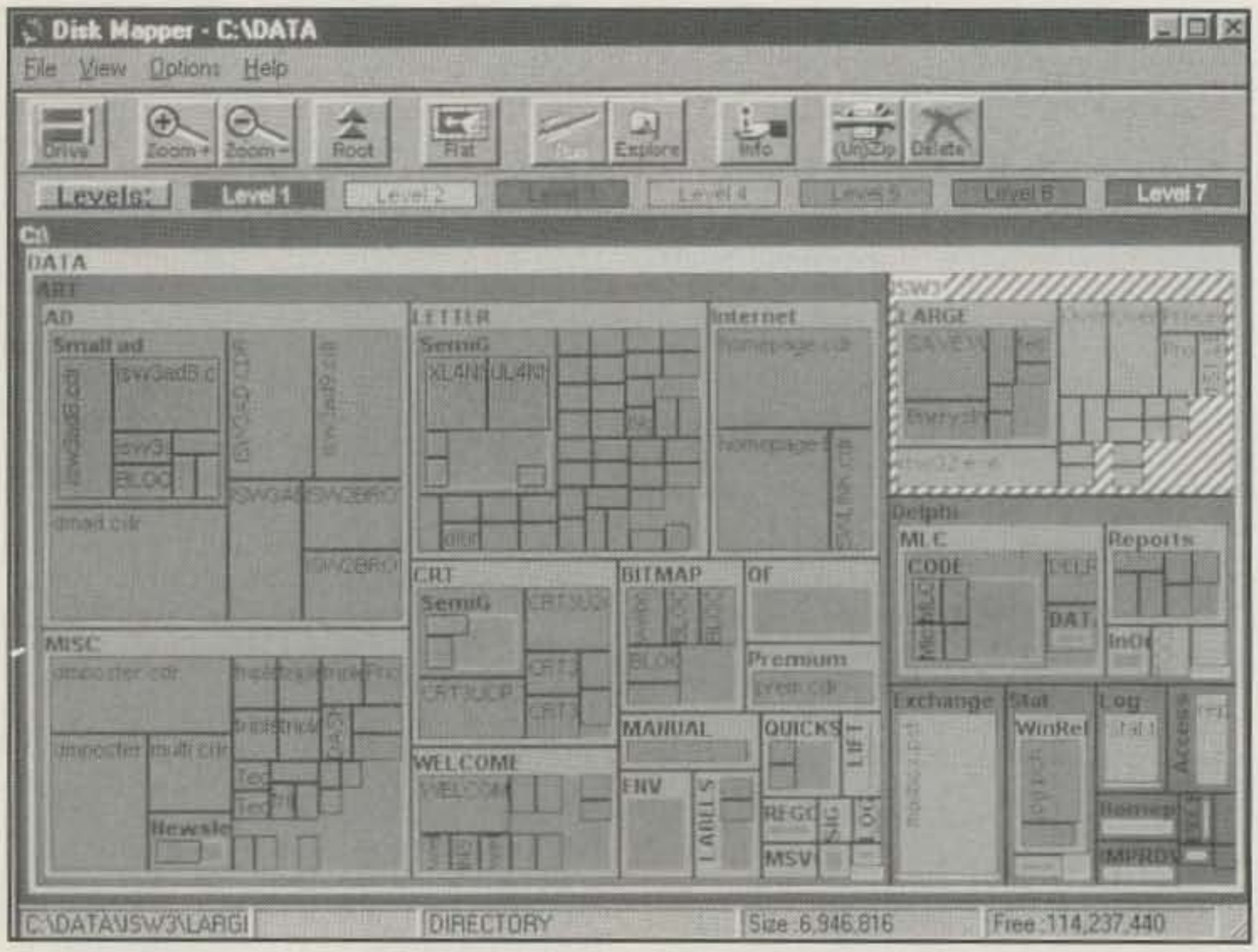
AAA Map'n'Go 2.0. In previous columns we highlighted several DeLorme CD-ROM-based mapping products. These included Street Atlas USA™, a slick computerized street map of the



Assuming you have an Internet link, DeLorme's AAA Map'n'Go 2.0 lets you access complete, up-to-date travel information through a special Web page. You can use the Internet to get an update on the weather, route around construction delays, and find special events such as fairs and festivals. The specialized DeLorme Map'n'Go site is found at <http://www.mapngo.com>.
(Photo courtesy DeLorme)

entire country; Global Explorer™, a "computer globe" that presents the world in much greater detail than any computer or printed atlas; and Map'n'Go®, which brings all kinds of North American travel planning information to your PC. We profiled Map'n'Go in March 1995; now DeLorme has come up with a much-revised edition, AAA Map'n'Go 2.0®, which bears the American Automobile Association's logo and includes AAA TourBook data.

We won't rehash our previous review, other than to note that AAA Map'n'Go is a compre-



Micro Logic DiskMapper presents you with an overview map of your entire hard disk. The program shows you the size of every file and directory; as the mouse pointer moves across the map, you can see the full file name, path, size, date, and extension type. Delete and Zap toolbar buttons let you easily remove or compress files. You also can color code the map by a variety of attributes, as well as choose the level of detail and whether to view available free space.
(Photo courtesy Micro Logic Corp.)

hensive travel planner for North American travel. It lets you plan a route from over 1,000,000 miles of routable roads, including in its listings some 22,000 hotels and motels; 10,000 campgrounds; 12,000 attractions; and 20,000 fairs and festivals.

With it you can map out your choice of scenic, quickest, or shortest routes, and select the type of roads you want to travel. You can take along as little or as much information as you wish. You can print out directions, an overview map, city maps, and a detailed travel plan that optionally highlights your routes and locates your choices for meals and accommodations. You also can add notes and symbols to provide special information or directions. The program is highly customizable and lets you select a custom user profile.

Some features in the new version (estimated street price of $39) let you search for specific street addresses; work with detailed, street-level maps for 241 metropolitan areas; and link with Global Positioning System (GPS) receivers and DeLorme's Phone Search USA™.

In addition, if you have an Internet connection, either through an online service or an Internet Service Provider (ISP), you can link to DeLorme's dedicated Map'n'Go web site, <http://www.mapngo.com>, to obtain updated information on weather conditions, road construction, special events, and more. About all that's not included are amateur VHF and UHF FM repeaters along your route (hint!). (This Web site is in addition to their site at <http://www.delorme.com>. Check them both out.)

For more information and a catalog, contact DeLorme, P.O. Box 298, Main Street, Freeport, ME 04032 (1-800-227-1656).

DiskMapper. As most of us are aware, the programs we place on hard disks these days are larger than ever, using up more and more valuable space, and downloads from the Internet fill up our hard disks even more. The bottom line is no matter how large a hard disk you have, you eventually fill up the disk and are forevermore figuring ways to reclaim some of that disk space.

DiskMapper is a new kind of PC utility that visually shows you just what's on your hard disk, so that you can delete or compress files you don't need or rarely use. Billed as "the road map for more hard disk space," it's intended to help you get the most out of available disk space. The goal is to avoid (or at least delay) having to buy a new and much larger hard disk.

However, instead of presenting disk occupancy information in simple file tree listings, the program uses a new, patent-pending "nested rectangle" technique devised to give you comprehensive information in an intuitive format that visually shows you what's taking up space. DiskMapper presents you with an overview map of the entire hard disk, letting you see how much or how little space subdirectories take up.

You can zoom into any subdirectory or subsubdirectory, zoom out again, and so forth. The program shows you the size of every file and directory; as the mouse pointer moves across the map, you can see the file name, path, size, date, and extension type.

Delete and Zap toolbar buttons let you easily remove or compress files, and you can launch programs and datafiles within DiskMapper. You also can color code the map by a variety of attributes, as well as choose the level of detail you'd like to see and whether to view available free space on your map.

Overall, the program's concept of operation is a very innovative one, which should see real application as hard disks become ever larger. I would, however, not rely on the program as my sole disk management tool, but would use it in conjunction with other utilities, such as a Windows undelete program and comprehensive hard-disk utilities such as Norton Utilities®.

DiskMapper is $49.95 and includes both Windows 3.X and Windows 95 versions in the same package. It's from Micro Logic Corp., P.O. Box 70, Hackensack, NJ 07602 (1-800-342-5930). A free trial download version of DiskMapper and other Micro Logic software can be found on the Internet at <http://www. miclog.com>.

Postscript: Micro Logic also is the publisher of the Info Select for Windows Version 3 Personal Information Manager (PIM), reviewed in February 1996. This is a special database program that lets you enter, retrieve, analyze, and cross-reference data, both words and numbers. (A PIM handles "random" bits of information you encounter every day, such as notes, names and addresses, parts lists, project plans, and magazine articles. This is information that often doesn't fit into well-defined formats, as does data that you can place in a conventionally structured computer database. A PIM such as Info Select can help you deal effectively with this hodgepodge of stuff.)

Letters

Once more we're just about out of space. Before wrapping it up this month, however, we'd like to acknowledge just a few of the folks who have written, faxed, e-mailed, phoned, or oth-

erwise corresponded with your columnist over the past several months. A tip of the hat goes to Steve Mansfield, N1MZA; Bob Raymond, NE1I; Edward Oros, AC3L; and Steve Hajducek, N2CKH. Thanks, gang.

Short Bursts

FCC Interference Policy. Each year the FCC receives thousands of complaints of interference to TVs, radio receivers, audio systems, telephones, and other home electronics gear. In most cases the FCC can't resolve the problems because the cause of the interference lies in the design or construction of these products and is not a true violation of any FCC rule.

To help consumers deal with these interference problems, basic information concerning interference solutions now is available on the Internet's World Wide Web (WWW) through the FCC Compliance and Information Bureau (CIB) home page. This basic downloadable information includes the *CIB Interference Handbook* and the *CIB Telephone Interference Bulletin.*

The *CIB Interference Handbook* includes a handy list of equipment manufacturers who offer specific assistance with interference problems (they all should do this). The *Handbook* is a contemporary, online update of the FCC's original, now out-of-date RFI booklet.

Both documents are accessible through the FCC's Web home page at <http://www.fcc.gov/cib/>. The list also is available through the FCC's fax-on-demand service at 202-418-2830. Request document 6904 when using the latter service.

The FCC stresses that it will continue to take "appropriate enforcement action" where it has been determined that interference actually is caused by violations of the Communications Act or the Commission's rules or policies.

On Ordering Stuff. When we mention a product in the column—whether it be an antenna, a software package, or whatever else—we don't expect you to whip out your checkbook or flash your credit card and send away for the product immediately, sight unseen, based solely on what you read in *CQ.* Bear in mind that in some cases we have the product in hand and actually have put it through its paces; in other cases, we're simply collecting and passing on available information we have at our disposal.

While we try to filter out junk product announcements and those which potentially are scams, we can't personally check out every product and vendor. Thus, you need to begin *your* investigation where *we* leave off, sending away to the manufacturer, distributor, or dealer for technical literature yourself. Today, that task is made easier by the proliferation of e-mail connections, fax-on-demand systems, and commercial Web pages that let you download information to your own PC. Place an order only after you're comfortable with the product and vendor.

Another reason for having product literature in hand is to confirm current product specifications, pricing, and shipping and handling charges, not to mention applicable sales and use taxes. Incidentally, we generally don't mention taxes in the column, since their applicability is very sticky in some states, and there's no certain way for us to tell whether or not you need to remit the tax. Obviously, if you live in the same state as the person or firm selling something, you normally should enclose the tax, if your state has one.

Looking Back Five

Five Years Ago in Antennas and Accessories. Okay, so now you know what the column is like for January 1997. But what was "hot" in January 1992? That column was "Antenna Notes—Part III."

We discussed the popular GAP series of HF verticals; the Performance Electronics VHF/UHF quads; the W1FC phased vertical switching network; the Slack Enterprises HF dipoles and heavy-duty dipole insulators; and the Ameritron QSK-5 T/R switch.

Turning to software, we highlighted Paul Keezer, NX1P's Log View for Windows; the PC Super Keyer software from Wally Blackburn, N8MWU, of CW Enthusiasts; new versions of the QQSL "Quick" QSL label program by Bill Mullin, AA4M/6; the DXLOG logger from PAYL Software; the GGTE Morse Tutor Advanced Edition; and Instant Recall, a personal information manager (PIM).

As for new books, we reviewed the landmark biography of a legendary DXer, *Don C. Wallace, W6AM, Amateur Radio's Pioneer,* by Jan D. Perkins, N6AW; the *Where Do We Go Next?* book of interesting and exciting DXploits by Martti Laine, OH2BH; and *Keys, Keys, Keys!* by *CQ* colleague Dave Ingram, K4TWJ (the latter two are still available from *CQ*).

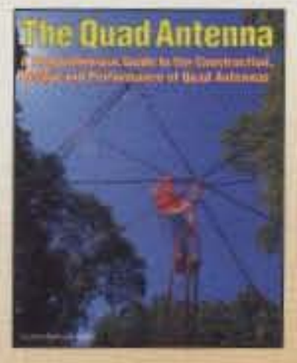
Wrap-Up

That's all for this time, gang. Next time more Antennas and Accessories topics of current interest. See you then.

Overheard: Long ago I learned that you shouldn't fight a battle if there's absolutely nothing to be won. 73, Karl, W8FX

CQ BOOKS

The Quad Antenna



by Bob Haviland, W4MB

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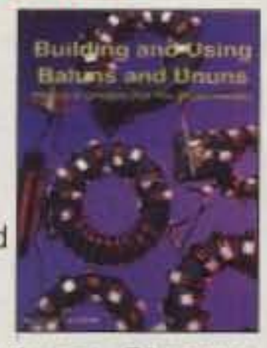

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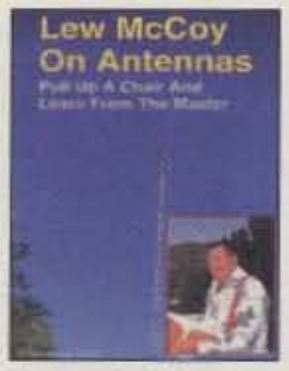

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BY BUCK ROGERS, K4ABT

PACKET USER'S NOTEBOOK

CONNECTING YOU AND PACKET RADIO IN THE REAL WORLD

The Best Gets Better—Part II

This month, as promised, we get to "the good stuff" you can do with MFJ's MultiCom for Windows™. You might want to reread Part I in the December issue just to bring you up to speed.
—K2EEK

Almost everyone who knows me knows that I'm a packet picture (digital image transfer and digital audio transfer/DIT & DAT) addict. In 1983 I developed a method to send digitized pictures via packet radio. I employed a crude method of taking the picture using an old black-and-white camera and a coarse version of the "TINNEY" digitizer. The pictures were 350 by 192 pixels and in black and white. I then loaded the pictures into a program called "GRAPHICOM©" and pixel blasted them into four artifact colors of red, blue, black, and white.

You may also remember that in 1983 there were few, if any, IBM or compatible PCs in the hands of amateurs. My computer was a Tandy (Radio Shack©) Color Computer that we respectfully referred to as the "COCO." It had tape, not disk, and 8 kilobytes of RAM, not 64 million bytes as I have in the 166 MHz Pentium I use today.

Once I built the picture into its final state back in 1983, I connected to George Reitz, N4AGO, via packet. We both went into the "transparent mode" and I sent him the picture—after he que'd me with the words "READY, send it." I then did the ALT K-S (AUTOTERM© command) to send the binary picture file to George. This picture file was usually 4K long, since GRAPHICOM had made it shorter by saving only a sampling of the original picture information.

I almost forgot to mention that the picture was not saved to disk. AUTOTERM only allowed it to go into "High" memory of the COCO. It was not displayed—yet. After the transfer was complete, George and I disconnected and he dumped AUTOTERM© (What do you mean? Why didn't we multi-task? Multi-tasking wasn't even a word in 1983.), the terminal program, and loaded GRAPHICOM to load and view the picture still in memory. Once GRAPHICOM had the memory-resident picture displayed, George had to use the "Peek and Poke" instructions of the COCO to save the picture to—*tape!* Even then there was the remote chance that there might be a glitch on the tape and the data would skip a point and lose the entire file. Alas, the picture was gone forever.

New Technologies

As we moved forward with our most favorite facet of the hobby, packet (and SSTV, packet pictures are error free) pictures, we reached the next level of packet picture transfer (PPT). In 1986 Bob Slomka and I spent many hours developing the first (DOS) version of MultiCom. Bob wrote the new code, and we alpha tested his latest routine for packet picture transfers. Once the picture transfer was fine-tuned to the point where the picture could be viewed on-screen as it was being received, Bob continued by improving it to the point where it would send the picture file to disk at the same time it was being received and displayed on the screen.

The task never ended, nor did the caveat for the format of the pictures. To some degree, this same caveat still exists today. The formats of 1986 and 1988 were either copyright protected or proprietary. Therefore, Bob had to create his own format for packet pictures. This brought about some problems, since the only way to have picture files for packet (hobby) use was to either use a video digitizer and save the files into Bob's proprietary format, or use Bob's screen-capture program to capture and save the picture into the same MultiCom format.

Time has allowed many changes and blessed MicroSoft with the wisdom of making a universal method of Windows™ picture format available for use by windows-based program writers. Sharing in the wisdom, Bob Rushby, VE3GLA, has in turn employed the use of the bit-mapped pictures as the MultiCom for Windows™ format for picture transfer via packet. No "peanut butter" graphic files here *(TNX, Al—ed.)*.

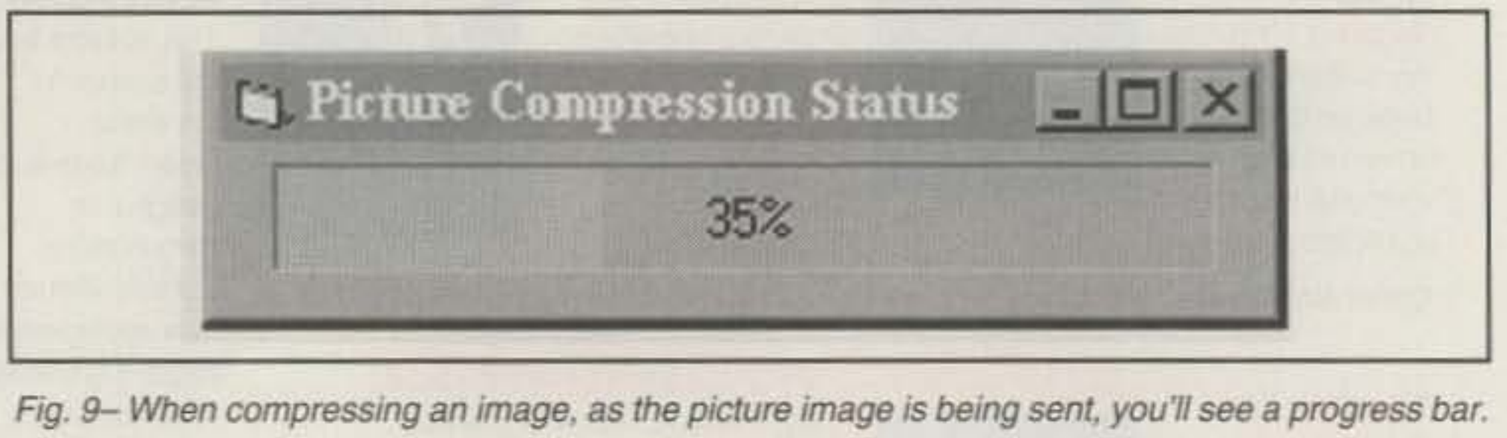

Fig. 9– When compressing an image, as the picture image is being sent, you'll see a progress bar.

A Universal Picture Format For MultiCom for Windows™

For the new user of MultiCom for Windows™ the best form of .BMP file to use is the RLE compressed bitmap pictures saved in the 256 color set. There are several programs that support the drawing, conversion, and editing of bit-mapped files. I use my registered copy of PaintShop Pro© version 3.11 (shareware). Using PaintShop Pro©, I can load in several different picture formats and save them into the .BMP or RLE format. Now I have a world of pictures from which to choose, since the BMP and RLE format provides me with a tool to build my picture database from a universal picture resource.

There are other programs that may be used to convert pictures into the .BMP and RLE picture formats. WINJPEG.EXE is a viewer that allows you to load the picture and save it into a different (.BMP) format. The picture viewers do not allow editing of the pictures, as does PaintShop Pro, but they do enable you to build a MultiCom for Windows™ picture database.

The Best Gets Better

MultiCom for Windows™ displays images line by line during reception. You do not have to wait for a whole image to be received before it is displayed. You can even display pictures as they are being received from stations that do not use MultiCom for Windows™! (Those stations cannot display images you send to them while the image is being received, however.)

MultiCom for Windows™ uses a different method of transmitting and receiving pictures than does MultiCom for DOS™. MultiCom for Windows™ uses the standard uncompressed and compressed .BMP image file format. You can create such files with many software packages, including the ones that come with Windows 3.1™ and Windows 95™. Because of this, you can even display images as they are being received from stations that are not using MultiCom for Windows™.

Packet images use the Windows standard .BMP files that many software packages create. You can use those packages to create images that you want to send, or to view and modify ones you have received. The best performance occurs when you are using compressed .BMP images (sometimes called RLE images) saved with a 256 color set.

Compressed and Non-compressed Images

Images take a lot of bytes. The number of bytes depends on the amount of detail in the image and the image's overall height and width. By using "compression," you can store many images with fewer bytes. Compression also can significantly reduce the amount of time it takes to transmit an image, thus reducing the amount of traffic on a packet channel and making this mode more enjoyable.

To really enjoy the fun of packet pictures with MultiCom for Windows™, use a simplex connect at 9600 baud. This will allow some pictures to be sent, received, stored, and displayed in less than one minute—error free!

Some software drawing packages can create compressed .BMP files. The exact method

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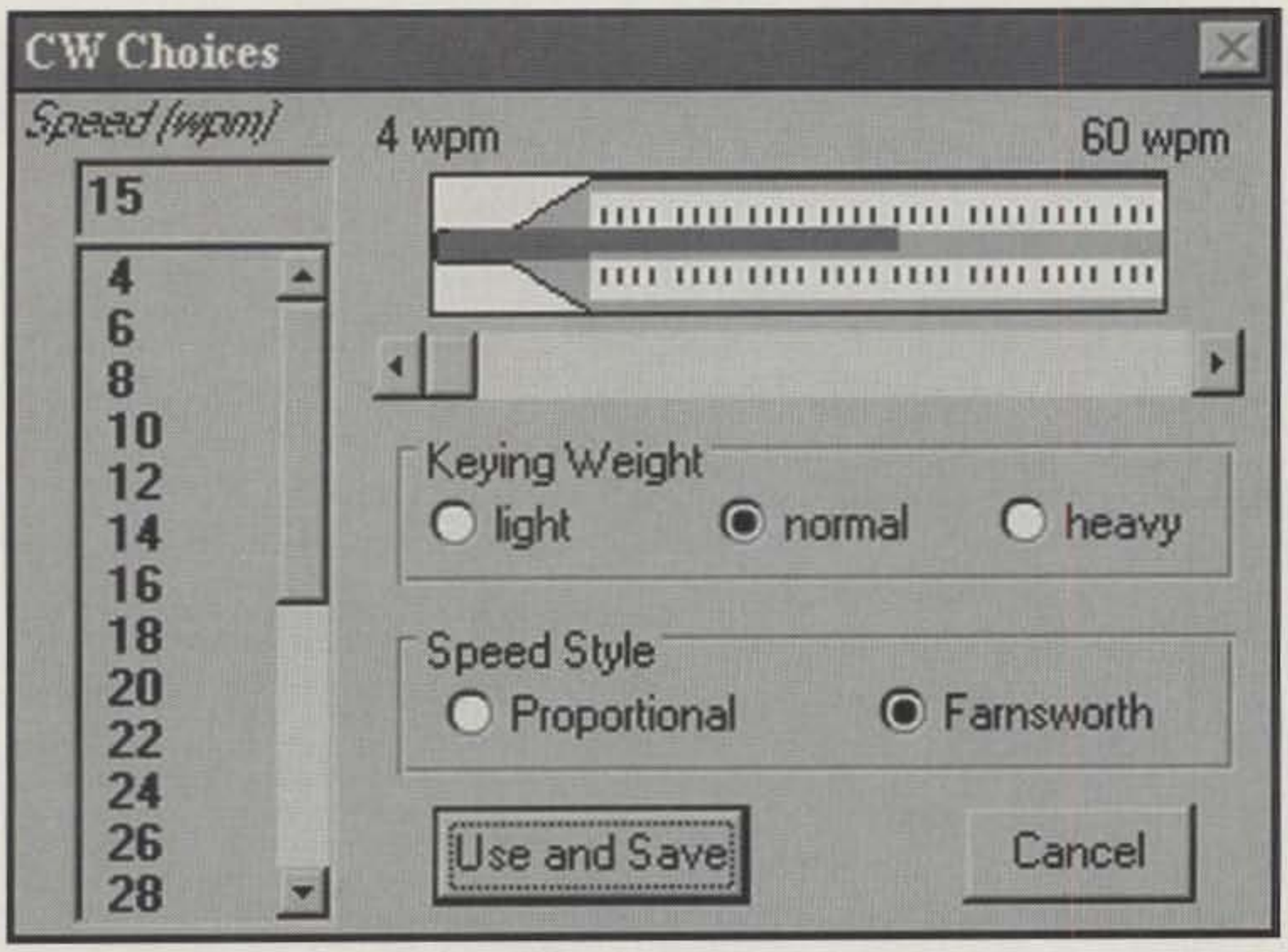

Fig. 10– Enter data in the CW Choices menu to control CW operation in MultiCom for Windows™.

of compression is an industry standard. The shareware package I mentioned earlier (WINJPEG) does this. WINJPEG is available from many on-line services or from companies that distribute shareware. MultiCom for Windows™ also can compress images for you before you transmit them. However, you are not forced to use compression. MultiCom for Windows™ automatically detects whether or not an image is compressed, and displays the image correctly.

Sending Packet Images

The instructions that follow assume you are

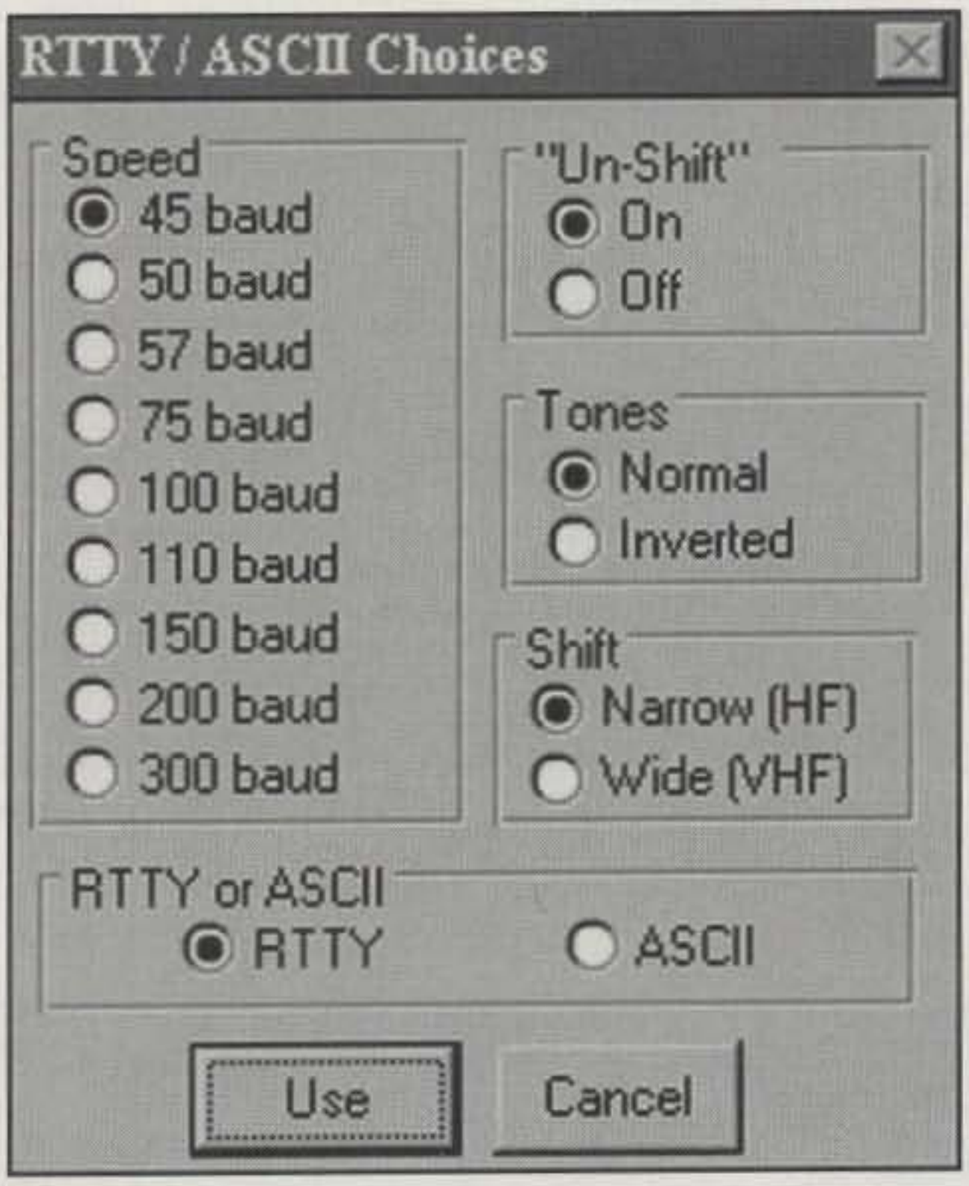

Fig. 11– A few choices need to be made before using RTTY or ASCII for the first time. This menu provides access by entering the RTTY mode. You can then either click on the Options button on the toolbar at the top of the screen or select the Options menu.

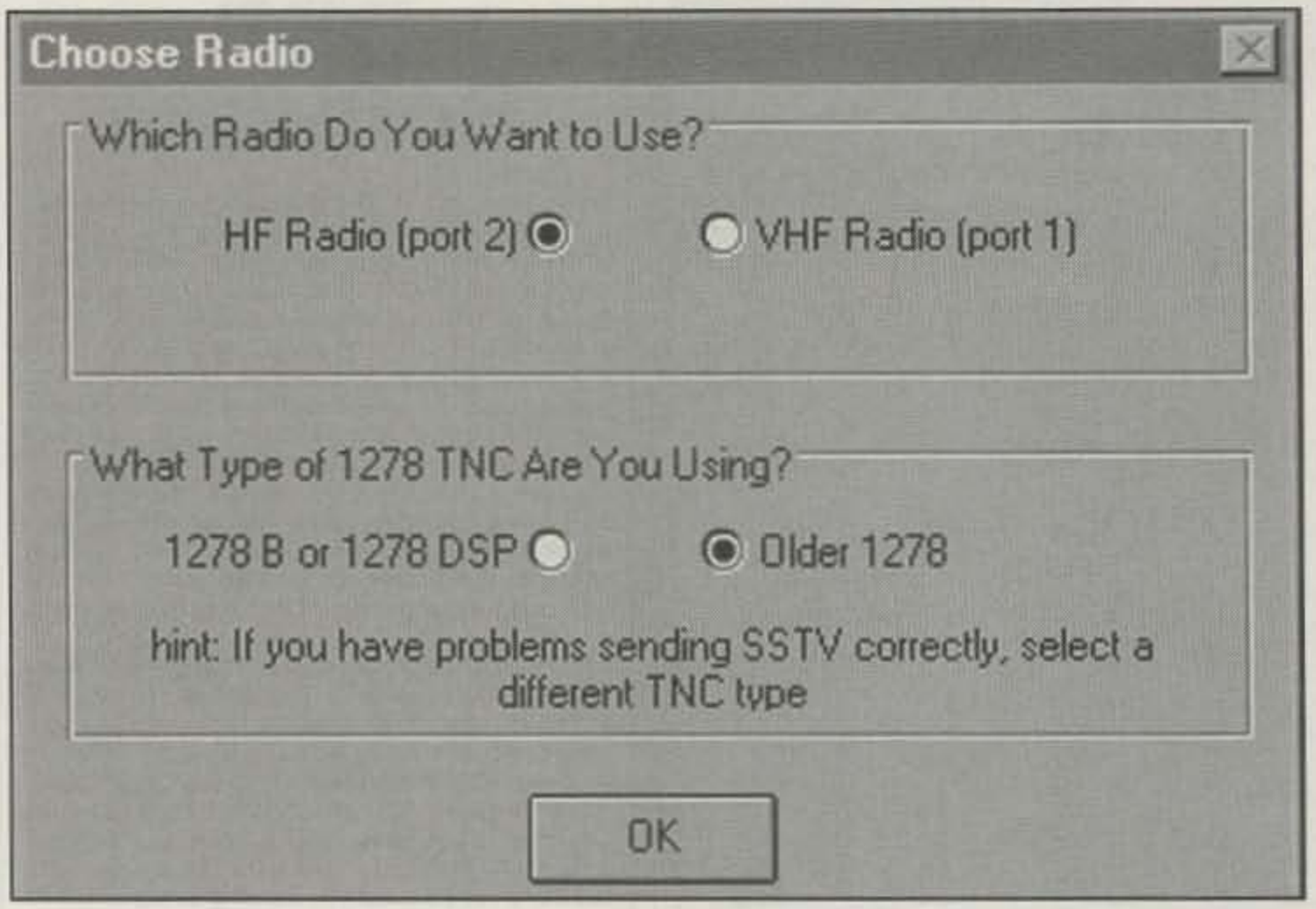

Fig. 12– To enter the SSTV and fax mode, either click on the SSTV/FAX mode button on the main screen, or select SSTV/FAX from the menu bar. A menu similar to the above will appear. Select the radio port you wish to use.

already connected to another station and that station is also using MultiCom for Windows™. Let the connected station know that you are going to send him/her a packet image. The other station must use MultiCom for Windows™ to display your image while it is being transmitted. That station should follow the "Receiving Packet Image" steps described in the following section. Do the following steps:

Click on the Image/File transfer button on the toolbar (this button is only visible when you have established a VHF packet connection with another station; it is invisible at all other times). The YAPP transfer menu will appear on your screen.

