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- **CQ Reviews: The New Kenwood TS-50S Transceiver**
- **High-Claimed Scores For The 1992 CQ WW DX SSB and CW Contests**

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THE RADIO AMATEUR'S JOURNAL

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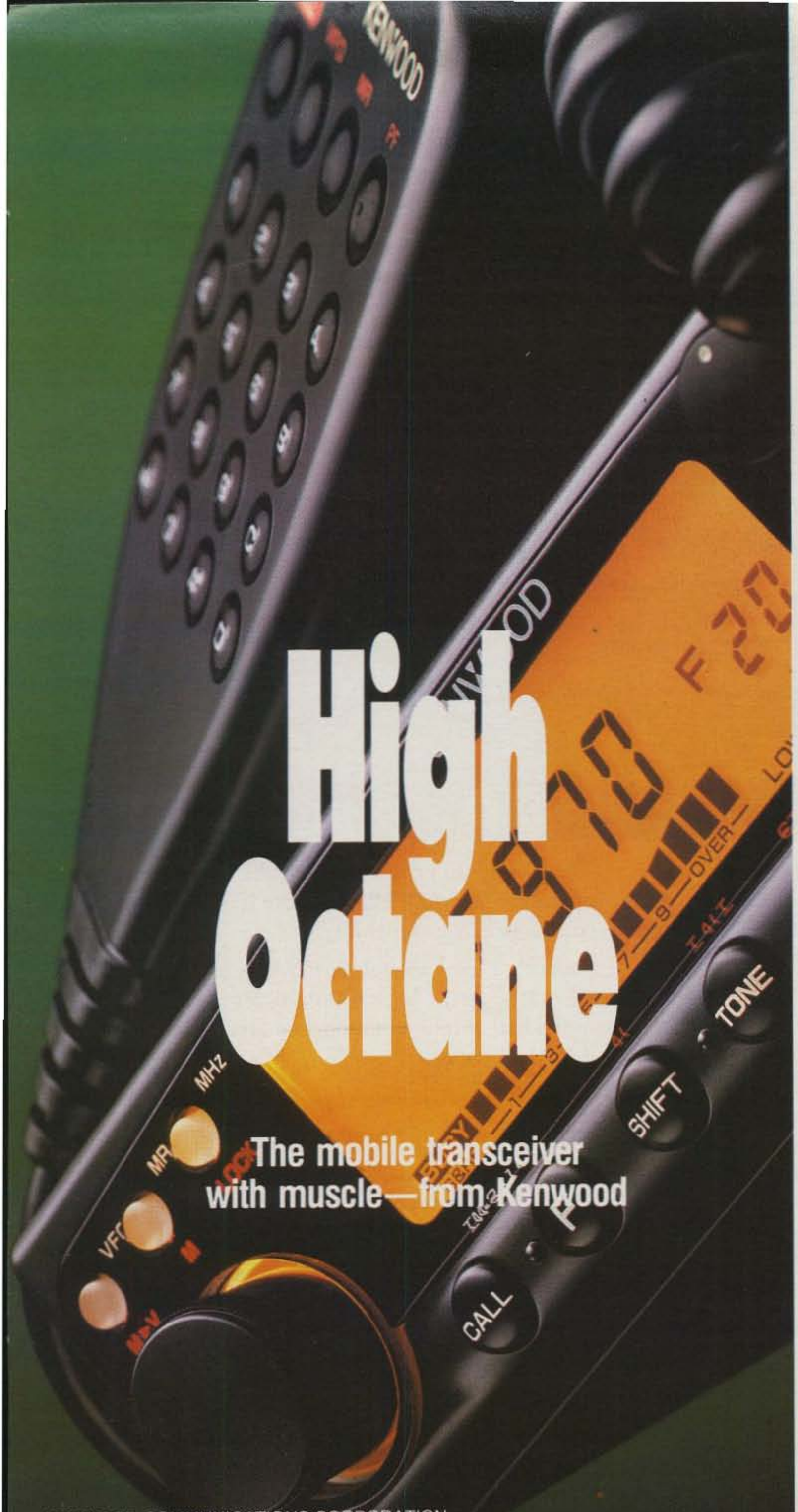

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- **CTCSS built-in, selectable from the front panel.** KQT-8 programmable decoder optional.
- **TM-241A provides 50 W, TM-331A is 25 W, TM-441A 35 W, and TM-541A 10 W.** Three power positions, 5, 10, and full. The TM-541A has two power positions, 1 and 10 watts.
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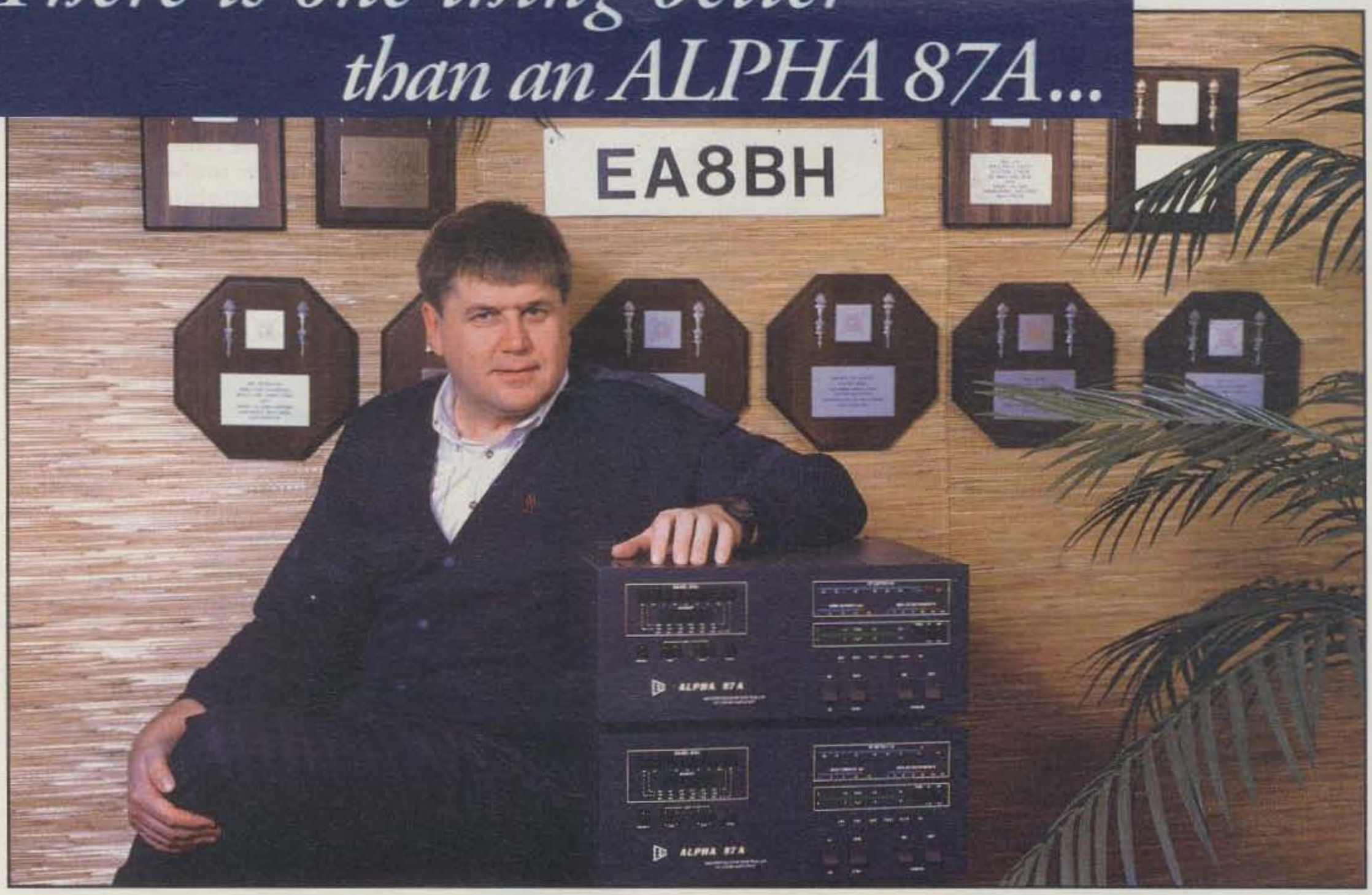

Competition in the amateur radio spectrum has become much more keen. Whether I'm operating at home or toiling in the DX vineyards of a remote island, I want everything about my station to be really effective and professional. I don't have time to scream endlessly in a pileup, and I won't tolerate missing a "new one".

When I discovered the no-tune *ALPHA 87A*, I realized that a new era had arrived in amateur radio: I couldn't be totally competitive without the *'87A*. Its truly *hands-off* operation makes contesting significantly more efficient... and more fun.

Martti Laine is arguably the best-known DXer in the world today. He seems to be everywhere: helping open Albania to amateur radio, building a superstation in EA8, dishing out mega-QSOs from inaccessible islands in the Antarctic and the South China Sea. And always plotting... "Where Do We Go Next?"

To paraphrase: the difficult, OH2BH does routinely; the impossible, from time to time. His amplifiers? ALPHA, of course!

The *'87A* doesn't even require valuable space at the operating position; I can remote it and have complete confidence in its reliability!

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Indeed there is something better than an ALPHA 87A. It's several of them.

I don't race go-karts. I race at Indy, and I'm grateful to ETO for their continuing innovations that push the envelope of excellence in amateur radio and DX.

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Martti Laine, OH2BH/EA8BH

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A publication of

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76 North Broadway
Hicksville, NY 11801-2953 USA.

Offices: 76 North Broadway, Hicksville, NY 11801. Telephone: (516) 681-2922. FAX (516) 681-2926. CQ (ISSN 007-893X) is published monthly by CQ Communications Inc. Second Class postage paid at Hicksville, NY and additional offices. Subscription prices (all in U.S. dollars): Domestic—one year $22.95, two years $43.00, three years $63.00; Canada/Mexico—one year $25.00, two years $47.00, three years $69.00; Foreign—one year $27.00, two years $51.00, three years $75.00; Foreign Air Mail—one year $80.00, two years $157.00, three years $234.00.
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Allow six weeks for change of address. Printed in the United States of America.
Postmaster: Please send change of address to CQ Magazine, 76 North Broadway, Hicksville, NY 11801.

The Radio Amateur's Journal

ON THE COVER: Ronald "Sig" Sigismonti, N3RS, at his station in Glenmoore, Pennsylvania. Sig is a regular participant in many contests and an avid CW operator. (Photo by Larry Mulvehill, WB2ZPI)

JUNE 1993 **VOL. 49, NO. 6**

FEATURES

DEPARTMENTS

ZERO BIAS

EDITORIAL

A short while ago I received a letter from Tony Musero, K3UKW, concerning a future enterprise Tony wants to get into. Tony is a frequent user of our Ham Shop classifieds and buys and sells used amateur gear. One of the points he raised in his letter was that at most amateur fleamarkets these days he sees less and less amateur gear and more computers, surplus, and other miscellaneous items. He wonders, in fact, what has happened to all the amateur gear made over the years. Where has it all gone?

In absolute terms, I don't think anyone, except the original manufacturer, ever really knows how many of a particular item are manufactured. However, if you pick an arbitrary number and spread that number worldwide over the entire amateur population and then factor in a certain amount of destruction per year, any long-range concentration of a particular item seems nil. As equipment ages, we also must take out a small number each year for people who simply collect gear for various reasons, and that leaves even fewer items on the open market.

Amateur gear, no matter how old it is, always seems to have some value, so it is rarely thrown away or junked. A one-year-old transceiver is still perfectly good and operational, whereas a one-year-old computer to some people has about as much value as a container of one-year-old milk. Get rid of it as fast as possible and get some new equipment.

Dayton 1993

At the Dayton Hamvention this year the fleamarket also seemed to feature more computer material than older amateur gear. With a bit of foresight (plus the daily FAX weather reports from Steve, N8BJQ), we planned on covering the fleamarket on Friday, as it looked like rain for Saturday and Sunday. Gail and I walked most of the fleamarket on Friday morning before the Hamvention opened to the public. We finished the rest on two breaks away from the CQ booth. There was definitely a lot of interesting stuff to see, if only to try to figure out what it was. The way it looks now, the fleamarket should extend out to the next county in a couple of years.

It was obvious that a number of folks who showed up had read my May editorial on heroes and stars, and I was quite flattered to hear that they agreed with me. One amateur came up to me at the CQ booth and quite seriously said, "This is the secret to working DX" as he handed me an airmail envelope. At first I assumed he meant that amateurs should include some means of getting a return card. "No," he said, "look inside." Inside the envelope was a little sign about the size of a call-letter badge, and it simply read "LISTEN." The back of the tag indicated that it was made by Skip Westrich, WB8OWM. If that was you, Skip, thanks. I'll put it up in my shack.

One item I saw in the fleamarket beckoned to me when I first saw it. I intended to go back for it, and as we all know too well, when I went out later to try to find it, I couldn't. It was a T-shirt with a cartoon figure sitting at the operating position. The writing across it said, "Help! I'm talking and I can't shut up!" Oh, well. I'll probably see it at another hamfest later this year. That will teach me to break the first law of fleamarkets: If you see something you like, buy it and take it with you.

There was a tremendous amount of new stuff to look at inside the arena, and you truly needed more than one day to see it all. Dayton is designed to be (whether on purpose or not) three days of total immersion in amateur radio. If you can leave there without being totally buzzed out by everything there is to see, people to talk to, seminars, banquets, hospitality suites, and miles and miles of walking amidst thousands and thousands of people, then you are doing something wrong. It's a total high.

Just when you think you've seen all the new amateur radio equipment there is to see, out pops loads of brand new stuff. The exhibitors at Dayton had a lot of new gear on display, and we certainly were kept very busy lining up anything new we could find for review. I don't care how jaded or complacent you are or how nicely you do with your Sky Buddy and single 6L6. Trust me; out there are whole new worlds you haven't dreamed of.

They say that timing is everything, but an hour before the Hamvention opened is cutting it a bit close. Just about an hour before the doors opened we received shipment of our new books and video tape. The first of our new books is by our Packet Radio Editor, Buck Rogers, K4ABT, and it is called *The Packet Radio Operator's Manual* (or "PROM," as Buck likes to call it). This book continues on from Buck's last book and also shows detailed hookups. The second book is by Bob Haviland, W4MB, and is entitled *Quad Antennas*. This is the everything you ever wanted to know about quads book, including how to build and use them. The next one is not exactly for licensed amateurs, but rather for those who have been curious about or who have expressed an interest in amateur radio. This one is called *Ham Radio Horizons, The Book*. It was produced jointly by CQ and the ARRL, written by Peter O'Dell, WB2D, and is an easy-to-read introductory text for the non-amateur. It is designed to reach out and promote our hobby to non-amateurs of all ages.

The last book in our series is the *1993 CQ Beginner's Guide To Amateur Radio*. This book features articles and a buyer's guide focusing on the needs of the new amateur. It is designed to address the questions most commonly asked by newcomers. We also received the first copies of our new video, *Ham Radio Horizons*, which is a 50-minute introductory video for the non-amateur. It shows and explains all the multi-faceted aspects of amateur radio in an easy-to-learn and enjoyable format. It is definitely people oriented.

The big question asked, though, was how was the food. To be truthful, I studiously avoided the grease-dogs and mystery-burgers. The soda was good and the large salted pretzels were fine. The CQ gang thoughtfully stocked up on goodies and fresh fruit at a local supermarket. Outside you couldn't help but smell the grills cooking what passed for Polish sausages (probably left over from Chopin's twelfth birthday party). Gail coined a new term in one area of the fleamarket when she described the smell as "Bar-B-Zene," an admixture of barbeque and kerosene, but heavy on the kerosene.

Where else on the face of the amateur radio world can you find everything you ever dreamed of? Start your plans to be at the next one, and I hope to see you there.

73, Alan, K2EEK

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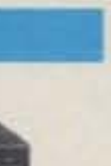

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If you worked ZC4Z during the last CQ WW DX CW Contest, you were probably happy to add Cyprus to your country total. This was not simply a DXpedition; it was an all-out effort to try to capture that event. Who says CW is dead?

The ZC4Z Story

Operating The 1992 CQ WW DX CW Contest From Cyprus

BY ROGER WESTERN*, G3SXW

Aphrodite, the Goddess of Love, rose from the sea on the island of Cyprus. This exotic island, far away in the Mediterranean Sea, has held travellers spellbound ever since with its romantic and mysterious charm. Down through the centuries emperors and kings conquered Cyprus for its riches and its strategic value, but really for its allure. It was once a present to none other than the love goddess Queen Cleopatra.

Set in a blue ocean, blessed with a balmy and welcoming climate, Cyprus is but a short sail from the shores of Turkey, Syria, Lebanon, Israel, and Egypt. Truly a cross-roads between continents, this island is shown on maps as a part of Asia and yet feels like Europe. In other ways, too, there is something of an identity crisis: the northern half is Turkish, the southern is Greek. The impervious "green line" separates the two.

The British took their turn in colonizing Cyprus and left their mark. English is universally the second language, currency is called the pound, and they even drive on the left side of the road. Independence from Britain was only thirty years ago, and a full military base is still maintained. You can learn more of the island's fascinating history from VP2ML's article in *CQ* magazine, November 1992 (p. 136) and his description of how ZC4 (Cyprus, British Sovereign Base Area) became a separate DXCC country. Therein lies the tale of the intrepid contest expeditioners from which this article was born.

The CQ World-Wide DX Contest is a fire like none other. It burns deep inside many, many contesters year in and year out. It generates amazing energy and motivation to achieve. For some it has become the focal point in the calendar. Detailed plans are developed over months or even years. Groups of operators come together from all over the globe to participate together, to strive for bigger and better things and—maybe—to win. One such group went to ZC4 for the CQ World-Wide CW Contest in November 1992.

*7 Field Close, Chessington, Surrey KT9 2QD England

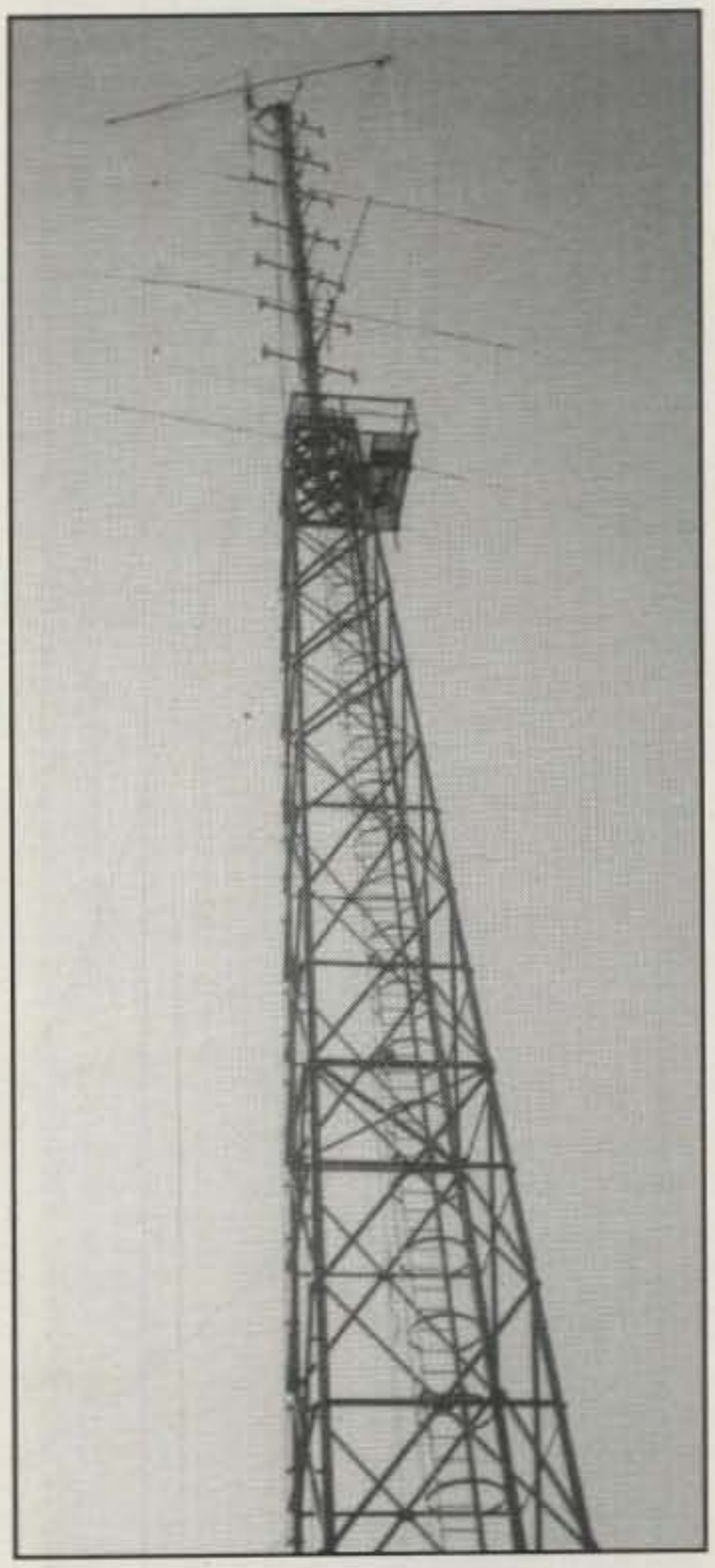
The Team

This group went to Cyprus not so much for romantic allure, like those erstwhile travellers, but to operate the contest from somewhere rare on the radio map. We entered the multi-operator/single-transmitter category, and the team consisted of G3SXW, GM3YTS, K5VT, K7GE, KC7V, and N7BG, much aided on the ground by 5B4MT, ZC4CZ, ZC4IW, 5B4CR, and others.

Members of our group had worked together before, putting together contest entries year after year for the WW, including record-setting multi-multi scores from KP2A, from 4UØITU (1989), CN5N (1990), and multi-single from The Gambia signing C56N in 1991. After the 1992 event we claimed a score of 11.5 million points. This was the culmination of enormous efforts and of making 6000 QSOs on CW in 48 hours. In a word, it was an ambitious project that succeeded in overcoming adversity by dint of team-spirit.

Advance Planning

November 1991: At midnight the 1991 CW contest ended. The C56N crew—including G3SXW, GM3YTS, K5VT and K7GE—had drunk some beers and reviewed the operation. (Results later



Here's something we all would like to have—a 150 foot self-supporting tower with an enclosed safety ladder. The ZC4Z gang made good use of it by placing the two-element 40 meter beam on top. At the 110 foot level is a four-element tribander. Hung between them are three 80/160 trapped sloping dipoles. (Photos by Tony Rogozinski, N7BG, and Rob Ferguson, GM3YTS)

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placed us sixth in the world in our multi-single category.) Quickly the conversation turned to that favorite question: "Where are we going next year?" It almost seems as if members of this group have travelled overseas for the CQ World-Wide Contest ever since leaving kindergarten. We couldn't break the habit of a life-time in 1992.

Various African options were being considered when the resonant voice of Vince Thompson, K5VT, murmured, "What about ZC4? You Brits might be able to organize that." What a great idea! The current World Multi-Single record was made from just a few miles to the north in Turkey, so the area must have good potential for a big score.

January 1992: If you don't ask, you don't get. Glynn, ZC4CZ, is an active local, so I wrote to him asking for advice. Al Slater, G3FXB, gave me his experiences from a trip there in March 1991. Some friends who had operated from Cyprus (5B4-land) the previous summer suggested Mike Townley, 5B4MT /ZC4MT. A friend's husband chatted at a party about the island and by sheer coincidence also recommended 5B4MT who, it turned out, is Engineering Manager for British Forces Broadcasting. That was hot! I telephoned Mike and explained our rather unusual requirements, and from that moment on he couldn't have been more helpful. The whole project was founded on his enormous cooperation.

February 1992: FAXes started to fly about the exciting potential of two alternative sites on ZC4, one on the Western Base Area at Episkopi, the other on the Eastern Base Area at Dhekelia. The team started to gel. We acquired detailed maps of the prime location, the recently vacated BFB transmitting site, at 250 feet above sea level at Dhekelia. The 150 feet tower was to be removed, so we did not plan on it.

April 1992: Discussions at the Visalia DX Convention and a short visit to Phoenix serve to cement the overall plan, draw up a list of participants, and outline antenna requirements. Responsibilities were sorted out and plans of action were agreed upon.

May 1992: We did a feasibility check on travel, accommodations, cars for hire, etc. Flights were frequent and affordable, and transmitting licences could be acquired, although a single-letter suffix (for snappy contesting) might be refused. We started to inquire about local antenna supports, and set up regular weekly skeds with 5B4MT on 15 meters. It all looked feasible, so the big issue was to decide the best achievable antenna setup.

June 1992: Rob Ferguson, GM3YTS, suggested a quick reconnaissance

Some of our hosts on Cyprus. From left to right are Glynn, ZC4CZ, Ivor, ZC4IW, Chris, ZC4CP, and Mike, 5B4MT/ZC4MT.

trip—a little sun, sand and sea, check things in detail on site, and so forth. We then realized it was also a great chance to carry some antennas and reduce the risks of excess airline baggage charges in November. We decided to carry an IC-735. Then Nigel Cawthorne, G3TXF, said all three of us should go together and do a WARC bands mini-expedition.

August 1992: G3SXW, G3TXF, and GM3YTS flew to Larnaca to operate for six days from the BFBS building. They achieved thousands of WARC band contacts, a few good ones on 160 meters, and G3SXW entered the Worked All Europe CW contest. We were really lucky, because the sale of the 150 foot tower fell through and it was still there. It was free-standing with huge dimensions, a hooped ladder, and a railed platform at the 100 foot level. We erected 160/80 meter dipoles high in the sky. It was a big bonus for the trip, but we knew it definitely wouldn't be there in November.

The insight gained from a reconnaissance operation is enormous. You learn all there is to be learned about local conditions, antenna placements, operating rooms, and everything, down to where to buy groceries. It all reduces risks and hassles when the main trip comes around. Especially valuable was discovering that horrendous power-line hash was wiping out 160 meters. 5B4MT got the local power company working on that.

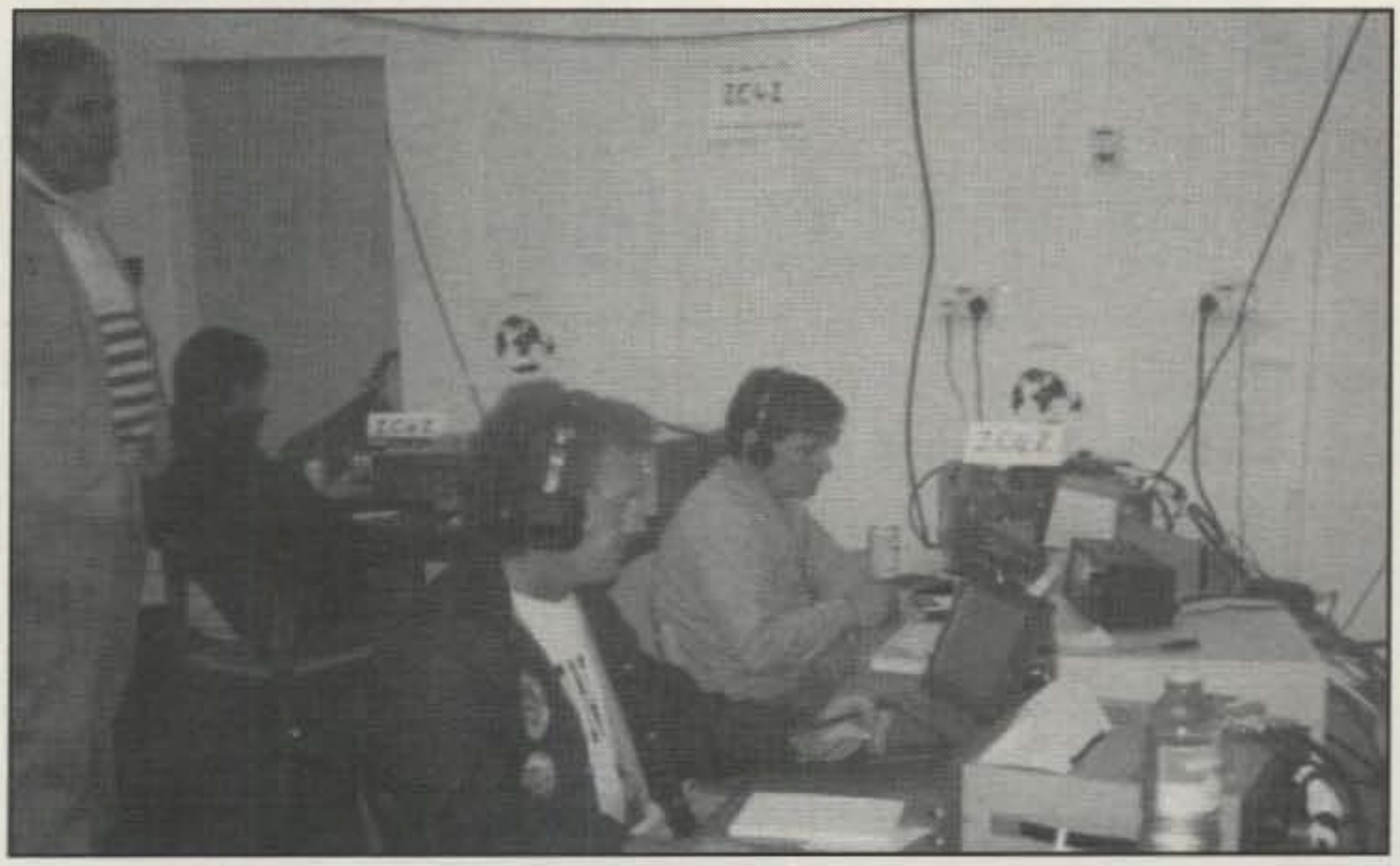
October 1992: Everything was in place. Nothing like advance planning to maximize chances of success. Excitement mounted, the beams were checked and repacked, and rigs were aligned. Jim Larson, K7GE, ordered and shipped the Cushcraft two-element 40 meter beam. The big tower was still there, but could be dismantled any day. All fingers and all toes were firmly crossed on that one. Copies of home licenses had been sent out, and 5B4MT set up both ZC4 and 5B4 licenses for each operator. Back came the news that all our first choice suffixes had been granted, including the single-letter suffix call ZC4Z. Personal calls are always two-letter and club calls always three-letter. They made an exception for us. (The "Z" suffix resulted from N7BG's evening spent with a keyer checking out which letter flowed best on CW).

Everything was looking good. The weather in late November was expected to be very comfortable.

The Countdown

We were all set. Travel plans had all been made, hotels booked. Everything was in place. On the weekend prior to the contest N7BG and KC7V passed through London and the troubles began. A linear has been left behind at JFK Airport in New York. The airline delivered it promptly to our hotel in Cyprus, so that panic was over by Tuesday, first problem solved. On the final sked with 5B4MT it was confirmed that the big tower was still there. We were really in luck, as the sale had fallen through again.

Arrangements had been made for loan of 60 foot masts, but suddenly we were facing a new plan that incorporated antennas way up in the ether. N7BG's face took on a determined look: "I'm putting that 40 meter beam way up on top." We talked through numerous options for antenna configurations. In the meantime, 5B4MT had delivered



ZC4Z up and running. In this view we can see (from left to right) K5VT observing, KC7V spotting, N7BG calling CQ, and GM3YTS hunting new multipliers.

drums of coax to the site, along with other essentials such as operating chairs/tables and a ladder to reach the flat roof, and he had reconnected the telephone. All modern conveniences!

Wednesday: All members of the team had arrived safely in Cyprus, flying in from all over, laden with huge suitcases and heavy "hand" luggage. The weather was cold and windy—not auspicious. It was not supposed to be like this in November, but it was so great to greet old friends and for the group to be together again. We drove the three miles from our hotel (in 5B4) to the site (in ZC4) and got to work. Three full days would be enough to get ready for the start of the contest late on Friday night.

There was a lot to do and up on that hill the strong wind added a challenge. We assembled the Cushcraft 402CD 40 meter beam and two Cushcraft tribanders (A4S and A3S) while N7BG explored the tower. Some fixings needed to be fashioned. Glynn, ZC4CZ, came to the rescue, showing us a local metal-work shop. Indeed, his intimate local knowledge helped us acquire various essentials such as nylon rope, electrical hardware, beer and pizzas. Glynn helped throughout the operation and was a big bonus.

We tried hauling up the 40 meter beam, but without a gin pole it just couldn't be positioned. N7BG was up that tower over three hours in the end and came down frozen. We were all disappointed at the lack of progress.

Thursday: Wind and rain. No way could anyone sit up there at 150 feet until it passed. By lunchtime the gin pole was commissioned along with appropriate hardware. We installed the A3S on aluminum poles on the flat roof away from the tower at about 45 feet above ground; KC7V laid out two beverages; K7GE built the Butternut vertical; and we unraveled three 160/80 meter trapped dipoles and cut their 72 feet coaxes. Indoor work to get the stations working was not the worry. It was all a question of getting antennas in place, because if you want a good score you need a big signal on all six bands.

In the meantime, K5VT and K7GE

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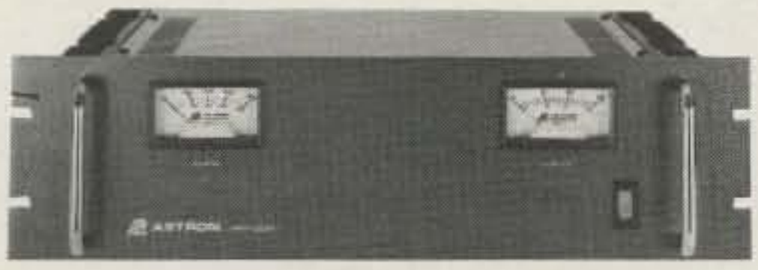

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RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

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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

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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)

were back and forth to the airport trying to find luggage that had been air-freighted two weeks before. It all had been delayed in London, and if it was not to us by the next morning we would be desperately short of equipment.

By the end of Thursday at least there was a A3S in the sky, but time was getting very short. The A4S would also be installed on the tower at the 110 foot level, and the system of three phased 160/80 meter trapped sloping dipoles would hang from between the two beams, so there really was nothing more to do until that 40 meter beam was in place.

We all then went out for dinner with 5B4MT/ZC4CZ as guests. It was a lovely evening, which also celebrated Thanksgiving, as well as N7BG's birthday! One of the rented cars collapsed enroute to the restaurant and needed replacing. Never had a car engine been the source of such weird noises!

Friday: Wind and rain had subsided. This was the last chance. N7BG went up the tower yet again, and of course with the gin pole installed, the 40 meter beam went up smoothly. It just soared like a bird. But there was so much to do: coax and rotor cable runs, then test, then quickly on to the A4S. It was still cold. In Cyprus at this time of year it should be comfortably in the sixties Fahrenheit.

In the midst of all this G3SXW took a call from home about a family crisis; that wiped out part of his day. GM3YTS had a panic call from his office. Two of us then had something less than 100% of our minds on the project.

The A4S was finally in position, but it would only rotate 120 degrees. It needed to be moved to a different support, but there was no time. With only one hour of daylight left, we started hauling up slopers. We all crossed our fingers, hoping that things would work the first time, because we were fast running out of time to fix anything.

The Butternut was ready to go, ZC4CZ having grounded it to a large metal roof, which would make it play nicely. The two beverages were all prepared with terminations. The lost luggage arrived at lunchtime—a close call! N7BG and K5VT finally came down the tower in pitch dark, hoping everything would work. All antennas tested fine except for the south sloper. The phasing switch box was not working, so we would have to use N/E and N/W slopers as separate antennas and try to fix the rest of the system during Saturday.

Indoors we had time to get organized, because the contest wouldn't be starting until 0200 local time. We set up the stations. A problem...The computers wouldn't talk to each other. We were running K1EA contest logging software with two notebook PCs. The null modem cable seemed fine, but they both showed "Running station." You know, if you ever get utterly desperate with a computer, then read the manual. You tend to forget that's what it's there for! We had forgotten to specify which one was "RATE" and which was "MULT" in the callsign field—signs of tiredness from hard work and much frustration. There were huge sighs of relief when that was solved.

Coax runs were laid out, but we found there were not enough switches to prevent passing coaxes between stations during the weekend. We all went for some dinner and a rest.

What's a contest DXpedition like without a terrific local dinner?! Going around the table from left to right are ZC4CZ, G3SXW, N7BG, 5B4MT/XYL, K5VT, KC7V, K7GE, 5B4MT, and GM3YTS.

Operating The Contest

Saturday: Everything seemed to be working. Amazing! The operating roster was pinned to the wall. N7BG kicked off with the CQing station (TS-930 and Alpha amplifier), GM3YTS on the multiplier station (TS-930, Alpha), and KC7V on the spotting station (TS-930).

We were off to a good start—144 QSOs in the first hour running on 40 meters and multiplier hunting on 80 meters. N7BG had nicknamed the 40 meter beam his "Death Ray," and it certainly performed like one! We called CQ on 40 meters all night, and they just kept coming. We made a total of 824 QSOs on that band in the first six hours. The multiplier station had a disaster, though. The sloping dipoles wouldn't load on 160 meters. No multipliers on that band the first night, and a major priority for an antenna party in the morning.

Through the daylight hours the QSO rate held up nicely on the HF bands, at between 117 and 193 per hour. Some one-pointer Asian stations were worked after sunrise when LF had dropped out but before Europe opened on HF. Europeans came thick and fast all morning. By afternoon the USA was good on 10 meters with mixed European and North American callers. K5VT and KC7V spent a lot of time up the tower trying to fix the sloping dipoles. The south sloper never did work, nor did the phasing switch box, but at least we had the northwest and north-east dipoles both working on both 80 and 160 meters.

The ETM8C keyer batteries were quickly replaced at one point. They nor-

Band	QSOs	QSO Pts	Pts/QSO	Zones	Countries
160	158	439	2.78	9	48
80	295	822	2.79	16	67
40	2276	6619	2.91	31	100
20	993	2826	2.85	35	118
15	1264	3537	2.80	36	107
10	755	2210	2.93	35	96
Totals	5741	16453	2.87	162	536

Total: 11,484,194 points

Table I- The claimed score 11,484,194 broke down as shown.

Hour	Saturday	Sunday	Hour	Saturday	Sunday
to 01	144	109	13	193	131
02	125	119	14	166	134
03	168	89	15	150	109
04	168	92	16	88	124
05	115	68	17	59	132
06	137	96	18	74	125
07	136	108	19	102	82
08	117	126	20	80	115
09	136	141	21	99	136
10	154	108	22	91	98
11	156	106	23	103	92
12	177	136	24	134	93

Table II- The hourly QSO rate broke down as shown here.

mally last two to three years, but Mr. Murphy was testing us to the limit! The other ETM8C had a paddle mounting come loose: quick swap and repairs effected. Later one of the Kansas City Keyers went intermittent, too. The 40 meter rotator also started cutting out. It had finished up sitting on an amplifier and was simply overheating.

The weekend was filled with such minor irritations, all being fixed almost right away, but providing a test of resolve and commitment. The team held up fine and just kept on solving problems as they arose.

Progress: A simple spreadsheet had been constructed for use on a third computer to track progress against the TA5KA world multi-single record. We didn't really expect propagation to permit a serious attempt on that record, but it was certainly our bench-mark. Each hour we simply keyed in the cumulative score from the K1EA screen and the PC calculated a prediction for how the final score would look at the end of the weekend. (The trick here is to have the cumulative hourly progress from some previous effort as a guide; we used the C56N 1991 log.)

At the end of the first night it was looking like only 9 million points (against the 13.9 million record). We'd finished from C56N with 8.5 million points and with inferior antennas, so this was really worrysome. As Saturday progressed the predictions gradually improved, and by lunchtime it was looking more like 11 million. Indeed, for the rest of the weekend the likely total stayed between 11 and 12 million. We pretty much knew the final outcome by Saturday lunchtime, but had to keep up the pressure.

DX Cluster: Great efforts had been made to get access to the European DX Cluster on packet radio. The benefit to multiplier totals would have been major. G4BAH and OD5ZZ had set up HF linking for us, but extreme winds the previous week had caused power loss at the 5B4 node that we needed to reach OD5, and there were no other viable VHF routes. The local 5B4 and OD5 Cluster nodes have almost no CW users to help generate spots. A last-minute arrangement was made whereby G4BAH passed DX alerts on 21 MHz SSB. This helped enormously and added to the fun while propagation held on that Saturday. Our grateful thanks to him.

Sunday: The 160 meter multiplier shortfall was mostly improved by a CQing session on that band early Saturday evening, plus continuous tuning throughout that night. Again 40 meters provided the bulk of the business for the CQ station that second night. Thanks to ZC4IW we operated in comfort that night with loan of his portable gas heater.

Sunday morning saw a gathering of all the ZC4s and several 5B4s to witness these strange goings-on and to take photographs. G3SXW apologizes for his ultra-brief hellos, but he was running pile-ups at the time!

We concentrated on 15 meters that afternoon, the rate holding up better there than on 10 meters. Predictions had settled down very solidly at the 11.5 million level. Rigs and computers continued to perform flawlessly, but the Butternut developed an infinite SWR, caused by breakdown of a PL259 back-to-back connector. In the evening the N/E sloper also went high SWR and never recovered. Blown traps? The beverages also stopped working. Lesson number one for beverages: Don't feed them with high-power RF, as the terminating resistors tend to go very black and disintegrate into dust! If you rely on TX/RX manual switching, as we had to, then someone will forget and it only needs once.

Throughout the last evening the QSOs kept coming on 40 meters. It was like a bottomless pit. As the numbers show this was by far our most successful band, partly because propagation was good, but especially due to that monster beam. Apologies to those who wanted us for multipliers on 80/160, but when you have only one CQing station,

in the multi-single category, you have to stay where the QSO rate is best.

We finished the contest in good shape, KC7V CQing and K5VT multiplier hunting. It was 2 AM, but there was a lot to do on Monday, so we started right away to dismantle all the equipment.

Antennas were dismantled in a fraction of the time it took to install them. It's always that way. And we were so lucky because the following day Cyprus was hit by another violent storm which would have made antenna work impossible up on that big tower.

By Monday night we were all packed, so it was party time in Nicosia and back to the hotel, where a dipole on the roof (at 80 feet) provided further pile-ups for 5B4/home calls. Gluttons for punishment. Tuesday/Wednesday we went our separate ways to cries of "See you at Dayton."

Results

The claimed score came out as shown in Table I, for a total of 11,484,194 points. This was, by our reckoning, a score that had only been bettered twice in the past, so we were well pleased with the outcome.

