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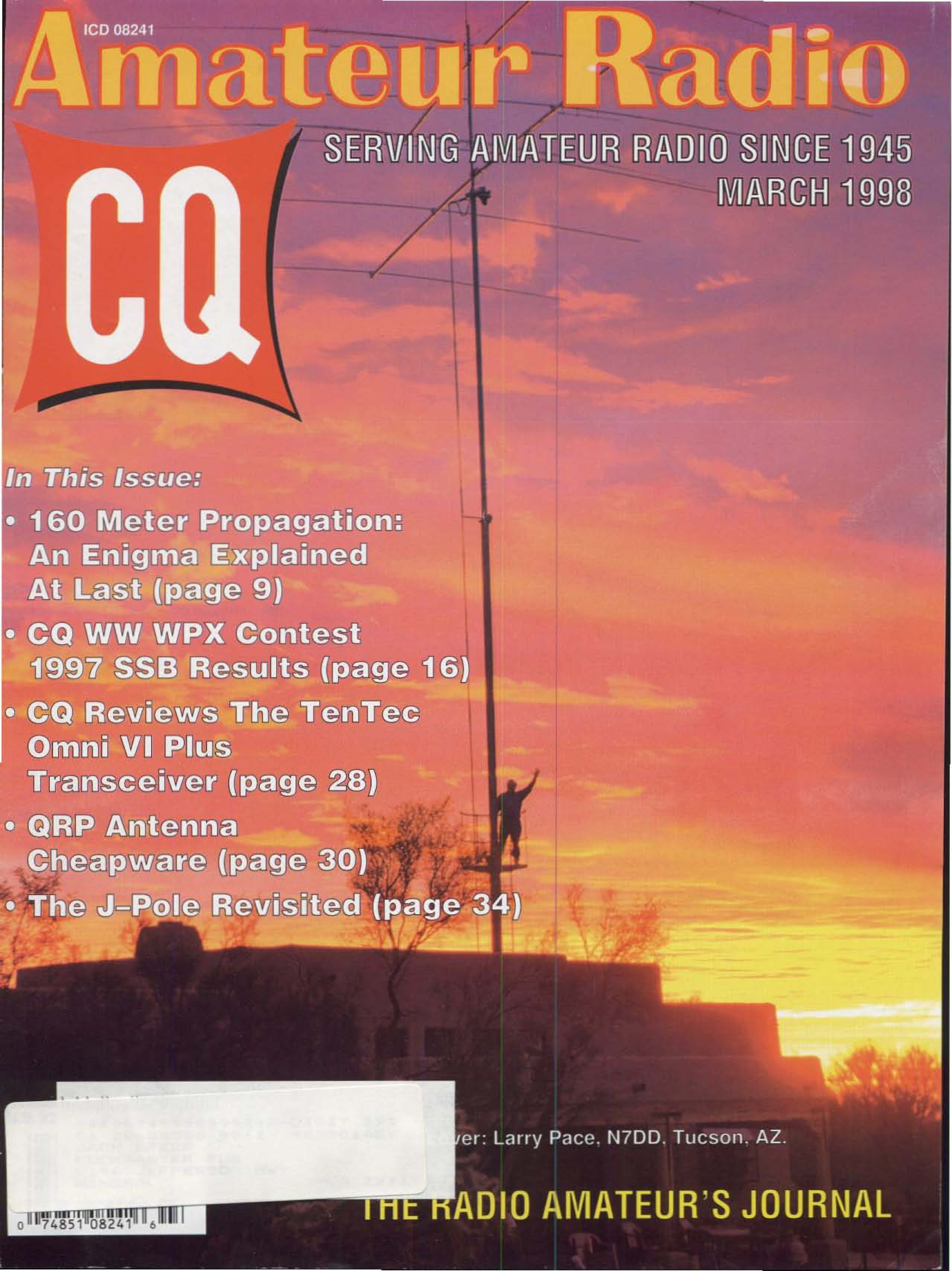
Amateur Radio

CQ

SERVING AMATEUR RADIO SINCE 1945

MARCH 1998



In This Issue:

...ver: Larry Pace, N7DD, Tucson, AZ.

THE RADIO AMATEUR'S JOURNAL

The Performance Tribander for the DX Years Just Ahead

- **New High Efficiency Computer Optimized Design for Maximum Gain and Ultra Clean Radiating Pattern**
- **100+ MPH Construction for Best Reliability and Long Life**
- **NEW *4L Log Cell* Driven Elements for better VSWR Bandwidth**
- **Trapless Driven Elements and Reflectors for Reliable Power Handling**
- **Interleaved Element Design for Mono-Band Performance**
- **Add-on kits available for 40 Meters**

The new X9 and X7 Triband Yagis are geared to set new standards in both radiating performance and mechanical reliability. Cushcraft's product development team has employed the latest computer modeling technology to achieve a superior electrical design as well as elegant new mechanical hardware and assembly techniques.

Each mechanical component was designed to 100+ MPH wind survival with a 1.25 safety factor. Traps were eliminated from the high current driven elements and reflectors using the new *4L Log Cell* design, which yields virtual monoband performance and maximum power handling capability. Traps are employed only in the lower current directors for increased gain and sharper pattern. The result is a truly high performance antenna family which will easily handle the legal limit.

SPECIFICATIONS		X9	X7
Frequency Coverage (Meters)		10, 15, 20	10, 15, 20
Total number of Elements		9	7
Maximum Gain (dB)	20M	13.0 @ 14 deg	12.5 @ 14 deg
@ One Wavelength	15M	13.9 @ 12 deg	13.0 @ 12 deg
	10M	14.0 @ 15 deg	12.9 @ 14 deg
Maximum Front to Back Ratio (dB)		30	30
Number of Elements per Band		4	3
VSWR Minimum		1.1:1	1.1:1
VSWR 1.5:1 Bandwidth (KHz)	20M	350	600
	15M	450	750
	10M	1500	1700
Longest Element, ft (m)		36.5 (11.12)	37.2 (11.33)
Turning Radius, ft (m)		21.7 (6.61)	20.0 (6.09)
Boom Length, ft (m)		28 (8.53)	18 (5.49)
Boom Diameter, in (cm)		2-1/2 (6.35)	2-1/2 (6.35)
Maximum Mast Diameter OD, in (cm)		2-1/2 (6.35)	2-1/2 (6.35)
Maximum Wind Survival, mph (kph)		>100 (>161)	>100 (>161)
Maximum Wind Surface Area, ft² (m²)		9.9 (.92)	7.9 (.73)
Windload @ 80 mph, lb (kg)		255 (116)	202 (92)
Maximum Power Handling (KW)		2	2
Weight, lb. (kg)		85 (38.5)	60 (27.2)
List Price		$995	$675

Typical radiation patterns.
Height: One wavelength.
Frequency: 20 M

CUSHCRAFT
COMMUNICATIONS ANTENNAS

48 Perimeter Rd, Manchester, NH, USA 03103 • 603-627-7877 • FAX: 603-627-1764
Email: hamsales@cushcraft.com

Dual Band Handheld FT-51R

The First Dual Band HT with WINDOWS!

Only one Dial/Volume knob required for easier use.

Three dual receive configurations VHF/VHF, UHF/UHF, or VHF/UHF with main band frequency on right or left side. Flexible programming allows transmit on main or sub band.

An 8 character alpha-numeric user help menu scrolls operation instructions in the bottom of the large, backlit display.

Digital battery voltage readout displays condition of battery in use. Scan skip function allows individual memory channel lock-out during scanning mode.

Spectrascope™ displays active adjacent frequencies in real time with relative signal strength.

FT-51R
2¼"W x 4¾"H x 1⅛"D
(2 Watt version shown.)

MH-29A2B
LCD Display Mic with Remote Functions. (Optional)

The new FT-51R Dual Band HT is state-of-the-art, and easy to use! So easy, you won't need an operating manual. Its exclusive, scrolling instruction menu located in the large, backlit display "window", guides you through total operation while simultaneously viewing the main display window.

You'll like some of the other new, exclusive features, too. Like Spectrascope.™ This unique feature displays real time, continuous scanning of activity on adjacent frequencies in VFO mode or 8 of your favorite memories. A cloning feature duplicates favorite channels to another FT-51R.

A digital battery voltage display, five power output levels, the largest backlit dual band HT keypad made, Smart Mute,™ two VFOs on both VHF and UHF, as well as available 2 Watt and 5 Watt versions, round out the exciting FT-51R. Plus, the optional MH-29A2B Display Microphone allows you to control volume and also access Memory, VFO, Call Channel, Band Selection and scanning functions. All of this in world's smallest dual band HT radio!

See the FT-51R with "windows" at your Yaesu dealer today!

"I can see two frequencies and alpha-numeric all at the same time."

"Scrolling instructions tell me what to do next!"

"I use the Spectrascope to find new contacts faster."

"Yaesu did it again!"

Specifications

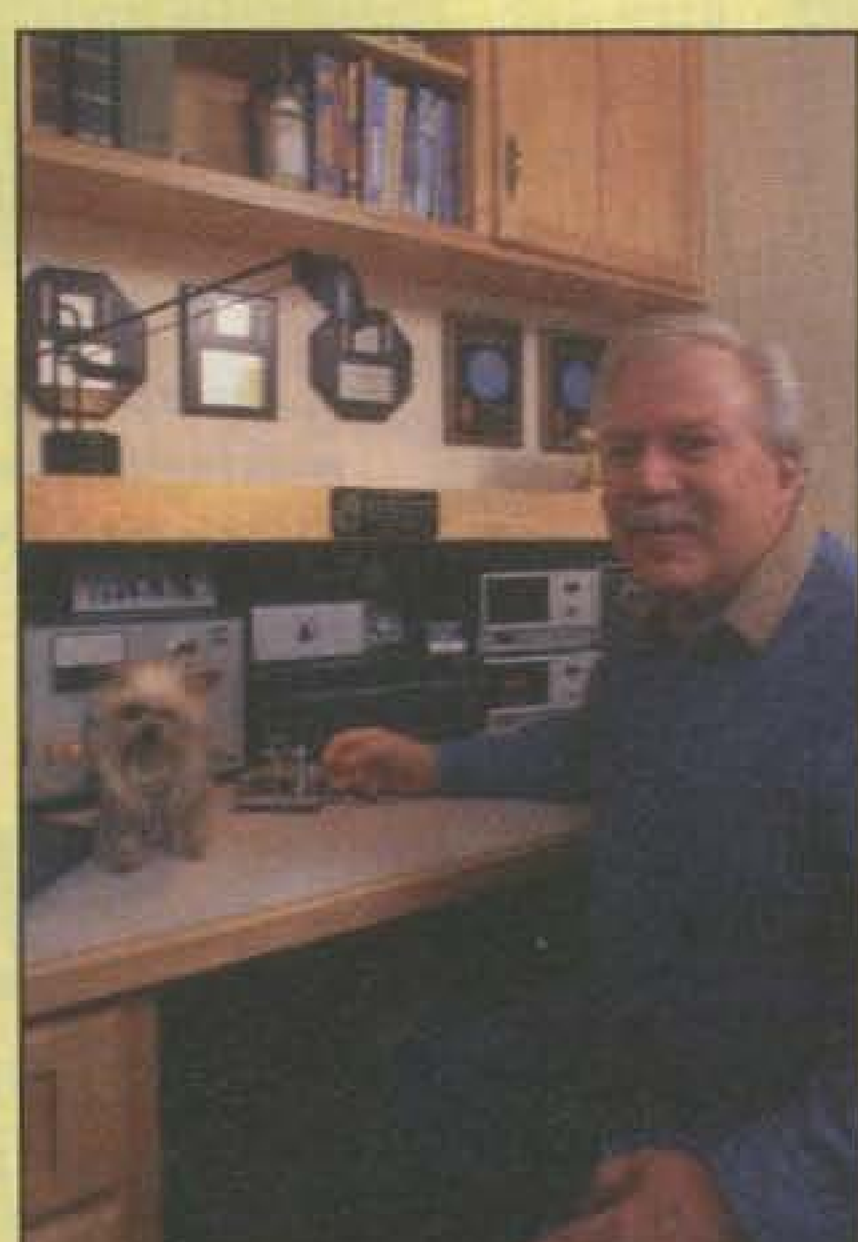
- Frequency Coverage
  VHF RX: 110-180 MHz
  TX: 144-148 MHz
  UHF RX: 420-470 MHz
  TX: 430-450 MHz
- Spectrascope™ Display
- Scrolling User Help Menu
- Alpha-Numeric 8 Character Display
- Up/Down Volume/Squelch Controls & Display
- Selectable Sub-Band TX Mute
- Automatic Tone Search (ATS)
- Digital Battery Voltage Display
- AM Aircraft Receive
- Scanning Light System (SLS)
- 120 Memory Channels (80 w/Alpha-Numeric)
- Large Backlit Keypad & Display
- Automatic Repeater Shift (ARS)
- Multiple Scanning Modes
- 3 Selectable Scan Stop Modes with Scan Skip
- Selectable 6-way Lock Functions
- Automatic Power Off (APO)
- TX/RX Battery Savers Built-in
- Handy Cloning Feature
- 5 Selectable Power Output Levels
- 5 Watt and 2 Watt versions
- Selectable RX Smart Mute™
- Cross-Band & One-Way Repeat Functions
- DTMF Paging/Coded Squelch Built-in

Accessories
Consult your local dealer.

YAESU
Performance without compromise.℠

CQ Amateur Radio
MARCH 1998 VOL. 54, NO. 3

FEATURES



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DEPARTMENTS

ON THE COVER: Sunset in Tucson, Arizona is made even more beautiful to the eye of the (ham) beholder by the presence of a neat antenna system. Larry Pace, N7DD, gets to enjoy this handsome station (shown at the left) and gorgeous sunsets (like this month's cover shot) all the time as he pursues his contesting activities. He's pretty successful at it, as the collection of *CQ* and ARRL plaques adorning the wall will attest. By the way, that's Sophie, the very small dog standing tall between the keyboard and paddle! (Photos by Larry Mulvehill, WB2ZPI)

ZERO BIAS

AN EDITORIAL

Not too long ago I was watching a TV drama the setting of which was a US aircraft carrier at sea. As escapist fare, it wasn't too bad. In fact, it was the topic of conversation among some friends of mine a week or so later. Among this group, I am the only amateur. Two of the fellows are veterans of the US Navy, and one of them served on the very ship depicted in the drama. The conversation extended quickly beyond the drama to what the ship was like and what life was like being stationed aboard her. One scene stood out for both of the Navy veterans as something new and marvelous. I have to admit that when they pinpointed the scene, its significance took on a different meaning to me.

The scene had one of the actors below decks walk up to apparently a coin-operated pay phone. Using a credit card, the character then placed a phone call back to the US—a simple, reliable phone call such as you could make from any pay phone in the US. Obviously, this hadn't been available to my two friends during their time at sea, and they both thought it was a great idea. Previously, during their time, they would have had to go to the radio room and work something out with amateur radio operators and the MARS system (both of which they were quite familiar with). What used to be traffic was, through the marvels of technology, an everyday phone call. Then someone else in the group recalled the banks of outdoor satellite phones for troops during Desert Storm, whereby soldiers easily could call home from some base in the middle of Saudi Arabia.

While I'm sure that MARS isn't going away, its traditional role as most of us saw it has been changing. The changes obviously are more apparent to the amateurs who volunteer and work long hours on our servicemen's behalf. Other changes in traffic handling sort of reflect how the world is changing and in a sense getting smaller—real small. In the 1950s and '60s the world still offered remote outposts populated by servicemen and scientists cut off from home and "civilization." The more wizened among our cadre of "real" amateurs can relate stories of traffic handling in really great numbers on a regular basis. A truly great service was provided by amateurs who handled traffic and facilitated phone patches for people thousands of miles away from home and family.

I remembered the feelings of admiration I had for many amateurs who made all of us proud by their devotion to a perceived duty. To me, it wasn't that long ago, a mere twinkling of time. Then this week I read a small article in the newspaper that sort of put that time in perspective. The article, via Bloomberg News, was about McMurdo Station, Antarctica. Specifically, it reported that MasterCard International Inc. and Wells Fargo & Co. had joined forces to put an automated teller machine (ATM) in McMurdo Station. I don't know if there are any stores there, or what there is to buy, but the article said that during the period from October 1994 through February 1995 more than 9000 tourists had visited the station.

The article triggered a memory of a *CQ* cover of a young man, about my age at the time, who was the winner of a prestigious award for handling traffic and phone patches from Antarctica. Well, it was a bit further back than I'd like to admit—39 years next month, April 1959. Jules Madey, K2KGJ, had been awarded the coveted Edison Award (given by G.E.) for his outstanding achievement of making over 12,000 phone patches during the previous three years for both servicemen in the Pacific and for people stationed in Antarctica. Remember, this was a couple of years before John Glenn's historic orbital flight, and the only small HTs that existed dwelt in the imagination of Chester Gould and were depicted in his famous comic strip, "Dick Tracy."

These days it's highly unlikely that any amateur will be making 4000 phone patches a year. While we still don't live in the most perfect technological world, it is apparent that we do live in an age where you can make a telephone call from anyplace on the globe, plus you can now pick up a few bucks while stopping off in Antarctica. No, MARS isn't going away, nor is the need for the service. What is going away and is gone is the notion that being someplace remote means being isolated and cut off from the real wold. In many instances, these remote areas are better served than our own local communities.

A part of what amateurs did and a service provided at no cost suddenly had value. The fact that technology could facilitate a phone call from practically anywhere and that banking transactions could surely follow suit meant revenue could be generated for these services. All it required was a concerted effort and singleness of purpose to see that problem, see the solution, and then implement a plan, engage a sales force, and provide a support system. Revenue would follow.

As global communication shrinks, we as amateurs still have a very important role domestically. In recent months we've seen drastic weather changes that have devastated vast areas of the country. It doesn't matter at the moment what you can blame it on. It's the immediate effect that has to be dealt with. I'm sure we'll hear and read stories about amateurs who provided emergency communications during the ferocious ice storms that hit the upper northeast and Canada. Amateurs have the unique ability, unlike most governmental agencies, to talk to each other. We characteristically supplement what's there and typically bridge the chasm that exists in inter-agency communications so that everyone has an idea of what's going on. We do it simply, effectively, consistently, and at no cost to the taxpayer. At the moment I can't see any way to make money out of this, so the job is, or should be, reasonably secure.

A combination of all of these technological infusions has changed the nature and texture of amateur radio. The pessimists, the naysayers, and all of our prophets of doom have seen the evolution in technology only as a death knell of amateur radio. Well, each change, each threat imaginary or real, each departure from what was has only increased our population, expanded our possibilities, and provided us with more fun that we ever could have dreamed of twenty years ago. However, it is different; it is changing all the time. Today, most of you would be lost without your computers. Fifteen or twenty years ago, though, readers were all over me for running articles on computers. The "real" amateurs of the day thought that the insidious computer had nothing to do with amateur radio and would only kill the hobby. Well, since that time we've had a proliferation of computers, internet growth, and the advent of the ever-popular e-mail. Right now, it's almost as if we invented it and we're letting some other folks use it now and then. Whatever else changes in the next fifteen or twenty years will be adapted and adopted, like it always was.

Looking ahead from my vantage point of being exposed to the effects of four sunspot cycles on amateur radio, I can safely prognosticate that things will be far different and better than they are now. The gear available at the end of Cycle 23 will be more amazing and even more impossible to build than the stuff you see today. Morse code as a requirement will be a fond memory, although still used by those who enjoy it. Nostalgia will still be a great place to visit, but not to settle down. John Glenn, at 76, wants to soar in space again, and even he doesn't want to do it in the same capsule as he did the first time.

Cycle 23 is already here. It's time to poke your head out and look around. If you want to see what's happening and what's likely to happen, then dust off your shoes and head to the nearest hamfest. Between now and then you could try to find out if there is a local club to join. Amateur radio is a participatory event. You can't bury yourself in your shack and hope that things either go away or at best stay the same. You can't expect some group or person to look after your interests if they don't know what those interests are. I expect that by the end of Cycle 23 more people will be on the DX Honor Roll and every other honor roll, and that more people will have participated in all of the various contests because, simply put, amateur radio belongs to the people who do something with it.

73, Alan, K2EEK

ANNOUNCEMENTS

Dayton ARA Scholarships – Once again scholarships are being offered to amateurs graduating from high school in 1998. Tere are eight scholarships up to $2000 each. Applicatants must send an SASE and request an application from DARA Scholarships, 45 Cinnamon Ct., Springboro, OH 45066. The deadline for *accepting* applications is June 1, 1998.

The Foundation for Amateur Radio, Inc. Scholarships – Sixty-six scholarships for the academic year 1997–98 are being offered to licensed radio amateurs, who 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 renge from $500 to $2500 with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Additional information and an application form may be requested by letter or QSL, postmarked prior to April 30, 1998 from: FAR Scholarships, 6903 Rhode Island Ave., College Park, MD 20740.

LIMARC Weekend Ham Radio Class – The second Weekend Class for the Technician license will be March 21–22 at Briarcliffe College, Bethpage, Long Island, NY. Accommodations are available nearby (Days Inn, etc.). Cost of the class is $35 including the workbook and lunch both days (doesn't include the $6.25 exam fee for the VE session on Sunday afternoon). For more info or registration call LIMARC's 24-hour info line at 516-520-9311 or e-mail George Tranos, N2GA at: <N2GA@aol.com>.

Royal Omani ARS First Day Issue – A commemorative postal stamp and first day cover has been issued by The Ministry of Posts, Telegraphs and Telephones of the Sultanate of Oman to commemorate the Silver Jubilee of The Royal Omani ARS. They are available for US$3 (to cover first-class airmail) with an SASE from: Royal Omani Amateur Radio Society, P.O. Box No. 981, Muscat, Postal Code: 113, Sultanate of Oman.

• The following Special Events are in March:

W4BKM, from Cherry Blossom Festival, Macon, Georgia; Macon ARC; 1500–2300Z March 21; phone 7.235, 14.240, 21.335; CW 7.135, 14.034, 21.135. For certificate send QSL and 9 × 12 SASE to Macon ARC, P.O. Box 4862, Macon, GA 31208.

W4C, 66th Carolina Cup Steeplechase Races, Camden, South Carolina (March 28); operations from March 14–29 on 3.903, 7.040, 7.235, 14.040, 14.228, plus others. QSL/SASE to Leon M. Morgan, N4LM, 2304 Moultrie Road, Camden, SC 29020-1716.

N8LC, from amateur radio open house, Macomb Mall, Roseville, Michigan; L'Anse Creuse ARC; March 7 from 1500–2100Z; voice operation in General portion of 40 and 20 meters, on or near 7230 on 40 meters and 14.330 on 20 meters. For a certificate, send QSL and 9x12 ($.64 postage) or business-size ($.32) SASE to N8LC, c/o Diane Scalzi, 21621 Briarcliff, St. Clair Shores, MI 48082-1299.

ZF2JB from Grand Cayman, in the ARRL DX Phone Contest, March 7–8, 80 meters single band for the contest plus 20 and 160 meters before the contest. QSL via KK9A.

• The following hamfests, etc., are in March:

Mar. 1, **Burnaby ARC 11th Annual Fleamarket**, New Westminster Armouries, New Westminster, BC, Canada. Contact (7–9 PM) Harry, VE7HNC, 604-530-3962, or Graham, VE7ABC, 604-530-1907, packet: <VE7ABC@VE7KIT>.

Mar. 7, **HAMCOM '98**, Florida Tringali Community Center, East Englewood, FL. Contact George Shreve, KA4JKY, 13591 Martha Avenue, Port Charlotte, FL 33981 (941-697-3445; e-mail: <gshreve@ewol.com>. (Exams.)

Mar. 7, **17th Annual Mike & Key ARC Electronics Show & Fleamarket**, Pavilion Exhibition Hall, Western Washington Fairgrounds, Puyallup, WA. Call 253-631-3756 (eves/weekends); e-mail: <mwdink@eskimo.com>. (Exams.)

Mar. 7, **Shore Points ARC Springfest '98 Hamfest**, Holy Spirit High School, Absecon, NJ. For information, call Eva, KB2QXU, 609-407-2923.

Mar. 7, **Mammoth Cave ARC Hamfest**, Cave City Convention Center, Cave City, KY. Contact Bill "Tate" Wilkinson, KE4KRN, phone 502-651-6561, e-mail: <bwilkinson@glasgow-ky.com>, or <www.scrtc.blue.net/mcarc/>. (Exams.)

Mar. 7, **Hamfest Under The Sun**, Ridgewood High School, New Port Richey, FL. Contact Rick, KF4GXS, or call 813-836-3900 or 813-842-2127.

Mar. 8, **Indiana Hamfest/Computer Show**, Indiana State Fairgrounds, East Pavilion Bldg., Indianapolis, IN. Call Dennis Baurenfiend, WB9ZNZ, 317- 996-3782, <dbauernfiend@cleveland.Dfas.mil>.

Mar. 13–14, **Tulsa Hamfest**, Maxwell Convention Center, Tulsa, OK. Voice/fax 918-622-2277; e-mail: <megriffin@ionet.net>; on web: <www.greencountry.cohamfest>. (Exams.)

Mar. 14, **Sebring 5th Hamfest/Computer Show**, National Guard Armory, Avon Park, FL. Contact Dennis Koranda, KF4JTM, phone 941-382-9560, web: <http://www.strato.net/~hamradio>.

Mar. 14, **HAMBASH '98**, Ararat Temple, Kansas City, MO. Contact Steve Dowdy, WJØI, 12411 Olive, Kansas City, MO 64146, 816-941-3392; fax 816- 941-3208; e-mail: <sdowdy@qni.com>. (Exams.)

Mar. 14, **Kerbela Hamfest**, Kerbela Shrine Temple, Knoxville, TN. Contact Paul Baird, K3PB, 1500 Coulter Shoals Circle, Lenoir City, TN 37772 (423- 986-9562).

Mar. 14-15, **St. Patrick's Day Hamfest/ARRL W. Texas Div. Convention**, Midland County Exhibit Building, Midland, TX. Contact Larry Nix, N5TQU, e-mail: <oilman@lx.net>; or <http://www.lx.net/edge/midswap.html>. (Exams.)

Mar. 15, **York Springfest**, York County Vo-Tech School, East Berlin, PA. Contact Ted Rodes, 717- 259-8063; <http://members.aol.com/yorkfest>. (Exams.)

Mar. 15, **Sterling-Rock Falls ARS 38th Hamfest**, Sterling High School Field House, Sterling, IL. Contact Lloyd Sherman, KB9APW, 815-336-2434; or e-mail: <lsherman@essexl.com>.

Mar. 15, **Tri-County ARS Hamfest '98**, Jefferson County Fairgrounds, Jefferson, WI. Call 920-563-6502 evenings.

Mar. 15, **TMRA 43rd Hamfest/Computer Fair**, Lucas County Recreation Center, Maumee, OH. Call Paul Hanslik, N8XDB, TMRA, 419-243-3836.

Mar. 15, **26th Annual Hamfest/Computer Show**, Palace Inn, Monroeville, PA. Call/fax 412-754-0562.

Mar. 15, **Charleston Area Hamfest/Computer Show**, Charleston Civic Center, Charleston, WV. Contact Charleston Area Hamfest/Computer Show, P.O. Box 916, St. Albans, WV 25177.

Mar. 21, **IRAC Hamfest**, West Orange High School, West Orange, NJ. Contact Jim, N2TDI, or Liz, N2WGH, Howe, 973-402-6066. (Exams.)

Mar. 21, **Hudson Fleamarket**, Hudson Lions Club, Hudson, NH. Contact John, KA1FYB, 603-881-5796; fax 603-598-0181; e-mail: <brunelle@tiac.net>.

Mar. 22, **LCARA 20th Annual Hamfest**, Madison High School, Madison, OH. Contact Len Sechrist, WS8O, 8550 Nowlen St., Mentor, OH 44060, 440-255-0112. (Exams.)

Mar. 22, **WECAFEST '98**, Yonkers Raceway, Yonkers, NY. Call 914- 741-6606 or <www.wec.org>.

Mar. 22, **LAMARSFEST '98**, Lake County IL Fairgrounds, Grayslake, IL. Contact Dave Gudewicz, KB9KDA, 847-937-8227 until 9:00 PM. (Exams.)

Mar. 27–28, **Columbus ARC 15th Hamfest**, Bartholomew County 4H Fairgrounds, Community Building, Columbus, IN. Call Marion Winterberg, WD9HTN, at 812-342-4670; e-mail: <winterbe@hsonline.net>.

Mar. 28, **MTARS Hamfest**, National Guard Armory, Tullahoma, TN. Call Larry Marshall, WB4NCW, 931-455-0070; e-mail: <lmarsh@edge.net>.

Mar. 28, **Annual Hamfest and Computer FleaMarket**, Michigan City High School, Michigan City, IN. Call Ron Stahoviak, N9TPC, 219-325-9089.

Mar. 28, **ARC of Parker County Hamfest**, Weatherford National Guard Armory, Weatherford, TX. Call Elizabeth Hunkele, 817-594-1700. (Exams 8 AM.)

Mar. 28–29, **Greater Baltimore Hamboree & Computerfest/ARRL Maryland State Convention**, Timonium Fairgrounds, Timonium, MD. Call 410-HAM-FEST or out-of-state 1-800-426-3378; on the web <www.gbhc.org>. (Exams.)

Mar. 29, **Southington ARA Fleamarket**, Southington High School, Southington, CT. Call Chet, KA1ILH, 860-628-9346. (Exams.)

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IC-W32A
ADVANCED FEATURES, EASY TO USE
Slim and compact, the IC-W32A is ICOM's top-of-the line 2M/440MHz dual bander. Up to 5 watts of power, NO FUNCTION BUTTON (simple to operate!) and plenty of whistles and bells. For example, a VHF/UHF exchange function allows you to assign VHF/UHF tuning and volume to either knob. A "guide" function provides quick identification for button assignments. Receive two frequencies on one band or search for signals on one band while waiting for a transmission on the other (V/V and U/U). With 200 MEMORY CHANNELS (100 per band) and 8-character alphanumeric tags, your favorite frequencies are always at hand. Use PC PROGRAMMING or the keypad to set features and memories. Get CTCSS encode/decode, CTCSS tone scan, DTMF encode/decode, battery voltage meter, auto power off, battery save and much more. Best of all, it's an ICOM.
IC-T7AHP
MORE POWER!
NOW WITH 4 WATTS OF POWER OUT OF THE BOX
Dual bands (2M/440MHz) at a single bander size and price! Even with lots of features, learning the IC-T7AHP is a snap. NO FUNCTION BUTTON
"'My favorite test is to grab a radio fresh out of the box and measure how long it takes to access my local repeater – without consulting the manual. For the ICOM IC-T7A my watch stopped at 60 seconds!'"
– QST, July 1997
Toggle between bands with one touch of the BAND key. Use the thumb "slide-lock" to secure the keypad. Up to 70 memory channels PC PROGRAMMABLE allow quick access to favorite frequencies and settings. If you get stuck, an "intuitive" help function pops up. Try one today.
For FREE Windows™ software, the cloning cable is included with radio. For CS-DOS cloning software, an optional OPC-474 cloning cable is required.
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You would think that with the 160 meter band relatively close in frequency to the 80 meter band that the two would exhibit very similar propagation characteristics. Truth be told, they are worlds apart. Cary Oler and Ted Cohen, N4XX, shed some light on why 160 meters is so unpredictable and what's being done to reveal its secrets.

The 160 Meter Band

An Enigma Shrouded in a Mystery—Part I

BY CARY OLER*, AND DR. THEODORE J. COHEN**, N4XX

About the Authors

R. Cary Oler

Mr. R. Cary Oler has 15 years of professional experience in the area of solar phenomena and ionospheric radio-wave propagation. He is the founder and president of the Solar Terrestrial Dispatch (STD), a private company that provides scientific, academic, and commercial organizations worldwide with real-time solar and geophysical data and forecasts. His clients include the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center (GSFC) and Jet Propulsion Laboratory (JPL), the U.S. Naval Research Laboratory (NRL), and the Russian Nuclear Physics Institute. The Solar Terrestrial Dispatch Web site is hosted by the University of Lethbridge, Lethbridge, Alberta, Canada. From there, Cary provides real-time propagation information and ionospheric forecasts, archived solar and ionospheric data, and information on STD's many products and services, including some of the most sophisticated ionospheric propagation software available today. While not a radio amateur, Cary is keenly aware of the many contributions amateur radio operators have made in the area of ionospheric propagation research, and he invites the Topband community, including shortwave listeners (SWLs), to contribute information on observed 160 meter conditions either via e-mail directly to him or through the Coordinated Amateur Radio Observation System (CAROS) Web page on the STD Web site.

Theodore J. Cohen, N4XX

Dr. Theodore J. (Ted) Cohen, N4XX, is no stranger to *CQ* readers. Over the last 30 years he has published more than 300 articles, columns, essays, and interviews in the radio amateur literature, the majority of them appearing in *CQ*. He is a co-author of *The NEW Shortwave Propagation Handbook* (written with George Jacobs, W3ASK, and Robert B. [Bob] Rose, K6GKU) and is well-known for his work relating high-frequency (HF) radio-wave propagation conditions to solar flux and geomagnetic indices. This work, described in the September 1974 issue of *CQ*, led the former National Bureau of Standards (NBS) to introduce WWV broadcasts containing current values for these parameters. (These broadcasts are heard at 18 minutes past each hour.) Now Ted has turned his attention to Topband and to the extraordinarily challenging problem of explaining radio-wave propagation in the range 1800–2000 kHz. This article is his (and Cary's) first published attempt to explain phenomena that for decades have both fascinated and frustrated the amateur community. Ted holds advanced degrees in physics and geophysics and has been licensed for over 45 years.

The propagation characteristics of the 160 meter band (1800–2000 kHz) have puzzled both amateur and professional communicators for decades. While located not that far below the 80 and 75 meter bands (3500–4000 kHz), predicting propagation on Topband, as it is affectionately called, has been an exercise in futility. For example, John Devoldere, ON4UN, in has book *Antennas and Techniques for Low-Band DXing*[1] notes that "... (T)he more I have been active on 160, the more I am convinced on how little we know about propagation on that band." Attempts by Devoldere to find a correlation between solar and geomagnetic indices (e.g., sunspot numbers, the **K** and **A** indices (whole day indices), and the three-hour **k**-index), and propagation on 160 meters, found little or none. Even Jeff Briggs, K1ZM, in his new book *DXing on the Edge—The Thrill of 160 Meters*,[2] comments that "(T)o me, personally, the biggest task yet unmet [on Topband] is figuring out just what makes 160 meters *tick*." Briggs even went so far as to say, "... I'll bet my last dollar that no one ... out there can predict the exotic openings with any degree of real accuracy ... " The following information won't put you in the position of winning that bet, but it sure will give you an appreciation for just how complex the phenomenon of radiowave propagation on Topband really is.

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Electron Density in the D-Region of the Ionosphere

Signals in the 160 meter band are most strongly affected by changes in the electron density of the ionosphere's D-region.[3] During the day, the D-region is strongly ionized, and so it is the major source of absorption on 160 meters. During the night, the density of the D-region drops dramatically (although it does not disappear completely); this results in a corresponding drop in signal absorption. Importantly, small changes in the density of the D-region can have a profound influence on absorption levels during the nighttime hours. The primary reason for this is that at low radio frequencies, electron collisions with neutral ions occur much more frequently than they do at higher frequencies. This results in what is known as a *high collision frequency*, which in turn results in high levels of signal absorption. Put another way, small increases in electron density at low frequencies produce large changes in signal absorption. When conditions on the 160 meter band are so good that you momentarily believe you are listening to a good opening on the 20 meter band, what may in fact have produced these extraordinarily good conditions were unusually large depletions in electron density in the D-region. Just what can cause such large drops in D-layer electron density is still not well understood by the ionospheric scientific community.

Effects Caused by the Electron Gyrofrequency

Propagation on the 160 meter band is difficult to predict for other reasons as well. One major reason, in addition to the unpredictability of the level of D-region absorption, is that the fre-

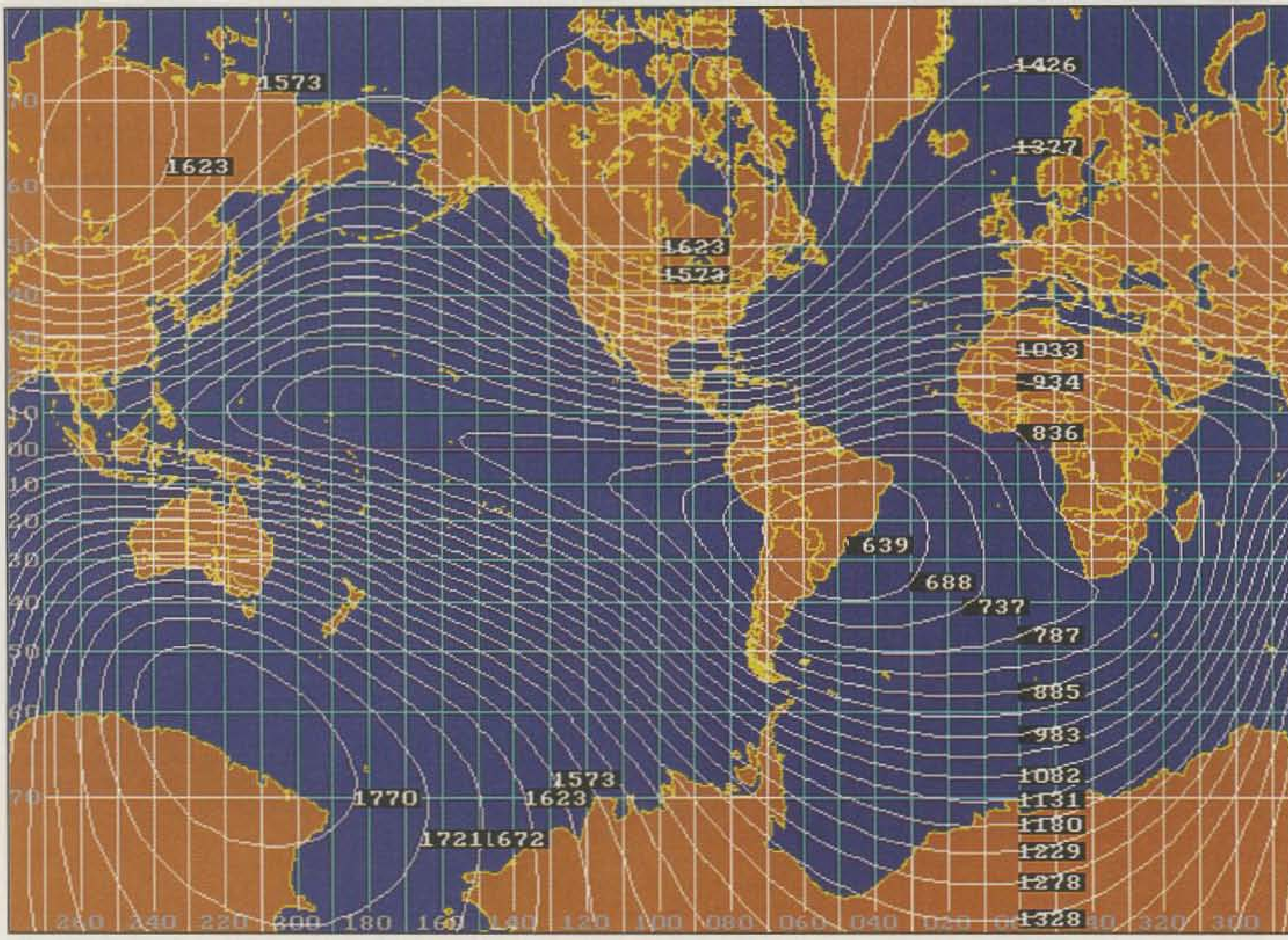

Fig. 1– Global map of electron gyrofrequencies, in kHz.

quencies in the 160 meter band are so close to the electron gyrofrequency (which is in the range 700 to 1600 kHz).[4] A map of the D/E-region electron gyrofrequencies (in kHz) is shown in fig. 1. Basically, the gyrofrequency is a measure of the interaction between a charged particle (here, an electron) in the Earth's atmosphere and the Earth's magnetic field. The closer a carrier wave is to the gyrofrequency, then, the more energy is absorbed by the electron from that carrier wave. This is particularly true for radio waves traveling *perpendicular* to the magnetic field.

In North America, we would expect that signals from, say, Western Europe would traverse paths roughly perpendicular to the Earth's magnetic field, and so they would be heavily attenuated because of their interactions with electrons in the D- and E-regions. Further, the signals should be strongly elliptically polarized, with the major axis of polarization lying in the direction of the magnetic field. (High-frequency [HF, 3–30 MHz] signals are more nearly circularly polarized.) Thus, in addition to the attenuation brought about by the proximity of the gyrofrequency to your Topband carrier frequency, the 160 meter signals you receive from, and transmit to, Europe also will arrive with decreased strength if your antenna and the antenna of the operator in Europe are not oriented to match this polarization.

Finally, during geomagnetic activity, such as that experienced following the occurrence of a flare on the Sun, the orientation of the Earth's magnetic field lines can change, producing variations in received signal strength. In some cases signals are degraded below usable levels, while at other times significant signal enhancement can occur.

Effects Caused by the Auroral Oval

The auroral ovals (one around each pole) have a profound impact on radiowave propagation. If the path over which you are communicating lies along or inside one of the auroral ovals, you will experience degraded propagation in one of several different forms: strong signal absorption (which is usually what happens), brief periods of strong signal enhancement (primarily caused by tilts in the ionosphere that allow signals to become focused at your location), or very erratic signal behavior (strong and rapid fading, etc., caused by a variety of effects such as multipathing, anomalous and rapid variations in absorption, non-great-circle propagation, and polarization changes).

Fig. 2 is a map showing the great circle path from Washington, D.C. to Japan. Also shown is the position of the overhead Sun (in the south Atlantic), the terminator (it is within an hour of sunrise on the East Coast of the U.S.), the poleward position of the *very quiet* auroral zone (the green line closest to the poles), and the expanded position of the auroral ovals during weak minor geomagnetic storm conditions (the green line closest to the equator).

As shown, the great-circle path from D.C. to Japan can be influenced in one of two primary ways. During exceptionally quiet geomagnetic conditions (**k**-indices of zero lasting for more than about 8 hours), the auroral zone can contract to the approximate poleward position illustrated by the highest-latitude green line in fig. 2 and allow the D.C.-Japan signal to pass relatively unscathed through the polar regions. But small increases in geomagnetic activity can produce large changes in the position of the auroral zone. If the equatorward boundary of the auroral zone crosses through the D.C.-Japan great-circle path, signal degradation will occur through absorption in the D- and E-regions and other instabilities of the auroral ionosphere.

Fig. 3 is an excellent example of the variability that can occur in the auroral zone. This sequence of images was obtained from the POLAR spacecraft (Ref. 5). It snaps pictures of the auroral oval every few minutes that its orbit allows. The top sequence of images (beginning at 0336 UTC on 10 December 1997) shows the appearance of the auroral oval in a very quiet state. Very little activity is visible and, in fact, all of the activity occurs well north of Alaska. A Topband signal crossing through the high-latitude regions would have stayed outside of the auroral zone, resulting in good signal strength and stability (compare with the poleward green-line in fig. 2). These were the conditions that apparently existed on 8 and 9 December 1997, as well, during which time exceptional propagation conditions were observed between the East Coast and Japan in the half-hour period just before sunrise on the East Coast.

Conditions, however, changed rapidly following the arrival of a mild interplanetary disturbance at 0530 UTC on 10 December (see the middle row of images). These images show a more energetic auroral zone about an hour and a half after the arrival of the disturbance. Notice how the zones have expanded and how they now encompass a good portion of Alaska. The most intense areas of auroral activity are also located in the areas nearest the equatorward boundary of the zone of activity. Signals propagated from Washington, D.C. to Japan or from the western U.S. to Europe would have had to penetrate through these disturbed regions. In so doing, they would have been heavily absorbed

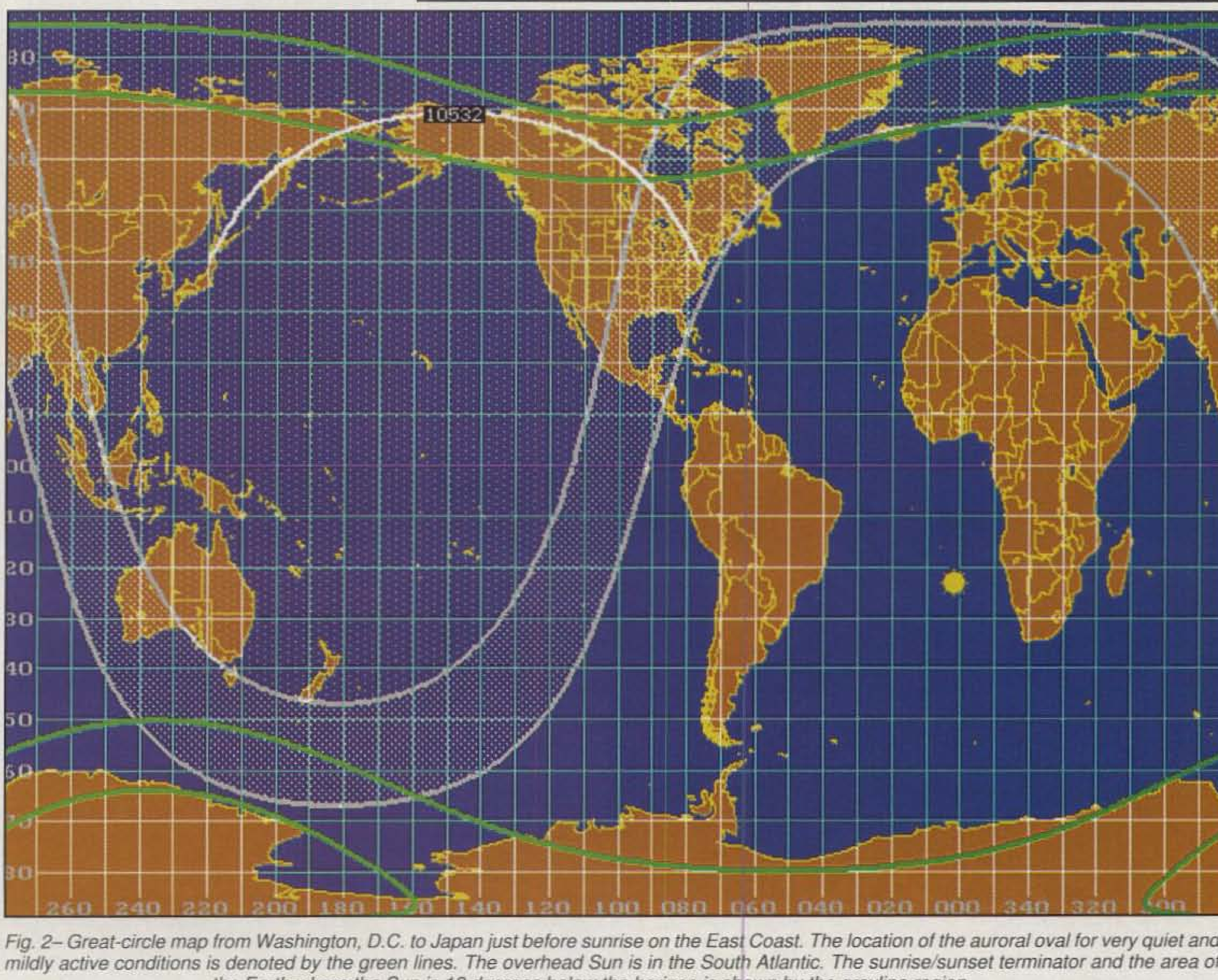

Fig. 2– Great-circle map from Washington, D.C. to Japan just before sunrise on the East Coast. The location of the auroral oval for very quiet and mildly active conditions is denoted by the green lines. The overhead Sun is in the South Atlantic. The sunrise/sunset terminator and the area of the Earth where the Sun is 12 degrees below the horizon is shown by the grayline region.

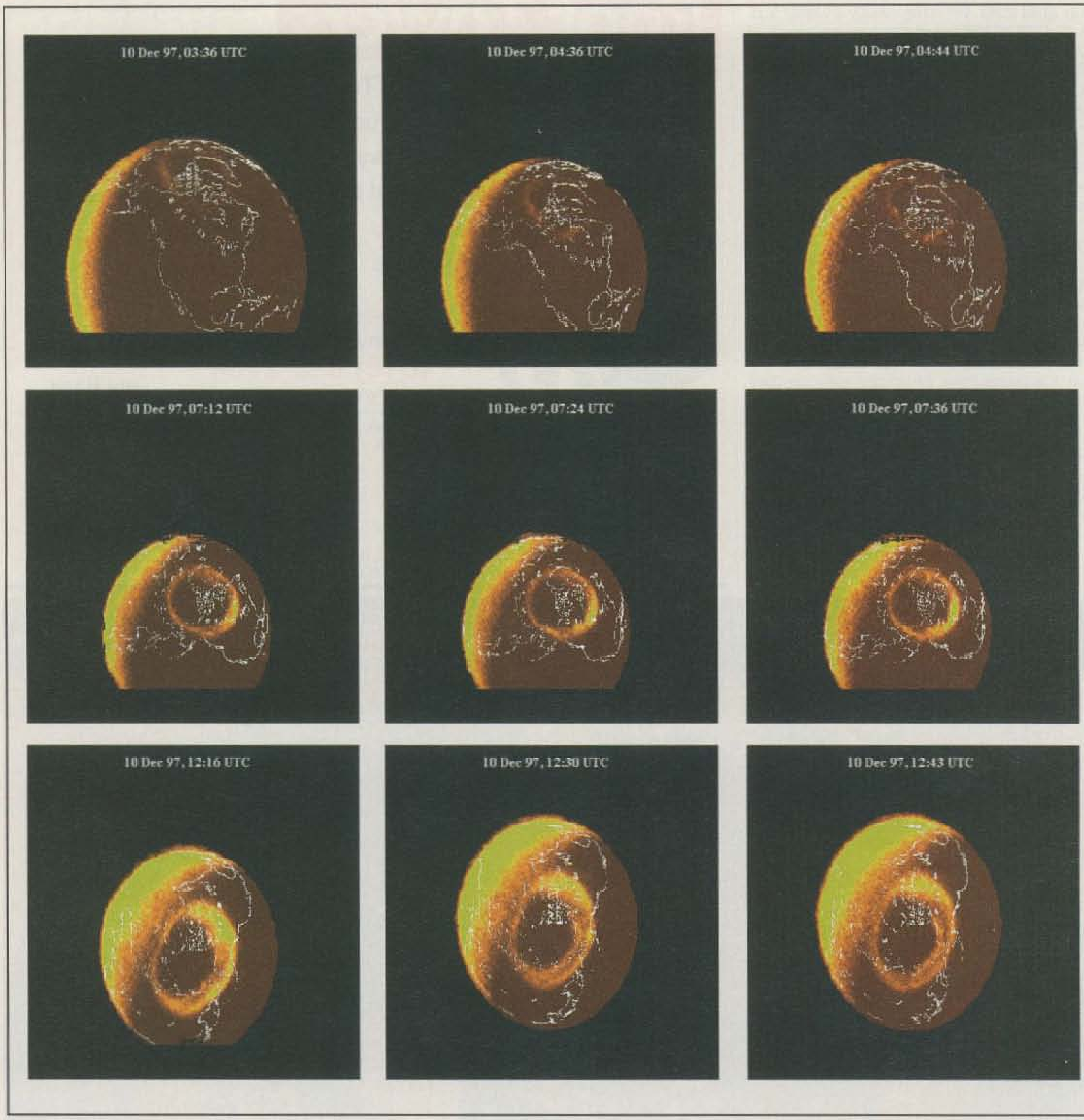

Fig. 3– The sequence of images is from the POLAR Spacecraft and shows the northern polar auroral oval. Top three images: very quiet auroral oval. Middle three images: intensifying auroral oval. Bottom three images: minor auroral storm conditions.

by the increased D- and E-region ionization that migrated equatorward to intersect the great-circle paths by 0712 UTC. During the height of the auroral activity, the oval intensified and expanded even further southward to completely engulf the Alaskan and much of the Canadian ionosphere. Communications between Washington, D.C. and Japan around 1216 UTC (near sunrise on the East Coast) would have been highly unlikely, if not impossible.

Another important aspect of the auroral ionosphere is its latitudinal thickness. In the top row of images, the auroral oval is very thin and diffuse, suggesting a much more stable ionosphere and weaker levels of ionization. A signal that passes through this auroral ionosphere would encounter its heaviest absorption only while it was within the auroral ionosphere.

When the auroral zone is contracted and latitudinally thin, it is possible for a Topband signal to navigate *through* the auroral zone without being heavily absorbed by skirting *underneath* it, as fig. 4 illustrates. During periods of very quiet geomagnetic activity, areas of the auroral zone may only have a latitudinal thickness of approximately 500 kilometers (300 miles). But radio signals reflected from the E-region can travel over distances of as much as 500 to 2,200 kilometers (300 to 1,375 miles) at heights *below* the ionosphere (for low take-off angles of between 20 to 0 degrees, respectively). When the geometry is just right, 160 meter radio signals can literally skirt underneath and through the auroral zone into the polar ionosphere (which is more stable) and from the polar ionosphere back into the middle latitude ionosphere without ever coming in contact with the auroral ionosphere. Such propagation is not as rare as you might think, and it can provide unusually stable openings to transatlantic and transpacific regions. But because the auroral oval is in continual move-

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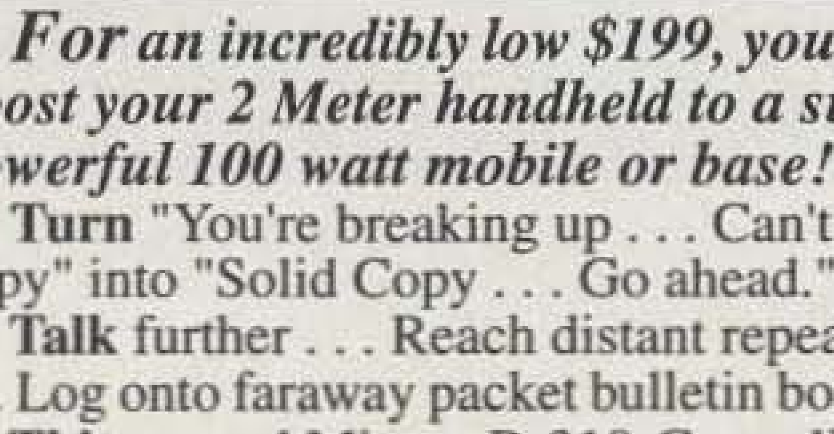

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The MIRAGE B-5016-G gives you 160 watts of brute power for 50 watts input on all modes -- FM, SSB or CW!

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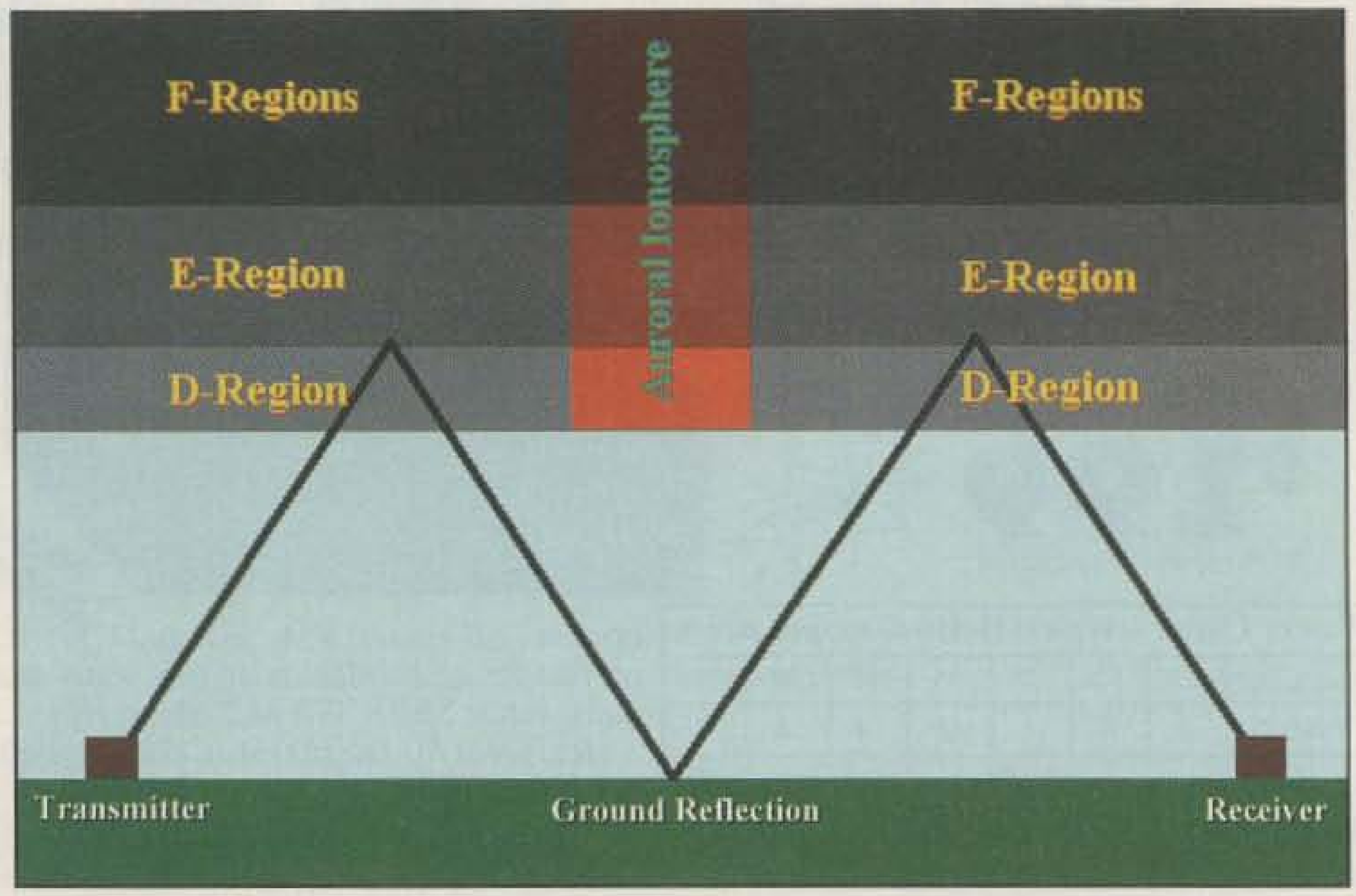

Fig. 4– An example of how a 160 meter signal can pass through the auroral zone without interacting with the disturbed conditions in the auroral ionosphere.

ment and changes rapidly, such conditions often do not last very long.

As nature would have it, the most heavily ionized region of the auroral ionosphere is that region nearest the local midnight sector, which, unfortunately, is an important time and region for 160 meter DX signal propagation. The midnight sector of the auroral zone is also the most unpredictable and volatile. Look how rapidly auroral activity changes near Alaska in the bottom panel of the images in fig. 3. In only 27 minutes, activity ranged from fairly intense (at 1216 UTC) to mildly active (at 1243 UTC). A closer inspection of these images also reveals fine structures that can materialize and dematerialize in a matter of minutes. Because the visible light manifested as the auroral ovals is produced by beams of energetic electrons being sprayed into the high-latitude ionosphere, even these small-scale features can have profound impacts on absorption levels of 160 meter radio signals.

Part of the trick to successfully working Top-band DX is to get your signal through the polar regions without passing into the auroral ionosphere. Operators in the western and southern regions of the United States can literally "shoot" their signals to Japan to the south of the auroral zone, avoiding the absorption that their colleagues to the north and east unfortunately encounter. Auroral-zone absorption probably accounts, in large part, for the fact that Stew Perry, W1BB (SK), recognized worldwide as the "Father of Top-band DXing," never completed a two-way contact with a Japanese operator on 160 meters.

Correlation of 160 Meter Signal Strength with Sunspot Numbers

It is interesting to note that 160 meter signal strengths are very difficult to correlate with solar activity. However, there *is* a weak correlation (Ref. 6).

The correlation between sunspot numbers and signal strength is only about 5% as strong as the correlation on higher frequencies. In fact, the correlation is so low that most empirical algorithms that predict signal strengths of 160 meter signals completely disregard sunspot numbers or solar flux levels. The weak correlation is primarily due to the fact that lower frequency signals (e.g., 1800–2000 kHz) are reflected by the lower regions of the *nighttime* ionosphere, when solar ionizing radiations have dropped to minimal levels. This explains why attempts to correlate conditions on the 160 meter band with sunspot numbers (or the 2800 MHz solar flux) fail.

Footnotes and Comments

1. Devoldere, J. (ON4UN), *Antennas and Techniques for Low-Band DXing*, The American Radio Relay League, Newington, CT, 1994, p. 1-21.

2. Briggs, J. (K1ZM), *DXing on the Edge: The Thrill of 160 Meters*, The American Radio Relay League, Newington, CT, 1997, p. 14-2.

3. Jacobs, G. (W3ASK), T. J. Cohen (N4XX), and R. B. Rose (K6GKU), *The NEW Shortwave Propagation Handbook*, CQ Communications, Inc., Hicksville, NY, 1995.

4. Davies, K., *Ionospheric Radio Propagation*, Dover Publications, Inc., New York, NY 1966.

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6. Ebert, W., "Ionospheric Propagation on the Long and Medium Waves," Tech. Doc. 3081, European Broadcasting Union, Brussels, 1962.

(Continued Next Month)

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Results of the 1997 CQ WW WPX SSB Contest

BY STEVE BOLIA*, N8BJQ

To quote VK2ARJ, "The WPX is like a box of chocolates—you never know what you are going to get." 1997 upheld that tradition. We endured storms, high QRN, and not very many sunspots during the weekend. While we were not blessed with great conditions, there were some memorable accomplishments, however.

DX

A familiar call returned to the top of the single operator category. KW8N borrowed P4ØV's fine station, and call, and finished on top. Second place went to Carlos, TIØC (TI2CF), who was only 700K behind Bob. Bob's three-point location and his QSO advantage paid off, with Carlos having the upper hand in multipliers. Ivo, 4V2A (9A3A), was right behind in third place, followed by last year's champion, YT1AD at TS8A, and Marko, N5ZO, at 8R1K. CT3BX was sixth, followed by NH7A, 5NØT, HC1OT, and VE3EJ. Four continents were represented in the top ten. JY9QJ was tops in Asia in 12th and OT7T (RA3AUU operating) was the top European in 13th.

TS8A won the Tribander/Single-Element (TS) category, followed by KP2/KF8UM, 9K2HN, UA9MA, and CW6V. VE9AA, 4N9BW, FK8HC, UT4UZ, and LY5W rounded out the top ten. All turned in very respectable scores, and the top four made the world leader box.

Argentina was again the center of 10 meter activity. LU8AQE edged out countrymen LU4VZ, LU2DW, and LU8HSO. ZX5J was the "big signal" on 15 meters, with LT1F second, ZP5XF third, and LU4HAW fourth. Pekka, EA8AH, set one of the three world records with his 20 meter win. Second place went to LP5H, followed by EA9AM and WH6CQH. Peter, ZX9A, made the second world record with his big 40 meter score. XQ8ABF was second, LU6MFD third, and 5B4MF fourth. The third world record was set by EA8/OH1MA with his big win on 80. 4N1A was second, followed by 6D2X and S55T. Top-band honors went to Yuri, VE3BMV/1, who just edged out S54E. S57M was third and LY1FW fourth.

Richard, KP2/KF8UM, was the top low power entry. FM5DN was second, LQØN (LU2NI) third, VP5E (K6HNZ) fourth, and LU8HLI fifth. LU4VZ topped the 10 meter entries, with LU8HSO second and PP5UB third. PP5UA edged out VK4MGA for 15 meter honors, with L5V third and 3B8/DL6UAA fourth. LS9F won on 20 meters, followed by 4N7B and RZ9AR. Forty meter honors went to Dale, VE7SV. RAØFU was second and LX1KC third. Andy, NP3D, turned in a great score to win the 80 meter category, with OK1FFU second and YU1FJK third. UN2O finished on top on 160, with UU4JMG second and RA9CPQ third.

TM7XX (F5MUX) was the Assisted champion. JM4UQM came in second and W6XR was third. EA3AML took 10 meter honors, EA3EJI did likewise on 15, and DL3NED won on 20 meters. N1HRW had a nice 40 meter score, EA3DX was the 80 meter champ, and DL7VRO won top band.

USA

Overall scores in the U.S. were down from 1996. Perennial champion KQ2M added to his

The ops of expedition trophy winner IZ9Z. From left to right are IK2SGC, IT9GSF, I4UFH, and IV3TAN.

One half of a very enthusiastic operating family is TA3YJ, who handed out a much needed multiplier on 20 meters.

*7354 Thackery Road, Springfield, OH 45502

impressive string of wins. K3ZO jumped up to second place, with NB1B third, KVØQ fourth, and K4AB fifth. W4AN was sixth; K7RI seventh; and WB9Z, KW9KW, and NQ4I rounded out the top ten.

Mick, W4YV, was the U.S. 10 meter winner. WB2BZR/3/T was second, and also the winner of the Novice/Tech plaque. W5VX was the 15 meter champion, followed by KS9K and WAØETC. WE9V compiled the top U.S. single band score on his way to his 20 meter win. N3HBX was second and K7ZZ third. W6KY won the 40 meter title, with KC4YM second. Led by W6KY, four of the top five 40 meter entries were low power. Eighty meters was a battle of the coasts, with the east just edging out the west. KE1Y represented the east and W6RJ the west. Bill, W4ZV, did a nice job on 160, followed by Leo, AA4MM, and KN2T.

WA4ZXA made a big jump from fifth in 1996 to the top of the '97 low power category. WS1A finished second; Ric, WO4O, was third; and NY3Y was fourth and KR4QI fifth. Novice/Tech winner WB2BZR topped the 10 meter entries, with Bruce, WA7BNM, winning on 15 meters and N4MO capturing 20 meter honors. W6KY topped all of the 40 meter entries, and KB3AFT was the top low power 80 meter entry.

Multis

ZXØF (Ops. PY5EG, N5FA, PYØFF, and PU5OMS) easily ran away with the multi-single crown with the top score in the contest. If you want to know how they did it, see the picture of the antenna farm. It's a combination of good operators, a great location, and lots of aluminum. Second place went to IZ9Z operated by IK2SGC, IT9GSF, I4UFH, and IV3TAN. HG1S was tops in Europe and third overall, followed by Asian leader C4ØM, and TM1C. In the U.S.A. W5ASP and K5GA got to experience contesting from the East Coast with K5ZD and won the U.S. KC7V in Arizona was second, followed by WW5DX, NY4A, and NK7U.

The multi-multi champ was WP3X (the new call of KP4XS). Ken and crew (AA8U, K3MM, K8CC, W8MJ, AA4S, and N4UK) made over 7300 Qs on their way to victory. Second place went to KH7R with a fine effort from Hawaii (not Kure). LU4FM finished third, followed by 4M1X and EU champ 9A1A. The U.S. title went to AEØM (Ops. AEØM, K2KW, K3EST, K6AW, N6RO, K6XX, AK6L, KM6F, and KX7M). KU4V was second and NE6N finished third.

The Rest of The Story

Expanded results of the new categories can be found in the March issue of *CQ Contest* magazine. Also in the March *Contest* issue are some good tips from N6KT for operating the WPX Contests. Rich speaks from experience, with several WPX wins and a couple of current world records. More WPX information can also be found on the WPX Contest web site at <http://ourworld.compuserve.com/homepages/n8bjq>. Check this site for current rules, a listing of logs received for each of the contests, and a few other items of interest.

For those who have not heard, I have moved. Please **do not** send any mail or logs to my old QTH. After years of dreaming about it, we took the plunge and bought a place in the country. Besides corn (22 acres), I've started planting towers, thanks to N8NR. The first has grown to 100 ft., and there is aluminum sprouting from it. If you're passing through downtown Thackery, Ohio stop in and listen to the corn grow.

We've added a couple of helpers to the WPX crew this year. Bob Rossi, NA2X, has come on board and Larry Weaver, N6TW, has taken on some the database duties usually done by N6AA. Thanks to these folks, Sergio, EA3DU, and Scott, N9AG, for all of the assistance given during the year. It is certainly appreciated.

Over 550 logs containing more than 525,000 contacts made it into the database. Slightly over 45,000 calls appeared in the file, of which nearly 24,000 were unique or busted calls. That's a bunch of "questionable" calls. It would be much easier, and more accurate, if we had an electronic log from each of you. This can be a disk, or you may (and are encouraged to do

TROPHY WINNERS

SINGLE OPERATOR, ALL BAND

WORLD: Stanley Cohen, WD8QDQ Trophy. Won by **Station P4ØV operated by Bob Hayes, KW8N.**

USA: Atilano de Oms, PY5EG Trophy. Won by: **Bob Shohet, KQ2M.**

AFRICA: Peter Sprengel, PY5CC Trophy. Won by: **Station TS8A operated by Hranislav Milosevic, YT1AD.**

EUROPE: Jim Hoffman, N5FA Trophy. Won by: **Station OT7T operated by Harry Booklan, RA3AUU.**

SOUTH AMERICA: Ron Moorefield, W8ILC Trophy. Won by: **8R1K operated by Marko Myllymaki, N5ZO.**

OCEANIA: Philip Fraizer, K6ZM Memorial. Won by: **Al Crespo, NH7A.**

***JAPAN**: The DX Family Foundation Trophy. Won by: **Masanobu Yamao, JH5ZJS.**

WORLD QRP/p: Dayton Amateur Radio Association Trophy. Won by: **Gerard Gendron, TM9K.**

USA QRP/p: Doug Zwiebel, KR2Q Trophy. Won by: **John Nistico, KC6ETY.**

SINGLE OPERATOR, SINGLE BAND

WORLD: John N. Reichert, N4RV Trophy. Won by: **Pekka Kolehmainen, EA8AH (14 MHz).**

WORLD (Low Power): Vern Fowler, W8BLA Trophy. Won by: **Horacio Calabrese, LS9F (14 MHz).**

WORLD 7 MHz: William D. Johnson, KVØQ Trophy. Won by: **Peter Sprengel, ZX9A.**

OCEANIA: D. Craig Boyer, AH9B Trophy. Won by: **Ken Wages, WH6CQH (14 MHz).**

USA 3.7 MHz: Lance Johnson Engineering Trophy. Won by: **Rolf Seichter, KE1Y.**

USA 7 MHz: Lewis Sayre, N7AVK Trophy. Won by: **Art Wallace, W6KY.**

USA 21 MHz: Bernie Welch, W8IMZ Memorial. Won by: **William Parry, W5VX.**

USA 28 MHz Novice/Tech: Jon Engelhardt, KAØZFX. Won by: **Robert Lutz, WB2BZR/3/T.**

MULTI-OPERATOR, SINGLE TRANSMITTER

USA: Oklahoma Comm Center Trophy. Won by: **K5ZD operated by K5ZD, K5GA, W5ASP.**

MULTI-OPERATOR, MULTI-TRANSMITTER

NORTH AMERICA: Burt Curwen, KL7IRT Memorial (James Dixon, NL7HI sponsor). Won by: **WP3X operated by AA8U, K3MM, K8CC, N4UK, W8MJ, AA4S.**

USA: Glenn Tracey, KC3EK Trophy. Won by: **AEØM operated by AEØM, K2KW, K3EST, K6AW, N6RO, K6XX, AK6L, KM6F, KX7M.**

CONTEST EXPEDITION

WORLD: Kansas City DX Club Trophy. Won by: **IZ9Z operated by I4UFH, IT9GSF, IV3TAN, IK2SGC, IT9EQO.**

This is Ari, OH1EH, operating OHØAM.