Click the button to indicate that you are sending a picture. Do either step (a) or step (b).

Step (a): Send the Image. If you know the file name of the image file that you want to send, simply click the OK button. MultiCom for Windows™ will ask you for the file name and will then show you the image. If that is the image you want to send, click "Yes." If you accidentally choose the wrong image, or you change your mind, click "No." MultiCom will then use the YAPP protocol to transmit your image to the other station.

Step (b): View and Compress an Image Before Sending. If you do not know the file name, or if you want to compress an image before sending it, click on the "View/Compress" button. MultiCom will ask you for the file name (it will assume you want to look at .BMP images, but you can ask it to look for other types). It will display your chosen image. Click "Yes" if you want to compress the file, or "No" if you do not.

If you compress a file, it will give the compressed file the same name as the original .BMP file, but will give it the extension .RLE. For example, if your image file was called "myimage.bmp," MultiCom for Windows™ will call the compressed file "myimage.rle."

As the picture image is being sent, you will see a progress bar (see fig. 9) as compression takes place. After compression is complete, you can go to the first step to proceed with transmitting the image. The amount of time depends on the file size, the quality of the link, and the amount of activity on the channel.

Receiving Packet Picture Images

You need to know that the other station is sending you a packet image. Click on the Image/File transfer button on the toolbar (it is only visible when you have established a VHF packet connection with another station, as we said before). A menu will appear. Click on the button to indicate that you are going to receive a picture. Because images are really data files, MultiCom for Windows™ automatically stores a copy of the image for you. Normally you will use the file name that the other user has given his/her image. However, you can indicate that you want to use a different file name, one that you select if you like. If you select this option, MultiCom for Windows™ prompts you for a file name.

Click on OK. Image reception will begin when the other station starts sending it to you using the YAPP protocol. Everything is automatic from this point on. A blank window appears where the image will be displayed. You will see a series of messages at the top of that window, indicating the progress of the image exchange. The progress steps are:

"Getting Ready": The file name, file size, and certain information about the image are being received. The size of the image form may change to accommodate the height and width of the image. No image is displayed at this point. If MultiCom for Windows™ determines that the image is not in .BMP or RLE format, it will attempt to halt reception.

"Receiving Color Map": About 1000 bytes of color information is received. No image is displayed at this point.

"Receiving Image": The image is displayed as it is received. The image begins at the lower lefthand corner of the form and displays from bottom to top. Note that you can move the image form around the screen with your mouse. The amount of time depends on the file size, the quality of the link, and the amount of activity on the channel. The progress of the transfer is shown in the YAPP screen, which is also visible.

Packet Images uses the amateur de-facto standard YAPP protocol to exchange images. This means you easily can display images from any station that sends you a picture with YAPP. Here's what you do (assuming you have already made a connection with another station):

Ask the other station to send you a picture in .BMP (preferably compressed) file format. The other station should start sending you the picture file with YAPP. You simply follow the image reception procedure just described.

"Continuous Wave"

CW Operation and the CW Options window opens a world of CW DXing advantages that make me want to rush to the next CW DX contest. With MultiCom for Windows™ I feel as if I have a full-featured keyer at my fingertips.

Enter data in the CW CHOICES menu to control CW operation in MultiCom for Windows™ (see fig. 10). This menu may be accessed while you are in the CW mode. You access the menu by clicking the Options button at the top of the MultiCom for Windows™ window, or by selecting Options from the menu at the top of the MultiCom for Windows™ window.

The red bar graph shows the current speed setting graphically, and the option box shows the speed in words per minute. You can specify your CW sending speed upon entering the CW mode in one of several ways. You can type in a value in the option box, click on a speed from the list below the option box, or drag the box in the bar below the speed graph to set the speed you want. As I mentioned before, this is like having a full-featured keyer at my fingertips. Keying Weight is just one of the many fea-

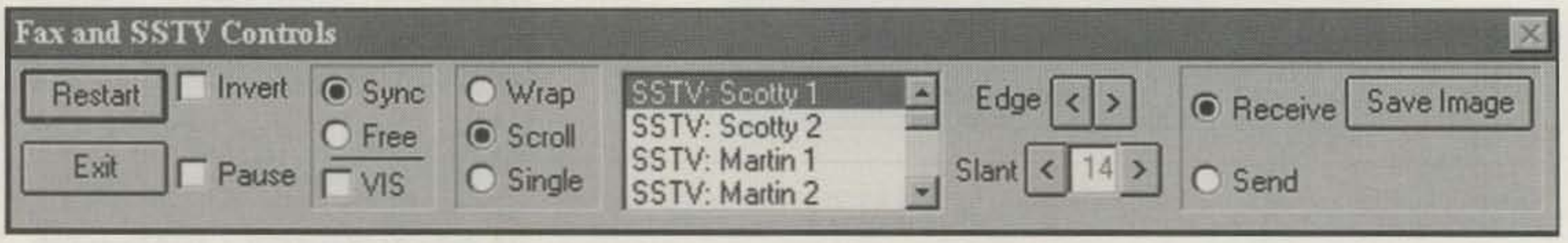

Fig. 13– In the SSTV and fax mode you will see two important windows: the Image Display Screen and the Control window.

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SL-15R	•	•	12	15	2⅝ × 7 × 9¾	13
SL-15R-GE	•		12	15	5⅛ × 7⅝ × 9¾	14
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RM-60A	50	55	7 ×19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ ×19 × 8¼	16
RM-35M	25	35	5¼ ×19 × 12½	38
RM-50M	37	50	5¼ ×19 × 12½	50
RM-60M	50	55	7 ×19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty [Amps]	ICS* [Amps]	Size [IN] H × W × D	Shipping Wt. [lbs]
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty [Amps]	ICS* [Amps]	Size [IN] H × W × D	Shipping Wt. [lbs]
• Switchable volt and Amp meter				
RS-12M	9	12	4½ ×8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 1	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES

MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty [Amps] @13.8VDC	@10VDC	@5VDC	ICS* [Amps] @13.8V	Size [IN] H × W × D	Shipping Wt. [lbs]
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
VS-70M	57	34	16	70	6 × 13¾ × 12½	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

CS - Intermittent Communication Service (50% Duty Cycle 5 min. on 5 min. off)

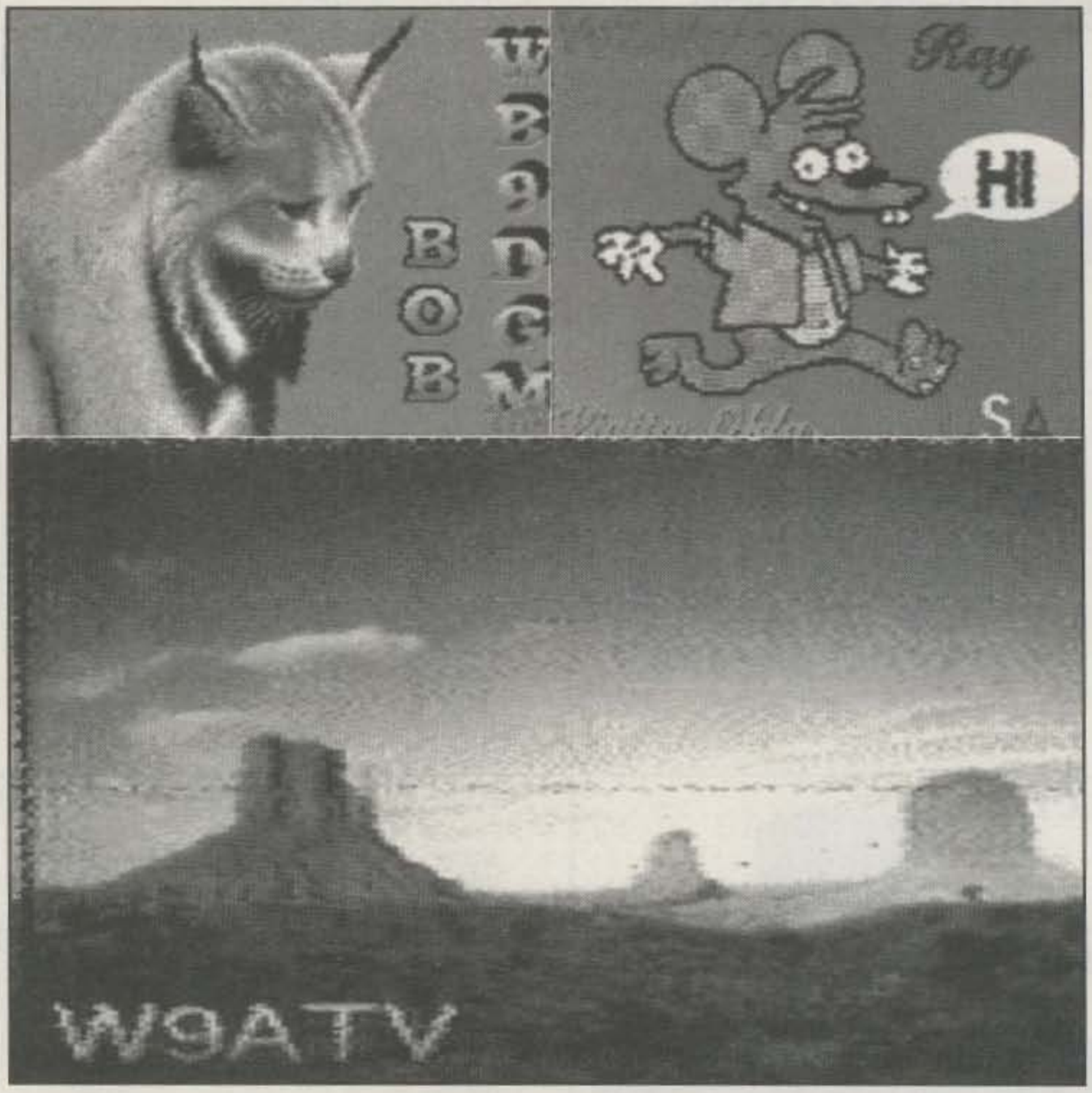


Fig. 14– Three pictures are worth three-thousand words. These three picture images were received off HF SSTV (14.230 MHz) using MultiCom for Windows™ and the MFJ-1278B/DSP.

tures of the full-featured and automated keyer in MultiCom for Windows™.

The Keying Weight value affects the relative ratio of "dash" times to "dot" times. Heavy weighting makes the dashes slightly longer, and light weighting makes them slightly shorter. Most often "normal" would be selected, but some transmitters will sound better to the station with which you are QSOing when you use "light" or "heavy" weight.

Speed Style or *Proportional* references the lengths of dots and dashes, and the spaces between characters change with the sending speed. For very slow speeds, this means very long dots and dashes, which some operators believe is difficult to copy.

Farnsworth uses proportional style *above* 15 wpm. At speeds below 15 wpm the characters are sent at 15 wpm, and only the spacing between the characters is adjusted. Some operators believe that this is a better way for low-speed stations to learn to copy CW.

Use, Cancel, and *Help* are "click ons." Use enables the changes you have made, while Cancel ignores any changes you have made.

Fun for the RTTY and ASCII Ops, Too

You need to make a few of choices before you use RTTY or ASCII for the first time. Only one menu is used for both modes, since RTTY is used much more than ASCII. The menu at fig. 11 provides this access. Enter the RTTY mode, then either click on the Options button on the toolbar at the top of the screen or select the Options menu. Click on the speed (baud rate) that you wish to use when you select RTTY or ASCII operation.

"Un-shift" means that the TNC reverts to Letters mode when a space or "new line" is transmitted. Normally you should consider setting this choice to "On" to avoid a garbled character causing a long string of numbers to be erroneously displayed on the screen.

You usually should set the tones choice to "normal." Occasionally, the other station may send inverted tones; in that case you should set the choice to "inverted."

Set the Shift choice to "narrow" if you are operating on HF. Set it to "wide" if you are operating on VHF.

You must be in the RTTY/ASCII mode to start an RTTY or ASCII QSO. You might want to call CQ, or you might want to tune in another station to call. When tuning in another station, make sure the "threshold" control is set so the yellow LED on your TNC is on while the other station is transmitting.

SSTV and FAX Operation

One of the most important features of your MFJ-1278 is its ability to receive and send SSTV pictures. MultiCom for Windows™ makes it easy to enjoy SSTV operation on HF and/or VHF. It also gives you the ability to receive many types of fax pictures. The sections that follow show you how to use these fascinating modes.

Entering SSTV and FAX Mode. To enter

SSTV and Fax mode, either click on the SSTV/FAX mode button on the main screen, or select SSTV/FAX from the menu bar. A menu similar to that in fig. 12 will appear. Select the radio port you wish to use. You also must specify which type MFJ-1278 TNC you have, because older MFJ-1278's transmit SSTV tones slightly differently than do 1278B's and 1278/DSP's. If you have an older 1278, you must have the 16-level-gray modem installed to send and receive SSTV with MultiCom for Windows™. After this is done, the normal MultiCom for Windows™ screen will disappear and the screens described in the following section will appear.

SSTV and FAX Windows. In SSTV and FAX mode you will see two important windows: the Image Display Screen and the Control window (fig. 13). The Control window is used to control SSTV and FAX operations. With it you can select the mode you wish and control how images are displayed. The Image Display window is used to display the images you are receiving and sending. When you enter the SSTV/FAX mode, it is blank.

When you select the SSTV or FAX mode, you may use scroll box on the Control window. Scroll up or down, and then highlight the mode you wish to use. You can change modes at any time while this menu is visible. You can choose from Scotty 1 and 2 SSTV; Martin 1 and 2 SSTV; Robot 72 Color SSTV; Robot 8, 16, and 32 Black & White SSTV; HF Weather fax; or a variety of other fax modes. Also, under good reception conditions, MultiCom can automatically detect Scotty 1, Scotty 2, Martin 1, Martin 2, and Robot 72C modes (see "Vertical Interval Signal" definition in a later paragraph). Normally, the signal you receive will "synchronize" automatically. This means it will appear starting at the top of the image with the edges positioned correctly. When "sync" is checked, your 1278 will wait until a "sync," or positioning, signal is received. No image will be displayed until sync is detected. However, you may have tuned in a signal that is already part way through sending an image, or the signal may be too weak for your 1278 to detect the sync signal. In that case, check "free" and an image will begin to be displayed immediately. In a few instances QRM or QRN will cause MultiCom to synchronize by mistake. Simply click "Restart" and MultiCom for Windows™ will attempt to resynchronize.

Vertical Interval Signal (VIS) or Automatic Mode Selection. If you check VIS, MultiCom for Windows™ will look for the special Vertical Interval Signal that most SSTV stations send. The VIS signal identifies the SSTV mode.

After detecting a VIS signal, MultiCom for Windows™ will look for the "sync" signal and then begin displaying the picture. The VIS feature may not detect the mode when signals are noisy or weak, or if QRM is present.

Some images (such as weather fax images) will be too long to display on a single screen. Also, you may want to have MultiCom for Windows™ keep on displaying while a series of images are received.

When "scroll" is checked, the Image Display Screen will scroll upwards when the screen is almost full. Any image scrolled past the top of the screen will be lost. This only applies to fax modes; SSTV modes fit on the screen.

When "wrap" is selected, the image will resume displaying at the top of the screen after the image has filled the screen. Again, this only applies to fax modes; SSTV modes fit on the screen.

When "single" is selected, only one image will be shown. When the screen is full, image display stops until "Restart" is clicked.

Summary

The three picture images shown in fig. 14 were received off HF SSTV (14.230 MHz) using MultiCom for Windows™ and the MFJ-1278B/DSP. Although printed in black and white, these images were received and displayed in realistic colors. No artifact colors were set. The color pallette is even and clean, which gives the images an appearance near that of the packet bit-mapped pictures.

We have touched on some of the outstanding features of this powerhouse Windows-based terminal program. A combo of MultiCom for Windows™ and the MFJ-1278B/DSP would make an ideal addition to your digital shack.

Contact your local amateur radio distributor, or MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville, Mississippi 39759 (1-800-647-1800 order line). You may visit the MFJ worldwide web site on the internet at: <http://www.mfjenterprises.com>.

*(Note re MFJ-1289"W" MultiCom for Windows™:*It is important to remember to add the "W" when ordering MultiCom for Windows™. The same model number without the "W" is the non-Windows version of MultiCom. MultiCom for Windows™ requires an MFJ-1278B or other MFJ TNC [features limited by TNC] and an IBM or compatible 386/33 computer with 4 to 8 Mb of RAM. Color SSTV and multi-gray-level fax require VGA graphic system. Hi resolution requires Hi color card. TheMFJ-1289W is priced at $59.95; the MFJ-1278B/DSP is $379.95, or the MFJ-1278B without DSP is $299.95.)

Happy New Year, and Have Fun Packeting. Also, don't forget to visit the SEDAN Packet Radio home pages at <http://www.sedan.org>.

BucK4ABT@inmind.com, or
K4ABT@SEDAN.ORG

BY DOUG DeMAW, W1FB

DOUG'S DESK

CONSTRUCTION PROJECTS, TECHNIQUES, AND THEORY

A Tunable BFO For Collins Filters

Those who build receivers that use Collins-Rockwell mechanical filters are sometimes perplexed because they lack the crystals required for building a BFO for upper and lower sideband reception. Not all Collins filters are designed for 455 kHz. Some have center frequencies that are offset from 455 kHz. These are known as upper- or lower-sideband filters. The BFO, or carrier generator in transmitters, operates at a single frequency between the two filter center frequencies, and the filters are switched to select the desired sideband.

Knowing the precise BFO crystal frequency for best performance can be a difficult challenge. Typically, the BFO or carrier generator frequency should fall 20 dB down from center frequency on the filter response curve. It is difficult to order the proper crystal when the filter characteristics are unknown. This may be the situation when we buy Collins filters at an amateur radio flea market or by mail. Although there are ways to "rubber" a 455 kHz crystal, very little frequency change can be realized through adjustment with a trimmer, or when using an inductor and a trimmer in series (VXO) between the crystal and circuit ground. Finally, 455 kHz crystals that are ground to the desired frequency are very expensive. They may cost $25 or more apiece!

A low-cost and practical alternative to crystal control is discussed in this article. I have used circuits similar to that in fig. 1 a number of times in homemade receivers. These BFOs are stable and can be made from ordinary components. The ability to move the BFO frequency over the filter passband has advantages, especially when there is QRM. It is easy to find the proper BFO frequency by adjusting the frequency control while listening to the desired signal. The control is adjusted for best SSB audio fidelity or the preferred CW beat-note pitch.

P.O. Box 250, Luther, MI 49656

Circuit Details

Fig. 1 shows how the circuit is configured. Q1 is the oscillator. A Colpitts L-C circuit is used. L1 is the primary winding of miniature transistor radio IF transformer. The secondary winding is not used. These transformers are available from Mouser Electronics and other parts distributors.[1] You can remove one from a discarded transistor radio. New units cost less than $1.50.

It is necessary to carefully remove the small capacitor that is located outside the IF transformer in its base. I pry them loose with a small knife blade or soldering aid. Light pressure is exerted until the pigtails snap. The transformer slug provides a wide inductance variation for the primary winding. The fig. 1 circuit requires 500 µH of inductance for the tuning range listed. The unloaded Q of the winding is approximately 90 at 790 kHz. It should be slightly higher at 455 kHz.

Fig. 1 shows that not all of the primary winding is used. Rather, the winding from the grounded end to the neutralization tap is utilized. This provides a wider tuning range around 455 kHz. Although the entire winding can be used, the core is all the way out of the inductor at 500 µH. The Q declines as the slug is withdrawn from the coil. L1 is shielded effectively when the transformer case is grounded.

BFO tuning is accomplished with a VVC diode that has a nominal capacitance of 56 pF. Suitable diodes are available from a mail-order vendor.[2] R1 is adjusted to change the frequency. The frequency can be shifted 2.5 kHz above or below center frequency with this control. Greater range may be had by decreasing the resistance of R3. A quality potentiometer will provide greater longevity than a low-cost

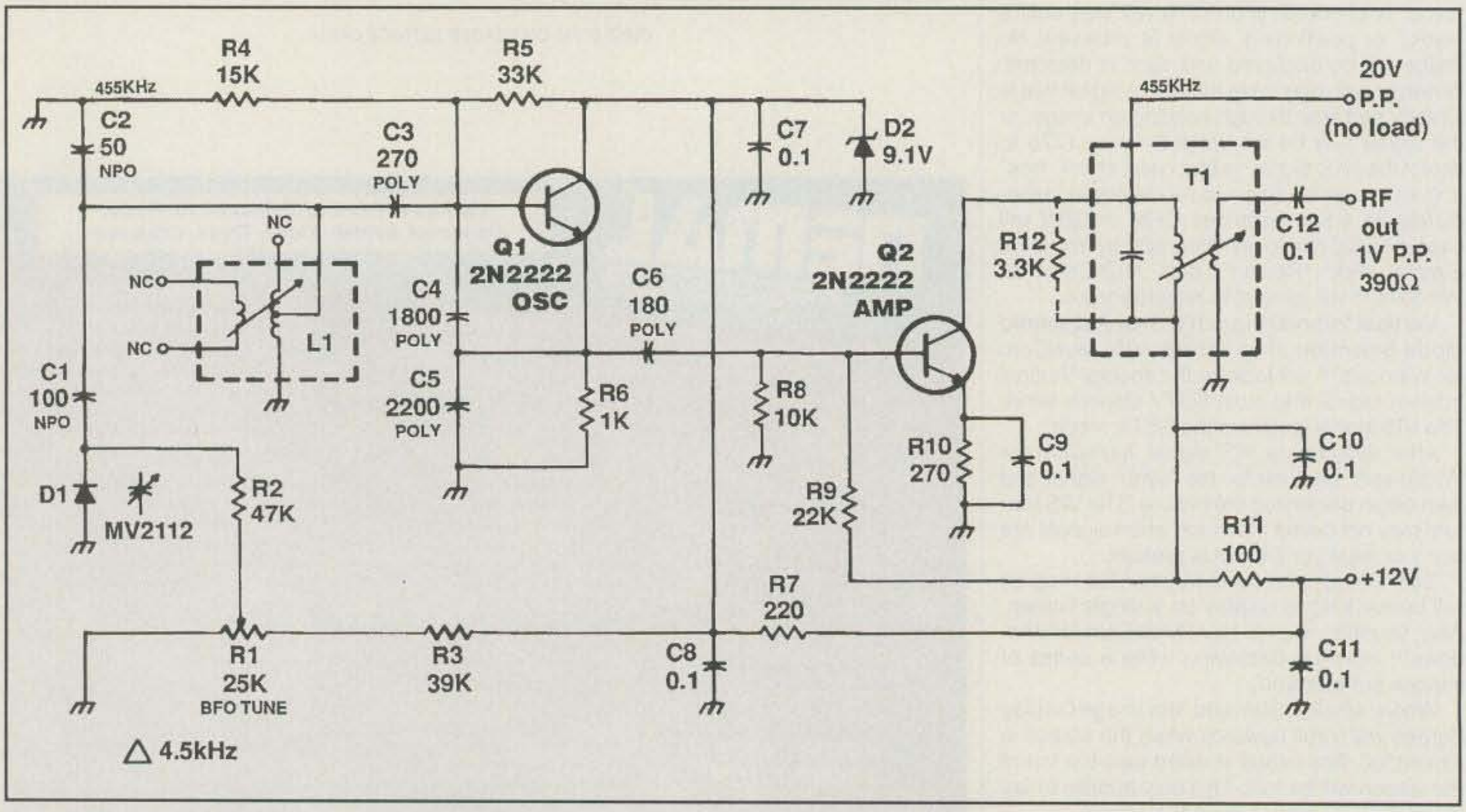
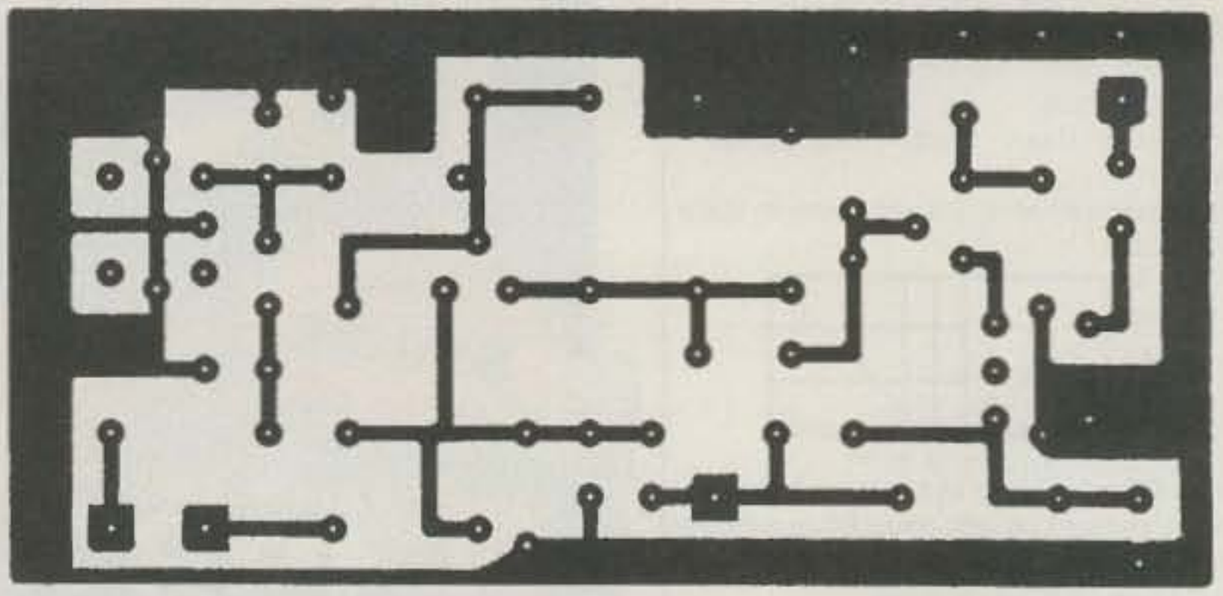
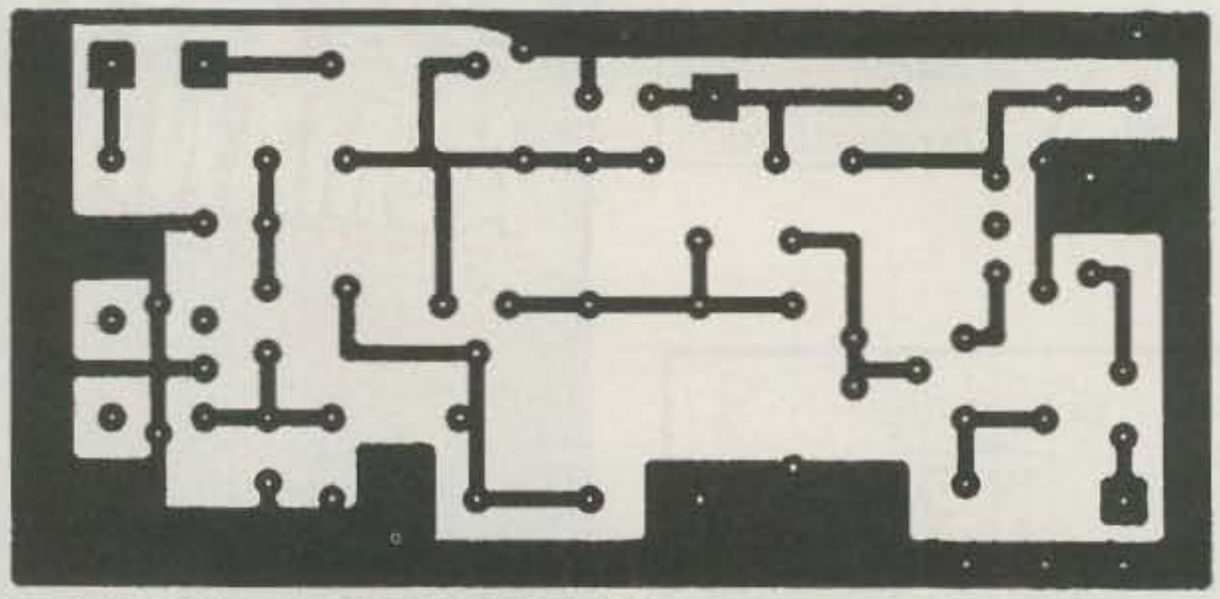


Fig. 1– Schematic diagram of the 455 kHz tunable BFO. Capacitors are disc ceramic unless otherwise indicated. Decimal value capacitors are in µF. Others are in pF. Resistors are 1/4 watt carbon. NP0 signifies zero coefficient, temperature-stable ceramic. Poly means polystyrene. D1 is an MV2112 or equivalent VVC tuning diode. D2 is a 9.1 V, 400 MW Zener diode. L1 and T1 are Mouser miniature 455 kHz IF transformers with black cores (see text). Q1 and Q2 can be 2N3904 or 2N4400 transistors (no circuit changes required). R1 is a 25K ohm linear-taper carbon potentiometer (see text).



(A) ETCHED SIDE



(B) COMPONENT SIDE

Fig. 2– Scale etching pattern for the circuit in fig. 1. Pattern A is viewed from the etched side. Pattern B is viewed from the component side.

imported one. I prefer a 2 watt carbon control of the Allen-Bradley type.

A combination of NP0 and polystyrene capacitors is used in the frequency-sensitive parts of the oscillator. Silver-mica capacitors should be acceptable at C3, C4, C5, and C6.

The Q1 operating voltage, and that for D1, is regulated at 9.1 volts by means of Zener diode D2. Any regulated voltage from 6.8 to 9.1 may be used.

BFO Amplifier

Q2 of fig. 1 amplifies the output from Q1 to provide sufficient output power for injecting diode-ring product detectors (+7 dBm). Q2 is a tuned class A amplifier. A miniature 455 kHz IF transformer comprises the collector tuned circuit. The built-in capacitor of T1 is not removed, as was the procedure for L1. Low-level output may be taken from the T1 secondary winding. I measured 1 volt pk-pk across a 390 ohm load. Greater output power may be taken from the collector of Q2 through a suitable blocking capacitor—the smaller the value the better. I measured 20 volts pk-pk at the collector with a 390 ohm termination across the secondary winding.

