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Amateur Radio

CQ

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MAY 1994

1945 Our 50th Year 1994

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On the cover: Mike Raskin, K4KUZ, Plantation, FL

RADIO AMATEUR'S JOURNAL

Kenwood's TM-942A/742A/642A—

Triple Triumph

TM-942A/742A/642A

F M M U L T I B A N D E R

Good things come in threes. Like Kenwood's distinctive TM-942A (144MHz/440MHz/1200MHz), TM-742A (144MHz/440MHz), and new TM-642A (144MHz/220MHz)—high-performance FM multibanders that demonstrate the best in mobile communications technology. Besides offering triple receive and display capability, the TM-942A can even receive all three bands simultaneously. For the TM-742A and TM-642A, you can choose one of several optional band units, enabling triple band operation with the same triple simultaneous receive. Top-notch features include 101 memory channels (all available for split operation), automatic band change, DTSS with page, and S-meter squelch. There's even a wireless remote control function. Yet operation is remarkably simple, thanks to sophisticated microprocessor control, high-visibility illuminated keys, and clear status displays. You wouldn't expect any less from Kenwood. But there's more: you can mount the controls and display separately from the main unit (requires optional kit) for unique 3-way convenience.

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The Radio Amateur's Journal

ON THE COVER: Down in south Florida—Plantation, to be exact—Mike Raskin, K4KUZ, does his CW DXing and contesting from this handsome setup. (Photo by Larry Mulvehill, WB2ZPI)

MAY 1994 **VOL. 50, NO. 5**

FEATURES

DEPARTMENTS

ZERO BIAS

EDITORIAL

May is usually my month of good intentions. I dig out a few notepads and some graph paper and make plans to clean up the rat's nest of wires and cables coming from my antennas into the house.

Over the years I've built up quite a supply of brackets, fittings, exotic hardware, waterproof boxes, and the like to do just about anything. I have an ample store of aluminum bar and various sizes of angle stock which I secured at a distress sale because it was water stained. That didn't matter to me, as it would be outside in the rain anyway.

I have all this stuff ready to go, including some rough drawings from my previous years' designs. Somehow, though, each new year's plans call for some sort of widget or bit of hardware that I don't already have. The plans get somewhat more elaborate each year, but as usual, my intentions are good.

The same philosophy sort of guides me in my shack. Don't get me wrong; everything is functional and does work. However, in my mind's eye I can see what it could be after I do this and that to dress it up. I don't think any of it will work any better even if I finish all these great ideas, but something within me says that it will. It might look better and be slightly roomier if I use up the stuff in the boxes and plastic bags that I've been collecting for years to do all this work. I might even pick up a few square feet of usable floor and shelf space to keep some other neat stuff.

I know that I'm not alone in this state of perpetual preparation. I see it all the time at hamfests, and I'm usually grateful that we don't *drive* to more of them. I marvel at some fellow amateurs who bring little wagons and grocery carts to hamfests and wheel out some of the biggest and strangest collections of things. Something one amateur learns never to ask another is "What are going to do with that?" It's the stuff that dreams are made of.

When I was young, I envisioned a shack with one wall covered with 6 by 30 foot racks holding all sorts of glowing (remember that?) and humming stuff. I could picture banks of meters (some of them even matching), the vanes of which moved in some syncopation, showing the state of everything.

Although these days everything tends to get smaller and smaller, I still see big racks show up at hamfests waiting for some dreamer to take them home and begin a new odyssey. There's always a good deal to be had (if you can either lift it or drag it away) of large, heavy, nondescript equipment in pre- or post-cannibalized condition, seemingly full of great parts and hardware, its original purpose long since forgotten.

Lately when people stop at our hamfest booth and thumb through our calendars, it is easy to spot the two kinds of dreamers and planners. *CQ*'s Amateur Radio Calendar features some great contest and DX antennas that most of us will only own or use in our reveries. However, the more mature of us gently pick up the Radio Classics Calendar, with its cover shot of a Harvey Wells Bandmaster, and suddenly a small crowd develops with people talking about either owning a Bandmaster or wanting one. Page after page elicits memories and tales of stations worked using some of that classic gear. There's probably even a niche market out there for Bandmaster reproductions. Two sets of dreams and two sets of dreamers.

During the mid-1950s through the early '60s while I nurtured my dream of 6 foot racks, I was very active on UHF/VHF. Oh, not to the extent of K2UYH, but active in my own way. Surplus abounded, and there was no shortage of things to build and try (no matter how big they were). AM was the mode, and the sunspots were riding high. Crystals were in vogue, and if you decided you needed a VFO, it was easy to convert a BC-459. In fact, you could also add a reactance modulator on the back deck and give FM a whirl. At that time commercial equipment was scarce, expensive, and not that much better than you could make yourself.

My, how times have changed. Just try to imagine how much room it would take and how big it would have to be (using late '50s technology) to try to approximate all of the functions and facilities of today's typical HT.

Part of this trip down memory lane, I guess, is to remind me not so much as to where we were, but where the focus was. For the most part, the focus was on building rather than doing. The doing part of amateur radio was quite dependent on the available technology and the literature. My favorite book of those days was *The VHF Handbook* by Frank Jones, W6AJF. He was certainly way ahead of his time and a genius. Through the years I must have built everything in that book, and it all worked. Of course Frank's major drawback *(sorry, Frank)* was aesthetics. Everything he ever built looked awful and seemed to come from a workshop without any tools—but it all worked. If you ever see a copy of his book in a fleamarket, pick it up. He said it all.

Today, especially on VHF, there is such a host of options in equipment, technology, and goals available that the focus most certainly is on what can be done with this cornucopia rather than inventing it all over again. Earlier this year we set out to produce a "how to" book and video on getting started and what you can do on VHF today. It is pretty amazing that with the equipment many of you have or can easily obtain off the shelf from your local distributor, you can accomplish things which were unheard of during the heyday of Harvey Wells. Obviously, the focus is on what you can do today—right now—without having to come up with today's equivalent of a parametric amplifier and two rooms full of 6 foot racks. Set aside those memories of Flash Gordon and Tom Corbett, Space Cadet. It's so relatively easy now that even grade-school kids can contact today's astronauts from their classrooms.

These are still exciting times for today's amateurs, regardless of the class of license. Check our ad in this issue for *CQ*'s latest VHF video and book. They just might have the impact on you that Frank's book had on me.

Hamfest Report

This editorial is usually written about one hamfest behind. So before the big one occurs, let me tell you about the Charlotte Hamfest, which took place in March.

Basically, if you missed it, you missed a really good time. For those of us from the Northeast it was one of those rare times this winter when we didn't see all that white stuff on the ground. (There was some green stuff there instead.) And there was this bright, shiny thing up in the sky which made it kind of warm outside.

The food looked good (and was), plus the committee kindly supplied the exhibitors with boxed lunches, which were also good.

I did get a sneak peek at a new product from one of our advertisers and was told it would be shown for the first time at Dayton (reason enough to go). While I can't tell you what it is, it looks like something a lot of you will want.

Did I have plenty of stuff to bring home? You bet! It was a good shopping show for everyone, including those who brought wagons and carts. Outside of great things for the shack, I bought a framed display of bullets (from both sides) purportedly dug up from the site of the battle of Chickamauga during the Civil War.

Arnie, John, and I even managed a side trip one evening. When we got back to the hotel after dinner, we noticed a Super K-Mart store about a block away. We decided to check it out (to see if they carried *CQ*, of course). Well, they carry *CQ* and *Popular Communications*, as well as just about everything else. It's really big, and you could probably use a golf cart to get around and shop the whole store. They even have their own UPS area, where I guess you can ship stuff home instead of trying to carry it to the other end of the store. I did check out the ice-cream shop, and the maple-walnut-praline was pretty good.

As the 1994 hamfest season goes into full swing, let me remind you once again of the first law of hamfests: If you see it and want it, buy it then, because it won't be there when you get back. If you don't want to carry it around, somebody else will be more than willing to do so (especially if it's at a good price). You can always buy it, put your name on it, and leave it there to be picked up later. That way you're always sure to get what you want.

73, Alan, K2EEK

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Add some zip to your CW keying with the KK-1 Keyboard Keyer from AEA. The KK-1 turns any AT-compatible keyboard into an easy-to-use, feature-packed Morse machine. Using the provided cable, the KK-1 will even share a keyboard with your computer!

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Take a break from tapping your paddles and call AEA's Literature Request Line at (800) 432-8873 for more information, or call us direct at (206) 774-5554. Contact your favorite ham radio equipment dealer for best pricing.

Connect with us

KH6-land, from Brussels, to commemorate the Beatification of Father Damien; Hawaiian hams; May 15–June 15; activities are planned for all bands, all modes, including the Novice subbands. For commemorative QSL card, send your card, an SASE, and name of operator worked to AH6KY, Apt. #608, 84-265 Farrington Hwy., Waianae, HI 96792, or directly to operator contacted.

7-land, from Intake, Montana; The Lower Yellowstone ARC; May 21 to May 22; 0000–2400Z; 40, 20, 15 meter General phone subbands; Novice 10 meter phone; CW 40 and 15 meter subbands. For certificate send SASE to Kaye Braun, N7AFE, P.O. Box 101, Savage, MT 59262.

W7STB, from Promontory, Utah, to commemorate the driving of the Golden Spike; The Ogden ARC; May 10 from 0001–2100Z; 3.970, 7.270, 14.280, 21.375 and 28.415 MHz. Send QSL and SASE to Ogden ARC, P.O. Box 3353, Ogden, UT 84409.

W7ZA, from Aberdeen, Washington, to celebrate the 40th birthday of The Grays Harbor ARC; The Grays Harbor ARC; 2300Z May 6 to 2300Z May 8; CW Novice portion of 10, 15, 20, 40, and 80 meter subbands as well as the General portion of the 20 meter band; SSB in the General portion of the 10, 15, 20, 40, and 80 meter subbands as well as the 10 meter Novice band. For QSL, send QSL and SASE to GHARC, P.O. Box 2250, Aberdeen, WA 98520.

8-land, Holland, Michigan, to celebrate Tulip Time; The Holland ARC; May 4–14; lower portion of General 20 and 15 meters and 28.400 MHz. For a certificate send QSL with callsigns worked and a 9 × 12 SASE to Barbara Siebelink, N8NXA, 6418 Otis Road, Saugatuck, MI 49453.

N8BIB, from Yanke Air Museum, Belleville, Michigan; May 30; 1200–2300Z; General portion of SSB 80–10 meters. For certificate, send QSL and 9 × 12 SASE to Frank A. Nagy, N8BIB, 24315 Waltz Road, New Boston, MI 48164.

W8BAP, from The Feast of the Flowering Moon, Chillicothe, Ohio; Scioto Valley ARC; 1300–2100Z May 28–29; General SSB section lower portions of 40, 20, 15 meters; possible Novice CW on 40 meters. For 8.5 × 11 certificate, send a large SASE to SVARC, P.O. Box 353, Chillicothe, OH 45601.

W8NP, from Massillon, Ohio, for Glory Days, 100 Days of High School Football; The Massillon, Ohio ARC; 1500–0200Z May 28–30; SSB 28.350, 24.950, 21.350, 18.150, 14.270, 7.270, 3.870; CW 28.125, 21.125, 18.080, 14.050, 7.125, 3.700 ± QRM @ 2 meter FM/SSB and SWLs welcome. For certificate, send QSL with 2 units of first-class postage and a 9 × 12 or #10 SASE for folded certificate. Send to MARC, c/o Don Wade, WD8DEA, 5245 Portage St. NW, North Canton, OH 44720.

WV8Y, from The 53rd Annual West Virginia Strawberry Festival; The Buckhannon Amateur Radio Klub; 0000-2400Z; May 20; on 1.887, 3.887, 7.287 MHz. For a certificate, send QSL and 9 × 12 SASE to WV8Y, P.O. Box 2044, Buckhannon, WV 26201.

KF9IA, from Scott Field, Scott AFB, IL to commemorate Armed Forces Day; May 21; 160–10 meters. QSL/SWL with SASE to 806 E. Illinois St., New Baden, IL 62265-1921.

W9DUP, from the First Division Museum at Cantigny, Wheaton, IL, to celebrate Armed Forces Day; The DuPage ARC; 1600–2300Z; May 21; SSB 7.250, 14.290, 28.400, 145.25 repeater; CW 7.040. For certificate send QSL and SASE to Jack Carr, NV9S, DARC, P.O. Box 71, Clarendon Hills, IL 60514.

KBØIWV, from Hanska Minnesota, Brown County, to celebrate Hanska's 10th Annual Syttende Mai to commemorate the anniversary date of the constitution of Norway in 1814; New Ulm ARC; May 21 from 1600–0400Z, May 22 from 1600–2300Z; 7.250, 14.250 MHz and the club repeater at 147.33+. For a certificate, send a QSL and a 9 × 12 SASE with two first-class stamps or a #10 SASE for a folded certificate (SWL reports okay) to Pat Mathiowetz, KBØIWV, NUARC, RR 4, Box 14-A, New Ulm, MN 56073.

WBØHSI, from the Lewis and Clark Rendezvous; St. Charles, Missouri; St. Charles ARC; 1300–2100Z May 21–22; 7.265, 14.265, 21.365, 28.465, 146.67, AO-13 Modes B and J, as propagation and QRM per-

10, 12, 15, 17, 20, 30 & 40 Meters

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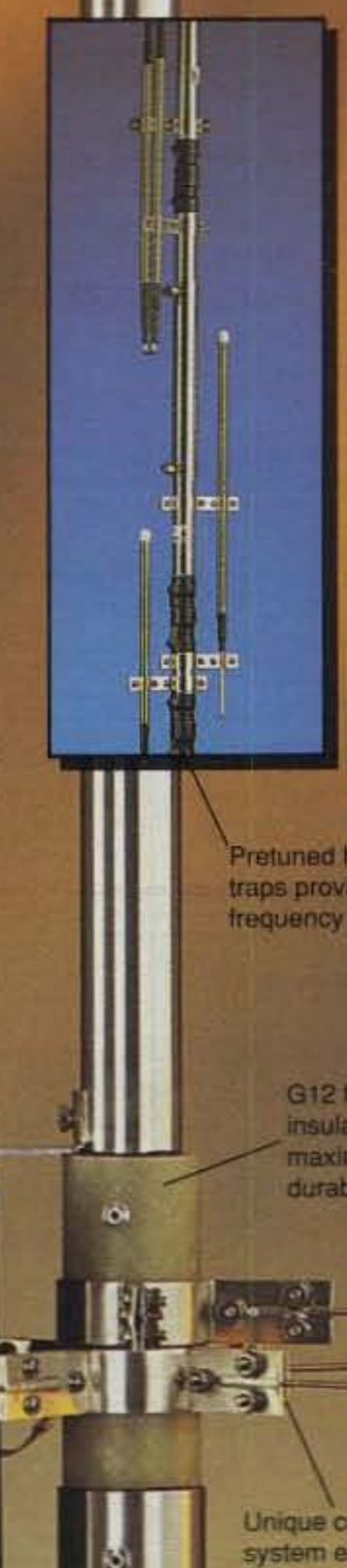
"My first QSO was ZA1A in Albania with my R7." NE8Z / HC1MD

"Metalwork, machining and traps well made . . . Assembly was straight forward and easy." WX6W

SPECIFICATIONS

Frequency, MHz	28, 24, 21, 18, 14, 10, 7
Gain, dBi	3
Electrical Wavelength	Half-wave
SWR 2:1 Bandwidth	10m-2 MHz / 12m-100 KHz 15m-450 KHz / 17m-100 KHz 20m-250 KHz / 30m-25 KHz 40m-75 KHz
Power Rating, Watts PEP	1800
Radiation Angle, degrees	16
Frequency Selection	Automatic
Horizontal Radiation Pattern, degrees	360
Height, ft (m)	22.5 (6.9)
Mast Size Range, in (cm)	1.5-1.75 (3.8-4.4)
Wind Load, ft² (m²)	2.25 (.21)
Weight, lb (kg)	12.3 (5.6)
Counterpoise Radials Supplied	7
Wind Survival, mph (kph)	80 (128)



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mit. For certificate, send QSL and a 9 × 12 inch SASE to St. Charles ARC, P.O. Box 1429, St. Charles, MO 63302-1429.

WØWYV, from the Strategic Air Command Museum, Bellevue, Nebraska; The Bellevue ARC; 1300–2200Z May 28–29; lower phone portion of the General 40, 20, and 15 meter bands, and if propagation permits, in the Novice portion of the 10 meter phone subband. For a QSL, send QSL card with contact number and #10 SASE to N4OWG, 1311 Greenwood Avenue, Omaha, NE 68133-2526.

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

April 30, **Susquehanna Valley Repeater Association 1st Annual Computer Show & Hamfest**, Elizabethtown High School, Elizabethtown, Pennsylvania. Call Bob Spangler, N3KND at 717-426-3377; or write to SVRA, 423 West Ridge Road, Elizabethtown, PA 17022.

April 30 – May 1, **XVI International DX Convention**, Rancho Park Hotel, Castelldefels (Barcelona), Spain. Sponsored by the Lynx DX Group. Contact Tony, EA5BY, phone/FAX 34 6 542 7834.

May 1, **Burlington Hamfest '94**, Burlington Drive-In Theater, Agency Street, Burlington, Iowa. Contact Chuck Gysi, N2DUP, Burlington Hamfest '94, P.O. Box 911, Burlington, IA 52601-0911; or call 319-752-3000 (voice/FAX).

May 1, **Spr. Kishwaukee ARC Hamfest**, Sandwich Fairgrounds, Sandwich, Illinois. For more information send an SASE to Howard, WA9TXW, P.O. Box 264, Sycamore, IL 60178.

May 1, **METRO 70cm Network Giant Electronic Flea Market,** Lincoln High School, Yonkers, NY. Contact Otto Supliski, WB2SLQ, at 914-969-1053, or write to METRO 70 CM Network, 53 Hayward Street, Yonkers, NY 10704. (Exams.)

May 1, **The Paul Bunyan ARC Hamfest**, Bemidji, Minnesota. Contact Steve Hake, Hamfest Chairman, 4331 Pincherry Road, Bemidji, MN 56601, or call 218-751-9558. (Exams.)

May 7, **Southern Tier Hamfest**, Marvin Park Fairgrounds, Owego, NY. For more information, contact STARC, P.O. Box 7082, Endicott, NY 13761-7082. (Exams.)

May 7, **Wisconsin Hamfest**, Manitowoc County Expo Center, Manitowoc, Wisconsin. For more information, send SASE to Mancorad RC, P.O. Box 204, Manitowoc, WI 54221-0204; or call Red at 414-684-9097 (days); or Ron at 414-793-4733 (eves). (Exams.)

May 7, **East Liverpool Hamfest**, Calcutta Fire Hall, East Liverpool, Ohio.Contact Dick Sisley, K8JKB, 1218 Northside Avenue, East Liverpool, OH 43920 (216-385-1245).

May 7, **Enid Hamfest Group First Annual Tail Gator Swapmeet**, Meadowlake Park, Enid, Oklahoma. Contact Fred, N5QJX at 405-242-3551; Tom, N5LWT, at 405-233-8473; or Dick, N5HEL, at 405-233-9869.

May 8, **The Athens County ARA 15th Annual Hamfest**, at the City Recreation Center, Athens, Ohio. Indoor space is available by advanced registration only (contact John Biddle, WD8JLM, 80 Wonder Hills Dr., Athens, OH 45701; phone 614-594-8901 after 6 PM). For general information, write to Carl J. Denbow, KA8JXG, 63 Morris Ave., Athens, OH 45701-1939.

May 8, **Medina County Hamfest '94**, Medina County Community Center, Medina, Ohio. For more information, send SASE to Medina Hamfest Committee, P.O. Box 452, Medina, OH 44258 (216-725-4492, 10 AM to 5 PM).

May 13–14, **Nebraska State Convention/ Hamboree #16 Convention**, Marina Inn, South Sioux City, Nebraska. Contact Dick Pitner, WØFZO, 2931 Pierce St., Sioux City, IA 51104 (712-258-1520).

May 14, **The Wexaukee ARC Annual Swap and Eyeball QSO**, Cadillac Middle School, Cadillac, Michigan. For more information and table reservations, contact Wexaukee ARC, P.O. Box 163, Cadillac, MI 49601 or call Dan, KE8KU, at 616-775-0998.

May 14, **The Skywide ARC Annual Spring Hamfest and Flea Market**, Westway United Church, Etobicoke, Toronto, Canada. For information call John Wilson, VE3WIL, 1-416-663-0178; Rex Sweetapple, VE3XER, 1-416-663-0288; or J. Young (Chairman), VE3CRB, 1-416-244-1292.

May 14–15, **Yakima ARC Hamfest**, Selah Middle School, Selah, Washington. For information contact Dick Umberger, N7HHU, at 509-248-3580. (Exams.)

May 15, **MIT Flea Market**, sponsored by the MIT Electronics Research Society, the MIT Radio Society and the Harvard Wireless Club. Albany & Main Street, Cambridge, Massachusetts. For space reservations or further information, call 617-253-3776.

May 15, **The North-West Ohio Tri-County Hamfest**, Fulton County Fairgrounds, Ohio. For table reservations or more information, send an SASE to 126 Muntz Street, Holgate, OH 43527, or call 419-264-7775. (Exams by appointment only. Contact Tom Hay before May 8 at 419-542-6192.)

May 15, **17th Annual Wheeling Hamfest and Computer Show**, Wheeling Park, Wheeling, West Virginia. Contact Triple States Radio Amateur Club, Inc., Box 240, RR 1, Adena, OH 43901, phone/FAX 614-546-3930.

May 15, **The Warminster ARC 20th Annual Hamfest**, Middletown Grange Fairgrounds, Wrightstown, Pennsylvania. For more information, contact Woody Woodside, N6XES, 215-672-8482 between 9 AM and 9 PM or write to him at 665 St. Davids Ave., Warminster, PA 18974. (Exams at 11 AM. Preregistration begins at 10:30 AM. Applicants bring the original and one copy of their present license and/or certificates of successful completion, if any, two forms of identification and the $5.75 exam fee. Novice exams free.)

May 20–22, **60th Annual Rochester Hamfest and Computer Show**, Monroe County Fairgrounds, Rochester, New York. For more information, contact the Rochester Hamfest office during weekday business hours at 716-424-7184. For a brochure, call or write Rochester Hamfest, 300 White Spruce Blvd., Rochester, NY 14623.

May 21, **Annual 76 Auction and Flea Market**,

(Continued on page170)

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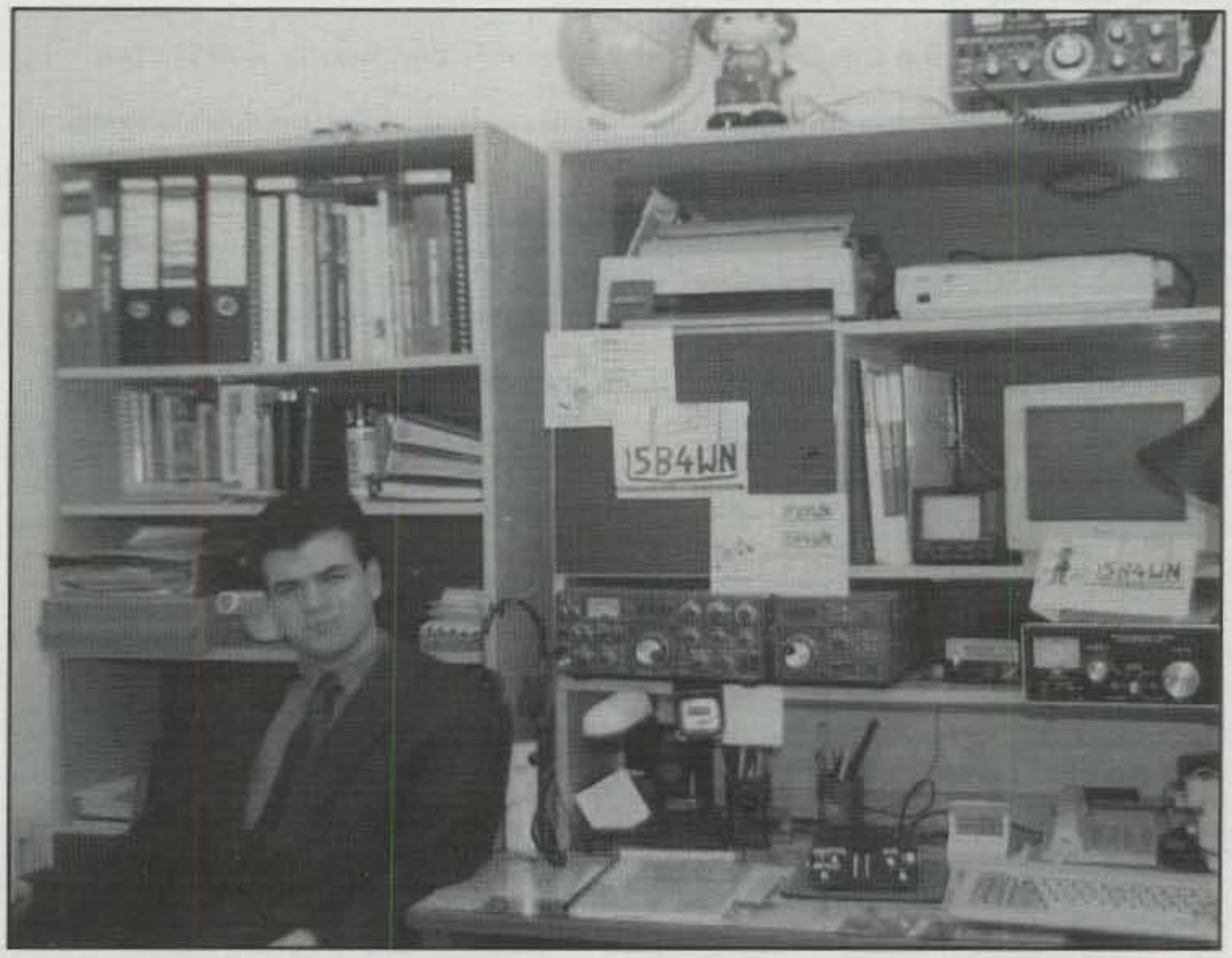
Results of the 1993 CQ World-Wide WPX CW Contest

BY STEVE BOLIA*, N8BJQ

Another CQ WPX CW Contest is in the history books. Conditions were a little better than 1992 and activity appeared to be up a little. One world record was broken, along with several continental records. 1994 will bring some changes to the contest which I hope will encourage more activity, especially from the US. The WPX will climb on the "information super-highway" in 1994 with electronic log submissions, and the addition of a single operator assisted category should lead to more participation.



In possibly his last CQ WPX CW Contest, Marios, C47W (5B4WN), turned in the top score on 40 meters. Marios off to the U.K. for medical school for the next several years.

DX

For the third year in a row, and fourth year out of the last five, Rasa, YU1RL, maintained his dominance in the all band section. In 1993 Rasa operated from Fernando de Noronha as ZXØF and edged OH2MM at EA8EA for the top spot. OH2MM was the last to beat Rasa back in 1990. The number three spot went to H28A operated by Ivo, 5B4ADA. K6NA at 9Y4H finished fourth, with P4ØJ in fifth place. 7Z2AB operated by K2XR was sixth, with John, VE3EJ, number seven. In addition to John's top North American finish, he was the winner of the World Combined SSB/CW plaque, donated by Carlos and Martin Monsalvo. Jose, CT1BOH, used his special call (CR7M) to take the top spot in Europe, with 4X/S59PR and S5ØA rounding out the top ten.

Ten meter scores were down a bit from last year, but there was still activity on the band. DL1VJ/T5 made 600 stations happy with a rare T5 multiplier on his way to the top spot. To make this effort even more notable was the fact that Bernd won the world using only 100 watts. PTØZ and OH6WZ were second and third. S58A operated by S58AM just edged US5I for 21 MHz honors, followed by 9A1CCY and low power entry 3ZØKN. YW1A with YV1DIG at the key topped the 20 meter entries, followed by VB7SZ, 9A7A, IB9T (IT9TQH), and ZD8LII in probably his last WPX contest from Ascension. C47W operated by Marios, 5B4WN, just edged out EA9LZ operated by EA7PN for 40 meter honors, with VB7SV, G3LNS, and HK1KXA providing lots of competition. The difference between number one and number six on 40 was just about 600K. In another close race YTØT edged out a win over VB7CC and K1ZM on 3.5 MHz. The top three were less than 50K apart. T99C managed to make 227 Q's on top band to claim the top spot. OH3RB (a low power station) and OK1DRU were second and third.

Low power scores were surprisingly competitive, with 7Q7XX and HA3UU both turning in 4 million point logs. Jim, 9V1YC, finished third with 3.3M points, followed by 5Z4TT at 2.8M and Carl, OH6XY, at ZA2A at just a shade under 2.8M. DL1VJ/T5 won the world on 10, followed by LU1AEE and VK2BQQ. 3ZØKN (one of the more unique calls in the contest) took the number one spot on 15, followed by LU6BEG and S53DZD. VO3SF, SV5/K5BDX, and S58MM were one, two, and three on 20 meters, with PA3AAV, T91ENS, and OK1FPG finishing in the same order on 40. SO2FCJ captured the 3.5 MHz title, with ON4ON and HA4FV providing the main competition. On top band OH3RB had the top low power score (as well as number two in the world overall), followed by DL3JSW and HA4FB.

USA

KQ2M at KM1H (I could start out all my stories this way) again made it a double header victory with a win in both the SSB and CW sections of the WPX contest. Bob has been number one since dethroning KT3Y in 1991. Getting closer to Bob was Tom, W2SC, at NR1E, who was less than 600K behind. In third place was KF3P, followed by Dave, K5GN, and Steve, K5MR. K3ZO was sixth, followed by N6TV, K3WW, W6EEN, and AA5DX.

WA2SYN won the plaque as the top 10 meter entry. KTØF did likewise on 15. KT3Y just made it past K1TO for 20 meter honors, followed by KE9A/4 and W5FO. KC1XX and W3BGN were neck and neck on 40 meters. Jeff, K1ZM, was number one on 3.5 (also third in the world), followed by WW2Y and WE3C. Top band honors went to AD1G.

Ralph, N5RZ, was the low power, all band champion with a nearly 2 million point effort. Second place went to K7SV, followed by K5RX, K2QMF, and K9LJN. WA9BOW took 21 MHz honors, with N8II claiming the top spot on 14 MHz. Following Jeff was KN6M/5, who was back on the contest scene after a lengthy absence. AA6XX edged out NA5Q for the top spot on 40 meters, and N4OT won the 3.5 MHz championship.

The top two in the QRP category stayed the same, with W2GD and AA2U duplicating their 1992 finish. Third in the world was UB4FXX, followed by KN1M and VE3KP. DK7QB topped the 28 MHz category, with UA9YC leading the way on 21. WB6JMS just edged out JR2BNF/1 for the top spot on 14 MHz. SMØDZH turned in an excellent score to win the 7 MHz title, as did OK2BXR on 3.5. YO2CJX was the top band champ. In the US, N5NMX won 28 MHz. K2KTT

*4121 Gardenview, Beavercreek, OH 45431

TROPHY WINNERS

SINGLE OPERATOR, ALL BAND

WORLD: Steve Bolia, N8BJQ Trophy. Won by: **Station ZXØF operated by Radivoje Lazarevic, YU1RL.**
USA: Steve Bolia, N8BJQ Trophy. Won by: **Station KM1H operated by Bob Shohet, KQ2M.**
OCEANIA: Tom Morton, KT6V Trophy. Won by: **Station NH6T operated by Jim Neiger, N6TJ.**
WORLD COMBINED SSB & CW: Carlos Monsalvo, LU6EBY, and Martin Monsalvo (Jorge Bozzo, LU8DQ Memorial Trophy). Won by: **John Sluymer, VE3EJ.**
EUROPE COMBINED SSB & CW: Les Nouvelles DX Group Trophy. Won by: **Aleko Savkova, LZ3ZZ.**
USA COMBINED SSB & CW: Oklahoma Comm Center Trophy. Won by: **Bob Shohet, KQ2M.**
WORLD QRP/P: QRP Amateur Radio Club International Trophy. Won by: **John Crovelli, W2GD.**

SINGLE OPERATOR, SINGLE BAND

WORLD: Pedro Piza Jr., NP4A (Pedro Piza, Sr., KP4ES Memorial) Trophy. Won by: **Station YW1A operated by Paolo Stradiotto, YV1DIG.**
OCEANIA: D. Craig Boyer, AH9B Trophy. Won by: **Station V7A operated by Kenneth Wells, V73C.**
USA: Kansas City DX Club Trophy. Won by: **Phil Allardice, KT3Y (14 MHz).**
WORLD 7 MHz: William D. Johnson, KVØQ Trophy. Won by: **Marios Nicolaou, C47W.**
WORLD 3.5 MHz: Lance Johnson Engineering Trophy. Won by: **Station YTØT operated by Sinisa Radulovic, YU1RA.**
USA 28 MHz: Walt Smith, K1DWQ Trophy (Bernie Welch, W8IMZ Memorial). Won by: **Jeffrey Singer, WA2SYN.**
USA 21 MHz: Wayne Carroll, W4MPY Trophy. Won by: **John E. Muhr, KTØF.**
USA 14 MHz: CQ Magazine Trophy. Won by: **Daniel Street, K1TO.**

MULTI-OPERATOR, SINGLE TRANSMITTER

WORLD: Ron Blake, N4KE Trophy. Won by: **Station P44V operated by AI6V and W1FEA.**
USA: Austin Regal, N4WW Trophy. Won by: **Station KQ8M operated by KQ8M, K8AZ, K8NZ, NI8L, WT8C, NX8R, N8LXS & N8AA.**

MULTI-OPERATOR, MULT-TRANSMITTER

WORLD: Roger Burt, N4ZC Trophy. Won by: **Station HG73DX operated by HA1's TJ, DAE, AH, TD, DAC; HA5's GF, IW, UA, FM, AWH, ML, TI; HA6's WX, ND, NF, OQ, ON, NY, NQ; HA7's VB & RY; HA8RG & HG5CCC.**

CONTEST EXPEDITION

WORLD: Ed Roller, K4IA Trophy. Won by: **Station 9Y4H operated by Glenn Rattmann, K6NA.**

CLUB (SSB & CW)

WORLD: CQ Magazine Trophy. Won by: **Northern California Contest Club.**
USA: Oklahoma DX Association Trophy. Won by: **Yankee Clipper Contest Club.**

World second high and new owner of the African all band record is EA8EA.

Shown here are BZ1QS and F6FYA, two of the ops at BT1BJ, one of the top Asian multi-single entries.

was the big signal on 21, with WD7I/Ø taking 7 MHz honors and W8QZA/6 winning on 3.5.

Multis

P44V—with Carl, AI6V, and Jack, W1FEA, manning the station—topped the multi-single standings, followed by European champ R6L. The Europeans dominated the top ten with RU1A third, OL1A fourth, and TM7C fifth. Rounding out the top ten were UZ2FWA, TM9C, 9H3XX, OM3KFF, and USA champ KQ8M. HG73DX repeated as the multi-multi winner, with UR8J second and KL7Y third. US7I finished in fourth, followed by LY7A.

In the US the ops of KQ8M used K8AZ's fine station to finish first in the multi-single class. The middle of the US was well represented in this category with KW8N placing second and K5XI third. AG6D and NY6Y claimed the fourth and fifth spots. The folks at WZ1R increased their score by over a million points on their way to the US multi-multi championship. Second place went to yours truly in my last foray into the land of the giants now that there is a packet assisted category.

The Rest of The Story

The Northern California Contest Club repeated as World Club champion with a near record 94M points. Will 1994 be the year they break 100M? The Aracuaria DX Group was second with 63M points, followed by the Yankee Clipper Contest Club with 59M and the Les Nouvelles DX Group with 56M points. The WPX contest also offers three combined SSB/CW plaques for single operators. The World Combined plaque was won by John Sluymer, VE3EJ. Aleko Savkova, LZ3WW, won the European Combined plaque, and Bob Shohet, KQ2M, the USA version. These plaques go to the operator (single op, all band only) who turns in the top combined score (you do have to operate both contests).

For the first time many of your logs, including most of the top scores, were run through N6AA's unique database services. Dick massaged nearly 200 disk files and provided us with a listing of unique calls and suspected bad calls. This provided an excellent starting point for checking the logs. Rest assured that the computer did no score reductions or QSO

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Kantronics KPC-3

It's one of the smallest TNCs you can buy. One of the least expensive. It uses the least power. And it's extremely user-friendly. Yet it offers enough performance to satisfy even advanced users. The KPC-3 has more than 20K in personal mailbox space that is inexpensively expandable to 100K; it runs on a 9-volt battery, so it's portable; and it's very affordable. So if you've been wondering why packet beginners and veterans alike choose the KPC-3, now you know. Maybe you should catch the same wave.

Kantronics

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WORLD TOP SCORES

SINGLE OPERATOR ALL BAND

ZXØF	**11,940,978**
EA8EA	10,693,146
H28A	8,891,400
9Y4H	**8,481,370**
P4ØJ	6,570,900
7Z2AB	6,211,994
VB3EJ	**5,888,256**
CR7M	5,645,267
4X/S59PR	5,526,815
S5ØA	5,203,698
S5ØL	4,742,221
KM1H	**4,670,618**
*7Q7XX	4,665,770
5U7M	4,287,940
*HA3UU	4,157,288
DK3GI	4,114,010
NR1E	4,097,820
NH6T	**4,078,653**
KF3P	3,947,030
4O7AV	3,938,403

28 MHz

*DL1VJ/T5	410,550
PTØZ	162,692
OH6WZ	160,992
*LU1AEE	88,893
LY2OU	37,772
*VK2BQQ	33,449
*HA8EN	26,325
OK1BMW	24,426
*OM3TEG	18,816
*DK2GZ	14,946

21 MHz

S58A	2,601,819
US5I	2,022,828
9A1CCY	1,988,910
*3ZØKN	1,719,852
KG6DX	1,606,528
OH6RM	1,506,444
G4CNY	1,421,809
ERØF	1,050,776
*LU6BEG	1,044,072
YT9T	998,049

14 MHz

YW1A	**4,338,567**
VB7SZ	3,261,106
9A7A	2,939,988
IB9T	2,743,440
ZD8LII	2,687,580
S5ØS	2,661,150
ZF2NE/ZF8	2,633,470
VE1ST	2,627,814
OK1DXS	2,332,200
VB5MX	2,315,601

7 MHz

C47W	**2,874,960**
EA9LZ	2,829,276
VB7SV	2,626,704
G3LNS	2,500,400
HK1KXA	2,365,440
V7A	**2,205,922**
S59AB	1,769,586
UA6LAM	1,707,048
VE2FU	1,623,146
KC1XX	1,421,472

3.5 MHz

YTØT	**453,908**
VB7CC	416,880
K1ZM	406,080
WW2Y	352,692
LY3BS	352,688
LY1DS	344,967
YT2WW	338,368
OH1NSJ	301,702
OM3TZW	285,696

1.8 MHz

T99C	63,990
*OH3RB	33,488
OK1DRU	29,106
*DL3JSW	20,424
*HA4FB	14,400
*UA3VVH	8,442
SP5GH	7,680
*SP8GYD	6,834
UB5ZME	2,030
AD1G	1,100

LOW POWER ALL BAND

7Q7XX	4,665,770
HA3UU	4,157,288
9V1YC	3,350,204
5Z4TT	2,878,722
ZA2A	2,759,192
NP2I	2,615,943
YB6AVE	2,528,620
TM6GG	2,175,084
N5RZ	1,996,467
K7SV	1,715,208
CK2C	1,686,501
FH/DK5WL	1,578,064
VB4VV	1,557,864
DL1IAO	1,520,500
K5RX	1,512,375
TE5T	1,494,060
7S5AA	1,421,910
OH3LIM	1,340,612
S56A	1,324,032
VB1HA	1,228,968

28 MHz

DL1VJ/T5	410,550
LU1AEE	88,893
VK2BQQ	33,449
HA8EN	26,325
OM3TEG	18,816
DK2GZ	14,946
OK1MGW	13,260
DF5WN	12,848
JI3BFC	3,256
JK1GXU	2,166

21 MHz

3ZØKN	1,719,852
LU6BEG	1,044,072
S53DZD	660,334
IT9AF	635,778
S59DJK	502,554
S57BU	487,160
LU4FD	450,216
G3SSO	431,552
UA9USK	409,960
HA6NW	326,688

14 MHz

VO3SF	1,240,782
SV5/K5BDX	1,184,535
S58MM	1,104,520
N8II	631,120
KN6M/5	591,408
T94P	545,478
W1WEF	540,930
K9KU	539,600
CH6BF	535,050
WA6UKI	534,560

7 MHz

PA3AAV	708,400
T91ENS	479,184
OK1FPG	350,132
OH3NXW	343,434
HG8Q	338,116
AA6XX	248,800
G4ZOB	244,664
NA5Q	225,250
RB5FT	198,470
OK2BCG	194,916

3.5 MHz

SO2FCJ	257,240
ON4ON	222,740
HA4FV	147,000
4N7MOD	117,392
S53CAB	102,076
S58BKL	101,260
UO5OED	76,320
RB5PE	67,800
S59DDR	55,620
N4OT	47,428

1.8 MHz

OH3RB	33,488
DL3JSW	20,424
HA4FB	14,400
UA3VVH	8,442
SP8GYD	6,834
UB5ZME	2,030

QRP/p

W2GD	**A**	**1,019,712**
AA2U	A	892,749
UB4FXX	A	806,760
KN1M	A	710,980
VE3KP	A	520,514
DK7QB	28	6,016
SP5ANX	28	4,232
UA9YC	21	147,840
OH2MPO	21	60,962
WB6JMS	14	126,480
JR2BNF/1	14	104,340
SMØDZH	7	119,232
JA6GCE	7	70,432
OK2BXR	3.5	62,640
SP4GFG	3.5	36,570
YO2CJX	1.8	1,188

MULTI-OPERATOR SINGLE TRANSMITTER

P44V	**11,477,437**
R6L	9,194,688
RU1A	7,013,420
OL1A	6,858,324
TM7C	6,653,808
UZ2FWA	6,489,469
TM9C	6,285,642
9H3XX	5,737,230
OM3KFF	5,343,135
KQ8M	**5,314,540**
IR2W	5,246,944
EA3KU	5,121,540
LY4W	5,034,330
S55AA	4,850,240
KW8N	4,824,689
K5XI	4,735,077
JJ3YBB	4,717,622
4N5M	4,612,140
AG6D	4,485,841
XE7X	4,412,180

MULTI-OPERATOR MULTI-TRANSMITTER

HG73DX	**16,543,420**
UR8J	14,328,475
KL7Y	10,868,685
US7I	10,625,523
LY7A	9,903,800
R6L	9,061,425
PA6WPX	8,283,630
WZ1R	8,165,315
CZ7Z	6,289,920
JA1YXP	3,629,170

removals. Any reductions were verified by a human. Dick has agreed to continue in this capacity for the 1994 contests.

My analysis of Dick's percent of unique calls shows that a majority of the logs checked had percentages less than 6%, with several in the 1% to 2% range. A couple of decent-size logs actually had zero uniques. Those with percentages much higher than 6% usually had a little trouble copying the code or typing. Our database was somewhat smaller than the CQ WW which might increase the percentages a little bit.

There will always be unique calls in logs, especially large logs, and we make no attempt to penalize for that. We would, however, like to see less bad calls in the logs, in fairness to all parties (the competitors and those of us who check logs). Please take a little extra time to make sure what you write down or type is correct.

Starting with the 1994 contests WPX logs can be submitted via e-mail on the internet. My e-mail address is sdb@ag9v.ampr.org. Logs will have to be in ASCII format with all of the required information. The log should be unformatted and space delimited. For those using "CT," the AK1AFORMAT will produce a file that is acceptable. Other popular logging programs should produce unformatted ASCII files in a similar format. A summary sheet and a sorted prefix list are also required. If I don't get a prefix list or summary sheet, I won't accept the

CW & SSB CLUB COMPETITION

NORTHERN CALIFORNIA CONTEST CLUB	**94,300,430**
ARACUARIA DX GROUP	63,850,729
YANKEE CLIPPER CONTEST CLUB	**59,424,328**
LES NOUVELLES DX GROUP	56,073,156
FRANKFORD RADIO CLUB	42,161,791
NORTH TEXAS CONTEST CLUB	40,355,232
HA DX CLUB	32,195,617
RADIO CLUB ROSARIO	29,230,514
SOUTHERN CALIFORNIA CONTEST CLUB	29,023,944
RHEIN RUHR DX ASSOCIATION	28,479,825
MAD RIVER RADIO CLUB	26,929,192
NORTH COAST CONTESTERS	26,438,317
FRASER VALLEY DX CLUB	25,894,242
POTOMAC VALLEY RADIO CLUB	25,211,389
KAUNAS UNIV. OF TECHNOLOGY RADIO CLUB	22,001,130
SLOVENIA CONTEST CLUB	21,744,700
CHILTERN DX CLUB	19,276,175
ALASKA DX ASSOCIATION	18,673,965
CROATIAN DX CLUB	18,456,290
TEXAS DX SOCIETY	17,780,340
FRENCH CRAZY CONTESTERS	17,310,349
BAVARIAN CONTEST CLUB	16,850,409
ECUADOR RADIO CLUB	16,254,635
SOCIETY OF MIDWEST CONTESTERS	15,168,469
U.R.E.	14,392,731
KIEV CONTEST GROUP	13,593,656
THE PAPUA NEW GUINEA CONTEST GROUP	13,440,570
CONTESTGROUP OUDE MAAS	12,172,340
RADIO CLUB RC540	11,974,238
WESTERN WASHINGTON DX CLUB	11,301,243
RADIOCLUB VENEZOLANO	11,158,698
CENTRAL VIRGINIA CONTEST CLUB	10,380,049
SOUTHEASTERN DX CLUB	9,661,602
NICOSIA CLUB	8,891,400
OKLAHOMA DX ASSOCIATION	8,210,282
ASCENSION ISLAND RADIO CLUB	8,144,169
KANSAS CITY DX CLUB	7,990,115
UBA	6,969,531
LAKE WETERN DX GROUP	6,873,680
RADIO SOCIETY OF KENYA	6,557,210
BRISTOL CONTEST GROUP	6,372,939
PRINCE GEORGE CONTEST CLUB	6,289,920
CT4NH HOUSE CLUB	5,645,267
PAPERINO DX GROUP	5,491,056
WILLAMETTE VALLEY DX CLUB	5,408,562
ST. CROIX AMATEUR RADIO CLUB	5,367,195
DELTA MIKE	5,246,944
RADIOTEAM FINLAND	4,915,077
OREGON NOCTURNAL CHORDAL CORPS	4,785,942
ESTARREJA DX CONTEST CLUB	4,777,425
WCARA	4,721,517
MACEDONIA DX GROUP	4,612,140
CENTRAL GERMAN CONTEST GROUP	4,587,513
NORTH FLORIDA DX ASSOCIATION	4,348,038
APDX RCP	3,777,757
ARSENAL CONTEST GROUP	3,719,998
MINNESOTA WIRELESS ASSOCIATION	3,658,263
CASCADE CONTEST CLUB	3,646,008
MAUI ARC	3,643,730
HMDXC	3,535,200
RADIO AMATEUR SOCIETY OF THAILAND	3,534,511
RIDERS OF THE STORM	3,449,250
WEYBURN AMATEUR RADIO CLUB	3,268,956
UKRAINIAN CONTEST CLUB	3,252,580
KOREAN DX CLUB	3,249,414
ARI	3,110,812
CANADIAN FORCE BASE GAGETOWN ARC	2,995,100
RADIO CLUB CORDOBA	2,852,748
THE SWL CLUB	2,821,280
CALGARY AMATEUR RADIO ASSN.	2,673,390
UDMURTIA CONTEST CLUB	2,625,335
BC DX CLUB	2,618,356
RADIO CLUB VARAZDIN	2,517,606
LICHFIELD ARS	2,500,400
NORTHERN MINNESOTA DX ASSOCIATION	2,422,362
KWAJALEIN AMATEUR RADIO CLUB	2,185,116
ALBANY RADIO CLUB	2,126,159
EGADS!	2,101,551
SP DX CLUB	2,064,015
SOUTHEND AND DISTRICT SOCIETY	2,053,056
SOUTHWEST OHIO DX ASSOCIATION	2,044,702
DAUBERVILLE DX ASSOCIATION	2,044,341
BOILED OWLS OF NEW YORK	2,018,410
PU AND CLIPPER CONTEST CLUB	2,014,020
SOUTHERN CALIFORNIA DX CLUB	1,960,140
GLOUCHESTER COUNTY ARC	1,912,144
CERKNO CONTEST CLUB	1,871,662
BLACKHAWK DX & CONTEST CLUB	1,862,642
VFDB (GERMANY)	1,726,340
SAAR PFALZ DX CLUB	1,578,064
TUPY DX GROUP	1,567,219
WINNIPEG DX CLUB	1,557,864
LATVIAN RADIO AMATEUR LEAGUE	1,555,121
ESRAC CONTEST TEAM	1,526,987
C.R.A.G.	1,485,320
LEFT COAST CONTEST CLUB	1,471,563
VOJVODINA DX CLUB	1,461,745
SALT CITY DX ASSOCIATION	1,403,458
CHESHIRE COUNTY DX ASSOCIATION	1,362,767
RADIO CLUB OF URUGUAY	1,343,146

log. I will confirm via e-mail all logs received. Queries may also be sent to this address. We continue to encourage disk submission for all logs done on a computer. Starting with this year, you may be asked to submit a disk if one does not accompany your log.

Joining the WPX committee for 1994 is Sergio, EA3DU, who will be assisting with checking the Spanish logs and others received at the Spanish *CQ* offices. Sergio has been serving as a *CQ* checkpoint for several years and has volunteered to help with the WPX contest logs. Welcome aboard, Sergio.

We are still looking for trophy donors, especially for the low power categories. Participation in this class is growing each year and deserves some recognition. If you or your club is interested, please drop me a note for more details. Along the same line, if you win a plaque, please take a few minutes to thank the donor. It will be appreciated.

Summary

That about wraps it up for this year. Remember the 1994 CQ WW WPX CW Contest will be May 28 and 29. Log forms and rules can be obtained from *CQ* in Hicksville for an SASE. Please mark form requests clearly so they can be opened and taken care of quickly. Also remember to mark your logs "WPX CW Contest." This makes it much easier for the folks sorting the mail in Hicksville. See you in the contests!

73, Steve, N8BJQ

Random Comments

Nice chance for a little pistol to work some of the big guns . . . *GM4HQF*. First CW QRP contest, but propagation couldn't match phone weekend . . . *K2KTT*. If 10 meter QRP and pitiful band condx are not a challenge, I don't know what is . . . *N5NMX*. I am consistently amazed at the tremendous competence of some operators, particularly HG73DX . . . *NZ5A*. I couldn't believe the conditions on 14 and 21 MHz, or was it my new 70 foot tower? . . . *SM3CCT*. Was mainly testing my WPX contesting program for my Amiga computer. Found 3 bugs . . . *VB5VA*. QRP is an exciting yet humbling experience, great for polishing operating techniques . . . *W2GD*. 10 meters was a dud at this QTH . . . *W4DEC*.

Another great WPX test. Where did all those U and R PX's come from? . . . *WB6JMS*. My portable operation was cut short due to a Kansas thunderstorm, but it was fun while it lasted . . . *WD7I/Ø*. Sorry worked only 30 hours . . . *4O7AV*. Newborn babies don't care about the contests—so doesn't our daughter. Boy I missed that bed! . . . *4X/S59PR*. It was very hot days here in Niger (40 degrees C) . . . *5U7M*. QSL via JH3RRA . . . *7Q7XX*. Our last contest with high power. All future will be low or QRP . . . *7Z2AB*. My first contest from USA to celebrate my 500 days of living in USA . . . *AA3BG*. Like the low power category. Wish I had more time . . . *AA5B*. Murphy struck first night. Rotator drifted past limit switch . . . *AA5DX*.

With the band condx plus QRN, got to watch the Indy 500 plus the NASCAR 600 and work the contest . . . *AA6DX*. Single Op, Low Power, Single Band 40 meters and QRN—a tough hand to play . . . *AA7FK*. Either conditions were great or my big new aluminum was great or both . . . *AB6FO*. Very lonely. Band good, but no sigs. Just me and W1AW code practice

EAST GEORGIA DX SOCIETY	1,319,074
KENTUCKY CONTEST GROUP	1,292,664
UTAH CONTEST CLUB	1,281,852
NEC FUCHU AMATEUR RADIO CLUB	1,276,185
RADIO AMATEURS OF CANADA	1,228,968
ROCHESTER DX ASSOCIATION	1,210,922
NOVIMAGUM CLUB	1,199,421
FALMOUTH AMATEUR RADIO ASSN.	1,185,678
THE OAKVILLE AMATEUR RADIO CLUB	1,026,312
LITHUANIAN DX GROUP	979,928
ARCTIC AMATEUR RADIO CLUB	914,282
CENTRAL ARIZONA DX ASSOCIATION	892,678
SCHENECTADY AMATEUR RADIO ASSN.	875,472
GRAND MESA CONTESTERS	842,746
LONE STAR DX ASSOCIATION	822,300
A.D.X.C.	801,640
LITHUANIAN CONTEST GROUP	728,994
WDXC	708,400
SIERRA FOOTHILLS ARC	700,737
CENTRAL SHENANDOAH VALLEY CONTESTERS	666,369
PRIE NERIES	635,700
COPS CONTEST CLUB	621,888
DIXIE DX'ERS CONTEST CLUB	591,186
FOX CONTEST CLUB	577,022
SOUTH JERSEY RADIO ASSOCIATION	544,098
WESTERN NY DX ASSOCIATION	509,580
PLATINUM COAST ARS	496,528
NO DOT DX'ERS	421,932
SAWYER COUNTY FISHING AND CONTEST CLUB	417,872
USKA	414,596
CARY ARS	397,015
NORTHSEA DX CLUB	353,115
FRENCH DX FOUNDATION	337,851
RDXA	336,256
JAYHAWK AMATEUR RADIO SOCIETY	322,509
SOUTHERN OREGON DX ASSOCIATION	320,902
TOP OF EUROPE CONTESTERS	311,379
DX NEWS MAGAZINE	310,170
STERLING PARK ARC	304,131
NORTHERN CALIFORNIA DX CLUB	282,152
ROMAN DX GROUP	260,040
SHANGHAI YOUNG HAM 2M NET	260,010
HALIFAX AMATEUR RADIO CLUB	254,070
CALIFORNIA CENTRAL COAST DX CLUB	235,920
SAN DIEGO DX CLUB	232,500
POWAY ARS	228,330
WEST PARK RADIOPS	227,191
REGINA AMATEUR RADIO ASSOCIATION	225,910
VALLEY RADIO CLUB OF EUGENE	217,172
MARIESTADS AMATOER RADIO KLUBB	204,740
STURDY MEMORIAL HOSPITAL ARC	204,171
KANKAKEE AREA RADIO SOCIETY	201,779
MONTE CAPRA DX GANG	200,207
BURLINGTON A.R.C.	192,786
NGH CONTEST TEAM	190,893
STOURBRIDGE & DISTRICT ARS	187,824
MILE HI DX ASSOCIATION	176,016
EASTERN HIGHLANDS ARC	175,570
TORONTO DX CLUB	153,819
DAMPERTHEIMER AMATEUR RADIO CLUB	142,552
LYNX DX GROUP	134,280
MARINANNAS AMATEUR RADIO CLUB	132,990
NORTH SHORE AMATEUR RADIO CLUB	132,311
ALICE SPRINGS AMATEUR RADIO CLUB	119,598
PEJL RADIO CLUB	119,232
SOUTHEASTERN MICHIGAN DX ASSN.	112,290
HARTS	102,816
NIAGARA PENNISULA AMATEUR RADIO CLUB	101,184
NORTH SHENANDOAH DX ASSOCIATION	92,253
ALPHA TANGO DX GROUP	87,816
YV DXPERTS TEAM	83,127
INDIAN RIVER AMATEUR RADIO CLUB	73,948
GADX	70,560
KINGSPORT AMATEUR RADIO CLUB	62,748
HOOSIER CONTESTERS	61,992
REDWOOD EMPIRE DX ASSOCIATION	49,616
RADIO CLUB OF TALLINN	45,724
SAN FERNANDO VALLEY RADIO CLUB	44,998
TWO RIVERS ARC	44,588
FRENCH UNO TELEGRAPHISTE	41,217
GRUPO ARGENTINO DE RADIOTELEGRAFIA	38,907
AMSTERDAM DX CLUB	38,700
CARA	35,333
ORDER OF BOILED OWLS	34,500
RIVER CITY CONTESTERS	32,016
MT. VERNON ARC	29,316
CALTECH ARC	28,470
TOKYO INTERNATIONAL RADIO ASSN.	25,620
DHAHRAN AMATEUR RADIO CLUB	24,119
KETTLE MORAINE RADIO AMATEUR CLUB	24,060
VERON	21,556
LES BACORES DX	18,870
NAKED CHICKEN CONTEST CLUB	17,297
MICHIGAN QRP CLUB	15,150
SDXG	14,946
ZARS	14,282
TANDEM RADIO AMATEURS CLUB	10,900
OE V.S.V.	10,508
TRINITY ARC	9,324
PUNTO FIJO DX CLUB	8,736
ARAB	8,658
COASTLINE ARA	8,418
LLLC	6,426
WICHITA AMATEUR RADIO CLUB	5,238
MONZA	1,564
ORLANDO AMATEUR RADIO CLUB	1,450

most of the time . . . *AD1G*. Daytime QRN levels were high here, and I couldn't hear much on 15 . . . *AD5Q*. It's the first time that I take part in worldwide DX contest . . . *BZ4DHI*. Really disappointed with the propagation on 40 meters. If only I tried 20 meters again . . . *C47W*. All wire antennas and low power! Try it sometime; I dare you! . . . *CK2C*. Couldn't believe how well I was doing the first six hours . . . *CR7M*.

Conditions were not nearly as good as last year, but the contest was exciting nonetheless . . . *DA1AM*. I had no rotator for the beam. It was looking to west . . . *DFØFA*. WPX—the real contest! . . . *DF4ZL*. The score of 421,525 points the best result in my Amateur Radio life! My age is 81 yrs! . . . *DL1TH*. Wish I had more time for the contest . . . *DL1VJ/T5*. Sailing near Mauritanian coast . . . *EA1FBJ/MM*. Is very difficult the competition with stations with kilowatt in antenna . . . *EA4EMO*. This test is fantastic. Thank you all stations . . . *EG1RJ*. Is my first contest . . . *F6FXW*. I like CW contest because all stations work on European bands . . . *FD1RAB*. I am ham radio since 8 months. It was my first contest . . . *FD1TFS*.

The number one station in Yugoslavia was 4O7AV operated by YU7AV.

USA TOP SCORES

SINGLE OPERATOR ALL BAND

KM1H	**4,670,618**
NR1E	4,097,820
KF3P	3,947,030
K5GN	3,868,128
K5MR	3,785,940
K3ZO	3,732,300
N6TV	3,261,555
K3WW	2,719,692
W6EEN	2,576,592
AA5DX	2,571,360
AD5Q	2,560,770
WØAIH	2,299,561
AA3B	2,279,210
WZ4F	2,041,083
K2LE	2,018,410
*N5RZ	1,996,467
K4XU	1,934,366
N7TT	1,902,222
N6EK	1,860,210
*K7SV	1,715,208

28 MHz

WA2SYN	**3,266**

21 MHz

KTØF	**229,471**
*WA9BOW	133,170
*WT8P	89,199

14 MHz

KT3Y	**2,261,870**
K1TO	**2,206,204**
KE9A/4	1,735,356
W5FO	1,485,960
K2TW	1,303,640
*N8II	631,120
*KN6M/5	591,408
NW6S	582,360
*W1WEF	540,930
*K9KU	539,600

7 MHz

KC1XX	1,421,472
W3BGN	1,298,916
KT7G	947,700
W3GH	924,216
NW6N	674,828
KT6V	641,282
NX7K	363,264
K6OY	320,436
*AA6XX	248,800
NA5Q	225,250

3.5 MHz

K1ZM	406,080
WW2Y	352,692
WE3C	164,052
*N4OT	47,428
K2ONP	28,080

1.8 MHz

AD1G	1,100

LOW POWER ALL BAND

N5RZ	1,996,467
K7SV	1,715,208
K5RX	1,512,375
K2QMF	1,215,657
K9LJN	1,155,018
AB6FO	1,110,795
KG1D	722,240
NA1R	721,063
W6PYX	610,452
KN4QV	558,008

21 MHz

WA9BOW	133,170
WT8P	89,199

14 MHz

N8II	631,120
KN6M/5	591,408
W1WEF	540,930
K9KU	539,600
WA6UKI	534,560
NT7Y	474,138
AE6Y	332,173
W7HS	235,144
KO4PY	195,391
WQ7R	144,720

7 MHz

AA6XX		248,800
NA5Q		225,250
W2UP		179,820
AA5B		124,440
AA7FK		97,384

3.5 MHz

N4OT		47,428

QRP/p

W2GD	**A**	**1,019,712**
AA2U	A	892,749
KN1M	A	710,980
N7IR	A	409,792
W4DEC	A	117,609
N5NMX	28	1,820
WA6FGV	28	798
K2KTT	21	11,020
WB6JMS	14	126,480
K9OSH	14	15,015
WD7I/Ø	7	3,404
W8QZA/6	3.5	256

MULTI-OPERATOR SINGLE TRANSMITTER

KQ8M	**5,314,540**
KW8N	4,824,689
K5XI	4,735,077
AG6D	4,485,841
NY6Y	4,241,648
N3BB	3,802,890
W8FN	2,695,480
AD1S	1,899,096
AC8W	1,897,360
KK4JF	1,288,255

MULTI-OPERATOR MULTI-TRANSMITTER

WZ1R	8,165,315
N8BJQ	584,766
NJ1T	10,348

My first contest expedition was really great fun. Ten meters was good; no pile-ups on 20 meters . . . *FH/DK5WL*. Please bring back 30 hours for single ops. Thanks for 100 watt section . . . *G4ZFE*. Condx not as good as last year plus a lot of commercial QRM on 40 made things harder . . . *G4ZOB*. I QRVed on 160 meters too, but I could only QSO with JA stations. Please call CQ Test on 160 meters! . . . *JE1SPY*. This contest gave me three new ones—P44, ZXØ, and ZF—and I am very happy. Thank you . . . *JF3IUC*. Big difference without a beam and CT from summer QTH . . . *K1VSJ/1*. A real fun contest. This was my first time out in this one. I'll be back! . . . *K2QMF*. Good 40 meter conditions, lousy 10 meter . . . *K3TLX*. Surprised when these bands were open so long. One area fadeout and another open . . . *K6ZUR*.

Really great to have a break from QRN on low bands for a change in CW WPX. The six pointers help . . . *K7SV*. Really enjoyed the contest and pleasantly surprised when 9K2ZZ answered my CQ . . . *K9KU*. This is my first official entry into WPX CW contest. Conditions were great on 15 meters . . . *KC6X*. First CW contest ever; took quite a while to figure out signals . . . *KE9WQ*. QRN from thunderstorms slowed us down . . . *KF4CI*. New FT-990 makes contesting fun! . . . *KGØDS*. Stateside activity seemed to be down a little bit . . . *KG6DX*. Not easy to work JA's from end of dipole . . . *KJ6DL*. Finally worked ZS! . . . *KL7FAP*. XT2BW and VQ9AC answered my CQ! Fought thunderstorms all weekend . . . *KMØL*. Mid-day absorption really makes it tough for low power ops to be heard in Europe on 20! . . . *KX7L*.

Birthday, relations, and visitors made QRM to my participation in the contest . . . *LU1EWL*. First contest. I am 18 years old. See you next year . . . *LU6BEG*. Nice to put LW9 in the contest for the first time ever despite the awful cndx. QSL via LU6EBY . . . *LW9EUJ*. Worked VK2BJ for first VK on 3.5! . . . *N4OT*. Always a fun event. Wouldn't miss it . . . *N7TT*. Nice contest but wish condx were better on 10 meters . . . *N8FU*. First time on as a single op. I really enjoyed my time on . . . *NJ8M*. Two years ago I had chicken pox, this year I had pneumonia . . . *NR1E*. What is the prefix of the Wall-Mart near your home? . . . *NU4Y*. Not enough power to reach USA properly on 20 meters. Nice EU opening on 10 meters . . . *OH1AF*.

This is one of my favorite contests. I was glad

to catch over 600 prefixes on a single band . . . *OH1HS*. Thanks for contest. I had to switch off my rig 2 hours before end of contest . . . *OK2PAY*. Biggest problem was passing serial nr. 599 to BT1BJ on 40 meters . . . *ON4XG*. Nobody told me the contest is now 36 hours! Only op'd 30! . . . P4ØJ. Fun to be back on 15 meters. Nice to work so many different PX's . . . *PA2REH*. PTØZ was in Rio de Janeiro city, not in an island. Hi! . . . *PTØZ*. Propagation wasn't so good. I did over 500 QSO, my private record . . . *SO2FCJ*. During first night QRN from lightning were very strong and I missed a lot of QSO's . . . *UB5LCV*. Can't operate full time because of TVI! . . . *UT5UGR*.

The lower sunspot numbers are starting to bite! . . . *VB2ZP*. Good WPX conditions both modes this year . . . *VB3EJ*. My first attempt at a single band. I really enjoyed it . . . *VB5MX*. 600 watts out. Upped my score by 1 meg over last year and spent 5 hrs. less time . . . *VE1ST*. Gave a tube for the attack, but lost some positional advantage; guess this doesn't work like chess . . . *VE2FU*. Thanks to everyone who made a special effort to dig my weak signal out of the grass . . . *VK1FF*. Turned my beam to Europe and Stateside called. When I turned back to the States, Europe called . . . *VO3SF*. Point/QSO average continues to fall—Arrrgh! . . . *VS6BG*. Thanks to Paul O'Kane, EI5DI, for his SUPER-DUPER contest logging program. Logging was so easy . . . *VU2PTT*.

Found that I couldn't work Europe during daylight hours even though I was reading many stations Q5 . . . *W1WEF*. Discovered the difference a linear can make—even an SB-200 with a G5RV antenna . . . *W2HTX/Ø*. Only one US ham failed to come back to my garden variety W3 prefix. Hope he missed W3 . . . *W3FTG*. Had a major power leak which restricted my operating time . . . *W6BIP*. First time ever worked a ZA in a contest . . . *W7QN*. Finally contest software for the MAC—Marathon . . . *WA6BXH*. My first ever WPX CW. Had a maaarvelous time! . . . *WA6UKI*. Eighty meter noise was tremendous, plus equipment problems, but still had fun . . . *WE3C*. No signals heard on 10 meters . . . *WE7B*. Had to call repeatedly to make the contact. Poor condx at this QTH . . . *WT8P*.

Very strong tropical QRN (40 dB peak); CU next year . . . *YV1OB*. YV1DIG . . . *YW1A*. My last contest from this location; propagation could have been better . . . *ZD8LII*. Where are those multipliers? 52 missing compared to last year's score (ZV5A) . . . *ZXØF*. OI5AY is a club station and belongs to the Radio Club of Finnish Paratrooper's School . . . *OI5AY*. After 15 years of phone contesting the first CW contest with our club. We learned a lot . . . *OT3L*. Conditions were PERFECT during the week before the contest, until the day before the contest . . . *WZ1R*.

Station Operators Multi-Op Single Transmitter

4N1A: YU1FX, YU1AC, YU1RA. **4N5M**: 4N5GB, 4N5GX, 4N5PK, 4N5JA, 4N5ET, 4N5CN, 4N5KO, 4N5BFC,4N5FK, YZ5AA. **9H3XX**: DL5MAE & DL6RAI. **AC8W**: AC8W, K8CC, K8DD, N8CQA. **AD1S**: AD1S, NJ1V, N5CE, KJØW, N5DLM. **AG6D**: AG6D, N4TQO, N1EE/6, N6IP, N6YK. **AR5N**: F2CW & SP5DIR. **BT1BJ**: F6FYA, FD1SQM, BZ1OK, BZ1AA, BZ1AB, BZ1QS. **DAØSAX**: Club Group. **DA2UK**: DA2EM, DA2OJ, DA2QX. **DJ7AA**: DL5LYM, DL8WAA, DJ7AA. **DLØDG**: DJ4EO, DL1EIC, DL1EJM. **DLØUM**: DL2ZAE, DF8WS, DH1FBL, DK7ZT. **DL3HWJ**: DL2HTO, DL3HWJ, DL6UST, DL8HWA. **E2ØAT**: HS1AAM, HS1CDX, HS1EUD, HSØ/G3NOM,

JA3KWJ, JJ1SDF. **EA3KU**: EA3KU, EA3AIR, EA3GAS. **ED5WU**: EA5's BM, FX, WU, AR, CHA, CPK, DKT, FEL, GFB, TX, OM, AAG, IFI, DL3DAI, Sergio, Alfredo, Kamikaze.

HA3KHC: Lovay, Nemeth, Toth. **HA8KCK**: HA8KH, HA8FW, HA8FT, HA8EK, HA8DZ, HA8DT. **HA8KVK**: HA8RH & HA8VK. **HG6Y**: HA6DX, HA6OA, HA6OB, HA6IOB, HA6OO, HA6OY, HA7PO, HA6OI. **IKØADY**: Club Group. **IK2NCJ**: IK2NCJ, IK2QEI, IK2MMF, IK2JUB, IK2CZB, IK2PFL, I2OKW. **IR2W**: IK2EGL, I2UIY, I2VXJ. **J42T**: SV2AVP, SV2BFN, SV2BBJ, SV2BOH, V73DO. **JA1YFG**: JO1BRW, JJ3OLZ, JF7TFK. **JA1YNE**: JP1OGL & JJ1BMB. **JA1ZLO**: JF1KML, JJ1MED, JG4DDN, JR5KDR. **JA3YBF**: JL1PEI, JF3HXJ, JG3JHI, JO3LDN, JO3QVG, JG4CLV, JK4ITY. **JA7YAA**: JF1CKX, JN1VYN, JQ3GKN, JF7KEG, JRØSPG, JF1SXL. **JA8YBY**: JO1DFG, JE8TNH, JF8TMI, JG8NFE, JR8DHA, JR8TON, JR8WJS. **JH5ZCP**: JA5AUC, JA5IGX, JH5PHC, JR5JAQ, JR5MYC, JE5IVW.

JH5ZJS: JA5BJC, JA5FDJ, JA5JCC. **JJ3YBB**: JA3FHL, JA3PJL, JH3FQF, JE3TXA, JI3ERV, JR7OMD. **JL1ZCG**: JO1BMV, JO1RUR, JS1INN, JHØNZN, JRØJFM. **JR1ZTT**: JI1WPV, JR9FFO, JEØBKI, JFØMQX, JRØUUU. **K5XI**: K5RC, K7GM, WT5U, K5TU, K5XI. **K8CX**: K8CX & Packet. **KC1F**: KC1F & Packet. **KK4JF**: KK4JF, K4NZL, Packet. **KQ8M**: KQ8M, K8AZ, K8NZ, NI8L, WT8C, NX8R, N8LXS, N8AA. **KU2Q**: KU2Q & K5NA. **KW8N**: KW8N, WD8IXE, NZ4K. **LA1K**: LA1BFA, LA4OFA, LA5IIA. **LA8G**: Club Group. **LXØRL**: LX2PA & PA3EZL. **LY3MR**: LY1FR, LY2RF, LY1DL, LY1FF. **LY4W**: LY2BKW, LY2IJ, LY2MW, LY2PX. **NØQKY**: NØQKY, WA3TLF, KBØEBH. **N3BB**: N3BB, NØDH, W5GAI, WB5VZL.

N4YET: N4YET, K4SAD, W4XD, WB4PJW, WD8LDY. **NNØM**: NNØM & NØZA. **NY6Y**: AC6T, AD6C, N6DX, N6IC, N6VR, N8SR, WA6CDR. **OHØAAQ**: OH2BCI, OH2BVF, OH2MAM, OH2NRV. **OH3AT**: OH3FS, OH3NBJ, OH3DC. **OH8LQ**: OH8LQ, OH8OX, OH8MCT. **OI5AY**: OH5BM & OH5LLR. **OK2KDS**: Club Group. **OK2KMR**: OK2BQZ & OK2PSM. **OK2KOD**: OK2BGR, OK2BNX, OK2PID. **OK6RA**: OK1FPO, OK2PSZ, OK2PZW. **OL1A**: OK1DFP, OK1DIX, OK1DWX, OK1FCW, OK1FIA, OK1FUA, OK1NK, OK2BFN. **OM3KAG**: Club Group. **OM3KFF**: OM3TPG, OM3TRG, OM3TLU, OM3TPW. **ON6AH**: ON4GO, ON5PV, ON6AH, ON6MH, ON6VL, ON6QR, ON7PC, ON9CMB.

OT3A: ON1ARZ, ON1AWB, ON1HH, ON4ALC, ON4AMI, ON4AML, ON4ASW, ON4AWU, ON4AWV, ON4BI, ON4DB, ON4NM, ON5OT, ON5UM, ON5WL, ON6EV, ON6ML, ON6MR, ON6PU, ON6VK, ON7NB, ON7SF, ON7VU. **OT3L**: ON4AEK, ON4AKL, ON6NL. **P44V**: AI6V & W1FEA. **PI4CC**: PBØAIU, PA3BSQ, PA3EPD, PA3FVW. **PI4ZLD**: PA3GCU & PA3EOB. **R6L**: UA6LO, UA6LV, UA6LFQ, UV6LPL, UA6-15Ø-263, UA6-15Ø-11Ø3, UA6-15Ø-14Ø3. **R9A**: RA9AA, UA9AU, RA9ANR, RA9AX, RA9ADE, UA9AR, UA91652820, UA91652821. **RE3A**: UL7IDX, UA3AGW, UV3DCX, RA3AUU, RV6HM, UL7ACI. **RU1A**: RV1AW, RW1AC, UA1ALZ, UA1ARL. **RW9C**: UA3AO, UW9CZ, UW9CK. **RZ1AWO**: UA1AAF, UA1-169-2391, UA1-169-9ØØ, UA1AQF.

S55AA: S53BM, S53EO, S53WW, S55AA, S59KW. **SK6NL**: SM6BSM & SM6HRR. **TM7C**: FB1MUX, FD1NLY, F6EMT. **TM9C**: F5IN, F6ARC, F6DZS. **UT4JWJ**: RT5JH & UT5JBZ. **UZØSXF**: UAØSLT, UAØSUI, UWØSN. **UZ2FWA**: UA2FF, UA2FJ, RA2FA. **UZ3AWR**: UA3-17Ø-126, UA3-17Ø-1169, UV3AEV, UA3-17Ø-79. **UZ9CWW**: UA9-154-21Ø5, UZ9CO, UA9CIR, RA9CEJ, UA9CDT, UA9-154-2441. **W5YL**: KZ5Y, WD5IWT, WA5PRI, KJ5KQ, AA5LE, WB5ZGC, KA5GZB. **W8FN**: W8FN, WD8AUB, WD8LLD. **WA1PMA**: WA1PMA & WS1F. **WA8LLY/6**: WA8LLY & Packet. **WF1L**: KA1EUX & WF1L. **WØØE**: AAØFO, NØFMR, WØØE. **WP4IIW**: WP4IIW & KP4TK. **XE7X**: Club Group. **YL1ZR**: YL2QD, YL2UD, YL3AD. **YR6F**: YO6DDF & YO6OBH.

CONTINENTAL LEADERS

AFRICA

A	EA8EA	10,693,146
28	*DL1VJ/T5	410,550
21	TU2MA	823,038
14	ZD8LII	2,687,580
7	EA9LZ	2,829,276
3.5	Z21HS	14,282
1.8	No Entrant	

ASIA

A	H28A	8,891,400
28	*JI3BFC	3,256
21	*UA9USK	409,960
14	UX9C	2,231,230
7	**C47W**	**2,874,960**
3.5	UL7JW	132,736
1.8	No Entrant	

EUROPE

A	CR7M	5,645,267
28	OH6WZ	160,922
21	S58A	2,601,819
14	9A7A	2,939,988
7	G3LNS	2,500,400
3.5	**YTØT**	**453,908**
1.8	T99C	63,990

NORTH AMERICA

A	VB3EJ	5,888,256
28	VE3HX	5,969
21	**KTØF**	**229,471**
14	VB7SZ	3,261,106
7	VB7SV	2,626,704
3.5	VB7CC	416,880
1.8	AD1G	1,100

OCEANIA

A	**NH6T**	**4,078,653**
28	*VK2BQQ	33,449
21	KG6DX	1,606,528
14	*VK4TT	134,136
7	**V7A**	**2,205,922**
3.5	No Entrant	
1.8	No Entrant	

SOUTH AMERICA

A	**ZXØF**	**11,940,978**
28	PTØZ	162,692
21	*LU6BEG	1,044,072
14	**YW1A**	**4,338,567**
7	HK1KXA	2,365,440
3.5	YV1OB	15,200
1.8	No Entrant	

MULTI-SINGLE

AF	No Entrant	
AS	JJ3YBB	4,717,622
EU	R6L	9,194,688
NA	**KQ8M**	**5,314,540**
OC	No Entrant	
SA	**P44V**	**11,477,437**

MULTI-MULTI

AF	No Entrant	
AS	JA1YXP	3,629,170
EU	**HG73DX**	**16,543,420**
NA	KL7Y	10,868,685
OC	No Entrant	
SA	No Entrant	

Station Operators Multi-Op Multi-Transmitter

CZ7Z: VE7AV, VE7CV, VE7EQZ, VE7MKA, VE7QO, VE7RBL, VE7SK. **HG73DX**: HA1TJ, HA1DAE, HA1AH, HA1TD, HA1DAC, HA5GF, HA5IW, HA6WX, HA5UA, HG5CCC, HA5FM, HA5AWH, HA7VB, HA8RG, HA5ML, HA5TI, HA7RY, HA6ND, HA6NF, HA6OQ, HA6ON, HA6NY, HA6NQ. **JA1YXP**: 7K1's EWD, QOE; 7L1's ETO, CBL, DGK; 7N1's IAP, SYP; JF1QOW, JJ1OJG, JP1AEQ, JI2KRK, JL2TSY, JS2XHM. **KL7Y**: KL7Y, KL7PJ, KL7AF, NL7G, KL7U, AL7BL. **LY7A**: LY3BBC, LYR346, LY2BMX, LY2FN, LY2BKZ, LYR1751, LY2NK, LY1DF. **N8BJQ**: N8BJQ & Packet. **NJ1T**: NJ1T & Packet. **PA6WPX**: PA3BUD, PA3BBP, PA3ERC, PA3EWM, PA3DMH. **R6L**: UA6LO, UA6LV, UA6LFQ, UV6LPL, UA6-15Ø-263, UA5-15Ø-11Ø3, UA6-15Ø-14Ø3.

UR8J: UB2JQ, UB2JX, UB2JZ, UB3JD, UB3JF, UB3JW, RB3IA, UB4JDM, UB5JIM, UB5JMR, UB7-Ø67-2. **US7I**: UB3IO, UB3IM, RB4II, RB5ID, RB1IA, UB5IUA. **WZ1R**: WZ1R, KY1H, KB1W, N1MM, NJ1F, NU1P, KB2R, K1MBO, AA1AS, KB1KE, KF2MM.

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 country names and groupings reflect the DXCC list at the time of the 1993 contest.)

CW RESULTS QRP/P SECTION

WORLDWIDE

W2GD	**A**	**1,019,712**	**786**	**452**
AA2U	**A**	**892,749**	**734**	**429**
UB4FXX	**A**	**806,760**	**1028**	**405**
KN1M	**A**	**710,980**	**660**	**380**
VE3KP	**A**	**520,514**	**542**	**317**
SM3CCT	**A**	**414,081**	**700**	**331**
XA5T	**A**	**412,335**	**414**	**255**
DL3KVR	**A**	**411,060**	**713**	**310**
N7IR	**A**	**409,792**	**509**	**337**
DL4JYT	"	281,200	555	296
GX5QK/P	**A**	**227,800**	**505**	**268**
OH3JF	**A**	**195,816**	**417**	**246**
KP4DDB	**A**	**172,912**	**317**	**214**
UB5PDM	"	167,085	355	237
YT7TY	**A**	**143,400**	**312**	**239**
9A3GU	**A**	**126,875**	**321**	**203**
W4DEC	**A**	**117,609**	**261**	**197**
LY3BY	**A**	**114,995**	**383**	**211**
WT3W	**A**	**103,040**	**239**	**184**
OH6NPV	"	95,760	262	190
KA1CZF	"	95,680	229	184
GM4HQF	**A**	**88,800**	**302**	**185**
PAØADT	**A**	**81,270**	**305**	**189**
N1CWR	"	73,990	185	151
SM5DQ	"	71,631	215	189
EA7AAW	**A**	**71,231**	**231**	**163**
YO5BQ	**A**	**63,648**	**223**	**156**
LY3BA	"	53,428	232	148
JA5CDL	**A**	**48,895**	**155**	**127**
EA3FBO	"	46,512	175	153
JA1GTF	"	42,510	125	109
DL2HBX	"	34,832	147	112
KV8S	**A**	**33,174**	**128**	**114**
LY2BB	"	22,176	106	88
DL6ZLG	"	19,350	97	86
EA1GT	"	14,973	137	93
EA6GP	**A**	**14,630**	**86**	**70**
NZ5A	**A**	**13,959**	**121**	**99**
AL7OI	**A**	**10,712**	**77**	**52**
GMØGNT	"	10,614	135	61
OE1KYW	**A**	**10,508**	**102**	**71**
SM7CZC	"	7,668	57	54
PA3FSC	"	5,460	62	52
OK1DZD	**A**	**4,930**	**60**	**58**
SP5NOG	**A**	**900**	**26**	**25**
SM6BSM	"	315	16	15
DK7QB	**28**	**6,016**	**78**	**64**
SP5ANX	**28**	**4,232**	**66**	**46**
N5NMX	**28**	**1,820**	**38**	**35**
WA6FGV	**28**	**798**	**24**	**21**
UA9YC	**21**	**147,840**	**308**	**210**
OH2MPO	**21**	**60,962**	**211**	**163**
OH2YL	"	52,440	174	138
ES1CR	**21**	**45,724**	**180**	**142**
4N5DR	**21**	**24,174**	**111**	**102**
K2KTT	**21**	**11,020**	**81**	**76**
JF3XMI	**21**	**504**	**19**	**18**
WB6JMS	**14**	**126,480**	**287**	**240**
JR2BNF/1	**14**	**104,340**	**217**	**188**
VB5VA	**14**	**36,424**	**133**	**116**
9A2EY	**14**	**35,074**	**197**	**142**
ON6TJ	**14**	**30,096**	**114**	**88**
DL4GBR	**14**	**21,804**	**183**	**79**
OK2PBG	**14**	**18,240**	**110**	**96**
9A3LN	"	16,835	98	91
K9OSH	**14**	**15,015**	**82**	**77**
VE2ABO	**14**	**10,797**	**67**	**61**
UA6LP/RVØQ	**14**	**8,896**	**80**	**64**
PY2APQ	**14**	**5,796**	**46**	**42**
K3TW	**14**	**5,500**	**54**	**50**
N3CZB	"	108	30	27
SMØDZH	**7**	**119,232**	**239**	**184**
JA6GCE	**7**	**70,432**	**152**	**124**
YO4AAC	**7**	**39,600**	**145**	**110**
JR9GXQ	"	5,148	40	39
UZ6AXQ	**7**	**4,675**	**80**	**55**
WD7I/Ø	**7**	**3,404**	**52**	**46**
DL8UKW	**7**	**828**	**19**	**18**
OK2BXR	**3.5**	**62,640**	**218**	**145**
SP4GFG	**3.5**	**36,570**	**161**	**115**
OM3THV	**3.5**	**18,304**	**105**	**88**
W8QZA/6	**3.5**	**256**	**16**	**16**
YO2CJX	**1.8**	**1,188**	**28**	**22**

SINGLE OPERATOR NORTH AMERICA

UNITED STATES

KM1H	**A**	**4,670,618**	**2299**	**722**
		(Opr. KQ2M)		
NR1E	**A**	**4,097,820**	**2141**	**652**
		(Opr. W2SC)		
K1XM	**A**	**1,484,841**	**910**	**463**
KB1AJY	"	263,578	356	281
KA1DWX	"	138,054	206	173
W1AX	"	99,375	229	159
K1JKS	"	35,616	106	84
KA1CLV	"	32,328	120	88
NO1J	"	31,724	120	103
W1CNU	"	16,770	110	94
K1TO	**14**	**2,206,204**	**1517**	**638**
W1WEF	**14**	**540,930**	**652**	**365**
NY1L	"	184,266	341	261
K2MN	"	1,530	32	30
KC1XX	**7**	**1,421,472**	**841**	**442**
K1ZM	**3.5**	**406,080**	**449**	**288**
AD1G	**1.8**	**1,100**	**22**	**20**
***KG1D**	**A**	**722,240**	**742**	**370**
***K1VWL**	**A**	**513,100**	**544**	**350**
*K1EFI	"	281,695	367	265
*K1VSJ/1	"	21,805	101	89
***KJ1N**	**7**	**7,810**	**83**	**71**
K2LE	**A**	**2,018,410**	**1307**	**527**
KW2J	**A**	**870,604**	**844**	**413**
AB2E	"	816,124	776	373
WA2VYA	"	444,084	420	276
W2FR	"	270,831	364	283
N1CC/2	"	235,620	400	255
NA2M	"	34,500	131	125
WA2SYN	**28**	**3,266**	**54**	**46**
K2TW	**14**	**1,303,640**	**1149**	**520**
WW2Y	**3.5**	**352,692**	**462**	**303**
K2ONP	"	28,080	138	108
***K2QMF**	**A**	**1,215,657**	**875**	**461**
***WA2ASM**	**A**	**434,478**	**500**	**319**
*AA2EM	"	381,936	487	292
*KE2ZU	"	336,063	410	273
*KM2L	"	313,742	427	286
*KA2AJT	"	267,010	345	270
*WA2EYA	"	228,854	366	254
*K2POF	"	215,059	342	233
*K2DB	"	188,564	325	236
*W2EZ	"	105,105	200	165
*W2OMV	"	89,262	215	162
*K2WR	"	31,578	142	114
*N2MBM	"	8,515	71	65
***W2UP**	**7**	**179,820**	**239**	**185**
*N2BQ	"	26,780	117	103
KF3P	**A**	**3,947,030**	**2039**	**655**
K3ZO	**A**	**3,732,300**	**1812**	**650**
K3WW	**A**	**2,719,692**	**1564**	**558**
AA3B	"	2,279,210	1502	565
K3KO	"	422,085	477	285
W3KV	"	246,888	362	243
WT3P	"	132,252	280	214
KB3TS	"	120,825	250	179
NY3C	"	65,664	179	144
KT3Y	**14**	**2,261,870**	**1577**	**635**
K3UA	"	52,632	166	136
W3GN	"	5,940	50	45
W3BGN	**7**	**1,298,916**	**765**	**422**
W3GH	**7**	**924,216**	**686**	**397**
			(Opr. W9XR)	
WE3C	**3.5**	**164,052**	**315**	**217**
AA3BG	"	25,654	111	101
***KB3MM**	**A**	**347,035**	**433**	**281**
***K3TLX**	**A**	**299,367**	**391**	**279**
*W3NX	"	90,234	224	162
*K3ND	"	45,724	126	92
*WA3HAE	"	44,588	179	142
*N3RC	"	29,316	100	84
***NJ3K**	**14**	**125,895**	**306**	**231**
***N3RW**	**7**	**6,048**	**38**	**36**
WZ4F	**A**	**2,041,083**	**1562**	**583**
NU4Y	**A**	**1,674,342**	**1278**	**557**
KD4HEL	**A**	**1,525,504**	**1182**	**472**
W4XJ	"	695,898	734	378
W3FTG	"	116,180	230	185
AB4RU	"	38,478	139	121
AA4KD	"	11,840	75	74
KE9A/4	**14**	**1,735,356**	**1298**	**566**
KF4CI	**7**	**84,036**	**165**	**149**
***K7SV**	**A**	**1,715,208**	**1120**	**534**
***KN4QV**	**A**	**558,008**	**635**	**374**
*N8LM	"	507,150	676	350
*K4BAI	"	460,388	554	358
*NK9C	"	323,400	468	300
*K4FPF	"	109,080	240	180
*W4YN	"	73,948	174	133
*N5FUS	"	72,420	199	170
*KN4MD	"	65,010	196	165
*AC4PQ	"	38,250	160	125
***WA6UKI**	**14**	**534,560**	**656**	**416**
*KO4PY	"	195,391	340	271
*W4OGG	"	19,800	100	90
*KQ4VG	"	493	17	17
***N4OT**	**3.5**	**47,428**	**173**	**142**
K5GN	**A**	**3,868,128**	**2007**	**666**
K5MR	**A**	**3,785,940**	**1961**	**684**
AA5DX	**A**	**2,571,360**	**1759**	**660**
AD5Q	"	2,560,770	1836	666
WB5B	"	445,835	558	361
KA5W	"	374,418	509	341
K5LP	"	160,864	280	176
K5HDU	"	110,390	251	190
K5EC	"	53,872	189	148
W5FO	**14**	**1,485,960**	**1294**	**580**
WF5E	**7**	**131,202**	**271**	**197**
***N5RZ**	**A**	**1,996,467**	**1363**	**599**
***K5RX**	**A**	**1,512,375**	**1062**	**545**
*N5UD	"	49,404	152	138
***KN6M/5**	**14**	**591,408**	**748**	**432**
***NA5Q**	**7**	**225,250**	**403**	**265**
*AA5B	"	124,440	232	170
N6TV	**A**	**3,261,555**	**1773**	**605**
W6EEN	**A**	**2,576,592**	**1647**	**617**
			(Opr. KA6SAR)	
N6EK	**A**	**1,860,210**	**1245**	**495**
AD6E	"	1,305,076	1067	509
AA6MC	"	1,235,040	1061	498
KC6X	"	1,021,539	1011	501
W6OAT	"	517,632	619	384
W6QHS	"	484,272	598	342
K6XT	"	360,112	465	317
AA6MV	"	334,845	494	315
N6AV	"	292,757	402	289
N6ST	"	223,512	332	268
NI6T	"	159,840	295	216
WA5VGI	"	141,520	305	232
N6IP	"	135,321	264	129
NF6R	"	127,988	280	196
N6ZZ	"	105,669		199
W6RFF	"	73,590	215	165
W6OUL	"	70,448	184	148
K6ZUR	"	49,616	151	112
AJ6V	"	24,832	120	97
W6BIP	"	11,163	65	61
NW6S	**14**	**582,360**	**660**	**422**
NW6N	**7**	**674,828**	**669**	**313**
KT6V	**7**	**641,282**	**565**	**311**
K6OY	"	320,436	388	258
KU6T	"	20,116	101	94
KJ6DL	**3.5**	**19,968**	**108**	**78**
***AB6FO**	**A**	**1,110,795**	**957**	**497**
***W6PYX**	**A**	**610,452**	**605**	**372**
*VE3SUN/WT6	"	327,222	511	318
*WA6BXH	"	223,012	376	254
*AA6EE	"	198,135	400	259
*N6JM	"	179,292	303	201
*W6HAL	"	174,636	325	231
*K6UO	"	142,956	265	209
*W6NT	"	132,665	250	169
*N6NF	"	100,536	268	213
*N6GL	"	97,846	316	203
*AA6DX	"	45,543	172	141
*W6FA	"	28,470	161	130
*N6AZE	"	13,135	81	71
***AE6Y**	**14**	**332,173**	**480**	**353**
*W6NNV	"	4,092	43	33
***AA6XX**	**7**	**248,800**	**345**	**244**
N7TT	**A**	**1,902,222**	**1297**	**558**
WE7B	**A**	**668,264**	**714**	**412**
K7SS	"	0	100	78
KS7T	**14**	**254,200**	**416**	**328**
W7AYY	"	3,570	36	34
KT7G	**7**	**947,700**	**773**	**351**
			(Opr. KS7O)	
NX7K	"	363,264	421	264
***KX7L**	**A**	**392,450**	**524**	**334**
***W7QN**	**A**	**197,955**	**398**	**265**
*K7DBV	"	185,256	325	249
*W7WHY	"	109,654	269	218
*KI7Y	"	69,360	190	170
*N7LQX	"	6,426	63	54
***NT7Y**	**14**	**474,138**	**705**	**426**
			(Opr. WØMHS)	
*W7HS	"	235,144	349	266
*WQ7R	"	144,720	340	268
***AA7FK**	**7**	**97,384**	**240**	**188**
*W7ZR	"	16,878	107	97
KV8Q	**A**	**929,968**	**850**	**442**
N8LXS	**A**	**583,128**	**641**	**364**
NJ8M	"	212,390	512	317
W8LRY	"	121,100	242	175
NF8R	**14**	**333,270**	**481**	**345**
***N8FU**	**A**	**369,738**	**565**	**334**
***W8UPH**	**A**	**221,880**	**362**	**258**
*N8AA	"	89,120	200	160
*W8IDM	"	76,725	191	165
*W8PN	"	6,627	49	47
***WT8P**	**21**	**89,199**	**232**	**187**
***N8II**	**14**	**631,120**	**667**	**392**
*K8LJG	"	112,290	229	197
*AF8C	"	3,441	38	37
WØAIH	**A**	**2,299,561**	**1348**	**599**
			(Opr. NØBSH)	
K4XU	**A**	**1,934,366**	**1362**	**593**
KE9I	**A**	**1,559,160**	**1264**	**568**
KS9W	"	560,303	706	391
K9MMS	"	402,855	497	321
K9BG	"	368,244	447	318
WA9KNP	"	341,544	515	321
W9HE	"	216,394	359	257
WB9HRO	**14**	**417,872**	**575**	**364**
WB9MLY	**7**	**95,604**	**240**	**186**
***K9LJN**	**A**	**1,155,018**	**1049**	**489**
***NA1R**	**A**	**721,063**	**783**	**431**
*KE9WQ	"	836	39	38
***WA9BOW**	**21**	**133,170**	**283**	**230**
***K9KU**	**14**	**539,600**	**619**	**400**
KMØL	**A**	**1,522,413**	**1187**	**551**
NSØB	**A**	**337,512**	**443**	**287**
NØAT	"	197,543	389	281
WBØO	"	141,219	300	213
W2HTX/Ø	"	73,738	159	143
WWØQ	"	7,918	96	74
KTØF	**21**	**229,471**	**398**	**253**
WEØB	**14**	**460,168**	**695**	**388**
NØØI	"	147,392	300	224
***KGØDS**	**A**	**406,464**	**546**	**348**
***KEØUI**	**A**	**122,298**	**259**	**187**
*KØIYF	"	117,624	243	174
*KØOAL	"	28,060	133	115
*WAØWHT	"	15,048	78	66
*ADØH	"	7,623	104	77
***WØIZV**	**14**	**34,056**	**136**	**129**

MARTINIQUE

***FM5CW**	**A**	**802,424**	**791**	**356**

ALASKA

KL7RA	**7**	**263,276**	**314**	**166**
***NL7DU**	**A**	**151,971**	**313**	**179**
***KL7FAP**	**14**	**43,992**	**147**	**117**

U.S. VIRGIN IS.