EARTH STATION **FT-847**

HF/50/144/430 MHz All Mode Transceiver

"Compact, too--great for our next 'rover' operation."

"HF, VHF/UHF, and satellite, all-in-one!"

"And the DSP helped me hear my first moonbounce signal ever!"

"Looks like Yaesu did it again!"

The FT-847 changes base station operation forever. Now, three radios in one--HF, VHF/UHF, satellite; technology in its finest application, from the world leader in amateur communication.

With its unequaled combination of features, like DSP filters—notch, NR and BPF, built-in 6-meter, voice monitor, separate sub-band dial, Shuttle Jog dial, Smart Search, and digital meter, the FT-847 is the only radio of its kind! Exclusively for satellite work, 19 memories exceed any other radio. For performance, power-up with 100W for HF/6-meter, and 50W for 2-meter and 430 MHz. Additional "must-haves" include cross-band full duplex, normal/reverse tracking, CTCSS and DCS encode/decode, and direct keypad frequency entry. Plus, the FT-847 is 1200/9600 bps packet-ready.

Take the next step in all-band performance and take home the FT-847 today!

The Yaesu FT-847 brings you the Earth, Moon, and (Shooting) Stars!

FT-736R

Satellite leader for over a decade.

Built-in AC power supply, CW filter, and band expansion slots up to 1.2 GHz make the FT-736R the ultimate VHF/UHF/Satellite transceiver!.

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

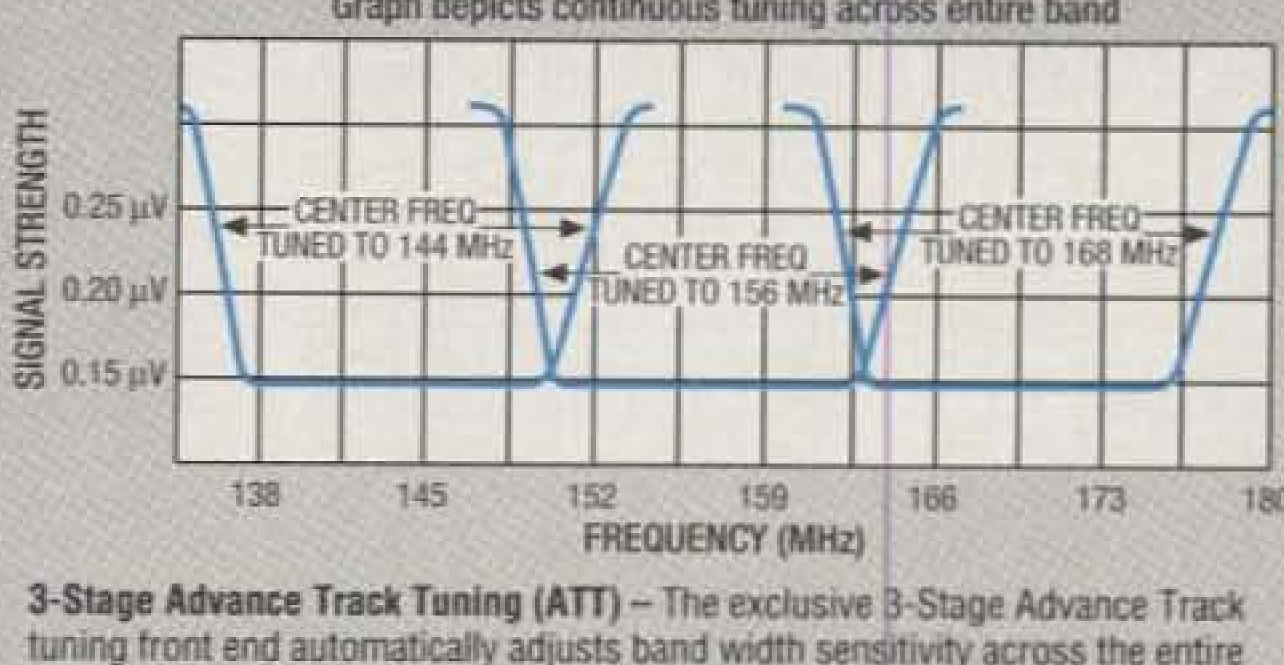
Advanced Track Tuning, Mil Spec, true FM. All in one radio!

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!"

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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

*800 MHz Cellular blocked

WORLD TOP SCORES

SINGLE OPERATOR ALL BAND

P4ØV	**14,761,773**
TIØC	13,481,361
4V2A	12,087,589
TS8A	**11,526,732**
8R1K	**10,857,848**
CT3BX	9,207,608
NH7A	**8,570,552**
5NØT	8,283,308
HC1OT	6,810,737
VE3EJ	6,393,044
8P9IJ	5,468,593
JY9QJ	5,446,170
OT7T	**5,197,648**
5X4F	5,044,598
KQ2M	**4,780,224**
*KP2/KF8UM	4,772,124
OD5NJ	4,634,952
YT1BB	4,481,720
9K2HN	4,465,968
JH5ZJS	4,434,507
UA9MA	4,335,936
RN6BY	4,326,511
TK5NN	4,212,426
FM5CD	4,088,250
GIØKOW	4,034,016

28 MHz

LU8AQE	559,630
*LU4VZ	504,216
LU2DW	456,688
*LU8HSO	335,654
*PP5UB	308,962
*ZD8DEZ	243,648
*LW6EQG	174,125
*PY2SR	167,757
*LU7HTJ	140,818
*PU2MHB	134,520

21 MHz

ZX5J	10,312,104
LT1F	4,941,594
ZP5XF	3,903,459
LU4HAW	3,034,750
*PP5UA	1,712,000
4F3GDX	1,623,447
*VK4MGA	1,598,766
5X1T	1,465,280
FM5GU	1,377,152
ZP6CC	1,314,612

14 MHz

EA8AH	**11,142,198**
LP5H	4,022,830
EA9AM	3,930,290
WH6CQH	**3,771,486**
OK1RI	3,761,380
IO4A	2,927,981
HD2RG	2,720,091
ZV8C	2,518,992
YTØA	2,221,320
OH1JD	2,215,516

7 MHz

ZX9A	**10,787,128**
XQ8ABF	6,121,222
LU6MFD	4,428,192
5B4MF	3,231,228
AH8A	2,897,880
KH6FKG	2,176,830
YT7A	2,161,452
*VE7SV	2,023,872
HA9RE	1,873,386
9A5Y	1,847,880

3.7 MHz

EA8/OH1MA	4,317,284
4N1A	1,559,000
6D2X	1,109,760
S55T	1,089,680
KE1Y	**1,074,672**
OE3A	1,038,880
W6RJ	1,010,070
TA3W	916,880
S57O	905,168
HA8JV	901,728

1.8 MHz

VE3BMV/1	397,760
S54E	379,620
S57M	285,648
LY1FW	232,638
OZ3SK	214,722
*UN2O	196,308
*UU4JMG	110,622
*RA9CPQ	108,290
OM7RU	104,160
EA8ZS	93,960

LOW POWER ALL BANDS

KP2/KF8UM	4,772,124
FM5DN	3,486,820
LQØN	3,269,370
VP5E	2,330,130
LU8HLI	1,628,958
LU5EWO	1,381,380
RAØFA	1,342,565
UA9CAW	1,194,336
YN6WFM	1,192,260
YB2CPO	1,068,930
LU1EYW	1,060,488
WP4NHM	1,017,686
WA4ZXA	987,936
S51F	876,040
YTØX	784,672
EA9IB	767,844
XE3LMV	761,760
ED3ELZ	742,000
VA3DX	**720,564**
OA4DAY	703,629

28 MHz

LU4VZ	504,216
LU8HSO	335,654
PP5UB	308,962
LW6EQG	174,125
PY2SR	167,757
LU7HTJ	140,818
PU2MHB	134,520
ZW1B	93,408
LU4HMV	75,616
PU2MRY	74,245

21 MHz

PP5UA	1,712,000
VK4MGA	1,598,766
L5V	1,261,316
3B8/DL6UAA	1,061,775
YC7JKS	1,035,348
4F4IX	792,285
LU1HTF	612,890
KP4/AA2OX	464,515
LU3ES	422,988
PY4OY	301,498

14 MHz

LS9F	2,153,859
4N7B	1,219,710
RZ9AR	881,474
DU1COO	729,280
RW9AB	723,384
PT2AW	708,111
DF7YU	633,046
Z39M	619,648
RN3QO	485,958
JH7VHZ	392,129

7 MHz

VE7SV	2,023,872
RAØFU	1,018,240
LX1KC	709,840
UR7CA	670,140
4N7CC	446,336
RA3WA	410,440
OH4KBC	381,728
TA3J	364,560
S54A	320,880
UR7TZ	295,390

3.7 MHz

NP3D	852,110
OK1FFU	437,760
YU1FJK	362,368
YO2LIF	339,840
OM5KM	334,020
9A3QK	303,996
S57KNC	278,000
YW5S	273,980
HA4XN	227,406
OZ2ZZZ	170,834

1.8 MHz

UN2O	196,308
UU4JMG	110,622
RA9CPQ	108,290
RA4NW	85,250
ES1CH	68,834
UA4UDF	59,520
UA3YLJ	50,688
RA2FAD	43,776
UT1ZZ	32,712
LZ2WA	32,340

TRIBANDER/ SINGLE ELEMENT

TS8A	11,526,732
*KP2/KF8UM	4,772,124
9K2HN	4,465,968
UA9MA	4,335,936
CW6V	3,820,914
VE9AA	3,017,020
4N9BW	2,836,995
FK8HC	2,760,936
UT4UZ	2,413,920
LY5W	1,995,188

LOW POWER

KP2/KF8UM	4,772,124
LU8HLI	1,628,958
LU5EWO	1,381,380
YN6WFM	1,192,260
S51F	876,040
YTØX	784,672
EA9IB	767,844
XE3LMV	761,760
EA8KK	544,644
WD5K	521,740

ROOKIE

NO6X	A	406,406
KB2RAS	A	204,472
KM5AV	A	198,882
PY2SZY	28	1,036
KGØUA	14	16,128

LOW POWER

IZ7ATC	A	248,442
OH4JLV	A	239,499
ON4CAS	A	197,200
VE1TRH	A	111,843
VE2SAI	A	109,824
PU2MHB	28	134,520
LA6FJA	7	2,340
S57KAA	3.7	64,872
ES1CH	1.8	68,834

BAND RESTRICTED

EC4AEW	A	22,366
EC7ACV	21	2,088
EC1DKD	3.7	34,320
FB1BJI	28	340
JK8HOS	A	90
NH6YK	28	25,641
OH3KCB	A	406,448
OM5AHI	A	38,610
S57NPR	3.7	52,852
YV4GLE	A	245,886

SINGLE OP ASSISTED

TM7XX	A	2,749,440
JM4UQM	A	2,381,475
W6XR	A	1,860,790
IO4A	A	1,435,236
*YU1NR	A	1,316,847
EA5BHK	A	1,298,856
DK7ZT	A	1,149,876
AA3JU	A	935,656
W5HVV	A	785,610
KA7ZUM	A	734,562
EA3AML	28	7,936
*JL4CVG	28	7,367
EA3EJI	21	97,125
IU2D	21	96,624
JQ1NGT	21	96,564
DL3NED	14	1,447,270
DL7IO	14	1,177,691
EA3CKX	14	1,052,694
F5PGP	14	1,023,360
RW4WR	14	845,543
N1HRW	7	265,230
*S58MU	7	65,296
EA3DX	3.7	441,540
YT4TD	3.7	104,784
DL7VRO	1.8	169,092

LOW POWER

YU1NR	A	1,316,847
ON5GQ	A	709,590
IY4M	A	481,650
YO2LDE	A	267,386
S5ØU	A	217,005
JL4CVG	28	7,367
JR9NVB	21	59,150
S57T	14	281,517
WR3L	14	73,650
S58MU	7	65,296

QRP/p

TM9K	**A**	**487,696**
LY3BA	A	422,820
YU1KN	A	315,000
KC6ETY	**A**	**279,792**
N7VY	A	278,967
ZY2Y	28	117,245
LW3EBJ	28	21,021
LU2HNP	21	39,483
JI5BKF	21	35,100
RJ9J	14	505,165
UA4SKW	14	199,320
S59D	7	125,970
IK8HOE	7	14,994
SP4GFG	3.7	155,806
UX2MF	3.7	148,400
RW4HHD	1.8	54,136
US5MPS	1.8	17,248

MULTI-OPERATOR SINGLE TRANSMITTER

ZXØF	25,497,504
IZ9Z	**11,616,531**
HG1S	9,186,237
C4ØM	8,513,496
TM1C	8,415,283
IR4T	7,564,320
3DA5A	7,425,200
JA1BRK/DU1	6,570,720
LZ9A	6,303,206
T9DX	6,013,104

MULTI-OPERATOR MULTI-TRANSMITTER

WP3X	**23,297,736**
KH7R	19,816,220
LU4FM	18,473,910
4M1X	16,814,160
9A1A	16,791,460
S52A	15,050,090
OT7A	14,075,810
S53M	8,352,520
AEØM	**8,165,408**
RW2F	6,974,268

so) e-mail your log to <N8BJQ@ERINET. COM>. The more logs we can enter into the database, the more accurate it becomes, and we can do a better job of log checking. Please, if you use a logging program, send us an electronic version of your log. The preferred files are CT's *.all or *.bin file, TRLogs' *.dat file, NA's *.qdf file, or a plain ASCII list of calls worked by band if you use another program. **Starting with 1998, disks will be requested of all top-scoring stations who submit a computerized log.** Failure to provide the disk could result in reclassification as a checklog.

Here are some stats from the logs received. Low power logs (769) now outnumber high power (654), and the split probably will widen as conditions improve. The three new categories picked up, with 157 entering the Tribander/Single-Element category. We also had 28 in the Rookie category (welcome to the WPX contest, and we hope you will come back), and 15 in the Band Restricted category. There were also 81 entries in the Single Op. Assisted group. The greatest majority of logs come from Europe, with North America second and Asia third.

A good assortment of multipliers were available in 1997. In the U.S. we can now request "vanity" calls, and some have taken advantage of that to get a good one for the WPX. There were a few of the vanity calls on this year, and I would expect more in 1998, which is good news for the prefix hunters. As always, we also had a large number of DX stations who were

Andy, NP3D, finished number one in the world on 80 meters low power.

USA TOP SCORES

SINGLE OPERATOR ALL BAND

KQ2M	**4,780,224**
K3ZO	2,982,213
NB1B	2,890,768
KVØQ	2,877,333
K4AB	2,090,192
W4AN	1,980,251
K7RI	1,949,310
WB9Z	1,905,904
KW9KW	1,367,744
NQ4I	1,293,812
W9LT	1,121,662
*WA4ZXA	987,936
NK6O	836,268
K1SD	761,264
WN6K	675,280
K1AR	648,081
NX5M	560,956
N1CC	502,456
NXØI	501,687
*WS1A	500,038

28 MHz

W4YV	43,956
***WB2BZR/3/T**	**9,204**
KØWUI	8,112
W7AYY	7,866
*W7USA	4,653

21 MHz

W5VX	**244,528**
KS9K	100,471
WAØETC	85,925
*WA7BNM	69,069
WT4K	63,578

14 MHz

WE9V	2,113,251
N3HBX	768,414
K7ZZ	376,380
*N4MO	353,472
W7FP	347,085

7 MHz

*W6KY	252,436
KC4YM	192,262
*KW4T	122,760
*WA4QDM	49,610
*AA9IA	48,280

3.7 MHz

KE1Y	**1,074,672**
W6RJ	1,010,070
N3OC	114,680
W5FO	83,232
AG4W	63,648

1.8 MHz

W4ZV	85,428
AA4MM	34,048
KN2T	16,650
KØCS	9,752

LOW POWER ALL BAND

WA4ZXA	987,936
WS1A	500,038
WO4O	448,749
NY3Y	443,751
KR4QI	330,084
ACØW	327,320
N2ED	255,258
W7ZMD	255,095
AE6Y	254,709
WA3HAE	251,370

28 MHz

WB2BZR/3/T	9,204
W7USA	4,653
WB4HFL	4,624
W9CNF/M	672
WBØGFV	504

21 MHz

WA7BNM	69,069
W4TD	41,382
KU6T	30,600
KØBCN	19,264
WJ7S	13,490

14 MHz

N4MO	353,472
WF1L	303,696
AKØA	179,305
KF6HAN	174,404
KB8IBS	161,392

7 MHz

W6KY	252,436
KW4T	122,760
WA4QDM	49,610
AA9IA	48,280
N5XUS	23,980

3.7 MHz

KB3AFT	5,760
N8LIQ	3,172
N6TPT	360

TRIBANDER/SINGLE ELEMENT (TS)

NC7M	1,401,830
K4VUD	1,395,208
N4ZZ	958,818
W1CU	725,835
K6BZ	721,920
NO9Z	700,440
KMØL	699,798
WC4E	686,424
KC6X	657,476
W6TKF	588,264

ROOKIE

NO6X	406,406
KB2RAS	204,472
KM5AV	198,882
*KQ6ES	74,102
*AB7RW	42,065

SINGLE OPERATOR ASSISTED

W6XR	A	1,860,790
AA3JU	A	935,656
W5HVV	A	785,610
KA7ZUM	A	734,562
N5JR	A	724,960
W8AEF	A	584,278
KCØZC	A	469,098
KBØWY	A	435,768
N6CCL	A	396,134
W9RM	A	307,818
*WR3L	14	73,650
*W9HV	14	49,410
WA2ZGO	14	38,781
N1HRW	7	265,230

QRP/p

KC6ETY	**A**	**279,792**
N7VY	A	278,967
N1TM	A	172,520
KC5WCO	A	57,060
KG5U	A	46,168
NT5CC	28	2,754
N1AFC	21	12,505
W6CN	14	49,500
W8QZA/6	7	10,164

MULTI-OPERATOR SINGLE TRANSMITTER

K5ZD	**5,287,320**
KC7V	2,650,008
WW5DX	2,307,646
NY4A	2,145,164
NK7U	2,112,613
WR4K	2,078,586
KZ6X	1,947,780
N8NR	1,765,950
N6MI	1,539,000
AAØYX	988,980

MULTI-OPERATOR MULTI-TRANSMITTER

AEØM	**8,165,408**
KU4V	4,284,824
NE6N	3,389,892
WM2V	708,968
NE9U	522,020

on expedition or used special calls for the contest. TS8A was a good catch from Tunisia, as were IZ9Z, 3DA5A, LQØN, 5NØT, T4ØFRC, 3A/DF8XC, 3B8/DL6UAA, 9L1MA, 9M2TO, and BA4TB. Thanks to all who made the effort.

The 1998 SSB contest will be held on 28–29 March. Mark that weekend on your calendar and join in. With the increase in sunspots, conditions could be really interesting. Don't forget to check 10 meters and work the low bands for the extra points. Working the double pointers can increase your score very quickly. If you need summary/log sheets, you can get them from *CQ* in Hicksville for an SASE. Mark plainly on your envelope that you are requesting log sheets. Please send your logs to *CQ* and mark the envelopes **WPX SSB LOG**. That way they won't get put in the wrong pile.

Hope to see you in the contest!

73, Steve, N8BJQ

Random Comments—U.S.

Fun to show the Texans why W1's like DX contests so much! . . . *K5ZD*. Not bad for the bottom of the cycle and modest antennas. . . . *N6MI* Conditions were absolutely terrible here! . . . *NY4A*. It was fun using our new club callsign for this contest. We got lots of comments on the WV2LI 2 x 2 call. . . . *WV2LI*. WOW, what a thrill to have a European pileup on 40 meters calling ME! . . . *KU4V*. Had a great time. Our first multi-multi and the radios dropped like flies. Ended with only one radio on the air. Lightning storm took us off on Saturday night. Lost the amp Sunday afternoon. . . . *N5KB*. Once again I had a terrific time. My thanks to all the American stations with the terrific prefixes. Wish there were more American participants. . . . *AA9IA*.

Real fun contest. Thanks for having it. . . . *AB4KL*. "Murphy was an OPTIMIST! He should have said "Everything will go wrong," especially 15 meter propagation." . . . *K1DWQ*. I thought that conditions during ARRL DX were horrible, but this weekend beat that hands down. Rain static, thunderstorms, no 15 meters (much less 10), and Easter Sunday took its toll. . . . *K1SD*. Conditions terrible, still had fun. . . . *K2FR*. Second time I have entered this WPX phone contest—fun again! Conditions not as good as last year. . . . *K4UK*. "Eleven AC power failures; one lightning strike on dipole (it fell) while learning to eat tofu! This is "real radio." . . . *K4VUD*.

Took 33 hours to score three-quarters of last year's total. Operated 23 hours last year. Forty, 80, and 10 were better than last year. Fifteen and 20 were worse. Very little Europe on 20 first day. No JA's on 15! Keep S/O at 36 hours. Consider same country Q's as 1 point rather than 0. Tnx good contest. . . . *K6BZ*. Bad Stuff: All bands worthless Saturday morning and midday. The noise level was awful and the propagation matched! Didn't hear any Europe. Good Stuff: Nothing broke! Things were better on Sunday. Twenty was a zoo, and I heard the usual "wall" of East Coast stations working Europe. I got a few of them, too. I actually got a run going on 15! Worked a few stations on 10 meters, including ZL. . . . *K6GT*.

First time I've ever worked WPX. What fun! . . . *K7ZZ*. Murphy hit. T-storms first night; shut down three times because of bad lightning. My best score yet on 40! . . . *KC4YM*. Best DX was 5X4F and best DX on 80 was FK8HC. . . . *KC5AK*. Had a great time! Heard places I've *never* heard before! . . . *KC5WJM*. Where are the sunspots hiding? Condx were terrible. My score is much lower than last year. I could hear very few EU's on 20 much less the other bands. No JA's on 15. Trying to get stations to listen up on 40 was a problem as usual. The silver lining to the dark cloud is I worked two new band countries on 75—BV and T8. . . . *KC6X*. Saturday and Sunday mornings conditions so bad unable to copy signals until 11 AM. Storms to the east caused terrible buzz noise. . . . *KC7UP*.

Great contest. Only operated about 30 hours with the flu. Good to hear 10 meters open to South America from Idaho. . . . *KJ7TH*. This was a good contest for me, but the lowest point per QSO rate I've ever had resulted in a rather low score. Points per Q would have been even lower, but 40 finally opened up to Europe with 30 minutes left in the contest. . . . *KMØL*. This is my second contest and I really enjoyed myself. I had quite a few problems (re: computer) and my radio has to go to the shop. Bands were not very good in my area and I am grateful for the South American sta-

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There's a Kantronics 9612 Plus about to enter service aboard Mir

There's a world of digital communications fun and adventure that *only hams can enjoy* and Kantronics makes it possible for you to explore it. No matter if you call our products TNCs, wireless modems or digital controllers, the "Outernet™" offers a world of adventure, including satellite communications, APRS®, DX spotting, BBS operations, WEFAX, EMWIN, TCP/IP links, remote control and sensing, telemetry, HF e-mail with commercial service providers and more!

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KPC-3 Plus

- 1200 bps - Now with more features!
- Packet, GPS/APRS, Host, KISS and WEFAX modes
- Personal Mailbox (PBBS) now supports multiple calls
- Copies NWS EMWIN with optional software
- Remote access, sensing and control with two A/D and two control lines
- KA-Node or option K-Net networking capability
- PBBS 100k, expandable with optional 512k RAM
- Uses external power or internal 9v battery
- NEWUSER mode and online help

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- Unique design allows the addition of *another port, high or low speed**
- KA-Node or K-Net option works with multiple ports
- Remote access, sensing and control capability
- Telemetry transmission capability
- NEWUSER mode and online help

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- Real time, battery backed clock
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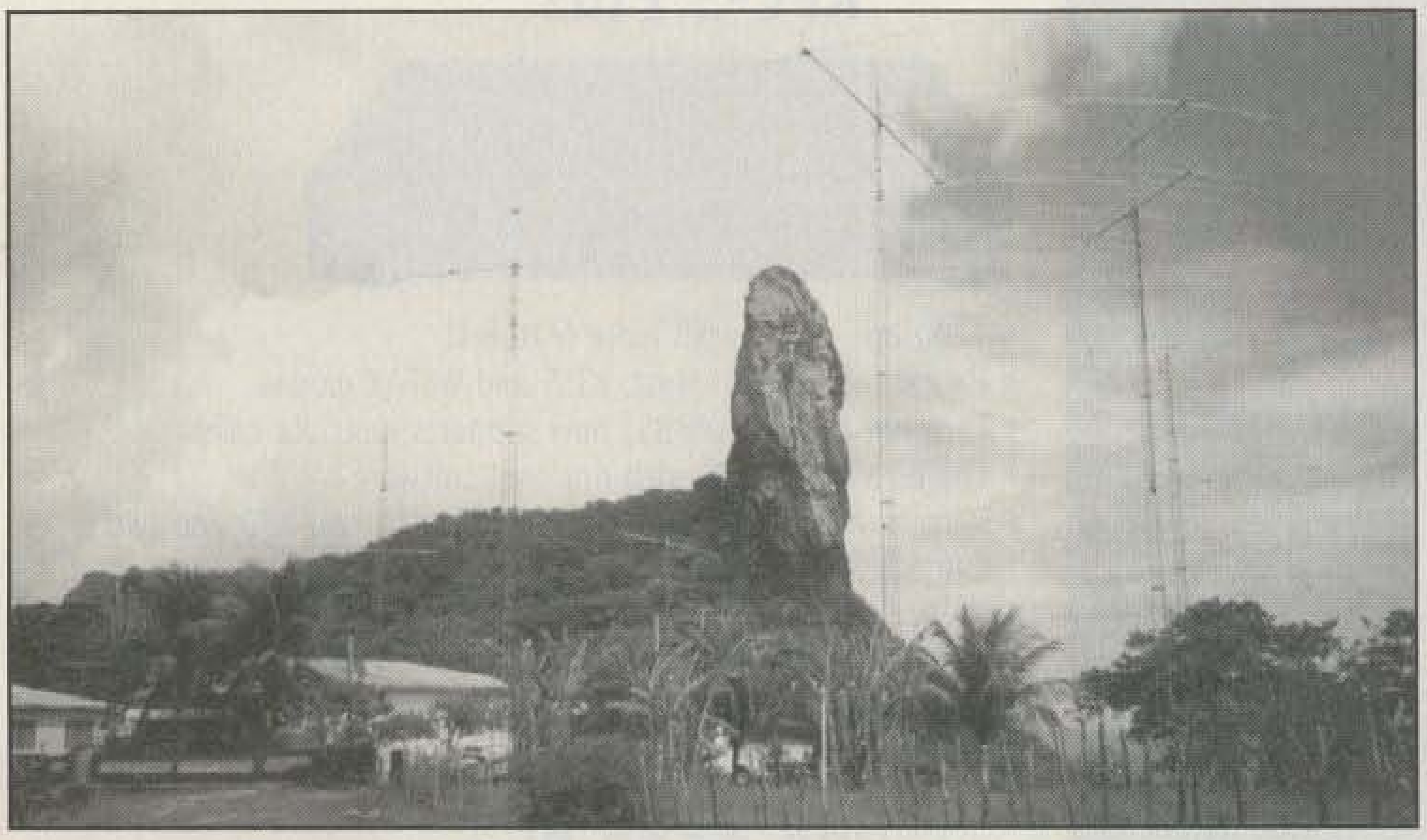


This is the antenna farm at ZXØF. It's no wonder they are loud everywhere.

tions I worked. I made mistakes and learned quite a bit. I will return next year. . . . *KM5AV.* Great contest. Band very noisy. Hope for better condx next year. . . . *KN2T.*

Special thanks to Bob, N2RM, for his great hospitality and efforts on my behalf. Experienced the worst and most punishing conditions since the 1985 ARRL phone test—UGH! Kept busy by killing nine wasps and one mouse during the weekend. Got excited by big pileup on 40 in last hour when SU1SK called me and gave me #1. . . . *KQ2M.* More than doubled my score from last year, which isn't saying much, but the contest was fun, especially when 10 meters opened up. . . . *KQ6ES.* Thanks to all who took the time to give me a shout during the weekend. . . . *KU4BP.* This was my first single op all band effort in 20 years! . . . *KVØQ.* Bettered my score from last year. Have new idea for antennas so that someday I'll not only hear Japan on 40 meters, but they'll hear me too! . . . *KW4T.*

Whose bright idea was it to schedule Easter on a contest weekend?. . . . *N1NQD.* My worse WPX yet! Severe power line interference all weekend plus spotty conditions! Sunday was better than Saturday, but lots of QSB! Rain static on Saturday wiped out 2 hrs of operation. . . . *N3HBX.* Condx in a word were "lousy"! On Sunday morning I went out to see if my antenna was on the ground—now that suggests "bad" condx. . . . *N4MO.* Only the second weekend on HF from the new QTH. 100 watts into a random length wire isn't the best, but for once I had no EMI problems in the house. ZXØF must have a great station to hear my signal in Brazil. K7FF and W6RJ from California sounded like they were next door. . . . *N6TPT.*

This was a contest to remember. I ran the first hour and a half on the vertical, and kept wondering why swinging the beam did not improve any of the signals. At hour 21, the commercial AC power went out due to the high winds. A large gelcel battery pack was plugged in to get the IC735 back on the air. Alexander, the contest cat, was on my lap helping to offset the dropping air temp. The beam was stuck, but the vertical was still in the yard. Logging was shifted to paper and I worked two new countries (Surinam and Gabon) on battery power. . . . *N7FL.* Static, static, static. . . . *N8LIQ.* My first WPX contest. Really enjoyed the QSOs. Already looking forward to next year! . . . *N9TMU.* Lots of daytime commitments = lots of nighttime operating. Brutal with low wires, low power, and blown RX pin diode in the front end. But that's contesting and I love it! Thanks for a great contest! . . . *N9VVV.*

Very noisy! 160 and 75 almost unusable here. . . . *NA2Q.* Wow! Conditions were tough. Try as I might, could never really get a run going on Sunday. During the whole contest I heard (and worked) only one JA on 20. Usually Sunday afternoon from here 20 meters opens to the Far East, but it didn't for this contest. . . . *NB1B.* This was the first time to operate on any band other than 160 from the "construction in progress" station. I operated off and on for 16 hours and so far I'm happy with the station. There is still a long way to go, though! . . . *NX5M.* Thanks very much to Bill, W4AN, for letting me test drive his station. This was my second serious single-op effort. The storm on Friday night made the low bands terrible and broke the 4 square. . . . *W4AN.*

Terrible (S9+10) line noise on 15 and 10 meters. Terrible QRN on 160 and 80. Enjoyed all of it. Don't change the rules. . . . *W5HVV.* Lots of stations, but not the Europe openings of last year. . . . *W5RNF.* Planned a serious single band 40 effort, but problems with 40 meter antenna system took all weekend to solve, so just played a little—about 4 hrs. Cndx still sounded punk from the NW. . . . *W7GG.* Worst possible QRN both nights! Lightning/thunder caused Saturday morning shut down! Power-line noise all day Sunday! . . . *W9LT.* My first WPX effort from this QTH. Conditions were poor, but as always a fun contest. . . . *WAØETC.* I couldn't spend a whole lot of time. Happy with what I got. . . . *WA3HAE.*

Great to hear the 10 meter band come alive! Great signals and they lasted for hours! . . . *WB6NFO.* Operated from W3ZZ and had a great time for part-time effort. . . . *WI2T.* Poor propagation makes good manners. . . . *WS1A.* "Squeezed" in operating time between involvement in four Easter musical presentations over the weekend, so I had to make the best of the eight hours I had left. Glad I did, since I must have had at least 100 comments of "thanks for the new mult." That's good, since the WPX contest is one of the reasons I requested this new callsign. . . . *WX6V.* Conditions in Arizona were better in WPX than the ARRL DX Contest. I improved my score from last year by 59%. This was due to doubling my tower height and working mults on the low bands. . . . *N7VY.* I'm beginning to think life is too short for 40 meter QRP! . . . *W8QZA/6.* My first contest actually submitting results. Had fun except when the rain raised my SWR. I also learned that my strategy will be a lot different next time. . . . *WB7OCV.*

Random Comments—DX

Enjoyed a nice contest with QRP mode and thanks for picking up my signal during the contest. . . . *JH1HRJ.* Poor conditions on 15 meters, but I enjoyed this contest. . . . *JI5BKF.* It's too hard to work QRP. QRM level very, very high. I lost so many good DX's. . . . *UA4SKW.* Contest was fantastic as usual. Conditions were not, as usual. . . . *C4ØM.* We were doing a demonstration for local SWLs this year. . . . *F5KAC.* With pieces of wires in March, crazy we are—hi hi. . . . *FK8KAB.* Worst conditions ever heard in over 20 years of ham radio. Easter didn't help to make things better. Even like this, WPX is one of the true competitive contests. . . . *IR4T.* We had a great time as we always do in a test, and we did quite good as well. Due to some technical problems we lost the opening to the States Saturday afternoon. . . . *J41W.*

Our first serious attempt at a major contest and enjoyed by all. The Easter holiday robbed us of some of our most experienced operators. . . . *M7G.* We had a great time during the contest. On 40 we had a low score because of the bad antennas we use. Good thing the 15 meter band was open all weekend! . . . *ON6ZX.* Very bad propagation and not too many operators made this contest the worst of the last years. It will be better next year! . . . OT7P. This is very good contest for new amateurs and our club station to teach new hams in this contest. . . . *YM2KC.* Many didn't know the KH7 prefix was Hawaii, not Kure. Lost three amps at the start. Conditions were great on all bands. . . . *KH7R.*

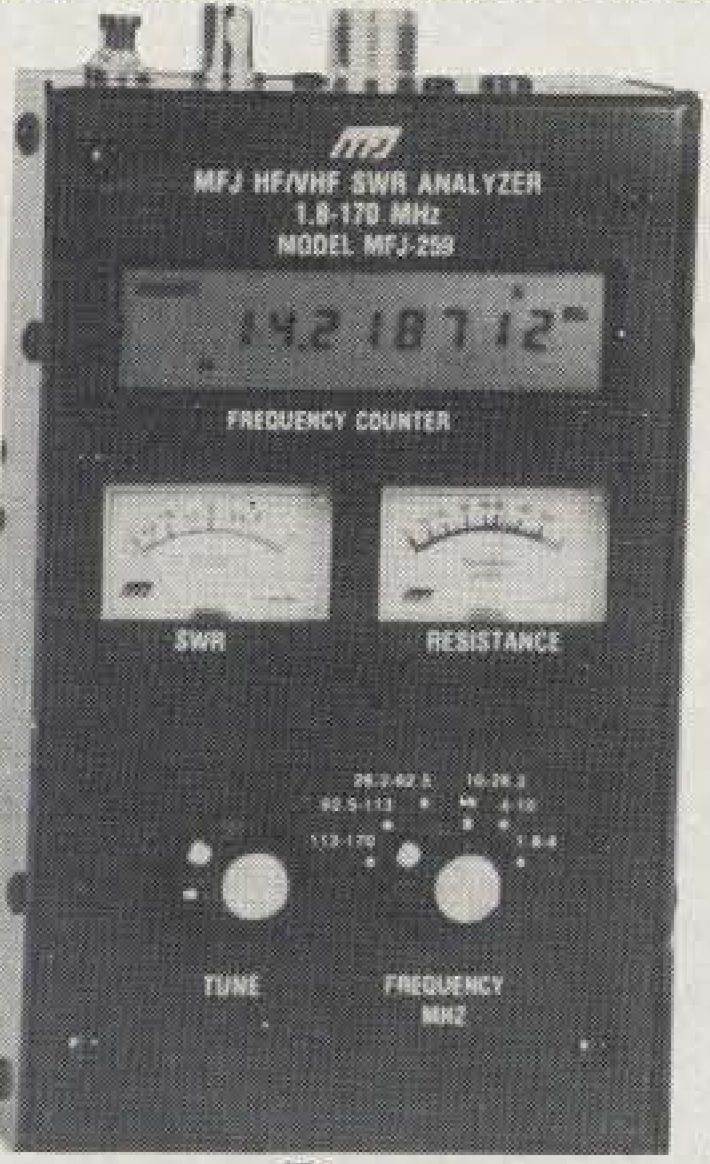
We all had fun as usual! The WPX test always provides the best bang for the buck under our circumstances. The new WP3X call is mucho better than the KP4XS call we used the last two years! . . . *WP3X.* Our first attempt in multi-multi category in WPX tests. CU guys in CW part. 73 from Stip. . . . *Z3ØM.* Operated from construction site of world's largest geothermal

(Continued on page 98)

This is Pekka, EA8AH (aka OH1RY), the 20 meter winner and new record holder.

MFJ *HF/VHF* SWR Analyzer™
with RF Resistance Meter

Read your antenna SWR from 1.8-170 MHz . . . 10-digit LCD frequency counter . . . RF Resistance Meter™ . . . smooth reduction-drive tuning . . . simple-to-use . . .



MFJ-259
$239⁹⁵

If you work with antennas, MFJ's revolutionary new *SWR Analyzer™* is the best investment you'll ever make! Now you can diagnose a wide range of antenna problems instantly with one easy-to-use instrument.

What the MFJ-259 Does

The MFJ-259 gives you a complete picture of your antenna's performance anywhere between 1.8 and 170 MHz -- you can even check SWR outside the ham bands without violating FCC rules. Set the bandswitch and tune the dial--just like your transceiver. SWR is displayed instantly!

RF Resistance Meter™

Does 2:1 SWR mean 25 ohms or 100 ohms? *The new MFJ-259 tells you at a glance!*

Now you can measure RF resistance up to 500 ohms at minimum SWR -- instantly -- on MFJ's *exclusive* side-by-side RF Resistance and SWR Meters!

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Watch the effects of spacing on radiation resistance as you adjust your antenna.

Here's What You Can Do . . .

Find your antenna's true resonant frequency from the shack.

Tune the antennas on your tower and watch SWR change instantly as you make each adjustment. You'll know exactly what to do by simply watching the display.

Tune critical HF mobile antennas in seconds -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on a single band, or analyze multiband performance over the entire spectrum from1.8 to 170 MHz!

Measure inductance, capacitance, resonant frequency of tuned circuits, transmission line velocity factor/impedance/loss.Test RF chokes, transformers, baluns.

Adjust your tuner for a perfect 1:1 match without creating QRM.

And this is only the beginning! The MFJ-259 is really *four* test instruments in one: an accurate RF signal generator, a high resolution 170 MHz frequency counter, *RF Resistance Meter™* and an *SWR Analyzer™*.

Free Manual

MFJ comprehensive 18 page instruction manual is packed with useful applications -- all explained in simple language you can understand!

For free manual write or call MFJ.

Take It Anywhere

The MFJ-259 is fully portable, powered internally by 8 AA batteries or 110 VAC with MFJ-1312B, $12.95. It's in a rugged all metal cabinet that's a compact 4x2½x6¾ inches. Take it to remote sites, up towers, on DX-peditions -- anywhere your antennas are located.

For rough service, pick up a convenient **MFJ-29B**, $24.95, padded carrying pouch to keep your MFJ-259 close at hand and looking like new.

How Good is the MFJ-259?

MFJ SWR Analyzers™ work so good, many antenna manufacturers use them in their lab and on the production line -- saving thousands of dollars in instrumentation costs! Professional installers and technicians use them worldwide.

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With the MFJ-259, you get full 1.8 to 170 MHz coverage, simple operation, instantaneous readings, a high accuracy frequency counter and MFJ's exclusive *RF Resistance Meter™*-- all for a low $239.95.

1.8-170 MHz *SWR Analyzers™*

MFJ-249
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MFJ-249 *HF/VHF SWR Analyzer™*. Same as MFJ-259 but less RF resistance meter. Includes 10-digit LCD frequency counter, *full* 1.8-170 MHz coverage and smooth vernier tuning.

MFJ-209
$109⁹⁵

MFJ-209 *HF/VHF SWR Analyzer™* is same as MFJ-259 without LCD frequency counter and RF resistance meter. Has jack for external frequency counter, smooth vernier tuning.

Carrying Pouch with Window

MFJ-29B
$24⁹⁵

Tote your MFJ-259 /249/209 *SWR Analyzer™* anywhere with this custom Carrying Pouch. Made with a special foam-filled fabric, it cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Clear protective frequency display and window cutouts for knobs let you use it without taking it out of pouch. Fully adjustable webbed fabric carrying strap has snap hooks on both ends. Wear around waist or over shoulder.

Keep your analyzer safe and looking new! **MFJ-29**, $19.95, no window or cutouts.

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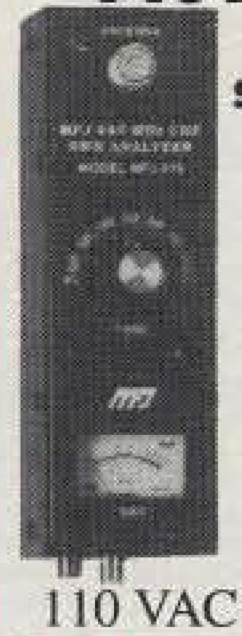
MFJ-66
$19⁹⁵

Plug a dip meter coupling coil into your *MFJ SWR Analyzer™* and turn it into a sensitive and accurate bandswitched dip meter.

With a dip meter you'll save time and take the guesswork out of winding coils, measuring inductance and capacitance, measuring velocity factor and electrical lengths of coax. Determine resonant frequency of tuned circuits and measure Q of coils. Set of two coils cover 1.8-170 MHz depending on your *MFJ SWR Analyzer™*.

440 MHz *SWR Analyzer™*



MFJ-219
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Read SWR of any antenna 420 to 450 MHz -- just plug coax of your antenna into SO-239 connector, set frequency and read SWR. Uses microwave integrated circuits and microstrip technology. Jack for external frequency counter. 7½x2½x2¼ in.

MFJ-219N, $99.95, sames as MFJ-219 but with "N" connector.

MFJ-219 uses 9 volt battery or 110 VAC with MFJ-1312B, $12.95.

MFJ 2 Meter *FM SignalAnalyzer™*

Measure signal strength over 60dB range - Check and set FM deviation - Measure antenna gain, beamwidth, front-to-back ratio, sidelobes, feedline loss in dB - Analyze audio quality with scope

NEW!

MFJ-224
$159⁹⁵

MFJ's revolutionary handheld 2 Meter *FM SignalAnalyzer™* lets you measure signal strength with over 60 dB dynamic range; check and set FM deviation of your packet and voice radios; measure antenna gain, beamwidth, front-to-back ratio, sidelobe suppression and actual feedline loss in dB.

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You can plug in headphones to help you tune in and identify signals easily. There's also a battery check function. Uses 9 volt battery. Measures 4x2½x6¾ inches.

Here are some countless jobs your MFJ *FM SignalAnalyzer™* can perform . . . evaluate antenna performance, detect feedline faults, plot field strength patterns, position your antennas, measure preamp gain, track down hidden transmitters, check and set deviation, analyze audio quality, scan the band, tune transmitters and filters, and much more!

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CIRCLE 154 ON READER SERVICE CARD

The TEN-TEC OMNI VI Plus Transceiver

BY PAUL CARR*, N4PC

Front view of TEN-TEC's OMNI VI Plus transceiver. A description of the new controls is given in the text.

If you have read the descriptions of the new rigs that are on the market, you realize that some form of DSP technology is incorporated in all the "top line" rigs. I must admit it seems that some manufacturers have introduced new models, and the most striking change is the inclusion of DSP technology. TEN-TEC chose a different approach: They decided to modify an existing rig that had already gained its fair share of the market.

The original rig was the OMNI V, which made its appearance in the late 1980s. It was a departure from the thinking at that time, in as much as it was an amateur-band-only transceiver. This made it easier from an engineering point of view to solve the inherent noise problems that were all too common with some of the earlier rigs that used synthesizer technology. This approach paid off very well. The OMNI V became well known for its excellent noise characteristics. TEN-TEC rigs had always been very highly regarded for their excellent CW characteristics, and the OMNI V continued to carry the torch.

The second version of this rig was the OMNI VI, which followed in the early 1990s. The OMNI V had already gained high acceptance in the marketplace, and the new model VI had many features that were requested by owners of the OMNI V. The number of memory positions was increased from 25 to 100; an RIT control and variable CW offset were incorporated. An automatic notch filter and a DSP-type LP filter were also added. The OMNI owners had a rig that could compete with anything on the market.

At first glance, one might overlook many of the new features of the OMNI VI Plus. The changes to the front panel are subtle. Remember, this is an upgrade, as opposed to a new rig. However, the changes are sufficient to warrant a new model number—564. The present OMNI VI owners have a choice of three upgrade packages (more about this later).

New Features of the OMNI VI Plus

One of the most impressive new features is a single-button noise reduction. I would confirm TEN-TEC's claim of as much as 15 dB noise reduction. This really can make a difference during marginal band conditions. Another modification is that the DSP LP filter is now available in all modes, and it is available from the front panel. TEN-TEC has changed the long menu into three shorter menus. The tuning rate for both the main tuning and RIT can be varied and stored in memory according to mode.

Now let's subject the front panel to closer inspection. There is no longer a 2.4 kHz button on the panel. That filter is the default condition when you disable the other filters. There are also now two 9 MHz narrow filter positions as opposed to the single selection on the OMNI VI.

The other filter selection buttons are labeled with the bandwidth, and they select filters in the 6.3 MHz passband tuning IF section. These are two narrow selection buttons which select optional filters in the first (9 MHz) IF section. The passband IF accepts optional 1.8 kHz, 500 Hz, and 250 Hz filters. The optional filters for the 9 MHz section are two 500 Hz filters, one of which is an 8-pole filter for CW, while the second is a 500 Hz, 6-pole filter for RTTY. A 250 Hz filter is also available for CW. Any two of these optional filters can be installed.

The remaining controls on the front panel consist of two rows of buttons to the right of the main tuning control. There is a button to activate the sidetone ON or OFF. With the sidetone on, you can set the audio level and the CW offset frequency for your individual preference. There is another button labeled LP, which activates the low-pass filter. The corner frequency of the filter is user selectable in 200 Hz steps. The low-pass filter is available in any mode, and the corner frequency can be stored in memory for the specific mode (CW/SSB), which is a very convenient feature.

The auto notch is very effective on phone. Heterodynes no longer exist (in the speaker, anyway). There is also a manual notch that is usable on CW and SSB. Some modern rigs lack this feature.

Overall Impressions

I could tell when I put the OMNI VI Plus into operation that I was sitting in front of a TEN-TEC rig. All of the controls are arranged in a very logical format. One of the tests that I perform on a new rig is to take the unit out of the box and put it into operation without consulting the instruction manual. (After all, that's the way most amateurs go about putting new equipment into service.) I am happy to say the rig passed this test with flying colors! I

*97 West Point Road, Jacksonville, AL 36265

must admit that I found it necessary to consult the instruction book when I visited the menus—yes, there are now three menus instead of the single menu of the OMNI VI. The instruction is very straightforward and easy to follow.

I feel I would be remiss if I failed to mention the CW features of this rig. The TEN-TECs are legendary when it comes to CW. The OMNI VI Plus has a built-in keyer that functions very smoothly from 10 to 55 words per minute. The dot-dash ratio is variable ±30% from the nominal 1:3 ratio. There are also provisions for connecting a straight key on the rear of the rig.

The full break-in features of this rig are what you have come to expect from TEN-TEC rigs. If your ears are good enough, you can hear between the dots during a QSO. The incoming signals seem to be present all the time. If you prefer a slower break-in rate, the length of the delay is fully adjustable from the front panel.

Additional Information

TEN-TEC offers three options for OMNI VI owners who want to incorporate the new features of the OMNI IV Plus into their existing rigs.

Option I—For $75 you can get a kit that provides DSP noise reduction, move the LPF control from the menu to the front panel, upgrade the menu, and add the new tuning speed feature.

Option II—For $125 you can get factory installation of the features in Option I, and TEN-TEC will replace nine keypad buttons. (Stick-on labels are provided for Option I.)

Option III—For $275 TEN-TEC will do a complete factory upgrade. This includes all features of Option II, plus replacing two circuit boards and a wiring harness necessary to add the second optional filter position in the 9 MHz IF. This brings the rig up to identical specs and features of the OMNI VI Plus.

For additional information on the available options, call 800-833-7373.

Summary

If you enjoy operating a "top-of-the-line" rig, I think you need to give this unit careful consideration. TEN-TEC has a no-risk, 30-day money-back guarantee. This will let you see how the rig performs in your shack. If for any reason you are not satisfied, return the rig in original condition and all you pay is the shipping. I'm sure you will be happy, though.

The OMNI VI Plus is priced at $2585.00. It is a product of TEN-TEC, 1185 Dolly Parton Parkway, Sevierville, TN 37862.■

The art of being frugal comes naturally to most amateurs. We tend to save things for "future use," which in the long run frees up landfills for more important stuff. VE3ERP has come up with another use for those little plastic film containers we've been saving for just such a project.

QRP Antenna Cheapware

BY GEORGE MURPHY*, VE3ERP

My original title for this article was "Free Hardware for QRP Antennas." However, in these days of computerspeak, I had no desire to be inundated with requests for free computers, towers, 5-element beams, etc. Therefore, I coined the term "Cheapware."

The "Cheapware" described herein consists of the plastic containers in which 35mm camera film is packaged. Your local film processor will be glad to give you as many as you want for free, which is about as cheap as you can get. The ones I like to use are Kodak™ containers. They are the ones with black bodies and gray lids. A little rummaging around in your junk box and the family button box will provide just about everything else you need for a QRP antenna.

The plastic film canisters can be cut and then trimmed very easily with an X-ACTO™ hobby knife equipped with a #11 (the long, tapered, skinny one) blade. *Don't* drill holes with an electric drill; the plastic is so soft the drill will go right through the plastic and probably anything else within range before you can stop the drill. One method of drilling holes is to simply roll a sharp drill bit slowly between your fingers and let it cut its way through the soft plastic. I'm not certain, but from the feel of it I suspect this is the method used to make the holes in Swiss cheese. Larger holes are best cut with a #11 blade in a hobby knife. Don't be too aggressive. This operation is about as energy demanding as carving snow with a blow torch.

QRP Antennas

Antennas for low power can be made with very fine monofilament steel fishing line, with insulators made from almost any nonconducting material. Traps do not need large air-core coils or transmitter-type capacitors. Toroid inductors and standard silver-mica capacitors work just fine. Baluns can be simple toroid devices. The "Cheapware" described in this article is primarily intended for QRP antennas and will handle up to about 50–100 watts.

Nothing I can find in the Amateur Code of Ethics says you should not connect your 300 milliwatt QRP transmitter to the bottom of 120 feet of hardline up to the 7-element full-size beam on top of your tower. However, this definitely would be a classic case of the tail wagging the dog. On the other hand, I would not suggest letting the dog wag the tail by firing up your QRP antenna with your 2 KW linear in its "numb-the-neighbors" mode. You have to draw the line somewhere.

Antenna Trap (fig. 1)

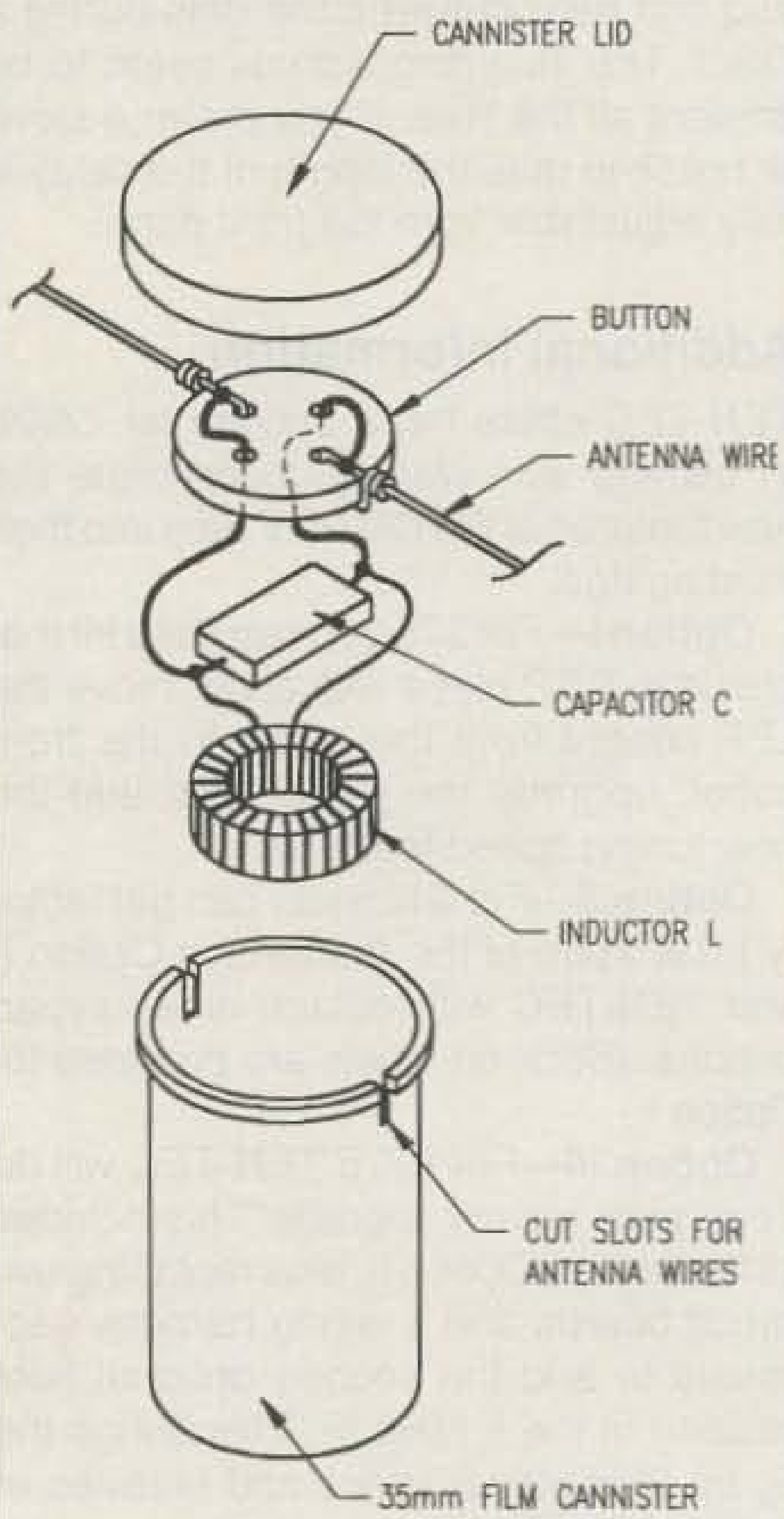
With the help of a large, plastic coat button, a silver-mica capacitor, and a toroid coil, you can make a very neat and weather-proof trap by enclosing the components in a plastic film canister. All you have to do to the canister is cut a couple of slots for the antenna wires.

Balun (fig. 2)

For this one you need to prepare the canister lid to accept a coaxial-cable chassis-mount connector. First, cut a mounting hole to suit the connector barrel. If you use an SO-239 connector, you will have to cut away the inner sealing ridge of the lid in four places and also cut four shallow slots in the top rim of the canister to clear the corners of the connector flange.

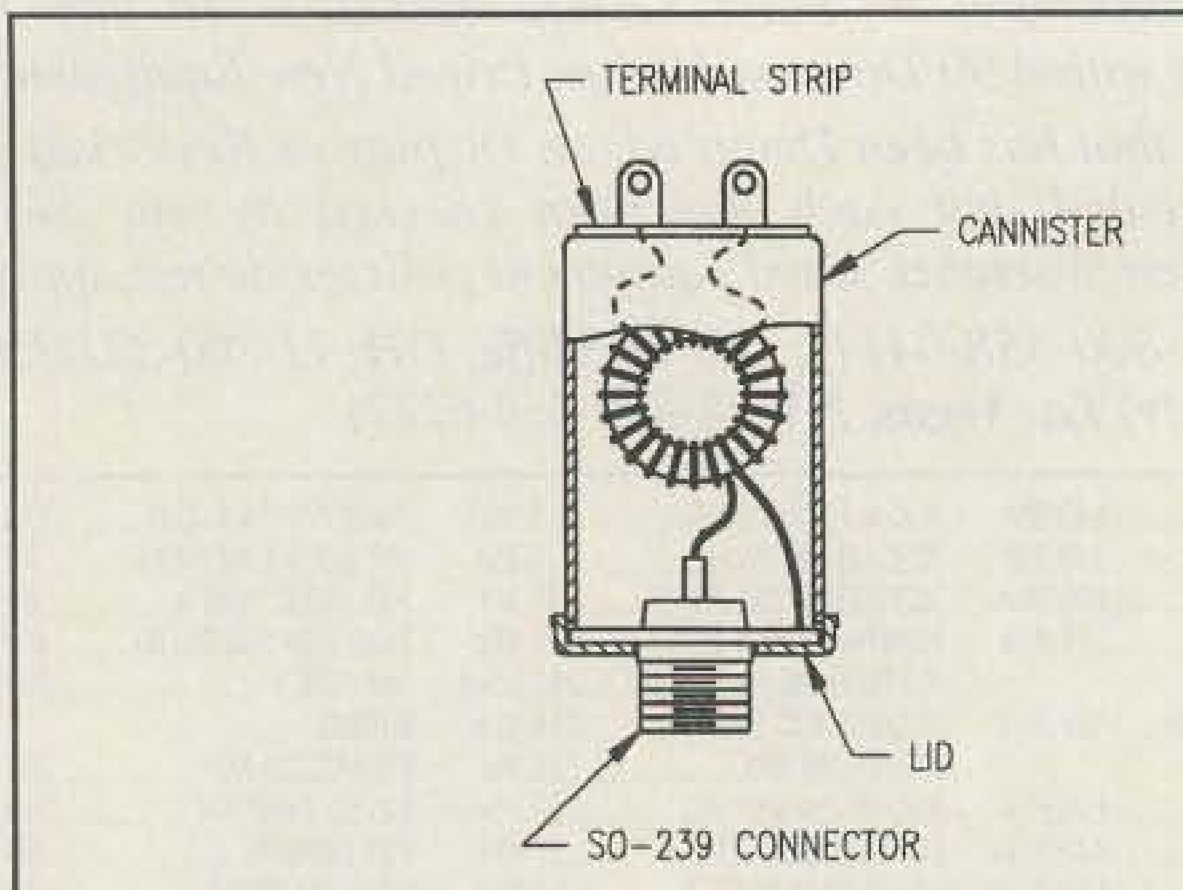
Solder the coil winding leads to the connector, and then attach the connector to the lid with epoxy adhesive. The cold end of the winding can be soldered into one of the connector's mounting holes, but if the plating on the connector makes solder adhesion difficult, simply install a screw, solder lug, and nut through a hole in the

Fig. 1– Diagram of a simple QRP antenna trap made from all those things you're glad you saved. ⟶



TRAP DATA – #18 AWG WIRE COILS					
TRAP FREQ. BAND	TRAP FREQ. MHz	C pF	L uH	AMIDON CORE	NO. TURNS
80	3.5	120	17.2	T-106-2	36
40	7.0	62	8.3	T-94-2	32
30	10.1	43	5.8		26
20	14.0	30	4.3	T-80-2	28
17	18.1	24	3.2		24
15	21.2	20	2.8	T-68-2	22
12	24.9	18	2.3		20
10	28.8	15	2.0		19

*77 McKenzie St., Orillia, ON L3V 6A6 Canada



SOME TYPICAL BALUNS							
WINDING Z		RATIO	LOWEST FREQ MHz	WIRE SIZE (AWG)	AMIDON CORE No.	No.TURNS	
PRI ohms	SEC ohms					PRI	SEC
450	450	1:1	3.5	#18	FT-82-43	12	12
450	75	6:1	7.0	#18	FT-50-43	9	4
300	75	4:1	1.8	#18	FT-82-43	14	7
150	75	2:1	3.5	#12	FT-82-43	7	5
500	32	15.6:1	2.0	#28	FT-37-43	20	5

Fig. 2– The film container can also serve as a housing for a low-power balun.

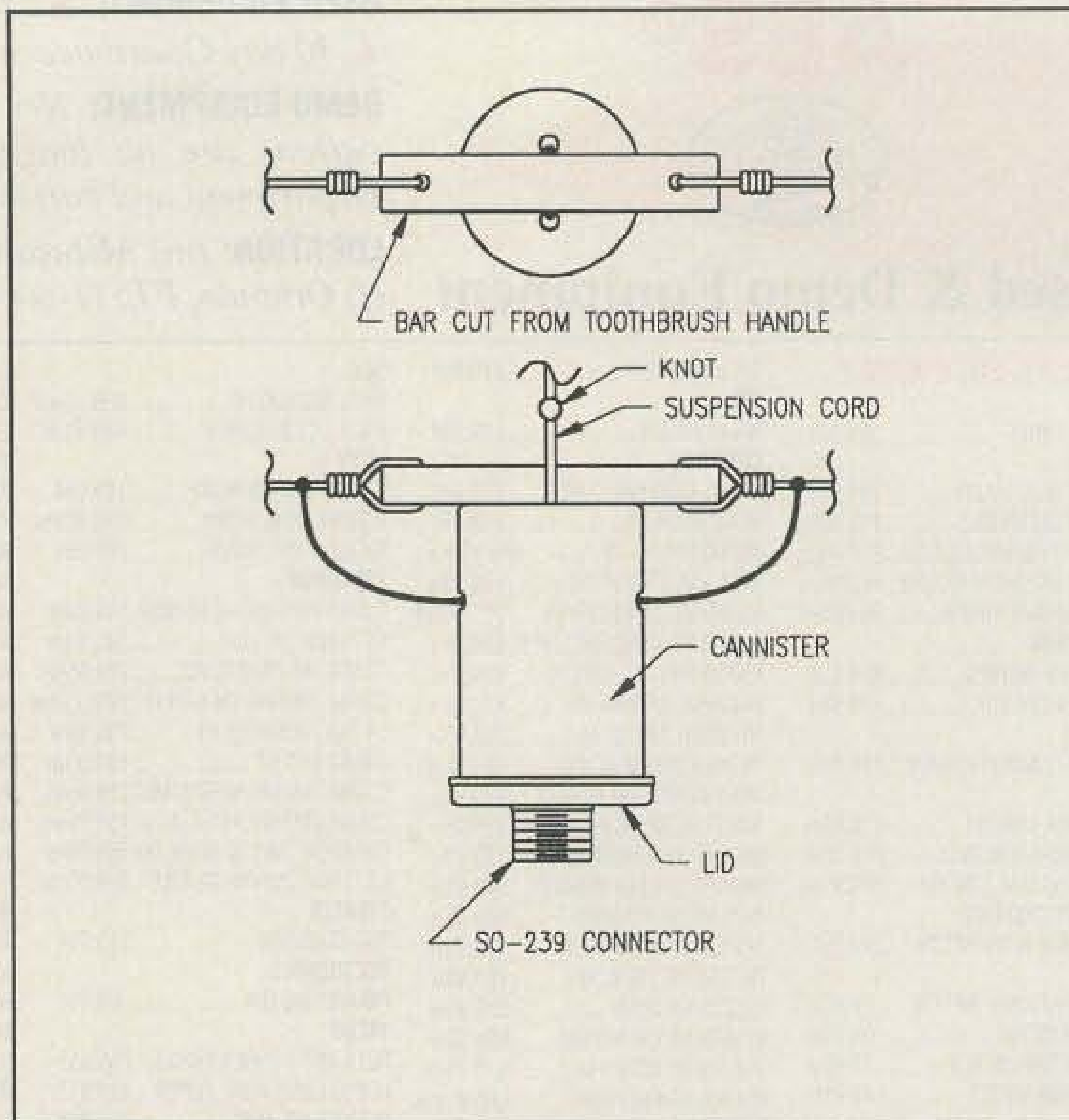


Fig. 3– If we add the remnants of an old toothbrush to a film container, we have the makings of a center support system for a dipole antenna.

lid and one of the connector mounting holes for the coil connection.

Make appropriate holes in the bottom of the canister and attach a suitable terminal strip for the balanced line with epoxy adhesive. If you do not trust epoxy as much as I do, you can use screws. To me, unless you intend to use this joint to raise the *Titanic*, it is a waste of good screws. Solder the transformer leads to the terminal strip lugs, and you are done.

Dipole Feed Point (fig. 3)

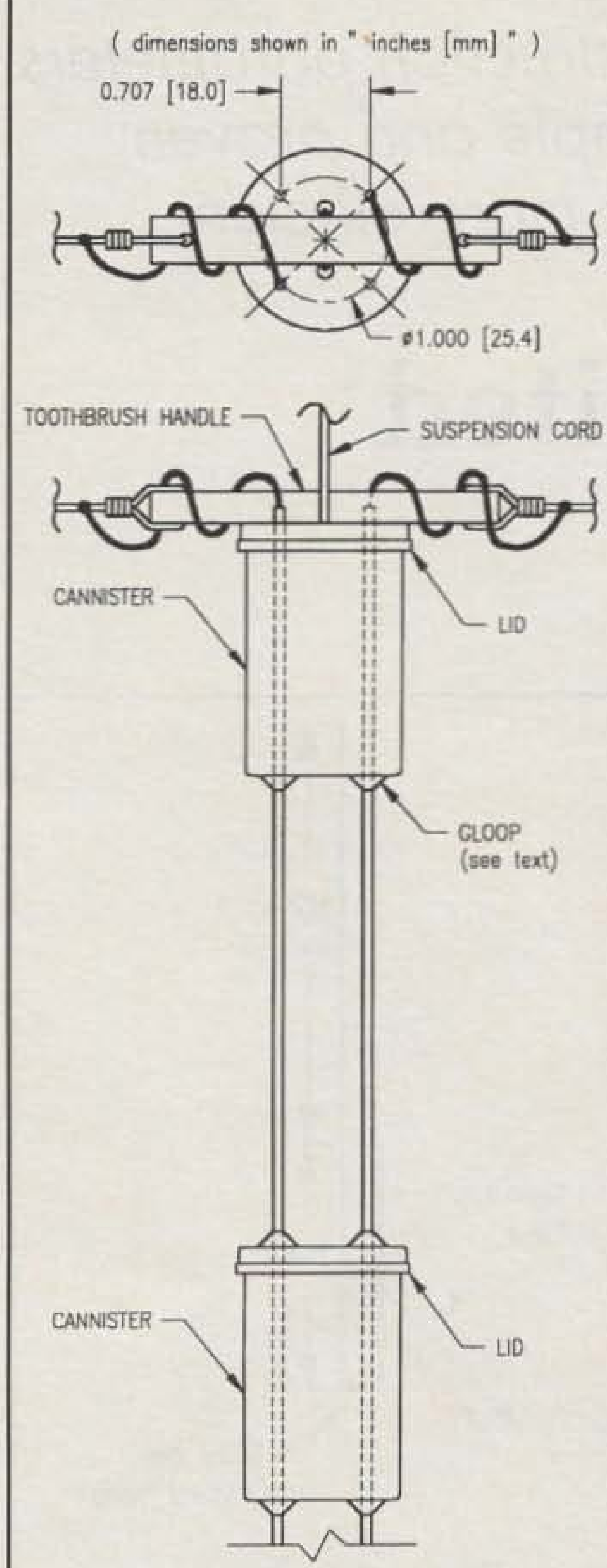
This one is real simple. Drill a couple of holes in a piece of toothbrush handle and fasten it to the bottom of a canister with epoxy adhesive. Drill a hole in the bottom of the canister on each side of the toothbrush handle, and install a suspension cord or wire through one hole, passing under the toothbrush handle inside the canister and out the other hole. Fit a connector into the canister lid as described for the balun, with leads long enough to reach through holes in the canister body to the ends of the dipole elements.

If you need a balun at the antenna feedpoint, just combine the details in figs. 2 and 3, connecting the leads of one transformer winding to the connector, and the other winding leads out through holes in the canister body to the antenna wires.

Open-Wire Line (fig. 4)

Plastic film containers make ideal spacers for four-wire and two-wire open-wire transmission lines. Four-wire lines offer the advantage of having lower impedances than two-wire lines, but have not been popular because they require complicated spacers. However, in the La-La Land of QRP, where life is good, the living is easy, wire is cheap, and complex spacers are free, you might want to try a four-wire line.

Make either two or four holes in the lid and canister bottom for the wires. A blob of gloop on each wire at the top and bottom of each container will hold it in place. Unless otherwise noted, gloop can be anything weatherproof that sticks to the surfaces being glooped, such as epoxy adhesive, silicone bathtub sealer, regular caulking compound, or a lump of solder.



CHARACTERISTIC IMPEDANCE			
WIRE SIZE		OHMS	
AWG	DIA.	2–WIRE	4–WIRE
#12	0.081"	385	151
#14	0.064"	412	165
#16	0.051"	440	179
#18	0.040"	468	192

Fig. 4– If you've been compulsive and saved a number of the containers, you can easily make open-wire spreaders.

Depending on the wire used, a distance between spacers of about 10–15 cm (4–6 inches) should be about right.

To connect the open-wire line to the antenna, use the old toothbrush handle shown in fig. 3 and install it as shown in fig.4. If you need a balun at the feed point, you can include one in the top canister.

Component Values

The component values in the tables of figs. 1, 2, and 4 are arbitrary values I chose using *HAMCALC* software.[1] If you have a computer and *HAMCALC*, you can change these values to whatever turns your crank.

Finally . . .

When all else is done, run a bead of epoxy adhesive all around the joint between the lid and body of all canisters to discourage separation. Seal all openings in lids and bodies with gloop. Relax. Read a good book. Enjoy QRP. Let the Big Guns dominate the airwaves. On contest weekends go fishing (with monofilament steel line, a good casting weight, a QRP Cheapware antenna, and your QRP transceiver) . . .

Footnote

1. *HAMCALC* is *free* software you can get from me by sending me US$5 to defray materials and airmail postage costs to anywhere in the world (ask for version 32 or later). *HAMCALC* comes as an MS–DOS/Windows 1.44 Mb 3½ inch diskette with over 200 programs of interest to amateur and professional RF enthusiasts. ■

K6MHE takes us through the design and construction parameters for his J-pole antenna. The design may be simple and proven, but a little computer tweaking can make it far more efficient.