R12 is optional. It should be used if Q2 has a tendency toward self-oscillation at resonance. This will depend upon the gain of the transistor used at Q2. BFO output power will decline if R12 is added. The foregoing pk-pk voltage measurements were taken with R12 in the circuit. Use care when adjusting the slug in T1. It is possible to tune the transformer to the second harmonic of 455 kHz. This happens when the slug is set for minimum inductance (all the way up). A midrange setting is necessary for resonance at 455 kHz.

Construction Details

Fig. 2 contains a scale etching pattern for the BFO PC board. The design was developed by way of DOS software called PCboards.[3] This is not an autorouting program that allows the computer to seek paths from point A to point B. All of the conductors must be placed with 90 degree angles, as shown. The software is easy to use with any IBM-compatible computer. Each move of the cursor represents 1/20th inch.

A shield box should be used to enclose the BFO. This will help prevent stray radiation to circuits other than the product detector. The shield box also protects the PC board from rapid temperature changes that can cause drift. Fig. 3 is the parts placement guide for the circuit shown in fig. 1.

Adjustment and Use

Terminate the T1 secondary winding with a 100 to 560 ohm carbon resistor. Connect a frequency counter across the load resistor. Set R1 at midrange and apply operating voltage. Adjust the L1 slug for 455 kHz (or other BFO frequency). T1 is adjusted for maximum output power with a scope or RF probe connected across the T1 load resistor.

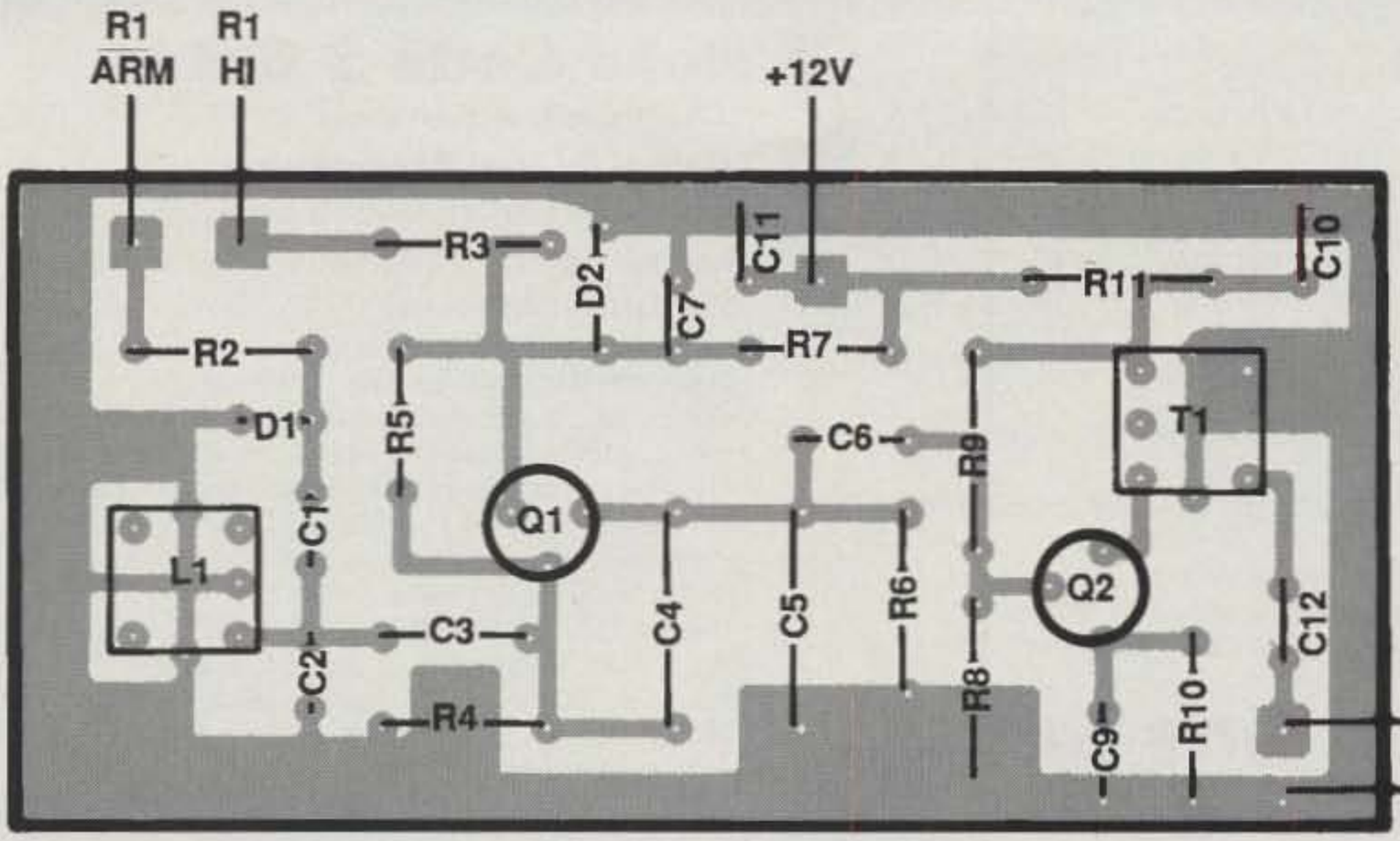


Fig. 3– Parts-placement guide for the BFO as viewed from the component side of the board. Drawing is not to scale.

If you do not have a frequency counter, tune a well-calibrated receiver to 455 kHz or 910 kHz (2nd harmonic) and adjust the L1 slug for maximum S-meter deflection. If the signal is not heard, connect a clip lead to the BFO output port and place the other end of it near the antenna jack of the receiver. If your receiver can be tuned to 455 kHz, you may peak T1 for maximum signal output while observing the S-meter.

The type of product detector you use (active or passive) will determine the level of BFO injection you need. Output may be taken from the T1 secondary winding or from the Q2 collector, as discussed earlier.

The desired sideband or CW signal is tuned in for maximum S-meter deflection. R1 is then adjusted for the desired USB or LSB signal quality or CW note pitch.

Frequency stability for the fig. 1 circuit is excellent. Short-term drift lasts for about 1 minute, during which time I measured a frequency change upward of some 70 Hz. Thereafter at a room temperature of 70° F the frequency wandered up and down about 3 Hz.

Closing Comments

This project can be completed in a few hours if you are able to make your own PC board. PnP Blue image-transfer film is inexpensive and simple to use. A packet of 8½" × 11" sheets with instructions is available from All Electronics Corp.[4] The PC board pattern (as viewed from the component side) is transferred to the PnP Blue with a photocopy machine. The film is placed over the blank PB board stock and the pattern is transferred to the copper surface with a household iron (set for silk or cotton). The film is peeled from the PC board after it cools. Black etch-resist compound remains on the PC elements but not on the areas to be etched. The component-side view of the board pattern is necessary because of the mirror image that results when ironing the film onto the circuit board. This is true also when using Tec-200 transfer film. Any standard method of etching may be used. The etch resist material is easily removed with paint solvent.

Notes

1. Mouser Electronics, 2401 Hwy. 287 N., Mansfield, TX 76063-4827. Phone 800-346-6873 for a catalog or ordering.

2. Hosfelt Electronics, Inc., 2700 Sunset Blvd., Steubenville, OH 43952-1158. Phone 800-524-6464 for a catalog or ordering.

3. PCboards, 2110 14th Ave., Birmingham, AL 35205. Autorouting software available also.

4. All Electronics Corp., 14928 Oxnard St., Van Nuys, CA 91411. Phone 800-826-5432 for a catalog or ordering. 73, Doug, W1FB

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- Opto Electronics add-on boards for PRO series Radio Shack Radios

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2. Enter any two frequencies and scan between them with ANY increment, time delay or pause.
3. Scan a file of frequencies, search by description or wildcards.
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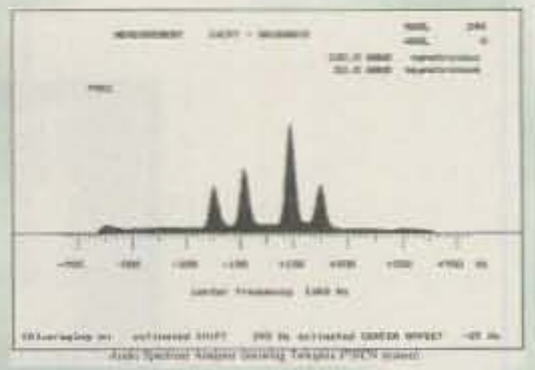
Hoka Code 3 Gold

"The most advanced Digital Signal Processing program for analysis and decoding of HF data communications!"



Code 3 Gold makes decoding easy for the novice and expert. Unlike the CW/RTTY decoders, Code 3 is an exclusive auto classification that tells you what you are listening to (30 + modes) and automatically sets you up to start decoding. Automatic analysis and oscilloscope functions are both selectable from almost anywhere in the program. The six Main Menu screens make moving around the Code 3 Gold program a snap. Code 3 is the most sophisticated and emcompassing decoder available. The 26 standard modes include:

- Morse • ARQ6-90/98 • FEC-A FEC100A/FEC101 • RTTY/BAudot/Murray • SI-ARQ/ARQ-S
- FEC-S • FEC1000 Simplex • Sitor CCIR 625/476-4 • SWED-ARQ-ARQ-SWE
- Sports info 300 baud • ARQ - Navtex • ARQ-E/ARQ1000 Duplex • AX25 Packet
- ARQ-N-ARQ1000 • Hellscreiber-Synch/Asynch • Facsimile all RPM (up to Duplex Variant)
- Sitor • RAW (Normal Sitor16 gray shades at 1024 x
- ARQ-E3-CCIR519 but without Synch.768 pixels Variant • ARQ6-70 • Autospec - Mk's I and II
- POL-ARQ 100 Baud • Baudot F788N • DUP-ARQ Artrac Duplex ARQ • Pacto • Twinplex
- TDM242/ARQ-M2/4-242 • WEFAX • ASCII
- TDM342/ARQ-M2/4Package includes: Code 3 Gold software, audio-digital converter and RS232 cable, all ready to go!
- Requirements: IBM compatible, MSDOS with 640kB of Ram, CGA or better monitor.

Available options:

Option 3 Piccolo	Option 4 Coquelet	Option 5 4 special	Option 8
ARQ & FEC systems: TORQ-10/11, ROU-FEC/RUM-FEC. HC-ARQ (ICRC) and HNG-FEC	SYNOP decoder		

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WiNRADiO World Station Database Manager

The WiNRADiO World Station Database Manager (WiNDATA), is an add-on utility for any version of WiNRADiO. It contains a database of over 300,000 radio stations worldwide, operating between 500kHz and 1.3GHz, which are suitable for reception by the WiNRADiO receiver.

System Requirements:

- IBM PC witha 386 or higher processor (486 or higher is recommended)
- at least 4 megabytes of RAM (8MB or more is recommended)
- 30MB or more of free hard disk space
- Microsoft Windows 3.1 or later (including WINDOWS 95)

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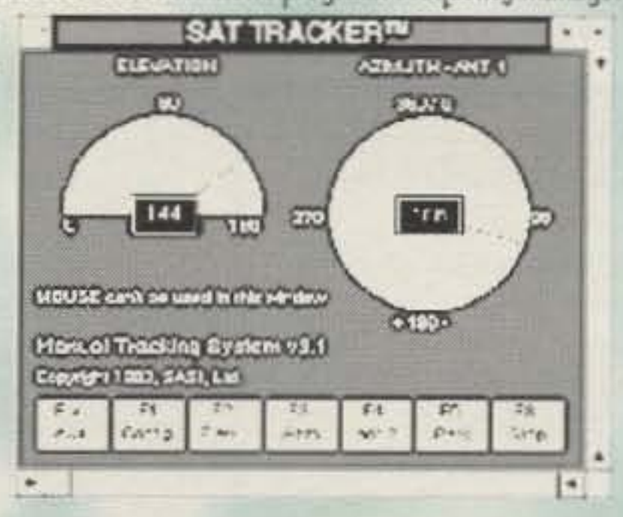

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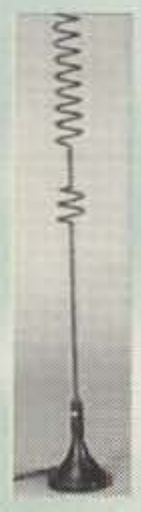

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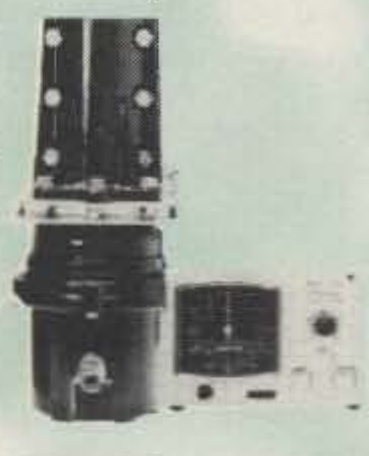

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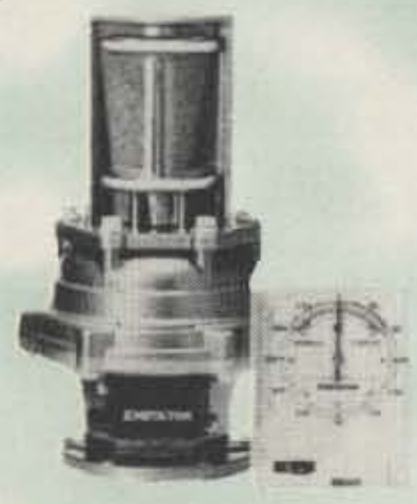

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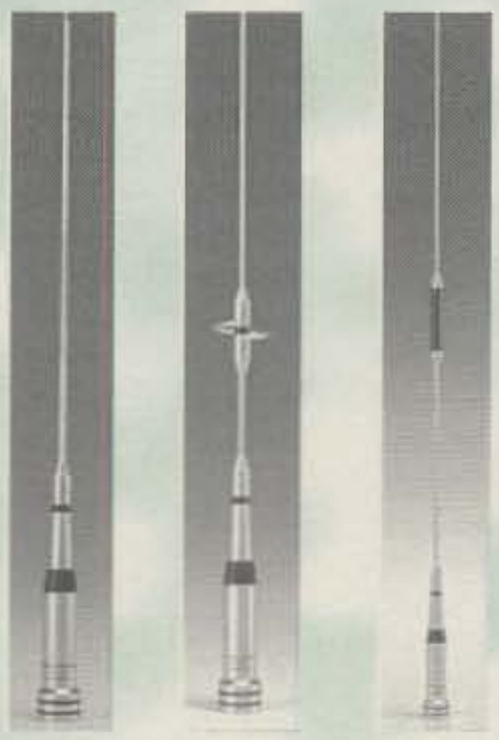

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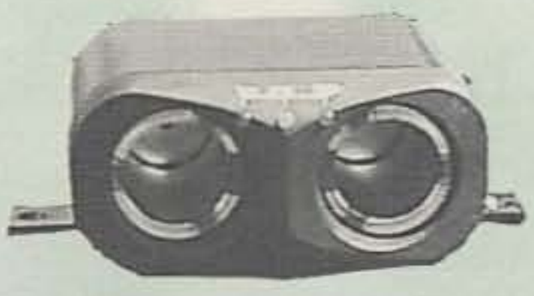

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BY JOE LYNCH, N6CL

VHF PLUS

ALL ABOUT THE WORLD ABOVE HF

VHF+ Contesting and Awards

The beginning of the new year is usually the time to set goals and resolutions. Perhaps your goal is to be a better contest operator or to complete the requirements for some of the VHF+ awards. This month we will give some hints on how to go about accomplishing these goals.

VHF+ Contest Operating. VHF+ and HF contesting are both alike and different. VHF+ contesting is like HF contesting in that the goal-setting and preparation involved are the same. In addition, some software written for HF contests is also available for VHF+ contests. The principal difference between VHF+ and HF contesting is the length of time between contacts. For instance, when the band isn't open (on 6 meters) or when there's simply no one to work (on the higher VHF+ frequencies), you may wait for hours between contacts. On the other hand, you may begin a 90 QSO hour in the next 15 minutes.

Patience is one skill you must have on VHF+ that's not as necessary on HF. Knowing when to wait and when to quit is also very important.

VHF+ Contest Strategy. What does it take to create a winning contest station? To give you a picture of what it takes to win, I'll borrow a bit from HF operators such as my friend John Dorr, K1AR, and a lot from the big guns of VHF+ contesting such as Dave Hallidy, KD5RO. Most of the advice that follows applies to the general VHF+ contests. However, some of the strategy also applies to Field Day and, to a lesser extent, the SMIRK contest.

Your Body. How you feel is just as important for the success of your contest station as the equipment it contains. Have you rested adequately before the contest? Even though VHF+ contests almost always allow you to get a good night's sleep (because the bands shut down at night), you still need to be in top shape for the endurance associated with contesting.

What are you eating? Some operators prefer a diet of pasta because it's high in carbohydrates. Taboos include caffeine (which includes chocolate) and sugar. (Some operators even avoid fruit, because of the high fructose content.) Both caffeine and sugar are stimulants that, after they wear off, could leave you in an energy crash. Don't try any new (especially spicy) foods just before the contest. Your digestive track may not approve.

Your Goals. Your biggest decision is probably to define what it means to win. Winning for you may involve being tops in the country for your category, or it may mean making ten contacts on 10 GHz. Setting a goal and writing it down helps you focus on what you intend to accomplish during the contest. Always remember: Whatever your goal may be, if you achieve it, you're a winner.

Your Station. What may seem to be the most obvious ingredient is also the most taken for granted. If you're contemplating operating a contest, your station must be in top shape. If you purchased a piece of new equipment recently, before the contest use it as much as it takes to become very familiar with it. Know the knobs and buttons and their functions. Know the equipment's strengths and weaknesses. If possible, make several dozen contacts with it.

Make sure every aspect of the station is working to your satisfaction. Check the antenna, the coax, the rotator, and the rotator lead-in. Check the radios, the power supplies, the preamps, the amplifiers, and the cables used to connect all these items.

Are you operating away from your home QTH? Assemble your antennas and towers or masts just as you plan to use them in the field. There are two important reasons to go through the exercise of setting up everything. The obvious one is to make sure the equipment is working properly. The second is to ensure that you have overcome the learning curve associated with station assembly. Hopefully this will make station assembly in the field much easier and much faster.

Once assembled, make several contacts with your "portable station" set up in the backyard. Be sure to make duplicate sets of cables, and check to see that they are working to your satisfaction. Also, make sure your field location is viable. Take a mobile or portable radio to the site. Check for power-line noise or other reception problems. Make sure that the lay of the land is sufficient to allow enough room for every station.

Look around your station. Is the setup comfortable? When you're in your ergonomically correct chair, is everything within easy reach?

Are you using software or paper logs? If you've chosen to use software, make sure the computer is working and you really know the software (don't try to learn it the night before the contest). If you're using paper logs, make sure you have enough log sheets, dupe sheets, scratch paper, and pencils (yes, pencils, because they erase more easily when you're trying to change an entry).

On the Air. VHF+ contests have an entirely different pace than HF contests. This sometimes frustrates HF operators who try contesting on VHF. Unless the band is open, you won't get the steady runs that HF contest operators experience. Therefore, it's imperative to tune through all the bands that you have available. This isn't as hard as it seems, because the other operator is just as motivated as you are to make multiple contacts.

Stay off the calling frequencies. This bears repeating. *Stay off the calling frequencies.* Too many flaming strings accusing someone of hogging the calling frequency.are started after the contest on the VHF reflector. It is best to stay away.

If you have a loud signal, people will come to you. If not, you can go to the loud signal. It takes only one station on the calling frequency to ruin it for everyone. When on 6 meters, stay out of the DX window. Reserve it for contacting DX stations only! During several recent June VHF QSO Parties, operators in Europe heard stations as far away as the southwestern part of the U.S., but couldn't be heard because of stateside QRM in the DX window.

Have Fun. This hobby is supposed to be fun, so naturally contesting should also be fun. Unless you make it enjoyable for yourself, you'll find the experience frustrating and unfulfilling.

How can you make it fun? One way is by setting goals. You may want to work enough stations to earn a pin in one of the ARRL contests. You may want to work stations in new grids only. You may want to run QRP and see how many stations you can work with as little power as possible. Another way to make it fun is to find a group of like-minded amateurs and make the contest an outing (similar to Field Day).

VHF PLUS CALENDAR

Jan. 1	Last quarter Moon.
Jan. 3	*Quadrantids* meteor shower predicted peak.
Jan. 8	New Moon.
Jan. 9	Moon perigee.
Jan. 15	First quarter Moon.
Jan. 18–20	ARRL VHF Sweepstakes.
Jan. 23	Full Moon.
Jan. 26	Moon apogee.
Jan. 31	Last quarter Moon.

The Most Popular VHF+ Awards and How to Achieve Them

Completing the requirements for any amateur radio awards involves goal setting. The VHF+ frequencies are no different. Once you've made a decision to go to these bands, you must decide whether or not to pursue specific goals. If you do, there's a principal difference between HF and VHF—time. While, as you'll see below, some of the requirements for popular VHF+ awards can be met in as short a time as a weekend, some aren't met for decades.

The most popular award for VHF is VUCC. Next most popular is WAS. Quite a ways down the list is DXCC.

VUCC. The award requirements for VUCC are as follows: For 6 and 2 meters, you must work 100 grid locators; for 135 and 70 cm, the requirement is 50; for 33 and 23 cm, you must work 25 grids; for 13 cm, the requirement is 10; and for all other bands the requirement is 5.

Six-meter operators from most parts of the country should have no difficulty obtaining VUCC. The regular existence of sporadic-*E* allows for fairly easy completion of contacts in distant grid locators. In fact, contest stations and other operators often contact stations in 100 different grid locators in one contest weekend.

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Compuserve 72124.2734@compuserv.com

The task is a bit more difficult on 2 meters. With a little luck, if you live in the center of a rather highly populated area and are also surrounded by highly populated areas, you should reach your goal pretty quickly. Here again, contest stations, and others, have been known to work stations in the required 100 grid locators in just one weekend. However, if you live outside, or even on the fringe, of these high population areas, the task becomes exponentially more difficult.

For example, if you live in the west, you're probably surrounded by vast expanses of land containing few amateurs, let alone VHF+ operators. Under these conditions, you must use extended forms of propagation to meet your goal. Meteor showers, sporadic-*E*, aurora, tropo, and EME become very important in these situations. Of all of these modes of propagation, meteor showers are probably the most predictable. You can look on a calendar, note the time of the next meteor shower, and then plan accordingly.

Those of you on a limited budget are probably least likely to choose EME as a way to meet your goal, but don't rule it out. San Hutson, K5YY, and Ray Soifer, W2RS, each presented excellent papers on EME made easy and relatively inexpensive at Central States VHF conferences. Both of these papers unlock some of the mystique of EME operation for the "little guy."

But I digress. We were talking about meteor showers. It's possible to make their predictability work for you. All you need to know is when the various meteor showers occur and what type of showers they are. Meteor showers are pretty well documented. In this column I list the current shower(s) for the month in the box on the first page. Additionally, many bulletin boards have software available that will help you predict when showers will occur.

An understanding of meteor shower types will unlock two more aspects of meteor shower propagation. How far can you work, and in what direction can you work?

First, let's look at how far you can work. Remember, meteor burn-up ionizes the *E*-layer. This means that you're limited to distances ranging between 700 and 1300 miles. Get a grid square map and draw a circle around your QTH that extends out to the 1000 mile mark. Add two more circles at the 700 and 1300 mile marks. These two additional circles represent the inner and outer limits for this mode. In other words, within these two circles lie most of the possible grid locators you can work via meteor scatter. You'll notice, however, that there aren't 100 grid locators within these two circles. More on that later.

How do you make meteor scatter work for you? Look at the *Lyrids*, which peaks around April 21–22 as an example. For this shower the average height of ionization is around 65 miles. This means that the probability of completing a meteor contact drops off significantly at distances over 1200 miles, and that contacts between 800 and 1000 miles enjoy a high probability of completion.

What about direction? The *Lyrids* is a good north-south shower. Therefore, plan to work stations to your north or south.

Now you know two facets of operation, so find stations located within your circle and within the directions encompassing a high probability of completion. Tim Marek, NC7K, has produced a booklet, "North American VHF/UHF Directory," which contains grid locators and

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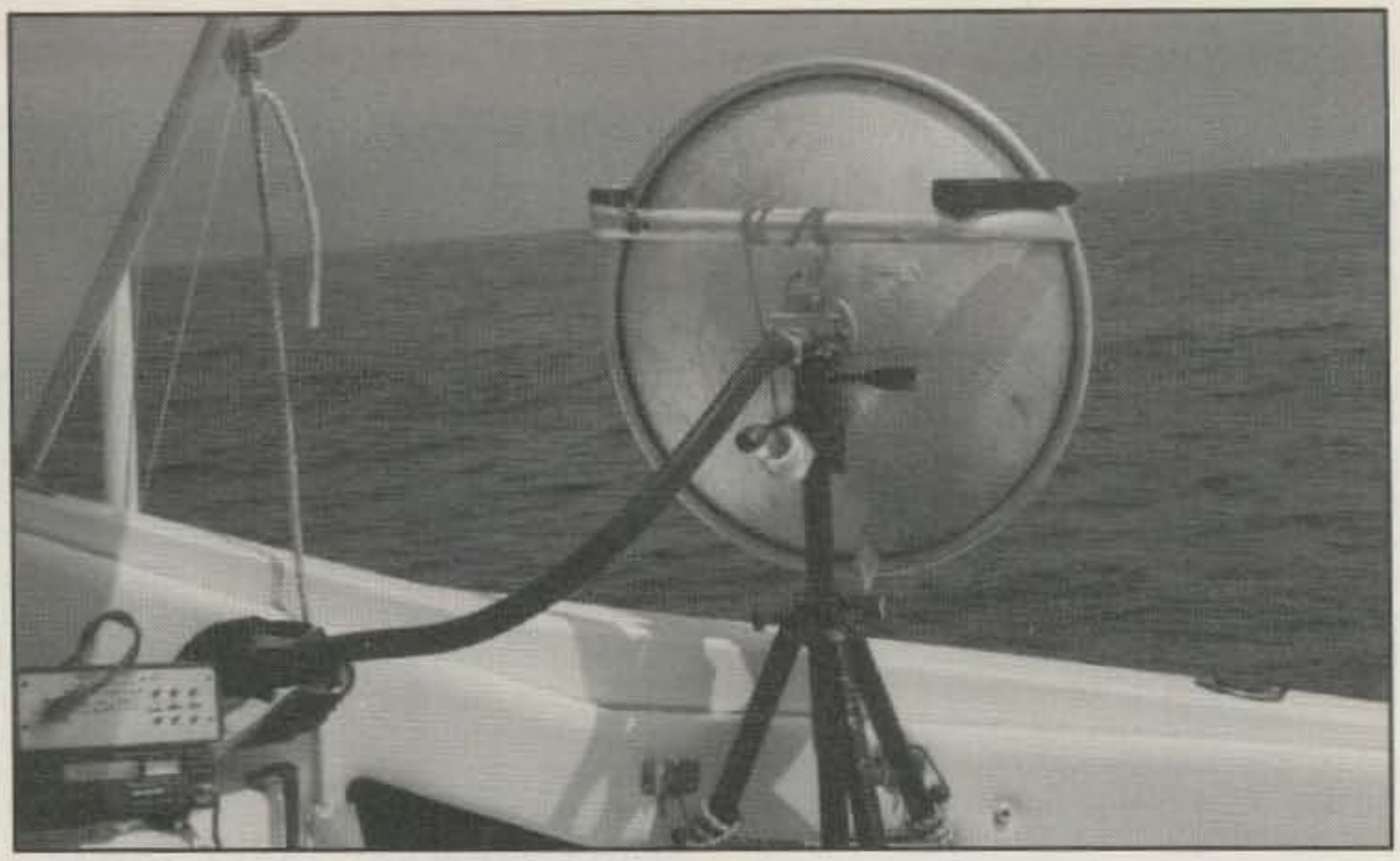


Gordon West, WB6NOA, used this 2 foot dish, hooked to the 100 mW transverter during the first weekend of the ARRL 10 GHz and above contest. (Photo courtesy WB6NOA.)

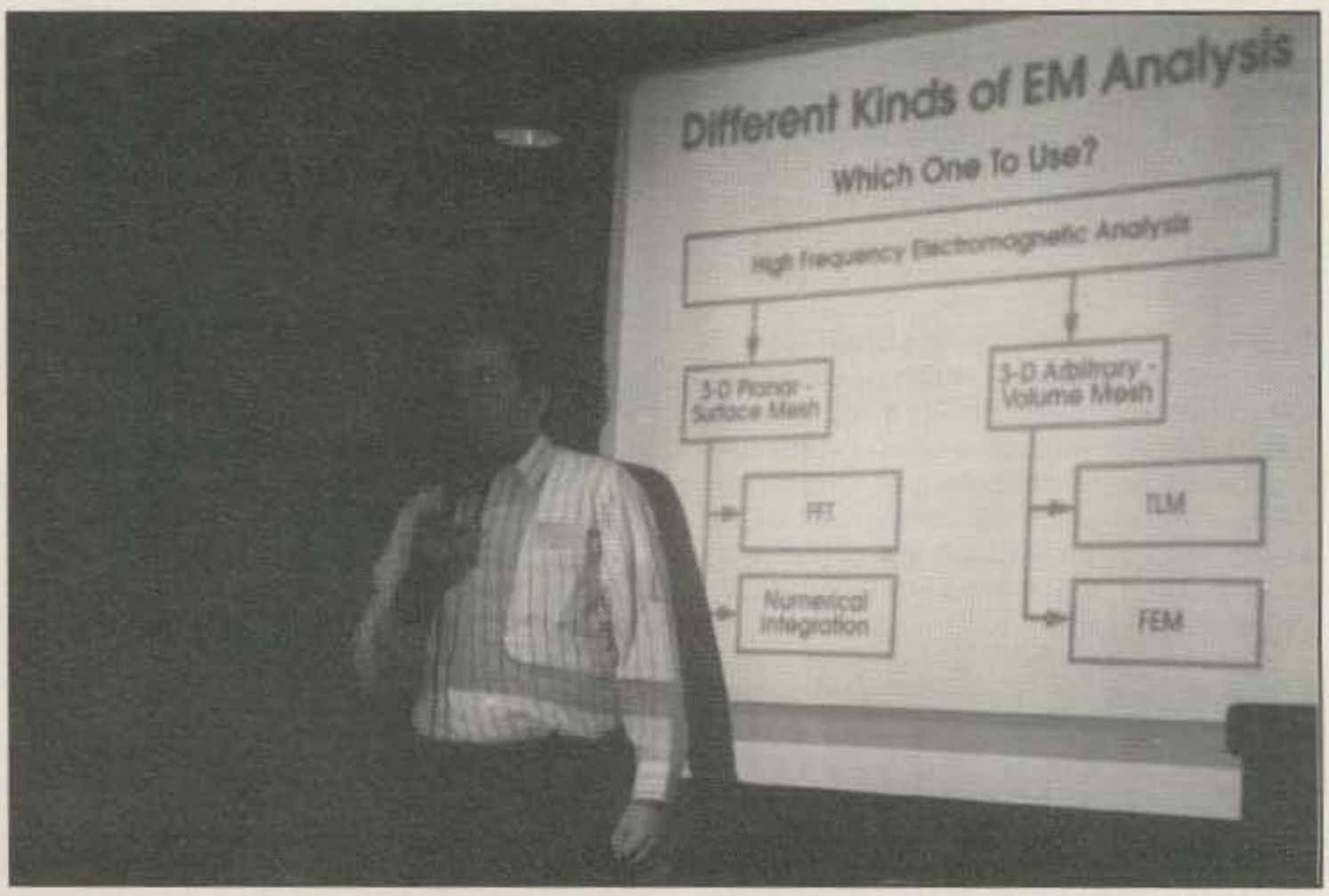
phone numbers (where available) of many of the active weak-signal VHF+ operators in North America. Contact Tim via his *Callbook* addresses for more information. Armed with this list, you can use it to call amateur radio operators and set up skeds.