***NP2I**	**A**	**2,615,943**	**1693**	**561**

COSTA RICA

***TE5T**	**A**	**1,494,060**	**1072**	**444**
		(Opr. TI4SU)		

CANADA

VB3EJ	**A**	**5,888,256**	**2566**	**704**
		(Opr. VE3EJ)		
VB6UX	**A**	**2,204,760**	**1442**	**570**
		(Opr. VE6UX)		
VB3AT	"	816,888	769	404
VE3CWE	"	366,980	424	295
VE3HX	**28**	**5,969**	**55**	**47**
VB7SZ	**14**	**3,261,106**	**1905**	**694**
		(Opr. VE7NTT)		
VE1ST	**14**	**2,627,814**	**1651**	**623**
VB5MX	**14**	**2,315,601**	**1572**	**617**
		(Opr. VE5MX)		
VE7UF	"	768,165	734	415
VB7SV	**7**	**2,626,704**	**1110**	**408**
VE2FU	**7**	**1,623,146**	**794**	**431**
VB2ZP	"	1,361,388	756	399
		(Opr. VE2ZP)		
VB6LB	**7**	**35,333**	**99**	**89**
VE3ST	**7**	**2,550**	**25**	**25**
VB7CC	**3.5**	**416,880**	**414**	**216**
		(Opr. VE7CC)		
***CK2C**	**A**	**1,686,501**	**1006**	**443**
		(Opr. VY2SS)		
***VB4VV**	**A**	**1,557,864**	**1206**	**504**
***VB1HA**	**A**	**1,228,968**	**830**	**404**
*VE1AZN	"	220,284	318	211
***VE6HPT**	**A**	**203,510**	**3363**	**235**
***VE3TEE**	**A**	**77,280**	**178**	**140**
*VE3ZTH	"	75,647	192	143
***VE2JBF**	**21**	**31,500**	**118**	**105**
***VO3SF**	**14**	**1,240,782**	**1072**	**454**
		(Opr. VO1SF)		
***CH6BF**	**14**	**535,050**	**621**	**369**
		(Opr. VE6BF)		
*VE6BMX	"	336,644	481	308
***VE3UWC /VE8**	**14**	**319,456**	**460**	**268**
***VB1FQ**	**14**	**254,070**	**389**	**270**
		(Opr. VE1CBV)		
*VB3DSN	"	156,468	276	221

MEXICO

XE2JNE	**A**	**1,033,155**	**962**	**405**
XE2/N6CL	"	50,000	157	125

CAYMAN IS.

ZF2NE/ZF8	**14**	**2,633,470**	**1733**	**595**
		(Opr. W5ASP)		

AFRICA

NIGER

5U7M	**A**	**4,287,940**	**2220**	**580**
		(Opr. JH4NMT)		

KENYA

***5Z4TT**	**A**	**2,878,722**	**1917**	**462**
		(Opr. SP5TT)		

LESOTHO

7P8EB	**A**	**81,696**	**190**	**138**
***7P8SR**	**21**	**85,077**	**212**	**137**

MALAWI

***7Q7XX**	**A**	**4,665,770**	**2750**	**565**

MOZAMBIQUE

C91J	**A**	**379,440**	**524**	**240**

CANARY IS.

EA8EA	**A**	**10,693,146**	**3653**	**762**
			(Opr. OH2MM)	
***EA1FBJ/MMA**		**192,165**	**332**	**213**

CUETA

EA9LZ	**7**	**2,829,276**	**1033**	**459**
			(Opr. EA7PN)	
***EC9LQ**	**21**	**180,362**	**331**	**182**

MAYOTTE

***FH/DK5WL**	**A**	**1,578,064**	**1425**	**358**

SOMALIA

***DL1VJ/T5**	**28**	**410,550**	**600**	**230**

IVORY COAST

TU2MA	**21**	**823,028**	**836**	**332**

ZIMBABWE

Z21HS	**3.5**	**14,282**	**65**	**37**

ASCENSION IS.

ZD8LII	**14**	**2,687,580**	**1580**	**567**
			(Opr. GØLII)	

SOUTH AFRICA

***ZS6NW**	**A**	**582,897**	**668**	**287**

ASIA

ISRAEL

4X/S59PR	**A**	**5,526,815**	**2721**	**665**
***4X4ZT**	**14**	**11,970**	**71**	**63**

CYPRUS

H28A	**A**	**8,891,400**	**3547**	**730**
			(Opr. 5B4ADA)	
C47W	**7**	**2,874,960**	**1152**	**440**
			(Opr. 5B4WN)	

KUWAIT

9K2ZZ	**A**	**3,793,110**	**2426**	**590**

CHINA

***BZ4DHI**	**21**	**315**	**17**	**15**

KOREA

***HL9WJ**	**3.5**	**17,856**	**143**	**62**
***HL9UH**	**A**	**92,886**	**264**	**137**
			(Opr. KG6UH)	
***HL5AP**	**14**	**7,367**	**63**	**53**

SAUDI ARABIA

7Z2AB	**A**	**6,211,994**	**3063**	**694**
			(Opr. K2XR)	

JAPAN

7L1GVE	**A**	**3,734,400**	**2074**	**640**
JH5FXP	**A**	**2,646,900**	**1723**	**519**
JH1AEP	**A**	**2,511,040**	**1485**	**560**
JH2UVL	"	2,432,224	1491	578
JA8RWU	"	2,018,625	1300	525
JR6EZE	"	1,796,672	1467	419
JA2EU	"	1,459,170	1039	465
JQ1VNM	"	811,152	744	387
JN3SAC	"	407,262	504	309
JR4QZH	"	283,752	376	252
JA3ARM	"	258,700	386	260
JE2WEN	"	230,145	338	229
JA1LDJ	"	158,646	288	193
JA3UWB	"	110,838	239	174
JH1AOU	"	31,240	117	110
JA4AQR	"	28,736	127	82
JL1RML	"	17,538	85	79
JA4RTX	"	9,200	49	46
JA2SWF	"	4,560	60	60

7L1ILE	*	1,334	25	23
JAØAXA	*	630	15	14
JG3KIV	**21**	**87,381**	**232**	**133**
JA6QDU	*	1,200	22	20
JA9CWJ	**14**	**501,831**	**540**	**333**
JA5APU	**14**	**278,256**	**410**	**272**
JF3IUC	*	212,524	328	268
JH7QXJ	*	156,716	288	193
JAØQNJ	*	32,568	135	95
JAØBQB	*	17,316	92	74
JA1BDI	*	14,948	80	74
JA7AXP	*	4,033	37	37
JK1GKG	**7**	**192,768**	**240**	**192**
***JH3DSO**	**A**	**870,480**	**814**	**390**
***JA7YFD**	**A**	**459,967**	**519**	**317**
			(Opr. JI7BGI)	
***JF1SEK**	**A**	**418,695**	**472**	**309**
*JA1NLX	*	282,690	406	270
*JA1WYQ	*	269,667	358	249
*JK4KBG	*	249,839	349	229
*JA7SUR	*	242,319	358	231
*JA1RKI	*	194,790	315	215
*JK1AJX/1	*	180,115	338	221
*JA9ODF/2	*	170,753	311	209
*JI1MTF	*	157,584	277	190
*JA1BUI	*	142,037	281	197
*JH7CJM	*	91,767	182	169
*JA3TOT	*	82,505	175	145
*JA1AB	*	78,489	189	153
*JH1JGZ	*	75,978	200	134
*JA1IXO	*	70,626	184	149
*JA2KPV	*	68,886	158	129
*JE3UHV	*	67,404	164	137
*JJ1LRD	*	62,100	181	138
*JA8AJE	*	42,721	133	119
*7K1MAG	*	41,088	123	96
*JK7KCC	*	35,123	125	103
*JA6QJG	*	34,686	122	94
*JA3TBT	*	34,128	133	108
*JA6BWH	*	32,799	114	87
*JA1BNW	*	31,924	123	92
*JA1KI	*	28,500	105	100
*JH5ZAB	*	28,000	108	80
*JA1JNR	*	21,556	105	68
*JI1RCB	*	20,925	104	75
*JR4ISK	*	20,610	102	90
*JE3CYH	*	17,325	85	75
*JF1SQC	*	17,064	88	72
*JK2VOC	*	13,176	77	61
*JA6HJP	*	12,980	61	55
*JF1LKM	*	9,639	71	63
*JN2AMD/3	*	8,127	80	63
*JE1KDM	*	7,400	44	40
*JE1KUP	*	4,440	40	37
*JR7CJO	*	4,100	51	51
*JA4MES	*	1,311	23	23
*7L1ICV	*	1,168	20	16
*JE3KGT	*	936	26	12
*JA5MOO/4	*	481	13	13
***JI3BFC**	**28**	**3,256**	**52**	**44**
*JK1GXU	*	2,166	41	38
*JAØGCI	*	1,081	26	23
***JHØEPI**	**21**	**84,512**	**218**	**139**
***JAØBMS/1**	**21**	**79,182**	**190**	**159**
*JJ1GQH	"	63,742	175	157
*JN2QYN/2	"	39,412	155	118
*JH1BDS	"	18,000	86	75
*JQ1NQT	"	13,248	76	69
*JG1RDV	"	10,974	67	62
*JA1AAT	"	2,890	34	34
*JA1XPU	"	1,890	28	27
*JH1BUB	"	1,386	32	21
*JA9XAT	"	300	15	15
***JR4GPA**	**14**	**129,762**	**256**	**178**
***JI1HHX/2**	**14**	**117,208**	**223**	**196**
*JA2DN	*	100,036	206	178
*JA4CUU	*	60,249	170	151
*JA2OJ	*	52,668	151	126
*JFØSGW	*	15,808	87	76
*JL3S8E	*	2,080	34	26
***JA6WIF**	**7**	**56,200**	**134**	**100**
***JH6GNU**	**7**	**50,610**	**131**	**105**
*JA2NNF	*	45,046	118	101
*JRØBQD	*	17,784	73	57
*JA7FFN	*	9,906	47	39
*JI7OED	*	8,536	53	44
*JE7HXC	*	2,300	25	23
*JO1ATK	*	1,980	19	18
*JA8LN	*	1,836	19	18
*JG1TVK	"	414	9	9
*JH1NXU	"	54	3	3
***JE1SPY**	**3.5**	**4,536**	**42**	**36**
*JH3LCU/Ø	"	60	10	6

ASIATIC RUSSIA

UX9C	**14**	**2,231,230**	**1566**	**545**
			(Opr. UV9CP)	
***UA9XHJ**	**A**	**470,334**	**572**	**258**
***UA9USK**	**21**	**409,960**	**543**	**296**
*UW9TM	*	325,470	429	285
***4K4POL/A**	**14**	**396,435**	**582**	**321**
*UA9XF	*	42,126	148	119

AZERBAIJAN

UDØ/DL6KVA	**A**	**1,236,816**	**1008**	**335**

TURKMENISTAN

UH8BO	**21**	**222,288**	**352**	**264**

UZBEKISTAN

UIØA	**A**	**2,463,810**	**1638**	**510**
		(Opr. UI9ACP)		

KAZAKHSTAN

UL7JW	**3.5**	**132,736**	**200**	**136**
UN7LZ	**14**	**1,336,210**	**1056**	**470**

HONG KONG

VS6BG	**A**	**1,018,500**	**1089**	**420**

INDIA

***VU2PTT**	**A**	**147,780**	**268**	**180**

EUROPE

CROATIA

9A2OB	**A**	**1,703,100**	**1477**	**525**
9A1CCY	**21**	**1,988,910**	**1487**	**615**
		(Opr. 9A3LG)		
9A2WV	*	854,139	934	429
9A2MP	*	430,272	688	324
9A7A	**14**	**2,939,988**	**1916**	**674**
		(Opr. 9A2VC)		
9A1CRJ	**7**	**476,420**	**660**	**287**
		(Opr. 9A2OU)		

PORTUGAL

CR7M	**A**	**5,645,267**	**3263**	**751**
		(Opr. CT1BOH)		
***CT4DX**	**7**	**50,190**	**113**	**105**

GERMANY

DK3GI	**A**	**4,114,010**	**2262**	**713**
DK2OY	**A**	**885,800**	**913**	**412**
DF1IAZ	**A**	**831,040**	**1026**	**424**
DFØFA	*	812,988	852	396
		(Opr. DL7VTM)		
DL3KDV	*	512,909	687	353
DL1TH	*	421,525	621	325
DL4HRM	*	353,377	580	313
DL1MFL	*	328,168	444	254
DL1ZQ	*	137,994	370	218
DL8UED	*	29,376	111	96
DK5OS	*	13,266	82	66
DL3JRA	*	5,750	58	50
DL3HWW	**21**	**4,048**	**50**	**46**
DL9AWI	**14**	**444,528**	**568**	**343**
DL2OAP	*	437,270	609	365
DL1JF	*	320,544	478	318
DJ5GG	*	242,256	424	309
DL2JX	*	131,887	315	227
DF4SA	**7**	**996,216**	**838**	**403**
DK3KD	**7**	**923,372**	**757**	**367**
DL1EFO	*	303,282	460	261
***DL1IAO**	**A**	**1,520,500**	**1420**	**500**
***DL7VOG**	**A**	**942,704**	**985**	**443**
***DA1AM**	**A**	**790,030**	**1110**	**398**
*DF4ZL	*	639,993	836	383
*DL7USW/P	*	457,146	674	327
*DK7FP	*	442,518	466	262
*DL5SWB	*	373,152	711	338
*DL8QS	*	353,115	555	315
*DL6JRA	*	350,100	572	300
*DL3JAN	*	346,500	656	308
*DL6RDR	*	310,873	552	293
*DJ5AV	*	279,990	508	306
*DL7BQ/A	*	278,332	547	298
*DL2GBB	*	254,254	469	286
*DJ1OJ/P	*	176,596	395	238
*DL7VBM	*	144,837	288	209
*DL2RON	*	141,487	323	218
*DL7VZF	*	109,172	286	196
*DL1DWT	*	72,996	196	154
*DL5SVB	*	72,063	233	157
*DL8WCM	*	65,121	166	147
*DL2DRZ	*	60,720	197	132
*DL3DBY	*	40,689	210	137
*DL2VLA	*	39,370	180	127
*DF3QN	*	25,758	155	106
*DL6UEG	*	13,065	72	65
*DL3KWF	*	3,344	40	38
*DL5AUJ	*	2,552	34	29
***DK2GZ**	**28**	**14,946**	**123**	**94**
*DF5WN	*	12,848	110	88
***DL5JRA**	**21**	**64,650**	**194**	**150**
*DL9GMC	*	7,371	53	39
***DF7TU**	**14**	**68,557**	**264**	**179**
*DL3AWJ	*	19,837	95	83
***DH4JZ**	**3.5**	**30,740**	**172**	**118**
***DL3JSW**	**1.8**	**20,424**	**145**	**92**

SPAIN

EA4KA	**A**	**2,103,570**	**1752**	**567**
EA1JO	**A**	**406,788**	**701**	**327**
EA3GHB	*	375,750	741	334
EA2CR	*	51,546	177	121
EA7HAB	*	47,196	200	138
EA5EFV	*	38,958	157	129
EA5JC	*	2,772	44	42
EA3BT	*	1,657	28	27
EA7IL	**14**	**301,419**	**539**	**313**
EA7XC	**3.5**	**37,962**	**139**	**111**
***EA1FDO**	**A**	**338,057**	**682**	**311**
***EA5GCT**	**A**	**259,588**	**547**	**292**
*EA5ACP	*	133,705	344	221
*EA7BY	*	126,812	305	196
*EA7HDO	*	62,624	205	152
*EA7CA	*	50,927	216	127
*EA4EMO	*	39,059	145	139
*EA3DVJ	*	28,652	145	116
*EA2CKP	*	19,749	95	87
*EA1BID	*	14,706	108	86
*EA4BT	*	7,728	60	56
*EA7CWV	*	6,634	68	62
***EA1DOD**	**21**	**108,953**	**278**	**221**
*EA3GIJ	*	5,015	59	55
***EG1RJ**	**14**	**196,639**	**506**	**269**
*EA3GF	*	504	20	18

BALEARIC IS.

EA6ZS	**A**	**35,670**	**173**	**123**
***EA6BD**	**21**	**69,144**	**211**	**172**

FRANCE

F6BEE	**A**	**3,559,380**	**2004**	**660**
F6CEL	**A**	**1,110,120**	**1199**	**440**
F5IG	*	990,570	689	534
FD1TFS	*	442,481	690	337
F6GIN	*	331,056	537	304
F6DZD	*	66,836	225	154
***TM6GG**	**A**	**2,175,084**	**1656**	**558**
		(Opr. F6FGZ)		
***FD1PTI**	**A**	**337,851**	**541**	**291**
*F1OIE	*	212,052	487	246
*FD1RAB	*	95,348	303	197
*F1JDG	*	6,327	80	57
***F6FXW**	**21**	**49,764**	**171**	**143**
***FF5KE**	**14**	**100,400**	**366**	**200**
		(Opr. FD1OQJ)		

ENGLAND

G4BUO	**A**	**3,778,218**	**2125**	**666**
G3TXF	*	333,086	553	299
G3SQX	**28**	**5,605**	**79**	**59**
G4CNY	**21**	**1,421,809**	**1224**	**521**
G3LNS	**7**	**2,500,400**	**1237**	**532**
G3YBT/P	**3.5**	**136,320**	**299**	**192**
***G3SWH**	**A**	**996,812**	**1102**	**428**
***G4ZFE**	**A**	**623,224**	**883**	**359**
*GØIDE	*	516,384	795	352
*G3ESF	*	497,600	773	320
*G3OOU	*	234,780	509	258
*GXØAAA	*	233,240	575	245
			(Opr. G3SXW)	
*G4ZME	*	131,936	361	217
*G4OBK	*	33,372	154	108
***G3SSO**	**21**	**431,552**	**590**	**352**
			(Opr. G3ZRJ)	
***GØNWG**	**14**	**177,936**	**385**	**264**
***G4ZOB**	**7**	**244,664**	**336**	**238**

SCOTLAND

***GM3CFS**	**21**	**121,632**	**279**	**224**

WALES

***GW3JI**	**A**	**550,715**	**791**	**341**

HUNGARY

HA7TM	**A**	**1,828,539**	**1099**	**411**
HA8FM	**A**	**1,594,790**	**1508**	**505**
HA5AGS	*	967,560	950	440
HA5NG	*	884,934	1062	422
*HA3UU	*	4,157,288	2262	698
*HA5NK	*	683,568	925	376
*HA6VA	*	247,965	394	325
*HAØDD	*	124,848	272	216
***HA8EN**	**28**	**26,325**	**162**	**117**
***HA6NW**	**21**	**326,688**	**510**	**328**
*HA1ZU	*	95,460	280	185
***HA9SU**	**14**	**491,486**	**724**	**397**
*HA8AT	*	137,280	346	240
***HG8Q**	**7**	**338,116**	**485**	**274**
***HA4FV**	**3.5**	**147,000**	**377**	**196**
***HA4FB**	**1.8**	**14,400**	**107**	**72**

SWITZERLAND

***HB9ARF**	**A**	**624,762**	**863**	**366**
***HB9HLE**	**21**	**17,205**	**102**	**93**
*HB9DFY	*	10,064	84	74

ITALY

IØZUT	**A**	**700,524**	**740**	**366**
IKØREH	*	67,353	190	157
IK2VJF	*	65,688	205	161
I5QQV	**21**	**49,432**	**182**	**148**
IK3NLK	**14**	**16,660**	**114**	**98**
***IKØHBN**	**A**	**896,535**	**1093**	**435**
*IKØQDB	*	52,560	223	146
*IK3QAR	*	47,270	186	163
*IK2IKW	*	36,533	136	119
*IK5QPS	*	14,028	96	84
*IK3SCB	*	4,995	44	37
***IK5TSS**	**14**	**147,752**	**345**	**253**
*IK1PMR	*	110,295	306	215

SARDINIA

***ISØUWX**	**14**	**5,280**	**68**	**60**
***ISØOMH**	**A**	**525,198**	**797**	**323**

SICILY

IB9T	**14**	**2,743,440**	**2007**	**690**
		(Opr. IT9TQH)		
IU9A	**14**	**2,119,644**	**1744**	**607**
		(Opr. IT9GSF)		
***IT9AF**	**21**	**635,778**	**892**	**418**

SVALBARD

JW6MY	**A**	**343,842**	**437**	**262**

NORWAY

LA4RJ	**A**	**775,632**	**613**	**286**
LA9DFA	*	315,262	656	283
LA6IHA	*	110,112	341	186
LA3UG	*	77,000	282	175
LA9HW	**3.5**	**235,586**	**495**	**221**
***LA4YW**	**A**	**586,656**	**793**	**388**
*LA9GY	*	10,404	58	51
*LA5AP	*	10,375	102	83
***LA2OG**	**21**	**15,750**	**92**	**90**

LITHUANIA

LY3BU	**A**	**1,257,724**	**1097**	**494**
LY2PAQ	**A**	**715,791**	**827**	**397**
LY2DX	*	637,290	868	365
LY2OA	*	454,474	567	343
LY2OU	**28**	**37,772**	**253**	**133**
LY2BIP	**14**	**692,300**	**850**	**430**
LY2BN	*	622,804	870	413
LY1DI	*	258,093	512	297
LY2BLA	*	13,203	91	81
LY3BS	**3.5**	**352,688**	**564**	**268**
LY1DS	*	344,967	576	267
***LY2BKT**	**14**	**68,162**	**226**	**173**

BULGARIA

LZ5W	**A**	**3,682,020**	**2338**	**654**
		(Opr. LZ3ZZ)		
LZ1BJ	*	365,800	630	295
LZ6R	**21**	**952,496**	**1016**	**472**
LZ2VP	*	43,136	167	128
LZ1LW	**14**	**44,268**	**240**	**186**
LZ1KBB	**7**	**16,416**	**120**	**36**
		(Opr. Christo)		
***LZ1IA**	**A**	**64,213**	**244**	**157**
*LZ1OJ	*	35,425	125	109
*LZ1YE	*	2,553	39	37
***LZ2GS**	**28**	**312**	**12**	**12**
***LZ2FM**	**14**	**225,792**	**487**	**294**
***LZ1FJ**	**7**	**12,240**	**86**	**68**

AUSTRIA

OE3EMN	**A**	**826,608**	**953**	**408**
OE9SLH	*	189,056	330	224

FINLAND

OH1AF	**A**	**2,335,660**	**1890**	**580**
		(Opr. OH1NOA)		
OH6LNI	**A**	**902,451**	**1026**	**451**
OH6MUE	*	338,844	645	302
OH3WS	*	254,492	355	298
OH2VZ	*	96,848	244	162
OH6WZ	**28**	**160,992**	**609**	**234**
OH6RM	**21**	**1,506,444**	**1319**	**564**
		(Opr. OH4YR)		
OH1HS	**14**	**1,817,920**	**1425**	**608**
OH9LVH	**14**	**1,320,000**	**1238**	**528**
OH6NEX	*	975,800	1247	476
OH3NM	*	233,478	384	306
OH1AA	**7**	**1,021,514**	**856**	**389**
		(Opr. OH1MYA)		
OH1NSJ	**3.5**	**301,702**	**540**	**251**
***OH3LIM**	**A**	**1,340,612**	**1367**	**508**
***OH2BSQ**	**A**	**739,845**	**952**	**401**
*OH2BNT/1	*	312,879	460	317
*OH1TN	*	202,797	408	259
*OH6LBW	*	192,156	420	239
*OH7NW	*	132,525	334	225
*OH9AB	*	31,088	125	116
*OH6UP	*	12,750	79	75
*OH5LBR	*	2,030	36	35
***OH6RC**	**21**	**130,053**	**302**	**231**
*OH8LC	*	20,790	114	99
***OH3MC**	**14**	**18,746**	**106**	**91**
***OH3NXW**	**7**	**343,434**	**487**	**273**
***OH3RB**	**1.8**	**33,488**	**160**	**104**

ALAND IS.

***OHØ /DL7CF/P**	**A**	**258,945**	**420**	**305**

CZECH REPUBLIC

OK1ZTW	**A**	**165,172**	**387**	**238**
OK1BMW	**28**	**24,426**	**127**	**118**
OK1AES	**21**	**272,903**	**441**	**307**
OK1DJO	*	221,076	384	276
OK1FHI	*	111,088	260	212
OK1DXS	**14**	**2,332,200**	**1594**	**650**
OK2PAY	**14**	**1,459,095**	**1366**	**555**
OK1ARN	**7**	**419,628**	**612**	**289**
OK1DRU	**1.8**	**29,106**	**151**	**99**
***OK1FMR**	**A**	**780,125**	**920**	**395**
***OK2BPO**	**A**	**336,217**	**490**	**301**
*OK2HI	*	318,378	477	282
*OK2BWJ	*	129,444	365	201
*OK2ON	*	106,596	273	189
*OK2SWD	*	52,820	201	139
*OK2PJD	*	33,402	135	114
*OK1DXW	*	14,508	103	78
*OK2SSS	*	13,468	84	74
***OK1MGW**	**28**	**13,260**	**116**	**85**
***OK1BLC**	**14**	**338,015**	**555**	**335**
*OK1MKI	*	112,710	310	221
*OK1JDJ	*	21,836	111	103
***OK1FPG**	**7**	**350,132**	**561**	**271**
*OK2BCG	*	194,916	327	222

SLOVAKIA

OM3PC	**14**	**329,067**	**533**	**311**
OM3TUM	**7**	**39,550**	**150**	**113**
OM3TZW	**3.5**	**285,696**	**490**	**248**
***OM3CDZ**	**A**	**402,477**	**660**	**307**
***OM3WST**	**A**	**356,058**	**620**	**302**
*OM3WST	*	356,058	620	302
*OM3CCC	*	346,896	602	292
*OM3PQ	*	297,092	540	289
*OM3TLI	*	172,293	408	227
*OM3CTX	*	107,136	287	186
*OM3CVN	*	35,776	126	104
*OM3DX	*	14,062	86	79
***OM3TEG**	**28**	**18,816**	**150**	**98**
***OM3CAB**	**14**	**113,632**	**338**	**212**
*OM3CFT	*	59,598	200	154
*OM3CNS	*	54,537	171	147
*OM3KXR	*	47,094	203	141
*OM3CDN	7	47,724	185	126

BELGIUM

***ON4KFM**	**A**	**447,720**	**469**	**280**
***ON4XG**	**A**	**367,913**	**629**	**311**
*ON4KRO	*	115,920	243	161
*ON5EU	*	24,976	150	112
***ON6CR**	**7**	**9,000**	**73**	**60**
***ON4ON**	**3.5**	**222,740**	**398**	**215**
***ON4ZD**	**21**	**323,301**	**510**	**303**
***ON4APU**	**14**	**99,576**	**310**	**216**

FAROE IS.

OY6A	**A**	**815,016**	**1520**	**348**
			(Opr. DK9FE)	

DENMARK

OZ5WO	**A**	**59,148**	**215**	**159**
*OZ2JZ	*	34,304	152	128
*OZ7AX	*	12,584	120	88
*OZ8XO	*	5,808	66	66
*OZ2RH	*	147	7	7
***OZ5DX**	**21**	**4,524**	**40**	**39**
*OZ8QW	*	2,886	40	39
***OZ/SM7GCZ**	**14**	**27,644**	**132**	**131**

THE NETHERLANDS

PA3BTH	**A**	**90,459**	**228**	**207**
PA3EYZ	**14**	**3,666**	**50**	**47**
PAØLOU	**7**	**9,576**	**63**	**63**
***PA3FNE**	**A**	**1,029,996**	**1081**	**459**
***PA3ELD**	**A**	**801,640**	**913**	**409**
*PAØKHS	*	28,290	148	115
*PA3BEJ	*	12,348	84	84
***PA2REH**	**21**	**54,080**	**172**	**160**
*PAØLRK	*	1,922	33	31
***PA3AAV**	**7**	**708,400**	**610**	**350**
*PA/DJ2YE/P	*	18,960	103	79

SLOVENIA

S5ØA	**A**	**5,203,698**	**2571**	**762**
S5ØL	**A**	**4,742,221**	**2555**	**727**
			(Opr. S59AA)	
S58A	**21**	**2,601,819**	**1745**	**641**
			(Opr. S58AM)	

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BY BRIAN BEEZLEY*, K6STI

An isotropic antenna radiates equally in all directions. Whenever I see a reference to this antenna in an amateur publication, it's often accompanied by the disclaimer "Of course, such antennas don't exist." Well, why not? Amateur radio antenna lore has many myths. I wondered if this was yet another.

To find out, I decided to try to create an isotropic antenna on my computer. I started with an Eggbeater Antenna. This is a pair of full-wave loops at right angles fed 90 degrees out of phase (see fig. 1). (Often the loops are circular instead of square, hence the antenna's name.) An Eggbeater is a Turnstile Antenna made of loops instead of dipoles. Table I gives the dimensions for 146 MHz.

Horizontal side—21.80 inches
Vertical side—21.80 inches
Loop offset—0.25 inches
Conductors—#12 copper wire
Feedpoints—2, phased 90°

Table I– Eggbeater dimensions for resonance at 146 MHz.

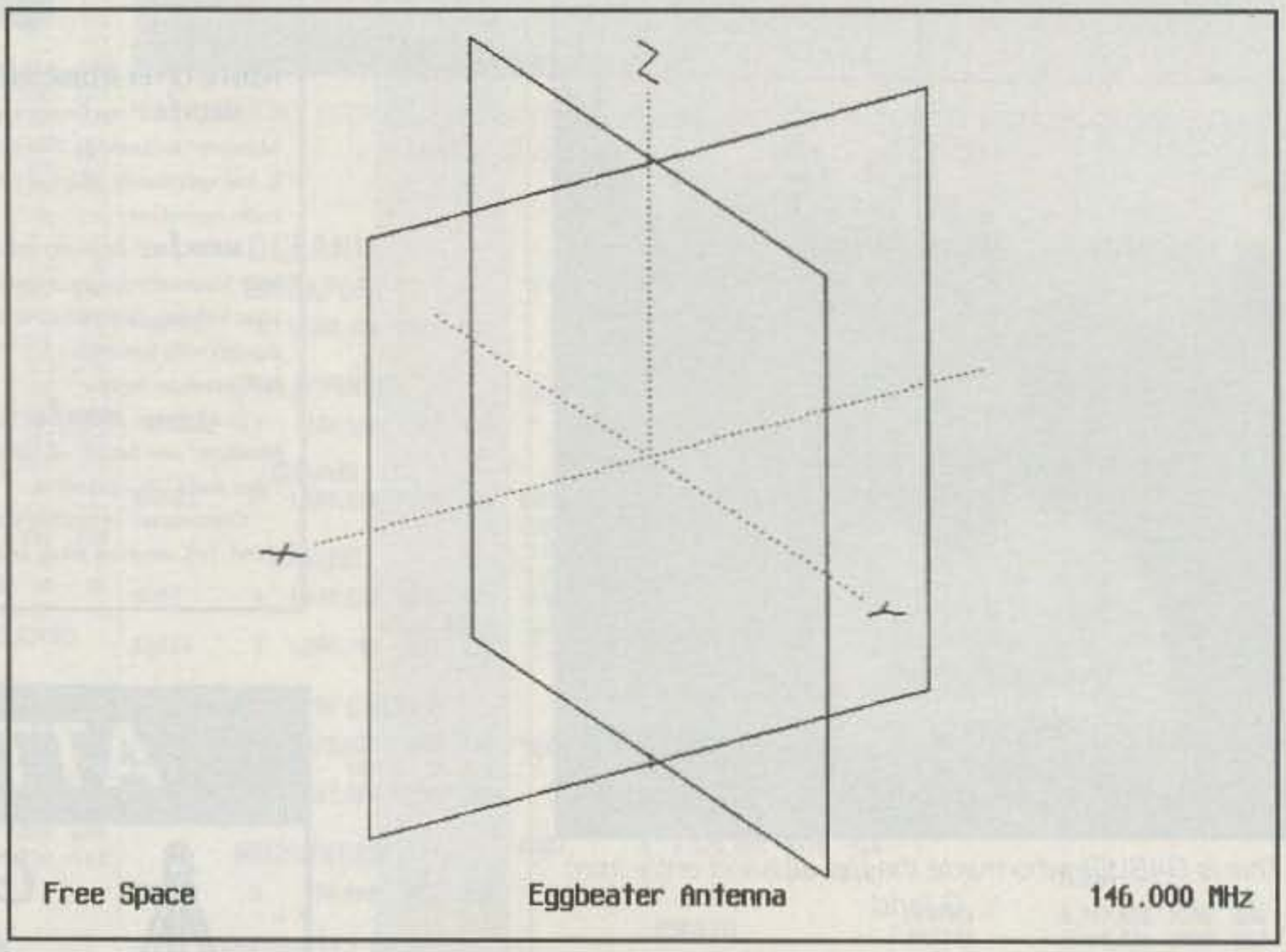

Fig. 1– Eggbeater Antenna geometry.

When I modeled this design, I got the results shown in figs. 2 through 4. Expanded rectangular coordinates are needed to reveal the small pattern variations.

While not perfectly isotropic, the Eggbeater comes pretty close. Peak-to-peak pattern ripple is less than 0.5 dB in the azimuth plane, less than 1.0 dB in elevation, and just slightly more than 1.0 dB over all angles. I wondered whether these numbers could be improved.

After fooling around a bit with loop dimensions manually, I remembered that the program I was using[1] had a special feature for automatically optimizing omnidirectional designs. I asked it to minimize peak pattern ripple over the whole radiation sphere. I added feedpoints to the wires opposite the existing feedpoints to help maintain pattern symmetry. (Full-wave loops with single feedpoints have slightly asymmetrical patterns, as you can see in fig. 3.) The program ground away for a few minutes, shrunk the loops somewhat, and came up with the dimensions in Table II. Response is shown in figs. 5 through 7.

Horizontal side—18.19 inches
Vertical side—20.68 inches
Loop offset—0.25 inches
Conductors—#12 copper wire
Feedpoints—4, phased 90°

Table II– Dimensions for best isotropic pattern at 146 MHz.

This design has less than 0.4 dB ripple in the azimuth plane, less than 0.2 dB in elevation, and less than 0.4 dB over the entire radiation sphere. It's hard to imagine an antenna application that might require a pattern more uniform than this.

After thinking about it, I concluded that it probably is impossible to obtain a perfectly omnidirectional pattern. Current flowing on an infinitesimal wire results in a radiation pattern similar to that of a half-wave dipole, with nulls off the ends. To fill in the nulls, you need additional wires. You probably can come as close as you like to a perfectly isotropic pattern with enough little wires (and patience), but it's not clear how to arrange a finite number to achieve a perfect pattern.

So What?

Let's say you decide to become the first on your block with a real isotropic antenna (or a close approximation) and you construct the design of Table II.[2] What good is it?

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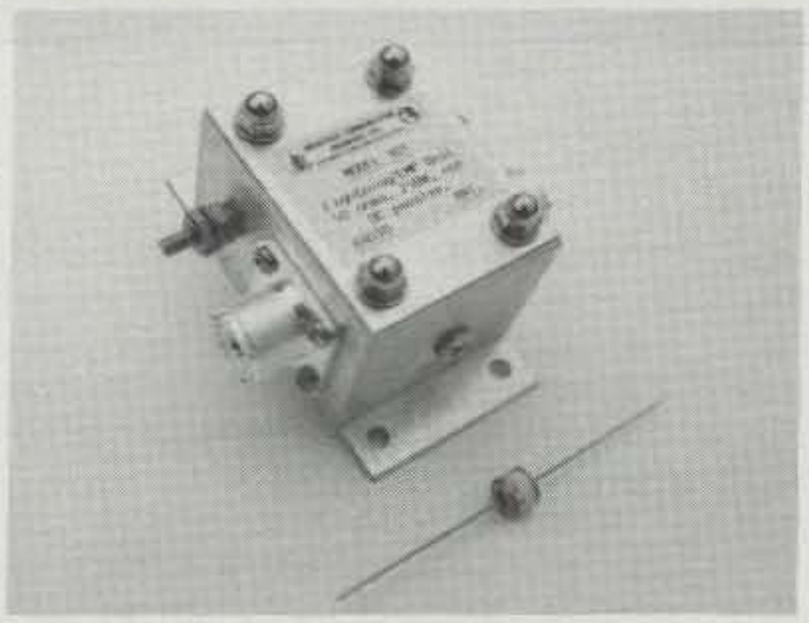

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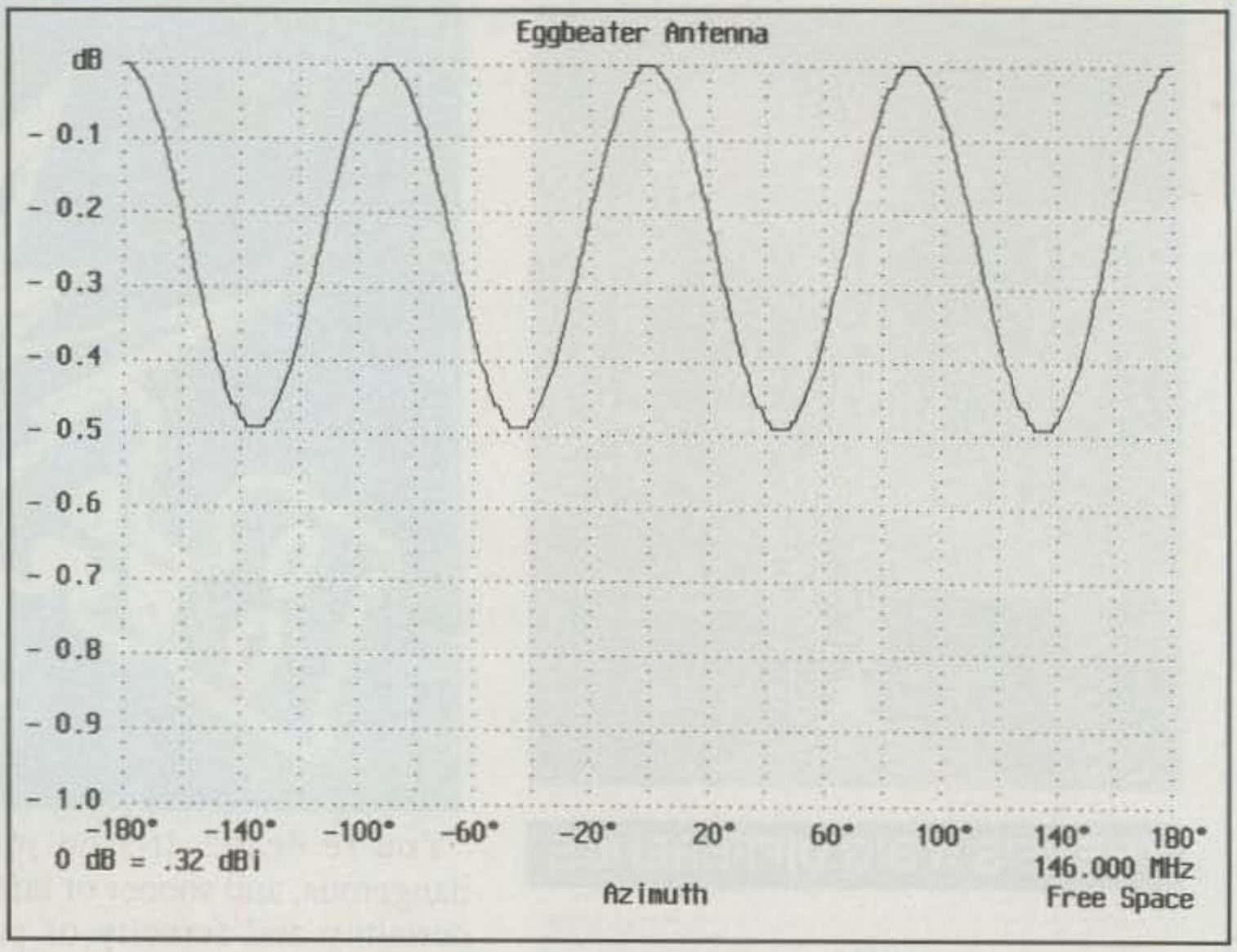

Fig. 2– Eggbeater azimuth response.

An isotropic antenna is useful whenever a signal may arrive from any direction. Eggbeaters often are used for communicating through non-geostationary satellites.[3] While a directional antenna such as a Yagi offers more gain, you must keep it pointed at the satellite as it passes overhead.[4]

For uniform, close-in coverage on 40 or 80 meters during local nets or domestic contests, an isotropic radiator comes in handy. The presence of ground can cause nulls in the elevation pattern of any antenna, so you must pick antenna height carefully.[5]

A tiny isotropic antenna with circular loops can be used with a 1.2 GHz handheld radio. The antenna can reduce sig-

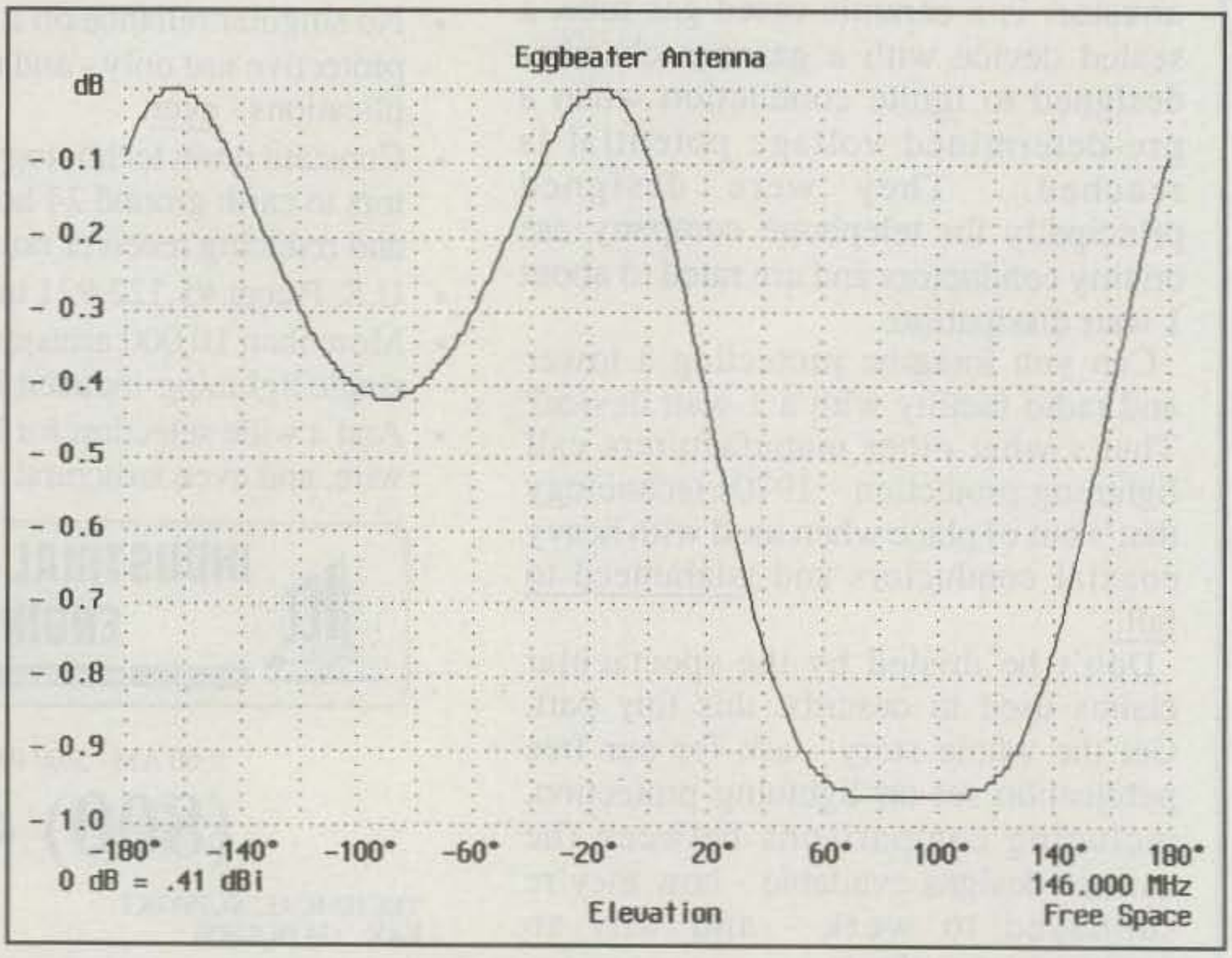

Fig. 3– Eggbeater elevation response.

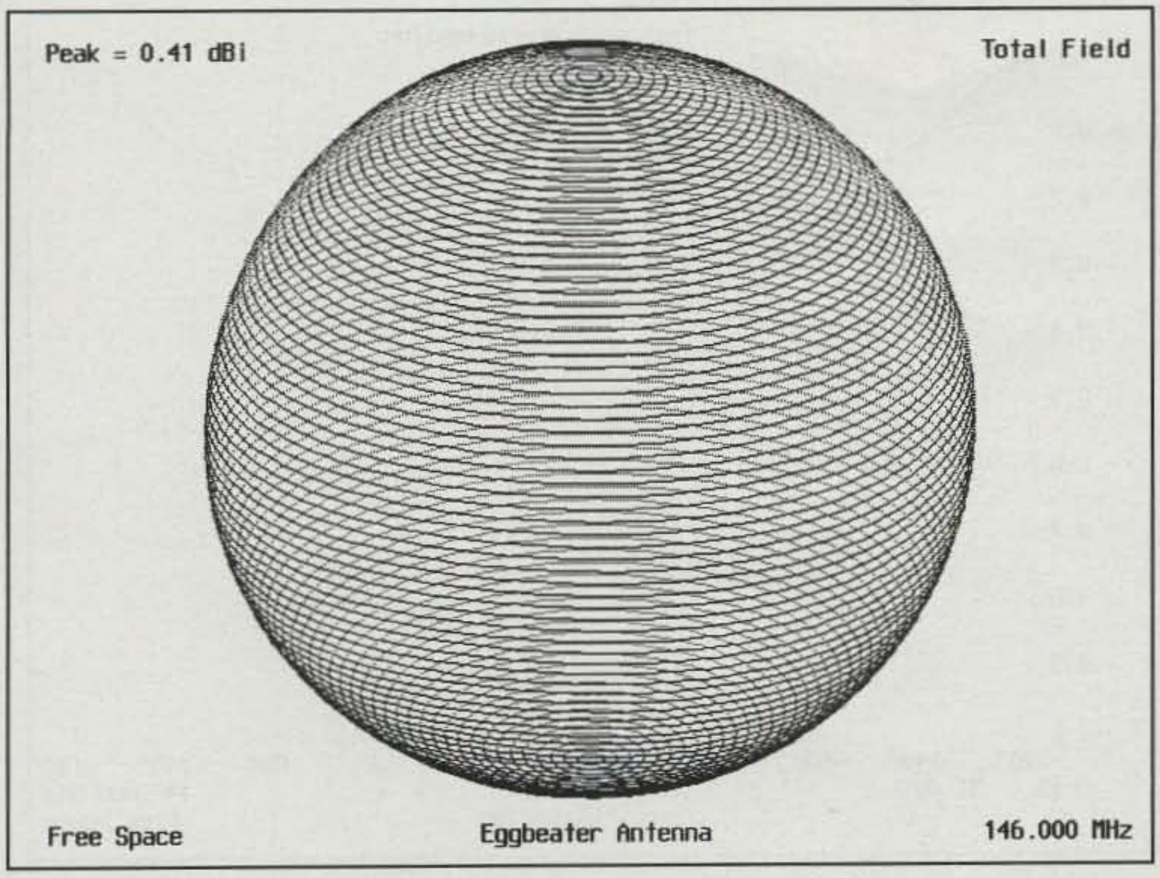

Fig. 4– Eggbeater 3-D pattern.

nal drop-out due to radiation-pattern nulls off the ends of a conventional whip. This may let you communicate while holding the radio in a more convenient position.[6]

Commercially, isotropic antennas are very useful with pagers, baby monitors, and other mobile telemetry systems. Absence of pattern nulls can increase data reliability and throughput.[6]

So the next time you read about the isotropic antenna "which of course doesn't exist," I hope you think, "Yes, but . . ."

Footnotes

1. AO 6.0 Antenna Optimizer.

2. Although it has three times as much pattern ripple, the Eggbeater of Table I is

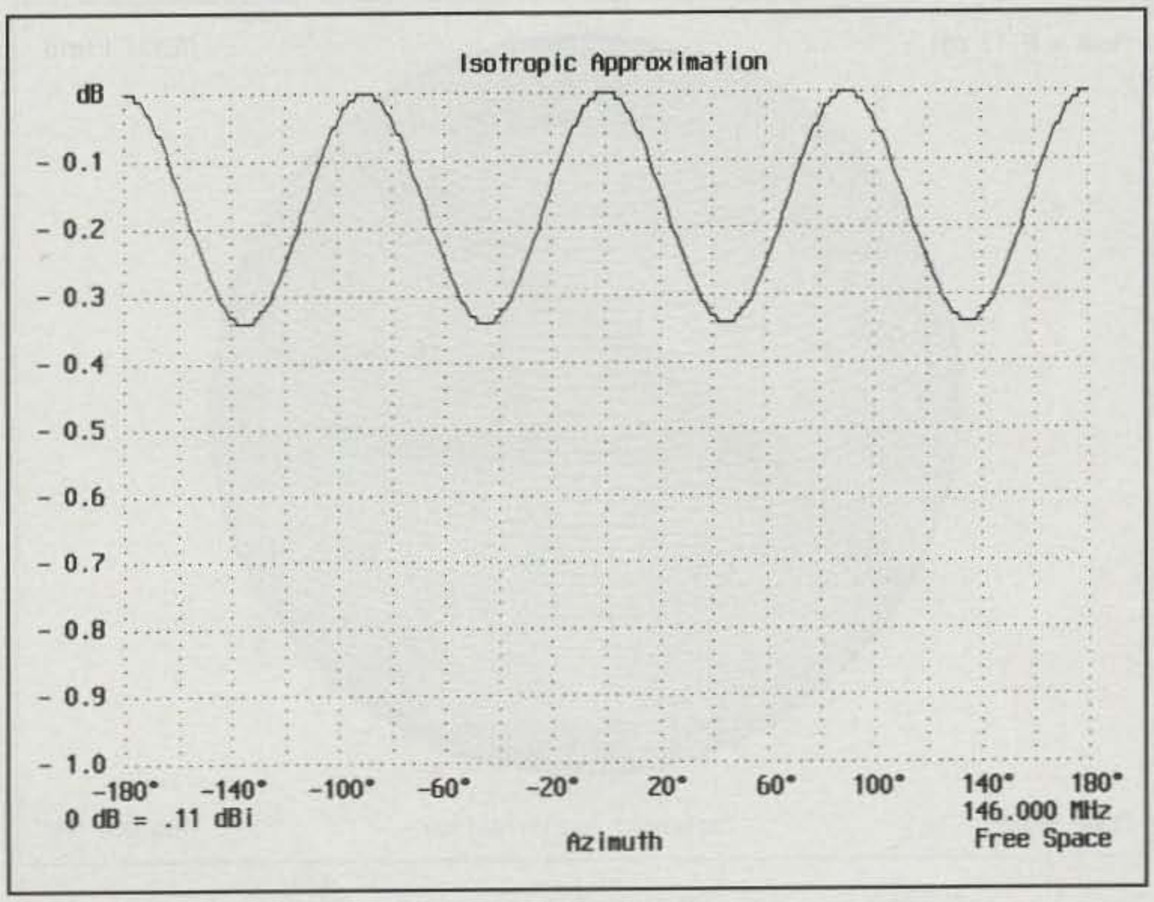

Fig. 5– Azimuth response of near-isotropic antenna.

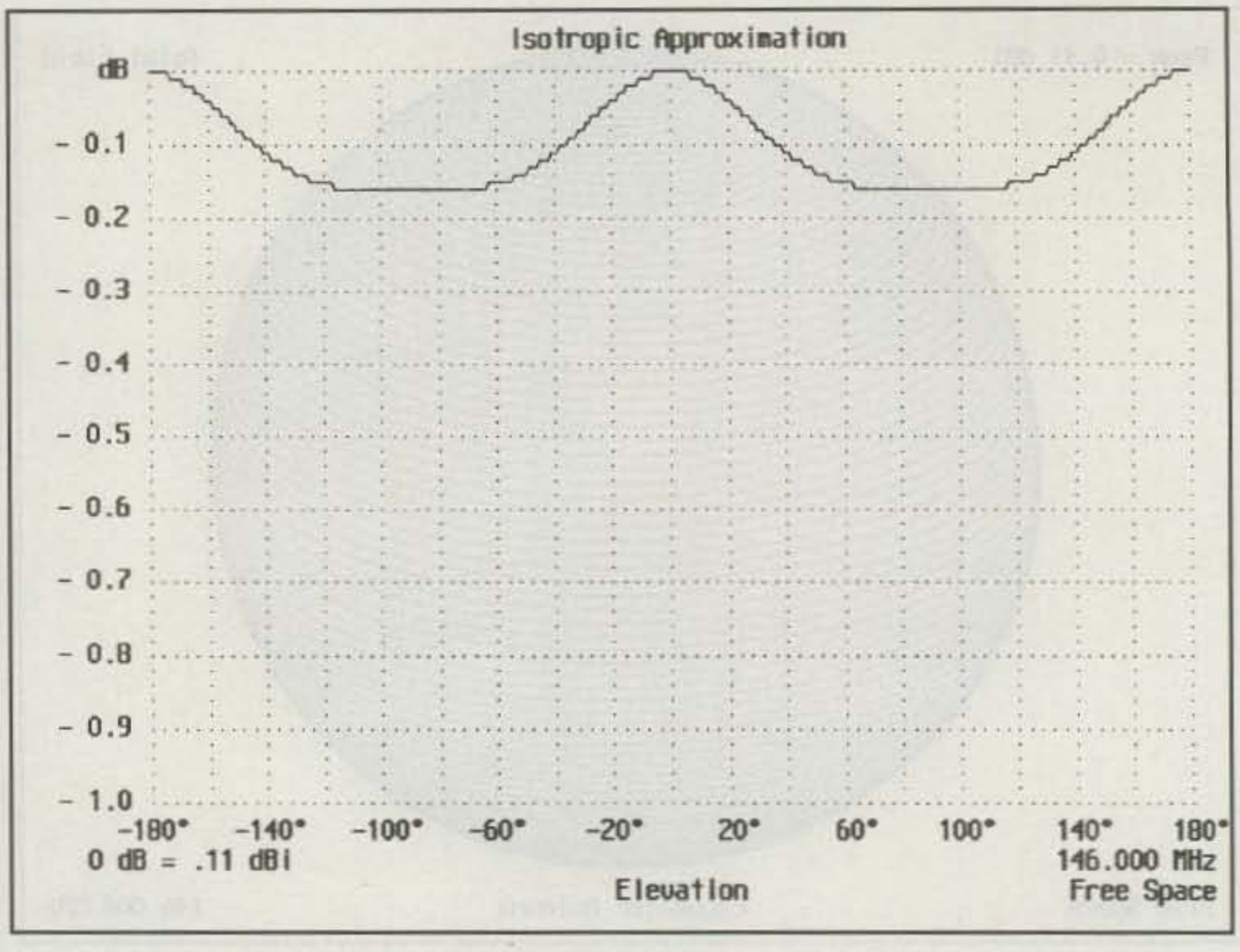

Fig. 6– Elevation response of near-isotropic antenna.

easier to construct, since it has a simpler feed system and is resonant.

3. Eggbeater antennas are available commercially from M² Enterprises.

4. Above the horizon, an Eggbeater exhibits elliptical polarization. This can reduce polarization fading due to satellite spin.

5. Planar, non-isotropic designs exist which can provide very uniform radiation patterns when used in conjunction with ground. For example, see "The Triangle Antenna" in the Fall 1991 issue of *Communications Quarterly*.

6. To provide complete immunity to antenna orientation, the receiving system must respond to any polarization. This requires an antenna with orthogonal outputs, a dual-channel receiver, and a voting circuit.

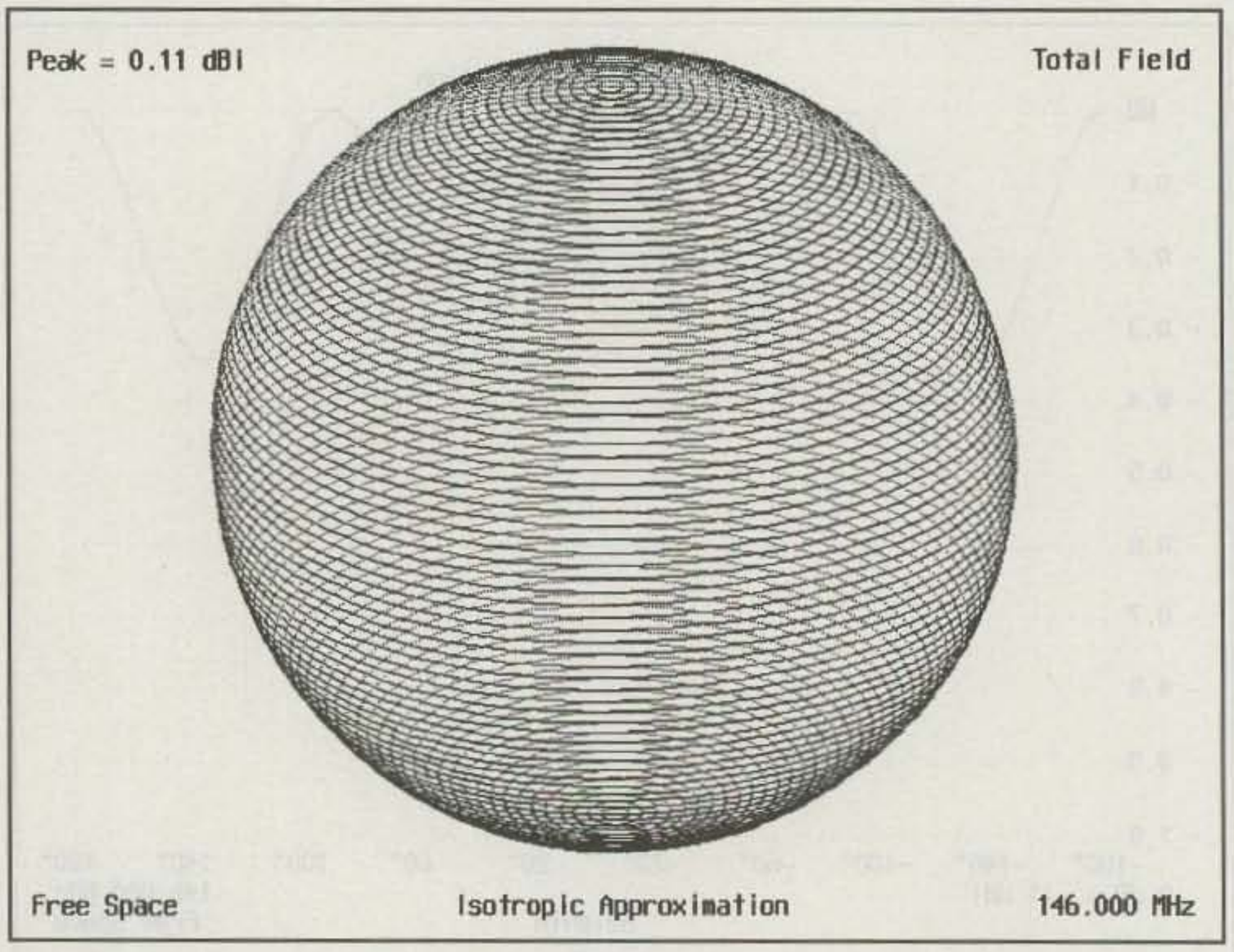

Fig. 7– Three-D pattern of near-isotropic antenna.

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CQ REVIEWS:

The A&A Engineering 20 Meter QRP CW Transceiver Kit

BY PAUL CARR*, N4PC

I have been a QRP enthusiast for most of my amateur career, and I never miss an opportunity to check out another QRP rig. I was happy when given an assignment to build and evaluate A&A Engineering's line of QRP transceivers. These transceivers are intended for backpacking, field day, or portable use, and they are nice additions to the home station if you want to put a little spice into your everyday operating. Here are the results of my evaluation.

Front view of the completed transceiver.

The Receiver Circuit

The receiver closely approaches a "receiver on a chip." The main building block is the Motorola MC3362 IC, which was originally intended for use as a VHF FM receiver. There are plenty of circuits within this chip to provide most of the necessary functions in the receive section. Now let's take a brief stage-by-stage trip through the receiver.

Starting at the antenna input, the signal first encounters a double-tuned preselector network which provides the initial selectivity for the receiver. The output of this network is routed to one of the two Gilbert-cell mixers contained on the chip. The mixer is internally connected to a varactor tuned oscillator that provides the VFO function for the entire transceiver. The VFO is tuned with a pair of panel-mounted potentiometers. There is no vernier tuning on the main control, so a second potentiometer is used for fine tuning.

The mixer is followed by internal buffer amplifiers. The output of these amplifiers is routed to a four-pole Cohn crystal filter. The filter was described by Wes Hayward, W7ZOI,[1] and is a favorite of many QRP builders. The bandwidth of this filter is about 400 Hz. If you think that is a bit too narrow, you can increase the bandwidth by changing five capacitors.

The output of the crystal filter is routed back to a second Gilbert-cell mixer within the MC3362. This second mixer is used as a product detector. A second local oscillator is used as a crystal-controlled BFO. So, within the framework of a single MC3362, the signal has been converted from RF to audio, including the oscillator functions necessary for this transformation. That's pretty impressive.

The signal is now routed to a second filter. The filter consists of a low-pass section followed by a high-pass section to provide a bandpass function. Audio filters are sometimes known to ring, but this filter has a nice bandpass response and there is no discernable ringing.

Well, so far so good, you may say, but what about automatic gain control? As you noted, there is no IF amplification, so any AGC function must occur in the audio section, and this is done by using an audio gain control chip (MC3340P) in conjunction with two operational amplifiers. The RC time constants are chosen to provide a fast attack and slow decay response, and adverse pops are not a problem at normal CW speeds. The control range is about 50 dB. This stage also drives the S-meter.

The LM386 has become the choice for the audio output stage for many designers and is used in this transceiver. The sidetone is routed to this stage after the AGC and audio gain control, and its level is unaffected by either. The audio is routed to an internal speaker or to low-impedance (4 to 16 ohm) headphones.

The Transmitter

The output from the VFO is routed to another IC (this time an NE6ØA, a Gilbert-cell transmit mixer).This chip also has the ability to provide a self-contained heterodyne oscillator. The crystal used here is the same frequency as those used in the crystal filter. It is pulled slightly (by a capacitor) to provide the necessary frequency offset for the proper injection frequency. The output of the mixer is routed through a double-tuned bandpass network to provide the necessary filtering prior to subsequent amplification.

Buffering of the transmit signal is provided by a high-frequency operational amplifier. Until recently, the use of op amps has been restricted to audio circuits, but the LM6321 is a circuit that is at home in the RF signal path. It has a very high input impedance and a low output impedance. Since it also has current gain, it is a natural for inclusion at this point in the signal path. The remainder of the transmit path consists of a 2N3866 class-A driver and a rugged 2SC1969 output

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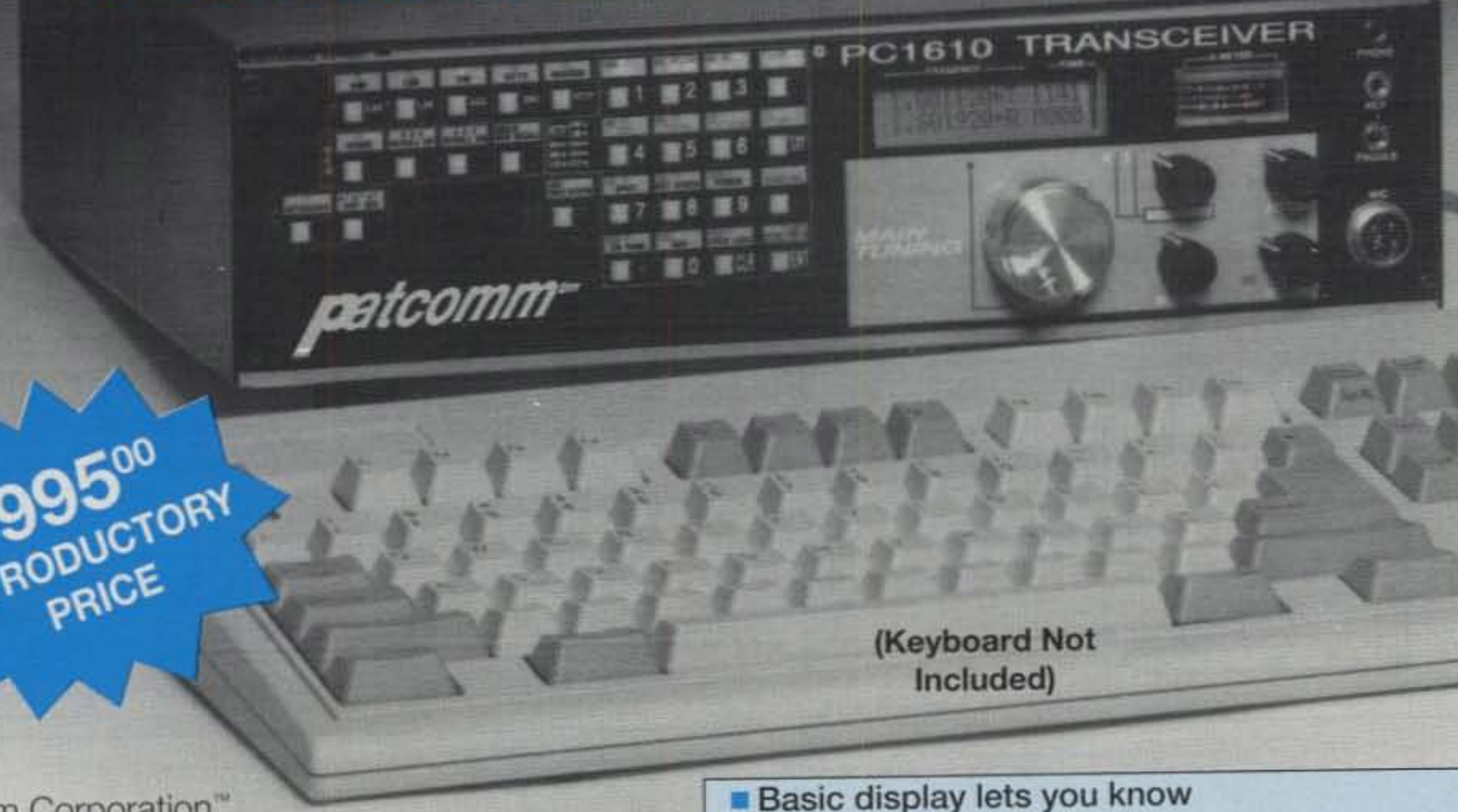

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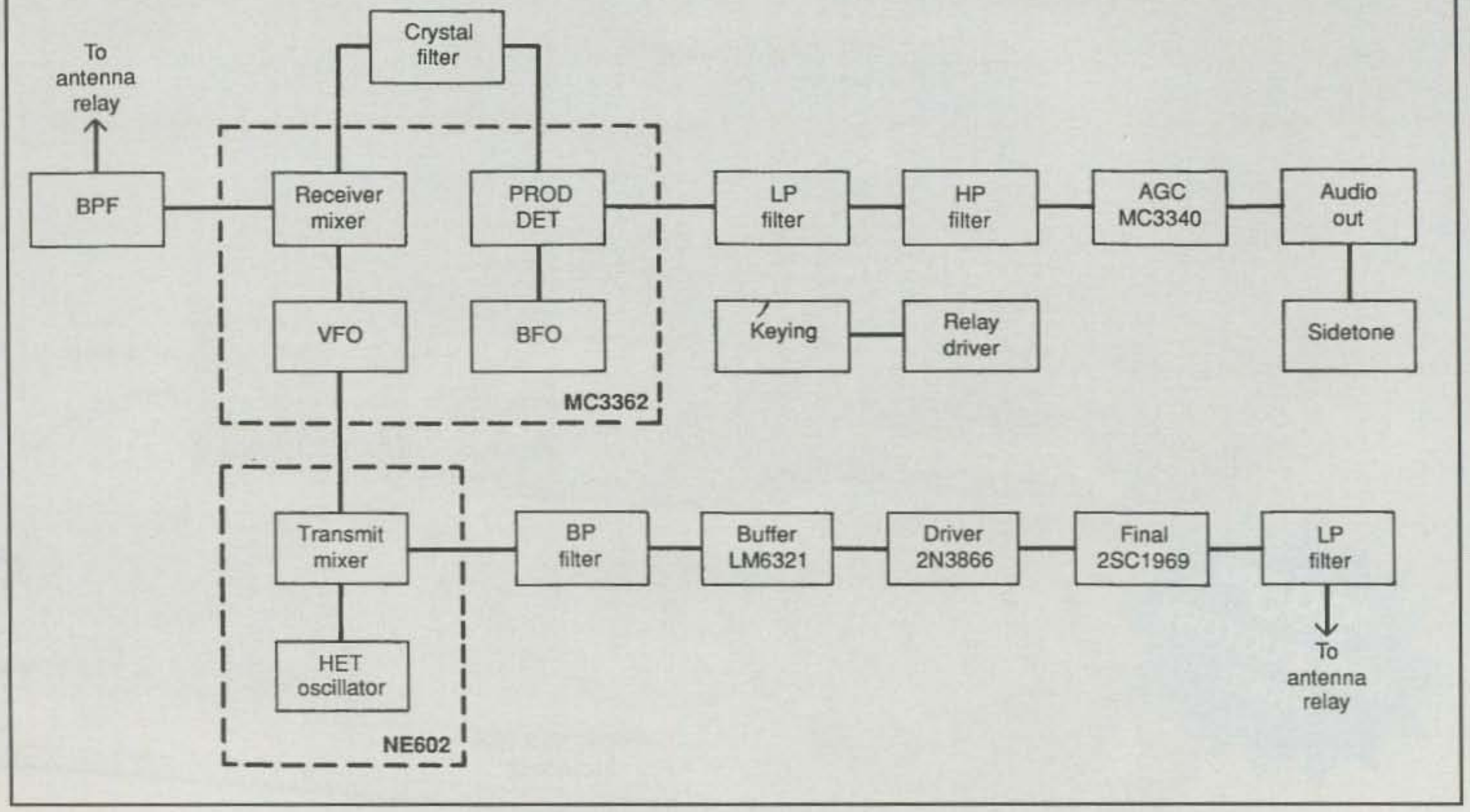
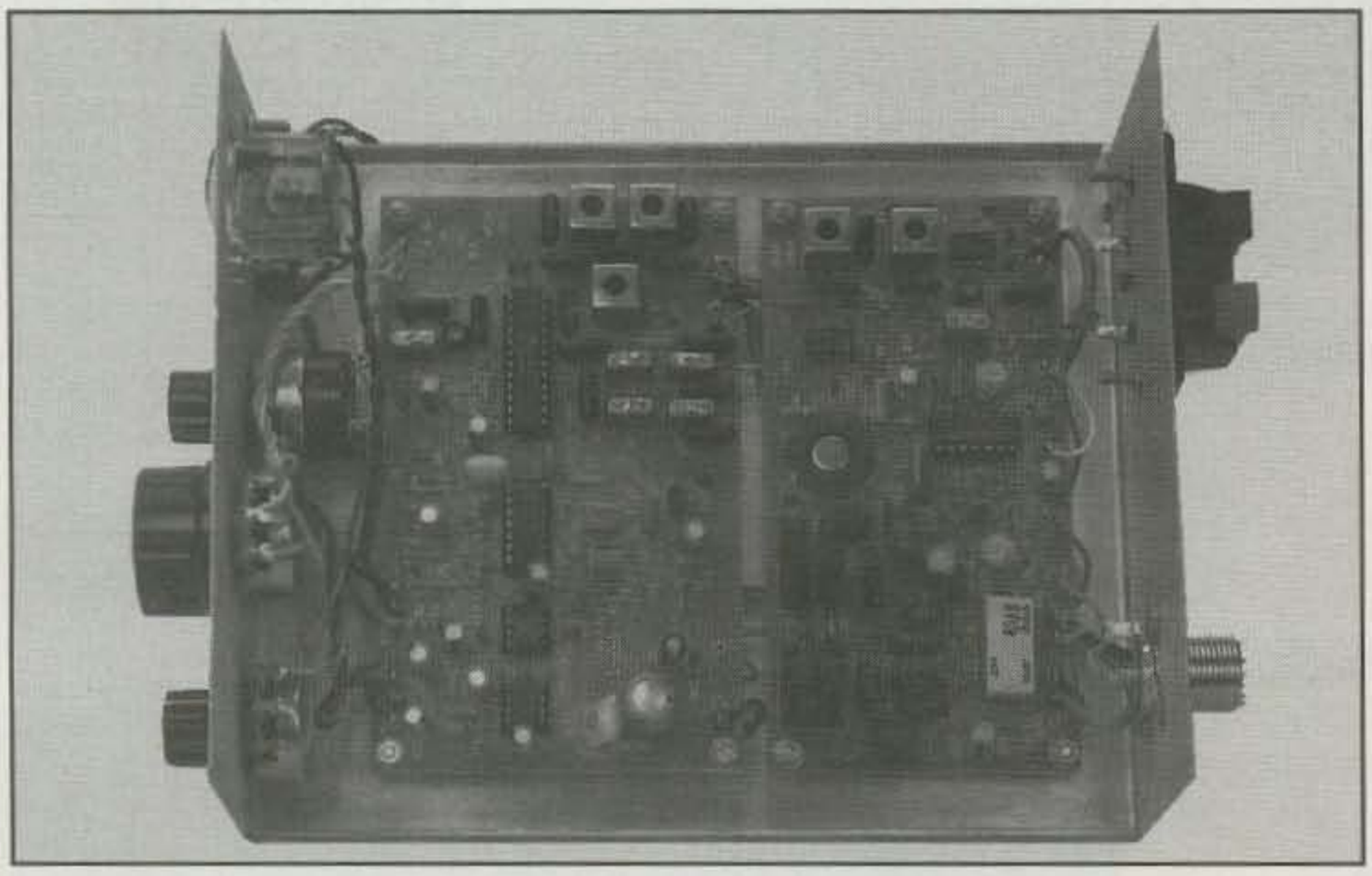


Fig. 1– A simplified block diagram of the 20 meter QRP CW transceiver from A&A Engineering.



The interior view shows the two circuit boards and component layout. Allow yourself plenty of time and patience to wire the kit. It's an enjoyable experience.

final amplifier. The final produces a 5 watt "legal limit" QRP output.

The Control Circuit

The keying, T/R switching, and sidetone-generation circuits are all on the Transmit board. Shaped keying is provided by a 4001 CMOS quad NOR gate and subsequent transistors. Two sections of the 4001 provide the sidetone. The antenna transfer is accomplished by a small DIP relay. Break-in time can be adjusted from almost full QSK to the better part of a second. I listened to the keying on a second receiver and found the signal very pleasant to hear.

Construction

There are two circuit boards to wire in the construction phase. I began with the receiver board. There are no detailed step-by-step instructions, but that is no problem. The parts are listed so that you can install the resistors, for example, and then proceed to the capacitors, coils, crystals, and other components. There is room on the parts list to check each time a part is installed so you will not overlook anything. The key is to install only five or so components at a time and then do the necessary soldering. This way your work does not become crowded.

The transmit/control board is wired in a similar manner. The key to success is not to rush your work. Never work when you are overly tired. To do so is to invite mistakes.

After both the receiver and transmitter boards are completed, visually check for wiring mistakes and correct any that you may find. The boards can now be mounted in the cabinet, and final chassis wiring can be completed. I work slowly, and my construction time was about twenty hours.

Testing and Alignment

After the boards are mounted in the cabinet, make another visual inspection to be sure that no wires have shorted. Use an ohmmeter to check that the power supply line is not shorted and that the on/off switch is properly wired. If everything checks, apply the supply voltage. Begin the alignment by setting the VFO to the proper frequency. A frequency counter is of great benefit here, but if you do not have one, listen for the third harmonic of the VFO on an 18 MHz receiver. Now go

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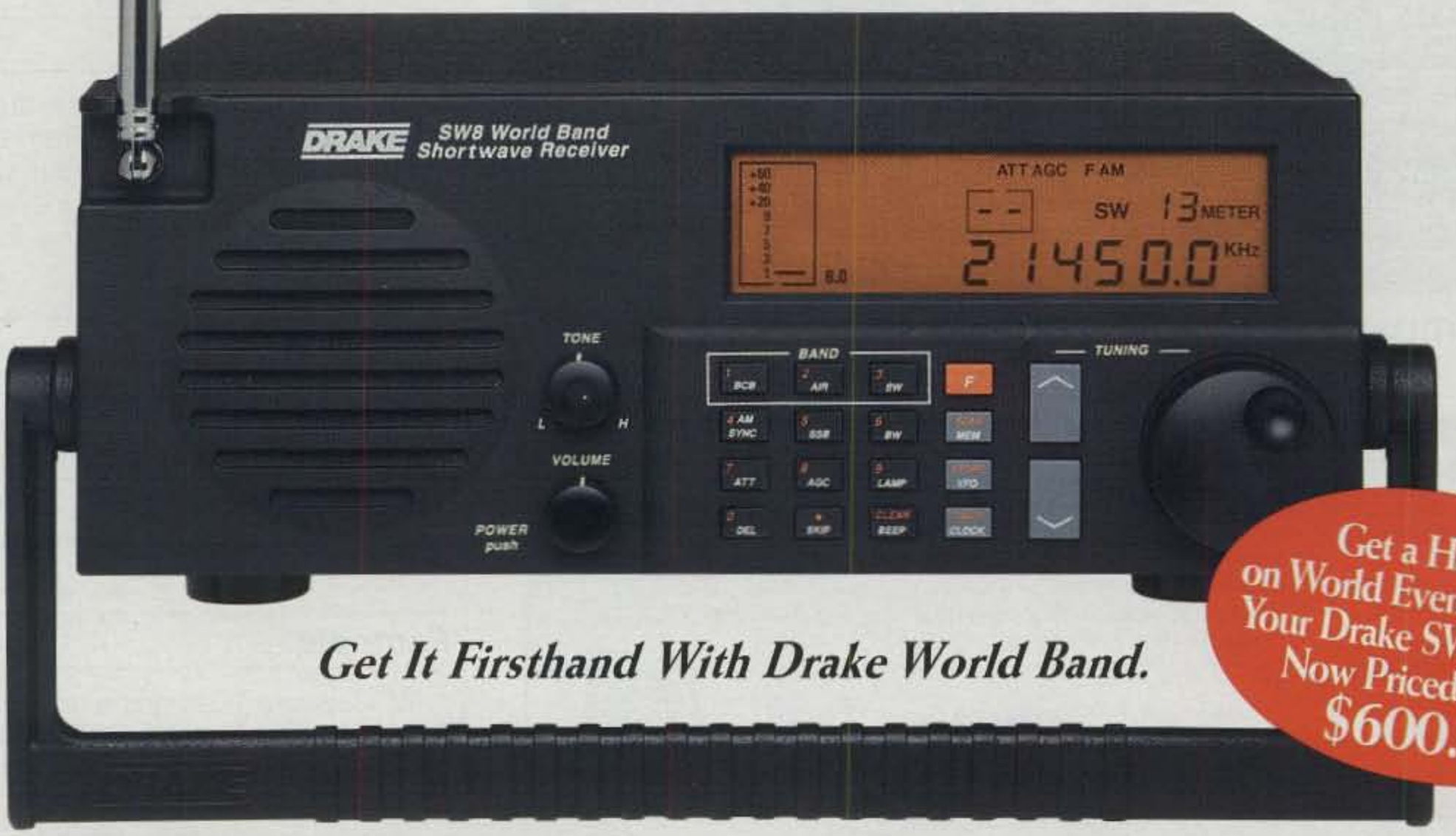

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to the alignment of the receiver front end.

Attach an antenna to the antenna input terminal. You should be able to hear signals on the 20 meter band. Take an alignment tool and peak the coils in the receiver bandpass filter. Repeat this procedure until no further improvement can be made.

Alignment of the transmitter is similar. Route the output through an SWR bridge to a dummy load. Peak the mixer bandpass filter until maximum output is attained. This procedure is straightforward and should pose no problem.

Test Results

The output from the transceiver is a solid 5 watts. The receiver sensitivity is sufficient to provide all the contacts that you could desire. There are two observations that I have made. First, the opposite sideband rejection seems to be slightly less than 40 dB. This is due to the geometry of the receive chip. The input and output of the crystal filter are only 0.2 inches apart and are limited by the pin spacing on the chip. I do not feel that this is a problem. After all, the opposite sideband rejection on a direct conversion receiver is 0!

The second weakness is temperature stability. This should provide no problem in the shack environment where the temperature is stable, but could lead to drift in field conditions. This problem is due to the temperature sensitivity of the varactor in the VFO. I would not rate this problem as serious, but it can cause the calibration to be off a few kiloHertz between cold and hot conditions. I checked the output with a spectrum analyzer and found undesirable products to be down by 44 dB. It is comforting to know that you are putting out a clean signal.

(The original design for the transceiver was done by Gary Breed, K9AY.)

On The Air

I have enjoyed using the rig. My first contact produced a 559 signal from Guatemala City, Guatemala, and this was off the end of my Lazy-H antenna. I have received many reports that the rig does not sound like QRP!

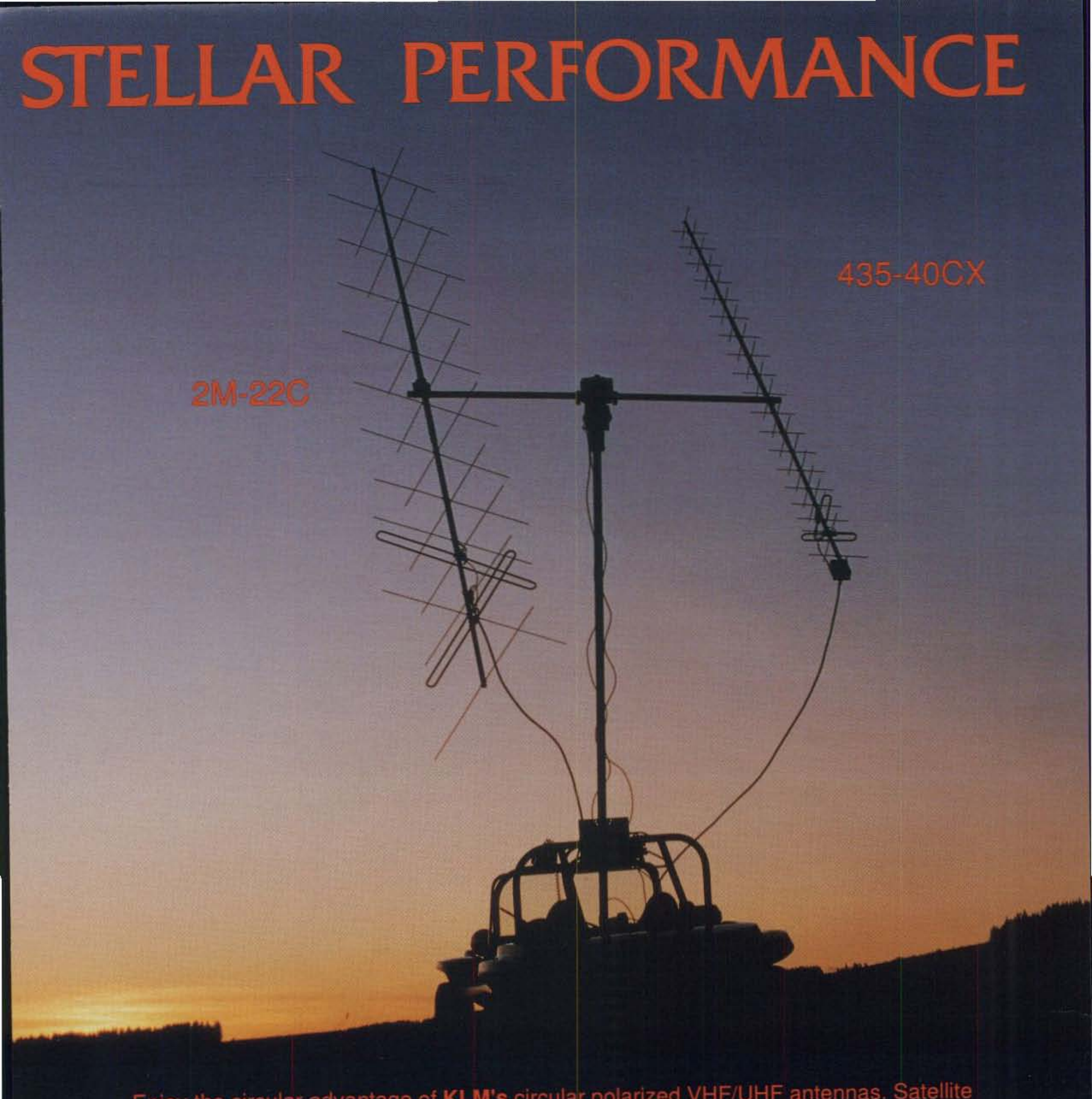
Availability

These kits are available from A&A Engineering, 2521 W. LaPalma #K, Anaheim, CA 92801 (phone 714-952-2114 and FAX 714-952-3280). The price is $159.95 plus shipping and handling. Kits are also available for 30 and 40 meters.

Footnote

1. W. Hayware, "Designing and Building Simple Crystal Filters," *QST*, July 1987, pp. 24–29. ■

STELLAR PERFORMANCE



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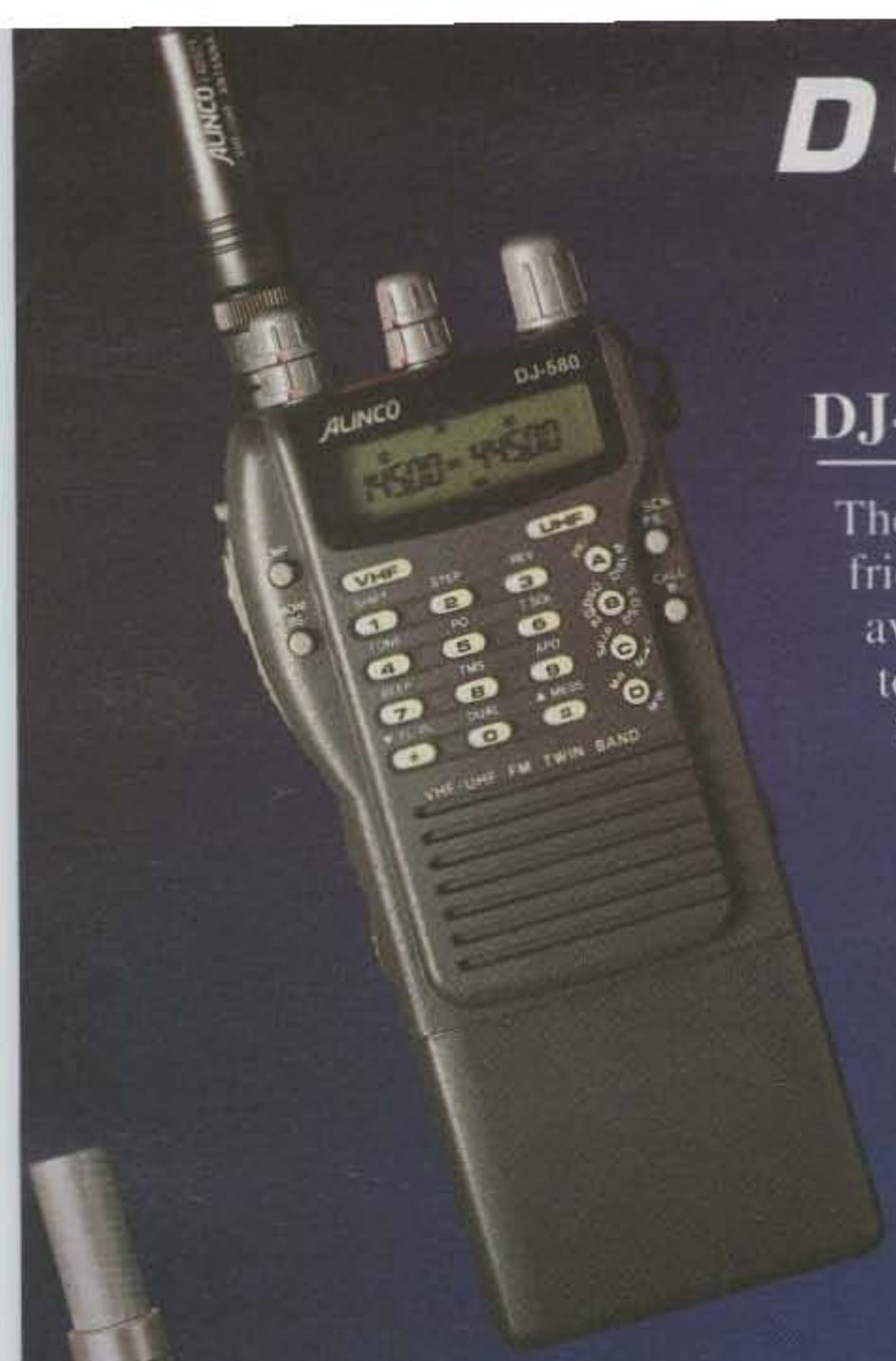
CIRCLE 156 ON READER SERVICE CARD

DEMAND THE BEST



DJ-580T *Best Performance*

The Right Features: Alinco's DJ-580T offers powerful user friendly features that make operating easier. Many new radios available today are so complex that an instruction manual needs to be carried with the radio. We have designed the DJ-580T to be user-friendly, but also sophisticated: It has the features you need, without any useless bells and whistles. This radio can receive 130-174 MHz, 420-474 MHz, and can be modified to receive AM from 118-142 MHz. Other outstanding features include cross-band repeat function, full duplex operation, backlit keypad, 8 scanning modes, CTCSS encode / decode, and DSQ for private paging.