At the end of the CQ World-Wide CW Contest, however, you're always dissatisfied with the number of multipliers. There are always so many that you missed. We worked hard at spotting and passing multipliers, but maybe we could have done even more. We did stick precisely to all the rules, though—only one CQing signal, properly completing each contact, the ten-minute multiplier rule, and so forth. On the QSO volumes? Well, we did say that the 40 meter "Death Ray" worked well!

The team thanks Mike Fulcher, KC7V, for taking on the task of preparing and submitting the contest entry.

Hourly Rates: There are always ups and downs, but we had targeted not to drop below 100 per hour in any individual hour. The multi-single record of 150 per hour (average for the whole 48 hours!) could never be matched, so that was not our goal. The figures are shown in Table II. It works out to 119.6 QSOs per hour (after removing duplicate contacts), which can't be bad. We dipped below that 100 level in 14 of the 48 hours, including some off-time with problems early Saturday evening.

Continents: We were looking for three-pointers, so we preferred Europe and North America to Asia/JA. It worked out at 66% Europe, 25% North America, 7% Asia, and 2% others. The ten most frequently worked countries were W 1393, I 231, DL 733, SP 221, UA 353, OH 193, UB 337, G 177, OK 312, and HA 134.

QSLs: It seems that ZC4 is still wanted by many for DXCC and other awards, and all QSLs will be answered efficiently. Cards should go via Mike Bill, AA7NO, P.O. Box 853, Glendale, AZ 85311, USA.

Our Thanks

Don't get the impression that the "thanks" in articles such as this are just for the record. They are heart-felt. This amateur radio thing is very special indeed when total strangers just pile in and offer so much help.

Without the local ZC4s and 5B4s this operation would have been barely possible, and at best a fraction of the score and fun would have been had. Thanks especially to Mike Townley, 5B4MT, who arranged loan of the site and its utilities, acquired local licenses, purloined all manner of strange items for us, and advised us on all manner of other local issues. Many, many thanks from all the team. You are a friend for life.

Also thanks to Glynn, ZC4CZ, for so much help on the ground. It made a huge difference. We wish you well in your new posting, Glynn.

Thank you to the Sovereign Base authorities for allowing us to invade you the way we did. We hope Dhekelia quickly returned to normal after our departure!

Thanks to ZC4IW for his support, and especially for the loan of that heater, which saved the day (night!). To 5B4CR, Thanos, what a character. Nothing was too much trouble.

The experience of this sort of cooperation from so many fellow amateurs ensures that we will each be seeking the opportunity to do the same for others whenever possible.

And finally, a special thank you to the 6000 amateurs who gave us a contact. If you enjoyed the event only half as much as we did, then we all had a super weekend. We hope to see you again during the last weekend of November each year . . . from somewhere! ■

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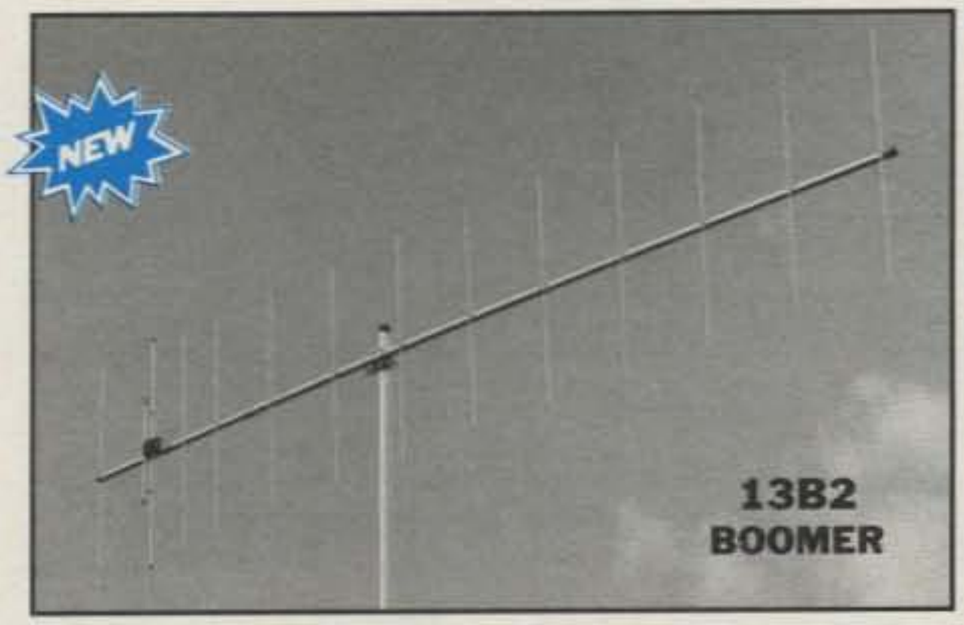

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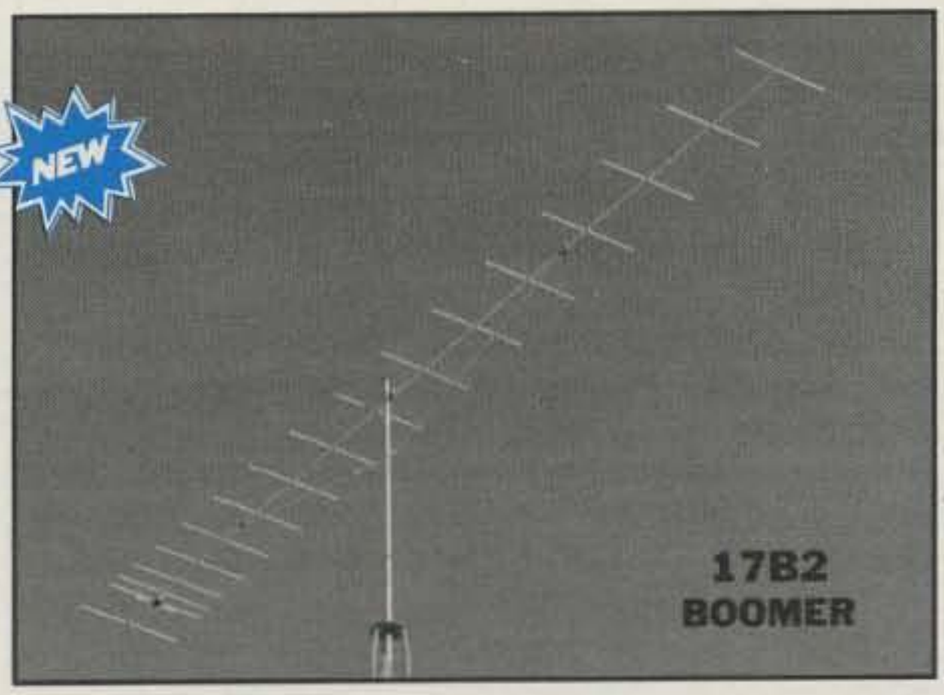

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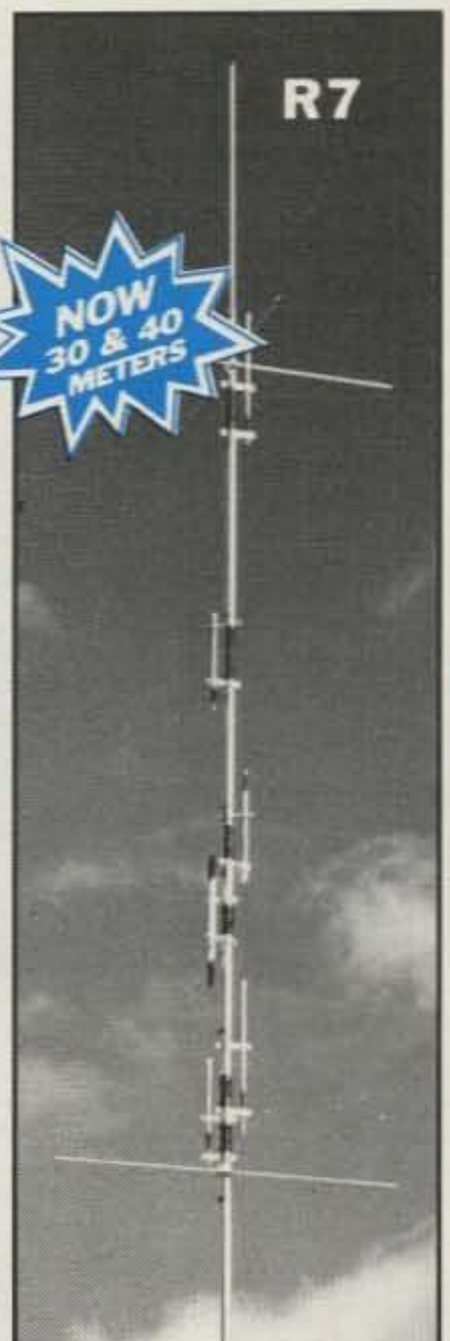

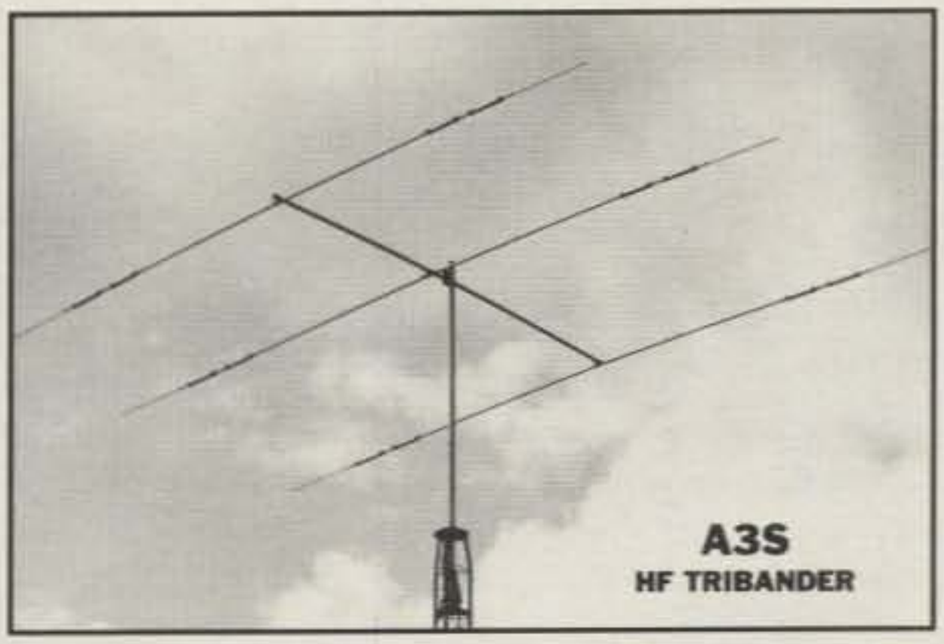

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CQ REVIEWS:

The Kenwood TS-50S Transceiver

BY LEW McCOY*, W1ICP

Every once in a while something comes along that simply revolutionizes our thinking in amateur radio. Usually this is some mode of operation or new piece of equipment.

For years amateur radio existed for CW and AM phone operation. After World War II the hobby started to move. The first major change was single sideband operation, and this author was in on the beginning of this new mode. SSB required considerable changes in receiver design. This mode soon became the accepted method of phone transmission. Next, with the advent of solid-state devices, we started to see revolutionary design changes. Much of this can be attributed to the huge success of FM and repeater operation. These modes then led to high-speed data-transmission design, and we quickly became addicted to packet and other methods of high-speed information transmission.

The advent of computer chips really revolutionized design in transmitters and receivers. At a convention one time I presented a lecture on the future design possibilities and use of computers in amateur radio. Many of my listeners thought I was blowing smoke (!), but if the facts be known, I didn't even begin to approach what was going to happen. And that leads us to this product review.

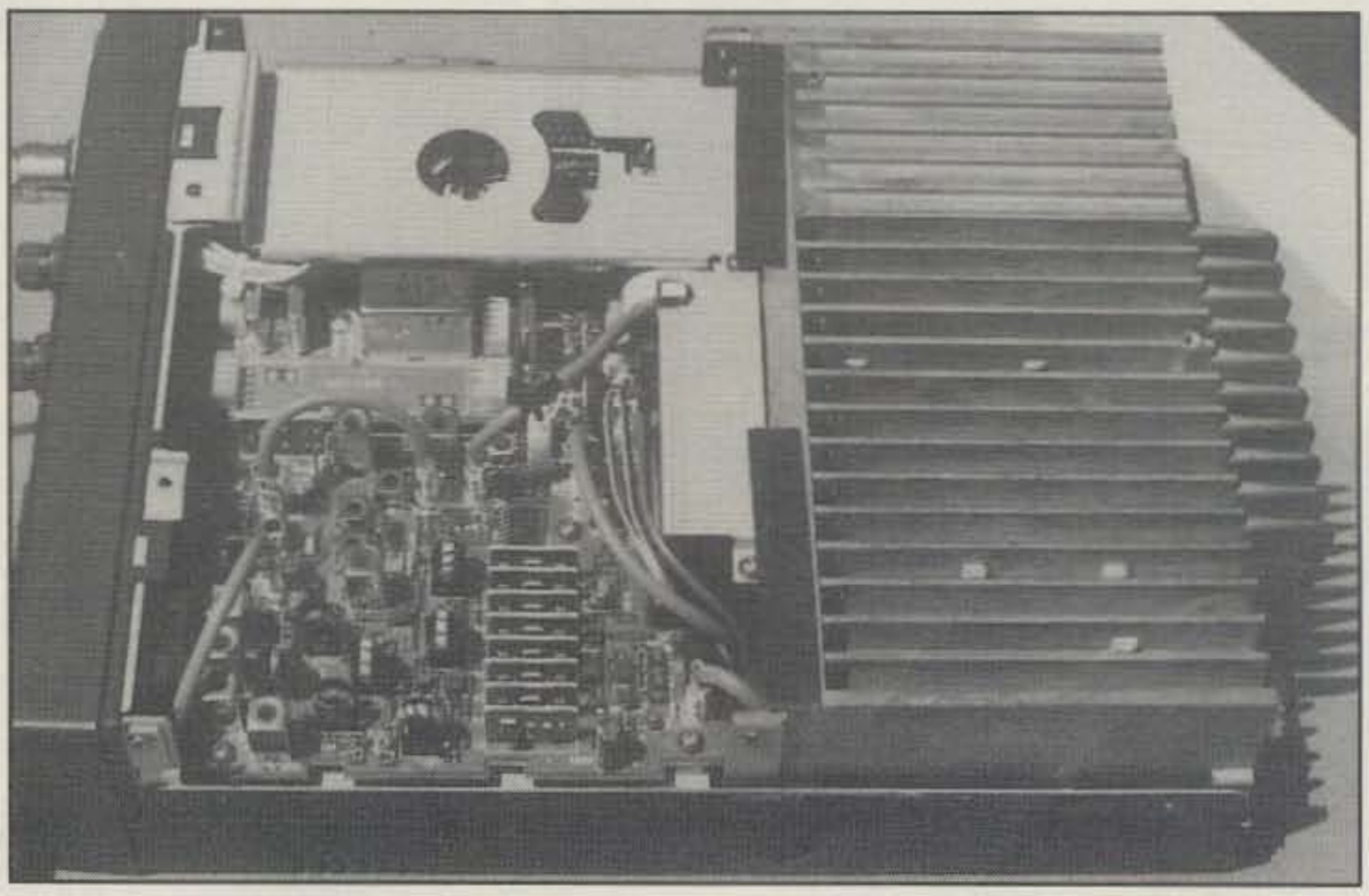
We all have marveled and wondered at Japanese design ability, particularly with computer chips in transceivers. The Kenwood TS-50S seems to be nearly the ultimate result of these techniques. Why? Let me spell it out for you. This is a transceiver with a general-coverage receiver going from 500 through 30 MHz, complete low-band amateur coverage 160 through 10 including WARC bands, and 100 watts output. Plus it has a multitude of special features including 100 (!) memories; CW, SSB, AM, and FM modes; and more which we will cover in this review.

But here is the real eye-opener and why I wrote the above introduction. The

A view of the front of the Kenwood TS-50S. As explained in the text, the mic serves as a "tuning" control along with other front-panel control items.

transceiver measures 179 by 60 by 233 mm. That's about 7 inches wide, 2 3/8 inches high, and 11 inches deep! This is small enough to put in a desk in the living room; no one will ever know it's there! This radio (and you can be certain that competitors will follow) is going to open up low-frequency mobile, plus put amateur radio within reach of many who do not have the space for large equipment.

Before I go any further, just how good



A view with the top cover removed. At the upper left is where the speaker sits (it is not visible in this photo). Note the large heat sink at the rear.

*Technical Editor, CQ, 1500 West Idaho Street, Silver City, NM 88061

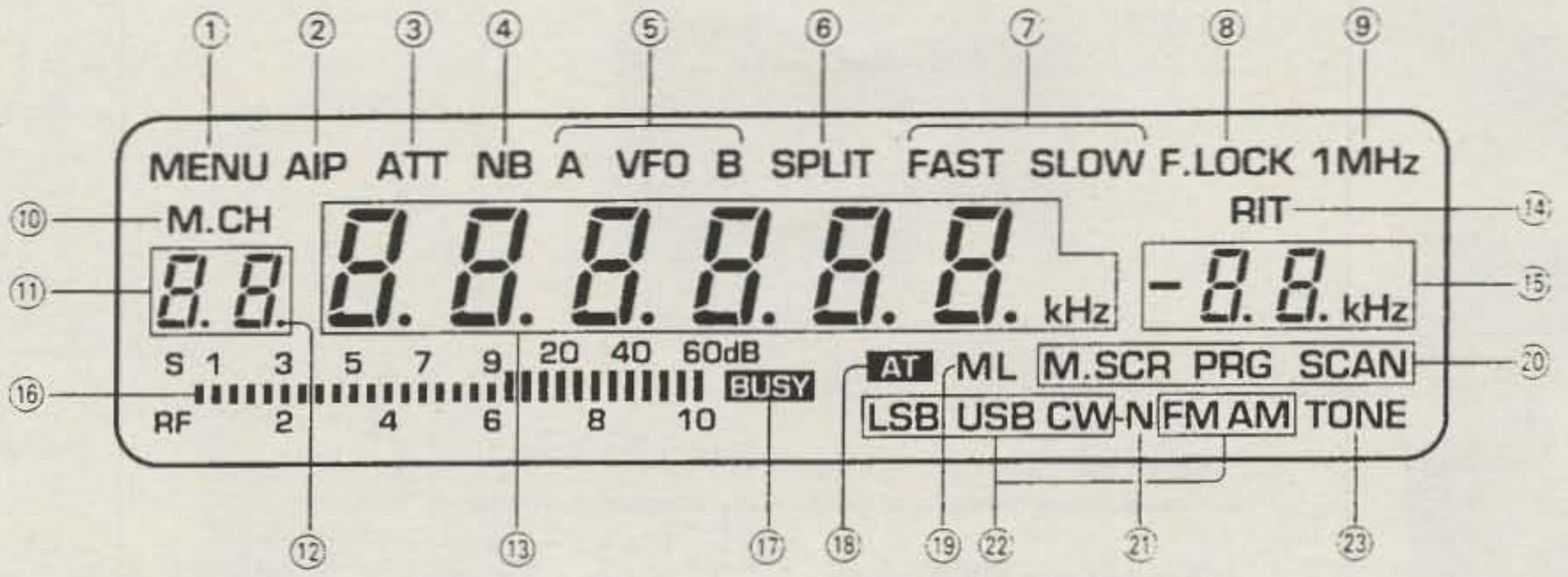
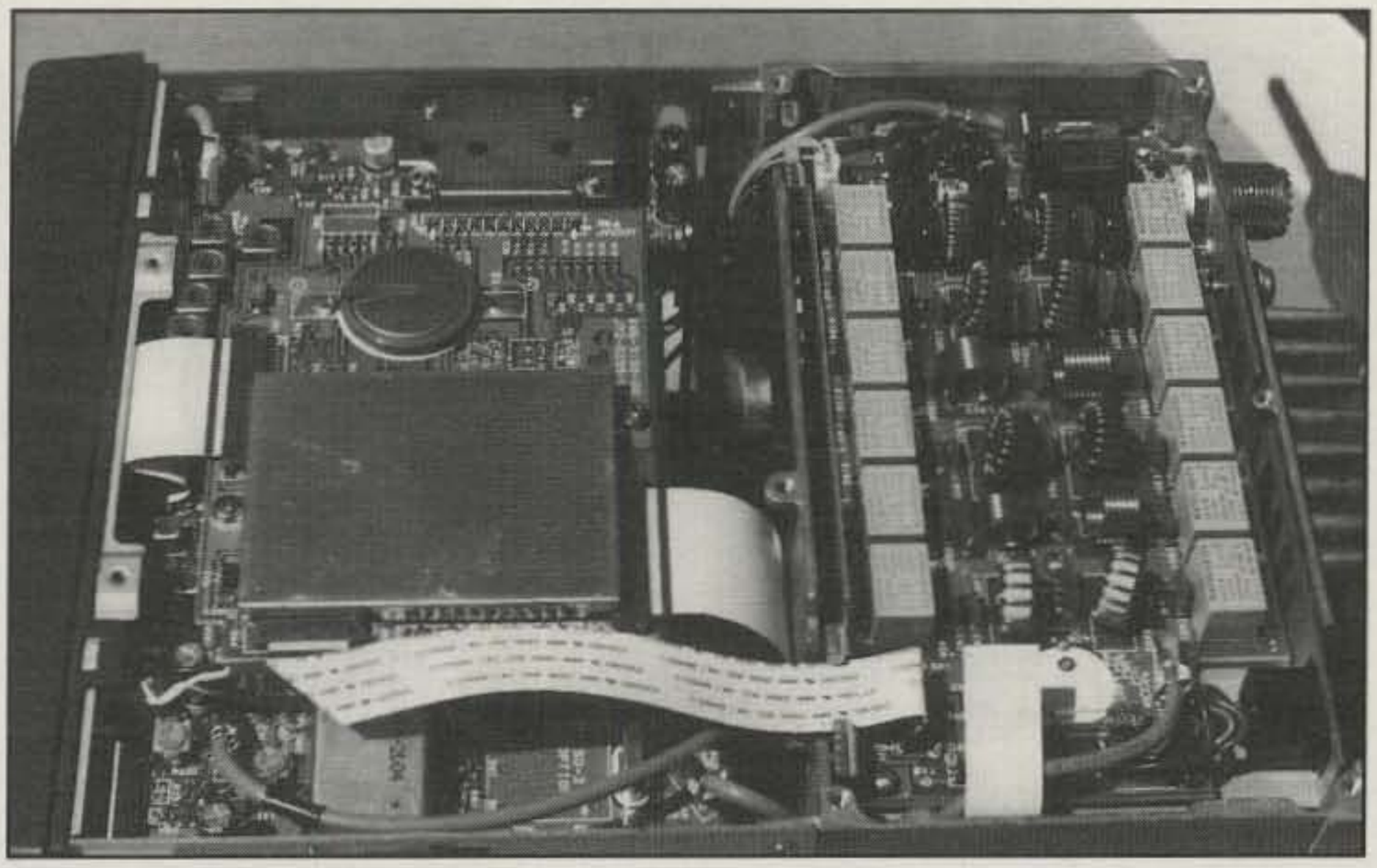


Fig. 1– This drawing, taken from the transceiver's manual, shows the display with the various functions.



In this bottom view can be seen the compact construction techniques.

is this small radio? The first questions I am asked are how easy is it to tune and are the controls too small. Let me assure you, I have large hands and I had no real problems tuning and using all the functions available. Let's get on with the review, and you be the judge.

The TS-50S weighs in at 6.4 pounds (power supply is separate), and power requirement is 13.8 volts (plus or minus 15 percent) at 1.45 amps receive and 20.5 amps transmit.

As I mentioned above, maximum output is 100 watts for SSB, FM, and CW with lower steps of 50 and 10 watts. For AM the maximum is 25 watts, down to 12.5 and 2.5. Output modes are SSB (balanced modulator), FM (variable reluctance), and AM (low-level). I very carefully measured power output in all the categories and found the manufacturer's ratings to be exact.

Important measurements in a new rig are selectivity and sensitivity. As to selectivity, for SSB the ratings are –6 dB for more than 2.2 kHz and –60 dB for less than 4.8 kHz. I found this selectivity more than adequate for SSB work. The same filter and ratings apply to CW, but there is an optional 500 Hz filter available for CW work if more selectivity is desired.

There is no doubt that this is going to be a popular DXpedition rig, so I am sure that many operators will be interested in the sharper filter. AM selectivity comes in at –6 dB for more than 5 kHz and –60 dB at less than 40 kHz. Additionally, in the SSB and CW modes you can improve the selectivity by using the IF passband tuning, a front-panel control.

Sensitivity rating at 10 dB ([S+N]/N) is less than 0.25 uV from 1.7 through 30 MHz. I found that the receiver had a "quiet" noise floor, and to use an old timer's phrase, was really "hot." In other words, it listened well. Keep in mind that this receiver is a full-blown job using double IF conversion techniques, or to put it another way, the receiver works as well as larger Kenwood transceivers.

In order to achieve the small cabinet size, many functions are "programmed" into the transceiver. For example, there is no mic nor RF gain as we normally would think of it. At first, I felt this would be a handicap—the lack of the two gain controls, that is. The RF gain is set in three steps via one of the buttons on the microphone. The gain can be set to 100, 50, or 10 watts output. I found that after using the transceiver, this was not a real handicap. In driving my amplifier, the 100 watt position was adequate for full amplifier output, and of course it was simple to retune the amplifier when I wanted less output. I also tried switching the transceiver power output down to 50 and 10 watts to reduce amplifier drive, which also works fine, but this of course required touching up the amplifier tuning.

The mic gain is set internally to either HIGH or LOW via a switch on the microphone. The gain can also be adjusted manually by removing the transceiver cover. I didn't do this, but I received many on-the-air checks that confirmed that the audio gain was set correctly. Incidentally, the manual that comes with the TS-50S is well written and extremely detailed (60 pages plus diagrams).

There are two basic MENU settings—**MENU A** and **MENU B.** By pressing the **F-LOCK** button twice, the front-panel display will show the menu-setting number and the function. For example, the **00 MENU A** will show 100 (or 50 or 10) as the power setting. Another example would be setting **05**, which is a CW setting for setting the break-in speeds (which are FULL/100/200/. . . up to 1800 mS). These settings are all controlled by using the tuning knob to control the

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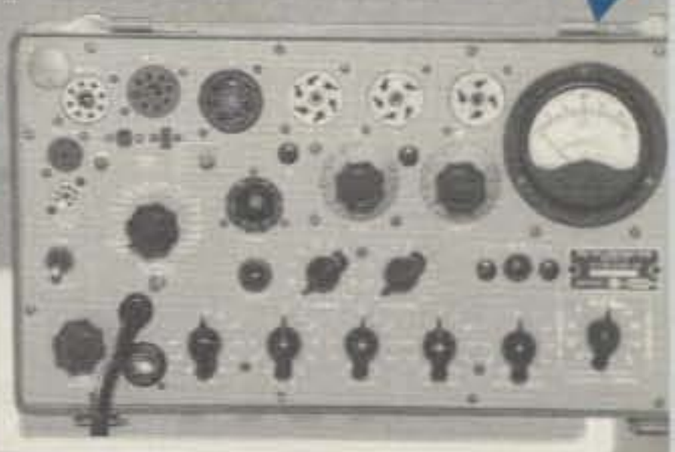

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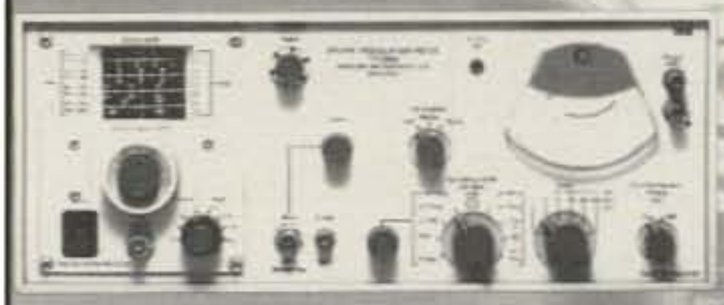

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- +23 to -120 dBm

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HP 5245L/5253B $299

Frequency Counter System

- Includes 5245L Mainframe (DC to 50 MHz) and 5253B Converter (50 to 500 MHz)
- Input voltage range of 50 mV to 1 VRMS
- Measures period, multiple period, average, ratio and multiple ratio
- Short term timebase accuracy of 2 parts in 10-10
- Eight-digit display
- The industry standard for many years
- Accepts other plug-ins

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HP 5254C $200

Counter Plug-In

- Covers 150 MHz to 3 GHz
- Sensitivity of -13 dBm to +13 dBm
- When used in HP 5248-series counters, this converter is only accessory plug-in required for up to 3 GHz coverage

HP 5255A $300

Frequency Converter

- Extends the range of the 5245L and 5246L counters from 3 to 12.4 GHz
- Can also be used as a direct counting prescaler from 1 to 200 MHz
- Input voltage range is 100 mV to 0.7 V
- Input impedance is 50 Ω
- Type N (F) input connector

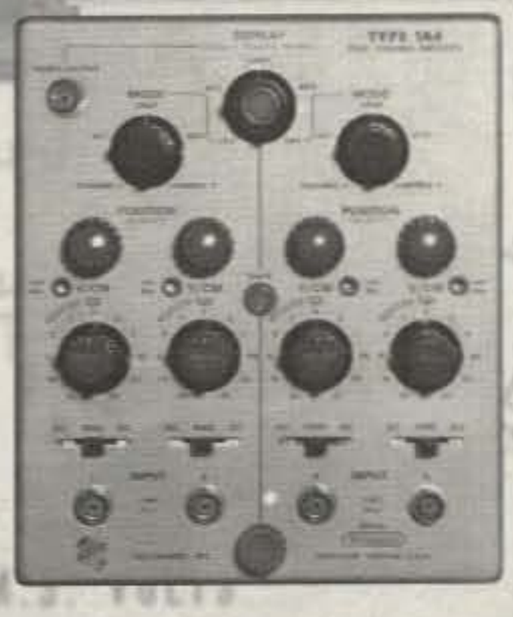
HP 334A $995

Distortion Analyzer

- Frequency range 5 Hz to 600 kHz
- Voltmeter range from 300 µV through 300 V in 13 ranges
- 0.1% full scale range
- Fundamental rejection > 80 dB
- Semi-automatic nulling
- RF detector input

TEK 1A4 $59

Four Trace Plug-In



- Solid-state design, FET inputs
- Used with TEK 500-series mainframes
- Deflection range: 10 mV to 20 V/cm, 11 calibrated steps
- Accuracy: ±3%
- Bandwidth: DC to 50 MHz
- Identical controls for all four channels, allows four channel adding: (±1 ±2) + (±3 ±4)
- Signal output

CIRCLE 165 ON READER SERVICE CARD

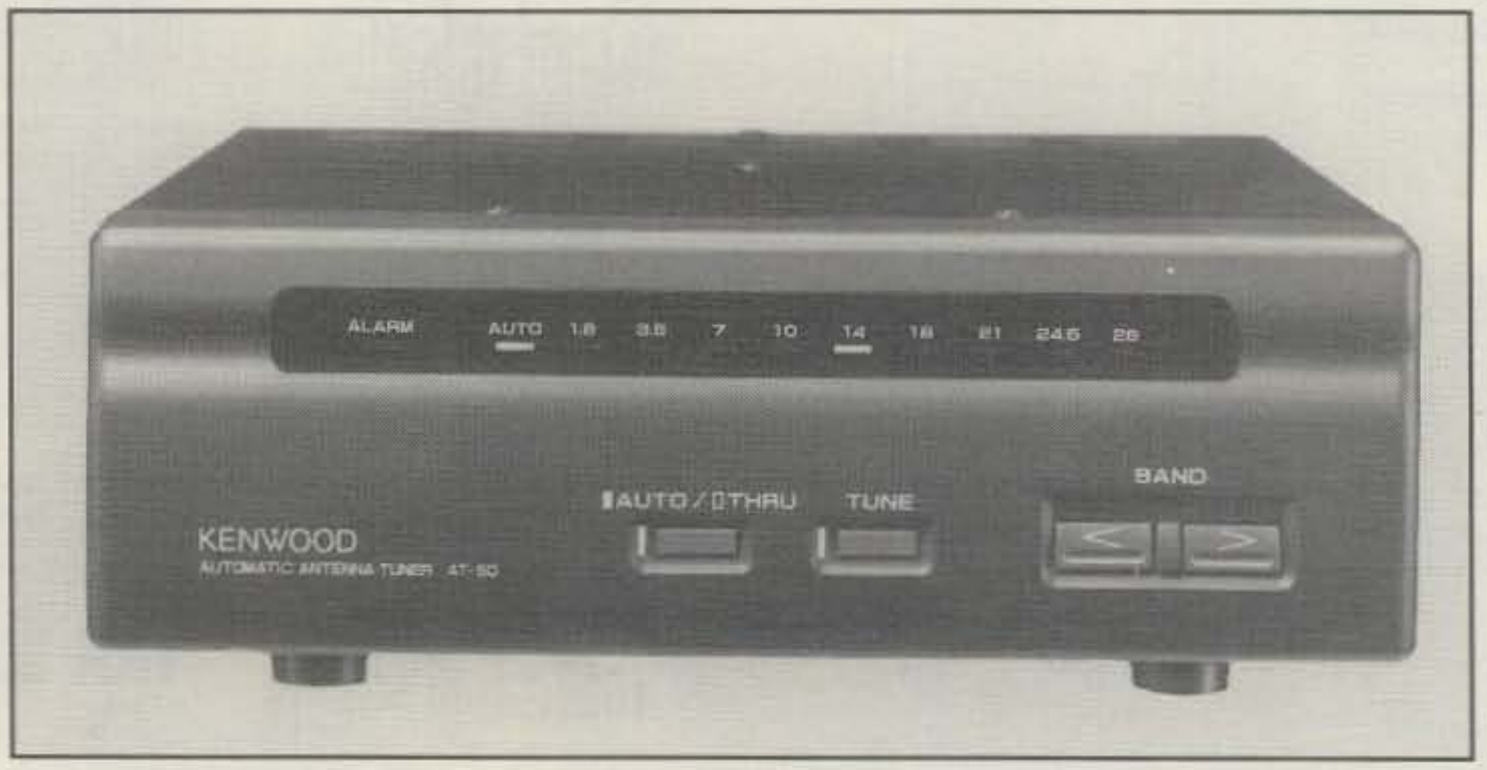
Menu No.	Description	Selections	Default	Reference page
00	RF output power switches through three levels (100, 50, and 10 W).	100/50/10	100	20
01	Display brightness switches through five levels.	OFF/d4/d3/d2/d1	d2	-
02	**AGC** mode switches between slow(S) or fast(F). (**SSB**, **CW** and **AM** only. No selection in **FM**.)	S/F	S (CW:F)	19, 27
03	IF filter select. (**SSB**, **CW**, and **AM** only. No selection in **FM**.)	0.5/2.4/6.0kHz	2.4kHz (AM:6.0kHz)	20, 22, 43
04	**SSB**/**CW** mode switches between two-steps (SSB) and three-steps (ULC).	SSB/ULC	SSB	17
05	**CW** keying delay switches between FULL (full break-in), or a value in milliseconds.	FULL/100/200/300/400/600/800/1000/1400/1800 ms	600	24
06	**CW** offset switches through the range of 400 to 1000 Hz in 50 Hz steps. Sidetone is fixed at 800 Hz.	400—1000	800	23
07	**CW** reverse function.	ON/OFF	OFF	23
08	Tuning control disable.	ON/OFF	OFF	-
09	Busy-Frequency Stop for program scan.	ON/OFF	ON	40
10	Busy-Frequency Stop for program scan switches between Time Operated (0) and Carrier Operated (1).	0/1	0	40
11	Busy-Frequency Stop for memory scan.	ON/OFF	ON	40
12	Busy-Frequency Stop for memory scan switches between Time Operated(0) and Carrier Operated(1).	0/1	0	40
13	Memory channel scan switches between all memory channels(ON)or only the desired channel group(OFF).	ON/OFF	OFF	37
14	RF meter sensitivity switches between X4 scale (ON) or normal(OFF). Only available with 10 W selected.	ON/OFF	OFF	20
15	Subaudible tone frequency. OFF may not allow repeater access.	ON/OFF	ON	20, 29
16	Frequency step size from microphone (**SSB** and **CW** modes only) switches through five step sizes.	10/100/1k/5k/10kHz	10kHz	49
17	Frequency step size from microphone (**FM** and **AM** modes only) switches through five step sizes.	10/100/1k/5k/10kHz	10kHz	49

Table I– MENU A is shown here. This will give the reader some idea of the various mode changes available.

menu number and the **UP/DOWN** mic buttons for the functions. I have included the tables for **MENU**s **A** and **B** to give you an idea of all the function changes available.

The actual tuning control bears some explanation. The tuning knob covers an increased tuning range as the knob is rotated faster. The range varies from 5 to 200 Hz steps. In other words, the faster you turn the knob the faster the tuning rate. Also, the **UP** or **DOWN** buttons on the panel and mic can be used for tuning, plus there is a one **MHz** switch on the panel that will increase the tuning rate greatly. To change bands you turn off the MHz switch and use the **UP/DOWN** buttons. RIT (Receiver Incremental Tuning) is also available. When switched on, the RIT shift value is shown on the panel.

As I stated earlier, there are 100 memory channels available. Numbers 00 through 98 store either simplex or split (duplex) frequencies. Number 99 stores **SCAN** start and end frequencies or simplex frequencies. Several parameters can be stored in channels 00 through



Front view of the matching antenna tuner, Model AT-50.

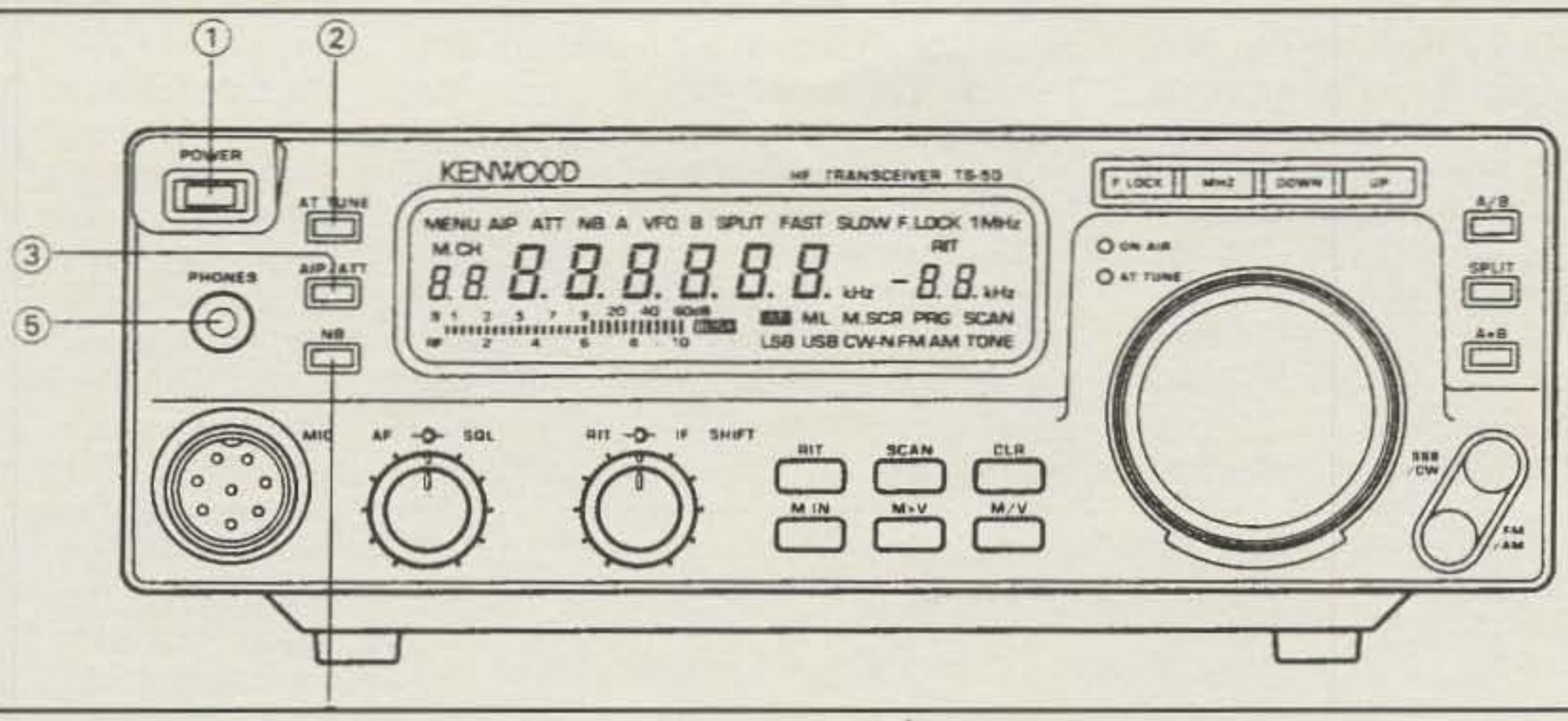


Fig. 2– In this drawing from the manual all the controls on the panel are shown.

Menu No.	Description	Selection	Default	Reference page
50	Beep sounds when any button is pressed.	ON/OFF	ON	43, 54
51	Modulation mode select switches between Morse(**ON**) or beep(**OFF**).	ON/OFF	ON	43
52	Alarm output switches between Morse(**ON**) or beep(**OFF**).	ON/OFF	ON	44
53	Tone frequency select for repeater access (39 tones)	67.0~250.3Hz, 1750Hz	88.5Hz	20, 29
54	Tone frequency type for repeater access (b: burst, c: continuous)	b/c	c	20, 29
55	Peak Meter Hold.	ON/OFF	ON	20
56	Memory channel automatic increment after data is stored.	ON/OFF	OFF	—
57	Tuning control able to change frequency in Memory Channel mode.	ON/OFF	OFF	—
58	Program Scan Hold.	ON/OFF	OFF	39
59	Memory Protect 1. ON prevents writing to or clearing any memory channel.	ON/OFF	OFF	14, 35
60	Memory Protect 2. ON prevents overwriting or clearing memory channels containing data.	ON/OFF	OFF	14, 35
61	AM Broadcast band(522 to 1620 kHz) frequency step size switches between two sizes in AM only. (U.S.A./Canada: 522 to 1710 kHz)	9/10kHz	9kHz*	49
62	1 MHz button frequency step size switches between 1 MHz and 500 kHz.	1000/500kHz	1000kHz	15, 36, 41
63	RIT maximum frequency shift switches between two values.	1.1/2.2kHz	1.1kHz	41
64	Automatic Power Off.	ON/OFF	OFF	42
65	PTT switch disable. ON prevents PTT from functioning.	ON/OFF	OFF	49
66	Microphone gain switches between high(H) or low(L).	H/L	L	22, 26
67	Microphone **PF1** key assignment.	00~99	83(Menu A)	49, 50
68	Microphone **PF2** key assignment.	00~99	00(Power Select)	49, 50
69	Microphone **PF3** key assignment.	00~99	36(TF-SET)	49, 50
70	Microphone **PF4** key assignment.	00~99	82(Monitor)	49, 50
71	**LSB** transmit carrier point shift. (10 Hz steps)	-100~+200	000	44
72	**USB** transmit carrier point shift. (10 Hz steps)	-100~+200	000	44

U.S.A./Canada: 10 kHz(Use Menu A, No.17 to vary step size)

Table II– Here is MENU B, showing available function changes.