How can you contact the remaining grid locators? The next most reliable mode of propagation is tropo. On any day you can make contact can of between 100 and 150 miles with a modest station containing a 150-watt brick and a 15- to 17-element long boom beam between 25 and 30 feet in the air. You can increase your distance out to about 350 miles or so by what some call "brute force." However, it's necessary that both your station and the distant station are optimized for low noise and efficient power transfer to the antenna. It also helps if the other station is running high power. This is important not only so you can locate the station, but also so you know the precise direction in which to aim your antenna and return a signal back to the station to complete the contact.

Additional tropo contacts can be made in excess of 350 miles when the conditions are "just right." These conditions exist when a weather front is strategically located and causes the air to stabilize for several hours to several days, "trapping" the signals in a tropo "zone" over l land or "duct" over water. Under the right conditions, distances nearing 1000 miles can be reached over land, and in excess of 2,500 miles over water.

With the exception of the over-water path, however, long-haul tropo only replicates the area already covered by meteor scatter. So the principal area of concentration to increase the number of grid locators worked remains the close-in grids "skipped over" by meteor scatter.

Neither of the other forms of propagation—



Jim Rautio, AJ3K, discusses computer-aided design of microwave circuits at the 20th Mid-Atlantic VHF Conference, in Horsham, Pennsylvania. (Conference photos courtesy CQ VHF magazine.)

sporadic-*E* and aurora—are predictable with any kind of degree of reliability. Sporadic-*E* openings on 2 meters are most likely to occur during the months of May through July, with June being the peak. Some rare openings also occur during December and January. The only way to determine when sporadic-*E* is occurring is to observe the lower bands, such as 6 meters, commercial FM radio, or low VHF TV frequencies. It's then a matter of tracking the MUF (maximum usable frequency) until it reaches 2 meters and hoping that someone is on the air in the direction of the opening. However, sporadic-*E*, like long-haul tropo, only replicates the area already covered by meteor scatter.

Aurora has its own limitations. It's a form of propagation that, when it occurs, tends to favor only the higher latitudes. On rare occasions it may track lower in the (northern) hemisphere. However, this may occur just once every couple of years. If you're trying to work your 100 grids within a limited time frame, especially if you live in the lower latitudes, don't even consider working via aurora. However, aurora can and should be considered as a way of filling in some of those blanks on the grid square map by those who live in the northern latitudes.

This discussion brings us back to the Moon. Although it takes more sophisticated equipment to get "on the Moon," the terrestrial distance is limited only to your common lunar window with the station you wish to work. Some who are close to their goal of working 100 grids have resorted to EME to get the last few. And, according to Ray Sofier, W2RS, there are plenty of high-power stations with good receivers who can complete a contact with your station.

How about VUCC on 135 cm? For the past several years this band has been neglected. Uncertainty has kept people off "in droves." Now that we know we have a protected segment, 135 cm should experience a resurgence in popularity.

The lower requirement of 50 grid locators for 135 cm reflects the lack of activity on the band, not the lack of propagation. Insofar as propagation is concerned, this band enjoys the best of both worlds—it shares propagation traits with its neighbors, 2 meters and 70 cm. Meteor scatter, albeit harder to work, does appear regularly on this band. EME exists, with slightly better conditions than 2 meters. Sporadic-*E* has been documented on very rare occasions. Tropo is considered by some to be better on this band, and aurora occasionally makes an appearance. The variety of propagation modes provides all the ingredients you need to work 50 grid locators.

Due to its higher popularity, 70 cm presents a unique opportunity to achieve VUCC. Because more stations are on the air, some operators find that the 50 grid square requirement is actually easier to attain than the 100 grid square requirement for 2 meters, despite the reduced propagation opportunities on this band.

Let's look at what's available. First, meteor scatter does exist, although it takes considerably more patience to complete a contact. Unfortunately, many of the so-called "lesser showers" just don't produce the propagation on this band that they do on 2 meters. Also, due to the dynamics of meteor scatter propagation, contacts in excess of 1000 miles are very rare!

On 70 cm tropo is the most popular way to fill in the blanks on the grid square map. As for 2 meters, tropo conditions exist regularly out to 150 miles. Brute force tropo can extend that to 350 to 400 miles. And when the band opens, tropo conditions can extend to more than double that range. Because of the nature of enhancement, tropo conditions often appear on 70 cm ahead of the lower bands.

EME can also be used to work additional grid locators. However it's unnecessary to use this mode, because at least 50 grid locators fall within tropo limits.

As we go higher in the spectrum, it becomes more difficult to complete VUCC for the respective bands. The requirements for 33 and 23 cm are the same—25 grid locators.

Tropo is the chief form of propagation on both of these bands. There are more than enough grid locators within the tropo limitations. However, due to the lack of population on the 33 cm band, the ability to garner the necessary grid locators is much more difficult. It becomes necessary to work a station on another band and bring it with you to 33 cm. This is sometimes achieved by working the station first on 23 cm!

Getting VUCC on all of the other higher bands involves getting help from your friends. Tropo is the chief form of propagation on these bands, and enough grids lie within average tropo limits for you to reach your goal. Unfortunately, not enough amateurs operate regularly from these grids on the required bands. Consequently, the only way to complete the requirements is to get others to activate the grids that you need.

The Worked All States Award. The Worked All States Award has been issued to operators on 6 and 2 meters, and 135 and 70 cm. On 6 meters, depending on where you're located in the country and where we are in the solar cycle, it may take you between one summer and ten years to garner all the states. The most difficult to snag are Alaska and Hawaii. Those who live in the southeast will most likely have to wait until an *F2* propagation mode peak to work Alaska. However, it is possible to work Alaska and Hawaii on multi-hop sporadic-*E*. Nevertheless, these events are rare and you must watch for them.

On 2 meters you must rely on the Moon. Only if you live within a circle that includes the eastern halves of Nebraska, Kansas, and Oklahoma and the western halves of Missouri and

Jim Eagleson, WB6JNN/9, introduces satellite operation to the weak-signal enthusiasts at the Mid-Atlantic VHF Conference. That's Sputnik on the screen behind Jim.

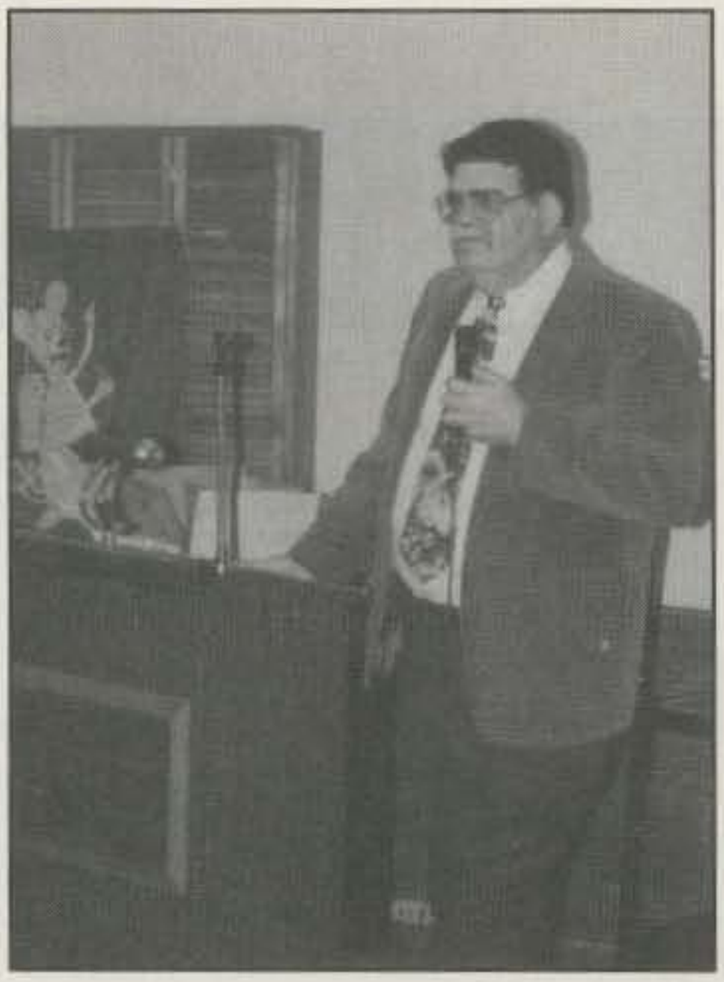
Arkansas can you work all of the "lower 48." Even so, you still have to rely on EME for your Hawaiian and Alaskan contacts.

For the other two bands for which WAS awards are available, all of the recipients had to work several states via the Moon.

DXCC Achievement. DXCC is not an award for the casual operator, even though this sunspot cycle has seen a number of DXCC awards issued for 6 meters. If you are very fortunate, you can work 50 countries via sporadic-*E*. The rest must be via some extended form of propagation, such as TE or F2. A QTH in the right part of the country is a must, once again. Fortunately there's a DXCC rule that states you can count contacts made from anywhere in your home country; so if you like to travel, you can work all you can from the southwest, move to Maine and work all the Europeans you can, then move to the west coast and work all the Asians you can. Theoretically, it's possible to achieve DXCC on the move! Here again, though, you must have quite a bit of luck. Nevertheless if this is your plan, it will still probably take you at least ten years to reach your goal.

Two meters is the only other band on which anyone has accomplished DXCC. Only a handfull of operators have achieved this milestone—and then only after investing thousands of dollars in their station and many years on the air.

Good Luck! So there you have it, some ideas on how to achieve your goals this coming year. Later on this year, let me know what goals you've achieved.



Gene Zimmerman, W3ZZ, VHF columnist for CQ Contest *magazine, was the banquet speaker at the Mid-Atlantic VHF Conference. His topic was "40 Years of Contesting."*

10 GHz From West Coast To East Coast

Gordon West, WB6NOA, took 10 GHz SSB contesting coast to coast during the recent two-part ARRL 10 GHz weekend events in August and September,

West operated during the August Part 1 weekend maritime mobile off of southern California. Despite being at absolute water level, West worked 10 GHz SSB easily over 400 miles south to Jack Henry, XE2/N6XQ. Jack was located deep down the Mexican coastline at the Vizcaino Peninsula.

Jack comments, "Hot weather, an infestation of scorpions, lousy band conditions, and a catalytic converter clogged up in the boondocks made my 10 GHz Mexico expedition a challenge. But I made 26 QSOs, and 11 of them were with Gordo, WB6NOA/MM, as he motored around California at 10 mile intervals."

Jack's best 10 GHz DX was 504 miles to WA6CGR/W6YLZ, located in the Santa Monica Mountains, slightly north of where Gordon was out on the water.

The maritime mobile operation by WB6NOA was welcomed by southern California 10 GHz operators who could count on several multiple contacts with one operator where each contact point was separated by more than 10 miles.

West comments, "Good weather, sunny skies, and a great bunch of 10 GHz operators would regularly beam their signals out to sea to pick up some additional multipliers."

For Part 2 of the ARRL 10 GHz contest, Gordon West took his 10 GHz equipment to the East Coast, making a pre-contest 5×9 contact with well-known VHF/UHF/microwave DXer Dick Knadle, K2RIW, on Long Island.

"The contact from my downtown New York City hotel to Dick out on Long Island was a fun one. Dick's efforts on making 10 GHz a popular mode along the East Coast can be appreciated by the enthusiasm he puts into completing the circuit," comments West. "When we first hooked up on 10 GHz, I had an RX/TX microwave relay go bad, and Dick was able to talk through the problem and come up with suggestions on solving the sticky relay. We ultimately chatted for almost an hour on 10 GHz while bouncing signals off of the New York City skyscrapers," adds West.

That weekend West operated from the Virginia Beach Hamfest hotel and attempted to communicate between Virginia Beach and Dick on Long Island, over a path of about 300 miles. West found that the double-paned windows in the hotel were attenuating signals dramatically, so he took to the roof with help from Chip Margelli, K7JA, Sid Wolin, K2LJH, and Jay Rosenzweig, N2FP.

"We had an approaching low-pressure system wipe out good microwave tropo conditions, so we didn't make it up to K2RIW on Long Island," comments Chip, who has accompanied West on several 10 GHz maritime mobile adventures.

Later on that evening West switched from 10 GHz SSB over to 10 GHz wideband FM and managed to snag an Advanced Receiver Research 10 GHz operator in Norfolk for at least one contact for the second part of the contest.

"Bruce Wood, N2LIV, and Doug McGarrett, WA2SAY, along with Dick, K2RIW, are all active with 10 GHz information nets held on the 2 meter band on Long Island, and I hope we will see as much enthusiasm for the 10 GHz band on the East Coast as we do presently here on the West Coast," comments West.

The 10 GHz amateur radio microwave band is 500 MHz wide, and is presently an underutilized band that offers some extraordinary long-range tropo excitement during the summer and fall months. Ten GHz equipment in the form of transverters as well as completely assembled systems are available from amateur microwave manufacturers. Ten GHz horns and dishes are easily obtained from microwave equipment suppliers with little retuning necessary.

It is estimated that there are only two hundred 10 GHz operators actively exploring the microwaves. West went on to Chicago to operate 10 GHz, but only managed one contact over 60 miles away, although signal strengths were so strong that he estimated this contact could have gone over a several hundred mile path.

"Ten GHz is not limited to just voice, either. There are 10 GHz crcssband repeaters, 10 GHz amateur television, 10 GHz packet backbone systems, and a handful of us on 10 GHz SSB, with an equal amount still using 10 GHz wideband FM gear, too," comments West. "And it's good exercise—taking your equipment up a flight of stairs to a building top, hiking to the top of a mountain, or hanging on in rough seas, 10 GHz is a kick," finalizes West.

Borrowing a metaphor from the southern California surfers, I speculate that the next time the surf's up, Gordon will be out hanging ten—10 GHz that is!

Current Contests

ARRL VHF Sweepstakes. This annual winter classic takes place between 18–20 January, beginning 1800 UTC 20 January and ending 0300 UTC 22 January. Exchange is your grid square. This is the only VHF contest that features club competition.

The complete rules appeared in December 1996 *QST*. Rules plus log/summary sheets are also available electronically from the League from several different sources, including their bulletin board (860-594-0306), and their home page (http://www.arrl.org) via the World Wide Web. As always, send or electronically file your log and summary sheets to the League.

Current Meteor Showers

The Quads. The *Quandrantids*, or *Quads*, is a brief, but very active meteor shower. Expected peak is around 1800 UTC on 3 January. The actual peak can occur ±3½ hours of the predicted peak. The best paths are north-south.

Long-duration meteors can be expected about 1½ hours after the predicted peak. As always, look to 3818 or 3843 kHz in the evening hours for opportunities for schedules.

New 6 meter Grenada Beacon

John Walker, WZ8D, reports that he, Joe, WB8GEX, and Byron, WA8NJR, installed the J3EOC beacon on 50.0565 MHz. He stated that he had already received reports from stations in ZP, LU, and PY, stating that they are hearing the beacon on TE each night between 2230 and 0130 UTC. They also reported hearing the V33K beacon on 50.055 MHz. The folowing is a list of stations he worked from October 23 through October 29 while in Grenada. Contacts were all on TE. Time each evening was from 2300 through 0100 UTC: ZP5FGS, ZP5BT, ZP5ZR, ZP5PT, ZP5HSB, ZP6VT, LU8EWD, LP5WT, LU8DIO, LU8DNY, LU1DMA, LW5EJU, LU9AEA, LU7FA, LU5JAU, LU9EHT, and PY2DSC. John asks that if you hear his beacon, drop him a note at his home QTH.

Tiago Frederico, CT1WW Silent Key

The VHF community, and all of amateur radio, lost a great VHF operator in October. Tiago Frederico, CT1WW, became a Silent Key on October 31. Shep, W7HAH, writes: "He was a leading figure for VHF/UHF DX in Europe, working on many of the VHF/UHF bands, giving many of us the country of Portugal here in the U.S. as well as other parts of our planet. Tiago was in his fifties and his sudden death was a shock to all who knew him. I myself talked Tiago to come to the U.S. to Central States get together several years ago."

Mid-Atlantic VHF Conference

The Mt. Airy VHF Radio Club, better known as the Pack Rats, sponsored the 20th annual Mid-Atlantic VHF Conference last October 5 in Horsham, Pennsylvania. About 65 people attended the event, which combined technical presentations on microwave circuits with introductions to satellites, 10 GHz operating, and weak-signal VHF work in general. It was also the scene of the tragic hit-and-run death outside the conference hotel of Thom Gooding, K4LHB, of Sterling, Virginia (FM18). The driver was later apprehended.

And Finally

West Coast VHFer Publishes Issue No. 200. In the five plus years that I have been doing this column, I have seen several VHF-oriented newsletters come and go (mostly go). I have also seen some change editors more than once. However, one newsletter seems to have real staying power. Bob, WA6IJZ, published his 200th issue of the "West Coast VHFer" in December. Unlike us computer techies, Bob still pounds it out on the old typewriter, and he does so after having suffered more than one stroke, which explains some of his unusual typos. Congratulations, Bob. We in the VHF+ community look forward to another 200 issues of your very fine newsletter.

Please let me hear from you concerning your milestones and achievements in this year to come. My best wishes to all for a wonderful and prosperous new year.

Until next month . . .

73, Joe, N6CL

BY BILL WELSH, W6DDB

BILL'S BASICS

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Reciprocal Licensing For U.S. Amateurs Operating in Europe

Dan McLean, GM3SUZ/AC5CA, provided the information in this article for the benefit of American amateurs who may want to operate as reciprocal licensees in Europe.

The EEC is now known as the European Union (EU). The existing CEPT licensing agreement enables any amateur from any EU country to temporarily operate an amateur radio station in any other EU country. Basically, you just need a copy of your amateur radio license plus a translation of it into the language of the country from which you intend to operate. This simple system does not apply to amateurs of non-EU countries, including Americans.

France requires three months notice prior to the intended operation. Germany requires six weeks prior notification, and their reciprocal license is only valid for three months.

The United Kingdom requires a two week notification prior to the intended reciprocal operation. Their reciprocal license is valid for one year and is renewable. In the U.K. the Radiocommunications Agency (RA) is similar in function to our Federal Communications Commission (FCC). The RA only recognizes the American Conditional, General, and Advanced classes of licenses; they do not recognize our Novice, Technician, or Extra class licenses. The RA considers these latter three license classes to be invalid, but they do allow our Extra class licensees to obtain a Class B reciprocal license, which is also issued to Conditional licensees for VHF operation. On the other hand, the RA issues Class A reciprocal licenses to American General and Advanced class licensees, providing full operating privileges on all bands. The RA has been discussing this anomaly with our FCC and ARRL, but it has yet to be resolved. American amateurs are advised to obtain a U.K. reciprocal license and to have translations made of it in the languages of every European country from which they intend to operate.

The MFJ-1729 Dual-Band, Magnet-Mount Mobile Antenna

This antenna provides 2.6 dB gain on 2 meters and 6.3 dB on 440 MHz. The radiator is 29.75 inches long and is designed to minimize vibration and associated standing-wave-ratio flutter. The black stainless-steel whip screws onto a stylish black base which features an outer pad to prevent scratching of the vehicle. This antenna can be used with output power up to 200 watts. It is supplied with 12 feet of coaxial cable terminated by a PL-259 connector. In addition, an adapter is provided which enables the user to match to a handheld's BNC connector. The listed price is $29.95 plus s&h fees. The address is MFJ Enterprises, Inc., PO Box 494, Mississippi State, MS 39762. A few weeks of use have convinced me to leave the MFJ-1729 on my car; it's a very good antenna.

45527 Third Street East, Lancaster, CA 93535-1802

National Widows Assistance Program

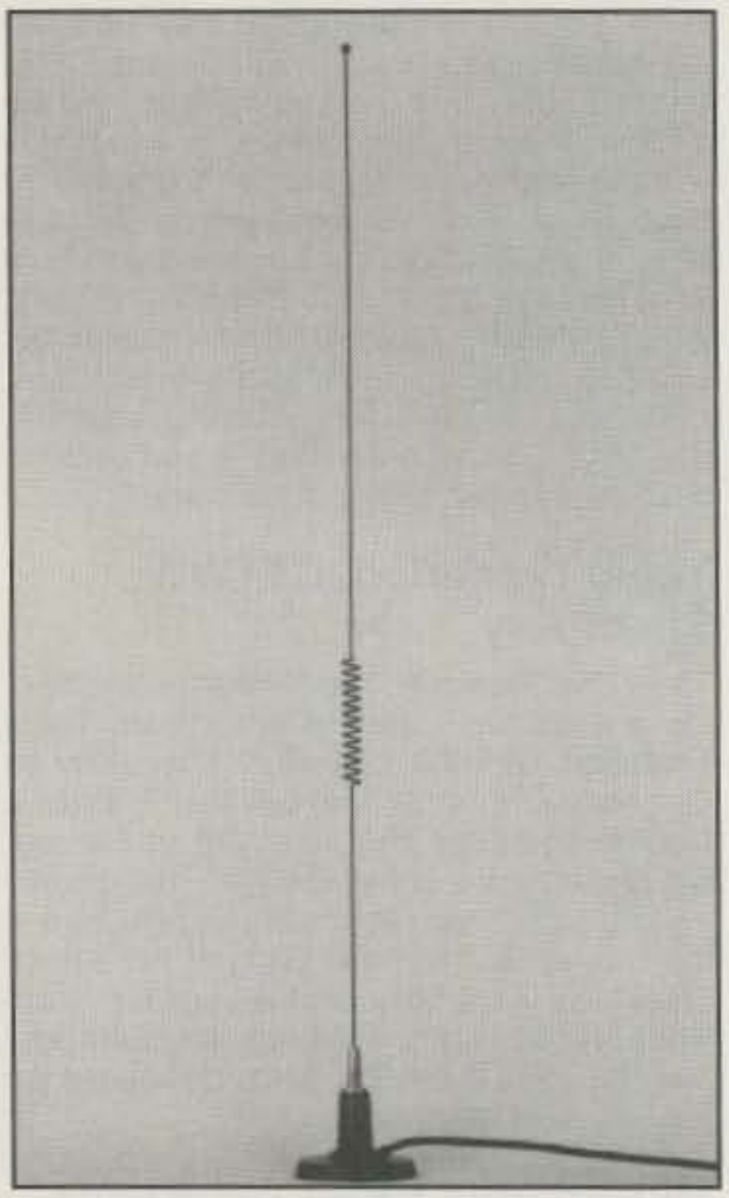
Tony Musero, K3UKW, has formalized a service which some of us have performed sporadically for many years. When an amateur dies, his/her family usually needs help selling the equipment and accessories. Tony will sell these items, list them for consignment, or buy them. He requires a detailed list of the items to be sold, a self-addressed stamped envelope, and the telephone number of a suitable contact person. Tony has provided this service since 1969. Contact him if you want to obtain financial details: The Key Source, P.O. Box 166, Mt. Ephraim, NJ 08059 (215-271-8898).

When you know that an amateur has died, it would be appreciated if you would help the deceased amateur's family disassemble and sell the station. If you cannot do the whole job, perhaps you could at least make a complete list of everything the family wants to sell and advise the family to contact Tony.

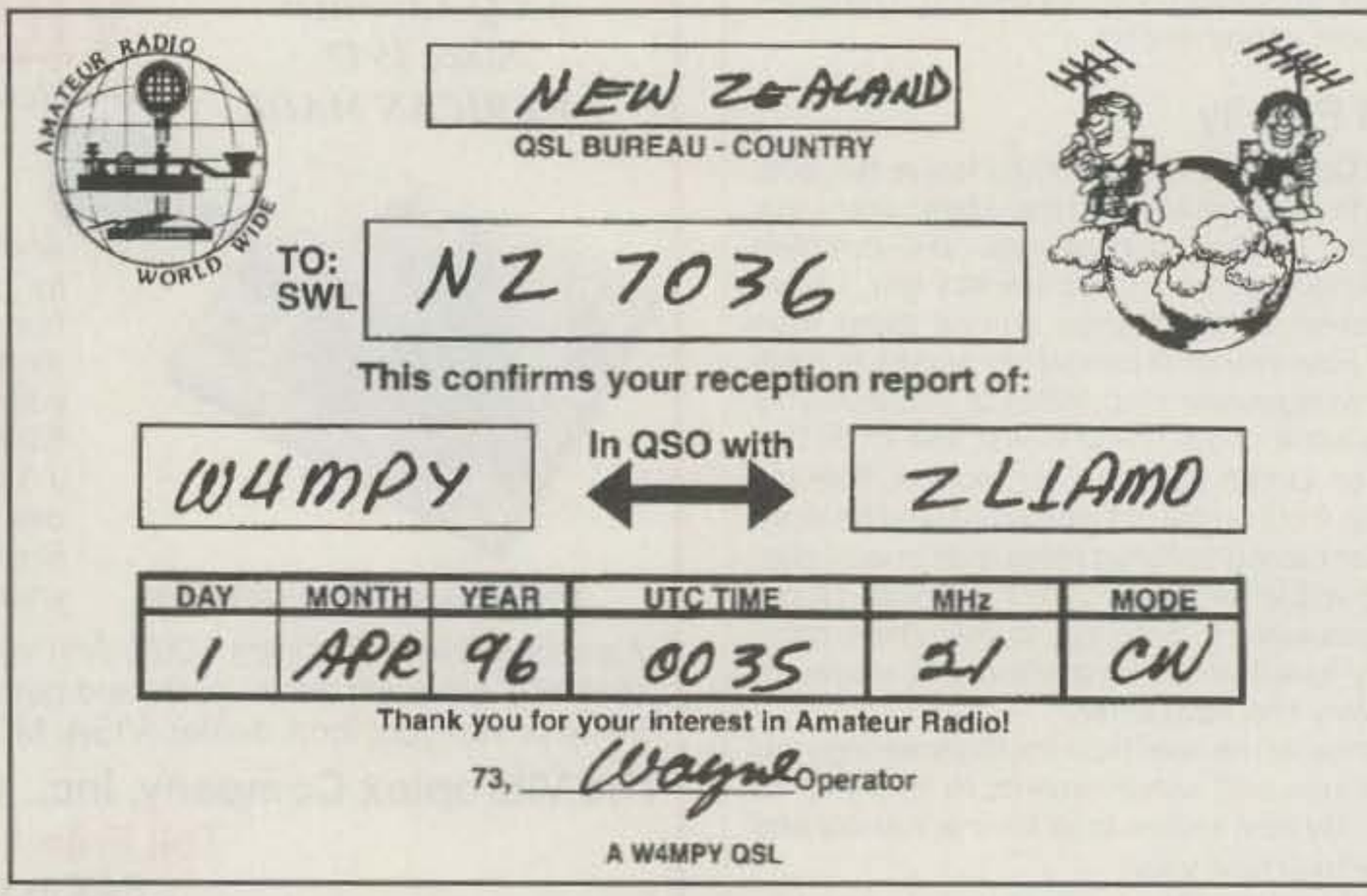
It is advisable to make a detailed list of the accessories and equipment in your own station and to update it yearly. Show the minimum anticipated selling price of each item. I have helped many families disassemble and sell stations of deceased amateurs. Usually surviving family members think station items are worth much more than the true values. If realistic prices are listed, item disposal is much simpler.

Help Wanted

Brother Leo B. Bobila, c.s. would very much like to become an amateur radio operator. He is very interested, but his financial situation is desperately low. If you think you might want to help him get started as an amateur, please write to him at the Scalabrini Theological House of Studies, 4 Thirteenth Street, New Manila 1112, Quezon City, Metro Manila, Philippines. Leo is



The MFJ-1729 dual-band, magnet-mount mobile antenna.



In addition to his line of amateur radio QSLs, W4MPY now has available a card for SWLs.

a seminarian who would greatly appreciate having an opportunity to make the Philippines more readily available to other amateurs. He would like to receive amateur radio magazines, equipment schematics, electronic parts, licensing data, and whatever else anyone may be willing to send to him. He is willing to build equipment. He is in a situation wherein he cannot spend the amount of money commonly associated with getting started on the amateur bands. Leo should prove to be an asset to amateur radio. Please let me know if you help him.

WJ2O Software

Previous "Bill's Basics" columns have provided information about software that is available from many sources. Much of that software is designed for use by amateurs who are not extremely active on the air, and a lot of it seems to be aimed solely at DX operation. If you have a wide variety of logging interests and/or you expect to make more than 50,000 contacts, you should evaluate WJ2O software. You can request a free copy of the "WJ2O Master QSO Logging Program" data sheet from Dave Farnsworth, WJ2O, P.O. Box 16, McConnellsville, NY 13401.

Shortwave Listener QSL Card

Wayne Carroll, W4MPY, prints a great assortment of QSL cards for amateurs. He has added a card which is designed to answer QSL card requests received from shortwave listeners. It clearly identifies the SWL and both of the amateurs involved in the contact. It also details the contact date, time, frequency, and mode. The price is $10 for an order of 100 cards shipped via first-class mail. There is no choice of ink color or paper stock. Wayne ships whatever he has printed. The ARRL Outgoing QSL Bureau Manager assured Wayne that these SWL cards are acceptable. Wayne encloses about ten of these SWL cards with each QSL order shipment. This is a *lagniappe*, which the dictionary defines as a small present given to the purchaser of an article by a merchant or storekeeper—a gratuity. His address is 682 Mt. Pleasant Road, Monetta, SC 29105.

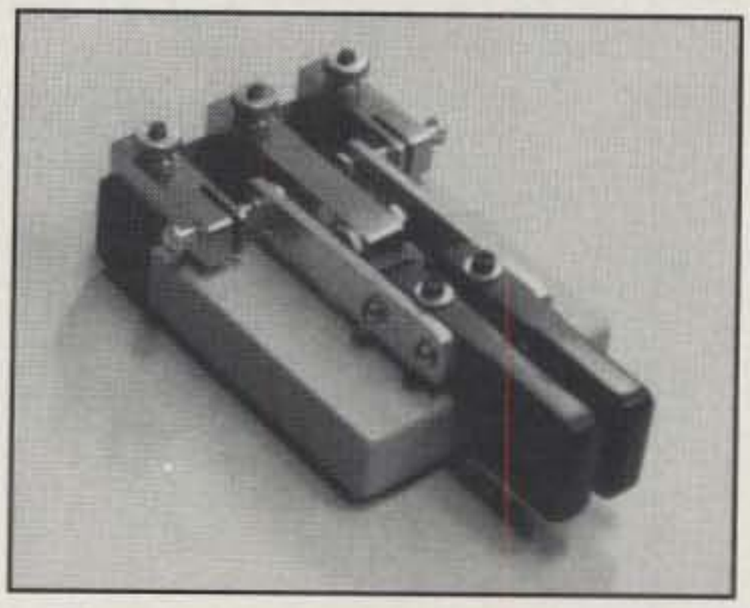
Iambic Paddle

Envirotronic, Inc. sells their Model 501E Iambic Paddle at $54.45, including s&h. Their address is 525 Silver Lake Road, St. Paul, MN 55112 (612-633-8551). Eugene Thoma, NØLSS, runs this company. The paddle is 2.5"W × 1.345"H × 4.75"L.

Communications Headset

Warren Gregoire and Associates has manufactured headsets used in aircraft since 1986. Several thousand of these popular headsets are in use worldwide. Warren, AB6XM, has now developed a boom-microphone headset that is specifically designed to meet our amateur radio communications needs; it is the TR-2000. The assembled headset costs $70.70, and the headset kit is priced at $50.70. Both prices include the shipping and handling.

The earphones are moving coil dynamic earspeakers which produce a 109 dB output at 1 milliwatt. The nominal input impedance is 4 ohms, but these earphones can be used within a range of about 1 to 40 ohms. The maximum input power to these earphones is 500 milliwatts. My comparisons to two more expensive headsets disclosed that the performance of the TR-2000 is at least as good as the performance of the higher priced headsets.



The iambic paddle from Envirotronic, Inc.