The J-Pole Revisited

BY DAN RICHARDSON*, K6MHE

The J-pole antenna has been around for decades. Its ease of construction, cost, and installation make it a favorite for the home builder. However, if conventional construction and installation methods are utilized, I have found that the performance of this antenna is less than optimum. I built my J-pole to avoid some common pitfalls, resulting in improved performance. If you are considering building a J-pole for yourself or if you presently are using one, the following information should be of interest to you.

A Bit of History

I have in my library an old government publication entitled "Antennas and Antenna Systems" (TM 11-314) printed in 1943 by the War Department, wherein the following description of the J-pole is given:

"The J antenna, so called because it resembles the shape of the letter "J," is a half-wave vertical element end-fed by a quarter-wave matching stub . . . It is intended for use with two-conductor open-wire transmission lines, a suitable value of line impedance being 600 ohms. Since the lower end of the matching stub is at zero potential with respect to earth, a direct ground may be made to this point, using a connecting wire of any convenient length, without disturbing the operation of the antenna . . ."

Today, amateurs normally use coax transmission line to feed an antenna. Otherwise, the above description and the illustration shown in fig. 1, printed over four decades ago, are essentially unchanged and still are published today in many amateur radio publications.

The operation of the J-pole is based on the assumption that the top 1/2-wavelength section is the radiation portion of the antenna, while the lower 1/4-wavelength stub is used for matching and doesn't radiate. This assumption is not entirely correct. I will endeavor to explain.

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Computer Modeling

Fortunately, today we have at our disposal inexpensive antenna-modeling software. We can, by using our computers, effectively evaluate many antenna configurations without so much as stringing a single wire. I used EZNEC[1] to model and analyze the J-pole for a closer look.

The First Scenario

I began by modeling a 2 meter J-pole at a typical backyard elevation of 30 feet above ground. The model was designed to represent the "plumber's delight" style of construction using standard 1/2 inch copper pipe and fittings. (As a reference for comparison, I also molded a 1/2-wave dipole at the same height.)

In the first analysis I molded only the antennas themselves. This was done to eliminate any possible distortions which could be caused by a supporting mast or transmission line. In other words, the antennas were just floating up there (the wonders one can do with computers) connected to nothing. I planned to add a conductive support mast and coax transmission line and evaluate their influences at a later time.

The resulting far-field elevation plots for this first scenario are shown in figs. 2 and 3. Two elevation plots are depicted for the J-pole in fig. 2, and the reference 1/2-wave dipole is shown in fig. 3. Fig. 2(A) was produced with the unconnected portion of the stub oriented to the right side; fig. 2(B) was generated by EZNEC with the stub rotated 90° azimuth (perpendicular to the view).

The 1/2-wave reference dipole's plot (fig. 3) is similar to that in fig. 2(B). However, the dipole produces a sharper dip in radiation directly overhead (180°).

EZNEC also revealed that the major lobe takeoff angle of 3° was identical for both antennas. Therefore, I used 3° for the elevation angle to compute the azimuth pattern comparisons in fig. 4. In this illustration (fig. 4) the unconnected leg of the stub is oriented towards the right (0° bearing) side. Observe that the J-pole exhibits a slight pattern shift or skewing in the same direction as the unconnected stub is positioned.

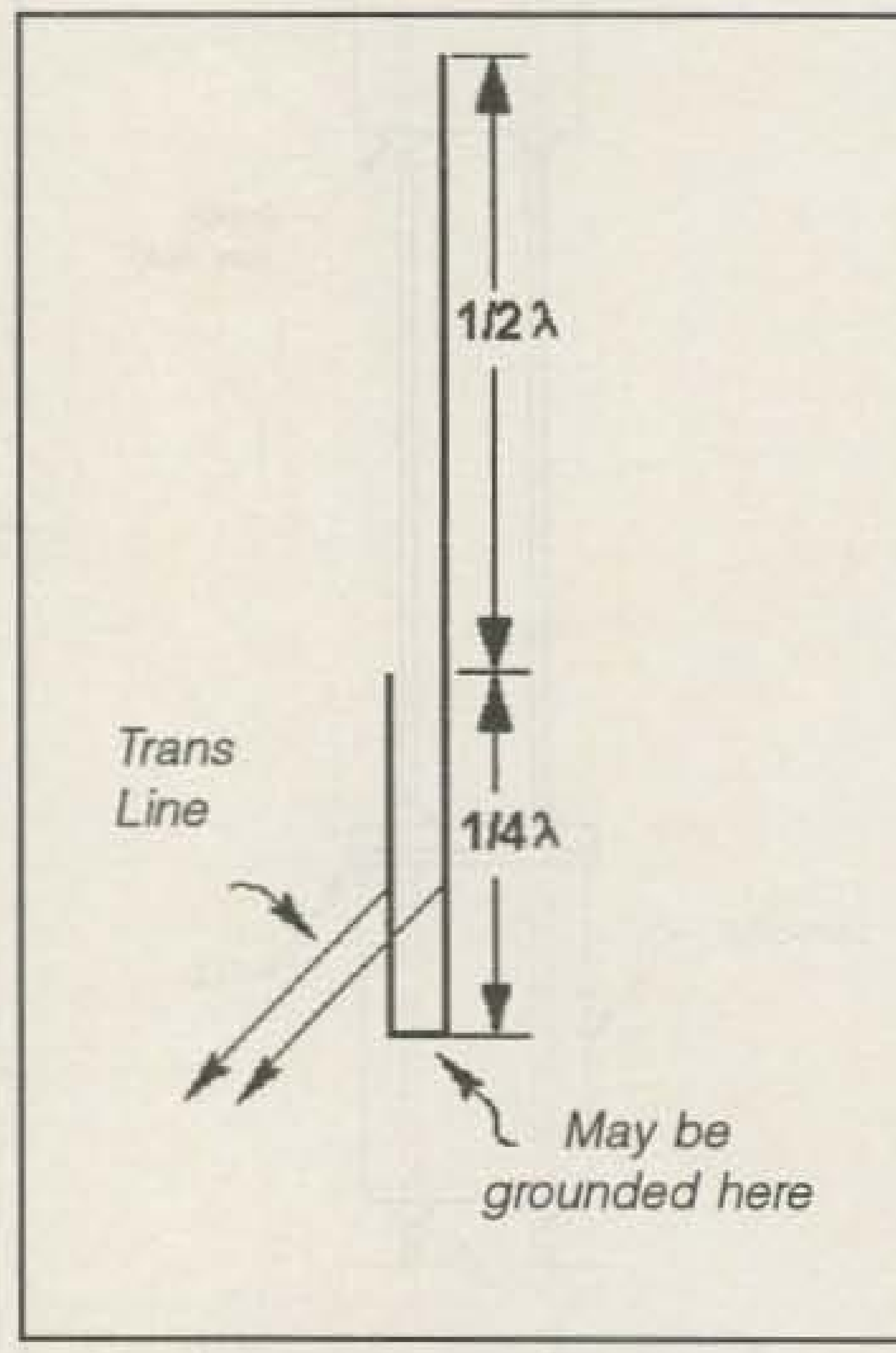


Fig. 1– Typical J-pole illustration.

An Incorrect Assumption

If the assumption that only the top 1/2-wave of the J-pole radiates and the 1/2-wave matching section doesn't, why isn't the J-pole's pattern much closer to that of the dipole? After all, aren't both antennas supposedly utilizing 1/4-wavelength radiating elements? Evidently, the matching stub must be influencing the J-pole's pattern. It does and here's why.

For negligible radiation to take place from the 1/4-wave matching stub, certain

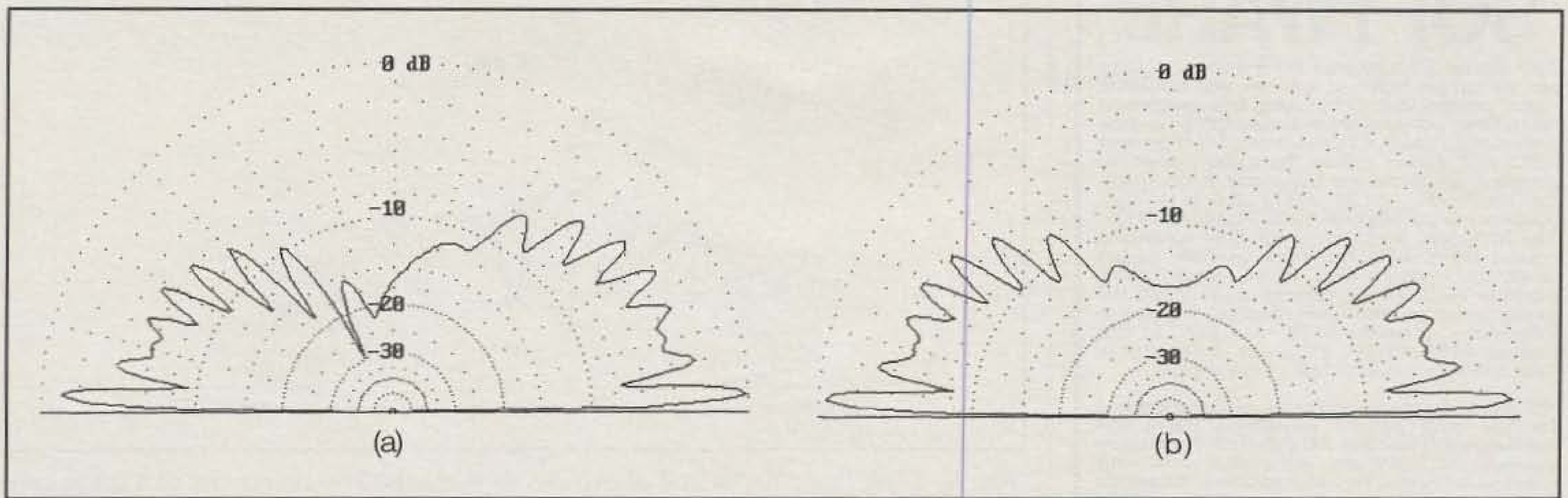


Fig. 2– Elevation plots of a J-pole mounted 30 ft. above ground. In view (A) the unconnected leg of the matching stub is located to the right side. In view (B) the unconnected leg is oriented perpendicular to the view.

conditions must be met. First, the spacing between the two parallel conductors must be very close in terms of wavelength. Second, the current in each conductor must be equal in amplitude with a phase differential of 180° (anti-phase).

Looking at the matching stub, it is obvious that at the unconnected (open) end of the stub no current exists, as that point exhibits an infinite impedance. However, what may not be readily apparent is the following: At the adjacent contrasting point of the stub, where it connects to the 1/2-wavelength element, the impedance is quite high. However, it is not infinite. Therefore, current must exist. (Indeed, if there was no current at that point, no power would be coupled to the 1/2-wavelength element.) Consequently, the current amplitudes between the parallel lines of the matching stub will not be equal. This was confirmed by examining the currents within the stub section computed by EZNEC. EZNEC's computations verified that the currents in the contrasting stub segments were not the same in amplitude. Additionally, EZNEC also reported that the phase relationships were not exactly 180°. The consequence of all of this is that some energy is radiated from the matching stub. Although the differences computed by EZNEC were not great, they were enough to produce the skewing of the J-pole's radiation patterns illustrated in figs. 2 and 4.

The Bottom Line

In the azimuth comparisons in fig. 4 EZNEC calculated that the J-pole's gain varies from approximately a maximum of 1 dBd at 0° to –1/4 dBd at 180°. Broadside to the stub section (90° and 270°) the gain is about 1/2 dBd.

In spite of the fact that EZNEC's calculations indicated that the J-pole had *overall* a slight gain advantage compared to the dipole, I concluded that the performance of both antennas would be about the same. The reason is that it is generally accepted that a change of 1 dB can scarcely be perceived by a receiving station. Therefore, from a practical point of view, a receiving station would normally not be able to distinguish between the J-pole and the dipole, based on the azimuth comparisons in fig. 4, as any variation would be 1 dB or less.

I next concentrated my efforts on understanding what consequences, if any, adding a support mast and coax transmission line would have.

The Second Scenario: Adding A Supporting Mast

The next step was to model a J-pole connected to a mast. For this analysis the base of the stub section was to be directly connected to a ground-mounted conductive mast.

EZNEC uses the Nec-2 engine for computations and will not permit wires to touch ground. In order to emulate a ground connection for the mast, a ground system was

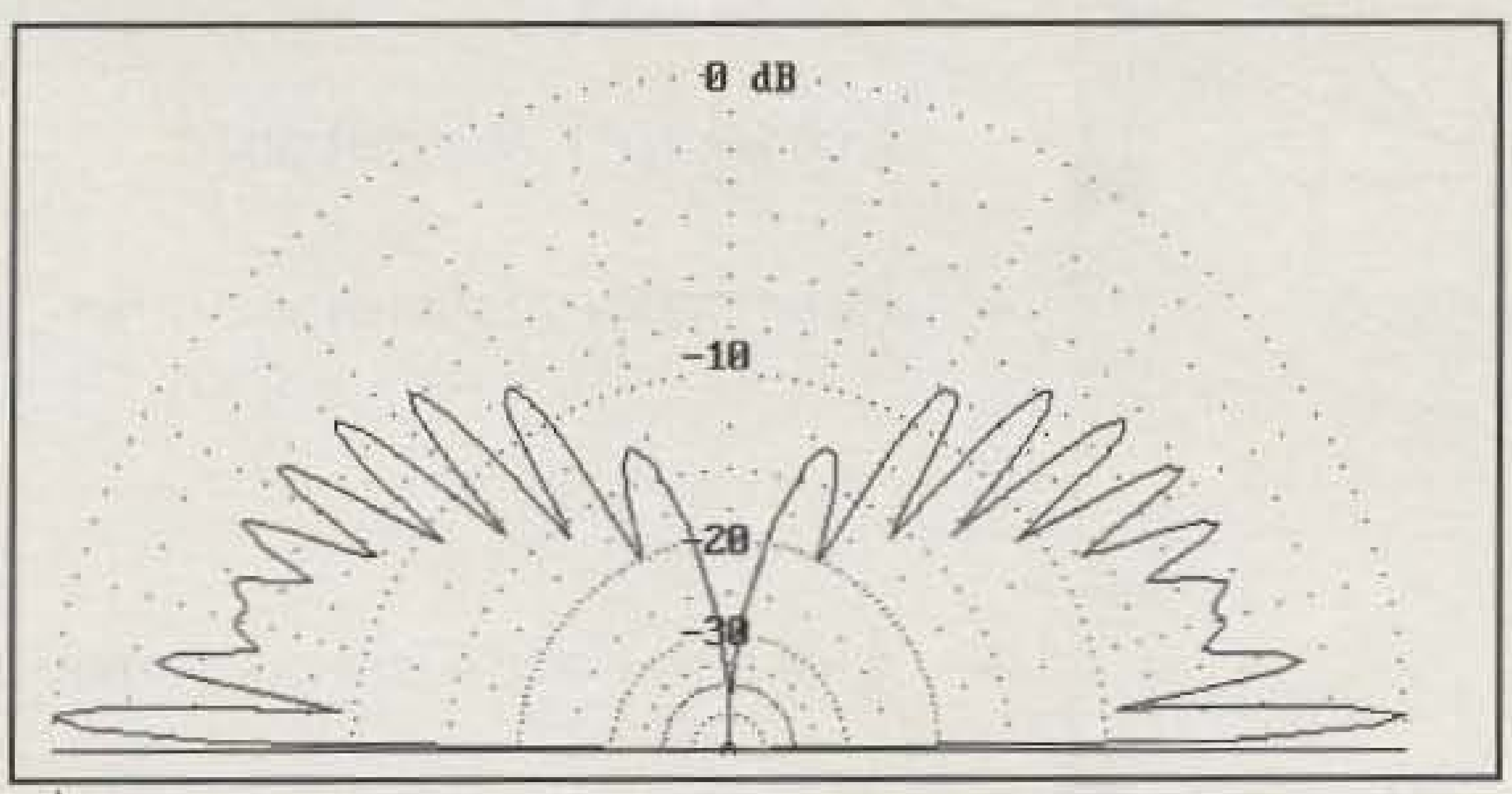


Fig. 3– Elevation plot for a 1/2-wave dipole mounted 30 ft. above ground.

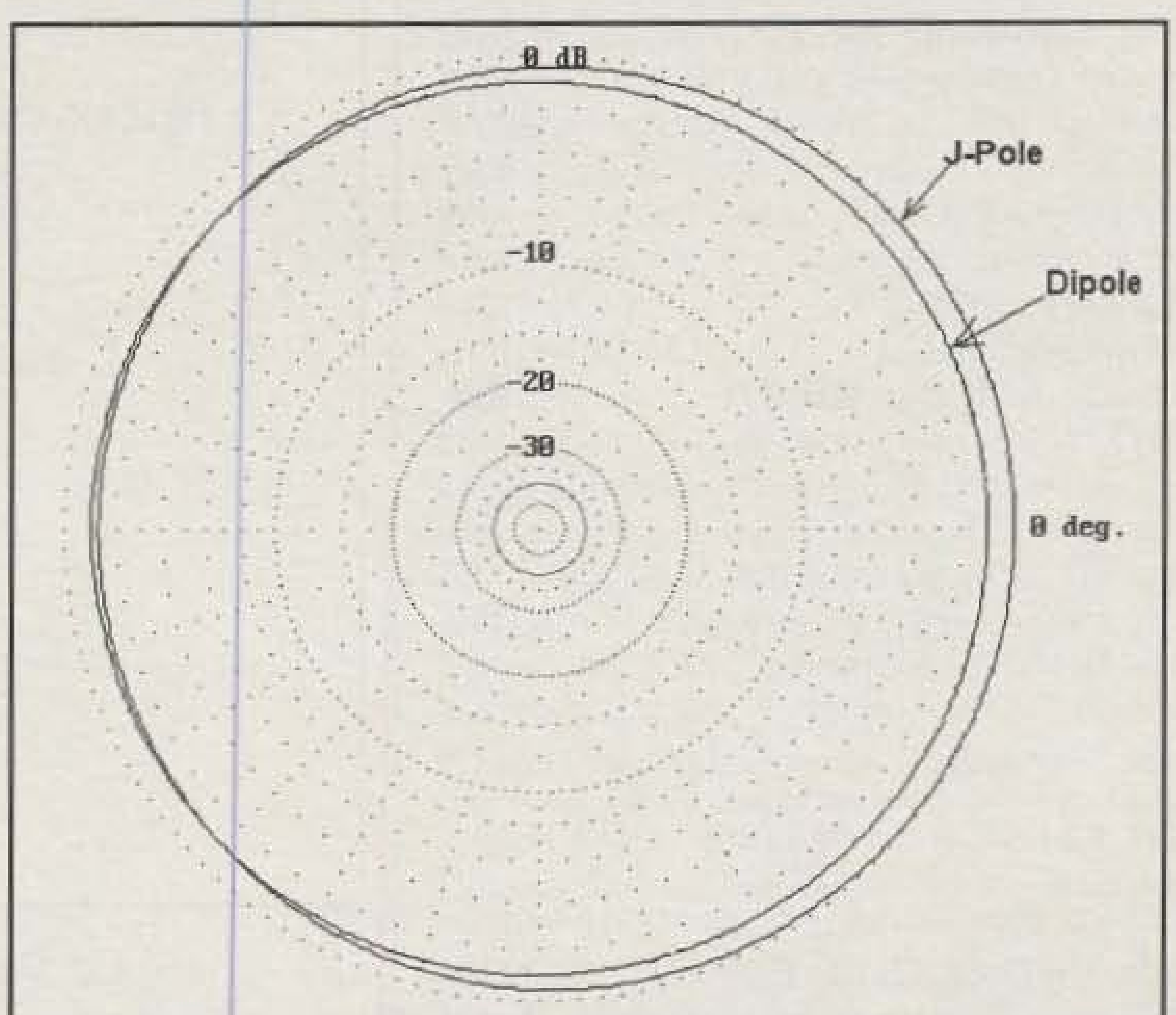


Fig. 4– Azimuth patterns at 3° elevation for a 2 meter J-pole and a 1/2-wave dipole mounted 30 ft. above ground.

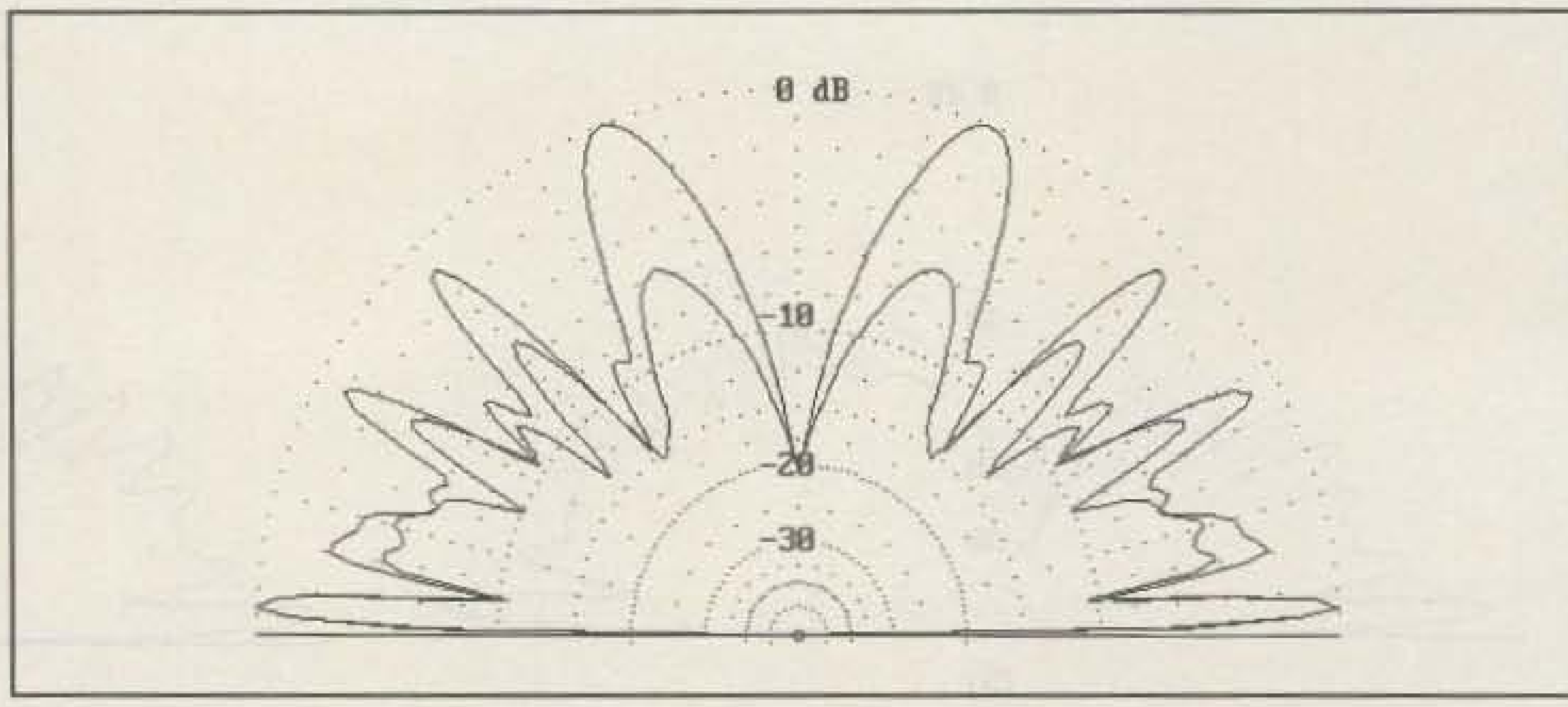


Fig. 5– Elevation comparison of two J-pole systems. The outermost plot is the conventionally built and installed J-pole, and the inner plot is a J-pole insulated from the support mast with a coaxial choke installed at the feed point (see text).

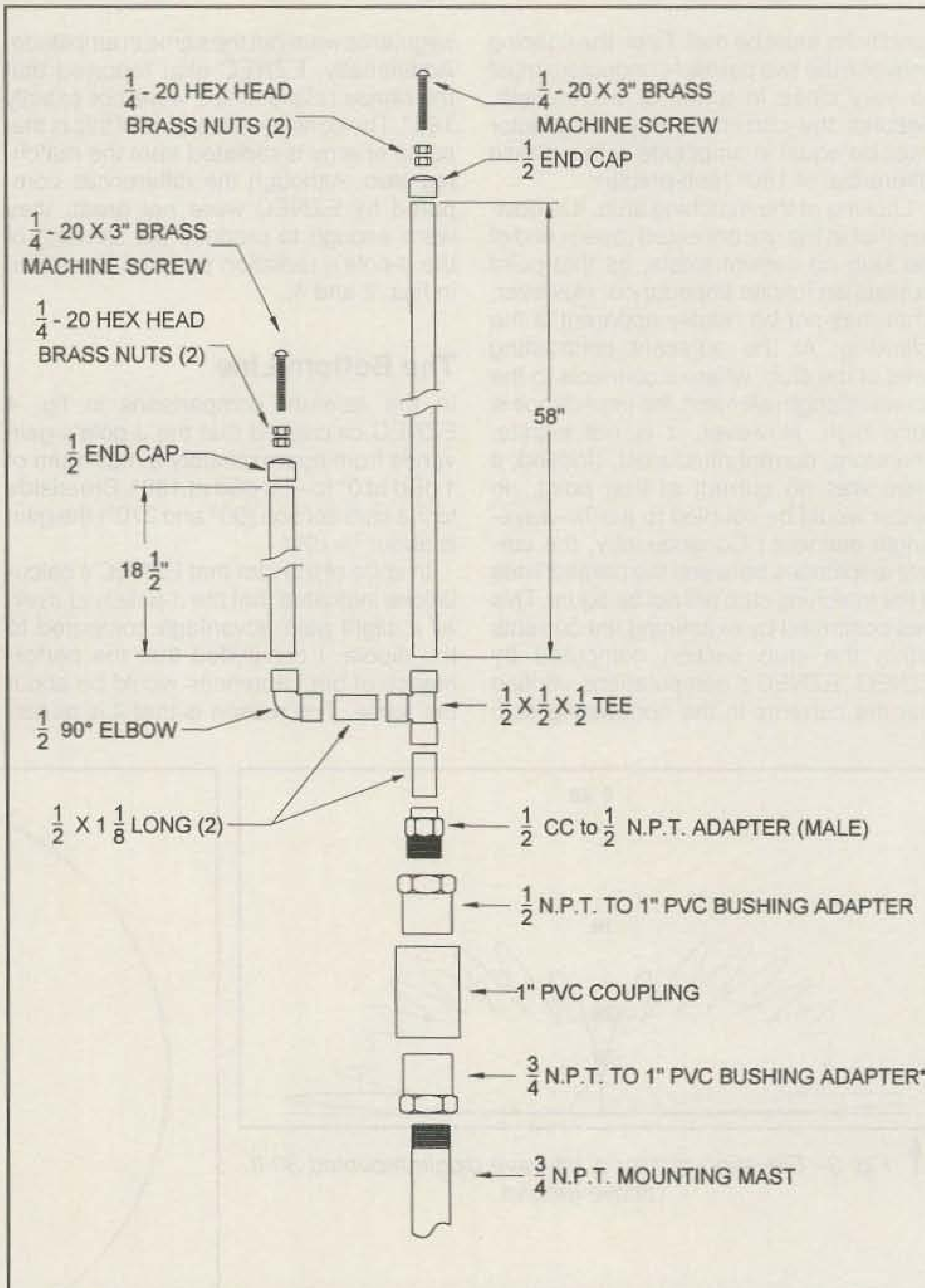


Fig. 6– Parts assembly and dimensions for a 2 meter J-pole.

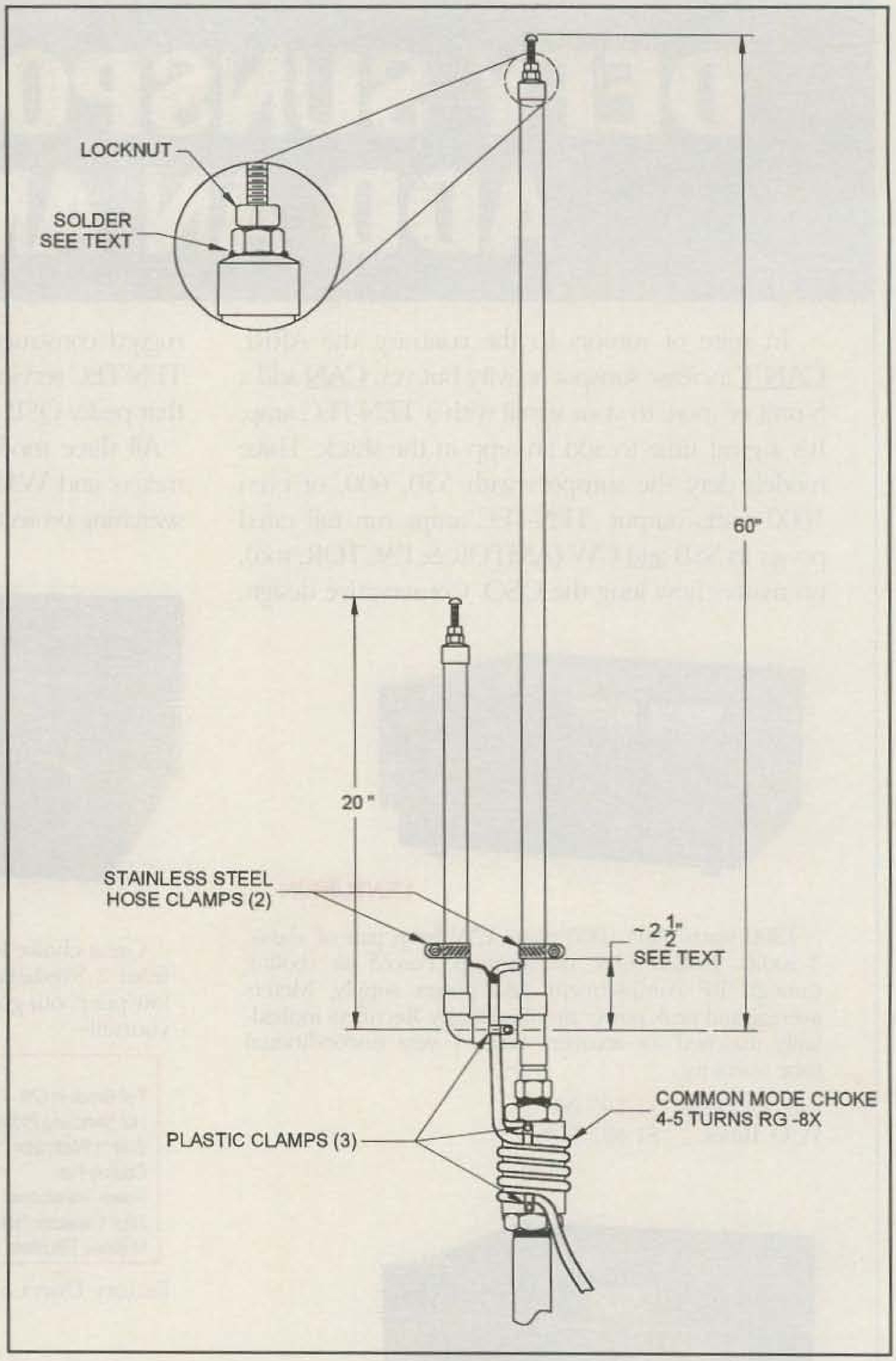


Fig. 7– The assembled J-pole with a common mode current choke formed using the coax transmission line.

modeled consisting of four 1/4-wavelength radials connected to and spreading out from the base of the mast. The base of the mast and the radials were located very close to (1/2 inch above) ground.

A series of computer-generated plot analyses were run at several mast heights varying from approximately 27 to 30 feet, including odd and even 1/4 wavelengths. As might be expected, there were variation in the elevation plots depending upon the height (length) of the mast. Most noteworthy, in all cases EZNEC reported an increase in the higher takeoff angles when the antenna was connected to the conductive mast. Consequently, based upon these analyses, I concluded mounting a J-pole to a conductive support does and will have an effect upon the performance of a J-pole. This is contrary to previous statements in many publications.

The Third Scenario: The Transmission Line

Although coax is a two-conductor transmission line, due to skin effect there are actually three conductive surfaces. One surface is the outer surface of the center conductor, the second is the inside surface of the sleeve (braid), and the third is the outside surface of the sleeve. It is this outer surface where an unwanted (common mode) current can be and usually is present.[2]

To find out to what extent the common mode current on the transmission line may affect the antenna's performance, I ran an analysis for a J-pole fed with a coaxial transmission line. In this analysis the antenna was at the same 30 foot elevation as I had used in the previous models.

To incorporate the third conductive surface of the transmission line in the antenna model, I used a method suggested by Roy Lewallen in the EZNEC manual. This entailed placing a wire very close to and running parallel with the transmission line. For this analysis the coax and the parallel wire were routed straight down from the antenna. Additionally, a mast section was not included to reduce possible misinterpretations of the analysis.

Examining EZNEC's calculations for this configuration revealed that common mode current does exist on the transmission line. The transmission line radiation resulting from the common mode current caused an increase in higher angle radiation patterns similar to that in the previous analyses of conductive masts.

At this point it was obvious that mounting a J-pole directly to a conductive mast and/or the common mode current on a coax transmission line results in producing a high proportion of signal being wasted at higher takeoff angles.

In the preceding analyses of the mast and coax transmission line we made reference to a theoretical J-pole attached to nothing—just floating up there 30 feet above ground. In the real world the antenna will be supported by something and will have a transmission line attached. What I needed now was a comparison under more realistic circumstances.

The Fourth Scenario: The Tale of Two Systems

I concluded by running a computer analysis for two complete J-pole systems. One system was a conventionally constructed and installed J-pole. By convention,I I mean the base of the antenna is directly connected to a ground-mounted conductive mast and fed with a coax transmission line with no provisions for controlling common-mode current. In the second system the J-pole was insulated from its mast and a coaxial choke was contrived by placing a 500 ohm series inductive reactance inserted on the wire simulating the outer shield of the coax at the antenna's feed point. The antennas in both systems were mounted 30 feet above ground, and all other parameters were the same— i.e., ground conductivity, applied power, and so on.

The resulting computer elevation plots are shown in fig. 5. In this figure the patterns are viewed with the unconnected leg of the stub oriented perpendicular to the view. Note the substantially higher angle radiation (outermost pattern) of the J-pole built and installed in the conventional fashion.

Unquestionably, based on the computer analysis, for better performance of a J-pole antenna at the desirable lower takeoff angles, it should be built and installed like most other antennas. That is to say, isolate it from any conductive supporting structures and employ some method to eliminate or reduce common mode current on the coax transmission line. It was these conclusions I applied in the building of my J-pole.

Construction

I used common copper to copper and PVC plumbing components obtained at the local building supply store to build the antenna. In addition to the ease of obtaining the plumbing fittings and their reasonable cost, there is the additional benefit that an open channel is maintained throughout the antenna elements. This permits draining of any possible internal moisture condensation.

The antenna construction (dimensions and assembly) information is given in figs. 6 and 7 and should be self-explanatory. The main departure from conventional "plumber's delight" construction practice is the use of the PVC pipe fittings, which serve a double purpose. They form an assembly which is used to insulate the antenna from the mast, plus they provide an excellent coil form for fabricating a coaxial (common mode) choke. The two PVC adapters and coupling are cemented together using standard PVC pipe cement.

Another slight variation from the conventional is the incorporation of adjustment screws (stingers) at the end of the elements. This was done to make the adjusting (resonating) of the antenna a much easier task.

I found using a tube cutter to be much superior to using a hacksaw for cutting the copper wire. Using a tube cutter makes it easier to maintain dimensional accuracy and provides a good straight cut, plus deburring is not required.

Soldering Tips

A few comments may be in order for those inexperienced in soldering copper pipe fittings.

First of all, be sure that all surfaces to be soldered are clean. I used a strip of emery cloth (180 grit) about 1 inch wide and 8 to 10 inches long. While holding the copper tubing in a vise, I used the emery cloth as one would use a shoe-shine rag and polished the copper tubing until it was bright and clean.

Next, prior to assembling the components for soldering a very thin coat of soldering paste was applied to the surfaces which were to be soldered. By thin I mean that when applied, the paste could barely be detected by eye, but it could be felt by touch. Applying too much paste will make for a gooey mess and can hinder more than help while soldering.

When soldering the joints at the base of the antenna, some care is required to keep all the components properly aligned, as the heat conduction is such that most, if not all, of the joints will be molten during soldering. I happen to have a large vise which did the job nicely, but wooden blocks and clamps could be made to work equally well.

Another point or two: Avoid applying too much solder. Remember that the strength is in the joint itself, not on the outside. Putting mounds of additional solder on the outside doesn't help and makes the job look sloppy.

Finally, avoid getting the joint too hot. This can result in oxidizing the copper surfaces and burning the paste and/or resin, which results in a weak, dirty, poor-conducting joint. I used a propane torch and played the flame slowly back and forth across the joint, touching the solder to the joint successively until it flowed. The solder should melt when touched to the surfaces (joints) you are soldering, not by the direct flame of the torch. If you are inexperienced in this type of soldering, it would be good insurance to purchase a couple of extra fittings and practice soldering them a time or two until you become comfortable. It really is not difficult to do.

A good method I found for securing the nuts for the adjustment screws to the end caps was to first solder the pipe caps to the end of the elements. Following that I cleaned the top surface of each cap with emery cloth and then applied a thin coat of solder paste to the cleaned area. Holding the antenna element in a vertical position in my vise and using the propane torch, I tinned the top portion of each cap, applying just enough solder to create a small crown of solder (less than 1/32 inch high at the center) and approximately 3/8 inch diameter.

Next the brass 1/4-20 nut was prepared by partially screwing the nut onto a screw and then grabbing the head of the screw in a vise so that the face of the nut was held in an upright position. I then cleaned and applied a thin coat of soldering paste to the face of the nut.

Next I applied heat using the propane torch, tinning the face of the nut with solder. However, before the solder had solidified, I used a small wire brush and brushed the face of the nut, leaving only a flash coating of solder. After cooling I removed the nut from the screw, and again clamping the antenna element vertically in my vise, placed the nut (tinned side) upon the end cap where I had previously applied the crown of solder. After carefully aligning the nut on the end cap, I slowly applied heat from the propane torch, playing the flame back and forth until I could see that the solder had fused. (*Note: No additional solder was added as it was not needed, and furthermore, had I attempted to torch the nut with the solder, chances are the nut would have moved, ruining the alignment.*)

For the final step I waited until after everything had cooled. Then, using a hand drill with #7 (.201 OD) drill bit, I drilled through the end cap using the threaded hole of the nut as a guide. After the drilling was complete, I passed a 1/4-20 tap through the nut to clean out any possible solder that might have been lodged in the threads and threaded the end cap.

Tuning

Element lengths and the transmission-line connection points are shown in fig. 7. I suggest you use these dimensions as a starting point, and then, if necessary, adjust the element lengths and/or feed points for minimum SWR indication on the portion of the band you desire. An antenna analyzer such as the Autek Research model RF-5 or the MFJ model 249 or 259 will work great. You can also use an SWR meter. However, using an analyzer makes the job much easier.

The final step was to seal the end of the coax at the antenna to prevent moisture penetration. I used a product called Liquid Electrical Tape[3], which I purchased at the local hardware store. This is a liquid vinyl coating that is brushed on and when cured, makes an excellent weather seal. To inhibit any possible wicking action, I completely covered all exposed portions of shield, foam dielectric, and center conductor. As an added precaution I also covered the stainless-steel clamps, including a portion of the antenna elements extending to about 1/2 inch on each side of the clamps.

Summary

Mounting a J-pole directly to a conductive mast and feeding the antenna with coax without some method of preventing or reducing common mode current on the transmission line will result in producing a high proportion of the signal being wasted at high take-off angles. For better ground-wave communication a J-pole should be isolated from any conductive supporting structures and a method of eliminating or greatly reducing the common mode current on a coax transmission line is required.

The J-pole which I built and which is presented in this article incorporates those features and provides a good, cost-effective antenna.

Asides

I maintained the spacing between the parallel elements of the stub section as close as possible using the plumbing fittings. During modeling the J-pole I had found that the more the spacing between the parallel conductors of the stub was increased, the more skewing of the azimuth pattern resulted.

Additionally, it has been suggested by some that increasing the top portion of a J-pole to 5/8 wavelength would improve performance. Running an analysis using that configuration resulted in a much higher imbalance in current amplitudes and phase relationships within the stub section. This produced considerably greater pattern skewing and distortions. Therefore, I concluded that using 5/8-wavelength top section of a J-pole would not be a good choice.

Acknowledgements

The information in this article is certainly not original on my part. I merely used computer-generated antenna patterns to restate and confirm what is known by most, if not all, professional engineers, but not many amateurs.

My thanks to the comments from Tom Rauch, W8JI, and others on the Internet antenna forum for spurring me into further investigating the antenna. Until that point I had always adhered to "conventional wisdom" regarding the operation of the J-pole published in many amateur publications.

Footnotes

1. EZNEC, Roy Lewallen, W7EL, P.O. Box 6658, Beaverton, OR 97007.

2. For a more detailed discussion of the common mode current problem with coax transmission lines, see Walter Maxwell, W2DU's article "Some Aspects of the Balun Problem" *QST,* March 1983.

3. Liquid Electrical Tape manufactured by Star brite, Fort Lauderdale, Florida, 33314. ■

CQ World-Wide WPX SSB Contest All-Time Records

The contest is held each year on the last full weekend of March. The All-Time Records will be updated and published annually. Data following the calls: year of operation, total score, and number of prefix multipliers.

WORLD RECORD HOLDERS

SINGLE OPERATOR

1.8	S52CD('95)	422,532	291
3.5	EA8/OH1MA('97)	4,317,284	562
7.0	ZX9A('97)	10,787,128	814
14	EA8AH('97)	11,142,198	981
21	ZW5B('95)	14,095,142	1054
28	ZW5B('92)	13,006,917	959
AB	HC8A('92)	24,809,300	1060
QRP/p	HC8A('94)	7,520,562	714

MULTI-OPERATOR SINGLE TRANSMITTER

HC8A('93)	32,502,677	1107

MULTI-OPERATOR MULTI-TRANSMITTER

ED8ACH('91)	47,278,236	1319

U.S.A. RECORD HOLDERS

SINGLE OPERATOR

1.8	K1ZM('95)	327,712	308
3.5	WE3C('95)	1,519,300	475
7.0	KC7EM('95)	1,950,228	495
14	KC1XX('95)	4,787,328	832
21	WN4KKN/6('92)	4,538,050	814
28	WM5G('89)	4,213,127	799
AB	KM1H('92)	7,854,840	945
QRPp	KR2Q('92)	1,269,960	557

MULTI-OPERATOR SINGLE TRANSMITTER

WC4E('92)	11,611,929	1113

MULTI-OPERATOR MULTI-TRANSMITTER

WZ6Z('89)	18,737,170	1138

CLUB RECORD

Northern California Contest Club('92)........97,527,906

QRPp RECORD

HC8A('94)........7,520,562

WPX (Prefix) RECORD

HG73DX('91)........1,337

CONTINENTAL RECORD HOLDERS

AFRICA

1.8	OH1RY/CT3('87)	290,140	163
3.5	EA8/OH1MA('97)	4,317,284	562
7.0	EA8AH('96)	7,101,380	715
14	EA8AH('97)	11,142,198	981
21	TR1G('90)	6,788,925	825
28	FR5DX('91)	7,543,818	831
AB	ZD8Z('94)	18,118,880	992

ASIA

1.8	UL7ACI('91)	331,008	128
3.5	UA9CSS('94)	1,074,780	315
7.0	H24LP('87)	5,348,975	503
14	H2A('91)	6,297,464	758
21	7L1GVE('92)	6,848,136	838
28	JH1AJT('89)	4,848,480	740
AB	7Z2AB('92)	9,177,296	809

EUROPE

1.8	S52CD('95)	422,532	144
3.5	YT6A('96)	1,976,436	558
7.0	S5ØA('95)	4,536,756	714
14	IU9S('94)	5,677,177	869
21	CT2A('92)	6,029,559	919
28	9H1EL('89)	5,882,825	787
AB	YZ9A('91)	8,518,112	928

NORTH AMERICA

1.8	VE3BMV('97)	397,760	226
3.5	TE1C('96)	2,161,568	496
7.0	TE1C('95)	7,281,630	745
14	KP2A('95)	7,088,976	912
21	FG5R('89)	9,936,240	912
28	J68AX('92)	4,709,985	651
AB	KP2A('93)	16,694,570	1006

OCEANIA

1.8	T32AF('83)	16,872	37
3.5	N6VI/KH6('94)	1,016,652	273
7.0	T32AF('93)	3,995,928	437
14	KG6DX('90)	4,558,527	733
21	AHØK('92)	7,206,850	698
28	P2ØA('92)	5,184,625	703
AB	WR6R/WH7('96)	11,258,410	815

SOUTH AMERICA

1.8	YV5JEA('84)	40,320	63
3.5	P4ØA('96)	1,715,076	426
7.0	ZX9A('97)	10,787,128	814
14	PYØFM('95)	9,660,432	939
21	ZW5B('95)	14,095,142	1054
28	ZW5B('92)	13,006,917	959
AB	HC8A('92)	24,809,300	1060

MULTI-OPERATOR SINGLE TRANSMITTER

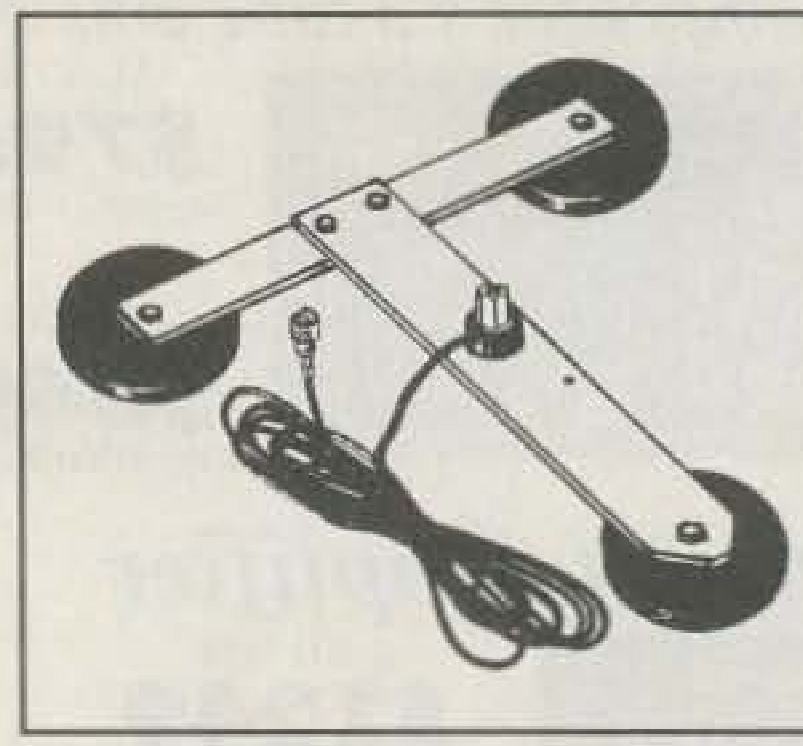
AF	EA8BR('94)	15,311,851	953
AS	TA5/NØFYR('91)	16,474,965	1005
EU	IJ4R('91)	16,027,956	1146
NA	VP2EC('92)	24,409,580	1115
OC	P2ØX('93)	13,440,570	858
SA	HC8A('93)	32,502,677	1107

MULTI-OPERATOR MULTI-TRANSMITTER

AF	ED8ACH('91)	47,278,236	1319
AS	VS6WO('94)	16,555,040	967
EU	HG73DX('91)	30,664,095	1337
NA	VP2EC('94)	39,530,455	1285
OC	FKØAW('89)	26,538,972	1002
SA	ZZ5EG('87)	38,096,250	1250

CQ SHOWCASE

Lakeview Company Tri-Magnetic Mount



Lakeview Company, "The Hamstick People," has announced that the Tri-Magnetic Mount, catalog No. 375, now comes with all stainless steel hardware. The mount holds all Hamstick antennas and many others with three black powder-coated magnets that have over 400 pounds of holding power. It comes with standard 3/8 inch by 24-thread mounting and 15 ft. of RG-58 coax with a PL-259 installed. The mount has a 12 inch by 14 inch foot print. The aluminum construction and stainless-steel hardware eliminate the problem of rust.

The 375 is priced at $39.95. The mount is also available with an NMO and SO-239 configuration for an additional $5.00. For more information, contact Lakeview Co., Inc., 3620-9 Whitehall Rd., Anderson, SC 29626, e-mail <hamstick@hamstick.com>, or circle number 101 on the reader service card.

SGC SG-2020 HF Transceiver

The SG-2020 was designed as a user-friendly HF transceiver. Features include: 1.8 to 29.7 MHz frequency range, 0 to 20 watts PEP transmitter power, 40 simplex or semi-duplex memories, built-in fully adjustable iambic "A" mode keyer operating under microprocessor control from 5 to 60 wpm, typical 300 ma total consumption in receive mode, and 2 Hz steps frequency resolution. The unit's rugged construction makes it suited to mobile and portable conditions.

The SG-2020's suggested retail price is $595. For more information, contact SGC, Inc., P.O. Box 3526, Bellevue, WA 98009 (425-746-6310), or circle number 103 on the reader service card.

MFJ-4035MV 35/30 Amp DC Power Supply

MFJ's new 35/30 amp adjustable, regulated, heavy-duty power supply features 35 amps surge and 30 amps continuous. The unit is front-panel adjustable from 1 to 14 VDC with detent set at 13.8 VDC. The power supply has lighted front-panel meters and an ON/OFF switch. Three different output terminals include a five-way binding post for HF/VHF radio, two pairs of quick connects for low current accessories, and a cigarette lighter socket for mobile accessories. It has a front-panel fuse holder, internal cooling fan, built-in circuit protection, and 110 VAC input which plugs into user's VAC wall outlet.

The MFJ-4035MV carries MFJ's "No Matter What™" one-year limited warranty. For more information, contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762 (601-323-5869; fax 601-323-6551; e-mail <mfj@mfjenterprises.com>; on the web <http://www. mfjenterprises.com>), or circle number 108 on the reader service card.

JPS Communications SPEC-12 Spectrum Display Kit

JPS Communications, Inc. has added the SPEC-12 Spectrum Display Kit to its product line. The kit is for the NIR-12 Noise/Interference Reduction and Filter Unit. It is a software and hardware kit that adds an audio spectrum analyzer function to the NIR-12. The complete SPEC-12 kit consists of a SPEC-12 SPL kit, which includes a 3.5 inch disk of personal computer software, a new PROM for the NIR-12, and the SDK-12 kit for the NIR-12. The SDK-12 provides a hardware serial port with which to send spectrum data to an unused serial data port on the PC for display. The PC software will run on either DOS or Windows on a 486 or faster PC. A 386 may be used if it has a math coprocessor. The SPEC-12 turns the PC into an audio spectrum analyzer capable of displaying your receiver's audio spectrum from 100 to 3450 Hz. While the unit is running, the full functionality of the NIR-12 is retained, so the displayed spectrum shows the effects of the NIR-12's noise reduction, tone removal, and bandwidth filter controls on received signals.

Control of the SPEC-12 is via the Function keys on the PC keyboard. Resolution may be toggled between 15 Hz and 30 Hz; display may be linear or logarithmic; display may be frozen; displayed signal may be displayed raw or smoothed. The display rate is 3 or 6 frames per second, as determined by the resolution key. The display dynamic range is 50 dB.

The SPEC-12 is available from the factory for $75, including shipping within the continental US. For those who already have the SDK-12 kit, the SPEC-12 SPL portion is $40, including shipping. For more information, contact JPS Communications, Inc., P.O. Box 97757, Raleigh, NC 27624-7757 (phone 919-790-1011; fax 919-790-1456; or circle number 105 on the reader service card.

Cable X-Perts 1998 Catalog

Cable X-Perts' latest catalog has technical information, new products, and detailed photographs, with prices. Included in the master catalog are coax cables, rotor and control cables, Jones quick-disconnect plugs, ladder lines, DC power "zip" cords, connectors, adapters, baluns, center insulators, G5RV antenna kit, I.C.E. products, surge supressors, beverage units, crimping tools, coax stripping tools, antenna switches, guy wire and accessories, LAN cables, antenna wire, and more.

For a copy of the catalog contact Cable X-Perts, Inc., 416 Diens Drive, Wheeling, IL 60090 (tech. 847-520-3003; fax 847-520-3444; e-mail <cxp@ix.netcom.com>; on the web <www. cablexperts.com), or circle 106 on the reader service card.

BY IRWIN MATH, WA2NDM

MATH'S NOTES

WHAT'S NEW AND HOW TO USE IT

A Primer on Digital Signal Interfaces

With the increasing availability of computer-controllable rigs in the amateur marketplace, the use and understanding of the various digital protocols used in controlling them—in particular RS-232, RS-422, and RS-485—is becoming more and more important. As a result, we thought that it would be a good idea this month to briefly discuss these protocols and see how they are related to each other.

To begin with, we all are familiar with standard "5 volt TTL." Logic 0 is roughly equal to anything from 0 to 0.8 volts, and logic 1 is roughly equal to anything from 2 to 5 volts. These are basic logic levels and are what the internal "works" of any rig using this logic protocol want to see. In addition, the impedance level associated with this logic family is roughly 3K ohms. While all of this is fine, transmitting TTL signals from one piece of equipment to another over any appreciable distance and at any appreciable speed is quite difficult. The worse-case difference between logic 0 and 1 is only 1.2 volts (2 – 0.8), and induced noise pulses greater than this can cause problems. The 3K ohm impedance doesn't help either (although there are 50 ohm TTL systems), since it is quite easy to induce QRM on a long 3K ohm line. This is the main reason for the development of the various specific transmission protocols to transfer data.

The first, and traditional, "grandfather" of all signal-transmission protocols is RS-232, shown graphically in fig. 1. Developed in vacuum-tube days, this protocol attempted to eliminate data errors by transmitting the two logic states as bipolar signals. As stated in the specification, logic 1 would be anything greater in amplitude that —3 volts, while a logic 0 would be anything greater in amplitude than +3 volts. The region between + and –3 volts is a "no-mans land" and is undetermined. In reality, the accepted levels are –5 to –15 volts for logic 1 and +5 to +15 volts for logic 0. The 3K ohm (minimum) line impedance still remains. It is interesting to note that the maximum data rate allowed by the formal specification is 20 kbps.

The intention behind the bipolar transmission was that positive and negative voltage levels should be quite easy to differentiate even in the presence of noise. The 10 volt differential between the logic levels allowed a great deal of noise immunity, and the wide voltage range took care of the losses on long, poorly terminated transmission lines, as well as the uncertainty of the accuracy of the voltage levels at the source. Even the familiar DB-25 connector was specified.

c/o CQ magazine

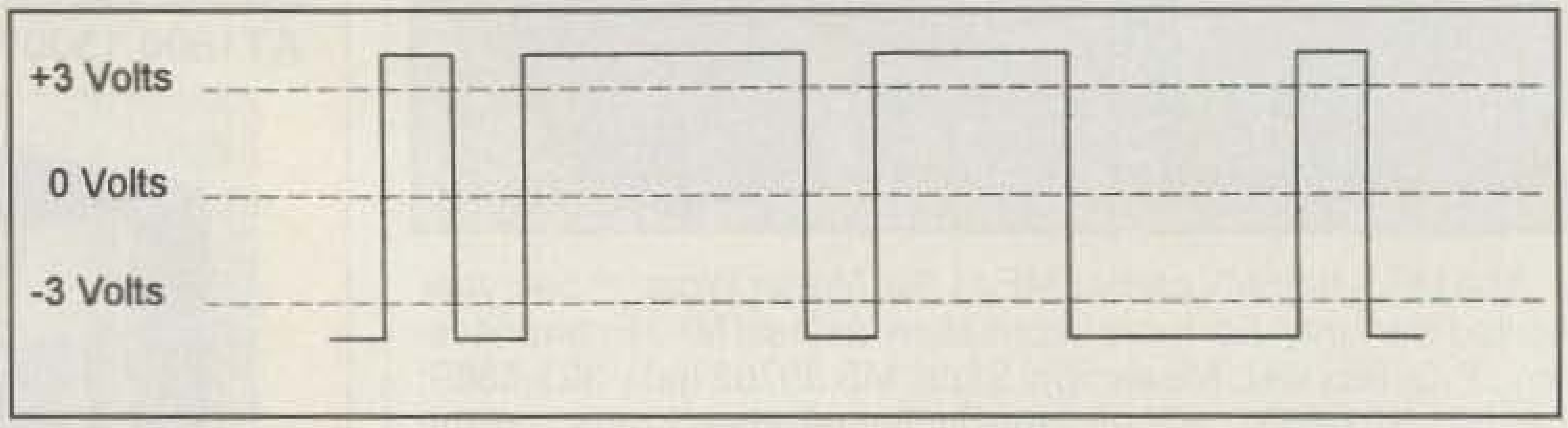


Fig. 1– Typical RS-232 waveshape.

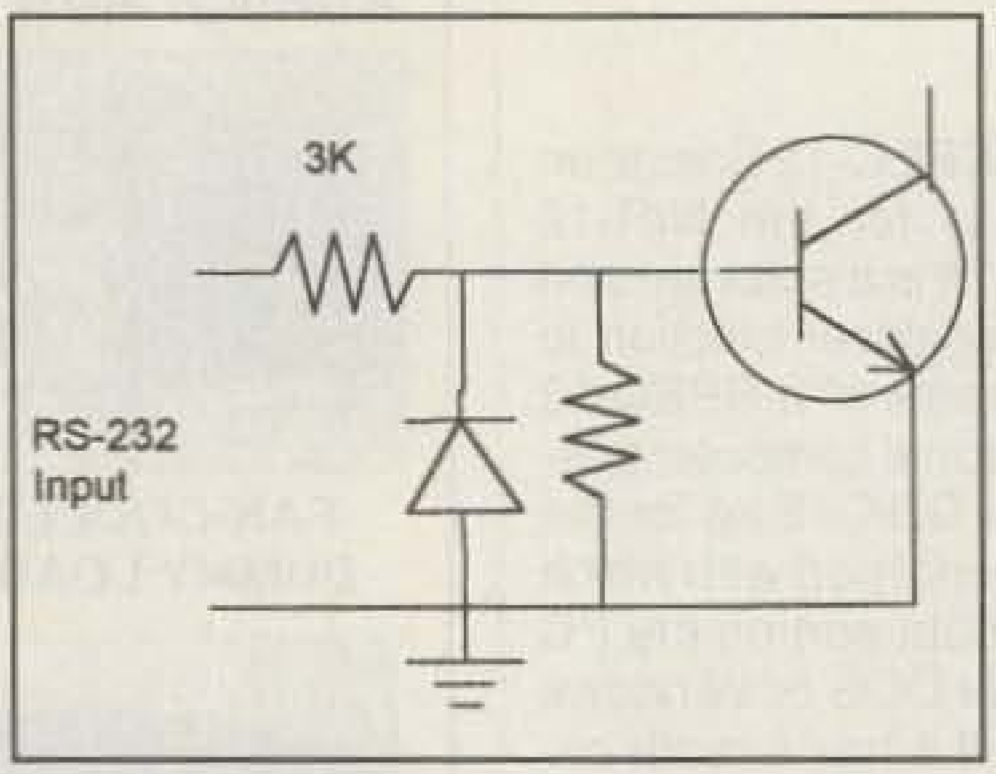


Fig. 2– Input circuit of MC-1489.

RS-232 was so popular that it is still in wide use today—with some minor variations. While the logic levels are still held to the voltages described, in many cases the reason for the negative voltage has been done away with. This can be seen by the input circuit of the popular, widely used MC1489 RS-232 line receiver (to TTL) shown in fig. 2. As you clearly can see, a diode shunts any negative voltage, which keeps Q1 turned off. A positive input turns on Q1 (the diode is reverse biased in this case), and the chip goes on to produce an output. It is interesting to note that in many cases a TTL signal will actually drive this chip as well. Another variation is in the data rate. While the original specification still calls out 20 kbps as the maximum, data rates of over 115 kbps are routinely transmitted and RS-232 chip sets are specified well into the hundreds of kilobits per second.

RS-422 is an attempt at transmitting higher data rates than the 20 kbps "limit" of RS-232. This protocol addresses the noise issue by providing a balanced, terminated twisted-pair line between the transmitter and receiver, as shown in fig. 3. Signals are sent differentially, meaning that for logic 1, conductor A is at +5 volts with regard to conductor B, and for logic 0, conductor B becomes +5 volts with regard to conductor A. Any noise induced on the line presents the same polarity on both conductors and is ignored. Because of the use of a twisted pair of wires, nominal line impedance of an RS-422 link is only 110 ohms, which by itself goes a long way toward increasing noise immunity. In addition, the data rate for RS-422 is specified at up to 10 megabits. As in the case of RS-232, RS-422 is very much with us, and chips such as the National Semiconductor DS8921 (shown in fig. 4) commonly exist to convert this protocol to and from TTL.

Since RS-232 and RS-422 both have discrete 1's and 0's and separate transmit and receive paths, converting from one to the other is done easily. Fig. 5 shows a simple circuit that will do the job quite well. The *only* consideration is to be sure that the data rates are compatible.

Of course, the data communications industry was not happy with the need to run three or four wires for a full-duplex link as with the above two protocols, so RS-485 was developed.

RS-485 is similar to RS-422 in that the signal is also differential. The main difference is that only two wires are used, and as a result, only half-duplex (one way) operation is permitted. This allows the two wires to act either as a transmit line or receive line. Obviously, this entails a mode-select (push-to-talk, if you will) feature. The best way to illustrate this is to refer to fig. 6, a schematic of a DS3696,

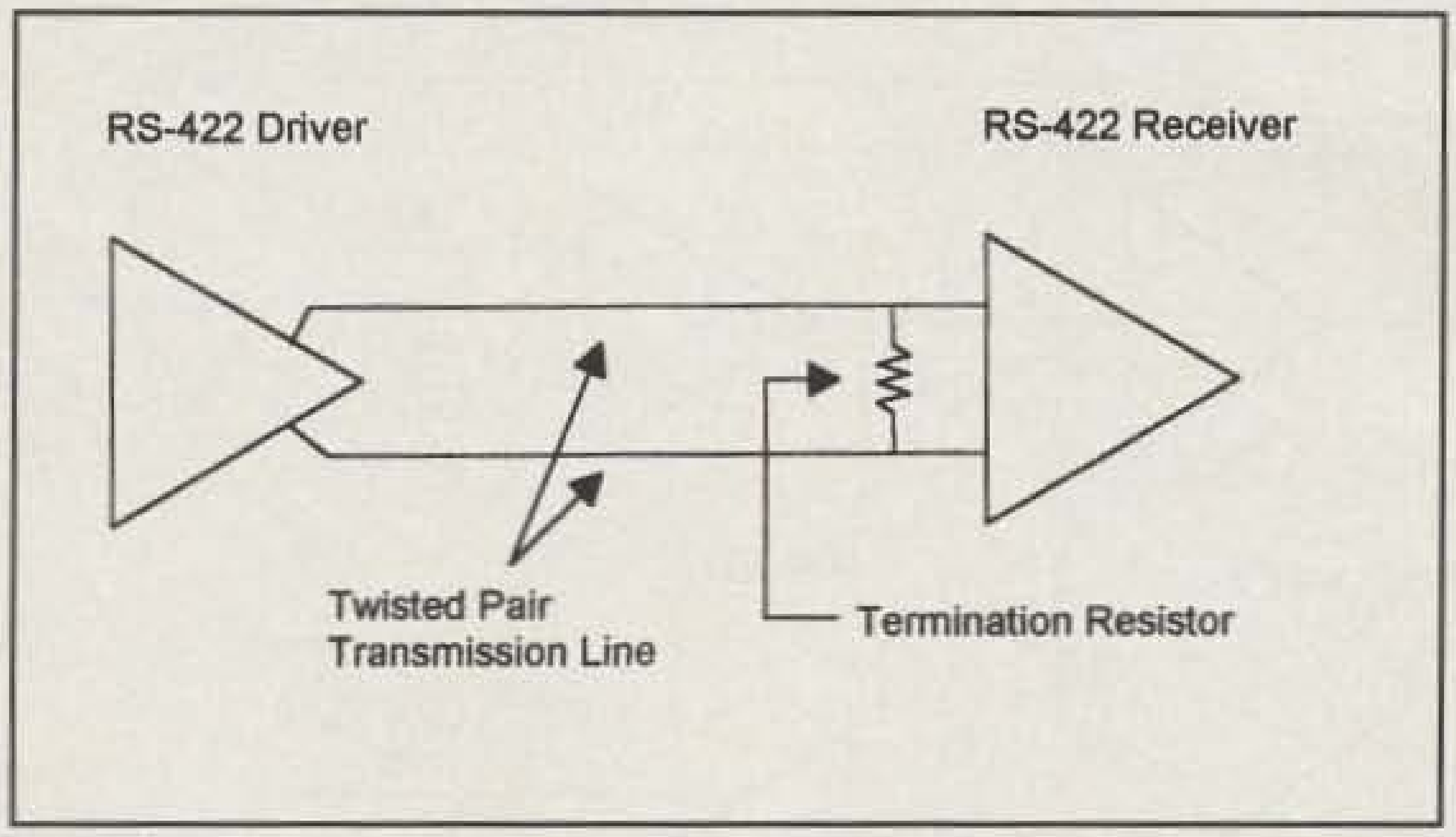


Fig. 3– Typical RS-422 transmission system.

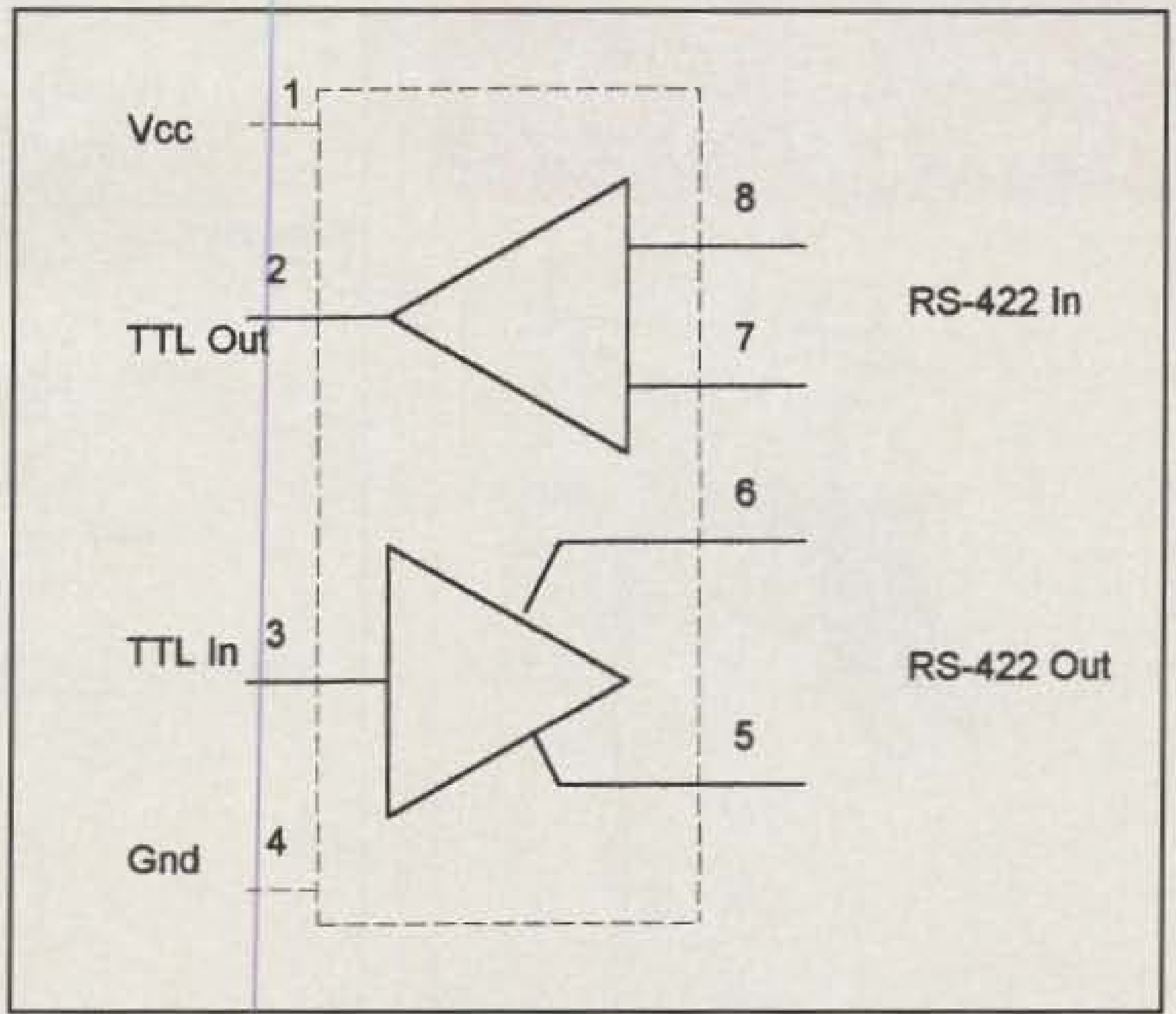


Fig. 4– Block diagram of DS-8921.

a typical TTL to RS-485 and RS-485 to TTL converter chip. As you can see, the transmitter and receiver sections of the chip are connected together. The mode select is then used to determine which portion is operational. When the transmit portion is selected, the receiver output is blocked. When the receive portion is selected, the transmit port is pulled to a high impedance so that it does not load the receiver. This high-impedance state is called the "tri-state" condition. Incidentally, the receiver section's input always presents a high impedance; it is its output that is shut off by the mode control.

The fact that the transmitter can be placed in a tri-state condition allows a data bus to be implemented fairly easily. Fig. 7 shows how this usually is accomplished. As you can see, any one station (at a time) can transmit while all other stations receive. Since all non-transmitting stations present a high-impedance load (the transmitters are in tri-state), the system works.