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DJ-F1T / DJ-F1TH *Best of Both Worlds*

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Standard features include: 40 memory channels (odd splits on all), 3 output power levels, DSQ code squelch and private paging, illuminated DTMF keypad, CTCSS encode, Automatic Power Off, and 8 scan modes. The DJ-F1T will receive 130-174 MHz and can be modified to receive AM from 118-142 Mhz.

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CIRCLE 47 ON READER SERVICE CARD

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DR-600T

DR-130T

DJ-180T

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Ergonomic, rugged design, combined with excellent sensitivity and great sound make this the radio of choice for demanding operators.

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No, it's not selective memory. Sometimes the good old days really were as good as we remember them. W9CNY shares some of those days with us—the days of "real radio."

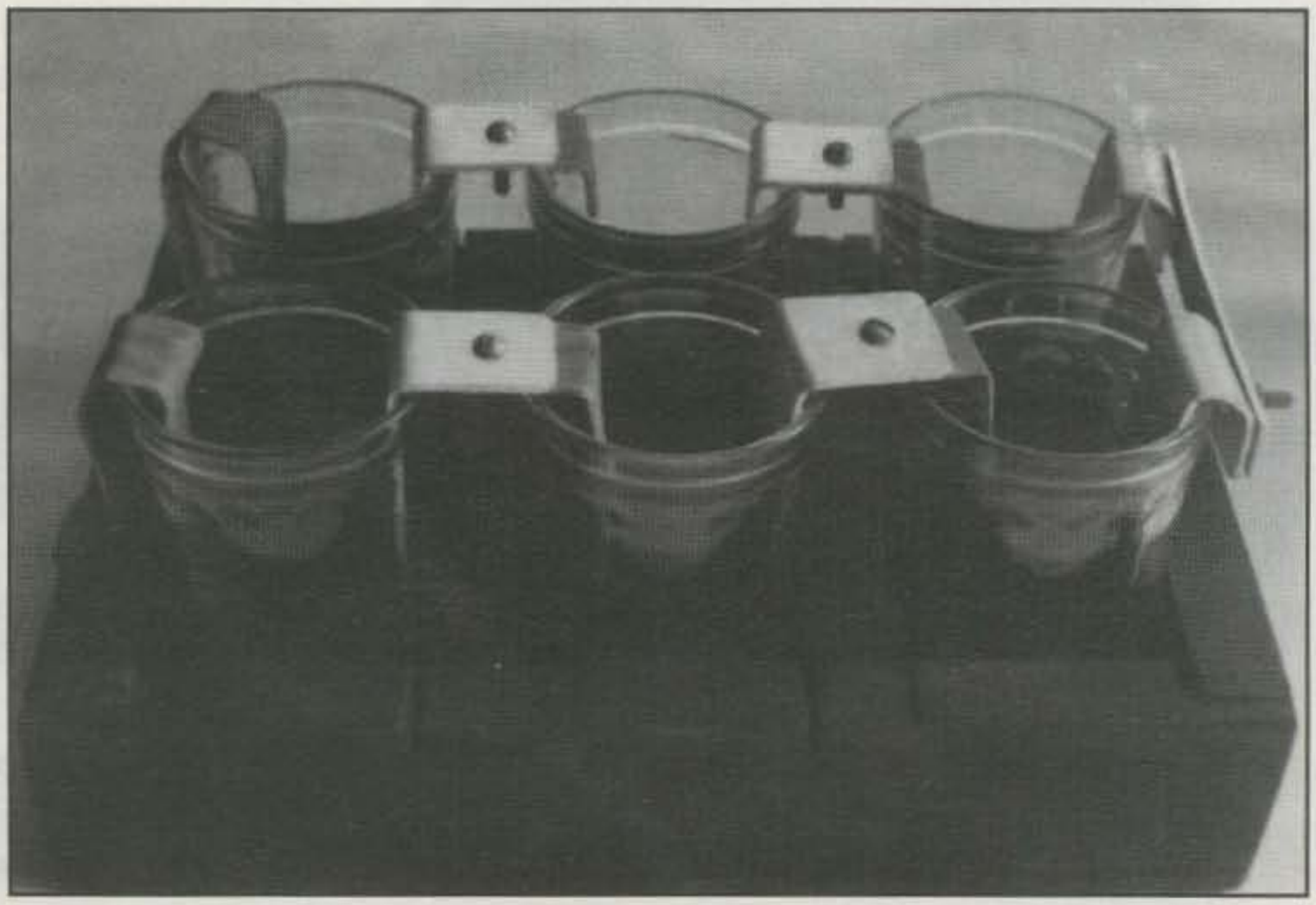
The Good Old Days!

BY LEWIS COE*, W9CNY

When we use the expression "the good old days of amateur radio," the time frame is usually related to the personal experiences of the speaker. For some, the expression may relate to the very earliest days when spark transmitters and crystal detectors were standard equipment. For this writer, the term is used nostalgically in reference to those golden years around 1924–25 when vacuum tubes first made simple and effective CW transmitters and receivers possible. Even the most financially limited of amateurs could usually scrape up enough money to buy a 202 transmitter tube and some kind of a triode receiving tube. Even lower in cost were other transmitter tubes such as the Western Electric VT2, which could usually be obtained at nominal prices. Many of these VT2's were discards from the telephone company's repeater amplifiers. Others were "liberated" from telephone company stocks by employees who were not above a little larceny to help a friend.

Some of the low-power transmitters used receiving tubes such as the 201A instead of the 5 and 7½ watt transmitting types. Other than the tubes, almost all of the equipment could be home built. There was no great pool of discarded electronic equipment from which to scrounge parts as there is today. Even broadcast radios were comparatively few and they were all battery operated. The standard transmitter was usually a Hartley oscillator, maybe a Colpitts, a tuned grid-tuned plate, or some other variation of the oscillatory circuit. The receiver was invariable a 1 tube regenerative detector and usually a 1 or 2 stage audio amplifier as tubes became more easily obtainable.

Later on an RF amplifier might be used ahead of the detector and this resulted in a very sensitive receiver. Very few amateurs tackled the complexity of a superheterodyne receiver. Very few amateurs tackled the complexity of a superheterodyne receiver. In those days most amateurs built their own equipment and in the process learned the basic theory pretty well. The only exceptions were well heeled individuals who might commission somebody to build a rig for them. Summer rebuilding of rigs was the normal practice. When summer static was bad, the time could be better used to rebuild for the coming winter operating season. Hopefully, each rebuilding incorporated some new components to make a better rig.



Replica showing typical construction of a chemical rectifier. Practical units had 24 to 48 cells. Solution was borax and water. (Photo by Lewis Coe)

Some amateurs were talented builders and turned out equipment that equaled or exceeded commercial products in looks and performance. There were not too many commercial rigs available, and they were usually beyond the financial reach of most operators. Also, they were designed to commercial standards of safety and reliability and did not lend themselves to the usual amateur practice of "pour on the power until she starts to smoke."

Looking back, it is a wonder that many of us survived the days when most rigs were just a jumble of parts screwed down to a board with exposed high-voltage wiring running all over the place. The term "bread board" comes from the days when any self-respecting kitchen had a board for rolling out dough for various pastry items. These boards could either be purloined from the kitchen or bought for a few cents at a hardware store, and they made a nice, smooth base to mount equipment.

One of the toughest problems facing the amateurs of 70 years ago was securing an adequate power supply for the transmitter. Commercial rectifier tubes were available but they were expensive, and being of the high-vacuum type, there was a large voltage drop involved. Motor generators were ideal, but here again not many operators could afford them. The solution for many was the chemical rectifier, affectionately dubbed the "soup jar" rectifier. This type of rectifier could easily be constructed by the average operator. It consisted of 24 to 48 small glass

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★ JST-145 COMING SOON ★

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9 DDS PHASE LOCK LOOP SYSTEM • A single-crystal Direct Digital Synthesis system is utilized for very low phase noise.

10 CW FEATURES • Full break-in operation, variable CW pitch. built in electronic keyer up to 60 wpm.

11 DUAL VFOs • Two separate VFOs for split-frequency operation. Memory registers store most recent VFO frequency, mode, bandwidth and other important parameters for each band.

12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.

13 COMPUTER INTERFACE • Built-in RS-232C interface for advanced computer applications.

14 ERGONOMIC LAYOUT • Front panel features easy to read color LCD display and thoughtful placement of controls for ease of operation.

15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with Power Factor Correction (PFC) and "silent" cooling system designed for continuous transmission at maximum output.

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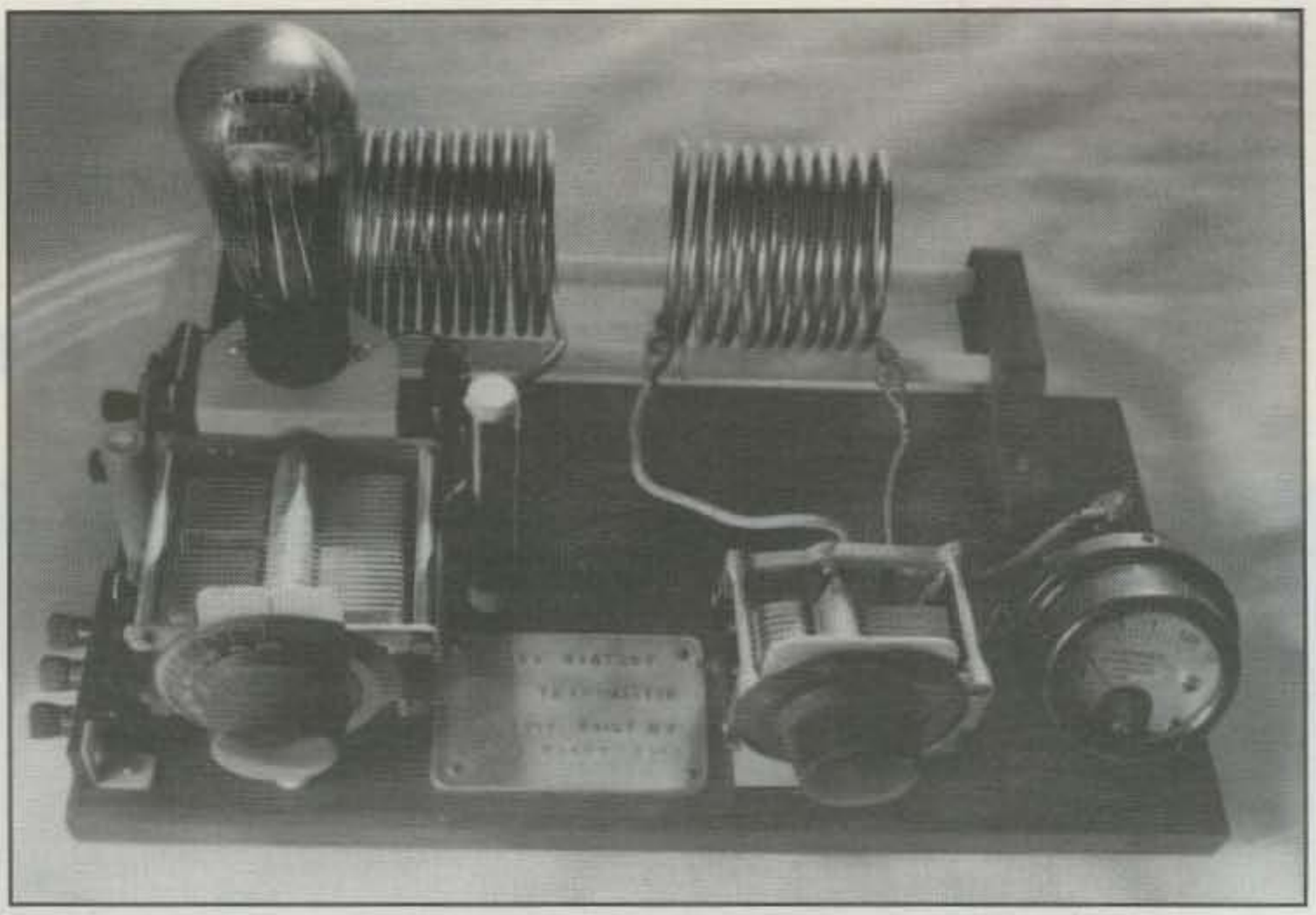
jars containing a solution of ordinary household borax and water. The elements were small strips of lead and aluminum connected in series. The individual cells were usually connected to form a full-wave bridge rectifier. Even without any filter the soup jars gave a not unpleasant note to the transmitter. With a choke and capacitor pure DC could easily be obtained. The chemical rectifier was messy and relatively inefficient, but it solved the problem of getting on the air. Typically, a small transmitter of the 5 or 10 watt variety ran with 400 volts on the plate. Not all amateurs had meters, so the exact power input was not even known, and even antenna current was often measured by a flashlight bulb shunted across a section of the lead-in wire. Eventually, a line of low-cost DC instruments was introduced under the name of Readrite. Amateurs quickly dubbed them "read wrong," but they were better than nothing for those who could not afford the more expensive Jewell or Weston instruments. The "Acme" transformer was a favorite power-supply component for early builders. It furnished high voltage for the plate rectifier and had low-voltage filament windings too. A few brave souls wound their own transformers using core iron salvaged from burned-out pole transformers. One expedient to avoid winding the thousands of turns required for the high-voltage secondary was to use 1000-turn honeycomb coils of the type used in receivers for long-wave reception.

Operating practices were somewhat different in the old days. No one listened for a reply on his own frequency. Even though the first CW transmitters were VFOs by nature, the transmitting frequency was chosen and stayed put. After calling CQ, for example, one started at one end of the band and tuned to the other end looking for replies. Switching from transmit to receive usually involved throwing several switches; not many stations had anything like quick break-in. CW telegraphy was the preferred method of operation for the majority, but "phone men" were starting to appear in ever increasing numbers. Most early phone operation was on the 200 meter band, and those stations were easily heard by broadcast listeners of the day. Some of the phone operators assumed the status of a small broadcast station and operated in long monologues. These pompous monologues caused a certain amount of resentment among the "dyed in the wool" CW operators who felt that the phone men were not real radio operators.



Replica of a "1929 Hartley" transmitter, built with several original parts, including the General Radio hot-wire ammeter for antenna current. The meter cost $2.50 on sale. Tube is a 71/2 watt 210. (Photo by Lewis Coe)

Around 1926 crystal control made its appearance. The first crystals were expensive, but the beautiful, stable signals they produced were the envy of all. By 1929 increasing attention was being given to improving the quality of amateur transmissions. The old self-excited oscillators, often with loose floppy connecting leads, tended to be unstable and were influenced by changes in the external load circuit.

It was found that by constructing an oscillator with heavy copper-tubing inductances and short and direct connections together with a high ratio of capacitance to inductance in the tank circuit greatly improved frequency stability. Stability was also enhanced by using loose inductive coupling to the antenna. The "Hi C" or "1929 Hartley" became a classic transmitter, and gradually the sloppy, chirpy CW signals disappeared.

Who would want to go back to "the good old days"? Not many of us, I guess, although it is interesting to contemplate a night on the air with modern equipment and the huge empty bands of the 1920s. Whenever I get to thinking along those lines, though, I think back to a cold winter night in a darkened room with thousands of tiny blue sparks dancing on the rectifier plates, and the sharp, tangy smell of the warm borax solution pervading the room. Then there is the click of the send-receive switch and out there in the night comes a faint whistle as a VK starts answering my call. It wasn't too bad a time to be an amateur radio operator! ■

MFJ Super CW Keyboard with Perpetual Memory™

. . . two line LCD display . . . includes RFI suppressed keyboard . . . eight 250 character nonvolatile message memories . . . 200 character type-ahead buffer . . . iambic keyer . . . powerful Morse Code Trainer . . .

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Send effortless CW as soon as you turn on this MFJ Super CW Keyboard -- there's no computer to boot up, no program to load -- just start typing.

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Big 200 Character *type-ahead* Buffer

Even "hunt and peck" typists can send perfect sounding CW because a large 200 character type-ahead buffer smoothes out your typing and gives you time to compose.

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Eight 250 character message memories let you store often used messages.

MFJ's unique nonvolatile *Perpetual Memory*™ saves your messages and settings up to 20 years without power or batteries.

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Only MFJ gives you an easy-to-read LCD display that *simultaneously* shows what you're typing in on one line and what you're sending out on another line.

You can review stored messages, keyboard settings and spot typing errors that you can quickly correct by backspacing.

LCD display is mounted on a sloped front panel and has a contrast control.

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MFJ *AutoCommand*™ lets you execute commands stored within a message.

For example, you can insert pauses and incrementing serial numbers, play messages continuously or call other messages.

Includes RFI Suppressed Keyboard

Keyboard *included* -- you won't have to supply your own keyboard.

It has excellent RFI suppression -- it won't lockup or send characters you don't want because of RF and you won't hear digital hash in your receiver.

SingleTouch™ Function Keys

No complex keystrokes! MFJ's *SingleTouch*™ function keys make it simple to store and recall messages, set speed, weight and tone, setup serial numbering, turn on/off transmitter tune, keying and handkey mode.

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Commonly used prosigns are assigned keys for easy use. You can also create *any* prosign by pressing Alt and any characters.

Full Featured *Iambic* Keyer

For fast break-in, plug in an iambic paddle and use it as a *full featured* keyer.

You can pause your playing buffer or message, insert your comments with your paddle and then resume playing.

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You can practice or teach Morse code in Farnsworth or normal mode.

Select letters, numbers, punctuations or prosigns or any combination for practice. Use standard 5, random 1 to 8 character groups or select specific six character sets.

Plus much more

Has speaker, sidetone, volume control and jack for external speaker or earphones.

You can vary speed from 5 to 100 WPM, weight from 5 to 95%, sidetone from 300 to 3300 Hz and serial number from 0 to 9999.

Has buffer and memory full audible indicators. Keys solid state and tube rigs.

AT101 compatible keyboard plugs into compact 3½x2½x3½ inch interface. Use 12 VDC or 110 VAC with MFJ-1312B, $12.95.

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Don't need an LCD display or Morse Code Trainer but want all the features of the MFJ-452 *Super* CW Keyboard? Choose the MFJ-451. It has two 100 character message memories instead of eight 250 characters message memories. **MFJ-451X, $79.95,** same as MFJ-451 without keyboard. 3½x1¼x3½.

MFJ Iambic Keyer Paddle

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MFJ Deluxe Iambic Paddle feature a ful l range of adjustments in tension and contact spacing, self-adjusting nylon and steel needle bearings, contact points that almost never need cleaning, precision machined frame and non-skid feet on heavy chrome base. For all electronic CW keyers.

The world's most powerful CW Keyboard

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Includes Keyboard!

Want *the world's most powerful CW keyboard* with all the features of the MFJ-452 *Super* CW Keyboard, 32K of lithium battery backed up message memory, plus much, much more?

Choose the MFJ-498 and you'll also get . . . an *FCC ExamSimulator*™ that sends random QSOs exactly like FCC exams -- when you can copy these random QSOs, you're ready to pass your exam and upgrade . . . MFJ's *QSO Simulator*™ simulates on-the-air contacts -- answer a CQ, call a station, enjoy a QSO and get operating experience while boosting your code speed . . . MFJ's new *WordRecognition*™ mode gives you hundreds of commonly used words -- learn to copy *entire* words in your head without writing it down, just like the pros. 6½x2½x6¾.

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CQ REVIEWS:

The Timewave DSP-9 Audio Noise Reduction Filter

BY TED COHEN*, N4XX

The Timewave DSP-9 audio noise reduction filter is designed to take a weak signal buried in QRM and line noise and turn it into a fully readable signal that appears to have the frequency all to itself. Before we get into how it actually performs, let's spend a little time discussing the theory behind the unit.

The Timewave DSP-9 audio noise reduction filter.

How It Works

A functional block diagram of the DSP-9 is shown in fig. 1. As seen, the preamplifierconditions the input signal to match the input requirements of the A-D converter. The latter changes the analog signal from the output of the preamplifier into a 16-bit digital signal. A conversion technique called "sigma-delta" is used for this purpose because it allows for oversampling with high accuracy and low distortion. All of the programs needed to implement the filters and to control the DSP-9 are contained in the program memory.

The Digital Signal Processor (DSP) is the heart of the unit. It mathematically manipulates the 16-bit digital signal at a 52 MHz clock rate to perform all of the filtering operations in the DSP-9. Without getting into the details, it's enough to know that the DSP-9 performs millions of operations per second in the process of creating highpass, lowpass, and bandpass filters. Moreover, as the input signal changes, the filter that you have selected changes to keep the noise minimized. This continually changing process is characteristic of an *adaptive* filter, and the DSP-9 runs such adaptive filters at a rate of 8000 times per second.

The goal of an adaptive filter for noise reduction is to separate the desired signal from noise. Noise has many forms. In fact, noise, by definition, is anything that you don't want to hear! If you are listening to a CW signal, a SSB signal is noise. However, if you are listening to a CW signal, a SSB signal is noise. However, if you are listening to a SSB signal, a CW signal is noise. Other kinds of noise include white (thermal) noise, atmospheric noise (static), power line noise, automobile ignition noise, heterodynes, and adjacent channel interference. To one degree of another, the DSP-9 is able to reduce—if not eliminate—these various noise sources.

But how does it do it? Well, to answer that question, we have to address a characteristic of any signal (including noise) called *correlation*. The degrees of correlation is relative. Random noise, such as white noise or static, is uncorrelated. Put another way, the value of the signal at any given time is unrelated to the value at the preceeding instant. Speech is moderately correlated, while repetitive noise, such as heterodynes or CW, are highly correlated. Some noise, such as line noise, may have both highly correlated components (60 Hz) and highly uncorrelated components (arcing across an insulator). Correlation is the basis for the adaptive filtering in the DSP-9. The adaptive filter changes 8000 times per second to reject (or pass, as the case may be) a signal with a predetermined degree of correlation. Adaptive filters work best to eliminate or reduce both highly correlated or highly uncorrelated signals. This is precisely the necessary condition needed to improve noisy speech signals. Adaptive filters improve CW signals by reducing uncorrelated noise while passing the highly correlated sine waves of the CW signals.

The digital signal processor also can create spectacular fixed filters. DSP filters are much more precise, don't drift, don't need alignment, and are much smaller than equivalent analog filters. Probably the most useful filter for amateur radio work is the linear phase Finite Impulse Response (FIR) filter. The advantage of linear phase filters is the lack of phase distortion for data signals. FIR filters, such as those developed by the DSP-9, exhibit no phase distortion, have very steep transition regions from passband to stopband, have flat passbands, and have linear phase . . . all simultaneously! The most familiar and noticeable benefit to such filters is the lack of ringing of CW signals in narrow bandwidths (even bandwidths as narrow as 50 Hz).

Finally, the DSP-9 can have random noise reduction, heterodyne elimination, and bandpass filtering active at the same time. And the signal delay through the DSP-9 ranges only from 10 to 30 ms., depending upon the modes selected. This is fast enough for break-in CW operation.

Once the signal has been processed by the digital signal processor, the D-A converter changes the 16-bit digital signal from the output of the DSP into an analog signal. This signal, in turn, is fed to the audio power amplifier, which increases the low-level analog signal from the D-A converter to a level sufficient to drive a loudspeaker or headphones. The audio power amplifier output ranges from 1.5 to 2.5 watts, depending upon the load.

How It Performs

Hooking the unit up is about as simple as can be. Audio for the DSP-9 is taken from your transceiver's earphone jack; in my case it is a TS-130S. It can be powered

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Full size performance . . . No ground or radials

Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters -- with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance gives you high efficiency for more power radiated. The result? Stronger signals and more Q-5 QSOs.

Full size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

Full size performance is achieved by using separate full size radiators for 2 through 20 Meters and highly efficient end loading for 30, 40 and 75 /80 Meters.

You get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR and it handles 1500 watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequency of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- on small lots, backyards, apartments, condos, roof tops, tower mounts.

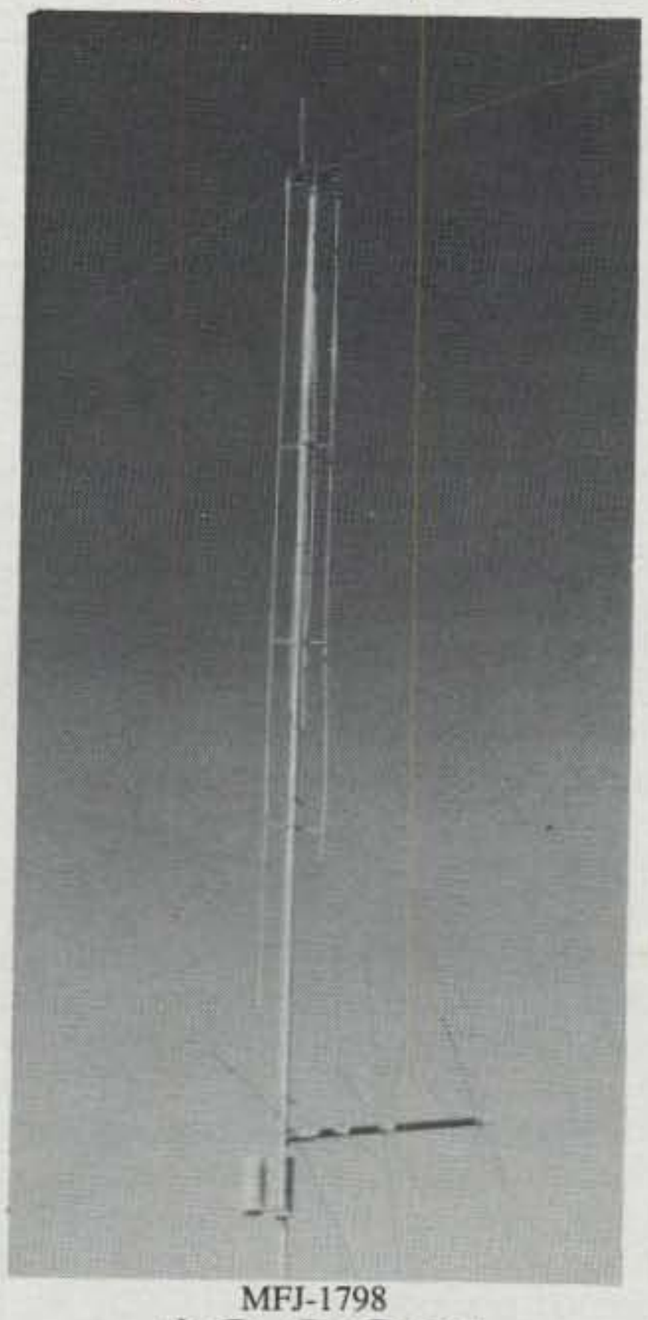
Separate *Full Size* Radiators

***Separate** full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. *In phase* antenna current flows in all parallel radiators.

This forms a very large equivalent radiator and gives you incredible bandwidths.

These radiator stubs provide automatic bandswitching -- there is absolutely *no loss* due to loading coils or traps.



MFJ-1798

$269.95

End Loading

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands.

Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

No Ground or Radials Needed

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation.

You can mount it from ground level to roof top and get awesome performance.

No Feedline Radiation to Waste Power

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with Teflon® coax and *can't* saturate, no matter how high your power.

Built to Last

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is used in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant Teflon® covered wire.

Teflon® is registered trademark of Dupont

MFJ *Super Hi-Q Loop*™

MFJ-1786 **$299.95**

MFJ's *tiny* 36 inch diameter *high efficiency* loop antenna lets you operate 10 to 30 MHz *continuously* -- including the WARC bands!

It's ideal where space is limited -- apartments, small lots, mobile homes, attics, motor homes.

Enjoy both DX and local contacts when you mount it vertically. You get *both* low angle radiation for excellent DX *and* high angle radiation for local close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ-1786 *Super* Remote Control has *Auto Band Selection*™. It auto-tunes to your desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune push buttons and built-in two range *Cross-Needle* SWR/Wattmeter lets you quickly tune to your exact frequency.

All *welded* construction, no mechanical joints, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter *round* radiator -- not a lossy thin flat-strip -- gives you highest possible efficiency.

Each plate in MFJ's *superb* tuning capacitor is welded for low loss and *polished* to prevent high voltage arcing. It's welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches and a continuous *no-step* DC motor for *smooth precision* tuning.

A heavy duty 1/8 inch thick ABS plastic housing with ultraviolet inhibitors protects it.

MFJ-1782, $269.95. Same as MFJ-1786 but remote control has only fast/slow tune buttons.

Super 80/40M Vertical

MFJ-1792 **$159.95**

Designed as a *high performance* antenna for 80 and 40 Meters, the MFJ-1792 features a *full size* quarter wave radiator for 40 Meters - - that's a full 33 feet of ruthless radiating power.

End loading -- the most efficient form of loading -- is used for 80 Meters. It's accomplished by a virtually lossless 4½ foot capacitance hat and a high-Q coil wound with Teflon® wire on a *low-loss* fiberglass form.

The *entire length* radiates power.

High strength 6061-T6 aluminum tubing, super strong solid fiberglass insulator, *Frequency Adaptive L-Network*™, heavy duty *swing* mount. Handles 1500 watts PEP. Requires guying and radials, counterpoises or ground screen.

MFJ-1793, $179.95. Same as MFJ-1792 but includes *full size* 20 Meter quarter wave radiator.

Box Fan Portable Loop

MFJ-1780 **$229.95**

No, it's not a fan -- it's a high efficiency portable loop antenna that's about the same size and shape as a 2x2 foot box fan, complete with carrying handle.

Carry it like a suitcase, tuck it in a corner of your car or check it as baggage on a plane.

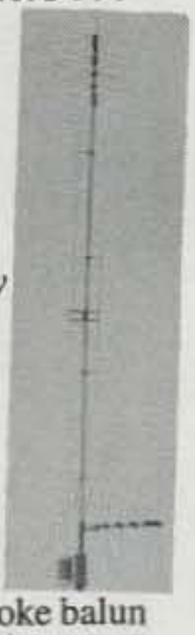
When you get there, set it on a table or desk and enjoy ragchewing or DXing.

All welded construction, covers 14-30 MHz *continuously* including WARC bands, handles 150 watts. Remote control has fast/slow tune buttons. Separate control cable not needed.

MFJ *halfwave* Vertical

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed!

MFJ-1796 **$199.95**



Operate 6 bands -- 40, 20, 15, 10, 6 and 2 Meters -- with this MFJ-1796 *ground independent halfwave* vertical antenna! No radials or ground ever needed!

It's only 12 feet high and has a *tiny* 24 inch footprint! Mount it anywhere from ground level to tower top -- on apartments, condos, small lots, even motor homes. Perfect for vacations, field day, DX-pedition, camping.

Efficient *end loading*, no lossy traps. *Entire length* is always radiating. *Full size* halfwave on 2 and 6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands.

Automatic bandswitching, low radiation angle, omni-directional, handles 1500 watts PEP. Goes together in an afternoon.

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and free instruction manuals
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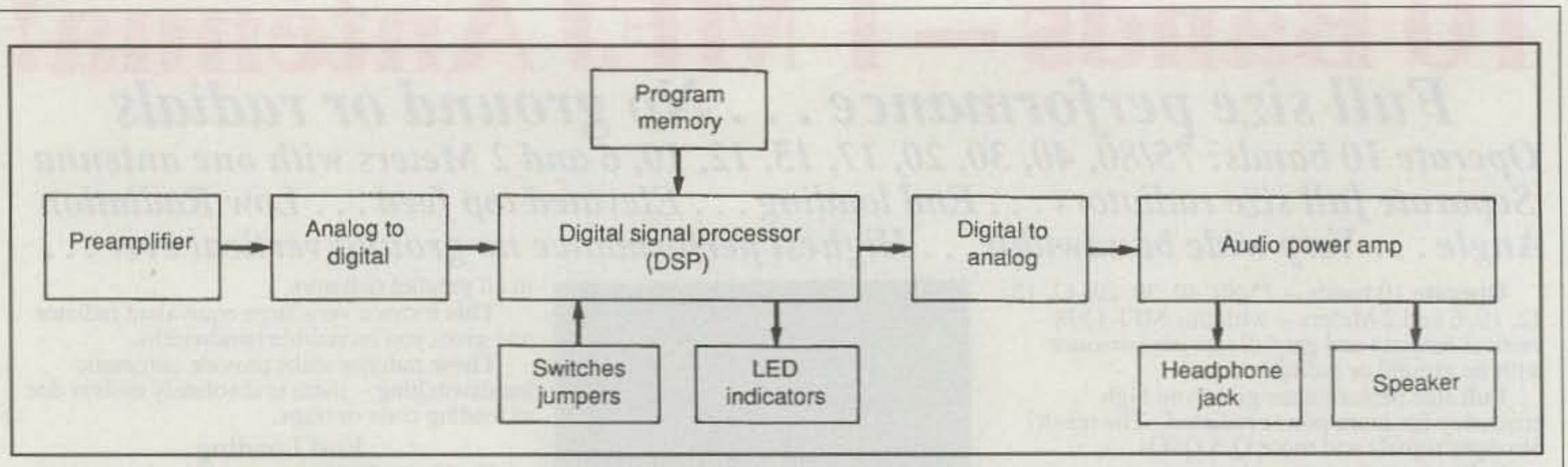

Fig. 1– A functional block diagram of the DSP-9 audio noise reduction filter made by Timewave.

from any convenient 12 VDC, 1 amp plug-in wall supply or from your transceiver's power supply.

From this point on, it was just a matter of setting the audio input level on the TS-130S (using the procedure outlined in the DSP-9's manual), and the unit was ready for use. I should note here that the instructions called for adjusting the audio output level of the receiver (transceiver) to the point where the **Overload** LED flashed. I never was able to achieve this condition, so I just set the level to the point where the **Normal** indicator lamp flashed with normal audio levels for a moderately strong signal. In discussions with Dan Kennedy and Dennis Pfab of Timewave, they suggested that the Overload LED may have gone bad or dislodged during shipping. They suggested that I check to see if it flashed momentarily when the unit is first turned on. If so, the LED is good, and what may be preventing the Overload LED from firing when using the TS-130S is a 22 ohm shunt on the audio line in the back of the unit (inside). Not only did they go through the procedure with me for removing this shunt, but also, they put several replacement LEDs into the mail in the event the LED indeed had burned out. How's that for customer service?! As it turned out, the Overload LED does flash when my unit is turned on, and though I could remove the 22 ohm shunt, I'm really not concerned about the whole thing. The system functions just fine when set using the Normal indicator.

I first tried the DSP-9 on 40 meter CW late one evening. At my QTH that night, the line noise was running S-2, signals from Europe were on the weak side (none peaking over S-5 on the meter), and Stateside QRM often made the Europeans difficult to copy. Enter the DSP-9! Pushing the **NRr** button enabled the random noise reduction feature for CW operation, and voila, the line noise disappeared! The band width option already was set to the default position at 500 Hz (200 Hz and 100 Hz filters also are available), and even the weakest signals jumped up in perceived strength. In fact, even though the S-meter never went above S-5, and usually stayed around S-2 or S-3, my ears were telling me that the stations to which I was listening deserved "RST 599" reports! In short order I worked 7X4AN, LZ2LT, IC8SDA, and YU7JX, all of whom had few takers because of their weak signals and co-channel interference from Stateside stations.

When using the DSP-9, I did note that at times, the background, with no signal present, sounded like "sounds of the deep." That is, it sounded as if one were listening to a sound recording made in the deep ocean. However, this is definitely of minor concern, and when chasing DX or ragchewing, it isn't even apparent.

I also tried the unit on 40M SSB. The DSP-9 made short work on interfering tones as well as of the line noise on the band. (Tone or noise reduction is available using one control.) Using the filter, I was able to dig out several amateur signals that were embedded in the ever-present QRM from the international broadcast stations in the band. Whether reading the "mail" or engaging in a QSO, the DSP-9 clearly can make SSB communication a far more enjoyable experience than it might otherwise be.

Audio noise reduction filters like the DSP-9 are clearly the right devices at the right time. The current solar cycle is headed down to a minimum that is not expected to reach bottom until August, 1994. At that time, the usable HF spectrum will be roughly one-half of the spectrum available at solar maximum! Given the crowding that already exists and that is making difficult the use of the band between 3 and 14 MHz, Amateurs and other HF operators will need all the help they can get to communicate effectively on the lower HF bands over the next five years or so. Having a DSP-9 or the like in your bag of tricks will go a long way towards achieveing that goal.

The Timewave DSP-9, for speech and CW operations, sells for $169; it is available from most of the major amateur dealers around the country. A more capable unit, the DSP-59, sells for $299; according to Timewave, it can be used for speech, CW, RTTY, SSTV, AMTOR, and PACTOR operations. For more information on both units, contact Alan Caplan, Sales Manager, Timewave Technology Inc., 2401 Pilot Knob Road, St. Paul, MN 55120.

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
$219.95

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!

Take the guesswork out of building matching networks and baluns for your antennas.

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-29**, $19.95, 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 installer and technicians use them worldwide.

Get More by Paying Less

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 $219.95.

1.8-170 MHz *SWR Analyzers*™

MFJ-249
$199.95

MFJ-249 *HF/VHF SWR Analyzer*™ has all the features of MFJ-259 but less RF resistance meter. Includes 1.8-170 MHz *continuous* coverage, 10-digit LCD frequency counter and smooth vernier tuning.

MFJ-209
$109.95

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. MFJ-249/MFJ-209 are 4x2½x6¾ inches and uses 8 AA cells or 110 VAC with MFJ-1312B, $12.95.

Carrying Pouch

MFJ-29
$19.95

Tote your MFJ-249, MFJ-259 or MFJ-209 *SWR Analyzer*™ anywhere with the MFJ-29 custom Carrying Pouch.

Made with a special foam-filled fabric, the MFJ-29 cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Wear it around your waist, over your shoulder, or clip it onto the tower while you work--the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends.

Protect your investment and keep your analyzer safe and looking like new!

Dip Meter Adapter

MFJ-66
$19.95

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*™.

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Write or call . . . 800-647-1800

10-160M *SWR Analyzer*™

MFJ-207
$79.95

If you're an HF man, this compact MFJ-207 *HF SWR Analyzer*™ will help you build 10-160 Meters antennas that'll make working DX almost routine.

Just plug in your coax to find the SWR of any HF antenna on any ham band 10-160 Meters. Has jack for external frequency counter. 7½x2½x2¼ inches.

2 Meter *SWR Analyzer*™

MFJ-208
$79.95

MFJ-208 2 Meter *VHF SWR Analyzer*™ finds the SWR of any antenna from 138-156 MHz. Jack for external frequency counter. 7½x2½x2¼ inches.

For Commercial VHF Radio

Same as MFJ-208 but for commercial VHF. **MFJ-217**, $79.95, covers 30-50 MHz and **MFJ-218**, $79.95, covers 150-170 MHz.

440 MHz *SWR Analyzer*™

MFJ-219
$89.95

The New MFJ-219 *UHF SWR Analyzer*™ lets you read SWR of any antenna 420 to 450 MHz--just plug in the coax of your antenna, set the frequency and read SWR. Uses latest high-tech microwave integrated circuits and microstrip technology. Jack for external frequency counter. 7½x2½x2¼ inches.

Bandswitch Dip Meter™

MFJ-203
$99.95

The MFJ-203 is a sensitive *Bandswitched Dip Meter*™ that covers all hams bands from 160-10 Meters. There are no plug-in tuning coils to keep up with or break.

Has detachable coupling coil, dual FET oscillator, op-amp meter amplifier and jack for external frequency counter. 7½x2½x2¼ in.

MFJ Antenna Bridge

MFJ-204B
$79.95

Great for determining feedpoint resistance of antennas and for designing impedance matching networks. Measure RF resistance up to 500 ohm. Covers all ham bands 160-10 Meters. Built-in resistance bridge, null meter, tunable oscillator-driver, frequency counter jack. 7½x2½x2¼ inches. Use 9 volt battery or 110 VAC with MFJ-1312, $12.95

MFJ-219/218/217/208/207/203 uses 9 volt battery or 110 VAC with MFJ-1312B, $12.95.

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If you have to ask why, you have no spirit of adventure. KI4WL has enough spirit for all of us. He combined two hobbies and an impossible dream, and it all came true.

5½ Feet of Maritime Mobile QRP And A New World's Record

BY GORDON WEST*, WB6NOA

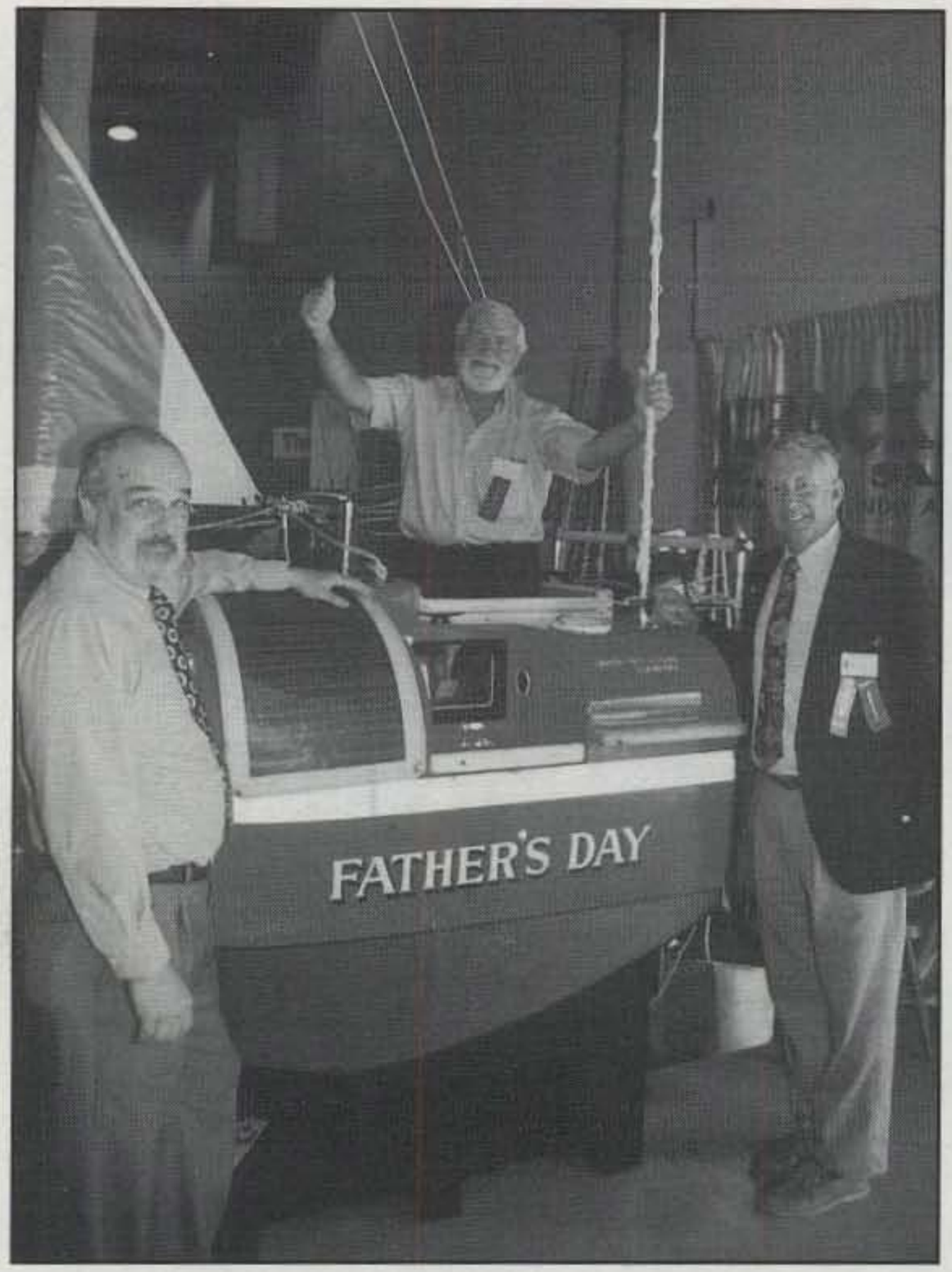
For over 1800 miles and 105 days in a 5½ foot boat, amateur and marine radio gave Hugo Vihlen, KI4WL, the strength and enthusiasm to complete a very unusual world's record voyage. "Running my radio for 15 minutes each day was the high point of my voyage," commented Hugo, a retired airline pilot who wanted to break the world's record for the smallest boat to make it across the Atlantic. "If I hadn't had the radios, I would probably have jumped ship," quipped Hugo.

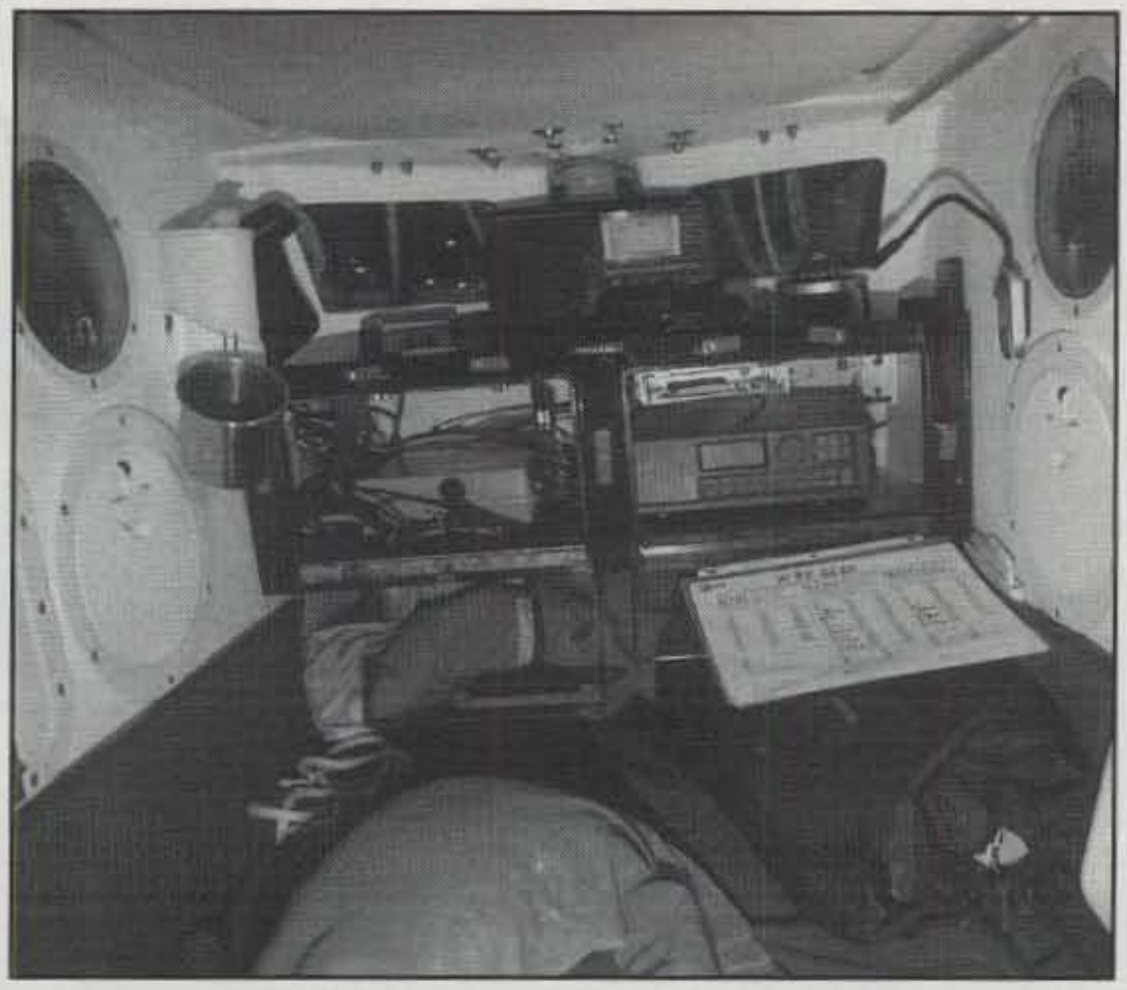
On his earlier voyage from North Africa to Fort Lauderdale, which covered 4500 miles in a 6 foot boat, all Hugo had was a shortwave receiver and a CB set. "The CB was useless. Even though the skip was in almost every day, I couldn't stand listening to the language," commented Hugo. "It was then I told myself I would get my amateur ticket. I would be able to put equipment aboard for my next Atlantic crossing on a boat smaller than the first one," added Hugo.

The reason for such a small boat was to beat any world record held by any other solo sailor with a longer boat. In fact, Hugo and his son, Dana, had to lop off several inches of the bow to keep the boat shorter than a 5 foot 4½ inch vessel attempting the same record Atlantic crossing. At 5 feet 2 inches, the boat, named *Father's Day*, was actually shorter than

*2414 College Drive, Costa Mesa, CA 92626

No, it's not half submerged or even going down. That's the whole boat. Here's Hugo Vihlen, KI4WL, aboard the Father's Day *under sail in a fresh breeze. Just in front of him on what constitutes the deck, you can see the solar panels. At the rear (aft) is the Outbacker antenna which kept him in touch with the world.*





Hardly more than two transceivers wide, this is an inside view of the cockpit of the Father's Day, *the world record breaker for the smallest boat to cross the Atlantic.*

Here's Hugo flashing a big smile and a winning thumbs-up while displaying the boat at this year's Tropical Hamboree in Miami. Standing at the left is CQ's Editor, K2EEK, and on the right is the author, WB6NOA.

Hugo's height, and measured only 30½ inches wide (beam). The boat was constructed from buoyant hard foam, one inch thick, encased in a tough fiberglass shell. Several hundred pounds of ballast were placed in the bilge to keep the boat upright in heavy seas, and 75 military Meals Ready to Eat (MREs), along with 8 cans of spaghetti, 90 cans of Nutrament, 75 cans of fruit cocktail, health bars and dried fruit, plus 2 gallons of M&M's and 25 gallons of water were also stowed below to keep the bottom down and the top up. "I also used a hand pump desalinator to make fresh water out of salt water," added Hugo. "I actually preferred the taste of the ocean water made into fresh water to the plastic taste of the older water in the jugs," he commented.

Two heavy 100 amp hour gel-cells supplied enough power to keep his electronic gear running for several hours each day. Two flexible solar panels were wired into the battery system to provide up to 2.4 amps of charging current at high noon on sunny days. But as it turned out, there were several weeks of heavy clouds, and the two 100 amp gel cells became so depleted that all he could do was monitor for approximately 30 minutes before his radio would cycle off.

"But toward the end of the trip, the sun came out, and my batteries began to charge up. I even rewired the reverse polarity zener diode in order to get as much charging current as possible," added Hugo. Without the zener diode in place, Hugo disconnected the solar cells from the batteries at night to prevent the cells from discharging the precious current charged during the day.

His main radio was an ICOM M600 marine single-sideband transceiver modified for amateur radio transmit. The ICOM M600 is a Part 80 type-accepted marine transceiver which meets the FCC equipment specifications for a voluntary radio-equipped vessel. Hugo decided to use his marine VHF and SSB equipment with his assigned marine station call letters. The ICOM M600 operates from 2 MHz to 26 MHz, and is synthesized for 300+ ITU (the International Telecommunications Union) ship-to-ship, ship-to-shore, and long-range distress frequencies.

In this instance, the ICOM M600 also makes an excellent amateur radio transceiver with capabilities of lower sideband, upper sideband, AM shortwave receive, and 100 user-memorized frequencies covering 160 meters up to 10 meters. Ten meters runs at reduced transmit power output.

While it is absolutely *illegal* to turn an amateur transceiver into a marine SSB transceiver, turning a marine rig into an amateur transceiver is common practice among mariners who want to stay within the Part 97 amateur radio FCC rules. Part 97, Subpart D, does not mandate that an amateur transceiver carry specific type acceptance from the FCC. Subpart D, 97.307(D), dictates emission standards, and these standards are easily met by all Part 80 marine radios which must actually meet even tougher standards for the marine radio service. FCC rule 97.11 has been interpreted by FCC engineer Jerry Freeman (Norfolk, Virginia office) as applying to those installations of marine radio equipment aboard boats which are required by law to carry an SSB transceiver. In those cases, ". . . the station must be separate from and independent of all other radio apparatus installed on the ship or aircraft. . . ." However, since Hugo's boat was not required by law to have a long-range SSB marine radio onboard, he as a licensed amateur operator could put on-board any type of radio apparatus as long as it would operate within the proper emission standards on authorized amateur frequencies. When Hugo wanted to call home on the AT&T high-seas marine operator service, he used this same set as a Part 80 autho-

MFJ's world famous 3 KW Antenna Tuner

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

The MFJ-989C is not for everyone. **However**, if you make the investment, you'll get the finest 3 KW antenna tuner money can buy. **Here's** why . . .

Massive Transmitting Capacitors

You get two *massive* 250 pf transmitting variable capacitors with detailed logging scales. They can handle *amps* of RF current and withstand 6000 RF volts because the plates are smoothed and polished and have extra wide spacing.

Precision Roller Inductor

A precision roller inductor lets you tune your SWR down to the absolute minimum. A 3-digit turns counter plus a spinner knob gives you exact inductance control.

Ball bearings on front and back shafts give you a velvet smooth vernier feel. Steel end plates and shafts give you lifetime durability.

You won't have arcing problems with this roller inductor. That's because firm springs put considerable pressure on a plated contact wheel for excellent electrical contact.

Wide, low inductance straps are used for high current connections and a new core gives you excellent RF properties for minimum loss.

MFJ-989C **$349.95**

Cross-Needle Meter

You get a lighted *peak* and average reading Cross-Needle SWR/Wattmeter with 200 and 2000 watt ranges. Its new directional coupler gives you accurate SWR and power readings over the entire 1.8 to 30 MHz range.

Super Heavy Duty Balun

You get a super heavy duty current balun for balanced lines. It's made with two giant 2½ inch powder iron toroid cores and wound with *Teflon*® wire connected to high voltage ceramic feedthru insulators. It lets you operate high power into balanced feedlines without core saturation or voltage breakdown.

Ceramic Antenna Switch

You get a two wafer 6 position *ceramic* antenna switch with extra large contacts for trouble free switching.

Plus much, much more

You also get a *built-in 300 watt dummy load*, full one year *unconditional* guarantee, flip stand, all aluminum cabinet, tough baked on paint, locking compound on all nuts and bolts. 3 KW PEP. Meter lamp needs 12 volts. Compact 10¾x4½x15 in. Made in the USA. Add $13 s/h.

Don't settle for less--get yours today!

MFJ's *deluxe* 300 Watt Tuner

MFJ-949E **$149.95**

More hams use the MFJ-949E than any other antenna tuner in the world! **Why?** Because you get proven reliability, the ability to match just about anything and a one year *unconditional* guarantee.

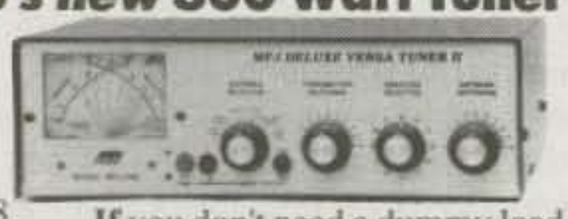
You get a lighted *peak* and average reading Cross-Needle SWR/wattmeter, antenna switch, 4:1 balun for balanced lines, 1.8-30 MHz coverage and a *full size* dummy load that easily handles 300 watts of abusive tune-up power.

New 8 position antenna switch lets you *pre-tune* into dummy load to minimize QRM.

The inductor switch is designed to withstand extreme voltages and currents--it's not an underrated off-the-shelf switch that can put you off-the-air.

Each MFJ-949E aluminum cabinet is chemically etched to strongly bond MFJ's tough *baked-on* paint. You won't find a tougher, longer lasting finish anywhere.

MFJ's *new* 300 Watt Tuner



MFJ-948 **$129.95**

If you don't need a dummy load but want *all* the other features of the MFJ-949E, choose the MFJ-948 for $129.95. The MFJ-948 features a *peak* reading *lighted* Cross-Needle meter with a built-in lamp switch, one year *unconditional* guarantee and is made here in the USA.

MFJ's *smallest* Versa Tuner

MFJ-901B **$59.95**

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

MFJ's *artificial* RF Ground

MFJ-931 **$79.95**

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

MFJ's *super value* Tuner

MFJ-941E **$109.95**

The new MFJ-941E gives you a 300 watt PEP tuner that covers everything from 1.8-30 MHz -- plus you get a lighted cross-needle meter, antenna switch and balun . . . for an incredible $109.95.

Antenna switch selects 2 coax lines (direct or through tuner), random wire, balanced line or external dummy load. 4:1 balun. 1000 volt capacitors. Measures 10⅝x2⅞x7 inches.

2 Knob Differential-T™ Tuner

MFJ-986 **$289.95**

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

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

MFJ's lighted *peak* and average reading Cross-Needle meter reads forward and reflected power in 2 ranges. Current balun reduces feedline radiation and forces equal currents into antenna halves that are not perfectly balanced. Covers 1.8-30 MHz. $13 s/h.

MFJ's *random wire* Tuner

MFJ-16010 **$39.95**

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

Antenna *Tuner/Artificial* Ground

New!

MFJ-934 **$169.95**

Artificial ground *and* full feature 300 watt 1.8-30 MHz antenna tuner. Has lighted Cross-Needle Meter, 4:1 balun for balanced lines.

An artificial ground can turn a random wire into an effective antenna that really works.

MFJ's *mobile* Tuner

MFJ-945D **$89.95**

Don't leave home without this *mobile* tuner! Have an uninterrupted trip as the MFJ-945D extends your antenna bandwidth so you don't have to stop, go outside and adjust your mobile whip.

Small 8x2x6 inches uses little room. *Lighted Cross-Needle* SWR/Wattmeter makes tuning easy while in motion. Has lamp switch. 1.8-30 MHz. 300 watts PEP. **Mobile mount**, MFJ-20, $4.95.

MFJ's *versatile* 1.5 KW Tuner

MFJ-962C **$229.95**

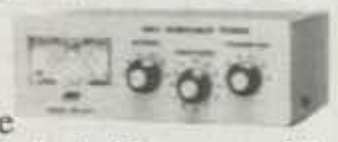
MFJ-962C lets you use your barefoot rig now and have the capacity to add a 1.5 KW PEP amplifier later.

You get MFJ's lighted *peak* and average reading Cross-Needle SWR/Wattmeter. It reads forward and reflected power in 2 ranges. Covers 1.8-30 MHz.

Plus . . . 6-position antenna switch and Teflon® wound balun with ceramic feedthru insulators for balanced lines. 10¾x4½x14⅞ in. Add $13 s/h.

MFJ's *portable/QRP* Tuner

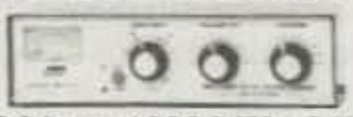
MFJ-971 **$89.95**



Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle SWR/Wattmeter has two switchable ranges: 30 and 300 or *6 watt QRP range*. 6x6½x2½ in.

MFJ's *VHF or UHF* Tuners

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



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

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CIRCLE 171 ON READER SERVICE CARD

rized marine SSB transceiver, and used his regular marine radio call letters.

The antenna system for both marine SSB as well as amateur radio HF frequencies was the combination amateur/marine, 6 foot Outbacker antenna manufactured by Terlin Antenna Company of Australia. All Hugo had to do to change bands was lean back and tap into the band of his choice, and the Outbacker whip was ready to go. An antenna tuner was also on board for fine-tuning the match on lower marine frequencies or the 80 meter band, but in general the Outbacker was broadband enough to cover those frequencies.

"At first we couldn't get the whip to resonate, but I talked with Gordon West, WB6NOA, and he told me how to hook up wide copper foil to the whip feedpoint and interconnect this with a ground plate into the sea water. As soon as we replaced our tiny ground wire with wide copper foil, the whip instantly tuned up on every band, and the match was a perfect 1:1:1," added Hugo.

Two 12 inch, porous ground plates provided more than enough surface area for an adequate ground plane for this 50 ohm antenna system to work. The heavy Outbacker spring was installed just in case this tiny boat tumbled all the way over in heavy seas. Luckily, even the big 20 foot swells in the middle of a low-pressure storm didn't get the *Father's Day* all the way over. "One time I was working a station on 20 meters, and a big wave turned me so far over that the tip of the whip went into the water, and the radio growled at me," commented Hugo. The SSB transceiver is protected against high SWR, and will sometimes rumble the speaker when the SWR exceeds 3:1 on transmit.

The SSB transceiver also doubled as a shortwave receiver. "My Radio Shack portable was great for tuning into BBC at 15 MHz—or at least great until a big wave came in and drenched everything in the cockpit. It instantly went up in smoke," commented Hugo. Amateur operators, familiar with the ICOM M600 SSB, talked Hugo through the steps on how to program the marine sideband for AM shortwave reception. "Getting 15 minutes of news every day was about all my little batteries could stand on an overcast day, but that's all I needed to lift my spirits," said Hugo. "After a couple of days of sun charging my solar cells and batteries, I would place a quick CQ and get word to everyone back home that I was okay," added Hugo.

His log indicates that several calls were placed through the AT&T high-seas marine operator station WOO in New Jersey, and WOM in Miami, to reach home. "Best 15 bucks I ever spent for 3-minute phone calls," smiled Hugo. The high-seas AT&T long-range duplexer, HF, SSB radio service can sniff out almost any kind of signal thousands of miles out at sea through the use of giant rhombic antennas. "I could switch the M600 down to a QRP 10 watts, and this was plenty of signal to get through to the marine operator," added Hugo. "But to get a signal onto the 20 or 15 meter amateur band, I had to go up to 50 or 100 watts to get through the QRM. This would kill my battery system quickly, so I tried to operate as much QRP as possible," commented Hugo.

When band conditions were not favorable on HF, Hugo operated two VHF handhelds on alkaline batteries to stay in touch with passing aircraft or super tankers in the shipping lanes. "Halfway across the Atlantic one ship actually stopped for me, and let me get aboard briefly for a hot shower and a change of clothes. If it hadn't been for my VHF marine handheld, they would never have spotted me out on the horizon," commented Hugo.

After 100+ days of bobbing around in the huge Atlantic and sailing at a whopping 2 knots of speed toward England, his battery-operated portable GPS receivers—a Magellan and a Garmin—both indicated he was only a few miles off Falmouth, England. He broke open his supply of M&M's and had a victory feast. He tuned into the BBC and found out that they were talking about *him*. He had been spotted by aircraft. He flagged down a passing fishing boat, and asked them to keep watch of his boat as he sailed into the wind for the protection of a nearby harbor. He was too close now to accept a tow, which would have invalidated his record, and his little outboard was there only for an emergency to get out of the way of any boat that might be bearing down on him in the dark.

"My radios are what kept me going throughout the three months at sea and a period of twenty straight days of overcast and mountainous seas," said Hugo. "And the next time I cross the Atlantic, I will compensate my ballast with more rechargeable, spill-proof batteries, and this will give me more time to work QRP DX from the tiniest little boat that has ever made it from one continent to the next. Thanks to all the amateurs and the high-seas marine telephone service, who kept me in touch on my record-breaking voyage," signed off Hugo. ■

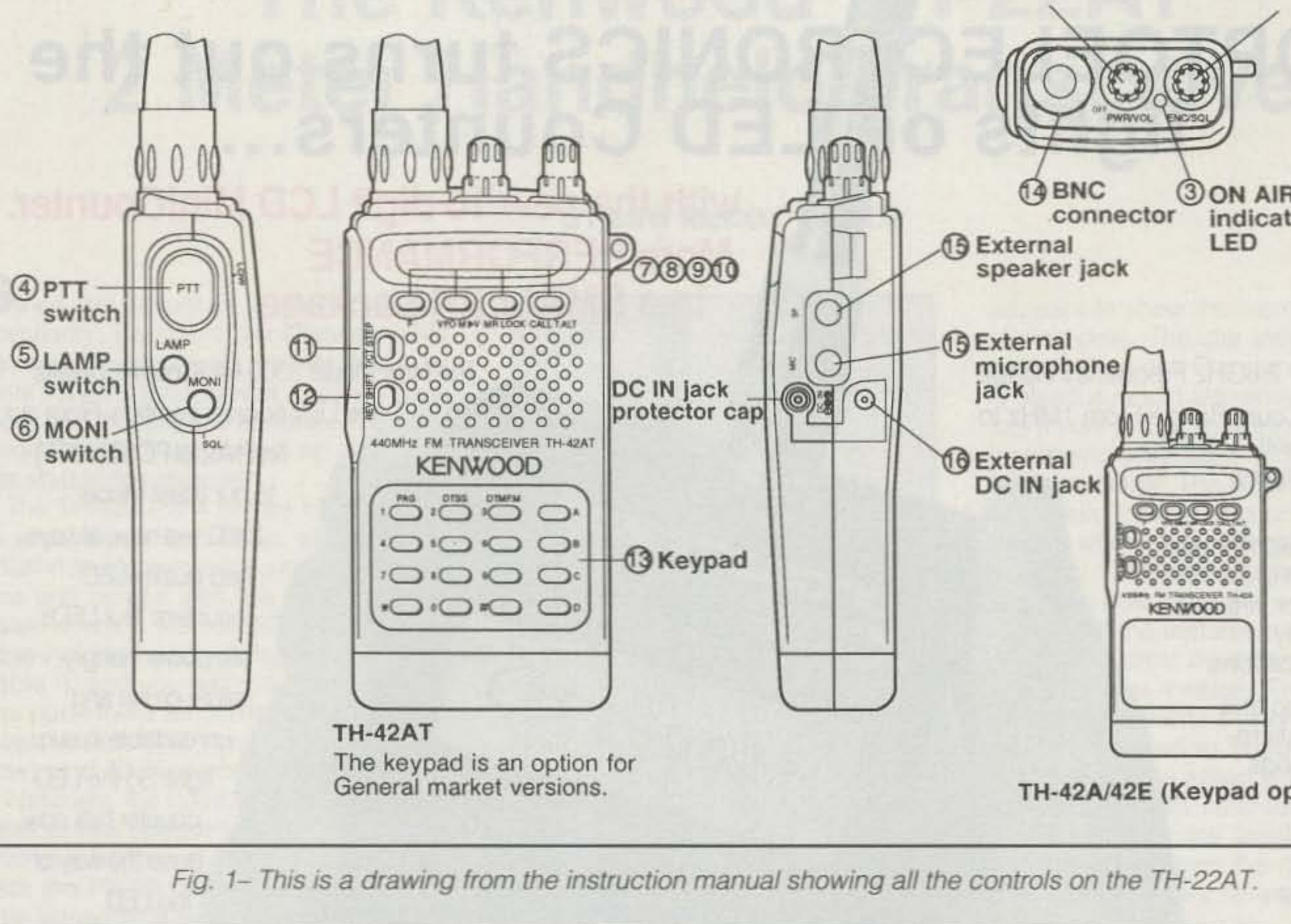

Fig. 1– This is a drawing from the instruction manual showing all the controls on the TH-22AT.

SPECIFICATIONS

		TH-22A/22AT/22E	TH-42A/42AT/42E
General			
Frequency range			
	U.S./Canada	144 to 148 MHz	438 to 450 MHz
	Europe	144 to 146 MHz	430 to 440 MHz
	Australia	144 to 148 MHz	—
	General market	144 to 148 MHz [1]	430 to 440 MHz
Mode		F2, F3 (FM)	
Usable temperature range		−20°C to +60°C	
Rated Voltage	External power supply (DC IN)	5.0 to 16.0 V(13.8 V)	
	Battery terminals	4.0 to 15.0 V (6.0V)	
Current	Receive with no signal	Average 45 mA	Average 45 mA
	Battery Saver ON	Approx. 15 mA	Approx. 15 mA
	Transmit with H, 13.8V	Approx. 1.3 A	Approx. 1.6 A
	Transmit with H, 6.0V	Approx. 1.3 A	Approx. 1.6 A
	Transmit with L, 6.0V	Approx. 0.5 A	Approx. 0.5 A
	Transmit with EL, 6.0V	Approx. 250mA	Approx. 250mA
Grounding method		Negative ground	
Dimensions (W x H x D)		56 × 116.5 × 24.5 mm	
Dimensions (projections included)		65 × 130.5 × 29.8 mm	
Weight [2]		Approx. 290 g	
Microphone impedance		2 kΩ	
Antenna impedance		50 Ω	

[1] Some versions have reduced RX and TX range: 144 to 146 MHz
[2] Antenna, hand strap, belt hook, and PB-32 included

		TH-22A/22AT/22E	TH-42A/42AT/42E
Transmitter			
Power output	H, 13.8 V	Approx. 5 W	
	H, 6.0 V	Approx. 3 W	Approx. 2.5 W
	L, 6.0 V	Approx. 0.5 W	
	EL, 6.0 V	Approx. 30 mW	
Modulation		Reactance	
Maximum frequency deviation		±3.5 kHz to ±5 kHz	
Spurious emissions		−60 dB or less	
Receiver			
Circuitry		Double conversion superheterodyne	
1st intermediate frequency		45.05 MHz	
2nd intermediate frequency		455 kHz	
Sensitivity (12 dB SINAD)		−16 dBμ 0.16 μV or less	−15 dBμ 0.18 μV or less
Squelch sensitivity		−20 dBμ (0.1 μV) or less	
Selectivity (−6 dB)		12 kHz or more	
Selectivity (−40 dB)		28 kHz or less	
Audio output (10% distortion)		200 mW or higher (8 Ω load)	

Specifications are subject to change without notice due to developments in technology, and are guaranteed within Amateur bands only.

Table I– General specifications of both the TH-22AT and TH-42AT.

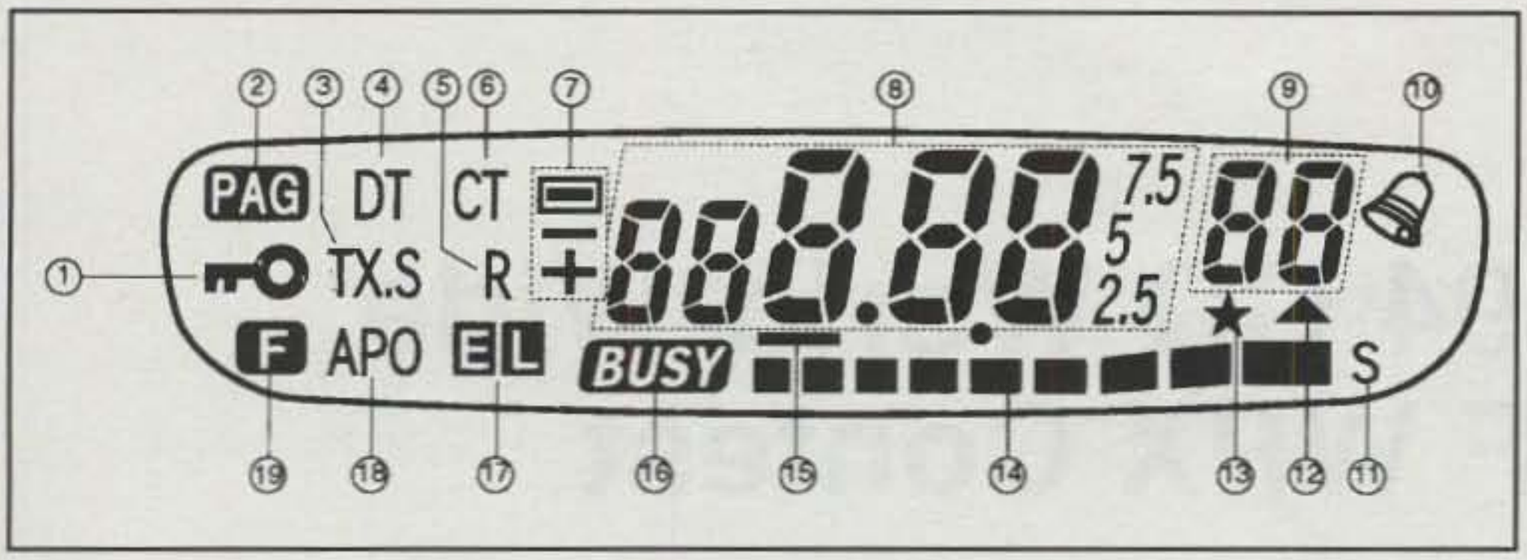

Fig 2– This is the readout (as shown in the instruction manual). All the various indications are explained in the text.

I found having a rig that could fit in a shirt pocket without being noticed was very worthwhile. Anyone who knows me knows that I do not have small hands nor small fingers, and I can state frankly that I had no problems whatsoever using the push-button switches.

I feel that Kenwood has a winner in this rig. I did not test their 450 MHz model, but I assume it would do just as well as the 2 meter model.

The list price of the TH-22AT is $349.95. It is manufactured by Kenwood U.S.A. Corp., P.O. Box 22745, 2201 E. Dominguez St., Long Beach, CA 90801-5745.

Most densely populated areas have such locations. Here in Silver City, New Mexico I don't have these problems. However, I usually have a chance to check out a VHF/UHF rig under real-world conditions in a place called South Mountain, in Arizona. South Mountain, located in Phoenix, is loaded with transmitters, so a drive up the mountain using your handheld quickly tells you how good a receiver really is—real-world conditions. Frankly, the TH-22AT passed with flying colors; it was clean.

I used the TH-22AT all day on several occasions and had a good chance to find out about the battery life. I found that never once did I run down the battery. (Yes, I can limit myself to 6 second transmitting time.)

Announcing:

The 1994 CQ World-Wide VHF WPX Contest

Starts: 1800 UTC Saturday, July 9, 1994
Ends: 2100 UTC Sunday, July 10, 1994

I. Contest Period: 27 hours for all stations, all categories. Operate any portion of the contest period you wish.

II. Objectives: The objectives of this contest are for amateurs around the world to contact as many amateurs as possible in the allotted 27-hour period, to promote VHF and above activity, to allow VHF and above operators the opportunity to experience the enhanced propagation available at this time of year, and for interested amateurs to collect VHF and above prefixes and Maidenhead locator grid squares for awards credits.

III. Bands: All authorized amateur radio bands above 50 MHz may be used, as authorized by local law and license class.

IV. Class of Competition: (1) Single op fixed station. (2) Multi-op class I fixed station. (3) Multi-op class II fixed station. A fixed station is defined as one that is a regular home station location. You may operate from your home station or you may be a "hired gun" at another home station to qualify for a fixed station category. A multi-op class I station is one which operates on all authorized amateur frequencies above 50 MHz. A multi-op class II station is one which operates on four or less of the authorized amateur frequencies above 50 MHz. (4) Single operator portable station. (5) Multi-op class I portable station. (6) Multi-op class II portable station. A portable station is defined as one which you set up away from a regular home station location. (7) Rover station. A Rover station is one which is manned by no more than two operators, must travel to more than one prefix and/or grid square and must sign "Rover" or /R. Please note: contacts from your home station cannot count as Rover contacts. These contacts must be submitted separately, in a separate category from the Rover category. Also, the spirit of this class is to encourage operation from rare grid squares by persons who are inclined to do so. It is not the intent of this class to encourage one operator to move from one super station to another super station in another prefix or grid square in order to compete in this category. (8) QRP station. This is a new category for this year. Anyone operating a station running 25 watts output, or less, is elgible to enter this category. There are no location restrictions. You can operate from your home QTH, or from the highest mountain you can find. However, you cannot run more than 25 watts output on any band.

V. Exchange: Callsign and Maidenhead locator grid square (4 digits—e.g., EM15). Signal reports are optional and need not be included in the log entry.

VI. Multipliers: The multiplier is the number of different prefixes worked plus the number of different grid squares worked per band. A "Prefix" and a "Grid Square" are counted once per band. Exception: The Rover who moves into a new grid square or prefix can count the same prefix and/or grid square more than once per band as long as the Rover is himself or herself in a new prefix or grid square location. Such change in location must be clearly indicated in the Rover's log. It is required that Rover category operators maintain separate logs for each grid square and/or prefix location.

A. The letter/number combinations that form the first part of the amateur callsign are considered the prefix. Examples: N8, Y22, WB3, ZS65, etc. Any difference in the numbering, lettering, or order of prefix will form a separate prefix. An operator on the air from a DXCC country different from his or her callsign is required to sign portable. The portable prefix must be an authorized prefix of the country or call area of operation. In the portable operation, the portable designator becomes the prefix. Example: N8BJQ, operating from Wake Island, signs N8BJQ/KH9 or KH9/N8BJQ. Conversely, KH6XXX, operating from Ohio, cannot sign /KH8, which is American Samoa's prefix. Nevertheless, that operator can sign /W8, /N8, /K8, etc., or any other prefix authorized in the US 8th call district. However, if the license you are issued designates a prefix as part of the callsign, that is the prefix you must use. Examples: W4/GØXYZ counts as W4; VP2M/N6CL counts as VP2. Portable designators without numbers will be assigned a zero (Ø) after the second letter of the designator to form the prefix. Example: WA4VCC/PZ becomes PZØ. All callsigns without numbers are assigned a zero (Ø) after the first two letters and/or numbers that form the prefix. Examples: 9NGHK counts as 9NØ; RAEM counts as RAØ. Aeronautical mobile (/AM), maritime mobile (/MM), mobile (/M), /A, /E, /J, /P, /R, or other portable or interim license class identifiers (/KT) do not count as prefixes.

B. A station in a call area different from that indicated by his or her callsign is not required to sign portable. However, the prefix of that station can be counted only once, and then only for the actual prefix. Example: N6CL is permanently located in Oklahoma (grid square EM15). However, N6CL chooses not to sign N6CL/5. If you work N6CL, you count the prefix only as N6, not N5, or N6 and N5.

C. The Rover who changes location during the course of the contest is free to contact as many other stations as he or she wishes. The Rover becomes a new QSO to the stations working him or her when that Rover changes either grid square or callsign district and indicates the change in prefix. Example: K5CPZ operates from EM16 in Oklahoma. When you work her you count the grid square (EM16) and the prefix (K5). While in Oklahoma she moves to EM06. You work her again. You then can count her from the new grid square (EM06). When she moves into Kansas and signs K5CPZ/Ø from EM07 you work her

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again. You then can count the grid square (EM07) and the prefix (KØ). Assuming you work her only on one band, you may claim credit for three QSOs with the potential of five multipliers (EM16, EM06, EM07, K5, and KØ), presuming you work no one else with the same prefix or in the same grid square. She in turn is able to count you as three separate QSOs and whatever multipliers you give her. That is, she can count your prefix and your grid square each time, for a total of six multipliers, assuming you stay in one location. Please note: Rover category entrants must maintain separate log sheets for each grid square and/or prefix.

D. The grid square is the Maidenhead grid locator to four digits (FM13).

E. Special event, commemorative, and other unique prefix stations are encouraged to participate.

F. Aeronautical mobile stations are not eligible to compete. However, an aeronautical mobile station can be worked for prefix credit only. Maritime mobile stations, however, are eligible and encouraged to compete from rare water-bound grid squares. A maritime mobile station is elgible to compete in the Rover category, provided it meets the necessary requirements to be considered a Rover station.

VII. Scoring: One point per QSO on 50, 70, and 144 MHz; 2 points per QSO on 222 and 432 MHz; 4 points per QSO on 903 and 1296 MHz; 6 points per QSO on 2.3 GHz and above. Work stations once per band, regardless of mode. Multiply total QSO points times total number of prefixes (PX) plus the total number of grid squares (GS) worked. This differs from the scoring for the CQ WW HF WPX Contest, where a prefix counts only once regardless of band (and countries, rather than grid squares, are the multipliers). Contest entrants may not transmit on 146.52 MHz, or your country's national 2 meter FM simplex calling frequencies, or commonly recognized repeater frequencies for the purpose of making or requesting contacts. Contacts made within your own country, in the DX window of 50.100 to 50.125 MHz, are discouraged. Contacts made on the SSB calling frequencies of 50.110 MHz, 50.125 MHz, and 144.200 MHz are discouraged. Contest participants are required to use UTC as the logging time.

Incentive scoring: Operators completing two-way CW or MCW contacts may add one point to the QSO value for each contact.

Example: W1XX works stations as follows:

37 QSOs, with 3 QSOs on CW (34 × 1 = 34; 3 × 2 = 6; 34 + 6 = 40) and 12 PX's and 10 GS's (22 multipliers) on 50 MHz.

45 QSOs (45 × 1 = 45) and 18 PX's and 8 GS's (26 multipliers) on 144 MHz.26 QSOs (26 × 2 = 52) and 10 PX's and 4 GS's (14 multipliers) on 222 MHz.

38 QSOs (38 × 2 = 76) and 11 PX's and 5 GS's (16 multipliers) on 432 MHz.

2 QSOs (2 × 4 = 8) and 2 PX's and 2 GS's (4 multipliers) on 903 MHz.

6 QSOs (6 × 4 = 24) and 3 PX's and 2 GS's (5 multipliers) on 1296 MHz.

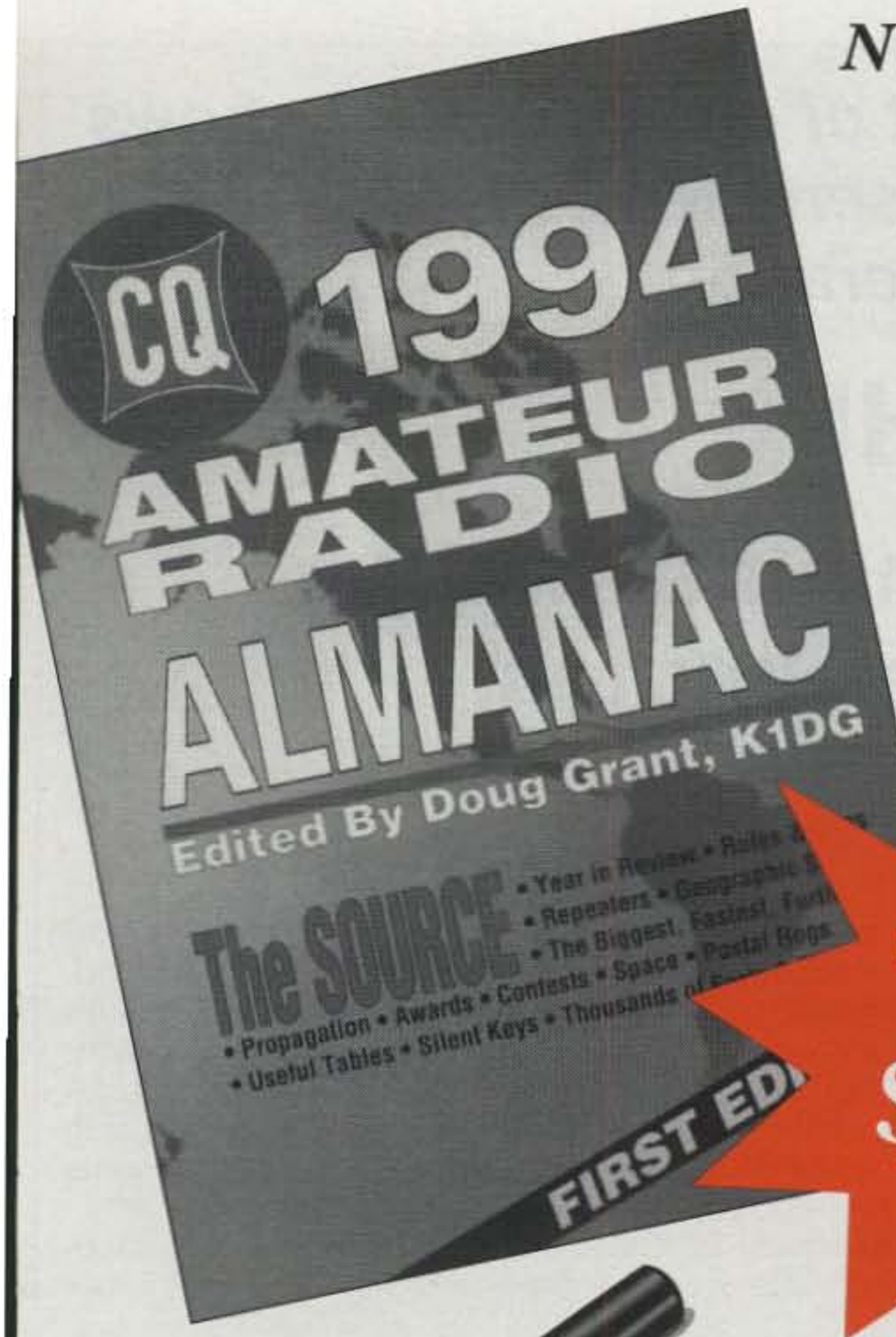
W1XX has 245 QSO points (40 + 45 + 52 + 76 + 8 + 24 = 245) × 87 multipliers (22 + 26 + 14 + 16 + 4 + 5 = 79) = 21,315 total points.

VIII. Awards: Engraved plaques will be awarded to the top-scoring stations in each category in the world (for a total of eight plaques). Parchment certificates suitable for framing will awarded to the top-scoring stations in each category in each continent. Certificates may also be awarded to other top-scoring stations who show outstanding contest effort. Certificates will be awarded to top-scoring stations in each category in geographic areas where warranted. Geographic areas include states (U.S.), call areas (Japan), provinces (Canada), and countries, and may also be extended to include other subdivisions as justified by competitive entries.

IX. Miscellaneous: An operator may sign only one callsign during the contest. This means that an operator cannot generate QSOs by first signing his callsign, then signing his daughter's callsign, even though both callsigns are assigned to the same location. All contacts above 300 GHz must use coherent radiation on transmissions and employ at least one stage of electronic detection on receive. A station located exactly on a dividing line of a prefix and/or a grid square must choose only one grid square and/or prefix from which to operate for exchange purposes. A different multiplier cannot be given out without moving the complete station at least one hundred meters.

X. Log Submissions: With the inclusion of the QRP category, this contest has been revised slightly from last year. Therefore, while the old log sheets are still usable, the old summary sheets are not. You must request logs and summary sheets from: the CQ VHF WPX Contest, CQ Magazine, 76 N. Broadway, Hicksville, NY 11801. Please include an SASE with your request.

Completed logs must be postmarked no later than August 31, 1994 to be eligible for awards. All logs should be mailed to: Joe Lynch, N6CL, VHF WPX Contest Chairman, P.O. Box 73, Oklahoma City, OK 73101. Please mark "VHF Contest Logs" on the envelope. Logs may be submitted on disk, provided a hard copy of the log is sent with the disk and the data is in an ASCII format compatible with an IBM-PC type computer.