Large, comfortable earmuffs combine with the noise-cancelling microphone to provide excellent performance even in high noise environments. A pair of replacement earmuffs costs $5, plus s&h. The soft, padded headband is adjustable. However, it is seldom necessary to adjust this caliper pressure.

The noise-cancelling electret microphone is designed with a rising characteristic above 2500 Hz to help operators be heard better during high interference conditions. This microphone requires 1.5 to 10.0 VDC, with the 1.5 VDC level preferred. The spring-loaded flexible boom "remembers" the user's position setting.

This overall headset provides optimum performance in the 300 to 3000 Hz desired frequency range with a roll-off below 500 Hz. It weighs 12 ounces. This headset is supplied with 5 foot long individually shielded microphone and earphone cables. Due to the variety of equipment connectors that exist, these cables do not have connectors with them. This headset is compatible with most amateur radio gear, whether it is new or old. The TR-2000 is

Warren Gregoire and Associates, manufacturers of headsets used in aircraft, now has available a boom-microphone headset for amateur radio operators.

sold with a 30-day money-back guarantee. Prior to returning a headset, the purchaser is required to call the company at 1-800-634-0094.

The kit appears to be easy to assemble. Seven tools and one adhesive are needed to build this 16-part kit. There are 47 easily understood construction steps. If assistance is needed, it can be obtained by calling 510-673-9393.

Simply stated, the TR-2000 is an excellent headset being sold at a low price. I always use headsets while operating. Warren Gregoire and Associates is located at 229 El Pueblo Place, Clayton, CA 94517 (phone 510-420-5701; fax 510-673-0538; toll-free orders 1-800-634-0094).

Mobiling At Reduced Cost

If you would like information about a device which may increase your gas mileage, you are welcome to send a self-addressed stamped envelope with your request to me using the address shown on the first page of this column. Government test results show gas mileage increases ranging up to 48.3 percent on 15 identical 5-liter vehicles. The average reported improvement was 28.3 percent. This data was supplied by Joel Robinson, Gasaver inventor.

MFJ-781 Digital Signal Processor Filter

This unit provides extremely effective filtering to any terminal node controller or multimode data controller. Input and output level controls, plus an accurate and easily used input level indictor, enable the user to make optimum use of this unit with minimum confusion. This filter enables you to easily copy AMTOR, Clover, facsimile, GTOR, Morse Code, PACTOR, packet, radioteletype, Slow-Scan TV, and WeFAX signals which could otherwise be buried beneath interference. Any of 64 data filters with 16 mark/space pairs, 4 shifts, and 4 baud rates are available. There are 32 code filters and 8 code tones available between 300 and 1000 Hz. When using Morse Code, the selectable "no-ring" bandwidths are 50, 100, 200, and 500 Hz. Customized filters are optimized to provide optimum performance when operating Clover, SSTV, VHF packet, or WEFAX. Automatic gain control helps maintain the audio level constant despite any signal fading condition. Automatic self-test is built-in for all controls and the digital circuitry. True bypassing can be selected by using the ON/ OFF/BYPASS switch.

The front panel includes a pair of in-or-out pushbutton switches. One is the center frequency switch, which enables selection of either of two center frequencies. The other one is the power On-Off/Bypass switch. An LED lights when input power is turned on. An input power level light glows red if the level is too high or too low, whereas it glows green when the input is correct. The input level adjustment is on the rear panel. The filter select rotary switch enables the user to choose any one of ten filter modes. These positions are marked CW (1 through 4), RTTY, AMTOR, PACTOR, HF Packet, VHF Packet/Clover, and SSTV/WeFAX.

It is easy to master correct operation of this filter. There is plenty of interference on the air, which made it easy to conduct a series of informative, successful tests. Those tests showed how well this unit functions.

The MFJ-781 is 4.5" × 2.5" × 5". The input power requirement is 10 to 16 volts DC. An optional MFJ-1312B can be used to power the unit from 115 volts AC. The MFJ-781 is priced at $129.95, whereas the MFJ-1312B is $12.95 (shipping and handling additional). Contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762.

Photographs Wanted

Photographs of new amateurs in their shacks provide introductions to a few of the newer licensees. Photograph size is unimportant, but good definition, contrast, andsubject matter are important. Color or black-and-white photographs can be used. 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.

The MFJ-781 digital signal processor filter.

Printed Aids

My previous 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) SASE to my California address. Licensing-course instructors are welcome to revise and/or duplicate these items to suit their requirements.

73, Bill, W6DDB

Alex Zagajewski, N2UAO (left), and Kyrilian Dyer, N2TZT, are charter members of the Taconic Hills High School Amateur Radio Club (KB2YLU). Their faculty advisor is Wayne Gearing, N2ROR, who lives in East Chatham, New York. Both of these young men have graduated from THHS. Alex is a freshman at Pace University in New York, and Kyrilian is a freshman at the Massachusetts Institute of Technology in Cambridge, Massachusetts. Both are active members of the Rip Van Winkle Amateur Radio Society. Kyrilian holds a private pilot's license and often operates aeronautical mobile in the Columbia County area.

Scanners/CB/Weather Stations

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Weather Stations

The Weather Monitor II (7440) comes complete with anemometer with 40 feet (12.2 m) of cable, external temperature sensor with 25 feet (7.6 m) of cable, junction box with 8 feet (2.4 m) of cable, AC-power adapter, detailed instruction booklet and one year limited factory warranty.

Now you can be your own weather reporter with the Davis Weather Monitor II. Our top-of-the-line weather station combines the most advanced weather monitoring technologies available into one incredible package. Glance at the display, and see wind direction and wind speed on the compass rose. Check the barometric trend arrow to see if the pressure is rising or falling. Push a button, and read indoor and outdoor temperature, wind chill, humidity and barometric pressure. Using the Weatherlink with Weather Talker option and your computer, you can issue your own spoken weather reports. Call 313-994-9000 for a demonstration. Our system can even call you. Our package deal includes the new ultra high resolution 1/100 inch or 0.2 mm rain collector part #7852, and the external temperature/humidity sensor, part #7859. The package deal is order #DAV1-Z for $479.95 plus $16.00 shipping. If you have a personal computer, when you order the optional Weatherlink computer software for $134.95, you'll have a powerful computerized weather station at an incredible price. For the IBM PC or equivalent order part #7862-Z. Apple Mac Plus or higher including PowerBook, order part number 7866-Z.

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Davis Weatherlink Software for IBM PC-Version 3.0 7862-Z ... $134.95
Davis Weatherlink Software for Apple-Version 3.0 7866-Z ... $134.95
Davis 4-Conductor 40' (12.2 m) extension cable 7876-Z ... $17.95
Davis 6-Conductor 40' (12.2 m) extension cable 7878-Z ... $21.95
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2400 baud modem for Weatherlink MEXT-Z ... $29.95
NEW! Davis aluminum Sensor Mounting Arm - 7702-Z ... $54.95
Davis Anemometer Mast Mount 7890-Z ... $15.95
Weatherlink language disks: Française, Deutsche, Italiana, Española 7863-Z $24.95
Barometer, Indoor Hygrometer & Thermometer, Clock/Calendar BA888-Z . $89.95
Indoor-Outdoor Thermometer/Barometer & Hygrometer by OSI BA213-Z ... $79.95
Thermometer with transparent calender & clock display by OSI TC188-Z ... $19.95
Thermometer with AM/FM clock radio by Oregon Scientific CR388-Z ... $39.95
Indoor/Outdoor Thermometer with Jumbo Display by OSI JB880EX-Z ... $24.95

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Mfg. suggested list price $769.95/**Special $357.95**
500 Channels · 20 banks · Alpha numeric display
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The Bearcat 9000XLT is superb for intercepting communications transmissions with features like TurboSearch™to search VHF channels at 300 steps per second. This base and mobile scanner is also ideal for intelligence professionals because it has a selectable attenuator to help eliminate annoying intermodulation from adjacent frequencies in highly populated areas and selectable AM, Wide FM and Narrow FM modes that allow you to change the default receiving mode of the BC9000XLT. Other features include ***Auto Store*** – Automatically stores all active frequencies within the specified bank(s). ***Auto Recording*** – This feature lets you record channel activity from the scanner onto a tape recorder. **Hi-Cut filter** to help eliminate unwanted static noise. You can even get an optional ***CTCSS Tone Board*** (Continuous Tone Control Squelch System) which allows the squelch to be broken during scanning only when a correct CTCSS tone is received. For maximum scanning enjoyment, order the following optional accessories: **PS001** Cigarette lighter power cord for temporary operation from your vehicle's cigarette lighter $14.95; **PS002** DC power cord - enables permanent operation from your vehicle's fuse box $14.95; **MB001** Mobile mounting bracket $14.95; **BC005** CTCSS Tone Board $54.95; **EX711** External speaker with mounting bracket & 10 feet of cable with plug attached $19.95. The BC9000XLT comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden warranty.

VHF Transceiver

RELM® WHS150-Z Transceiver/SPECIAL

Mfg. suggested list price $481.67/**Special $289.95**

Law enforcement and fire departments depend on the RELM WHS150 transceiver for direct two-way communications with their police or fire department, civil defense agency or ham radio repeater. The WHS150 is our most popular programmable frequency agile five watt, 16 channel handheld transceiver that has built-in CTCSS, which may be programmed for any 39 standard EIA tones. Frequency range 148.000 to 174.000 MHz. Will also work 144.000-148.000 with slightly reduced performance. The full function, DTMF compatible keypad also allows for DTMF Encode/Decode and programmable ANI. Weighing only 15.5 oz., it features dealer programmable synthesized frequencies either simplex or half duplex in both 5.0 and 6.25 KHz. increments. Other features include scan list, priority channel, selectable scan delay, selectable 5 watt/1 watt power levels, liquid crystal display, time-out timer and much more. When you order the WHS150 from CEI, you'll get a complete package deal including antenna, battery, belt clip and user operating instructions. Other accessories are available. A leather carrying case with swivel belt loop part #LCWHS is $49.95; rapid charge battery charger, part #BCWHS is $69.95; speaker/microphone, part #SMWHS is $54.95; extra ni-cad battery pack, part #BP007 is $59.95. The radio technician maintaining your radio system must order programming instructions part #PI150 for $18.00 to activate this radio. FCC license required for United States operation.

CB/Ham Radios

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Cobra HH40-Z CB 40 channel handheld transceiver .. $79.95
Maxon GMRS210+3-Z GMRS transceiver/SPECIAL $166.95
Ranger RCI2950-Z 25 watt 10 meter transceiver ... $219.95
Uniden GRANTXL-Z SSB CB Mobile ... $139.95
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Monitor police, fire, weather, marine, medical, aircraft and other transmissions with your Bearcat scanner.

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Digital voice logger

Now, anyone can record and archive their telephone calls and scanner radio traffic with our affordable Eventide brand digital communications loggers. Model VR204DAT4 give you powerful performance with a single DDS-2 DAT drive that records more than 500 channel hours of storage on four channels. For monitoring trunking systems, the Eventide VR240 Mark III digital logger gives you over two months of unattended recordings on up to 24 channels when ordered with *dual* 8 mm. high density CT tape drives. All systems include 60 channel hours (250 & 500 hours optional) of instant recall. Ideal for quickly replaying fast breaking radio action. FCC approved telephone interface is built-in and beeps are selectable on a channel-by-channel basis. Other options include GPS time sync. Order your tape logger from CEI today.

VR204DAT4 4 channel, single DAT drive, 500+ channel hours ... $7,395.95
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BY JOHN DORR, K1AR

CONTEST CALENDAR

NEWS/VIEWS OF ON-THE-AIR COMPETITION

Those Good Old Days of Contesting

January's Contest Tip Of the Month

Depressed that all you hear is noise on 9M2AX's 80 meter frequency because you don't have the 500 square miles needed for proper beverages? Don't give up hope. Many times I've found that using an antenna tuned for another band can improve your receiver's signal-to-noise ratio so that you can actually copy guys not otherwise possible. Try using your 40 meter antenna as a listening tool on 80. Different combinations may work for other bands, too!

Calendar of Events

Dec.	28-29	Stew Perry Topband Challenge
Dec.	29	RAC Canada Winter Contest
Jan.	1	ARRL Straight Key Night
Jan.	3-5	Michigan QSO Party
Jan.	4-5	ARRL RTTY Roundup
Jan.	10-12	Japan Int'l Low Band CW Contest
Jan.	11-12	North American CW QSO Party
Jan.	11-12	Lions in the Air Contest
Jan.	17-19	YL-ISSB CW QSO Party
Jan.	18-19	North American SSB QSO Party
Jan.	18-20	ARRL VHF Sweepstakes
Jan.	19	HA DX Contest
Jan.	**24-26**	**CQ WW 160 Meter CW Contest**
Jan.	25-26	REF CW Contest
Jan.	25-26	U.B.A. SSB Contest
Feb.	1	Northwest QRP Digital Contest
Feb.	1-2	Delaware QSO Party
Feb.	8-9	PACC Contest
Feb.	14-16	YL-ISSB SSB QSO Party
Feb.	15-16	ARRL CW DX Contest
Feb.	**21-23**	**CQ WW 160 Meter SSB Contest**
Feb.	22-23	REF SSB Contest
Feb.	22-23	U.B.A. CW Contest
Mar.	1-2	ARRL SSB DX Contest
Mar.	14-15	CLARA HF CW Contest
Mar.	18-19	CLARA HF SSB Contest
Mar.	**29-30**	**CQ WW WPX SSB Contest**

Despite poor conditions, a declining influx of new blood into our ranks, and the general cost of entry into the sport, contesting has never been better. How can I make such a bold claim? Well, look at the numbers. Participation is at an all-time high. Even though we're at the bottom of the sunspot cycle, it still took nearly 4 million points to win the CQ WW SSB Single Operator category in the U.S. As soon as the sun becomes sprinkled with just a little sunspot juice, 10 meters will be back with a vengeance, and so will interest around the globe.

Even though I have remained an optimist throughout our solar downturn, I recently couldn't help but remember those old days of contesting. Why do you ask? As it turns out, vanity calls are the culprit. Not only are the new 1X2 callsigns reminding me of the days when I cheerfully turned in WA2LQZ for K1AR, but one other call in particular stood out the other day—W2PV.

Maybe a few of you had the opportunity to operate from some of the multi-op stations of the past. Callsigns such as W3AU, W4BVV, K2GL, and many others come to mind. Well, as it turned out, my early experience in "big-time" contesting was at Whiskey 2 Papa Victor, the callsign of one of contesting's giants—Jim Lawson of Schenectady, New York.

During those days as a new contester I tried to manage the responsibilities of college while being a fanatic ham. Some accused me of majoring in amateur radio with a minor in electrical engineering. Anyone who had the pleasure of contest operating from a station such as W2PV will relate to this month's column with a smile. For the rest of you, just imagine what the old days of contesting used to be like.

Operating at W2PV was akin to visiting NASA, especially from the perspective of a young college kid who just recently had used his Swan 270 and tribander at 35 feet. I'll never forget the first time I drove up to Jim's house. He was located on a busy road in Schenectady (Route 7), and there was not a tree in sight as the QTH came into view. As you approached his house, you were struck by the staggering amount of aluminum in the sky behind the house. Jim was one of the first amateurs to adopt the use of stacked Yagis (including 3 over 3 on 40 meters), as well as the proud owner of one of Telrex's "Big Berthas." How does 10 over 10 on 10 meters grab you? Maybe you'd prefer to use the 8 over 8 on 15? The list goes on.

Jim lived in a modest house. He preferred to demonstrate his resources in terms of decibels rather than numbers of fireplaces. As you might imagine, a multi-multi station can take up a lot of real estate in a house. At W2PV the station was spread over most of the basement as well as a separate operating room upstairs. Despite the natural opportunity for disorganization, nothing could be further from the truth when it came to station design at the Lawson station. Every cable, control line, interface, switch, and amplifier setting was impeccably labeled. I'll never forget the time that we had a rotator problem late one night during a CQ WW. Most of us would immediately start climbing the tower. Not the case at W2PV. Jim's engineering background allowed him to develop a station technical guide. Inside this incredible piece of work was a color-coded reference manual that included site resistance readings for various conditions on all of his rotators. Jim had the problem figured out before we even had a climbing belt taken off one of the hooks in his shop!

Today's world of contesting seems to have a thyroid condition when it comes to antennas. Stacked beams are everywhere. If you don't have a 40 meter rotary, you're not in the game. How can you think about operating without a 4-square on 80 meters (with 160 meters right behind). Having said all of that, there is still nothing like the experiences we used to have firing up on 20 meters with our 5/4/4 stacked Yagis. In the days of W2PV (especially the late 70s and early 80s) there just weren't many stations like his. You stood out in the crowd, and believe me, it just doesn't get any better than that! So operating at W2PV was a dream, the good old days of contesting.

For you young bucks, there actually was a day in contesting when packet radio spotting didn't exist. Imagine being at one of today's multi-multi stations where you don't have six or more computers networked together. While we did have 2 meter spotting at our disposal, we certainly did not have high-tech intra-station communication between bands. And at Jim's station, it was even a more difficult problem because the stations were in different rooms. How did we solve the problem? As it turns out, this is one of the dark secrets of contesting. Jim, determined to work out a technical solution to allow his operators to communicate with each other, developed an elaborate intercom system. The secret was that the underlying radio technology for the system was low-powered CB radios. Imagine operating in "radio meca" while using a CB to pass a 9K2 to 20 meters. It was one of the many good old times of contesting.

If I can identify a common thread between the days of W2PV and today, it's camaraderie. We had so much fun in those days. We laughed and laughed, much like today. It had to be fun; there was no other possibility. Imagine the commitment of driving 4 hours (each way) to operate four out of seven weekends during the old days of two weekend ARRL DX Contests. Imagine the motivation it took to drive eight hours to operate in a CW SS from W2PV only to be buried way below the West Coast competitors. Why did we do it? I think it's because we loved it and loved being part of a team. The team at W2PV was one of the best groups of friends with whom I ever had the chance to associate, and many of us are still at it today.

I could write a book on some of our operating stories from W2PV. Most of us recall the story of JY1 calling in on 10 meters. Not being from the school of "shy personalities," the PV operator simply asked His Highness to QSY to 15 meters without skipping a beat. After all, he's only a king, right? JY1 cheerfully conceded to our request and even went on to 20! He was probably thinking, "Why not? It's only Jim Lawson"s station."

When you have the use of 20 elements on a band, you tend to get the feeling that you're the loudest guy around. For the most part, that was the case on 10 meters at W2PV. I'll never forget the time, however, when a fellow in Vermont unintentionally fired up on my frequency and

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e-mail K1AR@contesting.com
Compuserve ID: 71301,424

proceeded to run me off the band. Imagine the thoughts going through my head: "What could this guy possibly be running?"; "I didn't know they made amplifiers that big!"; etc. When I finally got his attention, I asked him about his antenna. It turned out to be a tribander at 50 feet! If you can describe the physics behind that one, I'd like to hear from you.

My reminiscing about W2PV reminds me of just how good the old days of contesting were. Jim was a force behind my birth as a contester. I had the chance to honor him (with others) as his premature death approached by presenting him with his #1 World Multi-Multi CQ WW trophy—the last contest his station ever won.

The next time you feel like complaining about the state of contesting today, think about your experiences of the past. We should always be looking forward in life, but so many of our previous experiences (and those of others) can be an encouragement to us all. That's what contesting is all about—a sport of memories and camaraderie that can't be beat!

Closing Thoughts

Your 1996 CQ Contest Surveys are pouring into my mailbox on a daily basis. Thanks for taking the time to make this year's survey a success. It's not too late to send your response to me. If you prefer, you can take a quick moment and reply electronically. The easiest way to reach me is via <K1AR@contesting.com>.

As always, I need to receive your "Contest Calendar" submissions for the April issue no later than February 1st. Make sure you send your information to my home QTH, please!

73 John, K1AR

ARRL RTTY Roundup

1800Z Sat. to 2400Z Sun., Jan. 4–5

This is the 9th annual all-digital contest sponsored by the ARRL. Any station may work any other station worldwide. You may operate more than one digital mode, but QSOs and multipliers are counted once only regardless of modes used.

Operation is limited to 24 hours out of the 30 hour contest period. Two rest periods must be taken in two separate blocks of time and must be clearly marked in the log.

Modes: Baudot, RTTY, ASCII, AMTOR, and packet.

Bands: 3.5–30 MHz on those frequencies recommended for digital operation (no 10, 18, or 24 MHz).

Categories: Single operator, multi-band, (1) less than 150 watts output, (2) 150 watts or more. Also multi-operator, single transmitter, all band.

Exchange: Signal report and QTH. State for the U.S.; province for Canada. DX will send a serial QSO number.

Scoring: One point per QSO. A station may be worked once per band for QSO credit.

Multiplier: Each US state (48), each VE province (12), and each DXCC country, counted only once, not once per band (KH6 and KL7 are countries; VO1/VO2 counts as one VE province). Entries with 200 or more contacts must submit a duplicate QSO check sheet.

Awards: Certificates to the top-single operator, both low and high power, and multi-operator scorers in each ARRL/RAC section and

each DXCC country. Novice/Tech entrant with at least 50 QSOs will also receive a certificate.

Detailed information appeared in the November issue of *QST*. Contest forms are available from the ARRL for an SASE and two units of first-class mail and are recommended.

Postmark your entry by February 9th and send it to: ARRL RTTY Contest, 225 Main Street, Newington, CT 06111.

Japan International DX CW Contest (Low Band)

2200Z Fri. to 2200Z Sun., Jan. 10–12

The object of this one is for amateurs around the world to work as many JA stations in as many JA prefectures as possible. It is sponsored by *Five-Nine* magazine. The maximum operating period is 30 hours (except for JAs, who can use the full 48 hour period) with off periods longer than 60 minutes. This is the low-band edition (others to follow in subsequent months), and operation is limited to 160-40 meters, exclusively.

Classes: Single operator—high power, low power, all band, single band; multi-operator; marine mobile.

Exchange: JA—RST and prefecture number (1-50). Others—RST and CQ Zone.

Scoring: 160 meters 4 points, 80 meters 2 points, 40 meters 1 point per QSO. Multipliers are total prefectures worked per band (DXCC countries for JA). Final score is total QSO points times multiplier.

Awards: Plaques and awards will be sent to the winners in each class around the world. A special contest award will be offered to anyone working all Japanese prefectures during the contest period.

All logs must be postmarked no later than February 28th and should be sent to: JIDX LFCW Contest, c/o *Five-Nine* magazine, P.O. Box 59, Kamata, Tokyo, 144 Japan. Contest results will be sent to anyone who includes one IRC and an SAE.

1997 North American QSO Party

CW: 1800Z Sat. to 0600Z Sun., Jan. 11–12
SSB: 1800Z Sat. To 0600Z Sun., Jan. 18–19

The object of this one is to work as many North American stations (and/or other stations if you are in North America) as possible during the contest period. North American stations are defined by the rules of the CQ WW DX Contests with the addition of KH6.

Classes: Single operator and multi-operator, two transmitters. Multi-operator stations muust keep a separate log for each transmitter and must have at least 10 minutes between band changes. Use of helpers or spotting nets by single operator entrants is not permitted. Single operator entrants may only have one transmitted signal at a time. Output power must be limited to 150 watts for eligible entries. Multi-operator stations may operate for the entire 12 hour period. Single operator stations may operate 10 out of 12 hours. Off times must be at least 30 minutes in length and must be clearly marked in the log.

Mode: CW only in CW parties. Phone only in phone parties.

Bands: 160–10 meters only (no WARC bands). You may work a station once per band. Suggested frequencies are 1815, 3535, 7035, 14035, 21035, and 28035 (20 kHz up from band edge for Novice) on CW; and 1865, 3850, 7225, 14250, 21300, and 28450 on phone. Try 10 meters at 1900Z and 2000Z, 15 meters at 1930Z and 2030Z, and 160 meters at 0430Z and 0530Z.

Exchange: Operator name and station location (state, province, or country).

Scoring: Multiply total valid contacts by the sum of multipliers worked on each band. Multipliers are states (including KH6 and KL7), Canadian call areas (VE1–VE8, VO1, VO2, VY1, and VY2), and other North American countries. Do not count USA, Canada, KH6, or KL7 as countries. Non-North American countries do not count as multipliers, but may be worked for QSO credit.

Team Competition: Team competition is limited to a maximum of five single operator stations (two minimum) as a single entry unit. *Pre-contest requirement:* To qualify as a team entry, you must register the name, callsign of each operator, and callsign of the station operated should the operator be a guest at a station other than his own (e.g., N4RJ op. by KM9P). Teams must be registered with the contest director before the contest.

Penalties: For each unmarked duplicate QSO, you lose that contact plus an additional three contacts; for each QSO for which you are not in the other station's log, you lose that QSO plus an additional one contact; and for each QSO for which the log data is incorrectly copied in any respect, you lose that contact. Entries with score reductions greater than 5% will be disqualified.

Awards: A total of five trophies will be awarded for the high score in each of the following categories: Single Operator CW and Phone, Multi-Operator CW and Phone, and Single Operator Combined score.

Certificates of merit will be awarded to the highest scoring entrant with at least 200 QSOs from each state, province, and North American country.

Send CW North American QSO Party entries to Bob Selbrede, K6ZZ, 6200 Natoma Ave., Mojave, CA 93501. All SSB logs go to Steve Merchant, K6AW, 1795 Cravens Lane, Carpenteria, CA 93013. Entries must be postmarked no later than 30 days after the party to be eligible for awards. Logs may be submitted on disk in the form of MS-DOS compatible ASCII files only.

HA DX Contest

0000Z to 2400Z Sun., Jan. 19

Sponsored by the Hungarian Radioamateur Society, this is one of several very popular Eastern European national contests. The contest is CW only and stations may be only worked once per band.

Exchange: RST plus serial number (599001). HA stations will also send a two-letter code corresponding to their county. The possible codes are: BA, BE, BP, BN, BO, CS, FE, GY, HA, HE, KO, NO, PE, SA, SO, SZ, TO, VA, VE, ZA.

Scoring: Count 6 points per HA QSO and 3 points for non-HA QSOs on other continents. Final score is total QSO points times sum of HA counties worked per band.

Entries are due six weeks after the contest and should be sent to: Hungarian DX Club, Box 79, Paks, H-7031 Hungary.

ARRL VHF Sweepstakes

1900Z Sat. to 0400Z Mon., Jan 18–20

This is the 50th ARRL January VHF Sweepstakes. ARRL Headquarters recommends that you use the official log forms. It will make your log keeping and the scoring much easier. A large SASE to Newington will get you the necessary forms.

Complete rules are in the December issue of *QST*. They are a bit complicated, so look them over carefully.

1995 YL-ISSB QSO Party

CW: Jan. 17–19 SSB: Feb. 14–16
0001Z Saturday to 2359Z Sunday

This event is open to all participants, but emphasis is on membership involvement.

Exchange: Signal report, state/province/country, partner's call, ISSB number.

Categories: Single Operator, DX-W/K Partner, YL/OM Team.

Scoring: Credit 3 points for member contacts within the same continent; 6 points for member contacts in different continents; 1 point for non-member QSOs. You can credit one multiplier for working both DX-W/K team members, each YL/OM team, US state, Canadian province, DX country, and each VK/ZL call area. Multiply your score by two if you use less than 100 watts throughout the party; by five for running less than 25 watts.

Frequencies: Use the General portion of the bands. Avoid net operations. Check 40/80 meters on the hour.

Awards: Certificates will be awarded to the top three scorers in each category. A special ZL award will be sent to the station working the most ZL contacts.

Logs must be received by March 31st and should be sent to: Rhonda Livingston, N4KNF, 2160 Ivy Street, Port Charlotte, FL 33952.

CQ WW 160 Meter Contest

CW: Jan. 24–26 SSB: Feb. 21–23
2200Z Friday to 1600Z Sunday

Complete rules were published in the November issue. The following is a brief overview.

Exchange: RS(T) and QTH. State for the U.S., areas for Canada, country abbreviation for DX.

Scoring: Contacts with stations in own country 2 points, other countries in same continent 5 points, and with other continents 10 points.

Multiplier: Each U.S. state (48), Canadian area (13), and DX country. (ARRL and WAE country lists and WAC boundaries are the standards.)

Awards: Certificates to the top-scoring stations in each U.S. state, Canadian area, and DX country. An assortment of 29 plaques for U.S. and world winners.

Penalties: Three contacts will be deleted for each duplicate that has not been removed.

Disqualification: Taking credit for excessive duplicate contacts, and the usual assortment of rule violations and unsportsmanlike conduct.

Mailing deadline for logs is February 28th for CW entries and March 31st for the SSB section. Logs should be sent directly to: CQ 160 Meter Contest, David L. Thompson, K4JRB, 4166 Mill Stone Court, Norcross, GA 30092. **Be sure to indicate CW or SSB on the envelope.**

U.B.A. Contest

Phone: 1300Z Sat. to 1300Z Sun., Jan. 25–26
CW: 1300Z Sat. To 1300Z Sun., Feb. 22–23

This one is sponsored by the Belgium Amateur Radio Union (U.B.A.). Any station may work any other worldwide. Numerous operating awards are available, and contest QSOs may be credited towards these awards.

Classes: Five categories exist—Single Operator, All Band/Single Band, Multi-Operator/Single Transmitter, QRP 5 watts, and SWL.

Frequencies: CW—3500–3560, 7000–7035, 1400–14060, 21000–21060, 28000–28060 kHz. SSB—3600–3650, 3700–3800, 7040–7100, 14125–14300, 21175–21350, 28400–28700 kHz.

Exchange: RS(T) and consecutive serial number. Belgian stations also give their province abbreviation.

Multipliers: All Belgian provinces, prefixes: ON4–9, DA1–2; and European Community countries.

Scoring: QSOs with ON count 10 points. European QSOs count 3 points. All others are 1 point. Final score is total QSO points times total multipliers.

Awards: There are several awards available, including trophies and certificates to the high scorers in each operating class.

Send your final results no later than 30 days after each contest section to: UBAHF Contest Committee, Galicia Jan, ON6JG, Oude Gendarmeriestraat 62, B-2220 Heist Op Den Berg, Belgium. Note that logs may also be submitted on disk in K1EA's CT or ASCII format.

1997 REF Contest

CW: 0600Z Sat. to 1800Z Sun., Jan. 25–26
SSB: 0600Z Sat. to 1800Z Sun., Fb. 22–23

The Reseau des Emetteurs Francais (REF) has the honor of inviting radio amateurs from around the world to participate in the REF Contest. The object of the contest is to establish as many QSOs as possible between radio amateurs around the world and French stations. French stations are defined as (1) stations from France and Corsica, (2) French military stations in Germany, and (3) overseas territories and departments (i.e., FG, FH, FJ, FK, FM, FO, FP, FR, FS, FT, FW, FY). Operation is on 80–10 meters only (no WARC bands).

Classes: Single Operator, All Band and Single Band, Multi-Single, SWL.

Exchange: RS(T) and serial number. French stations give RS(T) and department number. Overseas territories use RS(T) and prefix.

Scoring: Credit one point for QSOs within the same continent and three points for QSOs with another continent. All QSOs with French stations are worth 5 points. Multipliers are French departments, military stations, and territories per band. A special multiplier may be taken for working F6REF/00 per band.

Awards will be sent to the first-place single operator and multi-operator winner of each country. All logs must be received before March 15 (CW) and April 15 (SSB). Send your entries to: Reseau des Emetteurs Francais, REF Contest, BP 7429, 37074 Tours, Cedex 2, France.

BY NORM VAN RAAY, WA3RTY

AWARDS

NEWS OF CERTIFICATE AND AWARD COLLECTING

This month we feature USA-CA Award recipient Robert E. Demchak, KC1NA, USA-CA All Counties #902. We'll let him tell his own story.

"I am going to date myself with this. I have been around amateur radio since 1957. My uncle (now K1FL) was a young amateur radio operator, and we spent a lot of time building homebrew AM transmitters and Heathkit receivers and erecting different antennas. I could pass the written exams, but had a serious CW mental block. When I reached my teens, my interests swayed from radio to other endeavors, and in 1969 I joined the USAF. It was while I was in the USAF that my interest in amateur radio was renewed.