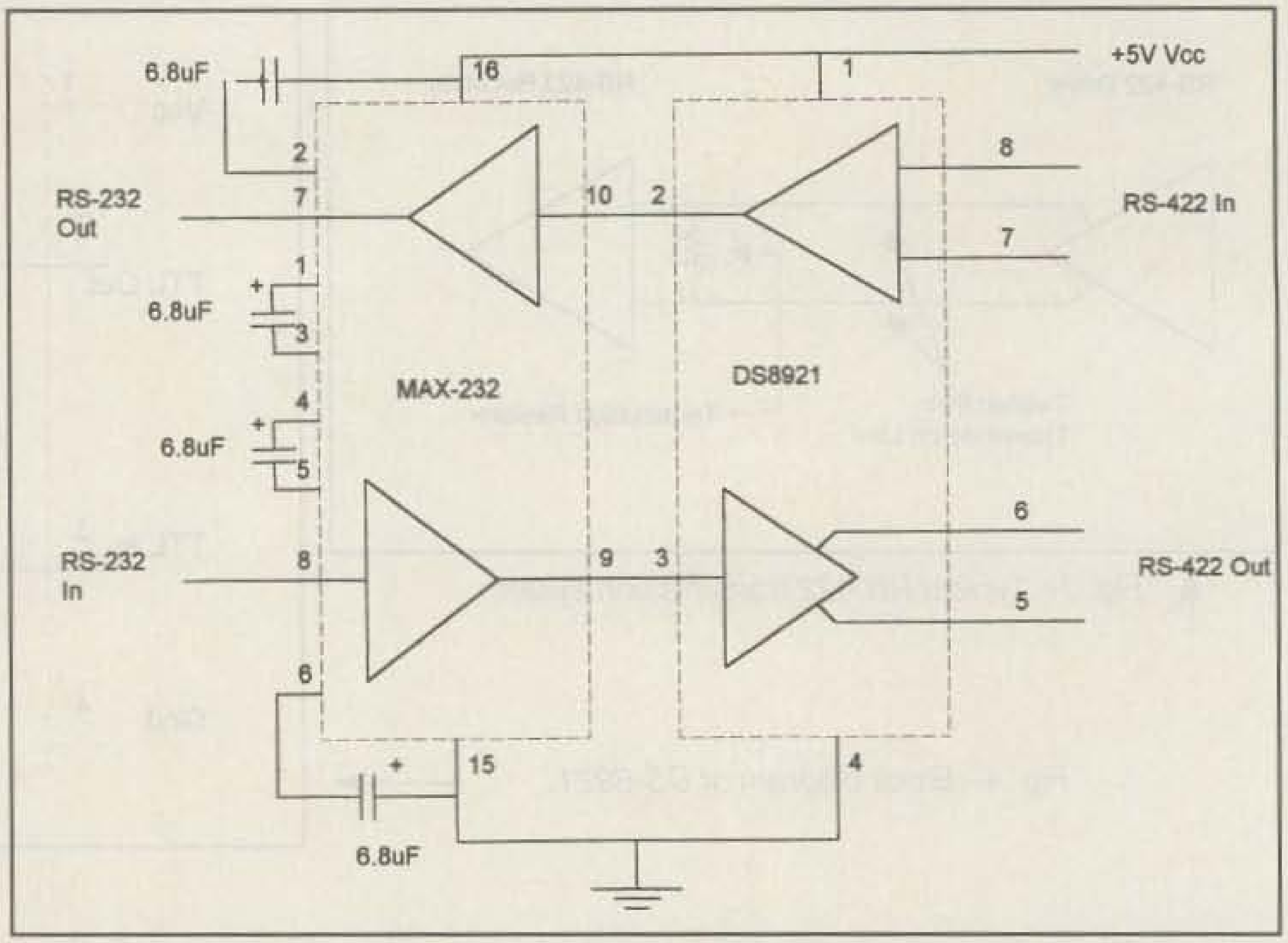


Fig. 5– RS-232 to RS-422 converter.

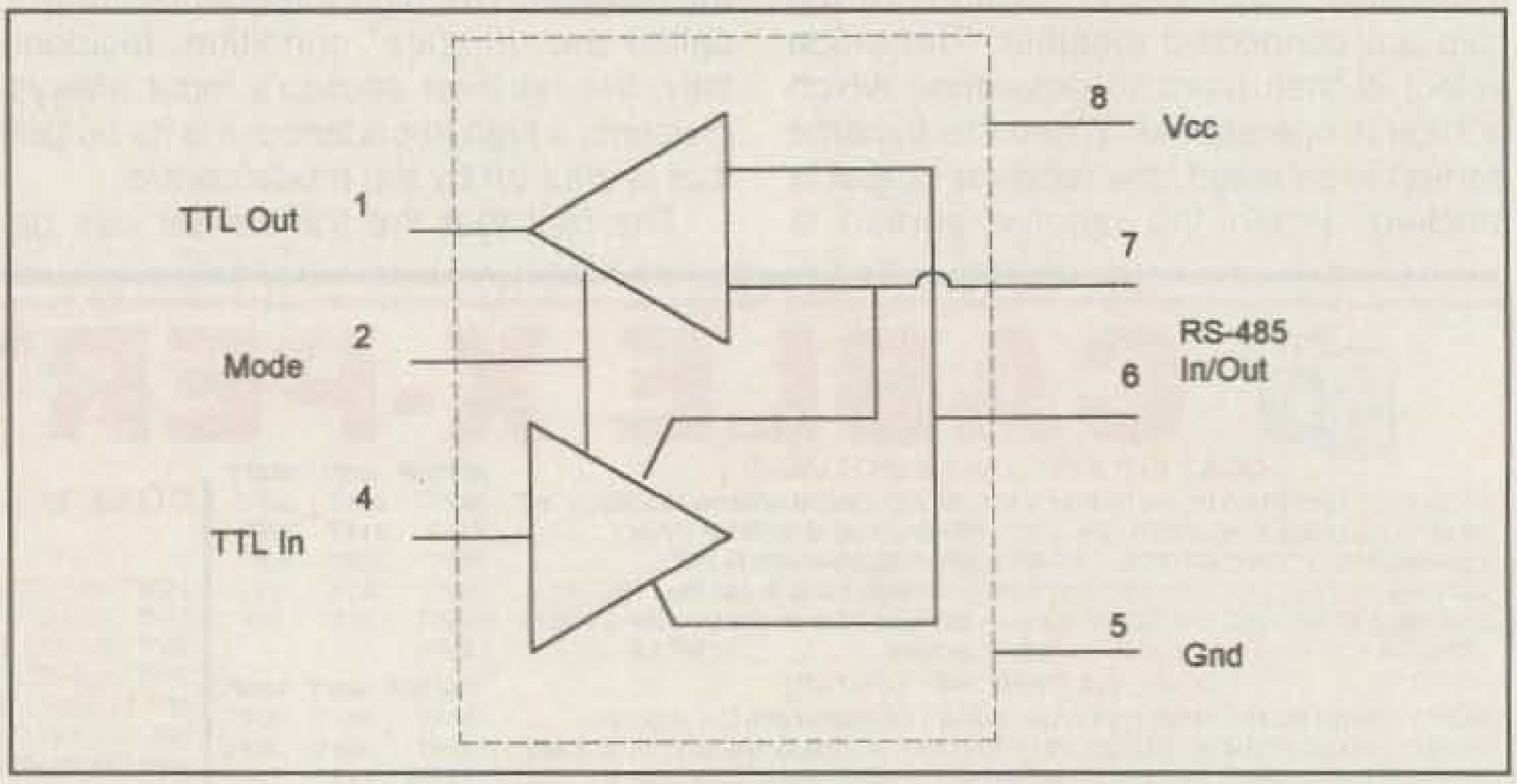


Fig. 6– Block diagram of DS-3696.

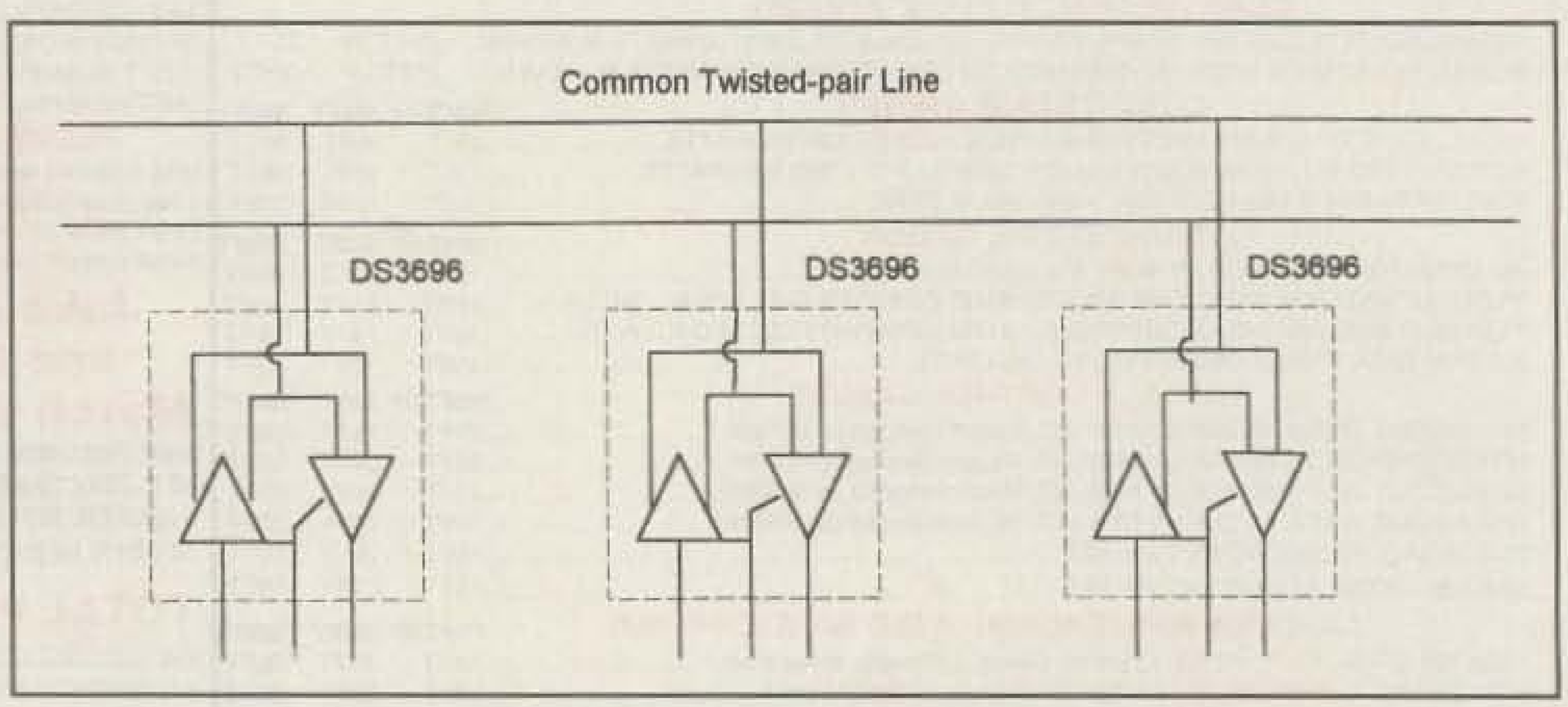


Fig. 7– RS-485 data bus transmission system.

The only "extra" information other than data that is needed is the determination when to switch a station from transmit to receive (via the mode control), and that is done with the system software.

I hope the above is useful to you, and that the various protocols you encounter in your investigations are a bit less confusing.

73, Irwin, WA2NDM

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SS-12	10	12	2.3 x 6 x 9	3.4
SS-18	15	18	2.3 x 6 x 9	3.6
SS-25	20	25	$2\frac{7}{8}$ x 7 x $9\frac{3}{8}$	4.2
SS-30	25	30	$3\frac{3}{4}$ x 7 x $9\frac{5}{8}$	5
SS-25M*	20	25	$2\frac{7}{8}$ x 7 x $9\frac{3}{8}$	4.2
SS-30M*	25	30	$3\frac{3}{4}$ x 7 x $9\frac{5}{8}$	5

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CIRCLE 163 ON READER SERVICE CARD

BY KARL T. THURBER, JR., W8FX

THE DIGITAL DIPOLE

FROM SOFTWARE THROUGH ANTENNAS FOR THE SHACK

Spring is Here!

Spring is in the air, and as *CQ* readers know, spring also spells "antennas." While the invigorating scent of the season is fresh in the air, we'll focus on some new antennas and accessories while saving room for more "software stuff" and a visit to the bookshelf before closing out the column. With that in mind, let's begin with antennas.

Antenna Notes

The "Holy Grail," or "Smithdom," Antenna. Perhaps comparing any antenna, especially multiband HF skyhooks, as being akin to the "Holy Grail" of the medieval Arthurian legend is somewhat overenthusiastic. Nevertheless, Ralph Smith, WØLDF, has brought to market the plans for a reasonably good-performing all-band HF wire antenna that covers the 160, 80/75, 40, 30, 20, 17, 15, 12, and 10 meter bands. The 138 ft. antenna reportedly is easy to build and install, being designed to be used at heights of about 25 ft.; doglegs and end drops won't ruin antenna performance.

Based on the "asymmetric fed harmonic antenna," otherwise known as the Windom, Ralph's patent-pending Holy Grail (or "Smithdom") design includes in the antenna only one LC tuned circuit fabricated with RG-174/U coaxial cable wound on a section of PVC tubing. A 6:1 balun is used to connect RG-8/U coax feedline to the antenna.

For the record, Windoms are good general-purpose HF skyhooks based on the classic off-center-fed (OCF) dipole designed by Loren G. "Windy" Windom, W8GZ, and published in *QST* for September 1929. His antenna, very popular among amateurs in the 1930s, allowed the cash-short amateurs of the era to work several HF bands efficiently and economically with a single flattop. Early versions used a single-wire or open-wire feedline, but most modern Windoms are fed with coax. The change in type of feedline reduces feedline radiation, prevents "RF in the shack" problems, and also minimizes the danger of electric shocks to passersby.

The Windom has the transmission line attached at a point between the middle and one end of the flattop. In its simplest form it uses a single-wire or open-wire feedline. It requires the use of an antenna tuner.

289 Poplar Drive, Millbrook, AL 36054

Amateurs long ago found they could productively use the antenna on multiple bands by inserting an insulator in the flattop and attaching a 300 to 600 ohm feedline at a point about one third in from one end. Many Windom/OCF dipole aficionados report good results with a 6:1 balun at this point instead of an insulator, to use more convenient coax feedline and often do away with the need for an antenna tuner. (These antennas are discussed in *The ARRL Antenna Book*, 18th edition, in Chapter 7.)

Some of the Holy Grail/Smithdom's features, as enumerated by Ralph in his product literature, include relatively low SWR on all bands, low cost, frequency stability, usability at moderate height, some gain on the higher bands, and spectrum conservation (no on-the-air tuning being required for QSY). The antenna also may be mounted in an inverted-Vee fashion.

Interestingly, Ralph also enumerates some of the antenna's disadvantages, something we rarely see in product literature. These "tell it like it is" disadvantages include relatively poor DX performance on 160 and 80/75 meters (due to typical low installation height), easy radiation of harmonics from your transceiver or transmitter, pattern deficiencies in some directions, and possible balun icing that can alter SWR results.

The construction plans are available for $14 from Smithdom Products, P.O. Box 780931, Wichita, KS 67278. Comparable plans, and possibly a kit, for a one-half-size Holy Grail (the "Smithdom Short") may be available by the time you read this.

Dynamic Electronics DP-8 Multiband HF and VHF Antenna. One very simple way to make a multiband, coax-fed antenna is to connect several half-wave antennas "in parallel" to a common center insulator. This is a variation and extension of "stagger tuning" of dipole antennas in which multiwire dipoles are cut for different bands. You'll find these types of antennas discussed in *The ARRL Antenna Book*, 18th edition, in Chapters 7 and 9.

Though convenient and not too much of an electrical problem to adjust, such parallel-dipole antennas often become cumbersome physically when more than two or three bands are required. However, it appears that Bill Chapple, W4GQC, has addressed the mechanical problems with his DP-8 Multiband HF and VHF Antenna.

Essentially a parallel-dipole antenna, the DP-8 consists of eight full-size dipoles, one for each HF band, 80/75 through 10 meters; 6 and 2 meter resonances occur as a result of antenna harmonic relationships. The DP-8 is 125 ft. long and uses 16 inch PVC spacers to separate the individual antennas. A SO-239 coaxial cable socket is used to accept a standard PL-259 coax connector.

The eight individual dipoles are made from #12 insulated stranded wire for the longest dipole, and from #14 wire for the others. There are no traps, and the antenna can handle power levels up to 5 KW. The insulated wires protect against corrosion and prevent shorting in case a limb or other object falls on the wires. Bill recommends the use of supports for the center and the ends. Two supports can be used; a Nylon rope between the two supports and the antenna's eye bolt provides additional support.

We've described the "workhorse" DP-8, priced at $139 plus $8 s/h, but Bill advises that he also offers some 14 other multiband dipoles in various combinations. Most variations involve how 80/75 and 160 meters are handled, and several "S-suffixed," half-size versions also are offered. These antennas vary in price from $35 to $189, depending on length and band combinations covered.

For more information, along with antenna diagrams, photos, and typical SWR curves, contact Dynamic Electronics, Inc., P.O. Box 896, Hartselle, AL 35640 (205-773-2758; e-mail <dei@whnt19.com>; web: <http://www.hsv.tis.net/~dei>).

RF Applications Update. We highlighted Bruce R. Knox, W8GN's RF Applications firm in several previous columns, most recently in February of last year. As you may recall, we described some of Bruce's flagship RF accessory products. These include the microprocessor-based P-1500 and P-3000 HF Digital Wattmeters; the P-2000A HF Digital Wattmeter; the P-100A Digital Wattmeter, which uses coaxial line sections and sensor elements from Bird Electronics® and Coaxial Dynamics®; the P-2000CW Audible HF Wattmeter, of interest to sight-impaired and mobile operators; and The Match Alert™, which monitors the transmission line to compare computed VSWR with a preset value.

Bruce advises that product development has continued. Highlights include developing a 5 KW version of the P-3000; the P-1 Serial Digital Wattmeter, which has an RS-232 serial interface and which can monitor two channels of RF power simultaneously; and a "range lock option" for the P-3000 that allows you to manually reset the auto-ranging function so that the digital bargraph ranges only "up" automatically.

Bruce also offers a quarterly newsletter, *The Watt®*, which contains several interesting discussions in each issue. In a recent copy, for example, Bill discussed some of the considerations, problems, and challenges involved in applying microprocessor technology to RF power and VSWR measurement, which historically have been analog applications.

To get on the newsletter mailing list, contact RF Applications, Inc., 7345 Production Drive, Mentor, OH 44060 (1-800-423-7252; e-mail: <sales@rfapps.com>; web <http://www.rfapps.com>).

Soft Stuff

FCC DataBase Program Update de K4HAV. Do we have any Ten-Ten International Net (10-10 for short) enthusiasts among us? Probably so, and many will recall that in several columns we described the 10-10 software offered by James D. Hardy, K4HAV, covering various specialized programs for 10 meter contesting. Jim's programs, of course, are for those who chase certificates and awards sponsored by the Ten-Ten International Net—the guys who proudly exchange their 10-10 numbers over the air.

Just a year ago, in the March 1997 column, we described Jim's FCC DataBase Conversion & Search Program. To recall, the program allows you to work with and process the FCC's online Amateur Callsign Database, which is available on the Net, and which you can download from the FCC FTP site at <ftp.fcc.gov>.

As we noted in last March's column, the "raw" database as downloaded is of little use, and his program makes it useful. This is a freeware program that takes the FCC file you downloaded, strips out the information that's not needed, condenses it, and breaks it down into prefixes that can be searched, displayed, and printed out.

However, in April 1997 the FCC made some changes in its data postings, effectively throwing a monkey wrench in the process. Notably, they deleted the date of birth (DOB) information in weekly postings, having received complaints that it was an invasion of privacy.

Without getting into the mechanical and other details (which are quite complex), suffice it to say that Jim has rewritten his program to partially overcome this and other problems using some "workarounds" he developed. These allow additional search and display options, some available only in the $10 registered version of his FCC DataBase Conversion & Search Program.

You can download the revised program from his personal FCC web page at <http://www.surfsouth.com/~jhardy/fcc.htm>. Or, go to Ten-Ten International at <http://www.Lehigh.EDU/lists/tenten-l>, where Jim has practically duplicated his FCC page.

For more information, contact Hardy Data Systems, P.O. Box 7304, Tifton, GA 31793-7304 (phone 912-387-7373; e-mail <jhardy@surfsouth.com>; Web: <http://www.surfsouth.com/~jhardy>.

Info Select Version 4 for Windows 95. In several columns, most recently in February 1996, we described Micro Logic's Info Select for Windows. As we pointed out, it's a very capable PIM, one that's easy to learn since it uses a data structure analogous to the familiar "stacks of paper" in which people tend to accumulate information. Program features include phone dialing, wordprocessing, and database functions; a computational capability; information overviews; and considerable more.

In case you're not familiar with PIMs, a PIM, or "personal information manager," is a free-form database that lets you enter, retrieve, analyze, and cross-reference data, both words and numbers. It handles "random information" that can cover a person's home, office, or hamshack, and can include notes, names, addresses, parts lists, projects, and magazine articles. All this information often doesn't fit into well-defined formats as does data you can place in a conventional database. Thus, a PIM can help you deal with a hodgepodge of unstructured stuff.

We won't go into the details of previous versions, but we'll say that the new version, Info Select Version 4 for Windows 95, offers many enhancements. These include e-mail and web support, allowing you to compose, send, receive, and organize Internet e-mail; improved data organizing and integrating features, including a "sorting bin"; file synchronization between desktop and laptop PCs; and wildcard searching.

Also new are writing tools, including a new thesaurus and a revamped spellchecker; OLE support, allowing you to embed or link graphics, spreadsheets, databases, and files of many types into Info Select 4 notes; and full 32-bit Windows 95 capabilities and support, to provide a more consistent and easier-to-use interface and better multi-tasking and file management.

The new program is $149.95, but previous users may upgrade for $69.95. Contact Micro Logic Corp., P.O. Box 70, Hackensack, NJ 07602 (201-342-6518; e-mail <info@miclog.com>; web <http://www.miclog.com>.

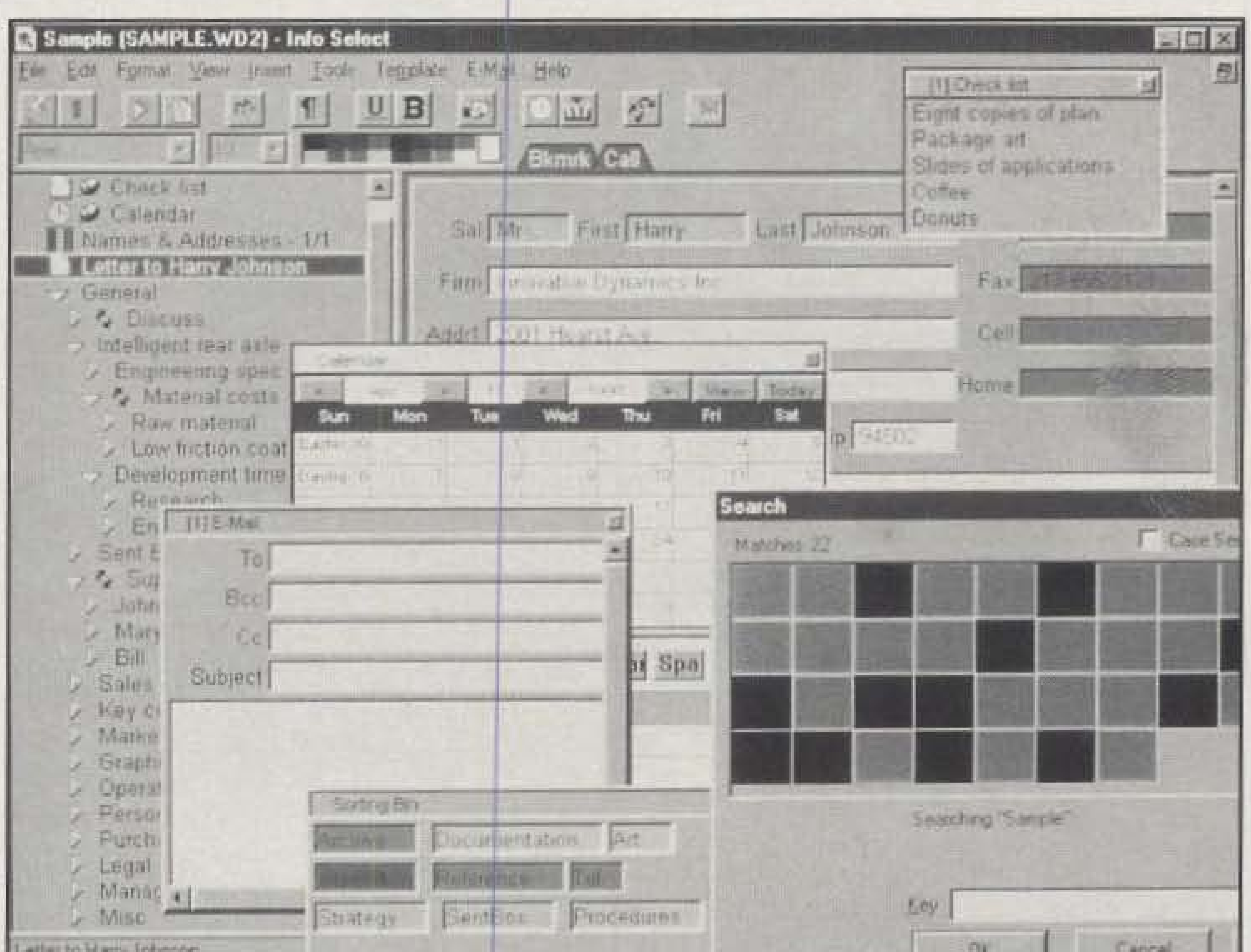


Fig. 1– A PIM, or "personal information manager," is a free-form database that lets you enter, retrieve, analyze, and crossreference data, both words and numbers. It handles "random information" that can cover a person's home, office, or hamshack, and can include notes, names, addresses, parts lists, projects, and magazine articles. Info Select 4 for Windows 95, shown here, is the latest upgrade in Micro Log's line of free-form PIMs. See text for details. (Courtesy Micro Logic)

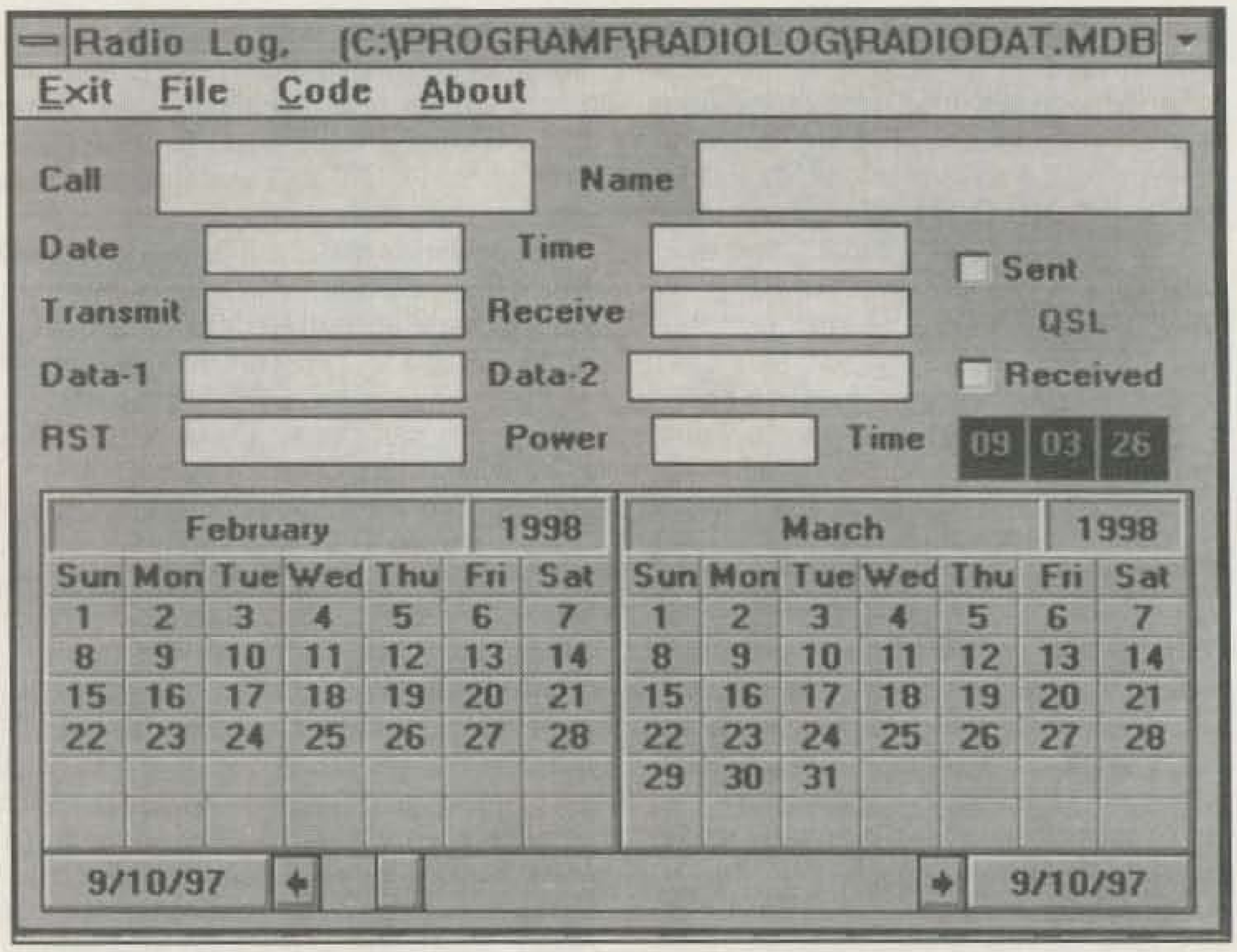


Fig. 2– RadioLog, offered by Billy Pinkerton, N4LXL, is a Windows 3.x-oriented program that has two major functions. The first is that of a logger, intended to perform both as a normal station log and as a contest log. A second feature is that of a code tutor, which includes a built-in code practice oscillator providing random characters at selectable speeds. See the text of this month's column for details.

DiskMapper Version 2 for Windows 95 & NT. A second program update from Micro Log also is on tap for this month. It's the latest version of the firm's innovative DiskMapper utility that we recently profiled in the column.

If you missed previous versions, 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. Instead of presenting disk occupancy information in simple file tree listings, the program uses a patent-pending "nested rectangle" technique to give you comprehensive information in a format that shows you what's taking up space, letting you see how much or how little space subdirectories take up.

DiskMapper Version 2 for Windows 95 & NT offers a number of advanced features over Version 1, including an "advisor" that helps you decide whether a selected file can be deleted. Also, in addition to a graphical file map display based on nested rectangles, Version 2 includes a standard file tree, allowing you to perform space-saving and file management functions with a single, easy-to-use utility program.

Version 2 also offers several new ways to clear disk space. An improved "mapping engine" provides for faster disk scanning and mapping, advanced tiling methods display more file names on the map, and there's a new file filter that lets you view only those files that meet conditions you specify.

DiskMapper Version 2 is $49.95; updates for previous users are $29.95. It's from Micro Logic, address above.

RadioLog by N4LXL. In last September's column we described an interesting, multipurpose Personal Information Manager (PIM) shareware program for Windows 95 offered by Billy Pinkerton, N4LXL. Though not specifically an amateur radio program, his JOB-JAR was designed to provide cost-effective, "use every day" functionality for the homeowner and small home business.

As we noted, JOB-JAR's main function is to track jobs or tasks that need your attention and that you intend to accomplish at another time. It also includes a wordprocessor, a spreadsheet, an appointments calendar, annual and monthly calendars, reminders, and a job or task function. The program also prepares and prints reports. Billy is at it again with another shareware program, RadioLog, a Windows 3.x program for radio amateurs.

The new program has two major functions. The first is that of a logger, intended to perform both as a normal station log and as a contest log; many of the capabilities of the program are automated. A second major feature is that of a code tutor, which includes a built-in code practice oscillator providing random characters at selectable speeds of 5, 8, 11, or 14 words-per- minute (wpm). Billy notes that

RadioLog is a follow-on to his previous program, Station.

RadioLog is shareware, which provides an opportunity for you to evaluate the program before purchasing it. If you would like to register it, you can do so by mailing a check in the amount of $15 to Billy Pinkerton, 1148 Newbern Street NE, Palm Bay, FL 32905. (Note: Copies of JOB-JAR are not available directly from Billy; use your favorite BBS, Internet shareware site, or shareware vendor to obtain a copy of RadioLog.)

From the Radio Bookshelf

Surplus Goodies from Nebraska. With his catchy motto of "where the hard to find parts are found and on hand," Bob Grinnell, WDØFDE, of Surplus Sales of Nebraska has one of the largest selections anywhere of RF and transmitting components and other goodies listed in his thick, slick surplus sales catalog. The 400-page catalog is chock-full of antennas, cabinets, cable and wire, capacitors, switches, filters, relays, insulators, tubing and sleeving, waveguide parts, transformers, vacuum tubes, connectors, and countless other goodies of interest to radio amateurs, experimenters, and homebrewers.

The firm also stocks manuals and hard-to-find parts for Collins amateur gear. They also offer manuals for several other amateur product lines, including various defunct manufacturers, plus the SGC, Inc. and Diamond Antenna product lines.

A catalog is $5 to domestic users, $10 to all others. But it's free after rebate on your first order from the catalog, or with any $25 or greater purchase. For a catalog, contact Surplus Sales of Nebraska, 1502 Jones Street, Omaha, NE 68102 (telephone 1-800-244-4567; or e-mail <grinnell@surplussales.com>; or web: <http://www.surplussales.com>).

Windows 95 Answers! Certified Tech Support, Second Edition. Has Windows 95 got you down? Are you patiently waiting for Windows 98 to arrive on the scene? Well, in the meantime I'd again like to draw your attention to the best-selling "Certified Tech Support" series of computer support and help books. These books were developed in cooperation with Stream International (web <http://www.stream.com/stream/home.html>), an experienced provider of "third party" technical support.

One of the most popular books in the series is *Windows 95 Answers! Certified Tech Support*, by Martin S. Matthews and Carole Boggs Matthews, which we first examined in the July 1996 column. Their book, now in its second edition, has grown to a 428-page compilation of frequently asked questions and their answers, based on several hundred thousand actual tech support calls.

The handy reference was created for all user levels and covers the latest and most useful features of Windows 95, such as installation basics; setting up, customizing, and optimizing; file management; printing; and multimedia. The book also includes enlarged and updated coverage of the integration of Windows 95 with the Internet. The comprehensively indexed book also includes support for all versions of Windows 95.

The second edition is $24.95, up from $19.95 for the previous edition. It's available in bookstores, or contact Osborne/McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710 (1-800-262-4729; web <http://www.osborne.com>.

Wrap-Up

That's all for this time, gang. Next time more Digital Dipole topics of current interest. See you then.

Overheard: Something I discovered a long time ago is that you never, ever can have *too many* friends.

73, Karl, W8FX

BY DAVE INGRAM, K4TWJ

WORLD OF IDEAS

A LOOK AT THE WORLD AROUND US

Survival Communications: Are You Really Prepared?—Part II

Last month we covered some of the ground floor basics of Survival Communications and discussed how its various concepts could be applied to different situations. We also pointed out survival communications is an extensive area, and it is covered much more thoroughly in my new book *Guide To Survival Communications* published by Universal Electronics, Inc., 4555 Groves Rd., Suite 12, Columbus, OH 43232. This month we continue with additional notes on equipment considerations, alternate/emergency power systems, and personal preparedness. Knowledge of precisely what to do and how to do it before a time of need or urgency arises is invaluable in today's world, and the more assets you have in your favor, the better you are able to survive emergencies.

A few months ago, an unexplained commercial power outage affected several midwestern states for an abnormally long length of time. The incident was studied by various groups, including survivalists, and it was also discussed on a number of shortwave broadcast programs. How and why the incident occurred during normal weather and environmental conditions and how it could affect such a large area was (and still remains) undetermined. The incident also raised public awareness of our society's strong dependence on the commercial power grid. Generally speaking, short-term power outages are not a major health and welfare threat. When an outage extends beyond 48 or 72 hours, however, conditions become more unstable and/or volatile. Lacking electrical power, a city's water pumps stop. Gasoline pumps at service stations become inoperative. Frozen foods in freezer cases and grocery stores thaw and spoil. During summers, air conditioners stop. During winter, conventional heating systems are inoperative. The darkness of night supports chaos. Battery stocks are depleted. Cell phone sites and the Internet are useless. This single example may be slightly hard hitting to many of you, but it reminds all of us of our weak spots—and the benefits that our knowledge of basic electronics and amateur radio can play in survival today.

More Notes on Equipment

Last month's discussions on survival communications gear focused mainly on operating parameters such as frequency coverage, scan modes, and memories. Now let's consider some additional and always beneficial factors concerning equipment for emergency preparedness: accessibility and reliability.

During inclimate weather most of us instinctively grab our 2 meter FM talkies, and that is a very commendable reflex. In respect to personal preparedness and security, one of the new-style super-small talkies that can be inconspicuously carried on a continuous basis is better than a larger and more feature-packed unit left in a drawer or car (photo 1). Although less portable, similar criteria apply to HF gear. Ultra-compact transceivers such as Kenwood's TS-50 or Alinco's DX-70 can be mated with/strapped to a 6 amp/hour gel cell for field-type operations at reduced power, provided overall size and weight are not major constraints. Homebrewing a pocket-size QRP rig such as Wilderness Radio's SST (Simple Superhet Transceiver) described in our January column is a clever alternative. Add a "Tape Tenna" antenna kit from Hamco, P.O. Box 25, Woodland Park, CO 80866, and you are set for communications from almost anywhere (photo 2). The little SST can be powered by an internally-mounted 9 volt battery, and delivers one to two watts out-

Photo 1– From the standpoint of personal security, Alinco's new business-card-size DJ-C1 is top notch. It can be inconspicuously and comfortably carried with you on a continuous basis rather than left in a car "until needed"—a true asset. (Photo courtesy Alinco International.

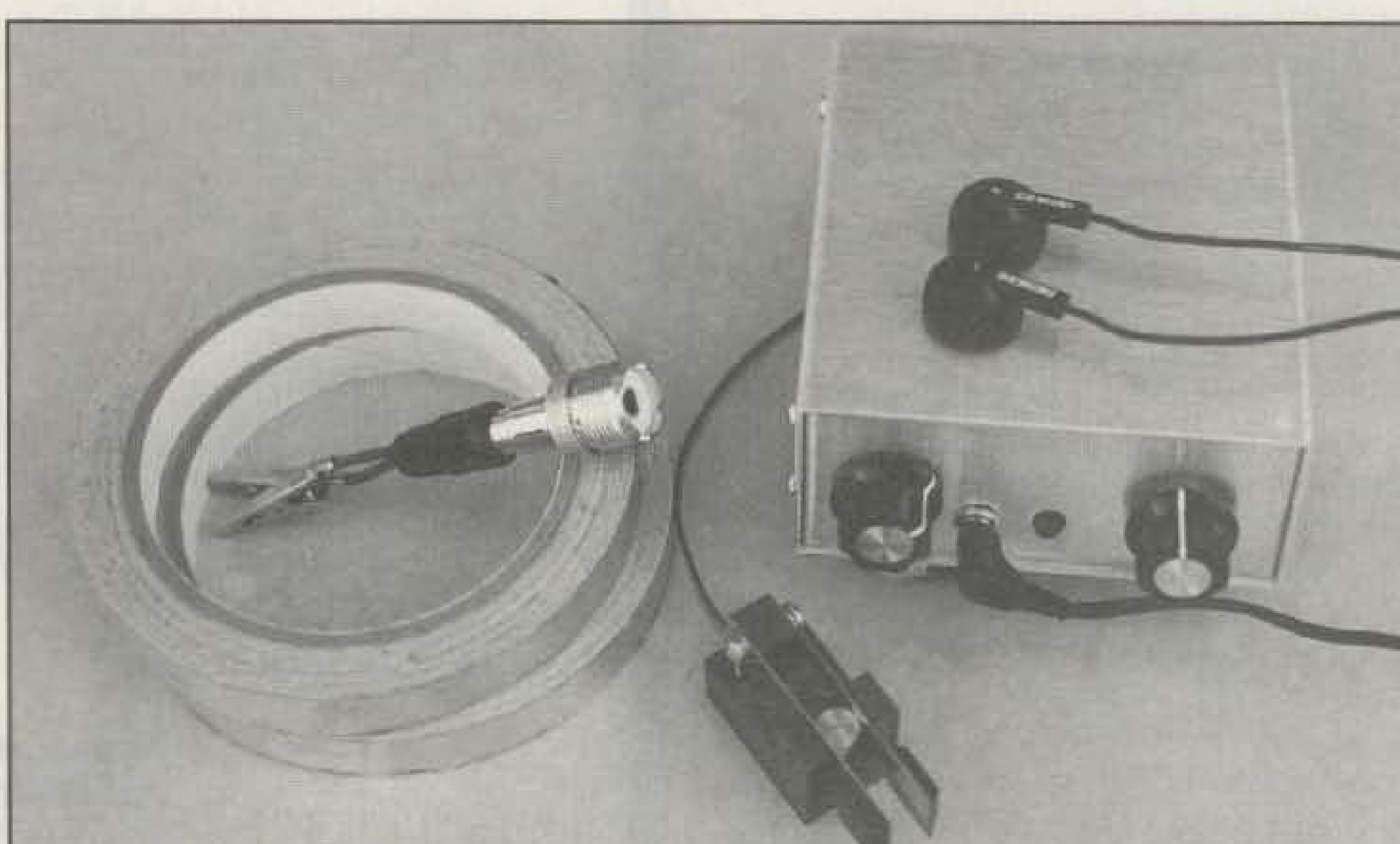


Photo 2– An HF setup for traveling or emergency preparedness need not be large to be effective. This palm-size SST transceiver and roll up "Tape Tenna," for example, are frequently used to work stations around the country on 20 meters.

4941 Scenic View Dr., Birmingham, AL 35210

NEW **Z750** • Dual-band 146/446MHz w/fold-over • Includes COMET exclusive theft-resistant lock!
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 446MHz 5.5dBi 5/8 wave x 2 • Length: 39" • Conn: Gold-plated PL-259 • Max Pwr: 200W

NEW **Z780** • Dual-band 146/446MHz w/fold-over • Includes COMET exclusive theft-resistant lock!
146MHz 6/8 wave 4.5dBi • 446MHz 5/8 wave x 3 7.2dBi • Length: 62" • Conn: Gold-plated PL-259 • Max Pwr: 150W

NEW **SBB-15** • Tri-band 52/146/446MHz w/fold-over **NEW BLACK COLOR**
Gain & Wave: 52MHz 0dBi 1/4 wave • 146MHz 4.5 dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 • Length: 58" • Conn: PL-259 • Max Pwr: 120W

NEW **SBB-7/SBB-7NMO** • Dual-band 146/446MHz w/fold-over **NEW BLACK COLOR**
Gain & Wave: 146MHz 4.5dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 • Length: 58" • Conn: SBB-7 PL-259/SBB-7NMO NMO • Max Pwr: 70W

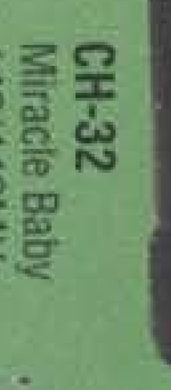
NEW **SBB-5/SBB-5NMO** • Dual-band 146/446MHz w/fold-over **NEW BLACK COLOR**
Gain & Wave: 146MHz 2.5dBi1/2 wave • 446MHz 5.5dBi 5/8 wave x 3 • Length: 39" • Conn: SBB-5 PL-259/SBB-5NMO NMO • Max Pwr: 120W

CX-224/CX-224NMO • Tri-band 146/220/446MHz w/fold-over
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 220MHz 3.5dBi 5/8 wave • 446MHz 6.0dBi 5/8 wave x 2 • Length: 36" • Conn: CX-224 PL-259, CX-224NMO NMO • Max Pwr: 100W

B-20/B-20NMO • Dual-band 146/446MHz w/fold-over
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 446MHz 5.0dBi 5/8 wave x 2 • Length: 30" • Conn: B-20 PL-259/B-20NMO NMO • Max Pwr: 50W

SH-55 • Super Flexible 146/446MHz HT Antenna
Gain: 146MHz 1.5dBi • 446MHz 3.2dBi • Length: 15.5" • Conn: BNC • Max Pwr: 10W

B-10/B-10NMO • Dual-band 146/446MHz cellular look-a-like • Gain & Wave: 146MHz 0dBi 1/4 wave • 446MHz 2.15dBi 1/2 wave • Length: 12" • Conn: B-10 PL-259/B-10NMO NMO • Max Pwr: 50W



CH-32
Miracle Baby
146/446MHz
HT Antenna
Gain: 0dBi
Length: 1.75"
Conn: BNC

- Gold-Plated Connectors
- High-Quality Craftsmanship
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CIRCLE 112 ON READER SERVICE CARD

put. I tested my SST's "real rig" capabilities during a recent Sweepstakes contest, and made contacts throughout the U.S. with it. Knowing I can grab two proven-reliable tiny rigs when needed and stay in touch with the "outside world" is both comforting and reassuring.

Looking further into reliability needs during unusual situations, many people are concerned about unauthorized use of nuclear energy and/or weapons and resultant EMP (Electro Magnetic Pulse radiation). If such occurred, the general consensus feels solid-state equipment would be rendered useless. Older style vacuum-tube gear is more stouthearted, and stands a better chance of survival (photo 3). How well-maintained is your old tube rig? Do you use it occasionally today?

Photo 3– Reliability during the most unusual situations is another important factor in survival communications, and the stoutheartedness of older vacuum-tube gear may prove beneficial for withstanding indirect effects of EMP radiation.

Alternate and Emergency Power Options

During any abnormal or emergency situation, a reliable source of power is a foremost consideration. Short-term needs (up to 50 or 60 hours) can usually be handled by batteries, provided load requirements are light or moderate. Beyond that point, or for living independent of commercial power lines, alternative power sources enter the picture. Let's take a "whiplash scan" of this vast area beginning with some notes on batteries.

First, conventional 1.5 volt AA and C size cells are good for applications requiring .5 to 1.0 ampere of current. Any number of cells can be wired in series for more voltage, or in parallel for more current. Regular carbon-zinc cells are the least expensive, but have the lowest current ratings and shortest lifespan. Alkalines deliver more current, plus they exhibit a very long shelf life. Rechargeable nickel-cadium cells are well-known for their high current ratings (favorites for talkies!). However, their shelf life is relatively short (leave them unattended for 3 or 4 months, and they probably will "go flat" when needed). Another recently introduced cell is Ray-O-Vac's "renewable alkalines," and their use for emergency applications is quite attractive. The cells exhibit long shelf life as do alkalines, can be recharged 25 to 100 times, do not develop a memory, and actually like frequent "top ups" for instant preparedness. Generally speaking, nickel-cadiums are recharged at 1/10 their maH rating for 10 to 11 hours. More information on recharging times, rates, plus details on a solar charger, incidentally, are presented in my March *CQ VHF* "Project Corner" column. Check it out!

The second most popular form of alternate energy is a gasoline engine-driven generator. Indeed, medium-size (1–4 KW) generators from familiar names such as Coleman are widely available and often used for operating small home appliances and blowers in heating systems during power outages. If we have a fireplace for heat and a cooler for foods, however, a smaller generator (which uses less fuel, produces less noise to attract undesired attention, and is easier to carry) is all we need for powering medium-size communications gear. Check out, for example, the neat little "Power Pony" shown in photo 4. This mini-generator measures only 10 by 10 by 11 inches, weighs 13 pounds, and runs 8 hours on a gallon of gas. It delivers 110 volts AC at 3 amps or 12 volts DC at 4 amps, and costs only $269. How's that for affordable emergency or field preparedness, gang! Power Ponys, plus numerous other varieties of generators up to 10 KW are available from the House of Generators, 16601 Unit D Gothard Street,

Photo 4– Need a super-portable mini-generator for emergency communications power or field use? This little "Power Pony" measures only "three coffee cups square," weighs 13 pounds, and delivers 110 VAC at 3 amps or 12 VDC at 4 amps. It is also available in a same-size 12 VDC/12 amp version. Power Ponys and larger gasoline or diesel generators up to 10 KW size are available from the House of Generators, 16601-Unit D, Gothard St., Huntington Beach, CA 92647.

Photo 5– Wind generators such as this 300 watt "Whisper" brand unit are easy as a triband beam to install, and they deliver a surprising amount of power during moderate wind conditions. Models from 600 to 4800 watts are available from Alternative Energy Engineering, P.O. Box 339C, Redway, CA 95560.

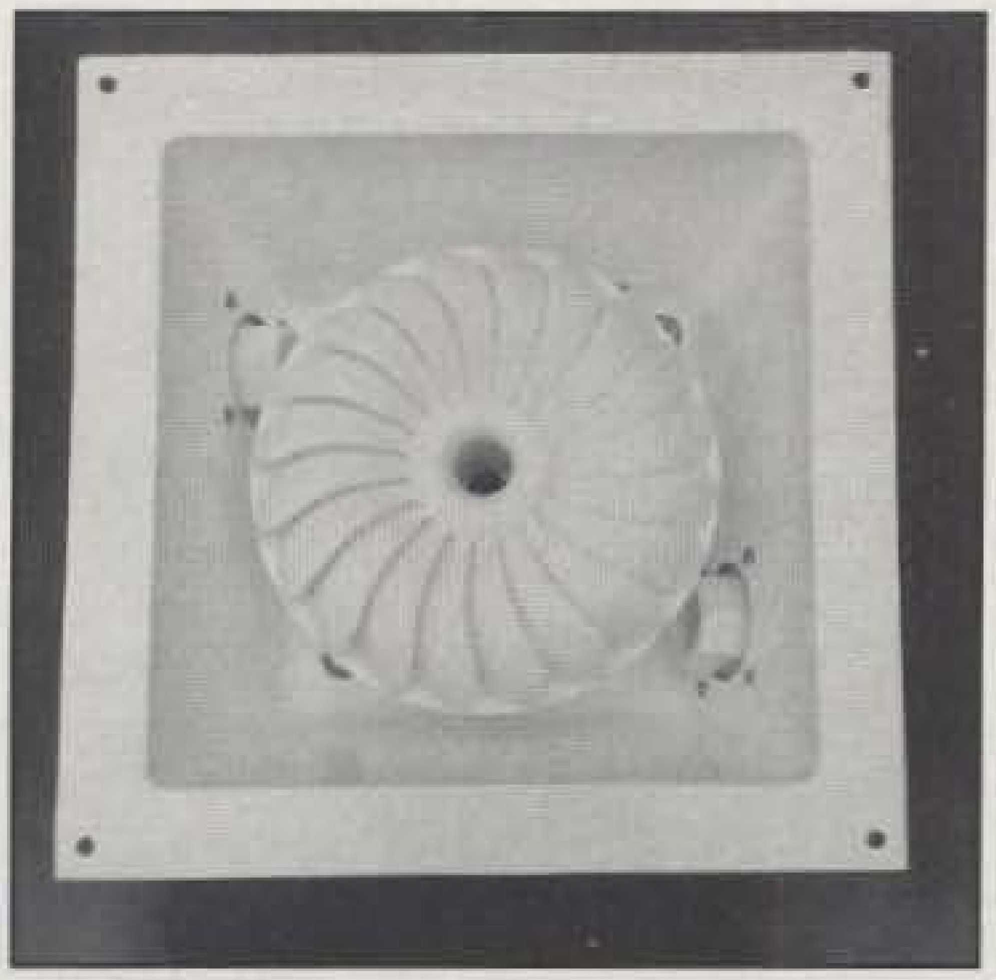

Photo 6– Hydropower generators such as this Harris unit are clever alternate energy ideas for people who live near streams or creeks. Typically, they are used in conjunction with other alternate energy equipment such as solar panels. When output of either one is low, the other "picks up the slack." Hydro power generators from 40 to 1400 watts are available from Alternative Energy Engineering Co.

Huntington Beach, CA 92647 (telephone 1-800-987-4484).

Next in popularity are the silent, environment-friendly and long-term alternative energy sources of wind, water, and solar power. If you live near a coastal area or mountaintop where winds average 12 mph or higher, setting up one or more wind generators is a smart move. Not only will it ensure emergency preparedness, it may also liberate you from dependence on commercial power. Modern wind generators such as the "Whisper" version shown in photo 5 are easy to install, quite rugged, and available in 12 VDC or 120/240 VAC models from 300 to 1500 watts output.

Small hydroelectric generators, ranging from a "Li'l Otto" model that produces 12 volts at 3 amps from waterflow comparable to a home faucet to a Harris Pelton Turbine unit that produces 1400 watts from an outdoor stream, are other alternatives (photo 6). Prime considerations for setup are a mild understanding of hydro principles (or good guidance!) and taking care to avoid upsetting natures balance or jeopardizing wildlife.

Finally, solar panels are an excellent choice for long-term alternate energy. They do not have moving parts to wear out, modern designs are both flexible and rugged, and any number of panels can be wired in series or parallel for increasing output wattage. (photo 7). Solar panels produce their peak output during bright sun times. However, they also produce respectable output during cloudy days. The efficient way to use solar, wind, or water power, incidentally, involves using them to charge batteries for storage and later "withdrawal" as needed (photo 8).

An outstanding source of wind, water, and solar energy systems plus 12 VDC to 120 VAC inverters, charge controllers, deep-cycle batteries, switchboxes, etc., of all types is Alternative Energy Engineering, Inc., P.O. Box 339C, Redway, CA 95560 (telephone 1-800-777-6609). Get one of their catalogs, and start planning your switch to self-reliance!

Develop A Survival Plan

Although seldom realized, many of us were exposed to some basic survival techniques as youngsters in school (do you remember fire drills?). The big question is do you prepare equally for emergencies

Photo 7– Solar panels are an excellent choice of low-maintenance and long-term alternate energy, especially when backed up with a generator for times of heavy loads. (Photo courtesy Tom Harrington and Universal Electronics, Inc.)

today? Do you have a plan that includes ensuring the safety and security of yourself, your loved ones, and relatives during emergencies? Only after that consideration has been addressed can we focus on helping others and providing communications assistance.

First, personal preparedness plans should include a "go anywhere" emergency kit with minimum contents of bottled drinking water, high-energy snack bars or MREs (Meals Ready to Eat), aspirin, bandages, duct tape, and extra batteries for your FM handheld, scanner, and/or flashlight. People requiring medicine for blood pressure, diabetes, etc., should also be sure a week's supply of in-date medications in the kit. Expansions beyond this "bare bones" point (such as extra clothing, blankets, a mini-grill for cooking and boiling water, etc.) depend on circumstances and personal needs, and can be addressed through camping or survival stores. One of the most well-equipped stores I have noticed is Major Surplus and Survival, 435C Alondra Blvd., Gardena, CA 90248 (telephone 1-800-441-8855). They carry everything from hand-crank radios and flashlights to pocket water purifiers, life vests, sleeping bags, MREs, and multifunction tool kits (great for antenna work!). Ring them up and check out their free catalog.

Families are often separated when an unexpected emergency hits. Thus, a pre-established plan for communications is vital. The developed plan should also be used/tested and refined as needed on a regular basis. If family members are within a 3 or 4 mile area, using 2 meters or FRS handhelds holds good merit. Bear in mind, FM repeaters may be out of service or overloaded with priority activities, however, and using an uncrowded or overlooked channel/frequency for "direct" operations may be necessary. If family members are separated by substantial distance, "reporting in" with an out-of-town relative (such as a retiree who is usually home) holds merit. In that case, all family members should carry a "survival plan" card with both emergency frequency notes and the "report in" contact's telephone number. Radio amateurs normally have the capability to reach out-of-stricken-area amateurs who can make collect telephone calls to a "report in" relative.

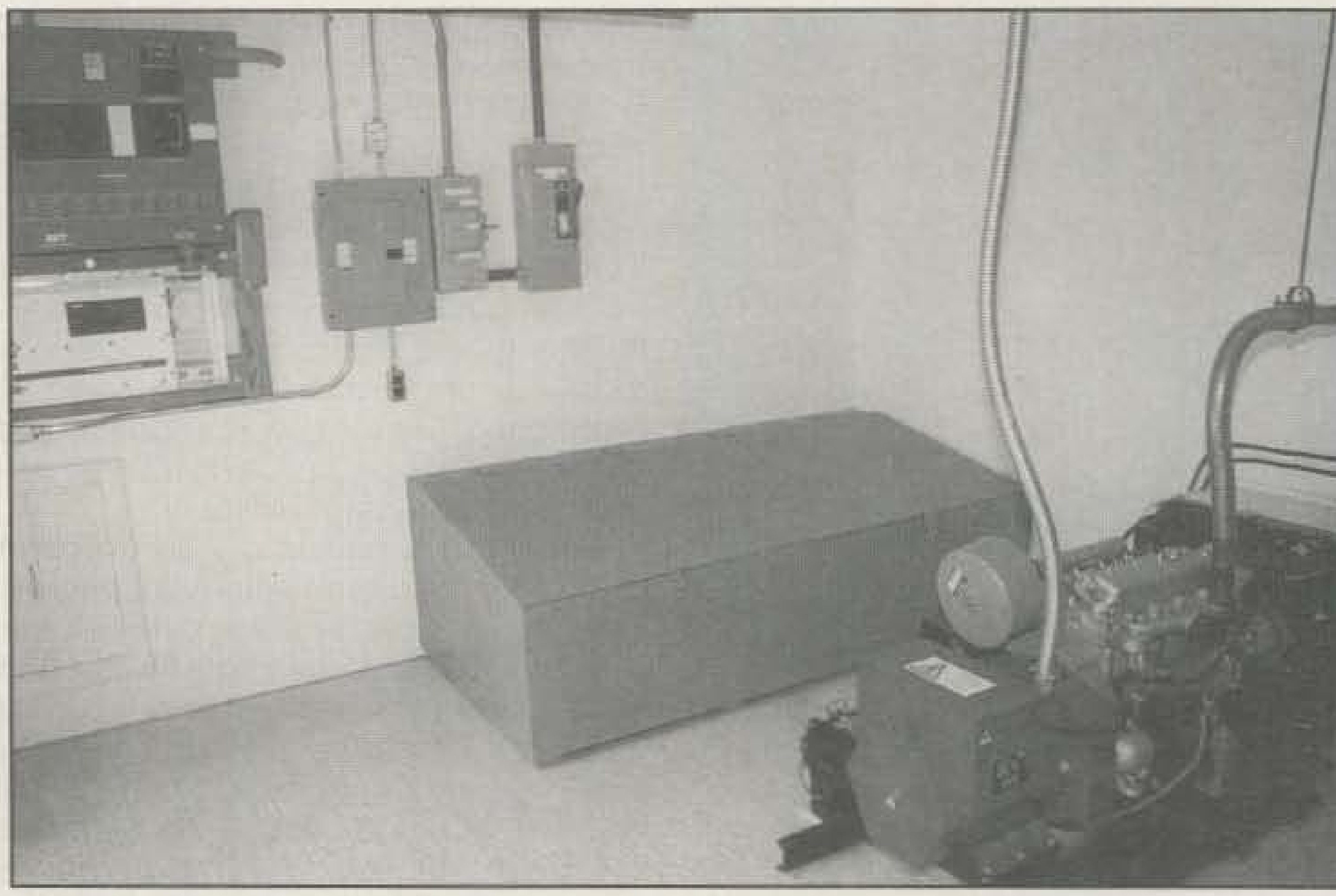

Photo 8– Basement view of a full alternate energy setup for independent living. Solar panels shown in photo 7 connect to bank of deep-cycle batteries (in box on floor) through charge controller (on wall). Diesel generator (10 KW) backs up system. Inverter on wall converts 12 VDC to 120 VAC. (Photo via Tom Harrington and Universal Electronics, Inc.)

Alternately, remember this tip: Many times, wired/pay telephones in stricken areas are not totally "out," but are "temporarily disrupted." They are often functional for making *outgoing-only* calls (carry lots of pocket change for using them!).

If you live alone, do you and other "independent lifestylers" check on each other once or twice daily via 2 meters? Once a habit of just saying "hello, we are fine" with specific friends on a repeater is formed, each looks (listens) for the other in a "watch over me" manner. FM repeaters can support more than drive-time chats. They can be a real asset to YLs, overtime or night workers, youngsters, and retirees!

Our discussion of emergency preparedness plans could continue indefinitely, but space is limited, so let's quick-add one additional note. Joining your local RACES and/or SKYWARN team and becoming a skilled volunteer is heartily recommended. These groups have superb training programs and other "unrealized until you are a member" benefits. How to join? Just "ask around" on your local 2 meter repeater! Do it soon!

The Closing Wire

We again have overflowed column space! Want to see more columns featuring Survival Communications and/or alternative energy systems? Drop us a note! Meanwhile, I look forward to chatting with you on 20 SSB one Sunday afternoon or on 30 CW one weeknight soon. Also, check out my upcoming May *CQ VHF* "Project Corner" on putting together an alternate energy system for your home rig and more. 73, Dave, K4TWJ

BY BUCK ROGERS, K4ABT

PACKET USER'S NOTEBOOK

CONNECTING YOU AND PACKET RADIO IN THE REAL WORLD

ZIPCODE ZIPNODE

Wow! Did I ever step in it! For the last six or eight issues of *CQ*, with a break in between one or two of them for a review or two, we've been building radios and modifying others to operate at 9600 baud. Many of these conversions were done to commercial transceivers or transceivers that were once in use by public service or utility services.

My purpose for following this line of conversion was mostly because these radios were cost-effective (cheap) and available at almost any hamfest. Easy to come by and for under $50, we could spend another $50 for the crystals and have a 9600 baud transceiver that would run over 50 watts on a hilltop making 9.6 Kb backbone packet.

All the time I was making these mods and conversions, I was also writing these pages in the "Packet User's Notebook" to give the system node operator (SNO) an easy platform to follow. In turn, this would help the SNO get the mod completed faster and the system backbone handling packet traffic much sooner.

As often happens, we tend to take for granted that most SNOs have the needed equipment to get this or that mod finished and out the door, up to the node site.

It didn't take long for several SNOs to remind me of where I have made a mistake. I have received tons—maybe less than a ton, but hundreds—of letters and e-mails with thanks for these columns, but included in some of these letters and e-mail was something else I picked up on.

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Where Are The Watts?

Some of you—well, quite a few—let me know about a "got'cha" that comes into play soon after you replace the crystals and begin the task of tuning the commercial standard transceiver to its new operating frequency. About every tenth letter or message dealt with this topic.

"Buck, when I tested the radio on the old frequency on which it was crystalled (up in the 160 MHz portion), it showed good power output. But when I put the new rocks in and attempted to tune the radio on the new frequency, there was no output."

Yep, that is a fact of life when you move a commercial radio down the band, over 10 MHz. In a few cases the commercial radio will have a broad enough band pass to handle a change of this magnitude. In most cases, though, we have to do a little "snoop'n" to find the watts.

Enter The "Sniffer"

Often referred to as an RF probe, the "sniffer" is a simple RF demodulator or diode detector built into a small cylinder (the one I use resembles the metal casing of a pocket flashlite I saw at a nearby "dollar store"), or metal tube. In the drawing at fig. 1 I've illustrated the component values and the simplicity of its construction.

This valuable tool can be built in less time than it takes to think about it, and as you will soon discover, it will become one of your most valued service tools. The "sniffer" is plugged into your digital voltmeter, or if you are lucky, into an old-fashioned vacuum tube volt meter (VTVM).

The next time you begin tuning a radio into which you've just installed new rocks, or moved the frequency across most of the visible light spectrum, you can find those missing watts. Whoops! Better make that the missing "milliwatts," for in the beginning, when you begin looking for the power that is *not* there, you'll need to begin looking around the first stages of RF. This is where the RF probe comes into play.

Actually, the first place you want to look for any sign of RF is at the output of the crystal oscillator. Once you have power there, move to the next stage, whether it is a buffer stage or a stage in the FM multiplier chain. It won't take long to find that you have the perfect tool to begin the tune-up of both the transmitter and receiver crystal oscillator stages. Tune for optimum power out of each stage and then move to the next stage.

Moving always away from the crystal oscillator stage towards the PA section, it won't be long before you see RF power showing up on your watt meter. You know, the watt meter that you have connected to the coax connector at the radio output. Oh, you know, the one that connects the radio into the "dummy" load.

The sniffer will also prevent lots of cracked ferrite bobbins and coil slugs by helping you find RF before you've cracked every bead in the exciter.

The RF probe I use is one that my son Glynn, WB4RHO, built about 20 years ago. It uses the old 1N34 diode. However, the sniffer can be built with just about any of the 1N914's or 1N4148's from your local RadioShack or Tech America store. If you are fortunate enough to get your hands on the old 1N34, it seems to be more sensitive to RF detection than "fast-switching" diodes such as the 1N4148's.

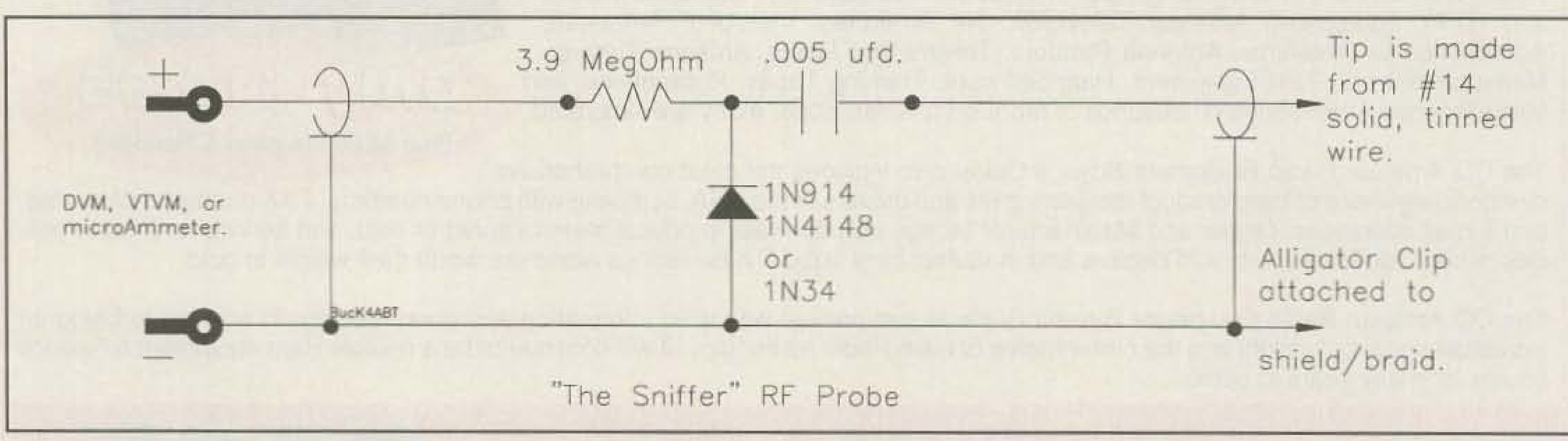


Fig. 1– This valuable tool can be built in less time than it takes to think about it, and as you will soon discover, it will become one of your most valued service tools. The "sniffer" is used in conjunction with your VOM, VTVM, or DVM.

The lead from the meter into the RF sniffer is a piece of small coaxial cable. I think Glynn used a piece of small phono shielded cable at both the goes-into and the comes-out-of the probe. The comes-out-of part of the shield is *only* the shield. The tip is made from a one inch piece of number 14 tinned (solid) wire. The shield is bonded to the inside of the metal case of the sniffer. I have a short (3 inch) piece of the flexible shield extending from the probe (tip) end of the sniffer. Attached to the shield is a small alligator clip for easy attaching to a ground near the area where I'm tuning.

If you happen to have a D'arsonval (meter with the pointer/needle), try the sniffer with it. If you have only the digital volt meter, then you are on your own, as here you will have to interpolate the readings high and peak to meter low or signal digress.

I picked up a RadioShack meter, an AutoRange VOM model 22-216, for under $35. Not only is this meter useful as an all-purpose bench VOM, it also responds very well with the sniffer I have.

Faster, Faster—Okay, 8 Times Faster

I also receive a lot of mail from readers who say they would like to make some of their present transceivers into 9600 baud radios. The idea behind these letters is to get across to me that the reader has some radios already surplus to their needs and they would like to build them into 9600 baud handlers.

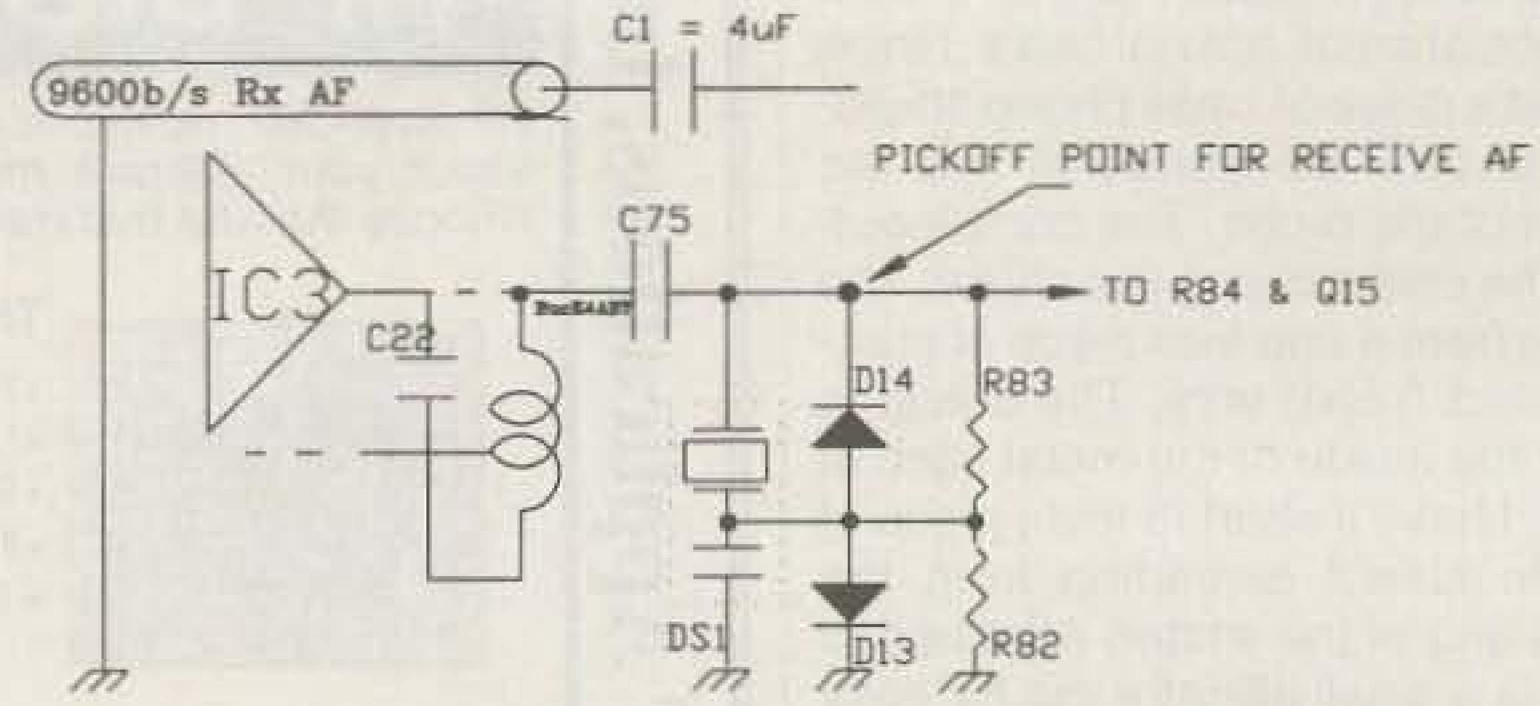
Ever since the James Miller, G3RUH, 9600 baud modem design was marketed by MFJ Enterprises, PacComm, and Kantronics, it has been gaining in popularity and application. The MFJ-9600 is used with the MFJ products, while the PacComm NB96 is used with the PacComm TNCs, and the Kantronics 9600 baud modem is implemented inside the Kantronics DataEngine (DE-56). Similar modem designs are also built into the AEA PK-96 TNC.