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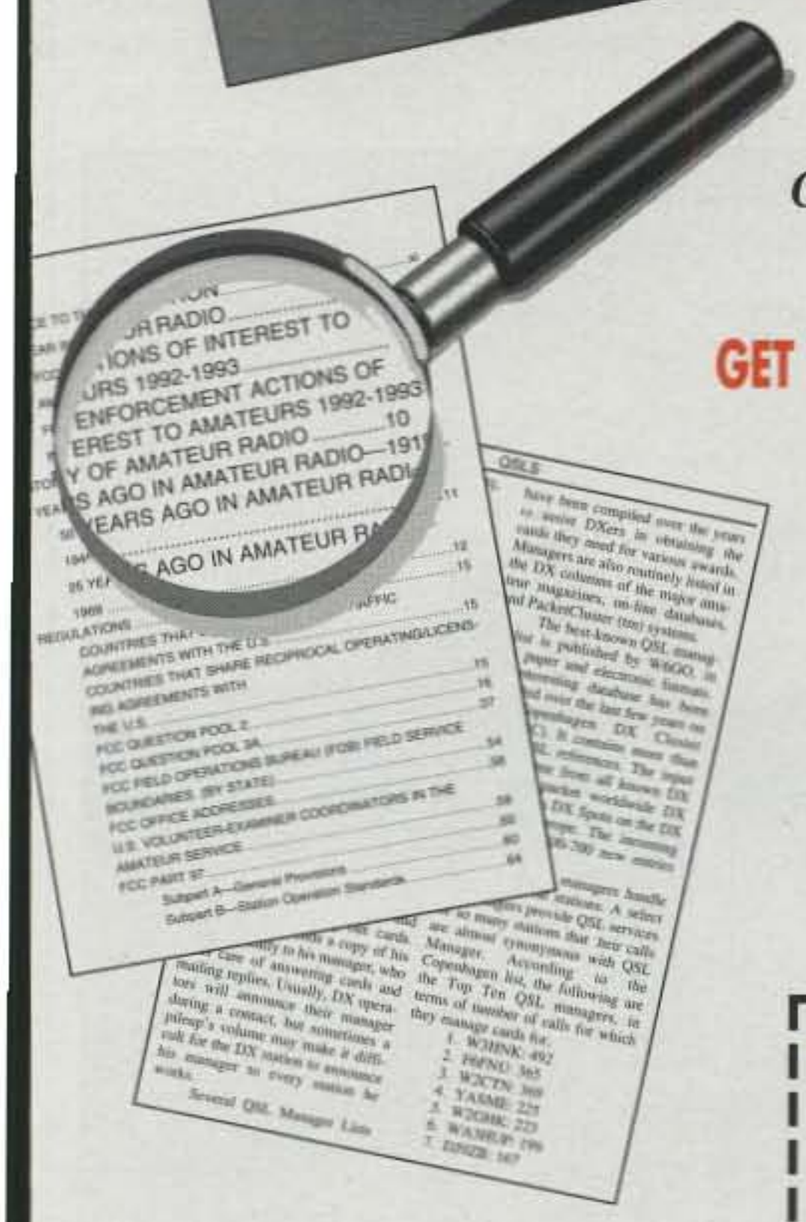

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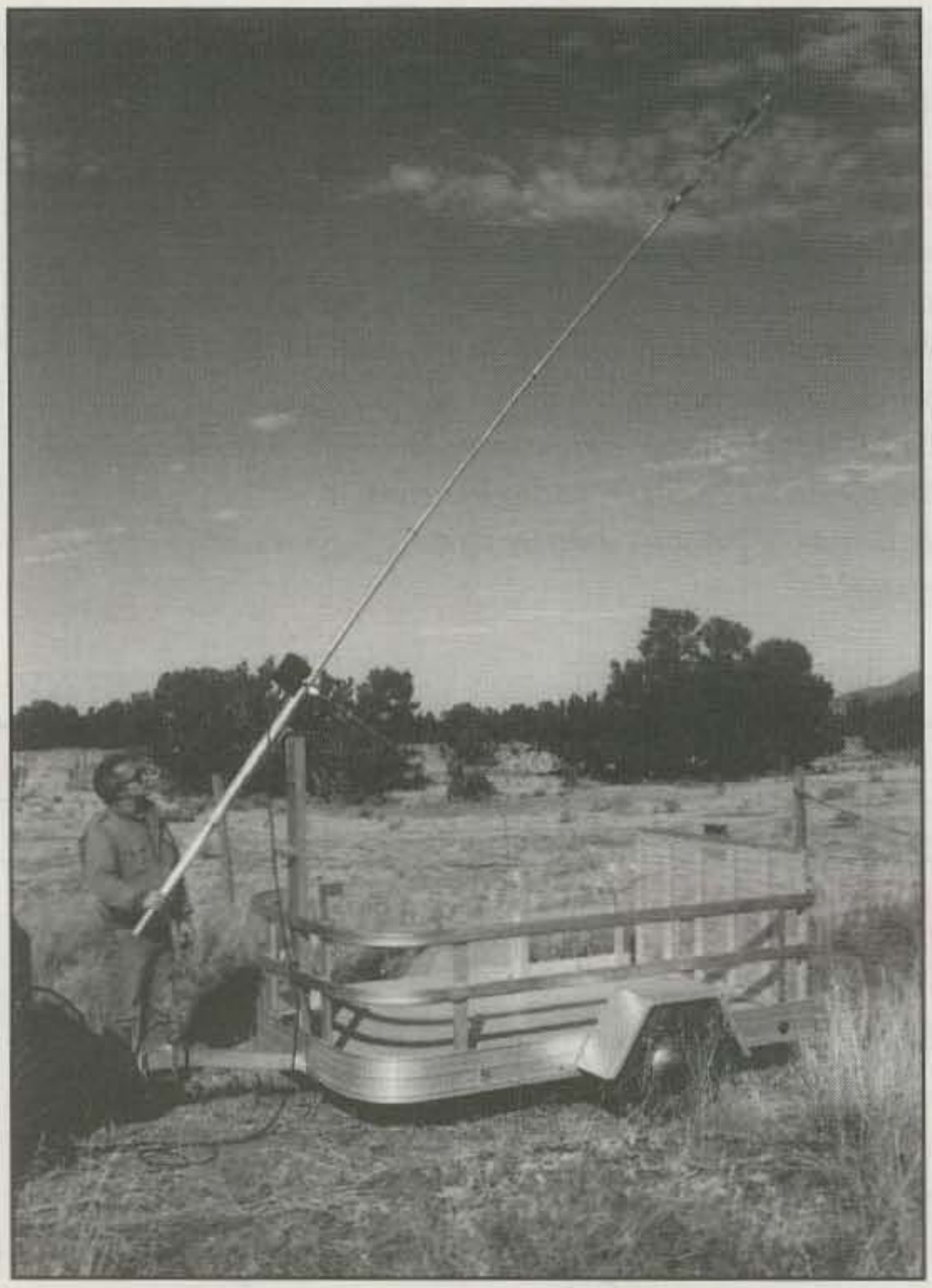
BY LARRY ARAVE*, WC7D

So you have that new antenna! Now what? Many times in the past I have built or assembled an antenna only to wonder, "Where am I going to put it?" The question is even more important when you want the antenna to be portable. What a shame to spend a significant amount of money on that special antenna and because of poor installation practice not be able to get full use of your investment.

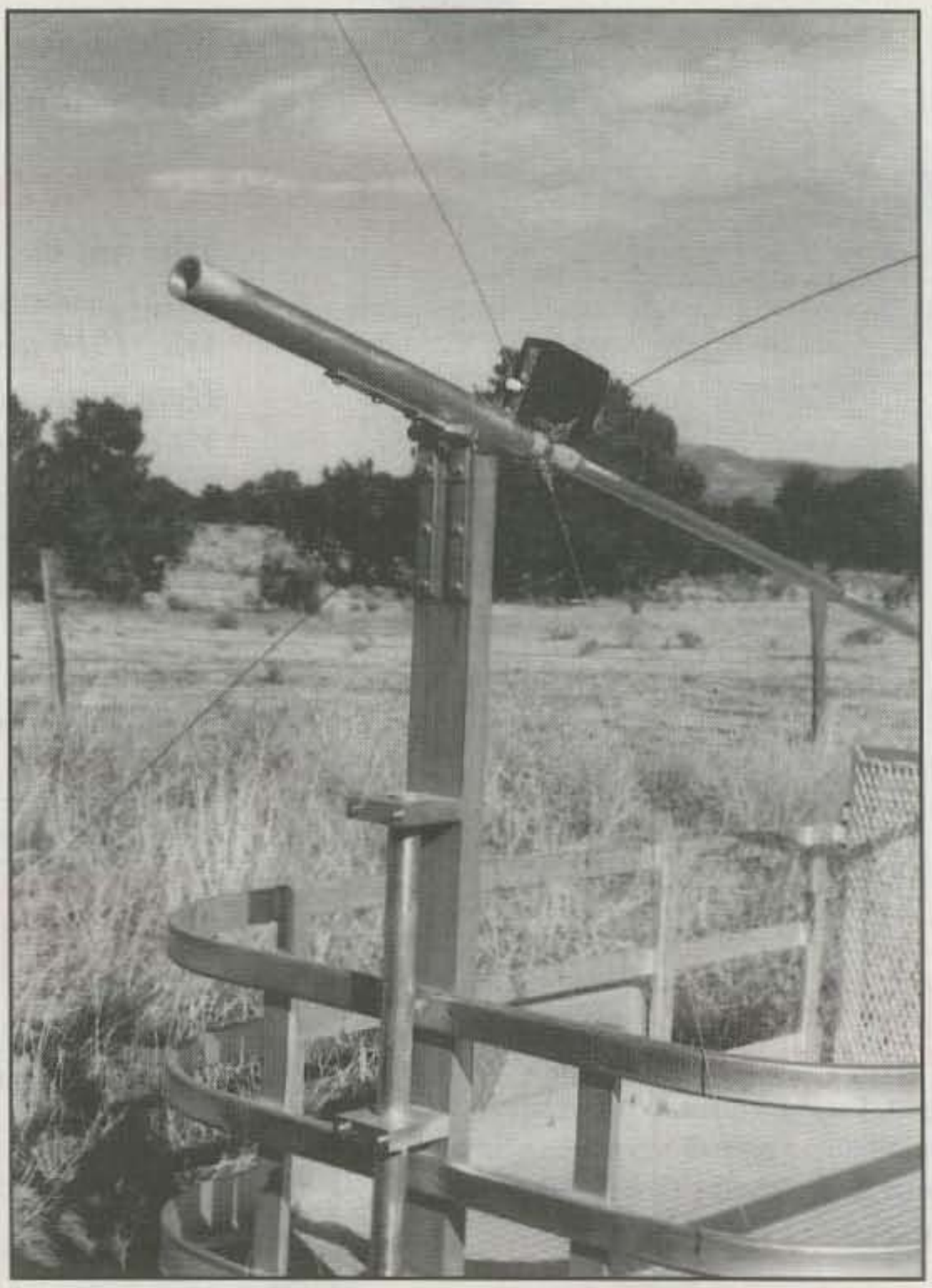
I'd like to share with you an antenna installation you can set up in l*ess than five minutes!* "Why?" you say. I can think of several uses, and I am sure you can think of even more. My portable antenna setup is being used with our recreation vehicle for easy setup when traveling. It can also be used for camping, field day, emergency services, or even in the backyard. In an emergency most of us can show up with radio equipment, but how long will it take to set up antennas? I'll attempt to explain how this portable antenna setup works and how to build it, but first some personal notes.

The subject of this article is not intended to impress you with someone's intelli-

**P.O.B. 9222, Albuquerque, NM 87119-9222*



The system is simple enough so that the antenna can be raised with one hand and be operational in about five minutes.



When not in use, the counterweight is simply held in the two aluminum clamps.

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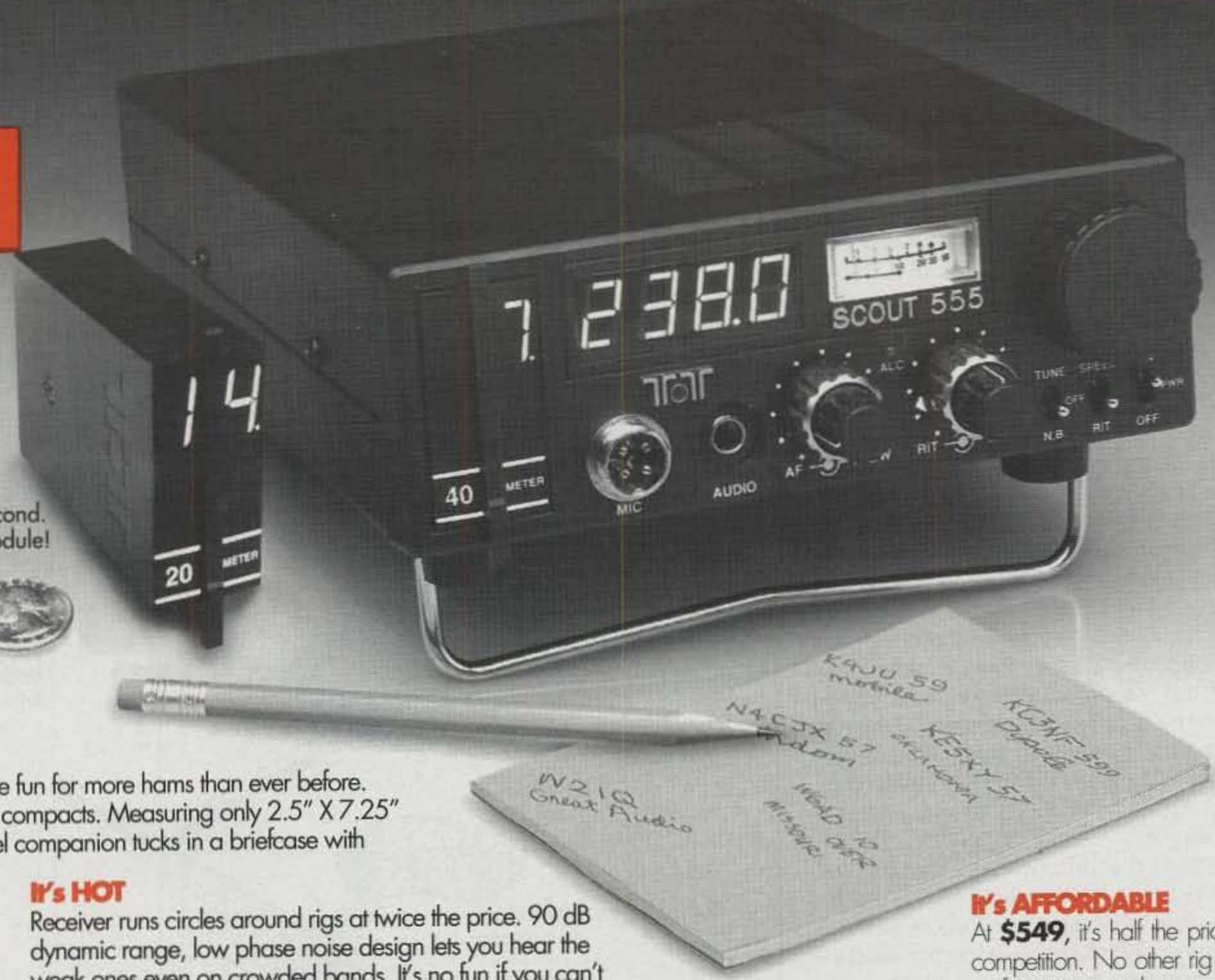

Change bands in a second.
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Receiver runs circles around rigs at twice the price. 90 dB dynamic range, low phase noise design lets you hear the weak ones even on crowded bands. It's no fun if you can't hear em!

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Just sit down and operate. Master every feature in minutes - no modern rig is as easy to use. Change band modules in a flash to work 160-10 meters including WARC.

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gence or deep antenna theories. In fact, those who know me would say deep thought and intelligence are contradictory terms in my case. My intention is to share some of my experiences with antenna projects. I guess at one time or another I have tried almost every antenna made. If you don't believe me, you can ask my wife!

In my 25-plus years of amateur radio experience I have used antennas in unusual places, depending on the need. For example, have you ever tried to get a beam rotator to rotate at a temperature of –101 degrees F at South Pole Station, Antarctica? Or what kind of antenna and antenna mount would you carry to the top of the 14,000 foot Grand Teton? Sometimes we learn things the hard way, and I know in some cases I would plan things differently. Anyway, I'm not asking you to go to the coldest place on earth or to carry your station up a tall, cold mountain. Even in the simplest of antenna installations there is a lot of trial and error, so I guess we can learn from each other.

How It Works

I have designed and constructed a special hinge (fold-up device) to be used to quickly raise and lower antennas. This device will also allow flexibility in raising, lowering, or removing the support structure. This fold-up device is now installed on a small 6 foot by 8 foot aluminum utility trailer. The antenna can be removed completely from the trailer with just one hinge bolt. This makes it very convenient to use the trailer as a utility trailer or an antenna trailer. The fold-up device can be installed on your RV or truck also. Right now I am using an R-5 Cushcraft antenna, but with a creative mind you can use any antenna.

To install the antenna you simply just set it on the hinge and insert the hinge bolt. To fold up the antenna you insert the counterweight, tilt up the antenna, and insert the clamp bolts (see photos). You then plug in your already made coax and you are on the air.

There you have it. Complete setup with very little effort, and most of all, *fast*. No more juggling or balancing acts with an 18 foot vertical trying to get it on a pipe!

Sounds simple, doesn't it? It is! And that's what I like about it. If you are interested, read on, and I'll tell you how to build your own.

Construction

The construction techniques I used can be varied somewhat to fit your needs. For example, I used all aluminum (except for the hinge) in my construction because I wanted it light and strong and was installing it on an aluminum trailer. You may decide to use steel or PVC when building

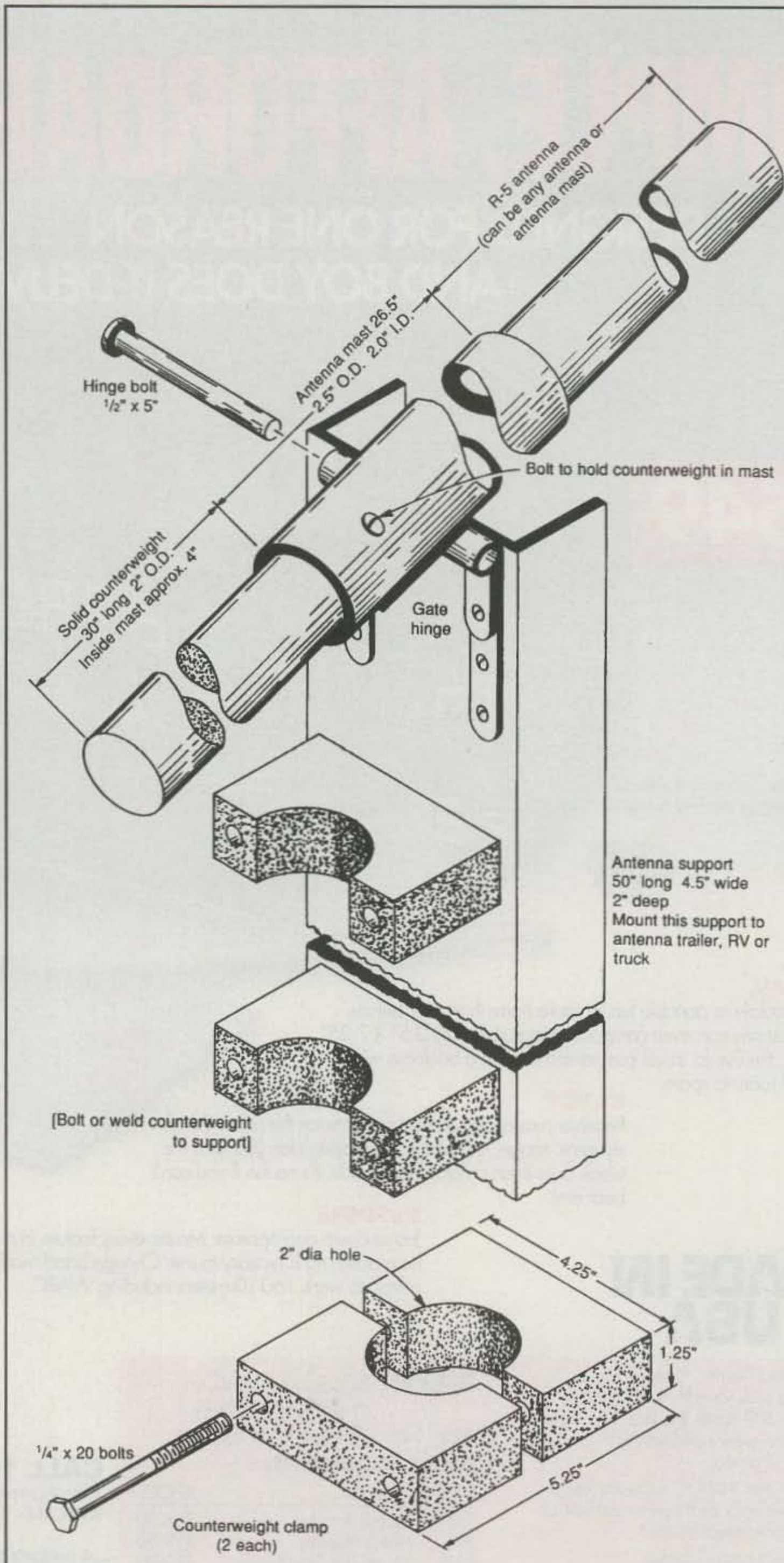

Fig. 1– Mechanical details of the antenna support system.

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yours. However, I strongly recommend you build the actual hinge the way I did. Through trial and error I eliminated other hinges because they didn't work. They either wobbled or bent due to the stress from leverage.

1. The Antenna Mast. I started with a piece of aluminum pipe 26.5" long by 2.5" OD by 2" ID. I inserted the base of the R-5 antenna *inside* (note: not outside) this pipe, then drilled and put in aluminum pop rivets.

2. The Counterweight. Here again I used aluminum, but you may choose to use steel or brass or whatever. My counterweight consisted of a **solid** bar 30" long by 2" OD. This counterweight is sanded or machined to slide inside the bottom of the antenna mast (described above). This counterweight is very important because it offsets the weight of your antenna so you can tilt everything up and down with just one hand. It also makes your antenna mount stronger.

3. The Support. The support is the stand or tower used to hold everything—antenna, mast, hinge, and counterweight. Again, for this you can use whatever is best for your needs. I used a section of heavy-duty aluminum channel 50" long by 4.5" wide by 2" deep. This support is permanently bolted to the front of my trailer, but could be installed on the back of the RV, truck, or wherever.

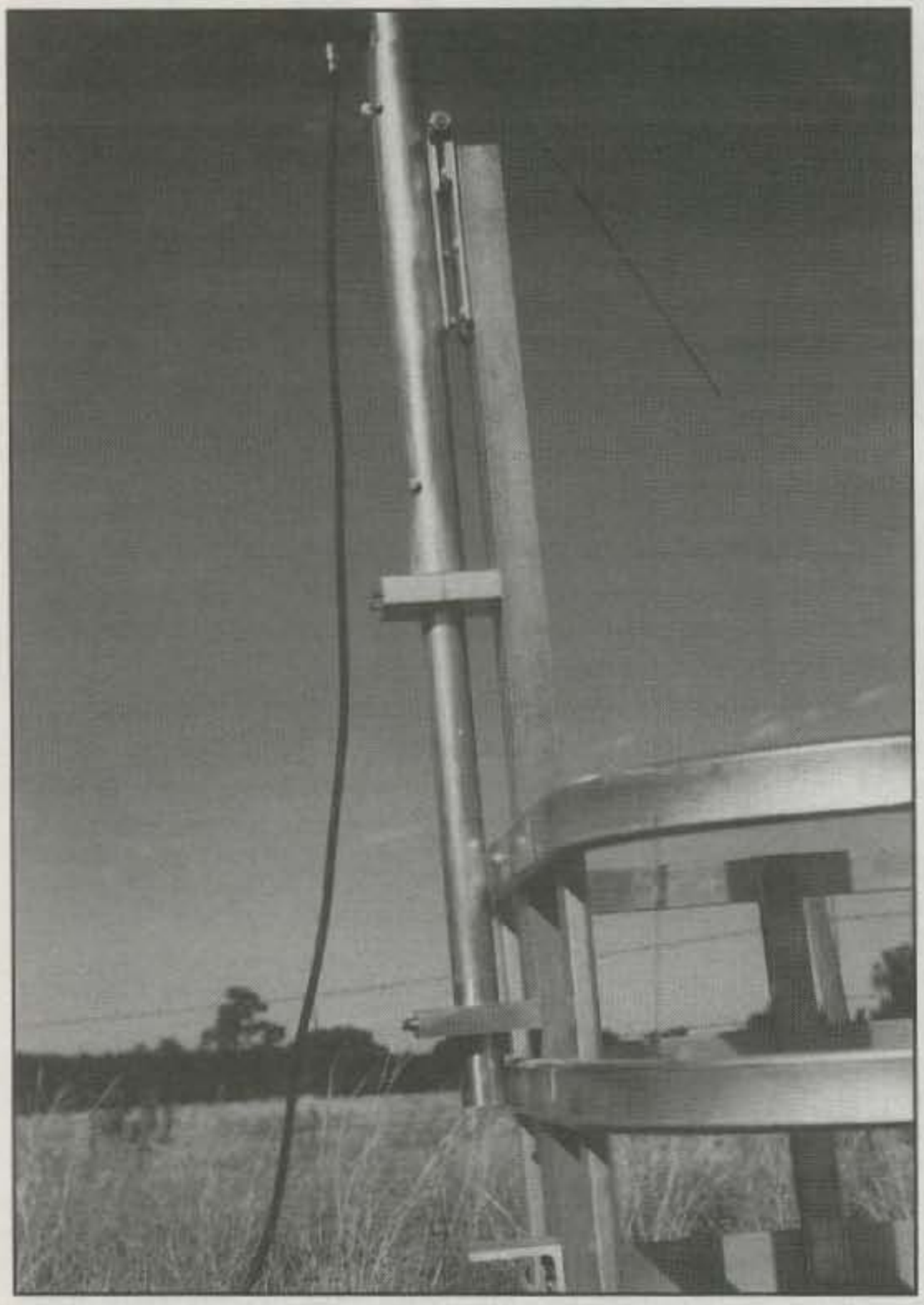
4. The Counterweight Clamps. The clamps are used to clamp the counterweight to the support after the antenna is folded up. You can make clamps using just ordinary U-bolts, or make something out of any material you might have around. I used aluminum to keep the antenna solid and vertical. Good clamps also take the stress off the hinge during high winds. I made the two clamps by using two solid blocks and then drilled and tapped quarter inch bolt holes on the sides. The last step is to cut the blocks in half at the center of the two inch holes. This makes very strong clamps that can also hold the counterweight in place when traveling. (See picture of clamps with counterweight inside.)

5. The Hinge. This is a small and simple part, but has a very important function. First the don'ts. Don't use a regular door or cabinet hinge. Even if you use the largest one you can find in the hardware store, it won't hold up under the stress. I learned the hard way, so you can save yourself time and money from my experience.

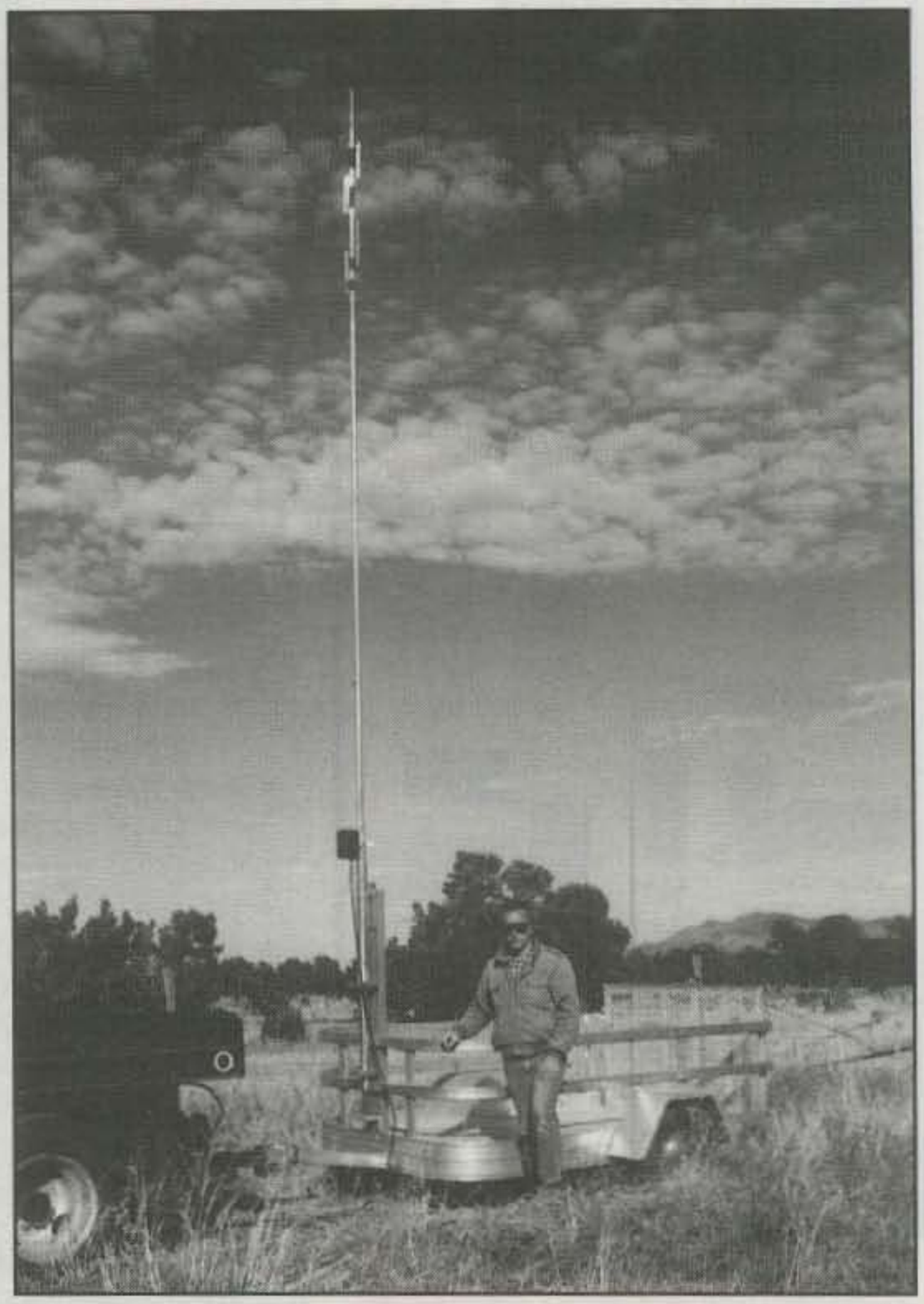
Okay, are you ready for the deep, dark secret? What hinge really works? No, you don't have to go to the machine shop and build one. The key word is *gate*. Go to your hardware store and purchase three large gate hinges. A gate hinge is a long, narrow, very thick steel strap with a loop on one end. I used three of these hinges, and they are 5" long by 5/8" wide by approximately 1/4" thick. The loop on the end has a hole almost 1/2" in diameter. You simply put the three gate hinges side by side and use a 1/2" bolt 5" long as the hinge pin. You may have to ream it out with your 1/2" drill bit so the bolt fits just right. You then bolt two of the gate straps to the support and the third to the antenna mast. You now have a *very solid hinge* (see the photos).

Cost

The cost to build this fold-up antenna mount will depend of course on the materials you choose to use. I found the only items you need to buy at your local hardware store are the three gate hinges and a handful of bolts. All the aluminum I used for this project was purchased at a local machine shop that has a large stock of surplus metals. Buying at a salvage yard or surplus place will save you a lot of money because you need not buy large quantities. I just picked out the pieces of metal I needed and paid by the pound. I was also able to rent the use of the machine shop tools. Overall, I guess I have approximately $20 in the gate hinges and bolts and $30 in aluminum. This of course does not count the amount of material I spent in research, but I am sure you will



In this view the counterweight is pinned to the antenna mast and the entire assembly is securely fastened by the heavy-duty clamps. The gate hinges can be seen at the top of the aluminum channel



Five minutes later you're ready to go.

build yours right the first time!

This project was well worth the time and money, and I was able to receive a lot of enjoyment and education experimenting with different ideas.

Conclusion

I welded a short piece of pipe to a small gate hinge on the back of the antenna trailer so I could travel with the antenna attached and folded down. This allows very quick setup and holds the antenna securely in place.

Wherever you use your portable antenna, *please don't forget safety*. With a portable antenna, as well as with all antennas, make sure you are in the habit of looking up for power lines before setup.

In the future I plan to install a fold-up 30 foot fiberglass pole to this same type of antenna mount. The pole will then be used to support a good, old classic inverted Vee, or perhaps a small beam. With your imagination the possibilities are endless.

This fold-up antenna is very useful and was a lot of fun to build. ■

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WORLD RECORD HOLDERS

Single Operator

1.8	UP3BP/UF('85)	125,240	101
3.5	YX3A('89)	1,004,060	305
7.0	VP2VCW('86)	4,641,120	586
14	YW1A('91)	4,617,456	732
21	ZD8LII('91)	5,118,527	743
28	ZS6BCR('91)	3,621,173	617
AB	ZV5A('92)	12,184,011	861

Multi-Operator Single Transmitter

YM5KA('90) 13,098,790 839

Multi-Operator Multi-Transmitter

HG73DX('93) 16,543,420 1060

CLUB RECORD

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

U.S.A. RECORD HOLDERS

Single Operator

1.8	K5UR('85)	13,668	102
3.5	K1ZM('93)	406,080	288
7.0	N5RZ('85)	1,754,664	452
14	K2VV('86)	2,525,880	582
21	K6LL/7('88)	2,163,388	557
28	N5RZ('89)	162,134	259
AB	KM1H('92)	5,313,160	760

Multi-Operator Single Transmitter

N4WW('88) 5,593,772 698

Multi-Operator Multi-Transmitter

NSØZ('88) 10,870,380 922

QRPp RECORD

VP2MU('91) 1,554,735

WPX (Prefix) RECORD

HG73DX('91) 1120

CONTINENTAL RECORD HOLDERS

AFRICA

1.8	ZS6BCR('85)	20	5
3.5	EA8RL('84)	453,456	201
7.0	AM9TY(92)	2,007,990	404
14	9J2AL('90)	1,333,724	436
21	ZD8LII('91)	5,118,527	743
28	ZS6BCR('91)	3,621,173	617
AB	EA8EA('93)	10,693,146	762

ASIA

1.8	UP3BP/UF('85)	125,240	101
3.5	UP2NK/UF('85)	701,012	221
7.0	C47W('93)	2,874,960	440
14	4Z6DX('91)	4,614,030	743
21	7L1GVE('91)	2,811,478	601
28	4X4UH('81)	1,081,262	338
AB	P31A('92)	10,293,858	762

EUROPE

1.8	UA2FF('87)	117,424	134
3.5	GW8GT('92)	740,440	346
7.0	G3LNS('93)	2,500,400	532
14	LZ5W('92)	4,222,665	837
21	4N4A('88)	2,585,460	615
28	9H1EL('88)	805,552	398
AB	CR7M('93)	5,645,267	751

NORTH AMERICA

1.8	VE3BMV('86)	43,428	77
3.5	HK3MAE/HKØ('87)	456,280	187
7.0	VP2VCW('86)	4,641,120	586
14	WC4E/KP4('86)	3,613,248	656
21	FS5T('89)	4,552,470	702
28	HI8JKA('89)	891,242	374
AB	V27T('89)	9,408,672	819

OCEANIA

1.8	KX6DC('88)	12,240	45
3.5	KX6DC('89)	258,258	143
7.0	V7A('93)	2,205,922	373
14	ZL3GQ('89)	2,775,744	576
21	N7DF/WH2('89)	3,243,450	525
28	KG6DX('81)	1,238,806	334
AB	NH6J/NHØ('88)	4,484,760	532

SOUTH AMERICA

1.8	YV1OB('86)	11,550	35
3.5	YX3A('89)	1,004,060	305
7.0	YX5A('87)	2,999,977	479
14	YW1A('91)	4,617,456	732
21	LTØA('91)	4,290,988	686
28	CE3DNP('89)	2,857,038	582
AB	ZV5A('92)	12,184,011	861

MULTI-OP SINGLE TRANSMITTER

AF	ZD8ØV('91)	10,938,352	848
AS	YM5KA('90)	13,098,790	839
EU	R6L('93)	9,194,688	939
NA	KP2A('89)	12,843,135	835
OC	AG9A/AH2('91)	9,005,641	787
SA	P44V('93)	11,477,437	851

MULTI-OP MULTI-TRANSMITTER

AF	EA9CE('84)	4,383,308	482
AS	JE2YRD('91)	8,388,942	866
EU	HG73DX('93)	16,543,420	1060
NA	WL7E('88)	12,826,296	952
OC	KH6XX('85)	8,551,399	647
SA	LQ5A('89)	8,290,016	784

QRPp

AF	5Y4FO('92)	649,057	311
AS	4X4UH('82)	1,028,904	344
EU	LZ2BE('91)	1,137,488	506
NA	VP2MU('91)	1,554,735	469
OC	FO8JP('86)	572,131	259
SA	OA8V('81)	444,768	246

CQ Books and Videos

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They are available in neon red, clear blue, orange, white, sky blue, rose, pink, and green. The sign is mounted between two sheets of clear acrylic and comes with a one-year limited warranty. They are also available with a bottom accent strip, boarder, or custom design. Each basic unit, tested and delivered, is $225. For ordering information send an SASE to Howie Cohen, WA2TVE, Just Neon, 409 James Street, Utica, NY 13501 (315-724-9150; FAX 315-792-903), or circle number 101 on the reader service card.

Audio Analyzer From Harlan Technologies

Harlan Technologies has introduced the Audio Analyzer, a program which gives a visual representation of some of the audio signals heard over the airways. The program uses a PC with a Sound Blaster compatible sound card as the input from the radio. The display can be real time or from a sound file (.VOC—voice file) so that it can be analyzed repeatedly. The program was originally used to view Slow Scan TV signals during the development of Slow Scan II for the Sound Blaster. The visual image gives the ability to view the wave forms of the many different types of Slow Scan on the air today. The program also works on RTTY, packet, AMTOR, Morse code, and any other mode that relies on a varying tone for its information. It can measure the length of a particular tone in milliseconds, as well as its frequency.

Requirements include a PC with hard drive, VGA monitor, and a Sound Blaster compatible sound card. Audio Analyzer can be purchased for $39.95 plus $5 s/h (Illinois residents add $2.50 tax). For more information, contact Harlan Technologies, 5931 Alma Dr., Rockford, IL 61108 (815-398-2683), or circle 102 on the reader service card.

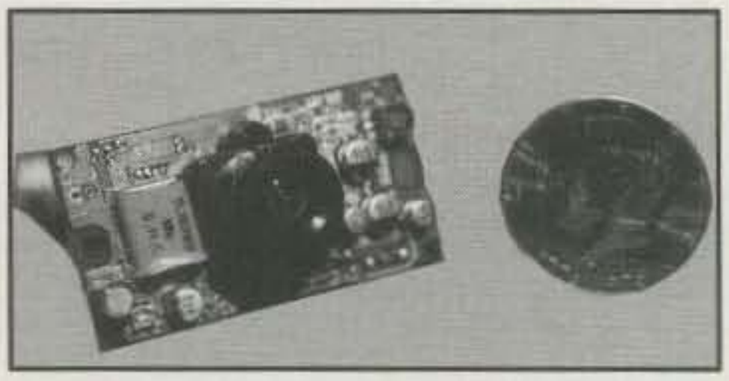
EMI-P15A Noise Filter From Marine Technology

Marine Technology, Inc. has introduced the EMI-P15A noise filter which protects communications equipment from power-line interference and isolates noise producing accessories. The EMI-P15A 12-volt, 20 amp electrical interference power-line filter is designed to eliminate alternator whine and other interference to communications equipment. The EMI-P15A will also prevent interference developed in noisy accessories from entering a vehicle's electrical system. Such devices include 12 VDC to 120 VAC inverters, large 12 volt motors in fans, pumps and blowers, and strobe lights and signals.

The EMI-P15A is 2 3/4 inches long, 3 inches wide, and 1 3/4 inches high and can be attached to any clean surface with its pressure-sensitive mounting strips. The suggested retail price is $34.95. For more information, contact Marine Technology, Inc., 2667 E. 28th Street, #505, Signal Hill, CA 90806 (800-772-0796), or circle number 104 on the reader service card.

Supercircuits PC-10XS Microvideo Camera

The Supercircuits PC-10XS microvideo camera weighs 1 ounce, produces 380 lines resolution, and works in light as low as 1 lux, with automatic exposure control. Output is standard NTSC composite video and it runs on 10–13.5 VDC, drawing 100 milliamps. The features of the PC-10XS allow it to be used for applications such as robotic and "toyvision" amateur TV installations. The PC-10XS mounts in R/C cars, planes, or underneath helicopters.



The PC-10XS and custom housings are available from Supercircuits, 13552 Research Blvd., Austin, TX 78750 (512-335-9777), or for more information circle number 105 on the reader service card.

Cushcraft A270-10S Dual Band Yagi

Cushcraft's A270-10S dual band Yagi for 2 meters and 70 cm is designed to provide the gain and directional characteristics of a Yagi and the convenience of a single antenna. The boom is 6 feet 2 inches long and weighs less than 2 pounds. Its wind load is .725 square

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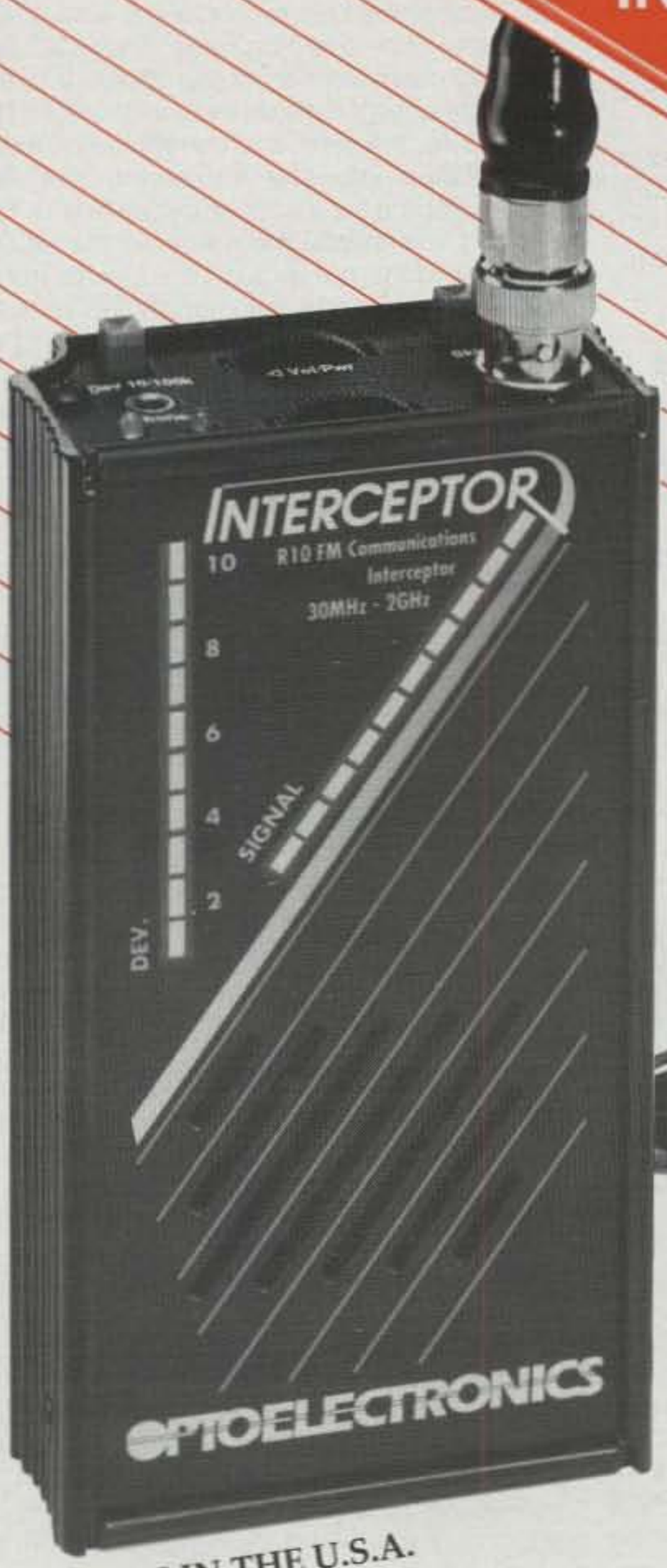

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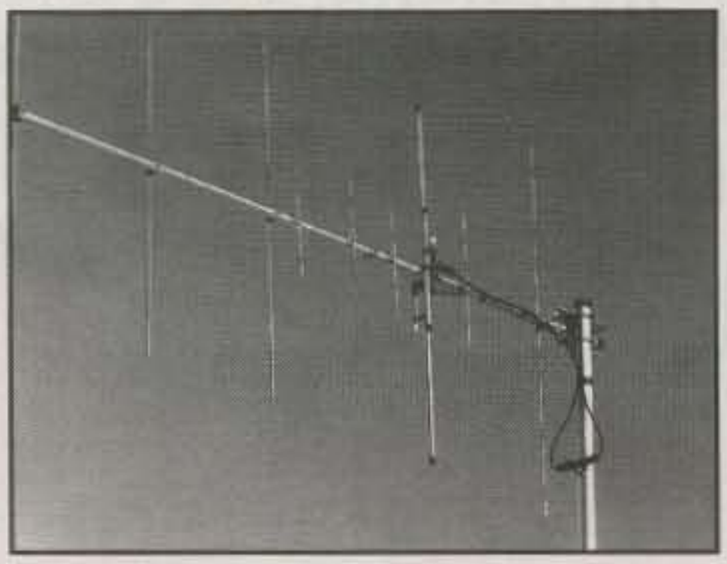

feet. The antenna covers the 144–148 MHz and 430–450 MHz bands. The A270-10S is available through dealers worldwide.

For more information, contact Cushcraft Corporation, 48 Perimeter Road, Manchester, NH 03103 (phone 603-627-7877; FAX 603-627-1764), or circle number 106 on the reader service card.

JPS NTR-1 Wide-Band Noise And Tone Remover

JPS Communications, Inc. has introduced a new noise reduction product designed primarily for the SWL and radio amateur. The NTR-1 Wide-Band Noise and Tone Remover has two front-panel-selectable bandwidths to provide optimum noise and tone reduction for AM/FM broadcasts, as well as SSB, CW, or Data broadcasts. An internal jumper provides further adjustment of the level of noise processing in the wideband mode to suit various types of listening habits. The NTR-1 provides noise reduction and tone removal for wide band and narrow-band signals.

The NTR-1 operates from 12 VDC, requires 500 ma peak current, and uses the same power pack used by other JPS amateur radio products. The unit is 1.7 inches high, 6.5 inches wide, 5.1 inches deep, and weighs 2 lbs. The NTR-1 is priced at $169.95 and is available from the factory and selected dealers. For more information, contact JPS Communications, Inc., P.O. Box 97757, Raleigh, NC 27624 (919-790-1011), or circle number 109 on the reader service card.

Additions To Fun-Kit Line From Jade Products

Jade Products, Inc. has announced new members of the Fun-Kit Line: the Lead-Acid/Gel-Cel Battery Charger Kits. This series of products is based on the Unitrode UC3906 battery charger chip. This "smart chip" is designed to sense the condition of the battery and adjust the charging requirements accordingly. The charger can be left connected indefinitely to the battery, keeping the battery ready for service at all times.The BC01 kit comes with an enclosure, an EMI filter on the line voltage input, and a current meter. The manual assumes no previous kit experience. Wire strippers, pliers, screwdrivers and soldering equipment are all that is needed for assembly. The unit can be built for either 0.5 amp or 1.0 amp maximum charging rates. The BC02 is a stripped-down version of the BC01. It is the complete charger, minus the enclosure, RFI filter module, line cord, and current meter. It can be installed into any equipment that can accommodate the 3×5 inch circuit board. The BC03 is essentially the same as the BC02, except it does not include the power transformer; the user needs to supply the 16 to 21 VAC for either 0.6 or 1.2 amps depending on the selected charging rate.

For more information, contact Jade Products, Inc., P.O. Box 368, E. Hampstead, NH 03826 (603-329-6995; FAX 603-329-4499), or circle number 103 on the reader service card.

AEA WeFax 256

Advanced Electronic Applications, Inc. has introduced their WeFax 256 software accessory for users of their DSP-2232/1232 multimode controllers. AEA WeFax 256 is a Windows™ program for reception and display of gray-scale WeFax images. It includes the following features: displays in real time true gray scale images from either the NOAA HF WeFax Service or the NOAA APT Satellite Service; provides two modes of resolution—500 or 250 pixels per line; all incoming data is stored in a buffer, which gives you the ability to increase the resolution after the image is received; incorporates a scrollable receive buffer capable of operating in stop or loop modes; supports BMP, GIF, PCX, TIF, and JPG image formats; and integrates an auto clock function to "wake up" the system.

AEA WeFax 256 requires an AEA DSP-2232 or 1232 multi-mode data controller with a receiver and antenna system for either HF, APT VHF, or microwave operation. It also requires a 386 PC-compatible computer or better, Windows 3.1, 2 MB of RAM, 5 MB of free hard drive space, and a VGA 256-color display or better.

For more information, contact Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036 (206-774-5554; FAX 206-775-2340), or circle number 111 on the reader service card.

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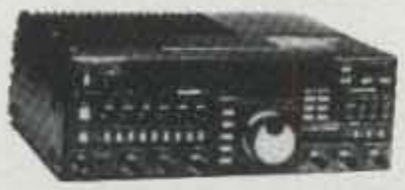

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OUR READERS SAY

More For The Novice, Please

Editor, *CQ:*

I am a new ham and have been getting your magazine for about seven months, I guess. At one point I thought real seriously about discontinuing your magazine because it, like *QST*, had very little to do with CW, and everything else was over a new Novice's head or beyond his need to know. But the issue before last (December 1993) came through with "CW Ragchewing," the last issue (January 1994) with "Open-Wire Feeders," and this issue (February 1994) with part two of "Working With Balanced Line" and "Myths of Low-Band DXing." Now it looks better to me.

I know with so many aspects of amateur radio it's hard to please everyone every time. Maybe you should have a Novice Corner or popular articles of the past featured. There appear to be two schools: those who use coax versus those who use balanced line—CW versus voice.

The other day I picked up an Eico 715 transmatch. Where can I get info on this? Who manufactured it? I realize it is a transmatch, but the internal components do not resemble a conventional unit. *(Can anyone help?—ed.)*

Keep up the good work.

John E. Easler
301 Myra Lou
Copperas Cove, TX 76522

February Corrections

Editor, *CQ:*

Thank you for printing my article in the February issue of *CQ* ("A ZS/K9 Bunny Hunt," page 22). However, my callsign is WA3CVC rather than the WA3CUC printed. I just wanted to make sure that the "U" isn't in my file, so the next time it won't sneak in there!

Henry Hill, WA3CVC
Florissant, CO

Editor, *CQ:*

Here we are in sunny Yuma, Arizona. The temperature is around 70 degrees F. The 2 meter ZIA link is full of chatter between hams from as far away as Colorado Springs, Colorado and Odessa, Texas. I've been reviewing my article ("A Simple Easy-Up, Easy-Down All-Band Antenna For Your RV," page 48), which appeared in the February issue of *CQ*.

I need to correct a couple of errors in the article. Fig. 1 (page 49), which is a schematic of a folded monopole vertical, should have a line connecting the top of the mast and the drop wire. The two must be electrically bonded at the top. This is really important. I don't imagine the antenna would function as expected if it were set up as shown in the figure. It would most likely perform acceptably, but the transformer action and reactance reversal features of the folded monopole design would be missing.

The second error is my address. When I originally submitted the article, my address was indeed California. But nearly a year ago we became residents of Texas, and our address is as follows: 101 Rainbow Drive, Apt. 3198, Livingston, TX 77351. Unfortunately, we discontinued the California forwarding address, and there is a strong chance that any letters of inquiry sent to me at the old address will be returned to the sender. My address is correct, however, in the 1994 *Callbook*.

Phil Morgan, WDØP
Livingston, TX

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ANTENNAS & ACCESSORIES

A LOOK AT THE SHACK FROM BOTH ENDS OF THE COAX

BY KARL T. THURBER, JR., W8FX

Antenna Revue

This month we'll catch up on some antenna, software, and book topics. Hopefully, doing so will clear out our in-basket to get it ready for next month. So let's get started by digging into the "antenna side" of things.

Antenna Topix

Time for Antenna Maintenance. Spring is in bloom, so it's a good time to take stock of your antennas—whether you have a full-fledged antenna farm, a modest urban lot installation, or just a simple mobile whip. Spring is *always* a good time to clean up your antenna installation, carry out preventive measures against future damage, and install new antennas.

The specific procedures to be followed vary depending on your actual antenna situation. In general, however, it's a good idea to inspect all antennas for tightness and sturdiness of assembly, weathered connections and fittings, and corrosion of metal surfaces, since you can never tell what you will find after the winter storms have faded. You can remove corrosion on copper and aluminum surfaces using fine steel wool.

At the same time, clean and wrap coaxial cable connectors and fittings with black electrical tape (or weatherproofing materials) to keep out moisture and corrosive pollutants. Also check the hardware, tightening and wrapping screws and nuts to minimize any loosening and corrosion. Carefully check the appearance of coaxial cable to see if it seems to need replacing; substitute old or cheap coax with more modern high-grade, weather-resistant cable types.

At the same time you're checking things over from a weather standpoint, also give your antennas a once-over to ensure that they are really safely installed and positioned, especially with respect to power lines. If your tower fell, where would it likely land, considering the prevailing wind direction in your area?

Wirebook II. While on the subject of antennas and coaxial cable, take a look at this booklet. This concisely written mini-manual is an excellent how-to-do-it source manual for coaxial cable, coax connectors, antenna wire, baluns, lightning protection, grounding, and RF and antenna accessories. It's available from The Wireman, Inc.

The 56-page *Wirebook II* is a highly readable collection of hints, tips, and advice. It's a potpourri of useful information gathered by Press Jones, N8UG, "The Wireman," as a consequence of thousands of conversations at hamfests, on the telephone, and from discussions with authors, researchers, tech reps, engineers, and quality-control people. Many readers of this column are aware of The Wireman's marketing of "certified quality" coaxial cable and other wire and cable products to the amateur community by mail-order, at hamfests, and through a small number of dealers.

The *Wirebook II* is $2 from The Wireman, Inc., 261 Pittman Road, Landrum, SC 29356 (1-800-717-9473).

G.S. Manufacturing Mobile Antenna. Gary Stookey, N7YIA, offers an all-band mobile antenna patterned after the original DK3 design by Don Johnson, W6AAQ. To recall, the W6AAQ DK3 antenna is an automatic, no-relays design used to cover 10, 20, 40, and 75 meters. The antenna resonates without taps or roller coils and tunes continuously to any frequency from 3.5 to 30 MHz. No jumpers, open or shorted turns, or other potentially degrading components are used, yet an essentially flat 1:1 SWR is claimed on all frequencies within the design range. One of the best features is that the antenna resonates at any frequency from 3.5 to 30 MHz without leaving your seat.

According to Gary, N7YIA, his antenna is similar, but is changed in several ways, including making use of different size coils for different applications, as in 160 meter operation. The N7YIA antenna uses a motor-driven center loading coil. A top whip of 55 to 103 inches can be used, depending on the band(s) on which you want to optimize performance, although Gary has standardized on a 72 inch whip as a good compromise.

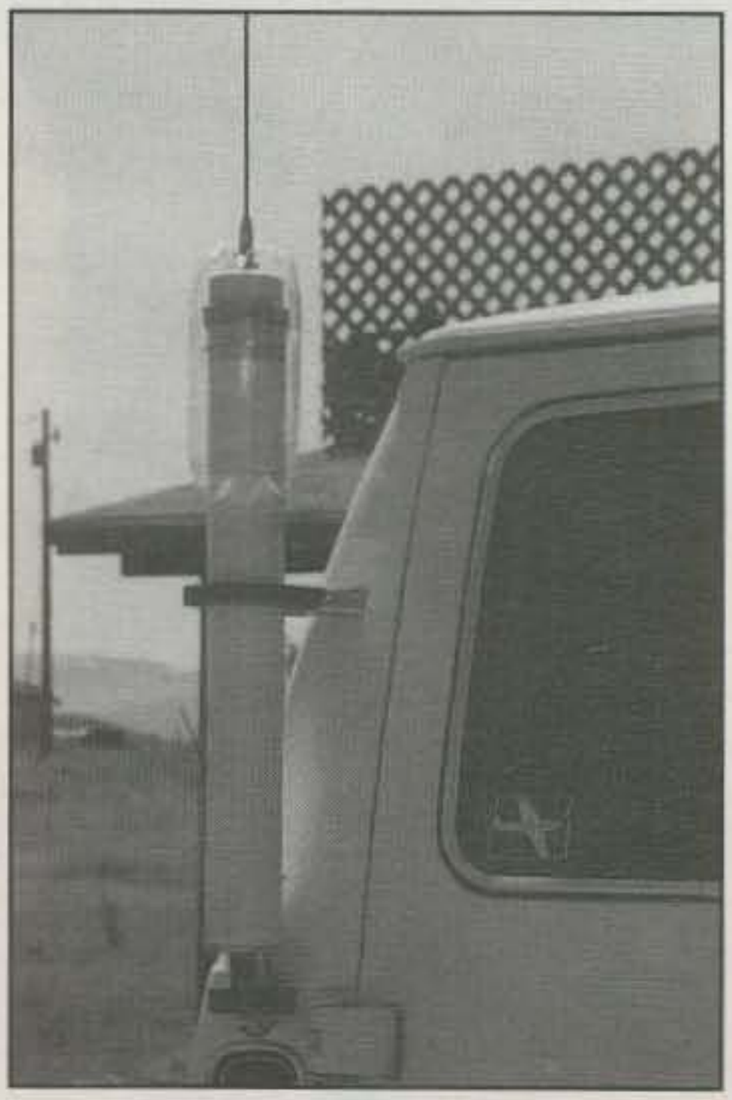
The antenna comes with a toroid coil for matching, a brass stud to mount it on, and an upper mount for mobile work. You supply the whip and an insulated mount to hold the brass stud, although Gary can on request furnish an insulator and steel mount that you can weld or bolt to the vehicle. The lower portion of the assembly (see photo) is either 24 or 32 inches tall, depending on the specific design. Power-handling capability is 300 watts with the furnished toroid.

Three versions of the GS-series all-band mobile antenna are available using either copper or aluminum tubes, priced from $220 to $230. A 160 meter version is $250, and other variations are offered. The standard DK3 design also is available.

Contact Gary Stookey, N7YIA, at G.S. Manufacturing, 4691 Beagle Rd., White City, OR 97503 (503-826-1067).

(If you wish to contact the DK3's original designer, it is Don Johnson, W6AAQ, 26659 Capay St., Box 595, Esparto, CA 95627-0595 [916-787-3905].)

Jo Gunn Enterprises Catalog. Jo Gunn Enterprises is primarily a supplier of high-quality CB base-station and mobile antennas for the 11 meter band. However, the company also offers several heavy-duty, omnidirectional 10 meter verticals suitable for amateur use. Several other Jo Gunn CB antennas, such as the popular Star and Conventional series directional beams, are available specially cut for 10 meters. All antennas offered are fabricated of 6063-T6 aluminum tubing.



The G.S. Manufacturing GS-series all-band mobile antennas are modifications of the DK3 design pioneered by Don Johnson, W6AAQ. Gary Stookey, N7YIA, offers the GS-series antennas by mail. Standard coverage is 80 through 10 meters, but a 160 meter version is also available. (Photo courtesy N7YIA)

One unusual 10 meter omnidirectional design is the "Hillbilly" antenna which offers both horizontal and vertical polarization. Another is the "Son of a Gunn" vertical which features some omnidirectional gain, with its 26 foot radiator.

A free catalog is available from Jo Gunn Enterprises, Route 1, Box 32C, Hwy. 82, Ethelsville, AL 35461 (205-658-2229).

Butternut Brochure. For about 10 years we have used a roof-mounted Butternut 2MCV two-collinear-section antenna for 2 meter work. The inexpensive ($45) vertical antenna, with its patented Trombone(R) phasing sections, has performed admirably as a utility 2 meter FM antenna as well as doubling as an antenna for a wideband VHF/UHF scanner, even working well outside its design range of 144–148 MHz. I was pleased to see in a recent Butternut flyer that the 2MCV is still available, and that a three-collinear-section model, the 2MCV-5, also is offered for $65.

Butternut's newest product is the HF9V-X, a loaded halfwave-type multiband vertical for 80/75, 40, 30, 20, 17, 15, 12, and 10 meters, priced at $210. While the new antenna is cautiously suggested as a "no-radial" vertical for situations in which even the smallest radial sys-

289 Poplar Drive, Millbrook, AL 36054

tem can't be installed, a companion counterpoise kit is offered for best performance.

I also see that in the most recent flyer Butternut continues to offer the long-popular HF5B "Butterfly™," a very compact multiband beam for 20, 17, 15, 12, and 10 meter use in limited-space situations; a similar 10/11 meter version, the 1011 Butterfly, is also sold. (The HF5B was reviewed by Bill Clarke, WA4BLC, in September 1988 *73 Amateur Radio Today*.)

A brochure with specs on all Butternut models and technical notes on vertical antenna design and ground/radial systems are available at no charge. Contact Butternut Electronics Company, P.O. Box 1234, Olmito, TX 78575 (210-350-5711).

Jade Products Twin-Lead Marconi. Will the real Marconi please stand up? There are several antenna types that lay claim to the name of the celebrated Italian inventor. In general, a Marconi is an antenna in which one end of the signal source is connected to a radiating element and the other end is connected to ground. Another definition holds that the Marconi is a "vertical monopole" operated against ground or a radial system. In any case, the Marconi allows the use of half the length of wire you would need for a full halfwave Hertz radiator. Here the ground acts as a mirror to take the place of the additional quarterwave of wire you'd need to resonate the antenna if the end were not returned to ground.

With its catchy company motto of "putting the amateur back in radio," Jade Products recently introduced its 160-Meter Twin-Lead Marconi as a complete, ready-to-install antenna kit for the top band that includes all necessary hardware, wire, twin-lead, connectors, and support rope. The antenna is approximately 126 feet long and can be installed with a portion of the twin-lead running vertically. Various matching arrangements are possible, including a configuration that allows coaxial cable feed.

The end-fed antenna includes a special support elbow for the twin-lead, thus preventing failure of the twin-lead from fatigue and flexing often caused by hanging the lead-in by a rope. The location of the support elbow is adjustable. This allows you to raise the antenna as high vertically as you can for good 160 meter performance, while at the same time reducing the length required of the horizontal flattop portion. If the elbow were installed at 35 feet, the horizontal section would be about 90 feet, shorter even than the length of an 80 meter dipole.

The 160 meter version is $39.95, while a shorter (64 foot) 80 meter version is $34.95. More details are available from Jade Products, P.O. Box 368, East Hampstead, NH 03826 (603-329-6995).

RF Applications Digital SWR Meter. Bruce R. Knox, N8LXS, has set up RF Applications, Inc. "to develop and market interesting and useful products to the amateur radio community." The company's first product was the D-144 Two Meter Deviation Monitor; it was highlighted in Stan Horzepa, WA1LOU's "Packet Perspective" column in September 1993 *QST*.

The recently introduced second product is the P-3000 Digital RF Power/VSWR Indicator, a state-of-the-art microprocessor-based instrument that gives fast and accurate power and VSWR readings in real time, with no adjustment or calibration required. The unit offers virtually instant, adjustment-free VSWR measurement; an auto-ranging bar graph display; a multi-functional power display; and a built-in amplifier protection control relay. The P-3000 is designed to be used in 50 ohm lines and can display power from about 10 to 3000 watts. The unit has two modules, a directional coupler, and a separate display unit. Price is $299.95, which includes the display, coupler, cables, and manual.

For specifications, contact RF Applications, Inc., 7345 Production Drive, Mentor, OH 44060 (216-974-1961).

New from Nemal. In the March 1990 column we mentioned the free "Nemal Cable and Connector Selection Guide." As we noted then, you can use the guide as a standard reference that provides detailed electrical and physical specs on more than 1500 cable and connector types. Also included in the guide are details on fiber optic products, cable ties, patch panels, heat-shrink tubing, and various adapters and cable assemblies. Nemal has updated the catalog since then; for a free copy, contact Nemal Electronics International, Inc., 12240 N.E. 14th Ave., North Miami, FL 33161 (305-899-0900).

Of special interest, Nemal recently introduced the Hamcable™ series of composite cables that are combined with a weather resistant *overall* jacket. These novel composite cables are designed to offer a neat, durable, and cost-effective solution to the needs of amateur radio operators using both coaxial and rotor cables. Nemal currently manufactures seven different composite combinations. These offer RG-8/U foam and poly coax, as well as RG-213/U, all with a minimum of 96 percent braid, in combination with standard and heavy-duty rotor cables.

DX Solutions Update. In April 1993 we highlighted the DX Solutions SAS-6 Smart Antenna Switch, an electronically controlled antenna switch that was introduced by Tim Pearson, KU4J, and Ed Blalack, WA4DPU, at the 1992 Huntsville Hamfest.

To recap, the SAS-6 is an RF switching control unit that automatically selects one of up to six predesignated antennas based on your transceiver or receiver's band of operation. The antenna selections are programmed from the switchbox front panel. The SAS-6 handles monoband or multiband antenna configurations. An outdoor relay unit, sold separately, is required for operation; the unit is compatible with most remote coax switches to directly replace the manual switching unit.

The SAS-6, which now is priced at $299.95, is compatible with most popular transceivers that have a serial port interface, through the firm's universal CT-232 computer/transceiver interface ($59.95). Something we didn't stress last April is that no software is required with the SAS-6. Since the interface is independent of software, the unit is compatible with all available logging, contest, and radio-control programs such as DXbase(C), CT™, HyperLog, LOGic™, Log EQF, and others.

What's new? Well, now you can control *two* different (or similar) radios with a special version of the CT-232, designated the CT-232 Dual Radio Interface. With the dual interface you can connect two radios to the same interface and select either radio with a front-panel switch. This avoids the need for multiple interfaces, extra cables, and A/B switches. The CT-232 Dual Radio Interface is $104.95.

For more information and a list of SAS-6/CT-

New From CQ . . . Radio T-Shirts!!

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$17.95
per shirt
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Please allow 4-8 weeks delivery

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To Order Toll Free Call (800) 853-9797 or FAX (516) 681-2926

232 configuration options, contact DX Solutions, 147 South View Drive, Huntsville, AL 35806 (205-971-9769).

AEA Update. It's been awhile since we noted AEA's antenna-related product lines. The last time was about three years ago when we highlighted the then-new AEA IsoLoop Antenna, which has been re-engineered to be a compact (35 inch diameter) loop that transmits and receives on any frequency between 10 and 30 MHz. The antenna is rated at 150 watts and normally is mounted in the horizontal plane (although it can be mounted vertically to produce a null in a given direction).

AEA's new digital products seem to get the most press, such as PC PAKRATT for Windows™, AEA FAX II, HamLink, and OpLink (used to access an HF station by telephone). However, AEA has also been busy with its line of RF accessories. A while back they introduced the IT-1 Automatic Tuner for the IsoLoop 10-30. Using the fast IT-1, adjusting the IsoLoop typically takes only 1 or 2 seconds. Features include a 12-button control keypad with audible beep, thumbwheel knob for manual control and fine tuning, eight programmable memories, and a 10-segment LED bar. Memory backup and a built-in serial computer interface are included.

One of the most interesting new products is the SWR-121 HF Antenna Analyst, AEA's answer to MFJ's line of SWR Analyzers™. The SWR-121's key selling point is its ability to produce a graphic screen display of your HF antenna's performance over its operating spectrum, showing SWR versus frequency. The display also gives SWR and return loss at the antenna's center frequency. The unit also can be used to test coax by measuring return loss. An RS-232 interface allows for remote control, remote display, and saving of plots. The operating range is 1 to 32 MHz.

For a free catalog and pricing information, contact Advanced Electronic Applications, Inc., P.O. Box C2160, 2006 196th St. S.W., Lynnwood, WA 98036 (206-774-5554).

Soft Topix

Ham Companion. Ham Companion™ is basically a propagation prediction program, but in reality it's a graphical, multi-purpose hamshack software package with many other features. Offered by Brinson Microware™, it features graphs for MUF, lowest usable frequency (LUF), and frequency of optimum transmission (FOT) that you can update with WWV sunspot number or solar flux information. You can view the graphs as they are displayed, or print them for future reference. With current propagation information at hand, you can see which bands are open to your favorite locations.

Besides propagation features, Ham Companion has color world maps that display time zones, short- and long-path bearings, distances, graylines, and more. You have the ability to zoom in on various locations with four levels of zooming, call up geographic data on pull-down menu, cross-reference prefixes and DX countries, look up Q-signals and Zones, and update databases with your own information. Over 100,000 locations around the world, including islands and island groups and U.S. military bases, are depicted. Various information pop-ups are available, including the DXCC countries list, prefixes, Morse code, the phonetic alphabet, conversion tables, and more.

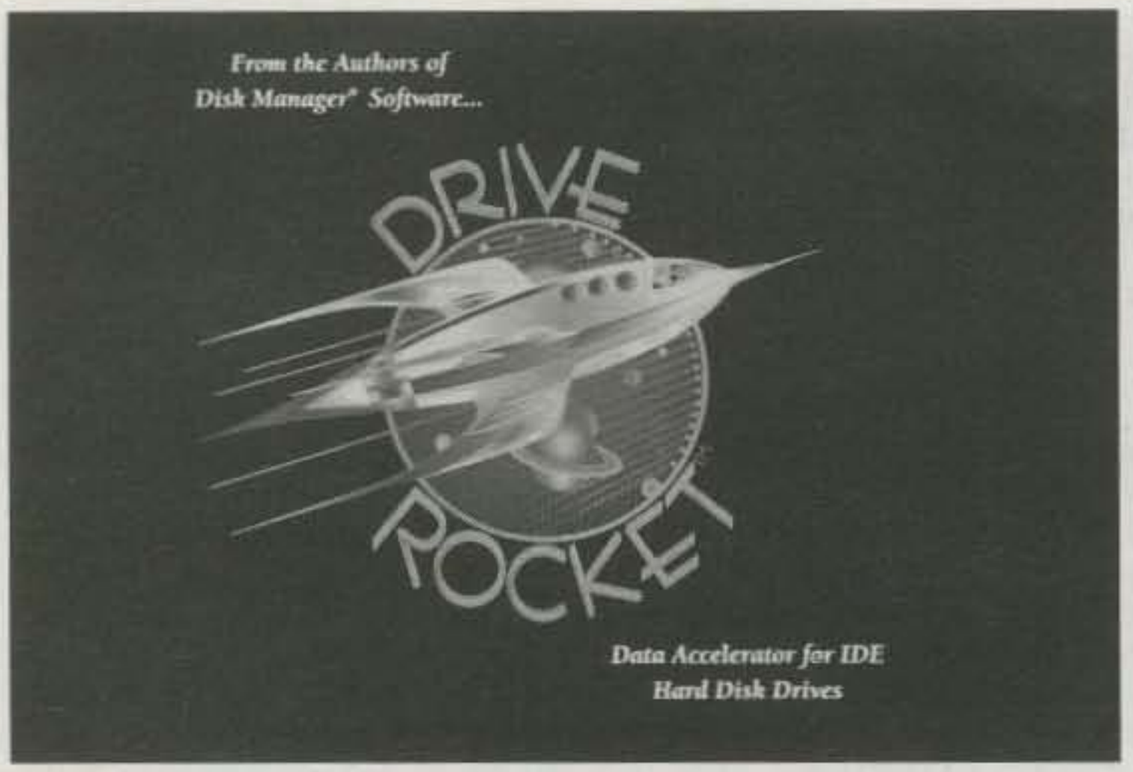
Ham Companion is $79.95 plus $5 ground shipping from Brinson Microware Corporation, 114 S.E. 4th St., Mooreland, OK 73852 (1-800-874-0771).

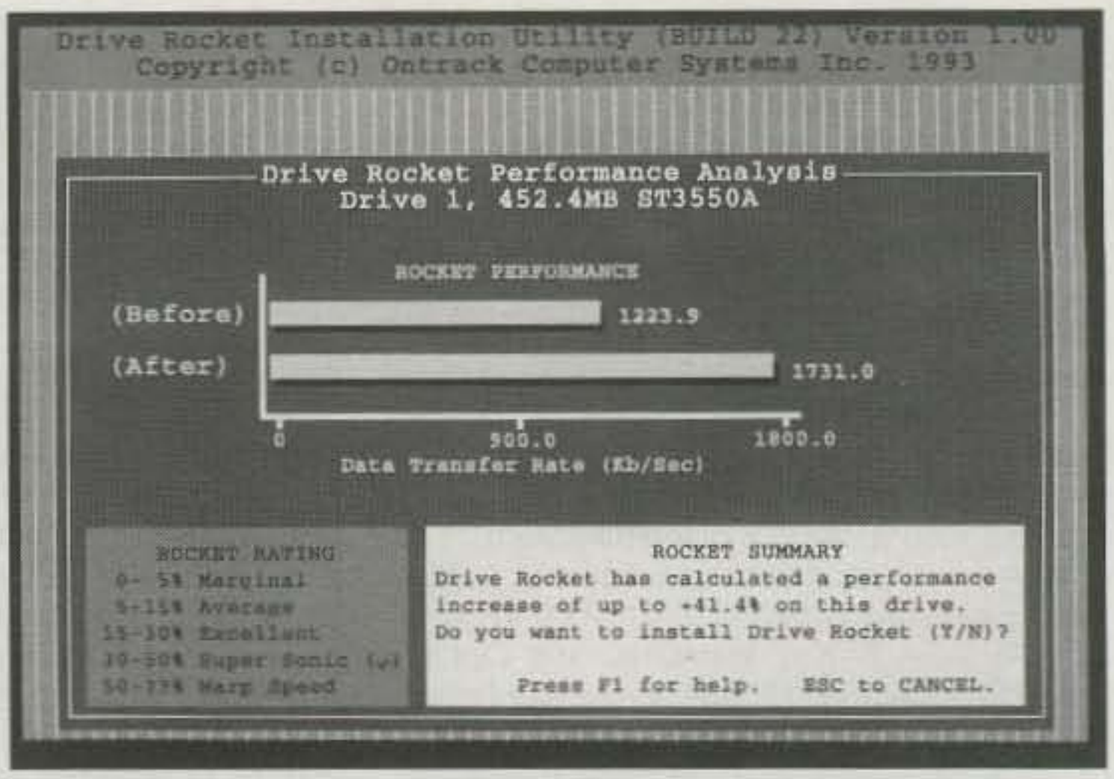
CAPMAN. Is a specialized propagation program more your style? Jim Tabor, KU5S, and Don Lucas, WØOMI, have introduced a comprehensive propagation analysis and prediction program known as CAPMAN, short for Computer Assisted Prediction Manager.

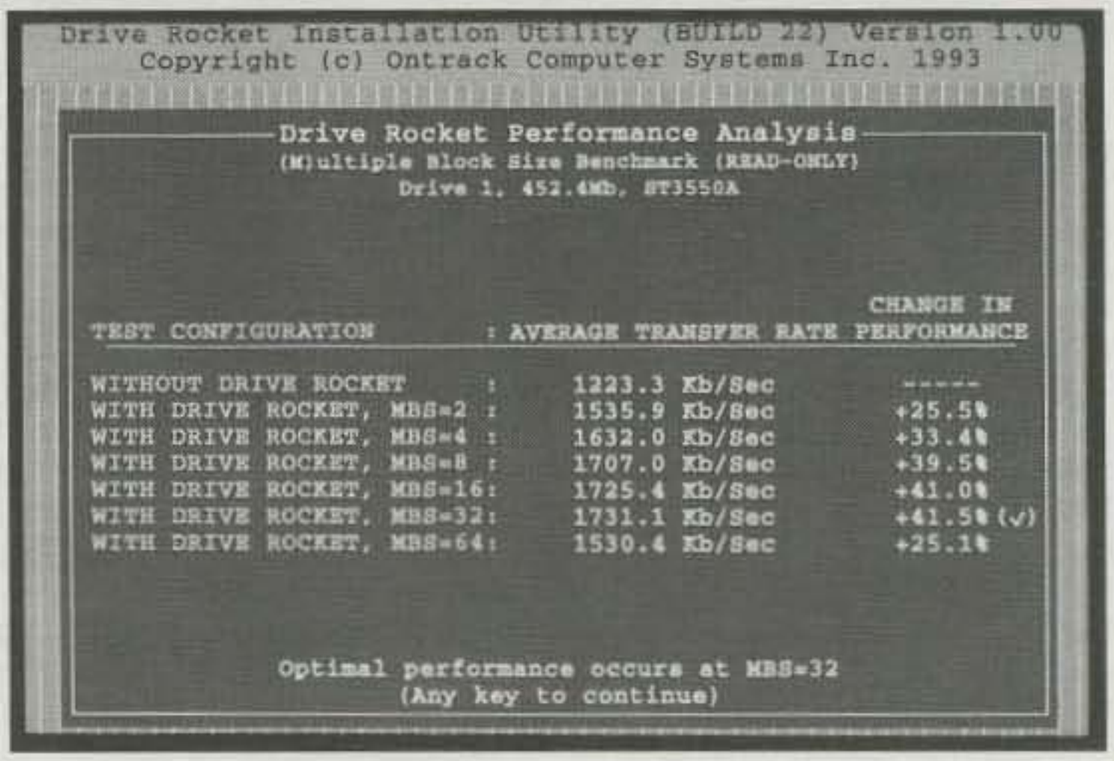
CAPMAN is a mouse-driven propagation package developed by the prime author of IonCAP (Ionospheric Communications Analysis and Prediction Program). As many *CQ* readers know, IonCAP is a standard by which other propagation prediction programs are judged. Until now, IonCAP has been notorious for being difficult to learn and cumbersome to use, but the new CAPMAN software is designed to overcome those problems while offering new features.

Although CAPMAN supports a large library of antennas, you can use MININEC or Elnec antenna analysis data to assist in generating your predictions. The program authors also say that for the first time you can configure the predictions to your own station qualities and play "what if" with antennas, besides tweaking power and other parameters.

The CAPMAN package allows complete customization for your own station, and a full-featured location database provides access to over 490 ITU prefixes. You can create input records and files for performing custom predictions. The choices of output include maximum usable frequency (MUF), frequency of optimum transmission (FOT), signal-to-noise







(Upper left)- Drive Rocket effectively speeds up your PC's hard drive. The device driver increases the rate at which most IDE drives transfer data so that your drive processes data at a higher level of performance. (Photo courtesy Ontrack Computer Systems)

(Upper right)- In the "Easy Installation Mode" Drive Rocket automatically tests and analyzes your system. The installed driver is compatible with all versions of DOS and Windows, as well as most disk cache, disk compression, and disk management utilities. (Photo courtesy Ontrack Computer Systems)

(Lower right)- Drive Rocket enables your IDE drive to read or write multiple sectors of data at one time, instead of one sector at a time, in what's known as block or multiple mode, to increase the data transfer rate. The driver's Multiple Block Size (MBS) analysis shows the percentage of performance increase with different MBS values. (Photo courtesy Ontrack Computer Systems)

(S/N) ratio, reliability, service probability, angles of takeoff and arrival, field strength, modes of propagation, and more. Various graphing functions are available.

CAPMAN incorporates the latest full commercial version of IonCAP, as used by over 450 government agencies and communications departments in the USA and more than 100 other countries. CAPMAN is a 32-bit program and requires an IBM PC or compatible with an 80386 or higher microprocessor. It's $89 postpaid in the U.S. from LUCAS Radio/Kangaroo Tabor Software, 2900 Valmont Road, Suite "H," Boulder, CO 80301 (303-494-4647).

NEC/Wires 1.0. Brian Beezley, K6STI, is well known for his antenna modeling and design software. One relatively new product that we described in a recent column is NEC/Yagis 2.0. As we noted then, NEC/Yagis provides high-accuracy analysis of Yagi antennas with the professional-standard Numerical Electromagnetics Code (NEC). The amateur version is $100. The professional version, NEC/Yagis-Professional, is $300.

Brian now also offers NEC/Wires 1.0. This implementation of the powerful and sophisticated NEC model is the first offered to amateurs for modeling general antennas made of wire or tubing. The NEC program, which is not a miniature version of another modeling program, has a modeling capacity several times greater than that of any MININEC-based program, runs much faster, and for most models is considerably more accurate. The new program is said to be the only antenna modeling program that can accurately calculate conductor and ground losses, input impedance, and gain for antennas close to earth.

NEC/Wires 1.0 reads AO and MN antenna files (as generated by two other of Brian's programs) so it's easy to analyze existing models. The program features automatic wire segmentation, symbolic dimensions, symbolic expressions, voltage or current sources, and much more. NEC plots azimuth and elevation patterns in polar and rectangular coordinates; you can overlay patterns for comparison. High-resolution color plots are available for producing hardcopy on dot matrix or laser printers.

The amateur version handles 1000 segments and is $100; a commercial version handles 1500 segments and is $150. For more information, contact Brian Beezley, K6STI, 507½ Taylor, Vista, CA 92084 (619-945-9824).

Drive Rocket™. If you're at all like me, you're always trying to figure ways to make your PC run "faster." Mostly, these efforts take the form of trying out various disk caches to take the load off of the PC's relatively slow hard disk and put it on the PC's much faster memory chips. Now there's another approach you can take.

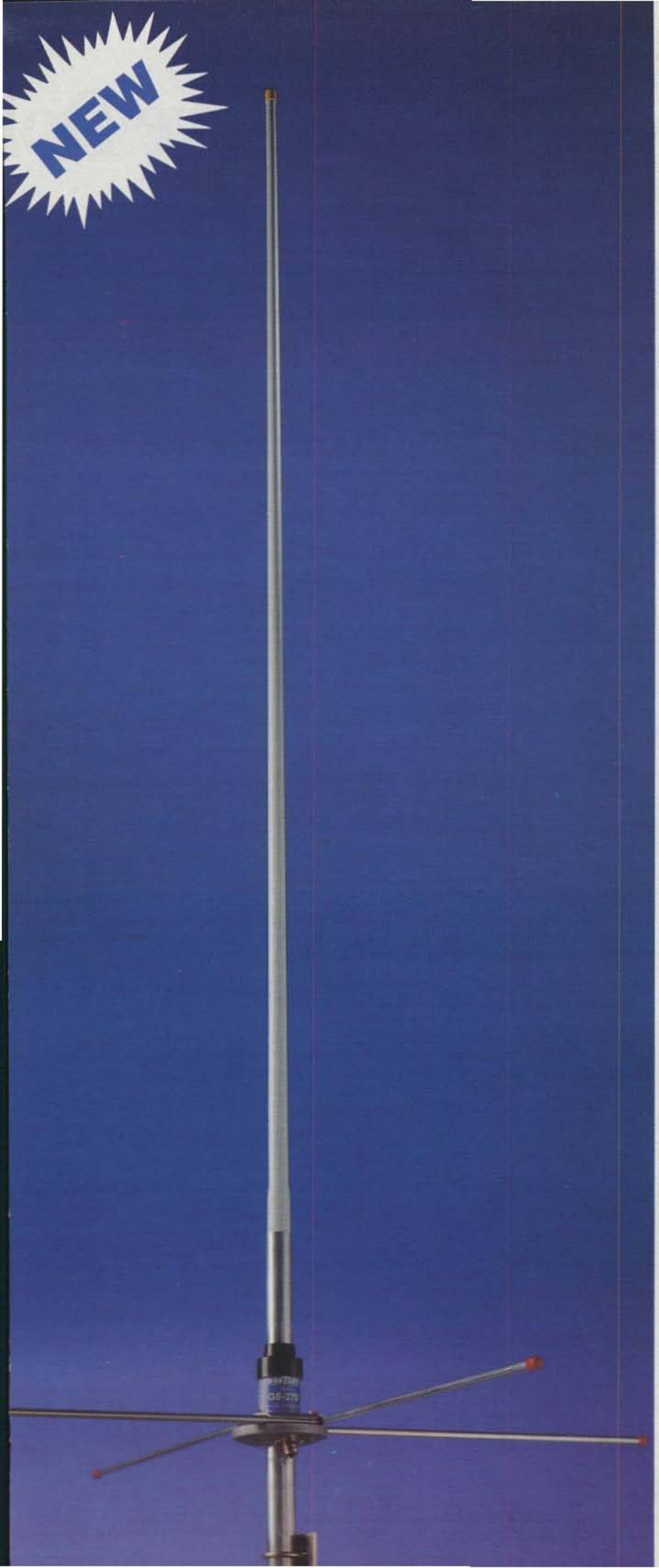
A unique PC utility product that adds speed to the hard drive itself has been introduced by Ontrack Computer Systems. The product takes the form of a device driver that increases the rate at which IDE drives process data so that your drive handles data at the maximum possible performance level.

The new Drive Rocket ™ data accelerator software is for IDE AT-interface hard drives. By boosting the rate at which the drive reads and writes data, the driver can significantly increase the effective speed at which data are processed. Ontrack's lab tests reportedly produced an average improvement in data transfer rate of 47 percent, with some drives performing more than 80 percent faster than previously.

The software package consists of drive benchmark and driver installation software, as well as the device driver itself. The driver increases the data transfer rate by enabling the IDE drive to read or write *multiple* sectors of data at one time, instead of one sector at a time. This faster transfer method between the host computer and the hard disk reduces the number of interrupts required, thereby increasing the data transfer rate.

Drive Rocket is compatible with all versions of DOS and Windows, as well as most disk cache, disk compression, and disk management utilities. The installation software automatically checks each drive to verify that it's supported, and it also runs a performance analysis which includes a graphical display showing the percentage of increase you can expect on your system. The program is priced at $39.95.

Does Drive Rocket work? Yes, indeed, though you should have an IDE drive greater than 80 MB in capacity. On my already fast (66 MHz) Gateway 80486DX2 system, however, the performance increase was only 18 percent. The good news is that you can check out the expected performance on your own computer system by downloading a performance-evaluation program from Ontrack's BBS and running



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The high performance of our well known G6-144 and G6-440 are combined in our new 2 meter/440 dual band vertical, model G6-270R.

A sleek, one piece tapered fiberglass radome eliminates the intermodulation and mechanical problems associated with two and three piece UHF radome designs.

Made in the U.S.A. of high quality American materials, the G6-270R offers 6 dBd gain (8.1 dbi)on both bands for outstanding fringe area performance.

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Model G6-270

Specifications:

Gain:	6 db VHF 6 db UHF
Bandwidth:	10 MHz UHF 3MHz VHF
Design:	4x5/8 wave collinear 440 5/8 over 5/8 collinear 2 meters Shunt fed-DC ground
Length:	100 inches
Weight:	6 lbs
Wind Survival:	100 mph
Mounting:	Includes hardware for 1-1/2" dia. mounting mast Mounting plate will accept 2" U-bolts, not included.
Termination:	Type N female

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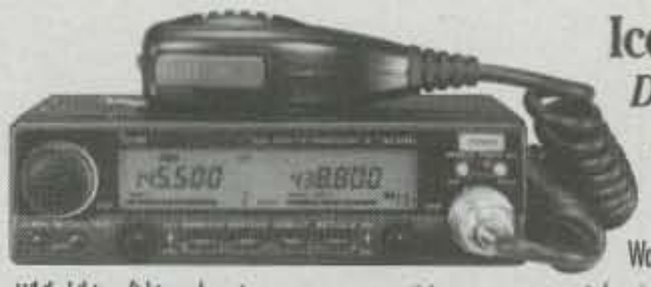
This high gain, wide band VHF/UHF antenna is excellent for DXing, Amateur Radio, FM broadcast, scanners, VHF/UHF television, government, cellular, and business band use. Covers all frequencies from 105 to 1300 MHz with outstanding performance such as forward gain of 10 to 12 dB and VSWR of 2.0:1 or less. Compact and lightweight, all aluminum design with multi purpose horizontal or vertical mounting. Comprised of 23 elements with a boom of 4.6 ft and the longest element of 4.6 ft. If you are thinking about getting your license and want only one antenna for both scanner and amateur radio use, get it all with this great antenna!
Also Available: CLP 5130 w/6m $299



Icom IC-3230H
Dual Band
Mobile
(2m/440 MHz)
Was ~~$699~~ Now **$639**

While hiking, fishing, shopping or any remote activity, you can transmit/receive with your handheld through the IC-3230H in your vehicle. All of the power and features of the IC-3230H are in your hand! This revolutionary dual band mobile is fully remotable with the optional UT-55 from its mic or any handheld with DTMF. The UT-66 option will announce the frequency back over the HT! Cross band repeat enables you to receive a signal on one band and re-transmit on the other. This allows your mono-band handheld to operate on another band, while extending your range. The IC-3230H also has full duplex, 36 memory channels and 14 auto dialing memories. 5.5" x 1.6" x 6.5".

Hurry! Order before new F.C.C. scanner law takes effect in April!

Icom IC-R1 $479
.1-1300 MHz Handheld
Communications Receiver

The IC-R1 is the ultimate in miniaturization in a hand-held communications receiver and our best seller! It covers 100 kHz to 1300 MHz continuously (no gaps) with AM, FM and Wide FM modes. Features include: 100 memory channels, several scanning modes, sleep timer, low battery indicator, and several battery power options (listed below). Comes complete with wall charger, flexible antenna and belt clip. The built-in internal NiCad battery lasts about 3 to 4 hours, the various battery options last much longer (BP-84 10 to 12 hrs.) Measures only 1.9" x 4" x 1.4" and weighs only 9.9 oz.

Alinco DJ-G1T
2M Handheld
Reg. ~~$339~~ Coupon Special **$309**

Export Sales Welcome!

This new handheld from Alinco features the unique Channel Scope that shows the signal strengths of 7 frequencies simultaneously! You can monitor either VFO frequencies or keep track of local repeater frequencies in memory. This is Alinco's most advanced handheld with 2m wide (108 to 174 MHz) and 440 MHz dual receive coverage. 80 memory channels come standard with 39 CTCSS tones, DTMF squelch, 2 types of priority watch, 6 scan types, illuminated keypad and an on air/busy lamp. The DJ-G1T takes you into a new age of 2m operation!

Hustler G7-144
2m Vertical
$129

- 7 dB maximum effective gain provides more consistent pattern-even in marginal areas
- Extremely low angle stacked 5/8 wave radiators provide superior gain
- Harsh environments do not affect mechanical or signal integrity
- High strength aluminum and fiberglass construction for all-weather durability
- 1 kW power capability, less than 2:1 SWR over 3 MHz bandwidth
- 15' 4" long, 10 pounds
- "N" connector

Icom IC-T21A
2m Handheld w/440 MHz
Receive
$329

The ultimate in 2m handhelds! 2m transceive and 440 MHz receive permit full duplex operation. The exclusive whisper mode allows telephone-like conversations while in duplex mode. The large display and backlit keypad provide ease of use. The new SC-1257 power module delivers a powerful 6 W of output power with 13.5 VDC- another Icom first! Up to 6 hours of operation time is possible with its power-saving features. Tone scan automatically selects subaudible repeater tones, 114 memory channels store all necessary repeater settings and 5 DTMF memories allow for easy dialing of your favorite phone numbers from an autopatch. This radio even scans 3 to 4 times faster than most other handhelds! Step up to the new Icom T21A today! Also available: T41A, 440 MHz version. Call for price and availability.

Kantronics KPC-3 *Packet TNC* $117
The KPC-3 is a small-sized, low power, full featured packet TNC designed with the new user in mind while providing all the power required by experienced packet radio operators. The KPC-3 incorporates the Kantronics full-featured PBBS, including reverse forwarding to a BBS, mail waiting LED, and remote sysop access. It comes complete with version 5.0 firmware, DB-9 connector, 2.1mm power connector, and two manuals: one a quick-start manual, the other a complete reference manual. Measures 0.8" x 5.2" x 5.2" and requires 6-25 VDC at only 40 mA max.

Alinco DR130T *High Power 2m FM Mobile*
Reg. ~~$329~~ Coupon Special **$309**

The DR130T is a powerful 2-meter mobile boasting 50 watts in high power transmit. Now, reaching those distant repeaters is no problem, and its compact size is ideal for even the tightest mobile installation applications. The DR-130T is loaded with great features like 20 memory channels (expandable to 100 memory channels w/optional EJ-19U memory expansion unit), user programmable transmitter time out timer, CTCSS encoder standard (optional EJ-20U tone squelch unit is also available), priority scan, memory scan & VFO scan, and much, much more.

Prices Limited To Stock On Hand

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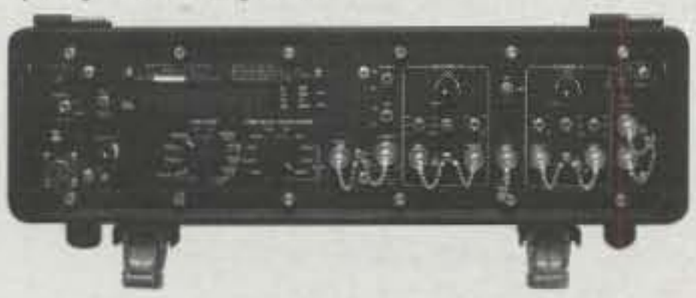
Ballantine 9648M

Portable Universal Counter $299

Portable, solid-state, general purpose Universal Counter. Frequency range: 0.1 Hz to 550 MHz; period range: 100 nS to 109 S. Frequency of a burst signal may be measured as easily as that of a CW signal. Loaded with features including autoranging, 9-digit, high intensity LED display, and eleven measurement modes which ensures the ability to measure just about all parameters of time. A, B, and C inputs provide versatility. Sensitivity on C input (sine wave) is as follows: 30 mV rms (30 to 100 MHz, 15 mV rms (100 to 450 MHz), and 25 mV rms (450 to 500 MHz). Built rugged to meet military specifications, this counter is enclosed in a combination case/lid that provides water and explosion proofing as well as shielding from EMI.