99. These include transmit-receive frequencies, modulation mode, filter bandwidth, lock-out on or off, AGC fast or slow, and tone frequencies. There is a built-in tone generator for repeater access which is set via MENU B.

An important feature in this day and age is that the TS-50S has two complete VFOs—**VFO A** and **VFO B**—and of course split-frequency operation is possible. This is very important for DX work and other amateur activities. They are both "full blown" VFOs, and all the features of the transceiver are available for both VFOs.

The S-meter is the digital straight-line type. One thing about using the meter that I liked occurs when checking the signal strength of received signals. A small black bar is moved out with the signal, making it easy to read the "highest" strength received. We old timers have become so ingrained using needle-type meters that it does take a little getting accustomed to with these newer methods. I personally like the digital readouts.

What is my bottom-line thinking about this latest transceiver? Before I answer that I would like to make a statement. I have been accused by my "friends" of never giving a bad review. That is definitely not true. I may have been guilty of not providing enough details and other items, but when writing reviews, the reader should keep several points in mind. The review is definitely the opinion of the reviewer. In my case, I have all the exotic test equipment one could want to run any test on the equipment. It would be simple, therefore, to write a review that has loads of graphs and charts explaining third-order products, intermodulation distortion, mixer noise, and on and on. Having done this for so many years, however, I don't believe the reader gives a darn, and such material quickly "turns off the reader."

As I said at the beginning of this review, the TS-50S is going to open a whole new world of amateur radio to many newcomers. Some new techniques are introduced. For example, we all are accustomed to having a front-panel RF and microphone gain control to adjust. Instantly, my reaction was "What gives?" But on using the transceiver, I quickly realized that a panel-mounted control just wasn't necessary. In my opinion (and I stress *my opinion*) the lack of a panel-mounted control is no big deal.

I mentioned earlier that I have large hands. If I had a complaint, it would be that the main tuning knob would be helped by a "spinner" control knob. Maybe this review will convince someone at Kenwood to add such a device. Frankly, after days of testing and using this transceiver, with it sitting on top of a larger conventional transceiver, I think I will continue to use the larger transceiver simply because of additional and

easier to use controls. However, there is no doubt that I very much want to own a TS-50S. I do a lot of RVing, and mobile homes have little space to spare. Obviously, the TS-50S is a solid answer to this problem, plus its general-coverage receiver comes in mighty handy. So the bottom line: What do I think of the TS-50S?

The receiver is very good. It is quiet, which means more technically, it has a low noise floor. Weak-signal detection is excellent. The selectivity is more than adequate. However, the bands are getting so crowded that one may be inclined to blame selectivity performance on any transceiver. But if two or more stations are using the same frequency at the same time, forget it. How is the unit in mobile operation? I haven't previously mentioned the noise limiter, but it is excellent. It certainly knocked down ignition noise very well. I should mention that my car has dual air bags. Be sure when installing a mobile unit such as the TS-50S not to interfere with the safety features in your car.

In mobile operation I liked the mic control buttons for controlling the transceiver. They are handy when one is driving. Also, the TS-50S panel readout is bright and easy to see.

Kenwood manufactures a matching Transmatch (antenna tuner), the AT-50. This tuner is very close to the same size as the TS-50S. Its power requirement is 13.5 volts at 2 amperes, which it obtains from the TS-50S via a cable. The tuner data claims that it will match antenna loads from 20 to 150 ohms. However, I made extensive tests into various antenna loads, the worst of which was an extended 80 meter Zepp using open-wire feeders. These antenna loads varied quite widely from the "20 to 150 ohm" figure.

The Zepp feed line was connected to the 50 ohm output of the tuner via the 4 to 1 balanced to unbalanced transformer I described a few months back. The procedure for tune-up consists of reducing the output power to 10 watts from the transceiver and then pressing the A-T button on the rig. The tuner then goes through its motions, looking for at least a 1.2 to 1 match. Once this is achieved, it shuts down. The action can take as long as 15 seconds. I was impressed by how easily the tuner matched the "crazy" load presented to it by the Zepp antenna on some bands. I also tested the setup mobile using a mobile antenna made by Kenwood. Again, the tuner easily matched the antenna load.

I should emphasize that the tuner is an automatically tuned device in that it senses the load and electronically switches components in and out until it achieves the correct combination for a match. Once the match is achieved at 10 watts, you can increase the transceiver output to 100 watts and the tuner remains matched.

The tuner circuit is quite complex, using a CPU chip to sense the mismatch. Once sensed, the information is fed to the various circuits to change component values to achieve a 1.2 to 1 or better match.

It is obvious from this review that I liked the transceiver. (There go my friends again!) I know I'll figure out a way to make a "spinner" knob, and if I do I'll let you know.

The TS-50S is manufactured by Kenwood Corporation, 2201 E. Dominguez Street, Long Beach, CA 90801-5745. The list price is $1199.95. The PS-53 AC supply sells for $249.95, and the matching AT-50 antenna tuner is $329.95. The optional CW filter, the (YK-107C) is $98.95.

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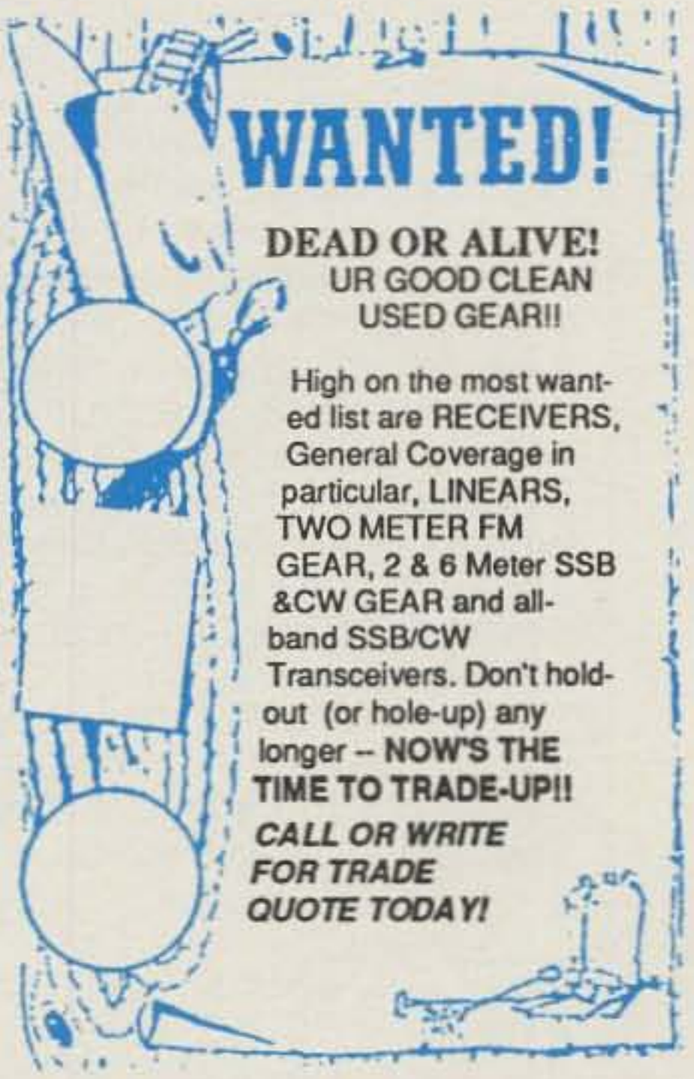

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CIRCLE 177 ON READER SERVICE CARD

Spectrum auctions make for great philosophical discussions, but hard currency speaks volumes.

Currents

"Going . . . Going . . . Sold"

BY RAY KOWALSKI*

President Clinton's State of the Union address in February focused entirely on the economy. Although the subject of spectrum auctions was not specifically mentioned by the President, the President's detailed, written plan submitted to the Congress the next day does contain an endorsement of the concept of spectrum auctions. If adopted—and adoption, in some form, now seems likely—this could have profound implications for all users and would-be users of the radio spectrum.

First, some background. The electromagnetic spectrum is a natural resource. It can be used to support an unlimited variety of valuable services, and it is never depleted by use. In fact, it is wasted when it is not used. This resource belongs to the public at large, but it cannot be used at will by every citizen, because intolerable interference would result.

For this reason, Congress in 1934 established the Federal Communications Commission to oversee the orderly and productive use of the spectrum. Although the spectrum continues to belong to the public, the FCC gives individuals or companies certain rights to use the spectrum. In other words, on behalf of the general public, the FCC grants a license to individuals or companies to use the spectrum. In return, the licensees must use the spectrum to serve the public interest in some way. (I have long felt that the Amateur Radio Service's tradition of communications in emergencies fulfills this requirement on behalf of all its licensees.)

The value of an FCC license depends upon the nature of the communications service which it supports. A private, land mobile, dispatch license which authorizes a ready-mix concrete company to communicate by radio with its trucks may not even be recognized as a valuable asset by the company. The radio frequency is probably shared with other companies, and if the company did not use radio, it could still be in the ready-mix concrete business.

A commercial television broadcast license, on the other hand, may be worth millions of dollars. The license authorizes the broadcaster to use, on an exclusive basis, one of a limited number of channels available in the community. Without the license, the broadcaster's cameras, studios, and transmitting equipment are virtually worthless.

Regardless of the actual value of the FCC license, as illustrated by the above extremes, the FCC license is, essentially, free. True, the FCC now charges a processing fee for most license applications, but no charge is made for the *value* of the license itself. However, the FCC's experience in licensing cellular radio telephone systems may change that.

Licensee Selection

A cellular license is like a broadcast license in that it may be used by the licensee to provide a for-profit communications service—in this case, mobile telephone service. The license is held on an exclusive, non-shared basis, and the number of available licenses in the community is limited to two.

Historically, whenever more than one entity simultaneously applied for a particular broadcast license, the FCC would decide the winner of the license by means of a comparative hearing. The hearing was conducted by an administrative law judge, who took testimony, received documents into evidence, and made a decision as to which applicant would better serve the public interest. This was a costly and time-consuming process, which usually featured a seemingly endless series of appeals and remands. The process could take several years.

The FCC and Congress were determined to avoid the comparative hearing process when it came time to award cellular licenses. Reasoning that there is no decisional difference among basically qualified applicants, the solution was to select the licensees of cellular systems by random selection—i.e., a lottery. For a few astute applicants, this solution turned out to be better than "Lotto America."

The winners of the lotteries were soon approached with buy-out offers. Many of the licenses were sold to the highest bidders. Applicants who had only paid a few hundred dollars to engineering consultants for the preparation of their applications sold their licenses for millions. Some never even built the systems, and consequently they never served the public interest. Yet they made a fortune simply by disposing of their initial operating authority.

This did not escape the notice of Congress and the FCC. Here were millions of available dollars, which could have been paid to the United States Treasury; instead the money was paid to private parties, who essentially auctioned off the licenses to the highest bidders. The debate about whether to authorize the FCC to select licensees by auction has raged ever since.

Spectrum Auctions

The opposition to the auction idea has always been that only "deep pockets" would be able to acquire spectrum. However, now that the President and the Congress seem willing to reach into these deep pockets in the interest of reducing the national debt, it appears

*Keller and Heckman, 1002 G St. NW, Washington, DC 20001

that the spectrum auction idea may finally take hold.

One of the prime examples of spectrum that is available for auction is at 900 MHz, where the FCC is looking to create nationwide and regional commercial dispatch systems, known as Specialized Mobile Radio (SMR) systems. In a Further Notice of Proposed Rule Making in PR Docket 89-553, the FCC has already stated that it would select licensees by "competitive bidding" (auctions) if the Communications Act were amended to permit it.

Other proceedings are also pending where auctions may come into play. For example, in ET Docket 92-9 the FCC is looking to clear a microwave band of existing users for the introduction of new technologies. One of these technologies, Personal Communications Systems, is proposed in General Docket 90-314. The FCC has specifically identified auctions as one way to select the licensees of such systems.

Similarly, the FCC is proposing to introduce commercial, private carrier, dispatch systems in bands below 800 MHz in PR Docket 92-235, a proceeding which it calls "Spectrum Refarming." Once again, auctions are being considered as the means for choosing the licensees of national and regional systems.

Perhaps the best-known source of "new" spectrum that might be available for auction is spectrum that currently is being used by the federal government. Now that the cold war is over and we've won, there is considerable interest in diverting resources from the federal government, especially the military, and employing these resources in civilian pursuits. One of these resources is radio spectrum.

There are presently four bills in Congress—H.R.707, H.R.857, S.335, and S.19 (Subtitle B)—each of which is known as "The Emerging Telecommunications Technologies Act of 1993." The underlying premise of each bill is that there is not enough nongovernment radio spectrum available to support the proposed new generation of commercial wireless communications services. Each bill also recites that the government does not need or use all of its allotted spectrum efficiently and could stand to give up some of it. These bills would require the federal government to identify a total of 200 megaHertz of spectrum and turn it over to the FCC for licensing to proponents of emerging communications technologies.

Three of these bills would give the FCC authority to select licensees by means of spectrum auctions. These bills recognize that substantial revenues could be derived from the spectrum

auctions, which would enhance the U.S. Treasury without adding to the tax burden. (If any of this sounds familiar, go back and reread my article in the April issue.) In light of the President's endorsement of the idea, there is an excellent chance that authority for the FCC to conduct spectrum auctions, perhaps at first on a trial basis, wil be enacted in this session of Congress.

Impact On The Amateur Service

At this writing, hearings and mark-up sessions are now in progress. In other words, lobbyists all over Washington are either trying to put something in or take something out of the final version that will be adopted. In this regard, I note that the bills as presently drafted would exempt "amateur operator services" from being subject to spectrum auctions. So amateurs don't have to worry about their spectrum, right? Not so fast.

What that exemption means is that individual amateurs would not have to bid for the right to be licensed. It does not mean that spectrum now allocated to the Amateur Radio Service could never be re-allocated and auctioned off.

If federal government agencies who use spectrum in the national defense and for other vital purposes are not beyond the reach of a spectrum grab, why should amateurs think that the Amateur Radio Service would be? The FCC's Chief Engineer, testifying before the Subcommittee on Communications of the Senate Committee on Commerce, Science and Transportation in support of S.335, stated,

"While 200 MHz may seem like a lot of spectrum, the demand for spectrum for commercial purposes will continue to grow unabated. . . . Therefore, it may well be possible to reallocate even more spectrum over time . . ."

He was talking about obtaining even more government spectrum for non-government use. But it does not take a genius to figure out that before the government is called upon to give up more spectrum, someone is going to want to examine what other sources of spectrum might be available from non-government sources. The Amateur Service comes to mind.

Although the current debate in Congress is about who should have to acquire spectrum by auction and who should be able to get it for free, it must not be forgotten that the impetus for spectrum auctions is coming from the prospect of revenues. According to the President's economic growth package, spectrum auctions could generate $4 billion in the first 4 years alone. Once the government becomes addicted to these revenues, its appetite for more will be nearly insatiable. There will be incentives to examine every possible source of auctionable spectrum. In years to come, this will place enormous pressure on the Amateur Radio Service, especially if someone gets the notion that the same number of users can get by with a smaller amount of spectrum.

User Fees

In the nearer term, a secondary impact of spectrum auctions will be the imposition of user fees. User fees are the annual fees that licensees would pay for the use of the spectrum. This is not the same as the one-time application fee, which is intended to defray the FCC's actual cost of processing an application for a license.

Since spectrum auctions initially would only apply to new licensees of commercial services, it is natural to expect these new licensees to complain that they need a "level playing field" to compete against existing commercial service providers who did not have to pay for their spectrum. The obvious way to accomplish that would be to impose annual use fees on spectrum users.

The appeal of user fees is that they are perceived to be fair and universal. They could be applied to every licensee, whether they are commercial users of spectrum or not. After all, should a rancher who grazes cattle on federal land expect to be able to market the cattle for profit and not pay something for the pasturage? The same thinking applies to telecommunications licensees.

Historically, the Amateur Radio Service has been able to exempt itself from or greatly reduce its liability to fees, such as application processing fees. I am not sure, however, that that will continue to be a wise approach. A service that not only does not pay its own way but also is a burden on the rest of the system is a candidate for major downsizing in a revenue-maximizing environment.

The strength of the appeal to politicians of spectrum auctions and user fees cannot be overstated. The income represents non-tax revenues which can make a significant contribution to deficit reduction. So far, the Amateur Radio Service is not subject to the pull of this force. But we see this force eventually having an effect.

Deep Thoughts

Finally, let me pose this question for the philosophers and economists who might read this. When people pay for their spectrum, either through bidding at a spectrum auction or through user fees, or both, what becomes of the public interest? As I mentioned at the outset, the *quid pro quo* for a free license had always been service in the public interest.

If the license is, essentially, purchased, do licensees still owe the same duty to the public at large to operate somehow in the public interest? If the license is purchased, does the licensee now have property rights in the license? If so, is the FCC's right to regulate the use of this property diminished?

Perhaps you might think that this is far afield from amateur radio. But I said when I began this series that we would not be limiting our discussion merely to amateur radio. Moreover, spectrum is spectrum, and like Einstein's laws the same considerations apply, in varying degrees, throughout the spectrum universe.

(Ray Kowalski is a partner in the Washington, D.C. law firm of Keller and Heckman, where he practices telecommunications law. For 19 years Ray was an official of the Federal Communications Commission. He was responsible for the Amateur Radio Service from 1980 to 1988, when he left the FCC for the private practice of law. He can be reached at 202-434-4230.)

MFJ *halfwave vertical* Antenna

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

Operate 40, 20, 15, 10, 6, 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! You can mount it anywhere from ground level to the top of a tower -- on apartments, condos, small lots, even on a motorhome. You can take it anywhere -- vacations, field day, DX-pedition, camping, nearly anywhere you go.

Frequency selection is fully automatic -- there are no moving parts, nothing to adjust -- all you do is transmit. It handles up to 1500 watts PEP. You'll work your share of DX because its *low angle of radiation* really reachs out and brings in DX.

During a contest, you'll love being able to *quickly* work one station after another from all directions because of its omni directional pattern.

It's so easy to put together that you can have it on the air in an afternoon.

How does MFJ achieve maximum efficiency in such a compact multiband antenna?

The key is *end loading* -- the most efficient form of loading known. The *entire length* of the antenna is always radiating power. There are no lossy traps to reduce effective length.

End loading provides multibanding and full electrical half wavelength on each HF band. An *optimum* combination of capacitive hat and inductive end loading delivers a close 50 ohm match without a lossy impedance matching network.

Efficient high-Q loading coils are wound on low loss *ceramic* forms. Large 1-inch diameter aluminum radiators are used to keep losses to a minimum.

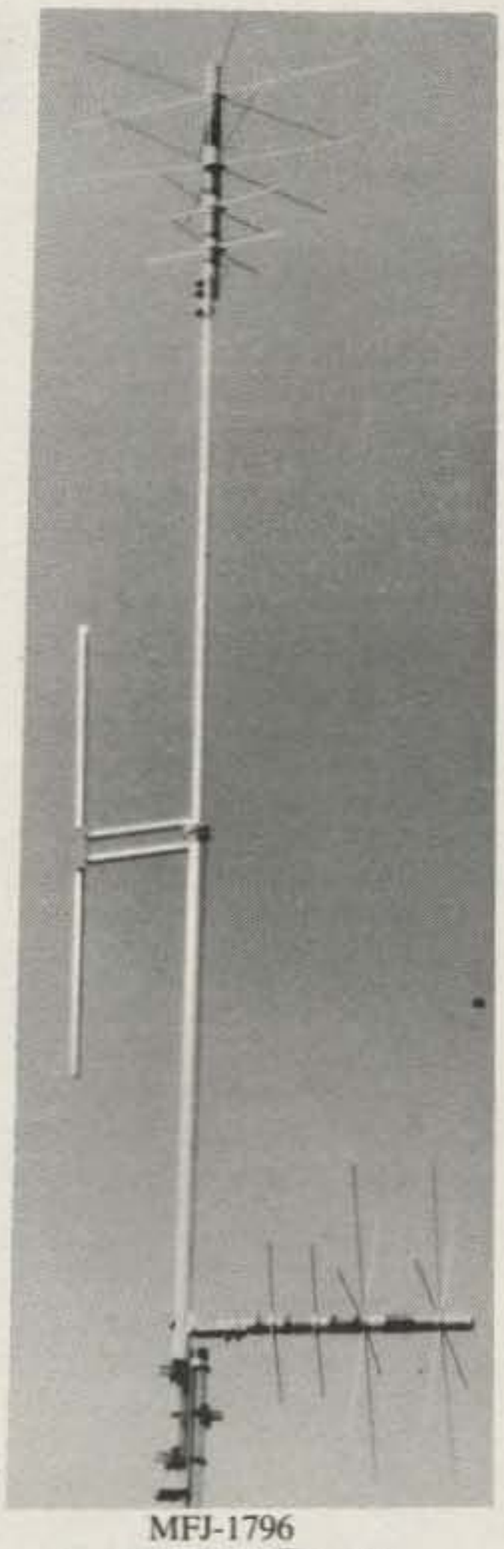
No Radials or Ground *ever* Needed!

The MFJ-1796 is balanced and center fed to totally eliminate the need for radials, counterpoises or a groundplane -- you don't have the kind of ground losses that's common with a quarter wave vertical.

No Feedline Radiation

There is no feedline radiation that causes pattern distortion and wastes power. The 50 ohm Teflon® coax feedline exits through the bottom radiator from a low impedance point -- the loading unit is mounted at right angles to decouple the feedline and to provide a low impedance point.

The feedline is further decoupled and isolated from the antenna with a highly efficient *air-wound* choke balun. This decoupling attentuates RF on the outside of the coax and minimizes feedline radiation that waste useful power.



MFJ-1796

$199.95

Easy to Adjust

It's very easy to optimize the MFJ-1796 for your favorite part of the band. Frequency adjustments are nearly independent -- adjusting one band has minimum effect on the resonant frequency of the other bands -- unlike most other multiband antennas.

Built to Last

You get an antenna built with heavy duty, extra thick wall aluminum radiators, machined aluminum parts and stainless steel hardware.

The coils are wound on tough *low loss* ceramic forms using durable *Teflon®* covered wire that's highly weather resistant.

Full halfwave on 2 and 6 Meters

On 2 Meters and 6 Meters, MFJ's unique stub decoupling and efficient full size halfwave elements really get you out with low angle radiation for lots of DX.

The *most* for your Money

For $199.95, the MFJ-1796 gives you the most for your money -- no other multiband, automatic band-switching, ground independent DX antenna even comes close.

No Matter What™ Guarantee

You get MFJ's famous one year *No Matter What*™ *unconditional* guarantee. That means we will repair or replace (at our option) your MFJ-1796 *halfwave vertical* antenna *no matter what* for a full year.

Continuing Service

MFJ Customer Service Technicians will help you keep your *MFJ halfwave vertical* performing flawlessly -- no matter how long you own it. Just call our toll-free help line 800-647-TECH (8324) -- *an MFJ exclusive.*

Made in USA

MFJ halfwave verticals are made in the USA. Help our fellow Americans by keeping our money here -- buy Made in USA.

Call Your Dealer for Your *Best* Price Today

Enjoy DXing and ragchewing on six bands from your apartment, condo or anywhere. Call your favorite dealer for your best price and order your MFJ *halfwave vertical* today!

Shortwave *Regenerative* Receiver *Kit*

MFJ-8100K

$59.95

Remember hunching over your regenerative receiver for hours with a pair of phones pressing uncomfortably against your ears?

You could hear just about anything that fancy superhets could hear. Sure, you had to play around with the regeneration control just right and have a steady hand to tune but you could hear'em.

Don't you wish you could relive some of this fun and excitement of your youth — share some of it with your kids and grandkids?

Well, you can – with the MFJ-8100 *World Band* Shortwave Radio *Kit.*

Spend a fun evening with your child or grandchild and help him put this simple kit together. When you two finish, watch him glow with excitement as he tunes the world bands – just like you did – and remember for life.

This baby performs. It has an RF stage to really pick up the weak ones and it goes into regeneration smoothly without pops or dead spots. Stations all over the world will come in loud and clear with just a 10 foot wire antenna.

Listen to international shortwave broadcasts, hams on SSB and CW, WWV, RTTY, packet and much more. Covers all or part of 75/80, 49, 40, 30, 31, 20, 25, 22, 19, 17, 16, 15, 13 Meters in five bands.

It has vernier reduction drive, bandswitch, volume and RF gain controls, uses a 9 volt battery and is built into a rugged aluminum cabinet.

Two earphone jacks let you and your child or grandchild listen together with your Walkman style earphones or plug-in speakers. 7x6x2½ inches.

Order one as a gift for your child or grandchild . . . or for yourself.

MFJ-8100K, $59.95 kit; MFJ-8100W, $79.95 wired and tested.

Teflon® is a registered trademark of Dupont.

300 KHz-200 MHz Active Antenna

MFJ-1022

$39.95

Wish you could hear everything your expensive general coverage transceiver or receiver is capable of receiving?

Your ham band only antenna does great in the ham bands . . . but plug this new MFJ all band *active* antenna into your general coverage transceiver or receiver and you'll hear strong clear signals from all over the world from 300 KHz to 200 MHz--including low, medium, shortwave and VHF bands.

You'll enjoy up-to-the minute international shortwave newscast, ship-to-shore, airline, commercial RTTY and even military traffic. Use your data controller to receive FAX news photos, weather maps, Navtex and more.

Take it on trips and use it with your mobile or QRP rig to listen.

Also improves weak noisy scanner radio reception from low band to high band VHF — hear signals you couldn't hear before.

A J-310 FET handles strong signals and a new *noiseless feedback* circuit gives you excellent low noise reception. A 4.5 GHz MRF-901 transistor lets you receive weak signals well into VHF.

Detachable 20 inch telescoping antenna. Uses 9 volt battery or 110 VAC with MFJ-1312B, $12.95. 3⅓x1¼x4 inches.

Nearest Dealer/Orders: 800-647-1800
Technical Help: 800-647-TECH(8324)

• 1 year unconditional guarantee • 30 day money back guarantee (less s/h) on orders from MFJ • Free catalog

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(601)323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (601) 323-6551; Add s/h.

MFJ . . . making quality affordable

Prices and specifications subject to change © 1992 MFJ Enterprises, Inc.

CIRCLE 179 ON READER SERVICE CARD

The 1992 CQ WW SSB Contest High-Claimed Scores

The following are SSB high-claimed scores. These are raw scores only, subject to verification.

WORLD ALL BAND

HC8A	16,516,968
EA8BH	14,485,769
9Y4H	11,449,152
ZD8Z	11,237,418
KP2A	10,848,925
P4ØW	9,952,704
VD3EJ	8,598,306
8R1K	8,215,144
ED8TK	8,050,716
K1AR	7,970,382
9M8R	7,915,505
S52AA	7,575,625
KM1H	6,449,296
OE6MBG	6,189,156
GW4BLE	6,072,632
4U1ITU	5,810,496
N6BV/1	5,265,230
KL7Y	5,233,920
DJ4PT	5,179,884
WR6R/KH6	5,001,216
3G3R	4,957,179
N2LT	4,791,042
YU7AV	4,720,267
W3BGN	4,249,182
N5RZ	4,221,084
JAØQNJ	4,083,723
5U7M	4,031,973
GMØECO	3,914,526
W9RE	3,879,230
K3ZO	3,863,856
RY7D	3,848,949
K2DM	3,842,289
JH5FXP	3,742,080
W2HPF	3,715,408
V47KP	3,615,462
DL8PC	3,608,640
JH7PKU	3,574,796
OG8LQ	3,535,760
DU9RG	3,509,568

28 MHz

ZW5B	2,971,218
LU6ETB	1,913,455
ZS6EZ	1,837,010
PJ9M	1,784,225
A22MN	1,748,304
IT9A	1,630,134
CE6EZ	1,401,236
CX5BW	1,315,965
LU1FOW	1,230,600
ZD8LII	1,155,132
OG1M	942,480
S59DKS	872,942
LU2QC	853,580
N4RJ	825,920
LU4MEE	776,164
KS1L	774,046

21 MHz

ZV5A	2,012,485
NP2E	1,795,248
VD7SV	1,685,502
JAØJHA	1,553,100
OK1RI	1,422,624
S58AB	1,296,364
LZ5W	1,234,135
K5MR	1,187,865
S57EK	1,164,205
WØUN	1,105,212
HAØMM	1,075,425
EH4MC	1,004,895
G4CNY	959,112
PJ9O	949,560
LZ4IM	922,944
AH6JR	919,320

14 MHz

PJ9P	2,000,808
OH2BH	1,894,102
IR4T	1,821,695
SM2EKM	1,706,036
5Z4BI	1,513,876
VO1QF	1,274,416
PR5T	1,266,092
9A7A	1,224,883
S57DX	1,160,707
G3FXB	1,125,168
7L1GVE	1,086,800
S59VM	1,048,194
YV5A	1,028,960
KG6DX	986,328
K4XS	961,576
K1RU	867,043
F2EE	802,464
OK3KFF	770,553

7 MHz

PJ9E	1,028,104
S59UN	929,075
FM5CD	817,260
H21A	750,120
V7MHZ	736,830
ZB2X	556,160
I8UDB	525,431
FR5DX	502,002
VD3CDX	501,714
IK3ORD	496,716
JA8IXM	487,396
DL8OH	467,043
AM92KW	466,992
TF3CW	456,540

3.8 MHz

TM5C	295,260
K1ZM	229,295
OH7UE	170,409
G3NAS	170,200
W6RJ	146,475
WE3C	139,788
S51NA	138,462
YV5MRR	126,242
S59KAB	109,204
S57AL	107,601

1.8 MHz

9A1HCD	60,450
4X4NJ	51,156
IV3PRK	46,546
UA9AT	39,558
S57AV	36,725
OH4NRC	34,782
G3KMA	30,954
WB9Z	22,557
OK1JDX	19,292
YV2IF	18,700

LOW POWER ALL BAND

TJ1GG	5,947,269
KH8/WB7RFA	4,378,752
VP2MBA	2,517,358
P29KH	2,194,836
VY2SS	2,084,500
YJØC	2,029,601
NH6T	2,009,128
N8II	1,970,400
II2A	1,895,355
7Q7XX	1,692,047
EA3BKI	1,291,836
KG1D	1,269,632
F6FGZ	1,264,788
KØEJ/4	1,257,608
CU3LF	1,229,844
EA8BWW	1,194,026
JK7EIG	1,191,424
WA2UUK	1,174,947
K4VUD	1,170,792
N6WLX/8	1,142,718
KB3MP/4	1,102,851
ON9CJM	1,039,600
NP2I	1,028,925
WB9IQI	1,017,720
XE1KK	1,013,508
4X6DK	1,006,992

28 MHz

FK8FU	812,110
4X4VF	678,561
AM6VQ	458,283
TL8NG	379,960
JH7XMO	359,310
KE5FI	309,792
LU3HIP	308,664
JHØZHQ	303,615
AP2MYC	298,352
EA6LA	294,508
WB5CRG	262,626
LU6EJP	253,277
VO2AA	247,400
SV3AQR	246,268
JH6SQI	244,200
KHØAS	241,045
OG3MFT	225,295
EI5DI	223,768
W4MM/KP4	218,579

21 MHz

CT3BD	926,652
OA4ANR	596,124
I5JHW	499,500
IV3KYQ	431,254
JF4ETK	423,465
VO1SF	411,012
LU2NI	404,624
JR7OMD/2	381,819
DU1EIU	342,888
VE6BMX	330,660
JA7ZWD	323,592
JF1LLT	315,348
IK1LBL	313,082
JHØEPI	306,285

14 MHz

YO4NF	541,960
YV4DSB	346,035
CQ7BWW	330,660
UA4WII	318,396
YL2GN	136,528
JA7DOT	122,100
JH7XVB	114,938
JEØUXR	114,376
K9YNF	113,573
SP6PAX	111,150
SM5BDA	110,952
SM3EDF	103,887
KD5IA	102,000

7 MHz

TG9AJR	395,488
S59CM	166,980
JA1LZR	132,348
N1XZ	69,906
FD1OZF	67,275
UB5QMA	60,145

3.8 MHz

S59ZA	70,240
SP5ZIM	55,230
S59ZZ	48,519
OK1DWX	46,716
AM5CGU	43,688
F6BVB	35,560
9A3QK	25,020
LZ1DM	22,500
K4UTE	22,356
YO3RU	21,660
AM3FQV	20,087

1.8 MHz

SM5AQD	35,402
OZ3SK	33,198

QRP ALL BAND

4M1G	2,587,688
K7RI	946,430
AA2U	890,923
KØLUZ/4	385,506
SM3CCT	355,725
N1AFC	342,482
LY3BA	340,360
IK1GKE	327,624
WT3W	286,890
NY3Y	231,028
N8CQA	199,215
OH5NHI	149,186
YU1KN	148,216

ASSISTED ALL BAND

WM5G	6,729,546
K3WW	5,323,409
DJ2YA	4,759,158
W1PH	4,296,240
JA8RWU	3,912,000
N2MM	3,861,000
KØRF	3,772,993
KC1F	3,596,724
K1IU	3,488,198
WB2K	3,270,075
WR3E	3,252,447
KZ3H	3,018,168
IK1GPG	2,866,696
DF8WS	2,773,980

MULTI-OPERATOR SINGLE TRANSMITTER

IQ4A	17,018,349
VP2EC	16,601,376
VP9AD	16,544,712
8P9Z	15,335,536
P4ØJ	14,134,362
ED9DX	13,031,200
CR3M	12,781,964
V31DX	12,467,232
UW2F	11,683,776
ZF8AA	11,468,574
Y34K	10,993,086
KP4GY	9,815,298
OH5NQ	9,363,104
F6BEE	9,283,410
PUØF	9,042,656
DLØWW	8,801,782
OK5W	8,660,837
VD7ON	8,536,812
K1DG	8,504,020
VP5S	8,422,785
YS1X	8,239,161
OT2L	8,063,770
6D2X	8,030,952

MULTI-OPERATOR MULTI-TRANSMITTER

PJ1B	44,083,305
9A1A	27,469,890
GØKPW	25,065,045
CEØY	23,095,515
OHØW	21,624,124
N2RM	20,108,660
OT2C	20,011,344
HCØE	19,190,288
HG73DX	18,242,520
CT5P	17,684,308
W3LPL	17,287,429
6V6U	17,222,168
GW8GT	17,162,460
DLØCS	15,256,176
K2TR	14,933,632
K3LR	14,741,688
NX1H	13,348,944
LU4FM	13,270,268
AA6TT	12,386,088
RLØL	11,618,131
ZM2K	11,364,613
RY1I	11,107,200
VD1DH	11,011,200
VE7ZZZ	10,863,854

USA ALL BAND

K1AR	7,970,382
KM1H	6,449,296
N6BV/1	5,265,230
N2LT	4,791,042
W3BGN	4,249,182
N5RZ	4,221,084
W9RE	3,879,230
K3ZO	3,863,856
K2DM	3,842,289
W2HPF	3,715,408
N6AR	3,592,904
W1WEF	3,383,280
W9ZRX	2,961,076
KØKX	2,913,576
W9UP	2,566,707
N7TT	2,537,325
N7AVK	2,465,617
NN7L	2,333,296
KE2NL	2,227,050
AA2GQ	2,190,300
WZ4F	2,002,536

28 MHz

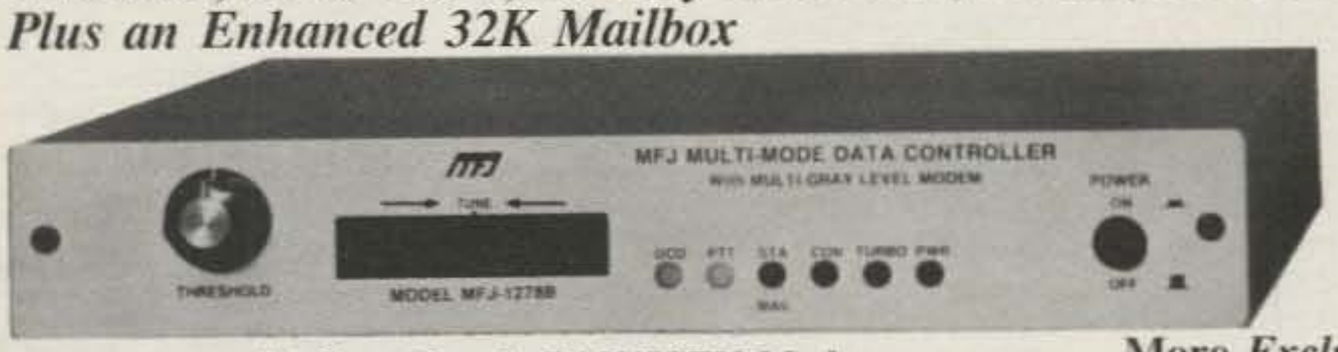
N4RJ	825,920
KS1L	774,046
KO4QW	442,964
WS1M	440,190
KA1ILG	361,680

MFJ gives you PACTOR at no extra cost

No other Multi-Mode gives you all these features -- *not one!*

. . . only the new easy-to-use MFJ-1278B Multi-Mode and MultiCom™ software gives you all these features plus 10 digital modes . . . PACTOR, Color SSTV, 16 Gray Level FAX, Packet, AMTOR, RTTY, ASCII, Navtex, CW and Memory Keyer Plus an Enhanced 32K Mailbox

New enhanced MFJ-1278B



MFJ-1278B Multi-Mode
$299.95

MFJ-1289 MultiCom™
$59.95

New features for MFJ-1278B

- New PACTOR Mode
- 32K bytes Enhanced Packet mailbox Allows separate callsign, auto forwarding and reverse mail forwarding, Remote Sysop access, Sysop paging, chat mode, mailbox C-text "Has-mail" LED indicator, Mailbox is expandable to 128K or 512K.
- New COLOR SSTV VIS tones. Allow other SSTV receiver to auto start picture
- 1 Megabit system EPROM
- 64K bytes battery backup RAM
- European RTTY tones selectable
- External reset, optional scope tuning output
- Selectable 19,200 baud terminal operation

Transmit and Receive Color SSTV

- Robot Color: 36, 72 Seconds
- Robot B/W: 8, 12, 24, 36 Seconds
- Scotty Color: 1 and 2
- Martin Color: 1 and 2

16 Gray Levels FAX/SSTV Modem

- 16 Gray Levels Weather/AP Wire FAX

Real-Time Packet Pictures

- SVGA, VGA, EGA, CGA Color Packet Pictures

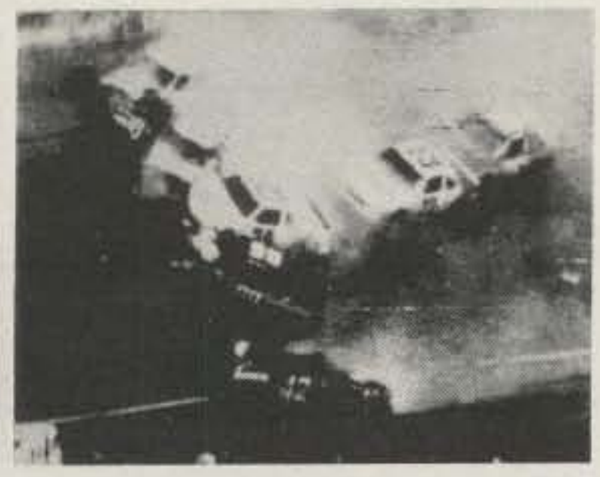
Standard Features

- *Auto* terminal baud rate: 300, 1200, 2400, 9600, 19,200
- Built-in 300 and 1200 baud packet modem
- Two software selectable radio ports
- Threshold control
- KISS interface for TCP/IP, MSYS compatible
- Anti-collision technology gets packets through faster, Host mode
- True DCD circuit designed for HF
- Normal or reverse FSK output
- RS-232 and TTL serial ports
- Fast-Start™ Manual

More *Exclusive* Features

- Automatic Signal Analysis™ for HF packet and AMTOR as well as RTTY and ASCII
- Built-in printer port
- Built-in sidetone amplifier with volume control
- TAPR internal modem header for high speed modem--2400 or 9600 baud
- 20-LED precision tuning indicator
- Automatic Digipeater™ Routing
- QSO and transfer files simultaneously
- Dedicated MARS mode
- *Individual* radio port level control
- *Stored* parameters for each mode
- CW iambic paddle input
- 10-user programmable message memory buffers
- Call Alert Beeper™
- Built-in packet connect bell
- IC sockets used throughout
- A/C power supply included
- One year *unconditional* guarantee

16 Gray Levels WeFax map received on 16.410 MHz. MFJ-1278B & MultiCom™ transmit and receive 16 Gray Levels FAX.

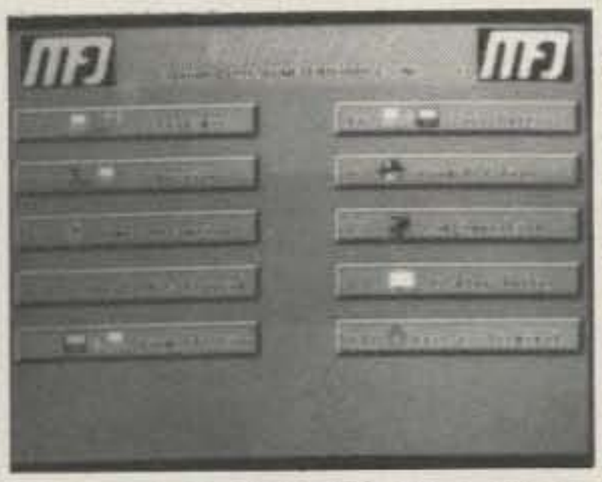


16 Gray Levels AP Wire Photo FAX received on 20.738 MHz. See tomorrow's news today.

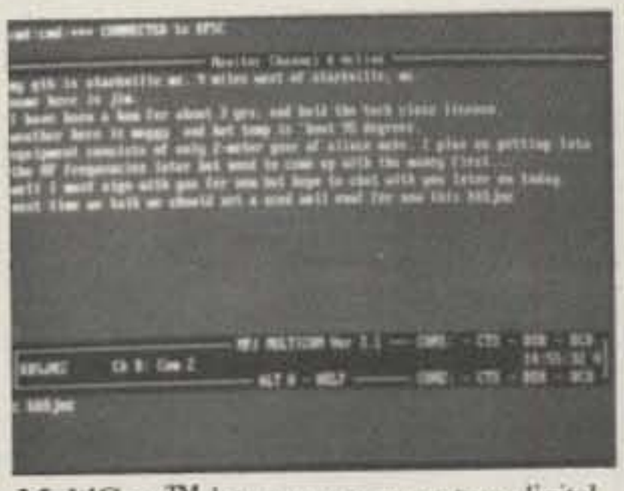
Full Color SSTV pictures received on 14.230 MHz. Robot 72-Second format. Transmit and receive color and B/W SSTV.