The MFJ-9600 modem is compatible with the internal disconnect headers in the MFJ TNCs, and other TNC2 clones.

Kantronics has also added a compatible 9600 baud system to their KPC-9612 PLUS. With all these 9.6Kb TNCs ready to plug and play, it's time to take another crack at whack'n away at the copper traces in some of our old VHF transceivers. This will give you a chance to get an idea of which area in the radio needs modifying.

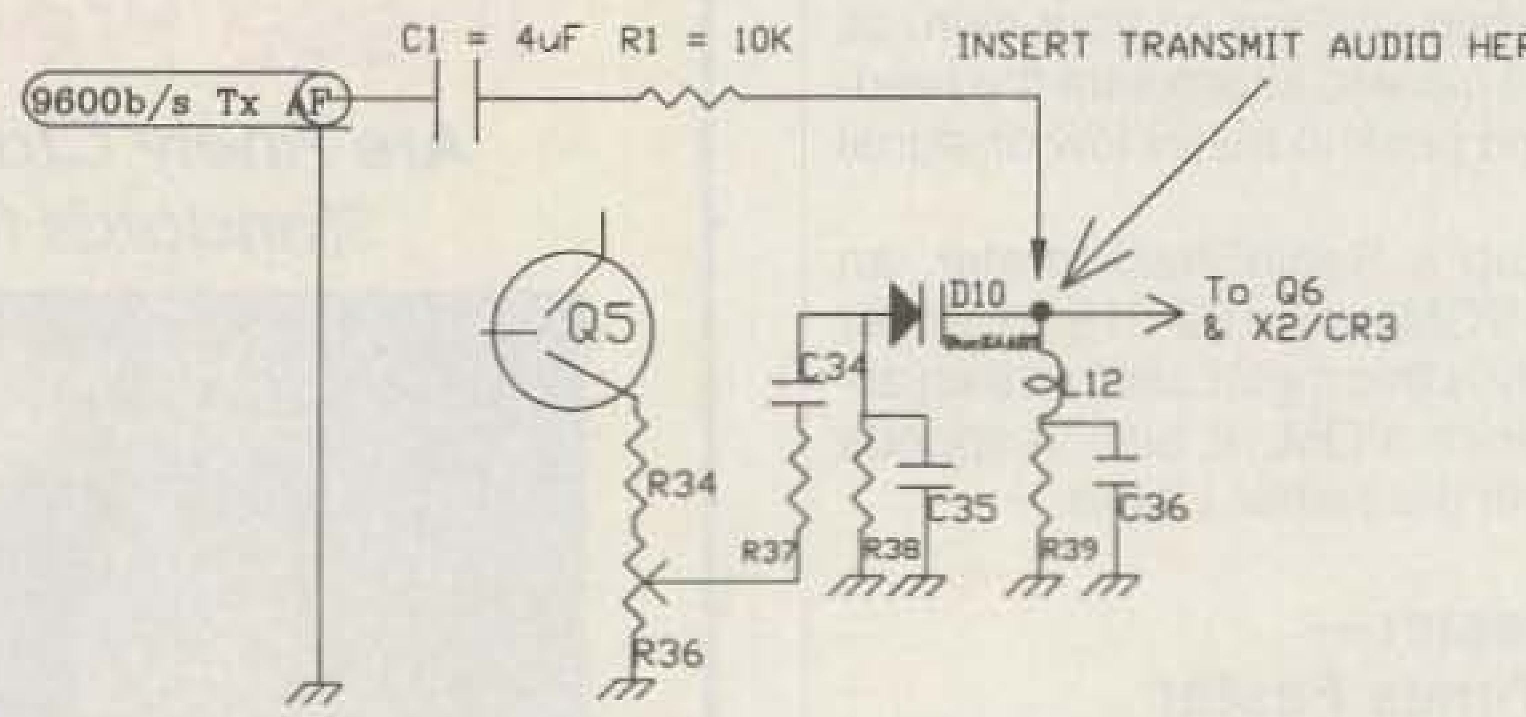
To make this short story, let's talk about the work area in the transceiver where we will be making changes. For the most part, our changes will be to the input and output sections of the radios. The Push-to-Talk (PTT) section will remain unchanged.

To make this effort work, we must mod-



9600 baud receiver modification in the ICOM IC-25.

(A)



9600 baud mod of the transmit section in the ICOM IC-25

(B)

Fig. 2(A) & (B)– The ICOM IC-25 employs discreet components in the modulator and discriminator stages. Note: All components shown in the above drawing are located on the main PC board.

ify the varactor DIRECT FM modulated stages for data input, and connect the receive AF output at the quadrature detector outputs.

Some transceiver manufacturers already have radios that are configured and wired with the tie-points that I am covering here. Some even bought them out to an accessory or separate 9600 baud connector. This kind of support is what we packeteers like to see.

Cutt'n, Chop'n, and Caveat!

Okay, you remember the rest of the story. I'm not responsible for any cuts, breaks, trashed radio, or bruised egos! You continue at your own risk.

These connections are for the varactor data (DFSK) input and the quadrature detector outputs (before the diodes, please). This is something that will allow the sysops among us to make the needed connections without tearing the guts out of a good transceiver.

Several sysops I'm acquainted with are using the MFJ version of the G3RUH modems in the MFJ-1270CQ Turbo TNCs and attaching them to radios with wide receive and transmit bandpass characteristics. It is preferred that a transceiver to be used at 9600 baud have a 17 kHz bandpass, since this is the amount of spectrum occupied by the Direct Frequency-Shift Keyed (DFSK) transceiver.

The MFJ-9600 modem design is licensed from James Miller, G3RUH, and is in use worldwide. This modem design gives the packeteer a means of creating a flexible transmit wave-form filter design that can compensate for audio differences in many production transceivers. One important feature that stands out in the G3RUH modem incorporated into these TNCs is the digital generation of the transmit audio wave-form. The precise shaping limits of the signal bandwidth can be made to tidy up the amplitude and phase response in the receiver dedicated circuits. The result is a compatible filter system within the data detection circuits for optimum data recovery and minimum errors.

Are You Sure It's "True"?

I have drawn two radios to illustrate the two sections in each transceiver where we will focus our attention. For now, or for this month anyway, I'm going to use the ICOM IC-25A and a later model ICOM IC-28A/H. Although they are both ICOM transceivers, each one uses a different approach to their means of "true" frequency modulation.

The ease of change is accomplished when you have plenty of time, as in all afternoon—two or three hours to work without interruption. I've attempted to make this project easy by identifying the points that you should look for in your transceiver (and schematic) diagram(s). At fig. 2(A) are the ICOM IC-25A receiver modification notes. In fig. 2(B) I've illustrated how the transmit circuitry is modified for 9600 baud DFSK.

The ICOM IC-25 employed discreet components in the modulator and discriminator stages. In the next set of drawings, ICOM moved to the use of integrated circuits in both the discriminator and modulated stages of the IC-28. This latter illustration will give you a better idea of what is in store in later radios, as the audio IC shown as IC1 in fig. 3(A) is also employed in many other models and even transceivers of other makes and brands.

If you plan to implement a 9600 baud modem in your TNC to transceiver combination, determine if the transceiver you hope to use employs TRUE or DIRECT FM, and *not* Phase modulation. The Phase-modulated transceivers are more contrary in a high-speed data transmission application.

The following is a partial list of transceivers that have been modified to operate at 9600 baud:

Alinco: DR-1200 DATARADIO, DR-110, DR-112 ALR-22, ALR-72, ALR 709.

ICOM IC series: 25A, 28A, 38A, 228, 271, 290H, 471, and 3200.

Kantronics: DVR 2-2 Data Radio (9600 bps ready when used with the DE-56 DataEngine). The D4-10 can be used with the DataEngine, or combined with other controllers.

Kenwood: TR series 751A, 7500, 7700; TM series 211, 212, 221, 231, 431; TS series 700 and 770.

Standard: C58, C140.

Yaesu: FT series 212, 221, 230.

The Caveat

Although I've made 9600 baud modifications to many of the transceivers mentioned above, some of these modifications were provided to me by helpful readers of this column. Some of these mods were *not* tested by me; therefore neither I, or the publisher, assume any responsibility for errors or damage resulting from the use of interface and modification information herein. Persons attempting these changes should also be familiar with micro-circuit soldering techniques.

Important Note

In some transceivers we've found IF pass-

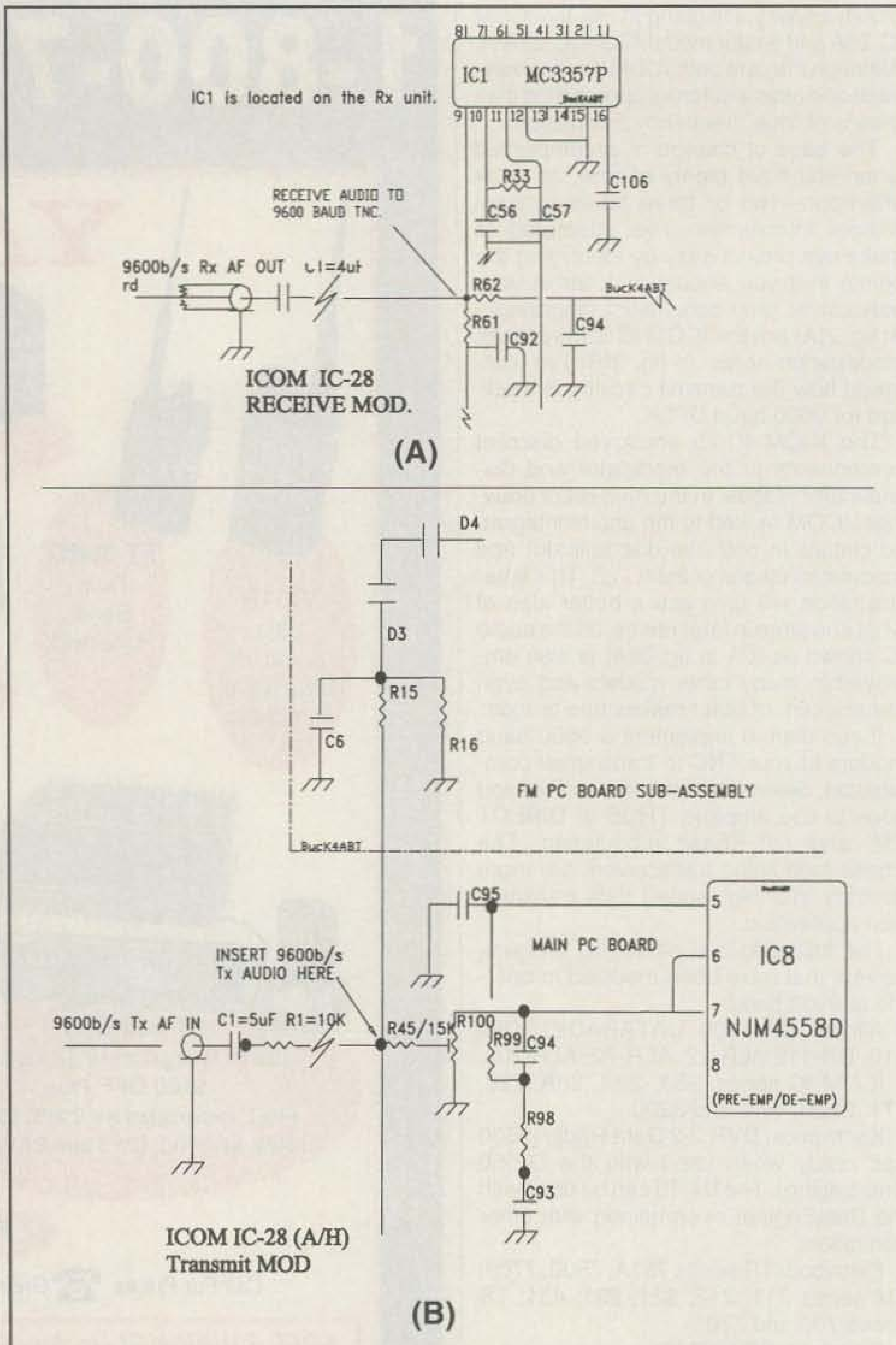


Fig. 3(A) & (B)– In the above illustration I've shown how the circuitry is modified for 9600 baud DFSK. Here ICOM uses integrated circuits in both the discriminator and modulated stages of the IC-28. This illustration will also depict the same audio circuits employed in many other transceiver models, makes, and brands.

band limiting caused by the 455 kHz ceramic I F filter. An R/C network may be needed to broaden, or by-pass, this filter so the 9600 bps data can reach the discriminator. An alternative would be to exchange the filter(s) for one (MURATA) with a wider band-pass characteristic.

When installing a 9600 bps modem into a TNC, or when connecting the TNC to the transceiver, use **shielded** wire to the transmitter modulator. Shielded wire is used in the R/C network shown in fig. 3(B) where components C1 (5 µFd NP) and R1 (10k ohm) are injecting the 9600 baud transmit audio. Use a separate shielded audio wire from the discriminator output for the receive audio (see fig. 3(A)).

Some Radios Are 9600 Baud DataReady

Some are off-the-shelf and ready to run 9600 baud, such as the Alinco DR-150. This radio is capable of handling both inputs at one time. I have one of the Alinco DR-150 transceivers interfaced with the Kantronics KPC-9612 Plus. The KPC-9612 Plus is capable of simultaneous 1200 and 9600 baud operation.

With this in mind, I connected the 9600 baud I/O of the KPC-9612 to the 9600 baud port at the rear of the Alinco DR-150 (see fig. 4). The 1200 baud port of the Kantronics KPC-9612 I interfaced to the MIC I/O at the front of the Alinco DR-150.

Consider the Future

Study the applications and uses of these radios, then discuss with other SNOs the possibility of adding 9600 baud to your local network or to your present packet radio backbone.

This implementation of high-speed trunks can be a joint venture by other systems, such as DX spotting or traffic forwarding. Through cooperation among sysops, the backbone can be utilized to move vast amounts of traffic over long paths without affecting the throughput at the user level. Again, I caution the sysop who might consider mixing various kinds of traffic. Please consider the end result before leaping into this line of fire.

Experience has taught some of us that mixing CONFERENCE, CONVERS, BBS forwarding, or DX SPOTTING nodes and networks into one system will bring the system to its knees. It is a matter of experience that has taught us to use separate frequencies for these multiconnect conference and spotting clusters.

A Final Note

A few months ago I wrote another column about the lack of concern by the ARRL centered around the use and application of the high-speed packet radio frequencies that were approved and set aside for mass data transfer. If you recall, these were 100 kHz wide channels that would enable packet radio to have a nationwide system that would rival the speed (actually faster) of the internet. These 219 to 220 MHz frequencies were approved for this use more than three years ago.

I know my words were heard (read), for soon afterward, a small paragraph appeared, tucked away deep within a TAPR newsletter, that told how the ARRL would like to dump the coordination and frequency use assignment off onto TAPR. As if TAPR didn't have enough problems of their own. It might appear that the League is trying to remove any association with packet radio from its roster. If the ARRL keeps dodging and passing responsibilities to other groups, examiners, organizations, and individuals, they may soon find they have nothing left to do, or maybe this is their goal!

Packet Radio Vendors

For more information or to order, you may contact your Kantronics dealer, or Kantronics directly at 1202 E. 23rd Street, Lawrence, Kansas 66046. Telephone order line is 913-842-7745. BBS @ 300, 1200, 2400, N,8,1 is 913-842-4678.

The TNC2 type clones MFJ-1270B (TNC) and MFJ-9600 (9600 baud modem) are available from MFJ Enterprises, Inc. Box 494, Mississippi State, MS 39762. Order line 800-647-1800.

A similar TNC2, 9600 baud TNC is available from PacComm Packet Systems, Inc., 4413 N. Hesperides St., Tampa, FL 33614 (800-223-3511).

Let's get busy at 9600 baud! Visit the home of packet radio networking at <http://www.PacketRadio.com>. E-mail me at K4ABT@PacketRadio.com.

73 de BucK4ABT

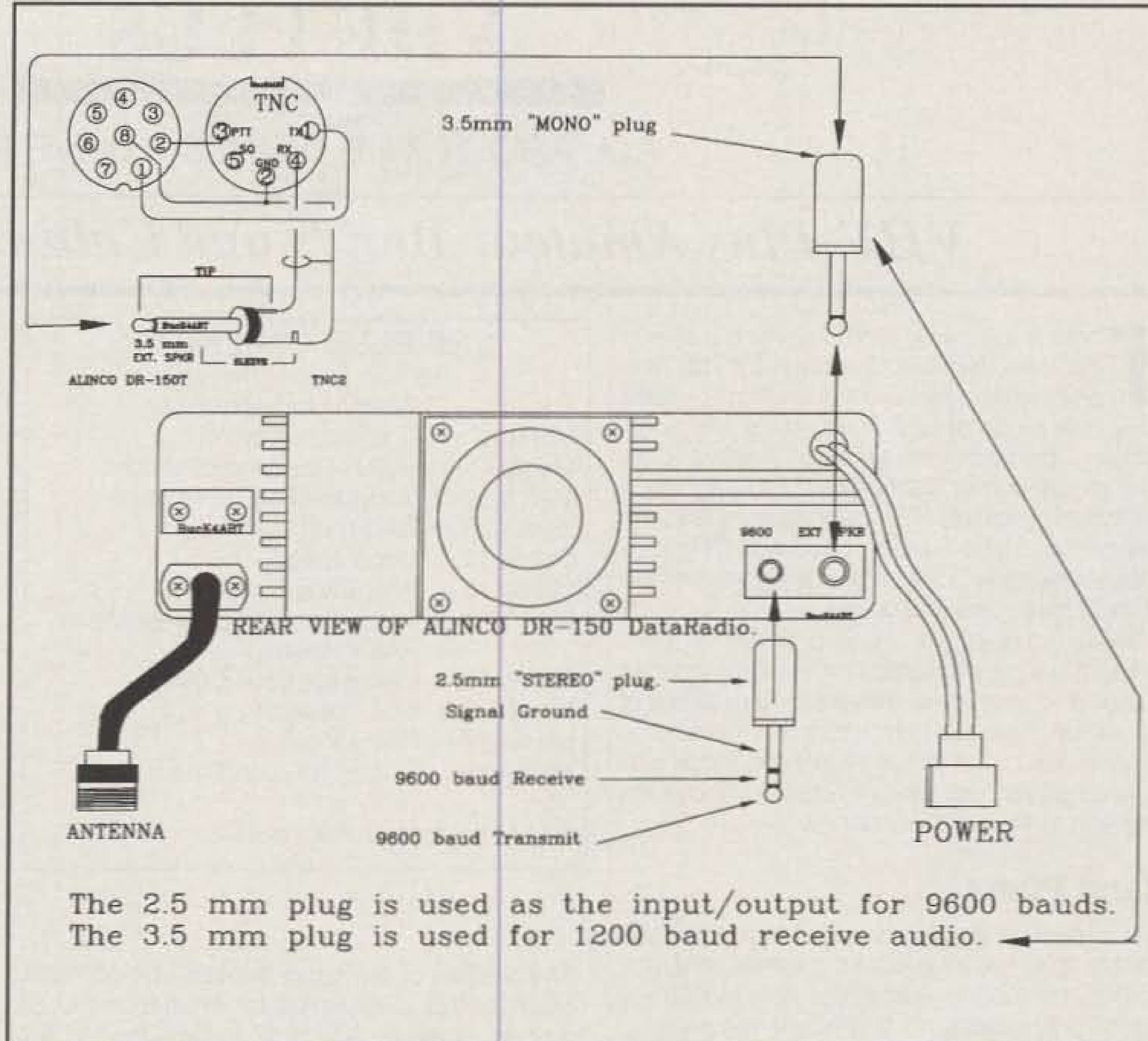


Fig. 4– There are many "off the shelf, ready to run" 9600 baud transceivers such as the Alinco DR-150. This radio is capable of handling both 1200 and 9600 baud input at one time.

BY JOE LYNCH, N6CL

VHF PLUS

ALL ABOUT THE WORLD ABOVE HF

VHF-Plus Amateur Bands and Calling Frequencies

There is a growing problem which is affecting the VHF-Plus amateur bands. The problem is encroachment—that is, those using one mode of communications and operating in a portion of the amateur band wherein that mode is not authorized. Among such encroachments are SSB operations within the CW portion of the 6 meter band and FM operations within the SSB, or weak-signal, portion of the 2 meter amateur band.

While it appears to be a problem of ignorance, it is a growing problem, nevertheless. In an effort to overcome this growing problem of ignorance, I am devoting this month's column to coverage of the various amateur bands and calling frequencies. I begin with the band plans for each of the amateur bands.

VHF-PLUS CALENDAR

March 1	Good EME conditions.
March 5	First quarter moon.
March 6	Highest Moon declination.
March 8	Moderate EME conditions.
March 13	Full Moon.
March 14	Moon apogee.
March 15	Poor EME conditions.
March 21	Last quarter and lowest Moon declination.
March 22	Very poor EME conditions.
March 27	Moon perigee..
March 28	New Moon.
March 29	Good EME conditions.

**EME conditions courtesy W5LUU*

Band Plans

The VHF-Plus amateur bands extend from 50 MHz to light. Here's a list of the amateur bands, authorized modes, generally accepted band plans, and operating privileges for each of them. A few notes: All Technician class licensees, regardless of having passed the Morse code test, and all other license classes above Technician are authorized to use all privileges on all the VHF-Plus frequencies. Novice class licensees are authorized full access to the 222–225 MHz amateur band and a portion of the 1240– 1300 MHz amateur band. For information about repeaters in your area, consult your local VHF/repeater coordinating organization or the *ARRL Repeater Directory*.

Calling Frequencies: Because activity is less frequent on the VHF-Plus frequencies than on HF frequencies, certain calling frequencies have been set up and agreed upon by a majority of operators on the VHF amateur bands. Whether you came from HF or repeater operation, or are a new amateur, you may be familiar with FM calling frequencies. However, you may not be familiar with the weak-signal calling frequencies. The purpose of the calling frequency is to establish a gathering point for operators to initiate contacts. Once a contact has begun, operators are urged to move off the frequency in order to keep it clear for others to start contacts. Unfortunately, sometimes during band openings one station will stay on the calling frequency and dominate all contacts, unfairly reducing other operators' chances. A list of calling frequencies for weak-signal and FM work for each band appears below.

50–54 MHz: Operation on this band is open to all licensees holding a Technician class or above license.

50.000–50.100 MHz. This portion of the band is exclusively for CW operation. The section of the band between 50.000 and 50.020 MHz is unofficially reserved for EME operation. The section of the band between 50.060 and 50.080 MHz is reserved for unattended U.S. beacon stations, although foreign (non-U.S.) and attended U.S. beacons can be found anywhere within the CW portion of the band. Rarely do stations who use this portion of the band for CW contacts operate below 50.090 MHz.

50.100–50.300 MHz. This portion of the band is for SSB operation, although CW contacts are permitted and do sometimes take place. The section of the band between 50.100 and 50.125 MHz is reserved for DX contacts only. Domestic contacts within this window are greatly discouraged.

50.300–50.600 MHz. This portion of the band is open for all modes of operation.

50.600–50.800 MHz. This portion of the band is reserved for non-voice communications, such as packet.

50.800–51.000 MHz. This portion of the band is reserved for radio-control operations, for controlling model airplanes or cars. There is a 20 kHz separation between each frequency used for such operations.

51.000–51.100 MHz. This portion of the band is reserved for a Pacific and European DX window. Because some countries have not granted privileges below these frequencies, DXers know to look here for some DX opportunities.

51.120–53.980 MHz. With a few exceptions (that are listed below), this portion of the band is used for FM and repeater operations. The frequencies of 51.500–51.600, 52.020–52.040, 52.520–52.540, and 53.000–53.020 are all reserved for FM simplex. The frequencies of 53.100, 53.200, 53.300, 53.400, 53.500, 53.600, 53.700, and 53.800 MHz are all reserved for radio remote-control operations.

Calling frequencies—28.885 MHz. This frequency is used to report immediate propagation on 6 meters from locations around the world. QSOs are discouraged, especially during 6 meter band openings. Once a contact is established on this frequency, the operators are encouraged to QSY immediately to a vacant frequency, usually up or down 5, 10, or 15 kHz. 28.885 MHz is invaluable to the serious 6 meter DXer because so much current information is exchanged continuously. While there is no formal net control, peer pressure generally keeps the frequency clear of idle chatter.

50.110 MHz. This is the DX-to-DX calling frequency. Intra-country and intra-continental QSOs (that is, QSOs within one's own country, or in the case of North America and Europe, one's own continent) are highly discouraged on this frequency, as well as between 50.100 and 50.125 MHz.

50.125 MHz. This has been the domestic calling frequency. There is a movement afoot to make 50.200 MHz the domestic calling frequency. Increasing numbers of operators are using the higher frequency as the calling frequency. Regardless of which one you use (preferably the higher one), once contact is established on this frequency, operators are encouraged to QSY up the band.

50.400 MHz. This is the domestic AM calling frequency. Many old-time 6 meter operators began on AM and haven't forgotten their love for it. Operations on this frequency occur across the country. Because it's not often used, communications established on this frequency tend to stay on this frequency. Therefore, it's not necessary to QSY, unless, of course, the band is open and the frequency may become busy.

52.525 MHz. This is the domestic simplex FM calling frequency. Once contact is established on this frequency, operators are encouraged to QSY to another simplex frequency, such as 52.490 MHz or 52.510 MHz.

144–148 MHz. Operation on this band is open to all licensees holding a Technician class or above

144.000–144.100 MHz. This portion of the band is exclusively for CW operation. The section of the band between 144.000 and 144.050 is reserved for EME operation. The section between 144.050 and 144.100 is reserved for both EME and weak-signal CW operation.

144.100–144.275 MHz. This portion of the band is for SSB operation, although CW contacts are permitted and do sometimes take place. The section of the band between 144.100 and 144.200 is used for weak-signal and EME SSB operation. The section of the band between 144.200 and 144.275 MHz is used for general SSB operation.

144.275–144.300 MHz. This portion of the band is for beacon stations.

144.300–144.500 MHz. This portion of the band is for amateur satellite operations.

144.500–144.600 MHz. This portion of the band is for linear translator inputs.

144.600–144.900 MHz. This portion of the band is for FM repeater inputs.

144.900–145.100 MHz. This portion is for weak-signal and FM simplex operation.

145.100–145.200 MHz. This portion of the band is for linear translator outputs.

145.200–145.500 MHz. This portion of the band is for FM repeater outputs.

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(phone 405-528-6625; fax 405-528-0746)
Internet jlynch@post.cis.smu.edu
Compuserve 72124.2734@compuserv.com

145.500–145.800 MHz. This portion of the band is set aside for experimental activities, such as communication between the space shuttle and Earth.

145.800–146.000 MHz. This portion of the band is for satellite operations.

146.010–146.370 MHz. This portion of the band is for FM repeater inputs.

146.400–146.580 MHz. This portion of the band is for FM simplex operation.

146.610–147.390 MHz. This portion of the band is for FM repeater outputs.

147.420–147.570 MHz. This portion of the band is for FM simplex operation.

147.600–147.990 MHz. This portion of the band is for FM repeater inputs.

Calling frequencies—3.818 MHz. This frequency is an unofficial calling frequency for meteor-scatter scheduling. It is especially active during major shower peaks. Please be courteous when using this frequency, as regular 75 meter operators also use it for nets and rag chewing. An alternative to this frequency is 3.843 MHz.

14.345 MHz. This is the international EME calling frequency. It is similar in nature to the 10 meter activity frequency for 6 meters, except on weekends (see below) there is no formal net. Because 20 meters is an extremely busy and crowded band, always check to see if you have a clear frequency before beginning a QSO. Once you've made a contact, be courteous and keep your QSO to an absolute minimum.

144.200 MHz. This is the calling frequency for all weak-signal contacts. Once contact is established on this frequency, operators are encouraged to QSY up or down the band.

144.340 MHz. This is the ATV coordinating frequency used by operators who generally operate on 439.25 MHz.

146.430 MHz. This is the ATV coordinating frequency used by operators who generally operate on 434.000 MHz.

146.520 MHz. This is the domestic FM simplex calling frequency. Once contact is established on this frequency, operators are encouraged to QSY to another simplex frequency. Simplex frequencies are defined as those starting on 146.415 MHz and are found every 15 kHz up the band to 146.595 MHz. Simplex frequencies also are found starting on 147.420 MHz and running every 15 kHz up the band to 147.585 MHz.

219–220 MHz and 222–225 MHz: Operation on the 219–220 MHz portion of this band is open to all licensees holding a Technician class or above license. Operation on the 222–225 MHz portion of this band is open to all licensees, regardless of license class. However, certain power restrictions apply. Within the 219–220 MHz portion stations may not operate more than 50 watts output. Within the 222–225 MHz portion of the band Novice licensees may not operate with more than 25 watts PEP output.

219.000–220.000 MHz. This portion of the band is reserved for high-speed, point-to-point packet operations.

222.000–222.150 MHz. This portion of the band is reserved exclusively for non-repeater type operation. By mutual nationwide agreement, only CW and SSB operations take place within this portion of the band.

222.150–222.250 MHz. This portion of the band is for general-purpose CW and SSB operation and, by local agreement, FM repeater inputs.

222.250–223.380 MHz. This portion of the band is for FM repeater inputs.

223.400–223.520 MHz. This portion of the band is for FM simplex operation.

223.530–223.640 MHz. This portion of the band is for digital and packet operations.

223.640–223.700 MHz. This portion of the band is for link and control operations.

223.710–223.850 MHz. This portion of the band is for simplex and packet operations and for FM repeater outputs.

223.850–224.980 MHz. This portion of the band is for FM repeater outputs.

Calling frequencies—222.100 MHz. This is the calling frequency for all weak-signal contacts. Because there's less activity on this band, it's not as necessary to QSY once contact has been established, except during a contest.

223.500 MHz. This is the domestic FM simplex calling frequency. Once contact is established on this frequency, operators are encouraged to QSY to another simplex frequency. Simplex frequencies are defined as those starting on 223.420 MHz and are found every 20 kHz up the band to 223.900 MHz.

420–450 MHz: Operation on this band is open to all licensees holding a Technician class or above license. However, certain geographic power restrictions apply to operations on this band. Consult the FCC rules to see if your location is affected by these restrictions.

420.000–426.000 MHz. This portion of the band is for ATV simplex or repeater operations, with 421.250 MHz being the video carrier frequency. This portion is also used for experimental and control links.

426.000–432.000 MHz. This portion of the band is for ATV simplex operation, with 427.250 MHz being the video carrier frequency.

432.000–432.070 MHz. This portion of the band is reserved exclusively for EME operation.

432.070–432.100 MHz. This portion of the band is reserved for CW weak-signal operation.

432.100–432.300 MHz. This portion of the band is reserved for CW and SSB weak-signal operation.

432.300–432.400 MHz. This portion of the band is reserved for beacons.

432.400–433.000 MHz. This portion of the band is reserved for CW and SSB weak-signal operation.

433.000–435.000 MHz. This portion of the band is reserved for auxiliary and FM repeater links.

435.000–438.000 MHz. This portion of the band is set aside for satellite operations throughout the world.

438.000–444.000 MHz. This portion of the band is for ATV repeater inputs; 439.250 MHz is the video carrier frequency.

442.000–445.000 MHz. This portion of the band is reserved for repeater inputs and outputs, on a local option.

445.000–447.000 MHz. This portion of the band is shared by auxiliary and control links, repeaters, and simplex operation, on a local option.

447.000–449.000 MHz. This portion of the band is reserved for FM repeater inputs and outputs, on a local option.

449.000–450.000 MHz. This portion of the band is reserved for FM repeater inputs and outputs, on a local option. However, it may also be shared with wind profilers in your area. Consult your local coordinating organization before establishing transmitting equipment on this portion of the band.

Calling frequencies—14.345 MHz. This is the international EME calling frequency. It's similar in nature to the 10 meter activity frequency for 6 meters, except on weekends (see below) there is no formal net. Because 20 meters is an extremely busy and crowded band, always check to see if you have a clear frequency before beginning a QSO. Once you have made a contact, please be courteous and keep your QSOs to an absolute minimum.

432.100 MHz. This is the calling frequency for all weak-signal contacts. Here again, because there is less activity on this band, it's not as necessary to QSY once contact has been established—except during a contest.

446.000 MHz. This is the domestic FM simplex calling frequency. Because there is less simplex activity on this band, it's not necessary to QSY once contact has been established.

902–928 MHz: Operation on this band is open to all licensees holding a Technician class or above license. However, certain geographic power restrictions apply. Consult the FCC rules to see if your location is affected by these restrictions. Pending FCC proposed rulemaking may affect major portions of this band. Due to the uncertainty of the band's future, most band plans and repeater operations have been suspended. Therefore, the listings below are ones that *recommend* activity. Incidentally, about the only regular operation presently taking place on this band is on the weak-signal calling frequency of 903.100 MHz and ATV repeaters.

902.000–904.000 MHz. This portion of the band is reserved for narrow-band, weak-signal operation.

902.000–902.800 MHz. This portion of the band is reserved for SSTV, FAX, ACSSB, and experimental operation.

902.300–902.400 MHz. This portion of the band is reserved for beacons.

902.800–903.000 MHz. This portion of the band is reserved for future EME and CW expansion.

903.000–903.050 MHz. This portion is exclusively reserved for EME operation.

903.050–903.100 MHz. This portion of the band is reserved for CW operation.

903.100–903.400 MHz. This portion of the band is reserved for CW and SSB operation.

904.000–906.000 MHz. This portion of the band is reserved for digital transmissions.

906.000–909.000 MHz. This portion of the band is reserved for FM repeater outputs.

909.000–915.000 MHz. This portion of the band is reserved for ATV operation.

915.000–918.000 MHz. This portion of the band is reserved for digital transmissions.

918.000–921.000 MHz. This portion of the band is reserved for FM repeater inputs.

921.000–927.000 MHz. This portion of the band is reserved for ATV operation.

927.000–928.000 MHz. This portion of the band is reserved for FM simplex and link operations.

Calling frequencies—903.100 MHz. This is the calling frequency for all weak-signal contacts. Once again, because there's so little activity on this band, it's not necessary to QSY once contact has been established—except during a contest. Note: In some areas 902.100 MHz is used as the alternative calling frequency.

906.500 MHz. This is the domestic FM simplex calling frequency. Because there's little simplex activity on this band, it's not necessary to QSY once contact has been established.

1240–1300 MHz: Operation on the 1240–1300 MHz portion of this band is open to all licensees holding a Technician class or above license. Operation on the 1270–1295 MHz portion of this band is open to all licensees, regardless of license class. However, within this portion Novice class stations may not operate more than 5 watts PEP output. Certain geographic restrictions apply to operations on this band. Consult FCC rules to see if your location is affected by these restrictions.

1240.000–1246.000 MHz. This portion of the band is reserved for ATV operation.

1246.000–1248.000 MHz. This portion of the band is reserved for NBFM point-to-point and digital operations.

1248.000–1252.000 MHz. This portion of the band is reserved for digital communication operations.

1252.000–1258.000 MHz. This portion of the band is reserved for ATV operation.

1258.000–1260.000 MHz. This portion of the band is reserved for NBFM point-to-point and digital operations.

1260.000–1270.000 MHz. This portion of the band is reserved for satellite uplink operations. It's also reserved for wide-band experimental and simplex ATV operation.

1270.000–1276.000 MHz. This portion is reserved for FM repeater input operations.

1276.000–1282.000 MHz. This portion of the band is reserved for ATV operation.

1282.000–1288.000 MHz. This portion is reserved for FM repeater output operations.

1288.000–1294.000 MHz. This portion of the band is reserved for wide-band experimental and simplex ATV operation.

1294.000–1295.000 MHz. This portion of the band is reserved for narrow-band FM simplex operation.

1295.000–1297.000 MHz. This portion of the band is reserved for narrow-bandwidth, weak-signal operation (no FM).

1295.000–1295.800 MHz. This portion of the band is reserved for SSTV, FAX, ACSSB, and experimental operation.

1296.000–1296.050 MHz. This portion is exclusively reserved for EME operation.

1296.050–1296.100 MHz. This portion of the band is reserved for CW operation.

1296.070–1296.080 MHz. This portion of the band is reserved for beacons.

1296.100–1296.300 MHz. This portion of the band is reserved for CW and SSB operation.

1296.300–1296.400 MHz. This portion of the band is reserved for beacons.

1296.400–1296.800 MHz. This portion of the band is reserved for cross-band linear translator operation.

1296.800–1297.000 MHz. This portion of the band is exclusively reserved for experimental beacons.

1297.000–1300.000 MHz. This portion of the band is reserved for digital communication operations.

Calling frequencies—1294.500 MHz. This is the domestic FM simplex calling frequency. Because there's less simplex activity on this band, it's not necessary to QSY once contact has been established.

1296.100 MHz. This is the calling frequency for all weak-signal contacts. Again, because there's less activity on this band it's not as necessary to QSY once contact has been established—except during a contest.

2300–2310 MHz and 2390–2450 MHz: Operation on this band is open to all licensees holding a Technician class or above license. Weak-signal operations are centered around ±100 kHz of 2304.100 MHz.

2300.000–2303.000 MHz. This portion of the band is reserved for high-speed digital communications.

2303.000–2303.500 MHz. This portion of the band is reserved for packet operation.

2303.500–2303.800 MHz. This portion of the band is reserved for TTY packet operation.

2303.800–2303.900 MHz. This portion of the band is reserved for packet, TTY, CW, and EME communications.

2303.900–2304.100 MHz. This portion of the band is reserved for CW and EME operations.

2304.100–2304.200 MHz. The portion of the band is reserved for CW and SSB operations.

2304.200–2304.300 MHz. This portion of the band is reserved for SSB, SSTV, ACSSB, FAX, packet AM, and AMTOR communications.

2304.300–2304.320 MHz. This portion of the band is reserved for propagation beacon networks.

2304.320–2304.400 MHz. This portion of the band is reserved for propagation beacons.

2304.400–2304.500 MHz. This portion of the band is reserved for SSB, SSTV, ACSSB, FAX, packet AM, and AMTOR experimental.

2304.500–2304.700 MHz. This portion of the band is reserved for cross-band linear translator inputs.

2304.700–2304.900 MHz. This portion of the band is reserved for cross-band linear translator outputs.

2304.900–2305.000 MHz. The portion is reserved for experimental beacons.

2305.000–2306.000 MHz. This portion is reserved for FM simplex 25 kHz spacing).

2306.000–2309.000 MHz. This portion of the band is reserved for FM repeater inputs (25 kHz spacing).

2309.000–2310.000 MHz. This portion of the band is reserved for fast-scan TV operations.

2396.000–2399.000 MHz. This portion of the band is reserved for control and auxiliary links.

2400.000–2410.000 MHz. This portion of the band is set aside for satellite operations around the world, with 2403.000–2408.000 MHz reserved for satellite high-rate data transmissions.

2410.000–2413.000 MHz. This portion of the band is reserved for FM repeater outputs (25 kHz spacing).

2413.000–2418.000 MHz. This portion of the band is reserved for high-rate data transmissions.

2418.000–2430.000 MHz. The portion of the band is reserved for satellite operations with 2430.000–2438.000 MHz reserved for satellite high-rate data transmissions.

2438.000-2450.000 MHz. This portion is reserved for wide-band FM, fast scan TV, FMTV, and slow-scan experimental operations.

Calling frequencies—2304.100 MHz. This is the calling frequency for all weak signal contacts. Again, because there's less activity on this band, it's not as necessary to QSY once contact has been established, except during a contest.

2305.200 MHz. This is the FM simplex calling frequency. Again, because there's less activity on this band, it's not necessary to QSY once contact has been established, except during a contest.

3300–3500 MHz: Operation on this band is open to all licensees holding a Technician class or above license. Weak-signal operations are centered around ±100 kHz of 3456 MHz.

3300.000–3456.000 MHz. This portion of the band is reserved for local options.

3456.000–3456.050 MHz. This portion of the band is reserved for EME operations.

3456.050–3456.100 MHz. This portion of the band is reserved for CW operations.

3456.100–3456.300 MHz. This portion of the band is reserved for CW and SSB operations.

3456.300–3456.400 MHz. This portion of the band is reserved for beacons.

Calling frequency—3456.100 MHz. This is the calling frequency for all weak signal contacts. Again, because there's less activity on this band it's not necessary to QSY once contact has been established, except during a contest.

5650–5925 MHz: Operation on this band is open to all licensees holding a Technician class or above license. Weak-signal operations are centered around ±100 kHz of 5760 MHz.

5650.000-5760.000 MHz. This portion of the band is reserved for local options.

5760.000-5760.050 MHz. This portion of the band is reserved for EME operations.

5760.050–5760.100 MHz. This portion of the band is reserved for CW operations.

5760.100–5760.300 MHz. This portion of the band is reserved for CW and SSB operations.

5760.300–5760.400 MHz. This portion of the band is reserved for beacons.

Calling frequency—5760.100 MHz. This is the calling frequency for all weak-signal contacts. Again, because there's less activity on this band, it's not necessary to QSY once contact has been established, except during a contest.

10.000–10.500 GHz: Operation on this band is open to all licensees holding a Technician class or above license. Weak-signal operations are centered around 10.368 GHz.

10.3683–10.3684 GHz. This portion of the band is reserved for beacons.

Calling frequency—10.368 GHz. This is the calling frequency for all narrow band (CW, SSB) activity.

24.000–24.500 GHz: Operation on this band is open to all licensees holding a Technician class or above license. Weak-signal operations are centered around 24.368 GHz.

47.000–47.200 GHz: Operation on this band is open to licensees holding a Technician class or above license. Few weak-signal operators are experimenting on this band. Whatever operations exist are centered around 47.100 GHz.

75.500–81.000 GHz: Operation on this band is open to all licensees holding a Technician class or above license. However, no regular weak-signal or any other amateur radio type operation is currently taking place on this band.

119.980–120.020 GHz: Operation on this band is open to all licensees holding a Technician or above license. However, no regular weak-signal or any other amateur radio type operation is currently taking place on this band.

142.000–149.000 GHz: Operation on this band is open to all licensees holding a Technician or above license. However, no regular weak-signal or any other amateur radio type operation is currently taking place on this band.

241.000–250.000 GHz: Operation on this band is open to all licensees holding a Technician or above license. However, no regular weak-signal or any other amateur radio type operation is currently taking place on this band.

300.000 GHz and above: Operation on these frequencies is open to all licensees holding a Technician or above license. Except for the light spectrum of 474 THz (red LASER) and 668 THz (blue LASER), no regular weak-signal or any other amateur radio type operation is currently taking place on these frequencies.

SVHFS '98 Conference Update

The following is from the Southeastern VHF Society: The second annual Southeastern VHF Society Technical Conference will be held on Friday and Saturday, April 3–4, 1998 in Atlanta, Georgia. The dates and location proved to be so popular with 1997 attendees that we are staying with the same weekend and location for 1998—the Atlanta Marriott Northwest located between Atlanta and Marietta, Georgia. A special conference room rate of $69 per night is available. For reservations, call the Marriott at 1-800-228-9290.

Call For Papers: Program Chairman Bob Lear, K4SZ, has issued a call for papers. If you are interested in making a technical presentation or having a paper published in the Proceedings, please contact Bob at <k4sz@stc.net> or at 706-864-6229.

Antenna Measurements: Antenna measurements are again planned to take place at the Georgia Tech Research Institute antenna measurement range on Friday, April 3rd. GTRI is one of the premier outdoor ranges in the US with a 90 ft. tower, 1500 ft. antenna range, and Scientific Atlanta test equipment. Friday morning 144-903 MHz antennas will be measured, and 1296 MHz and up antennas will be measured Friday afternoon. Pattern plots will be available to the top finishers in each band. For more information, contact Antenna Measurements Chairman Dale Baldwin, WBØQGH, at <wbØqgh@mindspring.com>.

Noise-Figure Testing: Noise-figure testing for 50 MHz through 24 GHz will take place Saturday, April 4th. Attendees will be assigned a testing time based on receipt of the registration form. Please remember to indicate the item(s) you will bring for measurement on your registration form. This will ensure you a time slot. For more information, contact Noise Figure Measurement Co-Chairmen Charles Osborne, WD4MBK, at <cosborne@pipeline.com> or Fred Runkle, K4KAZ, at <engineer@rightmove.com>.

In addition to technical presentations, antenna range measurements, and noise-figure testing, activities will include vendor displays, Friday evening fleamarket, Saturday evening banquet, SVHFS auction, and family programs. For more information on the Southeastern VHF Society or the 1998 conference, visit the web site at: <http://www.akorn.net/~ae6e/svhfs>.

And Finally . . .

A final note on calling frequencies: Most contests disallow contacts made on FM calling frequencies below 148 MHz. Also, some contests disallow domestic contacts made within the 6 meter DX window. My friend Gordon West, WB6NOA, once wrote to me decrying the activities of one "big gun" contest station that "parked" on 144.200 MHz during most of the ARRL June VHF Contest. Gordon felt it was a shame that many new amateurs' first experience with excellent propagation was marred because one operator inconsiderately monopolized a "calling frequency." In the situation in Gordon's example, the "big gun" could easily have been heard at 144.190 MHz or some other frequency close to the calling frequency.

Gordon also shared a story with me that sheds some light on this problem, by making a comparison between the calling frequency and surfing. Some time ago one of the TV news magazine programs featured a surfing spot at Newport Beach known as the Wedge.

Because of a jetty that right-angles the beach, waves created during a southerly swell in the surf bounce off it and form a wedge-like wall of water that can, as Gordon put it, ". . . catapult a body (surfer, or fool!) down the face of the wave for a death-defying ride that lasts, at most, around eight seconds." From the reports, it's quite a ride. The news magazine program reported that it's so popular that a number of guys plan their days around weather reports favoring the right conditions for the "wedge." In fact, one report has it that a couple of guys carry pagers, just so they can be paged to the surf.

Well, I'm sure you're beginning to see the similarity. To continue, the "wedge" is so confined that only a few people can ride it comfortably at a time. Unfortunately, there's a minority of surfers who want to ride it every time, blocking others who also want to experience the thrill of the ride.

I think you can see the comparison. The calling frequencies are only wide enough for a few to operate on them at a time. If the same people are on a calling frequency all the time, others can't even make a contact and move off the calling frequency.

So the next time the surf's up (or the band is open), remember to share. A calling frequency is just that—a place to meet and establish contact. As a courtesy to your fellow VHF-Plus operators, please QSY to a clear frequency nearby once you establish contact on a VHF-Plus calling frequency.

Most of this column has been devoted to our frequency spectrum. I felt that it was imperative that a full explanation of divisions, gentlemen's agreements, and so forth be spelled out so that we all have a handy reference from which to work our favorite portion of the band. With this published, theoretically, there should be no excuse for anyone operating on the wrong mode in a particular band. Even so, there are a few who "never get the word." It is up to us, as ladies and gentlemen, to pass that word on to these amateurs. You may copy this column and send it to that person as a way of informing them. I will also have it on my home page on the Internet (www.smu.edu/~jlynch).

That's all for this month. Hopefully, next month, along with this column, I will have the 1997 VHF Contest results. As always, thank you very much for your interest and support of this, your column.

Until next month . . .

73, Joe, N6CL

BY JOHN DORR, K1AR

CONTEST CALENDAR

NEWS/VIEWS OF ON-THE-AIR COMPETITION

A Once-in-a-Lifetime Contest Experience

March's Contest Tip of the Month

When tuning for multipliers, don't forget to look way up the band. In last year's CQ WW CW Contest I worked several key multipliers on frequencies such as 14081, 7062, 3566, etc. The only limit to working CW stations in a contest is when the "beeps" stop. Add to your score with your VFO next time!

Calendar of Events

Fb. 27-Mr. 1	**CQ WW 160 M SSB Contest**
Fb. 28-Mr. 1	North Carolina QSO Party
Fb. 28–Mr. 1	UBA CW Contest
Mar. 7-8	ARRL SSB DX Contest
Mar. 15-16	Wisconsin QSO Party
Mar. 17-18	CLARA HF Contest
Mar. 21-22	Bermuda Contest
Mar. 21-22	YL-ISSB QSO Party
Mar. 21-22	Russian DX Contest
Mar. 21-23	BARTG Spring RTTY Contest
Mar. 28-29	**CQ WW WPX SSB Contest**
Apr. 4-5	SP DX Contest
Apr. 4-5	EA RTTY Contest
Apr. 10-12	Japan Int'l DX Contest, High Bands
Apr. 13	Low Power Spring Sprint
Apr. 25-26	Helvetia Contest
Apr. 25-26	Ontario QSO Party
May 2-3	ARI Int'l DX Contest
May 2-3	MARAC County Hunters CW
May 30-31	**CQ WW WPX CW Contest**

My first contest was in 1970. It was an entry in the highly competitive battle that used to be called the Novice Roundup. Given the rising age of our population, operating a contest in 1970 is hardly a significant chronological statement. However, it was meaningful in that I caught a bug that's never left me; we call it contesting. As I reflect on that event, it's amazing to think that I spent nearly 20 hours to work about 225 stations. I think, though, it was an important prerequisite to developing the drive and determination needed to win in today's contest climate.

Although it's been several months, I can still remember a remarkable contest experience from last year as if it were yesterday—the 1997 CQ WW CW Contest. Yes, it was even better than that first Novice Roundup. I was prepared for this particular contest better than others. After all, I had missed the SSB event due to work commitments, so my interest was especially high for the weekend. Like previous years, I was going to be operating at my usual haunt, K1EA's station in Harvard, Massachusetts. And like previous years, there was a fair amount of work to do at the station to get things running. We really cut it close this year. With only five days to go, there was still no working rotator or feedline for the 40 meter beam. Thanks to KC1XX, however, all was well at show time.

Something told me that this contest was going to be special. The WWV numbers were certainly encouraging: SFI=112; A=0; K=0. Historically, low absorption has been a formula for success from Harvard. However, when tuning the bands an hour before the contest, I have to admit that nothing struck me as spectacular. The JAs on 20 meters were not especially loud. Europeans were medium strength on 40 meters. A CQ to Europe on 40 only yielded one or two stations calling. Yet I just knew in my gut that this was going to be good!

As in previous single operator efforts, I had the usual two-station, two-amplifier setup with one computer running CT™. With one minute to go before the start, I had everything a contester could want: use of one the best contest stations in the world, working equipment, amazing WWV numbers, and a steeping cup of coffee. What was I missing? A running frequency. With 45 seconds to go, T99DX decided to land on my frequency and start the contest with a 20 over signal. So for the first five minutes of the contest, I was a small pistol, tuning around and calling guys—hardly the kind of start that could be described as the contest experience of a lifetime!

Finally, after four or five QSOs I sneaked my way onto 7013 and began running stations. Although I've had better rates in the past, it wasn't too bad. By the end of the first half hour there were 63 QSOs in the log, including 9G, ZS, and yes, T99DX. I don't know about others, but my ability to use a second radio seems to drop off when rates exceed 100 QSOs/hour. If my rate is over that level, attempts to use a second radio will guarantee that rate to return to 100! So despite some guilt, I didn't use the second radio very much in the beginning stages of the contest. In fact, the first "second radio" QSO wasn't made until 0108Z.

All in all, the first hour was pretty good—127 QSOs. My trek continued on 7013 until about 0230Z, as the second radio began to come to life in the log with 19 additional QSOs being added to the "run" totals. Over the years I have used an operating technique that some people question, but it seems to work for me. Often while in the middle of a run I will simply stop running guys and start to look for multipliers in a search-and-pounce mode. My theory is that frequent "peppering" of a contest log with multipliers is a good psychological factor, as well as the bottom line impact it has on your score. And as long as you're contributing to the score at a level equivalent to your run rate, you'll be just fine. In this year's contest the key metric was a multiplier value of about eight QSOs. This is an especially good practice on CW, where run frequencies are relatively easy to find compared to SSB. So I left 7013 and worked 10 multipliers in 10 minutes (the equivalent of 90 QSOs) before the next band decision had to be made.

At this point I was beginning to have that nagging feeling that there were still no 80 meter QSOs in my log. I have to say that my first pass through 80 meters was hardly inspiring. In fact, the next 90 minutes were particularly dull, moving from band to band, using the second radio liberally. After making one more swing down multiplier lane on 40 meters, I sat down on 3505. In a relatively short period of time (maybe a half hour), someone turned on the 80 meter propagation switch. One quick CQ resulted in a pileup of Europeans calling me. They were astonishing loud, beginning with LA4XT. The first 15 minutes of this run yielded 34 QSOs. I felt like I was operating on 20 meters! It wasn't until 0547Z that I decided to do anything else. In that period of time 181 QSOs entered the log, including a 105 hour at 05Z. This was perhaps the best running experience I had ever had on 80 meters.

Although the experience on 80 meters was exhilarating, I had another nagging problem to deal with—no QSOs on 160. So for the next full hour, I did nothing but work stations on 160. Although questionable at the time, it turned out to be a good operating tactic—28 QSOs/32 multipliers, or the equivalent of a 284 hour!

Fortunately, 80 meters stayed open to Europe relatively late with my last QSO at 0733Z. The next few hours were relatively uneventful with lots of band changes and second radio use. With solar absorption so low, 40 meters remained open to Europe extremely late—past 1000Z. The next trade-off was about to occur, as I had to balance an opening on 20 meters against the multiplier opportunities presented by 160, 80, and 40. However, I knew that the high bands would prevail as 20 meters got off to an early start. In fact, I even worked RK6AYN at 1041Z on 15 meters. Boy, this was going to be a great weekend!

It turned out that 14005 became my FCC-assigned frequency for the first morning European run. The rate was pretty darn good, with a solid opening yielding 236 QSOs in the first 90 minutes. What I was discovering was that this weekend was going to be a QSO weekend unlike anything I had ever experienced. Every time I hit the F1 key, someone was calling. It was contest paradise. As 20 meters continued to percolate, I was listening to 15 meters on the second radio. The rate was so good on 20 that I didn't want to hit 15 too early. And with a fast rate, it was tough for me to do much more than listen for the "beeps" of growing signals out of the second station.

At 1038Z I made the big jump: 21010 here we go! V51C made the first 2 minutes interest-

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ing, but not as much as the running experience that was about to ensue. What followed as I entered the 11 and 12 hundred hours was a European run unlike any other I had ever enjoyed. For several hours I had a raging pileup calling me—not just five or six stations, but literally dozens. I kept looking out the window for palm trees, because it was obvious to me that this was not happening from the U.S.

Could I be operating from NP4A and have just forgotten because of my many years at K1EA? Was I simply hallucinating and not really working these guys? As amazing as it sounds, I was forced to listen to the edges of the pileup calling. There were simply too many stations in the fray to do anything else. Rarely did I copy a complete call the first time. When the bulk of the initial burst was over, I had logged a peak inter-hour rate of 219 QSOs/hour. Could it get any better than this? For the first time in my single-operating experience, I had a log that was averaging 100 QSOs/hour after the first 13 hours.

One of the secrets of successful contesting is remembering key events from previous years. One such example was a long-path 10 meter opening to Asia in the 1996 WW. With the second radio's VFO knob firmly in hand, I began tuning while still running on the main station. Sure enough, there was JH5ZJS booming in (well, booming for a LP JA on 10 meters). Snagging him was a breeze. So was VR2WO (and three others!). It just fueled what was proving to be an already incredible event.

Now having been on 21010 for hours, at this point I occasionally broke the run for 10 meters to work some multipliers. It turned out to always be a great tactic even though the run on 15 continued at a furious rate. For example, one quick 13 minute spin on 10 meters yielded 20 multipliers. It was proving to be impossible to use the second station in any other way during the day, as the run rate on the main radio was just too good. Coming back to 15 meters, I managed to land on 21001, where the pileups continued to the point where I was able to continue average a 100 QSO/hour rate into 1600Z.

Believe it or not, at 1600Z, even though 15 meters was still going nuts, I started to think about not only 20 meters, but also 40. With solar absorption being so low, it would not have been unreasonable to see the low bands open early this year. A strategic decision was made to leave 15 meters early and head to 20 (with, of course, a quick spin for more multipliers on 15 before leaving—20 mults in 18 minutes).

As it turned out, 14008 became my friend, and in the next 90 minutes I logged 205 stations. This turned out to be a great run on 20, because I really didn't have the chance to get a sustained 20 meter run going in the morning; 15 meters opened too early. By 1800Z I was still running on 14008. During the few hours I had been there, an occasional QSO made its way into the log from other bands, but the pace was just too fast to do much else. The one thing I was doing effectively, however, was keeping an ear on 40 meters. The timing decision between staying on 20 meters vs. moving to 40 was a critical step; especially in the first day. At 2011Z I made the big switch and fired up on 7009, which turned out to be just perfect. Over the next 109 minutes I worked 225 stations; the runs were, again, absolutely unbelievable.

Normally on 40 meters I don't waste my time playing with the long-path opening to Asia at 2130Z. The rate is usually not that great, and the value from a few extra multipliers is questionable. However, for some reason I did turn the beam to the southeast this time. My goal was "Try it for 5 minutes and see what happens." Well, again fate was in my favor, because not only did I log a quick dozen JAs, but also a DU and 9M6NA for double multipliers. You just have to love this contest!

Forty meters continued to produce, but I knew that 20 would be opening to JA, so with some consternation, I left my beloved 7009 and headed to Asia-land at 2230Z. Within seconds I was rewarded with a big JA pileup calling me, and yet again I wondered how I had missed remembering the details of my flight to the Caribbean, because clearly I was not operating in the States! After 90 minutes of running JAs on 20, another 161 QSOs made it into the log including a DU, HL, FR, VR, and V8EA.

So ended the first day—2356 QSOs, 408 multipliers: 2.8 million points. We age-challenged fellows remember when that would have been a fine score for the entire weekend. Believe it or not, it wasn't until the 24-hour milestone that I took my first real break (other than the biological variety). The action just didn't permit it!

For the next few hours I oscillated between bands with no significant runs going on. At 0227Z, therefore, I took what I thought was going to be my first of two sleep breaks—90 minutes. Back in the saddle at 0355Z, I continued to bounce around various bands with limited runs (at least compared to the past 24 hours). Then my memory kicked in again. I recalled from last year's WW that there is occasionally a decent Asian opening around the 06-08Z time. It's not so much a "running" opportunity as it is an opportunity to snag some good multipliers. Sometimes you work them to the south; other times it's while you're looking at them directly. Such was the case this year, as I snagged several JAs, BY, and UAØYAY in zone 23.

As I prepared to get ready for my second sleep period, I noticed that northern European signals were especially strong that morning on 40 meters. And the rate was still pretty good, too. Here's where the first real crisis took place. I had planned on sleeping for 1–2 hours. However, the rate was just too good. So, sucking in my stomach, I opted for the "F1" key in lieu of my pillow. What a great decision that turned out to be. Not only did the Europeans keep calling into the 11Z hour, but I had the most incredible JA run of my contest career on 40 meters. For hours, there was a constant stream of weak but workable JAs calling in. With no noise or QRM, it was a contesting dream. Peppered with an occasional European, the 08–10Z time frame yielded 210 QSOs. I learned later that virtually no other single operator shared this experience. Some day I'll have to figure out why that happened!

One of the problems with operating as a single operator is that you often have to leave the low bands early to get your run started on 20 meters. Fortunately (?), 20 meters opened late the second day, and I was able to extend my operating time on 160–40 meters, snagging some great multipliers. The inevitable 20 meter opening finally took place at 1130Z, and off I went for another day of high-band runs.

While a little slower, the European pileups continued on the second day—especially on 15 meters. The 12Z hour turned out to be reasonable, with 135 QSOs. However, I was painfully aware of the lack of any European QSOs on 10 meters in my log. For some reason I was convinced that the band would open this day. A quick listen to WWV's numbers told me that it had to be! Finally, at about 1315Z, I began to hear 10 meter European stations on the second station. Now a decision had to be made: Should I go to 10 and work these multipliers, sacrificing a 120+ rate, or wait? Well, I went to 10 meters. The temptation was just too great. It turned out that 10 meters opened widely for about 90 minutes. And, I actually hit the band about 30 minutes too early. Nevertheless, it was a fruitful operating period, as I worked about 200 stations in that 90 minute period.

At 1530Z I returned to 15 meters where the rate was reasonable, but nothing like that of the first day. It appeared that the great event was coming to a close—that was until 1655Z, when I had the next to last running fury, this time on 20 meters with a 130 hour.

I haven"t mentioned very much about multipliers over the weekend, but with rates such as the ones I enjoyed during the contest, so came the mults. The 1700Z 20 meter run was a good example, as ZK1TB, 9M2TO, YB2UDH, HSØ/VK3DXI, VU2TS, and others called to say hello.

Based on the success from the first day's experience on 40 meters, I was quick to remember the need to get there for one last hurrah on that band. Off to 40 I went at 2018Z, and the final run took place—another 200 QSOs in 105 minutes. How could this be happening near the end of the contest? Amazing conditions indeed.

It may seem strange, but the end of the contest almost turned into a disaster. By 2200Z I was very tired and not thinking at an especially high strategy level. There I was on 20 meters working a few JAs and others, forgetting that 15 meters could possibly be open to JA. And open it was! Unbelievably, I almost missed the entire opening. Fortunately, I did have enough energy left to end the contest with a final blast on 15. A blast it was with about 100 QSOs entering the log in the final push, including KH2, T32, FK, DU, VK8, JDØ, and others.

Finally the 0000Z hour came on Sunday night. It was perhaps only the second time I could remember when the end of the contest came and I wanted to keep going. After all, there were still stations calling me. And with the motivation I was enjoying at the time, there was no reason to stop other than the small matter of the rules and the fact that everyone else had turned their radios off!

Well, after all the dust settled, I managed to finish with a score of 8.1M points (8,120,840 points/ 4106 QSOs / 158 Zones / 521 Countries). Was it the contest of a lifetime? How could it be described as anything else? I'm convinced that I was operating from a radio hot zone. It was simply the right conditions at the right time for the right station. Frankly, there are many other quality operators who could have achieved similar results that weekend. It's an honor, though, to set a record and to enjoy the privilege of doing it in the CQ WW Contest. I don't know about the future of amateur radio as a hobby, but I do know this much: The CQ WW contest is alive and well. CW operation is equally alive; 4100 QSOs told me that loud and clear. If you had only half the fun I had that weekend, you had a great time indeed.

Final Thoughts

I'll be publishing the results of the 1997 CQ Contest Survey next month, covering the subject of Contest Ethics. You'll be surprised by some of the results!

That's all the room I have for this month. Remember, I must receive your contest announcements for the June issue no later than May 1st. Make sure you send your information to my new home QTH (2 Mitchell Pond Road, Windham, NH 03087), or preferably via e-mail to <K1AR@contesting.com>.

73 John, K1AR

Wisconsin QSO Party

1800Z Sun. to 0100Z Mon., March 15–16

This popular party is a shorty, only 7 hours, and it is again sponsored by the West Allis Radio Amateur Club. The same station may be worked on each band and mode, and mobiles in each county change. Wisconsin stations may contact other in-state stations for QSO and multiplier credit. Only one transmitter on the air at the same time.

Classes: Single operator and multi-operator and transmitter, both fixed and mobile, and Novice/Tech, both single and multi-operator.

Exchange: RS(T) and QTH. County for Wisconsin; state, province, or country for others.

Scoring: Phone QSOs count 1 point, 2 points for CW. Wisconsin stations multiply total QSO points by (U.S. states + VE provinces + Wisconsin counties) worked for their final score. DX contacts count for QSO points only. Others use total Wisconsin QSO points by the number of Wisconsin counties worked (maximum of 72).

Wisconsin mobiles can add a bonus of 500 points to their final score for each county outside their own from which they operate (minimum of 12 QSOs from each county). Mobiles may not sit on a county line and operate.

Frequencies: CW—3550, 3705, 7050, 7125, 14050, 21150. SSB—3890, 7230, 14290, 21350, 28400.

Awards: Awards will be sent to the highest scoring single operator in the contest and for each single operator class in each state and province. *Wisconsin:* The top 10 single operator scorers in each class will receive awards as well as highest multi-operator in each class and highest aggregate club score. Logs with more than 100 QSOs must include a separate dupe sheet for each mode with their entry.

Complete rules and entry forms are available from address below. Please be sure to include an SASE with your request. Send your logs to for logs is March 31st to: West Allis RAC, P.O. Box 1072, Milwaukee, WI 53201.

CLARA & Family HF Contest

1700Z Tues. to 1700Z Weds., Mar. 17–18

This is the 31st anniversary of the CLARA Contest, and it is open to YLs and OMs around the world on phone and CW on all HF bands. Each station may be contacted twice per band mode.

Classes: Single operator, all bands.

Exchange: Name, RS(T), QTH (Canadian province/DXCC county), and whether CLARA member or Family member.

Scoring: CLARA-CLARA QSOs are worth 5 points; CLARA-YL QSOs are worth 3 points; CLARA-associate OM QSOs are worth 2 points; CLARA-OM QSOs are worth 1 point.

Multiplier: Canadian provinces and DXCC countries.

Final Score: Multiply total QSO points times multiplier.

Awards: A variety of trophies and certificates will be awarded to high-scoring CLARA members, non-members, and OMs.

Send your entries no later than April 17th to: Jeanne Gordon, VA3WX, 478 Donegal Drive, Burlington, ON L7L 2M7, Canada.

Bermuda Contest

0001Z Sat. to 2400Z Sun., March 21–22

This is the 40th year for this popular contest open to all licensed amateurs. Activity will be on the 3.5, 7, 14, 21, and 28 MHz bands on SSB and CW. Cross-band or cross-mode contacts are not permitted.

You are limited to 24 hours out of the 48-hour contest period. Off times of no less than two consecutive hours must be clearly indicated on the log. Participation is for single operator stations only and previous winners are no longer restricted from official entries in the contest.

Exchange: RS(T) only.

Scoring: Five points for each QSO. A station may be worked on SSB and CW, but you may not take credit for an additional multiplier. Final score is the sum of QSO points times the number of countries on each band multiplied by the number of different VP9 stations worked on each band. (Note: It's each VP9 station, not each parish.)

Awards: Certificates will be awarded to the top-scoring station in each country (minimum of 100 QSOs and 3 VP9s). The overall worldwide winner will receive a trophy. *Note: The free trip to Bermuda for the top-scoring entry will be provided this year by the Bermuda Department of Tourism. In addition, accommodations will be given by the Palmetto Bay Hotel.*

Use a separate log sheet for each band and a dupe sheet for logs with 200 or more contacts. A penalty of three contacts will be deducted for each duplicate contact for which points are claimed. An excessive number of claimed duplicates means disqualification. The usual signed declaration is also required.

Entries must be *received* no later than June 1st by the Radio Society of Bermuda, Box HM275, Hamilton HM AX, Bermuda. Enclose 4 IRCs for acknowledgments.

Russian DX Contest

1200Z Sat. to 1200Z Sun., March 21–22

Sponsored by the Contest Committee of the SRR, this one is open to all amateurs worldwide on 160–10 meters (no WARC bands). Operation can take place on SSB and CW. The same station may be worked on another band or even on same band (but in this case with two restrictions—use another mode and do it not earlier than in 10 minutes after the previous QSO).

Classes: Single Op. All Bands (separately mixed mode, CW, SSB); Single Op. Single Band (mixed mode, CW, SSB) on 160, 80, 40, 20, 15, 10 meters; Multi Op. All Bands Single Transmitter; SWL (mixed mode). Note that the common 10-minute rule applies to multi-single entries.

Exchange: RS(T) + QSO number starting with 001; Russian stations—RS(T) + two letters (oblast designator).

Scoring: QSOs within own DXCC country 2 points; another country on same continent 3 points; other continents 5 points. Contacts with Russian stations 10 points for all participants. Multipliers are DXCC countries and each Russian oblast per band. Final score is total sum of QSO points from all bands multiplied by sum of multiplier points from all bands.

Awards: Winners of entries A (separately Mixed, SSB, CW) and C will be awarded plaques. Winners of other entries and runners-up will be awarded certificates. Stations with 200 or more QSOs will receive certificates of merit.

Send all entries to: Contest Committee of SRR, P.O. Box 59, 105122, Moscow, Russia. Logs can also be submitted by e-mail using .DAT or .BIN formats plus .SUM files to <ra3auu @contesting.com>.

Virginia QSO Party

1800Z Sat. to 0500Z Sun., March 21–22
1100Z Sun. to 0200Z Mon., March 22–23

This is the 23rd year the Sterling Park ARC has sponsored this party. The same station may be worked on each band and each mode for QSO credit. VA stations may work other in-state stations for QSO multiplier credit as well as VA mobiles operating from different counties.

Classes: Single Operator, Single/Multi Operator, Mobile, Club, Multi-Operator Single/ Multi-Transmitter.

Exchange: QSO number starting with 001 and QTH. County for VA; state, province, or DX country for others.

Scoring: Credit one point for each SSB contact; two points for CW; three points for working a VA mobile. VA stations multiply total QSO points by sum of US states, VE provinces, DX countries, and VA countries. Others multiply total VA QSO points by the number of VA counties worked (maximum of 95). Mobiles add to this the bonus points for Virginia counties in which QSOs were logged.

Frequencies: CW—1805 kHz and 50 kHz up from low end of 10, 15, 20, 40, and 80 meter bands. SSB—1845, 3860, 7260, 14260, 21360, and 28360. Also Novice bands (10 kHz up from bottom of Novice sub-band and 28360).

Awards: Certificates to top scorers on each state, province, DX country, and VA county. There are a variety of plaques available to category winners.

Logs: Indicate each new multiplier in a separate column as it is worked. Include a summary sheet showing the scoring and other pertinent information.

Mailing deadline for all entries is April 18th to: Virginia QSO Party, Call Box 599, Sterling, VA 20167.

CQ World-Wide WPX Contest

SSB: March 28–29 CW: May 30–31
0000Z Sat. to 2400Z Sun.

Complete rules were published in the January issue. The following are a few points to keep in mind. You may operate 36 hours out of the 48-hour contest period as a single operator station. Off-times must be a minimum of 60 minutes in length. Multi-op stations can operate the full 48 hours.

The definition of the prefix multiplier is spelled out in detail, but consider a prefix to be the letter/number combination which forms the first part of a call.

The multiplier is determined by the number of different prefixes worked and is counted *once* only, regardless of how many times it is worked on other bands.