Hewlett Packard 8405A

Vector Voltmeter $995

The HP 8405A Vector Voltmeter measures voltage vectors described by both magnitude and phase, 2 channels allows for ratio measurements. Measurement capabilities include insertion loss and group delay of passband-filters and other transmission devices, gain and phase margin of amplifiers, complex impedance of mixers, antennas, etc in the frequency range of 1 to 1000 MHz. Gain or loss in excess of 90 dB and phase measurements with 0.1° resolution over a 360° phase range are possible. Comes standard with BNC adapters only.

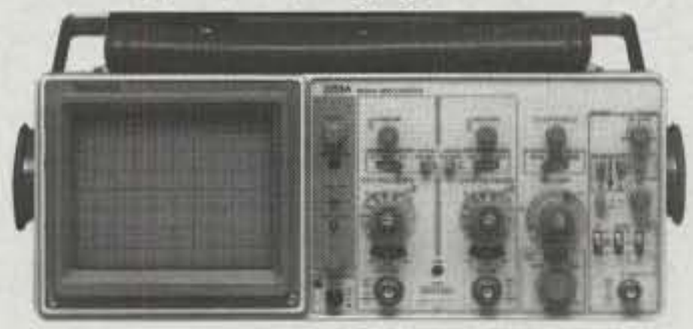
All Instruments Come With Manuals & Are Pre-Owned & Completely Operational Unless Otherwise Stated.

TV SYNC

Tektronix 2213A $750

60 MHz Dual Trace Oscilloscope

The 2213A's single time base delay provides the user with the performance of intensified and delayed sweep operations at a low price. Lightweight, 60 MHz bandwidth. Provides advanced triggering capabilities, sensitivity to 2 mV/div, and sweep speeds to 50 nS/div (plus X10 magnification). Triggering features include variable trigger holdoff, TV line, & TV field at any sweep speed, and peak to peak auto mode; will trigger alternately even with unrelated signals. Features also include Z-axis input, X-Y operation, and large, bright CRT.



General Radio 1310A

Audio Oscillator $199

Small solid-state unit. Frequency range of 2 Hz to 2 MHz. Up to 20 volts(160 mW) output into 600 Ω; Distortion < 0.25%. Impedance: 600 Ω, one terminal grounded.

Riser-Bond 2901B+ $895

Digital Time Domain Reflectometer

Locates faults in all types of metallic paired cable and displays distance directly on 4 1/2-digit liquid crystal display. Ranges: 15 nS pulse out, readability to 1,100 feet, 15 feet minimum and 125 nS pulse out, readability to 11,000 feet, 100 feet minimum; Accuracy: ± 1 %. Dynamic Range: 20 dBRL to 40 dBRL. Ability to display signal on an oscilloscope via a BNC output. Powered Cable, Open/Short, Low Battery, and Feet/Meter indicators. Light weight and rugged packaging with rechargeable NiCad batteries.

30 DAY RETURN POLICY
SATISFACTION GUARANTEED
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Vector Voltmeter System $795

Here's an easy way to measures the amplitude and phase relationship of two RF voltages. Frequency range from 1.5 MHz to 2.4 GHz. Sensitivity is -65 dBm. Incorporates twenty-three position range switch, selects overlapping bandwidths, fine tuning is fully automatic. Includes 0 to 1 V recorder output. Equipped with the S3 Sampling Head.

General Radio 1650A

Impedance Bridge $395

Self-contained impedance-measuring system for capacitance, resistance and inductance. Frequency of 20 Hz to 20 kHz, internal 1 kHz and DC. Resistance ranges: 1 mΩ to 11 MΩ; Capacitance: 1 pF to 1100 μF; Inductance: 1 μH to 1100 H. Basic accuracy of ±1%. Internal null meter or external readout possible.

Military USM390

Signal Generator $795

This late model, solid-state Signal Generator can fulfill many applications by providing calibrated test signals at any frequency from 1 to 1000 MHz. CW, Sine, Square, and Pulse outputs are available with output level continuously variable over an 80 dB range (-70 dB to +10 dB). A whip antenna is also furnished for use in checking radio receivers. This unit will operate from either 115 or 230 VAC (50 to 400 HZ) or an internal 28 V battery for field use. To protect during transportation and storage, the USM 390 is enclosed in a rugged, waterproof carrying case with cover.

RF Connector Adapter Kit $99.95

Contains 2 Pieces of Each: BNC Female, BNC Male, TNC Female, TNC Male, 'N' Female, 'N' Male, UHF Female, UHF Male, Mini UHF Female, Mini UHF Male, SMA Male, SMA Female, RCA Female, RCA Male, 'F' Female, 'F' Male, and 8 pcs Universal Adapter. Makes any interseries adapter you need. Silver Plated, Gold Contacts, Teflon Insulation. Comes complete in padded soft, zippered carrying case.

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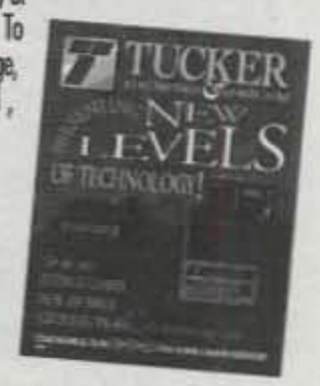

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CIRCLE 163 ON READER SERVICE CARD

it on your system, *before* purchasing Drive Rocket. To do so, call the Ontrack BBS at 612-937-0860 and download the program "RKT-TST."

For more information, contact Ontrack Computer Systems, 6321 Bury Drive, Eden Prairie, MN 55346 (1-800-752-1333).

Booklist Update

PolyPhaser Lightning Grounds Book. The most important single element determining the effectiveness of most lightning protection equipment and devices is the integrity of the ground to which they are connected. However, many amateurs don't realize that there are big differences in grounds for RF grounding and RFI suppression, power returns, and lightning protection. A "good ground" for one purpose may not be good for another. A ground for RF effectively takes the place of "the other half" of a normal dipole (as in a ground plane antenna) and often helps improve station efficiency and RFI suppression.

A second type of ground is the return or safety ground for electrical ground faults. This is a good ground for low AC frequencies but is not necessarily a good ground for either RF or lightning. The third type is the lightning ground, which must be capable of handling high but short-duration currents.

Grounding, especially for lightning protection purposes, is so important that PolyPhaser wrote a book about it. They offer Roger R. Block's 95-page, 8½" × 11" reference book, *The "Grounds" for Lightning & EMP Protection*, Second Edition. It features comprehensive information on proper techniques for grounding and protection against lightning, especially in a radio communications context. Though the $22.95 book primarily describes commercial installations, it's written in an easily understandable, nontechnical manner.

The book is described in PolyPhaser Corporation's free Lightning/EMP and Grounding Solutions catalog, a valuable reference for lightning suppressors and protectors, grounding products, and test equipment. Several pages are devoted to lightning protection and grounding information.

Contact PolyPhaser Corporation, 2225 Park Place, P.O. Box 9000, Minden, NV 89423-9000 (1-800-325-7170).

1994 World Satellite Catalog. If your interest in earth-orbiting satellites is broader than just amateur satellites, ask for a copy of the "MLE 1994 World Satellite Catalog."

The updated catalog describes the company's extensive book and videotape offerings, which collectively explain, footprint, index, and analyze the world's communications satellites. Several brand new products are offered, including the *World Satellite Installation Manual* and the *1994 Asia/Pacific Satellite Business Directory*. Other books and directories include the *World Satellite Encyclopaedia; World Satellite Almanac; World Satellite Annual; Inclined Orbit Satellite Tracking Guidebook; Hidden Signals on Satellite TV;* and many others. Software programs and videotapes also are available to help with tasks such as designing and installing your own satellite receiving system.

For a free MLE catalog, contact Mark Long Enterprises, Inc., P.O. Box 159, Dept. C, Winter Beach, FL 32971 (FAX only at 407-589-9411).

Great Radio Reads Update. In the May 1993 issue we discussed a new Tiare book by Robert J. Halprin, K1XA, *Ham Radio Contesting*. This $14.95 book was a comprehensive "how-to" treatment on the art of contesting.

Bob now has done a second book for Tiare, *The Code Book: Amateur Radio CW Operating*. In it he takes the interesting position that what could be more "high tech" than CW communications, with its "direct digital input to the brain by way of neurological audio ports"? As such, *The Code Book* is a tribute to the oldest wireless communications mode, and is a practical guide for those who want to make Morse code a bigger part of their operating scheme. Besides discussing the Morse code as a language, the Halprin book provides a wealth of useful information about ways to learn CW, and it includes several chapters on how to get the most out of amateur radio CW. It's $17.95 plus $2 shipping.

Gerry L. Dexter, who operates Tiare Publications, is a prolific writer who writes regularly for *CQ*'s sister publication *Popular Communications*. Gerry offers a good selection of books on SWLing, scanner and utility monitoring, amateur radio, broadcasting, and related pursuits. The Tiare "Great Radio Reads" catalog is available for $1 from Tiare Publications, P.O. Box 493, Lake Geneva, WI 53147.

Wrapping Up

That's about it for this time. Next time more Antennas and Accessories topics of current interest. See you then.

Overheard: It's a fact—there's absolutely no job so simple or mundane that it can't be done wrong.

73, Karl, W8FX

2 METERS IN YOUR SHIRT POCKET!

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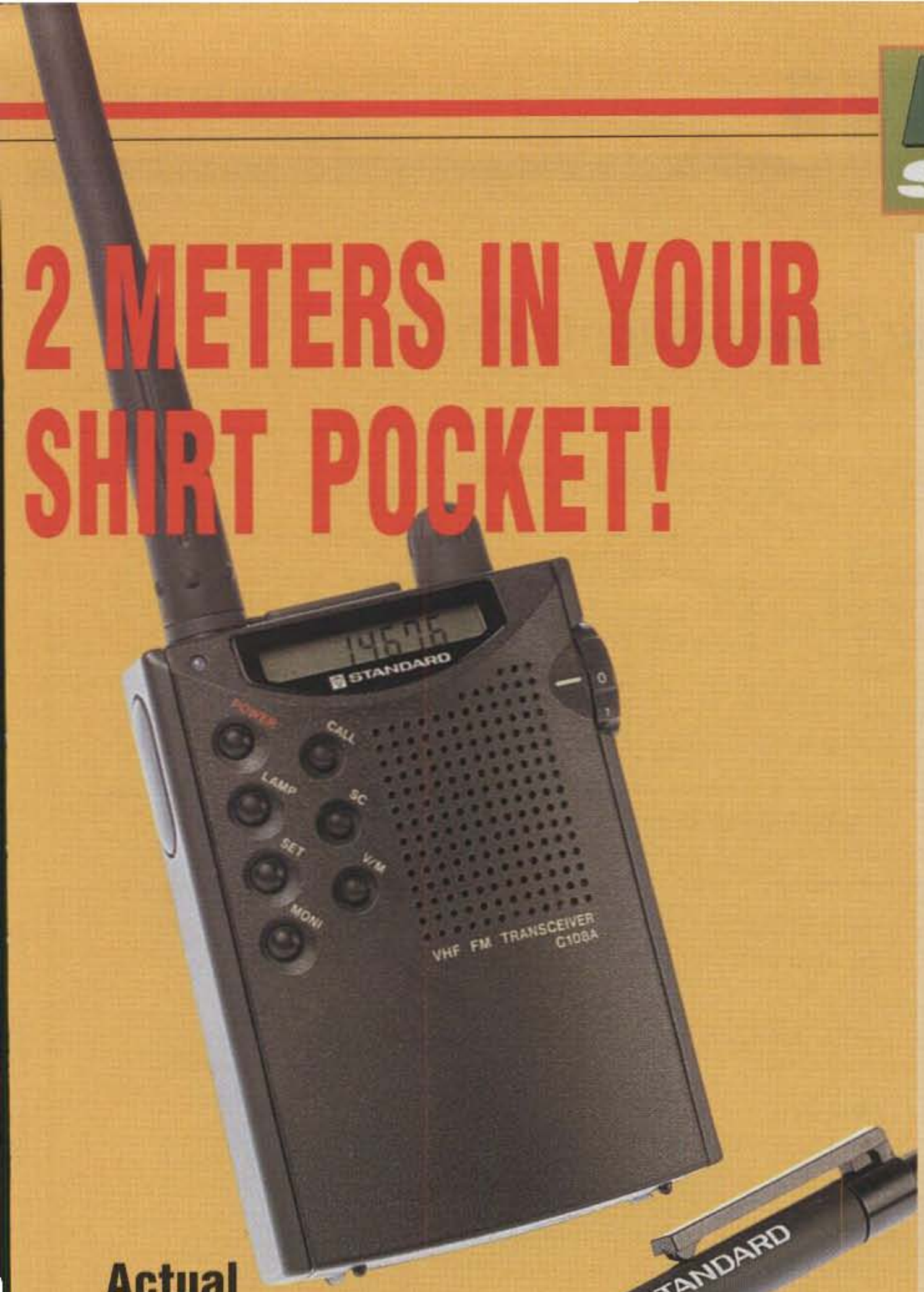

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MATH'S NOTES

BY IRWIN MATH, WA2NDM

WHAT'S NEW AND HOW TO USE IT

A Unique Power-Supply Chip

This column is sub-titled "What's New And How To Use It" and this month I would like to describe an unusual chip being offered by AT&T that is certainly new and unique—at least to me. I'll bet most readers are not aware that a company such as AT&T offers chips and related components for non-telephone applications as they do not normally sell through the usual component channels. They certainly do, however, and sometimes their offerings are quite unusual.

The ATT2405ABI is called an "off-line power suppy IC" by the manufacturer, and is supplied in an 8-pin DIP that can be connected directly to the AC power line to produce a regulated output of 5 to 24 volts DC at a load current of 50 milliamperes. A 100 milliampere version, identical in all other respects, is also available as the ATT2406ABI. What is unique about either chip is that they completely *replace* the transformer, rectifier, regulator, and other usual power supply components. That's right; you do not need any of those—very neat indeed! Furthermore, the output is regulated to ±5% and the input can be anything from 15 volts AC rms to 275 volts rms AC 50 or 60 Hz. This means the chip will operate from low AC voltages, a wide range of inexpensive plug-in adaptors, the 115 VAC line, and even a European 220 VAC line with no additional components or circuit value changes. In fact, the only drawback is that there is no isolation from the AC input line so an isolation transformer of some sort is a good idea.

Fig. 1 is the schematic of the typical hookup showing in block diagram form the operation of the internal circuit. The first half of the chip operates as a switching pre-regulator which allows C2 to charge to a level that is about 8 volts higher than the pre-selected output level. When this point is reached, the switch opens and C2 then discharges into the linear regulator, which is the second half of the chip. An internal band-gap voltage reference, coupled with the external sensing element, determines the actual output voltage. Capacitor C1 and resistor R1 form a low-pass filter to limit the rate of rise of the input voltage and R1 also provides a current limit on the input to prevent damage from overheating. Capacitor C3 is used for transient suppression, and C4 is the output filter capacitor.

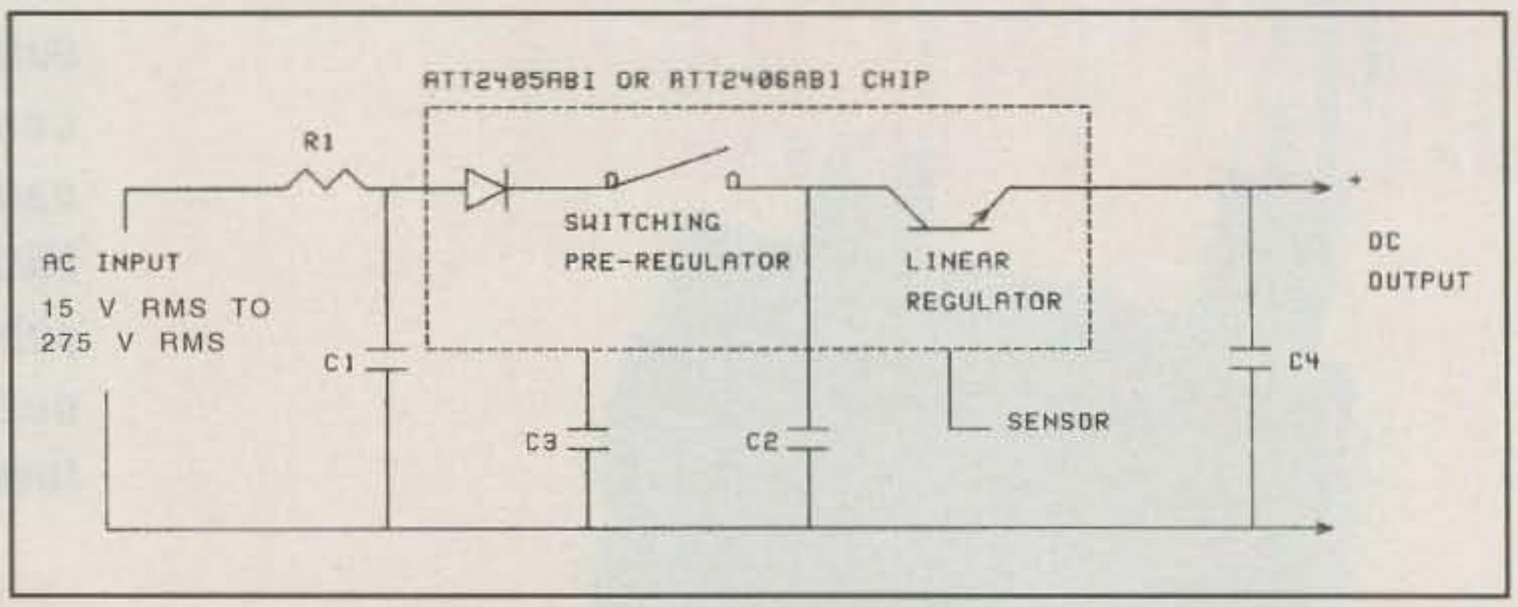
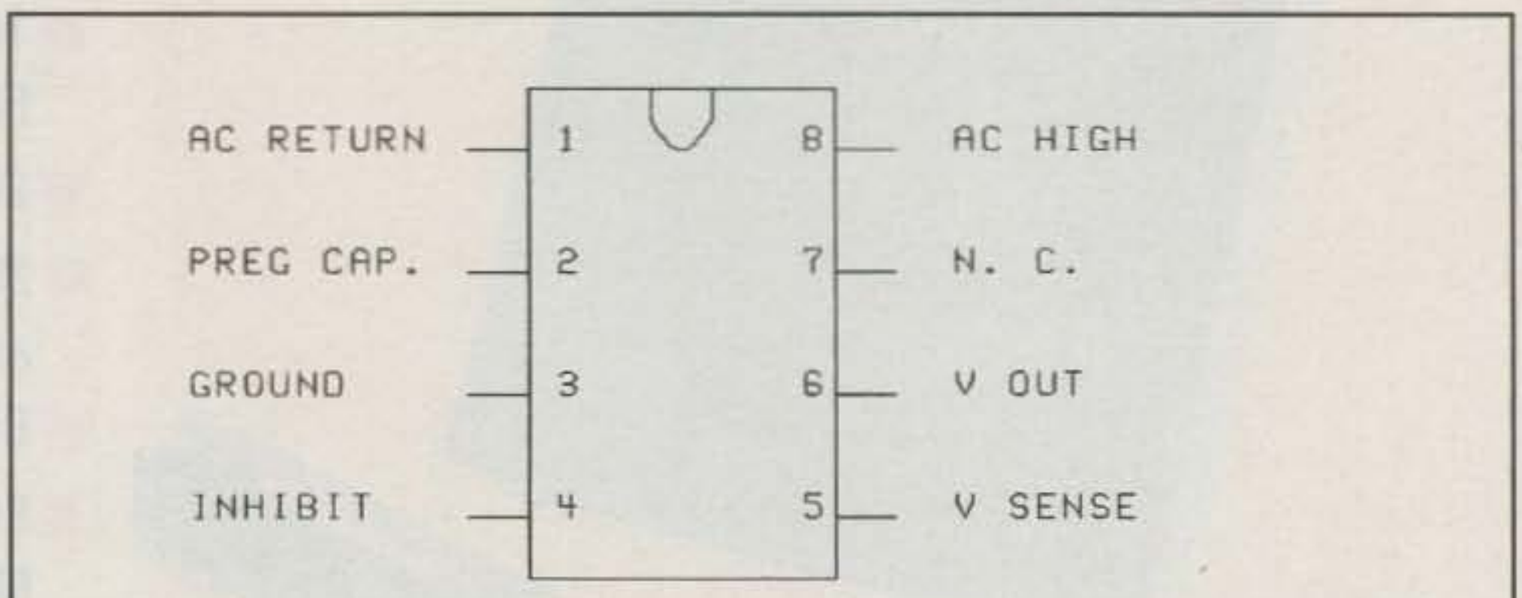


Fig. 1– Block diagram of ATT2405ABI/ 2406ABI operation.



PIN NO.	FUNCTION	DESCRIPTION
1	AC RETURN	POWER GROUND
2	PREREG CAP	C2
3	GROUND	CIRCUIT COMMON
4	INHIBIT	TRANSIENT SUPRESSION
5	V SENSE	SETS OUTPUT VOLTAGE
6	V OUT	DC OUTPUT VOLTAGE
7	N. C.	NO CONNECTION
8	AC HIGH	POWER INPUT

Fig. 2– Pin connections and functions.

Fig. 2 is a pin for pin description of the chip, and fig. 3 shows three ways to adjust the DC output level. You can use whatever method suits your application.

I am not certain what AT&T's policy is

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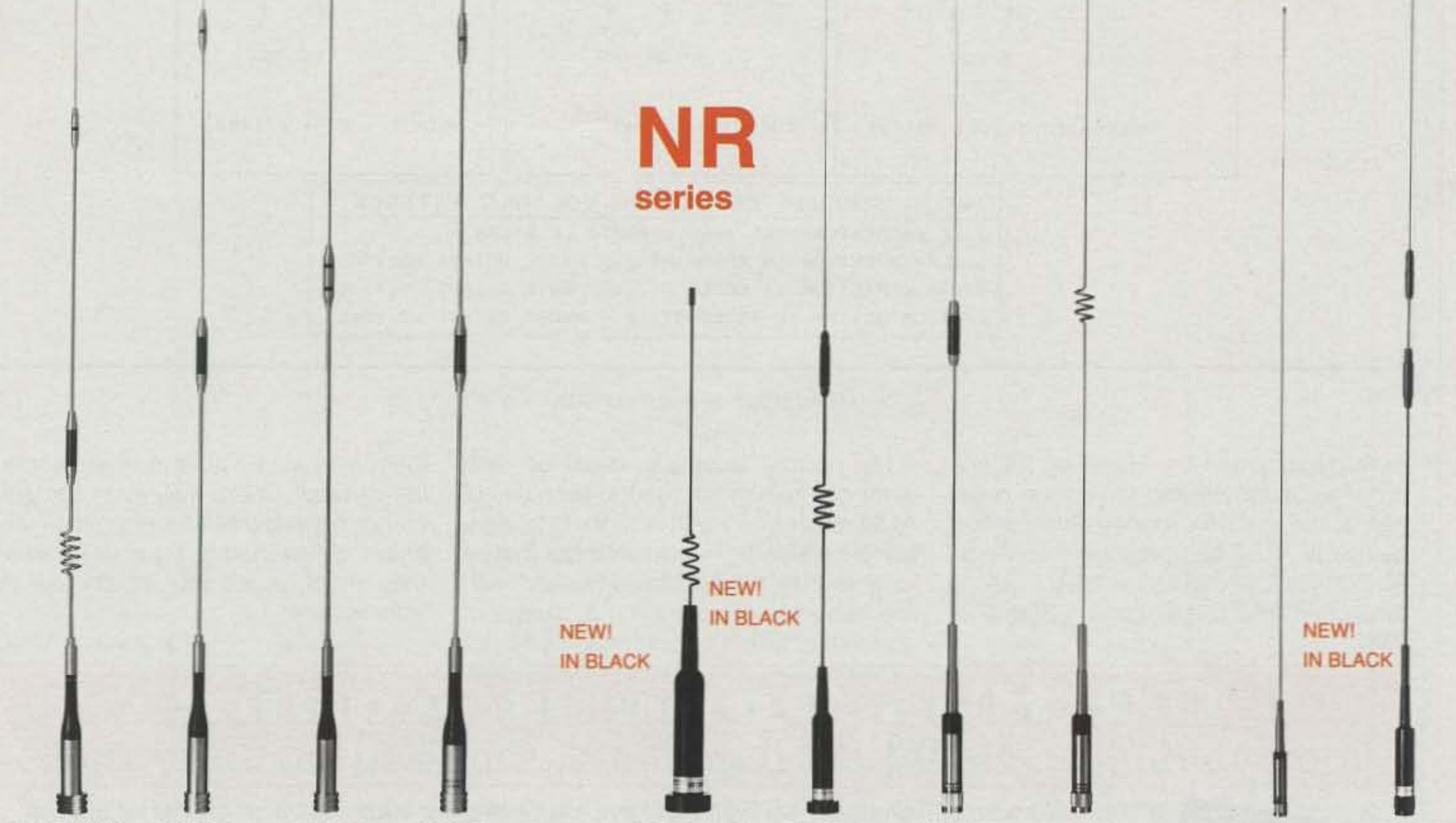

SG7200NMO SG7500 SG2000 SG7900 NR72BNMO NR73BNMO NR770R NR770H CR214S CR320A

NEW! IN BLACK (NR72BNMO)

NEW! IN BLACK (NR73BNMO)

NEW! IN BLACK (CR320A)

MODEL	BAND	GAIN(dBd)	POWER (w)	MOUNT	HT (IN)	ELEMENT PHASING
NR-72BNMO	2m/70cm	2.15	100	NMO	13.8	1/4 λ ,1/2 λ
NR-73BNMO	2m/70cm	2.15/5.3	100	NMO	33.5	1/2 λ ,2-5/8 λ
NR-770SA	2m/70cm	2.15/2.15	100	UHF	16.9	1/4 λ ,1/2 λ
NR-770HA	2m/70cm	3.0/5.5	200	UHF	40.2	1/2 λ ,2-5/8 λ
NR-770HNMO	2m/70cm	3.0/5.5	200	NMO	38.2	1/2 λ ,2-5/8 λ
NR-770RA	2m/70cm	3.0/5.5	200	UHF	38.6	1/2 λ ,2-5/8 λ
NR-790A	2m/70cm	4.5/7.2	120	UHF	57.5	6/8 λ ,3-5/8 λ
SG-7000	2m/70cm	2.15/3.8	100	UHF	18.5	1/4 λ ,6/8 λ
SG-7200NMO	2m/70cm	3.2/5.7	150	NMO	36.6	1/2 λ ,2-5/8 λ
SG-7500A	2m/70cm	3.5/6.0	150	UHF	40.6	1/2 λ ,2-5/8 λ

MODEL	BAND	GAIN(dBd)	POWER (w)	MOUNT	HT (IN)	ELEMENT PHASING
SG-7900	2m/70cm	5.0/7.6	150	UHF	62.2	7/8 λ ,3-5/8 λ
SG-2000	2m	5.2	150	UHF	62.6	7/8 λ
NR-140A	1-1/4m	3.8	100	UHF	36.2	5/8 λ
NR-124	23cm	8.4	100	N	25	4-5/8 λ
CR-214S	2m/1-1/4m	2.15/3.4	120	UHF	37	1/2 λ ,5/8 λ
CR-224A	2m/1-1/4m	5.0/6.0	150	UHF	68.5	7/8 λ ,2-5/8 λ
CR-320A	2m/1-1/4m/ 70cm	2.15/3.8/5.5	200/ 200/100	UHF	37.4	1/4 λ ,1/2 λ , 2-5/8 λ
NR-2000NA	2m/70cm/ 23cm	3.15/6.3/9.7	100	N	39	1/2 λ ,2-5/8 λ , 5-5/8 λ

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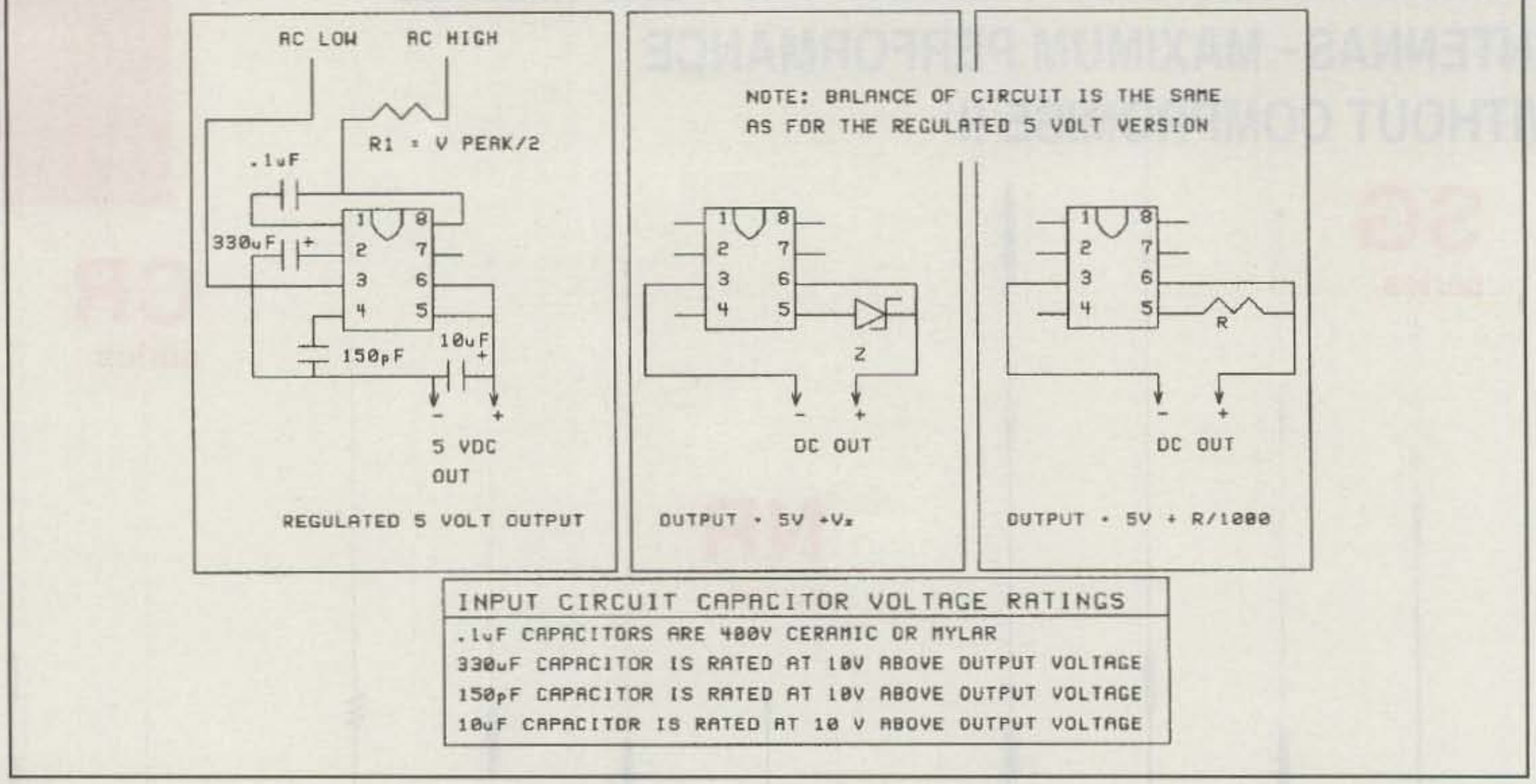

Fig. 3– Three ways to set the output voltage.

toward experimenters. However, the appropriate address and telephone number of the division responsible for the device is AT&T Microelectronics, Dept. AL-500404200, 555 Union Blvd., Allentown, PA 18103, telephone 1-800-372-2447.

My normal business dealings with other non-telephone related divisions of AT&T have been of the highest professional caliber, so I would estimate that as long as they are not "driven crazy" with idle requests or subject to a deluge of questions with no potential sales for them, you will be able to obtain some of the devices. There may even be some component distributors who stock these chips. Unfortunately, I do not know who they might be, so you are on your own with this one.

73, Irwin, WA2NDM

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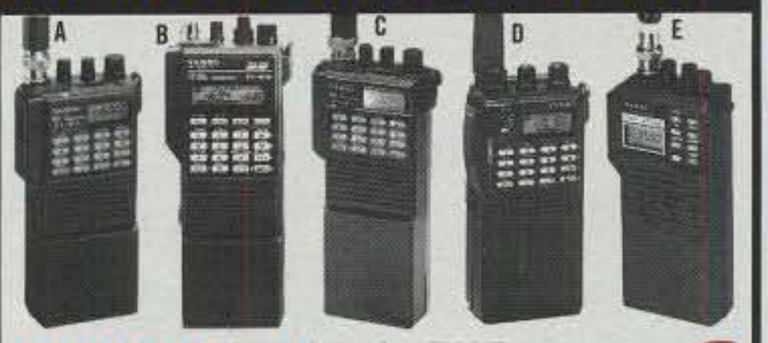

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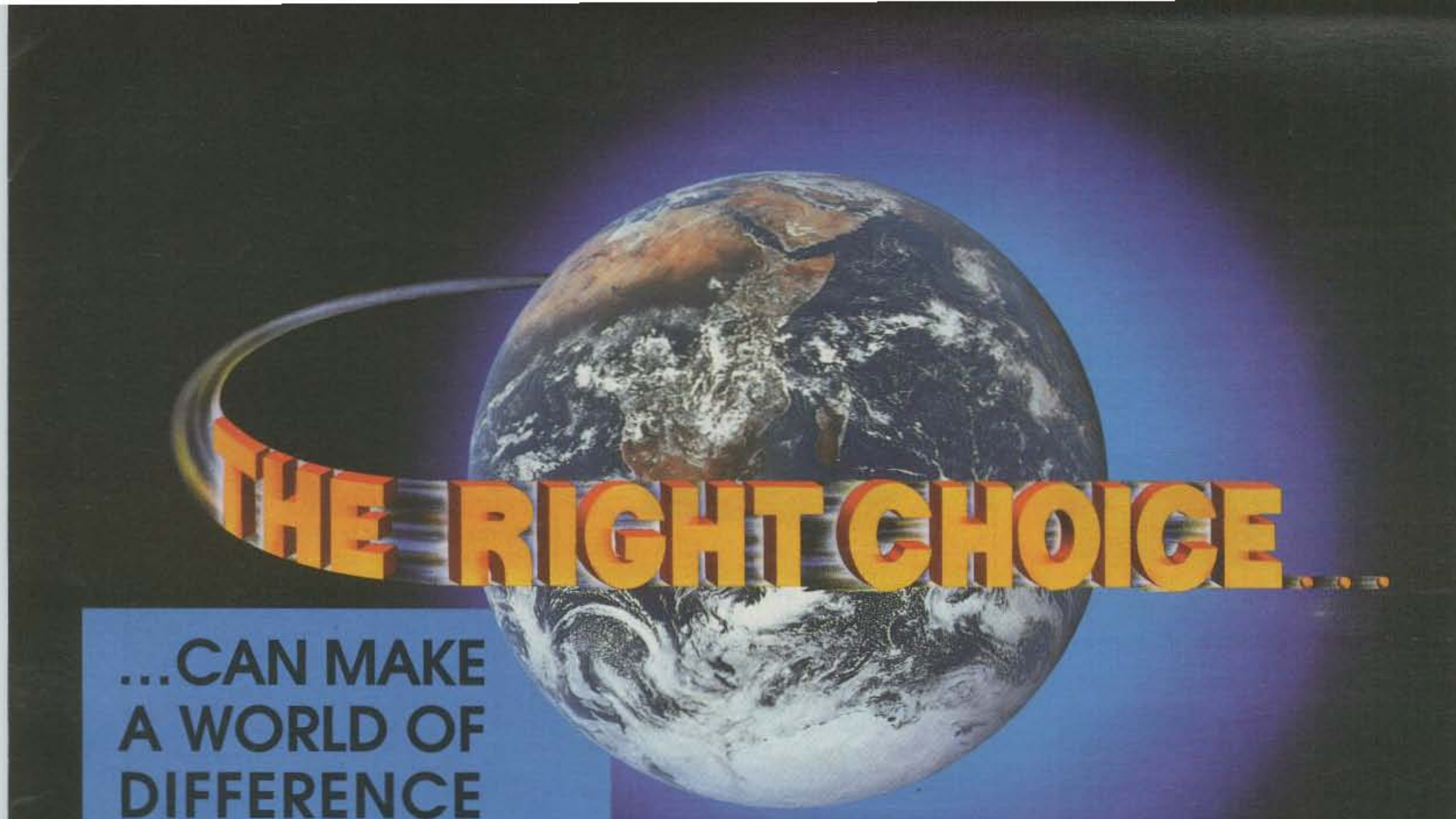

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DOUG'S DESK

BY DOUG DeMAW, W1FB

CONSTRUCTION PROJECTS, TECHNIQUES, AND THEORYs

Unstable Solid-State Amplifiers—Some Remedies

A dedicated experimenter whom I know once remarked, "It seems that my amplifiers always oscillate and my oscillators refuse to do that necessary task." I confess that this phenomenon has affected some of my circuits also, and it can tax one's patience. An oscillator that doesn't oscillate or an amplifier that does oscillate is affected by the feedback power in the circuit. Too little feedback prevents oscillation, whereas too much causes an amplifier to "take off." Excessive feedback power can spoil oscillator performance as well, causing squegging and the generation of spurious frequencies that are sometimes referred to as "frigglies" or "birdies." Oscillator problems are more easily resolved than those problems which plague amplifiers, since it's usually a matter of adjusting the feedback network to obtain the desired oscillator performance. Therefore, in this discussion we will look at the tougher problem of stabilizing solid-state amplifiers.

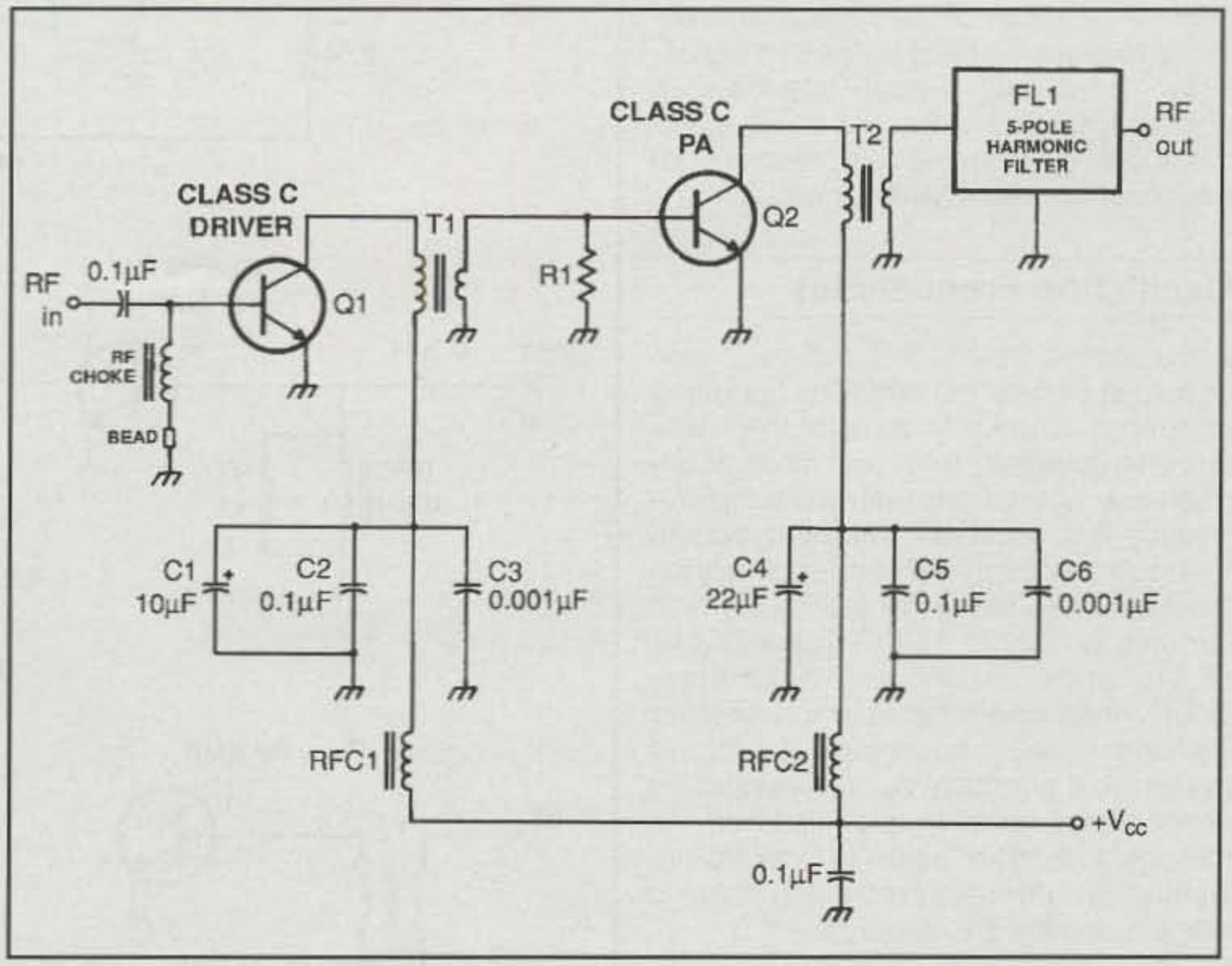


Fig. 1– Example of a two-stage RF amplifier that uses decoupling capacitors and RF chokes in the DC supply line. C1–C6 and RFC1, RFC2 are the decoupling components that prevent RF currents from flowing along the V_{cc} bus between the stages. The ferrite bead below the RF choke at Q1 lowers the choke Q to aid stability. R1 at Q2 serves the same purpose by reducing the T1 secondary Q.

What Causes Instability?

An ideal small- or large-signal RF amplifier would be unconditionally stable: It would not self-oscillate if its load was correct, open, shorted or somewhere between an open or shorted state. An ideal amplifier is difficult to design, especially if it is meant to operate over a broad range of frequency, such as from 1.8 through 30 MHz. Narrow-band multi-frequency amplifiers are the most difficult ones to tame when we decide to use bipolar transistors. This is because the transistor gain increases as the operating frequency is lowered. Hence, a given narrow-band amplifier might have 10 dB of gain at 30 MHz, whereas at 3.5 MHz it could rise to 20 dB or greater. The higher the circuit gain the more difficult it becomes to achieve stability. This is because the unwanted feedback power from the amplifier output to the input port has increased markedly, and this positive form of feedback causes self-oscillation. Positive feedback voltage is of the same phase at both amplifier ports. Negative feedback (180° out of phase) does not cause self-oscillation and is used in some designs to prevent instability. Positive feedback increases the amplifier gain, whereas negative feedback reduces the gain in proportion to the output power borrowed for use as feedback power. Most broadband amplifiers use negative feedback in one form or another, and this is why their efficiency is less than that of amplifiers that do not use feedback.

P.O. Box 250, Luther, MI 49656

The Usual Paths For Unwanted Feedback

Owing to the internal capacitances and resistances (i.e., collector to base) within a bipolar transistor, some output power is transferred back to the input circuit (base). In low-impedance circuits this may not create a problem because the amplitude of the feedback voltage is minimal. But if the amplifier is not terminated correctly, or if for some reason it is designed to look into a relatively high impedance, the demon of self-oscillation is likely to appear. It is easy to conclude that collector-to-base feedback should be okay, since those transistor terminals should be 180° out of phase. Unfortunately, the internal resistance can cause sufficient phase shift to allow positive feedback to occur. This problem is less likely to manifest itself when working with power FETs, because they have a lower internal resistance than their bipolar cousins. The internal capacitance is lower also.

Positive feedback can occur also via external routes, and this is usually the culprit when self-oscillation takes place. Stray capacitive coupling between the amplifier output and input terminals must be minimized to ensure stability. Unwanted RF feedback current may flow along the ground plane of the PC board, or it may be transported on the V_{cc} bus. Positive feedback can come not only from a single amplifier stage, but may involve two or three amplifiers in the same circuit block. For example, a given amplifier stage may, by itself, be completely stable, but when the driver stage is connected to it, the stability vanishes. This is because feedback can migrate from one

stage to the adjacent one, or even from a much earlier stage if the circuits are not properly RF-decoupled along the V_{cc} bus, as in fig. 1.

The placement of the amplifier input and output components or networks has a direct bearing on positive feedback also, since stray inductive and capacitive coupling is likely to occur if these circuit elements are too close together. In compact RF-amplifier circuits it is often beneficial to place a shield between the transistor input and output terminals to discourage stray inductive and capacitive coupling. A thin piece of brass or copper sheeting will serve this need.

Oscillation Frequencies

It is a common belief that self-oscillation occurs at or near the amplifier operating frequency. Strangely, most of the spurious energy results from oscillation at frequencies apart from the operating frequency. Self-oscillation frequently occurs from audio through VHF, depending upon the transistor f_T rating (frequency at which the gain is unity or 1). Oscillation at MF, LF, VLF, and AF is encouraged by the previously mentioned increase in transistor gain at the lower frequencies. It is for this reason that effective V_{cc} line bypassing is necessary for all frequencies from AF through VHF. This helps to prevent unwanted RF currents from flowing stage to stage along the DC supply line.

Preventive Measures

In addition to keeping stray RF currents off the DC supply lines on a PC board, it is necessary to minimize the Q (called de-Q-ing) in some parts of an amplifier circuit. The older term given to this was "swamping," which was done with parallel resistance or capacitance across certain circuit elements. That cure usually degraded the overall amplifier efficiency, because some of the RF power was dissipated in the swamping circuit. In a worst-case situation it also disturbed the impedance of the circuit.

Fig. 2 shows the use of ferrite beads and resistors as Q killers in a solid-state RF amplifier. One or two miniature beads may be slipped over a lead on an RF choke to lower the choke Q. In lab tests I performed with a 500 microHenry choke I found that a single 850 mu bead, thus used, lowered the choke Q from 60 to 10.

A resistor may be used in parallel with the RF choke to lower the Q, but if this is done, it is wise to choose a resistance value that is at least four times the characteristic impedance at that point in the circuit. Hence, if the input port of the transistor was, say, 10 ohms, the parallel resistor should be 40 ohms or greater.

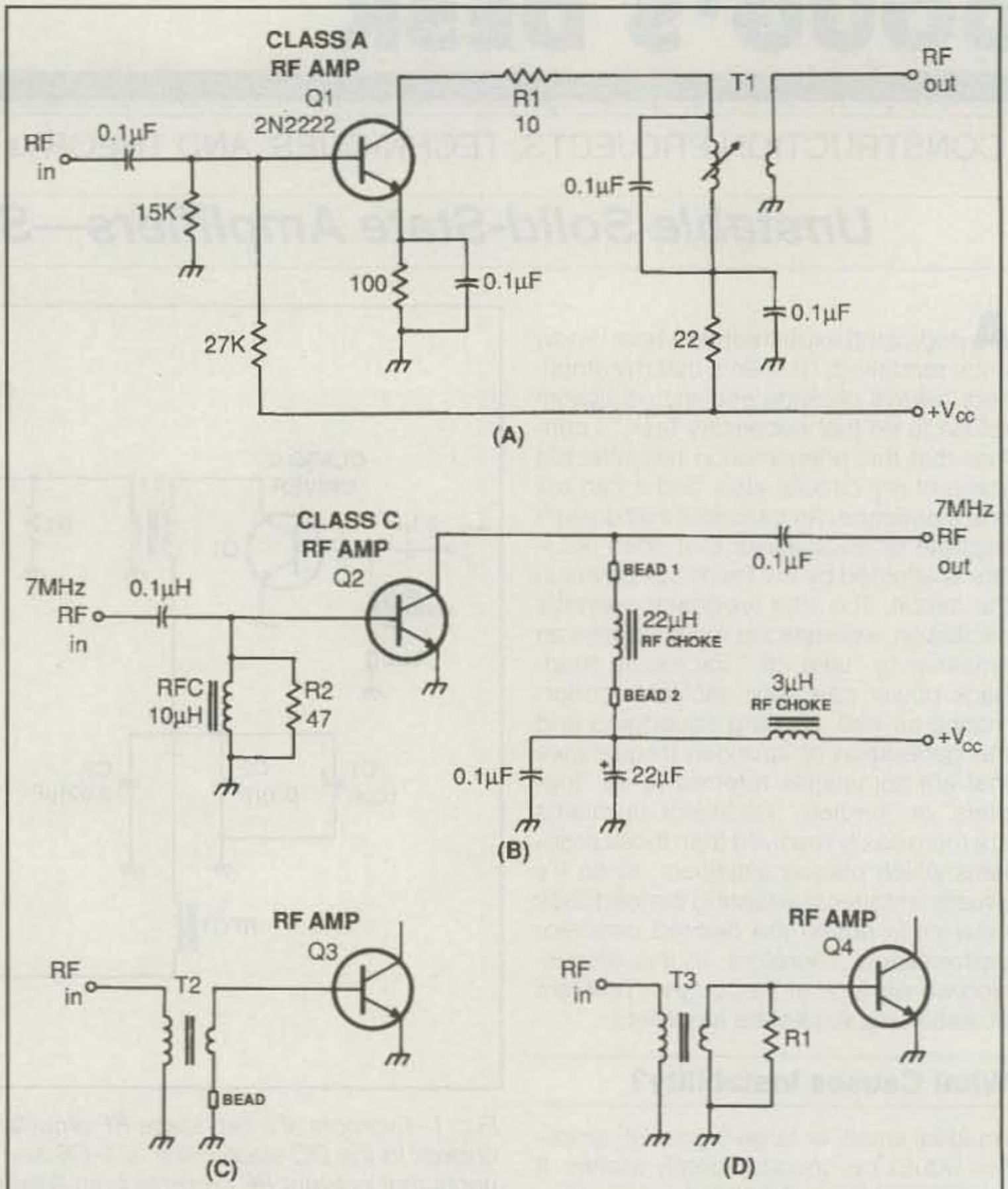


Fig. 2– Examples of methods for curing amplifier instability. R1 at A prevents VHF self-oscillations. Circuit B shows R2 across the RF choke as a means to lower the Q in that part of the circuit. Beads 1 and 2 at B reduce the Q of the collector RF choke. A single bead is used at C to reduce the Q of the T2 secondary winding. The same task is performed at D by means of R1 (see text for values).

Lower values of resistance will diminish the driving power to the amplifier and will disturb the impedance match at that point in the circuit. Resistors are commonly used across the secondary windings of broadband transformers to lower the Q. This is demonstrated in the circuit of fig. 1 at T1. The four-times rule applies here also.

VHF oscillations are cured easily by inserting a 10 ohm resistor in the signal path at the amplifier input (base) or by using a ferrite bead in place of the resistor. This is shown in fig. 3, which also illustrates the use of a collector bypass capacitor to damp VHF and UHF self-oscillation. Again, it is important to use only enough capacitance to kill the oscillation without disturbing the circuit impedance at the operating frequency by the introduction of too low an X_c (capacitive reactance). X_c must be at least four times greater than the collector impedance at the amplifier operating frequency. Therefore, if we had a collector impedance of 100 ohms at 7 MHz, the collector bypass capacitor (C1) should be no larger than 56 pF. This same capacitor would exhibit an X_c of 19 ohms at 150 MHz, if oscillation happened to occur at that frequency. The 19 ohm shunt impedance would represent a fairly effective path to ground for VHF currents. In an ideal example, however, C1 would have zero reactance.

Double-Sided PC Boards

Stability can be enhanced further by using double-sided PC boards. The copper foil on the component side of the board serves as a ground plane. This conductor is made common to the

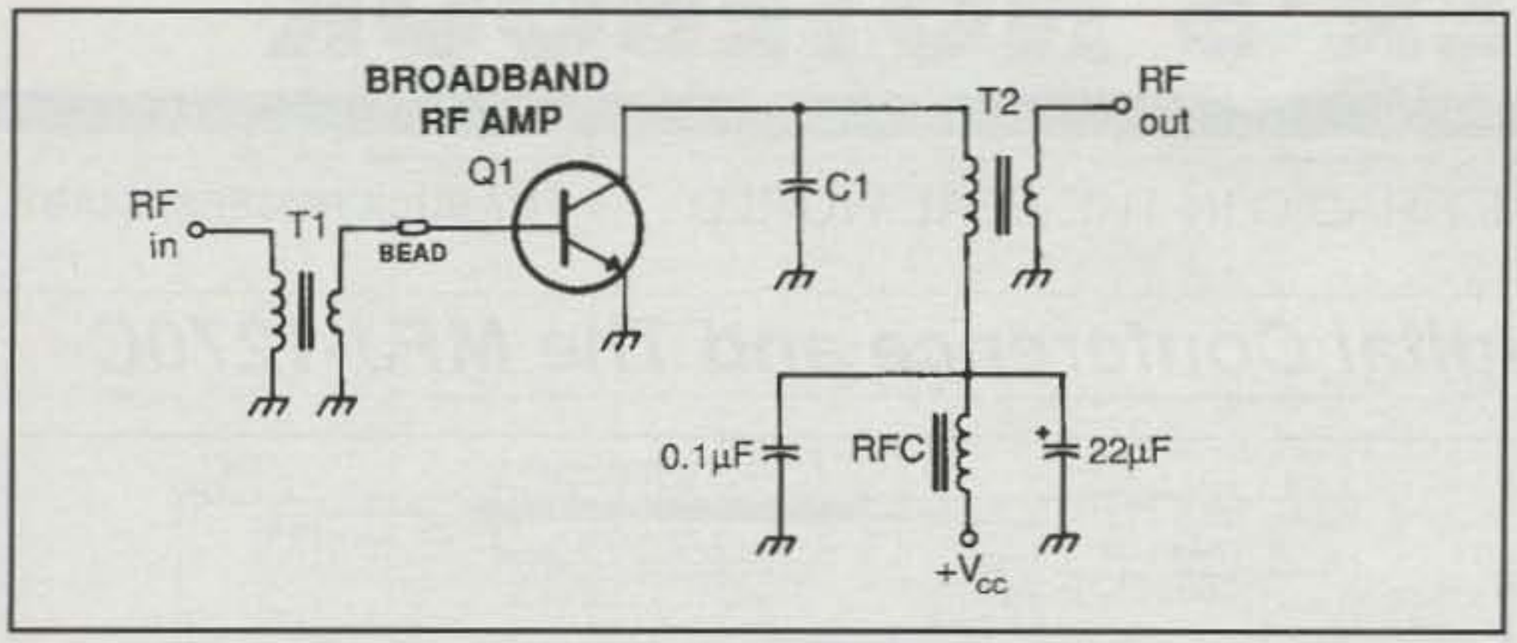


Fig. 3– VHF self-oscillations may be prevented by using a ferrite bead at the amplifier input. C1 can be added or used without the bead to damp VHF oscillations at the Q1 collector. The C1 X_c must be greater than four times the collector impedance in order to prevent power loss and impedance mismatching at the chosen operating frequency (see text).

ground bus on the etched side of the board at several points. Joining the two ground circuits can best be done by means of plated-through holes, but this is not a practical solution for most amateurs who make their own boards. An alternative technique calls for drilling the holes through the board at the key points, removing the copper around each component-side hole of the board, and using small bus wire to join the two ground conductors by passing the wires through the holes and soldering them on each side of the board. This ensures that circulating currents on the two sides of the board are shared by a common ground plane. This would not be the situation if the pass-through wires were soldered directly to the ground foil on the component side of the board. In other words, the RF currents on the component side might continue across the large conductor instead of flowing through the board to the ground conductors on the etched side of the board. The purpose for making the two ground circuits common at RF is to minimize the inductances of the ground foils by increasing their overall width. This lowers the X_L of the foils and allows RF currents to flow in the desired direction without backing up into areas where they can cause problems.

The ground foils on single-sided PC boards can be de-Q'd in problem areas by cutting the ground foil and bridging the gap with a short piece of bus wire over which an 850 mu ferrite bead has been placed. This approach is frequently useful when feedback energy flows along the ground elements of the PC board despite using considerable care when grounding the PC-board ground foil to the main chassis of the equipment.

Transistor Choice

Try to avoid using UHF or VHF transistors in HF-band RF power amplifiers. They have very high f_T ratings, which means they can develop tremendous gain at HF, and high gain leads to instability. It is better to select a power transistor that has an f_T no greater than approximately five times the highest planned operating frequency. Hence, if 29 MHz is the upper operating frequency of the amplifier, use a transistor that has an f_T on the order of 150 MHz. High f_T is not as much a matter of concern in broadband amplifiers that have shunt feedback networks, because the network effectively equalizes the stage gain over a broad spectrum.

In Conclusion

It goes without saying that short, direct leads are mandatory in the interest of stability. Wide PC-board trances are recommended for all RF circuits in order to minimize parasitic inductances. Effective mechanical connections between the PC board ground foils and the equipment chassis are vital in the interest of preventing unwanted RF circulating currents. All components need to be pushed snugly against the circuit board before they are soldered in place.

Each RF amplifier we build is likely to have its own instability problems, and each must be treated differently. It is seldom necessary to adopt all of the preventive measures discussed in this article. Learning to identify the problem area before attempting a cure is the best advice I can offer. This will save a lot of time when trying to determine which bandaid is required. The best preventive measure I can suggest is to use care when designing the circuit and laying out the PC board, so that the chance for instability will be minimized. An after-the-fact cure may be an exercise in futility and a cure impossible to realize.

73, Doug, W1FB

PACKET USER'S NOTEBOOK

CONNECTING YOU AND PACKET RADIO IN THE REAL WORLD

BY BUCK ROGERS, K4ABT

The SouthEast Digital Conference and The MFJ-1270C

It's time to begin planning for the SouthEast Digital Conference at Albany, Georgia. This annual event takes place in a new location this year, as the Albany Hamfest and SouthEast Digital Conference has outgrown the convention center where it had been held in past years.

The Albany Hamfest, SouthEast Digital Conference, and Georgia State Convention is to be held Friday and Saturday, June 17–18 at the Albany Civic Center. To make reservations for display and table spaces, contact John Crosby, K4XA, at P.O. Box 1205, Albany, Georgia 31702 (telephone 912-883-7910, or 24 hour FAX 912-883-5092). Talk-in VHF is 146.82; talk-in UHF is 444.500. There will be ARRL VEC exams, prizes, digital forums, manufacturers, dealers, and vendors. The forums will be presented by digital industry wizards. Bob Bruninga, WB4APR, will present a forum on the latest APRS and GPS applications as related to packet. Other forums will be presented on the use of the new networking formats, and still others will demonstrate the latest TNCs which deliver packet and data at speeds over 38,400 baud.

This year the SouthEast Digital Conference will be hosted by many of the leading packet, PACTOR, CLOVER, and digital specialists in this industry.

I will conduct a forum covering many recent innovations and technologies that are being introduced into the HF, VHF, and digital communications world.

On the same date and in walking distance of the Albany Hamfest and SouthEast Digital Conference will be the Geor-

211 Luenburg Drive, Evington, VA 24550

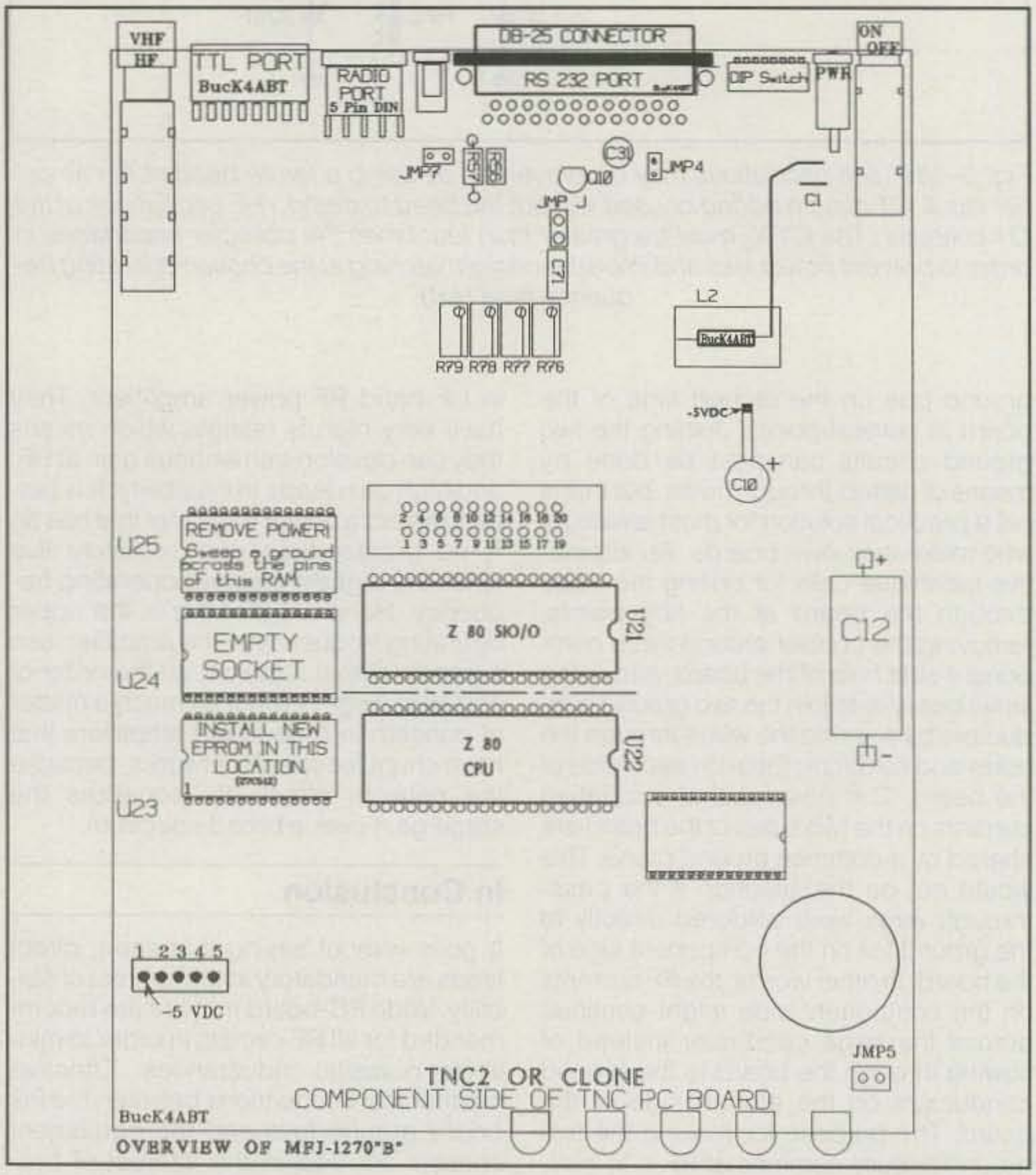
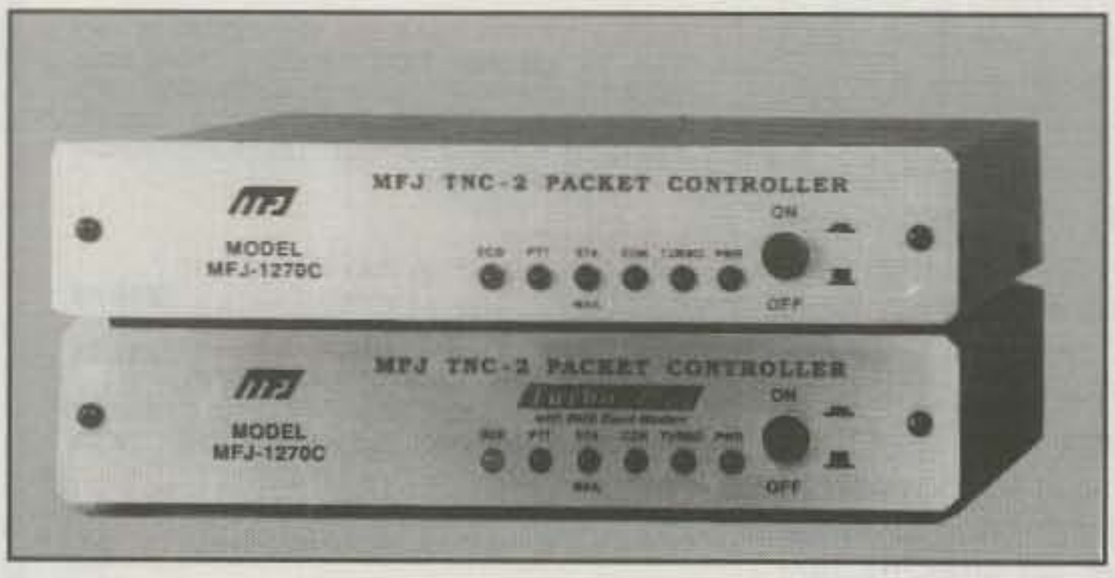
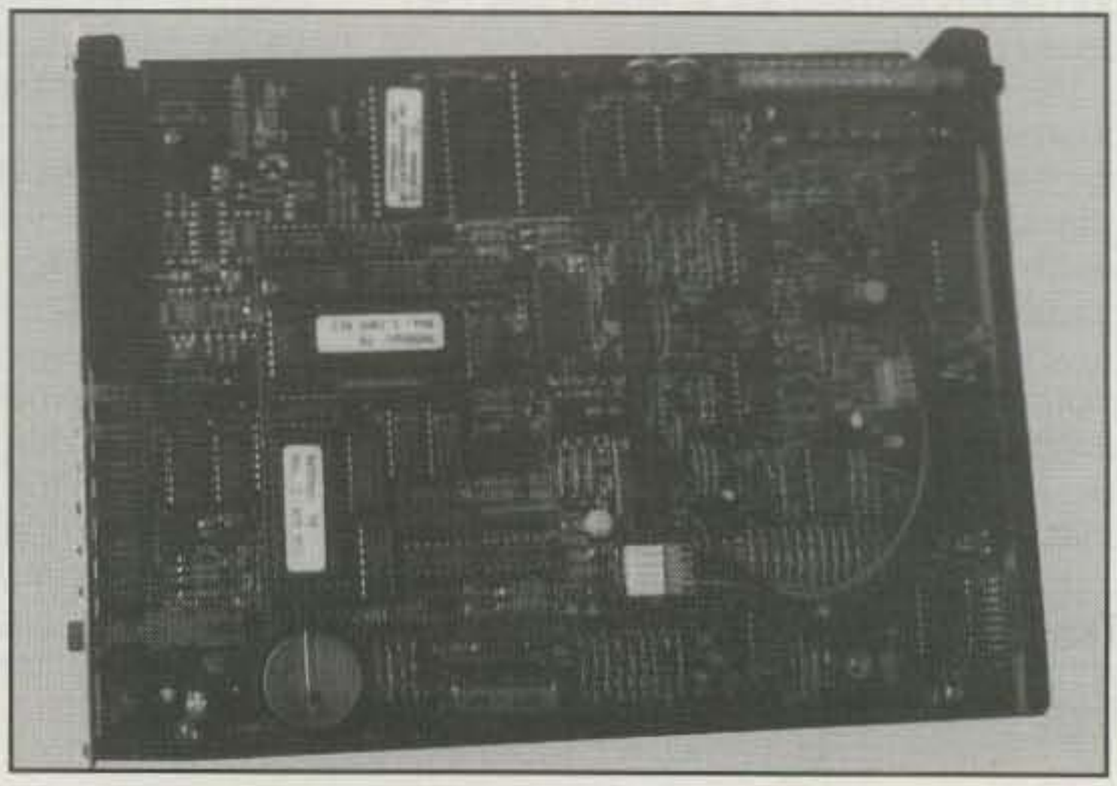


Fig. 1– In the MFJ-1270B note the position of the level and tone control pots. Maximum terminal baud rate of the "B" version was 9600 baud. In the MFJ-1270C the maximum RS-232 port speed capability is increased to 19,200 baud.



For the node SYSOP who plans to implement a 9600 baud gateway port, the MFJ-1270C Turbo Plus is 9600 baud ready. It will operate all three radio port speeds of 300, 1200, and 9600 baud. The RS-232 port speed can be set to 19,00 baud.



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- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

- LOW PROFILE POWER SUPPLY

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES

MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

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

RS-M SERIES

MODEL RS-35M

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

VS-M AND VRM-M SERIES

MODEL VS-35M

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

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

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

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

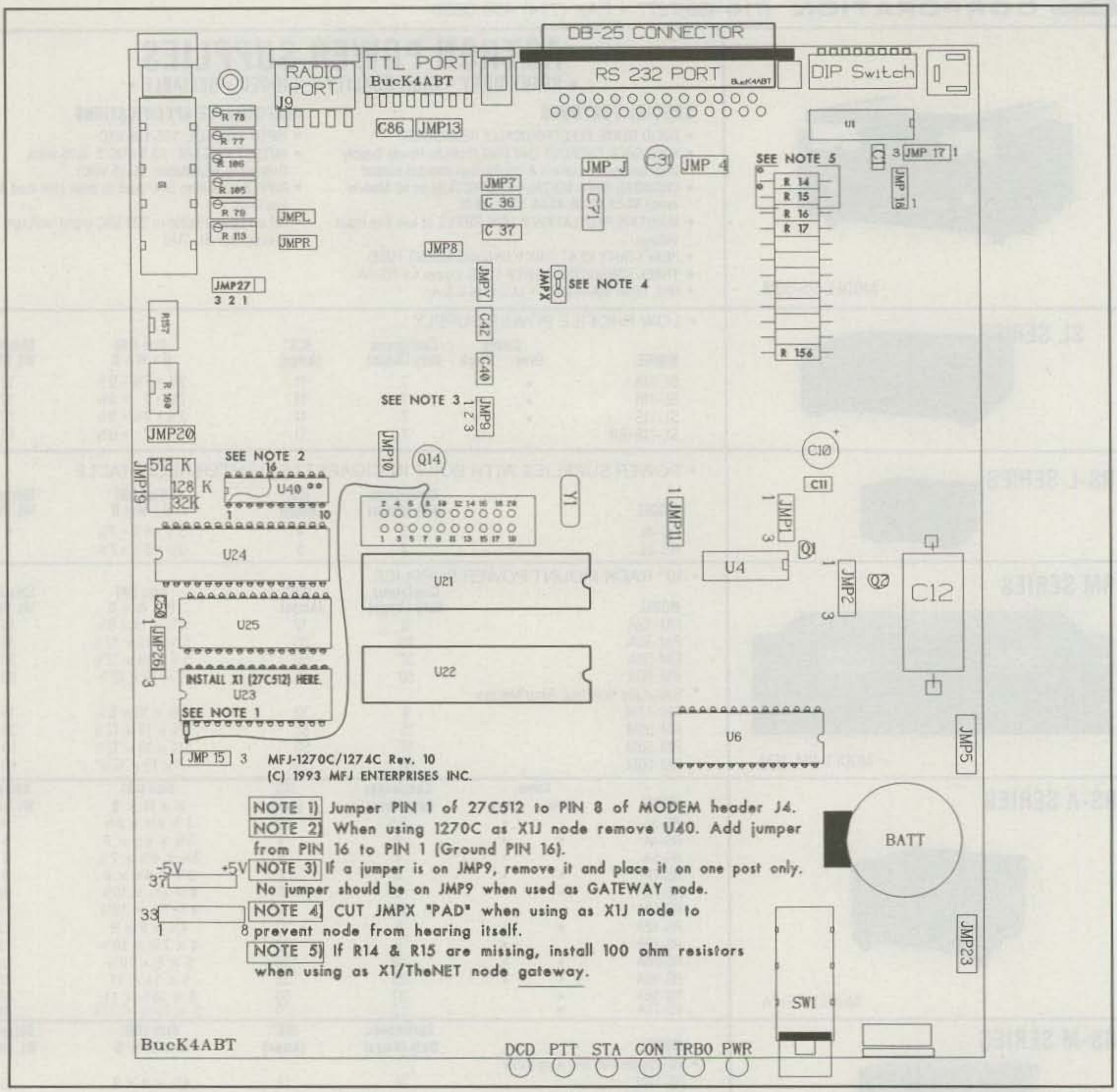

Fig. 2– Overview of the new MFJ-1270C. See notes one through five on the diagram for special instructions when using the MFJ-1270C in node service.

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Unpredicted Flurries

A flurry of letters from SYSOPs all over the world has prompted me to initiate this month's topic. The largest number of letters came from the USA and Canada.

Many TNC vendors advertise a new revision or version to current models. To denote that a change has been made in the model, the same model number is employed, while a new suffix is added to the model number to indicate there has been a change.

In the case of the MFJ-1270, the latest model displays a "C" suffix. The same applies to the MFJ-1274. In this month's column we will cover the MFJ-1270C. However, the MFJ-1274 will be understood to be the same, except for the addition of the tuning indicator on the MFJ-1274C.

From time to time there arises a need to update or install modifications into the TNCs we use in node service. There was no doubt in my mind that something was causing concern among the SYSOPs. I don't receive this much mail when everything is running smoothly. When mail begins piling in like it has in the last two months, it's time for me to look into the reason for the concern. I've answered all the letters that contained SASEs, and I included a full set of drawings, noting the changes and new jumper locations.

I contacted some of the TNC-2 clone manufacturers and told them I was plan-

Jumper location, position & functions for MFJ-1270C/1274C

Jumper #	Position	Function
JMP1	Pin 1 & 2	DCD (RS-232C) stays on
	Pin 2 & 3	DCD (RS-232C) stays on
	Off (default)	DCD reflects connect status
JMP2	Pin 1 & 2 (default)	4.92 MHz CPU clock
	Pin 2 & 3	2.46 MHz CPU clock
JMP4	ON	Disable Tx watch-dog
	OFF (default)	Enable Tx watch-dog
JMP5	ON (default)	Lithium battery connected
	OFF	Lithium battery disconnected
JMP7	ON	Analog loop back mode
	OFF (default)	Normal modem operation
JMP8	ON (default)	Demodulator enabled
	Off	Demodulator calibrate
JMP9	Pin 1 & 2	Calibrate U16 tones
	Pin 2 & 3 (default)	Normal modem operation
JMP10	ON	Digital loop back mode
	OFF (default)	Normal modem operation
JMP11	LEFT	Transmit data NRZ NEED PIN #
	RIGHT (default)	Transmit data NRZI
JMP13	ON (default)	TTL, RTS enable
	OFF	TTL, RTS disable
JMP15	Pin 1 & 2 (default)	256K firmware EPROM
	Pin 2 & 3	512K firmware EPROM
JMP17	Pin 1 & 2	2400 baud external modem clock
	Pin 2 & 3(default)	9600 baud external modem clock
JMP18	Pin 1 & 2(default)	Enable 19.2K baud terminal
		Disable 300 baud terminal
	Pin 2 & 3	Enable 300 baud terminal
		Disable 19.2K baud terminal
JMP19	Outside pair(default)	Enable 32K mailbox RAM
	Middle pair	Enable 128K mailbox RAM
	Inside pair	Enable 512K mailbox RAM
JMP20	ON	512K mailbox RAM installed
	OFF (default)	32K or 128K mailbox RAM
JMP23*	ON	Enable memory RESET
	OFF (default)	Normal operation
JMP26**	Pin 1 & 2 (default)	Normal +5Vb bbRAM operation
	Pin 2 & 3	Real-time clock installed
JMP27	Pins 1 & 2 (default)	Normal SW3 Operation
	Pins 2 & 3	Baud Rate Switch SW3 Bypass
JMPJ	ON	TX audio has flat response
	OFF(default)	TX audio 6db/octave pre-emphasized
JMPL	ON	TX audio loop back; PTT Radio Port J9
	OFF(default)	
JMPR	ON	Analog audio loop back; Radio Port J9
	OFF(default)	
JMPX	ON(default)	Speaker Transmit Tone Enable
	OFF	Speaker Transmit Tone Disable
JMPY	ON(default)	Speaker Receive Tone Enable
	OFF	Speaker Receive Tone Disable

*When JMP23 is shorted together, a RESET will occur in the MFJ-1270C or 1274C. After the RESET, all parameters will be at the default values. This equates to removing the battery-backed RAM battery except that this procedure enables a much faster and easier method to perform the RESET. Do not short this jumper more than a couple of seconds, or battery damage could result.

**MFJ offers an optional real-time clock module (the MFJ-43) which can be installed on the MFJ TNC mother board. This clock maintains the MFJ TNC clock setting. After installing the real-time clock module, the TNC user does not have to set the clock each time the TNC is turned on.

Table I– The jumper configurations of the MFJ-1270C.

ning to cover updates and changes in their wares. Only one of the TNC-2 OEMs responded. This month I will cover one of the more popular TNC-2 clones and the application of the TNC in node service.

A Picture is Worth 10,000 (Inflation) Words

To give the reader and node SYSOP a better look at what has occurred in the MFJ-

CAREFULLY remove Z80 (CPU) from socket U22. Install Z-80 CPU into 40 pin socket on the DEV PC board. Use care to be sure no pins are bent. NOTE position of the CPU notch and position it in the same direction on the DEV add-on board. CAREFULLY install the DEV PCB into the now vacant CPU socket at U22 of the MFJ-1270B.

Carefully solder the three wires from the (supplied) connector as shown. Blue is minus 5 volt line, WHITE is the receive audio line, and BLACK is ground.

Experience has shown a range of 35 to 45 for the "METER" feature command. If audio at U1 PIN 3 is below 1.5 VDC (open squelch), METER may be set higher.

For the initial setup of the transceiver, and the TNC/DEV PC board, You should use an FM service monitor similar to the "IFR" 1200S. This insures correct readings by users. Resistor R1 should be a value between 10,000 and 20,000 ohms. If the DEV reading are all the same, reduce volume level or increase value of R1 on the MFJ-52.

After calibration and setup of the transceiver and TNC/DEV, DO NOT MOVE the transceiver volume control.

With squelch OPEN, use R3 to set voltage at U1 PIN 3 near 1 to 2 VDC.

In most installations, Ive found that setting R3 full clockwise gives about 1.5 volts at U1, pin 3.

Set R6 first, read U1 PIN 8 and adjust R6 for 3.0 VDC

NOTE After installing the DEV PCB in some of the smaller TNC2 clones, I was unable to replace the TNC cover (HACK-SAW to the rescue).

BEND PIN ONE (1) OF 27C512 OUTWARD SO IT WILL NOT ENTER THE SOCKET AT U23 (PIN 1). CAREFULLY SOLDER ONE END OF A 4 INCH (#22 OR 24) JUMPER WIRE TO PIN ONE OF THE EPROM. SOLDER THE OTHER END OF THE WIRE TO PIN 8 OF THE 20 PIN MODEM HEADER AS SHOWN.

X1 EPROM USER SUPPLIED. X1 CODE IS AVAILABLE FROM MANY HAM BBS, Cleveland HamNET, etc... See November 93 CQ Magazine (Packet Users Notebook) for complete details for obtaining X-1 EPROM code.

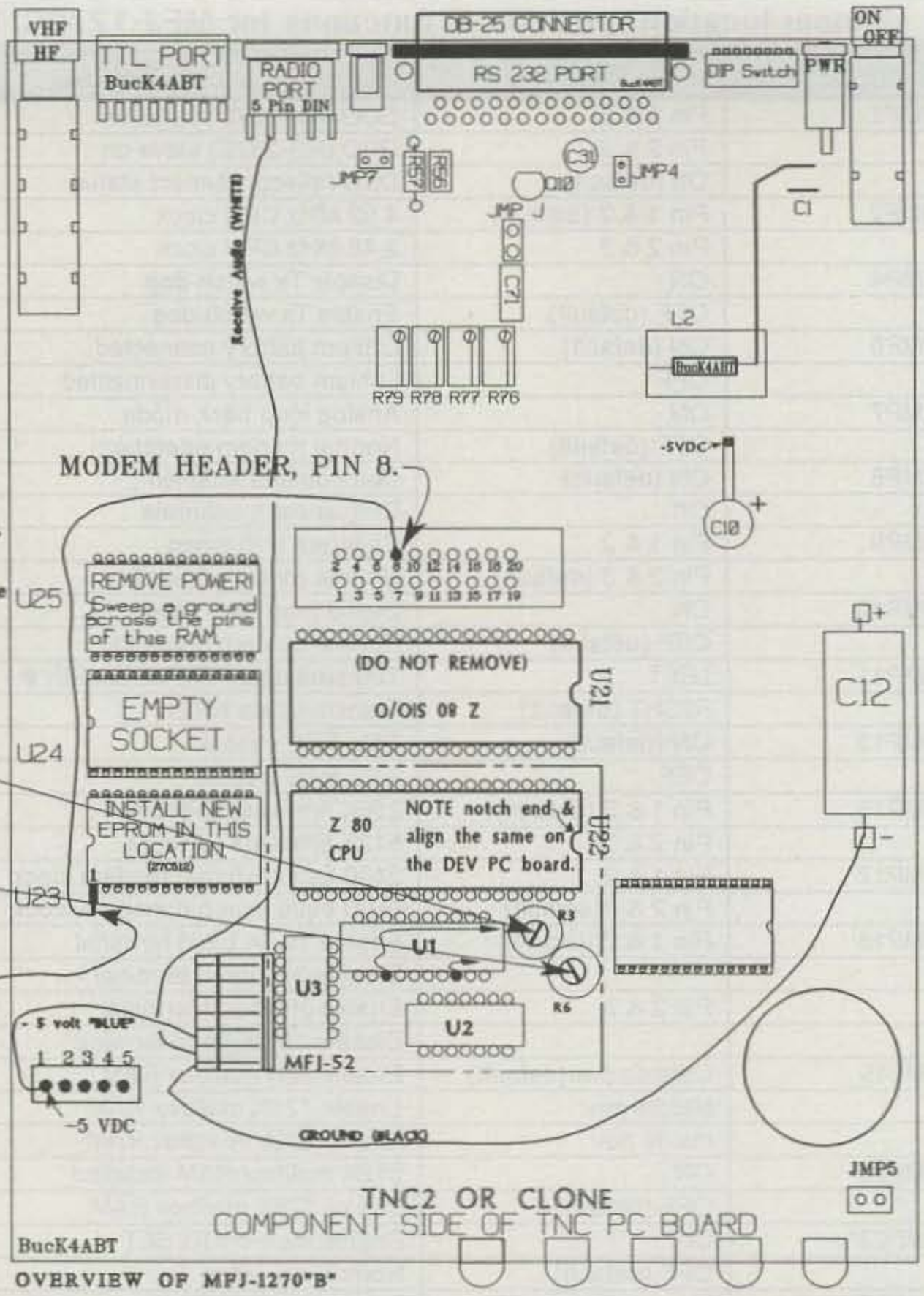

Fig. 3– Installation of the MFJ-52 deviation meter add-on PC board is the same for both the MFJ-1270B and C.

1270, it is necessary to include both the earlier MFJ-1270B drawing along with the latest revision drawing of the MFJ-1270C. This will give the user a clear picture of the difference between the two. Fig. 1 is an illustration of the MFJ-1270B and fig. 2 is the latest version, the MFJ-1270C.

Notice in fig. 2 that an IC was removed at U40 and a jumper was added from pin 16 to pin 1 of the U40 socket. In addition, a cut was made at JMP X to prevent the X1 node from "hearing itself" and listing its own call in the node list.

JMP J is now referred to as "pre-emphasis" control. In any case, it can still increase the level of the TNC output (transmit) audio level. As a matter of fact, when a jumper is installed across JMP J, there is enough audio level to drive the socks off a GE MASTR II or the Custom MVP.

Table Manners

To simplify the jumper configuration within the new MFJ-1270C, I've included Table I to provide further explanation of

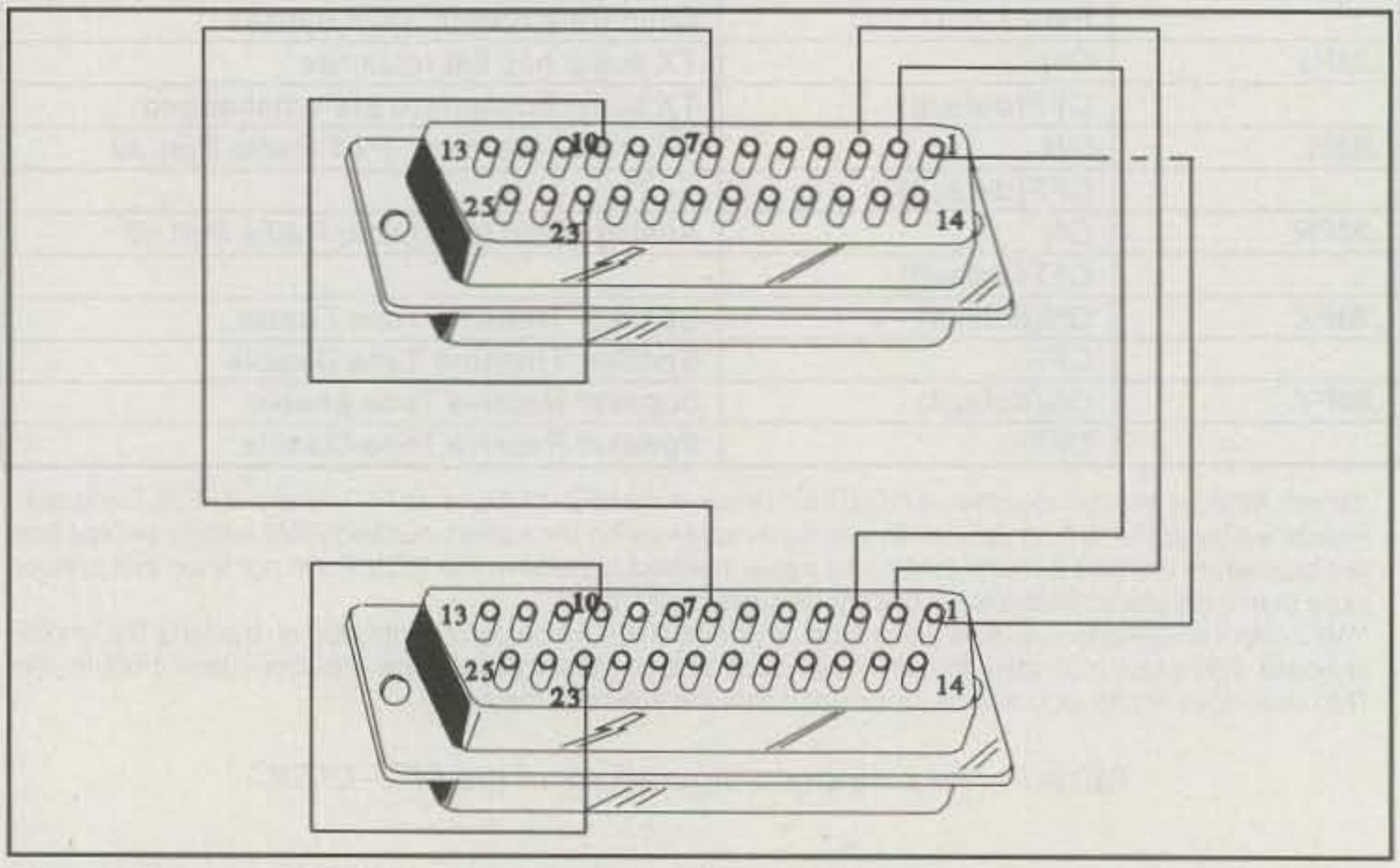

Fig. 4– Gateway RS-232 connector to enable node communications from one node port to another. Set the DIP switches to the same baud rate. The DIP switches are located at the rear of the TNC. Most nodes used at VHF have DIP switches 5 and 7 set ON; alll others are set OFF. If one node is operating on a backbone frequency at 9600 bps, the DIP switches will be set to match the radio baud rate. In the MFJ-1270C it is possible to have the node RS-232 port speed set to 19,200 baud.

DEFINITIONS of the seventeen X1 *MODE FUNCTIONS*

With the new X1-J version of theNET firmware, there also comes a set of 17 added command features. The application of these 17 features can increase the effectiveness of your network when they are properly configured.

No.	MIN	MAX		DEFINITION
1	0	1		Host Control to enable HARDWARE HANDSHAKE; MODE FLAG in HOST MODE **Enables the use of the *Esc C* and *Esc D* commands when using the RS-232 port.**
2	0	3600		CW ID repeat period in seconds. **Disables CW ID**
3	4	10		CW ID speed (10 milliseconds per DOT)
4	0	3		Nodes broadcast enable flags: **0 = None, 1 = HDLC only, 2 = RS-232 only, 3 = Both ports.** **3 = both ports if backbone access; 2 = matrix; 1 if LAN or user port.**
5	0	3		Crosslink select: 0 = None, 1 = HDLC, 2 = KISS, + selectCopy, 3 = KISS + ALLcopy **MATRIX mode for node stack use.**
6	0	255		TX keyup delay (TXDELAY) in ten millisecond increments. **35 = 350 milliseconds; for most transceivers,** add 5 mSec for radios with electro-mechanical relays or if node uses an external power amplifier.
7	0	1		Full Duplex enable. **0 if node is operated in simplex (normal) operation.**
8	0	65535	600	RS-232, PORT 1, node broadcast period in seconds. **Updates nodes in stack every 10 minutes.**
9	0	3		Node broadcast algorithm flag; 0 = off, 2 = RS-232 port; 1 or 3 not used.
10	600	3600	600	Beacon interval in seconds. **Although beacons are enabled in PARAMS to ID only during or after use.**
11	0	2	0	Connect redirect to BBS **Controls the use/action of the "C" command, and what it will do when issued.**
12	0	127	19	Help messages enable flag, 8 bit in TALK mode & case sensitive. **Enables: PLEASE WAIT.** (1) + all sysop commands, (2) + Routes are: ALIAS:CALLSIGN (16)
13	0	3		Hash node broadcast disable (1 bit per port) 3 will disable all #node broadcasting.
14	0	1		If set, will enable extra alias monitoring. **0 = WILL NOT recognize BBSalias,** DXalias, HOSTalias, set to 1 on user port if BBSalias is set.
15	0	1	1	Enables automatic node reconnection after remote disconnect. **Enable on user accessed ports and #nodes;** Disable on network step points (BBS..etc).
16	0	3	3	Slime trail control. Each bit controls a function; Bit 0 hides; Bit 1 causes slime to be ignored. **Set on non gateway port(s).**
17	0	3		Digipeat control. Each Bit controls a function: Bit 0 Node refuses L2 uplink digis. Bit 1 Node refuses digi downlinks.

Table II– The X1 mode functions defined.

the jumper locations and positions within the 1270C. This table explains which position is default, and which jumper position may be employed when other modifications or add-ons are implemented.

Fig. 4 is the umbilical to use when only a two-port gateway is employed. At fig. 5 I've described the diode matrix used when porting up to four nodes to four different frequencies or baud rates.

A Few Words About The X1 Node

In the latest X1 node code Dave Roberts, G8KBB, has installed another enhancement in addition to the deviation meter which he and Neville Pattison, GØJVU, implemented in version X1"J."

Along with installing the X1J or later node ware comes the very much desired application for the MFJ-52 deviation meter installation (available wired and test-

ed from MFJ for $29.95). This is a piggy-pack PC board (see fig. 3).

Several X1 users have requested the definitions of the 17 mode commands and features. In Table II I've condensed these definitions as much as possible, using the tables and X1 documentation as a guide.

May Tricks (Matrix)

In case you don't care to stuff the umpteen zillion diodes into a chunk of perf board, here is a less time-consuming answer. Order the NX2P EZ matrix kit. The NX2P EZ matrix kit has five ports and comes complete with DIP diode packs that are similar to an IC. This makes for easy assembly of the five-port diode matrix, and you are ready to put the node stack into operation much sooner. DE9 male connectors are also included.

The NX2P EZ matrix is available from Bill Slack, NX2P, for $32.95. The ordering address is Bill Slack, NX2P, 321 E. Shore Trail, Sparta, NJ 07871. The order line is open between 6 PM and 10 PM EST at 201-729-6927.