Robert E. Demchak, KC1NA, USA-CA All Counties #902, working and giving out counties from an 18-wheeler.

"Between June 1972 and July 1974 I spent time as a volunteer operator for the USAF MARS station in the Azores Islands. It was during a second tour in the Azores from July 1975 through June 1977 that I met Steve Wilson (now KF7SG). He rekindled my interest in amateur radio. We spent many hours talking about radio, both amateur and the 'other' (CB), as well as MARS. Eventually we were both reassigned, but we have kept in touch over the years.

"Our paths crossed again with a tour at Maelstrom AFB, Montana, where Steve was an active amateur as well as a MARS operator. Although he tried to get me to take the amateur exams, I was still reluctant.

"Four years passed with Steve playing radio, with me as a interested bystander. Time again came for reassignments. Steve headed for England, while I was 'forced' to spend two years on the Italian Riviera at Rimini, Italy as an advisor to the Italian Air Force's 5th Stormo Group. While 'laboring' at Rimini, I did get to spend some time on the beach and to enjoy the culinary delights. On one of these culinary excursions I met a wonderful woman from England, Margaret (now KE6IOY, and Mrs. Demchak).

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e-mail wa3rty@epix.net

SPECIAL HONOR ROLL

Chester A. Mackenzie, AA4HL
USA-CA All Counties #909
November 2, 1996

Alan R. Remington, W9MYZ
USA-CA All Counties #910
November 2, 1996

Daniel M. Craig, KC6CNV
USA-CA All Counties #911
November 2, 1996

Arne Nilsson, SM6VR
USA-CA All Counties #912
November 2, 1996

"With Steve, KF7SG/G4ZGY, and his wife Diane, N7NZI/GISPI, being in England and Margaret being from there, it was natural that visits were in the future. Those visits were made and involved a lot of time centered around British amateur radio. During visits new friends were made with GØMEV, GØMEZ, G6EUO, and G6XYX. Two years later I found myself assigned to England to build a new Cruise Missile base in England, RAF Molesworth, 40 miles from Steve.

"Steve, G4ZGY, and Diane, GISPI, along with the others, convinced me that I should get over the CW mental block and get my British license. Eventually I capitulated, sat for the British Radio Theory Exam (the US Advanced Class equivalent), and became G7CCY (British 'B' license) with 2 meter and up privileges. With my interest now piqued, Steve arranged for a US Novice exam session for six people from RAF Lakenheath, England. I became KB2GMV, a Novice.

"Research uncovered that VE examiners were available for US licenses at RAF Menwith Hill, England. Arrangements were made for a VE session at RAF Lakenheath for US and British personnel to take all exams. I agreed to sit for the exams if some of my British amateur counterparts, as well as Steve, would do the same. They agreed. We spent hours in preparation. Steve upgraded, Diane became N7NZI, and all of the others reached at least Technician Class. I became KC1NA and am still deeply interested in HF privileges from the UK.

"In order to get a British AH license (HF privileges) the examinee must first hand-copy CW random characters, numbers, and punctuation at a rate of 12 wpm. If successful, the examinee must then send a list of random characters, numbers, and punctuation at a rate of at least 12 wpm. A straight key must be used and both must be passed. I took the test and became GØMXK.

"Inevitably reassignments arrived. Steve and Diane were the first to depart and went to Williams AFB, Arizona. My wife and I went to March AFB, California two months later. Enroute to California, we visited with the Wilsons in Arizona. It was here that I started chasing paper. Steve had discovered the 3905 Century Club WAS nets. I soon discovered that I enjoyed the challenge.

"In June 1993 my wife and I took a trip to Montana with Steve (now retired from the USAF and living in Hanford, California) and Diane. It was on this trip that I discovered the Mobile Emergency and Independent County Hunters' Net on 14.336. I put out Clark, Nevada as my first county transmitted and started collecting counties. Once I started collecting, I was hooked. I spent hours going over all the cards I had from the 3905 nets and entering those counties into my data base. I was off and running.

"I retired from the USAF and eventually wound up driving an 18-wheeler. I now teach over-the-road driving of these trucks. Literally hours are spent on the air each day and night when I'm on the road, both putting out the counties (1621 counties transmitted as of 7-1-96) and working the counties. I put out counties on the 20 meter (14.336) and 40 meter (7.238/7.243) USA-CA nets, as well as on the 160 meter (1.8925 Oct.–Mar.), 80 meter (3.9035), and 40 meter (7.2335) 3905 Century Club WAS nets.

"I finished collecting all counties at 2021Z on July 17, 1996 with Calhoun, West Virginia put out by KSCWR/M as my last for the 'whole ball of wax.' I guess I'm sort of crazy, because I will start all over again! My short-term goals are to finish USA-CA a second time and to complete USA-CA Bingo. My long-term goal is to transmit from all US counties.

HONOR ROLL

500

NØWM	2939
KK6WI	2940
JA1AZS	2941
5B4ES	2942
AA4HL	2943
W9MYZ	2944
KC6CNV	2945
SM6VR	2946

1000

KK6WI	1420
AA4HL	1421
W9MYZ	1422
KC6CNV	1423
SM6VR	1424

1500

AA4HL	1185
W9MYZ	1186
KC6CNV	1187
RA6AR	1188
SM6VR	1189

2000

AA4HL	1090
W9MYZ	1091
KC6CNV	1092
RA6AR	1083
SM6VR	1094

2500

AA4HL	1019
W9MYZ	1020
KC6CNV	1021
SM6VR	1022

3000

AA4HL	925
W9MYZ	926
KC6CNV	927
SM6VR	928

The total number of counties for credit for the United States of America Counties Award is 3076. The basic award fee for subscribers 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 Magazine, 76 North Broadway, Hicksville, NY 11801 USA for $2.00. To qualify for the special subscriber rate, please send a recent CQ mailing label with your application. To be eligible for the USA-CA Award, applicants must comply with the rules of the program as set forth in the revised USA-CA Rules and Program dated June 15, 1991. A complete copy of the rules may be obtained by sending an SASE to Norm Van Raay, WA3RTY, USA-CA Award Manager, Box 76, Pleasant Mount, PA 18453-0076 USA. DX stations must include extra postage for airmail reply.

"In closing, I want to express my most sincere appreciation to all of the amateurs around the world (US and DX) who 'ace along with me.' The friendships, camaraderie, and assistance you provide (no less than two dozen emergency highway situations in which I was 'first on the scene' have been handled through you) mean more to me than mere words can express. I hope to have an 'eyeball' with each and every one of you some day.—73, KC1NA"

Awards Issued

USA-CA 500: William R. Eggelston, NØWM, #2939; Bill Chaney, KK6WI, #2940; Tetsho Sgow, JA1AZS, #2941; The English Radio School, 5B4ES, #2942; Chester A. Mackenzie, AA4HL, #2943; Alen R. Remington, W9MYZ, #2944; Daniel M. Craig, KC6CNV, #2945; Arne Nilsson, SM6VR, #2946.

USA-CA 1000: Bill Chaney, KK6WI, #1420; Chester A. Mackenzie, AA4HL, #1421; Alen R. Remington, W9MYZ, #1422; Daniel M. Craig, KC6CNV, #1423; Arne Nilsson, SM6VR, #1424.

USA-CA 1500: Chester A. Mackenzie, AA4HL, #1185; Alen R. Remington, W9MYZ, #1186; Daniel M. Craig, KC6CNV, #1187; Tom V. Stepanov, RA6AR, #1188; Arne Nilsson, SM6VR, #1189.

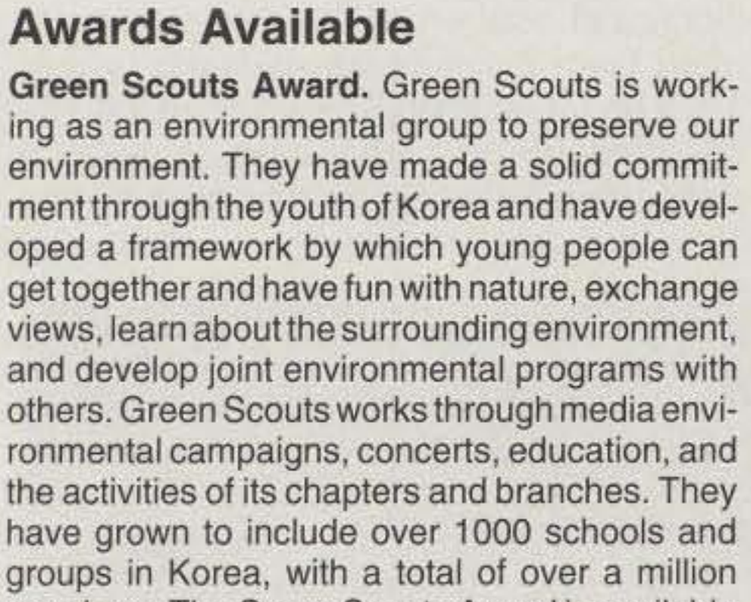
USA-CA 2000: Chester A. Mackenzie, AA4HL, #1090; Alen R. Remington, W9MYZ, #1091; Daniel M. Craig, KC6CNV, #1092; Tom V. Stepanov, RA6AR, #1093; Arne Nilsson, SM6VR, #1094.

USA-CA 2500: Chester A. Mackenzie, AA4HL, #1019; Alen R. Remington, W9MYZ, #1020; Daniel M. Craig, KC6CNV, #1021; Arne Nilsson, SM6VR, #1022.

USA-CA 3000: Chester A. Mackenzie, AA4HL, #925; Alen R. Remington, W9MYZ, #926; Daniel M. Craig, KC6CNV, #927; Arne Nilsson, SM6VR, #928.

Awards Available

Green Scouts Award. Green Scouts is working as an environmental group to preserve our environment. They have made a solid commitment through the youth of Korea and have developed a framework by which young people can get together and have fun with nature, exchange views, learn about the surrounding environment, and develop joint environmental programs with others. Green Scouts works through media environmental campaigns, concerts, education, and the activities of its chapters and branches. They have grown to include over 1000 schools and groups in Korea, with a total of over a million members. The Green Scouts Award is available to all licensed radio amateurs and SWLs who meet the following requirements.



The Green Scouts Award offered by the Interbeam Crew ARC, Korea.

Make the words "GREEN SCOUTS" using the last letter of callsigns contacted. Any bands or modes may be used, but not repeaters. Contacts must be on after October 12, 1994. Contacts must include HL or DS (Korea) station. Any of the callsign regions can be substituted with one of the following "joker" stations: HLØHQ, HL1AO, HL21BC, HL11FZ, HL11LW, HL21QS, HL1KHV, HL1LKF, HL10AH, HL10HM, HL10LT, HL20QM, HL1SOZ, DS1AGC, DS1AKO, and DS1DEQ.

A GCR list can be replaced with the validation of two or more licensed radio amateurs. No specific application form is required. However, callsign, date, time, band, mode, and RST must be stated on the application. Applications go to the Interbeam Crew ARC with the applicant's QSL card. Award fee is $ 6.00 US, or 6 IRCs.

Classes are as follows:

Class A—All contacts must be with a with different country (WAC).

Class B—All contacts must be made with YL stations.

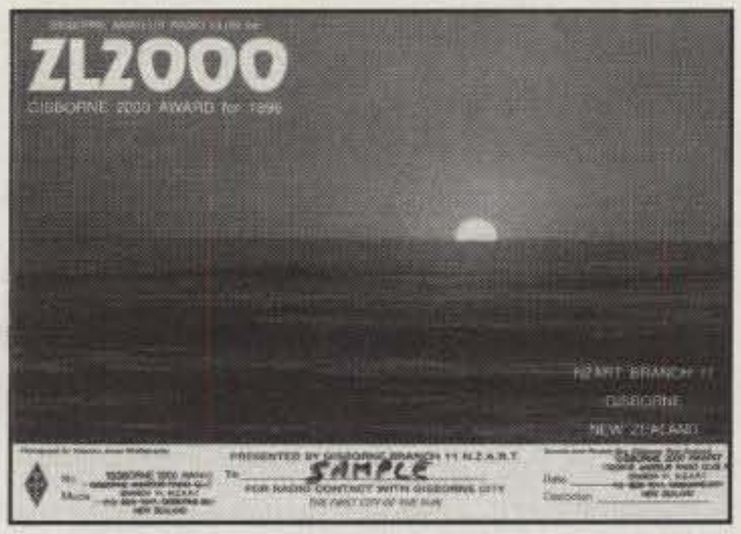
Class C—All contacts must be with an HL or DS (Korea) station (for example, HL1, HL2, HL3, HL4, HL5, HLØ, except HL9 stations).

Class D—Any QSLs.

The Green Scouts Award is managed by the Interbeam Crew ARC, C.P.O. Box 4090, Seoul, 100-340, Korea. Award manager is Youngki Lee, HL1LKF (hl1lkf@unitel.co.kr). For more complete rules contact the ARC or HL1LKF.

The Gisborne 2000 Award. The amateur fraternity is fast heading into a new century. To acknowledge this event, the Gisborne Amateur Radio Club (Branch 11, NZART) has instigated an annual award until the year 2000 using the callsign ZL2000. The award, known as the Gisborne 2000 Award, acknowledges the fact that Gisborne, New Zealand is unique in being the first city in the world to see the sunrise on a new day and in the new year. Gisborne will be the center of attention for much of the world during the new year period in the year 2000.

This international award is open to all amateur radio operators and SWLs. To achieve an annual award, only *one* contact is required with a ZL2000 station during the month of January



The Gisborne 2000 Award is sponsored by the Gisborne, New Zealand ARC.

each year, until the year 2000. All operators using the ZL2000 callsign must be full members of the Gisborne ARC. Any valid amateur frequency may be used, either phone or CW. The contact may only be made during the month of January each year. The award commences at 0001 (NZ time) January 1, 1997 (0101 UTC December 31, 1996), and each year thereafter, including the year 2000. The award concludes at 2400 (NZ time) January 31, 1997 (1100 UTC January 31, 1997) and each year thereafter, including the year 2000. All valid contacts with ZL2000 will be sent a QSL card via the NZART QSL Bureau. The award for each year will only be issued upon receipt of the application fee ($5.00 Australia and New Zealand, and US$l0.00) The application fee should reach the sponsors by June 30 of the year in which the contact is made. (Late entries will be processed at the discretion of the ZL2000 Award Committee.) A different pictorial award will be issued each year. Any operator or SWL who collects four awards, including the year 2000, will be issued with a complimentary award. One amateur operator or SWL who collects four awards including the year 2000 will be chosen to receive a special award in the year 2000.

All correspondence and award applications go to ZL2RIC, Gisborne 2000 Award, P.O. Box 1017, Gisborne, 3815 New Zealand.

73, Norm, WA3RTY

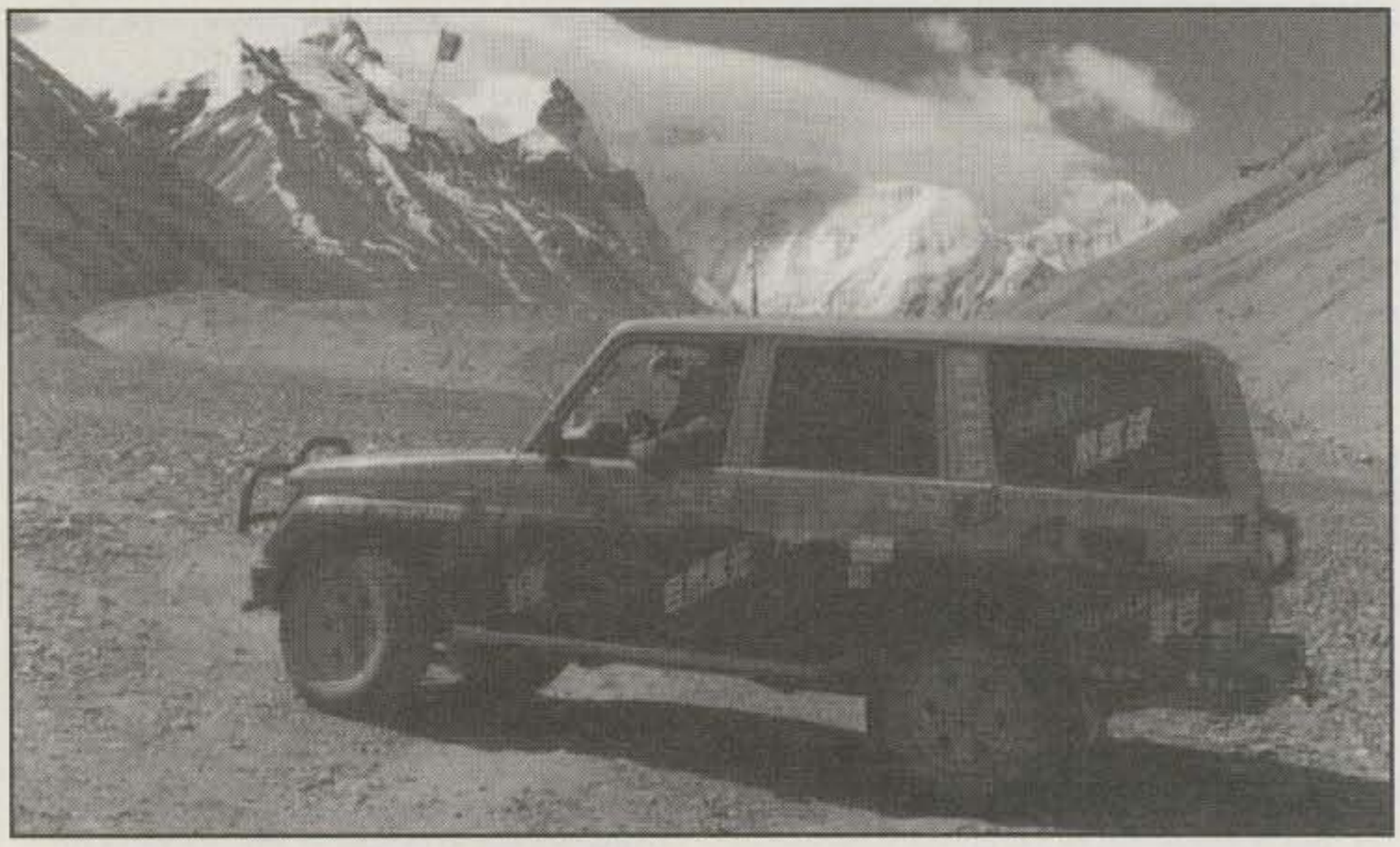
DX

BY CHOD HARRIS, VP2ML

NEWS OF COMMUNICATION AROUND THE WORLD

Tibet

Last summer two members of the Kunming Radio Sports Association (KMRSA) drove to the base of Mount Everest in Tibet and there operated as **BT96ZF/Ø**. This operation by Xi Haiging and Qian Yufeng marked the 1996 World Environmental Protection day. In connection with other sports organizations and youth groups, the two DXpeditioners drove more than 1000 miles through mountainous regions to reach the base camp at the foot of the world's highest mountain. The trip lasted 12 days. While not cleaning the area, which was the major reason for the journey, the pair handed out contacts from May 30 to June 5. For a QSL card, contact the KMRSA at First Floor, North Section of Building B, #73 Renmin West Road, Kunming Yunnan, People's Republic of China 650031.



The DXpeditioners drove to the foot of Mount Everest in this van.

Tibet is one of the most difficult spots in the world to contact on the amateur bands, especially for US DXers. Tibet lies almost half a world away, and both the long and the short path between Tibet and the US pass straight through the polar region. (Contacts through polar regions are especially difficult due to the higher absorption and scattering in the high latitudes.) Another reason Tibet is scarce on the amateur bands is that a ring of very high mountains almost completely encircles the country. The late Father Moran, 9N1MM, always had a hard time working stateside stations because of the Himalayan mountains to his north. The final reason so few US amateurs have a QSL card from Tibet is the small population of the region and its low level of technology.

Tibet is the largest, highest plateau in the world. It is almost the size of Alaska, and all but a small fraction lies at altitudes greater than 15,000 feet. Even the lowest parts of Tibet are high by our standards: their valleys range from 12,000 to 15,000 feet high. Passes over the mountains that encircle Tibet are as high as 18,000 feet. The Himalayas block the monsoon rains from getting to Tibet, and the country has very little rainfall. The temperature hardly varies with the seasons; it ranges between 20° and 45°F daily.

Tibet is probably best known as the traditional home of the Dalai Lama, the spiritual leader of millions of Buddhists. Tibetans believe that the founder of their sect is reincarnated periodically. The priests search for a young boy who can pass various tests to prove that the child actually is the reincarnation of their founder. The boy is specially raised by the priests in their spiritual lore and eventually becomes the secular as well as the spiritual leader of the Tibetan people.

This belief dates back to the beginning of the sect, and the unification of Tibet, in the 7th century. For most of the past 200 years Tibet has been under Chinese control. While the nation of Tibet was essentially independent from 1911–1950, the Chinese defeated Tibet's meager army in 1951. The leaders of their Buddhist sect fled Tibet in 1959, following an abortive uprising against the occupying Chinese.

Tibet's fascinating amateur radio story began in 1928. Harold Graham was a missionary in northern China and was operating from that site as AC9GH. In July 1928 he travelled to Koko-Nor on the Tibet-China border, where he repaired a radio previously sold to the Chinese, who

Some of the members of the Kunming Radio Sports Association.

P.O. Box 50, Fulton, CA 95439

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May 16, 17, 18, 1997 ■ Hara Arena, Dayton Ohio

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- Ticket requests that are received **AFTER** the deadline will be processed and **HELD** for pick-up at the Hamvention Office at the Conference Center entrance beginning Thursday, May 15 at 8:00 a.m.

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	Quantity		
Admission (valid all 3 days)	———	@ $13.00*	= $ ———
Grand Banquet	———	@ $25.00**	= $ ———
Alternate Activities			
Saturday Luncheon	———	@ $10.00	= $ ———
Sunday Luncheon	———	@ $10.00	= $ ———
Credit Card Service Charge.	———	@ $1.25/ticket	= $ ———
			Total $ ———

* $15.00 at door **$30.00 at door, if available

❑ ❑

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The WPX Program

SSB

2609 ..... S53EO
2610 ..... IK1YLO
2611 ..... ON4BCM

CW

2928 ..... DL2KDW

Mixed

1759 ..... K3MD
1760 ..... HA1DAE
1761 ..... DJ4GJ
1762 ..... KZ9A
1763 ..... 7N2UTO
1764 ..... JR5KQF

Mixed: 450 K3MD, HA1DAE, DJ4GJ, KZ9A, 7N2UTO. 500 HA1DAE, DJ4GJ, KZ9A, 7N2UTO, JR5KQF. 550 HA1DAE, DJ4GJ, KZ9A, JR5KQF. 600 HA1DAE, DJ4GJ. 650 HA1DAE, DJ4GJ. 700 HA1DAE, DJ4GJ, I7PXN. 750 HA1DAE, DJ4GJ, I7PXV. 750 HA1DAE, DJ4GJ, I7PXV. 800 HA1DAE, DJ4GJ, I7PXV. 850 HA1DAE, DJ4GJ, I7PXV, N1KCE. 900 HA1DAE, DJ4GJ, I7PXV, N1KCE. 950 HA1DAE, DJ4GJ, I7PXV, N1KCE, AA1KS, KB5OHT. 1000 HA1DAE, DJ4GJ, I7PXV, N1KCE, KB5OHT. 1050 DJ4GJ, I7PXV. 1100 DJ4GJ, I7PXV. 1150 DJ4GJ, I7PXV. 1200 DJ4GJ. 1250 DJ4GJ. 1300 DJ4GJ. 1350 DJ4GJ. 1400 DJ4GJ. 1450 DJ4GJ. 1500 DJ4GJ. 1550 DJ4GJ. 1600 DJ4GJ. 2850 WB2YQH.

SSB: 350 WD8ANZ, S53EO, IK1YLO, ON4BCM. 400 WD8ANZ, S53EO, IK1YLD, KB5OHT. 450 S53EO, JE1VJT, IK1YLO. 500 DL2KDW, S53EO, IK1YLO, LU4OFH. 550 DL2KDW, S53EO, IK1YLO. 600 DL2KDW, S53EO, IK1YLD. 650 DL1KDW, IK1YLO. 700 DL2KDW, IK1YLO. 750 DJ9SZ, IK1YLO. 800 DJ9SZ, IK1YLO. 950 IKØAPR. 1000 IKØAPR. 1050 JA2OCU. 1100 JA2OCU. 1300 OA4QV. 1350 OA4QV. 1400 IK2AEQ, OA4QV. 1450 OA4QV. 1500 OA4QV. 1550 OA4QV. 1600 OA4QV. 1650 OA4QV. 2250 LU8ESU.

CW: 350 DL2KDW, S53EO, DL8YR. 400 DL2KDW, S53EO, DL8YR. 450 DL2KDW, S53EO, DL8YR. 500 DL2KDW, S53EO, DL8YR. 550 S53EO, DL8YR. 600 S53EO, DL8YR. 650 S53EO, DL8YR. 700 S53EO, DL8YR. 750 DL8YR, KB5OHT. 800 DL8YR, KB5OHT. 850 DL8YR. 900 K2LUQ, DL8YR. 950 DL9YR. 1000 DL8YR. 1050 DL8YR. 1100 DL8YR. 1150 DL8YR. 1200 DL8YR. 1250 JA7FFN, DL8YR. 1300 DL8YR. 1350 DL8YR. 1400 DL8YR. 1450 DL8YR. 1500 DL8YR. 1550 DL8YR. 1700 VR2UW. 1750 VR2UW. 2100 JA9CWJ. 2150 JA9CWJ. 2200 JA9CWJ.

10 Meters:	S53EO, DJ4GJ, DL8YR
15 Meters:	S53EO, DJ4GJ, DL8YR, N1KCE, IK1YLO
20 Meters:	HA1DAE, S53EO, DJ4GJ, DL8YR, IK1YLO
40 Meters:	HA1DAE, S53EO, DJ4GJ, DL8YR, N1KCE
80 Meters:	HA1DAE, S53EO, DJ4GJ, DL8YR
160 Meters:	S53EO, DJ4GJ, DL8YR
Asia:	HA1DAE, S53EO, DJ4GJ, KL8YR, IK1YLO
Africa:	DJ4GJ, DL8YR, DF7HX, IK1YLO
No. Amer.:	HA1DAE, DJ4GJ, DL8YR
So. Amer.:	S53EO, DJ4GJ, DL8YR, N1KCE, JA2OCU
Europe:	DL2KDW, HA1DAE, DJ4GJ, DL8YR, IK1YLO
Oceania:	OZ5UR, DJ4GJ, KL8YR

Award of Excellence: W9IL

Award of Excellence With 160 meter endorsement: A6WJ

Award of Excellence Plaque Holders: I8YRK, W4CRW, SMØAJU, K5UR, K6XP, N5TV, K2VV, VE3XN, W6OUL, DL1MD, DJ7CX, DL3RK, WB4SIJ, SM6DHU, N4KE, I2UIY, DL7AA, ON4QX, WA8YTM, YU2DX, OK3EA, I4EAT, OK1MP, N4NO, ZL3GQ, VK9NS, DEØDXM, DK4SY, UR2QD, AB9O, FM5WD, I2DMK, W4BQY, IØJX, SM6CST, VE1NG, I1JQJ, WA1JMP, PY2DBU, HI8LC, KA5W, KØJN, W4VQ, KF2O, K3UA, HA8XX, 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, W5AWT, KBØG, HB9CSA, F6BVB, W1BWS, YU7SF, G4BUE, N3ED, DF1SD, K7CU, I1POR, LU3YL/W4, NN4Q, KA3A, YBØTK, VE7WJ, VE7IG, K9QRF, YU2NA, N2AC, W4UW, NXØI, W9NUF, N4NX, SMØDJZ, DK5AD, WB4RUA, DK5AD, WD9IIC, W3ARK, I6DQE, LA7JO, VK4SS, K6JG, I1EEW, I8RFD, I3CRW, VEFXR, N4MM, KC7EM, ZS6BCR, CT1YH, IV3PVD, KA5RNH, ZP5JCY, F1HWB, KC8PG, NE4F, VE3MS, K9LJN, ZS6EZ, YU2AA, I1WXY, IK2ILH, DEØDAQ, LU1DOW, N1IR, IK4GME, WX3N, KC6X, N6IBP, W5ODD, IØRIZ, I2MQP, I5ZJK, JAØSU, S51NU, K9XR, WØULU, HB9DDZ, F6HMJ, I2EOW, IK2MRZ, KS4S, KA1CLV, WZ1R, CT4UW, KØIFL, IN3NJB, WT3W, S50A, AA6WJ, W3AP, W9IL, OE1EMN, IK1GPTG, KØDEQ, DL5ARS.

Award of Excellence Plaque Holders with 160 Meter Endorsement: CT1YH, IV3PVE, KA5RNH, ZP5JCY, AB9O, FM5WD, SMØDJZ, DK5AD, SM6CST, I1JQJ, PY2DBU, W3ARK, HI8LC, KA5W, UR2QD, VE3XN, K6XP, LA7JO, W4VQ, K6JG, K3UA, HA8UB, W4CRW, N4MM, K7LJ, SMØAJU, KF2O, SM3EVR, K5UR, UP1BZZ, OK1MP, N5TV, K2POF, W8CNL, DJ4XA, IT9TQH, DL9RK, N6JV, ONL-4003, W1JR, W6OUL, W5AWT, KBØG, F6BVB, W4BQY, YU7SF, W5UR, N4NO, DF1SD, K7CU, I1POR, W8RSW, N4KE, I2UIY, YBØTK, W8ILC, W1BWS, VE7WJ, K9QFR, NN4Q, W4UW, NXØI, G4BUE, LU3YL/W4, I4EAT, WB4RUA, VE7WJ, N4NX, DEØDXM, VE7IG, K9BG, I1EEW, AB9O, CT1YH, IV3PVD, KA5RNH, ZP5JCV, I2MQP, IØRIZ, W5ODD, WX3N, IK4GME, HA8XX, YU1AB, F6HMJ, HB9DDZ, K9XR, KØJN, ZS6EZ, JAØSU, I5ZJK, I2EOW, KS4S, KA1CLV, KØIFL, K9LJN, WT3W, IN3NJB, S50A, AA6WJ, W3AP, KØDEQ.

Complete rules and application forms may be obtained by sending a business-size self-addressed, stamped envelope (foreign stations send extra postage if airmail desired) to: "CQ WPX Awards," P.O. Box 593, Clovis, NM 88101-9511 USA.

On the south side of the Himalayas Dick, 9N1ARB, and Rich, 9N1RHM, operate mobile from Nepal.

5 Band WAZ

As of September 30, 1996, 448 stations have attained the 200 Zone level.

New recipients of 5 Band WAZ Award with all 200 Zones confirmed:

ES1RA

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)
AA4KT, 199 (26)
K7UR, 199 (34)
NAØY, 199 (26)
WØPGI, 199 (26)
W2YY, 199 (26)
W9WAQ, 199 (26)
W1JR, 199 (23)
VE7AHA, 199 (34)
W1FZ, 199 (26)
IK2GNW, 199 (1)
W9CH, 199 (26)
ACØM, 199 (34)
IK8BQE, 199 (31)
JA2IVK,199 (34,40m)
K1ST, 199 (26)
ABØP, 199 (23)
KL7Y, 199 (34)
UY5XE, 199 (27)
NN7X, 199 (34)
DL3ZA, 199 (31)
OE6MKG, 199 (31)
HA8IB, 199 (2 on 15)
DK1FW, 199 (31)
OH2DW, 199 (1)
IK1AOD, 199 (1)
DF3CB, 199 (1)
UA3AGW, 198 (1, 12)
VO1FB, 198 (19, 27)
EA5BCK, 198 (27, 39)
KZ4V, 198 (22, 26)
K4PI, 198 (23, 26)
G3KDB, 198 (1, 12)
DK2GZ, 198 (1, 24)
KG9N, 198 (18, 22)
KM2P, 198 (22, 26)
GM3YOR, 198 (12, 31)
DKØEE, 198 (19,31)
KØSR, 198 (22, 23)
K3NW, 198 (23, 26)
WB6OKK, 198 (22, 37)
S57J, 198 (2,26)

The following have qualified for the basic 5 Band WAZ Award:

IN3ZNR, 178 Zones

Endorsements:

N6HR, 193 Zones
ES1RA, 200 Zones

1020 Stations have attained the 150 Zone level as of September 30, 1996.

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Manager, Jim Dionne, K1MEM, 31 DeMarco Road, Sudbury, MA 01776. The processing fee for all *CQ* awards is $4.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $10.00 for nonsubscribers. Please make all checks payable to the Award Manager. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. Questions regarding the WAZ Award may be sent to K1MEM with an SASE.