256 Color VGA Packet Picture received in real-time packet. Only MFJ-1278B and MultiCom™ has this feature.

Easy and simple . . . MultiCom™ Operating menu--each mode gives you 10 programmable function buffers.



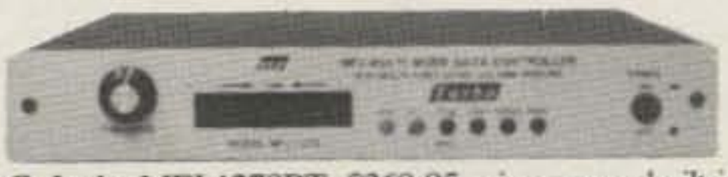
Dedicated MultiCom™ FAX menu. Getting on FAX and SSTV is as simple as pressing one or two keys.



MultiCom™ lets you carry on two digital QSO's *simultaneously* using two multi-modes or TNC's and two comm ports.

Need help? *Alt-H* brings up the on-line Help Menu that makes the MFJ-1278B very easy to use.

New MFJ-1278BT Turbo



Only the MFJ-1278BT, $369.95, gives you a built-in 2400 baud modem. Runs high speed packet without modifying your radio. Get the MFJ-1278BT and operate 300, 1200 and 2400 baud packet. The 2400 baud modem is also available separately. Order MFJ-2400, $89.95, for any MFJ TNCs and MFJ multi-modes.

MFJ-1278 and Multicom Upgrade*

Upgrade *your* MFJ-1278 to include PACTOR and the enhance mailbox--MFJ-56A (32K), $69.95; MFJ-56B (128K), $89.95; MFJ-56C (512K), $229.95.

New MultiCom™ upgrade Release 3.1. New features: Simultaneous dual multi-mode or TNC operation for DOS. New FAX module with auto receive, color FAX, PCX format compatible. YAPP binary file compatible. Order MFJ-49B for MultiCom™ 3.1 upgrade, $29.95. *Upgrade available for current MFJ-1278 and MultiCom user with proof of purchase.

If you use the MFJ-1278B and MFJ Multicom 3.1 and IBM compatible VGA computer you get all these features. Features may vary with other terminal program or other graphics systems.

Exclusive Optional Items

- Real-time clock, MFJ-43 $29.95
- Plug-in Scope tuning adapter, MFJ-44 $29.95
- 2400 baud internal modem, MFJ-2400 $89.95
- 9600 baud internal modem MFJ-9600 $109.95

Nearest Dealer/Orders: 800-647-1800
Technical Help: 800-647-TECH(8324)

• **1 year unconditional guarantee** • 30 day money back guarantee (less s/h) on orders from MFJ • Free catalog

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(601)323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (601) 323-6551; Add $8 s/h.

MFJ . . . making quality affordable

CIRCLE 174 ON READER SERVICE CARD

K7ZM 200,991
WA2SYN 199,800
NW6S 180,498
N6EE 145,503
W5CWQ 118,150
W6AXX/3 111,616

21 MHz

K5MR 1,187,865
WØUN 1,105,212
W6QHS 885,609
K2MT 819,660
K3ZJ/8 765,992
N4ZZ 678,315
N3BB/5 631,840
AE6E 564,978
W5WMU 552,448
N4CT 534,060

14 MHz

K4XS 961,576
K1RU 867,043
WØZV 603,484
W8TWA 306,024
W5FO 276,184
K9CAN 241,729
K2MGA 183,600
K5NU 178,308
KØBFR 177,300
N8SR/6 175,576
W1OP 165,924

7 MHz

W7XR 367,500
KC7EM 334,311
K1UO 268,498
K8PO/1 212,570
K6KM 164,000
K5NA 149,499
W5KFT 106,000

3.8 MHz

K1ZM 229,295
W6RJ 146,475
WE3C 139,788
W1GIH 96,928
KN6M/5 61,149
KMØJ 53,326

1.8 MHz

WB9Z 22,557
W2FCR 3,432
AA4MM 2,294
KG7D 1,612
WCØY 1,426
K4TEA 1,026

LOW POWER
ALL BAND

N8II 1,970,400
KG1D 1,269,632
KØEJ/4 1,257,608
WA2UUK 1,174,947
K4VUD 1,170,792
N6WLX/8 1,142,718
KB3MP/4 1,102,851
WB9IQI 1,017,720
AI6E/1 888,580
KE2ZU 839,636
WS1A 804,448
N1HOQ 779,662
W3UJ 770,049
WB6JPY 754,974
K6XV 751,430
KE2JO/4 706,914
NG9L 688,540
K4BAI 685,719
WAØRJY/7 678,452
KF8K 673,987
W7TSQ 670,076
WB6JMS 668,304
K1WJL 622,267
K9XR 612,813
N4TG 608,400
WS7V 568,320
N7LOX 518,661
N6ADK 516,030
KB2DM 512,478
WØVX/5 506,588

28 MHz

KE5FI 309,792
WB5CRG 262,626
W3EP/1 199,152
K6SVL/4 186,677
KC3PZ 148,960
WBØRTK 129,888
WB6MBF 114,144
NT7E 105,444
WA6FGV 101,304

21 MHz

WA2C/3 249,711
N4MO 232,831
WJ7S 211,260
KG5YA 185,130
WA6KUI/4 177,781
KA1GTR 158,389
WA4APM 157,904
K2MFY 156,728
KV8S 153,090
NY5B 145,768
KM6LP 103,936

14 MHz

K9YNF 113,573
KD5IA 102,000
WQ7R 97,104
W9JOO 87,904
WAØKDS/7 62,951
KIØF 62,358
AA8FF 57,876
WA3EEE 55,880

7 MHz

N1XZ 69,906
NQ1W/4 19,425
KIØI 18,063
AD8J/3 13,156

3.8 MHz

K4UTE 22,356

MULTI-OPERATOR
SINGLE TRANSMITTER

K1DG 8,504,020
N3RS 7,097,940
KS9K 6,669,102
KC1XX 6,655,750
K4ISV 6,124,446
K8AZ 6,077,600
K2WI 5,692,241
AA8U 5,071,058
W6GO 4,934,340
K1TO 4,803,136
W3XU 4,777,887
N1TZ 4,728,222
WB8K 4,726,300
K1VR 4,637,854
NN3Q 4,617,540
KØKR 4,333,662
AA2DU 4,189,563
WØCP 4,010,004
W1XE/Ø 3,675,480
W8BI 3,631,428
NE3F 3,572,160
NX3A 3,506,032

MULTI-OPERATOR
MULTI-TRANSMITTER

N2RM 20,108,660
W3LPL 17,287,429
K2TR 14,933,632
K3LR 14,741,688
NX1H 13,348,944
AA6TT 12,386,088
W4MYA 9,009,338
K4VX/Ø 8,233,984
KY1H 7,801,856
KY3N 7,301,608
K3ANS 6,984,111
WØAIH/9 6,700,464
NK7U 6,199,050
KN8Z 6,185,100
N6AW 5,541,176
NF2L 5,077,842

EUROPE
ALL BAND

S52AA 7,575,625
OE6MBG 6,189,156
GW4BLE 6,072,632
4U1ITU 5,810,496
DJ4PT 5,179,884
YU7AV 4,720,267
GMØECO 3,914,526
RY7D 3,848,949
DL8PC 3,608,640
OG8LQ 3,535,760
AM3NY 3,455,711
OG6NIO 3,066,866
OY6A 3,015,354
OH2PM 2,940,970
YU7BW 2,921,136
DK2XX 2,915,910
F6HLC 2,801,470
SP9LJD 2,564,550
DL2NBU 2,293,008
LA5M 2,269,046

28 MHz

IT9A 1,630,134
OG1M 942,480
S59DKS 872,942
SM6BJI 683,451
S57QM 653,626
ES1AR 602,864
G4PKP 509,172
OE3DSA 454,044
IØHCJ 448,380
GØAEV 405,383
PBØAFZ 398,607
9A1AKL 382,466
OH6RV 372,659
OK3CFA 368,676
F1NBX 356,785
S51MA 308,737
AM7BA 301,900

21 MHz

OK1RI 1,422,624
S58AB 1,296,364
LZ5W 1,234,135
S57EK 1,164,205
HAØMM 1,075,425
EH4MC 1,004,895
G4CNY 959,112
LZ4IM 922,944
RB5WA 881,927
OH1EH 875,862
TM1K 875,550
OK3CBU 808,659
SO3IF 785,465
II6K 751,625
LY2WW 690,382

14 MHz

OH2BH 1,894,102
IR4T 1,821,695
SM2EKM 1,706,036
9A7A 1,224,883
S57DX 1,160,707
G3FXB 1,125,168
S59VM 1,048,194
F2EE 802,464
OK3KFF 770,553
FF6KBF 684,160
IK1HJS 613,683
OK3RM 552,288
RB5QF 546,399
GWØARK 539,487
LY5A 523,438

7 MHz

S59UN 929,075
ZB2X 556,160
I8UDB 525,431
IK3ORD 496,716
DL8OH 467,043
AM92KW 466,992
TF3CW 456,540
4N1Z 403,056
F6EZV 393,965
GIØKOW 346,970
OG7MA 316,827

3.8 MHz

TM5C 295,260
OH7UE 170,409
G3NAS 170,200
S51NA 138,462
S59KAB 109,204
S57AL 107,601
S52CD 90,771
S59DZD 86,020

1.8 MHz

9A1HCD 60,450
IV3PRK 46,546
S57AV 36,725
OH4NRC 34,784
G3KMA 30,954
OK1JDX 19,292
EA3CCN 12,084

LOW POWER
ALL BAND

II2A 1,895,355
EA3BKI 1,291,836
F6FGZ 1,264,788
CU3LF 1,229,844
ON9CJM 1,039,600
ON4ATW 828,000
DK1QH 802,074
YL2SM 769,440
GJ/CT3GB 752,550
UX3D 742,223
EA3CWK 714,336
EA1EVW 676,764
DL2SCJ 672,592
GIØSAP 652,503
HAØHW 644,512
DK8FS 601,800
9H1DE 565,692
UA1TAN 555,713
OZ1LTB 515,862

28 MHz

AM6VQ 458,283
EA6LA 294,508
SV3AQR 246,268
OG3MFT 225,295
EI5DI 223,768
EA3GEG 199,906
PAØMIR 194,166
PBØALN 191,906
IK4LZH 175,644
G4XTA 171,217
EA3ELZ 170,742
OH4MDY 163,392
OH7NVU 140,250
OH6AT 139,279
HG8FH 136,170
OH3MMH 128,381
OH1QA 127,322
I4MFA 125,880
OG7NRW 117,696
OG8LRN 113,652
SMØHTO 109,375

21 MHz

I5JHW 499,500
IV3KYQ 431,254
IK1LBL 313,082
IT9RYJ 298,980
AO3CIL 185,220
SP6OJJ 173,621

14 MHz

YO4NF 541,960
CQ7BWW 330,660
UA4WII 318,396
YL2GN 136,528
SP6PAX 111,150
SM5BDA 110,952
SM3EDF 103,887

7 MHz

S59CM 166,980
FD1OZF 67,275
UB5QMA 60,145
SP9NLK 42,840
UB4TA 20,424
OK1DMS 18,963
S51EA 18,960
DK5VO 18,696

3.8 MHz

S59ZA 70,240
SP5ZIM 55,230
S59ZZ 48,519
OK1DWX 46,716
AM5CGU 43,688
F6BVB 35,560
9A3QK 25,020
LZ1DM 22,500
YO3RU 21,660
AM3FQV 20,087

1.8 MHz

SM5AQD 35,402
OZ3SK 33,198
SP9GDB 3,219

MULTI-OPERATOR
SINGLE TRANSMITTER

IQ4A 17,018,349
UW2F 11,683,776
Y34K 10,993,086
OH5NQ 9,363,104
F6BEE 9,283,410
DLØWW 8,801,782
OK5W 8,660,837
OT2L 8,063,770
DJ4AX 7,527,285
4J1FW 7,350,264
HB9H 7,325,470
S57MM 7,184,086
ON7UN 6,107,760
OH4MI 5,882,448
CU2T 5,864,448
PA3DWD 5,809,237
OE2XEL 5,544,040

MULTI-OPERATOR
MULTI-TRANSMITTER

9A1A 27,469,890
GØKPW 25,065,045
OHØW 21,624,124
OT2C 20,011,344
HG73DX 18,242,520
CT5P 17,684,308
GW8GT 17,162,460
DLØCS 15,256,176
RY1I 11,107,200
DFØDX 8,308,651
3Z25PAZ 6,849,990

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- *"Has mail" LED indicator*

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The MFJ-1272B is the most popular TNC/multimode accessory in ham radio! **Why?** Because you can switch between your microphone and packet TNC or multimode by pushing a button.

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Just plug the pre-wired cables into your rig's microphone connector and into your TNC and you're ready to go -- no more hunting for hard-to-find connectors and wiring up complicated cables.

Works with HF, VHF and UHF radios with 8 pin mic connectors—including Kenwood, ICOM, Yaesu, Alinco and others.

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[2]Kenwood HTs	MFJ-5026	MFJ-5026X	MFJ-5026Z	MFJ-5026YV
Yaesu 8 pin radios	MFJ-5080	MFJ-5080X	MFJ-5080Z	MFJ-5080YV[4] MFJ-5080YH[4]
[3]Icom 8 pin radios	MFJ-5084	MFJ-5084X	MFJ-5084Z	MFJ-5084YV[4] MFJ-5084YH[4]
Kenwood/Alinco 8 pin radios	MFJ-5086	MFJ-5086X	MFJ-5086Z	MFJ-5086YV[4] MFJ-5086YH[4]

1 does not include IC-W2A 2 does not include 2500 3 does not include 25A & 255A
4 YV models connect VHF port of KAM. YH models connect HF port of KAM

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MFJ-5224, $9.95, open end cable for Icom/Yaesu handhelds
MFJ-5226, $9.95, open end cable for Kenwood handhelds
MFJ-5268, $7.95, open end cable with 8-pin modular telephone plug for Yaesu FT-2400H, Kenwood TM641A, TM714A, TM732A

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CIRCLE 6 ON READER SERVICE CARD

In the past when we've discussed Transmatches, some VHF experimenters have felt left out. This month W1ICP discusses Transmatches for 2 meters and shows us how to build one.

How To Build A Transmatch For 2 Meters

BY LEW McCOY*, W1ICP

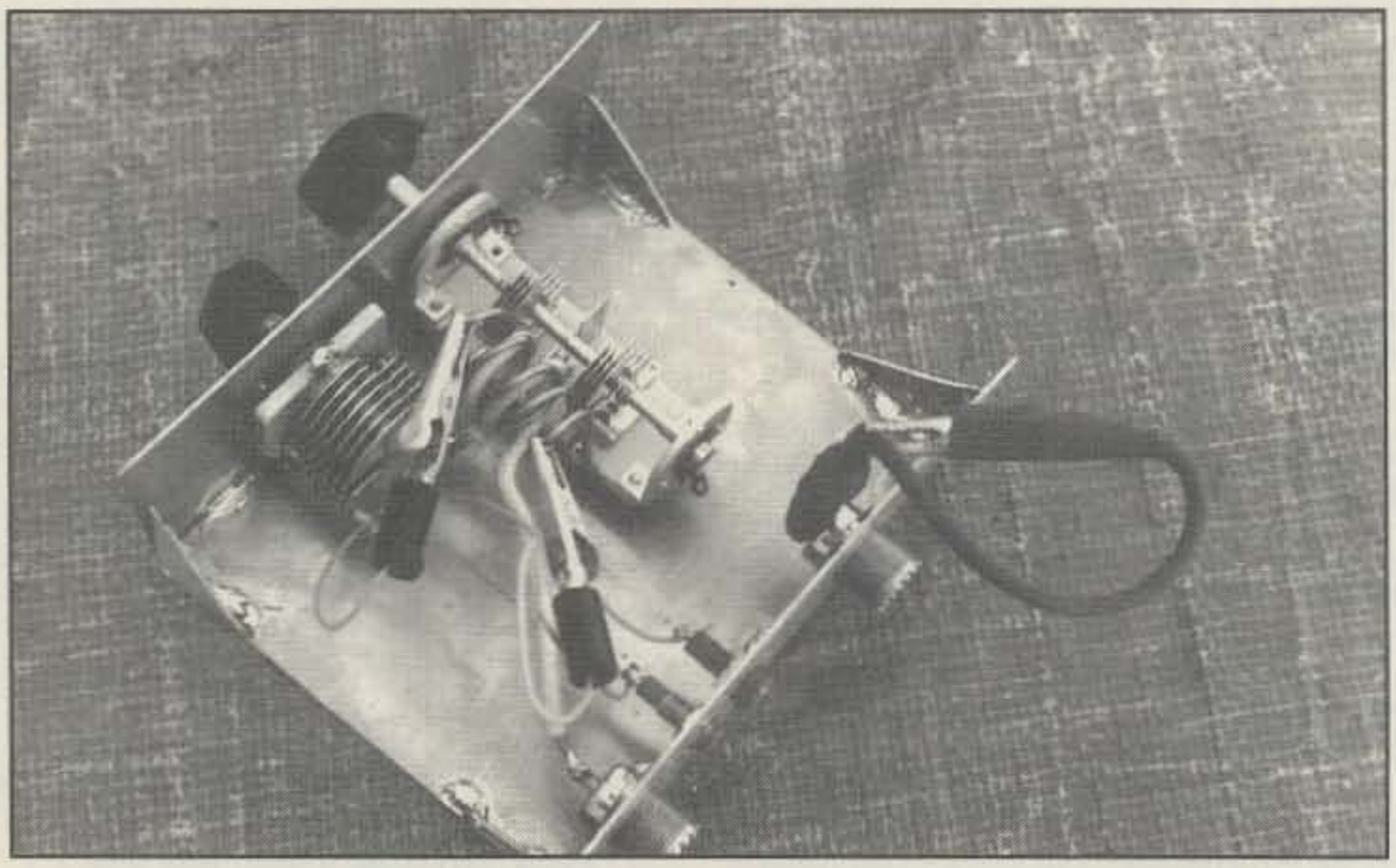
I've had many requests to do an article about constructing a Transmatch that can be used on 2 meters. I find that many amateurs wish to experiment with rhombics or V-beams or just oddball antennas on 2 meters. To do so, because the feed impedances of such antennas can vary widely, it is necessary to use some type of adjustable impedance transformer. Such a device will take the unknown impedance of the antenna and convert it to 50 ohms—a value required by modern transceivers. This device is usually an adjustable Transmatch.

The only reason I have held back in describing such a circuit is that it is almost impossible these days to buy small variable capacitors. Or if such capacitors are available, they are very expensive. Whenever I mentioned that fact to would-be constructors, however, the reply was always "Let us worry about that."

That may sound like a simple answer, but I still wasn't satisfied. I made it a point last year to see what was available at fleamarkets, and to my surprise there were plenty of small variable capacitors to be had. While not required, another item that proves very helpful is an old-fashioned grid dip meter.

For the scores of newcomers to amateur radio, a grid dip meter requires some explanation. In those good old days when amateurs built their own equipment (receivers and transmitters), most of the work consisted of making circuits that would either be fixed tuned or tunable to a desired frequency. This was usually accomplished by using a coil of a certain inductance, and that coil was resonated to various desired frequencies via a variable capacitor.

*Technical Editor, CQ, 1500 West Idaho Street, Silver City, NM 88061



Here is the Transmatch described in the text.

To try to make this clearer to the neophyte, I have shown two circuits at fig. 1(A) and (B). In the case of (A), the coil (LA) is "fixed" tuned by use of a fixed value capacitor. At B we use the same coil and a variable capacitor so that we can cover a "tunable" range of frequencies. One of the more vexing problems with such circuits is knowing, after making one, what the frequency happened to be.

Just a spot of history is appropriate here. The first grid dip meter was described in the early 1930s in *QST*. I believe that this first model is still in the ARRL museum. The circuit was simple enough. It consisted of a tunable tube-type oscillator that would be coupled to another circuit. A change in the grid current would occur when the two coupled circuits were resonant to each other. When metering the grid current in the tube, the meter pointer would "dip," indicating a resonance spot. A frequency meter was used to calibrate the grid dip meter. We therefore ended up with a known frequency checking device that could be used to check an unknown circuit.

The *QST* device was so large, however, that it was impractical to use. A brilliant amateur named Bill Scherer, W2AEF, one of my predecessor's here at *CQ* (he is now a Silent Key), then came up with a small grid dip meter. It was so small it could be held in one hand and brought very close to the circuit to be checked. For years the Millen company manufactured the Scherer grid dip meter, calling it the Millen Grid Dip Meter.

One of my problems—if it can be called a problem—is I feel strongly that history should be preserved. I was

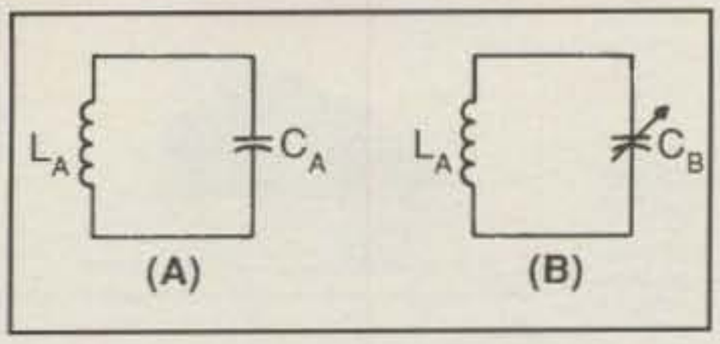


Fig. 1– At (A) is the fixed-tuned circuit using a fixed value of capacitance and resistance. At (B) the capacitor is variable, permitting tuning of the circuit to various frequencies.

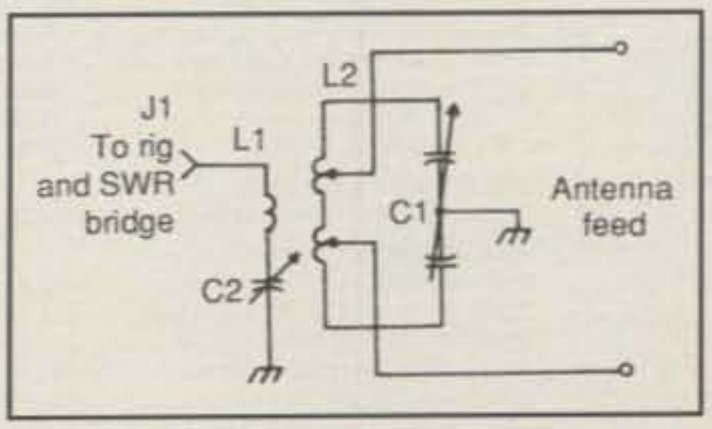


Fig. 2– This is the circuit diagram of the Transmatch. L1 and C2 comprise the input variable link circuit, and C1 and L2 are the primary circuit.

involved in many of these events, so forgive me if you feel I tend to ramble on. I do feel amateurs are interested in their history, however.

When it comes to constructing this project, where can you get a grid dip meter? Probably your best bet is to ask some of the old timers at your radio club, or any old timer for that matter. By old timer I mean anyone who has been in the hobby twenty years or so. You can still buy grid dip meters and they are useful for solving many amateur problems. They can be coupled to antennas to determine resonance, or to feed lines to see if the lines are resonant. How about checking tower guys to see if they are resonant and upsetting radiation patterns? A grid dipper will do the job. If you find one at a fleamarket, check to see that all the plug-in coils are present and also check to make sure it works. How much are they worth these days? Anything under $100 should be a buy.

Meanwhile, back to the 2 meter Transmatch. The circuit I used was cooked up by Ed Tilton, W1HDQ, and was described in many of the early ARRL *Antenna Handbooks*. I didn't have a chassis or box handy when I slapped together this unit. However, I do have a lot of copper-clad circuit board available, so I cut up some pieces and made a chassis/box. As you can see from the photo, it is nothing fancy. It took me about two hours to cut up the circuit board, solder the pieces together, drill the holes, and mount the components. Let me break away again here and discuss antennas and matching.

Today most of the amateurs on 2 meters use a coax-fed vertical, while others use beams. All of the current 2 meter rigs are designed to work into a 50 ohm load. Otherwise, either the rig won't put out rated power, or it won't load at all. This is done to protect the solid-state circuitry. This Transmatch was not really designed for these 2 meter verticals or beam types of antennas simply because these antennas are already matched and do not need a tuner. However, in the event one has a problem, I have provided for coaxial feed matching.

Essentially, the Transmatch is for antennas fed with open-wire line or TV twin lead, but it will work with coax feed. Let's face it: coax in long runs, say 150 feet or more, can be quite lossy at 2 meters so some amateurs may wish to use a low-loss line, such as open wire. Also, one doesn't need a lot of room to put up a 2 meter rhombic or V-beam to obtain a directional 10 dB gain signal. Such antennas can be fed with the insulated-type open-wire line with great success. I am thinking now of amateurs who may be marginal into a given repeater, and the subsequent answer is a high-gain directional antenna (that doesn't cost much!).

This Transmatch also can be used with random end-fed wires, or for example, a multiband, center-fed, low-band

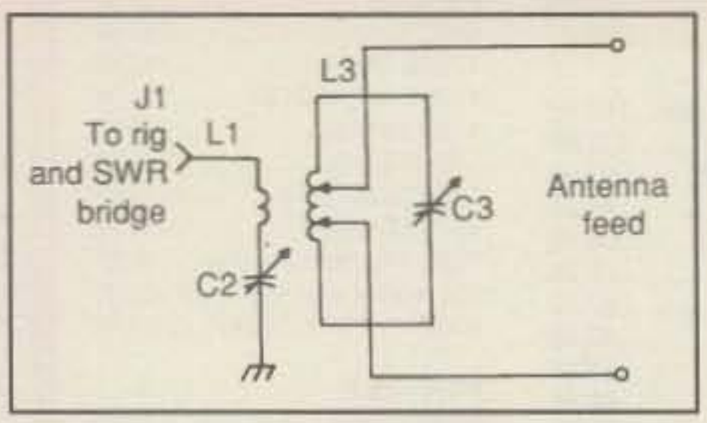


Fig. 3– Single-section variable version of fig. 2. (See text for details.)

dipole such as an 80 meter dipole. One of the antennas I use for tests is an 80 meter extended Zepp fed with open-wire line. Using this antenna on 2 meters I was surprised to find I could trigger several repeaters that my vertical would not access. I tried all kinds of "2 meter antennas." I ran a wire out to my tower, connected the single end to the Transmatch, and found I had a reasonably good antenna system. I also tried my 20 through 10 meter multiband beam, which also worked on 2.

All this experimenting was a lot of fun and provided interesting results. The Transmatch doesn't cost much, depending on what you pay for the variable capacitors and the coax fittings. The two variables I found at a fleamarket cost $3.00 for both.

Fig. 2 is the circuit I used, and fig. 3 is another configuration that will work and does not require a dual variable such as I used in the shown unit. Dual variables may be harder to find.

Study fig. 2. The output of the transceiver or transmitter is connected to J1 where the signal is routed through L1 and C2. For newer amateurs, this is an old-fashioned method of coupling which provides considerable matching flexibility. L1 is a link that is link-coupled to L2. L2 is tuned via C1. The unknown feeder/antenna load is tapped onto L2 via two clip leads. An SWR indicator is connected in the line from the rig to the Transmatch. The SWR indicator is set in the reflected reading mode. While feeding power to the Transmatch from the rig, both C1 and C2 are adjusted for a null, or zero, reading. If a zero reading in the reflected mode is not obtainable, then the clip lead taps are either moved in or out of the coil until a zero reading in the reflected position is achieved. The entire procedure is really quite simple.

In the event of single-wire feed or end-feeding a wire, the procedure is simple. Connect the single-wire terminal feed via the clip lead to the coil, starting at the outside of the coil or hot, ungrounded end of the coil. (In the fig. 2 configuration the grounded end is at the center, or rotor, of the stator.) Try matching and if you are not successful, gradually move the tap towards the grounded end, trying to match at each point. I did not find an antenna-system load I could not match perfectly, but that is not to say that such a condition doesn't exist. I would simply add 19 inches of wire to the feed end at the Transmatch, which would change the load, and in all probability would put it within matching range.

Construction Details

As I stated earlier, I made the "box" that holds the Transmatch from copper-coated circuit-board material. Any metal chassis or box can be used. My only recommendation is that you keep the two variables as close together as possible to avoid long lead lengths. My homemade box is 5 1/2 inches wide and 5 inches deep. The front and back panels are 2 1/4 inches high. (None of these dimensions are critical.)

If possible, in your search for variables try to find a small dual variable. The one shown is a Hammarlund 35 pF per section unit. To be used on 2 meters, however, you need to remove plates. Using needle-nose pliers, carefully bend the outside plates out and back a few times and they will come loose. Do this until you leave only four rotor and four stator plates on each capacitor section.

If you happen to get a slightly larger variable from a fleamarket, then you

may have to remove more plates. Your goal in the plate removal is to get a capacitor that covers 144 to 148 MHz with the coil described below. None of this is as difficult as it sounds, particularly if you can beg or borrow a grid dip meter. More on this in a moment. C2 and C3 should also have a minimum value of 35 pF. You may have to remove plates on these as well.

Coils L1 and L2 were made from ordinary No. 14 copper insulated house wire. I had some Romex No. 14 handy, so I stripped the insulation off a length to make L2. L2 consists of four turns of this wire (wound on a 1/2 inch diameter dowel and then slid off the dowel). The turns were then spread to cover a total of 1 1/2 inches. This coil was then mounted to the stator connections of the dual variable, one lead going to one stator and the other coil lead going to the other stator. I must emphasize that none of this is critical if you have a grid meter.

Once the coil is soldered to the capacitor, take the grid dip meter and couple the grid dip coil close to L2, and then tune the grid dipper to 144 MHz. Tune C1 and L2 through their range and watch for a dip in the reading, indicating the circuit has hit the 2 meter band. You can determine the range of this tunable circuit by setting C1 to maximum (plates fully meshed) and then tuning the grid dip meter, looking for a dip. Likewise, open the plates fully (minimum capacitance) and again use the dipper to find the other end of the range.

Next you need to make the link. It is made from a piece of insulated No. 14 solid wire. The link is also 1/2 inch in diameter, and the turns are inserted at the center of L2 (this isn't critical). One end of the link goes to the stator section of C2, and the other end is connected to the coax input fitting.

If you make the version shown in fig. 3, then the only change would be to make the L3 three turns instead of four. Spread the turns as described above, and use a grid dip meter to check to make sure the circuit is hitting 2 meters. The link is coupled to the bottom, or ground end, of L3.

Some newcomers may be confused by circuit-diagram symbols—particularly ground connections. Fig. 2 shows the rotors of both capacitors being grounded. This ground indicates the chassis, and in reality the rotors are grounded to the circuit-board case via their mounting points through the front panel.

You may find that in actually matching an antenna system the tuning of either capacitor may be too sharp, indicating too much capacitance in either variable. You can remove more plates. I cannot tell you how much simply because there are so many different types of variables to be found. Use the grid dip method. (And please don't write asking me, as I don't have time to answer and probably would not be able to help anyway.)

Sometimes, but not always, when using certain types of wire antennas one may encounter high-impedance loads, which could lead to RF getting into the rig via the Transmatch. A simple cure is to add a quarter wavelength of feeders (19 inches) in series with the feed line at the Transmatch. Or if it is a single-wire feed, then add 19 inches of wire as I mentioned earlier. This changes the load of the system to a low or different impedance, and in all likelihood gets rid of the problem. Another thing to do is to use a complete enclosure for the Transmatch box.

The important thing here is that with this Transmatch you can try any antenna on 2 meters, and I do mean any antenna. Anyone for a high-gain rhombic? A rhombic for 2 meters would only have to be 12 feet on a side to produce one heck of a lot of gain, to trigger that remote repeater, and I am talking 12 to 14 dB of good, honest gain. Like I said, however, don't write. Use the antenna books. I'm getting too darn old, and time is become more and more important to me. I will, though, add this: For repeater work and wire high-gain antennas, think vertical polarization. Good luck!

Do you remember the moment when you first became aware of amateur radio? If you were a kid at that time, as most of us were, then relive those days as you read KØHT's story.

My Love Affair With Amateur Radio

BY HUNT TURNER*, KØHT

"I look back fondly now on my love affair with radio, from the earliest yellow-dialed gleamings of its twilight Sgt. Prestons and Lone Rangers to those words spoken by Armstrong as he stepped from the last rung of man's longest ladder. Whether it be the tiny-screen antics of Clarabell or the digitized pictures of a Martian snowstorm, the searchings of SETI or the thousands of chats with friends around the world, count me as a lucky collector of aerial-launched memories. I still have my first QSL card, from a neighbor down the street, as well as the ones from space.

We were kids of the post-war forties, and magic was alive for Scotty VanCleef and me. That's what made it so much fun. There was only the faintest glint of Marconi in our heads (and not a clue of Tesla and the others) when we invented the spark-gap transmitter.

Boy Scout code practice caused it all. Quite by accident we had discovered (to the dismay of the neighborhood) that our battery-operated practice buzzers caused static on radios and TV sets. Being post-Neanderthal and somewhat educated, we deftly increased the range of interference by running a wire from the blue-flaming gap to a straightened-out coat hanger (watch out, Ed Sullivan!). Evolution took over, and soon everything was contained in a cigar box with a coat hanger wired to its side and a surplus J-38 telegraph key screwed to the lid. We prowled the yards and alleys with our Tampa Nugget walkie-talkies (or should that be walkie-codies?), sending SOS and our names across the screens of a hundred or more soap operas.

With the help of an index card full of dots and dashes and our AM radio dials tuned to an unoccupied spot (there were still a few in those days), Scotty and I sent late-night jokes across the neighborhood from under our flashlight illuminated sheets. We had, for a while, a secret world that no one knew about, for we were no longer tied to the strings and cans of our underlings. We had tamed nature and were riding upon the ether with the likes of Jack Benny and Milton Berle. I was HT-1 and he was SVC.

I don't know what happened to Scotty, but his memory shines bright; and now, after more than ten thousand legal QSOs on CW, I still hear the rhythms of his hesitating fist and that faint little buzz on the old Philco . . . HA, HA, HA, OVER.

After Scotty moved away I built a razor-blade radio. I still have the scar. (In my opinion, you get better reception on a tooth filling.) Then a cat-whiskered galina set (I think I hear something). Then a crystal diode set clipped to the fingerstop of the telephone dial (. . . Long Tall Sally . . . Little Richard . . . I'm sure . . . yes, . . . I'm almost sure that's what it is).

"Pop?"

"Uh-huh."

"Will you help me build a one-tube radio?" (My pop can do anything, anything!)

"Lemme see here . . . breadboard . . . components . . . yea, I know where ya can get "em."

Mister Koontz had a small shop just one block off Main and it was filled with all kinds of neat stuff. He repaired everything from lawnmowers to something called stereos. What he didn't have in that shop he could order, and you couldn't find a better price anywhere. He wore one of those banker's visors and always had a quarter inch of cigarette growing from his lip, sending small rivers of smoke past his eyes into a gathering cloud beneath the green. He never smiled.

"That's three and a quarter for the lot, boys," he said to Andy Grimes and me. We grabbed our stuff and ran. It was a bargain. A pity he didn't deal in baseball cards.

Ah, the A and B batteries:

"Ain't that tube awful bright, son?"

"Not anymore, Daddy."

Enter the transistor.

I was the first kid in class with a hidden Walkman, thanks to Allied Radio's two-transistor portable Knight kit—a belt-slung, Naugahyde marvel with a tiny earphone wire that followed the inside of a sleeve effortlessly. After two days I opted for a bolder approach.

"It's a hearing aid, Miss Twillis," I said. And she bought it . . . she bought it! For about ten minutes that is, until her first question concerning the fate of Pip and Miss Havisham lay buried beneath the strains of "Blue Suede Shoes."

"Hunt Turner, go to the office, right this minute!"

These were to become the twelve most familiar syllables in my educational career (strange that I should wind up being a teacher).

After surrendering my Knight kit (and my derriere) to Booger Bascomb, B.A., M.A., M.Ed., I lost interest for a while in radio, through tears behind a frosted glass door. In fact, I might have given up on it altogether, had I not learned something of its ability to lift a person out of the humdrum and carry him off to faraway worlds. In time, radio would become another way of seeing, a wonderful extension of the senses and the personality, but these electromagnetic

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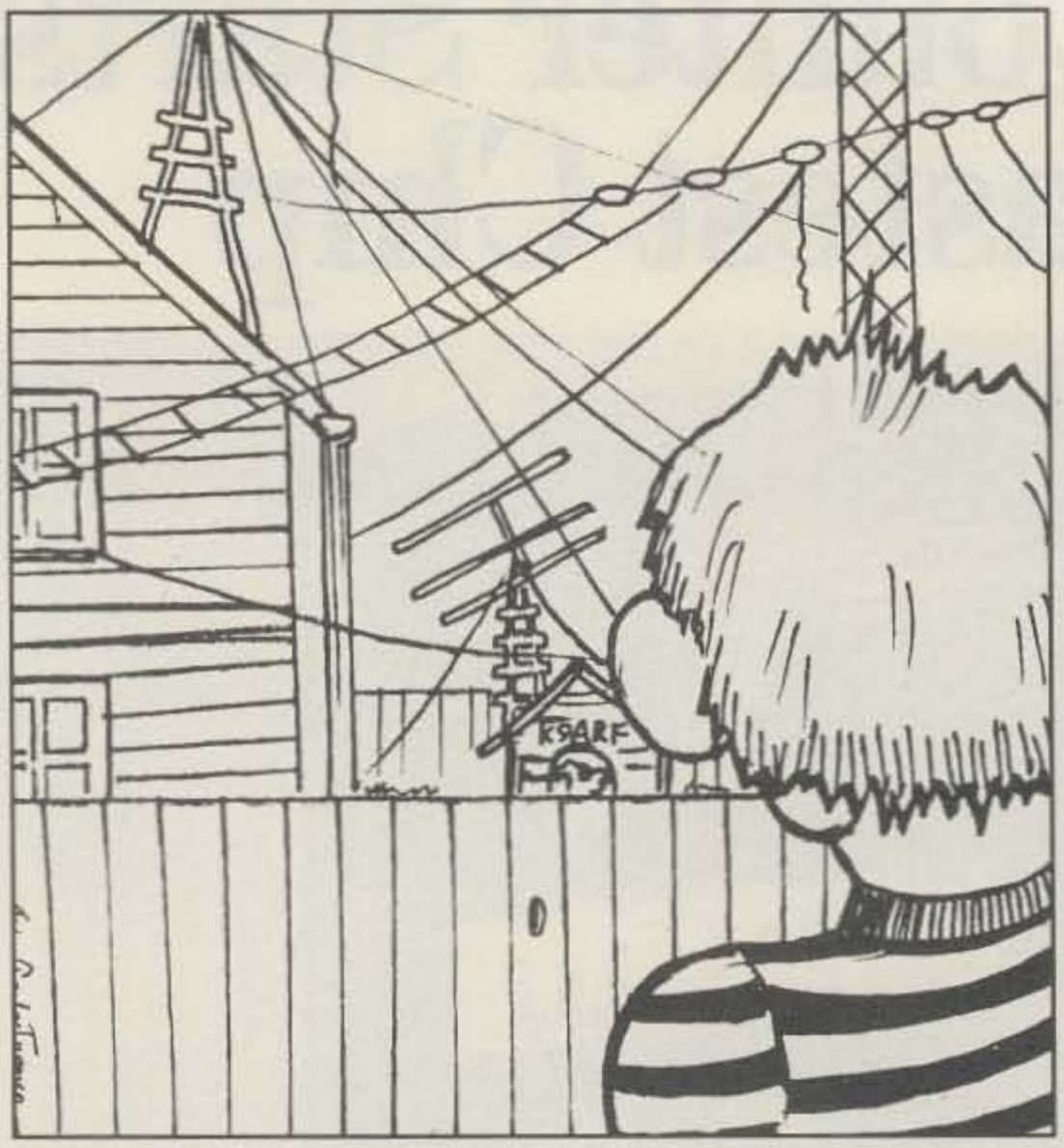

Scotty and I sent late-night jokes under our flashlight illuminated blankets.

Buckley's backyard looked like a substation capable of powering the city of Los Angeles.

seeds would have to wait for a bit more rain.

Meanwhile, Andy Grimes and I took up flying model airplanes. During this year-long interim, two young aces buried the equivalent of at least a Collins S-Line into the asphalt of surrounding parking lots. It was a good thing the war was over.

The rains came in the form of a classmate's testamony about a strange neighbor. He said that the place was a jungle of wires. To many kids in the neighborhood, its owner was simply a weird old man who hardly ever left the house. But to the more fanciful, old Buckley was a spy!

His house stood on a huge corner lot. At night it was always dark, except for a solitary upstairs window which glowed into the pre-dawn hours. There were large warning signs posted all around his fenced-in yard. A lonely old hound he called K9ARF snoozed with his head stuck out the doghouse door beneath a car tag plaque that bore his name. Whenever kids approached the fence, K9 would set up a howl, old Buckley would stick his head out the back door, and the kids would dart off down the alley, afraid the communists were after them.

Interesting, I thought. This I have to see. So I went over one Saturday afternoon by Huffy express.

My first exposure to an antenna farm was impressive. Buckley's backyard looked like a substation capable of powering Los Angeles. At first, all I could think of was a cadaver with nails in his head lying on a steel table somewhere in the basement. I could see old weird Buckley, too, standing calmly beneath flickering lights in a long white jacket, making notes on a clipboard and drooling. A humpbacked assistant ran amok through the shadows, throwing knife switches.

But I was young and impressionable. It might have been just a few dipoles. My first act of bravery was meeting this man of science.