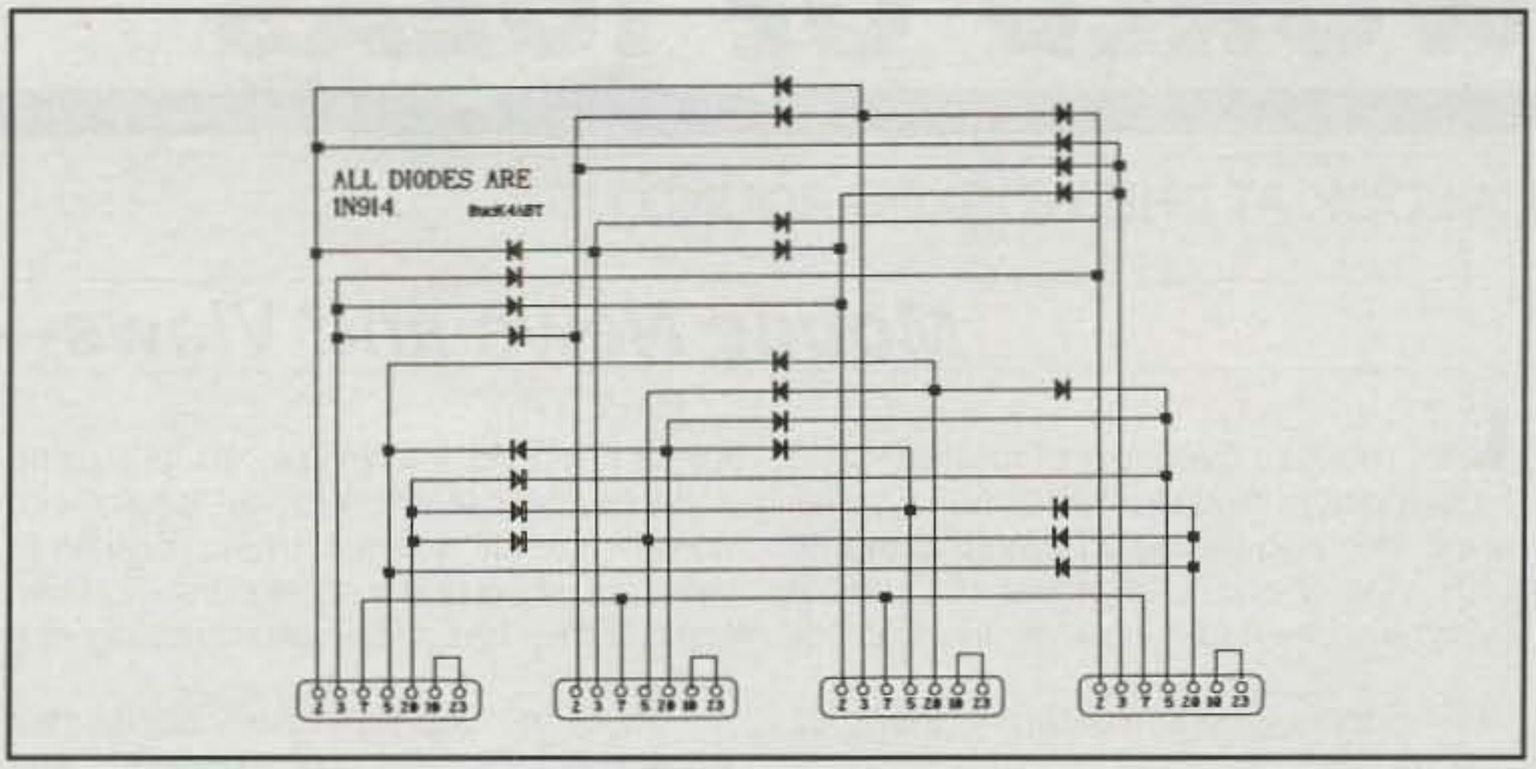

Fig. 5– When more than two nodes are interfaced to link LANs, trunks, and backbones, it becomes necessary to construct the diode matrix shown.

For more information about the MFJ-1270C and MFJ-1274C TNCs or the MFJ-52 deviation meter PC board, contact MFJ Enterprises, Inc., Box 494, Mississippi State, MS 39762 (telephone 601-323-5869 or FAX 601-323-6551). MFJ's order line is 1-800-647-1800, and their technical help line is 1-800-647-TECH (8324).

Happy Packeting!

de BucK4ABT @ WD4ELJ.VA

WORLD OF IDEAS

BY DAVE INGRAM, K4TWJ

A LOOK AT THE WORLD AROUND US

Mobile News and Views—Part II

Last month's overview of modern-style mobiling overfilled available space, so we are continuing the discussion this month with more news and views of outdoor hamming fun. A fascinating variety of topics is lined up for review, so let's jump right to the details. We will begin with some interesting notes, then progress to the area of unique mobile pursuits. Hold tight, as we are once again moving at a fast pace!

4941 Scenic View Drive, Birmingham, AL 35210

Perchance you have not noticed that equipment designs are changing and new trends are developing in the world of mobiling. Remote-controllable 2 meter/70 cm transceivers with crossband repeat capabilities have become "standard amateur radio gear" in vehicles for daily travels, and amateurs are seeking more horizon-expanding endeavors. Simultaneously, a new generation of deluxe mini-

Photo 1– (Top left) Left-rear view of WB9GIE's bicycle mobile setup. Note front touring bags and custom Aero handlebar. A homebrew 2 meter J-pole antenna has been substituted for the Hustler HF antenna in this photo.

Photo 2– (Above) The rear camcorder bag on WB9GIE's bicycle is opened to show Argonaut transceiver. Gel cells on each end of the bag are wired (inside the bag) to power the transceiver. Antenna, key, and mike cables emerge from bag when zipped closed for rough weather.

Photo 3– (left) WB9GIE's new Trek 7000 bicycle mobile setup is ready for HF action anytime and anywhere. Leroy uses this 21-speed mountain bike daily, traveling over 30 miles round trip between two jobs.

transceivers such as Ten-Tec's Scout, Kenwood's TS-50, and Outbacker's multiband "Perth" antennas have become today's most popular mobile setups. Going mobile with these delights is a cinch, even if you are a "first timer." Just remember two important points: be sure your antenna's mount (to which the coax shield is attached) is connected electrically to your car's frame, and the transceiver's ground/case is also connected to the car's frame (at the rig; not at the battery).

If you are using a trunklid mount, tighten its (under-lid) set screws to mark their clamp points, then unscrew them, remove the mount, and use a pocket knife to scrape paint from one or two of those marked clamp points. Next reinstall the mount, ensuring at least one set screw makes solid contact with trunklid metal. Then add a piece of wide braid (such as the shield removed from a piece of RG-8U) between your rig and the car's frame. Unsure which car bolts actually connect with the frame? Look under the front seat. The shiny bolts holding seat frames in place are usually good ground terminals.

Finally, check your setup as follows. Disconnect the DC power cord and the antenna plug from your transceiver and add a temporary jumper from the whip antenna to the mount's ground lug. Next touch one test lead from your ohmmeter to the transceiver's case (which is ground-strapped to the car's frame) and the other test lead to the antenna plug's center pin. If resistance reads over one ohm, rework all connections to achieve solid grounding. Finally, remove the rear jumper, connect the transceiver, tune the antenna, and enjoy great mobiling.

One final tip: Although improvising, I often use a sidetone-equipped CW keyer in lieu of an ohmmeter for quick-checking ground continuity. Every minute of fumbling saved can then become "hamming time." Enjoy!

Now let's shift views to some fascinating outdoor stations.

Silent Sport Mobile

Outdoor hamming is not limited to 50 or 100 watt mobile rigs in cars, trucks, and vans, and the continuing bicycle-mobile activities of Leroy Shelley, Jr., WB9GIE, truly support that fact. Leroy has been using a transceiver-equipped bicycle as his main means of daily transportation and amateur radio operating since 1974, and most of his travel is in snow-prone Wisconsin rather than sunny Florida. But as we discussed in last year's "Mobiling" column, Leroy has worked a creditable amount of great DX with his 2 watt Argonaut while pedaling in freezing cold and bouncing over ice chunks. That is gusto QRP operating for sure!

Now, after 45,000 plus miles of bicycle

Photo 4– Main offices of Terlin Aerials, home of the popular "Outbacker" mobile HF antenna. Some of the crew members were coaxed to stand in front of the building for this group shot. Tuning range and test vehicles are located 200 feet behind the building. (Photo by WD4FSY)

mobiling, Leroy has replaced his classic two-wheel Huffy with a new Trek 7000 21-speed mountain bike shown in photos 1, 2, and 3. His QRP gear also received a facelift, and the combo is now being used for both daily commuting and weekend camping/touring ventures. We understand Leroy even purchased a car during recent months, but he insists it will not detract from his bicycle mobile interests.

Leroy purchased the Wisconsin-made Trek 7000 bicycle in "bare bones" condition, then added special fenders, a custom Aero handlebar, and a dual halogen light system to make a super neat bike for road or trail. The trusty Ten-Tec Argonaut (which has been used for at least 10,000 miles of bicycle mobile operation and still works fine) was then fitted into a new super-cushioned, water-repellent camcorder bag. The bag attaches to the bicycle with clamp-on straps. Thus, the complete HF setup can be removed or swapped with a 2 meter setup when and

Photo 5– Don Arnold operating battery-powered portable from Sydney Harbor as VK2IBB. The ultra-modern building on the left is the famous Sydney Opera House. The skyline of city is on the right. (Photo by Don, WD4FSY)

YAESU

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if desired. Series-wired 6 volt gel cells in pouches on each end of the camcorder bag power the Argo during daily use, and a separate bag filled with regular D cells (and mounted on the rear fender's left side) is used for trips. Leroy says alkaline D cells are a good choice for QRP use when traveling because they are available anywhere, and quick replacement beats recharging.

Study the pictures of WB9GIE's bike, and you will also notice front-mounted touring bags. These bags are used to carry supplies, tools, camera, film, a first-aid kit, and camping items. Look at the handlebar and you can see the rig speaker and mike mount. A G4ZPY 3-in-1 keyer paddle like that featured in our last "Keys" column was also added on the right side after these photos were taken. Finally, an interchangeable mount that mates with a Hustler antenna for HF operation or a homebrewed J-pole for 2 meters round out this personal-powered chariot.

Has WB9GIE's "roll out and operate" setup piqued your interest in bicycle mobiling? Good show! It is terrific fun and an ideal way to pursue a good exercise program. How do you get started in this unique "silent sport"? Clean up your old bicycle, practice riding in some safe off-road areas, and join the Bicycle Mobile Hams of America for group support. Their quarterly newsletter is loaded with helpful information. For details send a large SASE to BMHA, P.O. Box 4009, Boulder, CO 80306.

Photo 6– Outbacking Don Arnold, shown here wearing an authentic DX duck-hunting suit and military "slouch" hat, heads into the bush country for some serious HF mobile DXing. The Outbacker antenna clamped to the luggage rack is about to see heavy-duty use. Don is also about to run out of road. (Self photo by WD4FSY)

Say you're already geared up for bicycle mobiling and feel the time is right to try a big-time endeavor? Check with Bob Faurot of 18 Paradise Drive, Sheridan, Wyoming 82801 about the "Ride Around Wyoming" bicycle tour June 12 to 17 (SASE required for info, or call 307-672-

6323). This 384 mile cycling experience covers dozens of famous attractions, both manmade and natural, includes food, lodging, accompanying baggage truck, repair van with mechanic, medical support, and more. There is a limit of 200 riders, but possibly that quota has not yet "topped over." The trek starts and ends in Jackson, Wyoming. What a blowout way to go bicycle mobile in style!

Mobiling Down Under

Since last year's mobiling column included some views from our friends in Great Britain, this year's column "balances the scale" by looking in the opposite direction to Australia. Outbacking Don Arnold, WD4FSY/VK2IBB (yes, the same friendly chap importing Terlin's "Outbacker" mobile antenna here in the U.S.) revisited Australia during January and returned with a big stack of great photos. The snow in many areas of the U.S. was knee deep during that time, but Australia was in its summer season and daily temperatures were 90 to 100 degrees—ideal for mobiling in the bush country.

Don carried a Kenwood TS-50 transceiver, some rechargeable 6 amp gel cells, a couple of Outbacker whips, and a roll of copper ground foil, and mobiled from one side of Australia to the other over a four week period. Before you conclude that this was a super joy ride, however, understand Don's main purpose was photographing and video-documenting Christian missionary work throughout Australia. He just managed to quickly secure a license, revisit the Terlin Aerial facilities while working around Perth, operate mobile while traveling, and squeeze in some portable work during rest time. Both operator and equipment were subjected to a rugged outback lifestyle, but everything came out great and Don worked the world with his "carry along station."

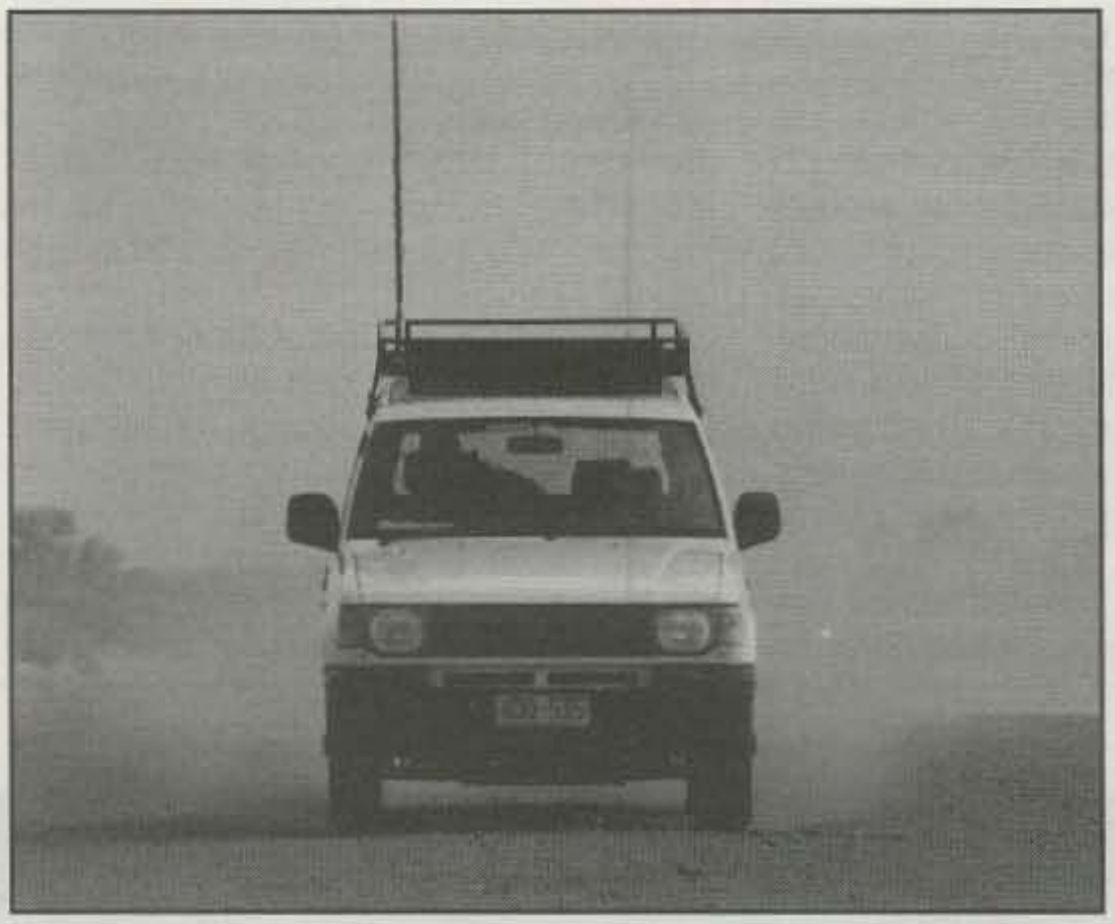
When in the vehicle Don used 100 watts and a 6 foot "Outbacker" antenna. When portable with batteries, he switched down to 50 watts for CQs and then shifted to 10 watts to work the pile-ups. Don says the Aussies are quite friendly , and their on-the-air manners are most commendable.

A limited number of Don's photos could be squeezed into this month's column, and there is a 1000 word story behind every picture. I quickly condensed details to fit available space, so read carefully as we continue.

First, the Terlin Aerial operation is housed in a building in Willetton and has a crew of approximately 15 people (photo 4). The aerials are made to precise specs, and then each one is installed on an actual vehicle and hand-tuned to resonance before being finished. Each aerial's top stinger is also scribed at its "center of all bands" point, which you can feel in the dark and vary for lowest SWR in CW or SSB band segments. The whips are made super-heavy-duty to survive bush country abuse—a challenge capable of leaving most mobile antennas bent beyond repair. Folks in the outback of Australia rely heavily on HF communications, and Terlin aerials are visible on one of every four or five vehicles. Road trains (massive 150 long super truck/trailers used instead of railways) especially favor Terlin antennas.

Don's down-under ham activities began with portable operations from Sydney Harbor (photo 5). The rig and battery were preconnected, so he just put the transceiver on the carry bag's top, propped up the aerial, stretched out two copper grounding straps (one not shown routes into the harbor's salt water), and began DXing.

Personally speaking, I think Don has really hit a winning idea with his "hand-carried HF station" concept. It packs and unpacks quickly, is easily carried, and goes anywhere for on-the-spot operating. The aerial even separates into three 2 foot sections that rubberband to an umbrella for transporting. I can hardly wait to try my



▲*Photo 7– He's not just mobiling, he's outbacking! Note the outline of the countryside filtering through the dust, the ruts in the road, swaying stinger on the antenna, and silhouette of the driver on the vehicle's right side. A classic photo for sure! (Thanks to WD4FSY)*

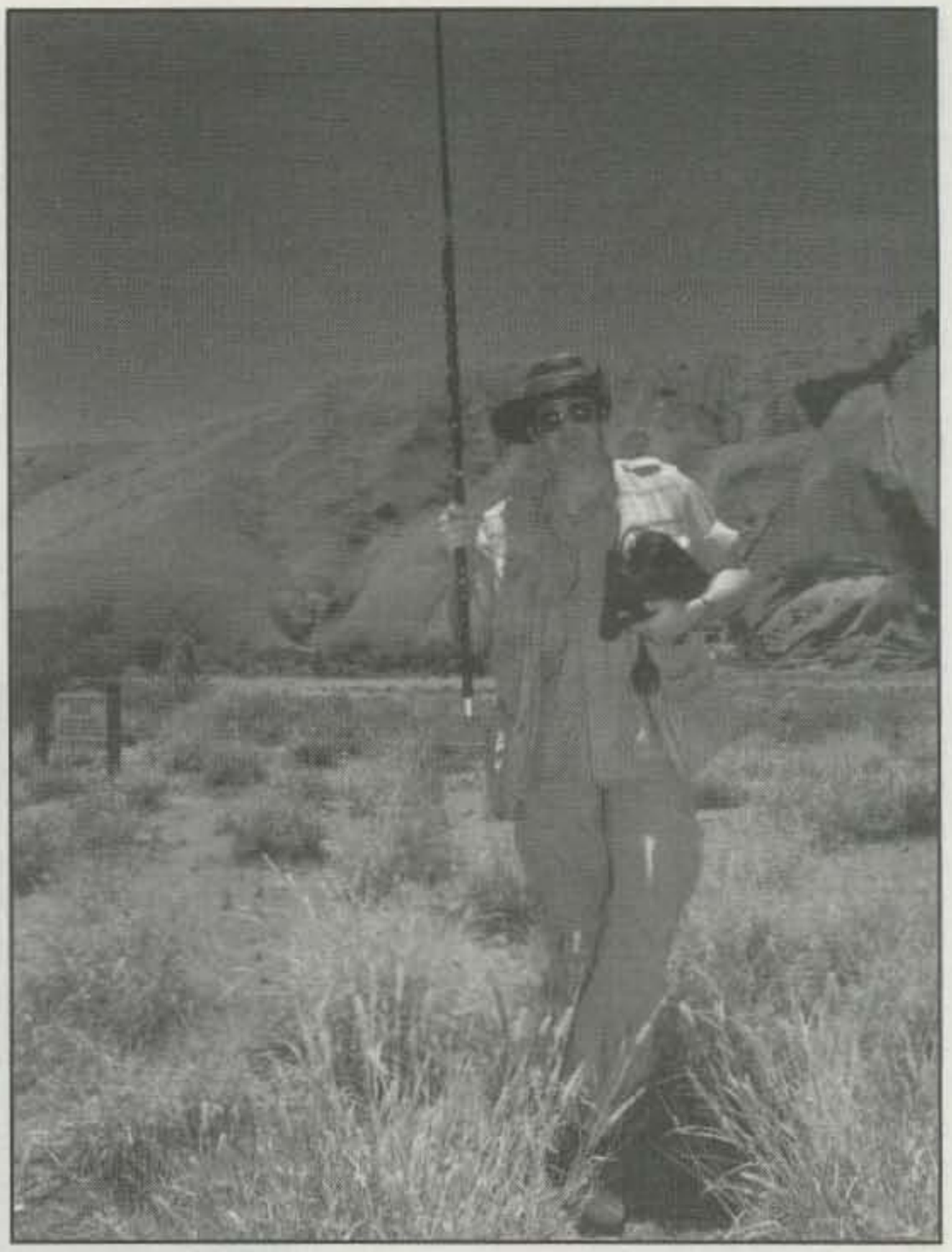


Photo 8– Ayer's Rock in central Australia may not qualify as a new country, but it is definitely a magnificent natural landmark. Quick portable operating from here is simple: bring your own rig and batteries! ►

own copy of Don's "rig in a bag" on a southern beach this summer.

Our next view (photo 6) shows Don heading into the bush country and set to operate as VK2IBB mobile in motion. Conventional attire has been exchanged for an Aussie DX duck-hunting suit, military "slouch" hat, and walkabout boots. The antenna has been clamp-mounted to the rental vehicle's luggage rack, the rig quick-cabled to the battery (cable just routed under the hood and through the door). The 6 amp gel-cell battery is recharging through the car's cigarette-lighter plug. Photo 7 shows Don trucking down a typical road in the outback. He is not running at excess speed; he is just blowing red dust and staying ahead of biting flies. The upcoming rut in front of the vehicle and swaying stinger on the antenna indicates this is not your usual glass-smooth freeway ride. Crocodile Dundee land for sure!

Photo 8 shows Don midway across Australia taking a portable operating break from Ayers Rock (photo 8). Aborigines refer to this world-famous landmark as being the center of the universe. Don describes it as a gigantic rock amidst an incredibly picturesque setting in the middle of nowhere. DXers who contacted Don at Ayers Rock surely refer to the exchange as one of their most unusual QSOs.

Don returned to the U.S. during late January and is now back on the weekend hamfest scene. Step up to him at an Outbacker booth, say hello, and tell him you saw the photos of his mini-expedition here in *CQ* (also check his ad in this month's *CQ*).

Conclusion

We have run out of space for this month's column, but I sense many readers still asking for more details on our briefly mentioned hand-carry HF setup or "station in a bag." Like you, I think this is a neat idea for out-of-car hamming while traveling or vacationing. There are also some appealing variations of such setups—briefcase rigs, den stations built into lift-and-go magazine racks, and more. Let's thus combine that topic with some other unique rig ideas and feature them in the next "World of Ideas" column.

Until then, 73 and we hope to chat with you on 14.180 to 14.225 kHz between 2200 and 2230 GMT some Sunday or 10.105 ±5 kHz some weeknight soon.

73, Dave, K4TWJ

ORDER NOW 1-800 4 HOBBY KITS

AIRCRAFT RECEIVER

Hear exciting air-craft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit.....**$29.95** Matching case set, CAR...**$14.95**

FM RECEIVERS & TRANSMITTER

Keep an ear on the local repeater, police, weather or just tune around. These sensitive superhet receivers are fun to build and use. Tunes any 5 MHz portion of the band and have smooth varactor tuning with AFC, dual conversion, ceramic filtering, squelch and plenty of speaker volume. Complete manual details how the rigs work and applications. 2M FM transmitter has 5W RF out, crystal control (146.52 included), pro-specs and data/mike inputs. Add our case sets for a nice finish.

FM Receiver kit Specify band: FR-146 (2M), FR-6 (6M), FR-10 (10M), FR-220 (220MHz).....**$29.95**
CFR Matching case set.....**$14.95**
FT-146 Two Meter FM transmitter kit.....**$79.95**

MICRO-MIKE

World's smallest FM wireless mike. Smaller than a sugur cube - including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT too!

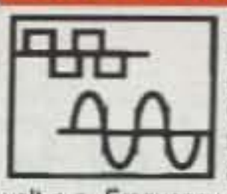
FM-5 Micro mike kit.....**$19.95**

FM WIRELESS MIKES

Pick the unit that's right for you. All units transmit a stable signal in the 88-108 MHz FM band up to 300' except for High power FM-4 and PB-1 Phone bug that go up to 1/2 mile.

FM-1 Basic unit.....**$5.95**
FM-2, as above but with added mike pre amp.....**$7.95**
FM-4, long range with very sensitive audio pickup.....**$14.95**
PB-1, Phone bug needs no battery, hooks to phone line.....**$14.95**
MC-1, Micro size sensitive mike cartridge for FM-1,2,4.....**$2.95**

SYNTHESIZED AUDIO GENERATOR



DDS (Direct Digital Synthesis) technology brings you a terrific audio generator at a fantastic price! Generates from 0. 01 Hz to 50 KHz with five digit LED display of frequency. Sine and square wave output adjustable 0-5 volt p-p. Frequency selected by direct keyboard entry and with handy continuous tune tuning knob. Crystal controlled accuracy of 10 ppm and two memories for rapid frequency changes. Retire that jury-rigged old generator and treat yourself to the pleasure of using a new state-of-the-art SG-550!

SG-550 Kit..**$199.95** SG-550WT assembled.....**$269.95**

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1.....**$29.95**
Shortwave converter kit, SC1.....**$27.95**
Matching case set for SR1, CSR.....**$14.95**
Matching case set for SCI, CSC.....**$14.95**

AM TRANSMITTER

High quality, true AM broadcast band transmitter is designed exactly like the big commercial rigs. Power of 100 mW, legal range of up to 1/4 mile. Accepts line level inputs from tape and CD players and mike mixers, tunable 550-1750 KHz. Complete manual explains circuitry, help with FCC regs and even antenna ideas. Be your own Rush Limbaugh or Rick Dees with the AM-1! Add our case set for a true station look.

AM-1 Transmitter kit.....**$24.95**
CAM Matching case set.....**$14.95**

SCANNER CONVERTER

Tune in on the 800-950 MHz action using your existing scanner. Frequencies are converted with crystal referenced stabilty to the 400-550 MHz range. Instructions are even included on building high performance 900 MHz antennas. Well designed circuit features extensive filtering and convenient on-off/bypass switch. Easy one hour assembly or available fully assembled. Add our matching case set for a professional look.

SCN-1 Scanner converter kit.....**$49.95**
SCN Matching case set.....**$14.95**
SCN-1WT Assembled SCN-1 and case.....**$89.95**

SURROUND-SOUND/REVERB

Add concert hall realism to your stereo, TV or even 2-way radio! Easily sythesize a stereo effect from mono sources or richly enliven regular music. Add a big-voice reverb to your radio voice that others will envy! Our reverb/surround sound kit uses a Bucket Brigade IC Device for reliable solid-state performance. Adjustable reverb, delay and mix controls to customize your sound. Easily connected to radios, stereos, CB's and TV's. Plently of audio to drive a small speaker for stand-alone operation too. Experierence the fun and realism that surround sound provides - without spending hundreds! Add our case set for a neat, pro look.

RV-1 Surround Sound/Reverb kit.....**$59.95** CRV Matching case set.....**$14.95**
RV-1WT Assembled RV- 1 and case.....**$99.95**

TOUCH-TONE REMOTE CONTROL

Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mV steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 mS to 40 hours! Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fi's, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

URC-1 Remote control kit.....**$129.95** CURC Matching case set.....**$14.95**
URC-1WT Fully assembled URC-1 and case.....**$189.95**

FM SUBCARRIER DECODER

Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

SCA-1 Decoder kit.....**$27.95** CSCA Matching case set.....**$14.95**
FR-1 FM receiver kit.....**$24.95** CFR Matching case for FR-1.....**$14.95**

L-C METER

Measure inductors from 10 uH-10mH and capacitors from 2 pF-2uF with high accuracy by connecting the LC-1 to any digital multimeter. Two pushbutton ranges for high resolution readings and we even give you calibration components to assure proper accuracy of your kit! Active filters and switching supplies require critical values, no one should be without an accurate LC meter. For a pro look, add our matching case set.

LC-1 LC meter kit.....**$34.95** CLC case set.....**$14.95**

MOTOR CONTROLLER

Control the speed and direction of any motor. Use our SMD-1 for those nice steppers you see surplus, and our MSC-1 for DC motors. The stepper driver features variable speed, half step rotation, direction and power down mode, can drive most any stepper motor. Our DC driver features pulse width modulation control allowing full motor torque even at low speeds and can drive motors up to 50 VDC @ 10 Amps! Add our case set for a professional assembly.

SMD-1 Stepper kit.....**$24.95** MSC-1 DC motor kit.....**$24.95**
CSMD SMD-1 case.....**$14.95** CMSC MSC-1 case.....**$14.95**

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit.....**$34.95**
CFM Case,whip ant set.....**$14.95**

DR. NI-CAD CONDITIONER/FAST CHARGER

Quit spending big bucks for replacement battery packs, rejuvenate and condition your batteries for peak capacity. Advanced circuitry has optimized discharge before charge to eliminate memory effect and to condition batteries that have been poorly cared for in the past. Quick charge rapidly brings battery to full charge in less than an hour-just 15 minutes for some types! And "top-off" charge mode squeezes every last bit of energy into each cell for the absolute most capacity. Switch-mode regulator controls constant current charge while being monitored by a negative delta-V system that cuts off the fast charge at the exact point of full charge-batteries are charged, not cooked! Charges NiCads or NiMH packs from 2 to 10 cells (easily expanded) and current capacities up to 10 Amp-hours. Runs on 12 to 15 VDC. Quit cooking your batteries, buying new packs, waiting hours for recharge, get a Dr. Ni-Cad today! Available in money saving kit form or wired and tested with case at a special price. Kit builders: add our matching case set for a snazzy finish.

DN-1 Dr. Ni-Cad conditioner/fast charger kit.....**$49.95**
CDN Matching case set.....**$14.95**
DN-1WT Fully assembled Dr. Ni-Cad with case.....**$89.95**

SPEED RADAR

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

SG-7 Complete kit.....**$99.95**

STEREO PEAK HOLD BARGRAPH

Finally a dual LED bar graph with a peak hold display! Bar graph displays are neat and eye catching but their speed is their downfall - they just can't capture the peaks. Our kit is like two units in one, a fast display to show the signal and a long persistance display to capture peaks, similar units go for hundreds of bucks! We offer 3 models: Linear for general use, Semi-Log for audio VU meters, and Log for power displays. Dual - for stereo! - 10 segment multi-colored LED display for snazzy, eye grabbing display and easily set ranges for virtually any signals, from voltmeters to audio VU meters to audio power amps to SWR meters. Complete intructions for easy hook-up to most any device. Add our matching case set for a sharp looking unit.

PH-14 Dual Linear bargraph kit.....**$39.95** PH-15 Dual Log bargraph kit..**$39.95**
PH-16 Dual Semi-Log bargraph kit.....**$39.95** CPH Matching case set.....**$14.95**

SPEECH SCRAMBLER

Descramble most scramble systems heard on your scanner radio or set up your own scambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a fine professional finish.

SS-70 Scrambler /descramblerkit.....**$39.95**
CSSD matching case set.....**$14.95**
SS-70WT Assembled SS-70 and case set.....**$79.95**

CRYSTAL RADIO

Relive the radio past with a crystal set like your grandfather built. Uses genuine Galena crystal and catwhisker. Several different types of radios are built, including standard AM broadcast, shortwave and even WW II foxhole style. To compare modern semiconductor detectors, we include a diode for comparison. No soldering required and we even give antenna ideas. Radio for free, get it now before Clinton taxes it!

CS-1 Crystal set kit.....**$19.95**

TOUCH-TONE DECODER

Grab Touch-Tone numbers right off the air, phone or tape. A simple hook-up to any radio speaker or phone line is all that is required to instantly decipher touch-tone phone numbers or codes. A 256 digit memory stores decoded numbers and keeps its memory even in the event of power loss. An 8 digit LED display allows you to scroll through the memory bank to examine numbers. To make it easy to pick out number groups or codes, a "dash" is inserted between sets of digits that were decoded more than 2 seconds apart. A "central-office" quality crystal controlled decoder is used allowing rapid and reliable detection of numbers at up to 20 digits per second! For a professionally finished look, add our matching case set. Start cracking those secret codes tomorrow with the Tone Grabber!

TG-1 Tone Grabber kit.....**$99.95** CTG Matching case set.....**$14.95**
TG-1WT Fully assembled TG-1 and case.....**$149.95**

DIGITAL VOICE RECORDER

Chatterbox digital voice storage unit will record your message of up to 20 seconds. Time is split up into four 5 second blocks which can be played separately or cascaded for longer messages. An LED display shows message location and current mode for easy operation. Nifty built-in interfaces allow simple connection to transmitters for automatic keying when the PTT is initially closed or after it is released. You can even loop your rig's mike through the Chatterbox. For contest or fun use, the CB-1 can drive an external speaker. Includes a built-in electret mike. For that finishing touch, add our matching case set.

CB-1 Voice recorder kit.....**$59.95** CCB Matching case set.....**$14.95**

ORDERS CALL **1-800-4 HOBBY KITS** (446-2295) ORDERS ONLY
TECH/ORDER/INFO (716)924-4560 FAX (716)924-4555

TERMS: Satisfaction guaranteed. Examine for 10 days. If not pleased return in original form for refund. Add $4.95 for shipping, handling and insurance. For foreign orders add 20% for surface mail. COD (U.S. only) add $5.00. Orders under $20 add $3.00 NY residents add 7% sales tax. 90-day parts warranty on kit parts. 1-year parts & labor warranty on wired units.

RAMSEY ELECTRONICS, INC 793 CANNING PARKWAY VICTOR NY 14564

BILL'S BASICS

BY BILL WELSH, W6DDB

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Novice-Technician Licensing Course
Part I—Introductory Information

This article will be presented in several parts. It will cover everything you need to know to pass the FCC element 2 (Novice) and element 3A (Technician) written examinations.

My wife, Marie, W6JEP, and I have conducted amateur radio licensing courses since 1948. We have run Novice, Technician, General, Advanced, and Extra class licensing courses. If you want information about the set of printed items we distribute to our students, you can request a data sheet from us. We have a set of 15 cassettes which can be used to take you from no knowledge of the International Morse Code to a proficiency of about 13 words per minute. If you want information about this set of tapes, please send a self-addressed stamped envelope (SASE) with your request to me using the address shown on the first page of this article.

Anyone who wants to check his or her ability to pass Novice and/or Technician written tests is welcome to use my series of examinations, particularly at the end of this course. I have eleven Novice tests and eleven Technician tests. I will mail them, one at a time, to anyone who requests them. Enclose your SASE with double first-class postage each time you mail an exam to me for correction. I will correct the test and mail it back to you with the next test. No charge is involved; just pay postage costs.

The FCC's amateur radio licensing examination elements are as follows:

Code
1A—5 words per minute
1B—13 words per minute
1C—20 words per minute

Written
2—Novice
3A—Technician
3B—General
4A—Advanced
4B—Extra

The FCC's element requirements for each class of license are detailed herein. As you upgrade, you just have to pass the additional elements which are required to upgrade. You are not tested again for elements you passed to obtain a currently valid license. As an example, when upgrading from General to Advanced, you just have to pass element 4A. The element requirements are as follows:

Novice—1A/2
Code-Free Technician—2/3A
Technician-Plus—1A/2/3A
General—1B/2/3A/3B
Advanced—1B/2/3A/3B/4A
Extra—1C/2/3A/3B/4A/4B

You do not lose operating privileges when you upgrade; you just gain additional privileges.

Note that the Code-Free Technician license applicant must pass both the Novice (element 2) and the Technician (element 3A) written examinations. Each test involves nine sub-elements, which cover the same nine subjects. Consequently, it is reasonable to combine both sets of information into one licensing course, which is what is presented in this article.

Novice and Technician-Plus amateurs have the following frequencies available to them:

45527 Third Street East, Lancaster, CA 93535-1802

Here is Mike Zane, K6URI, operating as ZF2VA from Grand Cayman in the West Indies. He spent one week operating from Cayman Brac before going to Grand Cayman for a week. Mike contacted 22 Novices during his mini-DXpedition and he enjoyed working them. If you worked him and you are listed in the current Callbook, he has mailed a QSL to you. If you are not listed, send QSO data and your address to Mike at P.O. Box 455, Lodi, CA 95241.

Meters/Band	kiloHertz
10	28,100–28,500
15	21,100–21,200
40	7100–7150
80	3675–3725

Code-Free Technician and Technician-Plus amateurs have the following frequencies available to them:

Band	megaHertz
23 centimeters	1240–1300
33 centimeters	902–928
70 centimeters	420–450
1.25 meters	222–225
2 meters	144–148
6 meters	50–54

Other frequencies, plus a variety of mode privileges, are also available to Novices and Technicians. The latest *Callbook* shows 51.43% of American amateur radio operators hold Novice or Technician licenses.

The FCC licensing examination sub-elements are arranged in the following sequence: Rules and Regulations, Operating Procedures, Radio Wave Propagation, Amateur Radio Practices, Electrical Principles, Circuit Components, Practical Circuits, Signals and Emissions, and Antennas and Feedlines.

I have found through experience that it is better to teach the required material in the following sequence. The number of related Novice and Technician test questions for each sub-element is also shown.

Sub-Element Subject	Exam Questions	
	Novice	Technician
Electrical Principles	4	2
Circuit Components	2	2
Practical Circuits	2	1
Signals and Emissions	2	2

Operating Procedures	2	3
Amateur Radio Practices	4	4
Rules and Regulations	10	5
Radio Wave Propagation	1	3
Antennas and Feedlines	3	3
(Totals)	(30)	(25)

The passing grade for these FCC tests is 75%, but you are not required to achieve a mark in excess of 75%. Consequently, the closest possible grade to 75% is accepted. The minimum passing grade for the Novice test is 73.3%, or 22 correct answers for the 30 questions. The minimum passing grade for the Technician test is 72%, or 18 correct answers for the 25 exam questions.

Until (and unless) the FCC eliminates the code tests presently required to upgrade, it is imperative to acquire required Morse code proficiency.

It is easy to acquire the knowledge needed to pass Novice and Technician FCC written examinations. I will be glad to receive your suggestions as you progress through this licensing course. Good luck!

Electrical Principles

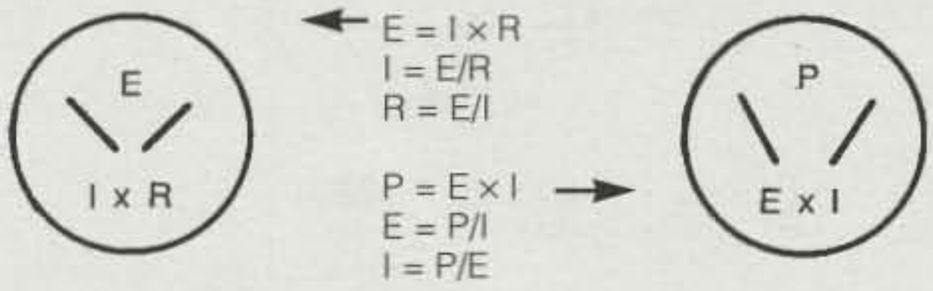
Prefixes and Conversions

Prefix	Symbol	Powers of Ten	Multiplication Factor
Tera	T	10^{12}	1,000,000,000,000
Giga	G	10^{9}	1,000,000,000
Mega	M	10^{6}	1,000,000
kilo	k	10^{3}	1,000
hecto	h	10^{2}	100
deca	da	10^{1}	10
basic unit			**1**
deci	d	10^{-1}	0.1
centi	c	10^{-2}	0.01
milli	m	10–3	0.001
micro	(Greek)μ	10–6	0.000001
nano	n	10–9	0.000000001
pico	p	10–12	0.000000000001

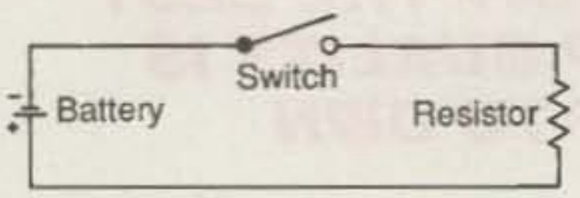
1 kiloHertz = 1000 Hertz
1.2 gigaHertz (GHz) = 1200 megaHertz (MHz)
3.525 megaHertz (MHz) = 3525 kiloHertz (kHz)
1000 kiloHertz (kHz) = 1 megaHertz (MHz)
1200 megaHertz (MHz) = 1.2 gigaHertz (GHz)
3725 kiloHertz = 3,725,000 Hertz (Hz)
7125 kiloHertz (kHz) = 7.125 megaHertz (MHz)
400 centimeters (cm) = 4 meters (m)
(1 meter = 39.37 inches = 3.28 feet)
500 milliwatts (mW) = 0.5 watt (W)
3000 milliamperes (mA) = 3 amperes (A)
3500 millivolts (mV) = 3.5 volts (V)
500,000 microFarads (μFd) = 0.5 Farad (Fd)
1,000,000 picoFarads (pFd) = 1.0 microFarad (μFd)

Ohm's Law and Power

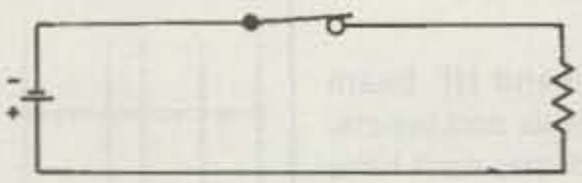
Ohm's Law shows relationships between voltage (E), current (I), and resistance (R). Cover the unknown quantity and the remaining exposed portion of the Ohm's Law "pie" shows the formula that should be used to determine the unknown (desired) quantity. The power (P) "pie" is used in the same manner.



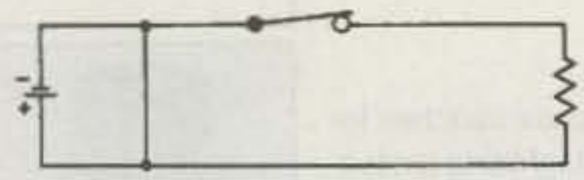
Electrical Quantity	Letter Symbol	Basic Unit	What It Is/Does
*Voltage	E	Volt	Provides electron push
Currant	I	Ampere	Electron drift
Resistance	R	Ohm	Opposes electron drift
Power	P	Watt	Energy dissipation rating



Open Circuit



Closed Circuit



Short Circuit
(switch could be open or closed)

Water pressure is similar to voltage; both provide the push behind the flow.

**Also called electromotive force (emf), IR drop, and potential difference. It causes electrons to flow through a closed (complete) circuit. No current flows through an open circuit, since the resistance is infinite. An excessive current flows through a short circuit.*

Typical Problems

I = 2A R = 50 E = ?
E = I × R = 2 x 50 = 100 volts
E = 200V R = 100 I = ?
I = E/R = 200/100 = 2 amperes
I = 3A E = 90V R = ?
R = E/I = 90/3 = 30 ohms
E = 12V I = 0.15A R = ?
R = E/I = 12/0.15 = 80 ohms
E = 12V R = 4800 I = ?

$$I = \frac{E}{R} = \frac{12}{4800} = 0.0025A = 2.5 \text{ milliamperes}$$

E = 12V R = 48,000 I = ?

$$I = \frac{E}{R} = \frac{12}{48000} = 0.00025A = 250 \text{ microamperes}$$

E = 12V I = 0.25A R = ?
R = E/I = 12/0.25 = 48 ohms
E = 120V R = 4800 I = ?

$$I = \frac{E}{R} = \frac{12}{4800} = 0.0025A = 2.5 \text{ milliamperes}$$

E = 120V R = 48,000 I = ?

$$I = \frac{E}{R} = \frac{12}{48000} = 0.00025A = 250 \text{ microamperes}$$

120V light bulbs – current flow
I = P/E
60W bulb: I = P/E = 60/120 = 0.5A
75W bulb: I = P/E = 75/120 = 0.625A
100W bulb: I = P/E = 100/120 = 0.83A
Higher wattage bulbs draw more current.

Electricity

A current that continuously flows in the same direction is direct current.

A typical car battery supplies 12 volts; it has positive and negative output terminals.

A current that flows in a different direction each alternate half cycle is alternating current.

The frequency of an alternating current is the number of complete (positive and negative, relatively) alternations that occur in one second.

The basic unit of frequency is the Hertz.

House power is typically 60 Hertz, and 120 volts.

2000 complete cycles = 2 Kilohertz.

Electrical current is limited by the resistance of the material through which the current is flowing.

Typical good electrical conductors include gold, silver, copper, and aluminum.

Good electrical conductors offer little opposition to the flow of electric current.

Typical good electrical insulators include glass, air, plastic, and porcelain.

Insulators offer high opposition to current flow, commonly preventing it entirely.

When an incandescent light bulb is energized, electrical energy is converted into heat and light.

Energy is the ability to do work.

Frequency and Wavelength

The term for the number of complete cycles that occur in one second is frequency.

The basic unit of frequency is the Hertz.

The audio frequency range is 20 to 20,000 Hertz. It is the range of frequencies humans can hear. 725 Hertz is a typical audio frequency. House power is typically 60 Hertz. Audio frequencies, intermediate frequencies, and radio frequencies are all alternating current frequencies.

Radio frequencies are 20 Kilohertz and above. 7125 Kilohertz is a radio frequency. 3,725,000 Hertz is 3,725 Kilohertz, another radio frequency.

One wavelength is the distance one point in an alternating current signal travels in one complete cycle. Wavelength decreases as frequency increases. Frequency decreases as wavelength increases.

A 10 meter signal is 32.8 feet long, since 1 meter is 3.28 feet in length. The length of a 6 meter signal is 19.68 feet. The length of an 80 meter signal is 262.4 feet.

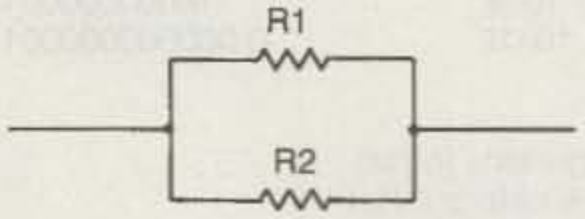
Resistance-Capacitance-Inductance

Resistance
The basic unit of resistance is the ohm.
The letter symbol of resistance is R.
Resistors in series are additive.

$R_T = R1 + R2$, etc.

The total resistance of two equal value resistors connected in series is twice the value of either one.

The total resistance of two resistors connected in parallel (shunt) is the product of the two resistors divided by their sum.

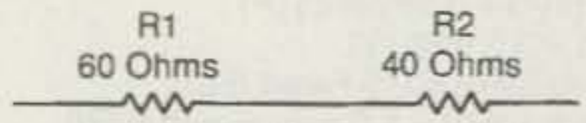


$$R_T = \frac{R1 \times R2}{R1 + R2}$$

The total resistance of two equal value resistors connected in parallel is one-half the value of either one.

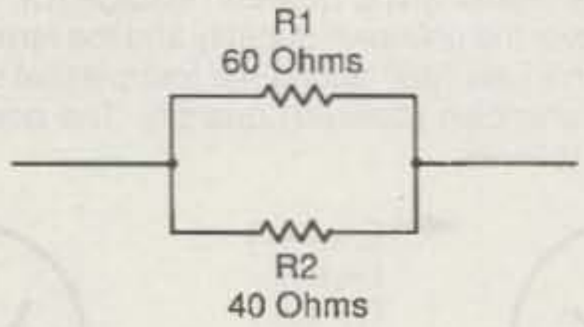
Examples:

Series Resistances



$R_T = R1 + R2 = 60 + 40 = 100$ ohms

Parallel Resistances



$$R_T = \frac{R1 \times R2}{R1 + R2} = \frac{60 \times 40}{60 + 40} = \frac{2400}{100} = 24 \text{ ohms}$$

Capacitance

The basic unit of capacitance is the Farad.

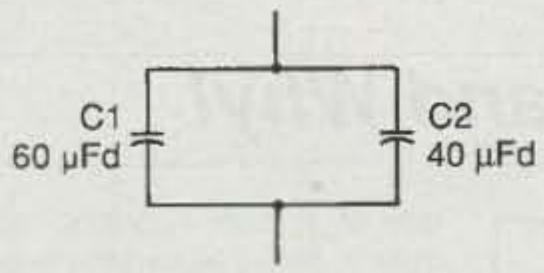
The letter symbol of capacitance is C.

Energy is stored in the electric field (between the plates) of a capacitor.

Capacitance and resistance formulae are opposite to each other for series and parallel connections.

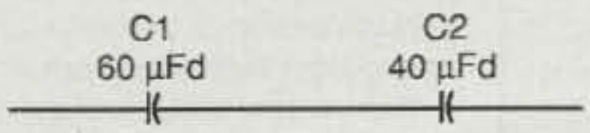
Parallel/shunt connected capacitors

$C_T = C1 + C2 = 60\ \mu Fd + 40\ \mu Fd = 100\ \mu fd$



Series connected capacitors

$$C_T = \frac{C1 \times C2}{C1 + C2} = \frac{60\ \mu Fd \times 40\ \mu Fd}{60\ \mu Fd + 40\ \mu Fd} = \frac{2400\ \mu Fd}{100\ \mu Fd} = 24 \text{ microFarads}$$



Inductance

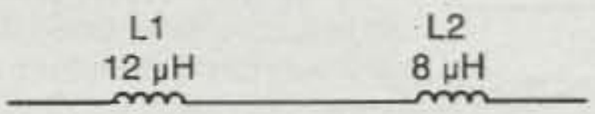
The basic unit of inductance is the Hhenry.

The letter symbol of inductance is L.

An inductor stores energy in its electromagnetic field.

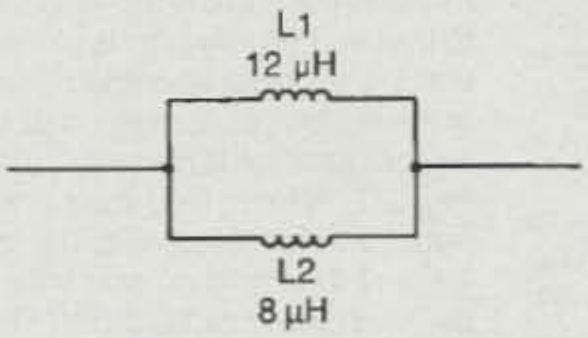
Total inductance formulae for series and parallel connected inductors are basically the same as for resistors.

Series



$L_T = L1 + L2 = 12\ mH + 8\ mH = 20$ milliHenries

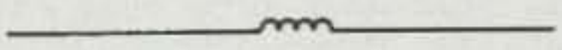
Parallel



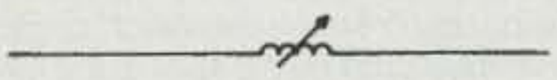
$$L_T = \frac{L1 \times L2}{L1 + L2} = \frac{12\ mH \times 8\ mH}{12\ mH + 8\ mH} = \frac{96 \text{ microHenries}}{20 \text{ milliHenries}}$$

$L_T = 4.8$ milliHenries

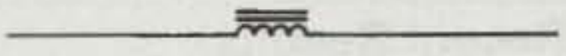
Symbols



fixed air core inductor



variable air core inductor



fixed inductor with magnetic core

Summary

This concludes the first part of this licensing course article. The second part will start with circuit components and continue on.

As always, I suggest you keep all the parts of this series in order for easy study reference. And as I mentioned at the beginning of this column, I can send to you my series of examinations and code study cassettes. See the first page of this article for ordering information and my California address.

Written suggestions and comments are welcome, but if you need a reply, please enclose an SASE.

73, Bill, W6DDB

CONTEST CALENDAR

BY JOHN DORR, K1AR

NEWS/VIEWS OF ON-THE-AIR COMPETITION

Using Two Radios—How and Why!

May Contest Tip

If you are a packet-assisted contester, always be sure to verify the callsign and exchange of the "spotted" station you are working. Many times a busted callsign has been spotted. Make the mistake appear on your screen—not in your log!

Calendar of Events

Apr.	23-24	Helvetia Contest (HB9)
Apr.	27-29	DX-NA YLRL SSB Contest
May	7-8	MARAC CW Contest
May	7-8	ARI International DX Contest
May	14-15	CQ-M Contest
May	14-15	Nevada QSO Party
May	21	NorthWest QRP Club CW Sprint
May	21-22	MFJ 90's RC QRP Contest
May	21-23	Michigan QSO Party
May	**28-29**	**CQ WW WPX CW Contest**
June	4-6	ARRL June VHF QSO Party
June	11-1	ANARTS WW RTTY Contest
June	18-19	All Asian CW DX Contest
June	25-26	ARRL Field Day
July	1	RAC Canada Day Contest
July	**9-10**	**CQ WPX VHF Contest**

In many respects, I am one of those guys who has resisted some of the changes in contest operating. For example, I did not immediately embrace computer logging (wasn't that forward thinking?), packet radio spotting, and many other modern operating aids. Like nearly everyone else, though, I eventually came around and began to see how many of these operating elements were not only fun, but essential to successfully competing at the national or world level.

One area that I have never discussed in this column is the topic of using two radios as a single operator. Let's begin by providing a brief definition of the concept. For starters, the application of two radios in this context applies to the single operator. Obviously, if you are a multi-operator station, you are already using two or more radios in your operation. The traditional single operator, however, is the user of a single radio setup—single operator, single transmitter. Makes sense, doesn't it?

I'm not sure when the concept was first tried, but some enterprising contester discovered that there was no physical reason why they had to be limited to only one transceiver while operating. The rule structure for most of the major contests did not offer any limitations (and still doesn't, although there have been some recent clarifications that I'll cover later). The actual implementation of the concept is quite simple. Your primary station remains "as is," while a new second transceiver is added to the mix. A "black box" is integrated into the design, allowing the operator to quickly switch headphones and mike/keyer lines from one radio to the other. At this point, you have it!

Having two radios available for use during a contest is one thing. Being able to use them effectively is quite another. The basic required skill is to have the ability to call CQ on Radio 1, while listening for needed QSOs or multipliers on Radio 2. Doug Grant, K1DG, often jokes about the fact that he is now listening or transmitting on *Studio B* during a contest.

With the hardware in place and the operating strategy understood, it should be obvious why this type of setup can be so advantageous to the single operator. Following are just a few examples.

One of the major operating decisions encountered during a contest is whether to search and pounce or call CQ. With two radios you can literally do both. While calling CQ on Radio 1, you can search and pounce on Radio 2. This type of operating affords you the luxury of calling CQ for longer periods than you may normally do. Remember, slower run rates are usually the motivation for converting to searching and pouncing. The addition of a second radio allows the primary station to continually call CQ while the other station is free to be moved about from band to band searching for new QSOs and multipliers. Another advantage of the second station is that it is much easier to pass needed multipliers from one band to another. Not only can you scope out a clear passing frequency, but you can more easily retain your original run frequency during the process.

The ARRL CW Sweepstakes Contest was one of the early contest environments that spawned this type of operating strategy. By its very nature, the SS is a fairly slow contest, especially during the doldrums of Sunday afternoon. A two-radio single operator can spend most of the time calling CQ for the occasional answer while searching for other needed QSOs on the second station. The really good operators even search and pounce on both radios at the same time—a real exercise in operating dexterity!

In addition to the ARRL SS Contest, two-radio setups have expanded into the world of DX contests and many other operating events. DX contests are perhaps the second most common environment for this type of operating, as are any contests that offer slow rate times for extended periods. My experience, as well as that of others, has yielded a finite impracticality for two-radio operation during high rate periods. There is simply too much activity occurring during a 200+ hour to also be worrying about activating a second station too!

As I mentioned earlier, two-station operating requires both dexterity and discipline. Dexterity comes into play because there is constant switching of operating environments as well as radios, headphones, antennas, computers, etc.—all varying based on the ingenuity of station design and layout. Put another way, you need to constantly be aware of what you're listening to and whom you're working—no easy task after 40+ hours of operating time. The second area to consider is discipline. Even though there are tremendous advantages that come from two-radio operating, it is by its very nature a more cumbersome environment to use. The discipline factor comes to play when you sometimes have to force yourself to tune with the second radio while the other one is transmitting.

This brings me to another point, and one which has been addressed recently by rule changes in some of the major contests. Most contesting convention now says that while you may use a two-radio setup, you are still limited to only one transmitted signal at a time. There is a very funny story from a few years ago when I was operating a CQ WW WPX CW Contest. My operation was only a casual event. Bill Fisher, KM9P, was out for blood! At that time the contest's rules did not exclude the ability to transmit on two bands at the same time from within the single operator category. Bill chose, quite legally, to operate with one signal on 15 meters and the other on 20 meters—both calling CQ. After a little tuning around, I quickly figured out that this was his strategy. Bill kept track of the band on which he worked stations by having one radio piped into the left side of his headphones and the other into the right. Although a virtual impossibility for me, Bill was extremely adept at operating this way. Always one for a good laugh, I took the opportunity to load my dual VFOs with both of his transmit (and listening) frequencies. When he stood by, I proceeded to call him by alternating bands according to the dots and dashes in my call. Imagine the confusion he encountered when he heard K1AR being sent alternately from one side of his headphones to the other, one dash/dot at a time! That operation, and others like it, proved that two-radio operating is a fine way to operate, but simultaneous transmissions are probably crossing the line of "single" operating as measured by the spirit of the law. Recent rule changes have since borne this out.

Some Recent Results

In the recently conducted 1994 ARRL SSB DX Contest I operated as a single operator using a two-station setup. It was very simply constructed by many station design standards, with a switch that selected the radio that I would listen to on the headphones. The transmitters were interlocked so that I could only transmit one signal at a time. To be honest, I was still a bit rusty, as this was only the second time that I had tried the technique. Within the first 30 minutes, however, the benefits were obvious. Not only could I maintain a decent 50–60 rate on 20 meters, but I was also able to pick up inter-

c/o CQ magazine

Contest Errata

CQ WW SSB WPX Contest

OH6NIO, All Band High Power, score 2,059,070, QSOs 1484, Mults 611.

VK3EW, 7 MHz High Power, score 1,027,200, QSOs 556, Mults 320, #9 in World.

N8AA, All Band Low Power, score 161,590, QSOs 286, Mults 286, #2 8th District USA.

N3HBX should have been listed as the #2 station in the 3rd Call District USA on 21 MHz.

CQ 160 Meter SSB Contest

Peter Baron, **VE3PN**, is the Canadian SSB Plaque Winner.

The N6NY entry should have been listed as Jack Althouse's correct call, **K6NY**.

esting multipliers on 10 and 15 meters that I may not have ever worked if I limited myself to the single station. In fact, that first hour ended up yielding 71 QSOs on the "run" radio and another 21 contacts on the second station. This type of result repeated itself over and over again throughout the weekend. Naturally, results diminish as you run out of stations to work, but at the end, I estimated there were over 250 "second radio" QSOs in my log—and a nice assortment of new multipliers. In addition, I was able to send a badly needed multiplier to another band with ease, as I could quickly find a clear frequency on the second band and call him intermittently as the primary station allowed. There was not a single time during the weekend when I lost my main run frequency while I was simultaneously chasing after someone else on another band.

Although I haven't calculated the actual number of band changes, there are several examples of CT log screens where every other QSO is on a different band for 20–30 minute stretches at a time.

Is This Fair?

In recent years there has been a lot of debate about fairness and equity in contesting. Naturally, fairness begins with adherence to both the literal interpretation of contest rules and the spirit in which they were intended. However, the debate enters in when you begin to apply creative technology or station designs to the operating approach. Years ago the "octopus" was a perfectly legal mode of operation wherein multi-single stations ganged together several transmitters and literally worked one station after another nearly as fast as a multi-multi operation. Realizing the impact this had on the multi-multi category, the 10-minute rule was created in response to a potentially damaging operating strategy.

In a similar vein, other rule changes have been implemented to "purify" operating categories and to keep them more in the spirit of their original intent. The elimination of spotting networks for single operators, geographic definitions (e.g., distance between transmitters) for a single station, and "one-signal" single operators are just a few examples of these changes.

I believe that the two-radio single operator maintains this spirit of "single" operation. There is still only one operator who is finding and working stations by himself. And, there is only one signal being transmitted simultaneously. The difference is that the operator is expanding the efficiency and effectiveness of his listening capabilities to work stations better and faster.

In a future column it may be interesting to publish more quantitative results of the two-setup. If you would like to share your results, please send them along!

The Contest/Antenna Forums At The '94 Dayton Hamvention

The Dayton Hamvention offers a rare opportunity to hear from some of the leaders in our hobby who share our common interests in contest operating and antenna design/installation. This year affords an excellent program that can't be missed, with one of the best lineups I've seen in years. Here are the details.

Contest Forum
Moderators Doug Grant, K1DG, and Charlie Morrison, WZ1R

"Building a World-Class Multi-Multi in the Pacific Northwest—AGAIN!" . . . Rush Drake, W7RM.

"Two Guys, Two Rigs and a QSO Every 8 Seconds—the P40L Story" . . . Jeff Steinman, KRØY, and Ralph Bown, N5RZ.

"The KN8Z Contest Station, Fort Sheller, Ohio" . . . J. R. "Doc" Sheller, KN8Z.

"Contesting in the Black Hole" . . . Bill Straw, WBØO.

"Genetic Engineering in Station Design—Cloning the K1EA Superstation" . . . Matt Strelow, KC1XX, and Ken Wolff, K1EA.

"GØKPW—The Stealth Multi-Multi of the U.K." . . . Dave Lawley, G4BUO.

"In Search of the Truly Unique (not a friend) Contest QSO—Log-Checking in the CQ WW" . . . Bob Cox, K3EST, and Dick Norton, N6AA.

Antenna Forum
Moderators Tim Duffy, K3LR, and Scott Jones, WR3G

"Antenna Basics and More" . . . Ron Lewallen, W7EL.

"All the Right Angles at All the Right Times" . . . Eric Scace, K3NA.

"Performance of Antennas Over Irregular Terrain" . . . Dr. James Breakall, WA3FET.

"The Study of Long Path Propagation at 28 MHz" . . . Carl Luetzelschwab, K9LA.

"Installation Hints for Constructing Towers" . . . John Brosnahan, WØUN.

"New Developments on 80 Meter DX Antennas" and "The Design and Construction of a Full Size 40 Meter Yagi" . . . John Devoldere, ON4UN, and Roger Vermet, ON6WU.

Final Comments

This year's Dayton Hamvention looks to be an exciting time for contesters. Naturally, I'll be there, and I'm looking forward to seeing many of you at the *CQ* booth. Dayton is always an exciting time to meet old friends and make new ones. Last year, I initiated the CQ WW Dayton Booth contest and actually kept a log of the contesters who came by. K1EA hasn't integrated this *specialized* contest into CT quite yet, so regression to manual logging forced me lose track of my "eyeball" DXCC count when it exceeded 50+ countries!

As always, please submit your calendar entries for the August column no later than June 1st. With increasing regularity, I have been receiving information for my column electronically via Compuserve and Internet. Refer to my electronic addresses printed in this column each month.

73, John, K1AR

ARI International Contest

2000Z Sat., May 7 to 2000Z Sun., May 8

This is the annual operating event sponsored by the Association Radioamator Italiani. The ARI DX Contest is managed by veteran contester I2UIY and should offer a significant amount of activity. Stations are allowed to work each other worldwide.

Classes: Single operator SSB, CW, or RTTY, single operator mixed, multi-single mixed, and SWL mixed.

Frequencies: 160 through 10 meters (no WARC bands) according to the IARU band plans. All stations (including single operator) must adhere to the standard 10 minute rule.

Exchange: Italians send RS(T) and province; all others send RS(T) and serial number.

Points: QSOs within your own country count only for multiplier credit. Count 1 point for QSOs inside your own continent, 3 points for QSOs outside your continent, and 10 points for Italian QSOs. Stations can be worked once per band and mode (e.g., 15 CW, SSB, and RTTY).

Multiplier: Italian provinces (103) and DXCC countries (not I or ISØ). Credit multipliers once per band.

Scoring: Final score is sum of QSO points times the sum of multipliers.

Awards: A plaque will be offered to the highest scoring station in each class. In addition, a certificate will be awarded to the top two to five placing stations as well as the leading scorers in each DXCC country.

Special Award: A pocket calculator will be awarded to all stations that work at least 100 Italian stations (outside Europe) or 250 Italian QSOs (inside Europe). A separate list of Italian stations worked is required for this award.

Free logging software is available for the ARI Contest. You may obtain your copy directly from the contest manager ($5 or 10 IRCs for expenses). Logs must be mailed 30 days from the end of the contest and addressed to: ARI Contest Manager, I2UIY, P.O. Box 14, 27043 Broni (PV) Italy.

MARAC County Hunters CW Contest

0000Z Sat., May 7 to 2400Z Sun., May 8

The Mobile Amateur Radio Awards Club is pleased to sponsor the 26th annual County Hunters CW Contest. Mobile and fixed stations from every county in the U.S. are invited to participate. Mobiles may be worked each time they change counties and must identify by signing "/M" after their callsign.

Exchange: QSO number, category (mobiles), RST, county, and state for US (province/DXCC country for others).

Scoring: Fixed station QSOs are worth 1 point. Mobiles and DX QSOs are worth 3 points. Final score is total QSO points times the total number of U.S. counties worked.

Frequencies: 3575, 7055, 14060, 21060, 28060 kHz.

Awards: Certificates will be awarded to the winning fixed stations in each state, province, and DXCC country (1000 points minimum).

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Size: 2-3/4" Wide x 1-1/2" Deep x 7-1/2" High

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Signal intelligence experts, public safety agencies and people with inquiring minds that want to know, have asked us for a world class *handheld* scanner that can intercept just about any radio transmission. The new Bearcat 2500XLT has what you want. You can program frequencies such as police, fire, emergency, race cars, marine, military aircraft, weather, and other broadcasts into 20 banks of 20 channels each. The new rotary tuner feature enables rapid and easy selection of channels and frequencies. With the AUTO STORE feature, you can automatically program any channel. You can also scan all 400 channels at 100 channels-per-second speed because the Bearcat 2500XLT has TURBO SCAN built-in. To make this scanner even better, the BC2500XLT has AUTO SORT - an automatic frequency sorting feature for faster scanning within each bank. Order your scanner from CEI.

For more information on Bearcat radio scanners or to join the Bearcat Radio Club, call Mr. Scanner at 1-800-423-1331. To order any Bearcat radio product from Communications Electronics Inc. call 1-800-USA-SCAN.

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Bearcat 8500XLT-H base/mobile	$369.95
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Bearcat 2500XLT-H handheld	$339.95
Sportcat 150-H handheld	$199.95
Bearcat 760XLT-H base/mobile	$199.95
Bearcat 700A-H info mobile	$149.95
Bearcat 560XLA-H base/mobile	$84.95
Bearcat 220XLT-H handheld	$229.95
Bearcat 200XLT-H handheld	$199.95
Bearcat 148XLT-H base/WX alert	$88.95
Bearcat 120XLT-H handheld	$159.95
Bearcat BCT2-H info mobile	$139.95

NEW! RELM® WHS150-H1

List price $481.67/**CE price $339.95/SPECIAL**

16 Channel - 5 Watt VHF scanning transceiver

Size: 2.45" Wide x 1.38" Deep x 6.4" High

Frequency range:148.000 to 174.000 MHz. continuous coverage. Will also work 144.000-148.000 MHz. with reduced performance.

The RELM WHS150 is our most popular programmable five watt, 16 channel handheld transceiver. Weighing only 15.5 oz., it features dealer programmable synthesized frequencies either simplex or half duplex in both 5.0 and 6.25 KHz. increments. Other features include scan list, priority channel, selectable scan delay, selectable 5 watt/1 watt power levels, liquid crystal display, time-out timer and much more. When you order the WHS150 from Communications Electronics Inc., you'll get a complete package deal including antenna, battery, belt clip and user operating instructions. The radio technician maintaining your radio system must order programming instructions part #PI150 for $18.00 to activate this radio.

Bearcat® 8500XLT-H

List price $689.95/**CE price $369.95/SPECIAL**

500 Channels · 20 banks · Alphanumeric display

Turbo Scan · VFO Control · Priority channels

Auto Store · Auto Recording · Reception counter

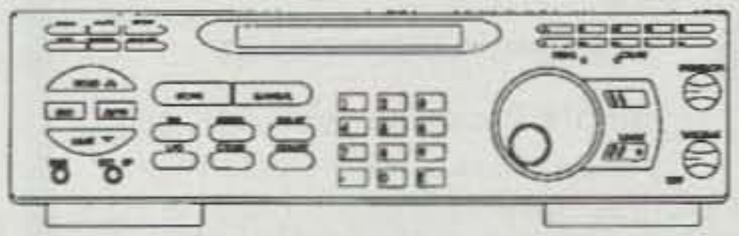
Frequency step resolution 5, 12.5, 25 & 50 KHz.

Size: 10-1/2" Wide x 7-1/2" Deep x 3-3/8" High

Frequency Coverage:

25.000 - 28.995 MHz. (AM), 29.000 - 54.000 MHz. (NFM), 54.000 - 71.995 MHz. (WFM), 72.000 - 75.995 MHz. (NFM), 76.000 - 107.995 MHz. (WFM), 108.000 - 136.995 MHz. (AM) 137.000 - 173.995 MHz. (NFM), 174.000 - 215.995 MHz. (WFM), 216.000 - 224.995 MHz. (NFM), 225.000 - 399.995 MHz. (AM) 400.000 - 511.995 MHz. (NFM), 512.000 - 549.995 MHz. (WFM) 760.000 - 823.9875 MHz (NFM), 849.0125 - 868.9875 MHz (NFM) 894.0125 - 1,300.000 MHz. (NFM).

The new Bearcat 8500XLT gives you pure scanning satisfaction with amazing features like Turbo Scan. This lightning-fast technology featuring a triple conversion RF system, enables Uniden's best scanner to scan and search up to 100 channels per second. Because the frequency coverage is so large, a very fast scanning system is essential to keep up with the action. Other features include ***VFO Control*** - (Variable Frequency Oscillator) which allows you to adjust the large rotary tuner to select the desired frequency or channel. ***Counter Display*** - Lets you count and record each channel while scanning. ***Auto Store*** - Automatically stores all active frequencies within the specified bank(s). ***Auto Recording*** - This feature lets you record channel activity from the scanner onto a tape recorder. You can even get an optional ***CTCSS Tone Board*** (Continuous Tone Control Squelch System) which allows the squelch to be broken during scanning only when a correct CTCSS tone is received. ***20 banks*** - Each bank contains 25 channels, useful for storing similar frequencies in order to maintain faster scanning cycles. For maximum scanning enjoyment, order the following optional accessories: **PS001** Cigarette lighter power cord for temporary operation from your vehicle's cigarette lighter $14.95; **PS002** DC power cord - enables permanent operation from your vehicle's fuse box $14.95; **MB001** Mobile mounting bracket $14.95; **BC005** CTCSS Tone Board $54.95; **EX711** External speaker with mounting bracket & 10 feet of cable with plug attached $19.95. The BC8500XLT comes with AC adapter, telescopic antenna, owner's manual and one year limited warranty from Uniden. Order your BC8500XLT from Communications Electronics Inc. today.



CB/GMRS Radios

The Uniden GMR100 is a handheld GMRS UHF 2-way radio transceiver that has these eight frequencies installed: 462.550, 462.725, 462.5875, 462.6125, 462.6375, 462.675, 462.6625 and 462.6875 MHz. This one watt radio comes with flexible rubber antenna, rechargeable ni-cad battery, AC adapter/charger, belt clip, F.C.C. license application and more.

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Uniden GMR100-H GMRS Handheld	$169.95
Uniden WASHINGTON-H SSB CB Base	$189.95
Uniden GRANTXL-H SSB CB Mobile	$149.95
Uniden PC76XL-H CB Mobile	$99.95
Uniden PC122XL-H SSB CB Mobile	$107.95
Uniden PRO510XL-H CB Mobile	$36.95
Uniden PRO520XL-H CB Mobile	$49.95
Uniden PRO538W-H CB & Weather	$69.95

Shortwave

ICOM R1-H ultra compact handheld wideband receiver	$469.95
ICOM R100-H superwide band mobile/121 memory	$649.95
ICOM R7100-H base with 900 memory (add $49.00 shipping)	$1,289.95
ICOM R9000-H base 30 kHz.-2 GHz. (add $149.00 shipping)	$4,999.95
ICOM AH7000-H super wideband discone type antenna	$109.95
Grundig Satellit 700-H1 portable with 512 memory &AC adapt.	$389.95
Grundig Yacht Boy 400-H digital portable shortwave	$199.95
Grundig Yacht Boy 230-H portable shortwave	$139.95
Sangean ATS202-H ultra compact 20 memory shortwave	$79.95
Sangean ATS606-H ultra compact 45 memory shortwave	$149.95
Sangean ATS606P-H shortwave with antenna & AC adapter	$169.95
Sangean ATS800-H1 portable 20 memory shortwave	$69.95
Sangean ATS803A-H portable with SSB reception & AC adapter	$159.95
Sangean ATS808-H portable 45 memory shortwave	$159.95
Sangean ATS818-H portable without cassette recorder	$189.95
Sangean ATS818CS-H with cassette recorder	$209.95
Sangean ANT60-H portable shortwave antenna	$9.95

Weather Stations

Public safety agencies responding to hazardous materials incidents must have accurate, up-to-date weather information. The Davis Weather Monitor II is our top-of-the-line weather station which combines essential weather monitoring functions into one incredible package. Glance at the display, and see wind direction and wind speed on the compass rose. Check the barometric trend arrow to see if the pressure is rising or falling. Our package deal includes the new high resolution 1/100 inch rain collector part #**7852-H**, and the external temperature/humidity sensor, part #**7859-H**. The package deal is order #**DAV1-H** for $524.95 plus $15.00 shipping. If you have a personal computer, when you order the optional Weatherlink computer software for $149.95, you'll have a powerful computerized weather station at an incredible price. For the IBM PC or equivalent order part #**7862-H**. For Apple Mac Plus or higher including Quadra or PowerBook, order part #**7866-H**.

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Uniden EXP9200-H 900 MHz. 2 line cordless phone	$329.95
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Cobra CP910-H 900 MHz. spread spectrum cordless phone	$269.95
ICOM GP22-H handheld global positioning system	$699.95
WR200-H weather radio with storm alert	$39.95
RELM WHS150-H VHF handheld 5 watt, 16 ch. transceiver	$339.95
RELM RH256NB-H VHF 25 watt synthesized transceiver	$289.95
Ranger RCI2950-H 25 watt 10 meter ham radio	$244.95
Ranger RCI2970-H 100 watt 10 meter ham radio	$369.95
Uniden LRD9000W1-H Super Wideband Laser/Radar Detector	$169.95
PWB-H Passport to Worldband Radio by IBS	$10.95
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POL4-H Police Call for IL, IN, KY, WI	$5.95
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POL6-H Police Call for DC, FL, GA, NC, PR, SC, VA, WV	$5.95
POL7-H Police Call for AL, AR, LA, MS, OK, TN, TX	$5.95
POL8-H Police Call for AZ, CO, ID, MT, NM, NV, UT, WY	$5.95
POL9-H Police Call for California, Oregon & Washington	$5.95
USAMMMOT-H magnet mount scan antenna w/Motorola plug	$29.95
USAMMPL-H magnet mount scan antenna with PL259 connector	$29.95
USAMMBNC-H magnet mount scanner antenna w/ BNC connector	$29.95
USAK-H VHF scanner/VHF transmitting antenna PL259 connector	$29.95
USASGMBNC-H glass mount scanner antenna with BNC connector	$29.95
USASGMM-H glass mount scanner antenna with Motorola jack	$29.95

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It's easy to order from CEI. **Mail orders to:** Communications Electronics Inc., Emergency Operations Center, P.O. Box 1045, Ann Arbor, Michigan 48106 U.S.A. Add $15.00 per radio for U.P.S. ground shipping and handling in the continental U.S.A unless otherwise stated. Add $8.00 shipping for all accessories and publications. Add $8.00 shipping per antenna. For Canada, Puerto Rico, Hawaii, Alaska, P.O. Box, or APO/FPO delivery, shipping charges are two times continental U.S. rates. Michigan residents add state sales tax. No COD's. 10% surcharge for net 10 billing to qualified accounts. All sales are subject to availability, acceptance and verification. Prices, terms and specifications are subject to change without notice. We welcome your Discover, Visa, American Express or MasterCard. Call 1-800-USA-SCAN to order toll-free. Call 313-996-8888 if outside the U.S.A. FAX anytime, dial 313-663-8888. **For technical assistance to solve your communications problem, call the Communications Electronics technical support hotline for $2.00 per minute at 1-900-555-SCAN.** Order your new electronic equipment from Communications Electronics Inc. today.

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CIRCLE 135 ON READER SERVICE CARD

Other certificates are available to the winning mobile in each state operating from three or more counties (ten QSOs/county minimum). Plaques will be awarded to the Top two scoring mobile and North American fixed stations, and DX station.

Completed logs, summary sheets, and county lists (required or entries with over 100 counties) must be received by June 2nd. Send your logs to: Jerry Burkhead, N6QA, 7525 Baltic Street, San Diego, CA 92111. Include a #10 SASE for contest results.

Georgia QSO Party

1800Z Sat., to 2000Z Sun., May 7–8

This once popular contest has been revived again. Open to amateurs worldwide, stations may be worked once per mode and band. The object is for non-Georgian stations to work as many Georgian stations as possible during the contest period.

Classes: Mobile, fixed, portable, CW and Phone, single and multi-single or multi-multi operations are permitted.

Exchange: GA stations send county and signal report. All others send signal report and QTH (state, province, or country).

Scoring: Credit phone QSOs with 2 points and CW contacts with 4 points. Non-Georgian stations use GA counties as multipliers (159 maximum). GA stations count states, provinces, GA counties, and DXCC countries. Final score is total QSO points times the sum of your multipliers. GA mobiles add 100 bonus points for each county from which you operated and made at least 10 QSOs.

Frequencies: CW—3540 kHz, and 40 kHz from the lower CW band edge. SSB—3855, 3975, 7243, 14240, 21330, 28400, 50240 kHz.

All logs must be postmarked no later than July 1st and should be sent with an appropriate summary sheet to: Sandy Walker, III, WB4EVH, 411 Wilson Drive, Centerville, GA 31028. Send an SASE for a copy of the final results.

Nevada QSO Party

0000Z Sat., to 0600Z Sun., May 14–15

This opportunity to work one of the "rare ones" is sponsored by the Frontier Amateur Radio Society. Stations may work each other once per band and mode on 160–6 meters. Authorized modes are CW, SSB, RTTY, SSTV, and packet.

Exchange: RS(T), state, province, or country. Nevada stations also send their county.

Scoring: Credit one point for SSB QSOs and 2 points for contacts made on all other modes. Non-Nevada stations multiply their total QSO points by the state, province, and country total.

Awards: Certificates will be awarded to the top scorer in each state, province, and DXCC country for General and above and Novice/Technician entries.

Entries must be postmarked no later than June 15th and sent to: Jim Frye, NW7O, 4102 Oakhill Avenue, Las Vegas, NV 89121.

Michigan QSO Party

1800Z Sat., May 21 to 0300Z Sun., May 22
1100Z Sun., May 22 to 0200Z Mon., May 23

This year's Michigan QSO Party will be sponsored by the Oak Park Amateur Radio Club. As usual, stations are allowed to be worked once on each band/mode. Portables and mobiles may be counted as new contacts each time they operate from a new county.

Exchange: RS(T), QSO number, QTH (county for Michigan stations, state/country for others).

Scoring: Michigan stations—1 point/QSO times (states + countries + Michigan counties). Each CW contact is 2 points/QSO. KL7/KH6 count as states and VE is considered a country. Credit 5 bonus points for each contact with the W8MB club station. Non-Michigan stations use similar scoring except multipliers/QSOs are limited to Michigan counties. Maximum multiplier is 85.

Frequencies: CW—1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125 kHz. SSB/VHF—1855, 3905, 7280, 14280, 21380, 28580, 50125, 144025, 146520 kHz.

Awards: Michigan—plaques are available to the high multi-operator/single-transmitter score, high Michigan (Upper Peninsula), high Michigan, high aggregate club score, high Michigan mobile, and high VHF entry (100 QSOs minimum). Certificates will be awarded to the high score in each Michigan county. Non-Michigan—high out-of-state plaque will be awarded and certificates for the high scorer in each state and country.

Mailing deadline for logs is July 1, 1994. Send your logs to Mark Shaw, K8ED, 27600 Franklin Road, Apt. 516, Southfield, MI 48034. Members of the Michigan QSO Party committee are not eligible for awards. Include an SASE for a copy of the final results.

CQ WW WPX CW Contest

0000Z May 28 to 2400Z May 29

Complete rules were in the January issue of *CQ*. Rules and summary/log sheets can be obtained from *CQ*, 76 N. Broadway, Hicksville, NY 11801. Check the current rules for the up-to-date trophy list. Results of the 1993 contest can be found elsewhere in this issue.

AWARDS

BY NORM VAN RAAY, WA3RTY

NEWS OF CERTIFICATE AND AWARD COLLECTING

This month's featured county hunter is:

Joseph Foster, ND3T
USA-CA All Counties #814
September 27, 1993

Joe was born in Alameda, California and was raised mostly in the Pacific Northwest. Married to his wife, Eleanor, for 45 years, they both love and enjoy their four children, three grandchildren, and great granddaughter.

At 20 Joe enlisted in the U.S. Navy. While stationed in Hawaii during the Korean War, he was assigned to the U.S. Navy Mobile Electronic Technical Unit #1. Joe's primary role was to assist the fleet in radar, sonar, and electronic communications. It was during this time that Joe found a set of WW II "V" disc Morse Code training records. While toying with the training records, Joe quickly developed a fondness for and fascination with Morse Code and received his first Novice license in May 1953.

While in the service Joe's most memorable story occurred. While he was stationed in Adak, Alaska, Joe was acting trustee of the amateur radio station. A merchant ship needed medical evacuation for an injured crewman. Joe coordinated the communications between the merchant ship and the medical evacuation teams throughout a 24-hour period to safely rescue the crewman.

A couple of years later Joe returned to the San Francisco Bay area where he became involved in mobile radio. Over the years he has gained an appreciation for the technological advances in mobile radio.

Joe recalls the typical mobile installation, which involved the use of antiquated WW II equipment modified using the ARC-S converter, combined with the car radio to receive messages, and the use of a two-tube AM transmitter. "In those days you didn't have a lot of money and you had to be frugal." The two-tube AM transmitter using the "Bob Carter" method of modulation (screen grid) barely allowed you to get messages across compared to the convenience of today's transceivers."

Subsequently, Joe was assigned to the Naval Security Group for a number of tours as an Electronic Maintenance Chief and completed 20 years of active service in the U.S. Navy.

After leaving the Navy, Joe spent 17 years employed by the FBI in the area of

Box 76, Pleasant Mount, PA 18453-0076

HONOR ROLL

3000

WA2AKB	854
KFØLZ	855
WØUBT	856
K1DFO	857

2500

WA2AKB	932
KFØLZ	933
WØUBT	934
WA7JHQ	935

2000

WA2AKB	010
KFØLZ	1011
WØUBT	1012
LZ1HA	1013

1500

WA2AKB	1098
KFØLZ	1099
VO1SF	1100
LZ1HA	1101

1000

KD1CJ	1310
WA2AKB	1311
KFØLZ	1312
LZ1HA	1313

500

VE5RD	2743
WA2AKB	2744
KFØLZ	2745
LZ1HA	2746
KB4ALC	2747
ON4ACG	2748
KB2PWS	2749
K2EEK	2750
WA5VGI	2751

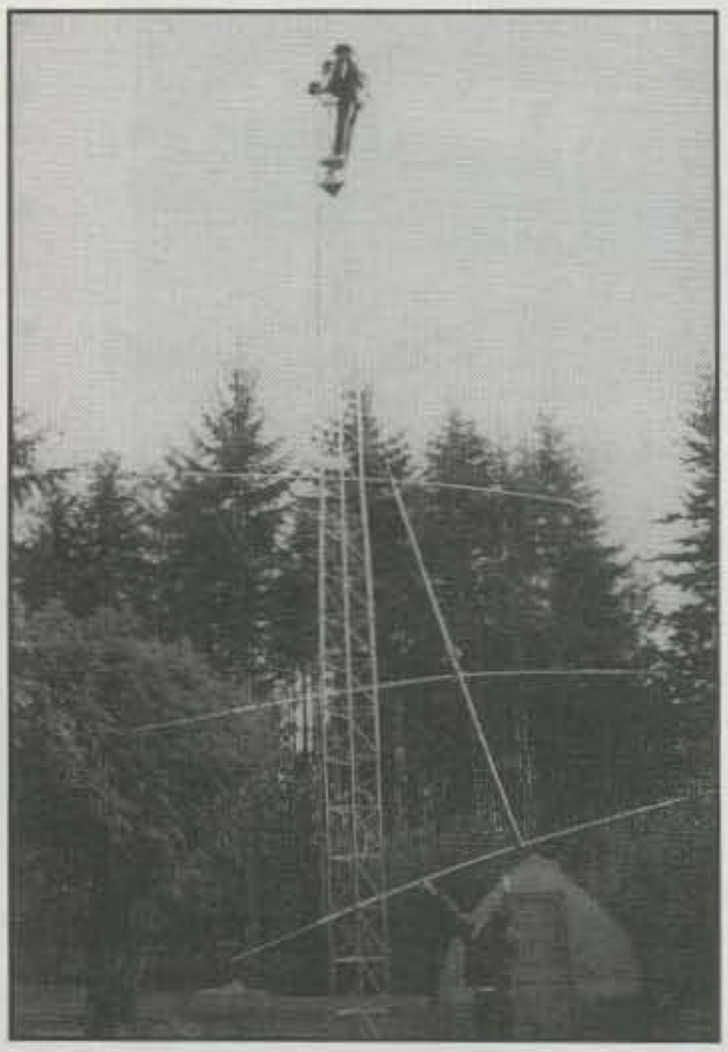
The total number of counties for credit for the United States of America Counties Award is 3076. The basic award fee for subscribers is $4.00. For nonsubscribers it is $10.00. Initial application must be submitted in the USA-CA Record Book, which may be obtained from CQ Magazine, 76 North Broadway, Hicksville, NY 11801 USA for $2.00. To qualify for the special subscriber rate, please send a recent *CQ* mailing label with your application. To be eligible for the USA-CA Award, applicants must comply with the rules of the program as set forth in the revised USA-CA Rules and Program dated June 15, 1991. A complete copy of the rules may be obtained by sending an SASE to Norm Van Raay, WA3RTY, USA-CA Award Manager, Box 76, Pleasant Mount, PA 18453-0076 USA. DX stations must include extra postage for airmail reply.

SPECIAL HONOR ROLL

Aaron Reitman, WA2AKB
USA-CA All Counties #832
Mixed Band/Mode, 02-10-94

David Weitzel, KFØLZ
USA-CA All Counties #833
Mixed Band/Mode, 02-11-94

Joe Foster, ND3T, USA-CA All Counties #814, in one of his favorite places with his loyal assistant, Sam.



ND3T's tower nestled among the pine trees with his antenna going up.

physical security. His primary efforts involved designing and using specialized equipment and techniques to support active field operations. Many cases involved the apprehension of racketeering and corruption operatives.

Joe was present during an armed bank robbery. In spite of the uneasy eye-to-eye contact with the bank robber, Joe relentlessly pursued him, dodging in and out of alleys, doubling back along Pennsylvania Avenue, while giving the District of Columbia police time to set up a barricade situation to seize the robber.

Throughout the years Joe has pursued numerous outside interests. Of a challenging nature, he made the difficult climb of Mt. Fuji—all 12,395 feet. Though remembering the tiresome climb, physical exhaustion, and worn-through boots sheared from the lava shale, Joe repeated the arduous climb the following year in 1968. Joe was awarded a First Degree Black Belt by the Kodokan Judo Institute of Japan in 1969. In 1978 he was approved by the American Kennel Club to judge K-9 obedience trials.

Meanwhile, advancing his educational interests, Joe was initiated into the Phi Theta Kappa National Honor Fraternity. Later, in 1985, he obtained his Certified Protective Professional (CPP) credentials from the American Society for Industrial Security and has since received a lifetime honorary membership.

Although involved in various interests, Joe's most favorite is amateur radio (he has achieved WAC, WAS, DXCC, and more). However, he found that something was missing. On the night of May 9, 1989 at 0304Z, while scanning the upper part of 20 meters, Joe heard a 59 signal: "This is A/M in Washington County, Nebraska QRZ, QRZ." Joe's account follows.

"Although Carl and I have never had an eyeball QSO, I will never forget the encouragement and help I received in getting started with County Hunting. There was the great feeling of sharing common experiences and marvelous personalities, and the excitement of meeting radio friends at the various conventions. There was the long dry period with 10 counties to go, and finally the miraculous high of highs in capturing my last county for the whole ball of wax—#3076, Amelia, Virginia from Ron, KA3DRO."

Joe has recently relocated from the East Coast and is readjusting as an official "Washingtonian." Joe is enjoying his retirement with Eleanor.

"People have always told me to put things where the sun doesn't shine. I never realized it was here in Port Orchard that they were talking about!" Joe finally took their advice and didn't waste any time erecting a 40 foot freestanding tower nestled among the 60 to 80 foot pine trees. Securing the antenna 50-plus feet above ground wasn't as difficult a challenge as he had thought it would be, since he has the convenience of a Journeyman Lineman as a son-in-law!

Joe's radio shack is complete, including his full-time constant sidekick Samantha, call letter suffix SAM (see the accompanying photo).