The WAZ Program

Single Band WAZ

15 Meter SSB

498 .....IV3TIQ

17 Meter SSB

11 .....I2EOW

20 Meter SSB

990 .....9K2HN
991 .....AB7AU
992 .....KC5HWR

20 Meter CW

469 .....SM5BRW
470 .....W6VEM

30 Meter CW

22 .....EA4AV
23 .....N6AW

All CW

97 .....KNØZ

RTTY

100 .....GM3ITN
101 .....I2EOW

160 Meter WAZ

71 .....WB9Z—39 Zone Endorsement
73 .....ON4ACG—40 Zone Endorsement
98 .....KE9A—31 Zones New
99 .....VA3DX—31 Zones New
100 .....SM3EVR—40 Zones New
101 .....G4BWP—35 Zones New
102 .....SP5EWY—40 Zones New
103 .....W8XD—30 Zones New

All Band WAZ SSB

4350 .....JA7ASD
4351 .....UA4SKW
4352 .....WR5Y
4353 .....ON4CM
4354 .....KNØZ
4355 .....IK4QJH
4356 .....DF2UD
4357 .....WA4AYC

CW/Phone

7705 .....IKØLWP
7706 .....DL1JDK
7707 .....KNØZ
7708 .....S52DD
7709 .....G3HQX
7710 .....NN7A (CW)
7711 .....S53EO

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Manager, Jim Dionne, K1MEM, 31 DeMarco Road, Sudbury, MA 01776. The processing fee for all *CQ* awards is $4.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $10.00 for nonsubscribers. Please make all checks payable to the Award Manager. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. Questions regarding the WAZ Award may be sent to K1MEM with an SASE.

were fighting Tibet soldiers in that part of the country. Harold repaired the balky transmitter, and using the self-assigned callsign of AC4AA, he became the first DXer to operate from Tibet. In 1936 Lieutenant Evan Nepean, G5YN, was the signal officer assigned to the British mission in Lhasa. Evan had to walk into Nepal from the end of the railroad, taking a month to complete the trip. Evan then assigned himself the callsign AC4YN and gave out rare Tibet contacts during his 18-month tour of duty.

Evan's replacement was Reg Fox, who had been operating from India under the callsign VU2DR. Reg operated under Evan's AC4YN callsign for a couple of years, but his 7 watt transmitter was seldom heard outside of Asia. Reg did work John Hunter, G2ZQ, and Fumio Horiguchi, J5CC, and made exactly three contacts with the US, including one with Doc Stuart, W6GRL. These three DXers thus worked their 40th zone for the rarest of all DXers' awards—pre-World War II Worked All Zones!

Another reason why Tibet carries a special place in amateur radio history is that it was "the jewel in the crown" for the Worked All Zones program from *CQ* magazine. Zone 23 quickly became the most difficult zone to work and confirm. In additional to Tibet, Zone 23 includes Mongolia JT, tiny Tuva UAØY, and some call areas in China. There wasn't any amateur radio in the other countries in Zone 23, so DXers were especially anxious to work Tibet.

Other pre-war operations from Tibet included those by J. Schultz, AC4JS, and Sakea Tamogami, J7GG. Reg Fox returned to Tibet in 1945 and operated again

CQ DX Honor Roll

The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more ACTIVE countries for the mode indicated. The ARRL DXCC Countries List is used as the country standard. Honor Roll listing is automatic when submitting application or endorsement for 275 or more countries. Deleted countries do not count and are dropped from listing as they occur. Currently there are 326 countries. To remain on the CQ DX Honor Roll, annual updates are required. Honor Roll updates may be made at any time, in any number. Updates indicating "no change" will be accepted to meet the annual requirement. All updates must be accompanied by an SASE for confirmation. The fee for endorsement involving the issuance of a sticker is $1.00.

CW

K2TQC 328	KB8DB 327	K9IW 326	K4IQJ 325	W1WAI 322	W3BBL 315	K4CXY 309	WG5G/QRPp 301	DJ1YH 288
K1MEM 328	N4MM 327	YU1HA 326	F3TH 324	K2JLA 322	N4AH 315	K4JLD 309	W6YQ 301	YU7FW 286
K2FL 328	K6LEB 327	I5XIM 326	K8LJG 324	KA5TQF 322	K2JF 314	VE9RJ 309	YU1TR 300	F6HMJ 284
K9BWQ 328	W9DWQ 326	IT9TQH 326	IT9QDS 324	AA5NK 321	AA2X 314	I1EEW 307	YU2TW 299	KF5PE 282
K2ENT 328	DL1PM 326	WA4IUM 326	W6DN 324	ON4QX 321	4N7ZZ 314	N1HN 307	YV5ANT 299	W4UW 279
DL8CM 328	K9MM 326	WA8DXA 326	WØJLC 324	K9QVB 321	W5OG 313	N3DQN 306	N4OT 299	I2EOW 278
N7RO 328	K2OWE 326	N5FW 326	W7CNL 324	HA5DA 321	WB4UBD 313	N5HB 306	KØHQW 296	KB8O 276
WØIZ 328	K4CEB 326	EA2IA 326	KB4HU 324	WB5MTV 321	KA7T 313	I4LCK 305	KH6CF 294	WG7A 276
G4BWP 328	KD8V 326	W7OM 326	W7ULC 323	IK2ILH 321	K9DDO 312	HB9DDZ 305	YU1AB 294	LU3DSI 275
K6JG 328	9A2AA 326	WØHZ 326	WA4JTI 323	K1HDO 321	WB4DBB 312	CT1YH 305	K7EHI 293	
I4EAT 328	N4KG 326	N6AR 325	W4OEL 323	IT9ZGY 320	K1VHS 311	OZ5UR 304	KE5PO 293	
SM6CST 328	OK1MP 326	K8NA 325	KUØS 323	N5FG 319	G3KMQ 311	G2FFO 303	K8JJC 290	
W2UE 328	PAØXPQ 326	KZ4V 325	DJ2PJ 323	N6AV 318	WA8YTM 311	K7JYE 302	IKØADY 290	
W2FXA 328	N4JF 326	I1JQJ 325	AG9S 322	VE7DX 318	N6AW 311	W7IIT 302	LA7JO 289	
K3UA 327	W9WAQ 326	IT9VDQ 325	NC9T 322	VE7CNE 317	OH3NM 310	WA4DAN 301	9A2AJ 289	
N7MC 327	AA4KT 326	W8XD 325	DL3DXX 322	N6CW 316	WB6OKK 310	HA5NK 301	G4MVA 289	

SSB

K4MZU 328	KB8DB 327	SV1ADG 326	IK8CNT 325	K9HQM 323	G4ADD 320	N5HSF 316	EA3CB 308	N6ITW 291
K2TQC 328	VE3MR 327	CX2CB 326	AI8M 325	KC5P 323	I4WZK 320	KB1HC 316	AB4IQ 307	YB1RED 291
K2FL 328	VE3MRS 327	TI2CC 326	W4UW 325	WDØGML 323	I4SAT 320	KV2S 315	W9IL 307	DJ2UU 291
DJ9ZB 328	OE2EGL 327	WA4ECA 326	WB6OKK 325	WW1N 323	I8LEL 320	WA9RCQ 315	N6AV 306	WA3KKO 290
EA2IA 328	K8CSG 327	IØZV 326	VE2PJ 325	K4SBH 323	K4JLD 320	N3ARK 315	TI2TEB 306	N5QDE 290
K2ENT 328	K1UO 327	I4LCK 326	I8LEL 325	WB2JZK 323	WE2L 320	KA4RAW 315	VE3DLR 306	OE7KWT 290
OZ5EV 328	DL9OH 327	K7EHI 326	K7LAY 325	CE7ZK 323	EA3EQT 320	K2AJY 315	W3YEY 306	4X6DK 290
VE1YX 328	WB4UBD 327	IKØIOL 326	IT9ZGY 325	K2ARO 323	WS9V 320	K7TCL 315	KF8UN 306	IK2PZG 289
W6EUF 328	K7LAY 327	IT9TGO 326	IT9TQH 325	LU7HJM 323	KU9I 320	NØAMI 314	XE1MDX 305	KF7VC 288
K2JLA 328	W2FXA 327	ZL1HY 326	K6LEB 325	KA9I 323	KE3A 320	OE6CLD 314	W6SHY 305	OK1AWZ 287
N7RO 328	W9DWQ 326	YU1HA 326	I2EOW 325	4N7ZZ 323	KD8IW 320	W5RUK 314	DK5WQ 305	IK2DUW 287
K6YRA 328	W9SS 326	W4NKI 326	IK1GPG 325	N5FG 323	AB7AU 320	N6RJY 314	EA5OL 305	W5OXA 287
W6BCQ 328	WA4IUM 326	KZ4V 326	I1JQJ 325	WN5IJZ 322	VE4ACY 320	DL3DXX 314	G4NXG/M 304	IK8BMW 286
K5OVC 328	WB1DQC 326	VE3GMT 326	VE7WJ 325	YV5IVB 322	ON5KL 319	OH5KL 313	KJ6HO 304	TU2QW 286
KZ2P 328	XE1AE 326	W4EEE 326	AI8S 325	XE1CI 322	WA4DAN 319	WDØDMN 313	VE3CKP 304	NM5O 285
VE7DX 328	KA3HXO 326	KE4VU 326	K1HDO 325	WB4PUD 322	KI3L 319	KD9CN 313	WB2NQT 303	EA1AYN 285
AA6BB 328	VE3XN 326	AG9S 326	KC8EU 324	LZ1HA 322	VE3HO 319	K1VHS 313	EA3CWK 303	EA3BT 285
EA4DO 328	YS1GMV 326	WA4WTG 326	N4KEL/M 324	ZS6AOO 322	XE1MD 319	OA4QV 313	WA9BDX 302	LU3HBO 284
ZL3NS 328	K9MM 326	WD8PUG 326	IK8BQE 324	WA5HWB 322	KB1JU 319	EA1JG 313	WA8MEM 302	KQ4WD 284
K6JG 327	ZL1AGO 326	W2CC 326	AA5NK 324	N2VW 322	WA5HWB 319	W1LQQ 313	KD4YT 302	IK2HBX 284
WA6OET 327	KF7SH 326	VE2WY 326	K2JF 324	TI2JJP 322	YV1AJ 319	I4CSP 313	CT1YH 302	KE6CF 283
SM6CST 328	ZS6LW 326	IT9TGO 326	WB5TED 324	W5XQ 321	PY2DBU 319	K4LR 312	RA2YA 301	N6CFQ 283
W3GG 328	VK4LC 326	AA4KT 326	W2FGY 324	KA5TQF 321	IØSGF 319	ZL1BOQ 312	W2LZX 301	YC3OSE 282
I4EAT 328	YV1AIP 326	PT2TF 326	YV1CLM 324	TI2HP 321	K9QVB 318	WA9IVU 311	XE2DU 301	VE7HAM 281
W4UNP 328	K9IW 326	KM2P 326	YV5CWO 324	I8XTX 321	KB5FU 318	KD5ZD 312	AB4NS 301	WZ3Z 282
YU1AB 328	WA4JTI 326	N5FW 326	W5LLU 324	I8YRK 321	AA4AH 318	ZS6BBY 311	WP4AFA 300	WN6J 281
F9RM 328	YV1AJ 326	I1EEW 326	I8KCI 324	K4PQV 321	G4GED 318	IN3ANE 311	YU2TW 300	YU1TR 280
PY4OY 328	YV1KZ 326	K9HDZ 326	I1POR 324	KS2I 321	W6NLG 318	F1OZF 311	AB4UF 300	KK4TR 280
OZ3SK 328	W9OKL 326	WA3HUP 326	VE4AT 324	OA4OS 321	IK8GCS 318	EI6FR 311	WB4UHN 300	KN4RI 280
XE1L 328	9A2AA 326	LA7JO 326	DU9RG 324	W7ULC 321	W6MFC 318	WA2FKF 311	KB8NTY 300	WØIKD 279
4Z4DX 328	KD8V 326	YV1CLM 326	KD5ZM 324	W3AZD 321	KF5AR 318	KQ4GC 311	YT7TY 300	EA3CWT 278
CX4HS 328	DL6KG 326	N6AW 326	KØHQW 324	WØULU 321	I8IYW 318	YZ7AA 311	KG6LF 300	WN5MBS 277
N4MM 328	KSØZ 326	ZP5JCY 326	W7FP 324	KB8O 321	NI5D 318	WA5SUE 311	WB6GFJ 299	VE2DRN 277
OE3WWB 328	N4KG 326	K5TVC 326	KA5TTC 324	OE7SEL 321	WA8YTM 318	KD5ZD 310	VE3CKP 299	GØLRX 277
IK1GPG 328	OK1MP 326	KB7VD 326	KE5PO 324	VE2GHZ 321	W6SHY 318	KA5RNH 310	EA5GKE 298	KC6AWX 276
K4MQG 328	W6DN 326	WB3DNA 325	WB4DBB 324	WDØBNC 321	F6BFI 318	I2MQP 310	KJ9N 298	OA4EI 276
K3UA 327	I2QMU 326	I8ACB 325	K4JLD 324	CT1EEB 321	WB6PSY 317	HA6NF 310	KB5WQ 294	NC3C 275
K9BWQ 327	PAØXPQ 326	N6AR 325	KB2MY 324	LU1JDL 320	9H4G 317	KF7RU 310	IT9VDQ 293	F5NBX 275
WØYDB 327	N4JF 326	WD8MGQ 325	EA3BKI 324	KF8VW 320	WA6DTG 317	EA5RJ 309	KJ5LJ 293	VE2AJT 275
W7OM 327	KB4HU 326	K8LJG 325	K8YVI 323	IØAMU 320	W8AXI 317	CT1AHU 308	TI2LTA 292	US1IDX 275
WB3CQN 327	KC4MJ 326	K8NA 325	NC9T 323	K4CXY 320	XE1XM 317	K4JDJ 308	K2EEK 291	

RTTY

K2ENT 321	NI4H 299	EA5FKI 284	K3UA 283	I1JQJ 273	W4EEU 269	KE5PO 263	G4BWP 256	KB8DB 255
WB4UBD 304								

as AC4YN. In 1946 Doc Stuart, W6GRL, was the first US amateur to make a contact with Tibet after the war, when he caught up with Reg Fox. Reg became the best shot at Zone 23 contacts for the next 14 years. There were a couple of other amateurs in Tibet, including Chak, AC4NC, at the Indian Embassy and Bob Ford, AC4RF, who operated in later years from Sikkim as AC3SS.

Following the invasion of Tibet by the Chinese in 1950, amateur radio activity in Tibet essentially ceased. Chak, AC4NC, kept a low profile at the Indian Embassy, shutting down his station for the next two years. When Chak left Tibet in 1953, all chances of a contact with Tibet were gone.

In 1957 Deb Shankar, VU2AX, arrived at the Indian Embassy. He operated as AC4AX for the next few years, again providing DXers with the best shot at Zone 23. China formally annexed Tibet in 1965, ending any hope DXers might have had to work the country. In 1974, reflecting political realities, the ARRL deleted Tibet from the list of current DXCC countries. (Fortunately for WAZ chasers, JT1AA came on the air from Mongolia in 1951, providing an alternative for Zone 23. China would not permit amateur radio until 1982.)

The Chinese staged a couple of special operations from Tibet, including BTØNMN from the vicinity of Mount Everest in 1987, and BTØLS and BTØZML in 1987. However, Tibet remains one of the most sought-after contacts in the long history of DX.

Special thanks to Jan Perkins, N6AW, for his fine book on Don Wallace, W6AM, which provided much of this history.

Islands On The Air

The *1997 RSGB IOTA Directory and Yearbook* is now available. The directory is a major step forward for the Islands On The Air program, now one of the most popular DXing programs. The directory includes the Honour Roll and Annual Listing, as well as the results of the previ-

QSL INFORMATION

1B1AD to DK7ZZ
3D2PN to OH5UQ
3D2RW to ZL1AMO
3ZØPEA to SP1NQF
4F4IX to DU4IX
4J3M to UD6DJ
4K8F to UA9AB
4L1DX to OZ1HPS
4L5A to IK3HHX
4L8A to OZ1HPS
4L8P to OZ1HPS
4M5LR to WS4E
4N1Z to YU1AVQ
4S7DA to W3HNK
4X1VF to K1FJ
5N3/SP5XAR to SP5CPR
5V7MD to AB7BB
5WØAN to DF8AN
5WØBS to AA8HZ
5WØDG to AA8HZ
5WØJB to AA8HZ
5WØKI to JE4IVL
5WØTR to AA8HZ
6W1/N2WCQ to PA3BUD
7Z1AB to KN4F
7Z5OO to W1AF
9A3NR to WA4JTK
9A4A to 9A4AA
9G1BJ to G4XTA
9G1YR to G4XTA
9HØA to LA2TO
9H3ON to PA3BIZ
9H3TZ to DL7VRO
9H3UD to DL8OBC
9H3UJ to PA3CRA
9H3UK to PA3DES
9J2SZ to SP8DIP
9K2MU to WA4JTK
9M2JJ to SMØOEK
9M6AG to JA9AG
9M8BC to HL5AP
9M8HIM to 9M8DB
9N1ARB to KV5V
9N1RHM to KV5V
A35PM to OH5UQ
A92FZ to W3HCW
A92GF to EA7FR
AH4/AHØW to KE7LZ
BØØKS to BV2KI
BV4MU to KA6SPQ
BV5CN to AA6BB
C5ØA to 6W6JX
C5ØBI to 6W6JX
C6AIE to WZ8D
CO3ZD to CT1ESO
CO6RQ to W3HCW
CU7R to CU7AA
D2FIB to SMØFIB
D68DV to DL4XS
D68XS to DL4XS
E21CJN to K3WUW
ED9IA to EA7ESH
EG1US to EA1MC
EK4JJ to GW3CDP
EL2/K4YT to W2TK
EM1KA to 9H3UP
EM8W to UY5XE
ER5AA to I8YGZ
ES96I to ES4RM
ES96M to ES1QD
ES96Q to ES5DE
EU1ØC to SP8JM
EU3FT to W3HCW
EX8F to DL8FCU
FG5HR to F6BUM
FM5CD to F5VU
FM5GU to WA4JTK
FOØCAA to CX3CE
FOØREB to CX4CR
FO5PI to F5OTZ
FP5CJ to VE2FB
HH2AW to 9A2AJ
HL5KY to W3HNK
HSØZBI to NW3Y
HV4NAC to IKØFVC
IC8SDA to IK8CQH
IK3PQH/IL3 to IK3ABY
J87CQ to N5FTR
JD1/7J1AYK to W5VSZ
JW7QIA to LA8D
JW9THA to LA9THA
JY1 to WA3HUP
JY5HF to JY5AR
JY8FO to KA1FFO
KC6BP to AA8HZ
KC6JF to KD6BTP
KE4EKV/6W1 to PA3BUD
KG4AU to N5FTR
KHØAC to K7ZA
KH4/AHØW to KE7LZ
KH8/K8AQM to AA8HZ
MØADG to KFØUI
OD5MM to HB9CYH
OD5PN to LX9EG
OHØ/SMØIHR to SM5HJZ
OHØMB to OH1VR
OIØJWH to DJ2PJ
OIØNJV to OH3NJV
OM9SIAD to OM3TA
P29TL to KF9TH
P29WK to N3ART
P49V to AI6V
PJ2MI to K2PEQ
PZ5JB to N3BTE
R1FJZ to DF7RX
R2MWO to DL1FCM
RUØLAX to W3HCW
S21A to W4FRU
S54E to S52CD
SO6USA/1 to DL9USA
SO8HW to SP8AG
SPØPAZ to SP6PAZ
SU1JR to 9K2RA
T3ØEG to KH6JEB
T32Z to N7YL
T92M to AIØY
T94KW to HAØHW
T98BBF to OH2IC
TA2IJ to DJ9ZB
TM5FER to F6KQK
TM5SOM to F5KOU
TT8SP to F5OIJ
UAØFZ to W3HNK
UR11ØØHA to UT7DX
UR4WWT to WR3L
UXØZZ to N3IRZ
V44KJ to WB2TSL
V47YC to K6MYC
V51CM to WA2JUN
V63CO to DJ9HX
V73C to N4GAK
V73GT to WF5T
VI75RAAF to VK4LV
VI9NS to VK9NS
VKØWH to VK9NS
VK8DX to N3AHA
VK9XB to JJ1TBB
VQ9WM to K7IOO
X5ØB to YU7KMN
X5EBL to YU1FW
XE3WAO to KD8IW
XJ1CWI to VE2CWI
XT2JF to N5DRV
YB3OSE to W7TSQ
YO3AC to W3HNK
YS1ZRB to K8ZAA
YS1ZV to KB5IPQ
Z3ØSVP to Z32KV
Z31JA to WA4JTK
Z32XX to KM6ON
Z35ØDRS to Z31FK
Z37FAD to YU5FAD
ZD8DEZ to GØDEZ
ZD8Z to VE3HO
ZF2DR to K5RQ
ZF2PA to W5ZPA
ZK1AAU to AA8U
ZK1HW to I5JHW
ZK1MJZ to K8MJZ
ZK1SCH to AB7FS
ZK2PN to OH5UQ
ZP1ØØH to ZP5AA
ZS8IR to ZS6EZ

CQ DX Awards Program

SSB

2205 .....KB1HC
2206 .....3A2MD
2207 .....IK2BHX

SSB Endorsements

320 .....OE3WWB/328
320 .....IK1GPG/328
320 .....W2FXA/327
320 .....K1HDO/325
320 .....VE4ACY/320
310 .....KB1HC/316
310 .....WA5SUE/311
275 .....IK2BHX/284
275 .....WZ3Z/283

CW Endorsements

320 .....W2FXA/328
320 .....K6LEB/327
320 .....K1HDO/321
320 .....WB4UBD/313
310 .....WB4DBB/312
275 .....W4UW/279

RTTY Endorsements

300 .....WB4UBD/303
275 .....K3UA/283
275 .....NI4H/299
250 .....W4EEU/269

Total number of active countries is 328. 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 airmail reply. Please make all checks payable to the awards manager.

ous year's IOTA contest and 1997 contest rules. Also included is the growing role of the Radio Society of Great Britain (RSGB) in the IOTA program, a report on IOTA conventions and meetings, stories of new and rare IOTA DXpeditions, the Most Wanted IOTA groups, and much more. Cost of the directory is US$16, including airmail postage from the UK to the US. The RSGB can accept most credit cards. Contact the RSGB at Lambda House, Cranborne Rd., Potters Bar, Hertz EN6 3JE, England.

The DXpeditioners arrive in Tibet.

Upcoming DXpeditions

The big news this month is the second attempt to operate from Heard Island VKØ in the past two years. In last year's effort the ship operator stole the huge deposit that the DXpeditioners had paid for the charter. The DXpeditioners determined that the available ship was not up to the daunting task of transporting DXpeditioners and equipment to the remote Antarctic island.

We hope this year's attempt will succeed. Look for VKØIR for two weeks, beginning around the middle of the month. For more on the DX history of Heard Island, see the DX column in the November 1995 issue of *CQ*.

73, Chod, VP2ML

BY FREDERICK O. MAIA, W5YI

WASHINGTON READOUT

REGULATORY NEWS IN THE WORLD OF AMATEUR RADIO

Big Changes Coming To 13 cm Amateur Band

At this point it appears that the same thing that happened to the 1.25 meter (220–225 MHz) amateur band back in the late 1980s will also happen to the 13 cm band (2300–2310 and 2390–2450 MHz) in the late 1990s. That is, the band will be divided up and reallocated to different services. The Amateur Service needs the 13 cm amateur band for current and future amateur radio satellite, weak-signal, and data operations.

Like most of the amateur bands above 2 meters, the 220 MHz band was a shared band. The United Parcel Company wanted to use the 1.25 meter band to coordinate package delivery via VHF radio. The problem was that the planned narrow-band use was not compatible with amateur radio activity. Therefore, in 1988 the FCC split the band into two segments and reallocated the band to two different uses. The Private Mobile Radio Service got 220–222 MHz and the Amateur Service kept 220–225 MHz, both on a primary basis.

The amateur community certainly was not happy about losing access to 220–222 MHz. However, there were some who felt that getting 3 MHz on a "primary" basis was better than sharing 5 MHz on a "secondary" basis.

After reallocation, the 220–222 MHz band was carved up into 400 five-kilohertz-wide narrowband channels to create 200 channel pairs. The FCC awarded 220–222 MHz licenses by lottery to various local and national users. The federal government retained about a third of the 220–222 MHz channels, which eventually will be used by the Commercial Mobile Radio Service (CMRS) for mobile radio to telephone interconnection.

Spectrum Demand Far Outstrips Availability

Up until the 1980s, radio frequencies and licenses were awarded by a time-consuming, costly procedure known as the "comparative process." Basically, the FCC held hearings to determine who should get the spectrum or license. In 1982 growing frustration with the comparative hearing process led to the passage of legislation permitting the FCC to award licenses by random selection or lotteries.

At first lotteries were regarded as a success because they were faster and less burdensome on the FCC and the applicants. It wasn't long, however, before the general public became aware of the opportunity to win a potentially valuable license for a relatively nominal application fee. The FCC was inundated with applications, many from "application mills." These firms, many of questionable reputation, got into the business of marketing tens of thousands of "cookie-cutter" applications for a fee. The idea was to increase an applicant's chances of being awarded a potentially valuable piece of the radio spectrum or a license.

Because of the high volume of applications, the benefits of lotteries—that is, timeliness and lower costs to applicants and the FCC—were lost, and questions of fairness arose. Lottery winners who had no intention of using the spectrum were able to obtain huge windfall profits (often in the millions of dollars) simply by selling their licenses to firms that actually did want to enter the telecommunications business.

To many people it seemed patently unfair that enormous profits were being randomly bestowed on applicants through the sale of the "public's airwaves." Also, the transfer of these profits to a private individual or firm seemed especially ironic in view of the Federal Government's chronic budget deficits.

Frustration with the lottery experience and the potential for added revenue sources prompted the adoption of legislation authorizing the FCC to auction licenses in some services. In a nutshell, Congress believed that the United States taxpayer should be the beneficiary of any windfall, not individuals who got the spectrum free by lottery.

Thus, the comparative process of the '70s evolved into the spectrum lottery system in the '80s, and finally gave way to the spectrum auction of the 1990s as Congress began financing at least a part of the Government's budget by selling frequencies to the highest bidder. This was sort of killing three birds with one stone. The idea was that the telecommunications industry, the burgeoning federal deficit, and the public through new services would all benefit. So far this concept has yielded over $20 billion for the U.S. treasury, with billions more to come!

There certainly was plenty of "demand," but there was little "product" to sell! All of the private sector spectrum had been assigned and was now in use. The Federal Government, on the other hand, had plenty, much of it little used. They did not want to part with it at first, but Congress had the final word.

A Short Primer on Spectrum Allocation

Much of the spectrum shared on a secondary basis by the Amateur Service primarily is allocated to the feds. It is important to know that the radio spectrum is really public property. While there are exceptions (such as multiplexed digital signals and spread spectrum), as a general rule, only one radio station can operate on the same frequency and at the same time and place without interference to others.

People wishing to use radiocommunication devices in a given area must cooperate if they are to avoid interference problems. Each user, in effect, prevents other simultaneous, nearby uses of a portion of the spectrum while he or she is transmitting.

The electromagnetic spectrum is an unusual natural resource, because unlike iron, oil, or coal, it is not destroyed by use. It fact, it cannot be consumed at all! When one user stops accessing a portion of the spectrum, another can readily use it.

The spectrum is scarce because at any given time and place one use of a portion of the spectrum precludes any other use of that portion. Uncoordinated, wasteful use can easily result in everyone suffering interference that prevents satisfactory operation and denies access to new users.

The use of the radio spectrum thus must be regulated, access controlled, and rules for its use enforced because of the possibilities of interference between uncoordinated uses. Since the possible number of stations operating in a band is limited, someone must establish spectrum use standards. And because of the distances reached by some radio signals, this regulation must be national and even international in scope.

National governments enact and enforce radio laws and regulations. Generally, this regulation is performed within a framework of international agreements, both regional and global in scope. The Geneva-based International Telecommunication Union (or the ITU, as it is known) is the worldwide governing body for wire and wireless communications. This specialized agency of the United Nations consists of representatives from nearly 200 nations who meet every couple of years at World Radio Conferences to consider future telecommunications. The next is WRC-97.

The ITU was formed in the mid-1800s to facilitate the delivery of telegraphic messages across international borders. Its most important function is the allocation of radio frequencies to eliminate harmful interference between stations of different countries.

In the United States, private-sector spectrum management is managed by the Federal Communications Commission. The basic document controlling telecommunications is the Communications Act of 1934, which created the FCC.

Among its duties, the FCC allocates frequency bands for the various radio services, determines frequencies to be used by individual stations, licenses and regulates stations and operators, and regulates common carriers involved in wireless and wireline interstate and foreign communications. However, radio operations of the Federal Government are not regulated by this agency.

The act authorizes the FCC to regulate non-Federal-Government use of the radio spectrum in the public interest, but it reserves for the President the authority to assign radio frequencies for use by the Government itself. The President, in turn, has delegated this responsibility to the Secretary of Commerce and the National Telecommunications and Information

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Administration (NTIA), an agency within the U.S. Department of Commerce, which is an executive branch agency.

The NTIA coordinates the Federal Government's use of its portion of the radio spectrum with the advice of the Interdepartmental Radio Advisory Committee (IRAC). Much of the work of the NTIA and IRAC is shrouded in secrecy due to national security issues. The bottom line, however, is that the NTIA doles out spectrum allocated to the Government. Also, the NTIA is the principal adviser to the President on telecommunications and information policies.

Almost every agency of the Federal Government uses the radio spectrum in performing their mandated missions. The law enforcement agencies (the Justice, Treasury, and Interior Departments) use it for command and control of their forces, just as state and local police and fire departments do.

Park Service forest rangers use the spectrum every time they use their transportable radios for control of crowds or forest fires. The Energy Department uses it to transmit power control data and commands for their dams and power grids. The Federal Emergency Management Administration (FEMA) uses it for communications to disaster sites via emergency radio networks. The Military Affiliate Radio System (MARS), which primarily is manned by amateur radio operators, uses Government and not amateur radio frequencies.

The National Aeronautics and Space Administration uses it during satellite launches. NASA must communicate with satellites to collect data and command them. NASA also must use the spectrum to track launch vehicles and satellites and destroy them if necessary.

The biggest user of Government spectrum is, by far, the Department of Defense. Nearly half of all Government spectrum is allocated to DoD for tactical and non-tactical uses. In the United States tactical uses generally are limited to specific testing sites and training facilities, but DoD's non-tactical applications are extensive and include aircraft command and control, mobile communication in and around military bases and air fields, and long-distance communications using satellites.

There are two distinct phases to spectrum management: the allocation phase and the licensing phase. The allocation of radio frequencies consists of dividing the spectrum into a number of segments, or frequency bands. These band assignments are influenced by the behavior of radio waves at different frequencies. Specific frequencies within the band are then reserved for specific uses by individuals or firms through licensing.

In the United States radio spectrum may either be allocated to Government or non-Government use "exclusively," or to "shared use." All amateur bands above the 2 meter band (except 222 to 225 MHz) and below 24 GHz are allocated to Government Radiolocation (military radar) on a primary basis.