Timidly, I rang the bell. To my surprise, a very ordinary man greeted me. He wore a plaid shirt with rolled-up sleeves, and held an ancient briar clamped firmly between his grinning teeth. I learned later that such people were called Elmer.

When I asked if he was a ham (I had heard the term before), he smiled as if he knew me. "W4XGW," he said, grabbing my hand firmly and shaking it vigorously with both of his. "Xylophonist Gone Wild." (That made a lot of sense). "Come in, my boy . . . come in." The heavy door closed behind us.

I thought he had blown his cover, giving away his code name, and after that xylophonist bit, maybe even more. Did he think I was some kind of agent sent back through time? Surely I was too young for the KGB, even in his eyes.

Unearthly sounds filtered into the hallway from the top of the stairs: squeals and voices of strange timbre. I followed him despite my fear and was soon put at ease, for he was truly a kind old gentleman.

"So, you're interested in these things, are you?" he beamed.

"Yessir, I am . . . very."

To me it was as arcane as an initiation into some secret society. I sat in a plush armchair, sipping a coke, as he prattled on enthusiastically about dipoles and Zepps and coax and Charlie Whiskey and QSB and a hundred other things that left me stupefied. Then came the magic moment.

"I'm basically a DXer," he said casually. "That means I like talking to faraway places. Would you like to see the station?"

I followed him apprehensively across the oriental rug and up the stairs, telling him I had once studied Morse code in the Boy Scouts. "Used to be a scoutmaster m'self," he said, raising his voice to get above the speaker noises. "That's where I learned it, too. Well, here we are, son, the shack."

It soon became clear to me that I had walked from an oriental rug onto a magic carpet. Buckley's shack was a microcosm of fascinating things—a Da Vinci room, harboring drawings and charts and globes and models of early biplanes and cocoons and butterflies, even a telescope! A radiometer on the windowsill twirled lazily in the late afternoon sunlight. "Should be some transequatorial on ten," the old man smiled.

As he spun the dial through noises representing islands and continents, I gazed for a moment at the walls. They were covered with colorful cards flaunting strange combinations of letters and numbers, and exotic place names such as Swaziland and Zanzibar. One carried silhouettes of the eerie statues on Easter Island while another depicted the Celtic circle of Stonehenge. Thus began a lifelong affection for those tiny works of art known as QSLs.

I felt as though I were standing on sacred ground. This unassuming man had been heard in all those places. Now he was passing the microphone to me. I remember that day as clearly as yesterday. It was the day I hurled my own voice all the way to Argentina and entered the global community.

Mister Buckley loaned me his tattered old copy of The Radio Amateur's License Manual and helped me build a code practice oscillator. The following Saturday I began my Novice studies under his patient tutelege. Two days later my father announced that he was changing jobs. Within a week we were packing up and moving from the soft sandy center of Alabama to a place in the mountains.

When I went to return Buckley's manual, he told me to keep it. He would see me on the air sometime soon.

I stacked all my comics, baseball cards, war-weary models, and vintage crystal sets into a single cardboard box (how small a life can be!). Tearfully, I shook hands with Andy Grimes (the best friend I ever had) and through the back window of a '55 Buick I watched the only world I had ever known roll away beneath the piney horizon.

I think it was my third day at the new school when I was sent to the office. Her accent was vastly different, but those twelve syllables had become Pavlovian. I shuffled off to check out the cat-o'-nine-tails. As luck would have it, the very student sent to retrieve me (in case I decided to take a leave of absence after the flogging) was a ham, a new Novice who lived just up the street.

We got our first RF burns together and learned that we could fare better on French tests through a mutual knowledge of Morse code.

"Hunt Turner, stop tapping your pencil against that desk!"

"I'm nervous, Miz Bundy."

My French grade took a dive when winter arrived and the radiators started banging. It was my first encounter with QRM.

In February, John Flemming and I got our Technician licenses together. We spent several weeks building rather humble little rigs affectionately called "Benton Harbor Lunchboxes." In reality these were 5 watt, 6 meter, AM television killers capable of rolling pictures on channel two for a 12 mile radius, when used in conjunction with a 4-element wide-spaced beam. Their effectiveness was only slightly reduced when no antenna was used. No one had bothered to tell us the band was dead 98 percent of the time, so we sat around ragchewing and answering death threats on the telephone.

In time, we became famous TV personalities. Though we denied being on the air, many had seen us on their screens, and one frantic lady claimed to have heard John's melodious voice burbling up through her toilet bowl (a clear case of rectification). Despite such complaints, we felt well within the law, for we had not caused a single case of tooth-filling interference.

John and I were among the first space communications pioneers. Desperate for a contact on 6 meters, we followed the path of ECHO I across the cloudless skies. After photographing it one night, we slipped the mast loose at the base and pointed the beam up at the fast-moving star. John sighted along the boom and grunted as I frantically called "CQ six" in a high, pitiful voice. We heard nothing, but our hearts were in the right

place. My reward came two and a half decades later, when I stood in the front yard and heard Owen Garriott on a 2 meter hand-held as he streaked across that same quadrant of sky.

One day the band did open, and a friendship was sorely tested. John and I were both "rockbound" on 50.5 megacycles. "Get off my frequency!" we screamed at one another—until the band went dead. Diplomacy prevailed. After mowing a few lawns, we chipped in and bought another expensive crystal.

The early summer E's brought lots of 5 watt QSOs and the QSLs started rolling in. But alas, there was no DX. We were crestfallen, until the congressional investigation took our minds off the vagaries of propagation. (Ollie North was just a kid then.) It seems a committee was formed against W4ONA-TV, despite its high Nielsen's. (I couldn't blame them, really.)

The FCC engineer arrived in a blinding snow storm, with several new dents in his car. His mood was less than sanguine. Sheepishly, I offered him a cup of hot coffee and gave him a formal tour of the station facilities (a "Benton Harbor Lunchbox" on a stool in the closet).

"That's it?" he blinked incredulously. "That thing is destroying TV reception countywide?" I beamed a little (maybe like a young Ted Turner). I was sent here at the request of your congressman for this? Oh well. How do you monitor the station's output, son?" I pointed to the flickering neon lamp. No meters? How do you know you're not exceeding the legal limit?"

"I don't, but the tube's capacity is less than 8 watts."

"Ya need them meters, son," he said gravely. "I suggest ya close 'er down. Fifty megacycles is the kiss of death in these mountains."

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The General: pimples, the promm, girlfriends (later wives) who don't understand how a metal box can be loved so much, the fifty precious cards, then the six, then . . . then the one hundred most important pieces of paper in a weary radio vagabond's life!

"He scoured the globe, when he shoudda been sleepin'. He took the long path when he shoudda been at work. He bows to a god called Boo-Vay! Tell me, Doctor. What's wrong with my husband?"

The Advanced: "Is there any cure?"

The Extra: "He wants me to get my Novice." She did, and now she's beginning to understand the eternal enigmas.

The other night I was awakened from a dreamless sleep by two icy feet.

"Wazza matter?" I mumbled. "Did I forget to put the cat out?"

"Nah," she grinned, "just checkin' the low end of 80."

My youngest daughter leans her head into the shack and timidly asks if she can tap the key. The circle is complete. A wide-eyed bundle of humanity sits upon my knee and falteringly sends the letters of her name. As those earliest CQ's made on 6 meters hurtle somewhere far beyond Alpha Centauri, I can't help but wonder to what strange and exotic worlds she will travel.

Buckley's gone now, a silent key, and so are many others whose cards are in the file. But the spirit lives on, and so do the memories of those who somersaulted across the sky, and landed in a room just down the hall. Thanks, Marconi.

(Drawings by John Clark Turner.)

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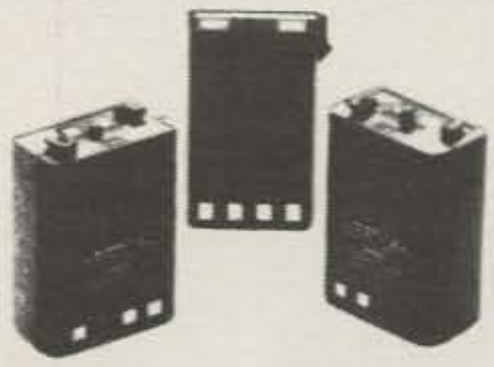

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If you want to learn about baluns, this is the place. W2FMI delves into their history, common misunderstandings about them, and several ways to definitely kill them. He also presents six balun designs that should handle most, if not all, of our needs.

A Balun Essay

BY JERRY SEVICK*, W2FMI

If you have seen recent issues of *CQ*, you are probably aware of my practical series on ununs (*un*balanced-to-*un*balanced transformers). Since many of you don't subscribe to *Communications Quarterly*, you are likely unaware of my in-depth series of articles on baluns (starting with the Summer 1992 issue). This balun series was prompted by recent articles in the amateur journals coining new terms for the 1:1 and 4:1 baluns (*current, choke,* and *voltage)* and proposing "new" designs using coaxial cables either wound around ferrite cores or threaded through ferrite beads. Since I disagreed (in considerable measure) with these recent articles, I decided to express my views and to present my designs of the various baluns. *Communications Quarterly* provided the ideal vehicle for this series.

This article presents some highlights of the series and my designs† for matching 50 ohm coaxial cable to balanced loads of 50, 75, 100, 200, 300, and 450 ohms. Although the balun series contains many other designs—which include (a) low-power baluns, (b) baluns matching 50 ohm cable to lower impedances, (c) baluns for the VHF band and above, and (d) baluns using 4:1 and 1:1 or 1:4 baluns in series-parallel (Guanella's technique[1])—the six designs chosen for this article are probably the most interesting for the majority of *CQ* readers. The highlights mentioned above will briefly include balun history and theory, misconceptions regarding their uses, and hostile environments for baluns.

Photo A– The three basic forms of the 1:1 balun: left, the Guanella (current/choke) balun; center, the Ruthroff balun; and right, the trifilar (voltage) balun.

A Little History and Theory

The first presentation on broadband baluns was by Guanella in 1944.[1] He proposed coiling a transmission line to form a choke where the input was isolated from the output (an isolation transformer), resulting in the rejection of the undesirable currents (common-mode, conventional transformer, and antenna currents). This approach then became the basic building block (a term coined by Ruthroff in 1959[2]) upon which all transmission line transformer theory is based.

Fig. 1 shows the basic building block with a connection (terminal 5) to the center of the load, R_L, resulting in Guanella's 1:1 balun. Since a center-fed dipole has a zero-potential plane (ground-plane) bisecting the center of the antenna, the effect is the same as grounding terminal 5.

If the reactance of the coiled (or beaded) transmission line is much greater than R_L and the line is "flat" ($R_L = Z_o$, the characteristic impedance) or very short compared to the wavelength, then terminal 4 is at $+V_1/2$ and terminal 2 is at $-V_1/2$—a balanced output. Thus, there

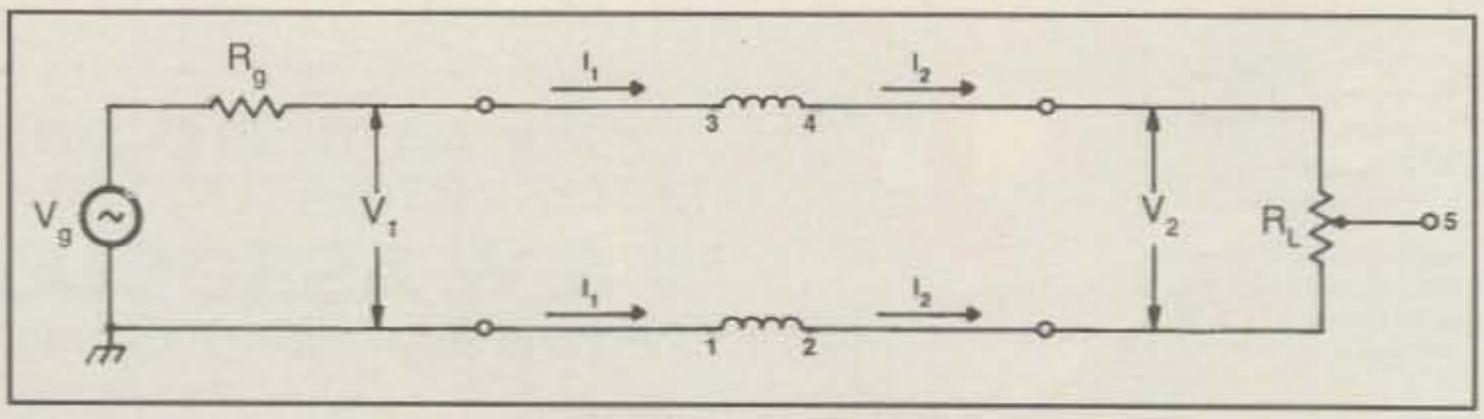


Fig. 1– Basic building block: the 1:1 Guanella balun when terminal 5 is grounded.

*32 Granville Way, Basking Ridge, NJ 07920

†Kits and finished units are available from Amidon Associates, Inc., 2216 East Gladwick St., Dominguez Hills, CA 90220.

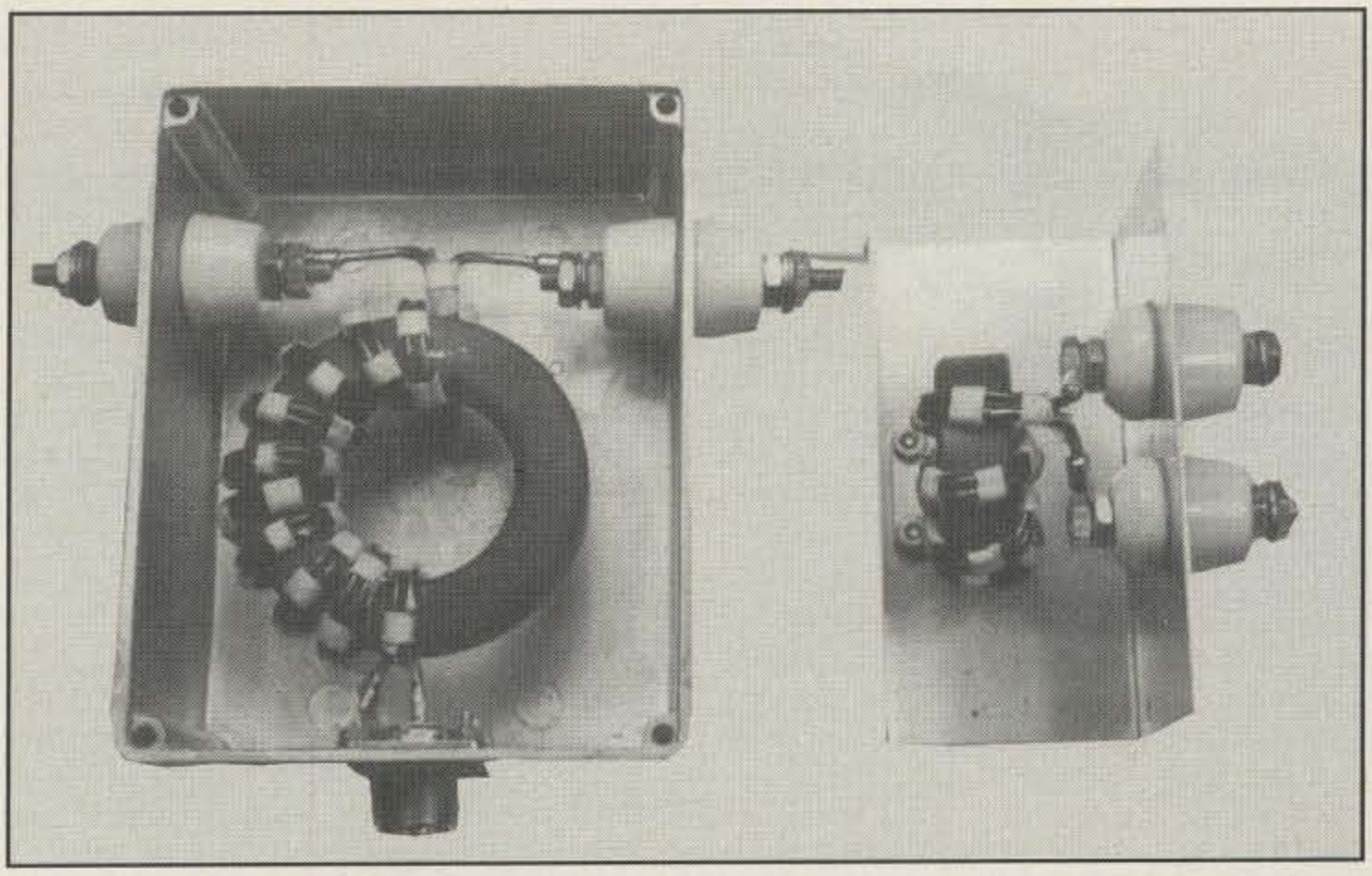


Photo B– Two 1:1 Guanella baluns designed to match 50 ohm cable to balanced loads of 50 ohms. The balun on the left covers the HF band (plus 160 meters). The balun on the right covers 14 MHz to 30 MHz (for Yagi triband beams).

is a voltage drop of $-V_1/2$ along both conductors of the transmission line. With sufficient choking so only transmission line currents are allowed to flow, this voltage drop accounts for most of the loss in all transmission line transformers using ferrite cores or beads. It is a dielectric loss which is voltage dependent and not harmful to the ferrite. With baluns operating at higher impedance levels or with loads greater than expected (VSWRs greater than 1:1), the voltage drops (and hence losses) are larger. Additionally, it was found that only low-permeability ferrites (less than 300) can yield the very high efficiencies of which these transformers are capable.[3]

Since the basic block is a choke (a lumped element) and a transmission line (a distributed element), the theory of baluns and ununs essentially involves the necessary reactance of the chokes and simple transmission line theory. Therefore, the same theory and analysis applies whether the baluns have coiled or beaded transmission lines or twin-lead or coaxial cable.

Incidentally, if terminal 4 is grounded instead of terminal 5, the basic building block becomes a phase-inverter with a voltage drop of $-V_1$. This connection not only involves more loss since the voltage drop is greater, but it also requires more reactance in order to prevent a shunting current to ground. And finally, if terminal 2 is grounded, the basic building block becomes a delay line. Since there is no voltage drop along the transmission lines, cores or beads play no role (electrically).

Balun Designs

1. The 1:1 Balun

There are really three different (and basic) forms of the 1:1 balun. The first (and latest) is the Guanella 1:1 balun shown in fig. 1. It uses twin lead or coax (two conductors) wound around a ferrite core or threaded through ferrite beads. Recently this form has been called a choke or current balun. Photo A (on the left) shows a bifilar winding on a ferrite toroid.

The other two forms of the 1:1 balun

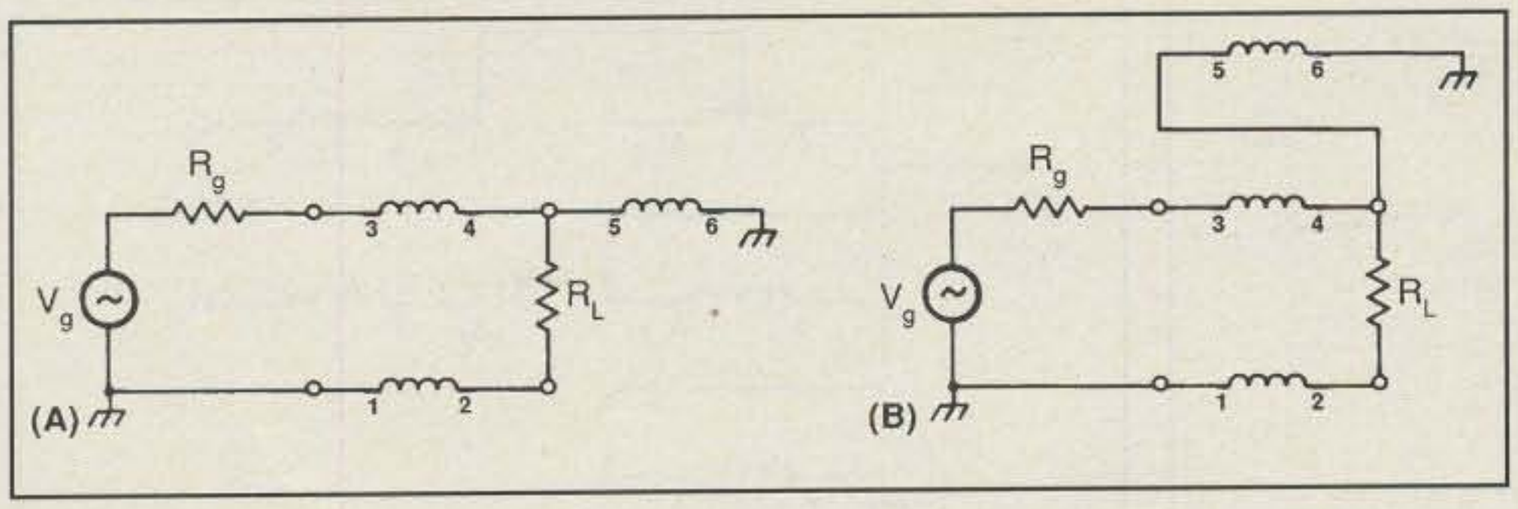


Fig. 2– The schematic diagrams of the two basic forms of the three-conductor 1:1 balun: (A) the Ruthroff balun and (B) the trifilar (voltage) balun.

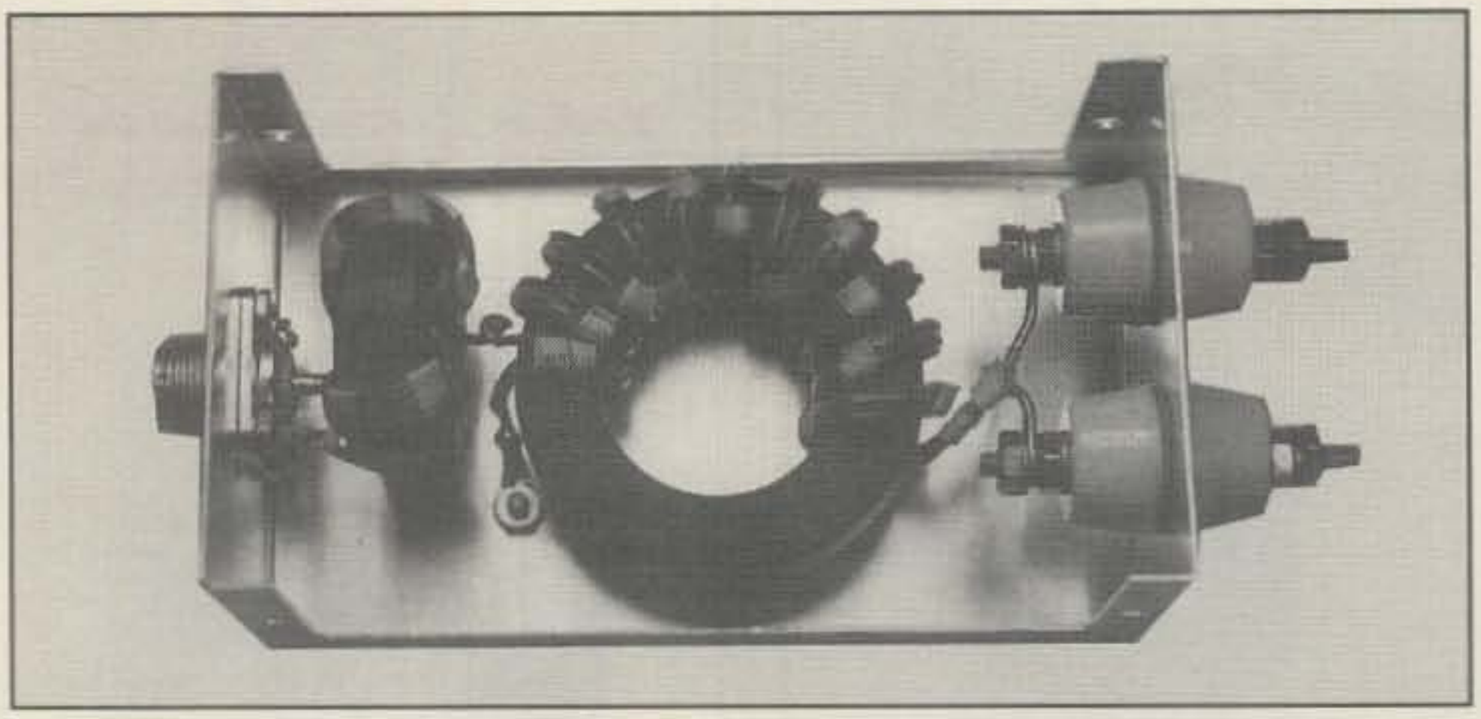


Photo C– A compound balun designed to match 50 ohm cable to a balanced load of 78 ohms (a 1:1.56 ratio).

have a three-conductor arrangement. Fig. 2(A) and photo A (in the center) show the Ruthroff balun. As you can see, the third wire is on a separate part of the toroid. This balun first appeared in Ruthroff's classic 1959 paper.[2] The third wire actually extends the low-frequency response, since the design acts as an autotransformer at the low-frequency end. At this low end of its response, the balun is susceptible to an unbalanced load. As the frequency is increased, it acts as a Guanella balun, since the choking action of the third wire makes it transparent to unbalanced loads.

The third form of the 1:1 balun is shown in fig. 2(B) and on the right in photo A. This is the design that mainly has been used for the comparisons with the "new" coaxial-cable 1:1 baluns. This trifilar-wound (voltage) balun is highly susceptible to unbalanced and mismatched loads over its entire response. This is so because this design consists of two transmission lines which are tightly coupled. Turrin[4] pointed out the differences in these three baluns in his important 1969 paper. Obviously, succeeding authors failed to take advantage of his important contribution.

Photo B shows two of my baluns designed to match 50 ohm cable to balanced loads of 50 ohms. The one on the left has 10 bifilar turns of No. 12 H Thermaleze wire on a 2.4 inch OD ferrite toroid with a permeability of 250. One wire is covered with two layers (spiral-wound) of Scotch No. 92 tape, raising the characteristic impedance close to 50 ohms (actually, since the winding is only 22 inches long, the characteristic impedance can vary between 45 and 55 ohms without any noticeable effect). The wires are clamped together every 1/2 inch with strips of Scotch No. 27 glass tape 3/16 inches wide and a little over 1 inch long. This balun has sufficient margins in inductive reactance and voltage breakdown to easily handle the full legal limit of amateur radio power from 1.5 MHz to 30 MHz. Even at 1.5 MHz this balun has sufficient reactance to suppress unwanted currents with a load of 150 ohms (a 3:1 VSWR). The balun is mounted in a 4"L × 3"W × 2.25"H Bud CU 234 aluminum box.

The balun on the right in photo B is a suggested design for triband Yagi beams (10, 15, and 20 meters). Since the reactance of the choke only has to be much greater than 50 ohms (actually 150 ohms for margin) at 14 MHz, fewer turns and a smaller toroid can be used. Specifically, this balun has 7 bifilar turns of the same wire (as above) on a 1.5 inch OD ferrite toroid with a permeability of 250. This balun can also easily handle the full legal limit of amateur radio power. It is mounted in a 4"L x 2"W x 2.75"H CU 2115-A minibox.

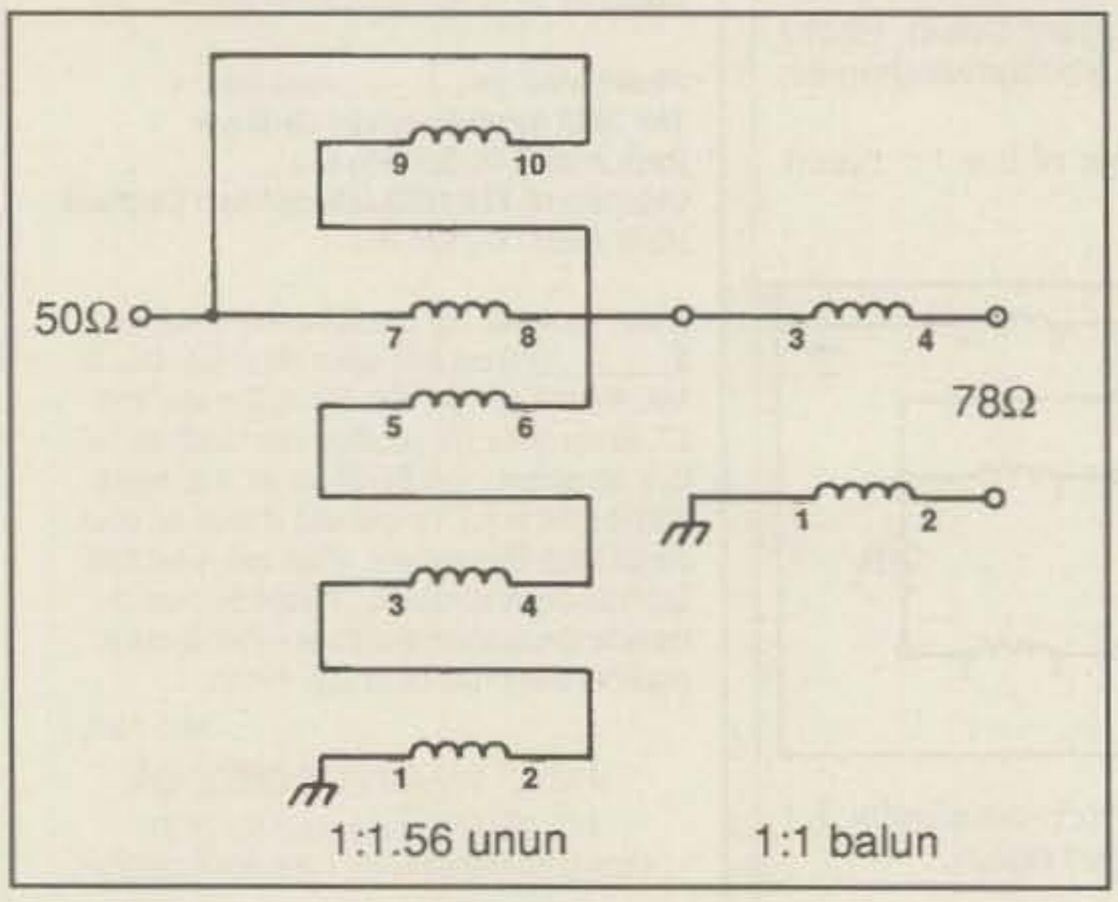
2. The 1.5:1 Balun

The resonant input impedance (radiation resistance) of a horizontal half-wave antenna is only 50 ohms at about 0.17 wavelengths above ground. At about 0.22 wavelengths, it's close to 75 ohms. At about 0.34 wavelengths, it approaches 100 ohms (the maximum value). Therefore, 1.5:1 and 2:1 baluns could be of interest to many amateurs. This section presents a 1.5:1 design.

Fig. 3 shows the schematic diagram of a 1.56:1 balun designed to match 50 ohm cable to a balanced load of 78 ohms (which is close enough to 75 ohms). It consists of a 1:1.56 unun in series with a 1:1 balun. Photo C shows the compound balun mounted in a 5.25"L × 3"W × 2.25"H CU 3006 minibox (Radio Shack carries a similar enclosure).

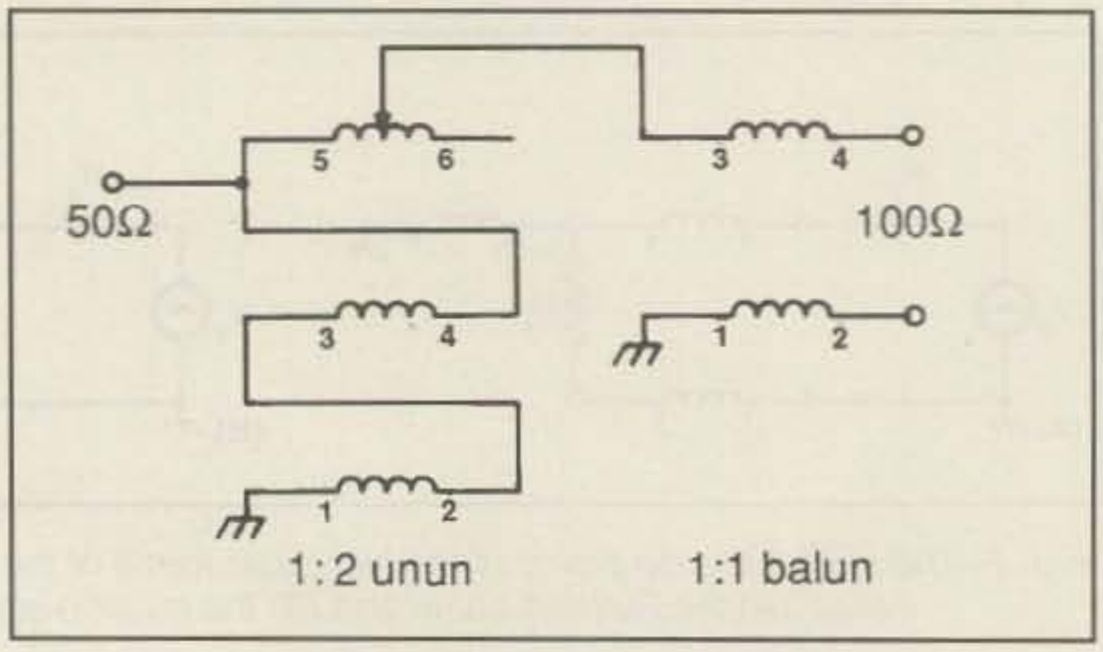
The 1:1.56 unun[5] has 4 quintufilar turns on a 1.5 inch OD ferrite toroid with a permeability of 250. Winding 7–8 is No. 14 H Thermaleze wire, and the other four are No. 16 H Thermaleze wire.

The 1:1 Guanella balun has 11 bifilar turns of No. 14 H Thermaleze wire on a 2.4 inch OD ferrite toroid with a permeability of 250. One wire is covered with Teflon tubing, giving a characteristic impedance very close to 78 ohms (the optimum value).



← *Fig. 3– Schematic of a 1:1.56 balun.*

Fig. 4– Schematic of a 1:2 balun. ↓



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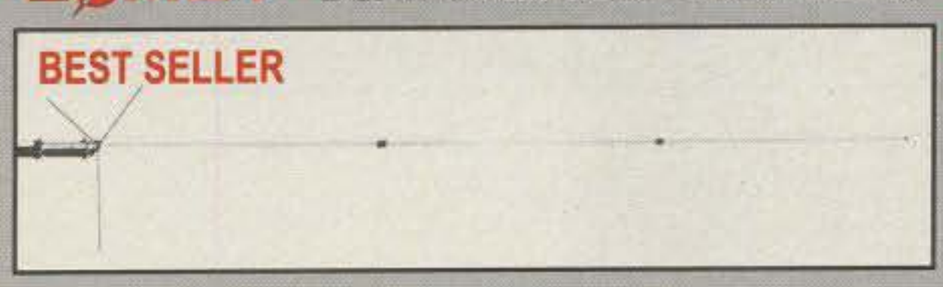
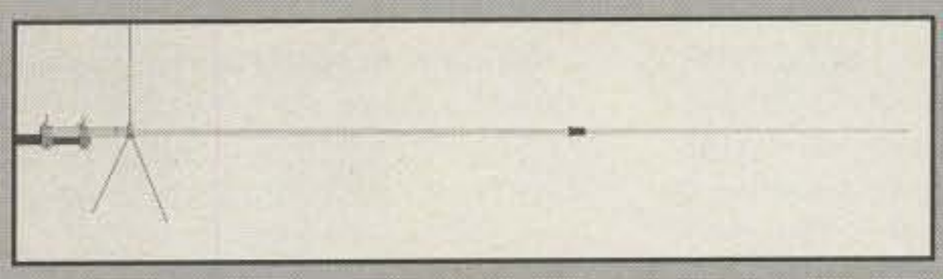
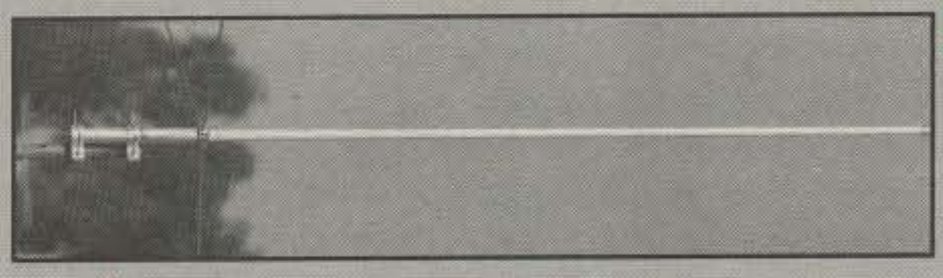


CA-2x4MAX
Gain & Wave:
146 MHz 8.5dB 5/8 wave x 3
446 MHz 11.9dB 5/8 wave x 8
Max Power: 200 watts
Length: 17' 8"
Connector: SO-239



CA-2x4WX
Dual-Band 146/446MHz
Gain & Wave:
146MHz 6.5dB 5/8 wave x 2
446MHz 9.0dB 5/8 wave x 5
Max Power: 200 watts
Length: 10' 2"
Connector: SO-239



CA-2x4FX
Dual-Band 146/446MHz
Gain:
146MHz 4.5dB
446MHz 7.2dB
Max Power: 200 watts
Length: 5' 11"
Connector: SO-239

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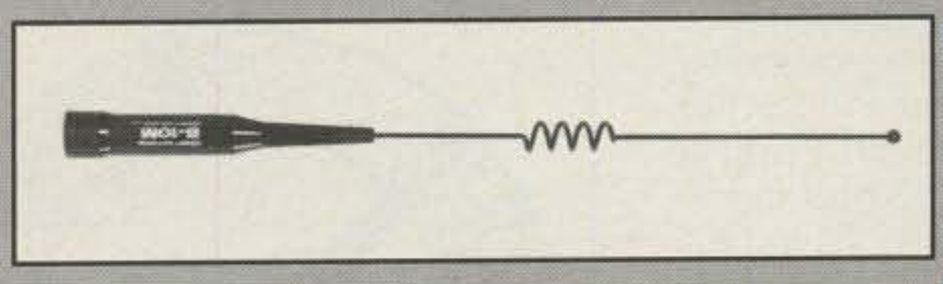
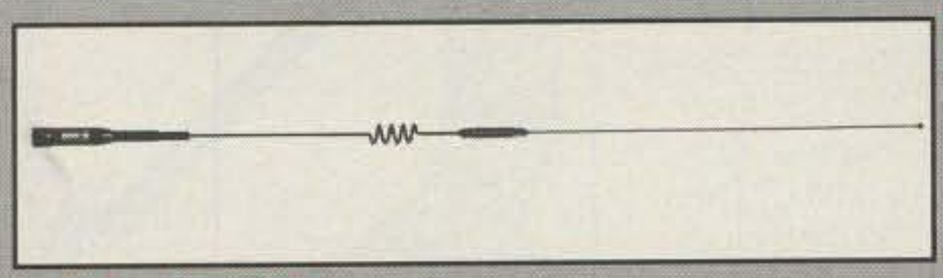
CA-2x4MB
Dual-Band 146/446MHz
Gain & Wave:
146MHz 4.5dB 7/8 wave
446MHz 7.0dB 5/8 wave x 3
Max Power: 150 watts
Length: 4' 10"
Connector: PL-259

BEST SELLER

CA-2x4SR
Dual-Band 146/446MHz
Gain & Wave:
146MHz 3.8dB 5/8 wave
446MHz 6.2dB 5/8 wave x 2
Max Power: 150 watts
Length: 3' 4"
Connector: PL-259

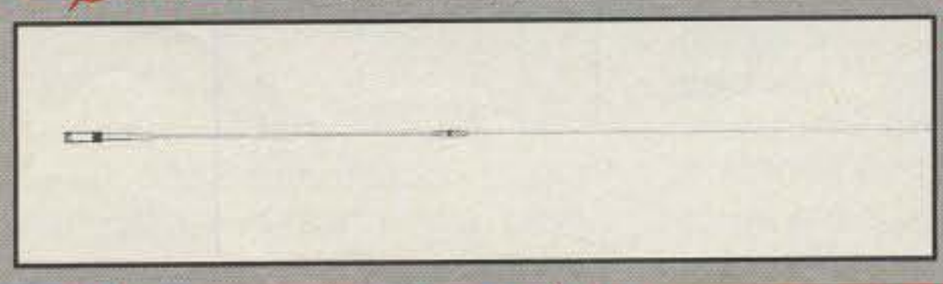


B-10/B-10NMO
Dual-Band 146/446MHz
Gain & Wave:
146MHz -dB 1/4 wave
446MHz 2.15dB 1/2 wave
Max Power: 50 watts
Length: 12"
Connector: PL-259 or NMO Style



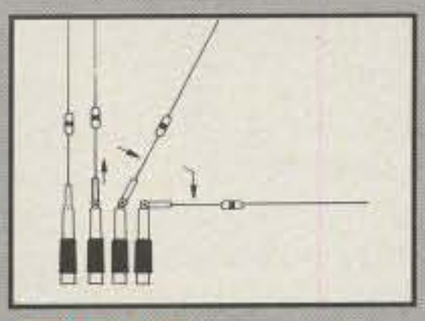
B-20/B-20NMO
Dual-Band 146/446MHz
Gain & Wave:
146MHz 2.15dB 1/2 wave
446MHz 5.0dB 5/8 wave x 2
Max Power: 50 watts
Length: 30"
Connector: PL-259 or NMO Style

COMET™ SINGLE-BAND MOBILE



CHL-185
2 Meter Mobile Antenna
Gain & Wave:
4.1dB 5/8 wave
Max Power: 200 watts
Length: 4' 8"
Connector: PL-259

CH-32
Miracle Baby 146/446MHz HT
Gain & Wave: 0dB
Max Power: 10 watts
Length: 1.75"
Connector: BNC



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SH-55
2M/440MHz
SUPER Flexible
HT Antenna
Gain & Wave:
146MHz 1.5dBi 1/4 wave
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Max Power: 10 watts
Length: 15"
Connector: BNC

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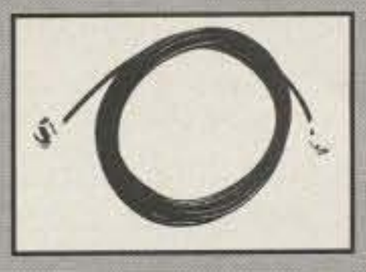
13 feet double shielded very low loss coax. + 12" RG-188 teflon coax. Gold-plated UHF (PL-259/SO-239) connectors. Allows easy entry from a lip-mount w/o causing coax or weather strip damage.



3D4M Standard Cable Assembly
13.5 feet of low loss coax. Gold plated UHF (PL-259/SO-2329) connectors.