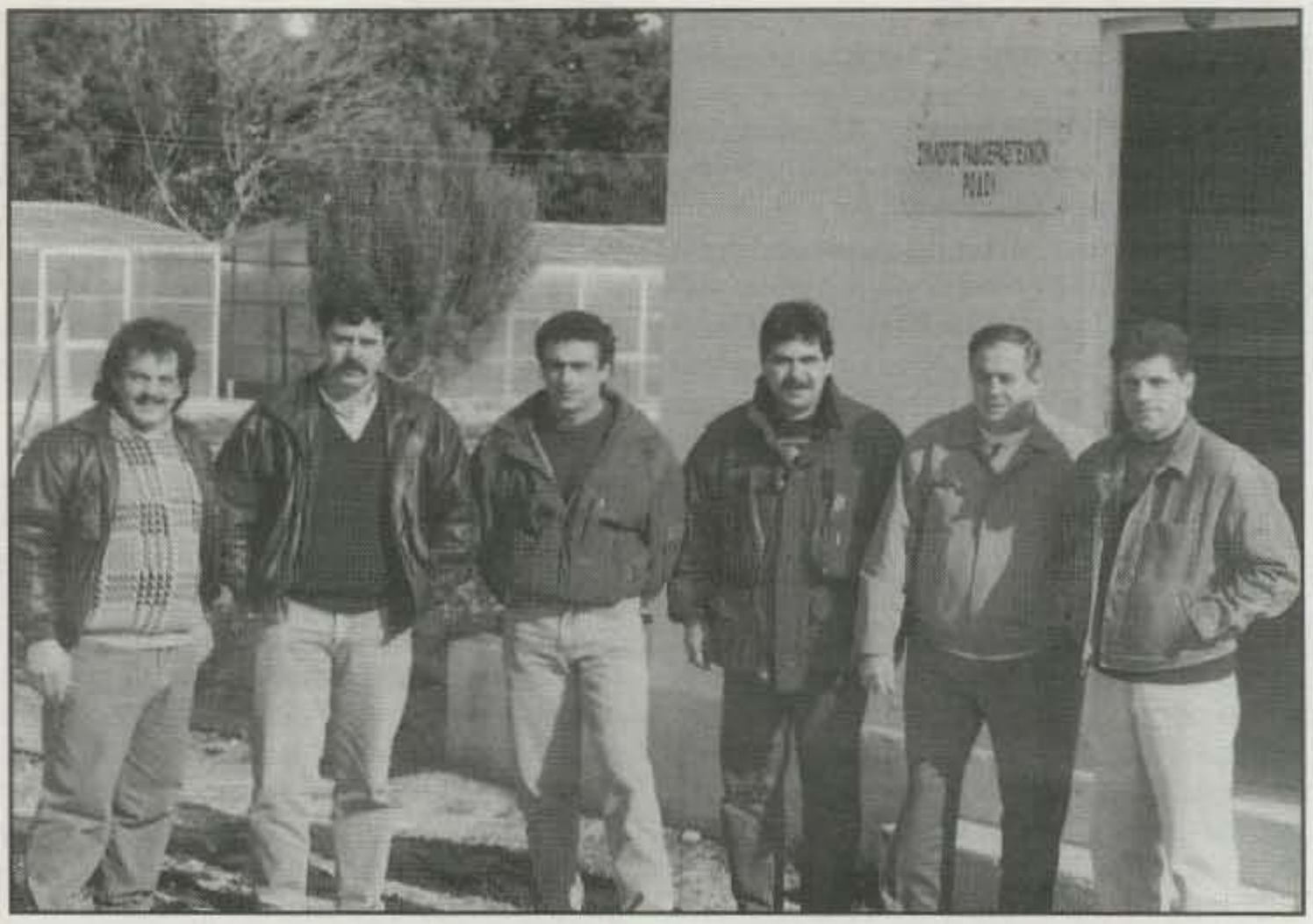
We congratulate Joe on his accomplishment.

Awards Issued

Alan M. Dorhoffer, K2EEK, began his quest for USA-CA by qualifying for USA-CA 500 #2750, All 10 Meter SSB. Alan is also well known as the Editor of *CQ*.

Aaron Reitman, WA2AKB, submitted a complete USA Counties Award Record Book and qualified for USA-CA 500 #2744, USA-CA 1000 #1311, USA-CA 1500 #1098, USA-CA 2000 #1010, USA-CA 2500 #932, USA-CA 3000 #854, and USA-CA All Counties #832 dated 02-10-94.

David Weitzel, KFØLZ, completed his quest and received USA-CA 500 #2745, USA-CA 1000 #1312, USA-CA 1500 #1099, USA-CA 2000 #1011, USA-CA 2500 #933, USA-CA 3000 #855, and USA-CA All Counties #833 dated 02-11-94.



Members of the SV5JK Club of Rhodes, Greece.

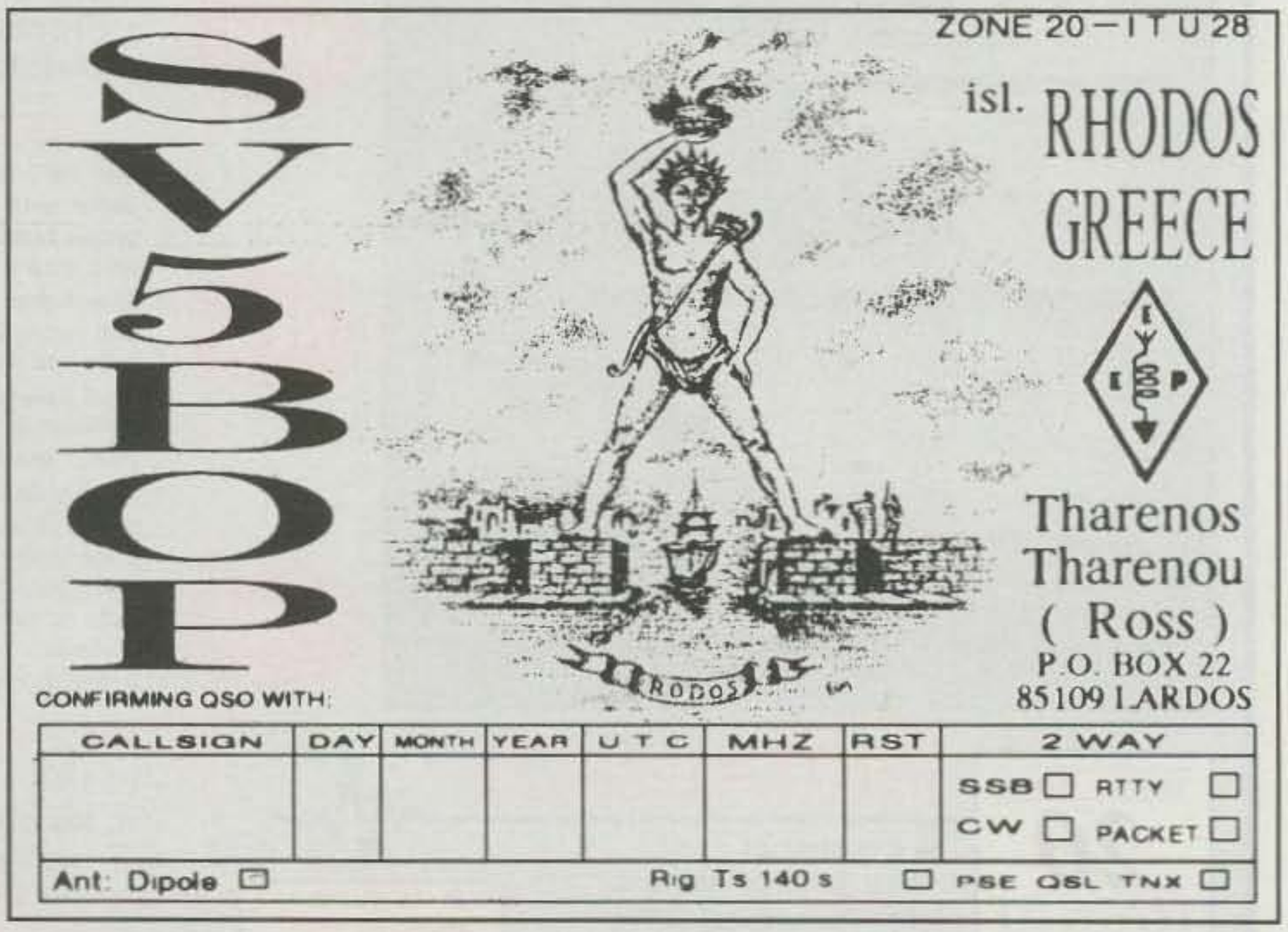
Congratulations to our two new Special Honor Roll recipients.

Awards

Colossus Award. Colossus was over 100 feet tall, or about 30 feet shorter than New York's Statue of Liberty. Sculptor Chares of Lindos took 12 years to cast the Colossus in bronze, finishing the work about 290 B.C. A masterpiece of technical and artistic achievement, it was one of the Seven Wonders of the Ancient World. But both the work and its creator were ill-fated. The sculptorr killed himself in despair when he discovered an error in his calculations (which an assistant had to correct), and the Colossus cracked at the knees and crashed to the ground during one of Rhodes' periodic earthquakes. It had stood as a triumphant memorial to Rhodian military prowess and artistic craftsmanship for less than 70 years.

The SV5JK Club of Rhodes Island, Greece honors the memory of the Colussus with this award. The general rules follow.

The award is issued to radio amateurs and shortwave listeners. Each claim must be accompanied by a list of confirmed



SV5BOP's QSL depicts the statue of Colossus, and the Colossus Award, offered by the SV5JK Club of Rhodes Island, honors its memory.

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DR-570T 2m/70cm Twin Band mobile • *Two radios into one!* Covers 2m/440MHz transmit with broadband receive including 130-170, 340-470 and 870-890MHz with user MARS/CAP modification. 45W out on 2m, 35W on 70cm. Full duplex cross band operation. Big, dual digital LCD display, illuminated front panel controls. Volume, squelch and tuning controls for each band. 20 memory channels, 4 scanning modes, priority. CTCSS encode/decode, internal duplexer. 16-key DTMF microphone with UP/DOWN key. 5¾"w x 2"h x 6⅞"d, 3¾ lbs..... $

Due to space limitations, some items, especially accessories, are not listed in this ad. For info, please ***Call Toll Free*** or see the AES® Catalog.

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DR-1200TH • 2m Data Radio, 9600 baud..... ☎

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ALINCO DJ-180TH • Same as 180T but **5W** ..... $

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ALINCO DJ-F1T 2m Mini HT • Wideband receive 130-174MHz and 118-136MHz and MARS/CAP transmit with modification. 8 scanning modes, autodialer, back lit keypad, 40 memories, call channel. CTCSS, DTMF encode and DSQ paging. 2.5W; 5W opt. 4⅛ "h x 2⅛ "w x 1½ "d, 14 oz..... $

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DJ-F1T/HP • Same as DJ-1FT but 5W with 12V 600mah nicad battery, standard..... $

***DJ-F1T/HP* – $20 Coupon**

New **DJ-G1T 2m HT** • Features 440MHz receive, "Channel Scope" spectrum analyzer, more! ..... $

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contacts or reception reports with details of callsign, band, mode, and signal reports. Each list must be accompanied by a statement from the applicant's National Society or two radio amateurs other than the applicant certifying that the QSL cards for the contacts claimed are in the possession of the applicant.

A fee of 10 IRC or $5US will be charged per award. An additional 2 IRCs or $1US is required for airmail delivery regardless of the number of awards claimed. Endorsements are available as follows.

Worked Colossus Award: For 3 confirmed contacts or SWL reports on 10, 15, or 20 meter bands.

Worked Colossus Award 2: For 4 confirmed contacts or SWL reports on any of five bands.

Worked Special Colossus Award: For 2 confirmed contacts or SWL reports on any band as well as one QSL from the club station, SV5JK.

SV5 Colossus Award: For having contacted or heard but not confirmed 4 stations on any band.

All correspondence should be sent to SV5JK Award Manager, P.O. Box 329, 85100 Rhodes Island, Greece.

CWJF, Crupo Juizforano de CW. The Radio Amateur CW group of Juiz De Fora Brazil offers this award to all amateurs who have worked three different CWJF members. Contacts on any band after 01 January 1993. Only two-way CW mode. Do not send QSL cards only GCR. Fee 5 IRCs. The award is also available to SWLs under the same conditions.

This award is available to all licensed amateurs and SWLs who have confirmed contacts with: (a) Brazilian stations using any suffix letters from the phrase "JUIZ DE FORA—A MANCHESTER MINEIRA; (b) three CWJF members.

One of the award certificates offered by the Radio Amateur CW Group of Juiz de Fora, Brazil.

The Diploma Cidade Juiz de Fora is offered for two-way CW contacts.

Contacts can be in any band, only two-way CW mode, after 01 January 1993. Do not send QSL cards, only GCR. Fee is 5 IRCs. Application should be addressed to CWJF, P.O. Box 410, 36001-970 Juiz de Fora, MG Brasil.

CWJF members as of June 1993: PP1RR; PP7CI, CW; PR8LJ: PT2CJ, FK, ON; PT9CEL; PU4HEN, WQN; PW8EM; PY1AFL, AJK, ALC, DDI, JN, LVF, QN, SL; PY2BBO, CJW, CZL, MT, NA, NX, OW, PI, TN, UJJ, YN, ZI; PY3LI; PY4AG, AJR, BIO, CY, EM, IU, JCP, KL, LH, PJ, QA, QE, RU, TO; VG, VV, WAS, WZ, YN; PY5AKW; PY6SS; PY7MY; PY8JA.

On A Personal Note

Well, the time of my dream trip to my father's homeland, the Netherlands, is fast approaching. I leave 23 May and return 9 June. There is still time for any Dutch amateur to request an in-person presentation. Call me at 717-448-2561.

I now have the ability to scan documents into my word processor for editing. If at all possible I would appreciate it if material sent could be typed with as large and clear type possible. Of course, I'll continue to type material if that is the way it comes in. For example, ND3T's material was scanned in.

Finally, if anyone has taken the season of Spring for Northeastern Pennsylvania, please return it! 73, Norm, WA3RTY

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VHF PLUS

BY JOE LYNCH, N6CL

ALL ABOUT THE WORLD ABOVE HF

NTIA Actions Threaten 13 cm Amateur Band

The National Telecommunications and Information Agency, a branch of the Department of Commerce, has issued a proposal to reallocate part of the 13 cm amateur band. This band is currently divided into two segments, 2300–2310 MHz and 2390–2450 MHz. These segments are authorized on a secondary, non-interference basis to Technician Class and above licensees.

The NTIA is charged with identifying frequency spectrum below 5 GHz which can be reallocated for possible FCC auctions. In its first proposal it identified 200 MHz of spectrum that can be reallocated. Of this 200 MHz, according to them 50 MHz can be reallocated immediately. Unfortunately for the amateur radio service, 35 MHz of the 50 MHz falls within the 13 cm amateur band.

The NTIA has proposed guidelines that would severely restrict amateur radio use of 2390–2400 and 2402–2417 MHz by August of this year. Additionally, it would restrict access to the 2300–2310 MHz sub-band by January 1, 1996.

According to NTIA, it justifies the reallocation of such huge chunks of the 13 cm by stating the following: "These bands are used by the military for radar testing systems such as target scattering and radar simulators, and telemetry systems. The amateur service is also allocated in these bands on a secondary basis. The bands have potential for new non-Federal radio-location and fixed and mobile communications technologies, and are located in close proximity to the 1850–2200 MHz band recently allocated by the FCC for personal communications services (PCS)."

It goes on to say that the 2390–2400 and 2402–2417 MHz bands will be available for immediate reallocation on an exclusive basis. However, a two-year delay is necessary in reallocating the 2300–2310 MHz band to study and develop sharing procedures and to implement the necessary improvements to the NASA deep space network operating in an adjacent band.

As typical with so many of the VHF+ frequencies, the Amateur Radio Service "piggybacks" along with the military on a secondary (to the military and other services) usage.

Unfortunately, because of the down-sizing of the military, the NTIA reasons that this band is ceasing to be of critical need to the military. With this tie-in to the military, the Amateur Radio Service could bear complementary damage.

As noted above, while the NTIA concludes that the band is little used by amateurs, it does recognize that amateur space communications is a viable use of the band. Therefore, it is setting aside the segment of 2400–2402 MHz for such experimentation.

As VHF+ operators, we use a portion of the band centered around 2304 MHz for "weak signal" work. This experimentation includes tropospheric enhancement and EME communications.

One of the principal EME operators is Paul Wilson, W4HHK. Paul reports that there are around 30 stations on EME worldwide. He and Bill Smith, W3GKP, made the first EME contact on this band on 19 October 1970. Paul points out that the Great Britain and German operators actually operate cross band on 2320.100 MHz, as that is the bottom of their band.

Paul uses a klystron with an estimated 150 watts at the feedhorn which is illuminating an 18 foot dish. He told your editor that he has used this same setup since that first EME contact.

Paul remarked that the EME operators hang around 2304.025–2304.050 MHz because of QRM from Russian satellites on 2304.0 MHz. This, he noted, would also be a problem for whoever might be a new user on that frequency under the NTIA plan.

While Paul rarely operates terrestrially on this band, he knows a number of his VHF+ friends who do. Additionally, over the years I have heard of regular operations from across the country on this band.

Within AMSAT, the Radio Amateurs Satellite Corporation, the 13 cm band has been viewed as critical to current and future amateur radio expansions, especially amateur space operations. While use of the band by amateur satellite operation is recognized around the world, other specialties also use portions of the band as well.

AMSAT President Bill Tynan, W3XO, expressed doubts as to the dependability of the availability of the small 2 MHz segment that the NTIA has set aside for amateur radio use. In the "W5YI Report" newsletter Tynan is quoted as saying, " . . . a little piece of spectrum like that is vulnerable. It would be easy to take two more megaHertz there and drop reallocation of some other part that is more vigorously defended."

Tynan also states, "We're using the 2400 MHz area right now for the DOVE satellite and for AMSAT-OSCAR 13. We have shown the utility of this band. It will become a mainstay of the Phase III D satellite to be launched in 1996."

Initial reports from the ARRL indicate that the League is gearing up for a strong defense of the 13 cm amateur band. Executive Vice-President Dave Sumner, K1ZZ, stated in a letter to the Directors of the League that the actions of the NTIA amount to a "wake-up call" alerting the Amateur Radio Service to this potential spectrum loss and the possibility of others in the future.

As explained by Tynan above, the amateur satellite service already has plans for the band. Additionally, long-range planners of usage of the amateur radio spectrum envision expansion of existing modes of communications currently taking place on this band and the expansion into this band of FM repeater operations. By way of illustrating these plans, you can take a quick look at page 49 of the *1993-1994 ARRL Repeater Directory* to see the adopted band plan for this amateur radio spectrum.

While the military and Amateur Radio Service seem to be the most adversely affected by the NTIA proposals, manufacturers and users of non-licensed (exempt under Part 15 of the FCC rules) local area network (LAN) computer linking devices also view the proposal as a threat to usage of their equipment. Interestingly, it appears that before the dust settles on this issue, there will be plenty of opposition to the NTIA's proposal from many different services.

So what can we do about the threat to this band? You can write thoughtful, well-constructed letters to the NTIA. Send an original and 10 copies to: Mr. Norbert Schroeder, Program Manager, Spectrum Openness, National Telecommunications and Information dministration, Room 4092, U.S. Department of Commerce, 14th Street and Constitution Ave-

P.O. Box 73, Oklahoma City, OK 73101

VHF-PLUS CALENDAR

April 30–May 1	Dayton HamVention and West Coast VHF Conference.
May 1	Very poor EME conditions.
May	Last quarter moon.
May 4	432 MHz Sprint, 1900–2300 local time.
May 6	*Eta Aquarids* meteor shower.
May 8	Moderate EME conditions.
May 10	Apogee and New moon.
May 14	ARRL 902, 1296, and 2304 MHz Sprints, 0600–1300 local time.
May 15	Poor EME conditions.
May 18	First quarter moon.
May 21–22	ARRL 50 MHz Sprint, 2300 to 0300 UTC.
May 22	Good EME conditions.
May 24	Perigee.
May 25	Full moon.
May 29	Moderate EME conditions.
June 2	Last quarter moon.
June 4-6	ARRL June VHF QSO Party, 1800 UTC 4 June to 0300 UTC 6 June. Note date change from previous years.

nue N.W., Washington, D.C. 20230 (telephone 202-482-3999, FAX 202-482-4396).

NTIA points out that all material received will be made available on NTIA's electronic Bulletin Board System (BBS) at 202-482-1199. Those providing comments are encouraged to electronically submit all information as well as sending material directly to Mr. Schroeder. The NTIA BBS uses a 14.4 kilobaud modem and is equipped to receive and transmit ASCII text or WordPerfect formatted documents.

Additionally, NTIA will sponsor meetings between Federal Government users of the spectrum and commercial representatives. The first of these meetings will be held in Room 4830 of the Herbert C. Hoover Building, 14th Street and Constitution Avenue N.W., Washington, D.C. 20230 on June 24, 1994 at 9:30 AM. Notice will be provided to the public about meeting details. If you are interested in attending this meeting, please provide the name of your representative by May 1, 1994.

My thanks go to my fellow CQ columnist Fred Maia, W5YI, and his "W5YI Report" newsletter for supplying the background information for this topic and to Dave Meier, N4MW, president of Central States VHF Society for supplying the address information.

Six Meters EME Single Yagi Style

As the sunspots continue to decline, dedicated 6 meter DXers increasingly look to the moon to work more countries. For example, Fred Fish, W5FF, is now up to 127 countries, with all of his latest "off the moon." These dedicated enthusiasts are challenging the accepted belief that one cannot work the moon with anything less than several large arrays and high power. Two hams—Shep Shepard, W7HAH, and Jimmy Treybig, W6JKV—have recently made tests that further confirm this belief. The following report is from Bob Magnani, K6QXY, on Jimmy and Shep.

"Over the New Year's weekend Jimmy Treybig, W6JKV, and his wife, Drew, traveled to St. Croix in the Virgin Islands. The intent of the trip was two fold: first to get away and relax for a few days, and second to also test a theory—the potential of 6 meter EME using a single Yagi and the tremendous ground gain obtainable over salt water.

"New Year's weekend was chosen because of the potentially good EME conditions, perigee, and very low sky noise. The St. Croix location is about 150 feet above sea level, and one looks out over the ocean on moon set.

"Jimmy took along a modified M2 Yagi that Mike Staal, K6MYC, had computer optimized for maximum gain. The antenna was 10 elements on a 46.5 foot boom. The antenna gain is estimated at 12.5 dBd! Jimmy ran about 800 watts output from a pair of 4X250B's.

"The first scheduled night of December 31st, New Year's Eve, produced outstanding signals from W6JKV/KP2. I listened as he easily worked K6MYC, with Jimmy's signals peaking about 6–10° before his moonset. The following night conditions were not as good, but signals were heard both ways between W6JKV/KP2 and K6QXY. On Sunday, January 2nd, our schedule produced tremendous signals once again and we worked easily. As a matter of fact, signals were so good near the end of the contact that they were of 'rag chew' quality! On Monday, January 3rd, Jimmy ran

Jimmy Treybig, W6JKV, operated on 6 meters EME from St. Croix around the first of the year. Jimmy made several contacts using the increased ground gain over salt water. (Photo via W6JKV)

with Ray, WA4NJP. Signals were heard both ways, but conditions were deteriorating and no complete two-way was made.

"By previous thinking, a single Yagi and 800 watts could not possibly have produced these amazing results. However, when you add in the 4 to 6 dB attributable to 'ground gain' on both the transmit and receive path, magical things begin to happen!

"The point I want to make here is that there are many equally equipped 6 meter stations operating worldwide that probably have EME capabilities and aren't even aware of it! On a further note, W6JKV/KP2 was able to hear his own echoes—every night!

"I have recently learned that Shep, W7HAH, in Montana, has successfully completed the first ever 'single Yagi to single Yagi' 6 meter contact. Shep worked an SM7 station in Sweden using a 'common EME ground gain window' with the moon at about 120 elevation for both stations. *(Ed. note: Shep reported to me that he worked SM7BAE on his descending moon and Shep's rising moon on 31 Jan.)*

"So how about it? Are you willing to give it your energy and try too? I have successfully now worked seven single Yagi stations off the moon on 6 meters. K6QXY, K6MYC, and W6JKV are anxiously looking for 6 meter DX stations to run with!—73 de Bob Magnani, K6QXY"

Operating The February Aurora From Colorado

I received the following from Ron Dunbar, WØPN, which reflects how he experienced that very exciting aurora on President's night.

"Having lived on the shores of Lake Superior in Duluth, MN and worked 44 states on 2 meters from there between 1975 and 1989 (without EME), you can imagine my disappointment when I moved to Lafayette, CO (six miles east of Boulder) and found out they only get maybe one or two aurora events and maybe two or three poor to fair tropo openings per year! Yes, Duluth may be cold in the winter (–42°F in January '89) and serve as home base for squadrons of FAA certified mosquitos and deerflies in the summer, but you could at least count on 12–15 really decent auroras, 10–12 decent tropo openings and maybe a really great ducting event per year!

"I have a propagation monitor which watches TV Channel 3 Video Carrier on 61.25 MHz (there's no channel 3 within 150 miles of me) 24 hours a day. The AGC output drives an integrating monitor with a threshold well above the 'normal' video carrier level as received on a dipole oriented to favor a NE direction. If the monitored carrier exceeds the threshold continuously for 5 minutes (to avoid false alarms due to airplane reflection), an 80 dB beeping alarm sounds for 10 seconds. This alerts me to 'above average' propagation conditions. Needless to say, I haven't had many alarms in the 5 years I've been living along the Colorado 'Front Range,' and I've never heard auroral buzz on the monitor here!

"Because 21 February was President's Day, I was home when the alarm first went off somewhere around 2200 UTC. I was busy doing other things, so ignored it and returned to my chores in the shop/garage. When I came back in a little later (around 0046 UTC 22 February), my wife, Joyce, remarked that the monitor had been beeping every 15 minutes or so. I was truly amazed when I turned up the monitor's audio and heard an intense aurora going on!

"I quickly powered up the rig (an old TS-700A w/GasFET, 150W brick, two junior boomers) and started tuning. In no time I heard or worked the following:

"0103 UTC: Heard KAØRYT in EN34 (Minneapolis, MN). He was 57A to 58A, but he was hearing a lot of QRM from the eastern midwest as well as the East coast, and I absolutely could not get his attention. I'm at about 40 degrees N and 105 degrees W. His signal was peaking at an azimuth of about 35 degrees. I was hearing a lot of weak signals, both CW and SSB, but nothing really workable.

"0127 UTC: Worked WDØCJM in EN25 (Benson, MN) on 144.092 (about 600+ miles). He was 57A and peaked at 45 degrees azimuth and had a great Au signal!

"I was also consistently hearing AF9Y in EN71 at 57A, working 1's, 2's, and 8's, which

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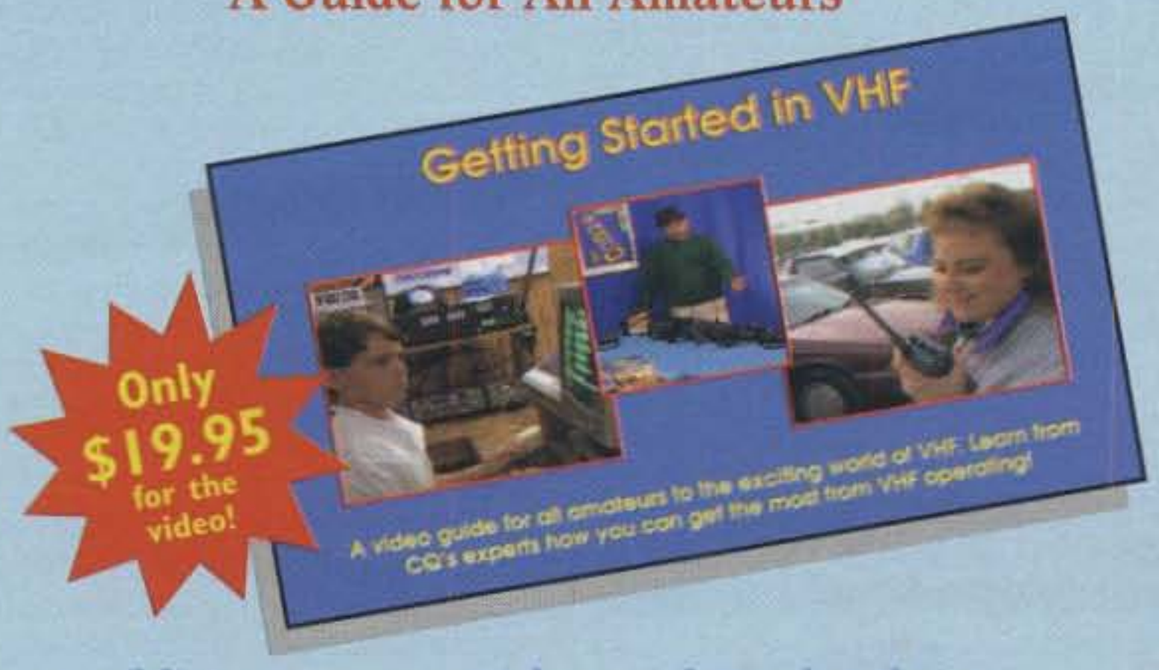

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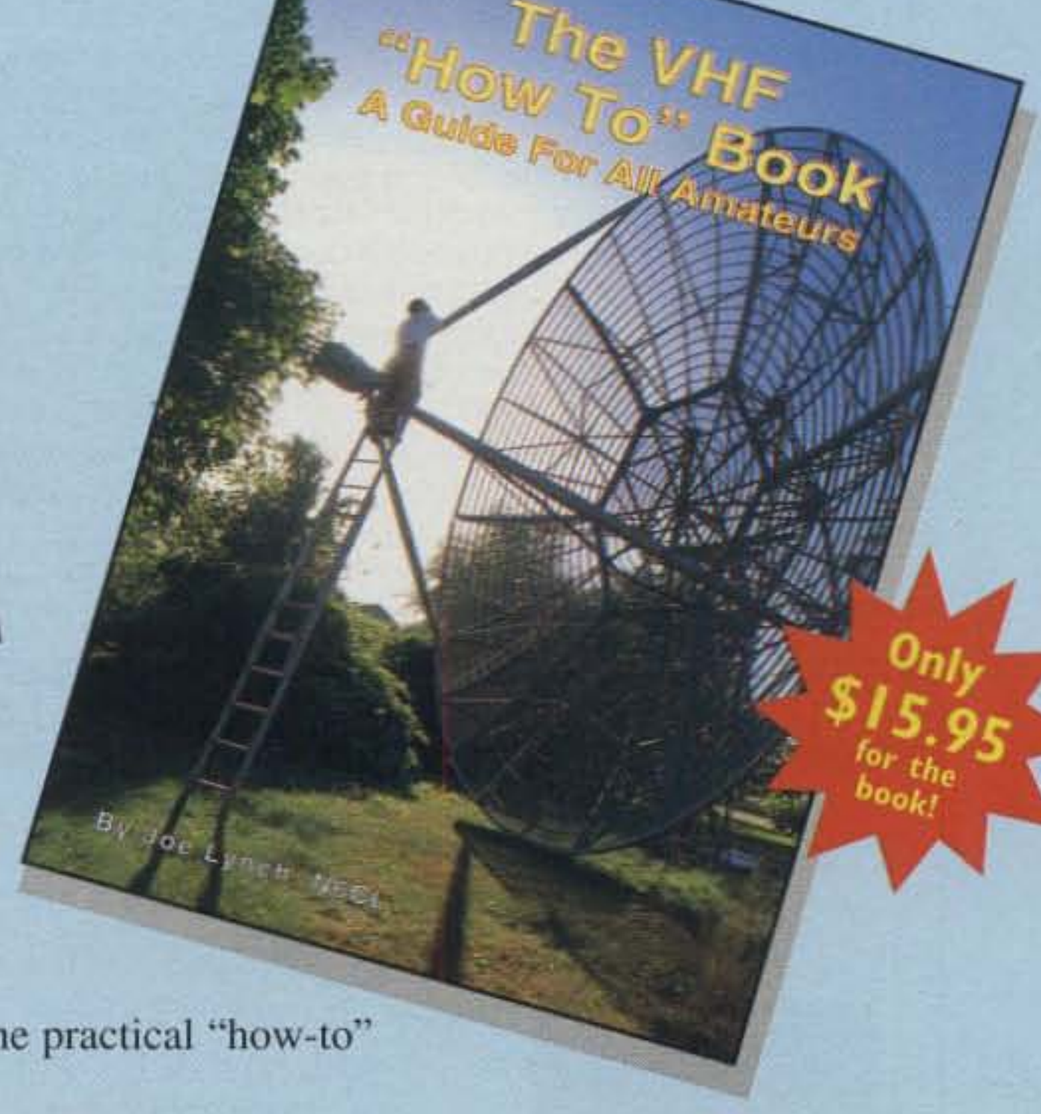

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I couldn't hear. Also, he was buried in QRM and couldn't hear me, although he did seem to QRZ me once.

"Aurora died down for me again at around 0140 UTC. It was time for me to go listen to WWV and learn that a major magnetic storm had commenced at 21 February at 0900 UTC. The 'A' index = 42, 'K' index = 5. That'll teach me to keep track of what WWV is saying when it's within a month of either equinox! *(Ed. note: "K" index was at sustained levels of "6" and occasionally reached "8" during the event.)*

"0245: Worked K9VGE in EN52 (WI, about 900+ miles); he was also 57A and it was a new grid for both of us.

"0247: Heard WØDZK, but couldn't get his attention.

"0248: WØEKZ called me, but he was pretty weak and an auroral fade took him out of the picture before we could complete the contact.

"0250: The adrenaline was pumping so furiously that K9VGE and I worked each other again, and I don't think either of us realized it until after the aurora was over!

"0300: Our Colorado Front Range SWOT net met on 144.220 as usual. I notified the net of the aurora and went back to tuning for Au.

"0354: Worked NØLL in DM78 (Smith Center KS), 58A, but he was hearing a lot more QRM than I was. (Larry is normally workable from here on any half decent night.)

"0358: Started hearing WA8MSF, Mike in EM79 (Cincinnati, OH) at about 1090 miles on SSB and he was T7–T8, perfectly copyable! Mike was working all sorts of stuff which I couldn't hear very well, and I began to believe I would never get his attention through the bedlam he was hearing. I decided that maybe plain old 'WØPN' didn't sound exciting enough, so I added 'DN70.' That worked the very first time! Mike and I finally worked on SSB at 0401 UTC! He was peaking at 60 degrees azimuth.

"0404: Worked Randy, NØLRJ, who was 57A even though he's no more than 25 miles from me! Hey, I want to work 100 grids on Aurora from here, even if it takes me until the next century to get it done!

"0410: Aurora died off; I expected it to reappear around local midnight, but it didn't, much to my disappointment. By 0700 UTC, the channel 3 signal was clean. There were no more signs of aurora. No alarms occurred during the night nor the next morning.

"General Comments: Having worked hundreds of auroras from the midwest as WØMJS, WB9NLF, and WØPN, I know how much QRM can occur in the eastern half of the country when a good aurora comes along. It was good to see that the gang was spreading out. Everyone seemed to be going down from 144.200 MHz, as far as 144.150 MHz on occasion.

"Because the far western stations can't hear most of the QRM, they don't seem to realize that it usually won't do any good to call 'CQ Au' on 144.200 MHz from the west. You're guaranteed to be buried by the louder eastern stations. Stations in the eastern half of the U.S. also need to remember that there's a bunch of western folks out here trying to work them and crank their beams over this way once in awhile.—73 de Ron Dunbar, WØPN."

VHF "How To" Book Arrives!

The book I have been writing for the past year about the VHF+ frequencies has finally been printed. The title is *The VHF "How To" Book*, and it is scheduled to be available at the CQ booth at Dayton. You can't miss it. It has a picture of Al Katz, K2UYH's EME dish on the cover.

I am very glad that they chose his picture. Al is one of the linchpins in the VHF+ community. He has worked in excess of 70 countries on 70 cm, all via EME. For eight years Al edited the VHF column for this magazine. If there ever was someone to emulate in the weak signal community, Al is that person.

Why did I write the book? When I began venturing into the world of VHF+, I had to consult several books to find all I needed to know. I had to look at one book for information on propagation, another book to find out about equipment design, and yet another book to learn frequency allocations and band plans. I had to consult more books about the fun of hidden transmitter hunting and sending signals through satellites. However, no books that I could find told me how to communicate over the local repeater.

Within the book, I've combined all the basic information for use as an easy reference for beginners, and as a continuous sourcebook for those who enjoy operating on these frequencies.

The book was written by you, about you, and for you. It was written by you because you were the challenge for me to learn more about the VHF+ world. It was written about you because you supplied the reports of your activities and challenges on the VHF+ frequencies. It was written for you, the new amateur, to provide you with the tools necessary to successfully operate on the VHF+ frequencies. It was written for you, the seasoned ham, to provide you with the challenge to further explore the wonderful world of the VHF+ frequencies.

Along with the book, *CQ* has released the latest in its "Getting Started" series video tapes, Getting Started on VHF. Produced by Rich Moseson, NW2L, this tape provides a visual exploration of the VHF+ amateur bands.

The book and the tape complement each other. You will find the tape useful as a self-training device or for conducting amateur radio classes for your club. You will find the book a reference volume as you pick your way through the many opportunities open to you as a ham on the VHF+ frequencies.

Both Rich and I look forward to meeting you at Dayton and answering your questions about the wonderful world of the VHF+ amateur bands. However, if you can't make it to Dayton, elsewhere in this magazine you will find ordering information on how to obtain your copies of the book and/or the tape.

SMIRK Leadership Undergoing Temporary Changes

Owing to increased job responsibilities, Founding Secretary of the Six Meters International Radio Klub (SMIRK), Ray Clark, K5ZMS, has asked Pat Rose, W5OZI, to assume temporary secretarial responsibilities of SMIRK. So for the foreseeable future, send your application for membership with an SASE to Pat at P.O. Box 393, Junction, TX 76849.

To join this organization, which promotes 6 meter operating, simply work six members of SMIRK and get their numbers. Then send the log data, along with the numbers and a check for $6.00 made out to SMIRK, to Pat.

Pat is also the contest chairman. If you are planning to compete in the SMIRK contest next month, then send an SASE for log and entry sheets to Pat. The contest is scheduled for 18–19 June and more information about it will be in next month's column.

Current Conferences

Unfortunately for Gracie Hastings, KK6CG, she received some incorrect information on the Dayton HamVention several months ago. Based on that incorrect information she and the Southern California Six Meter Club committed to a contract with the hotel in Cerritos for the West Coast VHF Conference on what turned out to be the same weekend as Dayton.

Having attended last year's West Coast conference, I was really looking forward to seeing my California friends. Unfortunately, I will be at Dayton and will miss the West Coast VHF conference. Perhaps next year will get things sorted out.

The dates for both events are 29 April through 1 May. If you are planning to attend the West Coast VHF Conference and need more information, contact Gracie at phone 714-990-9203 or FAX 714-990-1340. Excellent programs are planned.

If you are planning to visit Dayton, be sure to attend the VHF forums Saturday morning in Room 5. Seminars, beginning with Emil Pocock, W3EP, and myself, will start at 9 AM and run until 1:30 PM. Oh, yes—don't forget to stop by the CQ booth to say hello. I am looking forward to seeing you there.

Current Contests

ARRL Sprints: The 432 MHz Sprint is set for 4 May from 7–11 PM local time. The 902, 1296, and 2304 MHz Sprints are set for 14 May from 6 AM to 1 PM, local time. Note that each of these three bands is a separate contest, with separate logging requirements. Additionally, you may work no more than 5 consecutive hours during the time period listed above. The 50 MHz Sprint is scheduled for 2300 UTC 21 May to 0300 UTC 22 May. Exchange for all contests is your grid locator and callsigns. Complete rules were published in the March issue of *QST* and the results will be published in the November/December issue of *NCJ*.

Current Meteor Showers

The *Eta Aquarids*, a three-day long (between 4 May and 6 May) shower, is predicted to peak around 0013 UTC 6 May. This is a broad-based peak and several sub peaks are possible. It is best to stay alert over the entire three-day period. This shower is more popular in the southern latitudes because of the low (–1°) elevation of the radiant. Nevertheless, stations in the southern portion of the U.S. and stations in Central America can benefit from propagation caused by this shower. While not a productive shower, it did produced in excess of 110 meteors per hour in 1980. The best paths for propagation are northeast to southwest and southeast to northwest. East to west propagation is fair and north to south propagation is poor.

Additional potential for meteor scatter contacts may exist at the end of the month as the first signs of the *Arietids* begin to appear. Additionally, the minor showers of *Herculids* (19 May to 14 June, peak 3 June) may have some effect on elevating the number of meteors available.

The *Scorpiids* (29 May to 20 June, peak 5 June) is another southern latitude shower. Stations in the southern hemisphere may benefit from the slightly elevated (ten per hour) number of meteors entering the atmosphere.

This Column Now Available on WB4YZA BBS

In a response to a request from those in the visually impaired community, I have agreed to supply an ASCII file of this column after it has been published to the WB4YZA BBS. Scott Hedspeth has agreed to have both the ASCII and compressed versions available for download.

The blind and/or visually impaired have

made great strides using voice synthesizers in their computers. Supplying an ASCII file to a visually impaired reader who, in turn, can load the file into a software program that will drive the voice synthesizer will open a new source of information for him or her.

For access to Steve's BBS dial 704-284-4854. He has a modem capable of running at 38.4 k baud. The format is N, 8, and 1. Steve has a wealth of files available for downloading on a number of subjects. So even if you are not visually impaired, check in and see what you can find.

Incidentally, *CQ*'s sister publication, *Popular Communications,* is available in Braille. It is my understanding that *CQ* will also begin publication in Braille in the near future.

NA VHF Directory Now Available

Tim Marek, NC7K, has announced the recent publication of the *North American VHF Directory*. Available for $9.00, this publication lists over 1500 amateurs in over 375 grid locators. It contains the amateur's name, call, grid locator, phone number, and a brief description about the person. For your copy, contact Tim at 360 Prestige Ct., Reno, NV 89506, or call 702-972-4722.

HB9 Now Allowed 24 Hour 6 Meter Operation

Certain parts of Switzerland (HB9) are now allowed 24 hour operation with a maximum of 10 watts ERP. These parts include the following: western parts of Switzerland, around the Lac Leman (Lake of Geneva), the valleys in the southwest part of the country in Canton VS (Valais), some valleys in the Canton Tessin (TI) in the southwest part of the country, and some valleys in the southeast area in Canton Grison (GR).

Thanks to Pierre, HB9QQ, Neil, GØJHC, and Herb, W3IWU, for this information.

Final Call For CSVHF Papers

A final call for papers for presentation at the Central States VHF Society Conference has been issued. If you are interested in making a presentation or publishing a paper in the Proceedings of the CSVHF Society conference, which is scheduled for 28–30 July 1994, then contact Joel Harrison, WB5IGF, 528 Miller Rd., Judsonia, AR 72081 right away. Joel expects to wrap up his speaker's list early this month. So don't delay.

Rare Winter 2 Meter Sporadic Opening Reported

Gordon West, WB6NOA, reports that on 18 February stations in southern California were treated to a rare and brief sporadic-E opening between them and stations in the middle of Texas.

Daring to enter the fray of the controversial theory that lightning causes sporadic-E, Gordon claims that this event was caused by a thunderstorm between southern California and Texas.

Gordon reports that the first sign of a possible band opening was severe interference bars on television channel 2. Gordon listen to 10 meters and started noticing that he was hearing stations at an increasingly closer distance (a fairly certain indicator that the MUF is traveling upward). Next he started hearing signals on 6 meters. Gordon reports that stations in Texas were being heard with S9 plus 10 dB.

"All of a sudden," Gordon states, "television channels 2 through 6 were hammered with telltale horizontal lines of interference from distant sky wave stations." Gordon further reports that David Peters, KI6FF, who was calling CQ on 2 meters with his beam headed west, was suddenly being called by Kevin Templeton, KB5ZVV, in EM01, off the back of David's beam!

Over the next few minutes Gordon and several other operators in southern California worked stations in Texas with rock-solid signals both ways. Then, as soon as it started, it was over. Gordon watched the DX disappear, first on 2 meters, then on 6 meters, and eventually on 10 meters.

Gordon reports that he has dedicated a small television set with an outside antenna to alert him to just such an opening. He says that his Hitachi TV has an automatic mute circuit on its audio that activates when the TV is tuned to an unused TV channel. He reports that out of the more than forty 2 meter sporadic-E openings he has worked, all of them have been first detected using his TV/outside antenna combination. He concludes his report by suggesting that if all you have is cable, resurrect that old TV antenna and start looking for some 2 meter DX signs.

Incidentally, Gordon's reference to sporadic-E and lightning will probably bring in more mail. Just during this last month I received letters from Roger Cox, WBØDGF, and Neil Spokes, AB4YK, both commenting on the issue. I will have more coverage of this topic in a future issue of the column.

So What's Your Excuse?

The following is taken from the March issue of "Cheese Bits," the newsletter of the Pack Rats. It gives some of the "reasons" why some of their operators did not do as well as expected.

The winner of their "Crying Towel" award was Walt Zumbach, WA3AQA, with honorable mentions going to Len Martin, N3NGE, and Doc Whitticar, W3GAD. In order to keep from embarrassing any one of these "criers," the comments were left generically.

"For those who might want to learn something about what problems to avoid or to add to their repertoire of things to cry about, some of the problems reported are listed here. Some were reported by several Rats and are perennial favorites; so it may not be true that we learn from past mistakes. Some of the problems encountered were:

"Smoked 2 meter linear just before the contest; a bad microphone on the 222 MHz rig required the bad voltmeter to be repaired before being used and then repairing a soldering iron to resolder a bad connection and then finding that it was really a bad relay in the radio (are these the same guys who charge me enormous bills for fixing my car?); found that long-range planning is a myth; third tower for a four-op multi-op effort didn't get up until the weekend just before the contest; friend with computer for logging never showed up; rotator died on the temporary tower; had wrong antenna connected for 903; 2 meter pre-amp

suffered from too much drive power; 2 hour rotator replacement required 6 hours; bent mast for 2 meter vertical and 6 meter beam; and 2 meter antenna damaged in wind storm.

"Had to use broomstick for 903 MHz antenna boom; single op found out why he had gone multi-op on previous contests; UHF contest operation without a 2 meter liaison frequency is a severe handicap; ice on tower and antenna required a blowtorch for removal; water flowing through the operating area *(must have been from torching the tower—ed.)*; too many amps connected to an under capacity fused AC line; amp tuning capacitor knob broke off; blown Z50 choke; lost one side of the 220 V line coming to the house; diarrhea; 223.5 MHz amplifier caught fire (literally); wife's water broke Saturday morning of the contest; traffic jams; 2½minutes between contractions (Wife and baby doing fine. Dad, N3NGE, hoping to plan future events like this so as to not occur during contest times.)

"Two day air delivery of new crystals required 9 days; up all night getting 10 GHz rig working, including building a 400 Hz AC supply and then made only one contact; mast on outrigger for 10 GHz antenna farther away than arm's reach; found that 1C237 12 volt DC input cannot handle 110 VAC; burned up second 903 MHz amp; bad 432 MHz transverter; push-up mast for new antenna came apart while being erected with two 10 ft. sections and antenna already up; laptop for logging crapped out; worked Maritimes during 6 meter opening with attic-mounted squalo but couldn't work the locals; 2 meter simplex FM operation unsuccessful with rig set for repeat; horse sick (horse has since recovered much to Doc, W3GAD's relief); furnace switch open; furnace switch out again; and replaced leaky furnace pump."

Can you top any of these? Do you want to?

Tommy Henderson, WD5AGO Snowed Under

A late winter freak snowstorm dumped more than 12 inches of snow on Tulsa, Oklahoma. Unfortunately, all of it fell in Tommy Henderson, WD5AGO's 16 foot dish. It did not survive the added weight.

Tommy has already started rebuilding it and will be back on the air very soon. Unfortunately, one of the Murphy sayings among big antenna builders is "If it hasn't come down, it ain't big enough!" Tommy is yet another victim of Murphy madness and mother nature.

And Finally

My thanks go to all of you who inundate me with mail, FAXes, e-mail and phone calls. The acceptance of this column within the VHF+ community is truly remarkable. Rarely does a day go by without my receiving something from somebody for the column. I especially appreciate so many of you taking time to tell me how to connect with Internet. It turns out that CompuServe is planning direct access in the near future (probably by the time you are reading this). So I have my answer right in my backyard.

Nevertheless, keep the communications coming. My phone number is 405-528-6625; FAX is 405-528-0746; and CompuServe is 72124,2734. Until next month . . .

73, Joe, N6CL

Radio FUNdamentals

BY BILL ORR, W6SA

THINGS TO LEARN, PROJECTS TO BUILD, AND GEAR TO USE

1927: The Year of Living Dangerously

Amateur radio was not always protected by international agreements and government regulation. Indeed, there was a perilous period when the future of amateur radio was in question, threatened by nations who were hostile to the idea of private individuals having radio transmitting stations. Their views nearly won out. Amateurs could easily have been legislated out of existence by international agreement, but—and thereby hangs this tale—in the end, amateur radio survived and was recognized internationally as having definite and specific privileges, plus protection from encroachment by other interests, greedy for the amateur's little portions of the radio spectrum.

The Early Days

With the end of World War I, the handful of amateurs in the United States were permitted to go back on the air. These were exciting days; the changeover from spark transmission to CW was taking place. International DX grew by leaps and bounds as amateurs (as well as the commercial and military services) quickly realized the ability of the shorter waves (below 200 meters) to span the globe.

A 1924 interim conference in Washington attempted to solve the many problems growing out of the explosion of broadcasting and the increase in shortwave point-to-point and marine communication. No one was sure exactly what waves were good for what, and for that reason, everyone was out to get all that could be gotten from one end of the spectrum to the other.

The nonbinding American regulations heretofore in force were codified, and the Department of Commerce was confirmed as the licensing agency for all American radio stations. In addition, the first American amateur bands were specified: 1500–2000 kHz, 3500–4000 kHz, 7000–8000 kHz, 14,000–16,000 kHz, and 56,000–60,000 kHz. A subsequent assignment at 400–401 MHz was created for "beam experiments." Folklore has it that this frequency was chosen as the resonant wavelength of the popular electric heaters of that era. The copper bowl-shaped heater reflector was to serve as a dish for a 400 MHz transmitter!

Radiophone transmission was authorized only in the band of 1670 to 1760 kilocycles. Other countries assigned amateur bands of their particular choice at various spots in the spectrum.

This was all well and good, except that most amateurs had only a vague idea of their transmitting frequency, and many commercial and military stations operated well within the bands suggested for radio amateurs. There was little cooperation between nations on any frequency assignments.

It was a confusing situation in the United States that the underfunded Department of Commerce was ill-equipped to deal with.

Since amateur frequencies in other countries did not always coincide with the American assignments, the temptation to slide out of the band to work DX was very compelling! The Australian amateurs working around 9 MHz, in particular, were considered choice DX.

AMATEUR FREQUENCY BANDS
assigned by The Washington Convention of 1927

Kilocycles	Width in Kilocycles	Assignment	Approx. Meters on basis factor 3	Meters on basis factor 2.998	Harmonic family for centers of related portions		Amateur Purpose
					Kilocycles	Meters	
1715–2000	285	Amateur, Mobile, point-to-point	150 – 175	149.9 –174.8	1775	168.92	Domestic
3500–4000	500	" "	75 – 85.7	74.96–85.66	3550	84.46	"
7000–7300	300	Amateur Exclusively	41.1 – 42.9	41.07–42.83	7100	42.23	International Night
14,000–14,400	400	" "	20.83–21.43	20.82–21.42	14,200	21.11	International Day
28,000–30,000	2000	Amateur & Experimental	10.00–10.71	9.99–10.71	28,400	10.56	Experimental
56,000–60,000	4000	" "	5.00 – 5.36	4.997–5.354	56,800	5.28	"

Fig. 1– Taken from the January 1928 issue of QST, *these were the amateur frequency bands assigned by the Washington Convention of 1927.*

Radio Communication Control Collapses!

Other stations also flouted the assignments. In particular, a nasty squabble arose when the Secretary of Commerce entered into an agreement with the Canadian Government to allocate the exclusive use of six U.S. broadcast channels to Canadian stations. Coincidentally, the Zenith Radio Corp. of Chicago had applied for a broadcast license and was granted a frequency shared with a General Electric station in Denver. The resulting interference prompted Zenith officials to request one of the channels which had been allocated to Canada. The request was denied, but Zenith went ahead and

Fig. 2– Not all countries were in favor of giving broad privileges to amateurs, as can be seen by these cartoons, which appeared in the Jan. 1928 issue of QST.

48 Campbell Lane, Menlo Park, CA 94025

Highlights

Recognition of amateur radio.

Amateur bands near 160, 80, 40, 20, 10 and 5 meters.

Amateurs of every country in the same bands.

Ample bands for domestic work, ample for experimentation, probably enough for DX day work, uncomfortably restricted band for international night work.

Power of amateur stations fixed by each nation.

Each nation free to permit or prohibit amateurs as it desires; each nation free to withhold from amateurs any or all of the bands.

International amateur message traffic forbidden except by special arrangements between nations.

New system of amateur calls to indicate nationality, restoring intermediate "de" and abandoning "international intermediates".

Convention effective January 1, 1929.

Fig. 3– These highlights of the International Radio Conference were effective January 1, 1929. (Original in QST.*)*

used the Canadian channel anyway.

In April 1926 Zenith was sued by the government, and a decision was rendered which denied the right of the Department of Commerce to assign frequencies! In addition, the Attorney General of the United States issued the edict that the Secretary of Commerce had no power to withhold licenses from reputable U.S. citizens, nor authority to allocate frequencies for any stations! Thus, the last vestige of government control over all radio stations was removed. One can readily picture the chaos which immediately ensued. Amateurs could operate on any frequency they pleased, and the same went for commercial and broadcast stations. Unlicensed stations sprung up like weeds after a spring thaw.

(One interesting development was that a few amateur pioneers went on 20 meter phone, which heretofore had been prohibited. They were closed down quickly after the government got its act together.)

In all this confusion, while the United States projected to the world that it could not control its internal radio communication or enforce international agreements, was the spectre of a forthcoming International Radio Conference scheduled in Washington in 1927. The host country was setting a bad example for the remainder of the world!

Federal Radio Commission

Following the edict issued by the Department of Justice, Congress proposed a new bill establishing a Federal Radio Commission, with authority to allocate frequencies and to supervise radio discipline. It was signed into law in February 1927. Unfortunately, the lack of understanding of the radio situation by the legislatures created a stalemate wherein station licensing would be returned to the understaffed and poorly funded Department of Commerce and the Radio Commission would act only in an advisory capacity. This divided authority was worse than none at all and required additional legislation over the next two years to straighten out affairs. Meanwhile, the International Radio Conference was looming on the horizon.

The 1927 International Radio Conference

The ARRL, who had been working closely with the Department of Commerce and the Navy, approached the forthcoming Radio Conference in a bleak mood. Discussions with the just-formed U.S. Delegation revealed that most countries were either antagonistic towards amateur radio or were ignorant about it. In particular, the British representatives didn't seem to know anything at all about amateur radio and were amazed to find out that there were over 14,000 amateurs in the United States. Pre-conference meetings conducted informally by the U.S. Delegates led to the conclusion that the

friends of amateur radio were few in number. The opponents were in legion. As one observer said, "Things aren't going a bit well and the outlook is as black as the inside of an Eskimo's boot!"

On October 4, 1927 the Radio Conference was convened in Washington. Two hundred delegates, 178 special representatives (now called lobbyists), observers and uncounted functionaries, attaches and clerks from 79 countries were participants. The few amateurs from the ARRL were attached to the U.S. Delegation as observers, having no vote. Their primary interest was the Technical Committee, and the sub-committee on frequency assignments, presided over by the assistant Chief Engineer of the British Post Office, no friend of amateur radio.

The primary purpose of the Conference was to formulate international regulations to minimize interference between radio stations engaged in international service, or those which were international in their capabilities of creating interference.

The Conference recognized that the allocation of frequency bands to specific services was necessary. This eventually would include the "Private Experimental Station," which was recognized for the first time at any international conference. The question was what bands, of what width, were appropriate for the amateurs?

Unfortunately, the majority of nations declined to accept the band privileges afforded American amateurs. It was a very tense time. Kenneth Warner, W1EH, the ARRL Secretary who was on the American Delegation (along with Charles Stewart, W3ZS) described the Conference as "the eight busiest and most anxious weeks of one's life, weeks when the ultimate fate of the amateur hung momentarily by a thread."

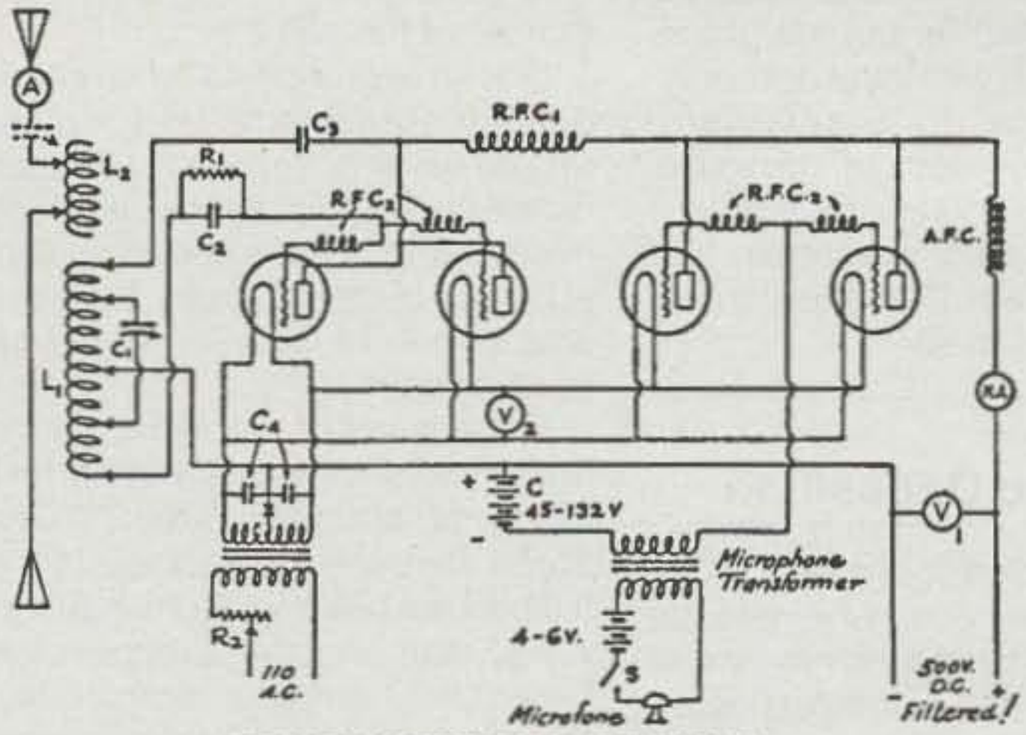
No One Likes Amateur Radio!

With regard to amateur radio, the Japanese delegation quickly proposed that amateurs be permitted to transmit, but only into dummy antennas! The general attitude of the Conference was that amateurs would cause unnecessary interference and would violate state monopolies on communications thus depriving states of revenue, and that control of amateurs was difficult, if not impossible. Furthermore, it was foolish to give away channels worth millions in potential revenue to amateurs who merely play and never really discover anything! Added to this was the fear that amateur licenses would possibly be granted to unscrupulous persons who might use such stations to undermine state security by fostering revolution or spreading Red propaganda. Finally, there was the dislike of additional administrative work demanded by the licensing and supervision of amateurs. It was a bleak situation.

Clearly, unlike the United States Government, who viewed amateurs as a national asset, other Conference members viewed them as pests, possible menaces, and usurpers of valuable spectrum space. Many influential delegates knew nothing of amateur radio. Some were mildly supportive; only a handful were truly in favor of the radio amateur.

These were the arguments and prejudices that confronted amateur radio during the fateful days of 1927. It appeared that the only way to prevent the strangulation of amateur radio was to first establish informal personal contact with as many members of the various delegations as possible and discuss the benefits of amateur radio before matters came to a decisive vote. Members of the American Delegation approached this task with vigor.

Mr. W. D. Terrell of the Department of Commerce helped to blunt the tide of opposition with a speech in favor of amateur radio, placing the American Delegation squarely behind amateur radio, much to the discomfort of the British Delegation, who proposed that amateurs be limited to narrow bands (not over 100 kHz wide) distributed at random throughout the shortwave spectrum. In addition, other countries wished to restrict amateurs by other means, prohibiting transmission of personal or factual information, or infor-



THE TRANSMITTER DIAGRAM

Shown mainly to point out that it is perfectly normal as to wiring and that good results depend on careful adjustment, not on a new circuit. The constants given are for 175-meter region which is where a phone should work best. The antenna happens to be a 5-wire cage 60 feet long, 40 feet up and L connected, but may be larger. The counterpoise is a 5-wire fan 90 feet long.

L-1 12 to 18 turns No. 6 bare copper on 5-inch tube, tapped each turn.

L-2 25 turns No. 6 bare copper on 7" tube, tapped each turn.

R.F.C.—1—Three hundred turns No. 26 on 3" tube.

R.F.C.—2 15 turns No. 26 on 1" tube. Mount on grid terminal of socket.

A.F.C. Iron cored audio frequency choke or modulation choke. Inductance 6 henries. Made as described or used R.C.A.—UP415 or make from Ballantine's design page 151.

R-1 Grid leak, 5,000 ohms.

R-2 Radiostat or other suitable variable resistance.

X Closed circuit jack for cutting in telegraph key.

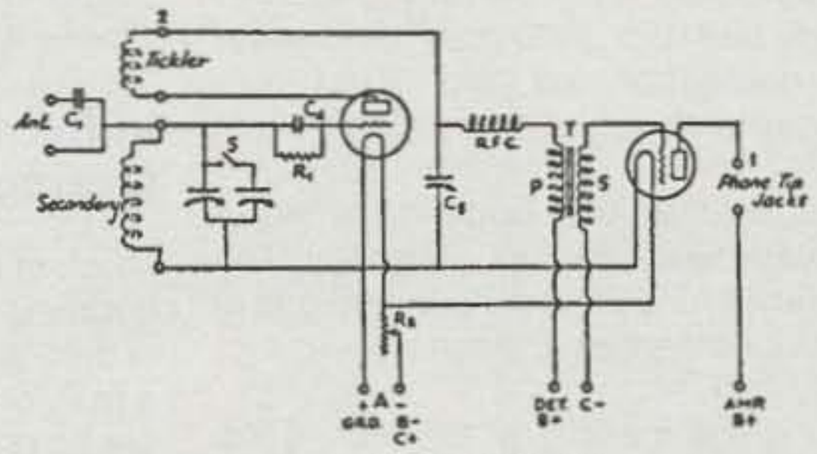
C-1 Primary tuning condenser, 500 μμfd. or larger.

C-2 Grid condenser 200 μμfd. or thereabouts.

C-3 Plate stopping condenser, 200 μμfd. or thereabouts.

C-4 Filament by-pass condensers, 600 μμfd receiving condensers.

V-1 Plate voltmeter.



THE CIRCUIT

C1 Antenna coupling condenser. Two plates ½" square, separated ⅛".

C2 Secondary tuning condenser. Small section of Cardwell dual condenser. 65 μμfd. maximum.

C3 Secondary tuning condenser. Large section of Cardwell dual condenser. 335 μμfd. maximum.

C4 Sangamo grid condenser. 100 μμfd.

C5 Throttling condenser. 500 μμfd. maximum.

R1 Grid leak. 5 to 10 megohms.

R2 Filament Rheostat. 50 ohms.

RFC Samson type 125 radio frequency choke

T Samson symphonic transformer.

Fig. 4– Typical transmitter and receiver circuits of the 1927 era.

mation for a third party, either within or without the country. The Americans strongly opposed this scheme, as it meant that foreign powers could establish control over communications within the United States.

It was a difficult battle for the American Delegation. The British seemed determined to squash the amateurs. The Americans were steadfast, aided to a large degree by Lt. Commander T.A.M. Craven, U.S.N., a great friend of amateur radio. Warner, in his summary of the Conference in the January 1928 issue of *QST* said with respect to Craven, "This young Naval officer has made an enduring name for himself. It may be said that he is personally responsible for the successful negotiating of the wavelength agreements. . . . he was the staunch and clever friend of the amateur and in large measure we owe him what we got from the conference due to his skill and perseverance."

Amateur radio was gradually saved from oblivion due in part to the informal meetings held by members of the American Delegation with their counterparts among the other delegations. Sub-committee reports favorable to amateur radio were developed. Position papers were circulated, and gradually opposition to amateur radio softened, as various delegations grasped the import of the American position, or decided to go along in a "scratch my back, I'll scratch yours" attitude. The concept of harmonically related bands centered at 160, 80, 40, and 20 meters was accepted. The Italian delegation backed the American band proposal, against the opposition of England and Canada. Other countries agreed, as they preferred to have the amateurs held in these spots rather than in other proposed places in the spectrum. It was a case of amateur radio gradually gaining ground by a combination of hard work, persuasion, and default.

How Wide Should The Amateur Bands Be?

Once the positioning of the bands had been agreed upon, the next decision to be made was the width of the various bands. Commander Craven sold the Technical Committee the idea that the 80 meter band should encompass 3500 to 4000 kHz, over the opposition of many delegates. The 20 meter band was tackled next, and the band was brutally cut down to 14,000–14,400 kHz. The American Delegation reluctantly accepted this, knowing the big battle would be over the 40 meter band, as the 20 meter band was virtually unknown territory. Personal persuasion and determination had carried the day for amateur radio so far. Would it hold for the forthcoming battle over 40 meters?

The American position was that the band should encompass 7000–8000 kHz. The British proposed 7000–7100 kHz, but later generously expanded their offer to 7000–7200 kHz. Canada and Germany objected to this proposal, as they claimed to have many existing stations operating in the 7100–7200 kHz range. Finally, Germany agreed to move one of their stations higher in frequency, thus opening the amateur proposal up to 7225 kHz. After more prolonged discussions, Germany agreed to further movement, and accepted the proposal of the amateur band falling between 7000 and 7300 kHz. The American Delegation decided not to "press their luck" and agreed to these band limits.

At last the future of amateur radio seemed secure. Warner, in reviewing the Conference, was bitter about the English position with regard to amateur radio and even more unhappy with the Canadians, who sided with the British, even though Canada's radio destiny was tied to the United States—not Europe. With regard to a Canadian representative, Warner said, "He hurt us a great deal." And of the British delegation, he said, "They pursued us relentlessly at every stage of the game."

Those who actively opposed amateur radio were Great Britain, Germany, The Netherlands, Japan, Belgium, and one of Canada's delegates. France was ambiguous.

Among the friends of amateur radio, Warner praised the efforts of Italy, Australia, and New Zealand. Individual delegates of Czechoslovakia, Roumania, and Spain were also friendly to amateur radio. Other nations who, if they had the opportunity, expressed themselves in approval of amateur radio were South Africa, Argentina, British India, Irish Free State, Hungary, and Switzerland. Unfortunately, every country didn't get the opportunity to formulate, discuss, and vote on each issue.

Generally speaking, those smaller countries, or those with only rudimentary communication systems, followed the leaders. The countries in the British Empire sided with the British; those in the French domain sided with the French. Countries economically tied to the United States sided with the Americans. Thus, it was good politics to persuade one of the major powers on a point in order to swing a block of votes in the right direction. Luckily, Warner and the American Delegation understood this situation well.

Final Amateur Band Assignments At Last!

Eventually the die was cast. The exhausted delegates agreed to the bands proposed for amateur radio by the Technical Committee as shown in fig. 1. In closing his summary of the Conference, Warner said, "No nation is obligating itself to permit the existence of amateurs—that is strictly its own business—and unfortunately the conference offered no opportunity to ensure the existence of amateurs in every country. Nor is any nation obligated to put the entire width of these bands at the disposal of her amateurs—in fact few of them will; the bands are merely those which nations have internationally agreed are to be used for amateurs in countries which so wish.... We may hope that there will be a much greater disposition in foreign countries to treat the amateur liberally."

And in the *QST* editorial of February 1928 Warner said, "We didn't get as great privileges as we wanted or as great as we think we were entitled to, but we got all that we were able to, with loyal and powerful assistance from our own Government. Unfortunately most of the other countries were unwilling to give amateur radio more than limited privileges, and some of them didn't want to make any provisions for amateurs at all."

In Retrospect: Overcoming the Opposition

Much of the opposition to amateur radio, it turned out, was because of ignorance of the true nature of the radio amateur and a fear for the safety of the state's monopoly on communications.

One great lesson learned by amateur radio as a result of the Washington Conference was that much had to be done to educate the communication authorities in many countries on the benefits of amateur radio. That task fell to the International Amateur Radio Union, the grouping of radio societies of various countries. Their educational efforts on behalf of amateur radio paid off mightily at forthcoming international telecommunication conferences.

And so amateur radio ran the gauntlet, facing possible extinction at the whim of the Conference. Heroic efforts by the American Delegation, aided by a few friends, gradually moved the hostile mood of the Conference to a neutral attitude. For the first time amateur radio and its frequency assignments were recognized internationally.

The structuring of the Conference, in addition, was an unexpected help. In the big argument between mobile services (marine radio) and point-to-point services, the amateurs were as a mouse caught between two battling elephants; they were unheeded and nearly trampled. When the delegates finally reached general agreement on these services, the U.S. Delegates suggested that at a later date the members should return and fit the amateurs into the overall picture. Commander Craven pointed out that if the amateur assignments were adjacent to the marine asignments, the former could quickly be taken over by the naval forces in case of any national emergency.

To solve the amateur problem and get it out of the way, a sub-sub-committee was formed to deal with various shortwave bands, including the amateur, and to report its findings back to the sub-committee. It was an odd assembly that decided the final fate of the amateur bands. There were seven: Colonel Mauborgne (U.S. Signal Corps), Commander Craven (U.S. Navy), Major Steel (Canada), Dr. Van der Pol (Netherlands) representing European broadcasters, Charles Rickard (Marconi Company), Captain H. Abraham (Telefunken of Germany), and K. B. Warner of the ARRL.

Once this group had hammered out frequency agreements and reported, the results were accepted by the sub-committee and quickly by the Technical Committee. And soon the conclusions were adopted by the Plenary Session and it was all over! Amateur radio lived to see another day!

The actions of the ARRL during these fateful days were vitally important to the future of amateur radio. Warner and Stuart were the centerpiece of the effort. If it had not been for them, backed by the ARRL staff and the support of the U.S. Delegation, amateur radio today would be less than it is. Remember that!

Lasting Effects of The 1927 Conference

Amateurs were taken aback at the drastic reduction in the bands. But the international agreements superceded any previous temporary and informal agreements that the American amateurs had accepted as a natural law. Gradually, the uproar subsided and great efforts were made to improve transmitter stability and receiver selectivity. In the following decade the technical basis for today's sophisticated communication techniques was established. The opening of the 10 meter band in early 1928 (the Conference did not concern itself with frequencies above 20 MHz) further spurred equipment development. New circuits, new tubes, new techniques made the new bands more than satisfactory, and amateur radio could breath easier—at least until the next International Radio Conference to be held in Madrid in 1932!

Bibliography

The study of International Radio Conferences and regulation relating to amateur radio is fascinating, as it provides a continuous display of the uneasy relationship to the rest of the communication world. The full story of the 1927 Conference is told in the January 1928 issue of *QST*. Additional Conference background is given in the December 1927 *QST* editorial and in various editorials throughout 1928. The story of the many Telecommunication conferences up to and including the Atlantic City Conference of 1947 is told in the April 1947 *QST*.

General discussion of the 1927 Conference and other conferences is provided in *History of Communications-Electronics in the United States Navy*, by Capt. L.S. Howeth, U.S. Government Printing Office (1963).

For the story of the change from the spark and arc transmitters to the vacuum

tube technology, from 1900 through the consent decree of 1932, which broke the RCA strangle-hold on radio development, see *The Continuous Wave Technology and American Radio, 1900–1932,* by Hugh Aitken, Princeton University Press, 41 William Street, Princeton, NJ 08540 (1985).

More on the Z-Match Antenna Tuner

My series of columns discussing the Z-Match tuner have resulted in a lot of mail from those experimenters who have built this little matching circuit. All of the users report good results. Bill, W8YFB, built one using parts from a surplus TU- 5 tuning unit. The ceramic coil form in the TU-5 was just right for the job. Bill rewound it with No. 12 bare copper ground wire. He purchased his variable capacitors from Fair Radio Sales. He found that on all bands except 10 meters he could match random loads falling between 10 and 5,000 ohms. The range was restricted to 4,700 ohms on 10 meters. His final version was similar to the unit described in my October 1993 column.

Lloyd Butler, VK5BR, kindly sent me the complete series of articles he wrote concerning the development of the tuner and his exhaustive tests employing a variable dummy load resistance and reactance. His articles were originally published in *Amateur Radio* (a W.I.A. publication) in the April and May 1993 issues. Additional material on the tuner appeared in the May 1989 and December 1990 issues of that magazine.

Further background information on the Z-match is given in the Winter 1994 issue of *Communications Quarterly* (a *CQ* publication). This is a reprint of an article by T. J. Seed, ZL3QQ, originally appearing in the New Zealand publication *Break-In* of March 1992. This covers the mathematical analysis of the Z-match, and points out that the circuit had been described as early as March 23, 1918 in Circular C74 of the Bureau of Standards. It would seem that there's nothing new under the sun!

The CQ 1994 Amateur Radio Almanac

No, it's not like *The Old Farmer's Almanac.* It has no information on crops or weather. However, it does have a staggering amount of fascinating information about amateur radio. I'm talking about the *CQ 1994 Amateur Radio Almanac,* published by CQ Communications, and edited by Doug Grant, K1DG. It's hard to describe this 484 page (!) book other than to say it is a complete run-down of all you want to know about amateur radio. The cover gives the reader a hint: The Year in Review, Rules and Regulations, Repeaters, Geographical Statistics, Propagation, Awards, Contests, Ham Radio in Space, Postal Regulations . . . whew!

The four-page index lists it all. Ham radio census? See pages 348 through 426. Operating events and contests? Pages 427 through 473. Propagation? Pages 181 through 236. Awards? Pages 270 through 302. And so it goes.

Ham radio personalities? Page 426 lists the King of Spain, EAØJC; the King of Thailand, HS1A; King Hussein of Jordan, JY1; the President of Italy, IØFCG; the President of Argentina, LU1SM; and more. Celebrities include Marlon Brando, FO5GJ; Stewart Granger, N6KGB; Priscilla Presley, N6YOS; Joe Walsh, WB6ACU; and others. Another list contains writers, authors, Nobel Prize winners, sports figures, and aviators.

Did you know more amateurs were born in 1947 than in any other year? And only one was born in 1988! Did you know W3CHE was the single-op winner for the ARRL DX Contest in 1939? Well, he was.

There's a big section on amateur radio and Internet, packets, and computers. And I found a complete list of amateur census by zip code! (There are 257 amateurs in my zip code, 94025.) I wonder, is there an award for working all zip codes? It's not listed in the *Almanac.*

You'll find out where the world's largest amateur radio antenna systems are located and what propagation will be like in 1994. There is a complete list of U.S. Rules and Regulations, plus questions from the FCC exam pool. And Part 97 of the Rules is given in detail.

But why go on? You'll have to read this amazing *Almanac* for yourself. It certainly opened my eyes as to what is going on in amateur radio today. I guarantee this is the best amateur radio book you can buy for $19.95. Gordon West, WB6NOA, says, "It is absolutely astounding."

Acknowledgements

Thanks to the following whose comments and ideas have been most helpful: W7LVN, K5IU, VK5BR, K2OB, NO5H, KH6SB, K5HP, G8PO, and K4WV. Your input is much appreciated!

Note: Drawings and illustrations are from the January 1928 issue of *QST* magazine, with thanks to the ARRL.

73, Bill, W6SAI

WASHINGTON READOUT

REGULATORY NEWS IN THE WORLD OF AMATEUR RADIO

BY FREDERICK O. MAIA, W5YI

FCC To Implement New Commercial Radio License Fees

The rewards of earning a commercial radio license are many. Besides being a wise addition to your resume, improving your self-esteem, and adorning your radio shack wall, a General Radiotelephone Operator License (GROL) qualifies you to install, operate, service, and maintain very sophisticated radio equipment.

The Federal Communications Commission privatized the administration of all of its commercial radio operator licenses last fall. Up until last September, all commercial radio operator license examinations were administered by the FCC at one of its 25 field offices. Now they are handled pretty much like amateur radio license examinations. Instead of a VEC (Volunteer Examiner Coordinator) managing VE teams, a COLEM (Commercial Operator License Examination Manager) oversees his Commercial Radio Test Centers. While there are 18 VECs, there are only 9 COLEMs.

Your author (Fred Maia, W5YI) heads up the only radio operator testing organization that is both a VEC and a COLEM. The W5YI-VEC handles amateur radio operator examinations and their National Radio Examiners division conducts commercial radio operator testing coast to coast. There are many changes coming! Here is the low down on what is going on in the commercial radio operator world.

Why Have A Commercial Radio License?

Radio operator licenses are required by international law to operate and maintain various commercial stations. These include radio stations aboard ships, on-land (coast) stations in the Maritime Service, on an aircraft, point-to-point radio circuits, and various broadcast stations.

Not every ship or aircraft requires the operator to have a commercial radio license—especially if they do not travel to foreign locations or they operate only in the VHF/UHF spectrum. A commercial radio ticket is required, however, to adjust, repair, or maintain maritime, aviation, international point-to-point, and broadcast transmitters—including hand-held transceivers. As a general rule, you have to pass various written or telegraphy examinations to obtain a commercial radio operator license.

You no longer need a commercial radio operator license, however, to operate, repair, or maintain two-way land mobile equipment such as that used by police, fire departments, taxicabs, truckers, businesses, ambulances, and the like.

Certain privately owned vessels and aircraft require the operators to hold a commercial radio operator license when they operate their radio stations in the medium- or high-frequency band. Here is a rundown of the nine FCC commercial radio operator licenses and how to obtain them.

Restricted Radiotelephone Operator Permit

Commonly referred to as an RP, this license is the easiest of all commercial radio licenses to obtain. Actually, it is yours for the asking. At least it is until July 1st. After that it gets expensive!

Seeking ways to reduce the deficit, the Clinton administration has tacked a $105 fee on this lifetime license. The new assessment is called a regulatory fee—a so-called "Section 9 charge" authorized by the Omnibus Budget Reconciliation Act of 1993. That's the name for the Clinton deficit reduction package.

Most "voluntary ships" (that's a vessel not required to carry radio equipment) do have the capability to operate SSB on the 2182 kHz emergency channel. The maritime (§80.165) and aviation rules (§87.89) require that radio operators hold at least an RP if they operate below 30 MHz. Leisure boaters and pilots operating between 300 kHz and 30 MHz won't be happy to learn that they are among those being targeted to help reduce the deficit. A higher class license is required if you carry passengers for hire. You do not need to hold an RP aboard your privately owned vessel or airplane, however, if you operate only on VHF frequencies and do not make foreign voyages or flights.

Right now there is a $35 filing fee for the license. And there is no examination to take. You simply complete an FCC Form 753 (or 755 if you are a non-resident alien not eligible to work in the United States) and send it to the Federal Communications Commission. There is even a temporary operating section attached to the license application that lets you begin to operate immediately.

Technical personnel at broadcast radio and television stations are also required to have at least an RP if they operate, repair, or maintain any kind of AM, FM, TV, or international broadcast transmitter (see Part §73.1860 and 1870).

We suggest that you quickly apply for the Restricted Radiotelephone Operator Permit if you think you might want to operate a radio station aboard a pleasure vessel or aircraft, or maintain commercial broadcast transmitters.

To be eligible for a Restricted Radiotelephone Operator Permit you need only be a legal resident (or eligible for employment in the United States) and be able to read, write, speak, and hear. You also must certify that you are familiar with the rules pertaining to the radio station you plan to operate.

The form is available by writing to the FCC at 1270 Fairfield Road, Gettysburg, PA 17325, or by telephoning their Consumer Assistance Branch at 717-337-1212. We will also send you the FCC Form 753 without charge if you send us a large SASE (send it to the W5YI Group, P.O. Box 565101, Dallas, TX 75356).

Marine Radio Operator Permit

The next commercial radio operator license is the MROP—Marine Radio Operator Permit. This license is needed to operate certain radios aboard commercial vessels, coast (maritime land), and aviation radiotelephone stations. All commercial ships navigating the Great Lakes or in the open sea must have at least an MROP. The Marine Radio Operator Permit also allows pleasure-boat operators to run high power (up to 1 KW PEP) SSB on maritime frequencies. Aircraft pilots operating on other than aeronautical spectrum also must hold the MROP.

Amateur radio equipment, by the way, may not be used on marine or aeronautical mobile frequencies. The rules specifically require that all maritime and aviation radio transmitters be FCC type accepted for Part 80 or 87 use. Amateur radio gear is not required to be approved by the Commission.

Right now there is only an examination fee associated with this license. This is the fee charged by the COLEM. It should be about $35, plus or minus, depending upon which testing organization administers the examination. Each charges a

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slightly different testing fee.

Effective July 1st, however, there will be an additional $45 regulatory fee tacked on to the COLEM fee. The fee is less than that of the Restricted Permit, since this is a five-year renewable license. The regulatory fee must be paid by separate check made out to the FCC and sent to an address in Pittsburgh, Pennsylvania. The Mellon bank collects all fees for the government. The testing fee is paid directly to the examiners. Effective July 1st, there will be two fees to pay for every new, renewal, or replacement license. More on renewals, duplicate, replacement, and modified (such as a change of name) licenses later.

The MROP examination, called Element 1, consists of 24 multiple-choice questions about marine radio law. The question pool of 170 questions is based on the Part 80 Maritime Service rules and regulations. The questions, the multiple choices, and the answers are widely available in the publishing marketplace.

General Radiotelephone Operator License

This is the highest class of commercial radiotelephone operator license available. Basically, this license replaces the old First and Second Radiotelephone Operator licenses that were discontinued by the FCC on June 15, 1984. It allows the operator unlimited operation, adjustment, repair, and maintenance of any radiotelephone transmitter in any service that requires a commercial radio operator. This includes the Broadcast, Maritime, Aviation, and International Fixed Public Radio Services.

Besides conveying all of the operating authority of the Marine Radio Operator Permit (MROP) and the Restricted Radiotelephone Operator Permit (RP), the GROL allows high power (more than 1 KW PEP) SSB operation in the maritime and aviation services.

The General Radiotelephone Operator License is issued for the lifetime of the holder. Effective July 1st, in addition to the COLEMs testing fee there will be a $105 regulatory fee.

Applicants must pass two multiple-choice examinations totalling 100 questions to qualify for the GROL. This is made up of the 24-question Element 1 (mentioned above) and an additional 76 questions on radiotelephone electronics (Element 3). There are about 900 questions in the combined Element 1 and 3 question pools.

All written examinations are constructed from the word-for-word questions and multiple choices released by the FCC. A low-priced General Radiotelephone Operator License study manual containing all questions, multiple choices, answers, and explanations is available from The W5YI Group (telephone toll-free 1-800-669-9594).

Radiotelegraph Operator Certificates

There are three commercial radiotelegraph licenses: the T-1 First, T-2 Second, and T-3 Third Class Radiotelegraph Operator. The First and Second Class allow the operator to operate, repair, and maintain all commercial radiotelegraph equipment and operate all radiotelephone stations. The Third Class Radiotelegraph authorizes operation at certain coast (land) stations. All three telegraph licenses authorize all privileges conveyed by the RP and MROP.

To obtain any of commercial telegraph licenses you must pass Element 1, Marine Law, and Element 5, Basic Radiotelegraphy Procedures. An additional Element 6 (Advanced Radiotelegraph Technology) is required for the T-1. Element 5 consists of 50 multiple-choice questions; Element 6 consists of 100. You pass if you answer 75% correctly. All commercial telegraph licenses are valid for a five-year term.

The First Class Radiotelegraph Operator Certificate is the only commercial radio license with an age and/or experience requirement. You must be 21 years old and have a year of commercial radiotelegraph experience to qualify for a T-1. The First Class Radiotelegraph Operator's Certificate is required for those who serve as the chief radio operator on a U.S. passenger ship.

The Morse code requirements for the Second and Third Radiotelegraph are the same—16 code groups (CG) per minute and 20 words-per-minute plain language (PL). The First Class telegraph has a higher speed requirement—20 CG and 25 PL. The code groups consist of three to six random letters, numbers, punctuation, and operating prosigns. The same 43 characters that are required in the amateur radio Morse code exams are required for the commercial version. A Morse code hand-sending examination is usually not required.

The good news for Amateur Extra Class ham operators is that they automatically receive examination credit for Telegraphy Elements 1 and 2 (16 CG and 20 PL) without testing. The bad news is that the written Element 5 and 6 question pools have not yet been released by the FCC. Right now there is only a COLEM testing fee. Beginning in July there will be an additional $35 regulatory fee to obtain any new commercial radiotelegraph operator certificate.

GMDSS Operator and Maintainer Licenses

The Global Maritime Distress and Safety System (GMDSS) is a satellite-based marine alerting system that will eventually replace radiotelegraph at sea as Morse code is phased out. The new Global Maritime and Distress Safety System (GMDSS) rules apply to all passenger ships and certain large cargo ships. These ships must implement the GMDSS rules by February 1, 1999.

Ships are required to carry at least two persons holding GMDSS Radio Operator's Licenses for distress and safety radio communication purposes. The GMDSS/O license qualifies personnel for the purpose of operating a GMDSS radio installation. One of the operators is designated as primary, the second as back-up for emergency communications.

Ships that elect the at-sea option for GMDSS equipment maintenance must carry at least one person who qualifies as a GMDSS Radio Maintainer. This maintainer may also be designated as one of the two required operators.

Both the GMDSS Operator and Maintainer must pass the 24-question Element 1, Marine Radio Law. In addition, the GMDSS Radio Operator must pass a 76-question multiple-choice examination (Element 7) on GMDSS operating procedures and practices. Passing score is 57 questions answered correctly.

The GMDSS Radio Maintainer exams contain 150 multiple-choice questions. There are 24 questions on Marine Radio Law (Element 1); 76 questions on Radiotelephone Electronics (Element 3); and 50 questions on GMDSS maintenance practices and procedures (Element 9).

Until July 1st the only charge is the COLEM examination fee. After July 1st, there will be an additional $35 regulatory fee on the GMDSS licenses.

Endorsements on Commercial Licenses

There are three endorsements that can be added to commercial operator licenses. The Ship Radar Endorsement may be placed only on the General Radiotelephone Operator License (GROL) or a First or Second Class Radiotelegraph Operator's Certificate. Applicants must pass a 50-question multiple-choice exam on the proper installation, servicing, and maintenance of ship radar equipment. The minimum passing score is 38 questions answered correctly.

The Six Months Service Endorsement is required on the radiotelegraph operator's certificate of anyone who serves as the sole radio operator aboard large U.S. cargo ships sailing the high seas. To qualify you must hold a First or Second Radiotelegraph Certificate and a radio officer's license issued by the U.S. Coast Guard, and have been employed as a radio operator on board a U.S. ship for at least six months.

A Restrictive Endorsement is placed on a license when a person has an uncorrected physical handicap which would prevent the performance on any duties authorized by a specific commercial radio license. Amateur Extra Class operators who receive a handicap exemption for the 20 wpm telegraphy Element 1(C) will have this Restrictive Endorsement placed on their commercial ticket. The Restrictive Endorsement permits installation, servicing, and maintenance of commercial radio equipment, but not operating duties.

There is no additional fee when an endorsement is added to a license.

Renewals, Replacement, and Duplicate Licenses

Effective July 1st, there are two separate fees on new and renewed commercial radio operator licenses. A new applicant for a commercial ticket pays an examination and a regulatory fee. There are two fees also when a licensee renews his/her commercial radio operator license—a regulatory fee and an additional application fee.

The regulatory fee is $35, which is based on a five-year license at $7 annually ($105 for a lifetime license). The application fee is an additional $45, which goes to offset the administrative costs of issuing the license. After July 1, 1994 it will cost a total of $80 to renew a Marine Radio Operator Permit, a Radiotelegraphy Certificate, or a GMDSS Radio Operator/Maintainer License.

Duplicate, modified, and replacement licenses carry only a $45 application processing fee, but no regulatory fee. The license will carry the original date of expiration.

Taking Commercial Radio Operator Exams

It is now easier than ever to take a commercial radio operator examination, since there are test centers in most major cities across the United States. All written tests must be constructed from a pool of known questions (and multiple choices) which are released to the public by the FCC.

Interested in getting a commercial radio operator license? Call 1-800-669-9594 to learn where the nearest test center is located or how to get the needed study material. National Radio Examiners even has a program for colleges, universities, and technical schools whereby instructors can administer commercial radio operator examinations as part of their training. Keep in mind that not all question pools have yet been released by the Commission, but those needed for the MROP, GROL, and the GMDSS licenses are now available.

73, Fred, W5YI

DX

BY CHOD HARRIS, VP2ML

NEWS OF COMMUNICATION AROUND THE WORLD

The "More Wanted" Countries

For the past 25 years *The DX Bulletin* (or its predecessor, *The West Coast DX Bulletin*) has conducted a survey of its readers to determine which countries these active DXers "need." The complete results of this worldwide survey of nearly 7000 DXers was published in the November/December 1993 issue of *The DX Magazine*, and copies are available from P.O. Box 50, Fulton, CA 95439 for $2 postpaid in the US. In addition to this survey of the 100 Most Wanted countries, DXers often nominate other countries they need, but which are not in the top 100 Most Wanted. These are the "More Wanted" countries. Beginning DXpeditioners and DXers seeking to combine a vacation with a DXpedition may wish to consider some of these More Wanted countries as possible destinations. Here's an analysis of the More Wanted countries, with predictions as to whether they will be More Wanted or less wanted at the end of 1994.

The country that is More Wanted so much that it will be included in the top 100 Most Wanted countries in 1994 is **Monaco 3A**. Monaco is the second smallest independent state in the world (DX trivia: What is the smallest country? Hint: It has the lowest birthrate of any country.) Monaco has a population of only 30,000 and an amateur population of about 60, according to the 1994 *Callbook*. Furthermore, Monaco is part of the CEPT agreement, whereby most European countries automatically honor each other's radio licenses. (The CEPT agreement is similar to the reciprocity in amateur radio licenses between the United States and Canada; no additional paperwork is required to legally operate in the other country.)

The reasons Monaco is so wanted are geography and a restriction on antennas. Monaco covers the side of a mountain that slopes steeply into the Mediterranean. While the propagation path to the south (Africa) is clear, the path to the north and west (US and Japan) is blocked. A DXpeditioner could overcome this handicap with high power and large, directional antennas. Unfortunately, the amateur power limit in Monaco is only 100 watts, and portable antennas are prohibited. Potential DXpeditioners would have to borrow use of an existing station or operate with mobile antennas. Running 100 watts into a short vertical whip hardly generates the kind of contact totals that will move a country out of the More Wanted category. However, a concerted effort to work Japanese and US West Coast DXers would make a lot of amateurs very happy. Perhaps some European DXers can team up with some of the local 3A amateurs and eliminate the backlog of demand for this tiny principality.

The next More Wanted country is the **Sudan ST**. The Sudan is the largest country in Africa, about one fourth the size of the US. It is located on the eastern side of the continent, bordering on the Red Sea, south of Egypt. Sudan has no active resident amateurs among its population of some 25 million. In recent years there have been some isolated amateur operations in the Sudan by visitors. Among the most notable of these was Eric Biorck, WZ6C, who operated /ST4 from the Kordofan region. (Eric is presently in Bangladesh operating as S21ZG.) A military government and near-continual war in the southern part of the country contribute to the scarcity of Sudan on the amateur bands. While an enterprising DXpeditioner might surmount the difficulties of staging a major operation from the Sudan, it would hardly classify as a vacation. Look for Sudan to become More Wanted in 1994.

Third on the More Wanted country list is **Oman A4**. Oman is an Arab oil state at the mouth of the Persian Gulf. It has some 80 licensed amateurs in its population of 1.5 million, some of whom are quite active. The local amateurs could easily reduce demand for Oman with a little encouragement. (Those DXers who spend their energy looking for new DXCC countries have undoubtedly noticed that Omani territory on the tip of the Musandam Peninsula is separated from the rest of the country by the United Arab Emirates. However, the 50 miles of separation by another DXCC country are not enough to meet the requirement of DXCC Country Criterion Point 3, which is 75 miles.)

Number four on the More Wanted list is **Wake Island KH9**. However, the 1993 Most Wanted survey was conducted prior to the Wake Island DXpedition led by Javier Campos, AH6MM. That very workable operation by a team of Cal Poly stu-

P.O. Box 50, Fulton, CA 95439

9A2AJ in Zagreb, Croatia, operated as T93T from war-torn Bosnia-Herzegovina.