The ITU allocation plan divides the world into three geographical regions. Any segment of the radio spectrum can be allocated to one or more radio services, either on a worldwide or regional basis—as long as the allocation fits the general band plan agreed upon by the ITU nations. The FCC frequency allocations generally conform to those for ITU Region 2, North and South America.

A communications priority system exists when an allocation has been made to more than one service. "Primary" radio services take precedence over "secondary" services. Radio stations operating on a secondary basis cannot cause interference to primary stations, and are not protected from interference from primary services.

Spectrum Transferred To Private Sector

In the early 1990s Congress and the NTIA basically determined that the Government had more spectrum than it needed—and the private sector not enough. The Omnibus Budget Reconciliation Act of 1993 (the same legislation that authorized sale of "Vanity" callsigns) required the Secretary of Commerce to identify and transfer at least 200 megahertz of Federal Government spectrum to private sector use.

Congress also wanted fast action! The Reconciliation Act required the Secretary of Commerce to identify the potential reallocable bands of frequencies and to have specific spectrum recommendations in place within 18 months (or by February 1995). The first 50 megahertz had to be reallocated to the private sector almost immediately.

How is The Amateur Service Involved?

On February 10, 1994 the Department of Com-

merce released a report identifying the first 50 megahertz of Government spectrum that would be transferred to the private sector. The three bands were 2390–2400 MHz, 2402–2417 MHz, and 4660–4685 MHz.

The law provides for non-Government operation on Government frequencies above 25 MHz, provided the NTIA and FCC agree and harmful interference is not caused to Government stations. Even though allocated to the Government, the first two 13 cm bands were also shared by the Amateur Service on a secondary basis.

A year later (February 7, 1995) the FCC opened the 2390–2400 MHz band for use by Data-PCS devices and provided for continued use of the 2402–2417 MHz band by unlicensed Part 15 devices. The good news is that they upgraded the Amateur Service allocation in both of these bands from secondary to primary. The 4660–4685 MHz band was allocated to Fixed and Mobile Service use.

Data-PCS, by the way, is a new class of unlicensed, low-power Personal Communications Service "nomadic" digital transceivers. They include devices such as wireless LANs (local area networks), digital cordless telephones, electronic article surveillance equipment, utility metering devices, fire and security alarm devices, and wireless bar code readers.

The FCC ruled that both amateur and unlicensed Part 15 operations at 2402–2417 MHz would continue under the current rules pending an inquiry into whether any rule changes were necessary to facilitate more effective sharing. On October 25, 1996 the FCC decided that no additional sharing rules or formal coordination procedures were needed.

What About The 2300–2310 MHz Band?

The 2300 to 2310 MHz band was also reallocated to the private sector in 1995, but the FCC has not yet decided what it will do with it. In any event, a "fast track" ruling will have to be completed, since Congress wants certain 13 cm spectrum sold to the highest bidder! One theory is that it could be used for wireless Internet access that could allow mobile and portable operation. Communications experts agree that these frequencies would be perfect for nationwide mobile high-speed wireless data service—particularly Internet access—where they could significantly improve transmission quality over current cellular service.

Currently, in the United States the 2300–2310 MHz segment is allocated to the Amateur Service on a co-secondary basis along with the Government Fixed and Mobile Services which must not cause harmful interference to the Amateur Service. The primary allocation has yet to be decided.

It appears, however, that the Amateur Service will be losing access to at least a portion of this band. In a last-minute effort before adjourning, the 104th Congress passed a budget bill which requires the FCC to auction 30 megahertz of 13 cm spectrum. This bill was signed into law by President Clinton on October 4, 1996. Here is the text of the legislation.

Title III—Spectrum Provisions

Sec 3001. Competitive Bidding For Spectrum

(a.) Commission Obligation To Make Additional Spectrum Available—

The Federal Communications Commission shall—

(1) reallocate the use of frequencies at 2305–2320 megahertz and 2345–2360 megahertz to wireless services that are consistent with international agreement concerning spectrum allocations; and

(2) assign the use of such frequencies by competitive bidding pursuant to section 309(j) of the *Communications Act of 1934* (47 USC 309(j)).

(b.) Additional Requirements—

In making the bands of frequencies described in subsection (a) available for competitive bidding, the Commission shall—

(1) seek to promote the most efficient use of the spectrum; and

(2) take into account the needs of public safety radio services.

(c.) Expedited Procedures—

The Commission shall commence the competitive bidding for the assignment of the frequencies described in subsection (a)(1) no later than April 15, 1997. The rule governing such frequencies shall be effective immediately upon publication in the Federal Register. . . .

(d.) Deadline for Collection—

The Commission shall conduct the competitive bidding under subsection (a)(2) in a manner that ensures that all proceeds of the bidding are deposited in accordance with section 309(j)(8) of the *Communications Act of 1934* not later than September 30, 1997.

(Note: The bandwidth 2.310 to 2.320 GHz and 2.345 through 2.360 GHz is currently allocated to unlicensed digital satellite radio and mobile radio applications.)

It appears, then, that the Amateur Service will lose some access to the 13 cm band, but retain a portion of it on a primary basis—the same thing that happened to the 1.25 meter band nearly 10 years ago. The question remains, is it better to have a wider secondary use or a smaller primary access?

The spectrum reallocation process is far from over! The NTIA is now in the process of turning over still more Government spectrum to the private sector for reallocation. Some of it also could be spectrum that is shared by the Amateur Service. For example, the 420–450 MHz, 902–928 MHz, 1240–1300 MHz, 5.650–5.925 MHz, and 10.00–10.50 GHz amateur bands all are shared bands that are primarily allocated to Government (military) radar. Will any of these bands be on the next round of reallocations? Stay tuned!

73, Fred, W5YI

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BY GEORGE JACOBS, W3ASK

PROPAGATION

THE SCIENCE OF PREDICTING RADIO CONDITIONS

New Sunspot Cycle Brings CQ WW DX Contest SSB Weekend Much Improved Conditions!

By most accounts we are now in the beginning of a new sunspot cycle, the 23rd since telescopic records have been kept. This seemed to be very evident during the 1996 CQ World-Wide DX Contest SSB weekend. HF propagation was mostly High Normal or better, and conditions on all bands were noticeably improved over last year's WW DX SSB Contest weekend.

A considerably greater number of DX openings were reported for 15 meters, and even the 10 meter band showed signs of life again. Table I summarizes worldwide HF propagation conditions based on reports jointly made by USAF and NOAA through the Space Environmental Services Center, Boulder, Colorado, and further confirmed by early contest log returns.

Sunspot Cycle 22 Progress

The Royal Observatory of Belgium, the world's official keeper of sunspot records, reports a monthly mean sunspot number of 1.8 for September 1996. This results in a smoothed running sunspot number of 10 centered on March 1996. This was the lowest level of monthly sunspot activity since June 1986. The sun was completely spotless every day during September, except between the 1st and 4th, and on the 7th and 12th.

Canada's Dominion Radio Astrophysical Observatory in Penticton, B.C. reports a corresponding mean 10.7 cm solar flux level of 69 for September 1996. This results in a smoothed level of 72 centered on March 1996. A level of approximately 72 is forecast for January 1997. Table II is a listing of smoothed sunspot numbers observed to date for Cycle 22, the present solar cycle.

Cycle 23 Progress and Predictions for 1997

Table III presents two independent expert predictions for the end of Cycle 22 and for Cycle 23 through 1997. The first prediction is made by the National Geophysical Data Center, Boulder, Colorado (NGDC) and the second by the Space Environment Center (SEC), also located in Boulder. Both sets of predictions are based upon data observed through September 1996.

1997 HF Conditions Better Days Coming

While Table III shows a wide variation between predictions for solar activity expected during 1997, both the NGDC and SEC data agree (although the exact date cannot be confirmed for several more months) that the end of Cycle 22 took place late in 1996, and that the sunspot count will rise again during 1997. According to the NGDC, the rise of new Cycle 23 should be relatively slow, climbing from a mean level of 7 predicted for January to a level of 16 by December. The SEC prediction is far more optimistic, calling for 1997 to begin at a level of 14 and increase to 48 by December. This wide variation is an example of the difficulty even experts have in attempting to predict solar activity!

The good news is that Cycle 23 seems to have begun and that the new cycle will rise during 1997, bringing with it improved propagation conditions on the HF bands.

Here is a thumb-nail sketch of propagation conditions expected during 1997 on each amateur band between 6 and 160 meters.

6 meters: *F-2* layer ionospheric DX openings are still unlikely, although a very occasional one may be possible during the daylight hours by the end of the year. Improved short-skip openings are expected during the sporadic-*E* summer season.

10 meters: Asleep for the past few years, this band is expected to awaken during 1997 with an increasing number of DX openings during the daylight hours, especially during the equinox and winter months. Expect improved short-skip openings during the summer sporadic-*E* season.

12 meters: Should behave very much like the 10 meter band, but open somewhat more frequently and to more areas of the world.

15 meters: An increasing number of openings are expected. It should be a good band for worldwide DX during the daylight hours of 1997, particularly during the equinox and winter months. Few east-west DX openings are expected during the summer months, but regular north-south openings should be possible.

17 meters: Should behave much like 15 meters, but open more often and remain open for DX an hour or two longer.

20 meters: Increasingly improved conditions are expected on this band during the hours of daylight, with good worldwide DX openings possible throughout the year. DX conditions on this band tend to peak for a few hours after local sunrise and again during the sunset period. During the winter months some nighttime DX openings are expected. During the summer months, however, frequent early evening DX should be possible, sometimes continuing during the night. Twenty meters should be the best all-around DX band during the new year.

30, 40, 80, and 160 meters: These are basically nighttime DX bands. Exceptionally good worldwide DX should continue on 30 and 40 meters from about two hours before sunset to approximately two hours after sunrise during all seasons, and on 80 and 160 meters during the equinox and winter months.

January Conditions

With increasing solar activity expected, HF propagation on the 10, 12, 15, 17, and 20 meter bands is expected to improve compared to last

LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for January 1997

	Expected Signal Quality			
Propagation Index.....	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 4, 19, 22, 30	**A**	**A**	**B**	**C**
High Normal: 3, 10, 14-15, 20, 25, 28-29, 31	**A**	**B**	**C**	**C-D**
Low Normal: 1-2, 5-6, 9, 13, 16-18, 23-24, 26-27	**B**	**C**	**D**	**D-E**
Below Normal: 7, 11-12, 21	**C**	**C-D**	**D-E**	**E**
Disturbed: 8	**C-D**	**D**	**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 S9 and S6, with some fading and noise.

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

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.

2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any date of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be fair (C) on January 1st and 2nd, good (B) on the 3rd, excellent (A) on the 4th, fair (C) on the 5th and 6th, etc.

Geographical Area	October 26	October 27
Polar	Low Normal	Low Normal
Auroral	Low Normal	Low Normal
Middle Latitude	High Normal	High Normal
Low Latitude	High/Above Normal	High Above Normal
Equatorial	Above Normal	Above Normal
10.7 cm Radio Flux	71	72
WW Geomagnetic Ap Index	5	4

Table I– Summary of HF propagation conditions reported jointly by the USAF and NOAA during the CQ WW DX SSB Contest weekend of October 26–27, 1996.

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W - 30

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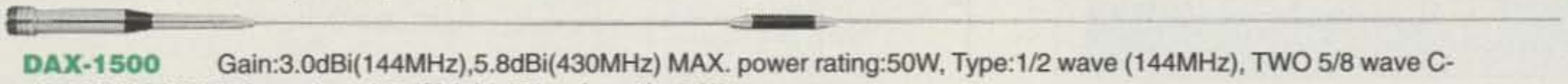
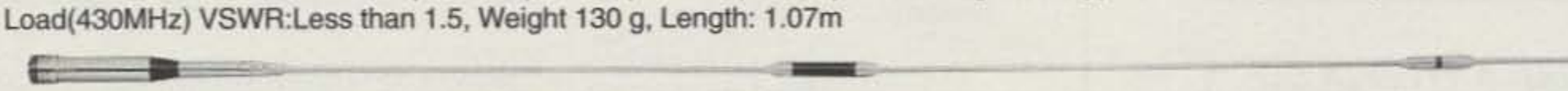


- **DAX-3500** Gain:2.15dBi(144MHz), 5.3dB(430MHz) MAX. power rating: 120W, Type: 1/2 wave, TWO 5/8 wave Phased element(430MHz) VSWR:Less than 1.5, Weight: 260g, Length:0.89m



- **DAX-1000** Gain:2.15dBi(144MHz), 5.5dBi(430MHz) MAX. power rating:50W, Type:1/2 wave (144MHz), TWO 5/8 wave (430MHz) VSWR: Less than 1.5, Weight: 120g, Length: 0.95m

- **DAX-1500** Gain:3.0dBi(144MHz),5.8dBi(430MHz) MAX. power rating:50W, Type:1/2 wave (144MHz), TWO 5/8 wave C-Load(430MHz) VSWR:Less than 1.5, Weight 130 g, Length: 1.07m

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HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular meter band (10 through 160 meters) as shown in the left-hand column of the chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate meter band column (15 through 80 meters) for a particular geographical region of the continental USA as shown in the left-hand column of the charts. An * indicates the best time to listen for 80 meter openings.

2. The propagation index is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parentheses, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of days during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) 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.

3. Times shown in the charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 AM; 13 is 1 PM, etc. In the Short-Skip Chart appropriate *standard* time is used at the path midpoint. For example on a circuit between Maine and Florida, the time shown would be EST, on a circuit between New York and Texas, the time at the midpoint would be CST, etc. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones add 2 hours in the PST zone; 3 hours in the MST zone; 4 hours in the CST zone; and 5 hours in the EST zone. Add 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 14 or 2 PM in Los Angeles; 17 or 5 PM in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *standard* time in other areas of the USA subtract 8 hours in the PST zone; 7 hours in the MST zone; 6 hours in the CST zone; and 5 hours in the EST zone. For example, at 20 GMT it is 15 or 3 PM in New York City.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts CW or 300 watts PEP on sideband; the Alaska and Hawaii Charts are based upon a transmitter power of 250 watts CW or 1 KW PEP on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 dB gain above these reference levels, the propagation index will increase by one level; for each 10 dB loss, it will lower by one level.

5. 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.

CQ Short-Skip Propagation Chart
January & February 1997
Local Standard Time
At Path Mid-Point

Band (Meters)	Distance Between Stations (Miles)			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	Nil	Nil	10-15 (0-1)	10-15 (1) 15-16 (0-1)
15	Nil	10-16 (0-1)	09-10 (1) 10-15 (1-2) 15-16 (1) 16-18 (0-1)	09-10 (1) 10-12 (1-2) 12-15 (2-3) 15-16 (1-2) 16-18 (1) 18-19 (0-1)
20	Nil	09-10 (0-1) 10-12 (0-2) 12-14 (0-3) 14-16 (0-2) 16-20 (0-1)	07-08 (0-1) 08-09 (0-2) 09-10 (1-4) 10-12 (2-4) 12-14 (3-4) 14-16 (2-4) 16-17 (1-3) 17-18 (1-2) 18-22 (1)	07-08 (1) 08-09 (2-3) 09-11 (4) 11-14 (4-3) 14-16 (4) 16-17 (3-4) 17-18 (2-3) 18-19 (1-2) 19-20 (1)
40	07-09 (0-1) 09-10 (1-3) 10-11 (3) 11-15 (3-4) 15-16 (3) 16-18 (1-2) 18-20 (0-1)	07-08 (1-2) 08-09 (1-3) 09-11 (3-4) 11-15 (4-3) 15-16 (3-4) 16-18 (2-3) 18-20 (1-2) 20-02 (0-2)	07-08 (2) 08-09 (3-1) 09-11 (4-1) 11-15 (3-1) 15-16 (4-2) 16-18 (3-4) 18-20 (2-4) 20-02 (2-3)	07-08 (2-1) 08-15 (1-0) 15-16 (2) 16-18 (4-3) 18-20 (4) 20-02 (3-4) 02-04 (2-3) 04-07 (2)
80	07-08 (1-2) 08-09 (3-4) 09-18 (4) 18-19 (2-3) 19-21 (1-2) 21-06 (0-1) 06-07 (0-2)	07-08 (2) 08-10 (4-2) 10-16 (4-1) 16-18 (4-2) 18-19 (3-4) 19-21 (2-3) 21-06 (1-3) 06-07 (2)	07-08 (2-1) 08-10 (2-0) 10-16 (1-0) 16-18 (2-1) 18-19 (4-3) 19-21 (3-4) 21-06 (3) 06-07 (2)	07-08 (1) 08-16 (0) 16-18 (1-0) 18-19 (3-2) 19-21 (4) 21-03 (3) 03-06 (3-2) 06-07 (2-1)
160	17-19 (3-2) 19-05 (4) 05-07 (3) 07-09 (2-1) 09-17 (1-0)	17-18 (2-1) 18-19 (2) 19-21 (4-3) 21-05 (4) 05-06 (3) 06-07 (3-1) 07-09 (1-0)	17-18 (1-0) 18-19 (2-1) 19-21 (3-1) 21-03 (4-3) 03-05 (4) 05-06 (3-2) 06-07 (1) 07-08 (1-0)	18-19 (1-0) 19-21 (2-1) 21-03 (3) 03-05 (4-2) 05-06 (2) 06-07 (1-0)

ALASKA
January & February 1997
Openings Given in GMT

To:	*15 Meters*	*20 Meters*	*40 Meters*	*80 Meters*
Eastern USA	21-23 (1)	18-22 (1) 22-00 (2) 00-01 (1)	03-10 (1) 10-12 (2) 12-13 (1)	07-11 (1)
Central USA	20-23 (1)	18-22 (1) 22-00 (2) 00-02 (1)	03-11 (1) 11-13 (2) 13-14 (1)	07-11 (1)
Western USA	20-21 (1) 21-23 (2) 23-00 (1)	17-18 (1) 18-22 (2) 22-00 (3) 00-01 (2) 01-03 (1)	02-03 (1) 03-04 (2) 04-06 (3) 06-14 (1) 14-15 (2) 15-16 (3) 16-17 (1)	05-12 (1) 12-14 (2) 14-15 (1) 12-14 (1)*

HAWAII
January & February 1997
Openings Given in Hawaiian Standard Time

To:	*15 Meters*	*20 Meters*	*40 Meters*	*80 Meters*
Eastern USA	07-10 (1) 10-12 (2) 12-13 (3) 13-14 (2) 14-15 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-15 (3) 15-16 (2) 16-17 (1)	17-19 (1) 19-21 (2) 21-00 (3) 00-03 (2) 03-04 (1)	19-21 (1) 21-01 (2) 01-03 (1) 23-02 (1)*
Central USA	11-13 (1)** 07-09 (1) 09-11 (2) 11-13 (3) 13-15 (2) 15-16 (1)	06-07 (1) 07-10 (2) 10-13 (1) 13-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	17-19 (1) 19-20 (2) 20-03 (3) 03-04 (2) 04-06 (1)	19-20 (1) 20-22 (2) 22-01 (3) 01-03 (2) 03-05 (1) 23-03 (1)*
Western USA	11-14 (1)** 07-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-08 (2) 08-10 (4) 10-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	16-18 (1) 18-19 (2) 19-22 (4) 22-02 (3) 02-04 (2) 04-08 (1)	19-20 (1) 20-22 (2) 22-04 (3) 04-05 (2) 05-07 (1) 22-05 (1)*

 # See time conversions for use in other time zones in "How To Use Short-Skip Charts," appearing in the box at the beginning of this column.
** Indictaes best time for 160 meter openings.*
*** Indicates best time for 10 meter openings.*
For 12 meter openings interpolate between 10 and 15 meter openings.
For 17 meter openings interpolate between 15 and 20 meter openings.
For 30 meter openings interpolate between 40 and 20 meter openings.
Note: The Alaska and Hawaii Propagation Charts are intended for distances greater than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

Month	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Jan.		18	58	142	151	148	124	71	37	24	11
Feb.		20	65	145	151	148	116	69	35	23	10
Mar.		22	71	150	152	147	108	67	34	22	10
Apr.		24	78	154	149	146	103	64	34	21	
May		26	84	157	147	146	100	60	33	19	
June		28	94	158	144	145	97	56	31	18	
July		31	104	159#	141	146	91	55	29	17	
Aug.		35	114	158	141	147	84	52	27	15	
Sept.	12	39	121	157	142	145	80	49	27	13	
Oct.	13	44	125	157	142	142	76	45	27	12	
Nov.	15	47	130	158	142	138	74	41	26	11	
Dec.	16	51	138	154	144	132	73	39	26	11	

Table II– Progress of sunspot Cycle 22 from September 1986 to March 1996. The peak of Cycle 22 is shown with #.

January, while conditions on 30, 40, 80, and 160 meters should remain about the same as last January.

Atmospheric noise levels (static) are expected to be at their lowest values of the year in the northern hemisphere during January, and signal levels on all bands are expected to be exceptionally strong during most openings.

10 and 12 meters: DX openings should be possible to southern and tropical regions during the daylight hours, with signals peaking during the afternoon. An occasional opening towards Europe and the east may be possible between 8 and 11 AM, and towards the Far East during the late afternoon. Some short-skip openings, between approximately 1300 and 2300 miles, are also forecast for the afternoon hours.

17 and 15 meters: Good 15 and 17 meter DX openings are forecast to many areas of the world during the hours of daylight. Fairly consistent short-skip openings, as a result of regular F-layer reflection, are also expected during the daylight hours for distances ranging between approximately 1000 and 2300 miles.

20 meters: Openings to most areas of the world are forecast for 20 meters sometime between sunrise and the late afternoon hours. Signals are expected to peak for about an hour or two after sunrise and again during the afternoon. Good short-skip openings over distances ranging between 750 and 2300 miles should be possible. Occasionally the band should remain open toward southern and tropical areas into the evening hours.

30 and 40 meters: DX openings should begin during the late afternoon hours, with conditions peaking during the hours of darkness and at sunrise. Both bands may remain open for DX for as long as two hours or so after local sunrise. Atmospheric noise, or static, should remain at low seasonal levels during the month, and signals often may be exceptionally strong. Good short-skip openings are also forecast during the hours of daylight over distances ranging between approximately 150 and 750 miles. As darkness falls, the short-skip range should increase to between 1000 and 2300 miles.

80 meters: With low static levels continuing through the month, fairly good DX openings are expected to many areas of the world during the hours of darkness. During the daylight hours short-skip should be possible up to about 300 miles. During the hours of darkness, the skip should increase, with openings possible between distances of approximately 400 and 2300 miles. It may be a toss-up between 80 and 40 meters for the best DX band openings during the late evening and early morning hours.

160 meters: A considerable improvement is expected in propagation conditions on this band during January. Fair DX openings are forecast to many areas of the world from a few hours after sundown to shortly after sunrise. Short-skip openings up to 2300 miles should also be possible during the hours of darkness. Because of extremely high solar absorption in this frequency range, even during the periods of low sunspot activity ionospheric propagation generally is not possible on 160 meters during the daylight hours.

Remember the following rule for 30, 40, 80, and 160 meter DX openings. Conditions on these bands maximize as the sun rises on the eastern terminal of a path. For example, for openings between North America and Europe, conditions should be optimum as the sun rises in Europe. For openings between the South Pacific and North America, look for the strongest signals as the sun rises over North America.

Month	1996 NGDC	1996 SEC	1997 NGDC	1997 SEC
Jan.			7	14
Feb.			7	16
Mar.			8	17
Apr.	9	8	8	19
May	9	7	9	21
June	9	7**	10	24
July	8	7	11	26
Aug.	8	9	12	30
Sept.	7	10	13	34
Oct.	7	11	13	38
Nov.	6*	11	15	43
Dec.	6*	12	16	48

*Table III– Predicted mean smoothed sunspot numbers for the end of Cycle 22 and for the new Cycle 23, through 1997. An * indicates the beginning of Cycle 23 as predicted by the National Geophysical Data Center (NGDC), Boulder. An ** indicates the prediction made by the Solar Environment Center (SEC), Boulder.*

VHF Ionospheric Openings

There is a fairly good chance for some meteor-scatter-type openings during the first week of January when the *Quadrantids* meteor shower is expected to take place. This is usually a major shower, and it should peak on the 1st and 2nd with about 30 to 40 meteors entering the Earth's atmosphere each hour.

January is generally a poor month for VHF ionospheric propagation. Auroral activity is usually at a low seasonal level, and there is little sporadic-*E* activity expected. The best bet for ionospheric openings is on days when HF conditions are expected to be Below Normal or Disturbed. These appear in the Last-Minute Forecast at the beginning of this column.

Short-Skip Charts

This month's column contains a Short-Skip Propagation Chart for use between distances of approximately 50 and 2300 miles. Special charts for use between the mainland and Alaska and Hawaii are also included. Instructions for use of these charts are given elsewhere in this column. DX charts for January appeared in last month's column.

73, George, W3ASK

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(continued on page 115)

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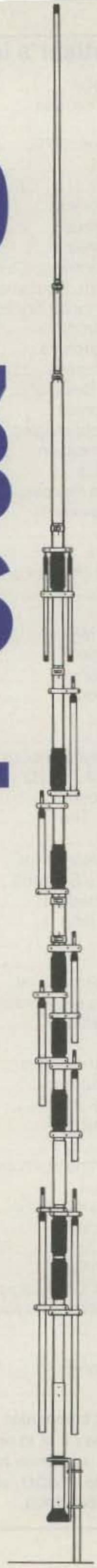

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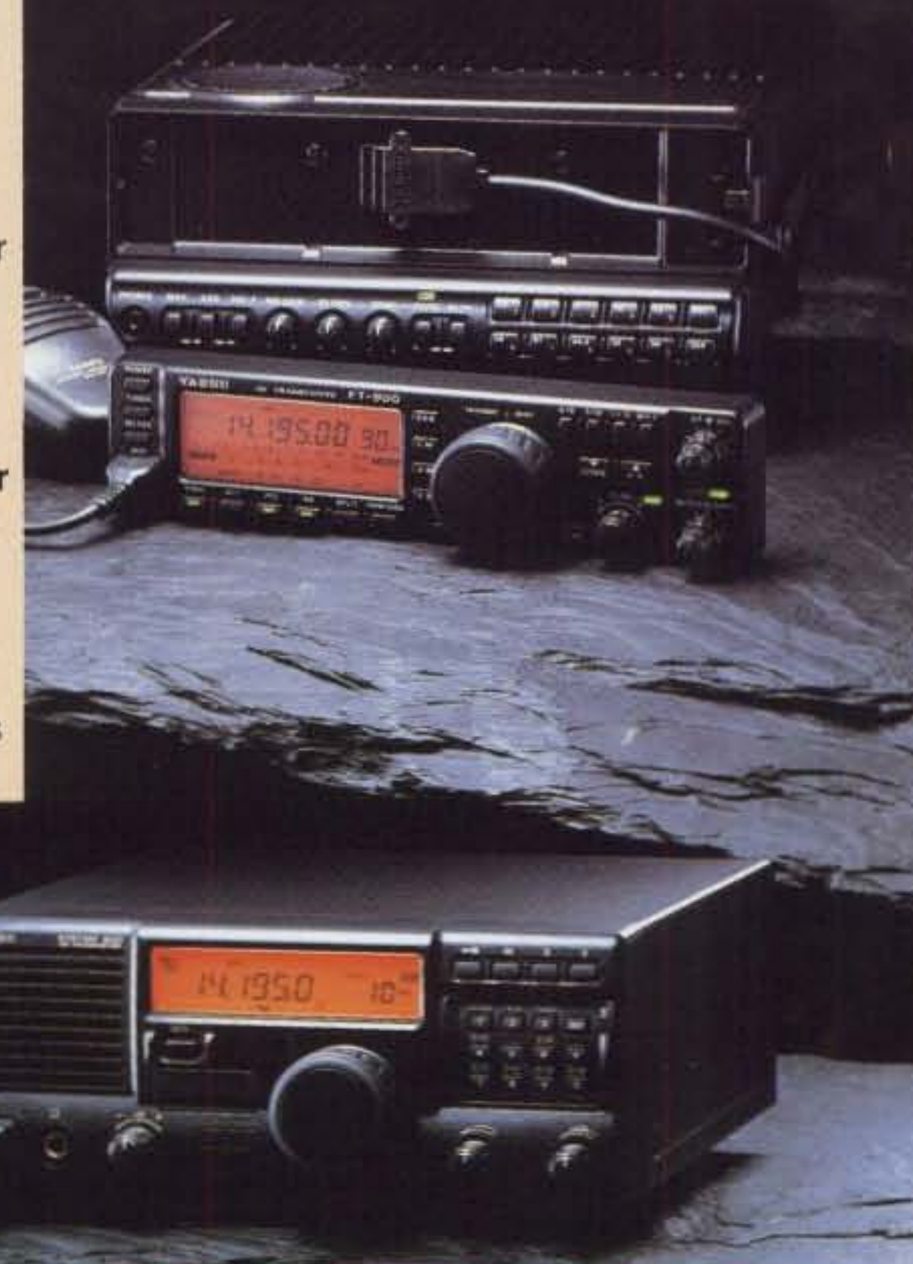

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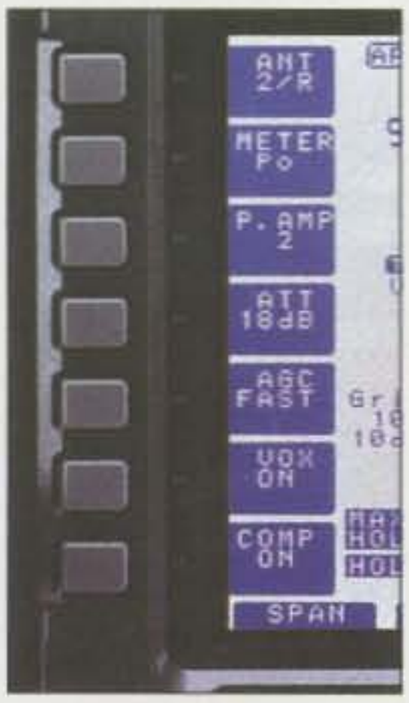
- 4.9" Concentrated Information LCD Display with dot matrix characters
- 5-100 variable-control watts of 100% stable output power (5-40 W on AM)



☞ *Large soft key buttons allow for on-screen control of alphanumeric naming, programmable "memo-pad" info, attenuation levels, antenna selection, AGC speed, and more!*

- SSB/AM/FM/CW/RTTY
- Fast, built-in automatic antenna tuner with preset 100 kHz steps
- Dual watch
- Twin passband tuning
- 101 memory channels
- 13.8 volt operation

IF-DSP

New, adjustable IF-DSP on transmit and receive! Bring in signals crisp & sharp, and send clean for improved QSOs.

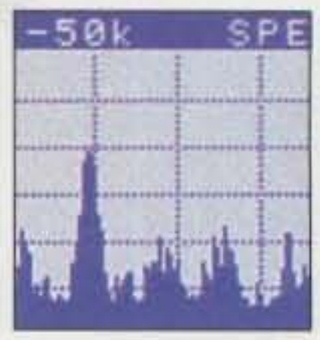
- Noise reduction
- IF notch filter (auto or manual)
- Selectable Audio Peak Filter (APF)
- Phase Shift Network (PSN) modulation/demodulation

plus:

- **PC programmable†:** ICOM's CI-V interface is built-in
- High-performance memory keyer

PC Ready!

☞ *Use the IC-756's LCD spectrum scope to visually find nearby airwave activity! The displayed info scrolls as the frequency changes!*



- Level/width noise blanker controls
- Speech synthesizer
- CW announcements to aid the visually impaired

VALUE

Step up to a higher performance rig. The IC-756 is built 100% ICOM reliable, and it's priced only slightly higher than other models with far fewer features.

Call ICOM's brochure hotline today at 206-450-6088 or plan to visit your ICOM dealer soon!

Available in early 1997*

*This device has not been approved by the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased until the approval of the FCC has been obtained.
† Option CT-17 required. Questions? Contact ICOM Technical Support in the HamNet forum on CompuServe @ 77540,525 (Internet:75540.525@compuserve.com) ©1996 ICOM America, Inc. The ICOM logo is a registered trademark of ICOM, Inc. All specifications subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 756CQ1196Y

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