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In matching 50 ohm cable to a balanced load of 78 ohms, the impedance transformation ratio is literally flat (within a percent or two) from 1.5 MHz to 40 MHz! This balun can also easily handle the full legal limit of amateur radio power.

It might be pointed out that (separately) the 1:1 (75:75 ohm) balun would make an excellent isolation transformer for 75 ohm hardline, and the 1.56:1 (50:78 ohm) unun an excellent match between 50 ohm cable and 75 ohm hardline.

3. The 2:1 Balun

As mentioned above, the 2:1 balun should prove useful for matching 50 ohm cable to a resonant half-wave dipole at a height of about 0.34 wavelengths above ground. But it probably will find more use in matching 50 ohm cable to quad antennas which have resonant input impedances close to 100 ohms. For the HF band (including 160 meters) I found two ways of designing a 2:1 balun. One used a 2:1 (or 1.78:1 or 2.25:1)[6,7] step-down unun in series with a 1:4 Guanella balun (step-up). The other used a 1:2 step-up unun[6] in series with a 1:1 balun and is the one described in this section.

Fig. 4 shows the schematic diagram of the 1:2 balun. Photo D shows the balun mounted in a 5"L × 4"W × 3"H CU 3005-A minibox. The 1:2 unun has 7 trifilar turns on a 1.5 inch OD ferrite toroid with a permeability of 250. The output tap is at 6 turns from terminal 5. Winding 5–6 is No. 14 H Thermaleze wire, and the other two are No. 16 H Thermaleze wire.

The 1:1 balun has 14 bifilar turns of No. 14 H Thermaleze wire on a 2.4 inch OD ferrite toroid with a permeability of 250. Both wires are covered with Teflon tubing, resulting in a characteristic impedance of 100 ohms (the optimum value). A crossover, placing 7 turns on one side of the toroid and 7 turns on the other, is used so the output and input are on opposite sides of the toroid. Although this technique has no electrical advantage at HF, the mechanical advantage is obvious. Fig. 5 shows the construction of the crossover.

When matching 50 ohm cable to a balanced load of 100 ohms, the response is literally flat (within 2 to 3 percent) from 1.5 MHz to 30 MHz. This balun can also handle the full legal limit of amateur radio power.

4. The 4:1 Balun

As was mentioned earlier in this article, Guanella[1] and Ruthroff[2] had different approaches for their 1:1 baluns. However, the differences in their approaches for 4:1 baluns were even greater! Fig. 6 shows their schematic diagrams. As you can see, Guanella connects two transmission lines in parallel on the 50 ohm side and in series at the 200 ohm side. Ruthroff connects a single transmission line in a phase-inverter configuration.[3] Since Ruthroff's balun adds a direct voltage to a voltage that traverses a single transmission line, the high-frequency response suffers because of the phase-delay.

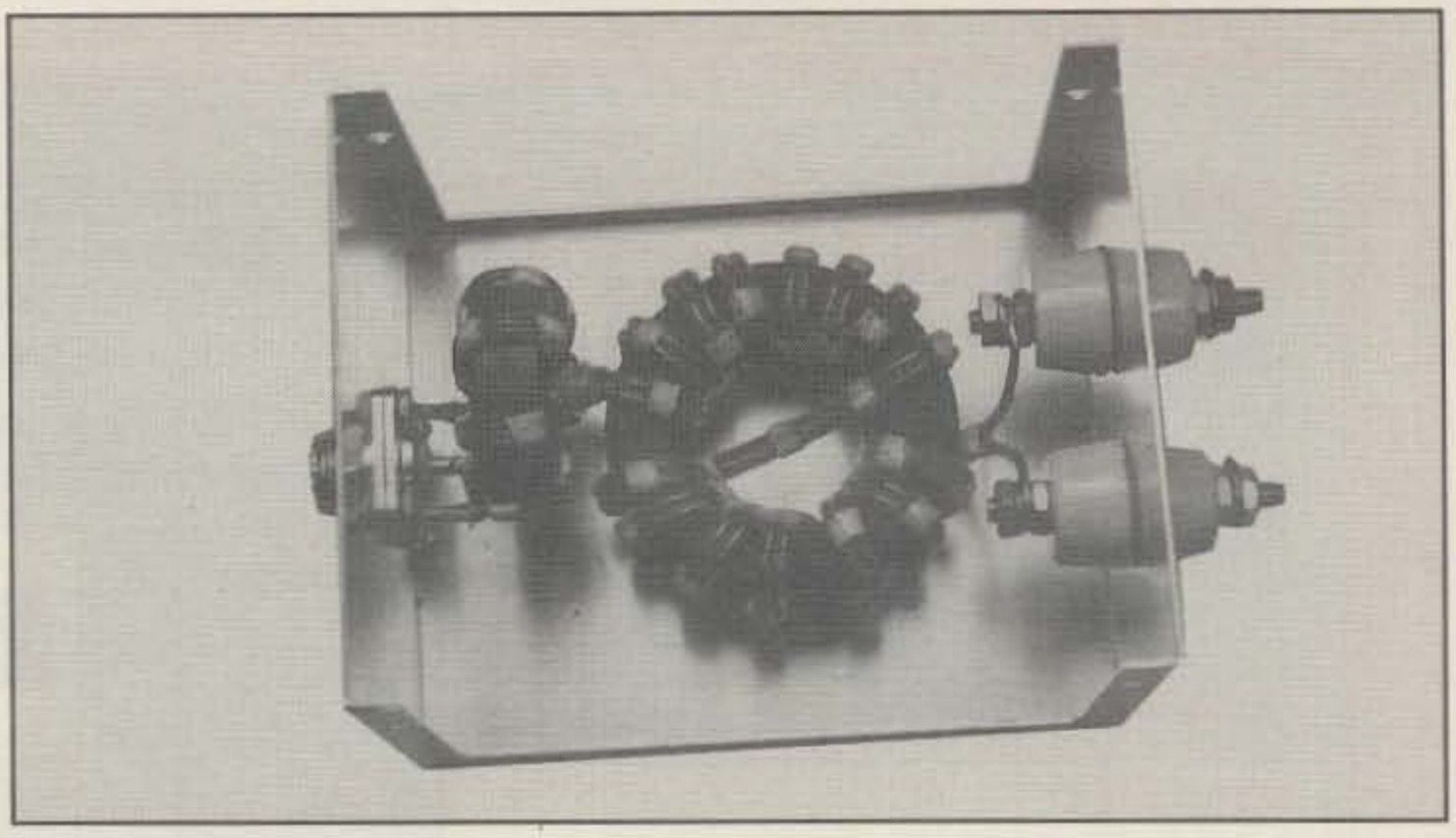

Photo D– A compound balun designed to match 50 ohm cable to a balanced load of 100 ohms (a 1:2 ratio).

Guanella's approach adds voltages with equal delays. Additionally, Ruthroff's balun is susceptible to unbalanced loads while Guanella's isn't. Incidentally, Ruthroff's 4:1 balun has also been called a voltage balun.

Photo E shows a Guanella (current) 4:1 balun mounted in a 5"L × 4"W × 3"H CU 3005-A minibox. It has 14 bifilar turns of No. 14 H Thermaleze wire on each of the two 2.4 inch OD ferrite toroids with permeabilities of 250. Each wire is covered with Teflon tubing, resulting in a characteristic impedance close to 100 ohms (the optimum). The windings also employ a cross-over after the seventh turn as is shown in fig. 5. For ease of connection, one toroid is wound clockwise and the other counter-clockwise. The spacing between the toroids can be between 1/4 inch and 1/2 inch. When matching 50 ohm cable to a balanced load of 200 ohms, the transformation ratio is constant (within 2 percent) from 1.5 MHz to 45 MHz. This balun can also handle the legal limit of amateur radio power. This balun would probably perform satisfactorily if wound with ordinary No. 14 house wire (solid) or with Teflon-covered No. 14 tinned wire. But the design in photo E has withstood peak pulses of 10,000 volts! It could be worthwhile to take the extra effort and use Teflon-covered No. 14 H Thermaleze wire.

A single-core version using two coiled transmission lines on a single core looks interesting and should be investigated. It results in balanced currents and unbalanced voltages. I would use two coiled transmission lines with 7 bifilar turns of the same wire on the same core as above.

5. The 6:1 Balun

The 6:1 and 9:1 baluns have taken on more interest lately because of the availability of 300 ohm and 450 ohm ribbon. Also, it is well-known that folded dipoles, using 300 ohm ribbon, have a resonant input impedance *(in free space)* close to 300 ohms. Since broadband designs require characteristic impedances of 150 ohms, they are more difficult to construct. Furthermore, these higher-impedance baluns are more sensitive to their enclosures if they are metallic. The

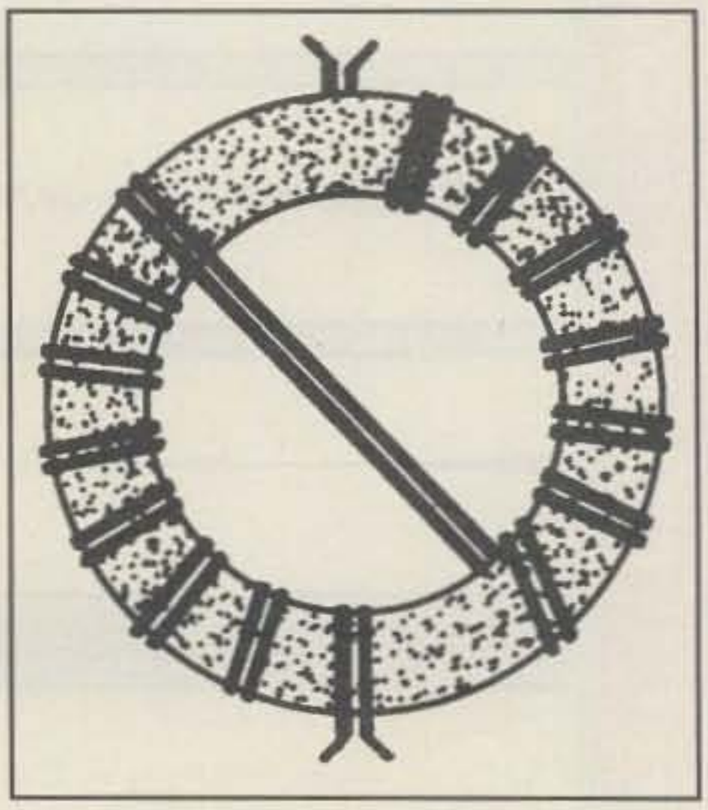

Fig. 5– Construction of a 1:1 Guanella balun with a crossover placing the input and output leads on opposite sides of the toroid.

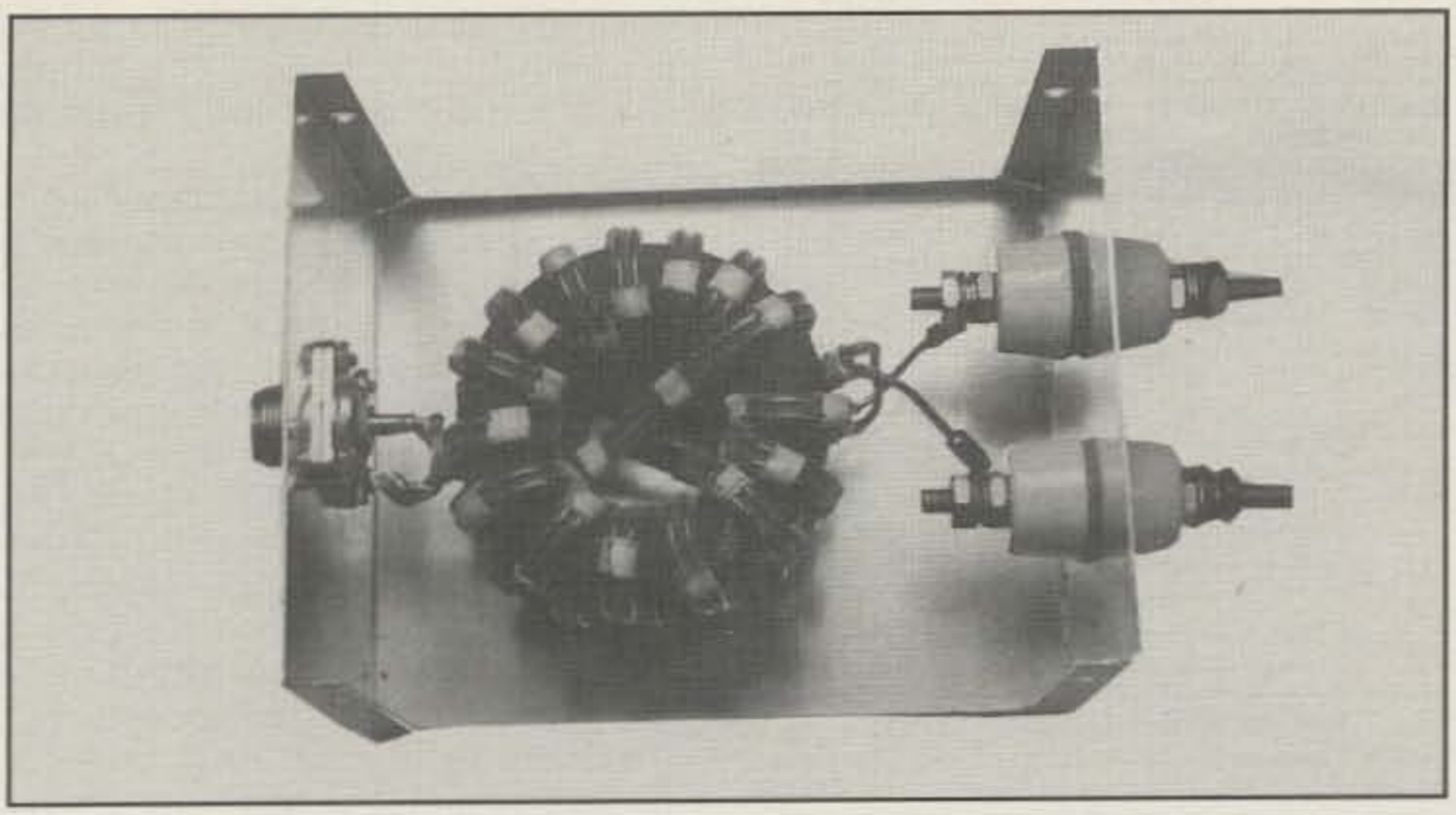

Photo E– A 4:1 Guanella balun mounted in a CU 3005-A minibox.

grounded walls, if nearby, tend to lower the characteristic impedance of the windings.

Fig. 7 shows the schematic diagram of a compound balun designed to match 50 ohm cable to a balanced load of 312.5 ohms. This ratio of 6.25:1 should satisfy most 6:1 requirements. The 1:1.56 unun has 4 quintufilar turns on a 1.5 inch OD ferrite toroid with a permeability of 250. Winding 9–10 is No. 14 H Thermaleze wire, and the other four are No. 16 H Thermaleze wire.

The 1:4 Guanella balun has 14 bifilar turns of No. 16 SF Formvar wire on each toroid. The wires are covered with Teflon tubing and further spaced with Teflon tubing, resulting in a characteristic impedance close to 150 ohms. The toroids have an OD of 2.4 inches and a permeability of 250. They can be spaced between 1/4 inch to 1/2 inch from each other. For ease of connection, one toroid is wound clockwise and the other counter-clockwise.

In a non-conducting enclosure the response is essentially flat (within 2 to 3 percent) in matching 50 ohm cable to a balanced load of 312.5 ohms from 1.5 MHz to 30 MHz. When mounted in a 5"L × 4"W × 3"H CU 3005-A minibox (as shown in photo F), the impedance transformation ratio increases by 10 percent from 1.5 MHz to 30 MHz. If interest is only in operating from 3.5 MHz to 30 MHz (with the same enclosure), then I suggest using 12 bifilar turns on each toroid instead of 14. This would result in a change in the ratio of less than 5 percent across the band because of an increase in the characteristic impedance of the windings. This balun can also handle the full legal limit of amateur radio power.

6. The 9:1 Balun

An efficient and broadband 9:1 balun, matching 50 ohm cable to a balanced load of 450 ohms, is one of the most difficult baluns to construct. It can only be achieved by using Guanella's approach of connecting three transmission lines in parallel on the 50 ohm side and in series on the 450 ohm side. The schematic diagram is shown in fig. 8. It is difficult for the following reasons: (1) the low-frequency model[3] shows that the choking reactance of the windings is only one-half that of a 4:1 balun, (2) a 150 ohm characteristic impedance winding limits the number of turns that can be placed on the popular 2.4 inch OD ferrite toroid, and (3) it is more sensitive to the proximity of the walls of conducting enclosures.

Photo G shows a 9:1 design mounted in a 6"L × 5"W × 4"H minibox. It has 14 bifilar turns of No. 16 SF Formvar wire on each of the three toroids which have 2.4 inch ODs and permeabilities of 250.

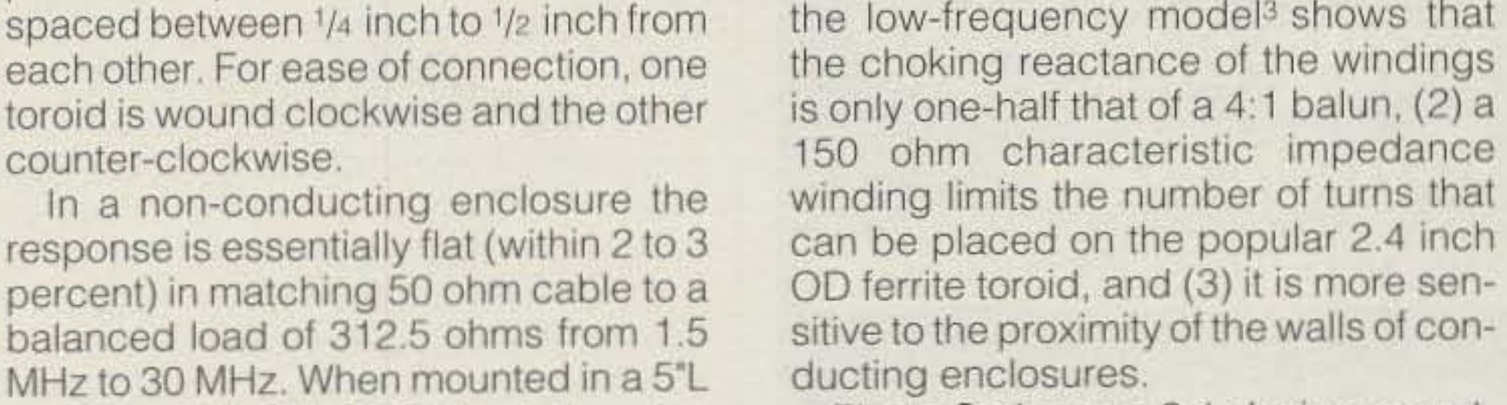

Fig. 6– Schematics diagrams of 4:1 baluns: (A) Guanella's and (B) Ruthroff's.

Each wire is covered with Teflon tubing and further separated by Teflon tubing, resulting in a characteristic impedance close to 150 ohms. The toroids have a 1/2 inch spacing (acrylic) between them.

If mounted in a non-conductive enclosure or in a large minibox (photo G), when matching 50 ohm cable to a balanced load of 450 ohms, the response is essentially flat (within 3 to 4 percent) from 1.5 MHz to 450 MHz. When mounted in the smaller CU 3005-A minibox, the balun exhibited a resonance which increased the impedance ratio by 20 percent at 21 MHz. Since the choking reactance is not as large as that of the 4:1 balun (for the same number of turns), it is recommended that this balun not be operated (at the full limit legal of amateur radio power) on 160 meters with a VSWR greater than 1.5:1. If a 9:1 balun is to mainly be used on 80 and 160 meters, I would recommend 16 bifilar turns on toroids with 2.68 inch ODs and permeabilities of 290. These toroids are *not* inexpensive!

Misconceptions

From recent discussions "on the air" and phone calls concerning baluns, I think the most *expensive* misconception regarding baluns is the assumption that a 9:1 (450:50 ohm) balun would match 50 ohm cable (or the output of a linear or transceiver) to 450 ohm twin lead without considering the effect of its termination. In truth, the 9:1 balun would only see 450 ohms if the line were terminated in 450 ohms. In reality, if the line were terminated in a 50 ohm dipole, the balun would see 50 ohms when the line is a half-wave long and 4050 ohms when it is a quarter-wave long. The 9:1 balun is clearly useless in this application.

But by far most misconceptions regarding baluns are due to the very many that perceive these devices as conventional transformers which transmit the energy from input to output by flux linkages and not as transmission line transformers which transmit it by an efficient transmission line mode. This is clearly shown by the writers who have compared their "new" coaxial-cable (coiled about a toroid or threaded through ferrite beads) baluns with baluns using wire transmission lines coiled about a ferrite rod or toroid. They claim their baluns were better because the others (1) were limited by leakage inductance, (2) did not exhibit true 1:1 impedance transformations, (3) were prone to core saturation, (4) added a reactive component to the input impedance, (5) were susceptible to unbalanced and mismatched loads, and more important, (6) had *more loss*.

If the writers had accepted the right

model for these devices (given to us by Guanella and Ruthroff)—the model which would have shown that they are really chokes (lumped elements) and configurations of transmission lines (distributed elements)—then these are the parameters they should have considered in their comparisons: (1) the characteristic impedances and lengths of the transmission lines (the high-frequency capability), (2) which form of the 1:1 balun or 4:1 balun is used by the other balun, (3) the low-frequency capabilities (safety margins), (4) power capabilities, and (5) efficiencies.

If the writers had used the proper parameters in their comparisons, they would have found that mismatch loss was mistaken for real (ohmic) loss, high-frequency response was limited by standing waves and not leakage inductance or shunting capacitance, the beaded-coax balun had *more* loss than a well-designed balun using wire transmission lines coiled about a toroid (a so-called transformer-type), and that their comparisons were made with either the trifilar (voltage) 1:1 balun or the Ruthroff 4:1 balun, both of which are inferior designs.

In fact, the perception that the transmission line transformer is actually a conventional transformer is so prevalent that a new name for this class of devices is being considered. It is *Broadband Transmission Line Matching Networks*. This name (without the word transformer) would help dispell the wrong perceptions and standardize the schematic diagrams. It would put the coiled or beaded transmission lines (in the high-frequency models) horizontally and eliminate the phasing or polarity dots.

Hostile Environments

There are three major failure mechanisms with all forms of baluns. They are (1) voltage breakdown, (2) core or bead damage due to excessive magnetic flux, and (3) excessive heating due to the high voltages along the transmission lines (dielectric losses). Some details on these three failure mechanisms are as follows.

1. Voltage Breakdown

If a half-wave dipole suddenly presents a high impedance to the balun by a part of the antenna breaking away or by the operator making a mistake by changing the band such that the balun sees the high impedance of a full-wave or quarter-wave antenna, an arc-over can occur. This is particularly true if the balun uses single-coated wire. If the balun uses the popular trifilar form (on the right in photo A and fig. 2), an ohmmeter would not detect the short, since the third winding is a short at DC. This is also true of Ruthroff's 1:1 balun. But baluns using heavy coated wires, plus a layer or two of Scotch No. 92 polyimide tape for spacing (to obtain a characteristic impedance close to 50 ohms), would have a much higher voltage-breakdown capability. Coaxial cables also have the same advantage.

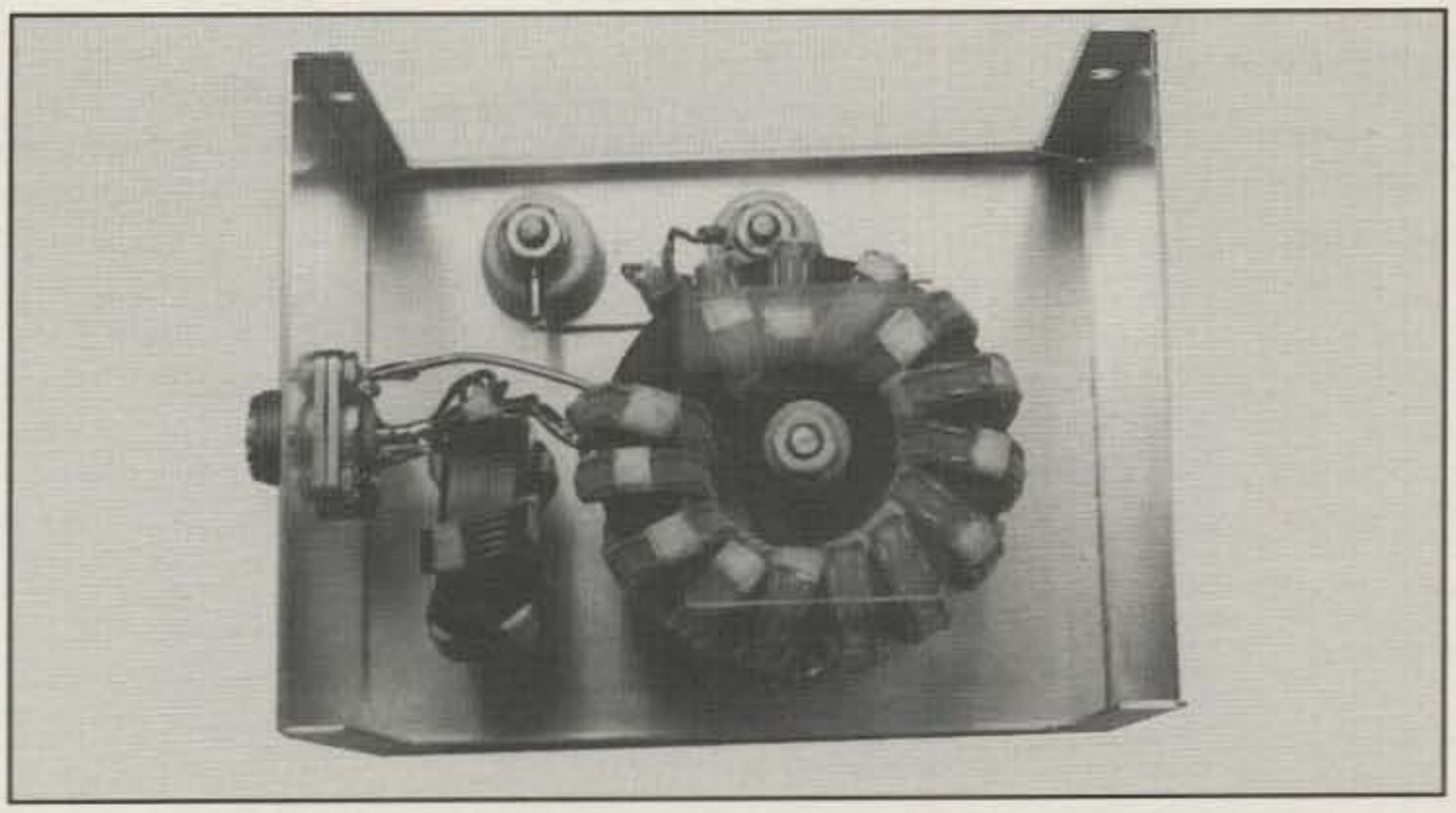

Photo F– The 6.25:1 balun of fig. 7 mounted in a CU 3005-A minibox.

2. Core or Bead Damage

One of the main objectives in the design of broadband baluns is to have sufficient margins in the choking reactance (by coiled or beaded lines) such that only flux-cancelling transmission line currents are allowed to flow. A good rule-of-thumb would be to have the choking reactance (at the lowest frequency of interest) at least three times greater than is required in a matched condition. For example, the choking reactance of a 1:1 (50:50 ohm) balun should be much greater than 50 ohms in a matched condition (VSWR of 1:1). But for a safety margin, it should be much greater than 150 ohms (VSWR of 3:1). With insufficient reactance, the excessive flux can damage the ferrite cores and beads. This damage appears as an increase in loss in the ferrite and not as a change in the permeability. Rod-type baluns have been prone to this failure mechanism because of the difficulty in achieving sufficient choking reactances.[3]

If one has access to an impedance bridge,[3] then the margin of safety can easily be measured. All one has to do is terminate the balun in a load two or three times greater than it was designed for and measure the input impedance at the low-frequency end. If the input impedance does not decrease and become inductive, then sufficient margin exists. Since the Guanella 1:1 (current) balun has only two conductors (no

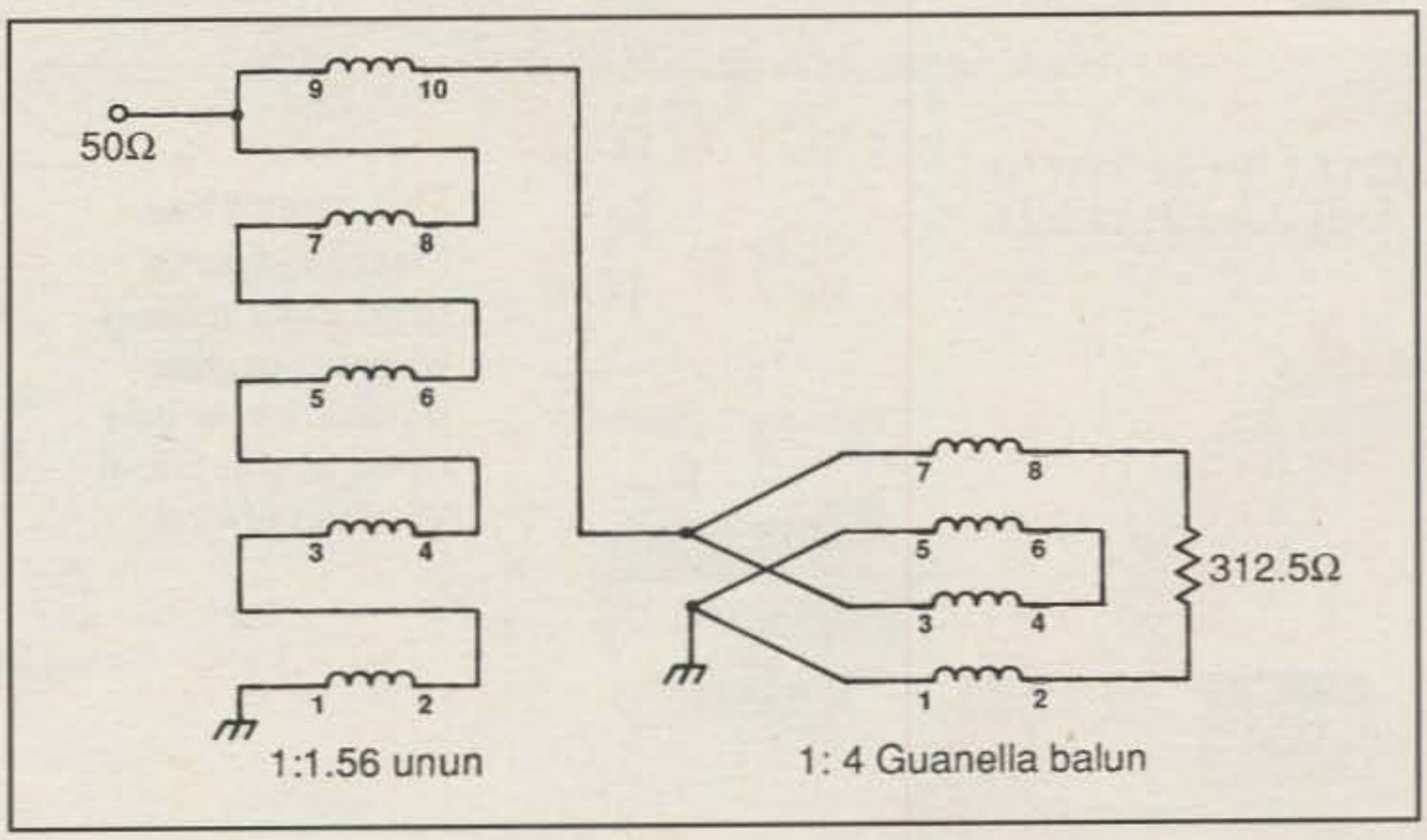

Fig. 7– Schematic diagram of a 6.25:1 balun.

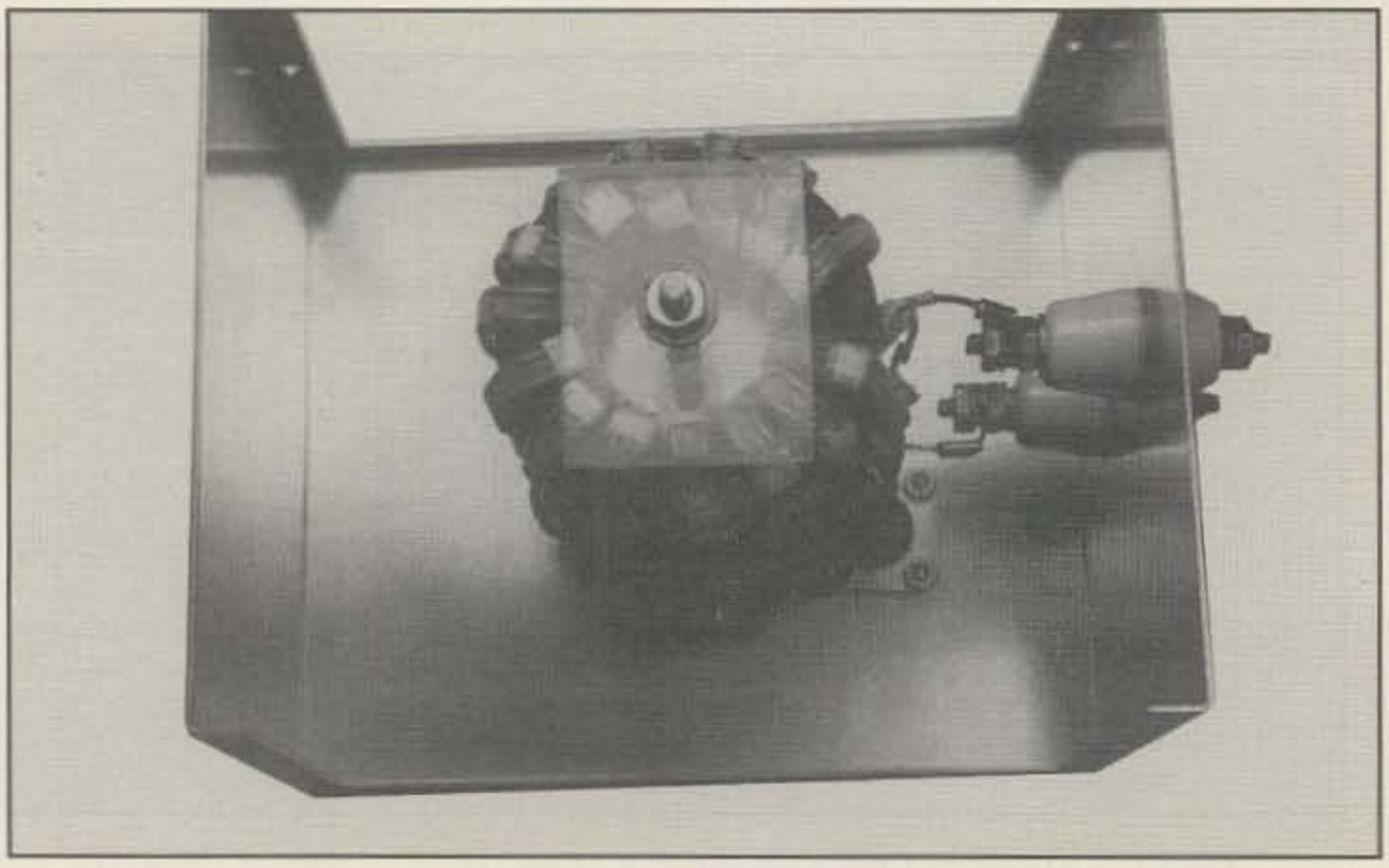

Photo G– The Guanella 9:1 balun mounted in a large minibox.

return to ground), then making the measurement with a load center-tapped-to-ground is required.

3. Excessive Heating

This is the failure mechanism that is probably the most important and least understood. It is critically important in the power ratings of baluns which, as yet, have not been standardized by any professional group. In amateur radio jargon, this type of failure is known as a "smoked" balun.

From very accurate insertion-loss measurements on ununs,3 several important results related to this failure mechanism were obtained. They are:

(1) With ferrite materials, this loss is related to the voltage level and not the current level as in conventional transformers. Therefore, this loss is a dielectric-type.

(2) This loss is also related to the permeability of ferrite materials. The higher the permeability, the greater (most generally) the loss. And only low-permeability (less than 300) nickel-zinc ferrites yield the very high efficiencies of which these baluns are capable.

(3) This loss is also frequency-dependent. Furthermore, the higher the permeability, the greater the frequency-dependency.

From the high-frequency models of the six baluns described in this article, it can be shown that the 1:1 balun has the lowest voltage drop along the length of its transmission line, and the 6:1 and 9:1 baluns have the highest. Therefore, the 1:1 balun has less loss than the 6:1 and 9:1 baluns. In matched conditions it appears from the data that the 1:1 balun could have a loss of 0.04 dB to 0.08 dB, and the 6:1 and 9:1 baluns 0.12 dB to 0.24 dB. These are losses in the HF band with ferrites of 250 permeability. The losses with the other baluns in this article fall in between these values.

With mismatched (larger) loads, however, the voltage drops increase, and as a result so do the losses. With a VSWR of 2:1, the loss could increase by at least 40 percent. With a VSWR of 4:1, the losses could more than double.

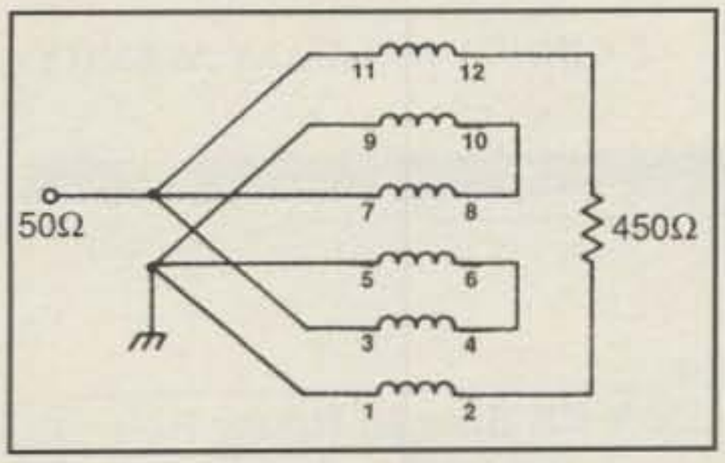

Fig. 8– Schematic diagram of the Guanella 9:1 balun.

Several conclusions can be reached concerning hostile environments. They are:

(1) Rod-type baluns using single-coated wires are most susceptible to voltage breakdown and damaging core flux.

(2) Trade-offs can be made in low-frequency response for efficiency. By using permeabilities of 125 instead of 250, all of the baluns in this article could have lower losses by about a factor of two. However, they would give up the 160 meter band in exchange!

(3) Beaded-coax baluns have the most loss since they require high-permeability beads in order to obtain the necessary choking reactance in the HF band.

(4) The most hostile condition is when the balun is presented with a very high impedance load. This could "smoke" the balun due to excessive dielectric loss and/or core flux. Dielectric loss is not harmful to the core or beads, but excessive magnetic flux is.

(5) The multiband off-center-fed dipole can present high impedances to baluns, which can result in excessive loss. VSWRs of 4:1 are not uncommon. In fact, some consider a 3:1 VSWR a *light* mismatch with these antennas! Furthermore, since the coaxial cable feedline is not in the center of the dipole where the zero-potential (ground) plane is, the induced current on it is much greater then on the one feeding a center-fed dipole.

(6) Baluns in most antenna tuners are probably subjected to more severe hostile environments than baluns matching antennas. Since powered-iron doesn't exhibit any dielectric loss[3] and is known to be linear (can stand high core-flux), the intriguing question arises as to whether this is the material of choice in tuners. The "knock" on powdered-iron is its low permeability. Material with a permeability of 10 (the "red" mixture) is the most popular. But no one (including the author) has investigated the use of higher-permeability powdered-irons in baluns. Remember, the balun is a choke and a configuration of transmission lines. Once the transmission line mode comes into play, the high-frequency response of the core is not important. Therefore, the use of large powdered-iron cores with permeabilities of 25 and greater looks interesting and warrants investigation.

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1. G. Guanella, "Novel Matching Systems for High Frequencies," *Brown Boveri Review,* Volume 31, September 1944, pages 327–329.

2. C. L. Ruthroff, "Some Broad-Band Transformers," *Proceedings of the IRE,* Volume 47, August 1959, pages 1337–1342.

3. Jerry Sevick, W2FMI, *Transmission Line Transformers,* 2nd edition, Amateur Radio Relay League, Newington, Connecticut, 1990.

4. Richard H. Turrin, W2IMU, "Application Of Broad-band Balun Transformers," *QST,* April 1969, pages 42, 43.

5. Jerry Sevick, W2FMI, "The 1.5:1 and 1.33:1 Ununs," *CQ,* November 1992, pages 27–30.

6. Jerry Sevick, W2FMI, "The 2:1 Unun," *CQ,* August 1992, pages 13–18.

7. Jerry Sevick, W2FMI, "The 4:1 Unun," *CQ,* January 1993, pages 30–36.

Correction

In W2FMI's article "A Multimatch UNUN," April 1993 *CQ,* fig. 1 has tap C coming off of point 4. It should be point 2. Kits furnished by Amidon are supplied with the correct drawings.

AWARDS

BY NORM VAN RAAY, WA3RTY

NEWS OF CERTIFICATE AND AWARD COLLECTING

The Story of the Month for June is:

Eugene Eggebratten, W7GVF
USA-CA #691
All 20M SSB Mobile to Mobile
1-24-91

This month we salute Gene, W7GVF, for reaching one of the highest goals in amateur radio—the United States of America County Award. Gene is a retired Deputy Chief of the Seattle, Washington Fire Department and was first licensed in 1957.

Gene's amateur radio activities include Air Force and Navy-Marine Corps Military Amateur Radio Service (MARS). During the Vietnam war he was a west coast gateway station for Navy-Marine Corps MARS, handling radio teletype traffic to and from southeast Asia. He also handled phone patch traffic for Operation Deep Freeze in Antarctica for two years. Gene's RTTY experience goes back to the golden days of "the green keys" when the fun was in building your own terminal units. He has 110 countries confirmed on RTTY and 227 confirmed on other mmodes.

Gene writes that in 1986 he was about to take a trip from Seattle to eastern South Dakota when a friend mentioned that there was a bunch of people hanging around 14.336 calling county hunters who were always looking for counties. Gene writes:

"My friend said that I would probably be going through some rare counties in Montana and the Dakotas and that I might enjoy tuning in on that frequency. I installed my ICOM 740 in the car and mounted an antenna on the rear bumper and we were off.