Another point to keep in mind is that in the Multi-Operator, Single Transmitter category only one transmitter and only one band may be used during the same 10-minute period. Picking up a new multiplier on another band during the same time period is prohibited.

An alphabetical/numerical check list of claimed prefixes is a requirement and must be included with your log. Note that contest logs may be submitted on disk (MS-DOS compatible) in standard ASCII or .bin, .res, .dbf, or .wks formats. To reduce the administrative burden, please label your computer entries with a unique name (e.g., N8BJQ.BIN). In addition, you may now submit your logs electronically (in MIME or UUENCODE format) to <n8bjq@ erinet.com>.

Deadline for submitting your SSB entry is May 10th, and July 10th for the CW section. **Be sure to indicate SSB or CW on the envelope.**

Logs go to: CQ Magazine, WPX Contest, 76 N. Broadway, Hicksville, NY 11801. Questions pertaining to the WPX Contest can be sent to the WPX Contest Director Steve Bolia, N8BJQ, 7354 Thackery Road, Springfield, OH 45502 USA or via <n8bjq@erinet. com>.

BY NORM VAN RAAY, WA3RTY

AWARDS

NEWS OF CERTIFICATE AND AWARD COLLECTING

This month we profile Eldon M. Hall, N8STF, CQ USA-CA All Counties #931.Eldon received his Novice license in 1966 as WN8VXC. His interest in the hobby was renewed in 1992 and he upgraded to Tech Plus and received his present callsign. In 1993 he upgraded to General, and in 1995 to Advanced.

Eldon has been married for 41 years, and he and his wife Mary have six children and ten grandchildren. After 31 years at Dow Chemical Company, he retired in 1994 as Senior Software specialist on IBM and mainframe computers. Community activities include board positions with four area blood centers.

Eldon holds a rating as a multi-engine instrument private pilot and is pursuing a commercial pilot certificate. He is president of the Midland Amateur Radio Club and the Central Michigan Amateur Repeater Association.

Having been prompted by W9SUQ (Larry, USA-CA #889) and W8QOI (Raleigh, USA-CA #882), it took three years for Eldon to make his first county hunter contact, but two years and three months to work all 3076 counties. A large impetus to his running counties and accomplishing his goal has been his wif'e interest in "the game" and going to counties for others. She is his route-maker, navigator, and logger. If only everyone had such an understanding spouse!

Awards from Belgium

The first award to be featured this month is a handsome multicolored classic coat-of-arms design from Belgium on behalf of the 50th anniversary of the country's national society.

UBA 50 Award. Earn 50 points by contacting Belgian amateurs during calendar year 1998. Club stations of all UBA divisions will be using the special prefix ON50 throughout 1998 and will count 4 points each for the award. Other "normal" Belgian stations count 2 points each. Special contest stations count 2 points each: OT8A, OT8B, OT8C, OT8D, OT8E, OT8G, OT8H, OT8K, OT8L, OT8M, OT8N, OT8O, OT8P, OT8Q, OT8R, and OT8T. SWL okay. Each station may only be worked one time. All bands and modes may be used. Send GCR list and fee of 200 BEF, DM10, or $US5 to: Danny Commeyne, ON4ON, Rozenlaan 38, 8890 Dadizele, Belgium. *(TKS ON4CAS)*

And while you're working on getting the ON's into your log, earning the MCL Award might be a side benefit.

MCL Award. Contact members of the Mechelen division of the UBA after 1 Oct 1981. SWL members also count. The award is available in two classes.

Class 1—Belgians need 15 points, other EU 7, all others 5.

Class 2—Belgians need 10, other EU 5, and all others 3.

There are no band restrictions. Each station may be contacted once. Point values: FM = 1, SSB = 2, other modes = 3. Belgians must include at least 8 MCL members for Class 1 and at least 5 for Class 2. MCL club stations ON4AGL and ONL-486 count 1 point extra in each mode. If contacts are made during the annual ON contest, log extract will be accepted. GCR OK. Fee for Class 1 = BEF150, US7, DM10 or 10 IRCs. Fee for Class 2 = BEF100, DM7, $US5, or 7 IRCs. Apply to Egbert Hertsen ON4CAS, Postbus 85, Mechelen 2, B-2800 Mechelen, Belgium.

Members are ON1AAD, AAS, ABB, ACN, AGN, AJG, AKH, ALY, AMS, ARO, AVR, AWJ, BAU, BD, BDY, BGJ, BHP, BK, BLH, BMC, BMJ, BN, BOJ, BOR, BTM, BTO, BVR, BXG, CFI, CGN, CIE, CJM, CJO, CLP, DBB, FS, OT; ON2ADD, ACE, ACK, ALR, AMX; ON4ABN, ADC, AGS, AIR, ALE, AMC, AMF, APR, APV, ASE, OVF, AVM, AVY, AWA, BAW, BCG, CAS, ED, EM, FV, JT, QO, VTM, XG, ZN; ON5BT, CG, GO, MV, SP, WL; ON6BE, CG, DY, EP, HP, HZ, II, JG, OB; ON7EU, FS, JF, JH, LN, SN, UD, US, VC, WD, WX.

Awards from Brazil

Brazil has a number of active clubs with awards programs. One of these, Pica-Pau Carioca, recently assumed management of several old-time Brazilian awards which were originally sponsored by *Eletronica Popular* magazine, in addition to their own large series of awards. Thanks to PY1CC for the following information.

Worked All PY Award. Make one con-

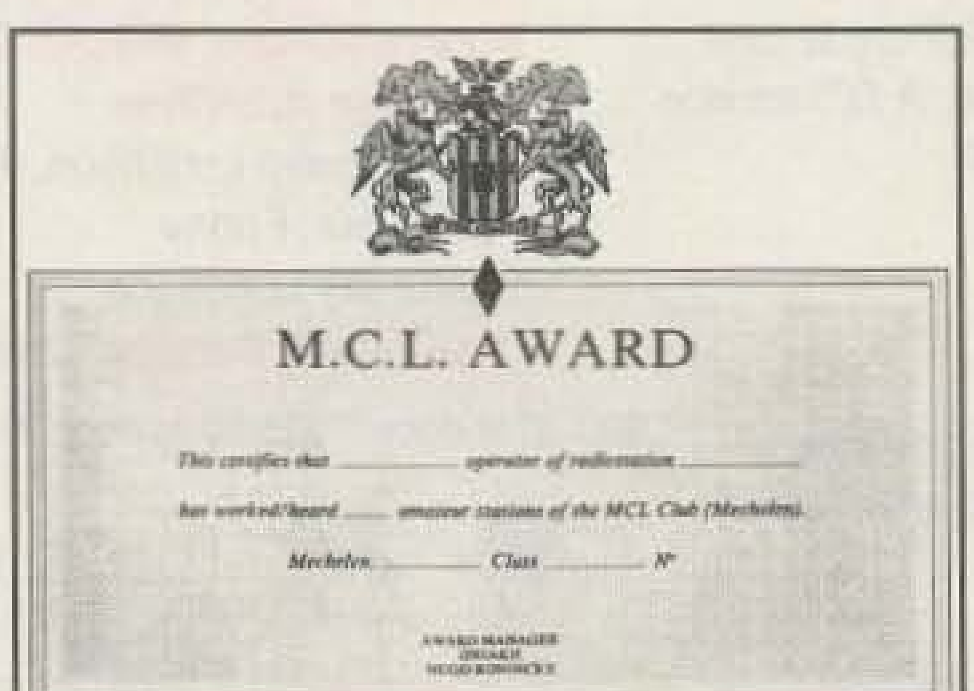
65 Glebe Road, Spofford, NH 03462-4411
e-mail: k1bv@top.monad.net

USA-CA Special Honor Roll

George L. Courtney, NA7W
(WB7FEN)
USA-CA All Counties #943
3 December 1997

Byron Berger, KF8UN
USA-CA All Counties #944
8 December 1997

The UBA-50 Award is offered on behalf of the 50th anniversary of Belgium's national society.



The M.C.L. Award is issued for contacting members of the Mechelen division of the UBA after October 1, 1981.

USA-CA Honor Roll

500		1500	
NA7W	2995	NA7W	1221
KF8UN	2996	KF8UN	1222
AB5SE	2997		
N5WRX	2998		
KB6HW	2999		
DL8YR	3000		

2000	
NA7W	1124
KF8UN	1125

1000		2500	
NA7W	2461	NA7W	1050
KF8UN	2462	KF8UN	1051
DJ4GJ	2463		
KB6HW	2464		

3000	
NA7W	960
KF8UN	961

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. To qualify for the special subscriber rate, please send a recent *CQ* mailing label with your application. Initial application may be submitted in the USA-CA Record Book, which may be obtained from *CQ* Magazine, 76 North Broadway, Hicksville, NY 11801 USA for $2.50, or by a PC-printed computer listing which is in alphabetical order by state and county within the state. 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 March 1, 1997. A complete copy of the rules may be obtained by sending an SASE to Ted Melinosky, K1BV, 65 Glebe Road, Spofford, NH 03462-4411 USA. DX stations must include extra postage for airmail reply.

The Worked All PY Award is issued for making one confirmed contact on any band or mode with each of the nine continental PY call areas.

firmed contact on any band or mode with each of the nine continental PY call areas (PY1 to PY9).; no other Brazilian prefixes (PP, PR, PS, PT, etc) are valid. Contacts must be after 15 May 1981. All contacts must be made from the same call area, or where no call area exists, from the same state or country. GCR list is acceptable. No fee for non-Brazilian applicants, but it is suggested that 5 IRCs be sent to help defray costs.

Endorsements are available for all CW, Phone mode only, QRP operation—with a statement that no more than 10 watts input was used in all contacts, credit for one PYØ worked (only Brazilian oceanic islands included in the DXCC list are valid). The sponsor reserves the right to require the originals or photocopies of one or more of the contacts.

Apply to: Carneiro PPC, R. Afonso Pena 49/701, Tijuca - Rio - RJ, CEP 20.270-240, Brazil.

Eletronica Popular Atlantic Award (EP-AA). Confirm contact on any band or mode with 60 different countries of the Atlantic Ocean border, one of which must be a Brazilian oceanic island (PYØ). Minimum report is 33 phone or 338 CW. The current DXCC countries list will be used. Only countries of the Atlantic border proper (and not of interior seas, such as Baltic or Mediterranean) are valid for the EP-AA. Contacts must be made on or

The Electronica Popular Atlantic Award given for confirm contacts with 60 different countries of the Atlantic Ocean Border (see text).

after 31 March 1967. Other requirements and fees are per above rules for WAPY.

Country list: C5, C6, CE, CE9, CM, CO, CT, CT2, CT3, CX, D2,3, D4, DJ, EA, EA8, EI, EL, F, FG, FM, FP, FY, G, GD, GI, GJ, GC, GM, GU, GW, HH, HI, HK, HP, HR, J3, VP2G, J5, CR3, J6, VP2L, J7, VP2D, JW, JX, K, W, N, A, KC4, KG4, KP3, KP4, KP4-Descheo, KS4, KV, LA, LU, LU-Z, ON, OR4, OX, XP, OY, OZ, PA, PJ, PJ-St Marteen & Dep PY, PYØ-Fernando, PYØ-St. Peter, PYØ-Trinidade. PZ, S9, SM, TF, TG, TI, TJ, TN, TR, TU, TY, VE, VO, VE1-Sable, VE1-St Paul, VP1, VP2A, VP2E, VP2K, VP2M, VP2S, VP2V, VP5, VP8-Falkland, VP8-S. Georgia, VP8-S. Orkney, VP8-S. Sandwich, VP8-S. Shetland, VP9, XE, YN, YS, YV, YVØ-Aves, ZB, ZD7, ZD8, ZD9, ZF, ZS1,2,4,5,6, ZS3, 3C, 3X, 3Y, 4K, 4U1UN, 5N, 5T, 5V, 6W, 6Y, 8J, 8P, 8R, 9G, 9L, 9Y.

USA Diamond State Award

If you've thought about starting with county hunting but wanted to earn a certificate for something less than the base amount of 500 different counties for USA-CA, here's the perfect place to start. KE3WH offers a handsome certificate for contacting all three counties of the smallest state, Delaware.

The Diamond State Award is issued for contacting Delaware's three counties.

Contact each of Delaware's three counties: New Castle, Kent, and Sussex. No date limitation. SWL okay. Send cards plus fee of $US2 to D. Hart, KE3WH, 6 Harpers Place, Bear, DE 19701.

NZART Awards Sponsor Change

The New Zealand Association of Radio Transmitters offers a large collection of awards, and I've asked for samples for a future column. A recent change in awards manager now requires mail to be sent to: Alan Chapman, ZL3GX, NZART Awards Manager, P.O. Box 1733, Christchurch 8015, New Zealand.

URL of The Month

The 425 DX Group from Italy is well known on the Internet for their very complete online DX newsletter and QSL manager data sources. They've also collected an outstanding group of some 44 Italian awards and display the rules at the following address: <http://www-dx.deis.unibo.it/htdx/awards/awards.html>. Most of the awards are presented in both Italian and English. Several have excellent images of the award. It is a good site to visit and bookmark.

Wanted: Samples of the awards your club or national society sponsors. Send them to the address shown at the beginning of the column.

73, Ted, K1BV

DX

BY CHOD HARRIS, VP2ML

NEWS OF COMMUNICATION AROUND THE WORLD

DXing with Contests

This is international SSB contest month, with two major SSB competitive events. The ARRL SSB International DX Contest March 7–8 and *CQ*'s WPX SSB March 28–29 are two of the year's three biggest SSB DX contests (the third is the CQWW DX test in October). Thus, March provides SSB DXers with some extraordinary DXing opportunities.

There are two main reasons for making contests part of your overall DXing strategy. First, more DX stations in more countries are on the air and making lots of contacts during contests than at any other time. Unlike during a major DXpedition, when every DXer in the world is chasing after the same handful of stations on different bands, there are hundreds of potential contacts on the air all weekend. Competition for a given contact is thus greatly reduced—a real boost to DXers without a world-class signal.

The other important reason not to neglect contests is dedicated contest DXpeditions. In every major contest, dozens or even hundreds of contest DXpeditioners spread out across the globe, setting up powerful, multiband stations and making thousands of contest QSOs. Let's look at these two DXing opportunities and how to make DX contacts in each case.

Making contacts in a major contest is very similar to breaking a normal DX pileup, with two exceptions. First, the contacts are almost always on frequency, not split. Again, this makes DXing in contests easier than "regular," non-contest DXing. A DXer doesn't need dual VFO control nor an outboard receiver to monitor both the DX station and the pileup. All the action is right on frequency. On SSB this means the DXer can tune in the calling stations being worked and thus be right on the correct transmitting frequency.

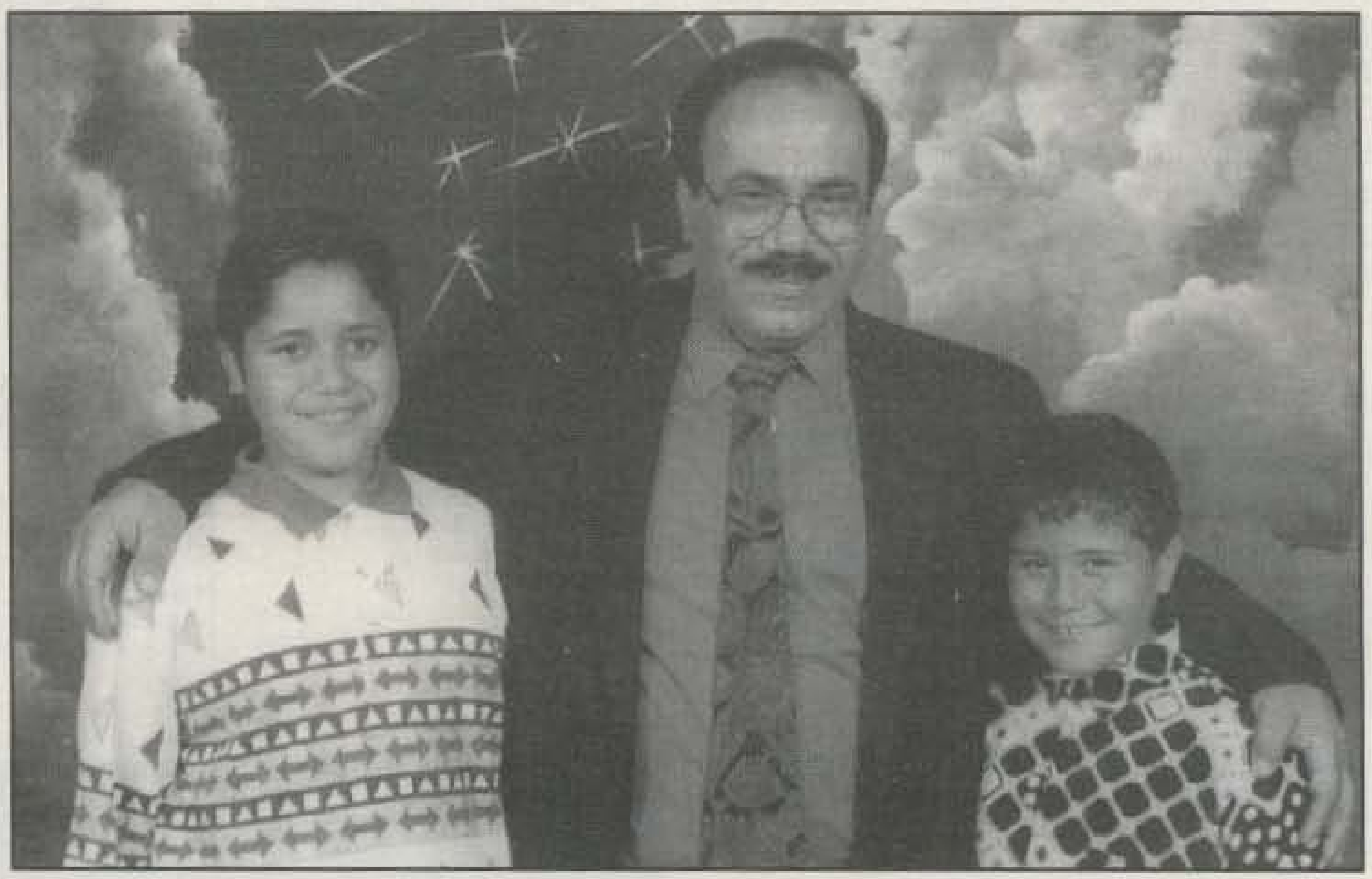
Second, the content of the contest QSO is slightly different from that of a non-contest DX QSO. In addition to sending a signal report (and 99.9% of all contest signal reports are 59 or 599), the rules of each contest require exchanging some contest-specific piece of information. In the CQWW contest this is the CQ zone of the transmitting station. In the ARRL DX test it is the state/province of the US/VE operator and transmitting power level for DX stations. In the WPX the contest exchange includes a consecutive serial number beginning with one.

Mila Fedorova, UA3WFM, composes songs about radio when she is not operating high-speed CW. (Z32KV photo)

Any DXer looking for new countries or band-countries in a contest should take a few minutes and read the rules of the contest. If you don't intend to send in your log, you don't need to memorize all the different entry categories and log deadlines, but you should note the dates, times, bands, and the required exchange. Furthermore, don't send any non-contest comments to the contesting DX station, such as your name, exact location, weather, and so on. Stick with the required contest exchange.

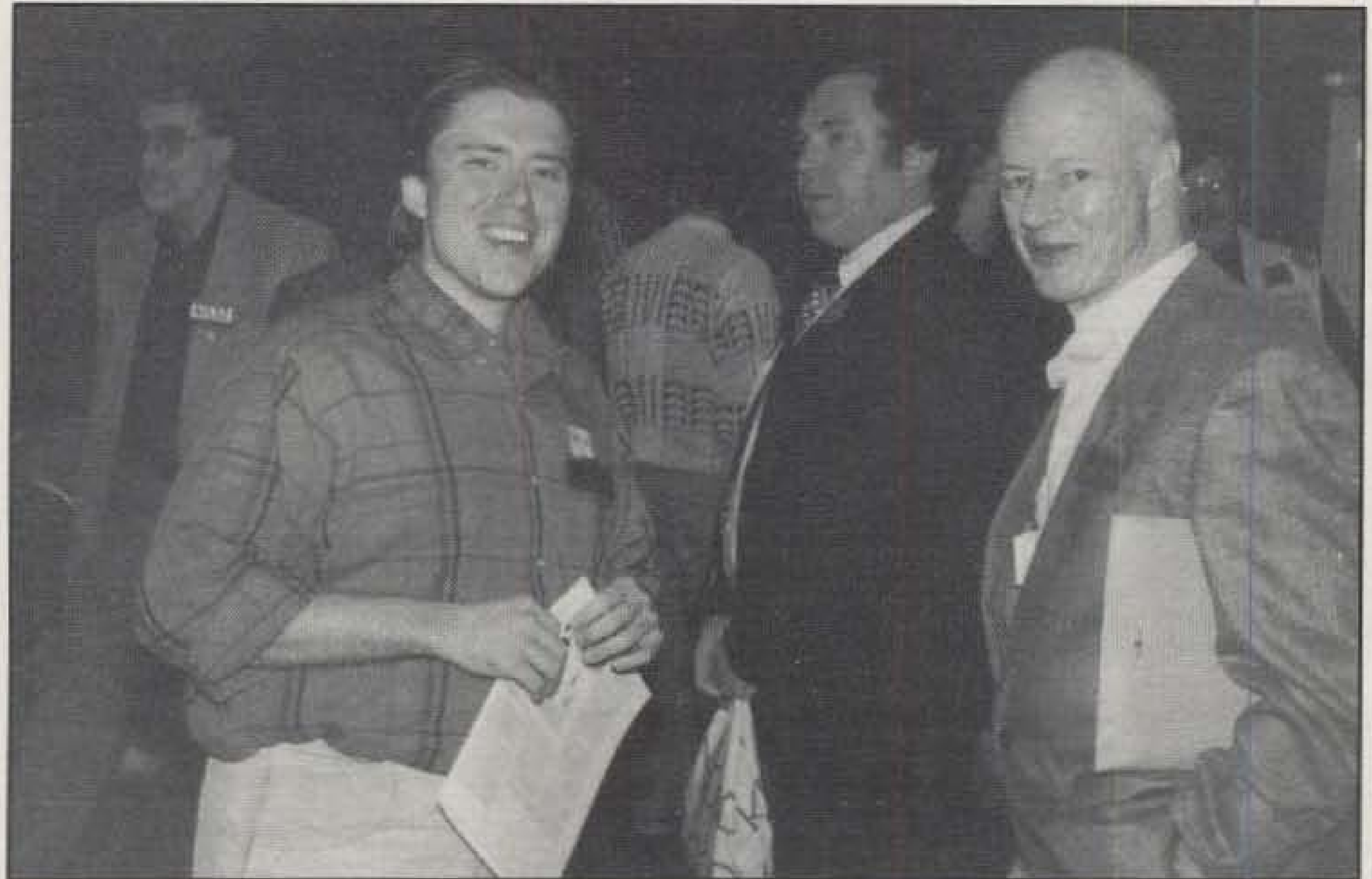
Since you are not entering the contest to compete with other contests, you can ignore the rules defining entry categories. Run as much power as necessary to complete the QSO, change bands as often as you desire, and go ahead and use PacketCluster® or other information-sharing techniques. Note that if you take this approach, which will make DXing in the contest much easier, you then cannot change your mind and submit your entry, except as the contest rules permit.

To get the most DX mileage out of a contest, the DXer must do some homework before the contest starts. Begin with a copy of the previous year's results. DX stations who enter contests tend to have specific contest preferences; they enter the same tests year after year. Note the stations in which you have the most interest. Using propagation-prediction software or other means, determine on what bands and at what times you have the best chance to work these desired stations. Note that there is no guarantee that a particular station will be active this year, or that the station will meet your optimal openings. However, to be successful, a



Munzer, JY5HX, here with his two sons, operates both CW and SSB. (Thanks W9XY/JY8XY for the photo)

P.O. Box 50, Fulton, CA 95439
e-mail: chod@compuserve.com



Bob Johnson, W9XY (ex-WB9YXY), discusses his trip as JY8XY with Ken Miller, K6IR. (Thanks KE9A)

DX contester wants to be loud into all major populations of amateurs and multipliers as much as possible. This usually means being on the right band at the right time to be loud into the U.S., plus Europe and Japan in the WPX test. In other words, the contester is looking to make it easy for you to work him or her in the contest.

With your chart of bands and times in hand, make up a large "cheat sheet" with the required contest exchange in front of you. In the excitement of making the DX contact and entering the QSO information into the log, it is very easy to forget the correct exchange. If the DX station does not receive the required exchange, he or

The WPX Program

SSB

2660 .... 5A1A 2661 .... UAØFZ

CW

2973 .... UAØFZ

Mixed

1796 .... 9A1CGK 1797 .... UAØFZ

CW: 350 N1KC, UAØFZ. 400 N1KC, UAØFZ. 450 N1KC, UAØFZ. 500 N1KC, UAØFZ. 550 N1KC, UAØFZ. 600 N1KC, UAØFZ. 650 UAØFZ. 700 UAØFZ. 750 UAØFZ. 800 UAØFZ. 850 N2SH, UAØFZ. 1200 K2PK. 1250 K2PK. 2250 JA9CWJ.
SSB: 350 UAØFZ. 400 UAØFZ. 450 UAØFZ. 500 UAØFZ, JL2HUJ. 550 JL2HUJ, UAØFZ. 600 JL2HUJ, UAØFZ. 650 JL2HUJ, UAØFZ. 700 WD8ANZ, UAØFZ.
Mixed: 450 KM4A, UAØFZ. 500 KM4A, UAØFZ. 550 KM4A, UAØFZ. 600 KM4A, UAØFZ. 650 KM4A, UAØFZ. 700 WD8ANZ, UAØFZ. 750 JH5OXF, UAØFZ. 800 JH5OXF, UAØFZ. 900 JH5OXF, UAØFZ. 950 JH5OXF, UAØFZ. 1000 JH5OXF, UAØFZ. 1050 UAØFZ. 1100 UAØFZ. 1150 UAØFZ. 1500 CE1YI. 1550 CE1YI. 1600 CE1YI. 2450 N4UH.

10 meters: UAØFZ
15 meters: YU1JU, K1NU, UAØFZ
20 meters: UAØFZ
40 meters: YU1JU, UAØFZ
80 meters: K1NU, UAØFZ

Asia: N1KC, UAØFZ
Africa: N1RT, UAØFZ
No. America: UAØFZ
So. America: UAØFZ
Europe: UAØFZ
Oceania: UAØFZ

Award of Excellence Plaque Holders: K6JG, N4MM, W4CRW, K5UR, K2VV, VE3XN, DL1MD, DJ7CX, DL3RK, WB4SIJ, DL7AA, ON4QX, 9A2AA, OK3EA, OK1MP, N4NO, ZL3GQ, W4BQY, IØJX, WA1JMP, KØJN, W4VQ, KF2O, W8CNL, W1JR, F9RM, W5UR, CT1FL, W8RSW, WA4QMQ, W8ILC, VE7DP, K9BG, W1BWS, G4BUE, N3ED, LU3YL/W4, NN4Q, KA3A, VE7WJ, VE7IG, N2AC, W9NUF, N4NX, SMØDJZ, DK5AD, WD9IIC, W3ARK, LA7JO, VK4SS. I8YRK, SMØAJU, N5TV, W6OUL, WB8ZRL, WA8YTM, SM6DHU, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, DK4SY, UR2QD, AB9O, FM5WD, I2DMK, SM6CST, VE1NG, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, HA8XX, K7LJ, SM3EVR, K2SHZ, UP1BZZ, EA7OH, K2POF, DJ4XA, IT9TQH, K2POA, N6JV, W2HG, ONL-4003, W5AWT, KBØG, HB9CSA, F6BVB, YU7SF, DF1SD, K7CU, I1POR, K9LJN, YBØTK, K9QFR, YU2NA, W4UW, NXØI, WB4RUA, I6DQE, I1EEW, I8RFD, I3CRW, VE3MS, NE4F, KC8PG, F1HWB, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, KC7EM, YU1AB, IK2ILH, DEØDAQ, I1WXY, LU1DOW, N1IR, IV4GME, VE9RJ, WX3N, HB9AUT, KC6X, N6IBP, W5ODD. IØRIZ, I2MQP, F6HMJ, HB9DDZ, WØULU, K9XR, JAØSU, I5ZJK, I2EOW, IK2MRZ, KS4S, KA1CLV, WZ1R, CT4UW, KØIFL, WT3W, IN3NJB, S5ØA, IK1GPG, AA6WJ, W3AP, OE1EMN, W9IL, S53EO, DF7GK, S57J, EA8BM, DL1EY, KUØA.

Award of Excellence Plaque Holders with 160 Meter Endorsement: K6JG, N4MM, W4CRW, K5UR, VE3XN, DL3RK, OK1MP, N4NO, W4BQY, W4VQ, KF2O, W8CNL, W1JR, W5UR, W8RSW, W8ILC, K9BG, W1BWS, G4BUE, LU3YL/W4, NN4Q, VE7WJ, VE7IG, W9NUF, N4NX, SMØD-JZ, DK5AD, W3ARK, LA7JO, SMØAJU, N5TV, W6OUL, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, UR2QD, AB9O, FM5WD, SM6CST, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, K7LJ, SM3EVR, UP1BZZ, K2POF, IT9TQH, N6JV, ONL-4003, W5AWT, KBØG, F6BVB, YU7SF, DF1SD, K7CU, I1POR, YBØTK, K9QFR, W4UW, NXØI, WB4RUA, I1EEW, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, YU1AB, IK4GME, WX3N, W5ODD. IØRIZ, I2MQP, F6HMJ, HB9DDZ, K9XR, JAØSU, I5ZJK, I2EOW, KS4S, KA1CLV, KØIFL, WT3W, IN3NJB, S5ØA, IK1GPG, AA6WJ, W3AP, S53EO, S57J, DL1EY.
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.

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 328 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	W4QB 328	OK1MP 326	I1JQJ 325	W1WAI 323	I4LCK 320	N1HN 313	HB9DDZ 307	KØHQW 299
K1MEM 328	K2OWE 328	N4JF 326	IT9VDQ 325	WB5MTV 323	K6CU 319	K9DDO 312	CT1YH 305	YU1AB 294
K2FL 328	K6LEB 328	W9WAQ 326	W8XD 325	AG9S 322	K2JF 319	WB4DBB 312	K7JS 305	G4MVA 294
K9BWQ 328	K9MM 328	AA4KT 326	K8LJG 325	DL3DXX 322	HA5NK 319	K4JLD 312	G2FFO 303	I2EOW 294
K2ENT 328	W6DN 327	K9IW 326	W7CNL 325	KA5TQF 322	N6AV 318	K1VHS 311	W7IIT 302	KB8O 292
DL8CM 328	K3UA 327	YU1HA 326	K2JLA 325	4N7ZZ 322	VE7DX 318	WA8YTM 311	K8JJC 302	F6HMJ 292
N7RO 328	N7FU 327	I5XIM 326	IT9QDS 324	AA5NK 321	N6CW 316	N6AW 311	WA4DAN 301	IKØADY 290
WØIZ 328	N4MM 327	PAØXPQ 326	WØJLC 324	ON4QX 321	N4CH 316	N5HB 311	WG5G/QRPp 301	DJ1YH 288
G4BWP 328	IT9TQH 327	WA8DXA 326	KB4HU 324	K9QVB 321	W3BBL 315	LA7JO 311	W6YQ 301	YU7FW 286
K6JG 328	K4CEB 327	N5FW 326	N5FG 324	HA5DA 321	N4AH 315	OH3NM 310	N4OT 301	KF5PE 282
I4EAT 328	WA4IUM 327	W7OM 326	DJ2PJ 324	K1HDO 321	NØFW 315	OZ5UR 310	YU1TR 300	W4UW 282
SM6CST 328	K4IQJ 327	WØHZ 326	W4OEL 324	IT9ZGY 320	AA2X 314	K4CXY 309	YU2TW 300	LU3DSI 282
W2UE 328	F3TH 327	IK2ILH 326	W7ULC 323	VE7CNE 320	W5OG 313	VE9RJ 309	KE5PO 300	WG7A 282
W2FXA 328	EA2IA 327	N6AR 325	WA4JTI 323	W6SR 320	WB4UBD 313	9A2AJ 309	KH6CF 300	YC2OK 280
N4KG 328	NC9T 327	K8NA 325	KUØS 323	KA7T 320	G3KMQ 313	W3II 308	YV5ANT 299	PY4WS 276
K8PV 328	9A2AA 326	KZ4V 325						

SSB

K4MZU 328	IT9TQH 328	YV1KZ 326	W6SR 326	K8YVI 323	G4ADD 320	KV2S 315	W9IL 307	YB1RED 291
K2TQC 328	IT9TGO 328	W9OKL 326	N4CH 326	K9HQM 323	I4WZK 320	WA9RCQ 315	N6AV 306	DJ2UU 291
K2FL 328	WD8MGQ 328	9A2AA 326	4N7ZZ 326	KC5P 323	I4SAT 320	N3ARK 315	TI2TEB 306	4X6DK 291
DJ9ZB 328	I1EEW 328	DL6KG 326	K4JLD 326	WDØGML 323	WE2L 320	N4HK 315	VE3DLR 306	WA3KKO 290
EA2IA 328	IØZV 328	KØKG 326	K1HDO 326	WW1N 323	EA3EQT 320	K2AJY 315	W3YEY 306	OE7KWT 290
K2ENT 328	VE3MR 328	OK1MP 326	K9PP 326	K4SBH 323	WS9V 320	K7TCL 315	XE1MDX 305	N6CFQ 290
OZ5EV 328	DL9OH 328	WB3CQN 326	I8ACB 325	WB2JZK 323	KØFP 320	I4CSP 315	DK5WQ 305	IK2PZG 289
VE1YX 328	ZL1AGO 328	I2QMU 326	N6AR 325	CE7ZK 323	KE3A 320	N6RJY 315	EA5OL 305	VK3IR 289
W6EUF 328	SV1ADG 328	PAØXPQ 326	K8NA 325	K2ARO 323	N4CSF 320	NØAMI 314	G4NXG/M 304	KF7VC 288
K2JLA 328	LA7JO 328	N4JF 326	AI8M 325	LU7HJM 323	W8AXI 320	W5RUK 314	KJ6HO 304	OK1AWZ 287
N7RO 328	VE3XN 328	KB4HU 326	W4UW 325	VE4ACY 323	W6SHY 320	DL3DXX 314	VE3CKP 304	IK2DUW 287
K6YRA 328	K9MM 328	KC4MJ 326	VE2PJ 325	KB8O 323	ON5KL 319	OH5KL 313	WB2NQT 303	EA5GMB 287
W6BCQ 328	K3UA 327	CX2CB 326	I8LEL 325	VE2GHZ 323	WA4DAN 319	WDØDMN 313	EA3CWK 303	IK8BMW 286
K5OVC 328	K9BWQ 327	TI2CC 326	IT9ZGY 325	KD8IW 323	KI3L 319	KD9CN 313	EA3BT 303	TU2QW 286
KZ2P 328	WØYDB 327	IKØIOL 326	K6LEB 325	YV1JV 323	VE3HO 319	K1VHS 313	YC2OK 303	NM5O 285
VE7DX 328	W4QB 327	ZL1HY 326	IK1GPG 325	WN5IJZ 322	XE1MD 319	EA1JG 313	WA9BDX 302	EA1AYN 285
AA6BB 328	VE3MRS 327	YU1HA 326	I1JQJ 325	XE1CI 322	KB1JU 319	W1LQQ 313	WA8MEM 302	IK2HBX 284
EA4DO 328	OE2EGL 327	W4NKI 326	VE7WJ 325	WB4PUD 322	PY2DBU 319	K4LR 312	KD4YT 302	VE7HAM 284
ZL3NS 328	K8CSG 327	KZ4V 326	AI8S 325	LZ1HA 322	IØSGF 319	WA9IVU 312	CT1YH 302	KE6CF 283
K6JG 328	K1UO 327	VE3GMT 326	W7FP 325	ZS6AOO 322	KF8UN 319	KD5ZD 312	N5QDE 302	WZ3E 283
WA6OET 328	WB4UBD 327	W4EEE 326	N5FG 325	WA5HWB 322	K9QVB 318	WA2FKF 312	RA2YA 301	YC3OSE 282
SM6CST 328	K7LAY 327	KE4VU 326	AC7DX 325	TI2JJP 322	KB5FU 318	K4JDJ 312	W2LZX 301	WN6J 281
W3GG 328	W2FXA 327	AG9S 326	KØHQW 325	OE7SEL 322	AA4AH 318	ZS6BBY 311	XE2DU 301	KK4TR 281
I4EAT 328	IK8CNT 327	WA4WTG 326	K2JF 325	WDØBNC 322	G4GED 318	IN3ANE 311	WP4AFA 300	YU1TR 280
W4UNP 328	N4KG 327	WD8PUG 326	KC8EU 324	W5XQ 321	IK8GCS 318	F1OZF 311	YU2TW 300	KN4RI 280
YU1AB 328	K8PV 327	W2CC 326	N4KEL/M 324	KA5TQF 321	W6MFC 318	EI6FR 311	WB4UHN 300	WD9ACQ 280
F9RM 328	K5TVC 327	VE2WY 326	IK8BQE 324	TI2HP 321	KF5AR 318	WT4K 311	KB8NTY 300	WØIKD 279
PY4OY 328	NC9T 327	AA4KT 326	AA5NK 324	I8XTX 321	I8IYW 318	YZ7AA 311	YT7TY 300	EA3CWT 278
OZ3SK 328	W9SS 326	PT2TF 326	WB5TED 324	I8YRK 321	NI5D 318	WA5SUE 311	WB6GFJ 299	VE2DRN 277
XE1L 328	WA4IUM 326	KM2P 326	W2FGY 324	K4PQV 321	WA8YTM 318	GM4XLU 311	VE3CKP 299	GØLRX 277
4Z4DX 328	WB1DQC 326	N5FW 326	YV5CWO 324	KS2I 321	F6BFI 318	K6BZ 311	YV4VN 299	9A9R 277
CX4HS 328	XE1AE 326	K9HDZ 326	W5LLU 324	W7ULC 321	KX5V 318	KA5RNH 310	KJ9N 298	K3LC 277
N4MM 328	KA3HXO 326	WA3HUP 326	I8KCI 324	W3AZD 321	CE1YI 318	I2MQP 310	W5OXA 296	KC6AWX 276
OE3WWB 328	YS1GMV 326	YV1CLM 326	I1POR 324	WØULU 321	WB6PSY 317	HA6NF 310	KB5WQ 294	OA4EI 276
IK1GPG 328	KF7SH 326	N6AW 326	VE4AT 324	CT1EEB 321	9H4G 317	KF7RU 310	IT9VDQ 293	N3RX 275
W7OM 328	ZS6LW 326	ZP5JCY 326	KD5ZM 324	OA4QV 321	WA6DTG 317	AB4IQ 310	KJ5LJ 293	F5NBX 275
K4MQG 328	VK4LC 326	W7BOK 326	KA5TTC 324	OE6CLD 321	XE1XM 317	EA5RJ 309	TI2LTA 292	VE2AJT 275
K7JS 328	YV5AIP 326	WB3DNA 326	KB2MY 324	LU1JDL 320	ZL1BOQ 317	CT1AHU 309	KQ4WD 292	US1IDX 275
DU9RG 328	K9IW 326	I2EOW 326	EA3BKI 324	KF8VW 320	N5HSF 316	EA5KY 308	K2EEK 291	Z31JA 275
W6DN 328	WA4JTI 326	KE5PO 326	YV5IVB 324	IØAMU 320	KB1HC 316	EA3CB 308	W6WL 291	
I4LCK 328	YV1AJ 326	XE1VIC 326	N2VW 324	K4CXY 320	W6NW 315			

RTTY

K2ENT 324	NI4H 305	EA5FKI 284	YC2OK 281	I1JQJ 273	W4QB 273	W4EEU 269	KE5PO 268	G4BWP 267
WB4UBD 310	K3UA 287							

she might not log the contact. The cheat sheet is a small piece of insurance that has saved many a contact.

Okay, the contest has started and you see the spotting information one of the DX stations you are chasing put out on the PacketCluster network. Get to the appropriate frequency and very carefully tune in the successful callers, not the DX station. This is because the DX contester is most likely using the RIT (receiver incremental tuning) on his or her rig. The calling stations are seldom truly zero-beat, and an active contester continually tunes across the pileup. By zero-beating the successful calling stations, you are on the DX station's exact listening frequency. You should have no trouble copying the DX station; if so, use **your** RIT to tune in the DX. Remember to turn your RIT off as soon as you work the DX station, or you'll have continual trouble zero-beating later.

Next listen for the rhythm of the contesting station. Every operator has a rhythm, a pattern of transmitting and listening. Listen closely for the techniques used by the successful callers. The most likely rhythm of an experienced operator in a major contest is very fast! The contester will try to come back to the first complete callsign copied, to maximize rate.

This suggests using a very tight VOX or a fast foot switch, with minimal VOX delay. You'll want your receiver to come on very quickly after you send the contest exchange, as the contester will not waste any time confirming your information. You may miss the confirming "QSL" and not know if you are truly "in the log."

Note that the contester is listening for the first **complete** callsign. **Never** send just part of your callsign in a contest pileup. In fact, outside of some very specialized circumstances, you should **never** send just part of your callsign for identification.

Try giving your callsign without phonetics, unless you have a particularly difficult callsign to understand. With clear enunciation, the DX contester may well be able to copy most, if not all, of your callsign without the time-consuming phonetics.

The WAZ Program

Single Band WAZ

20 Meter SSB

1017 .... OE1WHC
1018 .... KF9YT
1019 .... KO4YB

80 Meter SSB

71 .... TI5KD

20 Meter CW

478 .... AI6Z
479 .... N4XX

30 Meter CW

25 .... JH2CLV

40 Meter CW

196 .... K6VX

160 Meter WAZ

122 .... K6VX, 32 Zones New
123 .... KF2O, 30 Zones, New
87 .... SV8JE, 40 Zones, Endorsements

All Band WAZ

SSB

4413 .... DL6LE
4414 .... LA7SGA
4415 .... WK3I
4416 .... JH1BAM
4417 .... ON4AOI
4418 .... HK3BZO
4419 .... UT5UAG
4420 .... K9YUG

CW/Phone

7769 .... KØKO
7770 .... AD4YM
7771 .... JH2CYU
7772 .... GØCYL
7773 .... I1FHA (CW)

All CW

109 .... F5YJ
110 .... WK3I
111 .... K6YUI
112 .... HB9LCW
113 .... ON4AOI

Phone

628 .... EA6SX

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.

You'll have an opportunity to correct any errors in your callsign when you give the contest exchange.

Log your contact carefully. The odds are high that the contester is using some form of logging software and thus will easily be able to find your callsign when you request a QSL card. However, if the contester is using paper logs, an error of even a few minutes in your time or a band mistake may mean the QSL manager never finds your call. Take a moment to confirm the time and band in your log.

Contests not only encourage activity among resident DX stations, but also attract lots of contest DXpeditions. These contest-oriented expeditions provide DXers with several extra chances to make and confirm new band countries. While the bad news is that contest DXpeditions, on the whole, don't go to particularly rare

Vit, UA4FAR, made all the gear in his Penza shack. (Z32KV photo)

5 Band WAZ

As of November 30, 1997, 471 stations have attained the 200 Zone level.

New recipients of 5 Band WAZ Award with all 200 Zones confirmed:

EA6SX ON4AOI ACØM

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)	GM3YOR, 199 (31)
AA4KT, 199 (26)	KZ4V, 199 (26)
K7UR, 199 (34)	W8DX, 199 (34)
WØPGI, 199 (26)	N4CH, 199 (18 on 10)
W2YY, 199 (26)	UA3AGW, 198 (1, 12)
W9WAQ, 199 (26)	VO1FB, 198 (19, 27)
VE7AHA, 199 (34)	EA5BCK, 198 (27, 39)
W9CH, 199 (26)	K4PI, 198 (23, 26)
IK8BQE, 199 (31)	G3KDB, 198 (1, 12)
JA2IVK,199 (34,40m)	KG9N, 198 (18, 22)
K1ST, 199 (26)	KM2P, 198 (22, 26)
ABØP, 199 (23)	DKØEE, 198 (19,31)
KL7Y, 199 (34)	KØSR, 198 (22, 23)
UY5XE, 199 (27)	K3NW, 198 (23, 26)
NN7X, 199 (34)	UA4PO, 198 (1, 2)
OE6MKG, 199 (31)	K5RT, 198 (22, 23)
HA8IB, 199 (2 on 15)	JA1DM, 198 (2, 40)
OH2DW, 199 (1)	OE1ZL, 198 (1,31)
IK1AOD, 199 (1)	9A5I, 198 (1, 16)
DF3CB, 199 (1)	KE9A, 198 (18,23)
F6CPO, 199 (1)	DJ4GJ, 198 (1, 31)
W6SR, 199 (37)	OH2VZ, 198 (1, 31)
S57J, 199 (2)	W2YC, 198 (24, 26)
W3UR, 199 (23)	W6DN, 198 (17, 34)
KC7V, 199 (34)	

The following have qualified for the basic 5 Band WAZ Award:

EA6SX, 200 Zones	G5LP, 177 Zones
ON4AOI, 200 Zones	CT1AHU, 169 Zones

Endorsements:

DJ8WD, 190 Zones	GM3WIL, 193 Zones
KF2O, 194 Zones	ACØM, 200 Zones
W9GSB, 195	

1064 Stations have attained the 150 Zone level as of November 30, 1997.

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.

places, the good news is that they are usually very easy to work from their not-so-rare spot.

People don't go to contest DXpeditions with the idea of being difficult to contact, or to make only a small number of QSOs. Most such operations plan on loud signals and directional antennas on most of the bands, with a sufficient team of operators to keep going throughout the entire 48 hours of the contest.

Further, these groups are highly motivated toward the contest. They didn't go all that way, hauling tons of extra baggage, only to quit after a few hours. Often the best time to call these operations is on Sunday, after the real competitors have made their necessary QSOs earlier in the event. At times, some of the multi-multi operations are begging for contacts on Sunday.

Again, a little homework will go far toward making your contest participation DX-successful. You should use the regular means of obtaining DX information to make a list of the contest operations in which you have an interest. The Internet DX reflector, various electronic and print newsletters, and the Contest Internet reflector are good sources of up-to-date contest DXpedition news. As above, make your personal band-time plan for working these stations. Note that these stations will be easy to work, and the larger operations will be available around the clock, so plan accordingly.

The same pileup-breaking techniques discussed above prevail here. Send your callsign rapidly and completely, in the same rhythm as the contester. Give your correct contest exchange and nothing else, and take care in logging correctly.

Contest DXpeditions often provide considerable additional contact opportunities outside the contest itself. Operators often

CQ DX Awards Program

SSB

2240................ON4BCM

CW

969........................F5IUZ

SSB Endorsements

320...............VE3XN/328	310..................K6BZ/311
320...............K9MM/328	275..............KQ4WD/292
320.................K9PP/326	150............ON4BCM/169
320..........WDØBNC/322	

CW Endorsements

320................K9MM/328	320................K2JLA/325
320................IK2ILH/326	

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.

set up a few days ahead of the contest and test equipment and antennas. The astute DXer can catch these warm-up operations and skip the frenzy of the contest pileup. Also, many of these operations will be on the new bands before the contest, if only for fun. Since contacts on 10, 17, and 12 meters don't count during the major contests, catching these contest DXpeditions on the new bands before the test is often the best way to pick up these band countries. Don't plan on working the operators **after** the contest, however. The odds are good that the operators are too tired to spend much more time on the air after the 'test.

The one big negative about DXing during contests has become less of a problem since computer logging has come to dominate the field. In years past, getting a QSL card out of a contest DXpedition was often much more difficult than working the operation in the first place. Dedicated contesters have little interest in QSLing; for them the entire operation is over at the end of the contest. Dealing with hundreds of cards—many with wrong dates, times, or bands—was a time-consuming and thankless task. However, thanks to ease of finding callsigns in a computerized log, contest QSL managers have become much more efficient. Most log programs will spit out QSO labels for each contact with a given station, regard-

QSL Information

3A/DF8XC to DL1YFF
3D2KY to JA3MVI to
4B1AC to XE1BEF to
4JØGAT to DL1VJ
4NØAV to YU7AV
4NØS to YU7JDE
4N7ØDX to YU1DX
4O9S to YU7KMN
5JØT to YU1FW
8P6CV to KU9C
8P6DA to KU9C
8Q7BV to HB9DIF
8R3ØK to OHØXX
8S3FRO to SM3CVM
9H3XY to G4ZVJ
9H3ZV to G4ZVJ
9K2/SP5UAM to SP5ELA
A35KY to JA3MVI
BV2YA to JP1RIW
C6AJT to W4CJK
EK7DX to DL1VJ
EM5UNG to UT3UZ
EM7V to UR7VA
EO7V to UR7VA
ER7A to ER1DA
FG7AG to F2GA
G6T to G3NYY
GB8ØØSA to GØREP
GM6V to GM4DMZ
GM6Z to GM0KWL
IG8R to I8RIZ
II7DX to IK7MCJ
II7I to IK7RWD
IO2L to I2OKW
IO7A to IK7DXP
IQ1A to I1JQJ
IQ1Z to IK1NLZ
IQ2S to I2JSB
IQ4KID to IK4BWC
IQ7A to IK7XIV
IRØI to IKØOZB
IR2B to IK2XDT
IR2P to IK2DUW
IR4C to IK4THF
IR7A to I7ALE
IR9AF to IT9AF
IU7G to IK7RWD
J2ØD to F2GA
J28DM to F2GA
J28DP to F2GA
JT1FBB to W9JOE
JWØL to G3WFT
KHØA to to JF1MIA
L75AA to LU4AA
LM2SKI to LA2T
LR3Y to LU1YU
LU1ZS to LU2CN
LU4D to LU4DXU
LV1V to LU1VV
LX2LX to LX1NO
LY5W to LY1DR
M6G to G1AHM
OK8EAO to DL1CW
OL4Z to OK2ZU
OT6P to ON6AH
PR4Y to PY4OY
RUØB to UA9OBA
S5ØHQ to S57NW
S52A to S56MM
S79MAD to GW4WVO
TA3ZI to DL8OBC
TK1A to DF7RX
TR8RG to F2GA
TT8GA to F2GA
TT8JWM to N4RXL
TZ6SI to DJ6SI
UAØZDA to RA3AR
UD6DFT to UA9AB
UE1A to RV1AC
UOØZ to I8YGZ
URØD to UT5DK
UR5U to UR5UW
UTØU to UT5UDX
UT8I to UT8IM
UX2M to UR4MZL
UX2MM to DL3BQA
V29Y to JRØAMD
V8EA to JH7FQK
VK9PG to JR5XPG
X5ØB to YU7KMN
VU2JBS to VK9NS
YB1AQS to DK7YY
YN6WW to JA6VU
YQ2R to YO2DFA
YR2R to YO2DFA
YTØE to YU1BO
YTØX to YU7AL
YT4I to YU4WU
YT9N to YU7FIJ
YT9W to YT1WW
ZD8T to AC4IV
ZF2CA to I4ALU
ZK1MVI to JA3MVI
ZK2KY to JA3MVI
ZPØV to ZP5WYV
5B4AGC to George Beasley, P.O. Box 1344, CY-8133 Paphos, Cyprus
5B4/G3LNS to George Beasley, P.O. Box 1344, CY-8133 Paphos, Cyprus
9H1DF to Louis Gatt, 77/1, St. Julian's St., B'Kara, BKR 14, Malta
9K2SS to Ali M. Belal, P.O. Box 12388, Shamiea 71654, Kuwait
9Z4CT to Nigel Darwent, P.O. Box 20, San Fernando, Trinidad
A45XR to Krzysztof Dabrowski, P.O. Box 2038, Muscat 111, Oman
A71CW to Krzysztof Dabrowski, P.O. Box 22101, Doha, Qatar
CT3HG to Alves, P.O. Box 556, P-9007 Funchal, Madeira, Portugal
DS2RDG to Myung Gu Eo, 380-2 Jumun Ri, Jumunjin Eup, Kang Nung City, Kang Won, Korea
DU9HKD to Renoir A. Abrea, 9023 Naawan, Misamis Oriental, Philippines
FG5DN to M. Oria-Relmy Thomas, Papyrus II, Escalier 34, Apt. 3431, F-97139 Abymes, France
FK8VHN to Didier Lavisse, Caserne Normandie, B. P. 12, F-98842 Noumea, France
HL5FUA to Jong Sool Choi, P.O. Box 15, Ullung Island 799-800, Korea
HSØGBI to Cherdchai Yiwlek, P.O. Box 9, Maptaphut I. E., Rayong 21151, Thailand
JL1KFR/JD1 to Ryoichi Tojo, 2-5-37-1-102, Miyazaki, Chuo-ku, Chiba City, Chiba 260-0806, Japan
P43E to Emily Thiel, P.O. Box 614, Oranjestad, Aruba
SV1DVX to Nikos Devetzoglou, Olympou 62, GR-152 34 Halandri, Athens, Greece
SV1ENG to Antonis A. Parashis, El. Venizelou 203, GR-141 22 Athens, Greece
SV1PM to George Tselentis, Naxou 5, Dasos Haidariou, Athens, Greece
SV3CGV to Ger Antonopoulos, Maizonos 12, GR-262 23 Patras, Greece
TA1FA to Suat Iscan, P.O. Box 63, Fatih TR-34260, Istanbul, Turkey
V5/DL7UFS to Frank Steinhauser, P.O. Box 441, Swakopmund, Namibia
VU2KBJ to Kaustubh Joshi, 20 Prashant Nagar, Navi Peth, Pune 411 030, India
VU2XO to M. R. Patel, 501, Giriraj Apt., Race Course Circle, Baroda 390 007, India
YC3CVZ to Drs. Farid Dimyati, P.O. Box 25 SBS, Surabaya 60401, Indonesia
YC8HGM to Hm. Sjafaruddin Mz., Komplek Pertamina A4/4, Jl. Rappocini Raya, Ujung Pandang 90222, Indonesia
ZD8V to Paul L. Hutley, CSR 6310 Ascension, P.O. Box 4235, Patrick AFB, FL 32925
ZP1ES to Erwin Siemens, C. C. 1153, Neuland, Paraguay
ZP9DZA to Helmut Paster, Minga Guazu, Alto Parana, Paraguay

The table of QSL managers is courtesy of John Shelton K1XN, editor of The GOLIST, P.O. Box 3071, Paris, TN 38242 (phone 901-641-0109; e-mail: <golist@iswt.com>).

less of the date, time, or band listed on the incoming QSL card.

One potential difficulty is finding out QSL routes for contest DXpeditions. The GOLIST, Internet resources, and even on-the-air requests are ways to find correct QSL routes. However, before you ask "What's your QSL route?" of the contest station, please listen for 5–10 minutes to see if the contester will volunteer that information. Few things are as frustrating for a serious contester trying to maintain a good rate than having several callers in a row ask for QSL information. A operator in a rare country knows perfectly well that many of those listening want the QSL information direct from the horse's mouth, so to speak, and will announce that information as often as necessary.

Note that fancy QSL cards and personal notes are most likely wasted on a contest QSL manager. The most important aspect of QSLing contest contacts, after getting the correct QSL route, is to include a self-addressed, stamped envelope (SASE) with enough postage for return of your requested cards. These groups are contesters, not QSLers, and the prudent DXer tries to make their life as easy as possible, so SASEs are a must.

With the expected increase in solar activity as sunspot Cycle 23 matures and with the usual good propagation in the spring, DXers should find some excellent DX opportunities in the contests this month. And who knows? Maybe you'll discover you like the competitive nature of contesting, and enter a contest for real sometime.

DX Activities

Charles Lewis and his wife (ex-S92SS/A22AA and S92YL) are now **SVØLM** and **SVØLN**, respectively. Charles says: "Address is (Name or call), Box 1001, GR-67100 Xanthi, Greece or (Name), American Embassy (KAV), PSC 108 Box 39, APO AE 09842. I always respond via the same mode received. In other words, anyone hoping for Greek stamps will get them if they use the Greek address. I respond to all, regardless, but hold in much higher esteem those using the APO who are kind enough to send an SASE. Our old logs are handy and we are happy to respond to requests for QSLs for ancient contacts. I'm still getting requests for A22AA all the way back to '89!"

Terje Berg, LA3EX, is operating as **JX3EX** from Jan Mayen for the next month or so. He likes 21300 or 28500 from 10–1300Z and around 14200 kHz at 1600Z. On 40 meters try 7050 between 17 and 2000Z. QSL to Terje Berg, 8099 Jan Mayen, Via Norway.

TR8CR is F8EN from Gabon until March 12, mostly CW. QSL via F6AJA.

XT2DM is F5RLE to March 9th, again mostly CW.

AA1M, KA1MD, and **W1USN** will operate **V2/** from Antigua Feb. 23 to March 2.

Charlie, K4VUD, will operate the ARRL SSB test as **9N1UD**; QSL home call.

NH4/NH6YK: Ted plans to be on Midway March 18-29 and will operate as his work permits.

Bob Furzer, N6BFM, is back in Kuwait and is active as **9K2ZZ** for the rest of the year. QSL via W8CNL, direct only; no bureau cards, please.

Doug, W3CF, will operate as **V26DX** from Antigua February 27 to March 8. He'll join the Frankford Radio Club's **V26B** multi-multi effort in the ARRL SSB test March 7–8. QSL V26DX to KU9C and V26B to WT3Q.

Finally, look for Ed Hartz, K8VIR, who is active from Chatham Island **/ZL7** through April. Try 14260 and 21300 kHz plus or minus. QSL to Ed Hartz, K8VIR/ZL7, P.O. Box 9, Te Anau, New Zealand.

DX information thanks to The Daily DX, a daily e-mail DX newsletter. For more information on The Daily DX, contact W3UR at <bernie.mcclenny@mail.wdn.com> or fax to 301-854-5105.

73, Chod, VP2ML

BY FREDERICK O. MAIA, W5YI

WASHINGTON READOUT

REGULATORY NEWS IN THE WORLD OF AMATEUR RADIO

Letters To The Editor

We save the letters and e-mail messages that you write to us, and every so often we try to answer the ones of general interest. Let's tackle some this month. By the way, our e-mail address is <fmaia@internetMCI.com> if you wish to write to us.

Q: I keep hearing that other services and industry want our frequencies. How can they get them if they are allocated to us?—*Herb Andrews, New Rochelle, NY*

A: The allocation of radio frequencies involves the setting aside of segments of the radio spectrum for the use of particular radio services. It is a very complex matter indeed, especially now that our government has decided to sell spectrum to raise money for the U.S. Treasury. The band assignments are influenced by the behavior of radio waves at different frequencies and the needs of the user.

All frequency assignments must be performed within a framework of international agreements, both regional and worldwide in scope. The worldwide governing body of telecommunications is the International Telecommunication Union. The ITU, with more than 180 member countries, is a specialized agency of the United Nations.

There are different kinds of frequency allocations. The international plan calls for three different geographical regions. The United States, Canada, and Central and South America are located in ITU Region 2. In the United States, radio spectrum may be allocated to either government or non-government use exclusively or shared by one or more radio services. These allocations must follow the international plan for ITU Region 2.

The NTIA (National Telecommunications and Information Administration) oversees government spectrum, while the FCC (Federal Communications Commission) manages non-government frequencies.

Sometimes more than one service shares spectrum internationally, but our FCC only allows use in the U.S. by one of them. It is thus legal under international law for our FCC to extend use to another radio service—or to reallocate amateur spectrum to other uses—as long as the new use conforms to the international table of allocations.

When more than one radio service shares an allocation, the services are designated as "primary" or "secondary." Radio services that are designated as secondary may not interfere with primary services and are not protected from their interference.

Some amateur bands are allocated to the Amateur Service exclusively in all three ITU Regions (such as all amateur bands 10 through 20 meters). Some bands are exclusive amateur spectrum in ITU Region 2 and used by other services in other regions. For example, 7100 to 7300 kHz is in the U.S. 40 meter amateur band, but allocated to shortwave broadcasting in other parts of the world. The 6, 80, and 160 meter bands are used by other services outside of Region 2. And the 146 to 148 MHz segment of the Region 2 two meter band is not allocated to the Amateur Service in Region 1.

To make matters even more complicated, some countries (including the United States) have taken a "footnote" exception to the international spectrum allocation plan and are not bound to follow it.

All amateur bands above 2 meters allocated by the FCC to the U.S. Amateur Service are also internationally allocated to other services. It is therefore possible for the FCC to permit these other services to also share these frequencies, or to reallocate spectrum used by the Amateur Service to other internationally approved radio services.

The FCC is mandated by Congress to provide for the widest use of radio "in the public interest." It is not an easy job. The primary problem of expanded radio use is the scarcity of frequencies. One of the ways that the Commission deals with the short supply of spectrum is through frequency sharing. We can expect to see more and more of it.

Q: I heard that the Morse code is about to be ended on the amateur bands. What can you tell me about it?—*R. Fletcher, Bismark, ND*

A: In the early days of amateur radio it was thought that amateurs should be proficient in the mode to assist if necessary in the safety of life at sea, and it became a part of the International Radio Regulations. (Since radio respects no boundaries, it is internationally governed.) Ever since that time, the member nations of the International Telecommunications Union (ITU) have steadily been relaxing the requirement to the point where CW proficiency is now only required on the high frequency amateur bands below 30 MHz.

Now that manual telegraphy is being totally phased out on the high seas, there really is no reason to mandate the mode. The telecommunications regulators of most countries really see no reason to require code proficiency as a licensing requirement.

It is the amateur community itself that wants to keep it, especially those who went to the trouble of learning it so they could communicate long range on the low bands. Requiring Morse proficiency also keeps the number of participants to a manageable level, since the range of HF is worldwide.

My own view is that the Morse requirement should be abolished and other means adopted to strain out the best candidates for amateur radio, if indeed a filter is even needed.

The ITU nations were to make a decision last year at WRC-97 (the World Radio Conference held at Geneva last November) as to whether they would be considering the qualifications for amateur operators at their next conference in 1999. It is at these meetings that the various nations get together to agree on telecommunications matters. But due to a heavy agenda at WRC-99, it was agreed to put the matter off until WRC-2001. The Morse HF licensing requirement therefore will be with us for some time to come.

Even when the ITU nations agree to abolish the manual telegraphy requirement (which will surely happen), it does not mean that it will automatically end in each of the countries that make up the ITU. It will merely mean that a country would be free to drop the requirement if they so desire.

FCC rule making necessary to drop the code requirement in the United States would probably take another couple of years. Plan on the Morse code being a licensing requirement for at least another five years, and it could more! My guess is

National Volunteer Examiner Coordinator, P.O. Box 565101, Dallas, TX 75356-5101 (817-461-6443)

that the manual telegraphy mode will be around *forever* for those who want to use it. My objection is forcing the mode on otherwise qualified radio amateurs who have no interest in using the mode.

Q: Why does a person have to pass lower class amateur radio written license examinations if he can pass the higher ones?—*G. Adams, Carmel, CA*

A: In a nutshell, because the written amateur license examinations are "additive." That is, most of the question pools from which the written examinations are constructed relate to a specific license.

For example, the Novice questions cover beginning privileges, practices, and equipment. The Technician question pool is more oriented to VHF operation, while the General class covers HF. The three lower class (Novice, Technician, and General class) question pools contain questions on RF safety. There are none in the Advanced and Amateur Extra class pools. The higher class examinations cover more advanced construction practices and examining others for amateur tickets, and so fourth.

You need to know all of the subject matter included in the lower class exams, not just the material covered in the Extra class exam. Thus, the question pools serve as an outline of what you need to know to advance up the amateur radio ladder. You can't start at the top. You need to climb up one rung at a time, learning as you go.

Each written exam question pool is revised every four years. On July 1, 1998 new Element 3B (General class) questions will be implemented. There are nearly 2300 questions in the five different question pools.

On the other hand, you can go straight to the fastest speed Morse code examination if you want to. And if you can pass the 20 words-per-minute test, you do not have to take the code exam at 5 or 13 wpm.

Q: Why can't I buy a new amateur linear amplifier with 10 meters included? Is it legal to use an amplifier on 10 meters? —*L. Pergola, Omaha, NE*

A: In 1978 the FCC outlawed the commercial manufacture and sale of external RF power amplifiers and kits capable of boosting any signal between 24 MHz and 35 MHz. The reason for the ban was to put a stop to some questionable manufacturers who were making CB linear amplifiers under the false pretense that they were for the Amateur Service.

Since the 10 meter amateur band is so close to the 11 meter citizens band, even legitimate amateur amplifiers work well at 27 MHz. Furthermore, unlicensed operators were using amateur linears to run high power on the "fuzzy frequencies" above and below the CB band.

The FCC also adopted rules to require type acceptance (government equipment approval) of *any* amplifier capable to operation below 144 MHz. One of the new rules was that the amplifiers had to be driven with at least 50 watts of RF input power. And any amplifier that had special instructions or features (such as accessible wiring, controls, or circuit boards) that when altered would permit operation between 24 and 35 MHz would not be approved.

The FCC does, however, permit appropriately licensed amateurs to restore 10 meter capability in one commercially available amplifier or to homebrew a single 10 meter amplifier for their own use. The actual modification or construction cannot be done by a dealer. You must do it yourself or have another amateur do it for you. However, a licensed amateur may sell his 10 meter equipped amplifier to a dealer (or another amateur). It is the responsibility of the seller to ensure that the buyer is properly licensed.

Q: I'm confused! How are amateur radio callsigns determined. Who gets what?—*A. Haywood, Waterloo, IA*

A: With millions of radio stations of all types furnishing a variety of communications services throughout the world, it is necessary that these transmissions carry distinguishing callsigns. As a general rule, all transmitting stations of the world are required to identify themselves at regular intervals.

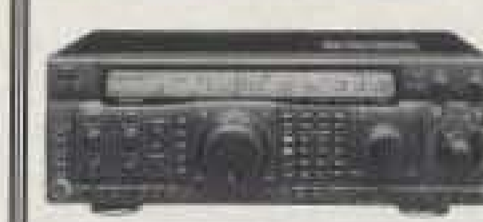
Station callsigns have a three-fold purpose. They identify the *nationality* of the station, they identify the *type* of station, and they identify the *individual* station. Radio callsigns, in effect, are the "license plates" that identify communication traffic on the radio highways.

Since 1927, and by international agreement, the first characters of a callsign indicate the country in which the station is authorized to operate. The callsign prefixes are coordinated by the ITU.

The United States is assigned three prefix letters—N, K and W—and shares the initial letter A with some other countries. The letter A is assigned to the Army and Air Force; N to the Navy and Coast Guard, and K and W to other domestic stations, government and non-government.

Part 2 of the FCC Rules details the composition of all callsigns and the blocks of letters that are assigned to each radio service. According to law, U.S. amateur station callsigns must consist of 1 or 2 prefix letters, 1 digit, and up to 3 suffix letters. The prefix letters may be K (or KA–KZ), N (or NA–NZ), W (or WA–WZ), or AA to AL. (The single prefix letter A may not be used.) The numeral is 1 through zero (Ø) and the suffix letter blocks are A to Z, AA to ZZ, and AAA to ZZZ.

Using the Part 2 guidelines, the FCC issues amateur callsigns under three different programs. An amateur's first callsign will be assigned in strict sequence from an alphabetized list. This is known

as the **Sequential Call Sign System.** There are four callsign groupings (A,B, C, and D) with the shortest callsigns being reserved for the higher class amateur licenses.

For example, W5YI is a Group A (1-by-2 letter format) callsign. Group B callsigns are 2-by-2 format, Group C are 1-by-3 format, and Group D at 2-by-3. Amateur Extra class amateurs qualify for Group A (or lower group) callsigns, Advanced class Group B, Technician, Tech Plus, and General class Group C and Novice Group D. When all of the callsigns have been used up within a block, callsigns from the next lowest block are sequentially assigned.

Amateur radio operators are permitted to change their sequential callsigns without a cost, but they may only request another sequential callsign appropriate for their license class grouping. You cannot choose a specific call sign under this program.

The Vanity Call Sign System permits amateurs to select an exact callsign of their choice—that is, as long as it contains a format appropriate for their license class.

Amateur *Extra* class operators may select any available Group A, B, C, or D callsign.

Advanced: Group B, C, or D.

Technician, Tech Plus, or General C class: Group C or D.

Novice: Group D only.

You may also select any numeral—that is, the digit does not have to coincide with your geographical radio district.

A callsign is normally assignable two years following license expiration or death of the amateur who previously held the callsign. Unlike sequential callsigns, which are free, a vanity callsign costs $50, payable to the FCC. Club stations and close relatives may select the callsign of a deceased member of the club or family.

You request a vanity callsign by using FCC Form 610-V, either the paper variety or the electronic document located on the Internet at the FCC's website.

The Special Event Call Sign System permits amateurs to temporarily use a 1-by-1 format callsign during an event of special significance. You merely substitute the special event callsign for your own during the station ID announcement. Once an hour you must also transmit your FCC-assigned callsign.

An example of a 1-by-1 callsign is K1A. There are 750 of them. The format of each callsign consists of the single letter K, N, or W followed by a single digit and a single letter A to Z, except X, which is not available to amateur stations.

Any licensed amateur may temporarily use a 1-by-1 callsign during a "special event." You do not have to hold any special class of license to qualify for a 1-by-1 special event callsign. The use of these callsigns is managed by "coordinators" of which we (W5YI) are one. You can contact us via e-mail at: <fmaia@internetMCI.com> to obtain one. A special event callsign may be used for a maximum of 15 days. There is no cost to reserve a 1-by-1 callsign.

Q: I keep hearing old timers talk about the "Incentive Licensing" fiasco of the '60s. What is that all about?—*G. Rogers, Pueblo, CO*

A: It all started in 1965 when the FCC released a *Notice of Proposed Rulemaking* proposing to make incentive licensing and distinctive callsigns a reality.

The reason given for need of an Incentive Licensing program was to pump more interest into amateur radio, since it had stagnated badly due to CB and strides by industry. ". . . there must be a continuing movement towards the goals set forth in *Section 97.1* of the Rules," the FCC said.

The objective was to encourage the more than 100,000 General class and 40,000 Advanced class licensees to learn more about electronics and upgrade to the higher class licenses. More knowledgeable amateurs would make a better contribution to the radio art—or so it was thought.

The FCC had also proposed an intermediate "stepping stone" between the Advanced and Extra class ticket, but later decided against it. The new Amateur First Class license was to have required 16 wpm code and a written examination more difficult than the Advanced.

The motivation, or the "incentive," for amateurs to upgrade would be so-called "reserved frequencies" that would be available to Advanced and Extra class licensees.

In late 1967 the FCC began a three-phase program to "remodel and revitalize" amateur radio. New rules re-established the Advanced class (which had not been available for 15 years) between the General and Extra license classes.