Luca, IC8WIC (seated), recently visited the shack of Cliff, KB9N.

dents and others should have made a significant dent in the need for this Pacific island. Look for Wake to be much lower on the 1994 survey.

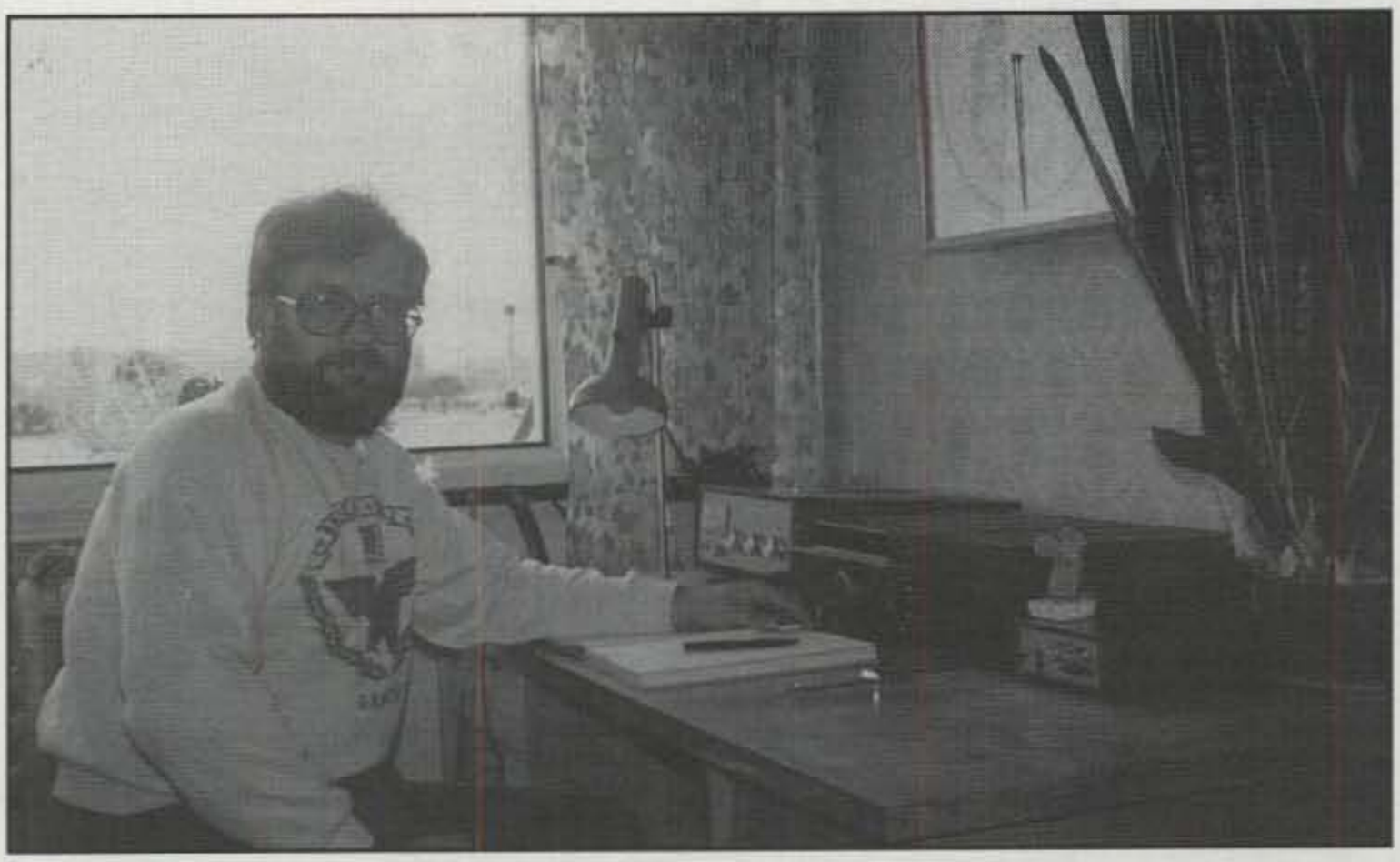
The fifth More Wanted country is **Macao XX9**. Macao is Chinese territory under Portuguese administration, and consists of two small islands and a tiny chunk of mainland, some 20 miles south of Hong Kong, on the Chinese coast. The territory is scheduled to be returned to China on December 20, 1999. Macao is a tourist destination, noted for its casinos. Alberto, XX9AS, is the most active resident amateur, but he is not able to meet the demand for Macao contacts, especially from the US east coast and Europe. Fortunately, Martti Laine, OH2BH, has plans to build a serious contest station in Macao. Multi-op contest operation and the use of this station by visiting operators will help to reduce demand for Macao before it joins the list of deleted DXCC countries when the Chinese take over in 1999. Meanwhile, visitors to Hong Kong might consider taking the hydrofoil over to Macao to operate.

The country that was sixth on the More Wanted list was **Walvis Bay ZS9**. This country was probably deleted from the DXCC Countries List, effective Feb. 28, 1994, when the enclave was ceded to Namibia by South Africa. See the February 1994 DX column for more details.

Next on the More Wanted list is **West Malaysia 9M2/4**. Malaysia consists of two parts: peninsular Malaysia, which includes the capital of Kuala Lumpur, and Sabah and Sarawak on the island of Borneo, some 325 miles to the east. West Malaysia is slightly More Wanted than **East Malaysia 9M6/8**, which ranks 11th. Malaysia's relative rarity is due more to its location than to any restrictions on travel or amateur licensing. It's simply a long way to the large amateur populations of Europe and the US. DXpeditioners should definitely consider making Malaysia a priority, with particular emphasis on Europe and the US east coast.

Eighth on the More Wanted list is **Pakistan AP**. Foreigners have almost no chance of getting licensed in Pakistan, so it's up to the resident amateurs to increase their efforts to ease the pent-up demand for this Asian country. Again, its location works against making lots of contacts. Pakistan is almost directly across the North Pole from most of the US, and polar paths are notoriously weak and unreliable.

The ninth More Wanted country suffers from some of the same problems of geography. **Singapore 9V** has an adequate number of resident amateurs, many of whom are very active. However, Singapore is simply a long way from the bulk of the amateur population, which leads to short openings and poor signal-to-noise ratios. Note that many of the More Wanted countries, along with several Most Wanted ones, lie in the same region.



Jeri, OK1AVI, operates this neat station from the Czech Republic. (K8JJC photo)

Rounding out the Top Ten More Wanted countries is another in Europe: the **Dodecanese SV5**. The Dodecanese are a series of Mediterranean islands closer to Turkey than to Greece. The best known of these islands is Rhodes, but many of the other islands in the region are popular tourist destinations. SV5TS is an active resident, but obviously he is not able to single-handedly reduce demand,

The WPX Program

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2435 ..... JI6URU 2437 ..... IK4GNH

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2807 ..... S53AP

MIXED

1644 ..... OE6CLD 1647 ..... JQ1NGT
1645 ..... W6/S52NC 1648 ..... OH1AJ
1646 ..... IK4NPC

Mixed: 450 OE6CLD, W6/S52NC, JQ1NGT. 500 OE6CLD, W6/S52NC, JQ1NGT. 550 OE6CLD, W6/S52NC, JQ1NGT. 600 OE6CLD, W6/S52NC, JQ1NGT. 650 OE6CLD, W6/S52NC, JQ1NGT. 700 OE6CLD, W6/S52NC, JQ1NGT. 750 OE6CLD, JQ1NGT. 800 OE6CLD, WWØE, JQ1NGT. 850 OE6CLD. 900 OE6CLD. 950 OE6CLD. 1000 OE6CLD, AA9F. 1050 OE6CLD. 1100 OE6CLD. 1150 OE6CLD, WK3Z. 1200 OE6CLD. 1250 OE6CLD, WØIZV. 1300 OE6CLD. 1350 OE6CLD. 1400 OE6CLD. 1450 OE6CLD. 1750 VE9RJ. 1800 W3KH. 2050 IK2ILH. 2100 IK2ILH. 2150 W4UW. 2900 I1EEW.

SSB: 350 IK4HPU, DJ8WQ, VP8CEH. 400 EA1ET, IK4HPU, DJ8WQ, VP8CEH. 450 WWØE, IK4HPU, DJ8WQ. 500 KJ5LJ, WWØE, IK4HPU, DJ8WQ. 550 KJ5LJ, IK4HPU, DJ8WQ. 600 KJ5LJ, DJ8WQ. 650 KJ5LJ, DJ8WQ. 700 DJ8WQ. 850 WK3Z. 1050 I6DQE. 1100 I6DQE. 1150 I6DQE. 1200 I6DQE, NG9L, IK2AEQ. 1250 I6DQE. 1300 OE6CLD. 1350 OE6CLD. 1400 OE6CLD. 1450 OE6CLD, N2AC. 2100 EA8AKN. 2150 EA8AKN. 2200 EA8AKN. 2250 EA8AKN. 2300 EA8AKN. 2350 EA8AKN. 2550 I1EEW.

CW: 350 S51ZY. 400 S51ZY. 450 S51ZY. 500 S51ZY. 550 S51ZY, K2LUQ. 600 JE3CYH, S51ZY. 650 EA7TG, S51ZY, WK3Z. 700 S51ZY, WK3Z. 750 K1CVF, S51ZY, WK3Z. 800 S51ZY. 850 VE5RD, S51ZY. 900 S51ZY. 950 W4UW, S51ZY. 1000 S51ZY. 1050 S51ZY. 1100 S51ZY. 1150 S51ZY. 1200 S51ZY. 1250 S51ZY. 1300 S51ZY. 1350 S51ZY. 1400 S51ZY. 1450 I1EEW, S51ZY. 1550 OZ5UR. 1600 OZ5UR. 1750 VE9RJ. 1950 W8IQ. 2000 W8IQ. 2550 N2AC.

10 Meters: DJ8WQ.
15 Meters: SM3LGO.
20 Meters: S53AP, SM3LGO.
40 Meters: AB5C, WK3Z.
80 Meters: AB5C, SM3LGO
160 Meters: WK3Z

So. Amer.: HB9BHY, OZ5UR
Europe: EA1ET

Award of Excellence: F6HMJ, HB9DDZ.

Award of Excellence with 160 Meter Bar: F6HMJ, HB9DDZ.

Award of Excellence Plaque Holders: I8YRK, W4CRW, SMØAJU, K5UR, K6XP, N5TV, K2VV, VE3XN, W6OUL, DL1MD, DJ7CX, DL3RK, WB4SIJ, SM6DHU, N4KE, I2UIY, DL7AA, ON4QX, WA8YTM, YU2DX, OK3EA, I4EAT, OK1MP, N4NO, ZL3GQ, VK9NS, DEØDXM, DK4SY, UR2QD, AB9O, FM5WD, I2DMK, W4BQY, IØJX, SM6CST, VE1NG, I1JQJ, WA1JMP, PY2DBU, HI8LC, KA5W, KØJN, W4VQ, KF2O, K3UA, HA8XX, HA8UB, W8CNL, K7LJ, W1JR, F9RM, W5UR, WB8ZRL, SM3EVR, CT1FL, K2SHZ, UP1BZZ, W8RSW, WA4QMQ, EA7OH, K2POF, DJ4XA, IT9TQH, W8ILC, K2POA, N6JV, W2HG, ONL-4003, VE7DP, K9BG, W5AWT, KBØG, HB9CSA, F6BVB, W1BWS, YU7SF, G4BUE, N3ED, DF1SD, K7CU, I1POR, LU3YL/W4, NN4Q, KA3A, YBØTK, VE7WJ, VE7IG, K9QRF, YU2NA, N2AC, W4UW, NXØI, W9NUF, N4NX, SMØDJZ, DK5AD, WB4RUA, DK5AD, WD9IIC, W3ARK, I6DQE, LA7JO, VK4SS, K6JG, I1EEW, I8RFD, I3CRW, VEFXR, N4MM, KC7EM, ZS6BCR, CT1YH, IV3PVD, KA5RNH, ZP5JCY, F1HWB, KC8PG, NE4F, VE3MS, K9LJN, ZS6EZ, YU2AA, I1WXY, IK2ILH, DEØDAQ, LU1DOW, N1IR, IK4GME, WX3N, KC7X, N6IBP, W5ODD, IØRIZ, I2MQP.

Award of Excellence Plaque Holders with 160 Meter Endorsement: CT1YH, IV3PVE, KA5RNH, ZP5JCY, AB9O, FM5WD, SMØDJZ, DK5AD, SM6CST, I1JQJ, PY2DBU, W3ARK, HI8LC, KA5W, UR2QD, VE3XN, K6XP, LA7JO, W4VQ, K6JG, K3UA, HA8UB, W4CRW, N4MM, K7LJ, SMØAJU, KF2O, SM3EVR, K5UR, UP1BZZ, OK1MP, N5TV, K2POF, W8CNL, DJ4XA, IT9TQH, DL9RK, N6JV, ONL-4003, W1JR, W6OUL, W5AWT, KBØG, F6BVB, W4BQY, YU7SF, W5UR, N4NO, DF1SD, K7CU, I1POR, W8RSW, N4KE, I2UIY, YBØTK, W8ILC, W1BWS, VE7WJ, K9QFR, NN4Q, W4UW, NXØI, G4BUE, LU3YL/W4, I4EAT, WB4RUA, VE7WJ, N4NX, DEØDXM, VE7IG, K9BG, I1EEW, AB9O, CT1YH, IV3PVD, KA5RNH, ZP5JCV, I2MQP, IØRIZ, W5ODD, WX3N, IK4GME, HA8XX, YU1AB.

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.

5 Band WAZ

As of January 31, 1994, 372 stations have attained the 200 Zone level.

New recipients of 5 Band WAZ Award with all 200 Zones confirmed:
JH7QXL

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)
K6YRA, 199 (34)
PY7ZZ, 199 (34)
KØCS, 199 (34, 40m)
AA4KT, 199 (26)
K7UR, 199 (34)
NAØY, 199 (26)
VE7DX, 199 (34)
WØPGI, 199 (26)
W2YY, 199 (26)
W9WAQ, 199 (26)
K6EID, 199 (34)
W1JR, 199 (23)
N7RT, 199 (34)
VE7AHA, 199 (34)
W1FZ, 199 (26)
IK2GNW, 199 (1)
W9CH, 199 (26)
ACØM, 199 (34)
G3MXJ, 199 (12)
IK8BQE, 199 (31)
JA2IVK, 199 (34, 40m)
W6TC, 199 (34)
KA5W, 199 (26)
OH8KN, 199 (20)
DF4DI, 199 (6)
SM6AHS, 198 (12, 31)
K1ST, 198 (19, 26)
4X6DK, 198 (4, 6)
ABØP, 198 (23, 34)
UA3AGW, 198 (1, 12)
KL7Y, 198 (34, 36)
VO1FB, 198 (19, 27)
EA5BCX, 198 (27, 39)
KZ4V, 198 (22, 26)
K4PI, 198 (23, 26)
G3KDB, 198 (1, 12)

The following have qualified for the basic 5 Band WAZ Award:

KA5W, 199 Zones
JH7QXL, 200 Zones
EA2KL, 192 Zones
KØOST, 156 Zones
OH8KN, 199 Zones
DF4DI, 199 Zones
W7YS, 166 Zones

Endorsements:

W4UW, 186 Zones
GM3YTS, 193 Zones
AA4EL, 180 Zones

880 Stations have attained the 150 Zone level as of January 31, 1994.

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Manager, Jim Dionne, K1MEM, 31 DeMarco Road, Sudbury, MA 01776. The processing fee for all *CQ* awards is $4.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $10.00 for nonsubscribers. Please make all checks payable to the Award Manager. Applicants sending QSL cards to a CQ checkpoint or the Award Manager must include return postage. Questions regarding the WAZ Award may be sent to K1MEM with an SASE.

The WAZ Program

Single Band WAZ

10 Meter SSB

472.....KA8LQZ 473.....K4PR

15 Meter SSB

464.....JM1PPQ 465.....YC2BAB

17 Meter Mixed

24.....WB2NQT

All CW

43.....LW2DFM

Satellite

9.....DG2SBW 10.....N4SU

160 Meters

74.....4X4NJ (40 Zones)

All Band WAZ

SSB

4146.....JR9NVB 4149.....KG8CZ
4147.....EA7HAL 4150.....JR9FJY
4148.....WG9L 4151.....W2NNZ

CW/Phone

7431.....WN5IJZ 7435.....OH1AJ
7432.....WT8F 7436.....KE4CQ
7433.....WA6NKQ 7437.....IK2HSW (CW)
7434.....K2FU 7438.....WB8RVK

Applications and reprints of the latest rules may be obtained by sending a self-addressed stamped envelope (75 cents) size 4¼ × 9½ to the WAZ Manager, Jim Dionne, K1MEM, 31 DeMarco Rd., Sudbury, MA 01776. Applicants forwarding QSL cards either direct to the WAZ manager or to a check point should include sufficient postage for safe return of their QSL cards. The processing fee for all *CQ* awards is $4.00 for subscribers and $10 for non-subscribers. Please make all checks payable to the Awards Manager. In order to qualify for the subscriber rate, please enclose your latest CQ mailing label with your application. Send any questions to K1MEM by mail and include an SASE (please do not telephone).

especially from the US West Coast. Greece is part of the CEPT agreement, so most European DXers can operate from the Dodecanese without having to put up with Greece's hidebound bureaucracy. This would be an excellent vacation/DXpedition choice.

The remainder of the More Wanted countries are needed by only a small fraction of the world's most active DXers. Most are regionally needed, due to distance from concentrations of amateurs, rather than any travel or licensing difficulties. Among these countries are **Mayotte FH, Seychelles S7, Ogasawara JD1/o, Swaziland 3DA, Thailand HS, Tuvalu T2,** and **San Felix CEØX**. Many of these countries have adequate tourist facilities, and would be good choices for DXpeditions. Potential DXpeditioners should pay particular attention to long-haul paths, as much of the demand for these countries comes from amateurs more than 7000 miles away.

The 1994 Most Wanted countries survey will be conducted in August. DXers who are not readers of *The DX Bulletin* may participate by sending a business-sized, self-addressed, stamped envelope (SASE) to *The DX Bulletin* at P.O. Box 50, Fulton, CA 95439.

Last year the Most Wanted country was **Peter 1 Island 3Y**, but the 3YØPI DXpedition made more than 60,000 contacts in February, so look for Peter 1 Island to fall way down the list in 1994. Bhutan A5, Libya 5A, Heard Island VKØH, and Yemen 7O will probably top the 1994 Most Wanted list.

Speaking of Most Wanted lists, the ARRL has published a list of the most needed countries, based on the computerization of DXCC records. One might think that this wide-based report would be more useful than the voluntary Most Wanted survey conducted by *The DX Bulletin*. It probably is at the More Wanted level, but the ARRL hasn't published this information yet. However, the ARRL's survey cannot be used for the most impor-

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 329 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 329	K6LEB 329	OK1MP 328	ON4QX 323	WB4RUA 320	K9TI 317	K4CXY 310	WA8YTM 300	K7JYE 283
K1MEM 329	KD8V 329	K8LJG 327	PAØXPQ 323	K4IQJ 320	K1HDO 317	VE7DX 310	YU2TW 300	KF5PE 282
W9DWQ 329	9A2AA 329	WØIZ 327	K9QVB 323	F3TH 320	W3BBL 317	K4JLD 310	OZ5UR 295	W2LZX 279
N4MM 329	N6AR 328	EA2IA 327	W7CNL 323	I2QMU 320	K2JF 316	K2JLA 309	YV5ANT 294	HB9AFI 278
K2FL 329	W2FXA 328	IT9TGO 326	WA8DXA 323	AA5NK 320	Y33VL 316	KA7T 309	KB3X 289	HA5NK 278
DL1PM 329	YU1HA 328	W7ULC 326	DJ2PJ 323	WB5MTV 320	N4AH 316	W6DN 308	VE1RJ 288	WB6OKK 277
K3UA 329	SM6CST 328	N7MC 326	K9AB 322	W1WAI 320	W5OG 315	KB4HU 308	WG5G/QRPp 288	KA3R 277
K9BWQ 329	AA4KT 328	WØHZ 326	IT9QDS 322	N6AV 319	I5XIM 314	IK2ILH 307	W7IIT 287	W3HQU 276
K9MM 329	N4JF 328	W9WAQ 326	IT9ZGY 322	AA6AA 319	WA2HZR 312	K1VHS 306	KØHQW 286	WF9K 276
K2ENT 329	W2UE 328	WØJLC 326	K4XO 321	KUØS 319	W4OEL 312	N1HN 306	CT1YH 284	N5FG 275
K2OWE 329	K8NA 328	WØSR 325	N2KW 321	N5FW 318	NC9T 311	W8URM 305	N4OT 284	YU7FW 275
K4CEB 329	WA4IUM 328	KB8DB 325	G4BWP 321	N6CW 318	OH3NM 311	WA4DAN 302	WB4UBD 284	
I4EAT 329	KZ4V 328	WA4JTI 325	VE3HO 321	W8XD 318	VE7CNE 311	KA2DIV 301	HB9DDZ 284	
K6JG 329	K9IW 328	N7RO 324	IT9TQH 321	KA5TQF 318	AA2X 311	G3KMQ 301	KP4P 283	

SSB

K4MZU 329	DL6KG 329	KC8EU 327	KA5TQF 324	WA4DAN 321	NC9T 318	F1OZF 312	I4CSP 303	OK1AWZ 287
K2TQC 329	KZ2P 328	KM2P 327	WB4PUD 324	AA6AA 321	YV5IVB 318	K1VHS 312	N6RJY 303	IK8BMW 286
K2FL 329	K6YRA 328	WD8PUG 327	K6WR 323	KB3X 321	OE7SEL 318	EI6FR 312	WA9BDX 303	N8BJQ 285
W9DWQ 329	DL9OH 328	LA7JO 327	WA3HUP 323	KE4HX 321	I8IGS 318	N1ALR 311	KD5ZD 303	W6SHY 285
W9SS 329	CX1TE 328	K7LAY 327	K9HDZ 323	WD8PUG 321	W3GG 317	XE1ZLW 311	WA8MEM 303	KB5RF 284
WA4IUM 329	K5OVC 328	VE2WY 327	KØGT 323	KI3L 321	XE1XM 317	KF8VW 311	RA2YA 302	KD9CN 284
DJ9ZB 329	AA6BB 328	WB3DNA 327	K4MQG 323	KR9O 321	KB3OQ 317	I2MQP 311	W2LZX 302	KJ5LJ 284
WB1DQC 329	KA6V 328	I2QMU 327	YV5CWO 323	VE3HO 321	YV1CLM 317	KB7IVU 311	VE6PW 301	NU4Y 283
XE1AE 329	K5TVC 328	K6LEB 327	TI2HP 323	XE1MD 321	LU7HJM 317	KA5RNH 310	NO4J 301	VE3IMO 283
EA2IA 329	I8ACB 328	SV1ADG 327	VE7WJ 323	KB2MY 321	KV2S 316	TI2JJP 310	WP4AFA 301	XE1ILI 283
K2ENT 329	N6AR 328	K8CSG 327	I8XTX 323	KB1JU 321	YT7DX 316	ZL1BOQ 310	WA5SUE 301	K2EEK 283
OZ5EV 329	KSØZ 328	IK8BQE 327	I8YRK 323	CE7ZK 321	WA9RCQ 316	W3SOH 310	YU2TW 300	YC3OSE 282
KA3HXO 329	W2FXA 328	K2JLA 326	N5FW 323	K9QVB 320	KB9OC 316	N6AHV 309	WT4T 300	YV1JV 282
CX4HS 329	YU1HA 328	K2JF 326	TI2CC 323	KB5FU 320	KB8O 316	KP4P 309	W7KSK 300	WB2NQT 282
F9RM 329	WD8MGQ 328	WB5TED 326	K4PQV 323	AA4AH 320	WB2JZK 316	XE1MD 309	VE3FJE 300	VE4MT 282
I4EAT 329	XE1L 328	W6BCQ 326	I4LCK 323	G4GED 320	EA3EQT 316	WA8YTM 309	AB4UF 300	EA8TE 282
KB8DB 329	W6EUF 328	PAØXPQ 326	N2KW 323	NJØC 320	N3ARK 316	KP4EQF 309	I8IGS 299	WAØQII 281
VE3XN 329	K8LJG 328	WB4UBD 326	WA4WTG 323	K7EHI 320	IK7DBB 315	IØSGF 309	K5DUT 299	VU2DVP 281
YU1AB 329	KB4HU 328	PY4OY 326	KØHQW 323	W6NLG 320	KC2FC 315	N5HSF 309	I2ZGC 299	W8/DL2SCA 281
VE1YX 329	K8NA 328	W2CC 326	SM6CST 323	IK8GCS 320	WA5HWB 315	KA4RAW 309	NW5K 299	LU6FAZ 281
N4MM 329	OE3WWB 328	WZ4I 326	KS2I 323	N5FG 320	WB4DBB 315	W8URM 308	WB6GFJ 299	KB5MRT 281
N7RO 329	VE3MR 328	W2FGY 326	I8KCI 322	W6MFC 320	HR1KAS 314	N6AV 307	Y33VL 299	WN6J 281
YS1GMV 329	VE3MRS 328	I2EOW 326	IØAMU 322	K4SBH 320	OH5KL 314	WD5P 307	KJ9N 298	NXØI 280
K9MM 329	OE2EGL 328	WØSR 326	K4CXY 322	WE2L 320	WDØDMN 314	TI2TEB 307	VE3CKP 297	YU1TR 280
4Z4DX 329	W4NKI 328	IK1GPG 326	K9AB 322	WØULU 320	ZS6AOO 314	VE3DLR 307	EA5RJ 296	WN5K 279
ZL1AGO 329	KZ4V 328	AA5NK 326	G4ADD 322	N2VW 320	F6BFI 314	KX5V 307	HP1JC 296	4X6DK 279
KF7SH 329	K3UA 328	IKØIOL 325	LA7JO 322	CX1TE 319	W5GVP 314	XE1MDX 306	VE3XO 294	KK4TR 279
ZS6LW 329	VE3GMT 328	IT9TQH 325	OA4ED 322	K9TI 319	N6PTI 314	VK3JF 306	KJ6GC 294	KAØZFX 279
VK4LC 329	K9BWQ 328	WA4ECA 325	I4WZK 322	K1UO 319	PY2DBU 314	EA2AOM 306	WB4UHN 294	HA5NK 279
YV5AIP 329	IK8CNT 328	K9HQM 325	K8YVI 322	WB6OKK 319	K7TCL 314	4X4JO 306	IT9VDQ 293	VU2CVP 278
ZL3NS 329	WØYDB 328	KC5P 325	I4SAT 322	KF5AR 319	K4LR 313	WA2FKF 306	W8AXI 293	VE7HAM 278
K9IW 329	OZ3SK 328	K1HDO 325	W6DN 322	I8IYW 319	W1LQQ 313	N4KE 305	OA4QV 293	K4BYK 277
K6JG 329	W4EEE 328	N4KEL/M 325	KE5PO 322	KD5ZM 319	I8INW 313	K3LUE 305	AA2FN 293	WN5MBS 277
WA6OET 329	AI8M 328	W5LLU 325	W7ULC 322	I1POR 319	K8CMO 312	WF9K 305	TI2LTA 292	CT1AHU 277
WA4JTI 329	OK1MP 328	WDØGML 325	I8LEL 322	VE2GHZ 319	K8NWD 312	NI5D 305	K9EC 292	KG6LF 277
YV1AJ 329	W4UW 328	WN5IJZ 325	KB7VD 322	KU9I 319	ZS6BBY 312	G4NXG/M 305	N6ITW 291	YB1RED 277
YV1KZ 329	KE4VU 328	W7FP 325	K4JLD 322	KQ9W 318	WA9IVU 312	KJ6HO 305	CP5NU 290	VE2DRN 277
N6AHU 329	W7OM 327	VE2PJ 324	WS9V 321	WB6PSY 318	K3NEE 312	WA1DHM 304	CT1EEB 290	WØIKD 277
EA4DO 329	WØSFU 327	XE1CI 324	AI8S 321	WB3CQN 318	WDØBNC 312	W3YEY 304	WA3KKO 290	KC6AWX 276
W9OKL 329	IT9ZGY 327	W5XQ 324	VE4AT 321	9H4G 318	N5ORT 312	ACØA 303	I4UFH 289	EA5GKE 276
9A2AA 329	N4JF 327	K2ARO 324	ON5KL 321	ZL1BIL 318	IN3ANE 312	KB9LN 303	YB1RED 289	NX4Y 275
KD8V 329	AA4KT 327	VE7DX 324	IK8BQE 321	WA6DTG 318	4N7ZZ 312	AB4PY 303	TI5RLI 287	AB4NS 275

RTTY

K2ENT	307
WB4UBD	275
K3UA	261
NI4H	252
KE5PO	228

tant purpose of such surveys: determining major DXpedition destinations.

The reasons for this are twofold. First, there is a long lag time in crediting DXCC cards. It can easily take a couple of years from the time a major DXpedition takes place and all DXCC records are updated. This means the ARRL's survey is not as up to date as *The DX Bulletin*'s annual effort. The other problem is that many of the DXers whose DXCC records are in the ARRL computer are not really active. Many are Honor Roll members who may have worked all countries many years ago. Others just get on to work a "New One." DXpeditioners plan operations based on who needs them now, not who worked the country 20 years ago. Readers of weekly DX newsletters are much hungrier to make DX contacts than those in the ARRL database, and they are much more likely to contribute financially to help turn DXpedition dreams into reality.

Another difference between *The DX Bulletin*'s Most Wanted survey and the ARRL's most needed list is the regional variations. Many of the countries outside the top 50 Most Wanted are wanted only in certain regions. For example, many Pacific islands are near the top of the Most Wanted list in Europe, but are considered common in the western US. The ARRL intends to upgrade its software to permit regional analysis, presumably based on postal codes, as today location cannot be determined from a callsign.

All these problems can be overcome with some creative programming, of course. When the ARRL corrects its most

QSL Information

ED7TFT to EA7OH
EK7DX to DL1VJ
EL2PP to N2CYL
EM5HQ to RB5QW
EP2A to EP2HZ
ERØFL to NK4U
ER1AM to SP9HWN
ER1OO to SP7LZD
ER2DX to KD1CT
EVØA to F6AML
EXØX to DL4DBR
FG/F2YT to F2YT
FGØGDI to TK5VN
FG4GJ to F6CYJ
FJ5AB to N2HIG
FM5FE to FD1NCZ
FOØPT to DJØFX
FT5XJ to F5NLL
FY5GF to F2YT
FY5GJ to F2YT
HH2LQ to KM6ON
HH7PV to AA5DW
II1D to IK1OUK
J28FX to F5MGZ
KG4DX to WB6EQX
KG4HG to WD9APE
KP4SX to YU7KMN
L4ØA to LU4AA
L5V to LU3VAL
LI4ØWG to LA7G
LZ9A to LZ2KTS
OHØAY to OZ1ZJ
OX3XR to OZ3PZ
PJ9JT to W1AX
PYØTM to PY1RO
PYØZFB to JH2MRA
T91ESP to DL3KCI
T9S to DL1QQ
TL8MS to DL6NW
TU2KC to F5LBL
UD8F to 4Z4UT
UNØAA to DL6ZFG
UN9LX to UL7LS
V31JU to WA2NHA
V31JZ to NN7A
V51E to K8EFS
VP2EE to KA3DBN
VP2MBO to KE9XY
VP2MH to KC4DWI
VP8PTG to G4RFV
XQØX to CE3ESS
YS1DRF to W2PD
YS9DC to HR1MRG
ZD8M to G3UOF
ZF2MC to N7CA
ZF2SP to KBØJBX
ZF2WB/ZF8 to WB5MUH
ZF8BS to AA6KX
ZK1AT to WB6EQX
ZL7AA to ZL2AL
ZSØPI to DJ4LK
ZYØSK to PS7KM
ZYØSP to PT7AA
4K1F to Nikoli Komissarov, 1862 Woodbine St., Ridgewood, NY
HH2MED to P.O. Box 1095, Port au Prince, Haiti
YL2TW to P.O. Box 92, Smiltene, Latvia

needed list for the time lag and bias toward older, less active DXers, its most needed list will finally supplant *The DX Bulletin*'s Most Wanted survey as the standard. Meanwhile, look for the results of the 1994 Most Wanted survey later this year.

DX Gatherings

The Hamfest du Quebec will be held in Sorel-Tracy, Quebec, Sunday, May 29. Location is the Curling Club in Tracy. For more information, contact the Club Radio-Amateur Sorel-Tracy, C. P. 533, Sorel, Quebec, Canada J3P 5N6.

The Association of Radio Amateurs of the Republic of Mexico (ARARM) will hold their annual convention in Puebla, Mexico, July 21–23. The convention will feature seminars on a variety of topics of interest to amateurs, as well as cultural programs and tours, culminating in a Gala Fiesta Mexicana for amateurs and their families. ARARM would particularly like to invite amateurs from the USA and other countries. For additional information, contact Frank R. Smith, AHØW/XE2FIN, Consulate of Finland, 5933 West Grovers Avenue, Glendale, AZ 85308, or by telephone at 602-876-2718.

The Radio Society of Great Britain (RSGB) holds its international HF and IOTA convention at the Beaumont Conference Center, Old Windsor, Berkshire, England, Oct. 7–9. More information is available from G3NUG, Further Felden, Long Croft Lane, Felden, Hemel Hempstead, Herts HP3 0BN, UK; telephone and FAX 44-442-62929.

DXCC Personnel Changes

The ARRL announced on Feb. 7 that Tom Hogerty, KC1J, has been transferred to a new position of Special Projects Manager, and now reports to ARRL Executive Vice-President Dave Sumner, K1ZZ. Tom guided the DXCC Desk into the era of computerization. Under his leadership procedures changed from an all paper-based system to full computerization. His new responsibilities include applying what was learned to improving ARRL Headquarters services generally.

Bill Kennamer, K5FUV, takes Tom's place as DXCC Manager. Bill has been with the ARRL since June 1992, when he joined the staff as DXCC Specialist. Bill is the founder of *QRZ DX*, and now writes the "How's DX" *QST* column.

Larry Vogt, BV/N4VA, demonstrates Morse code for scouts at the BVØBSC operation in Taipei, Taiwan. Larry is working with the Foundation for International Radio Service (FAIRS) in training amateurs in ITU Region 3.

Amateur Radio in Andorra

By J. Manel Sauri, C31US, President URA

Andorra now has its own constitution and is the 184th member of the United Nations and a member of the International Telecommunications Union (ITU). No C30 guest licenses have been issued in the past three years, and Andorra is not in the CEPT (the European common license) agreement. Some illegal stations monitored recently include **C31/OZ3JK/m, C31LX, C31NP, C31AZ**, and **C30EJA**. Many cards from Japan and the US are arriving for these stations. The current prefix system has C31xxx callsigns for residents with full privileges on all bands; C32xxx calls for restricted operation; and C33xxx for beginners.

Upcoming DXpeditions

The Oklahoma DX Association and the Cal Poly students who went to Wake Island last year are aiming for a **Cocos Island TI9** operation this month. They have obtained permission to land and operate, with six stations, including RTTY and satellites. However, they need help with the cost of the charter vessel—US$38,000. Contributions may be sent to Craig Boyer, AH9B, Box 88, Wellston, OK 74881. Clubs and significant contributors will be noted on the QSL card. They will make arrangements to handle QSLing promptly.

Dick Schott, KA2PHQ, plans a multi-island DXpedition around eastern Canada throughout the month of May. His targets include Campobelle NA-014, Brier NA-127, Tancook NA-081, Cape Breton NA-010, Prince Edward Island NA-028, La Madeleine NA-038, Miscou NA-068, and Orleans NA-128. He also plans to hit some islands that count for the Canadian Award in the region. Try IOTA frequencies 14260, 21260, and 28460 kHz.

QSL Information

A22MN QSLing is delayed due to computer changes of manager Ken Shepter, WA8JOC. Ken promises that all A22MN

CQ DX Awards Program

SSB

2069	WDØGML	2071	WN5IJZ
2070	N6ITW	2072	WU2J

CW

895	W6/S52NC

SSB Endorsements

320	N6AHU/329	320	N2VW/320
320	W9OKL/329	310	VE2GHZ/319
320	EA4DO/329	310	I8IYW/319
320	AI8M/328	310	N3ARK/316
320	KE4VU/328	310	WA8MEM/303
320	W4UW/328	275	N6ITW/291
320	OK1MP/328	275	KJ5LJ/284
320	SV1ADG/327	150	N2PKP/178
320	K8CSG/327	150	WU2J/158
320	IK8BQE/327	28 MHz	KJ5LJ
320	WDØGML/325	28 MHz	WDØGML
320	WN5IJZ/325	28 MHz	WA5SUE
320	WB4PUD/324	OSCAR	WDØGML
320	KA5TQF/324	QRPp	WU2J
320	K4JLD/322	3.5/7 MHz	WDØGML
320	KB7VD/322		

CW Endorsements

320	K9IW/328	310	W3BBL/317
320	OK1MP/328	310	K4JLD/310
320	N7RO/324	300	KA7T/309
320	DJ2PJ/323	275	K7JYE/283
320	WB5MTV/320	275	YU7FW/275
310	KUØS/319	150	I8IYW/199
310	KA5TQF/318		

Total number of active countries is 329. 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.

cards will be handled as soon as possible, but asks for patience on the part of DXers. He awaits QSLs for the OH7XM/A22MN 40 meter contest operation. Please don't send duplicate cards.

QSL **GJ4GG** at Ivy-Stone House, Rue de la Croix, St. Clement, Jersey JE2 6LQ, Channel Islands, Great Britain (*don't* put "England" in the address). His 1994 *Callbook* address is incorrect.

FW/Y58IO cards are coming out from Fritz Bergner, DL7VRO, Sterndamm #199, 12487 Berlin, Germany.

9U5DX cards from Baldur, DJ6SI, are coming out of the Czech Republic, taking advantage of the extremely low airmail postage in that country. This means that putting German airmail postage on the return envelope won't work.

QSL **UX2HO** via Tony Petroncari, I2PJA, Via E. Togni 87, 27043 Broni, Italy, or via the Italian bureau.

QSL **EZ5A, EZ5AA, EZ5DX, EZ5EZ, EZ5EA** via Tony Miller, W5BWA, 5812 Hiawatha Dr., Alexandria, LA 71301. These are the new callsigns of Victor, ex-UH8EA.

BY9GA is **not** confirmed via AA5NK. Mike reports getting cards from Europeans for contacts on Jan. 1, and Mar. 15 and 22, on CW. He thinks these were pirate QSOs.

Likewise, KA3BDN is **not** QSL manager for the contest call of **VP2E**. He does handle cards for **VP2EE**.

QSL the 1993 CQ WW SSB contest operation of **VP5N** via Jack Imhof, N2VW, P.O. Box 65, Fort Dix, NJ 08640. Jack was not in the Caicos in February.

QSL Good Guy: F6CYV, QSL manager for **FK8KAB/p,** returned one of two US$1 sent, along with a preprinted note explaining that only one US$1 was necessary for direct airmail return of the card!

Nikolai Komissarov, KF2KT, manager for **4K1F** and **4K2BY**, has moved again, without leaving forwarding information with the USPS. His new address is 1862 Woodbine St., Ridgewood, NY 11385.

Tom Polak, 9A2AJ, handles cards for **YO4OO/4U, /4X, /5B4; YU3PR/4U, /4X, /5B4, /YI; YZ3BAR/5B4; 4N4TG; 4N4AO; 4N4YS; 4N4/9A2AJ; 4N2AJ; P31A; P34A; P39ADA; P30ADA; H21A; C42A; C41A; 5B4ADA; 5B4ADR; 4X/S59PR; 9A/4N4TG; 9A3SM; 9A1HBC; Y93T**. His address is Brace Domany 6/19, 41000 Zegreb, Republic of Croatia.

N5FTR handles cards for **A41KJ, KG4DD, P29BT, V31ML, V31BR, 9M8FH, 9M8LL, 9M8YL, 9M6LS, Z21BA**.

QSL **YCØARO** via his stateside address: Orin Snook, c/o Fluor Daniel Jakata, 10 Twin Dolphin Drive, Redwood City, CA 94065.

QSL **PJ5/K3UOC, PJ8H, YV/K3UOC, PJ/K3UOC, 4M4A, 4M5V, P46S,** and **YW5LT** via the Harvard Wireless Club, W1AF, 6 Linden St., Cambridge, MA 02138.

QSL **VP2MCU** and **VP2MCY** to Don Daze, KC5AK, 8706 Winningham Lane, Houston, TX 77055.

73, Chod, VP2ML

PROPAGATION

BY GEORGE JACOBS, W3ASK

THE SCIENCE OF PREDICTING RADIO CONDITIONS

February Storminess

One of the most severe and long-lasting radio storms took place during February, disrupting the ionosphere and HF propagation for 12 days of the month.

The first period of radio storminess began on February 5, when the worldwide figure for measured geomagnetic activity (Ap) rose to 24. This level of geomagnetic activity generally indicates geomagnetic or ionospheric storminess. The higher the figure, the more intense the storm. Levels greater than 34 define a severe storm, which is often accompanied by blackout conditions on the HF bands. The Ap level remained above 24 until February 15, a period lasting for 10 days. The storm reached peak intensity on February 6, 7, and 8 when the worldwide Ap figure soared into the upper 50s, high enough to cause blackout conditions on the HF bands!

A second intense radio storm took place on February 21 and 22, with the Ap figure reaching 60. Incidentally, this period of radio storminess was predicted in the Last Minute Forecast appearing in the February "Propagation" column.

Radio storms are caused by excess charged particles which are emitted from the sun. As this radiation approaches the earth's atmosphere, it is deflected by the earth's geomagnetic field towards the magnetic poles. The rapid drift of these particles disturbs both the geomagnetic field and the ionosphere. The greatest disturbance takes place in polar regions, where they are often accompanied by auroral displays. The greater the intensity of solar radiation, the more the disturbances are felt in temperate regions. During very severe storms, as occurred during February, solar radiation causes a weaker ionosphere and increased signal absorption, resulting in a blackout of HF radio communications to many areas of the world.

Storms like those which took place this past February are not so unusual during periods of very high sunspot count, but they are supposed to be rare during a relatively low sunspot period, such as we are now in.

Solar Cycle Progress

Sunspot Cycle 22 continues to decline steadily towards its minimum, much as expected.

11307 Clara St., Silver Spring, MD 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for May 1994

Propagation Index.....	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 6, 18, 20	A	A	B	C
High Normal: 5, 11-12, 21-23, 25-26	A	B	C	C-D
Low Normal: 4, 9-10, 13-14, 17, 19, 24, 27, 30-31	B	C	D	D-E
Below Normal: 2-3, 7-8, 16, 29	C	C-D	D-E	E
Disturbed: 1, 15, 28	C	D	E	E

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

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

C—Fair opening, signals between moderately strong and weak, varying between S9 and S6, with some fading and noise.

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

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.

2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any date of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be poor (D) on May 1st, fair-to-poor (C-D) on the 2nd and 3rd, fair (C) on the 4th, good (B) on the 5th, excellent (A) on the 6th, etc.

The Royal Observatory of Belgium reports a mean sunspot number of 59 for January 1994. Daily values ranged from a low of 25 on January 17th to a high of 104 on the 5th. The mean level observed during January results in a smoothed sunspot number of 55 centered on July 1993. This is a drop of one point from the previous month's level.

A smoothed sunspot number of 41 is forecast for May 1994. The smoothed sunspot count for last May (1993) was 60.

The Dominion Radio Astrophysical Observatory of Canada reports a corresponding drop in 10.7 cm solar flux levels, with a mean value of 115 reported for January 1994. This results in a smoothed value of 110 centered on July 1993. A smoothed level in the low 100s is forecast for May 1994.

Historical statistical data concerning the sun, sunspots, and geomagnetism are again available on floppy disks from the National Geophysical Data Center, NOAA.

A disk is available containing daily and monthly mean sunspot numbers since 1818, smoothed monthly numbers since 1749, and yearly means since 1700. Data on floppy disk is available for $50, and in report form for $15 (Report UAG-95).

A disk is also available containing 2800 MHz (10.7 cm) solar flux observations (daily, monthly, and yearly means) made at Canadian observatories from 1947 to the present. The cost for this disk is $50.

A third disk in this series is available and contains compressed yearly files of geomagnetic indices (both A and K figures as well as other data) from 1932 to the present. This disk also contains yearly files of adjusted solar flux since 1947. The price of this disk is also $50.

Additional information can be obtained, and the disks purchased directly from the National Geophysical Center, NOAA, Code E/GC2, Dept. 925, 325 Broadway, Boulder, CO 80303-3328 (telephone 303-497-6761).

May Propagation

In May optimum frequencies for DX propagation are *lower* during most of the daylight hours—but *higher* during the late afternoon, early evening, and nighttime hours—than were observed during the winter months. A considerable increase is expected in sporadic-E ionization during the month, and this should result in more frequent short-skip openings on the

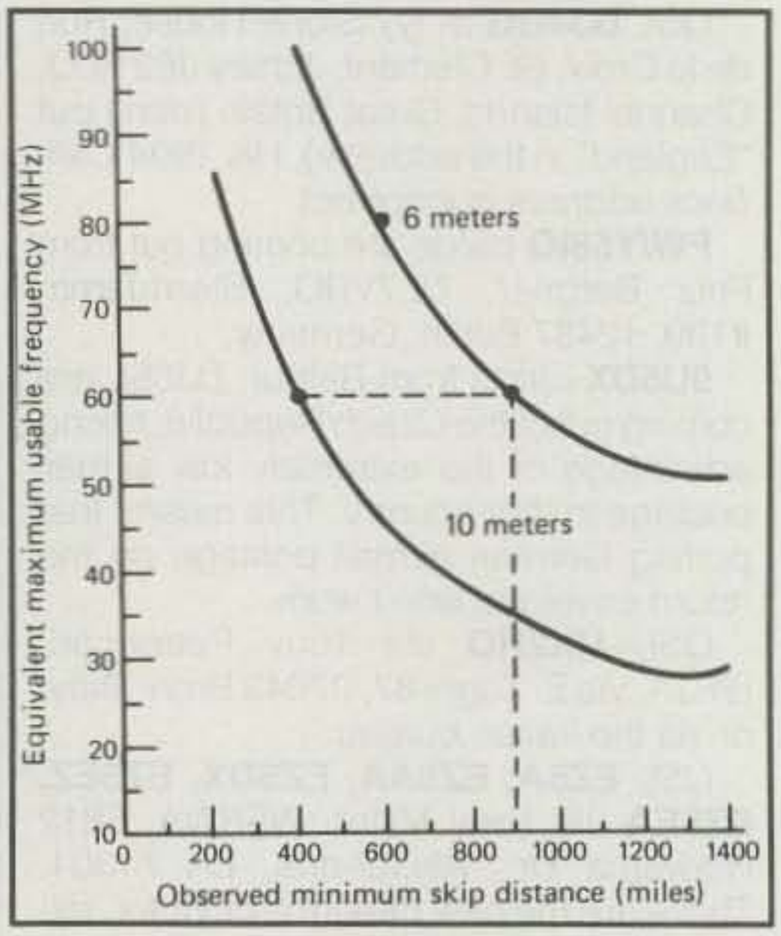

Fig. 1– How to predict 6 meter short-skip openings.

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Modern, high-performance stations use COMET Antennas, Duplexers, Triplexers and Accessories! COMET products are designed to provide an exceptional level of signal quality and coverage area. Whether operating mobile or from your base station, COMET products make you sound good. No other product line has the selection, convenience, quality and performance!

DUAL-BAND MOBILE ANTENNAS

FL-67S Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 4.5dBi 5/8 wave 446MHz 7.2dBi 5/8 wave x 3	1.5:1 or less	150 watts	4' 11"	Gold Plated PL-259

FL-62S Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 3.5dBi 1/2 wave 446MHz 6.0dBi 5/8 wave x 2	1.5:1 or less	150 watts	3' 5"	Gold Plated PL-259

NEW!

SB-7/SB-7NMO Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 4.5dBi 5/8 wave center-loaded 446MHz 7.2dBi 5/8 wave x 3	1.5:1 or less	70W FM	4' 7"	PL-259 or NMO style

NEW!

SB-5/SB-5NMO Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 3.0dBi 1/2 wave 446MHz 5.5dBi 5/8 wave x 2	1.5:1 or less	120W FM	38"	PL-259 or NMO style

NEW!

SB-2/SB-2NMO Dual-Band 146/446MHz

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi 1/4 wave 446MHz 3.8dBi 5/8 wave	1.5:1 or less	60W FM	18"	PL-259 or NMO style

NEW!

B-10/B-10NMO Dual-Band 146/446MHz, Cellular Look-a-like

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 0dBi 1/4 wave 446MHz 2.15dBi 1/2 wave	1.5:1 or less	50W FM	12"	PL-259 or NMO style

B-20/B-20NMO Dual-Band 146/446MHz, Cellular Appearance, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi 1/2 wave 446MHz 5.0dBi 5/8 wave x2	1.5:1 or less	50 watts	30"	PL-259 or NMO style

NEW!

SB-25/SB-25NMO Mono-Band 146MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 4.1dBi 5/8 wave center loaded	1.5:1 or less	100W FM	4' 9"	PL-259 or NMO style

NEW!

TRI-BAND MOBILE ANTENNAS

CX-224/224NMO Tri-Band 146/220/446MHz, w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi 1/2 wave 220MHz 3.6dBi 5/8 wave 446MHz 6.0dBi 5/8 wave x 2	1.5:1 or less	100 watts	3'	PL-259 or NMO style

FJ-15S Tri-Band 52/146/446MHz w/Fold-Over

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
52MHz 2.15dBi 1/4 wave 146MHz 4.5dBi 5/8 wave 446MHz 7.2dBi 5/8 wave x 3	1.5:1 or less	120 W FM	4' 10"	PL-259

HF MOBILE AND HT ANTENNAS

HA-4S Quad-Band HF 40/*(20)/15/12/10 Meters w/Fold-Over

Wave:	VSWR:	Weight:	Length:	Max Power:	Connector:
1/4 wave	2:1 or less	1 lb. 14 oz.	4' 4"	120W SSB (200W SSB 28MHz)	PL-259

*L-14HS Optional 20 Meter Coil

NEW!

SH-55 Super Flexible 146/446MHz HT Antenna

Gain & Wave:	Max Power:	Length:	Connector:
146MHz 1.5dBi 1/4 wave 446MHz 3.2dBi 5/8 wave x 2	10 watts	15.5"	BNC

CH-722SA High Gain HT Antenna
Gain & Wave: 146MHz 3.0dBi 1/2 wave
446MHz 5.5dBi 5/8 wave x 2
Max Power: 50 watts
Length: 35", 2 sections, 18" each
Connector: BNC

CH-32 Miracle Baby
146/446MHz HT Antenna
Gain & Wave: 0dB 1/4 wave
Max Power: 10 watts
Length: 1.75"
Connector: BNC

DUPLEXERS AND MOBILE MOUNTS

CF-4106K, I, J,
146/446MHz
Band Pass, Ins Loss, Max Pwr.
1.3-150MHz, 0.1dB, 800w PEP
400-540MHz, 0.2dB, 500w PEP
Isolation: 60dB
CONNECTORS:

	4160K	4160I	4160J
Output:	SO-239	SO-239	SO-239
Low In:	PL-259	PL-259	SO-239
High In:	PL-259	N-Male	SO-239

RS-21
Trunk, hatchback, rear door (van, blazer, etc.) mount. Adjustable to virtually ANY angle. Rubber-coated base protects vehicle paint.

NEW!

RS-820
Heavy-Duty, Low Profile Trunk Lip or Hatch Back Mount. Rubber-coated base protects vehicle paint.

WS-1M
Multi-Adjustable Window Clip Mount.
11.5 feet of high quality coax. Gold-plated UHF Conns. for Antennas up to 40" in height.

NEW!

3D4M Standard Cable Assembly
13.5 feet of low loss coax. Gold plated UHF (PL-259/SO-239) connectors.

3D5M Standard Cable Assembly
Same as 3D4M, but 17 feet of coax

CK-5M Deluxe Cable Assembly
13 feet double shielded very low loss coax + 12" RG-188 teflon coax. Gold plated UHF (PL-259/SO-239) connectors.

CK-5M5 Deluxe Cable Assembly
Same as CK-5M, but 17 feet of coax

NEW!

MINI SPEAKER/MIC

HM-P2K/F
Mini spkr/mic featuring full TX/RX quality!
Light weight, extremely small: 1"x2" with collar pocket clip.
HM-P2K: Kenwood Version
HM-P2F: Icom/Yaesu Standard/Alinco/etc.

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HF bands, and on 6 meters as well. A seasonal *increase* in the static level is also normal for May.

The following is an overall picture of HF amateur band openings expected during May 1994. For specific times of DX openings refer to the DX Propagation Charts which appeared in last month's column. This month's column contains Short-Skip Propagation Charts valid for May and June, as well as charts centered on Alaska and Hawaii. The Short-Skip Charts contain propagation forecasts for openings varying in distance between 50 and 2300 miles. For day-to-day propagation conditions expected during the month, see the Last Minute Forecast, which appears at the beginning of this column.

10 Meters: This band should continue to offer occasional DX conditions into Central and South America, parts of Africa, and the South Pacific area. Band conditions should peak during the afternoon hours when signals should be strongest, but check at other times during the daylight hours as well. DX openings on this band should follow the sun westward. Expect a considerable increase in short-skip openings between distances of approximately 750 and 1400 miles.

12 Meters: Much the same pattern as on 10 meters. Since this is a lower frequency range, the band can be expected to open a bit more often than will 10 meters and stay open for an hour or so longer.

15 Meters: A seasonal decrease in DX openings on this band is normal for May and the summer months, but some fairly good openings to many parts of the world still should be possible during the hours of daylight. The afternoon hours should be best for DX possibilities. Numerous short-skip openings between approximately 600 and 2300 miles should be possible on many days.

17 Meters: The propagation pattern should be similar to 15 meters. With decreasing solar activity and summertime propagation conditions in the northern hemisphere, the somewhat lower frequency range of this band may well prove to be a propagation asset. On many days when conditions will not permit 15 meters to open, check this band for openings. When 15 meters does open, expect the same opening on 17 meters, but the band should remain active up to an hour after 15 meters closes. When compared to 20 meters, daytime openings may be similar, but often signals will be stronger on 17 meters.

20 Meters: This is expected to be the best band for DX during May. Opening shortly after sunrise, good DX conditions can be expected to one area of the world or another through most of the daylight hours and well into the hours of darkness. Peak conditions are expected during the sunrise period and again during the late afternoon and early evening. Expect excellent short-skip conditions, often with exceptionally strong signal levels, between distances of approximately 350 and 2300 miles. Quite often, particularly during the late afternoon and early evening, optimum conditions will exist for both short and long skip, and stations a few hundred miles away will be heard at the same time as DX stations several thousand miles away, causing considerable QRM!

30 Meters: This can be another propagation asset during the summer months. Peak openings are expected during the nighttime hours, much like 40 meters, but often with higher signal levels and somewhat lower noise levels.

40 Meters: Fewer DX openings are expected because of the shorter hours of darkness and the higher levels of static expected in the northern hemisphere during May. However, some good openings to many areas of the world should still be possible during the hours of darkness and the sunset and sunrise periods. Good daytime short-skip openings also should be possible for distances ranging between approximately 150 and 750 miles, with nighttime openings extending up to the one-hop limit of 2300 miles.

80 Meters: A considerable decline in DX possibilities is expected during May because of the shorter hours of darkness and seasonal increase in static levels. Some fairly good DX opportunities should continue to occur, however, for openings to many areas of the world during the hours of darkness and the sunrise period. Weak signals will often be masked by high static levels. Excellent short-skip openings should be possible during the daylight hours over distances of approximately 50 to 250 miles. During the hours of darkness short-skip openings should increase up to approximately 2300 miles. Short-skip propagation also may often be marred by high static levels.

160 Meters: Skywave openings are considered to be hopeless during the day on this band because of the high-absorption levels and seasonally high static lev-

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 (10 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. On the Short-Skip Chart appropriate daylight time is used at the path midpoint. For example on a circuit between Maine and Florida, the time shown would be EDT, on a circuit between New York and Texas, the time at the midpoint would be CDT, 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 PDT zone; 3 hours in the MDT zone; 4 hours in the CDT zone; and 5 hours in the EDT zone. Add 10 hours to convert from HDT 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 daylight time in other areas of the USA subtract 8 hours in the PDT zone; 7 hours in the MDT zone; 6 hours in the CDT zone; and 5 hours in the EDT 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
May & June 1994
Local Daylight Savings Time
At Path Midpoint

Band (Meters)	*Distance Between Stations (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	Nil	08-09 (0-1) 09-13 (0-2) 13-17 (0-1) 17-21 (0-2) 21-23 (0-1)	08-09 (1) 09-13 (2) 13-17 (1-2) 17-21 (2) 21-23 (1) 23-07 (0-1)	08-09 (1-0) 09-21 (2-0) 21-23 (1-0) 23-07 (1-0)
15	Nil	07-09 (0-1) 09-13 (0-2) 13-17 (0-1) 17-21 (0-2) 21-00 (0-1)	07-09 (1-2) 09-13 (2-3) 13-17 (1-2) 17-19 (2-3) 19-21 (2) 21-00 (1) 00-07 (0-1)	07-09 (2-0) 09-13 (3-1) 13-17 (2-1) 17-19 (3-1) 19-21 (2-0) 21-07 (1-0)
20	Nil	07-09 (0-2) 09-12 (0-3) 12-17 (0-4) 17-19 (0-3) 19-23 (0-2) 23-07 (0-1)	07-08 (2) 08-09 (2-3) 09-12 (3-4) 12-17 (4) 17-19 (3-4) 19-20 (2-4) 20-21 (2-3) 21-23 (2) 23-07 (1)	07-08 (2) 08-09 (3-2) 09-15 (4-2) 15-17 (4-3) 17-20 (4) 20-21 (3) 21-23 (2) 23-07 (1)
40	08-10 (0-2) 10-16 (1-4) 16-18 (2-4) 18-20 (1-3) 20-22 (0-2) 22-08 (0-1)	08-10 (2-4) 10-15 (4-2) 15-16 (4-3) 16-19 (4) 19-20 (3-4) 20-22 (2-3) 22-08 (1-2)	08-09 (4-3) 09-10 (4-2) 10-15 (2-1) 15-16 (3-1) 16-19 (4-2) 19-20 (4) 20-22 (3-4) 22-01 (2-4) 01-03 (2-3) 03-06 (2)	08-09 (3-1) 09-10 (2-1) 10-16 (1-0) 16-19 (2-1) 19-20 (4-3) 20-01 (4) 01-03 (3) 03-06 (2) 06-08 (2-1)
80	08-10 (4) 10-18 (4-3) 18-20 (4) 20-22 (3-4) 22-00 (2-4) 00-06 (2-3) 06-08 (3-4)	08-10 (4-1) 10-16 (3-0) 16-18 (3-1) 18-20 (4-2) 20-00 (4) 00-06 (3-4) 06-08 (4-3)	08-09 (1) 09-10 (1-0) 10-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-3) 22-02 (4) 02-06 (4-3) 06-08 (3-2)	08-09 (1-0) 09-18 (0) 18-20 (1-0) 20-22 (3-2) 22-02 (4-3) 02-06 (3-2) 06-08 (2-1)
160	06-09 (4-1) 09-10 (2-0) 10-19 (1-0) 19-21 (3-1) 21-23 (4-2) 23-06 (4-3)	06-09 (1) 09-19 (0) 19-21 (1-0) 21-23 (2-1) 23-01 (3-2) 01-04 (3) 04-06 (3-2)	08-09 (1-0) 09-21 (0) 21-23 (1) 23-01 (2-1) 01-04 (3-2) 04-07 (2) 07-08 (1)	08-21 (0) 21-01 (1) 01-04 (2) 04-06 (2-1) 06-07 (1) 07-08 (1-0)

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ALASKA
May & June 1994
Openings Given in GMT

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	Nil	20-02 (1)	22-00 (1) 00-02 (2) 02-04 (3) 04 05 (2) 05-06 (1) 10-12 (1) 12-14 (2) 14-16 (1)	Nil
Central USA	Nil	21-04 (1)	22-02 (1) 02-03 (2) 03-05 (3) 05-06 (2) 06-07 (1) 12-13 (1) 13-15 (2) 15-16 (1)	08-12 (1)
Western USA	Nil	20-23 (1) 01-03 (1) 03-05 (2) 05-06 (1)	00-02 (2) 02-04 (3) 04 07 (4) 07-08 (3) 08-09 (2) 09-15 (1) 15-18 (2) 18-00 (1)	07-09 (1) 09-14 (2) 14-15 (1) 11-13 (1)*

HAWAII
May & June 1994
Openings Given in Hawaiian Standard Time

To	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	Nil	12-15 (1) 15-17 (2) 17-19 (1)	13-15 (1) 15-17 (2) 17-19 (3) 20-04 (2) 04-08 (1)	19-20 (1) 20-23 (2) 23-02 (1) 21-23 (1)*
Central USA	Nil	12-15 (1) 15-18 (2) 18-20 (1)	15-16 (2) 16-17 (3) 17-19 (4) 19-20 (3) 20-22 (2) 22-04 (1) 04-05 (2) 05-07 (3) 07-09 (2) 09-15 (1)	19-20 (1) 20-21 (2) 21-01 (3) 01-02 (2) 02-04 (1) 20-21 (1)* 21-00 (2)* 00-03 (1)*
Western USA	13-17 (1)	09-12 (1) 12-15 (2) 15-17 (3) 17-18 (2) 18-20 (1)	06-08 (4) 08-16 (3) 16-19 (4) 19-20 (3) 20-22 (2) 22-05 (1) 05-06 (2)	18-19 (1) 19-20 (2) 20-22 (3) 22-02 (4) 02-04 (3) 04-05 (2) 05-07 (1) 19-20 (1)* 20-22 (2)* 22-02 (3)* 02-04 (2)* 04-05 (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.

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.

For 12 meter openings interpolate between 10 and 15 meter openings.
For 17 meter openings interpolate between 15 and 20 meter openings.
For 30 meter openings interpolate between 40 and 20 meter openings.

els, which combine to prevent communications. Openings up to about 1200 miles should be possible fairly regularly, however, during the hours of darkness and the sunrise period. An occasional opening beyond this range may be possible when static levels are low.

VHF Ionospheric Openings

Sporadic-E ionization should increase considerably this month, and some fairly good 6 meter openings should be possible between approximately 1000 and 1400 miles. These openings are most likely to occur between 10 AM and 2 PM and between 6 and 10 PM local daylight time, although they can also occur at other times. During periods of intense and widespread sporadic-E ionization, two-hop openings considerably beyond 1400 miles may occasionally occur on 6 meters, and openings between approximately 1200 and 1400 miles may be possible on 2 meters!

Here's a useful tip for predicting 6 meter short-skip openings from observations made on 10 meters. The geometry of propagation is such that as the skip distance *decreases* on 10 meters, the highest frequency that will be reflected by sporadic-E ionization *increases*. By observing the *minimum* skip heard on 10 meters, and using the relationship shown in fig. 1, it should be possible to tell whether or not 6 meters is open and over what distance.

For example, if the minimum skip heard on 10 meters in a south-westerly direction is observed to be 400 miles (it's the distance to the *nearest* skip station that counts, not others), from fig. 1 the intersection between 400 miles and the 10 meter curve corresponds to an MUF of 60 MHz. This means that there is a very good chance that 6 meters should also open in the same general direction. The minimum skip distance that can be expected on 6 meters can be found from fig. 1 by locating the intersection between 60 MHz and the 6 meter curve. The resulting distance is found to be 900 miles. A useful rule of thumb to remember is that when skip stations are heard less than 500 miles away on 10 meters, the chances are very good that 6 meters will also open in the same general direction.

The *Eta Aquarids* meteor shower should intersect the earth's atmosphere between May 4th and 6th. This is a major meteor shower, and it should reach maximum intensity during the afternoon of May 5th, with a predicted hourly meteor count in excess of 20. Chances are excellent for meteor-burst openings during the period of the shower.

While there is generally little auroral activity during May, some displays could occur during periods of radio storminess. Check the Last Minute Forecast at the beginning of this column for those days that are likely to be Below Normal or Disturbed during May.

73, George, W3ASK

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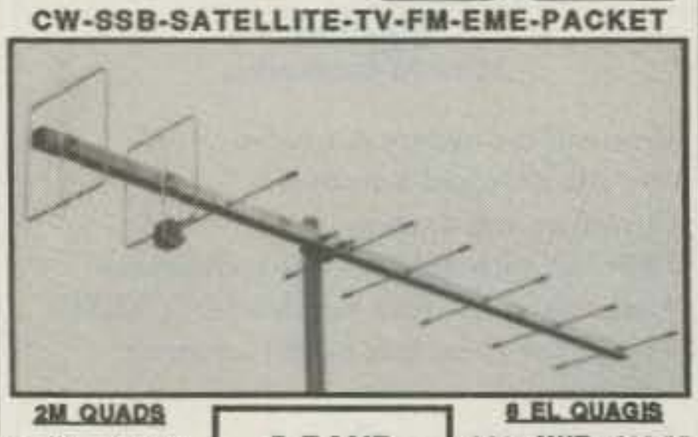

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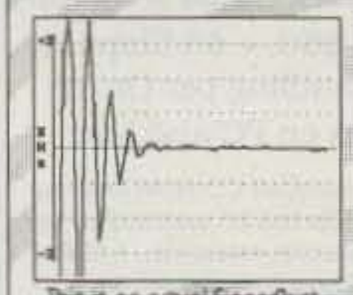

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Advertiser's Index

(continued on page 171)

Announcements

(from page10)

VFW Post 6342, N. Smithfield, Rhode Island. Contact Rick Fairweather, K1KYI, 106 Chaplin Street, Pawtucket, RI 02861, or call 401-725-7507 (7–8 PM).

May 21, **9th Annual Lancaster County Hamfest and Computers**, Ephrata Senior High School, Ephrata, Pennsylvania. Contact the Ephrata Area Repeater Society, Inc., 906 Clearview Ave., Ephrata, PA 17522 (717-336-2514 after 6 PM). (Exams.)

May 21, **Paducah Hamfest**, Noble Park Civic Center, Paducah, Kentucky. Contact David Fraser, KQ4IU, 5715 Blandville Rd., Paducah, KY 42001 (502-554-7999); or Paul Smith, N4FFO, 229 Nickello Hts., Paducah, KY 42001 (502-898-6834); packet address @ W4NJA.WKY.KY.USA.NA. (Exams.)

May 21, **The Pikes Peak ARA Swapfest**, Liberty High School, Colorado Springs, Colorado. General information contact Harv Hunter, WA3EIB, 719-597-8964; testing information contact Rick Brown, KDØSU, 719-531-9423. (Exams.)

May 21, **North Hills Radio Club Annual Hamswap**, Carmichael Elks Lodge, Carmichael, California. For more information, contact NHRC, P.O. Box 41653, Sacramento, CA 95814-0635.

May 21, **TwinsLAN ARC Tailgate Swapfest**, Honeywell Ridgway facility parking lot, Minneapolis, Minnesota. Contact Bill Brisley, NØBSN, 18025 Cynthia Drive, Minnetonka, MN 55345-4206 (612-474-0118).

May 21, **Cherryville Hamfest**, Warren County Farmers Fairgrounds, Phillipsburg, New Jersey. Contact Keith Burt, KF5FK, 908-788-4080. (Exams, contact Marty Grozinski, NS2K, 908-806-6944.)

May 22, **Long Island Hamfest/Computer Show**, Plainedge High School, Plainedge, New York. Contact Andy Feldman, WB2FXN, 516-928-3868 (eves. 7–10 PM); or Walt Wenzel, KA2RGI, 516-957-5726.

May 22, **Great Hagerstown Hamfest**, Hagerstown Jr. College Athletic & Recreation Center, Hagerstown, Maryland. Contact Page Pyne or Fred Bailey at 301-714-0688, or write Antietam Radio Association, P.O. Box 52, Hagerstown, MD 21741. (Exams; info contact Pat, KQ8E, 304-289-3576, or Gaylord, W3DFW, at 301-724-0674.)

May 22, **Decatur Area Hamfest**, Richland Community College, Decatur, Illinois. Contact Decatur Area Hamfest, Spencer A. Carter, N9LVW, P.O. Box 4595, Decatur, IL 62525 (call 217-692-2460 eves.). (Exams.)

May 22, **The Twenty Over Nine Radio Club 10th Annual Hamfest and Computer Show**, Canfield Fairgrounds, Canfield, Ohio. Contact Don Stoddard, N8LNE, 42 S. Whitney Ave., Youngstown, OH 44509 (216-793-7072), or Dave Mellott, KE8KT, 2895 Penny Lane, Austintown, OH 44515 (216-793-0816).

May 28, **Springhill Hamfest**, Springhill Civic Center, Springhill, Louisiana. Contact David Smith, KF5BF, P.O. Box 812, Springhill, LA 71075 (318-539-3226).

May 28, **Columbia Hamfest & Computer Expo**, Columbia, Missouri. Contact W. "Mac" McKenzie, Jr., K4CHS, Central Missouri Radio Association, P.O. Box 283, Columbia, MO 65205 (314-882-7413 days; 314-442-7619 eves).

May 29, **Hamfest Du Quebec**, the Curling Club, Sorel-Tracy, Quebec, Canada. Contact Club radioamateur Sorel-Tracy, C.P. 533, Sorel (Quebec) J3P 5N6.

May 29, **Chicago ARC Annual Hamfest**, DeVry Institute of Technology, Chicago, Illinois. For more information or reservations call 312-545-3622, or 312-666-1606; or write CARC, 5631 W. Irving Park Rd., Chicago, IL 60634.

May 29, **Gastonia Area ARC Memorial Day Hamfest**, Karyae Park, Gastonia, North Carolina. For more information, contact GAARC, P.O. Box 85, Iron Station, NC 28080-0085, Attn.: Bill, WB4TSW. Phone 704-732-1005; FAX 704-434-5832.

Advertiser's Index *(cont'd)*

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FT-2200
2 Meter Mobile. Compact Size With 3 Power Levels

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FT-416
2M/440MHz Handheld 41 Memories, CTCSS En/Decode Built-In. Multiple Power Levels

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FT-990
100 Watt HF Transceiver With General Coverage Receiver

ICOM

SALE

IC-2GXAT
2 Meter Handheld With Up To 7 Watts Output

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6 Meter Portable For Mountain Or Remote Campsite, USB, LSB, CW, FM

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FT-5100
Compact 2M/70cm Mobile. Built-In Antenna Duplexer

FT-11R
2 Meter, FM Handheld. World's Smallest Size HT With Full Sized Keyboard

$100 OFF

FT-890AT
100 Watt HF Transceiver With Dual VFO's

SALE

IC-737
New, Affordable HF Transceiver With Plenty Of Features

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Medium, Medium/ Heavy, Heavy Duty And Azimuth-Elev.
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FT-5200
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FT-530
2M/440MHz Handheld With Multiple Power Levels, 82 Memories And Aircraft Receive

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1786	$214
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284, 5, 6, 7	$ 22
249	$169
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949E	$129
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989C	$288

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1-800-821-7323 East/Midwest

1-800-345-5686 West

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

NEW

Specifications

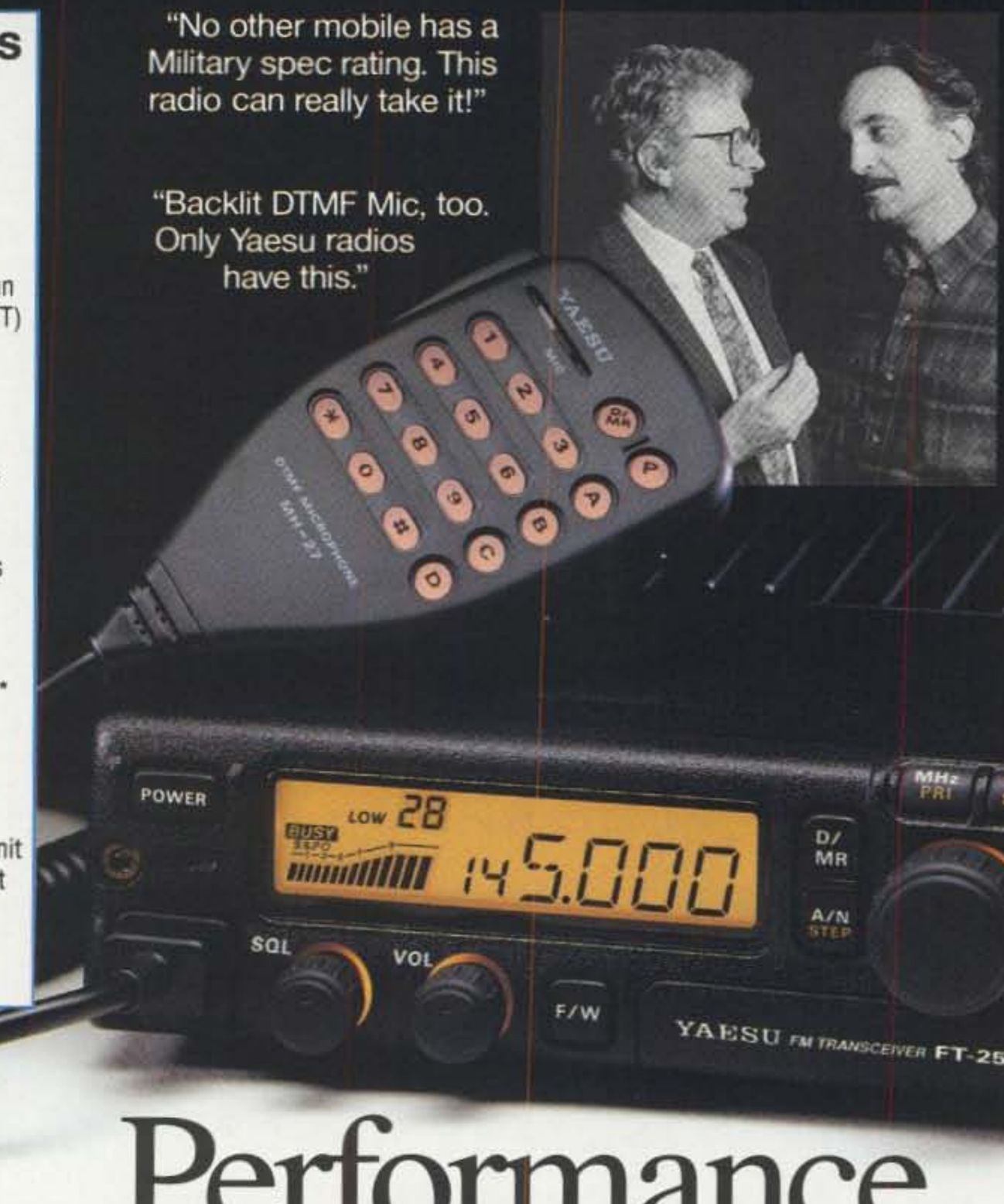
- **Frequency Coverage:**
  FT-2500M
  RX: 140-174 MHz
  TX: 144-148 MHz
  FT-7400H
  RX/TX: 430-450 MHz
- Rugged Military Spec Design
- Advanced Track Tuning (ATT)
- Selectable Alpha-Numeric Display
- Largest Display Available
- Power Output:
  FT-2500M 50/25/5 Watts
  FT-7400H 35/20/5 Watts
- Flip 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:**

FTS-17A	CTCSS Decode Unit
FRG-6	DTMF Paging Unit
SP-4	External Speaker
FP-700	Power Supply

*FT-2500M

"No other mobile has a Military spec rating. This radio can really take it!"

"Backlit DTMF Mic, too. Only Yaesu radios have this."



"3-stage advanced track tuning really reduces intermod. Its great!"

"Yaesu did it again."

US MILITARY APPROVED MIL-SPEC 810

Performance beyond the call of duty.

Just when you thought you had the most formidable mobile built, we made the FT-2500M. It's the next evolution of powerful, rugged mobile radios.

The FT-2500M, based on the acceptance of the popular FT-2400H, takes its durable quality, features, and performance then goes one better! The FT-2500M has a new easy-to-operate front panel design with rubber coated knobs and large amber display, and the Yaesu exclusive 3-Stage Advance Track Tuning feature which reduces intermodulation and front-end overload. With its superior technology, the FT-2500M is as close as you can get to commercial grade performance in amateur frequencies.

The FT-2500M is the only mobile with a Military spec rating; the only mobile radio with the most often used controls on the front and those you "set and forget" neatly hidden; and the only mobile radio with a backlit DTMF mic. With its extra large heat sink and one-piece die-cast chassis, the tough FT-2500M is unlike any other mobile in its class.

So test the mettle of your mobile, if it doesn't measure up to the endurance standards set by the U.S. Military, you need the FT-2500M. Designed for flawless performance in rough and rugged situations, the FT-2500M is really formidable – just what you'd expect from Yaesu. See it at your dealer today!

YAESU

Performance without compromise.℠

FT-2200/7200

Just 5.5"W x 1.6"H x 6.5"D, the FT-2200/7200 radios are designed to fit into today's more compact cars with ease.

SPECIFICATIONS • Frequency Coverage: FT-2200 RX: 110-180 MHz, TX: 144-148 MHz. FT-7200 RX/TX: 430-450 MHz. • Wide Receiver Coverage: 110-180 MHz • AM "Aircraft" Receive: 110-139 MHz • Built-in DTMF Paging/Coded Squelch • Selectable Channel Only Display • 10 Memory DTMF Auto Dialer • Backlit DTMF Mic • Power Output 50/25/5 Watts (FT-7200 35 Watts) • 50 Memory Channels • Remote Operation w/ Optional MW-2 • CTCSS Encode Built-in • Optional Digital Voice Storage System. Accessories: See your authorized Yaesu dealer.

"Built-in VOX? Right!"

"Dual Decode. Now that's a first!"

"Wow, a real Battery Voltage Readout!"

"Yaesu did it again!"

FEATURES	Yaesu FT-530	Kenwood TH-78A	Alinco DJ-580	Icom IC-W-21AT
Memory Channels	82	50	40	70
Slide-out Lithium Battery	YES	NO	NO	NO
Dual CTCSS Decoder	YES	NO	NO	YES
Battery Voltage Readout	YES	NO	NO	NO
Automatic CTCSS Tone Search	YES	NO	NO	NO
Transmit Battery Saver (Repeater & Simplex Operation)	YES	NO	NO	NO
Built-In Vox	YES	NO	NO	NO
One Touch Reverse Button	YES	NO	NO	NO
Dual In-Band Receive (V+V, U+U)	YES	YES	NO	YES
Programmable External Speaker Audio	YES	NO	NO	YES
Optional Digital Display Mic with "S" Meter	YES	NO	NO	NO
AM Aircraft Receive	YES	YES	YES	YES

The Best vs. "the rest".

FT-530
Dual Band Handheld

- **Frequency Coverage:**
  2-Meter 130-174 MHz RX
  144-148 MHz TX
  70 cm 430-450 MHz RX/TX
- 4 TX Power levels:
  w/FNB-25: 2.0, 1.5, 1.0, 0.5W
  w/FNB-27: 5.0, 3.0, 1.5, 0.5W
- DTMF Paging and Coded Squelch
- AOT – Auto On-Timer with built-in clock and alarm functions
- IBS – Intelligent Band Select (provides automatic TX band select on scan stop)
- Backlit keypad and display with time delay
- Built-in cross-band repeat function
- APO – Automatic Power Off
- 5 Watts output w/ FNB-27 battery or 12 VDC
- 2 VFO's for each band
- **Accessories:**

NC-42	1-Hour Desk Charger
FNB-25	600 mAh Battery (2 watt)
FNB-26	1000 mAh Battery (2 watt)
FNB-27	600 mAh Battery (5 watt)
FBA-12	6 AA Cell Holder
CSC-56	Vinyl Case w/ FNB-25
CSC-58	Vinyl Case w/ FNB-26/27
E-DC-5B	12 VDC Adaptor
YH-2	Headset for VOX
MH-12A2B	Speaker Mic
MH-18A2B	Lapel Speaker Mic
MH-19A2B	Mini Earpiece Mic
MH-29A2B	LCD Display Mic with Remote Functions
MMB-54	Mobile Mounting Hanger

No other dual band handheld beats the FT-530 on features for performance and ease of use. With the largest backlit keypad available, 82 memories, exclusive Dual CTCSS Decode and AM Aircraft Receive, the FT-530 is simply the best value there is.

Compare for yourself, then forget "the rest." See your dealer for the best dual band handheld you can buy. The FT-530.

YAESU

Performance without compromise.℠

FT-11R/41R
2m/70cm Handhelds

- **Frequency Coverage:**
  Wide Receiver Coverage:
  FT-11: 110-180 MHz RX,
  144-148 MHz TX
  FT-41: 430-450 MHz RX/TX
- Selectable Alpha Numeric Display
- New Compact Battery Design
  4.8V produces 1.5 Watts
  9.6V produces Full 5 Watts*
- 150 Memory Channels
  (75 when Alpha Numeric)
- AM "Aircraft" Receive
  (110-136 MHz)
- Small Compact Size w/ Easy Operation (measures only:
  4"H x 2¼"W x 1"D)
- Rx/Tx Battery Savers
- High-efficiency MOS FET Power Module
- Large Back-Lit Keypad and Display
- Up/Down Volume/Squelch Controls
- Built-in DTMF Paging/Coded Squelch
- Automatic Power Off (APO)
- **Accessories:**
  FNB-31 4.8V, 600 mAh Battery
  FNB-33 4.8V, 1200 mAh Battery
  FNB-38 9.6V, 600 mAh Battery
  FBA-14 6 AA Size Battery Case
  FTS-26 CTCSS Decode Unit
  NC-50 Dual Slot 1-Hour Desk Charger
  CA-10 Charge Adapter (required w/ NC-50)

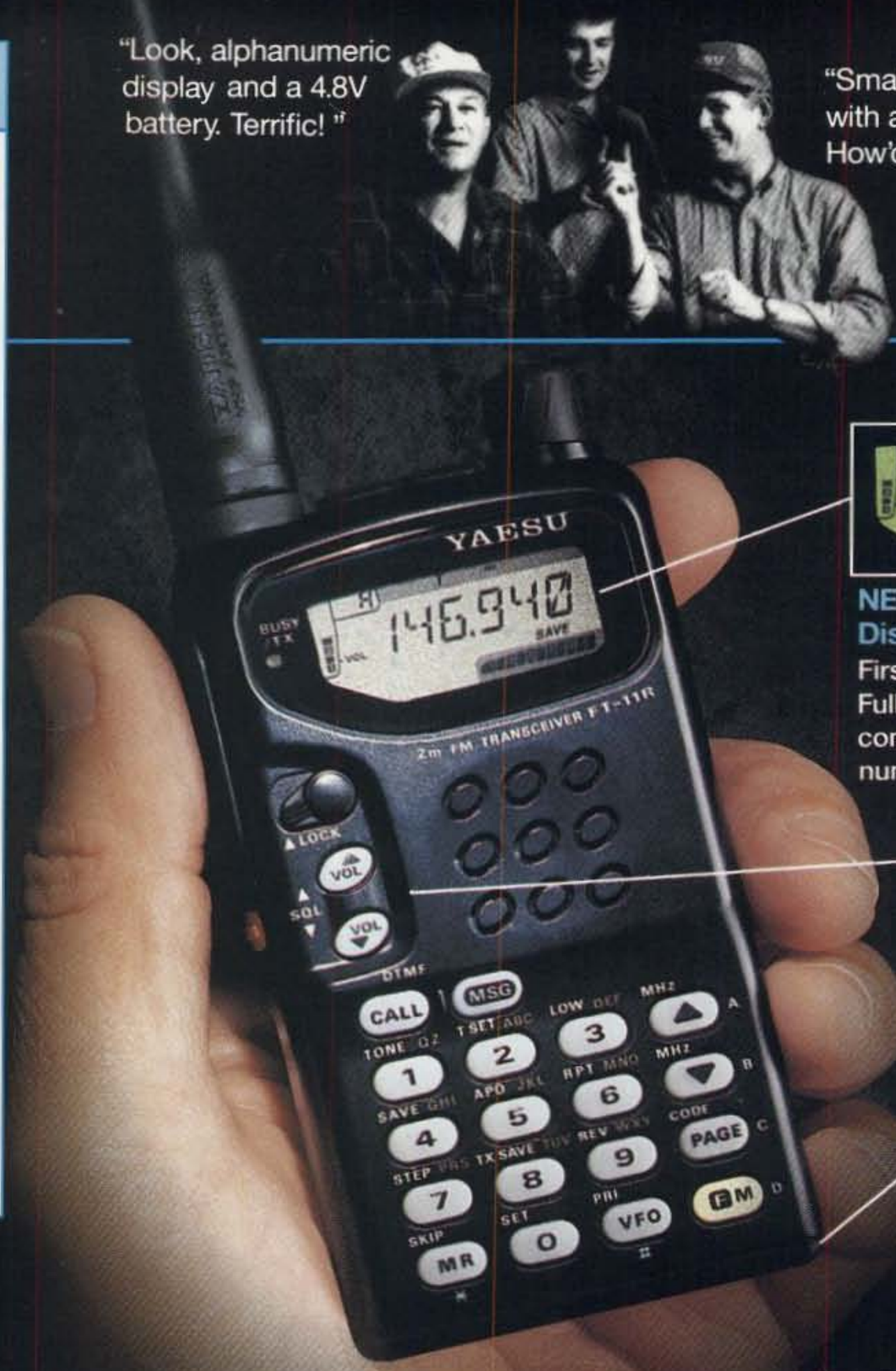
*FT-11 Only.
FT-41, 3.5 Watts

"Look, alphanumeric display and a 4.8V battery. Terrific!"

NEW!

"Small and thin – with a full sized keypad! How'd they do that?"

"Yaesu did it again!"



NEW Alphanumeric Display
First time for Yaesu HT Full function LCD combines letters and numbers.

NEW Up/Down Thumb Control
with Volume and Squelch Bar Graph. No other radio has this. Back lit, too!

NEW Compact Battery Design
4.8V gets you 1.5 Watts. A first for amateur radio.

Get a grip on this!

World's smallest size HT with a full sized keypad
Measures only: 4"H x 2¼"W x 1"D

"Small" is relative, isn't it? It could mean size – which in this case it does. And, it could mean "reduced", which it doesn't! Nothing missing from the hot new FT-11R HT from Yaesu except bulk! You're going to wonder just how all the features of this full-function radio fit in. Until you remember Yaesu pioneered 2-way radio micro technology.

To see what this really means to you, check out all the new features. Like the alphanumeric display. This Yaesu HT first, lets you tag your favorite frequency by name, call sign or number. Or, the new "voltage stingy" battery. It's an industry first for amateur radio. Smaller and compact, the 4.8V battery gives you 1.5 watts on TX. And, if that's not enough, there's an optional drop in, dash mount battery charger.

You see it's not a small time performer. Just small sized. The FT-11R. Another small example of Yaesu superiority. See your dealer today!

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Performance without compromise.℠

Attention :

DX Hunters, Contestors, Multi-Band Operators, Rag Chewers and Mobile Operators:

HIGH PERFORMANCE BEST FEATURES

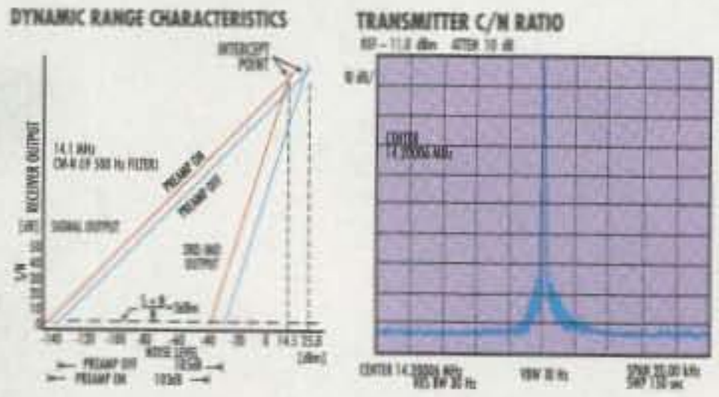
IC-737A

A Winning Combination of Performance and Features Previously Offered Only on Rigs Costing Thousands More!

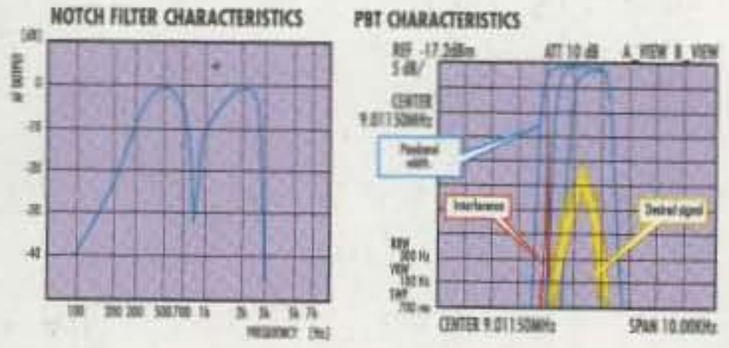
HIGH PERFORMANCE

New D.D.S. (Direct Digital Synthesizer) System – Miniaturized and improved technology provides phenomenal performance increases (higher PLL lockup speeds and improved C/N ratio, phase noise and blocking characteristics).

Pass Band Tuning – Electronically narrows the IF passband to eliminate interference signals (more effective than IF shift offered on competitive models).



Notch Function – Tune out an interfering signal frequency to eliminate unwanted CW or AM carrier tones, while preserving the desired signal's audio response. The combination of PassBand Tuning and Notch Function is very effective on crowded bands.



100% Duty Cycle – Large cooling fan and heatsink provide a stable 100 W in SSB, CW and FM modes (40 W in AM).

See your participating ICOM dealer today and view a video demonstration of this product!

VHS

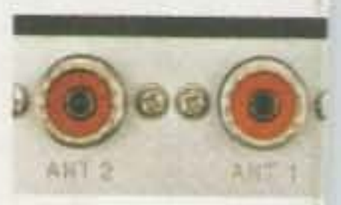
More High Performance – With full break-in (QSK), built-in electronic keyer, speech compressor, noise blanker, fast/slow AGC, preamp, attenuator, many tuning functions (including direct keypad entry) and dual CW filters (optional).

BEST FEATURES

Auto Antenna Tuner – Fast, quiet and smart, *"Spot checks showed that it could match loads with indicated SWRs as high as 10:1"* (February 1993 QST review). Auto-preset memories for each band, **including 160 M**.

Quick Split Function – Transmit and receive frequencies are **displayed simultaneously**. Both can be tuned independently. Call DX stations operating split frequency faster than any of your competition operating a single frequency display model.

Auto Antenna Selector – Two antenna connectors let you select the best antenna for band and conditions from the front panel. Stores to both band memory and memory channels.



Double Band Stacking Register (DBSR) – Memorizes two frequencies and modes **in each band**. Can be used like extra VFOs in one band. Use one register for CW and the other for SSB if you like.

10 Memo Pad Memories – Push "Memo Pad–Write" to quickly store a frequency & mode, for example, if you find a piled-up DX station. Recall just as quick with "Memo Pad–Read."

Large LCD Display – Easy to read in all lighting conditions. Won't "wash out" in direct sunlight.

MORE GREAT FEATURES

- Voice Activated Transmit (VOX)
- 101 Memory Channels
- Multiple Scanning Modes
- General Coverage Receiver
- PC Compatible (w/optional CI-V)
- Many compatible options available
- Dial Lock
- All Mode Squelch
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CIRCLE 165 ON READER SERVICE CARD

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