"I was not accustomed to the procedures or protocol, so the first few days were a little rough. However, through the help of some friendly and kind net control stations it got easier. We were able to put out quite a few counties. After keeping track, I decided to start county hunting myself and to work them all 20 meter mobile to mobile. Of course, the propagation was good in the midwest. Little did I know what was in store for me when I got back west of the Rockies and to west coast propagation.

"Along the way to working my 3076 it has been my privilege to give out 890 counties in 38 states, making more than a few people happy. It was my pleasure to give Eddie Puskas, WA8RSQ, his last county for his USA-CA Award from Lincoln, Oregon. I decided to try to have Eddie give me my last county, if possible. On January 5, 1991 WA8RSQ gave me Wirt, West Virginia for my last one.

"It has been fun, and I've met the nicest bunch of people in all amateur radio. I can call dozens of them friends. I thank all the county hunters who were patient with my weak, puny signal from the northwest and who helped with a lot of relays. I especially want to thank those who went many miles out of their way to give me that rare one."

Gene's wife, Lois, gets special thanks for her patience, sitting in the car, engine off, with the temperature 90-plus while he gave out those county lines. Lois didn't complain when Gene cut a hole in the roof of their new Suburban to mount his antenna. People stare at that 5-band array on the roof. Amateur radio wives (widows) sure deserve a lot of gratitude for their patient tolerance.

County Hunting is not Gene's only passion. He and Lois have a 30 foot "Aluma Lite Trailer" in which they love to travel (even though it tends to de-tune the antenna). Gene also loves to fish and spends the first week in June fishing for salmon in southeastern Alaska. He also enjoys mountain climbing, cross-country skiing, and overnight snow-shoe treks into the beautiful northwestern mountains.

We say Bravo Zulu (well done) to W7GVF for his achievement.

Box 76, Pleasant Mount, PA 18453-0076

Gene Eggebratten, W7GVF, USA-CA #691, All 20 Meter SSB Mobile to Mobile January 24, 1991.

W7GVF mobile from San Juan County, Washington.

USA-CA Special Honor Roll

L. Wayne Burr, AA4HD
USA-CA All Counties #797
Mobile to Mobile SSB, 3-12-93

John P. Levo, WA8KIW
USA-CA All Counties #798
Mixed, 03-20-93

USA-CA Honor Roll

3000		1000	
AA4HD	822	KØLTM	1266
WA8KIW	823		
2500		**500**	
G3SPU	898	JG1TSF	2663
		DL7XR	2664
		JA1XGI	2665
2000		CP1FF	2666
G3SPU	976	HB9AUT	2667
		DK7NP	2668
1500		EA7OH	2669
DK1QH	1066		

The total number of counties for credit for the United States of America County 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 Communications, 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, 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 Custodian, Star Rt. 40, Box 76, Pleasant Mount, PA 18453-0076 USA. DX stations must include extra postage for airmail reply.

In Appreciation

Consistently, those receiving USA-CA certificates mention the assitance of net control stations. These folks deserve our gratitude and patience, as they work under very difficult conditions. Thanks, guys and ladies.

Awards Issued

Wayne Burr, AA4HD, submitted his good documentation for USA-CA 3000

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Dual Channels for operation with one or two connected radios. Separate equalizers, PTT paddles, and output cables for each channel.

Built-In Equalizers with individual bass and treble controls for each channel. Easily set to produce full-bodied sound or emphasize highs for penetrating DX pileups. Noticeably superior to factory-supplied mikes.

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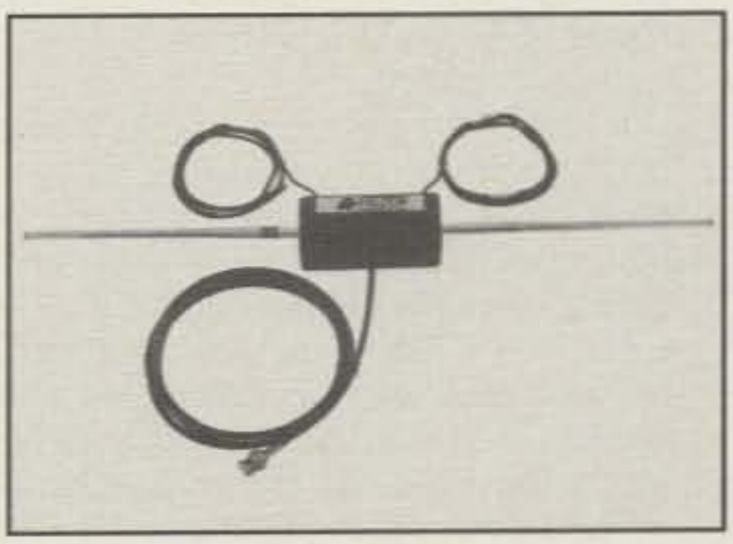
Electret Mike Element on 20-inch gooseneck. Flexes to fit every operating need.

Ready To Plug In And Use! Supplied complete with two preinstalled mike plugs and cables that fit all HF, VHF & UHF transceivers with 8-pin mike connectors. Wiring is field changeable using only a screwdriver! Requires 4-1.5v cells or 6-25 VDC ext. power. A super mike you will enjoy year after year, rig after rig!



F121A PORTATENNA The ideal portable VHF/UHF antenna for FM handhelds and scanners! Retracts to only 8.7 inches long for carrying, yet extends into full size, ground-independent half-wave dipole for 2 meters, 222MHz, 70cm, and all frequencies in between. Produces significantly greater range than "ducky" antennas.

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Super Handy for Vacationing and/or Emergencies. Just pull out the telescoping elements to markers and hang it from a door, window, etc. and you are ready to operate!

Ready To Use. Supplied complete with preinstalled 6 ft. 50-ohm cable and BNC connector to fit all popular FM handhelds. A real gem!

F251A AND F252A AUDIO DISTRIBUTION AMPLIFIERS The quick and easy way to switch audio from up to 7 rigs or other audio sources to a number of speakers inside or outside the shack. Great for combining outputs from several transceivers to a master station speaker, switching that signal to audio filters, packet TNCs, kitchen speaker, etc! Avoids cable swapping confusion!

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Internal Amplifier. Inputs are highly isolate and maintain a constant 10 ohm impedance. Volume remains steady when adding or removing an input or an output. Low output Z. Gain internally adjustable from 0-12dB. Requires 13.8 VDC power. Inputs are RCA phone jacks. Outputs are screw terminals on a plug-in terminal strip.

Two Models. F251A has single amplifier with 7 switch-selectable inputs and 4 switch-selectable outputs. Dual Channel F252A has 2 amplifiers, each with 7 inputs and 4 outputs. "Brings your shack together" in a neat and effective manner!

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#822, as did John P. Levo, WA8KIW, USA-CA 3000 #823. Wayne, AA4HD, claims to be only the second person to work all Mobile to Mobile the first time around.

Robert C. Moore, G3SPU, came in with USA-CA 2000 #976 and USA-CA 2500 #898. We are looking forward to awarding Bob his number in the near future.

Horst Werning, DK1QH, received USA-CA 1500 #1066 for submitting his completed confirmation record book.

Tom Bishop, KØTLM, upgraded his USA-CA quest with USA-CA 1000 all 6 Meter SSB. Congratulations to Tom for his achievement.

It has been said that a long journey begins with the first step. The following have taken that first step by submitting their documentation for the basic USA-CA 500: Masato Shimizu, JG1TSF, USA-CA 500 #2663; Joachim Giliesch, DL7XR, USA-CA 500 #2664; Haruhisa Uchida, JA1XGI, USA-CA 500 #2665; Mario Iberkleid, CP1FF, USA-CA 500 #2666; Nino Balzarini, HB9AUT, USA-CA 500 #2667; Rudolf Hiem, DK7NP, USA-CA 500 #2668; Jose Mendez, EA7OH, USA-500 #2669; Mike Tsarev, UA9AO, USA-CA 500 #2670.

Endorsements go to: Michael Eilers, K8OOK, USA-CA All Counties #480, who received additional endorsements for 1000 confirmed all mobile contacts on 75 meters and 500 mixed mode contacts on 15 meters. At press time Mike garnered another endorsement, 500 mixed mode contacts on 160 meters. Keep it up, Mike.

Awards Available

President and Award Manager Kremer Francis, F6FQK, notified us that Eugene Neil, WA3KKO, St. Petersburg, Florida, with 200 SSB QSOs, is on the second listing for the Council of Europe's European World Wide Award (see February 1992 *CQ* p. 67). Other amateurs honored were as follows.

200 SSB: LU2NI, IK7DBB, FE1ETM, FE1JJM, HB9DUK, DZ1CID, OZ1ACB, FE1JSK, HB9BGV, F6FOK, PA3DKE, 5R8DG, TN1AT.

200 CW: OK2PO, FE1LJF, F3AT, XE1MD, 3A2LF.

200 Mixed: OE3ESA, CD7KR, HB9BGV.

Satellite: FE1GYA, HB9STY, DG6PU, FE1ET.

Monoband 28 MHz: F1CUN, F6GCB, PA3ETV.

5 Band Mixed: OK3EY.

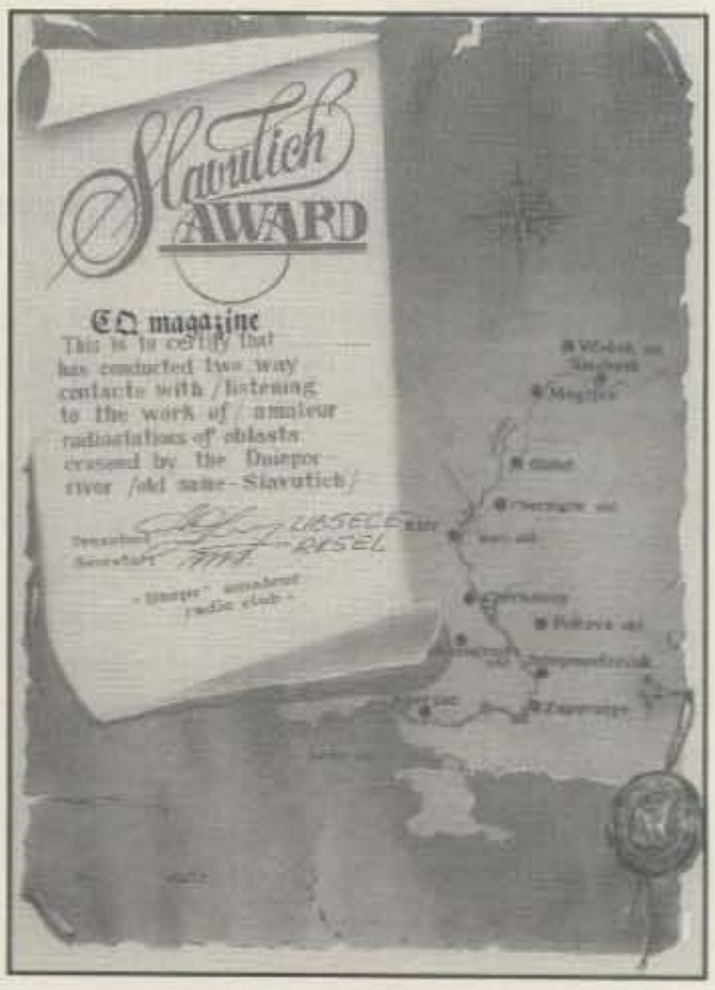
9 Band Mixed: OK3EY.

Dniepr Award. This certificate, along with a special booklet of color photo cards depicting views of the Ukraine, is awarded by the Ukrainian Radio Club of

One of the awards available from the Ukrainian Radio Club.

Dniepropetrovsk to all licensed foreign radio amateurs (or SWLs) who can submit proof of two-way radio contact (or confirmed SWL reports) with amateur radio stations in all of the oblasts of the Ukraine, including ten stations from the Dniepropetrovsk region (UB suffix beginning E, oblast 060). The same station may be worked on different bands. The award may be issued for specific bands or modes if all supporting information is included with the application. QSOs must have been made since January 1, 1976.

The Slavutich Award. The Slavutich Award is issued along with a booklet of color photos depicting views of the



The Slavutich Award sponsored by the Ukrainian Radio Club.

Dniepr River area, to all licensed amateur stations (or SWLs) for proof of two-way radio contact (confirmed SWL reports) with amateur radio stations in republics or oblasts crossed by the Dniepr River (old name was the Slavutich River). There are no restrictions in band or mode. All contacts must be dated since January 1, 1976.

The following are republics or oblasts crossed by the Dniepr River:

1. Vitebsk, Oblast 006, UC-W, Byelorussia.
2. Smolensk, Oblast 155, UA3L-, Russia.
3. Mogilev, Oblast 010, UC-S, Byelorussia.
4. Gomel, Oblast 007, UC-O, Byelorussia.
5. Chernigov, Oblast 081, UB-R, Ukraine.
6. Kiev, Oblast 186, UB-U, Ukraine.
7. Kiev, Oblast 065, UB-U, Ukraine.
8. Cherkassy, Oblast 080, UB-C, Ukraine.
9. Poltava, Oblast 071, UB-H, Ukraine.
10. Kirovograd, Oblast 066, UB-V, Ukraine.
11. Dniepropetrovsk, Oblast 060, UB-E, Ukraine.
12. Zaporozya, Oblast 064, UB-Q, Ukraine.
13. Kherson, Oblast 078, UB-G, Ukraine.

Total of 12 oblasts, 3 republics, 12 QSOs.

To apply for either award send a cover sheet with your name, call, mailing address, and a GCR list of confirmations showing date, call, mode, frequency, and report. DO NOT send QSL cards, only GCR list. Application fee for either award is 10 IRCs or equivalent hard currency. Address: Award Committee, P.O. Box 1334, Dniepropetrovsk 320027 Ukraine.

John Baer, WA6AJB, received and translated this information from Sandy Orlov, UB5ECE. Sandy also included the following information, which should be of interest to award collectors.

"Unlike most of the ex-USSR, mail seems to be getting through to the Ukraine. This should be of some consolation to award applicants who would otherwise be reluctant to send any mail (especially IRCs) to CIS countries. Although regular airmail has been getting through to the Ukraine with low loss, registered airmail is probably more reliable, albeit much slower." Sandy, UB5ECE, visited the Awards Division of the Central Radio Club-Moscow in December 1992 and had a chat with the chief. His report:

"At the present time the Central Radio Club (CRC) is issuing the following diplomas: R-150-S, RAEM, COSMOS,

R6K, and U-DX-C. The current rules are the same now as they have been for many years. The other awards—R-100-O (Worked 100 Oblasts), W-100-U, R-15-R, 5BW-100-U—and the appropriate endorsements for those awards are still being issued by the CRC, but only for contacts up through December 31, 1991 (the reorganization of the former USSR). Contacts after January 1, 1992 are not counted. The old award R-10-R is still issued by the CRC, but only for contacts dated December 31, 1983 or earlier."

"At the present time the CRC still has plenty of award forms for awards such as R-100-O, W-100-U, etc., those awards left over from the former USSR. I hope they will make up new rules for such awards, but as it stands the new plaques of the CIS awards are much less interesting than before."

"The CRC awards committee had been contemplating a new Worked All Oblasts award, an award which would have involved working what oblasts were left on two different bands. Because of the restructuring of oblasts, especially in the ex-USSR, that project has been abandoned."

Thanks to John and Sandy for this update on the awards situation in the former USSR.

Worked Antarctic Bases Award (WABA). This award program, sponsored by the Associazoione Radioamatori Italiani and the Diamond DX Club, is for amateur radio operators and shortwave listeners (SWLs) interested in monitoring or establishing two-way contact with radio stations operating in Antarctica located from 60 degrees to 90 degrees south. (The Antarctic continent starts at 60 degree south.) Contacts may be made on any band from 10 to 160 meters using any mode since January 1, 1961, the year of the signing of the Antarctic Treaty.

Awards are based on level of difficulty. *The Simple Level:* 15 confirmed contacts with 15 different amateurs representing at least five of the nations having bases on the continent. The Simple Level may not be upgraded to any higher level. Any amateur radio operator who has operated a station from Antarctica is eligible for this award without the necessity of submitting QSLs and log extract. These awards will have "OPERATOR" printed on the certificate.

Hard: 10 confirmed contacts with 10 different bases representing at least 5 different countries having bases on the continent. The Hard Level may be upgraded to Honor Roll and Top Honor Roll.

Honor Roll: 25 confirmed contacts from 25 different bases representing at least 15 countries having bases on the continent.

The Worked Antarctic Bases Award sponsored by the Associazoione Radioamatori Italiani and the Diamond DX Club.

Top Honor Roll: 50 confirmed contacts with 50 different bases representing at least 20 countries having bases on the continent.

Simple, Hard, and Honor Roll Awards consist of a personalized 200 by 240 millimeter aluminium silk-screen color

plate with a depiction of Antarctica. Top Honor Roll Award is a personalized 800/1000 silk-screen on 11 gram silver plate. National flags with adhesive backing are obtained by confirming contacts with 50% of that nation's Antarctic amateur radio stations, as determined by reference numbers in the WABA directory. Twenty-five nations have bases on the continent. Contacts with special stations IR1ANT, Torino, Italy during the Antarctic Adventure January 27, 1991; IYØA and INØG, Rome, Italy; IY8UN Naples, Italy (stations in daily contact with IAOPS, the Italian Station on Antarctica) are valid and may be used to achieve 50% of the bases needed to complete a country requirement.

The fee for WABA all classes is 20,000 lire, 25 IRCs, or US $15.00. Honor Roll and Top Honor Roll plates are free when the applicant has a minimum of 10 flags for the Honor Roll and 20 flags for Top Honor Roll. Honor Roll and Top Honor Roll plates are free if the applicant has a minimum of 10 flags for Honor Roll and 20 flags for Top Honor Roll.

The Diamond DX Club has designated the following amateurs as checkpoints for the WABA Award: DL-OE Thomas Roesner, DL8AAM; EA, EA6, EA8, EA9, CT, CU2, CT3, C3, Jose Ardid, EA5KB; F, LX, ON, TK, 3A2, Jean-Pierre Guillou, F9RMG; GD, GI, GJ, GM, GU, GW, EI, Brian Adams, G4RFV; HB9-HBØ Fritz Zwingli, HB9CSA; Asia outside the ex-USSR Yukihiro Deguchi, JI6KVR; USA and Central America James S. Model, K9PPY; South America, Natan Sterental, OA4OSL; A, OH, OY, OZ, SM, TF, Rurik Lonnroth, OH2QQ; ex-USSR Valery Kharchenko, RA6YRVE; VO1, VO2, VY, Garry V. Hammond, VE3XN; VK, ZL, Jim B. Smith, VK9NS.

Applicants for the WABA Award should submit required proofs of contact (log extract showing callsign of station worked, date, time, frquency, mode, signal report, and name of Antarctic base) to the appropriate check point. Further information and the WABA Directory may be obtained from the Diamond DX Club's Award Manager, Giuseppe Iannuzzi, I8IYW, P.O. Box 5083, 80144 Naples, Italy.

The following amateurs and SWLs have received the Worked Antarctic Bases Award as of January 16, 1993: BRS44266, CT1UB, DK1RV, DK3PZ, DK5NJ, DL7CW, EA4KK, EA4MY, EA5KB, EA7CI, EDØBOD, G3TOK, G4YAA, HB9CSA, I1HYW, I1JQJ, I1KFB, I1SNW, I1ZL, I2AT, I2FUG, I2LPA, I2MQP, I2MWZ, I2PHN, I2YDX, I5DCE, I5OYY, I8ACB, I8IHG, I8IYW, I8KCI, I8KNT, I8SAT, I8WES, I8XTX, I8YRK, I8YZPI, KØGPP, IK1EDC, IK1GPG, K1JJB, K2HT, IK2MLY, K6FHX, K8BMW, IK8DOI, IK8FUN, IK8HVH, ISØJMA, K9PPY, KC8PG, OA4OS, OE2-205572, OE3WWB, OH2QQ, OH3MIG, OK11198O, K3JW, ON5KL, ONL4003, RA7OH, UY5XE, VE3XN, VE7IG, WØ6437, W3KH, W4BAA, W9DC, W9DWQ, YBØRX, YL1XZ, ZL2AKV.

Announcement

In order to maintain the integrity of the USA-CA program, effective July 1, 1993, before the USA-CA All Counties award is issued and a number assigned all applicants must submit confirmation for five counties chosen by the USA-CA Custodian. An applicant may facilitate the award process by requesting a list from the Custodian prior to applying for the award and by submitting the QSL cards with the formal application.

73, Norm, WA3RTY

1992 CQ WW DX CW Contest High-Claimed Scores

The following are CW high-claimed scores. These are raw scores only, subject to verification.

WORLD
Single-Op High Power
All Band

EA8EA	12,063,024
P4ØW	9,740,456
JY8VJ	8,236,800
9Y4H	8,114,100
8P9Z	8,092,252
EA9LZ	8,005,160
6V6U	7,896,600
D44BC	7,815,399
P4ØI	7,534,916
4M2BYT	7,275,895
P4ØJ	6,756,103
ZS6EZ	5,943,014
NH6T	5,920,915
A61AC	5,898,568
9M6NA	5,877,630
FS/AI7B	5,653,860
S52AA	5,513,460
VE3EJ	5,091,216
7Z2AB	5,001,477
PTØF	4,971,754
EA6ZY	4,106,641
G4BUO	4,044,430
VP5T	3,974,373
VD7SZ	3,955,605
4X/S59PR	3,928,380
YU7AV	3,894,930
JHØKHR	3,755,376
5U7M	3,555,240
JA5DQH	3,469,362
BV/K1RX	3,421,748
YT1AD	3,345,520
G3MXJ	3,319,734
YU7BW	3,291,208
H44IO	3,115,575
C9RJJ	3,108,266
OZ1LO	3,025,932
OH6WZ	2,969,339
JH7WKQ	2,938,221
H21A	2,751,393
XE1/AA6RX	2,723,870
UB7W	2,709,504
RØF	2,704,683
JH1AEP	2,682,720
RB5QF	2,652,195
JA8RWU	2,621,944
UT4UZ	2,478,464
G3VHB	2,444,160
JAØQNJ	2,417,628
OA4CWR	2,318,316
UT4UX	2,199,012
JA1NUT	2,128,944
WJ2O/KP4	2,121,350
VO2WL	2,036,428
HZ1HZ	2,009,360
JH2UVL	1,959,408
GJ/K2WR	1,840,125
JL2LOR	1,798,158
JT1/UA3DK	1,789,284
WP4IIW	1,780,614
RY8B	1,770,002
VK8AV	1,730,814
DJ5JH	1,691,687
G3UFY	1,665,348
JW9XG	1,647,992
JR1IJV	1,647,846
9A2AJ	1,582,212
DL1SBR	1,561,875
SM3PZG	1,542,425
YE2C	1,539,200
VD3AT	1,534,456
JF1SEK	1,512,457
SM3PZG	1,509,480
F6CEL	1,469,400
V47KP	1,461,129
DL7MAE	1,382,370
VD4VV	1,324,050
SM6DHU	1,306,692
RWØAB	1,291,980
VE3KP	1,231,672
S51FA	1,202,000
OY1CT	1,189,944
JA9CWJ	1,184,960
XE1VV	1,153,376
LY3BU	1,117,240
JT1CS	1,095,168
SV5/W4PRO	1,095,024
PW2N	1,094,373
VE1AL	1,090,452
OK2TBC	1,083,537
LA6MP	1,023,230
9A2OB	1,017,720
VE2AYU	1,012,044

28 MHz

D68GA	1,313,235
P4ØX	1,213,776
XR3A	1,042,848
CX5BW	988,410
A22MN	813,841
9H1EL	804,540
9A1CCY	695,680
S59AA	630,180
ZS6NW	622,440
S51QZ	468,194
PJ9M	453,549
EA2IA	426,092
HA9PP	359,640
RB5QW	319,680
AL7CQ	314,160
IØHCJ	309,450
SM6BJI	298,768
OE3DSA	280,980
PAØOOS	270,153
HA7TM	269,392
JR3NZC	264,537
LZ1MC	260,117

21 MHz

CR3W	1,656,466
ZD8LII	1,633,427
FM2GO	1,110,700
9Y4VU	1,087,804
J33A	957,060
OH2BH	779,960
N6VI/KH6	723,840
LZ5W	705,500
IR4T	607,936
OK1ALW	576,504
JH7DNO	562,240
S57EK	520,536
G4CNY	486,185
JR6EZE	452,880
LZ4IM	412,720
OG8VJ	361,440
JA5CKD	345,720
LZ1BJ	334,574
JH3CXL	332,766
HA8VK	322,924
YT7WW	322,915

14 MHz

FY5YE	1,453,626
TU4SR	1,299,825
7L1GVE	1,181,937
OH4NRC	950,544
RZ9UA	949,780
ZV5A	832,312
9A7A	779,100
UA9TS	731,218
KG6DX	730,944
S57DX	654,732
4N5M	645,420
ES5MC	622,557
OG8LQ	602,390
JA7FTR	537,572
S59WA	517,497
OH6NEX	474,176
SM2EKM	431,120
OK2PAY	390,300
IN3NJB	376,614
SMØTW	374,535
UB5NQ	318,790
JR1XFS	295,603
FF6KBF	270,072
IØIA	264,040
OG1AT	252,306

7 MHz

PJ9U	1,212,712
ZF2TG	1,162,412
S59UN	1,038,173
4N1Z	816,101
I3JSS	763,140
OK3RM	709,376
YX5A	645,916
FM5BH	618,583
YL2KL	612,522
LY5R	601,809
IT9TQH	583,184
9A3IQ	558,129
LXØRL	534,612
SP7GIQ	530,222
OG7MA	495,880
EA7KW	452,867
UL8GO	391,820
VE6JY	383,670
UA6LTI	367,140
LZ5G	346,080
V73C	340,896
JAØKAZ	324,324
RB5NS	320,410
UJ8JA	292,240
UL7BAY	282,492

3.5 MHz

TI1C	516,180
CT3FN	390,048
G3KDB	360,822
OE3GSA	359,915
SN3A	329,076
S59KAB	289,050
SM6MCW	280,930
OK3TPV	255,719
F2CW	237,558
OH7UE	218,766
PA3DFT	206,232
S53EA	203,528
SM6DYK	185,259
OH2PM	174,720
OH2BCI	174,592
S51OJ	172,088
LY3BS	164,302
LY1DS	155,268
EA7BJ	150,768
S51NA	149,836
OZ7HT	147,630
UF7FXC	136,800
I3VHO	134,640
LY2BCO	125,677

1.8 MHz

4X4NJ	154,380
ON4UN	120,980
UF6QBA	98,262
9A1HCD	84,624
ON7TK	82,790
PJ9V	64,531
CT1AOZ	63,858
UA9AT	61,831
OY9JD	52,990
G4PIQ	50,410
KH6CC	42,769
G3KMA	33,361
F6CWA	28,644
OK1JDX	22,446

Low Power
All Band

7Q7XX	3,257,128
C6AHJ	2,815,302
9V1YC	2,679,948
NP2I	2,375,856
VD2ZP	2,375,400
OG6NIO	2,296,625
5Z4TT	2,014,530
OA4ZV	1,954,555
LZ3FN	1,904,750
EA5WU	1,903,265
UB5QMA	1,885,152
VK3DXI	1,862,762
F6FGZ	1,736,805
GD4UOL	1,604,283
DL2SCJ	1,430,352
J79MAE	1,408,491
J79MAE	1,408,491
HA1CW	1,362,072
OE2VEL	1,298,355
VO1SF	1,271,726
VE2LID	1,227,910
VP2EST	1,165,352
OH3LIM	1,149,120
DA1AM	1,115,154
OZ8AE	1,021,108
UX3D	1,020,558
G3SWH	1,009,964

28 MHz

5NØZKJ	597,624
H27W	568,624
ON4WW	480,361
ON4RU	464,758
JH2QXG/2	334,866
G3KHZ	319,340
CX4SS	261,000
VK4XA	251,120
EI5DI	238,784
S57AL	233,632
PY2NQ	226,197
LY1DW	180,561
PY2OU	179,935
S57JZ	177,004
SP2FWC	165,340
JA1KFX	155,070
JA1NLX	152,355
JA6CNQ	144,360
JEØUXR	138,456
LZ2GP	128,610
LZ1FI	125,882
VE6BMX	121,512

21 MHz

8P9DF	522,750
S57DZD	347,060
U5WF	315,980
KH6XT	298,860
SP5JTR	244,180
KH6HNT	212,520
JQ1NGT	204,880
JE1VTZ	197,040
ON6CW	190,890
RA9CEJ	184,896
YB6TI	183,708
JAØBMS/1	176,220
LY1CM	165,960
UC2OIY	162,864
JE1REU	155,754
SP8LZC	152,692
I3JTE	132,787
SP7VCO	129,120
OH3MEO	127,420
PY2YP	127,260
OK3CAP	126,730
UA9SCX	125,164
OK2ON	123,585
OK1DJO	121,914

14 MHz

4M5X	1,170,498
7Q7TA	206,752
YL2GN	174,960
PAØLVB	138,300
PA3ELD	125,742
JF6OJX	119,840
4X4ZT	119,600
SP6PAX	111,150
HA5LZ	108,395
UB5RAF	96,092
UA9XW	90,636
EA2IF	85,387
FFØXX	82,700
7K1BWM/1	81,242

7 MHz

VK6LW	533,696
JH7PKU	513,110
F1MXH	266,772
LZ6L	245,481
LZ1ZX	245,480
JA1LZR	171,212
RB5QCV	123,970
TE1T	116,117
IO9AF	97,524
JK1GKG	87,690
PA3AAV	79,696
SP3LWP	79,170
G4ZOB	72,768
JA7XBG	67,023
UT5BP	62,216
I2IFT	56,420
YL2UZ	52,185

3.5 MHz

UA9XS	101,626
UV3WU	91,605
OK1DUG	89,440
S59ZZ	75,594
OK3CND	66,994
4N5W	63,378
4N7MOD	62,868
OK2ZBU	62,216
9A3QK	36,840
LA1B	28,404
ES1CW	28,014
JE7LHT	27,202
SP9NLK	25,550

1.8 MHz

T32AF	49,210
SP5ZIM	37,027
OG3MMF	30,745
OH1KF	22,176
PAØVDV	18,411
SM6OLL	18,368

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Even under the most crowded band conditions, the TEN-TEC Omni-VI receives the weakest signals loud and clear. Signals the competition can barely hear. In fact, the "weaklings" are the Omni-VI's meat and potatoes. That's because our advanced crystal mixing virtually eliminates phase noise. And the meticulous design provides much more *usable* dynamic range than the competition. But that's not all the remarkable Omni-VI has going for it.

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DJ4KW 17,325
SP6GDB 16,182
SP9AAB 16,002
OK2PWJ 15,389
S51RW 14,586
HA4EHQ 13,359
RB4INR 12,582
LA4LN 11,610
OK3TQX 11,550
VE3DO 11,375
OG4YR 11,368

QRP

DL3KVR 473,518
SM3CCT 381,124
LY3BA 348,475
UA4YJ 279,651
JA1GTF 258,770
EA3IW 224,343
JA9YAV 216,909
JA1AA 174,085
LX2PA 170,766
KP4DDB 158,102
UB4FXX 144,720
UB4IM 139,101
UL7CN 138,504
4F3AAL 136,234
DL2RUG 130,299

Assisted

4U1ITU 4,282,980
DF3CB 3,235,176
DJ2YA 2,557,733
UT2L 1,970,616
VD7DX 1,415,811
F6BEE 1,352,780
DL4MEH 1,031,595
DJ9IE 1,015,456

Multi-Operator Single Transmitter

UX1A 13,414,175
ZC4Z 11,482,100
IQ4A 10,290,865
LZ9A 9,595,436
DLØWW 8,610,588
UW2F 8,093,534
TM9C 7,957,051
KH2S 7,927,817
EA3KU 7,186,419
RL5P 7,140,348
4U1VIC 7,078,778
OK5W 6,767,485
II2A 6,571,656
HG1S 6,474,348
DJ4AX 6,116,165
VD7SV 6,038,172
Y33VL 5,888,205
LY4W 5,611,980
S79S 5,312,475
OK3KCM 5,292,284
GB5DX 5,181,192
JH5ZJS 5,057,052
OK3KAG 4,693,335
DLØUM 4,360,500
HZ1AB 3,924,936
GX3PRC 3,644,900
VQ9IO 3,639,718
Y38I 3,478,626
HG6Y 3,433,954
JA7YAA 3,310,420
TM5SA 3,306,996
OT2D 3,257,820
G3OZF 3,120,587
DKØMM 2,919,190
LU7DP 2,860,242
PI4COM 2,859,615
ON6AH 2,856,708
S55AA 2,850,730
DFØRR 2,840,343
DLØCMA 2,830,070
JE6ZIH 2,829,464
HA8KCK 2,738,412
LA8SDA 2,599,152
GU3HFN 2,529,660
OL3A 2,503,314
RK3B 2,430,472
SKØUX 2,343,315
UZ1AWO 2,303,716
G3LZQ 2,302,510
K3TEJ/KP4 2,247,552
HA3KNA 2,232,360
OK3KFO 2,194,610
RK3A 2,151,996
YT1R 2,113,310

Multi-Operator Multi-Transmitter

EA9EA 31,292,840
KHØAM 25,352,718
9A1A 19,139,620
HG73DX 19,091,748
GW8GT 18,595,059
OHØW 17,817,717
VS6WO 17,799,960
NL7G 15,070,656
DLØCS 12,476,760
RY1I 10,320,133
EZ6L 10,095,894
VE2CSI 8,727,510
JA3ZOH 8,603,448
LY7A 8,261,409
ZM2K 8,173,854
JA1YDU 8,057,600

USA
Single Op High Power All Band

KM1H 6,071,108
N4RJ 6,022,764
N2NT 5,815,000
KN8Z 5,561,217
W1KM 5,477,190
N6BV/1 5,465,230
K3ZO 5,033,224
N2LT 4,898,169
W3BGN 4,371,246
K1ZZ 4,062,497
W2SC 3,832,160
K5GN 3,766,785
W4RX 3,755,216
N6UR 3,729,600
N6AR 3,687,670
W9RE 3,611,400
W1WEF 3,193,664
K8GL 3,027,674
K4PQL 3,017,698
K5MA/1 2,641,353
W6QHS 2,426,052
K4XU 2,416,540
NN7L 2,392,716
W3UM 2,386,814
AK3Z 2,369,630
W6EEN 2,244,784
W4XJ 2,240,430
AA4S 2,202,839
KFØH 2,146,552
K3MD 2,138,304
N6ND 2,091,740
W9UP 2,036,881
K9MA 1,918,476
KØKX 1,751,708
WZ4F 1,714,552
W3VT 1,497,432
K2SIG 1,486,956
W3RJ 1,470,924
K7SV 1,418,274
N8AA 1,395,248
W1BR 1,382,829
N2GC 1,282,656
N4ZC 1,259,874
WM5G 1,246,665
N6EK 1,206,290
N4TO 1,200,947
N1CC 1,186,485
K3JGJ/2 1,130,745
N6TV 1,063,975
WCØY 1,061,280
K3KO 1,059,300
K7WK 1,057,632
K2ONP 1,011,522
KA1DWX 1,007,453
KE7X 1,007,076

28 MHz

KA5W 446,439
K8CX 426,717
N4ZZ 358,239
K5RX 351,771
W6YA 317,704
N4UA 290,080
K9QVB 242,224
KN5H 231,564
N8AGU 210,539
NA5C 205,100
WB2YQH 176,624
N6ZB 168,948
W9GIL 142,287
K2ZJ 140,832

21 MHz

K2SS/1 694,485
WØUN 647,168
N4CT 579,312
N3KK 542,654
K8MFO 519,750
W5VX 511,187
KC1SJ 455,920
K4TKM 445,005
AA5ZQ 370,018
KZ6E/Ø 361,788
N9KAU 321,229
K1VUT 266,400
N6MZ 261,083
N7RO 248,168
N4IR 239,776
AL7H/Ø 236,812
WB8B 221,366
WZ6Z 220,100

14 MHz

K2VV 946,960
KW8N 815,948
N2BA 765,525
K5MR 507,325
N5CR 481,929
NQØI 424,461
KCØD 423,072
K9CAN 301,622
N9AW 260,610
W8TWA 214,064
KA7T 138,000
WA7FAB 121,975

7 MHz

K8PO 840,504
W7XR 800,624
K4XS 683,459
KBØG 638,736
W2UP/3 521,076
K1UO 497,060
W3GH 467,892
WØZV 440,316
N6RO 392,615
W4BQF 267,344
K5NU 244,640
W1BIH 207,242
K6XV 191,268
W5UN 189,736
K6KM 164,000

3.5 MHz

K1ZM 427,992
K1IU 319,634
W1MK 282,870
WE3C 155,610
KØRF 139,072
KOØU 117,938
N5RZ 92,538
KT6V 87,032
W8JGU 78,642
KO7V 72,980
N2KW 70,470

1.8 MHz

K2EK 34,522
K5UR 25,612
KVØQ 16,272
N6SS 13,112
K4TEA 11,880
WB9Z 11,328

Low Power All Band

W2TZ 2,204,170
N8II 2,061,360
KG1D 1,468,736
KM1X 1,328,892
WA2VYA 1,249,246
N8RR 1,208,830
K1EBY 1,195,821
N4YDU 1,166,915
KB3MP/4 1,126,216
N5AW 1,062,400
WA1FCN 1,060,575
WB8YJF 1,026,084
KX3Y 1,019,151
WS1E 1,003,408
K1YRP 998,010
W3UJ 992,670
W3HVQ 963,200
K5ZD 923,286
K5KLA 890,012
W6JTI 873,624
WG3I 841,061
W9OA 723,086
W6UQF 719,946
N1HOQ 707,328
W4OUN 660,292
KN4QV 655,473
KB3MM 633,216
NA1R 630,105

28 MHz

WB4TDH 250,962
WA6KUI 188,760
W7ZR 184,482
K2MFY 155,241
N3JT 66,736
WA6FGV 53,676
AA7FK 53,152

21 MHz

N4MO 345,693
W9HLY 207,944
AA7RN 127,608
KW8J 123,786
KK4SM 120,171
WT8P 94,142
K6OMB 90,720

14 MHz

K2AW 118,430
KD5IA 98,171
WQ7R 33,945
KW3M 28,296
W8UMR 23,568

7 MHz

W9CH 100,050
K2POF 83,752
KO9Y 77,982
KIØI 40,500
K9UIY 37,036
K1HBX 35,002
WA2ASQ 31,228

1.8 MHz

AA9AX 2,709
WØRT 561
N4UZ 392

QRP

AA2U 1,197,000
N7IR 414,836
N1AFC 397,902
WB6JMS 248,196
KQ1V 185,724
WM4Z/5 169,747
WØVX/5 121,590
KIØG 103,540
NØAX 93,312
WAØRJY 85,648
N5NMX 75,824
KA1CZF 71,116

Assisted

K8AZ 5,051,650
K3WW 4,885,029
K5NA 4,670,928
KC1XX 4,592,247
WR3E 4,161,024
W1PH 4,155,585
K2SX 3,901,296
W3XU 3,895,273
KC1F 3,731,013
AA2DU 3,300,545
K2PS 3,125,240
W2REH 3,064,380
K1VR 3,033,600
K2WK 2,956,653
W8FJ 2,778,272
W3FV 2,324,938
K5NW 2,277,801
AA3B 2,261,714
K8MR 2,151,898
N4AA 2,070,276
W1RR 1,940,253
W1GD/2 1,664,520
NW3Y 1,573,684
N4DW 1,536,470
K6OY 1,489,926
K3ND 1,486,086
K2NJ 1,484,966
K3VW 1,474,560
K1GW 1,461,774
KF2O 1,436,015
N3II 1,377,244
N4XR 1,368,470
K2BU 1,337,553
KF8QE 1,333,632
WE1F 1,333,605
NR2H 1,329,032
K5LP 1,289,600
W6OAT 1,224,520

Multi-Operator Single Transmitter

N3RS 8,685,140
K1KI 8,263,388
K1DG 7,988,038
WW2Y 6,170,010
N4WW 5,928,093
W5WMU 5,470,751
W1OO 5,396,178
W6GO 5,252,702
N4AR 4,837,710
K2SG 4,573,608
KN2M 4,300,470
AA1K 4,287,140
WD8LLD 3,968,982
W3GG 3,364,740
WØCP 3,121,965
NK7U 3,075,776
W8BI 2,942,640
NCØP 2,940,416
NN3Q 2,818,458
K8LX 2,740,400
K2QMF 2,617,112
W9KDX 2,431,906
K6XT 2,379,104
K2TE 2,279,928
K3DI 2,159,410
K4LTA 2,148,311
KS9B 2,016,384

Multi-Operator Multi-Transmitter

K1AR 20,007,138
N2RM 18,988,416
W3LPL 17,443,384
AD1C 13,075,282
KY1H 10,529,090
AA6TT 9,716,568
WØAIH 8,103,120
N6DX 8,078,434
KY3N 6,883,182
NQ4I 6,548,211
W4MYA 6,110,976
W6BA 5,931,225

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HF EQUIPMENT	Regular	SALE
TS-950SDX Dlx xcvr w/keyer/DSP/filters	4599.95	**3899**
SP-950 External spkr w/audio filters	114.95	
YK-88CN-1 270 Hz CW filter (1st IF)	86.95	
YK-88SN-1 1.8 KHz SSB filter (1st IF)	86.95	

TS-850S 9-band Xcvr/mic	1849.95	**1569**
AT-850 Internal auto antenna tuner	216.95	**199.95**
TS-850S/AT 9-band Xcvr/tuner	2049.95	**1749**
PS-52 Heavy duty power supply	269.95	**249.95**
RM-1 Remote control unit	52.95	
SO-2 TCXO unit	154.95	**144.95**
SP-31 External speaker	84.95	
YG-455C-1 500 Hz CW filter (2nd IF)	152.95	**144.95**
YG-455CN-1 250 Hz CW filter (2nd IF)	166.95	**156.95**
YK-88C-1 500 Hz CW filter (1st IF)	102.95	
YK-88CN-1 270 Hz CW filter (1st IF)	86.95	
YK-88SN-1 1.8 KHz SSB filter (1st IF)	86.95	
TS-450S 9-band Xcvr/SW Rcvr/mic	1379.95	**1129**
TS-690S 9-band Xcvr w/6m/mic	1599.95	**1349**
AT-450 Internal 80-10m auto tuner	216.95	**199.95**
TS-450S/AT 9-band Xcvr/tuner/mic	1579.95	**1249**
MB-430 Mobile mounting bracket	39.95	
PS-33 Light duty 20.5A power supply	239.95	**219.95**
PS-53 Heavy duty 22.5A power supply	249.95	**229.95**
SO-2 TCXO unit	154.95	**144.95**
SP-23 External speaker	72.95	
TU-8 CTCSS tone unit	42.95	
YG-455C-1 500 Hz CW filter (2nd IF)	152.95	**144.95**
YG-455CN-1 250 Hz CW filter (2nd IF	166.95	**156.95**
YK-88C-1 500 Hz CW filter (1st IF	102.95	
YK-88CN-1 270 Hz CW filter (1st IF)	86.95	
YK-88S-1 2.4 KHz SSB filter (1st IF)	92.95	
YK-88SN-1 1.8 KHz SSB filter (1st IF)	86.95	