The following year Extra class ticket holders got their "incentive"—exclusive 25 kHz CW and phone segments at the lower edge of the 75/80, 40, 20, and 15 meter bands. The "Incentive Licensing" program had the support of the American Radio Relay League.

The problem was that the reserved frequency blocks came from what was previously General class spectrum. When the final phase of "Incentive Licensing" went into effect in 1969, General class operators found that they had to upgrade to reclaim frequencies that were previously available to them. Many never forgave the ARRL for supporting the loss of their frequencies.

See you next month.

73, Fred, W5YI

PROPAGATION

BY GEORGE JACOBS, W3ASK

THE SCIENCE OF PREDICTING RADIO CONDITIONS

47th Anniversary and Counting!

Although this column will appear in the March 1998 Issue of *CQ*, it is being written just moments before that famous ball at Times Square drops to herald the New Year, 1998. This is always a vivid reminder to me that another year has passed, and that a new one has begun. Forty-seven years have gone by under my editorship of this column, and the beginning of my 48th year is marked by this month's column.

I have written this column in more than two dozen different countries throughout the world, and twice under wartime conditions, and have never missed a deadline. I have reported propagation conditions during most of sunspot Cycle 18, throughout the recording-breaking Cycle 19, and during Cycles 20, 21, and 22. I am eagerly looking forward to continuing to bring propagation information to the amateur radio community through the great years that lie ahead in the new Cycle 23.

As I have mentioned many times before, my biggest reward for writing this column is the comments that I receive from readers and users of the information I write about. This is the fuel that continues to energize me to write this column each and every month, no matter where I might be.

Solar Cycle Progress

The Royal Observatory of Belgium reports a monthly mean sunspot level of 39.3 for November 1997. This results in a 12-month running smoothed sunspot number of 18 centered on May 1997. This is an increase of one point from the previous month's level. During November daily levels of solar activity varied between a high of 58 on the 3rd and a low of 19 on the 10th. Cycle 23 has been a very slowly rising cycle to date. It began during May 1996 with a count of 8, and has increased only by a count of 10 to reach 18 at the end of its first year.

According to daily observations made at Penticton, British Columbia by the Dominion Radio Astrophysical Observatory of Canada, the adjusted mean level of 10.7 cm solar flux for November 1997 was 98. This results in a 12-month running number of 79 centered on May 1997. The level of 10.7 cm flux is paralleling very closely the slow increase of the new cycle.

A smoothed sunspot number in the low 50s and a 10.7 cm solar flux level of approximately 115 are forecast for March 1998, as the new cycle is expected to increase more rapidly during 1998.

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LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for March 1998

Propagation Index	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 4-5, 11, 18, 24	A	A	B	C
High Normal: 2-3, 8, 12-13, 17, 23, 25-26, 31	A	B	C	C-D
Low Normal: 1, 6-7, 10, 14-15 19, 22, 27-28, 30	B	C-B	C-D	D-E
Below Normal: 9, 16, 20, 29 25	C	C-D	D-E	E
Disturbed: 21	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 S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S6, with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find the *propagation index* associated with the particular path opening from the 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 path opening for any given day of the month. For example, an opening shown in the Propagation Charts with a *propagation index* of 3 will be fair-to-good (C-B) on March 1st, good (B) on the 2nd and 3rd, excellent (A) on the 4th and 5th, etc.

Scientists Finally Agree On Start and Growth of Cycle 23

A year ago we reported in this column the results of a panel of the world's leading solar scientists who met during September 1996 to review the progress of Cycle 22 and to make forecasts for Cycle 23. There was disagreement at that time among the experts in determining when Cycle 22 had ended and when Cycle 23 had begun.

In the year since that meeting, a slow but steady increase in monthly sunspot numbers and 10.7 cm solar flux levels has made it clear that Cycle 23 began during May 1996 with a sunspot value of 8.1.

In light of this and other new data, 11 of the 12 original panel members met again during September 1997 in Sunspot, New Mexico at the National Solar Observatory/Sacramento Peak Visitors Center. The panel agreed that with the data confirmed, there was no compelling reason to alter their previous prediction of the amplitude and shape of Cycle 23. The following statement now reflects the opinion of the panelists regarding the expected behavior of Cycle 23. It should be a large

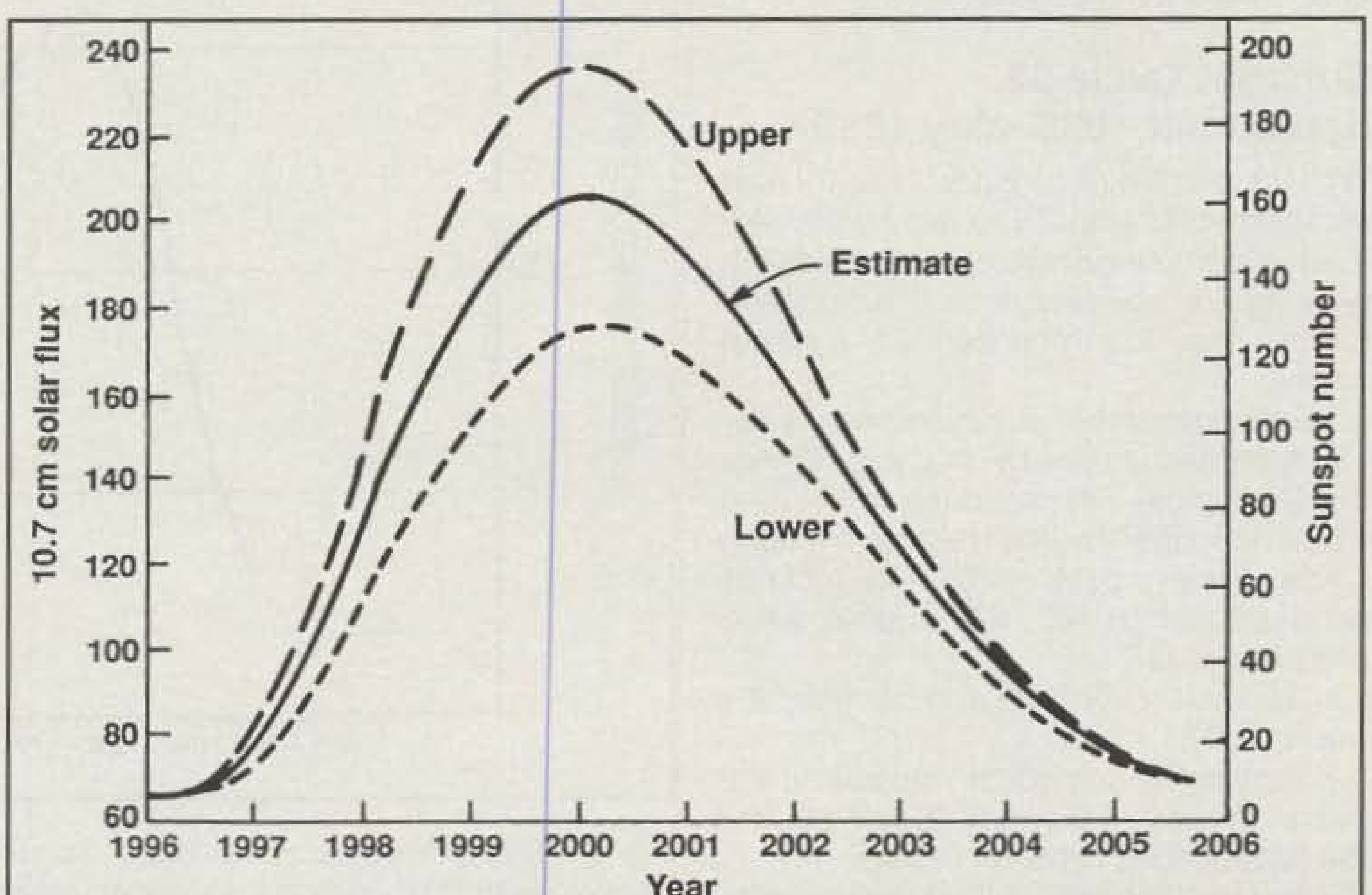


Fig. 1– Blue-ribbon panel of solar scientists confirm earlier prediction for sunspot Cycle 23. It is expected to be of near record intensity, and accompanied by great HF propagation conditions. (Original graph by SEC/NOAA)

Month	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
January		18	58	142	151	148	124	71	37	24	10
February		20	65	145	151	148	116	69	35	23	10
March		22	71	150	152	147	108	67	34	22	10
April		24	78	154	149	146	103	64	34	21	9
May		26	84	157	147	146	100	60	33	19	8*
June		28	94	158	144	145	97	56	31	18	
July		31	104	159#	141	146	91	55	29	17	
August		35	114	158	141	147	84	52	27	15	
September	12	39	121	157	142	145	80	49	27	13	
October	13	44	125	157	142	142	76	45	27	12	
November	15	47	130	158	142	138	74	41	26	11	
December	16	51	138	154	144	132	73	39	26	11	

*Table I– Smoothed sunspot numbers recorded for the entire life of sunspot Cycle 22 between September 1986 and May 1996. The peak of Cycle 22 is shown with #; the end of the cycle is shown with *.*

cycle, but it is not expected to exceed Cycle 19, the largest known solar cycle, which reached a smoothed monthly maximum of 201 in March 1958.

The panel confirmed its earlier predictions that:

• Cycle 23 will have a smoothed monthly sunspot number maximum of 160, with a range of 130 to 190.

• Cycle 23 will have a smoothed monthly 10.7 cm solar flux maximum of 205 with a range of 175 to 235.

• Cycle 23 will reach its maximum during March 2000 with a range of June 1999 to January 2001.

Fig. 1 shows the panel's prediction for Cycle 23. The entire panel report can be found under "SEC Publications: Solar Cycle 23 Project Summary of Panel Findings Sept. 1997 Update" on the home page of the Space Environmental Center at <http://www.sec.noaa.gov>.

Sunspot Cycle 22 September 1986–May 1996

With the demise of sunspot Cycle 22 now established as May 1996, we can review it as a completed cycle. The following were its vital statistics, with a comparison to the previous recorded 21 sunspot cycles.

• *Sunspot number at maximum of cycle:* 159 recorded in July 1989. Cycle 22 was the third most intense recorded, being exceeded only by the record-breaking Cycle 19 with a peak of 201 and Cycle 21 which peaked at 162. (Mean peak value of all cycles is 113.)

• *Sunspot number at end of cycle:* 8.1 (mean is 6).

• *Ascending period to maximum:* 2.8 years (mean is 4.0 years). Cycle 22 was the fasted rising cycle on record.

• *Descending period from maximum to minimum:* 6.8 years (mean is 6.8 years).

• *Cycle length:* 9.7 years (mean is 10.8 years).

• *Interval between two adjacent peaks:* 9.7 years (mean is 10.9 years).

Table I is a list of the entire monthly smoothed sunspot numbers recorded for sunspot Cycle 22. Fig. 2 displays this data graphically.

March Propagation

March is a month of equinoctial propagation on the HF bands. This is typified by fewer east-west openings on 10, 12, and 15 meters; more hours of daylight in which DX openings can occur on 15, 17, and 20 meters; fewer hours for DX openings on 30, 40, 80, and 160 meters; improved openings on all bands between the northern and southern hemispheres; and seasonal increase in static levels on all bands.

During much of March and continuing into early April, relatively similar HF propagation conditions exist in the temperate regions of both the northern and southern hemisphere (where it is fall) as compared to the more extreme ionospheric conditions that exist when it is summer in one

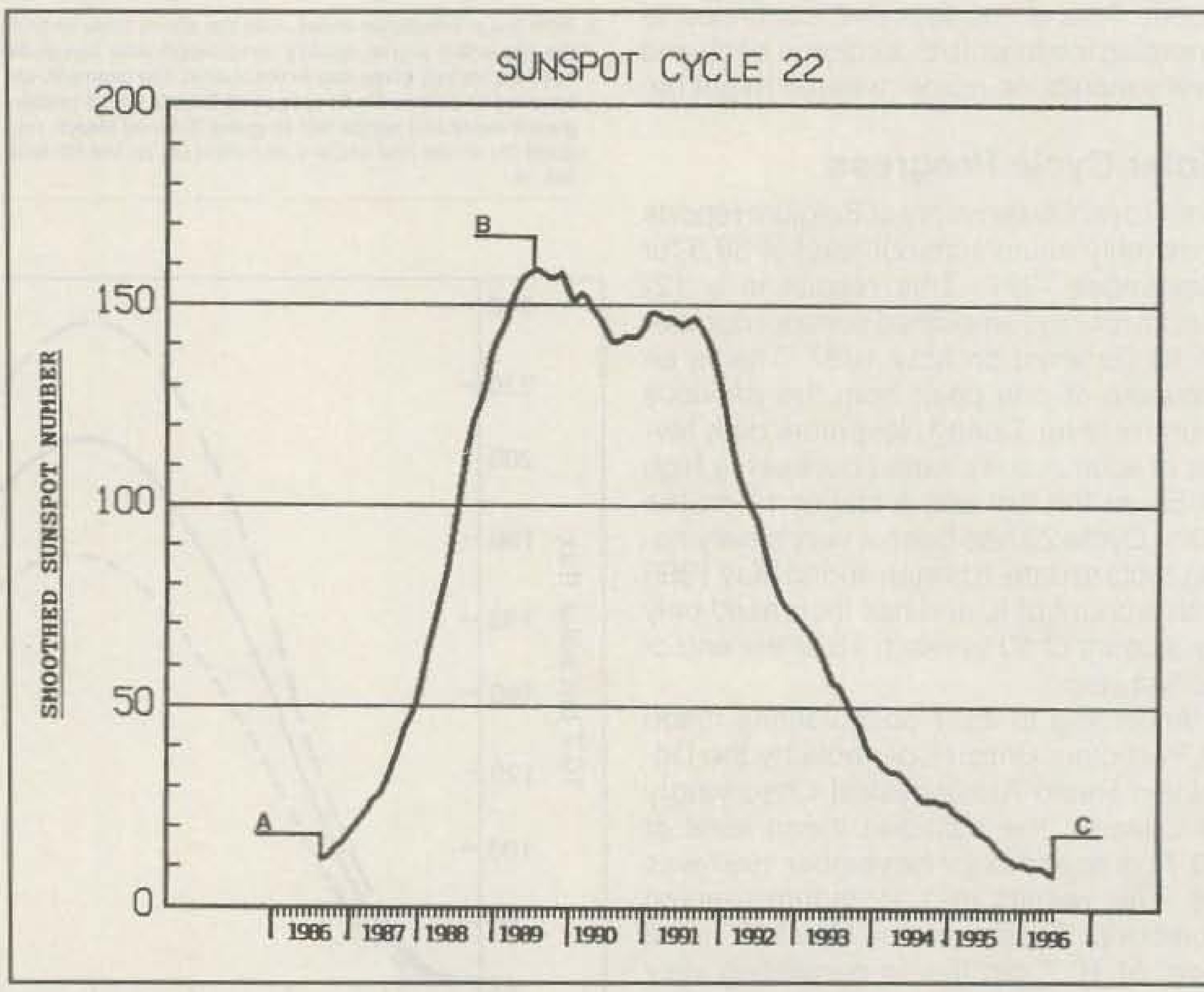


*Fig. 2– Sunspot Cycle 22 epilogue, September 1986 to May 1996. **A** indicates start of cycle with a smoothed sunspot number of 12 during September 1986; **B** notes the cycle peak of 159 recorded during July 1989, and **C** points to the end of the cycle with a count of 8, recorded during May 1996. Cycle 22 was the third most intense and the fastest rising cycle recorded.*

hemisphere and winter in the other. As a result, DX openings between both continents are usually at their best during March and April and again during September and October. Good inter-hemispheric openings are forecast this month for all bands between 10 and 40 meters, with some openings possible on 80 and 160 meters as well. Typical of such openings are the paths from the U.S. to South America, to Australasia, and to central and southern regions of Africa, etc.

The best times to look for inter-hemispheric openings are shortly before local sunrise and again shortly *after* local sunset on the 30, 40, 80, and 160 meter bands, and for an hour or two after sunrise and again from an hour or two *before* to about an hour or two *after* local sunset on 20 meters. For 10, 12, 15, and 17 meter interhemispheric openings check towards the southeast and south from a few hours before noon through the early afternoon hours. Check later in the afternoon for openings toward the south, southwest, and west.

On a worldwide basis it should be a toss-up between 15 and 20 meters for the best DX band during the *daylight* hours of March. Some 10, 12, and 17 meter openings should also be possible during the daylight hours. From sundown to midnight, DX honors will likely be shared among 20, 30, and 40 meters, with 20 opening towards the south, southwest, and west, and 30 and 40 opening towards the east, north, and south. Some fairly good 80 meter DX should also be possible during this time period, with conditions much like 40 meters, but with weaker signals and high noise levels. From midnight to sunrise, best DX bands should be 40 and 80 meters, with some openings also possible on 160 meters. Openings during this time period should peak towards the south and west. For more detailed information, refer to the DX Propagation Charts which appeared in last month's column. This month's column contains Short-Skip Propagation Charts centered on Alaska and Hawaii. The Short-Skip Charts contain band-opening information for predominately one-hop paths, ranging in distances between approximately 50 and 2300 miles.

For day-to-day changes in HF propagation conditions expected during March, see the Last-Minute Forecast, which appears at the beginning of this column.

VHF Ionospheric Openings

Trans-equatorial (TE) scatter propagation usually improves during March and the spring season, and some 6 and possibly 2 meter openings should be possible by way of this mode during the month. TE openings must cross the magnetic equator at or near a right angle, and the best time for such openings is between 8 and 11 PM local time. Conditions favor openings between the southern tier states and the southern countries of South America, but some openings may be possible from northern states as well.

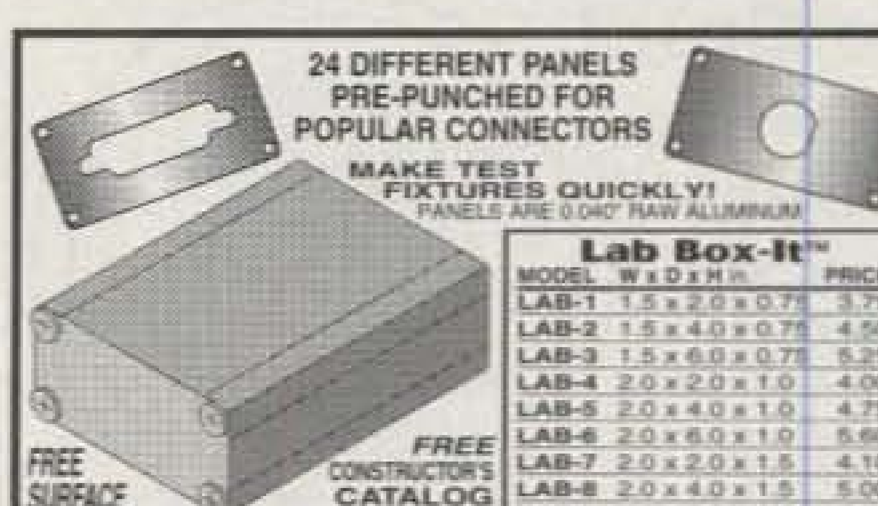
Auroral activity also tends to increase during March, and there is a good chance for a number of VHF ionospheric short-skip openings by means of auroral-scatter propagation. Check the Last-Minute Forecast for those days expected to be Below Normal or Disturbed, since these are the days on which VHF auroral openings are most likely to occur during March.

A seasonal increase in short-skip openings due to sporadic-*E* propagation is also expected during March, and an occasional 6 meter opening should be possible during the month. Short-skip openings due to sporadic-*E* propagation generally occur during the daylight hours over distances between approximately 1000 and 1300 miles.

Not much meteor activity is expected during the month, although some VHF meteor-scatter-type openings may be possible when minor meteor showers peak on March 15–16 and March 25–26.

73, George, W3ASK

(Charts are on following page)



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
March & April 1998
Band Openings Given In Local Standard Time At Path Midpoint Using 24-Hour Time System

Band	Distance Between Stations (miles)			
(meters)	*50-250*	*250-750*	*750-1300*	*1300-2300*
10	Nil	Nil	08-09 (0-1) 09-12 (0-2) 12-14 (0-3) 14-16 (0-2) 16-18 (0-1)	08-09 (1-0) 09-12 (2-1) 12-14 (3-2) 14-16 (2-3) 16-17 (1-2) 17-18 (1) 18-20 (0-1)
15	Nil	08-09 (1) 09-15 (0-2) 15-17 (0-1)	07-08 (0-1) 08-09 (1) 09-10 (2) 10-15 (2-4) 15-17 (1-3) 17-18 (0-2) 18-20 (0-1)	07-08 (1-0) 08-09 (1) 09-10 (2-3) 10-15 (4) 15-17 (3) 17-18 (2-3) 18-20 (1-2) 20-21 (0-1)
20	11-13 (0-1) 13-15 (0-2) 15-16 (0-1)	07-10 (0-1) 10-11 (0-2) 11-13 (1-3) 13-15 (2-4) 15-16 (1-3) 16-18 (0-3) 18-20 (0-2) 20-07 (0-1)	06-08 (1-2) 08-10 (1-3) 10-13 (3-4) 13-15 (4) 15-18 (3-4) 18-20 (2-3) 20-22 (1-2) 22-06 (1)	06-07 (2-1) 07-08 (2) 08-10 (3) 10-15 (4-3) 15-18 (4) 18-20 (3-4) 20-22 (2-3) 22-02 (1-2) 02-06 (1)
40	06-07 (1-2) 07-09 (2-3) 09-18 (3-4) 18-19 (2-3) 19-21 (1-2) 21-00 (0-1)	06-07 (2-3) 07-09 (3-4) 09-11 (4-3) 11-13 (4-2) 13-15 (4-3) 15-18 (4) 18-19 (3-4) 19-20 (2-4) 20-21 (2-3) 21-00 (1-2) 00-06 (0-1)	06-07 (3-2) 07-08 (4-2) 08-09 (4-1) 09-11 (3-1) 11-13 (2-1) 13-15 (3-1) 15-17 (4-2) 17-19 (4-3) 19-20 (4) 20-21 (3-4) 21-00 (2-3) 00-02 (1-3) 02-06 (1-2)	06-08 (2-1) 08-15 (1-0) 15-16 (2-0) 16-17 (2-1) 17-19 (3-2) 19-21 (4-3) 21-22 (4) 22-00 (3-4) 00-02 (3) 02-05 (2-3) 05-06 (2)
80	07-08 (2-3) 08-11 (3-4) 11-18 (4-3) 18-20 (3-4) 20-22 (2-3) 22-02 (1-2) 02-05 (1) 05-07 (1-2)	07-08 (3-2) 08-11 (4-1) 11-16 (3-0) 16-18 (3-2) 18-20 (4-3) 20-22 (3-4) 22-02 (2-4) 02-05 (1-2) 05-07 (2)	07-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-02 (4) 02-05 (2-3) 05-07 (2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-02 (4-3) 02-05 (3-2) 05-07 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3) 22-03 (4) 03-05 (4-3)	05-06 (1) 06-19 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-2) 03-05 (3-2)	05-06 (1-0) 06-19 (0) 19-20 (1-0) 20-22 (2-1) 22-03 (2) 03-05 (2-1)

ALASKA
March & April 1998
Openings Given in GMT

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	21-23 (1)	20-21 (1) 21-23 (2) 23-01 (1)	20-23 (1) 23-02 (2) 02-05 (1)	06-13 (1) 07-12 (1)*
Central USA	21-00 (1)	20-22 (1) 22-00 (2) 00-02 (1)	20-00 (1) 00-02 (2) 02-04 (3) 04-05 (2) 05-06 (1)	07-09 (1) 09-12 (2) 12-14 (1) 08-12 (1)*
Western USA	21-01 (1)	20-22 (1) 22-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	18-21 (1) 21-00 (2) 00-03 (3) 03-05 (2) 05-07 (1)	06-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-15 (1) 09-10 (1)* 10-12 (2)* 12-13 (1)*

HAWAII
March & April, 1998
Openings Given in Hawaiian Standard Time

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	10-12 (1) 12-14 (2) 14-15 (1)	08-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	07-13 (1) 13-15 (2) 15-19 (3) 19-21 (2) 21-05 (1) 05-07 (2)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (2) 02-03 (1) 20-22 (1)* 22-01 (2)* 01-02 (1)*
Central USA	10-11 (1) 11-14 (2) 14-16 (1)	06-08 (1) 08-13 (2) 13-16 (3) 16-17 (2) 17-18 (1)	08-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-23 (2) 23-05 (1) 05-08 (2)	18-19 (1) 19-22 (2) 22-01 (3) 01-04 (2) 04-05 (1) 19-21 (1)* 21-02 (2)* 02-04 (1)*
Western USA	09-11 (1) 11-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-15 (4) 15-17 (3) 17-18 (2) 18-20 (1)	15-18 (4) 18-20 (3) 20-00 (2) 00-04 (1) 04-06 (2) 06-09 (4) 09-11 (3) 11-13 (2) 13-15 (3)	17-19 (1) 19-20 (2) 20-21 (3) 21-23 (4) 23-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-22 (2)* 22-04 (3)* 04-05 (2)* 05-06 (1)*

See explanation in "How To Use Short-Skip Charts" in box at the beginning of this column.

* Indicates best time for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a propagation index of (2), or higher.
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 20 and 40 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.

KENWOOD

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TS-870S

Extensive user-adjustable digital and analog filtering. DSP filter, no optional filters needed. Built-in RS-232C port for directly interfacing to a computer

TS-570D/S

6-bit DSP technology for superb audio quality on both transmit and receive. Large LCD display. Scrolling Menu system offers 46 types of functions. Automatic antenna tuner. TX: 160-10M Amateur bands (6M on S model), RX: 500khz to 30 mhz. Radio Control Program software allows PC control of radio. RS-232 computer port for up to 57,600 bps PC control. Dedicated packet port. Electronic Keyer built-in. Worlds first CW auto tune

NEW

TH-G71A

144/440Mhz FM Dual Bander. 6W VHF, 5.5W UHF at 13.8VDC. PC Programmable. 200 memory channels with alphanumeric display. MIL-STD 810E (rain & shock) CTCSS tone scan. Wide range coverage.

TS-50S

super-compact, 100 watt, 160m-10m transceiver, General Coverage Receiver. DDS(Direct Digital Synthesizer) with fuzzy control. AIP system. 100 memory channels. CW reverse. Menu system

TH-235A

Kenwood's new TH-235A (144MHz) handheld was designed to be user-friendly and offer all features one could need in an HT. The easy-to-use menu system, 60 memory channels and built-in keypad put everything you need at your fingertips. Features such as programmable squelch and DTMF memory will prove to you that the compact TH-235A was designed for utmost convenience.

TS-60S

50mhz all-mode operation. Max 90W RF output SSB,CW,&FM). 100 memory channels. DDS w/"fuzzy logic" control. AIP, IF shift(SSB&CW) and opt 500hz CW filter. Dual menu system

TS-790A

144Mhz/440Mhz dual-band operation. 1200Mhz unit(opt.). All mode operation. Satellite communications with Doppler effect frequency correction. 59 multi-function memory channels with lithium battery back-up

TH-22AT

144Mhz single band operation. MOS FET power module. Built-in DTMF keypad. 40 memory channels in E2PROM (plus 1 call channel). Multiple scan functions(VFO, call & memory). Dual scan stop modes(CO & TO)

TM-255A

144Mhz all-mode operation. 101 memory channels. DDS with "fuzzy logic" control. TF-SET (TX frequency set). DTSS selective calling with page. 1200/9600 bps packet capable

TM-261A

Memory indexing. Inovative menu setup method combines sophisticated features with simple operation. Programmable with a RX and TX tone(CTCSS) seperately

TM-742ABL

144/440 Mhz dual-band operation. Four band options to choos for tri-band operation: UT-28S, 28Mhz 50W; UT50S, 50Mhz 50W; UT220S 220Mhz 25W; and UT1200 1.2Ghz 10W. Dual/triple receive. 101 memory channels per band.

TM-V7A

2m/440mhz dual band. Built-in CTCSS, DTSS, and page functions. Guide mode serves as an on board instuction manual. Data connector for 1200/9600 bps packet. Detachable control panel. Cool blue reversible LCD. 280 memory channels. Programmable memory for storing five operating profiles

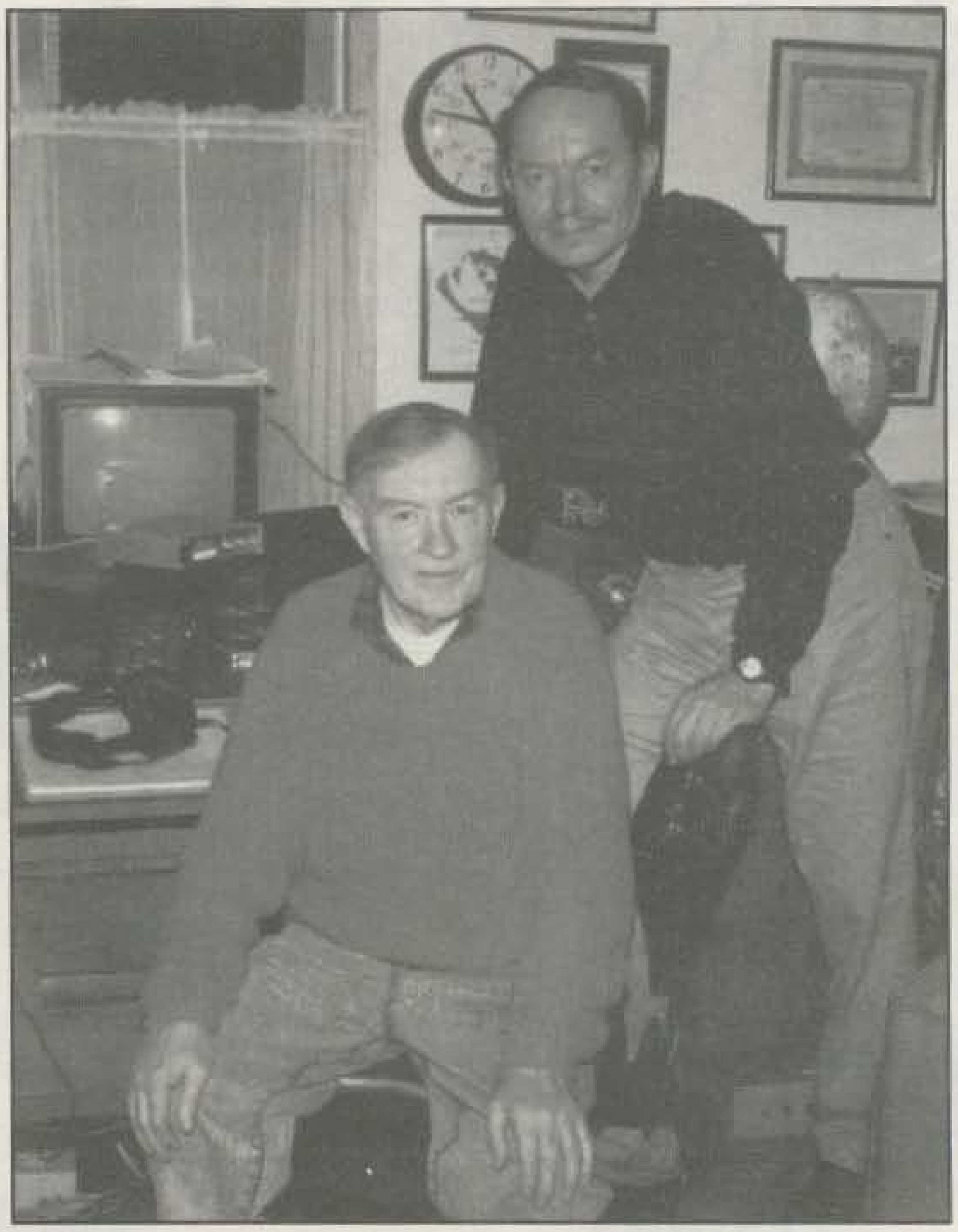
CONTINENTAL LEADERS

AFRICA		OCEANIA	
1.8	EA8ZS....93,960	1.8	No Entrant
3.5	EA8/OH1MA.....4,317,284	3.5	No Entrant
7	YL3IZ/MM....661,650	7	AH8A....2,897,880
14	**EA8AH....11,142,198**	14	**WH6CQH....3,771,486**
21	5X1T....1,465,820	21	4F3GDX....1,623,477
28	ZD8DEZ....243,648	28	*NH6YK....25,641
AB	**TS8A....11,526,732**	AB	**NH7A....8,570,552**

ASIA		SOUTH AMERICA	
1.8	UN2O....196,308	1.8	HC1HC....4,536
3.5	TA3W....916,880	3.5	YV4FZM....305,184
7	5B4MF....3,231,228	7	**ZX9A....10,787,128**
14	YM2ZW....1,833,400	14	LP5H....4,022,830
21	RZ9UA....373,828	21	ZX5J....10,312,104
28	JH6SQI....14,129	28	LU8AQE....559,630
AB	JY9QJ....5,446,170	AB	**P4ØV....14,761,773**

EUROPE		MULTI-SINGLE	
1.8	S54E....379,620		
3.5	4N1A....1,559,000	AF	**IZ9Z....11,616,531**
7	YT7A....2,161,452	AS	C4ØM....8,513,496
14	OK1RI....3,761,380	EU	HG1S....9,186,237
21	CT1FJK....162,470	NA	3E1DX....5,693,272
28	EA4DXP....14,490	SA	ZXØF....25,497,504
AB	**OT7T....5,197,648**	OC	JA1BRK/DU1....6,570,720

NORTH AMERICA		MULTI-MULTI	
1.8	VE3BMV/1....397,760		
3.5	6D2X....1,109,760	AF	No Entrant
7	*VE7SV....2,023,872	AS	JA3ZOH....3,907,578
14	WE9V....2,113,251	EU	9A1A....16,791,460
21	FM5GU....1,377,152	NA	**WP3X....23,297,736**
28	VP2VF....52,008	SA	LU4FM....18,473,910
AB	TIØC....13,481,773	OC	KH7R....19,816,220



Seated is Mr. 160, Jack, VE1ZZ. Standing behind is the '97 WPX Mr. 160, Yuri, VE3BMV.

power plant, Ormoc City, Leyte. . . . *4F5MW.* Ten years ago it was possible to win WPX from EU. Nowadays you have to work hard to get into top 5 even from Caribbean. No way HF contesting will die. . . . *4V2A.* This was a good one. Fair propagation after all, no equipment breakdown this time, solid catering backup by XYL, also I did not fall asleep. . . . *5NØT.*

Wow, I didn't think low-band condx could be any worse than during the ARRL phone weekend, but static crashes were 30-40 dB over 9 on Friday night and then got worse on Saturday night. Congratulations to OH1MA for a great signal and score. . . . *6D2X.* WPX is always an enjoyable contest. This was my first time operating from outside Canada. I'll be seeing everyone next year from the same QTH. . . . *8P9IJ.* A great pleasure to have been able to visit Malta, meet 9H1 friends, and operate the contest! . . . *9H3ZZ.* Lousy conditions. First contest in 30 years with no German QSO. . . . *CT1FJK.* It's my third international DX contest. It was fun. . . . *CX3DHT.* Condx terrible—on Saturday only a few USA stns. . . . *DJ6QT.*

Before the contest started were vfb condx to W/VE. After starting contest, the condx went down due to aurora. Missed strong DX signals for the first two nights, impossible to work some more US stations. Last night's condx came back, but unfortunately to that time, the WPX ended. That's life! . . . *DK8FD.* First WPX. Hard job with only a trap dipole. CU next time with better antennas. . . . *DL6DCX.* Frustrating to hear so many stateside above 3800 and only a few listened below the American phone band. It is so easy to operate split herewith reducing the noise level on receive. . . . *DL8PC.* First time in WPX. Lots of fun even with low power. Definitely back for more. Looking forward to the CW leg. . . . *EI6FR.*

My home QTH in Ukraine, only 70 km south of Kagul, Moldavia. Have the license ERØF until the end of 1997. . . . *ERØF.* Good contest but propagation was bad. I had no QSO with USA/VE station. I hope luck in the next year. . . . *EW1EA.* Had to pick a band to work at night because my daylight hours HAD to be split between Easter duties and decorating the bathroom! Not sure whether the paint fumes helped my powers of concentration or not, but I do know I had a lot of fun. . . . *GØKRL.* A very enjoyable contest working so many countries and prefixes in a short space of time. . . . *GØMRH.* Hard going. No opening to States! . . . *G3SEM.* Well, conditions stunk, plus I overslept on my last off period so I only operated just over 34 hours instead of 36.

GIØKOW, who was my alarm clock, is now sacked. All bands were terrible across the Atlantic. The West Coast just never really materialized. Oh well, roll on the CW contest. I prefer it anyway. . . . *GIØKOW.* My "old faithful" SB220 amplifier packed in when I had eight hours to go; lost about 2 hours trying to sort problem (without success!), so spent the last part of contest running 100 watts. . . . *GW4BLE.* All antennas are mounted on a balcony at the sixth floor of a building. . . . *I6NOA.* Minimum propagation. Very difficult to North America! . . . *IN3XUG.* I like working contests! CU agn. . . . *JA2CWU.* The 28 MHz band was dead asleep, but I was still alive calling CQ Contest! So fun! . . . *JH6SQI.* Too much sleeping! . . . *JK1KNB.*

I love the DX contest. . . . *JM6EBU.* Good contest but bad propagation. . . . *JQ1BVI.* Very difficult to work European and East Coast of USA because of poor condition. But I satisfied with number of QSO over 500. . . . *JR4QZH.* I thought that I did my best with my equipment. I was sorry I couldn't get any W-stations—"strange." . . . *JR5HCU.* As always a great fun contest. Aloha and mahalo to all. . . . *KH6FKG.* Low sunspot activity and right in the center of town with an old 12 AVQ is not a good combination! . . . *LA8GK.* Where were Europe and Japan? . . . *LU5DSE.* The propagation compared to last year was really bad especially to the USA. I've made only about 55% of QSOs compared to previous year, but had lot of fun as always. . . . *OK1RI.*

My second edition of the WPX contest and it was great to work some new prefixes for my WPX award. Achieved the WPX Award of Excellence as a SWL, but still have a long way to go as a licensed ham. . . . *ON4CAS.* Poor conditions on 75 and 20 to USA. Not a single W on 15. . . . *OT7T.* A good contest but I think that running <100 watts on 80 meters in Europe must be likened to competing in the Indianapolis 500 on a bicycle. . . . *OZ2ZZZ.* Hope next year better condx. The top hit for me was ZXØF on three bands. . . . *PAØKDM.* Not to win but just for fun and to increase operating practice. . . . *PA3GZC.* Sorry, noisy neighbors did not let me work with full power. . . . *RAØFA.*

Very happy to make first time from this new QTH

This is the 80 meter station and antenna of Naoki, JM1LPN/1.

One of the top EU stations on 40 is Elemer, HA9RE.

From left to right are VR2SS, JA1NXK, 7K2BLP, JA1BRK, and 7L1FPU, the ops of Oceania multi single leader JA1BRK/DU1.

over 3000 QSO. Of course such very poor propagations on HF, but 7 MHz was fine with new 2-ele Yagi by Cushcraft. . . . *RN6BY.* Finally I succeeded in participating in a contest (illness, broken antenna, snow crossed my plan in January and February). I was satisfied with the antennas and contest, but I was sorry the propagation was so bad. No openings to JA and USA! In the future I'll try to be on from one of the DXpedition locations. . . . *S5ØR.* Very poor conditions, to big A factor of geomagnetic activity and aurora. So that was all. What I can do? I'm waiting sunspot jump. . . . *S51AY.* Poor condx, but I was sole S56 obliged to give mult! . . . *S56A.*

First WPX SSB in years. CU in the CW part. . . . *SM2DMU.* I am licensed in Greece for "C" class, meaning that on HF band I can transmit until the limited power of 50 watts. . . . *SV7CLI.* All band bid provides me with gorgeous choice of "highest point rate band." Away with single band frustration (no takers) on this one. Activity has increased in all bands for WPX without a doubt, especially low freq. . . . *TIØC.* This was my first Single Op Assisted and first contest with my new tribander A4S. A lot of fun. See you during CW party. . . . *TM7XX.* Almost nothing was heard from the west through this Zone 15 megawatts wall in north-east corner of Europe near Asian border. . . . *UA1OMS.* Very good contest, but very poor conditions. . . . *UA9CI.*

QSL via W3HNK. . . . *UK7F.* It was my pleasure to take part in this contest. . . . *UN2O.* Almost no propagation to the US. Very short opening to Japan. . . . *UT4UZ.* Great contest. Worked my farthest DX (AH8A), then bettered it the next evening (3DA5A)! . . . *VA3JFF.* What a static bombardment second night! . . . *VE3BMV/1.* One of these years I'll mount a serious 36 hour effort! Had a great time, thanks to all contacts, and see you in the WPX CW! . . . *VE3STT.* Murphy postponed arrival until the 47th hour. Only had to operate barefoot for 45 minutes. Conditions were yuk! . . . *VE7AV.* This was my 424th contest. Conditions were worse on the second day. For a long time only CT3BX came through and I had worked him already. . . . *VK2APK.*

The WPX is like a box of chocolates—you never know what you are going to get! . . . *VK2ARJ.* I didn't plan to enter but the propagation was good enough for me to QSO using a wire dipole only. Result: some new countries for my log! A great pity that many of the big stations (genuine 5x9 to us in South Pacific) didn't turn their beams to us at the end of the day! What happened to Europe?. . . . *VK4MOJ.* Abandon 36 hour experiment. Bring back 30 hour rule! . . . *VK5GN.* A very enjoyable contest, my first attempt on my own. . . . *VK6NU.* Incredibly low score for amount of time expended. Mountains to N/E/W precluded runs to U.S. and Europe. . . . *WP2/WI9WI.* Very bad propagation this year. I did not work any JA or W stations. . . . *YL2TW.*

YQ2R is a special call for the 1997 WPX Contest from YO2KJI Children's Radioclub from Resita. First time YQ2 prefix "on air." Special thanks to Valy, YO2LDC, for his cooperation (equipment). . . . *YQ2R.* This was my 22nd CQ WW WPX Contest SSB and my 1905th contest log entry at all. . . . *YU7SF.* Biggest disappointment: The linear amplifier high-voltage plate transformer failure while wife calling CQ DX to try to keep a clear frequency 20 minutes before contest started, which made me lose 5 hours while trying in vane to repair it. . . . *YW5S.* Highlight was getting called by V73AT, 12000+ miles away at 10:15 PM on 10 meters. Would like to claim longest distance QSO on 10 meters, ZD8 to V73! . . . *ZD8DEZ.*

Station Operators Multi-Op Single Transmitter

3A/DF8XC: DL1YFF & DF8XC. **3DA5A:** JM1CAX & JH7PKU. **3E1DX:** HP1VXH & HP1XBI. **9AØC:** 9A3TF, 9A3CY, 9A7GTJ. **9A1CEI:** 9A3RE, 9A6TCE, Mark, Hrle. **9A1CHY:** 9A4AI, 9A6TEC, Goricki. **9A7A:** 9A7V, 9A8A, 9A2ME, 9A3OS, 9A3TR, 9A4RX. **9M6TCR:** KQ1F & K1XM. **AAØYX:** AAØYX & KGØZI. **AE5T:** AE5T & KJ5SU. **C4ØM:** 5B4AFM & 5B8AH. **CK7U:** VE7WRA, VE7WNA, VE7TTQ, VE7CDL. **CT1EGF:** CT1EGF, CT1DSJ, CT2FUR. **CV1T:** CX2TL & CX8CP. **DFØHTE:** DF7ATW, DH5SBE, DK1SAM, DL1SEL, DL3SBI. **DK7WJ:** K7WJ, KC5RFB, NØMX, WY1X. **DLØSLZ:** DL1AQU, DL3ARK, DGØOGF, DE1SLZ. **DX1E:** 4F1EJD, DU1BVD, DU1KQG, DU1OOP, DY1FDD, DY1FYU, DY1RAN, DY1RSM, DY1FLE, DU1MQA, Eric, Naisa, Richie, Aida. **EA3BT:** EA3BT & EA3AOK.

ED1WPX: EA1US, EA1DAX, EA1FEQ. **ED1WWE:** EA1BTO, EA1CJJ, EA1FAU, EA1FDI, EA1FFH, EC1CFD. **ED4RKU:** G. Zobizarreta, J. Canales, J. Lopez, R. Fernandez, J. Bautista. **ES5Q:** ES5MC, ES5RY, ES5RW, ES5RN, ES5QX, ES5MG. **EU5F:** EU6DX, EW6MM, EW6EW, EW6AF. **EX9A:** EX2M & EX7MM. **F5KAC:** F6JSZ, F-16353, F-173Ø3. **F5KIN:** F5IXR, F11556, F16156. **FK8KAB:** FK8AH, FK8FS, FK8FU, FK8FK. **GW7A:** GØKXL, GØDBE, GØPZO, G4WSE, GØSTU, G4NXG, GØVBD, GØIEQ, G1AOF. **HA8KCI:** HG8DK, HA8EN, HG8LVS, Peter. **HG1S:** HA1TJ, HA1DAC, HA1AH, HA1AV, HA1DAE, HA1BN. **HG4DFR:** Akos, Gyorgy, Janos, Ferenc, Tibor, Zoltan. **II2K:** I2KHM, IK2SGF, IK2ZJJ, IZ2AVK. **II7P:** IK7EZP, IK7DXP, IK7JWX. **IK2HKT:** IK2HKT & IK2CIO. **IO2L:** I2OKW, IZ2ACZ, IZ2HAJ, IK2YYE.

IQ4T: IK4HVR, IK4SXJ, IK4WMH, IK4TVP, IK4ZHH, IK4AKS, I4IFL. **IQ8X:** IK8UND & IK8HCG. **IR4T:** I4JMY, IK4IEE, IK2QEI. **IT9KWF:** Club Group. **IZ9Z:** I4UFH, IT9GSF, IV3TAN, IK2SGC, IT9EQO. **J41W:** SV1DPJ, SV1CIB, SV1CDN. **JA1BRK/DU1:** JA1BRK, JA1NXK, 7L1FPU, 7K2BLP, VR2SS. **JA1YKX:** JQ1VNM, JH4OWG, JQ1PCT, JG1EGG. **JA2ZJW:** JH2CMI & JK2XXK. **JE6ZIH:** JR6GKT, JF6DEA, JK6SEW, JI6BRB. **K5ZD:** K5ZD, K5GA, W5ASP. **KB1BQZ:** KA1VMG, KB1LN, N1HRA, K1JN. **KC2AOZ:** N2DEM & KA2CDJ. **KC7V:** KC7V & N7MB. **KD8SQ:** KD8SQ & KB8YNW. **KO7X:** KO7X, W7CT, NG7M. **KO7Z:** KF6HIN & K6PU. **KP3P:** KP3P, KP4TQ, NP3A, KP4WK, KP4XM. **KT3T:** KT3T, NE3F, KT3O. **KY4DX:** K4WW, K4AT, N4GN. **KY6M:** KB6HRB & KC6UCH. **KZ6X:** N6KI, WB6NBU, K6AM, KE6WEO, N6UZH, KD6QK, N6NC, N2UE, KE6SQI.

L4ØH: LU9HOA, LU4HTW,LU4HKN, LU4HMF, LU2HQI. **LU1NF:** LU1NDC, LU8NAR, LU2NAA, LU4NAD. **LU3VAL:** LU2VDP, LU3UAT, LU3VMS, LU8UAR, LU8VDP, LU9VI. **LY1DQ:** LY1DQ, LY1DT, LY3BHY. **LZ9A:** LZ1JK, LZ1JY, LZ1UK, LZ2CC, LZ2DF, LZ2EV, LZ2HE, LZ2HM, LZ2JE, LZ2PO, LZ2TX, LZ2UU, G3SZA, Vasko. **M7G:** GØUZF, GØWTD, G4WJR, R7VOQ, G3ZRE, G7SUR, M1ADC. **M7S:** Club Group. **N1DRQ:** N1DRQ & N1UFY. **N3PUR/AG:** N3PUR/AG & K3MD. **N6MI:** N6NB, N6MU, N6MI. **N8NR:** N8NR, N8BJQ, N9AG. **N9THC:** N9THC & N9TZQ. **NK7U:** NK7U, K7ZO, W7ZRC, N7BZ. **NL8/NO7F:** NO7F & WL7COJ. **NN5AA:** K5NA & K5DU. **NN6NN:** W6XK, W6PS, KC6PDJ. **NY4A:** AA4NC, K4MA, KS4XG. **OE3S:** OE1ETA, OE2GEN, OE2MON, OE2VEL. **OH5NQ:** OH5NQ & OH1WZ. **OH7AAC:** OH6LNI, OH7MHL, OH7KIR, OH7LTK, OH7WV.

OH8AA: OH8LQ, OH8MCT, OH8PF. **OK1KCF:** Club Group. **OK2KOD:** OK2BDI, OK2BHM, OK2PID, OK2BJ. **OK8AUY:** LX1NO, OK1RR, OK1MD, OK1FJD. **OL5T:** OK1NR, OK1ITC, OK1DNR, OK1DXF, OK1HSK, OK1MUJ. **OM7F:** OM7PY, OM7IR, OM7ATI, OM3WBC, OM7ARI. **OM9A:** OM2TW, OM2DX, OM2ZZ, OM3EI. **ON6ZX:** ON1DDC, ON6NL, ON6ZX. **OT7P:** ON4LAM, ON4LZ, ON5OO, OH6AH, ON6MH, ON7PC, ON7ZV. **OZ5BAL/P:** OZ2ELA, OZ3XO, OZ1HDF, OZ1CHL, OZ1GER, OZ1FDH. **OZ7HAM:** OZ1ETA, OZ1JO, OZ1BIZ. **PA6WPX:** PA3BBP, PA3BWD, PA3ERC, PA3ERL, PA3EWP, PE1PZS. **PY3MHZ:** PU3AGP, PY3AFS, PY3BZA, PY3PAZ, PY3MRZ. **RK3AWE:** RK3FM, RK3FT, RU3DGD, RA3DKE. **RK3DWH:** RA3DUT, RX3DCX, RZ3FA. **RK4WWA:** UA4WA, RW4WA, UA4WAN.

RK9CWW: UA9CDC, RZ9CØ, UA9FQY, RA9CKQ, RA9CMO, Serge. **RK9JWJ:** RA9JAC, UA9WO/9, UA9-162-316. **RO3A:** RV3ACA, RV3AJD, UA3-17Ø-72, RX3DRG. **RU6LWZ:** UA6LV, UR5MVZ, RV6LNA, RV6LOB, UR5IBG. **RW6AWT:** RN6BN, RN6MM, UA6NP, UA6AAY, RU6AB, RA6AX. **RZ4AYT:** UA4ALI, UA4AIY, UA4-156-1Ø57. **SØ2R:** EA3CB, EA3CZM, EA3GBU, Laarbi, Mehdi, Mulahi. **SKØHS/5:** SM5ARL & SMØMPV. **SKØUX:** SMØDRD & Gema. **SN6U:** SP6NVK & SP6OPE. **SX2T:** SV2CWY, SV2AEL, SV2BFN, SV2BXZ, SV2BXJ. **T9DX:** T93M, T93Y, T94NE, T94NF, T94LW, T94TU, T97M, T99S, T99T. **TF3IRA:** Club Group. **TMØPX:** F5BSB, F5BZB, F5BRW, Laurent. **TM1C:** F6CTT & F6JSZ. **TM2S:** F5P3ED, F2KN, F5CW. **TM2V:** F6GLH, F6GYT, F1Ø881. **UA3AB:** Club Group. **UK8IWW:** Gena, Nagornyi, Shereshov.

UR4MWU: UR6MW, UR5MB, UR5MA, UR4MT. **UT4UWC:** Max, Vlad, Alekx, Artem, Alex. **VA3SK:** VA3SK, VA3MW, VA3RRK, VA3PC. **VE5SF:** VE5SF & VE5CPU. **VE6SV:** Club Group. **VK1DX:** VK1FF, VK1PJ, VK1AUS, VK1DT, VK1TW, VK1PRG. **VK4EMM:** VK4EMM, VK4XY, VK4UW, VK4TPW. **W7IG:** KE7CR, N7HA, N7TL, W7IG. **WB2QLP:** WB2QLP & KE4RGH. **WR4K:** W4FDA, N4KE, AA4B, W4UE, N4JBK, WR4K. **WT1L:** K1HD, W1SJ, KM1Z, N1WYA, KA1NRR. **WV2LI:** N2GA, K2DO. **WW5DX:** KN5H, K7UP, W5FX, Net. **YM2KC:** TA1E, TA2FE, TA2IJ, TA2DS. **YM3DL:** TA3ZI, TA3ZJ, TA3ZK. **YO9KVV:** YO9FNR & YO9GJY. **YU1L:** YT1VA, YT1EPG, Aleksandra, Ivan, Dusan, Jovanovic. **YZ7A:** Joska, Lee, Ferj, Ati. **ZXØF:** PY5EG, N5FA, PYØFF, PU5OMS.

Station Operators Multi-Op Multi-Transmitter

4M1X: YV1CR, YV1OB, YV1DRK, YV1GUZ, YV1HFO, YV2IF, YV2EMA, YV5OD, YV5AMH, YV5AYL, YV5EED, YV5FAA, YV5JCB, YV5FQD, YV5LMW, YV5MHX. **9A1A:** N4KW, 9A9A, 9A5W, 9A2DQ, 9A6A, 9A3NR, 9A4OM, 9A3GW, 9A7R, S51D, S51R, 9A6D, 9A2R, 9A3ZA. **AEØM:** AEØM, K2KW, K3EST, K6AW, N6RO, K6XX, AK6L, KM6F, KX7M. **BV9AYA:** BV2KI, BV2KS, BV4AS, BV9AYA, JP1RIW. **JA3ZOH:** JG3KIV, JI3OPA, JR4ISF. **JO1YAO:** JA1ATK, JH1AZO, JE1KFX, JA1PEJ, JR1PIZ, JL1TXC. **KBØJYL:** KBØJYL & NØYUR. **KH7R:** KH7R, AH7R, WH6R, K1ER, WH6T, KH6U, KH6ND, KH6IFN, KH6HK, KH6JAT, AH6MZ, AH6HU, NH6XO, KH6BM, KH7CE, WH6XR. **KU4V:** KU4V, N4ZC, K4ZA, KZ2I, WA4PXP, W4WNT. **LU4FM:** LU1FZR, LU2FYU, LU6FEC, AZ8FAG, LU9FIO, LU4FGV, LU6FAZ, LU9FQT, LU7FN, LU6BEG, LU6FPI, LU9FEC, LU4FPZ, LU5FYR, LU5FAO, LU6FUQ, LU3FSP, LU2FYA.

LY3MR: LY1FF, LY1FR, LY2BIL, LY2BKF, LY3NFW, LY3NJ, LYR-122Ø. **N1SNB:** N1UJB, N1SMB, N1SNB. **N5KB:** N5KB, K5ZO, KC5WEG, KC5ZMV, KC5ZMU. **NE6N:** W6EEN, K6XC, W6AQ, KI7WX, W6ORD, AI6V, K2CX, N7UE. **NE9U:** NE9U, WØAIH, NØKK, NØAXL. **OH7AB:** OH7MA, OH7UE, OH8SR, OH7JCX, OH7NVU, OH7MSW, OH7MKR, OH7KNV, OH7JVD. **OT7A:** DF3TJ, DL3EBM, DL6ET, ON1AEI, ON1AFF, ON1AWB, ON1CIM, ON1CIO, ON1DAL, ON1DEK, ON1DEL, ON1DJU, ON1GL, ON1MAR, ON2AIM, ON2BDD, ON2BEU, ON4ADZ, ON4AID, ON4AJW, ON4AMX, ON4ASB, ON4AUC, ON4AWH, ON4AWU, ON4AWV, ON4BAA, ON4BAG, ON4BCB, ON4BI, ON4CDC, ON4CDE, ON4CDZ, ON4DB, ON4FI, ON4ON, ON5CD, ON5DH, ON5GO, ON5OT, ON5RW, ON5UM, ON6DN, ON6HP, OH6HZ, ON6LK, ON6MR, ON6PU, ON7AW, ON7HU, ON7NB, ON7SF, ON7VU, ON7YZ, ON9CFB, ONL4531, PA3EBT, VE6WQ, Anouk, Julienne, Linda, Marc, Nathalie, Nicole.

RK9AZZ: Club Group. **RM3T:** RK3TA, UA3TN, RZ3TX, RW3TJ, RW3TN, UA3TT. **RW2F:** RA2FA, RN2FA, UA2FB, UA2FF, UA2FM, UA2FX, RA2FZ. **S52A:** S5ØA, S55OO, S59AA, S57W, S59L, S58MC, S53CC, S53EA, S53R, S56MM. S53M: S57DX, S53ZO, S59KW, S51OI, S51QA, S57Q, S57C, S51ZO, S51RJ, S51DM, S51RS. **T4ØFRC:** CO2KG, CO2GQ, CM2KC, CO2GG, CO2GK, CM2DA, CO2LG, CM2EE, CO2NT, CM2II. **VE6JY:** VE6BF, VE6DGG, VE6EX, VE6DXX, VE5FF, VE6AQE, VE6FR, VE6SLV, VE6KCM, VE6LCB, VE6PV, VE6JY, UA9AML, VE6LDX, VE6MK. **WM2V:** WM2V & K2KV. **WP3X:** AA8U, K3MM, K8CC, N4UK, W8MJ, AA4S. **Z3ØM:** Z31GX, Z31RC, Z31GB, Z31JA, Z31MM, Z32AF, Z32AM, Z32XA, Z32XX, Z32MC, Goran, Zoki.

Number groups after call letters denote following: Band (A = all), Final Score, Number of QSOs, and Prefixes. An asterisk (*) before a call indicates low power. Certificate winners are listed in boldface. (Note that the country names and groupings reflect the DXCC list at the time of the contest.)

SSB RESULTS
QRP/p SECTION

WORLDWIDE

TM9K	A	487,696	662	374
		(Op: F5BEG)		
LY3BA	A	422,820	730	348
YU1KN	A	315,000	454	360
KC6ETY	A	279,792	315	232
N7VY	A	278,967	516	311
SP7LZD	A	257,530	504	283
7J6ACT	A	208,624	380	221
		(Op: KP4FP)		
N1TM	A	172,520	320	227
YU1LM	"	151,230	383	213
OK1DKS	A	138,432	355	206
LU1VK	A	107,381	251	167
DL2IAN	A	86,764	283	199
KC5WCO	A	57,060	113	80
KG5U	"	46,168	146	116
CT1ETT	A	40,950	151	130
N7IR	"	25,840	117	76
F5RAB	"	19,998	111	99
ON7CC	A	17,940	106	92
SQ3DWR	"	14,300	105	100
CT3HF	A	13,764	69	42
EA2SN	A	6,305	97	65
HB9FBI	A	3,696	44	42
F5NYK	"	435	16	15
ZY2Y	28	117,245	289	179
LW3EBJ	28	21,021	113	91
LW7EGO	"	8,060	75	65
JF3EIU	28	2,821	46	31
NT5CC	28	2,754	35	27
		(Op: KY5N)		
XE1HKR	28	600	27	20
LU1FNH	"	516	16	16
LU2HNP	21	39,483	156	123
JI5BKF	21	35,100	154	100
JH1HRJ	"	23,876	128	94
N1AFC	21	12,505	80	61
WA6FGV	21	8,487	77	69
JR1NKN	"	7,956	72	52
XE2HWB	21	6,100	85	61
RJ9J	14	505,165	680	355
UA4SKW	14	199,320	427	302
JR4DAH	14	67,536	201	144
JA2JSF	"	51,480	165	132
W6CN	14	49,500	194	165
RA3UAD	"	23,520	130	98
HAØGK	14	11,781	102	77
IZ7AZP	14	11,396	94	74
N8XA	14	4,730	45	43
EA2CR	14	3,828	60	58
SQ2CFJ	14	2,405	53	37
WB7OCV	14	1,353	34	33
S59D	7	125,970	253	195
IK8HOE	7	14,994	52	51
W8QZA/6	7	10,164	70	66
K9FOH	7	4,320	34	30
SP4GFG	3.7	155,806	344	217
UX2MF	3.7	148,400	301	212
LY2FE	3.7	81,396	240	171
YO8BGE	3.7	25,654	126	101
OK2KRT	3.7	22,320	120	93
OM3CGA	3.7	15,088	94	82
YO2LGX	3.7	4,802	53	49
RW4HHD	1.8	54,136	184	101
US5MPS	1.8	17,248	98	77
YO4FRF	1.8	8,820	70	63
UR4UCP	"	4,032	51	48

SINGLE OPERATOR
NORTH AMERICA

UNITED STATES

NB1B	A	2,890,768	1478	632
K1SD	A	761,264	685	392
W1CU	"	725,835	685	415
KD1YN	"	499,772	529	364
NQ1K	"	395,604	512	324
KZ1K	"	201,780	408	295
		(Op: K1PLX)		
KA1DWX	"	168,920	241	164
KC1WH	"	58,776	259	186
KV1W	"	43,440	137	120
WS1M	21	32,334	148	102
K1DWQ	"	15,663	89	69
WA1MKS	14	131,068	257	217
K1EU	"	58,344	181	156
KE1Y	3.7	1,074,672	921	439
***WS1A**	A	500,038	605	382
***K1HT**	A	119,295	233	165
*K1VSJ	"	25,830	115	90
*N1RJF	"	18,270	100	90
*N1OFO	"	1,092	29	28
***WF1L**	14	303,696	562	342
*K2MN	"	828	18	18
KQ2M	A	4,780,224	2220	772
K1AR	A	648,081	558	381
N1CC	"	502,456	560	362
NI2P	"	301,730	408	286
KF2O	"	263,872	355	248
NA2A	"	219,373	369	259
KD2KS	"	207,233	378	247
KB2RAS	"	204,472	330	244
K2QMF	"	163,020	265	195
K2FR	"	154,128	265	208
W2ZZ	"	86,040	213	180
W2DMV	"	50,256	172	144
AB2BA	"	38,646	152	113
W2VU	"	1,683	37	33
NA2X	28	204	17	17
AF2K	14	23,968	123	112
K2ONP	3.7	20,412	89	81
KN2T	1.8	16,650	85	75
***NA2Q**	A	358,560	507	332
***N2ED**	A	255,258	366	261
*N2JIX	"	144,320	315	220
*KS2G	"	42,588	148	126
*K2CS	"	37,771	140	107
*KG2HS	"	20,461	100	79
*K2WB	"	17,748	99	87
*N2LQQ	"	17,444	119	98
*K2DL	"	16,464	101	84
*KG2BI	"	9,652	90	76
*N2NYR	"	3,395	37	35
***K2BQW**	14	53,500	241	207
*N2MBM	"	2,580	43	43
*KA2GSL	"	1,100	20	15
K3ZO	A	2,982,213	1551	639
WE3E	A	516,972	698	402
W3IZ	"	127,544	316	214
N3IYX	"	75,348	3207	161
N3RC	"	55,772	201	146
N3UE	"	34,944	151	112
WV3B	"	4,154	66	62
K3WW	"	0	56	48
N3HBX	14	768,414	940	498
AI3Q	"	187,726	300	253
WA3DMH	7	11,822	50	46
N3OC	3.7	114,680	228	188
***NY3Y**	A	443,751	544	339
***WA3HAE**	A	251,370	418	294
*K3PP	"	125,976	222	174
*K3QK	"	98,674	290	206
*WK3I	"	43,641	145	117
*W3TWI	"	22,560	122	96
*AD8J	"	19,950	88	75
*N3II	"	15,498	85	82
*KA3MYM	"	14,448	102	86
*W3CP	"	8,910	68	54
*W3QYL	"	55	5	5
***WB2BZR/3/T**	28	9,204	98	59
***KB3AGZ**	14	74,202	195	166
*W3FQE	"	2,072	30	28
***KW4T**	7	122,760	243	186
***KB3AFT**	3.7	5,760	100	72
K4AB	A	2,090,192	1930	676
W4AN	A	1,980,251	1496	611
		(Op: KQ4HC)		
K4VUD	A	1,395,208	1200	548
NQ4I	"	1,293,812	1239	556
N4ZZ	"	958,818	1166	518
WC4E	"	686,424	1025	444
NX4W	"	401,051	682	371
K3KO	"	318,240	401	272
AD4TR	"	269,040	463	285
K4LM	"	263,856	386	276
NM4K	"	237,776	620	308
KR4TG	"	226,674	354	257
N4MM	"	114,450	233	175
W4IF	"	55,419	181	147
K4VV	"	21,216	100	78
W4YV	28	43,956	188	99
WT4K	21	63,578	247	166
KC4DWT	14	236,113	424	289
KT4W	"	4,368	67	56
KC4YM	7	192,262	309	217
AG4W	3.7	63,648	335	208
W4ZV	1.8	85,428	351	189
AA4MM	"	34,048	189	133
***WA4ZXA**	A	987,936	961	492
***WO4O**	A	448,749	642	357
*KR4QI	"	330,084	526	318
*NW6S	"	156,657	342	237
*AB4KL	"	102,575	495	275
*N4GJ	"	98,892	268	201
*N4YKD	"	77,100	225	150
*K4BAI	"	60,568	205	134
*WA4VIY	"	58,800	209	150
*KU4BP	"	43,657	199	149
*KF4PUJ	"	34,020	152	108
		(Op: W9WI)		
*KØEJ	"	27,499	136	107
*K4UK	"	16,160	98	80
*WB4DNL	"	10,758	77	66
***WB4HFL**	28	4,624	50	34
*W9CNF/M	"	672	17	14
***W4TD**	21	41,382	166	121
***N4MO**	14	353,472	464	336
*AD4UM	"	91	8	7
***WA4QDM**	7	49,610	135	121
NX5M	A	560,956	1005	418
KM5AV	A	198,882	381	254
N5MYH	"	100,608	320	192
N5LZ	"	95,872	353	224
KC5AK	"	63,104	174	116
KG5U	"	46,168	146	116
WD5CSK	"	44,520	216	159
W5VX	21	244,528	531	272
NN5Z	14	95,604	507	257
		(Op: K5PX)		
NA5B	7	1,792	78	56
W5FO	3.7	83,232	325	204
K5UCV	"	14,560	144	112
***WD5K**	A	521,740	708	380
***KD5QI**	A	118,776	295	202
*NN5T	"	109,917	258	177
*KF5YZ	"	109,032	281	177
*WK5K	"	33,938	217	142
*K5YRZ	"	11,074	124	98
*KM5CF	"	5,760	90	72
***KØBCN**	21	19,264	106	86
***KB5KYO**	14	50,760	300	188
*W5RNF	"	26,240	197	160
*KC5WJM	"	14,112	155	112
*K5XN	"	1,440	50	48
***N5XUS**	7	23,980	137	109
NC7M	A	1,401,830	1304	515
NK6O	A	836,268	1079	454
K6BZ	"	721,920	1113	480
WN6K	"	675,280	818	367
KC6X	"	657,476	964	422
W6TKF	"	588,264	801	381
NO6X	"	406,406	624	319
K6GT	"	228,227	395	241
KI6T	"	156,992	330	223
WB6NFO	"	148,941	322	201
W6BH	"	134,232	304	168
W6ZN	"	99,840	303	192
		(Op: W6ZQ)		
W7CB	"	70,840	143	110
N6ZZ	"	55,968	171	106
KD6QK	"	16,878	110	87
W6BIP	"	15,750	79	75
AD6AB	"	7,659	89	69
K6III	14	56,952	228	168
N2ALE	"	600	15	15
W6RJ	3.7	1,010,070	896	387
***AE6Y**	A	254,709	608	311
***AC6WD**	A	207,214	442	266
*AL7PO/NU6	"	173,514	461	239
*KD6DAE	"	94,346	246	161
*K6UM	"	92,901	250	173
*KQ6ES	"	74,102	229	158
*W6SA	"	73,440	231	153
*N6JM	"	51,040	154	116
*K6TV	"	47,655	183	135
*WX6V	"	43,665	167	123
*N6NF	"	14,839	99	71
*KE6WEO	"	3,380	56	52
*AA6EE	"	121	11	11
***WA7BNM**	21	69,069	230	171
*KU6T	"	30,600	140	102
***KF6HAN**	14	174,404	417	236
***W6KY**	7	252,436	386	223
***N6TPT**	3.7	360	21	20
K7RI	A	1,949,310	1789	605
		(Op: K7ST)		
W7GG	A	286,011	502	297
N7WWQ	"	178,714	414	234
KJ7TH	"	162,393	408	259
W7HS	"	95,823	245	189
KC7UP	"	82,512	239	191
AF7O	"	72,534	209	157
KE6UP	"	37,224	128	99
N7WJJ	"	34,398	165	126
W7AYY	28	7,866	76	38
K7ZZ	14	376,380	597	369
W7FP	"	347,085	642	405
W7EB	"	209,935	729	347
W7TSQ	"	1,073	30	29
***W7ZMD**	A	255,095	602	313
		(Op: WA7NIY)		
***W7QN**	A	90,516	341	228
*N7FL	"	58,765	196	161
*AB7RW	"	42,065	193	179
*KR7X	"	24,400	118	100
*KA7KUZ	"	12,285	115	91
***W7USA**	28	4,653	49	33
***WJ7S**	21	13,490	88	71
*WJ7R	"	21,329	108	77
W9LT	A	1,121,662	924	466
WZ8T	A	344,100	648	370
WB8TLI	"	325,725	455	303
W8JY	"	177,338	320	239
***WA8WV**	A	140,760	272	207
***K8GT**	A	103,800	218	173
*K8CV	"	60,648	193	152
*N8QVP	"	56,780	250	170
*N8KOJ	"	39,022	155	109
*W8UPH	"	38,038	150	133
*KT8X	"	24,564	102	92
*N8DXR	"	10,584	108	84
*WB8BUQ	"	8,450	70	65
*W8IDM	"	1,596	30	28
***KB8IBS**	14	161,392	317	262
*W8SJU	"	78,660	218	171
***N8LIQ**	3.7	3,172	66	61
WB9Z	A	1,905,904	1421	637
NO9Z	A	700,440	914	449
K9NW	"	390,182	505	349
KBØC	"	278,690	417	290
W9BCV	"	61,824	219	104
WO9S	"	33,990	119	103
KF9VJ	"	4,977	77	63
KS9K	21	100,471	370	217
WE9V	14	2,113,251	1692	721
N9LCR	"	69,972	301	204
***N9VVV**	A	160,460	309	226
***NG9L**	A	73,278	207	177
*N9OGE	"	21,010	160	110
*N9YXA	"	10,878	111	74
*N9TMU	"	4,700	65	50
*WB9LRK	"	4,242	51	42
***AA9IA**	7	48,280	172	142
KVØQ	A	2,877,333	1987	661
KW9KW	A	1,367,744	1446	602
KMØL	"	699,798	1205	461
NXØI	"	501,687	1112	459
KØGAS	"	239,440	627	328
WØTT	"	98,748	452	211
K1LR	"	54,668	206	158
KØXD	"	48,544	245	164
KØZM	"	38,940	173	132
WØID	"	24,640	121	112
KGØEJ	"	18,468	100	81
KAØBHO	"	3,120	66	48
KAØBAT	"	1,369	41	37
KØWUI	28	8,112	64	52
WAØETC	21	85,925	287	175
N7DR	14	25,576	105	92
KGØUA	"	16,128	124	112
WØPPF	"	7,828	84	76
KØCS	1.8	9,752	127	92
***ACØW**	A	327,320	536	334
***KAØWWT**	A	113,184	324	216
*WRØA	"	111,672	327	216
		(Op: WØMU)		
*NØIGP	"	34,276	238	164
*WØIOL	"	12,920	96	76
*KBØWQT	"	6	2	2
***WBØGFV**	28	504	15	12
***AKØA**	14	179,305	621	329

BARBADOS

8P9IJ	A	5,468,593	2527	689
		(Op: VE3VET)		

BAHAMAS

***C6AJR**	A	334,644	674	316

CUBA

CO8RCB	14	155,085	450	245

MARTINIQUE

FM5CD	A	4,088,250	2404	711
FM5GU	21	1,377,152	1328	464
***FM5DN**	A	3,486,820	1894	626

HAITI

4V2A	A	12,087,589	4196	907
		(Op: 9A3A)		

ALASKA

KL1V	A	213,744	432	183

US VIRGIN IS.

***KP2/KF8UM**	A	4,772,124	3094	653
***KP2BH**	A	503,750	570	310
*WP2/WI9WI	"	117,750	250	157
*NP2Q	"	50,061	198	123
*NP2DJ	"	7,975	68	55

PUERTO RICO

WP4KDE	A	7,056	56	48
***WP4NHM**	A	1,017,686	875	398
*WP4LNY	"	291,060	434	220
***KP4/AA2OX**	21	464,515	700	305
***NP3D**	3.7	852,110	570	329

COSTA RICA

TIØC	A	13,481,361	4269	927
		(Op: TI2CF)		

CANADA

VE3EJ	A	6,393,044	2448	788
		(Op: VE7NTT)		
VE9AA	A	3,017,020	1783	601
VO1MP	A	1,764,963	1082	499
VE6JO	A	988,871	1190	377
VE3KPU	"	632,833	613	361
VE7XO	A	182,308	280	238
VE6KRR	A	70,350	183	134
VE4RP	A	60,759	175	129
VE1RJ	21	8,183	61	49
VE3DNR	21	36	4	4
VA7A	14	1,854,371	1457	569
VE7AV	"	908,314	974	418
VA3MG	3.7	837,408	775	286
VE3BMV/1	1.8	397,760	383	226
VA3YMG	1.8	36,630	152	110
***VA3DX**	A	720,564	587	372
***VE7CFD**	A	498,300	691	275
*VE7TLK	"	326,368	528	248
*VA3NR	"	157,080	250	165
*VA3SWG	"	156,927	279	181
*VE3STT	"	130,176	257	192
***VE1TRH**	A	111,843	221	153
***VE2SAI**	A	109,824	216	156
*VA3JFF	"	77,568	156	128
*VE2AWR	"	75,544	183	142
***VE9ZL**	A	54,126	130	93
*VE2OWL	"	4,655	54	49
***VE3HX**	28	6	2	2
***VE6BMX**	14	46,898	172	131
***VE7SV**	7	2,023,872	1099	381
***VE3OIL**	3.7	54,432	486	112

BRITISH VIRGIN IS.

***VP2VF**	28	52,008	202	88

TURKS & CAICOS

***VP5E**	A	2,330,130	1836	506
		(Op: K6HNZ)		

MEXICO

4B1AC	14	546,084	858	308
		(Op: XE1BEF)		
6D2X	3.7	1,109,760	759	340
		(Op: K5TSQ)		
***XE3LMV**	A	761,760	1012	345
***XE2AC**	28	17,918	100	62

NICARAGUA

***YN6WFM**	A	1,192,260	1447	372

AFRICA

MAURITIUS

***3B8/DL6UAA**	21	1,061,775	975	363

TUNISIA

TS8A	A	11,526,732	3415	772
		(Op: YT1AD)		
***3V8BB**	21	61,254	177	123
		(Op: Z32AU)		

NIGERIA

5NØT	A	8,283,308	2783	869
5N3/SP5XAR	14	144,590	261	190
***5NØFPK**	28	29,260	135	77

KENYA

5X4F	A	5,044,598	2124	773
5X1T	21	1,465,280	1055	482
		(Op: ON6TT)		

SIERRA LEONE

***9L1MA**	A	43,308	149	108
		(Op: KBØLFV)		

MADEIRA IS.

CT3BX	A	9,207,608	2950	857

CANARY IS.

EA8AJO	A	418,616	455	268
EA8AH	14	11,142,198	3807	981
EA8/OH1MA	3.7	4,317,284	1289	562
EA8ZS	1.8	93,960	138	116
***EA8KK**	A	544,644	542	324
***EA8AG**	A	315,282	378	281
***EA8AD**	14	95,634	208	154

CUETA & MELILLA

EA9AM	14	3,930,290	2066	637
***EA9IB**	A	767,844	574	396
***EA9BF**	A	209,498	300	218
*EA9BH	"	53,235	150	117

ASCENSION IS.

ZD8DEZ	28	243,648	439	192
		(Op: GØDEZ)		

SOUTH AFRICA

ZS6SA	A	3,296,920	1688	635
ZS6IR	7	8,960	42	40
***ZS6PHD**	A	184,685	314	215

MARITIME MOBILE

YL3IZ/MM	7	661,650	408	275

ASIA

AZERBAIJAN

*4K9W	14	11,771	92	79

ISRAEL

*4Z5FL	A	697,651	647	349
*4Z5FI	A	266,358	344	206
*4Z5JQ	"	69,174	175	126
*4Z4TA	"	28,000	101	100
*4Z5FW	21	23,760	100	90

CYPRUS

5B4MF	7	3,231,228	1237	462

KUWAIT

9K2HN	A	4,465,968	2320	663

WESTERN MALAYSIA

*9M2TO	A	157,528	507	194

CHINA

*BA4TB	A	185,679	610	207

ARMENIA

*EK4JJ	A	18,316	83	76

TURKMENISTAN

*EZ8CQ	21	8,260	48	25

SOUTH KOREA

*HL5BPH	A	9,800	63	56

THAILAND

*HSØAC	A	402,560	759	320
		(Op: HS2JFW)		

SAUDI ARABIA

7Z500	A	564,040	663	295

JAPAN

JH5ZJS	A	4,434,507	2020	693
JE1LFX	A	553,392	609	324
JA2BNN	A	532,840	628	308
JAØQWO	"	304,164	458	238
JA7YAL	"	238,882	394	226
		(Op: JG7LQU)		
JA9JFO	"	162,870	311	178
JR1LEV	"	135,828	250	198
JR2AGL	"	133,397	302	181
JH1UUT	"	127,551	298	183
JRØWZR	"	119,448	223	158
JA2AXB	"	96,255	216	155
JJ3VPY	"	90,552	213	154
JGØOXL	"	28,140	110	84
JA2VQF	"	21,630	132	70
JN7CPW	"	17,933	87	79
JA1HP	"	17,020	104	74
JA3CE	"	9,075	62	33
JA1AAT	"	8,640	74	45
JA2TKO	"	5,469	88	43
JA2QVP	"	3,808	35	32
JA6QDU	"	252	13	12
JH6SQI	28	14,129	115	71
JH6AUS	"	12,300	112	75
JH4WBY	"	336	14	12
JG4AKL	14	400,328	490	326
JA7BEW	14	166,520	320	230
JA2CWU	"	93,247	231	173
JH2AQI	"	31,654	125	98
JA9CCG	"	18,560	96	80
JAØHYU	"	6,500	56	50
JP6NUI	"	3,885	41	35
JK1LUY	"	78	6	6
JA5IP	7	13,640	63	55
JAØGZ	"	986	18	17
JA5ARW	"	20	3	2
JA2DLM	3.7	18,774	76	63
*JJ1VRO	A	484,548	542	298
*JQ1BVI	A	403,754	527	293
*JA6ZLI	A	263,538	452	242
		(Op: JJ6WYS)		
*JA6UBK	"	243,516	411	223
*JA1BUI	"	237,363	303	267
*JK1KNB	"	206,537	360	241
*JA6SRB	"	179,208	341	228
*7K3OWM	"	170,332	342	194
*JE1XCZ	"	151,096	333	202
*JA1GYO	"	148,056	288	186
*JM1NKT	"	140,868	309	172
*JHØHON	"	90,420	201	137
*JE1UFF	"	84,560	235	151
*JN1NOP	"	74,550	234	142
*JA5EO	"	71,295	184	147
*JG2REJ	"	61,962	155	138
*JA4CZM	"	61,008	185	124
*7N1NHH	"	45,360	164	120
*JE9LLO	"	44,408	151	104
*JA8JCR	"	42,184	158	99
*JM2CCL	"	33,166	130	103
*7K2QOX	"	26,650	107	82
*JR1MRG	"	26,640	141	74
*JA1NQU	"	25,991	126	79
*JJ3OOZ	"	25,760	121	92
*7J1ABD	"	25,564	121	83
*JA1AB	"	25,487	129	77
*JH1CTV/3	"	14,301	83	63
*JE9PFD	"	11,712	80	61
*JA3LXY/2	"	9,798	81	46
*JH1KQB	"	9,699	70	53
*JA8TEZ	"	6,815	58	47
*JH2WHS	"	6,210	57	46
*JJ2TKX	"	5,652	44	36
*JG1TVK	"	5,550	42	37
*JH3AKD	"	5,280	47	40
*JE9OZW	"	4,687	51	43
*JA2BEY	"	3,927	45	33
*JR1GGB	"	3,876	48	34
*JA2GHP	"	3,456	45	36
*JA1AAV	"	2,250	30	25
*JA1STY	"	2,106	31	27
*JI3PBP	"	1,128	27	24
*JO6XHE	"	1,045	22	19
*JE7DOT	"	690	18	15
*JA1EIS	"	576	12	12
*JE1HXZ	"	133	7	7
*JK8HOS	"	90	5	5
*JK8FRL	"	36	3	3
*JA4AQR	28	144	8	8
*JI3BFC	21	50,176	202	128
*JN2AMD	21	30,488	148	103
*JA3LEZ	"	28,227	138	97
*JR5HCU	"	26,481	136	97
*JR7LVK	"	16,259	106	71
*JA6BIF	"	15,960	102	76
*JJ3XHT	"	13,790	101	70
*JA7KM	"	12,078	85	66
*JM3QIS	"	7,809	71	57
*JHØEPI	"	7,701	73	51
*JA1XPU	"	5,109	55	39
*JF2PXB	"	2,871	40	29
*JH2IIC	"	2,496	38	32
*7K1EQG	"	1,352	28	26
*JI1WPV	"	966	22	21
*JA1EEG	"	765	19	17
*JG1GCO	"	612	18	17
*JL1MWI	"	385	13	11
*JR3KAH	"	324	13	12
*7M1CUN	"	322	17	14
*JM2BHI	"	275	12	11
*JA2YGP	"	108	6	6
*JA3ORD	"	52	5	4
*JH7VHZ	14	392,129	523	317
*JR7WFC	14	138,312	273	204
*JR2LIS	"	116,610	260	195
*JR4GPA	"	30,805	125	101
*JG3WCZ	"	21,600	102	80
*7N2UQC	"	12,972	91	69
*JA1KI	"	5,246	52	43
*JAØGEY	"	3,441	45	37
*JG1EHF	"	2,436	31	28
*JE1GZB/3	"	990	26	22
*JK2PVL/Ø	"	684	24	18
*JM6EBU	"	574	17	14
*JA7AXP	"	210	11	10
*JG1FGL	"	18	4	3
*JE1VTZ	7	81,180	141	123
*JM4WUZ	7	75,924	131	114
*JH6FTJ	"	24,570	111	91
*JE9REN	"	2,916	32	27
*JA3MXP	"	806	15	13
*JRØBQD	"	494	17	13
*JE1SPY	3.7	3,456	44	32
*JM1LPN/1	3.7	2,706	37	33
*JA1QZC	"	1,800	39	25
*JI4HKA	"	176	8	8
*JG7LBN	"	42	5	3

OGASAWARA

*JD1BIA	21	1,269	33	27

JORDAN

JY9QJ	A	5,446,170	2314	621

LEBANON

OD5NJ	A	4,634,952	2056	658

TURKEY (ASIATIC)

YM2ZW	14	1,833,400	1428	445
TA3W	3.7	916,880	552	292
*TA3YJ	14	40,362	150	93
*TA3J	7	364,560	305	210

ASIATIC RUSSIA

UAØFDX	A	519,138	736	302
RUØSL	A	233,099	502	257
UAØDC	"	222,812	416	212
RXØAE	14	1,329,628	1227	491
UAØWY	14	1,043,745	1000	467
RUØSU	"	270,351	505	279
*RAØFU	7	1,018,240	881	344
UAØSR	7	50,880	124	106
RAØCG	3.7	121,064	277	148
*RAØFA	A	1,342,565	1302	431
*UAØAPP	"	53,605	229	151
*UAØSE	21	6,552	81	63
*RAØCL	14	5,865	65	51
UA9MA	A	4,335,936	2053	704
RM9RX	A	996,034	787	377
UA9UR	28	560	18	16
UA9AR	28	560	18	16
RZ9UA	21	373,828	589	338
RK9AWC	14	1,012,775	862	425
RW9UP	"	841,916	898	436
RA9FF	"	1,044	31	29
*UA9CAW	A	1,194,336	820	429
*UA9CI	A	632,100	549	301
*RK9SWF	"	485,433	400	351
*UA9ACJ	"	472,064	468	256
*RW9QA	"	420,930	428	270
*RA9XU	"	163,856	266	196
*RW9WF	"	108,480	203	160
*RA9FDR	"	102,527	221	163
*UA9WUU	"	56,448	171	144
*UA9SFR	"	36,252	112	106
*UA9YAB	21	17,640	149	90
*RZ9AR	14	881,474	824	389
*RW9AB	14	723,384	701	408
*UA9YO	"	282,924	425	271
*UA9MCA	"	279,720	396	270
*RA9CPQ	1.8	108,290	167	119

UZBEKISTAN

*UK8IG	A	216,184	369	244

KAZAKHSTAN

UN6T	A	223,925	562	265
*UK7F	A	236,060	405	220
*UN2O	1.8	196,308	294	126

HONG KONG

VS97BG	A	1,276,560	2256	405
VR2RX	"	328,692	1209	196
		(Op: JR1JCB)		

INDIA

*VU2PAI	A	577,728	586	354

VIETNAM

*XV7TH	A	18,630	140	90

MACAO

XX9AU	A	59,040	240	144

EUROPE

CROATIA

9A2YC	A	139,776	289	208
9A5Y	7	1,847,880	1270	522
		(Op: 9A3LG)		
9A2AJ	3.7	809,218	921	401
9A9D	3.7	732,544	830	388
		(Op: 9A4KK)		
9A4RU	"	433,752	636	318
9A6KCL	"	225,504	453	243
*9A3IJ	A	534,726	748	366
*9A4KA	A	185,942	375	239
*9A6P	"	124,915	307	215
		(Op: 9A3ZO)		
*9A2OO	"	11,139	84	79
*9A4RV	14	31,625	162	125
*9A4VV	"	5,810	20	20
*9A1CFZ	7	4,982	48	47
*9A3QK	3.7	303,996	480	294

MALTA

*9H3ZZ	14	51,552	217	179
		(Op: VE3ZZ)		

PORTUGAL

CT8T	A	3,064,004	1906	674
		(Op: CT1DVV)		
CS6AHU	"	633,420	755	405
CT1FJK	21	162,470	317	211
CT1ASU	14	361,974	649	366
CT1BNW	"	109,500	260	219
*CT1ELF	28	2,418	34	26
*CT1ERY	"	672	16	14
*CT1FLD	14	14,200	109	100
*CT2GFK	7	104,308	222	178
*CT2FZZ	"	6,100	51	50

GERMANY

DF6QV	A	1,254,818	1166	547
DK9DA	A	656,124	793	428
DL4OCL	"	369,920	628	320
DL1JPL	"	361,884	607	318
DL6DCX	"	274,164	524	268
DF6QN	"	197,073	399	243
DL1AZZ	"	184,800	344	240
DL2YAK	"	131,760	362	216
DL3DBY	"	59,906	240	154
DL5ANS	"	32,700	152	109
DL9XW	"	29,155	130	119
DJ4DY	"	28,137	130	113
DL3DCY	"	24,885	141	105
DL7GW	"	19,140	118	87
DL9HCT	"	6,786	69	50
DJ8XT	"	6,240	54	52
DL8KDC	"	4,565	56	55
DJ6QT	14	1,271,256	1063	564
DK2OY	14	1,072,000	1100	536
DL2DX	"	671,402	763	422
DL6NDN/P	"	146,652	356	242
DL1EK	"	115,218	283	222
DL6AX	"	26,096	126	112
DL7YS	"	3,612	42	42
DL8EAQ	7	75,560	200	165
DJ2YE	"	25,020	100	90
DL5AUJ	"	4,536	42	42
DL5FCO	"	544	17	17
DK8FD	3.7	825,648	910	412
DL8PC	3.7	677,652	811	379
DL3LAB	"	653,400	827	363
*DJ8UV/P	A	596,810	852	370
*DL5ZB	A	177,816	406	239
*DK6BT	"	173,394	381	234
*DL5JMN	"	107,759	327	197
*DK7ZH	"	104,244	303	204
*DL/OK8KYP/P	"	103,356	294	198
*DF1HF	"	92,910	246	190
*DL1TS	"	88,360	288	188
*DL4DBM/P	"	84,280	244	196
*DL8SDC	"	81,282	270	186
*DL4SKF/P	"	56,536	206	148
*DF2WF	"	47,368	172	124
*DL6MDT	"	40,300	167	124
*DF1UU	"	33,915	151	133
*DL3SKF/P	"	31,720	150	122
*DL6AG	"	31,473	140	117
*DL3BRA	"	30,600	170	136
*DL5ST	"	28,728	150	114
*DL8NTC	"	20,412	126	108
*DL3DRN	"	13,760	89	80
*DL1SBF/P	"	9,438	79	66
*DL1NOF	"	6,903	69	59
*DF7YU	14	633,046	707	433
*DK3DM	"	251,720	442	310
*DL1MGB	"	172,466	386	254
*DL9NEI/P	"	31,248	149	124
*DL3ZAI	7	6,360	63	53
*DJØBX	"	684	19	18
*DF9JZ	3.7	9,088	70	64
*DL8AAE	1.8	450	15	15

SPAIN

EA2IA	A	1,633,000	1381	568
EA3BOX	A	1,052,276	1101	503
EA3CJ	"	858,687	1052	447
ED3SD	"	627,264	765	396
EA1MK	"	282,504	499	316
EA1JO	"	215,826	420	282
EA3FWE	"	173,843	476	263
EA5AL	"	112,200	310	200
EA1BXM	"	105,011	213	173
EC5AJY	"	12,320	99	77
EA1VM	"	3,772	46	46
EA1BCK	21	21,627	135	89
EA2CLU	14	1,810,704	1437	634
ED3WPX	"	70,590	183	130
		(Op: EA3ANE)		
EA5ALP	"	1,961	39	37
EA7DHP	7	611,310	610	355
EA3AVP	3.7	344,128	525	304
EA3ALV	"	160,446	319	221
EA3ELM	"	37,604	143	119
EA1DVY	1.8	32,200	127	100
*ED3ELZ	A	742,000	860	424
*EA3BKI	A	651,420	807	423
*EA2ASB	A	461,058	404	257
*EA7GXD	"	395,675	499	323
*EA5EOR	"	288,288	494	308
*EA3FHN	"	230,040	520	284
*ED3ASS	"	224,840	458	280
*EA1FAD	"	196,402	420	283
*EA5AFH	"	185,310	380	261
*EA4AYB	"	172,287	344	243
*EA2ATV	"	154,128	360	247
*EA1BLI	"	122,905	341	235
*EA1BJ	"	122,905	341	235
*EA1CEI	"	100,274	238	181
*EA3AM	"	79,866	240	174
*EA3DVJ	"	75,864	327	174
*EA2AHP	"	71,378	206	178
*EA1FFC	"	65,965	196	167
*EA7EWX	"	53,250	183	142
*EA2BNU	"	45,630	163	135
*EA4BSC	"	45,621	150	137
*EA3NA	"	44,850	139	138
*EA7AFM	"	44,550	150	150
*EA5CGU	"	43,232	143	112
*EA1BAW	"	23,124	134	123
*EC4AEW	"	22,366	127	106
*EA5XN	"	20,430	100	90
*EA2JZ	"	12,802	76	74
*EA1BZP	"	9,086	82	77
*EA1CIL	"	8,614	80	73
*EA7BDL	"	8,372	59	52
*EA4HR	"	4,183	50	47
*EC4ALI	"	4,094	54	46
*EA1DFP	"	2,652	27	26
*EA7ALO	"	768	16	16
*EA4DXP	28	14,490	109	70
*EA7GGP	"	2,024	31	23
*EA4DWY	"	722	22	19
*EA7HBP	21	47,601	109	70
*EA7DPU	"	29,568	122	96
*EA7GTF	"	15,925	128	91
*EA1AKP	"	7,728	66	46
*EA4EJR	"	6,908	53	44
*EC7ACV	"	2,088	30	24
*EA1AJV	14	259,108	454	307
*EA3GEG	14	241,920	496	320
*EA3BD	"	151,547	375	253
*EA4CT	"	98,040	336	215
*EA3CS	"	72,954	229	193
*EA4EOI	"	38,070	155	135
*EA4ASX	"	19,695	113	101
*EA1AAW	"	15,132	102	97
*EA1AW	"	10,218	81	78
*EA1FDG	"	6,901	78	67
*EA7DBO	7	127,262	254	197
*EC1DKD	3.7	34,320	133	120
*EC2BAH	"	5,936	56	53

BALEARIC IS.

*EA6YW	A	1,886	23	23

IRELAND

EI4DW	A	428,646	589	359
*EI4II	A	250,047	405	343
*EI6FR	14	297,850	578	350

ESTONIA

ES4RD	A	101,202	290	202
*ES6PZ	A	619,654	599	487
*ES1QD	"	39,168	173	144
*ESØLMT	7	21,620	95	94
*ES6RHT	"	9,130	71	55
*ES1CH	1.8	68,834	213	141

BELARUS

EW3LN	14	35,168	153	128
EU8MA	"	11,440	100	80
EW8MW	7	9,900	72	66
*EU1SA	21	17,670	122	95
*EW1EA	14	27,600	158	120
*EU4BD	7	38,976	134	112
*EW2CR	"	1,829	35	31

FRANCE

F5BBD	A	544,320	810	360
F5AMH	A	426,708	652	324
F2RO	"	126,896	316	206
F5TCN	"	121,550	321	221
F6HMQ	21	75,922	311	187
TM2DX	14	1,081,350	814	445
		(Op: F6GWV)		
F6FUN	"	46,800	166	144
F6DRP	"	20,076	104	90
F5RZJ	7	655,512	619	382
F2NH	"	39,250	135	125
F5NGA	"	34,582	96	92
*F5JKK	A	208,413	380	279
*F5PIQ	A	167,736	357	241
*F5PCX	"	164,715	410	237
*F6FNA	"	148,231	349	227
*F5YJ	"	111,600	324	200
*F5OIH	"	102,828	303	209
*F5POJ	"	100,746	316	193
*F6JSP	"	64,076	240	166
*F5JBF/P	"	61,050	227	165
*F5NBK	"	49,728	186	148
*F5SSN	"	23,108	118	109
*F/DL4VBS/M	"	18,887	123	101
*F8IN	"	14,787	111	93
*FB1BJI	28	340	20	17
*F/EA4ATI	14	6,674	83	71
*F5JDG	7	22,932	126	98

ENGLAND

G3SEM	A	726,700	891	430
GØAEV	28	6,510	107	70
G4ZFE	21	22,230	177	117
G3WGN	3.7	662,300	719	370
G3XSV	"	103,740	239	182
*G4IDL	A	175,796	402	284
*GØMRH	"	35,306	173	127
*GØKRL	3.7	65,178	208	153

NORTHERN IRELAND

GIØKOW	A	4,034,016	2414	736
		(Op: GIØNWG)		
GIØKVQ	"	43,489	200	157

SCOTLAND

GM3BCL	A	229,220	459	292
GM7V	7	1,057,050	1150	405
		(Op: GM4YXI)		

WALES

GW4BLE	A	3,275,125	1949	665
GW7J	A	1,413,429	1344	543
(Op: GW0GEI)				

HUNGARY

HA6NF	A	875,305	1010	445
HA5AGS	A	354,654	530	306
HA8ZO	"	2,716	32	28
HG5M	14	719,355	947	455
(Op: HA5MY)				
HA9RE	7	1,873,386	1159	523
HA3KNA	"	295,362	435	269
(Op: HA3OV)				
HA8JV	3.7	901,728	1006	404
HA6NL	"	253,870	453	265
*HA9MCQ	A	35,750	150	130
*HA0UU	"	8,160	110	51
*HA4YV	14	10,857	93	77
*HA5COX	7	152,028	306	206
*HA1DAZ	"	39,270	145	119
*HA8CQ	"	20,296	101	86
*HA4XN	3.7	227,406	430	251

SWITZERLAND

HB9AAA	A	256,662	400	291
HB9IQY	"	134,596	336	209
*HB9FBS	A	145,770	355	226
*HB9ARF	"	107,952	265	208
*HB9AON	"	1,456	28	26

ITALY

IU2M	A	2,102,648	1608	607
IR4R	A	2,007,325	1400	575
(Op: IK4ALM)				
IQ7A	A	1,354,815	1450	561
(Op: IK7XIV)				
IK4ADE	"	825,184	934	428
IK6GPZ	"	333,792	501	304
IZ2AMS	"	276,768	527	288
IK8AFN	"	0	200	0
IR3T	"	54,390	181	147
IK7WUE	"	16,443	71	63
IK2TKU	"	9,045	81	67
IK6WEB	"	2,017	66	38
I8KPV	28	10,176	81	64
IV3BMV	"	425	27	23
IQ4A	14	2,927,981	1816	721
IN3XUG	"	284,563	503	323
IR7S	7	677,652	826	379
IK2MPR	"	1,066	41	26
IV3TMV	3.7	589,510	714	353
*I6NOA	A	440,334	581	306
*IZ7ATC	A	248,442	431	282
*IK3PQG	"	161,880	380	228
*IO0KHP	"	113,680	316	196
*IK0XBX	"	109,590	272	195
*IZ7AUE	"	105,771	226	211
*IK4QJM	"	98,105	304	205
*IK7RVY	"	93,895	272	211
*IK7WPD	"	88,100	258	188
*IK0WHN	"	65,940	230	157
*IK5TZW	"	62,205	208	165
*IK4ZZH	"	50,337	166	141
*IK2UVR	"	28,300	124	100
*IK2RPE	"	24,072	130	102
*IK8IFW	"	10,868	85	76
*IK2RPK	"	8,580	73	65
*IK8SHL	"	8,432	72	62
*IK3SCB	"	3,600	44	40
*IZ3AYU	21	7,198	68	59
*IV3UHL	14	301,497	533	343
*IK3SSJ	"	119,570	302	278
*IK2YSA	"	52,920	216	168
*I1QBI	"	45,300	180	150
*IK0YUM	"	1,716	34	33

SICILY

IT9STX	14	1,641,798	1614	591
IT9STG	14	1,592,352	1539	608
*IT9AJP	A	108,576	258	208
*IT9ORA	"	1,512	32	28

NORWAY

LA5YV	A	5,605	59	59
LA2DDA	"	1,271	35	29
LA2IR	14	140,880	334	240
LA7WCA	3.7	5,720	60	44
*LA4EU	A	80,379	166	117
*LA8GK	"	11,340	103	81
*LA9CJA	"	3,256	49	44
*LA2MJA	21	22,491	180	119
*LA4GIA	14	106,575	203	175
*LA7CL	7	37,288	152	118
*LA6FJA	"	2,340	35	30

LUXEMBOURG

LX9DIG	A	832,140	1014	414
(Op: DL7JKM)				
LX1EP	A	211,116	514	241
LX2SM	21	10,108	95	76
*LX1KC	7	709,840	740	380

LITHUANIA

LY5W	A	1,995,188	1686	629
LY5A	A	1,896,084	1574	558
LY6M	A	1,419,087	1500	489
(Op: LY1DS)				
LY2CX	"	66,584	233	164
LY3BH	21	135,135	429	231
LY2OX	14	121,303	400	217
LY3BX	7	379,260	575	294
LY2BUU	"	242,824	406	254
LY1DD	"	123,880	312	190
LY6K	3.7	642,240	840	360
(Op: LY3BS)				
LY3MM	"	334,068	549	291
LY2HN	"	244,992	429	264
LY2DX	"	176,788	365	229
*LY2TZ	A	215,296	456	256
*LY3BY	"	1,550	32	31
*LY2BI	21	3,528	56	49
*LY2TX	3.7	36,240	146	120
*LY2OU	1.8	9,360	76	65

BULGARIA

LZ1RN	A	383,244	596	293
LZ1BJ	"	235,944	453	261
LZ7N	14	1,603,264	1517	611
LZ8A	14	1,337,486	1330	577
LZ5QZ	"	129,375	410	225
*LZ4BU	A	6,655	60	55
*LZ1QQ	21	8,820	76	70
*LZ2WA	1.8	32,340	135	110
*LZ2UZ	"	5,382	45	23
*LZ5CY	"	145	7	5

AUSTRIA

OE8CIQ	A	282,750	528	290
OE2BZL	"	84,240	227	180
OE3A	3.7	1,038,880	1075	430
(Op: OE1EMS)				
*OE3R	A	69,888	229	156

FINLAND

OH3OJ	A	810,229	1207	409
OH6KZP	A	442,288	724	359
OH3JR	"	279,675	491	275
OH2VZ	"	41,667	160	129
OH1AF	21	155,085	577	245
OH1HS	"	134,320	540	230
OH1JD	14	2,215,516	1624	673
OH1KAG	3.7	432,566	641	313
*OH3KCB	A	406,448	766	304
*OH4JLV	A	239,499	571	267
*OH5NHI	"	210,910	509	262
*OH3JKV	"	13,736	88	68
*OH2LYP	"	13,596	132	103
*OH2RL	"	3,388	50	44
*OH1LEG	21	58,245	309	165
*OH5PA	14	2,516	40	37
*OH1LVR	"	100	10	10
*OH4KBC	7	381,728	521	302
*OH2LNH	"	1,728	28	27
*OH6ZH	"	968	22	22

ALAND IS.

OH0AM	A	2,980,740	2556	658
(Op: OH1EH)				

CZECH REPUBLIC

OK1EP	A	475,303	564	383
OK2QX	"	219,742	509	281
OK1SI	"	128,702	330	203
OK1GW	21	25,197	161	111
OK1RI	14	3,761,380	2080	802
OK2PVF	"	385,994	714	349
*OK2VWB	A	156,420	383	220
*OK1FJD	A	155,363	394	221
*OK1JOC	"	133,660	368	205
*OK2PLK	"	131,988	331	204
*OK1BA	"	131,824	341	214
*OK4MM	"	118,978	346	202
*OK1KVK	"	112,290	322	197
*OK1KZ	"	101,748	284	183
*OK1UHZ	"	61,776	225	156
*OK1AXB	"	58,102	169	139
*OK2TBC	"	55,648	224	148
*OK2PBG	"	50,304	210	131
*OK2SWD	"	22,325	122	95
*OK2BUT	"	21,996	121	94
*OK1AVY	"	19,008	120	88
*OK1ARI	21	28,910	162	118
*OK2BEE	14	66,810	243	170
*OK2PCL	"	40,086	153	131
*OK1JN	7	252,384	416	264
*OK1FFU	3.7	437,760	707	304
*OK2PPM	"	135,014	307	209
*OK1DDV	"	684	19	18

SLOVAKIA

OM3IAG	A	242,944	465	256
OM3TMU	"	73,472	250	164
OM6NM	3.7	142,800	306	204
OM7RU	1.8	104,160	264	186
*OM3YK	A	189,774	383	234
*OM6TY	"	116,813	320	199
*OM7SM	"	78,353	202	187
*OM5AHI	"	38,610	187	117
*OM3TA	7	50,440	154	130
*OM2SM	"	12,768	82	76
*OM5KM	3.7	334,020	532	285

BELGIUM

OT7T	A	5,197,648	2528	788
(Op: RA3AUU)				
ON4XG	"	91,816	279	18
*ON4CAS	A	197,200	439	272
*ON4BBR	"	44,992	207	152
*ON7YP	"	34,322	162	131
*ON4CU	14	25,000	132	115

DENMARK

OZ7DN	A	568,812	563	321
OZ5EV	"	293,328	419	336
OZ5WQ	"	44,897	190	139
OZ5DX	21	351	15	13
OZ1INN	14	190,944	424	272
OZ5LH	"	62,363	200	151
OZ3SK	1.8	214,722	427	237
*OZ1ACB	A	154,358	402	226
*OZ4NA	"	92,820	281	182
*OZ7AEI	"	33,005	170	115
*OZ5ABD	"	13,920	110	87
*OZ1JVX	14	36,576	193	144
*OZ1BUR	"	13,892	107	92
*OZ2ZZZ	3.7	170,834	353	229

THE NETHERLANDS

PA3GKE	A	52,052	200	143
PA0JR	"	5,704	169	62
PA0IJM	3.7	144,144	340	198
*PA0KHS	A	293,940	594	284
*PA0KDM	"	97,680	290	185
*PA3GZC	"	9,424	80	76
*PA3EVY	"	6,370	82	65
*PA0MIR	3.7	159,600	331	228
*PA2SWL	"	95,160	250	183

SLOVENIA

S59ZA	A	3,414,362	1900	658
S59A	A	1,505,880	1116	564
S54X	"	571,557	763	357
S55A	"	215,202	431	267
S56A	"	146,714	326	218
S52CO	"	131,208	345	231
S51AY	28	6,400	105	64
S53FO	21	7,392	80	66
S50R	14	2,006,478	1520	657
S58AB	14	1,918,620	1486	627
S58D	"	1,072,603	1005	469
S55T	3.7	1,089,680	1125	424
(Op: S50Y)				
S570	3.7	905,168	969	407
S50L	"	744,480	936	376
S51S	"	727,610	930	377
S50D	"	526,746	705	347
(Op: S57AD)				
S52CW	"	497,860	705	341
S57LZA	"	126,266	298	203
S54E	1.8	379,620	576	285
S57M	1.8	285,648	500	264
*S51F	A	876,040	927	440
*S52FB	"	72,584	243	172
*S53DX	"	44,243	199	151
*S54DL	28	1,974	55	42
*S52OT	21	58,353	255	159
*S57U	14	205,920	423	288
*S54A	7	320,880	431	280
*S53XX	"	101,916	224	171
*S57KNC	3.7	278,000	507	278
*S57J	3.7	146,288	300	223
*S57MSU	"	93,104	256	184
*S57KAA	"	64,872	218	159
*S57NPR	"	52,852	189	146
*S57NTW	"	28,728	148	114

SWEDEN

SM2DMU	A	1,023,420	1274	461
SM4AIO	A	213,060	510	268
SM4SET	"	137,418	379	222
SM5ALJ	"	67,818	311	178
SM3AF	"	30,381	163	123
SM5OK	"	5,600	59	50
SM0KV	21	21,518	171	106
SM5LPO	14	464,400	844	387
SM6FJY	"	3,978	42	39
*SM7HSP	A	23,856	124	112
*SM0BDS	"	20,009	117	107
*SM7DXQ	"	6,804	57	54
*SM6AHU	14	20,272	133	112

POLAND

3Z2GD	A	1,435,378	1287	518
SP9QMP	A	968,840	1096	457
SP5BB	"	64,107	236	153
SP6CZ	"	13,838	87	74
SP9DAM	"	13,478	130	62
SP9LAS	"	1,826	26	22
SP2JMR	21	29,618	146	118
SP5GRM	14	1,269,950	1150	550
SP6FBD	"	43,056	200	144
SP9JXC	"	640	22	20
SP3JHY	7	85,656	212	166
SP9MAV	3.7	104,276	235	199
*SP7SEW	A	404,432	142	112
*SP2AHD	A	122,508	295	249
*SP5ALV	"	102,637	269	197
*SP9RPW	"	59,444	210	154
*SP9KJU	"	38,556	155	126
*SP9HZF	"	30,765	146	105
*SP1RWK	"	31,535	160	119
*SP1MHV	"	18,228	91	84
*SP9IKN	"	11,773	173	88
*SP8TDE	"	8,832	69	64
*SP7LHX	"	8,618	72	62
*SP4GHL	"	7,824	78	48
*SP2XDR	"	6,579	72	51
*SP6OPE	"	4,408	46	38
*SQ3BYH	"	3,626	54	49
*SP5XMM	"	3,256	50	44
*SP9EH	"	2,100	42	20
*SP1RKB	"	1,008	21	18
*SP3SLO	21	37,632	180	128
*SP7DZA	"	10,716	102	76
*SP9RVD	"	5,400	76	54
*SP5LCC	"	1,736	39	31
*SP6SOX	"	175	21	7
*SP8HXN	14	62,000	165	125
*SQ5AAS	"	28,080	202	90
*SP2GNB	"	5,073	64	57
*SP7RFF	"	4,260	99	30
*SP5BPB	"	2,560	44	40
*SP1EOI	7	53,360	170	145
*SP9DEM	3.7	29,866	123	109
*SP2CYK	"	13,904	86	79
*SP5OXJ	"	10,252	71	68
*SP1DTG	1.8	13,320	87	74

GREECE

SV2YC	A	2,370	32	30
*SV1DET	A	264,740	504	310
*SV1CID	7	228,288	360	246
*SV7CLI	"	20,952	119	97

CORSICA

TK5NN	A	4,212,426	2368	734

TURKEY (EUROPEAN)

*TA1FA	A	353,012	515	284
*TA1BM	A	24,543	111	101
*TA1AL	"	574	15	14

EUROPEAN RUSSIA

RN6BY	A	4,326,511	3004	751
RW1AC	A	739,538	1117	394
UA1OMX	"	732,060	907	420
RA1AA	"	576,271	774	331
UA4LU	"	493,434	629	347
RU3DX	"	278,756	561	307
UA6LAK	"	247,860	441	255
UA6JY	"	236,316	430	282
UA3BZ	"	112,332	321	253
U1BA	"	75,795	220	155
RW4YA	"	68,951	290	191
UA4WAD	21	68,932	208	118
RZ1ZZ	14	431,210	701	403
UA3SEG	14	144,204	366	244
RK3AD	"	28,899	157	117
RW4AA	7	1,134,312	918	453
UA1OMS	"	346,332	453	294
RX3APM	3.7	498,624	699	336
RA3VV	"	162,078	340	227
UA1ODN	"	87,450	222	165
RW6AH	"	62,410	205	158
RA4CC	1.8	52,164	186	138
*RW4PL	A	644,028	849	357
*RU4WE	A	364,140	570	289
*RK3PWJ	"	135,584	333	223
*RV1CC	"	74,976	261	176
*RV6LMG/3	"	69,426	302	174
*UA1AKE	"	28,314	133	99
*RV4LC	"	27,248	126	104
*UA6LP	"	15,801	82	69
*RN3QO	14	485,958	770	398
*RW4FX	"	182,600	418	275
*UA1OMZ	"	115,921	341	241
*RA3WA	7	410,440	491	310
*RX6AY	"	166,428	282	207
*RX3DRU	3.7	119,652	186	177
*RV4LP	"	115,632	273	198
*RA4NW	1.8	85,250	237	155
*UA4UDF	"	59,520	163	160
*UA3YLJ	"	50,688	200	132

KALININGRAD

*RA2FAD	1.8	43,776	168	128

UKRAINE

UT4UZ	A	2,413,920	1915	642
UT3UZ	A	719,320	1025	392
UR4QHJ	"	594,152	996	394
UT4UO	"	573,903	771	363
UR5UW	"	447,678	686	323
UX5UO	"	437,988	608	323
UY5ZZ	"	337,108	568	284
UY5TE	"	158,562	396	207
UR5XEP	"	20,158	120	95
UR5ZO	"	9,408	102	56
UT5UGR	21	41,400	273	138
US1E	14	1,661,404	1628	626
UT3RN	"	90,804	345	188
UT7MD	"	47,740	195	155
ER0F	7	1,528,860	1143	498
(Op: UX0FF)				
UR7E	7	1,275,960	1023	465
UT0ZZ	"	667,206	746	367
UX0HA	"	164,512	312	212
UX1VT	3.7	344,344	561	301
UX3HX	3.7	319,759	551	281
UR8V	"	255,000	456	255
UT5UJO	"	140,030	614	209
UX1UA	1.8	67,648	210	151
UY1HY	"	43,086	324	129
*UY2ZA	A	630,564	835	374
*UR5ASM	A	165,110	370	209
*UU9JQ	"	91,506	453	202
*US5EVD	"	62,730	216	153
*US8IBJ	"	54,912	210	156
*UB5BCJ	"	36,800	155	115
*UT5UOC	"	33,798	167	130
*UR5XAW	"	29,700	117	99
*UT5UML	"	21,504	131	96
*US8ICA	28	90	9	6
*UR7M	14	222,336	666	288
*UY8W	"	66,024	243	168
*US5L	"	64,896	264	164
*UR7CA	7	670,140	723	365
*UR7TZ	"	295,390	429	271
*UT8IM	"	163,488	320	208
*UX3M	"	70,148	172	142
(Op: UR3MP)				
*UR8QR	3.7	137,376	310	212
*UT3WJ	"	21,390	111	93
*UU4JMG	1.8	110,622	253	179
*UT1ZZ	"	32,712	145	116

LATVIA

YL2SW	A	194,142	407	247
YL2KO	21	93,984	461	178
YL0A	14	926,026	1094	491
(Op: YL2GM)				
YL2GN	7	372,608	528	284
*YL2TW	A	364,716	656	297
*YL1ZF	"	343,299	678	308

ROMANIA

YO7KJS	A	10,404	75	68
YO2R	3.7	618,184	845	332
(Op: YO2DFA)				
*YO3FRI	A	702,294	943	402
*YO5CYG	A	403,091	612	307
*YO2ARV	"	111,860	298	188
*YO3CDN	"	37,740	101	85
*YO9GJY	"	30,396	134	102
*YO7CEG	"	26,010	129	102
*YO3JF	14	162,324	452	243
*YO4DCF	"	40,068	181	126
*YO4ATW	"	33,462	163	117
*YO9FEH	"	6,728	73	58
*YO3GOD	7	264,160	416	254
*YO2LIF	3.7	339,840	607	295
*YO9IAB	"	75,520	221	160
*YO5KUW	"	20,540	154	130

YUGOSLAVIA

YT1BB	A	4,481,720	2474	760
YT1AD	A	3,168,585	2037	735
(Op: YU1DX)				
4N0AV	A	3,057,155	2056	685
(Op: YU7AV)				
4N9BW	"	2,836,995	2151	659
(Op: YU7BW)				
YU4WU	"	226,440	402	255
YU7SF	"	24,300	129	100
YZ4BYZ	21	17,700	148	100
(Op: YU4SO)				
YT0A	14	2,221,320	1734	692
(Op: YZ6X)				
YU1JW	14	1,260,820	1283	521
YT7A	7	2,161,452	1303	562
4N1A	3.7	1,559,000	1234	500
(Op: 4N1DXX)				
YU4AU	1.8	85,324	256	166
*YT0X	A	784,672	1115	434
(Op: YU7AL)				
*YU7CB	A	368,865	582	315
*YU1BO	"	276,552	505	276
*YU1KNO	"	67,270	204	155
*4N7TA	"	4,032	56	48
*YU1RA	28	15	6	5
*YU1HA	21	26,660	136	124
*YU7YZ	"	1,128	25	24
*4N7B	14	1,219,710	1246	545
(Op: YU7BJ)				
*4N7CC	7	446,336	565	317
*YU1FJK	3.7	362,368	557	298
(Op: YT1WA)				
*YU7KM	"	65,600	203	164

MACEDONIA

Z31RU	3.7	197,944	357	227	
*Z32KV	A	1,856	35	32	
*Z37FCA	"	368	16	16	
*Z39M	14	619,648	1030	412	(Op: Z31FK)

OCEANIA

SINGAPORE

*9V1ZW	21	77,462	468	154

THE PHILIPPINES

DU1SSR	A	276,378	443	219	
4F3GDX	21	1,623,447	1590	353	
DU1SAN	14	800,100	795	350	
*DU1LER	A	372,288	760	168	
*4F5MW	"	81,250	204	130	(Op: WD5AAH)
*4F4IX	21	792,285	1080	255	
*DU1COO	14	729,280	754	344	
*DU1FZB	"	143,448	3085	172	

FRENCH POLYNESIA

FK8HC	A	2,760,936	1710	536

SAIPAN

WH0AAV	21	1,244,880	1401	315
*KH0CE	14	283,554	552	177

HAWAII

NH7A	A	8,570,552	3272	632
WH6CQH	14	3,771,486	2369	573
KH6FKG	7	2,176,830	1029	361
*NH6YK	28	25,641	120	77

AMERICAN SAMOA

AH8A	7	2,897,880	1223	410

AUSTRALIA

VK5GN	A	3,354,138	1783	558
VK3TZ	A	1,669,143	1060	427
VK2ARJ	A	980,218	843	346
VK8AV	A	164,500	301	188
VK4MOJ	21	6,642	60	54
VK2APK	14	840,693	757	399
*VK4MGA	21	1,598,766	1459	398
*VK6NU	21	126,555	303	143

INDONESIA

YB5QZ	A	2,335,320	1433	499
YB6INU	A	818,712	737	332
*YB2CPO	A	1,068,930	1008	370
*YC5OBB	"	33,088	117	94
*YC7JKS	21	1,035,348	759	478
*YC0WWW	"	177,184	321	196
*YC9WZJ	"	85,728	224	152

NEW ZEALAND

ZL1ANJ	A	3,717,350	1991	559

SOUTH AMERICA

GUYANA

8R1K	A	10,857,848	3517	824	(Op: N5ZO)

CHILE

CE8SFG	A	1,992,214	1373	529
CE6NES	21	133,962	292	166
XQ8ABF	7	6,121,222	1630	653

BOLIVIA

CP1FF	7	3,016	26	26
*CP1AA	14	57,968	168	138

URUGUAY

CW6V	A	3,820,914	1901	711
*CX3DHT	A	7,255	147	95
*CX4VA	"	5,355	45	45

ECUADOR

HC1OT	A	6,810,737	2672	667
HD2RG	14	2,720,091	1572	593
HC1HC	1.8	4,536	30	28
*HC3AP	7	75,978	83	81

ARGENTINA

LU1HLH	A	2,643,780	1596	556	
LU2BAR	A	426,098	530	314	
AY9H	"	163,416	410	203	
LU8AQE	28	559,630	729	293	
LU2DW	"	456,688	658	272	
LT1F	21	4,941,594	2232	769	(Op: LU1FKR)
LU4HAW	21	3,034,750	1720	610	
LU4HKL	"	49,569	162	123	
LP5H	14	4,022,830	1977	707	
LU7HLF	14	1,285,606	964	458	
LU6MFD	7	4,428,192	1318	579	
LT5V	7	1,227,392	645	344	
LU8FDZ	3.7	9,600	57	50	
*LQ0N	A	3,269,370	1871	606	(Op: LU2NI)
*LU8HLI	A	1,628,958	1166	498	
*LU5EWO	A	1,381,380	1078	460	
*LU1EYW	"	1,060,488	957	396	
*LU4DFH	"	231,061	350	229	
*LU6AMD	"	223,816	370	202	
*LU2DKN	"	103,418	191	166	
*LU8FXF	"	78,085	216	161	
*LU5EVK	"	28,100	151	100	
*AY7D	"	8,140	60	55	(Op: LU7DW)
*LW8ERM	"	84	6	6	
*LU4VZ	28	504,216	652	298	
*LU8HSO	28	335,654	526	242	
*LW6EQG	"	174,125	367	199	
*LU7HTJ	"	140,818	321	181	
*LU4HMV	"	75,616	228	136	
*LW2EOC	"	70,300	220	148	
*LU5DSE	"	43,188	166	122	
*LU5HCI	"	42,229	173	121	
*LU5WFT	"	15,318	115	69	
*L5V	21	1,261,316	1054	421	(Op: LU5VC)
*LU1HTF	21	612,890	652	334	
*LU3ES	"	422,988	521	303	(Op: LW1ECO)
*LS9F	14	2,153,859	1362	551	(Op: LU5FCI)
*LU8EWD	"	332,004	409	292	
*LU2JCW	7	2,320	20	20	

PERU

*OA4DAY	A	703,629	781	333

ARUBA

P40V	A	14,761,773	4709	843	(Op: KW8N)

BRAZIL

PY2PD	A	1,281,192	1100	422	
ZZ1K	28	70,994	228	154	(Op: PY1KB)
PY2SZY	"	1,036	35	28	
PU7TDD	"	75	16	15	
ZX5J	21	10,312,104	3643	968	(Op: PP5JR)
PY3BD	"	151,848	311	171	
ZV8C	14	2,518,992	1512	588	
ZX9A	7	10,787,128	2308	814	(Op: PY5CC)
PY1CAS	3.7	12,980	69	55	
*PW2N	A	567,630	687	315	
*ZW2L	A	192,643	387	211	(Op: PU2RUX)
*PY2QW	"	174,840	264	235	
*PY2OZF	"	68,672	224	148	
*PU2VJJ	"	7,395	79	51	
*PP5UB	28	308,962	500	241	
*PY2SR	28	167,757	368	199	
*PU2MHB	"	134,520	304	177	
*ZW1B	"	93,408	265	168	(Op: PY1OB)
*PU2MRY	"	74,245	226	155	
*PX1I	"	44,672	189	128	(Op: PY1KS)
*PU2PXR	"	36,442	152	137	
*PU2WDP	"	35,226	159	114	
*PU1KDR	"	19,201	139	91	
*PY1FC	"	7,680	90	60	
*PY2DUN	"	170	12	10	
*PP5UA	21	1,712,000	1200	500	
*PY4OY	21	301,498	420	254	
*PY2APQ	"	10,136	80	56	
*PT2AW	14	708,111	694	369	
*PT7SD	"	37,120	120	116	

SURINAM

PZ5DX	A	1,712,880	1139	520

VENEZUELA

YV1GUZ	A	4,224	62	44	
YV5NKV	21	178,466	372	181	
YV4FZM	3.7	305,184	267	204	
YV4AZF	"	49,914	99	94	
*YV4GLE	A	245,886	395	214	
*YV5NWG	A	215,498	328	214	
*YV7QP	"	102,370	706	145	
*YV2FEQ	28	45,036	204	108	
*YW5S	3.7	273,980	271	190	(Op: YV5LIX)

PARAGUAY

ZP5MAL	A	2,888,254	1619	619
ZP2EHA	"	276,318	404	258
ZP5XF	21	3,903,459	1947	691
ZP6CC	21	1,314,612	998	468

SINGLE OPERATOR ASSISTED

UNITED STATES

W6XR	A	1,860,790	1243	587
AA3JU	A	935,656	802	436
W5HVV	A	785,610	827	435
KA7ZUM	A	734,562	941	446
N5JR	"	724,960	869	460
W8AEF	A	584,278	823	389
KC0ZC	A	469,098	867	438
KB0WY	"	435,768	665	402
N6CCL	A	396,134	792	382
W9RM	A	307,818	419	294
K7WP	"	271,492	555	299
N1NQD	A	266,513	334	247
NE8I	"	238,788	376	268
ND5S	"	194,184	310	232
W3HVQ	"	164,220	299	210
K2LE	"	141,705	295	235
NZ1Q	"	108,678	227	177
K2BX	"	101,935	226	185
KD1NE	"	100,648	216	184
K6XX	"	82,864	165	118
KZ2A	"	73,352	215	173
AE1M	"	65,826	180	159
AD4G	A	39,216	226	152
AA0CY	"	19,065	120	93
W1LRZ	"	10,505	60	55
*KE3XG	A	54,108	211	167
*N2TTT	A	33,500	104	100
*WB3ECU	"	27,071	135	107
WA2ZGO	14	38,781	149	139
*WR3L	14	73,650	177	150
*W9HV	14	49,410	166	135
N1HRW	7	265,230	673	315
K9OSH	"	252	16	14

DX

TM7XX	A	2,749,440	1872	640	(Op: F5MUX)
JM4UQM	A	2,381,475	1436	565	
IO4A	A	1,435,236	1317	524	(Op: IK4PVR)
EA5BHK	A	1,298,856	1114	543	(Op: EA5KY)
DK7ZT	A	1,149,876	901	507	
DL5IC	"	639,216	688	414	
JR4QZH	"	446,908	504	308	
EA5YJ	"	439,468	558	362	
IR2W	"	434,612	683	358	
ZZ2E	A	431,112	546	276	
JH4NMT	"	402,144	492	284	
9A6ACY	A	392,502	325	209	
EA1ABM	"	262,605	495	305	
DF1IC	"	230,928	425	272	
ON9CBE	A	168,474	348	258	
YV6DBW	A	107,100	267	170	
JA9XBW	"	92,120	215	140	
DL9GMN	"	86,480	271	184	
ZZ2Z	"	58,671	173	123	
*YU1NR	A	1,316,847	1266	511	
*ON5GQ	A	709,590	833	434	
*IY4M	A	481,650	589	390	(Op: I4ABF)
*YO2LDE	A	267,386	493	269	
*S50U	A	217,005	435	255	
*JK2VOC	A	193,817	386	221	
*F5IJT	A	185,906	400	271	
*S53G	"	128,754	312	207	
*F6JSZ	"	60,047	201	149	
*F5NBX	"	20,500	100	100	
*JA0BMS/1	A	17,784	110	78	
*EA4AUF	A	1,320	22	22	
EA3AML	28	7,936	114	62	
*JL4CVG	28	7,367	75	53	
EA3EJI	21	97,125	260	185	
IU2D	21	96,624	285	198	(Op: I2TZK)
JQ1NGT	21	96,564	319	156	
*JR9NVB	"	59,150	207	130	
DL3NED	14	1,447,270	1145	590	
DL7IO	"	1,177,691	1039	547	
EA3CKX	14	1,052,694	943	502	
F5PGP	14	1,023,360	1014	492	
RW4WR	14	845,543	1051	503	
YT4I	14	811,536	1050	464	(Op: YZ7ED)
7N2UTO	14	80,107	201	161	
*S57T	14	281,517	501	321	
*S58MU	7	65,296	193	154	
EA3DX	3.7	441,540	617	330	
YT4TD	3.7	104,784	314	177	
DL7VRO	1.8	169,092	403	231	

MULTI-OPERATOR SINGLE TRANSMITTER

UNITED STATES

K5ZD	5,287,320	2303	773
KC7V	2,650,008	2125	654
WW5DX	2,307,646	2215	638
NY4A	2,145,164	1546	644
NK7U	2,112,613	1609	587
WR4K	2,078,586	1697	666
KZ6X	1,947,780	1636	540
N8NR	1,765,950	1294	610
N6MI	1,539,000	1240	570
AA0YX	988,980	1573	530
KB1BQZ	868,230	982	495
AE5T	856,960	1189	520
WT1L	785,760	927	480
KO7X	785,385	1184	465
KO7Z	452,816	755	364
NN6NN	444,222	862	414
KT3T	431,713	625	349
W7IG	410,592	527	329
NN5AA	382,976	790	374
N3PUR/AG	280,881	540	309
KD8SQ	206,980	375	262
WB2QLP	183,150	492	275
WV2LI	142,560	320	220
N9THC	118,940	280	190
N1DRQ	114,246	247	198
KY4DX	112,096	425	226
KC2AOZ	67,860	215	156
W0EEE	56,871	138	89
KY6M	9,594	93	82

NORTH AMERICA

3E1DX	5,693,272	3229	676
KP3P	4,709,760	2332	704
CK7U	3,234,600	1931	540
VE6SV	2,324,808	1635	564
VA3SK	2,190,986	1293	553
VE5SF	636,398	746	347
NL8/NO7F	104,058	250	141

AFRICA

IZ9Z	11,6616,531	3246	753
3DA5A	7,425,200	2866	760
S02R	4,735,192	2212	616

ASIA

C40M	8,513,496	3513	636
RK9CWW	5,858,802	2365	703
EX9A	4,901,116	2472	667
YM3DL	3,269,808	1830	464
YM2KC	2,388,216	1088	604
JE6ZIH	2,269,775	1350	557
JA1YKX	906,878	805	422
UK8IWW	353,367	539	213
JA2ZJW	337,960	450	284
RK9JWJ	33,464	176	94

EUROPE

HG1S	9,186,237	3893	939
TM1C	8,415,283	3429	919
IR4T	7,564,320	2760	918
LZ9A	6,303,206	3208	826
T9DX	6,013,104	3292	816
OE3S	5,859,204	2876	852
9A7A	5,353,942	2616	794
TM2V	4,635,088	2590	772
RU6LWZ	4,537,296	2681	778
RW6AWT	3,950,525	2800	725
OH8AA	3,778,584	2441	696
9A0C	3,659,250	1488	425
OZ5BAL/P	3,207,600	2196	720
IQ4T	3,192,748	1941	676
EA5BY	3,126,977	1915	721
OH7AAC	3,065,862	2311	681
ED1WWE	2,897,154	2061	702
LY1DQ	2,514,526	2008	613
II2K	2,358,055	1696	623
OH5NQ	2,228,560	1830	626
OK8AUY	2,224,800	1735	600
DT7P	2,083,820	1621	620
ES5Q	2,073,060	2191	540
OM9A	2,003,490	1705	565
GW7A	1,914,115	1715	595
RK3DWH	1,856,078	1668	569
TM0PX	1,755,708	1613	533
IK2HKT	1,600,398	1414	534
RK4WWA	1,564,434	1473	522
DL5T	1,526,987	1446	539
EU5F	1,470,822	1602	474
DK7WJ	1,396,460	1297	524
SX2T	1,373,907	1576	471
PA6WPX	1,363,456	1350	512
IO2L	1,353,711	1245	529
IO8X	1,304,063	1249	521
ON6ZX	1,234,394	1150	518
ED6URM	1,221,595	1253	505
YZ7A	1,093,248	1159	468
J41W	936,243	1056	441
M7G	900,090	1161	438
EA1FY	883,116	957	481
RK3AWE	760,140	1130	412
SK0UX	760,128	1083	428
DF0HTE	735,487	911	421
TM2S	705,116	922	431
SK0HS/5	667,896	961	408
RO3A	546,788	914	374
ED1WPX	511,589	644	377
F5KIN	489,216	713	364
EA3BT	480,398	669	401
OK2KOD	450,120	690	341
9A1CEI	377,009	617	331
IT9KWF	320,199	556	313
RZ4AYT	318,710	563	290
3A/DF8XC	312,768	555	288
OZ7HAM	287,638	556	299
II7P	282,282	514	286
ED4RKU	278,124	478	308
YU1L	222,048	479	257
SN6U	210,924	456	243
HA8KCI	194,184	443	248
UT4UWC	133,045	273	205
DL0SLZ	105,924	260	194
CT1EGF	82,075	235	175
UR4MWU	77,376	308	186
UA3AB	71,595	170	129
OM7F	46,410	186	130
OK1KCF	26,304	124	96
M7S	22,738	201	138
9A1CHY	15,272	111	92
F5KAC	14,310	100	90
TF3IRA	10,032	93	76
HG4DFR	4,876	60	53
YO9KVV	2,210	41	26

OCEANIA

JA1BRK/DU1	6,570,720	3623	486
VK4EMM	3,641,978	1790	578
VK1DX	2,426,026	1736	458
FK8KAB	318,498	563	218
DX1E	293,349	459	229
9M6TCR	33,048	137	81

SOUTH AMERICA

ZX0F	25,497,504	6193	1093
CV1T	2,655,114	1103	539
LU3VAL	2,374,295	1436	539
L40H	1,391,335	1102	451
LU1NF	1,244,592	991	432
PY3MHZ	212,289	400	231

MULTI-OPERATOR MULTI-TRANSMITTER

UNITED STATES

AE0M	8,165,408	4,113	872
KU4V	4,284,824	2,675	808
NE6N	3,389,892	2,303	671
WM2V	708,968	671	401
NE9U	522,020	906	430
N5KB	234,094	678	322
N1SNB	113,420	330	212
KB0JYL	3,675	67	49

NORTH AMERICA

WP3X	23,297,736	7,336	1,078
T40RFC	3,327,456	2,227	548
VE6JY	3,150,624	1,978	592

ASIA

JA3ZOH	3,907,578	1,932	681
BV9AYA	1,994,569	3,648	397
JO1YAO	1,571,062	1,168	487
RK9AZZ	126,824	237	166

EUROPE

9A1A	16,791,460	6,207	1,085
S52A	15,050,090	5,611	1,045
OT7A	14,075,810	6,125	1,055
S53M	8,352,520	3,889	902
RW2F	6,974,268	3,958	818
Z30M	6,318,916	3,834	778
LY7A	4,868,769	3,602	687
OH7AB	3,078,800	2,370	688
LY3MR	2,846,928	2,590	592
RM3T	2,292,388	2,058	556
ED7VG	615,615	744	385

OCEANIA

KH7R	19,816,220	6,261	835

SOUTH AMERICA

LU4FM	18,473,910	4,972	1,010
4M1X	16,814,160	5,153	968
LR3Y	2,636,704	1,537	632

CHECKLOGS: The following logs were used for cross-checking. Checklogs and SWL logs are appreciated. AA8UP, CE5BPE, CT1DJE, CX7BY, DF5PP, DJ0SH, DJ5IO, DL1ET, DL3MG, DL5KVG, DL8KWA, EA1AAA, EA1CZF, EA1EXJ, EA2BAP, EA3ASX, EA3FCQ, EA5AEN, EA5AOM, EA5BZS, EA5KY, EA7FNK, EA7GR, EA8BXQ, ER5AA, ES5RW, EU1TU, EU2MM, EW8DA, IV3OWC, JW5HE, K3SWZ, K6FM, KB2TAT, KC5NTD, KX7J, LA0BX, LA2XIA, LA4OGA, LA8ZJA, LA9LO, LA9NM, LU4IC, LU6ESP, LY1FM, LZ1GU, LZ1KWT, LZ3RN, LZ4UU, N0XCF, PA0UV, PU3WPA, PY1BNE, PY1LVF, PY1SH, PY2SY, PY2TI, PY3AJB, PY3CEJ, PY3FBI, PY3PT, PY3UEB, PY8MD, RA1QX, RA4LI, RA4UF, RK3RZZ, RU3RR, RX3MX, S53BM, SM0CSX, SM0KV, SM3CBR, SM3CBR, SM7BZV, SO3MAQ, SP2DWA, SP4AS, SP4KWO/P, SP4SAF, SP5CEQ, SP6BEN, SP6BYE, SP6FIB, SP6JLL, SP7VCK, SP8JMA, SP8KBZ, SP8UFT, SP9MDY, SP9MQH, UA0AOZ, UA0CW, UA3WCN, UA4FTA, UA9OS, UK9CID, UN9PQ, UT4UP, UT5UAG, VE3BR, W5BA, YC0LOW, YC6HPO, YC9WGA, YL3BZ, YO5CUU, YO5OFJ, YO8CRU, YV2NY, YW6W, YZ1GD.

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(continued on page 107)

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PLEASE CHECK OUT: http://www.GLR.com/dwm

HEARD ISLAND commemorative T-shirts, same shirt as team is wearing on QSL card. Proceeds benefit VKØIR DXpedition. Fast order turnaround in time for Christmas. Personal checks on U.S. banks okay. Please no credit cards. Sizes remaining: large, extra-large. 100% cotton, U.S. made. $20 Priority Mail stateside, $25 DX Air Mail, postage included. Tom Anderson, WW5L, 3505 Cliffwood Drive, Bedford, Texas 76021-2043 (phone 817-498-2820; e-mail <WW5L@gte.net>).

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CONTEST STATION FOR RENT: Chalet 9,000 ft. in Colorado Rockies. Two-element, 40 meter beam @ 85 ft., 8-element log periodic @ 50 ft., slopers on 75. TS930SAT and Alpha. WØLSD, Ken, Box 156, Buena Vista, CO 81211 (telephone 719-395-6547; e-mail <diverken@chaffee.net>).

CLASSIC RADIOS: RadioFinder web list revised weekly: <www.radiofinder.com>; telephone/fax 1-313-454-1890; or <finder@radiofinder.com>.

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FOR SALE: ICOM 730 Multiband transceiver GC $250; 3-element Triband Yagi antenna 10-15-20 meters GC $50; 30 ft. aluminum tower with heavy-duty aluminum mast and TV rotator GC $75. Call 609-728-3426.

Advertiser's Index *(cont'd)*

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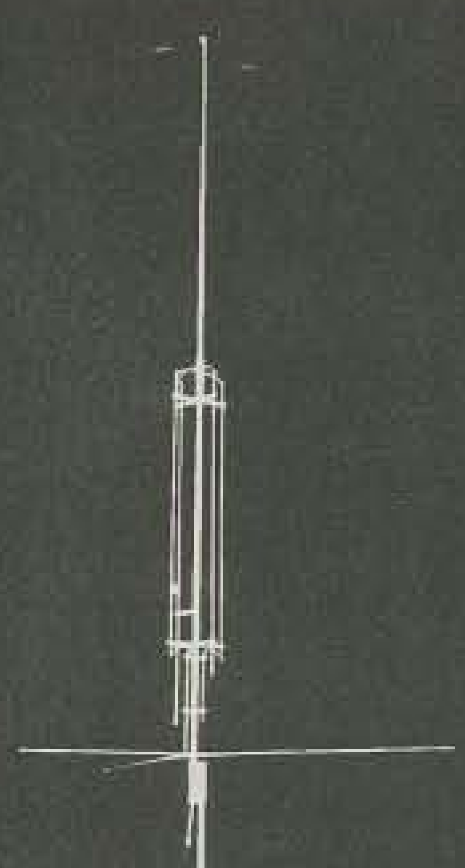
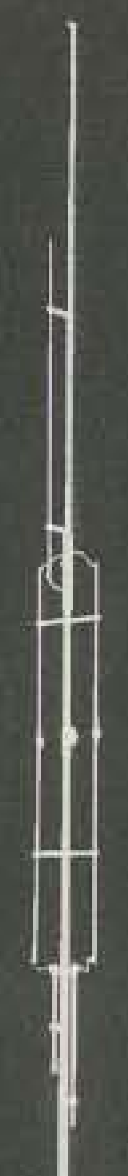
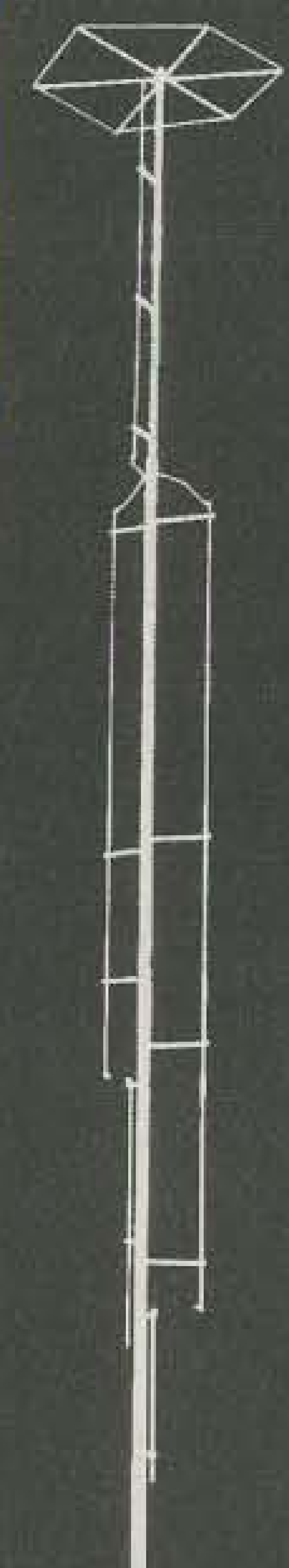
GAP: THE PERFECT ANTENNA

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. W hen 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."

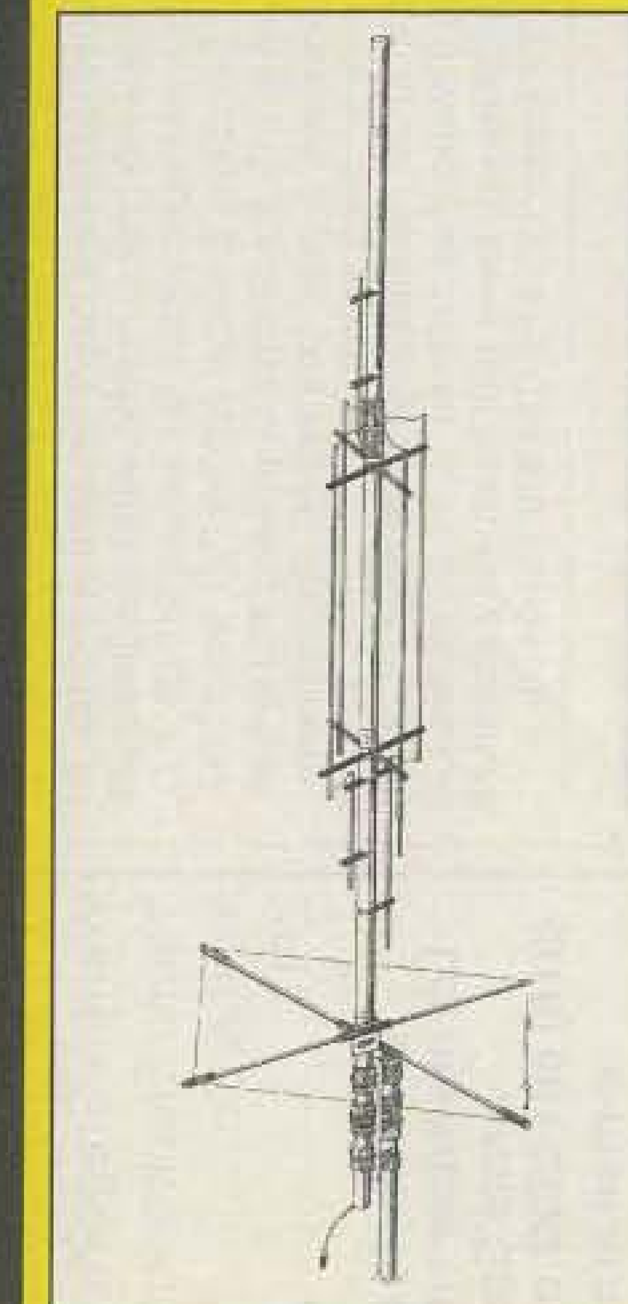
73–"This is a real DX antenna, much quieter than other verticals."

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

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