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TS-50S *Super compact* HF Xcvr	1199.95	**1039**
AT-50 External automatic tuner	329.95	**299.95**
MB-13 Deluxe quick release bracket	42.95	
PS-33 Light duty 20.5A power supply	239.95	**219.95**
PS-53 Heavy duty 22.5A power supply	249.95	**229.95**
SO-2 TCXO unit	154.95	**144.95**
YK-107C 500 Hz CW filter	98.95	
TS-140S 9-band Xcvr/mic	979.95	**849.95**
IF-10C Computer interface unit	54.95	
IF-232C Level translator	104.95	
MB-430 Mobile mounting bracket	39.95	
PS-50 Heavy duty power supply	259.95	**239.95**
SP-23 External speaker	72.95	
TU-8 CTCSS tone unit	42.95	
YG-455C-1 500 Hz CW filter	152.95	**144.95**
YK-455C-1 500 Hz CW filter	102.95	

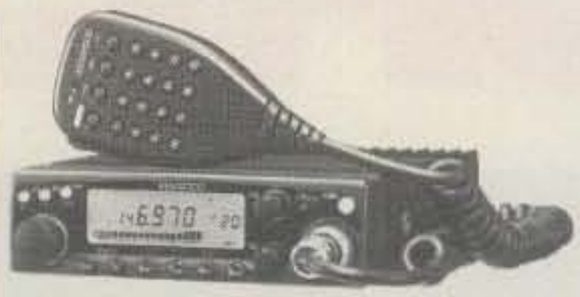
COMMON ACCESSORIES	Regular	SALE
TL-922A 2KW PEP HF linear (3-500Zs)	2049.95	**1749**
SM-230 Sta. mon. w/pan; 950/850	1049.95	**949.95**
AT-300 Ext. auto tuner; 850/450/50	624.95	**569.95**
DRU-2 Digital record unit; 850/950	129.95	**122.95**
DSP-100 digital signal proc. 450/850	669.95	**609.95**
VS-1 Voice synthesizer; 5000/751A,	64.95	
VS-2 Voice synthesizer; 950/850/450	64.95	
HS-5 Deluxe headphones	69.95	
HS-6 Lightweight headphones	49.95	
HW-3 V 2.2 3½" HamWindows IBM soft.	139.95	
IF-232C Level translator	104.95	
LF-30A 1kw PEP low pass filter	49.95	
MA-5 5-band HF mobile antenna	154.95	**139.95**
VP-1 HD spring, bpr mt for MA-5	58.95	
MC-60A Ampl. desk mic w/up-down	134.95	**129.95**
MC-80 Electret desk mic w/up-down	89.95	
MC-85 Multi-funct. electret desk mic	146.95	**136.95**
MC-90 2-head DSP desk microphone	234.95	**214.95**
PC-1A 8-pin phone patch	114.95	**109.95**
SP-41 Compact external speaker	39.95	
SP-50B External mobile speaker	42.95	
SW-2100 1.8-30MHz SWR/pwr meter	154.95	**144.95**

SHORTWAVE RECEIVERS	Regular	SALE
R-5000 100 KHz-30 MHz digital receiver	1129.95	**889.95**
DCK-2 DC cable kit w/cig plug	12.95	
IC-10 IC kit for computer control	39.95	
MB-430 Mobile mounting bracket	39.95	
SP-23 External speaker	72.95	
VC-20 108-174 MHz VHF converter	221.95	**199.95**
YK-88A-1 AM filter	92.95	
YK-88C 500 Hz CW filter	92.95	
YK-88CN 270 Hz CW filter	92.95	
YK-88S 2.4 KHz SSB filter	92.95	
YK-88SN 1.8 KHz SSB filter	92.95	
R-2000 150 KHz-30 MHz digital Rcvr	829.95	**649.95**
VC-10 118-174 MHz VHF converter	209.95	**189.95**
YG-455C 500 Hz CW filter	133.95	**124.95**
YG-455CN 250 Hz CW filter	155.95	**99.95**
RZ-1 500KHz-905MHz AM/FM scan Rcvr	629.95	**499.95**

VHF/UHF TRANSCEIVERS	Regular	SALE
TR-751A 25W 2m SSB/FM Xcvr w/TTPmic	669.95	**599.95**
TU-7 Programmable encoder	42.95	

TS-790A 45w 2m/40w 440 SSB/FM xcvr	2049.95	**1749**
PS-31 Power supply	209.95	**189.95**
SP-31 External speaker	84.95	
TSU-5 Programmable CTCSS decoder	52.95	
UT-10 10w 1.2 GHz module	569.95	**519.95**
VS-2 Voice synthesizer	64.95	
TM-641A 50w 2m/25w 220 FM xcvr/TTP	879.95	**759.95**
DTU-2 Digital paging unit	24.95	
PG-4K 13' remote cable kit	47.95	
PG-4L 23' remote cable kit	79.95	
TSU-7 CTCSS decoder unit	51.95	
UT-28S 50w 10m unit	315.95	**289.95**
UT-50S 50w 6m unit	315.95	**289.95**
UT-220S 25w 220 MHz unit for 741A	315.95	**289.95**
UT-440S 35w 440 MHz unit for 641A	315.95	**289.95**
UT-1200 10w 1.2 GHz unit	409.95	**369.95**

TM-742A 50/35w 2m/440 FM Xcvr w/TTP	879.95	**759.95**
UT-28S 50w 10m unit	315.95	**289.95**
UT-50S 50w 6m unit	315.95	**289.95**
UT-220S 25w 220 MHz unit	315.95	**289.95**
UT-1200 10w 1.2 GHz unit	409.95	**369.95**
TM-942A 2m/440/1.2 FM Xcvr/TTP	1229.95	**1049**
TM-631A 50/25w 2m/220 FM Xcvr w/TTP	749.95	**649.95**
RC-10 Remote controller handset	249.95	**229.95**
KQT-8/TSU-6 Prog CTCSS decoder	46.95	
TM-732A 50/35w 2m/440 FM Xcvr w/TTP	769.95	**609.95**
TSU-7 CTCSS decoder unit	51.95	



TM-241A 50w 2m FM Xcvr w/TTP mic	459.95	**379.95**
TM-331A 25w 220 FM Xcvr w/TTP mic	489.95	**419.95**
TM-441A 35w 440 FM Xcvr w/TTP mic	499.95	**429.95**
TM-541A 10w 1.2GHz FM Xcvr w/TTP mic	599.95	**519.95**
DRU-1 Digital recorder	125.95	**119.95**
DTU-2 Digital paging unit	24.95	
RC-10 Remote controller handset	249.95	**229.95**
KQT-8/TSU-6 Program CTCSS decoder	46.95	
TR-851A 25w 430-440 MHz SSB/FM Xcvr	771.95	**669.95**
TU-7 Programmable encoder	42.95	
VS-1 Voice synthesizer	64.95	
PS-50 Heavy duty power supply	259.95	**239.95**

HANDHELDS	Regular	SALE
TH-225A 5W 2m FM HT/batt/cgr/TTP	429.95	**369.95**
TH-315A 2½W 220 FM HT/batt/cgr/TTP	439.95	**379.95**
TH-28A 2½W 2m FM HT/batt/cgr/TTP	399.95	**309.95**
TH-48A 2W 440 FM HT/batt/cgr/TTP	429.95	**339.95**
TH-78A 2½W 2m/440 FM HT/batt/cgr/TTP	599.95	**459.95**

ACCESSORIES for TH-225A/315A	Regular	SALE
BC-7 Desk rapid chgr for PB-1/2/3/4/12	114.95	
EMC-1 Lapel clip mic/ear piece	35.95	
HMC-2 VOX/boom mic headset	59.95	
KNB-4/PB-4 1600ma 7.2v (1.5w) battery	76.95	
KSC-6/BC-8 Desk chgr for PB-1/2/3/4/12	27.50	
PG-3E Cig cord w/filter	26.95	
SMC-31 Speaker/mic w/right angle plug	54.95	
SMC-32 Mini water resistant spkr/mic	37.95	
TSU-4 Decoder	46.95	

Accessories for TH-28A/48A/78A	
BC-15A Rapid charger; PB-13/14/17/18	104.95
BT-8 AA alkaline battery case	20.95
EMC-1 Lapel clip mic/ear piece	35.95
ME-1 Memory expansion board	29.95
PB-13 700ma 7.2v battery	59.95
PB-14 300ma 12v (5w) battery	84.95
PB-17 700ma 12v (5w) battery	94.95
PB-18 1100ma 7.2v battery	84.95
PG-2W DC cable w/fuse	10.95
PG-3H Cigarette lighter cord w/filter	25.95
SMC-33 Speaker/mic w/remote control	51.95
SMC-34 Spkr/mic w/vol. + function keys	54.95

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TS-450S HF xcvr	$1129	**DC-21** DC adapter; TH-A/B	9.95
TS-450S/AT HF xcvr/tuner	1249	**EB-3** Battery case; 2600A/3600A	6.95
TH-27A 2.5W 2m handheld xcvr	299.95	**HMC-1** VOX headset	29.95
TH-47A 1.5W 440MHz handheld xcvr	249.95	**LH-3** Leather case; 2600A	9.95
TH-28A 2.5W 2m handheld xcvr	309.95	**MS-1** Mob. stand/charger/ps; 2600A	49.95
TH-48A 2.5W 440MHz handheld xcvr	339.95	**PB-9** 600ma 7.2v Batt. w/chgr	19.95
TH-78A 2.5W 2m/440 FM HT/TTP	459.95	**PB-10** 600ma 7.2v Battery	9.95
TM-732A 2m/440 FM xcvr/TTP	609.95	**SC-22** Soft case; TH-75A w/PB-6	4.95
BC-6 2-pack quick chgr; PB-21/H	39.95	**SC-26** Case; PB-7/8/9 w/26AT	4.95
BC-15 (not A) Rapid chgr; PB-13/14	49.95	**TU-4C** Encoder; TW-4000A	19.95
CD-10 Call Sign Display	49.95	**TU-6** Encoder; 21/31/41AT	9.95

Optional Accessories for some products are not listed. For information, call us Toll Free or see the latest AES® Catalog. All Prices and availability subject to change without notice.

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ANTENNAS & ACCESSORIES

A LOOK AT THE SHACK FROM BOTH ENDS OF THE COAX

BY KARL T. THURBER, JR., W8FX

New Antenna Stuff '93

This month we bring you some of the new offerings so far this year. These days there's always something new afoot, so let's get going.

DIGI-FIELD FSM. Digital field strength meters (FSMs) are gaining in high-tech popularity these days. Recently in the column we described the Nye Engineering FSM, the FS 73 Signal Cube. The Nye FS 73 is untuned and broadbanded, covers the range 0.1 to 450 MHz, and has a large digital display to indicate RF amplitude and low battery power. It is $159 from Nye Engineering Co., Inc., 4020 Galt Ocean Dr., Suite 606, Fort Lauderdale, FL 33308 (305-566-3997).

Now there's a digital competitor afoot. The I.C. Engineering DIGI-FIELD FSM claims a frequency response from DC to 1.3 GHz. As such, it appears to be a good unit for antenna development, experiments, comparisons, and adjustments. It's useful in observing antenna radiation patterns, and it can produce a three- dimensional map of your antenna's radiation. You can also use the unit to observe feedline radiation, measure RF levels in equipment resulting from different grounding methods, as an RF sniffer for 60 Hz noise sources such as motors, and as a detector of microwave-oven leakage.

The I.C. Engineering unit is designed to be used either with its own telescopic antenna or with an external antenna with a PL-259 connector. The unit also has a detector output connector for AM monitoring and similar uses. It has a 3½ digital LCD display with low battery indicator; future models should have a backlighted display. It's $119.95 from I.C. Engineering, 16350 Ventura Blvd., Suite 125, Encino, CA 91436 (1-800-343-5358).

Optoelectronics Frequency Counters. Optoelectronics has added several new frequency counters and add-on accessories to its already broad line of frequency measuring equipment.

If you'd like to turn your PC into a desktop frequency counter, consider the PC-10 Universal Frequency Counter-Timer. It provides a blend of sensitive radio instrumentation and PC-based data manipulation and analysis. It is an IBM PC-AT compatible circuit card that uses Microsoft Windows ™ 3.1 as a control panel and display window to make your PC think it's a frequency counter. The PC-10 also can output frequency data to a companion communications receiver, such as an ICOM R7000, allowing precise and instant tuning and listening to radio signals detected by the counter. The PC-10 features data logging to disk to keep records or measure frequency drift; user-controlled lockout frequencies are written to a file to override local broadcasters or other RF sources. The unit covers 1 MHz to 2.4 GHz and is priced at $199.

317 Poplar Drive, Millbrook, AL 36054

If you'd like to make your desktop PC serve as a capable frequency counter, Optoelectronics offers its PC-10 Universal Frequency Counter-Timer. The PC-10 includes a drop-in circuit card and software to operate under Windows 3.1. The 10-digit counter covers from 1 MHz to 2.4 GHz. The PC-10 directly tunes radio receivers such as the ICOM R7000, resulting in a uniquely configured "self-tuning" radio. (Photo courtesy Optoelectronics)

There also are several new Optoelectronics high-sensitivity handheld frequency counters in the Handi-Counter™ series. Because the new counters are more sensitive than conventional counters, they are used extensively in frequency-finding applications and for picking up transmitters and other RF sources at relatively great distances, in addition to classical frequency and time measurements. With the new counters, a useful response to frequencies that are only 10 to 15 dB greater than the background RF level is possible.

The Model 3000 in the Handi-Counter series is billed as the first handheld multifunction counter with period, time interval, and ratio (between two frequencies) measurement capability. All models in the Handi-Counter series are capable of operation over the range 10 Hz to 3 GHz. The counters are priced from $99 to $259 or more, depending on the model and options selected.

A catalog of frequency measuring and finding equipment is available from Optoelectronics, 5821 N.E. 14th Avenue, Ft. Lauderdale, FL 33334 (1-800-327-5912).

Rabun Labs Lightning Detection and Protection System. If you live in a part of the country that frequently is affected by strong electrical storms, you're well aware of the possibility of damage to your amateur radio and other electronic equipment, computers, telephones, FAX machines, modems, and antennas. Often, when a nearby storm threat-

The I.C. Engineering DIGI-FIELD FSM has unique features that make it appropriate for amateur radio, commercial, CB, instructional, and educational use. The digital display instrument is designed for use up to 1.3 GHz and can be used for everything from snooping out 60 Hz noise sources and detecting microwave-oven leakage to observing antenna patterns. (Photo shown courtesy I.C. Engineering)

ens, you disconnect and ground high-value equipment as a safety precaution—if you're home or remember to do so before leaving home. Now there's an automatic solution to the problem of equipment protection.

At the January Consumer Electronics Show, Rabun Labs introduced the Incipient Lightning Detection and Protection (ILD/P) System. The system continually monitors the atmosphere and typically detects the presence of lightning when a storm is five to ten miles away. It protects equipment by automatically disconnecting AC power sources, coaxial cables, and telephone lines, and temporarily grounding them. The system automatically restores power and other connections after a period of time and when the storm has passed safely out of the local area.

The Rabun units have built-in disable circuitry that senses when your equipment is turned on and prevents equipment shutdown while in use. However, a visual indicator still reminds you that the ILD/P system is disabled so you're aware that the equipment remains vulnerable. Several ILD/P models are offered for amateur radio and two-way communications gear, satellite receiving systems, personal computers, well-pump motors, and air-conditioning compressors.

More information on the ILD/P System is available from Rabun Labs, Inc., P.O. Box 790, Clayton, GA 30525 (1-800-788-1824). For pricing and delivery information contact the manufacturer's representative, Pete Nicholls, N4BHB, at LPS Marketing, 308 Sterling Dr., Warner Robins, GA 31088 (912-929-9416).

Goodies from Douglas RF Devices. Some time ago we received a thick packet of information on Douglas RF antennas and Doppler radio direction-finding units. All are quite interesting designs.

One is the DK3 Continuous Coverage HF Mobile Antenna. It is primarily for serious HF mobile work, but can be used in portable, mobile home, apartment, motel/hotel, and other difficult environments. The vertical antenna resonates without taps or roller coils and tunes continuously to any frequency in any band from 3.5 to 30 MHz, without the need to stop or get out of your vehicle. The DK3 features one-step assembly: just mount the whip on the base and it's ready for installation and use without tuning, tweaking, or tip pruning. No jumpers, taps, or open or shorted turns are used, yet a flat 1:1 SWR is claimed on all frequencies within the design range. A remotely tuned version ($229) and an automatically tuned version ($389) are available. A related product is the Dual DK3 rotatable all-band dipole, which essentially consists of two horizontal DK3s; only 19 ft. long, it can be mounted atop an RV. It is $389.

Also offered is a 2 meter J Antenna priced at $27.50. It covers the entire 2 meter band with low SWR and a claimed gain of 2.9 dBd; it features a half-wave radiator over a quarter-wave matching section. Weatherproof aluminum and stainless-steel construction are used for dependability and long life. An optional tower standoff bracket is available, as is an add-on director element for conversion of the antenna to a unidirectional beam.

Douglas RF also offers the DF Maximizer, a professional quality, Doppler-based VHF/UHF radio direction-finding (RDF) system. The RDF unit is basically an audio device that works in conjunction with your radio receiver to determine the direction from your location to the source of a given radio signal. It features proprietary "vector averaging" that significantly cuts multi-path problems inherent in most Doppler-type units. The $450 unit features a 16-point LED vector display, coarse and fine calibration controls, an RS-232 serial port, audio filtering, and automatic signal attenuation in excess of 150 dB. Options include an LCD display, a magnet-mount antenna array consisting of four separate antennas, and a permanent-mount antenna array. All systems require, in addition to the RDF unit, an antenna array and a receiver which you provide.

For more details and a flyer, contact Douglas RF Devices, P.O. Box 246925, Sacramento, CA 95824-6925 (tele. 916-688-5647).

The Optoelectronics Handi-Counter ™ series of sensitive portable frequency counters boasts features usually found only on expensive laboratory bench models. The Model 3000, shown here, is a full-range multifunction counter that covers 10 Hz to 3 GHz. Shown behind it is the APS104 Active Preselector, a tunable bandpass filter system used to dramatically increase the possible frequency detection distance from a transmitter. (Photo courtesy Optoelectronics)

Worldcom Technology Active Antenna

Worldcom Technology specializes in the design, manufacture, and sale of innovative radio accessories, especially for SWLs and scanner enthusiasts. The Worldcom catalog features items such as an FM wireless device to transmit scanner or shortwave receiver audio to a nearby FM radio; a voice-actuated scanner to tape recorder patch; several

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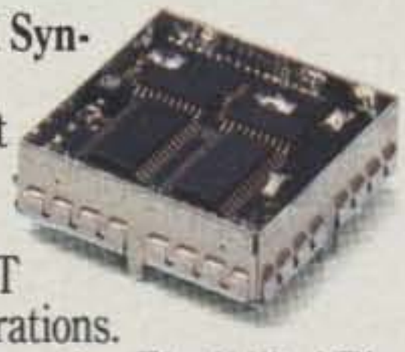

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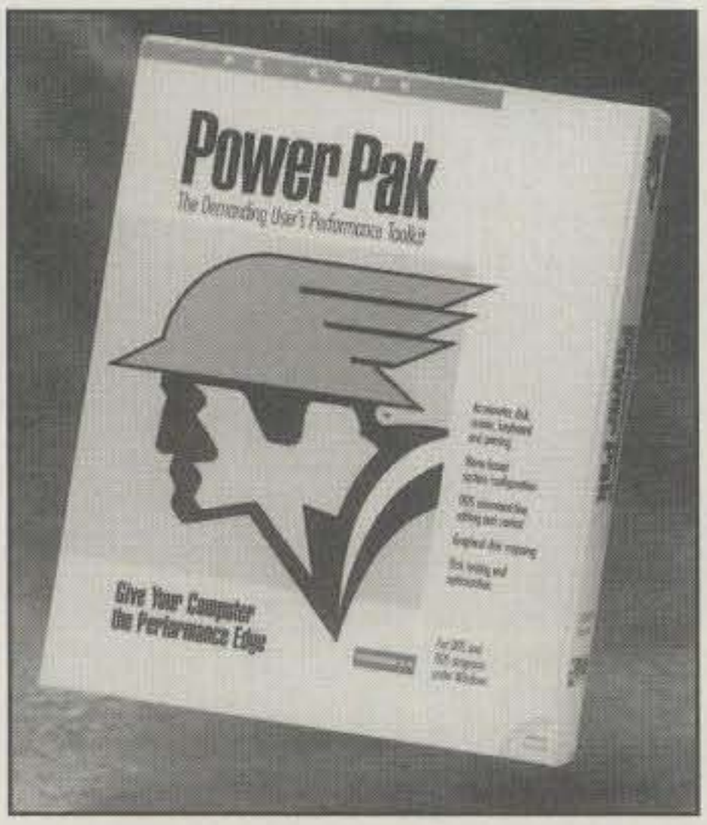


PC-Kwik's Power Pak V3.0's integrated utilities make every part of your PC system and software run faster, smoother, and better. Through the use of several specialized utility modules, the Power Pak utilities work together to effectively speed up your computer by a claimed 300 to 900 percent. V3.0 also reportedly is as much as 50 percent faster than previous versions. (Photo courtesy PC-Kwik Corporation)

inexpensive active (preamplified) antennas; an AM broadcast band interference notch filter; and various patch cables, adapters, and other radio listening-post accessories.

A newly introduced accessory is the NXL-1000 Noise-Canceling Indoor Shortwave Antenna. It's a mediumwave and shortwave active antenna that offers high gain and sensitivity, preselection, high noise rejection, and an optional crystal calibrator. The NXL-1000 ($89.95) rejects noise by using an electrostatically-shielded Faraday loop antenna atop the unit; the shielded loop inherently cancels most noise. The loop is mounted on a tilt/turn table mount to allow further nulling of specific noise sources as well as nulling of strong interfering stations. Use of the loop is said to make possible reception in locations where the noise level is so high that reception would otherwise be impossible.

For a catalog and specs on the NXL-1000, contact Worldcom Technology, P.O. Box 3364, Ft. Pierce, FL 34948 (407-466-4640).

New Software '93

Phadean Engineering Antenna Design Programs. Phadean Engineering develops and markets very reasonably priced antenna modeling and design programs; most of the programs cost between $10 and $30. All programs offered provide graphics support to generate on-screen plots of computed results.

As this is written, at least 13 separately sold diskettes of mostly single-purpose, antenna-related programs are available. Each diskette's purpose is narrowly specialized, either by function or antenna type, with respect to certain aspects of antenna modeling and design. Disks are available in both 3.5 and 5.25 inch sizes that cover sloping Vees, Yagis, dipoles, ground effects, tower array patterns, antenna utility and mathematical calculations, and other functions.

If you're interested in the toolbox approach to antenna design and modeling, contact Phadean Engineering Co., Inc., P.O. Box 611, Shrewsbury, MA 01545-8611, for a catalog.

AO 5.0 Antenna Optimizer. We've watched the evolution of Brian Beezley, K6STI's comprehensive, high-accuracy IBM PC antenna modeling software over the past several years. Two programs, MN Antenna Analysis Software and YO Yagi Optimizer, lie at the heart of his antenna-modeling packages.

In January Brian introduced the AO 5.0 Antenna Optimizer. It combines the fast, high-accuracy MININEC algorithm from MNC 4.5 (which it replaces) and upgraded optimizing techniques from YO Yagi Optimizer in an integrated, $100 program. Beezley's AO 5.0 allows you to improve existing antenna designs and to create new ones in ways not previously possible. For most applications, AO 5.0 completely eliminates the need for trial-and-error antenna modeling and tedious design tweaking.

AO is especially suitable for modeling high-performance applications, but it also can be used to design more modest antenna systems. For instance, AO can automatically optimize LC values, trap placement, and wire length for a trapped, multiband HF dipole, and maximize the design for lowest SWR simultaneously at ten selected HF frequencies. The program also can automatically adjust apex angle and wire length of an inverted-Vee dipole for both lowest SWR and resonance.

The new AO 5.0 also includes an innovative, three-dimensional radiation pattern display that depicts the antenna's entire radiation pattern at once. The pattern can be rotated, translated, scaled, and sliced by the user. The new display lets the antenna designer evaluate the results of AO's three-dimensional radiation pattern optimization and it also helps reveal any radiation-pattern problems not otherwise apparent, such as high-angle backlobes away from the principal axes.

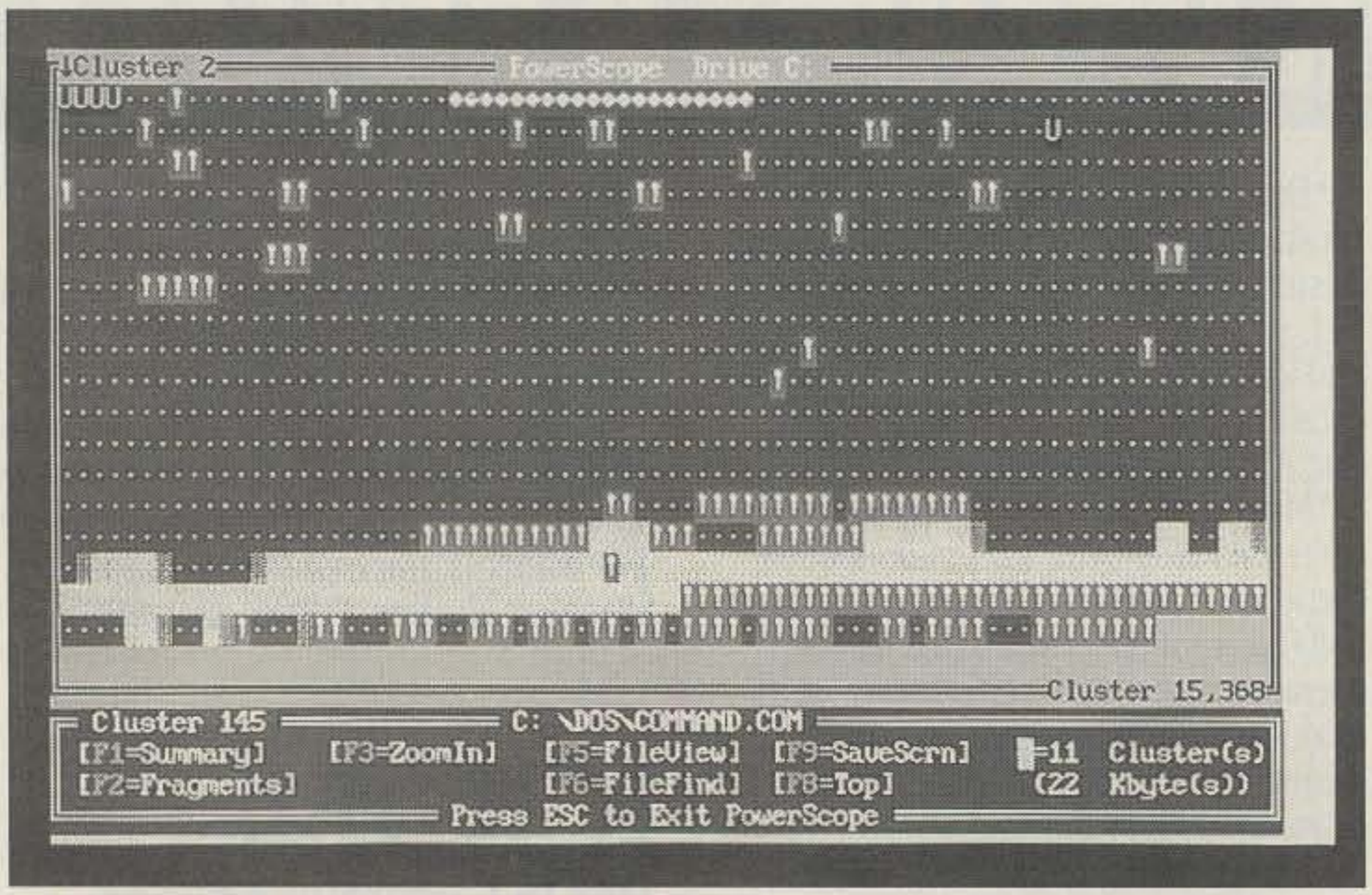
For a flyer of currently offered antenna design and modeling programs and sample program printouts, contact Brian Beezley, K6STI, 507-1/2 Taylor St., Vista, CA 92084 (619-945-9824 from 0700 to 1800 Pacific time).

QSO-Simulator and CW Trainer. Gote Lofstedt, a Swedish SWL (SM5-7609), is a regular reader of our column. His interest in the variety of software topics we cover in the column prompted him to send me a copy of his new QSO Simulator software with interactive CW, designed for the IBM PC and compatibles.

The main characteristic of QSO Simulator is its universe of 200 "artificial hams" who are running QSOs and contests with each other and waiting for contacts with the outside world. You can answer a station or make your own CQ calls by typing on the keyboard, tapping out code with the SHIFT key on the keyboard, or using a straight key or keyer connected to the serial port. An on-screen world map shows the location of the computer-based stations; the active stations are shown as blinking points marked with antennas. Your text can be displayed during, before, or after a sequence.

Along with QSO Simulator, a CW training program also is available for those who want to improve their copying and sending abilities. Each program is available on 3.5 or 5.25 inch diskettes for $35 each, or both for $60 (U.S.). Prices include shipping and handling from Gote Lofstedt at Sim-Data Linko, Djurgardsgatan 71, 6tr, S-582 29 Linkoping, Sweden.

List Enhanced. Just about anyone and everyone using an IBM PC has a copy of the popular $37 shareware file viewer, List Plus, on his or her PC. Practically the entire PC community uses List as a much-superior replacement for the DOS TYPE command. According to developer Vernon D. Buerg,



PC-Kwik's Power Disk disk optimizer, once sold separately from Power Pak, now is included in the Power Pak package. Power Disk performs a variety of disk tests and also identifies and cleans up fragmented files for improved disk and file performance and reliability.(Photo courtesy PC-Kwik Corporation)

HF Equipment	Regular	SALE
IC-781 Xcvr/ps/tuner/scope	$6659.00	**5399**

IC-765 Xcvr/ps/keyer/tuner **Special!**	$2919.00	**2299**

IC-751A 9-band xcvr **Closeout!**	$1659.00	**1249**
PS-35 Internal power supply	239.00	**219.95**
FL-63A 250 Hz CW filter (Ist IF)	64.00	
FL-52A 500 Hz CW filter (2nd IF)	124.00	**114.95**
FL-53A 250 Hz CW filter (2nd IF)	124.00	**114.95**
FL-70 2.8 kHz wide SSB filter	64.00	
IC-735 HF xcvr/SW rcvr/mic	1169.00	**979.95**
PS-55 External power supply	239.00	**219.95**
AT-150 Automatic antenna tuner	479.00	**409.95**
FL-32A 500 Hz CW filter	75.00	
EX-243 Electronic keyer unit	69.00	
UT-30 tone encoder	21.00	

IC-737 ***New!*** 160-10m transceiver	$1599	**1349**

IC-725 HF xcvr/SW rcvr/mic	$919.00	**769.95**
AH-3 Automatic antenna tuner	523.00	**449.95**
IC-728 HF xcvr/SW rcvr/mic **Special!**	1119.00	**839.95**
IC-729 HF xcvr/SW rcvr w/6m	1449.00	**1199**
AT-160 Antenna tuner **Special!**	423.00	**299.95**

HF Accessories:	Regular	SALE
IC-2KL HF solid state amp **Special!**	$2159.00	**1768**
IC-4KL HF 1 kw amp w/ps	7609.00	**6199**
SP-3 External speaker	71.00	
SM-6 Desk microphone	52.00	
SM-8 Desk mic; two cables, scan	96.00	
AT-500 500w 9 band auto ant tuner	631.00	**529.95**
AH-2 8-band tuner w/mt and whip	836.00	**709.95**
AH-2A Antenna tuner system, only	623.00	**529.95**

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VHF/UHF Base Transceiver	Regular	SALE
IC-275H 100w 2m FM/SSB/CW	$1619.00	**1359**
IC-475H 100w 440 FM/SSB **Special!**	1849.00	**1498**
IC-575A 25w 6/10m xcvr/ps **Closeout!**	1455.00	**1049**
IC-575H 100w 6/10m xcvr **Special!**	1739.00	**1309**

VHF/UHF FM Transceivers	Regular	SALE
IC-28H 45w 2m FM/TTP mic	$399.00	**339.95**
IC-228H 45w 2m FM/TTP mic	439.00	**369.95**
IC-229A 25w 2m FM/TTP mic **Closeout!**	449.00	**319.95**
IC-229H 50w 2m FM/TTP mic	449.00	**379.95**
IC-38A 25w 220 MHz FM xcvr	449.00	**379.95**
IC-449A 35w 440FM xcvr/TTP	539.00	**449.95**
IC-2330A 2m/25w/220 FM **Special!**	839.00	**639.95**
IC-1201 10w 1.2GHz FM xcvr **Special!**	869.00	**629.95**

Dual band FM Transceivers	Regular	SALE
IC-2410A 25w 2m/440 **Closeout!**	$889.00	**599.95**
IC-2410H 45w 2m/35w 440 FM/TTP	949.00	**799.95**
IC-3230A 25w 2m/440 FM **Closeout!**	759.00	**569.95**
IC-3230H 45w 2m/ 35w 440 FM/TTP	859.00	**719.95**

Multi-band FM Transceivers	Regular	SALE
IC-901 50w 2m/35w 440 FM xcvr	$1089.00	**899.95**
UX-R91A Broad band receiver unit	549.00	**459.95**
UX-19A 10w 10m unit	329.00	**279.95**
UX-59A 10w 6m unit	379.00	**319.95**
UX-S92A 2m SSB/CW module	649.00	**549.95**
UX-39A 25w 220MHz unit	489.00	**409.95**
UX-129A 10w 1.2GHz unit	599.00	**499.95**
UX-49A 440MHz module for IC-900	379.00	**319.95**
IC-970A 25w 2m/430MHz xcvr/ps	2899.00	**2399**
IC-970H 45w 2m/430 MHz xcvr/ps	3139.00	**2599**
UX-R96 50-905 MHz receive unit	429.00	**359.95**
UX-97 1.2GHz band unit	1079.00	**899.95**

VHF/UHF Mobile Antenna	Regular
AH-32 2m/440 Dual Band mobile ant	$ 43.00

VHF/UHF Repeaters	Regular	SALE
RP-1520 2m 25w repeater	$2419.00	**1999**
RP-2210 220MHz 25w repeater	2049.00	**1699**
RP-4020 440MHz 25w repeater.	2489.00	**2069**
RP-4020/50W 440 50w repeater	2709.00	**2249**
RP-1220 1.2GHz 10w repeater	2819.00	**2349**

Due to space limitations some ICOM items, especially accessories, are not listed. For information, please Call Toll Free or see the latest AES® Catalog.

Handhelds	Regular	SALE
IC-P2AT 2m HT **Special!**	$429.00	**299.95**
IC-P3AT 220 HT **Special!**	429.00	**339.95**
IC-P4AT 440 HT **Special!**	479.00	**339.95**
IC-2AT 2m HT* **Special!**	279.00	**199.95**
IC-02AT/HP 2m HT/TTP	359.00	**299.95**
IC-03AT 2.5w 220 HT/TTP	339.00	**279.95**
IC-2SAT 2m/TTP **Special!**	389.00	**309.95**
IC-2SRA 2m/25-905 rx	589.00	**489.95**
IC-24AT 2m/440MHz/TTP	469.00	**389.95**
IC-3SAT 220MHz HT/TTP	369.00	**309.95**
IC-4SAT 440 HT **Special!**	409.00	**329.95**
IC-4SRA 440/rx **Special!**	589.00	**479.95**
IC-2GAT 2m HT/TTP	409.00	**339.95**
IC-4GAT 440MHz **Special!**	409.00	**309.95**
IC-12GAT 1.2 HT **Special!**	529.00	**419.95**
IC-W2A 2m/440 **Special!**	599.00	**449.95**
IC-X2A 440/1.2 HT **Special!**	759.00	**599.95**
IC-2iA 2m HT	360.00	**299.95**
IC-4iA 440MHz HT	435.00	**369.95**
IC-W21A 2m/440 HT	589.00	**499.95**
IC-W21AT 2m/440 HT/TTP	629.00	**529.95**

Aircraft band handhelds	Regular	SALE
A-2 5W PEP synth aircraft HT	575.00	**449.95**
A-21 Navicom Plus Aircraft HT	680.00	**529.95**

Shortwave Receivers	Regular	SALE
R-1 100kHz-1.3GHz AM/FM pocket	$549.00	**469.95**
R-71A 100kHz-30MHz rcvr	1229.00	**1029**
RC-11 Infrared remote controller	77.00	
FL-32A 500 Hz CW filter	75.00	
FL-44A SSB filter (2nd IF)	191.00	**174.95**
EX-257 FM unit	53.00	
EX-310 Voice synthesizer	64.00	
R-72 30kHz-30MHz SW rcvr **Special!**	1129.00	**799.95**
R-100 100kHz-1.856GHz AM/FM	739.00	**619.95**
R-7000 25MHz-2GHz rcvr **Special!**	1459.00	**1099**
RC-12 Infrared remote controller	77.00	
TV-R7000 ATV unit	188.00	**169.95**
R-7100 25MHz-2GHz receiver	1509.00	**1269**
R-9000 100kHz-2GHz all mode rec	5969.00	**4929**

Limited Specials	Regular	SALE
IC-24AT 2m/440 HT/TTP	$469.00	**$389.95**

Includes: FREE UT-50 tone squelch unit ($48 Value).

IC-2410H 2m/440 FM/TTP	$949.00	**$799.95**

Includes: FREE UT-55 DTMF tone enc/dec unit, UT-66 voice synth. and UT-67 tone squelch ($144 Value).

IC-3230H 2m/440 FM/TTP	$859.00	**$719.95**

Includes: FREE UT-55 DTMF tone enc/dec unit, UT-66 voice synth. and UT-67 tone squelch ($144 Value).

Closeouts/Specials	Regular	Now
IC-751A 9-band HF xcvr/SW rx	$1659.00	**$1199**
IC-765 HF xcvr **Special!**	2919.00	**2199**
R-7000 25MHz-2GHz rec **Special!**	1459.00	**1099**
IC-575A 25w 6/10m xcvr/ps	1455.00	**1049**
IC-229A 25w 2m FM xcvr/TTP	449.00	**319.95**
IC-2410A 2m/440 FM xcvr	889.00	**599.95**
IC-3230A 25w 2m/440 FM xcvr	759.00	**569.95**
IC-2AT 2m HT* **Special!**	279.00	**199.95**

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N6MG, List has been distributed as shareware for several years and is used by about 30,000 known (registered) users and probably between 500,000 and 5,000,000 unknown ones. And for good reason: the program does its job of finding and viewing files so well, and with so little fuss or fanfare, that most users wouldn't consider going without it. Its basic claim to fame is the ability to take practically any type of ASCII or wordprocessor format file and pop it up on the screen from the DOS prompt or from a file selection screen.

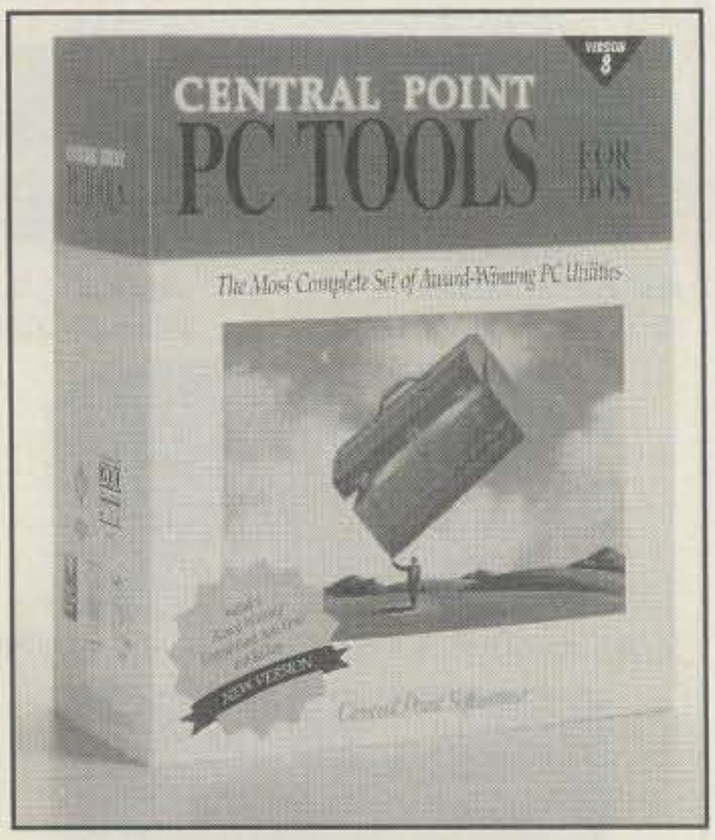
Now List has gone commercial with List Enhanced, a $99 product that's the first retail version; it adds several extra features. List Enhanced is a full-fledged file browser and viewer as well as a file, archive, and directory management program. It includes built-in file compression features as well as support for IBM mainframe-type EBCDIC files and various enhanced video modes. The program has filters for 7- and 8-bit formats as well as hexadecimal files, and it can view files of up to 32 MB. Complementing the ability to view very large files, List Enhanced offers a variety of video modes, including 132x25, 132x43, and 80x43 characters, if your video display card and monitor support them. Other features include convenient file tagging, a new sweep command (which runs a single DOS command against a tagged group of files), a tree directory display, and viewing/management features for ARC, ZIP, and other compressed files. You can view compressed files without actually extracting them.

What are List Enhanced's negatives? Very few, indeed. Just to be ornery, I'd like to be able to view wordprocessor files in their native format, and prefer to see List Enhanced offer more concessions to the pull-down menu crowd. List still primarily is a character-based, DOS command line oriented product, with its user interface in need of some minor sprucing up. Otherwise, it's a bona fide steal at $99. Contact Buerg Software, 850 Petaluma Blvd. North, Suite F, Petaluma, CA 94952 (707-769-5478).

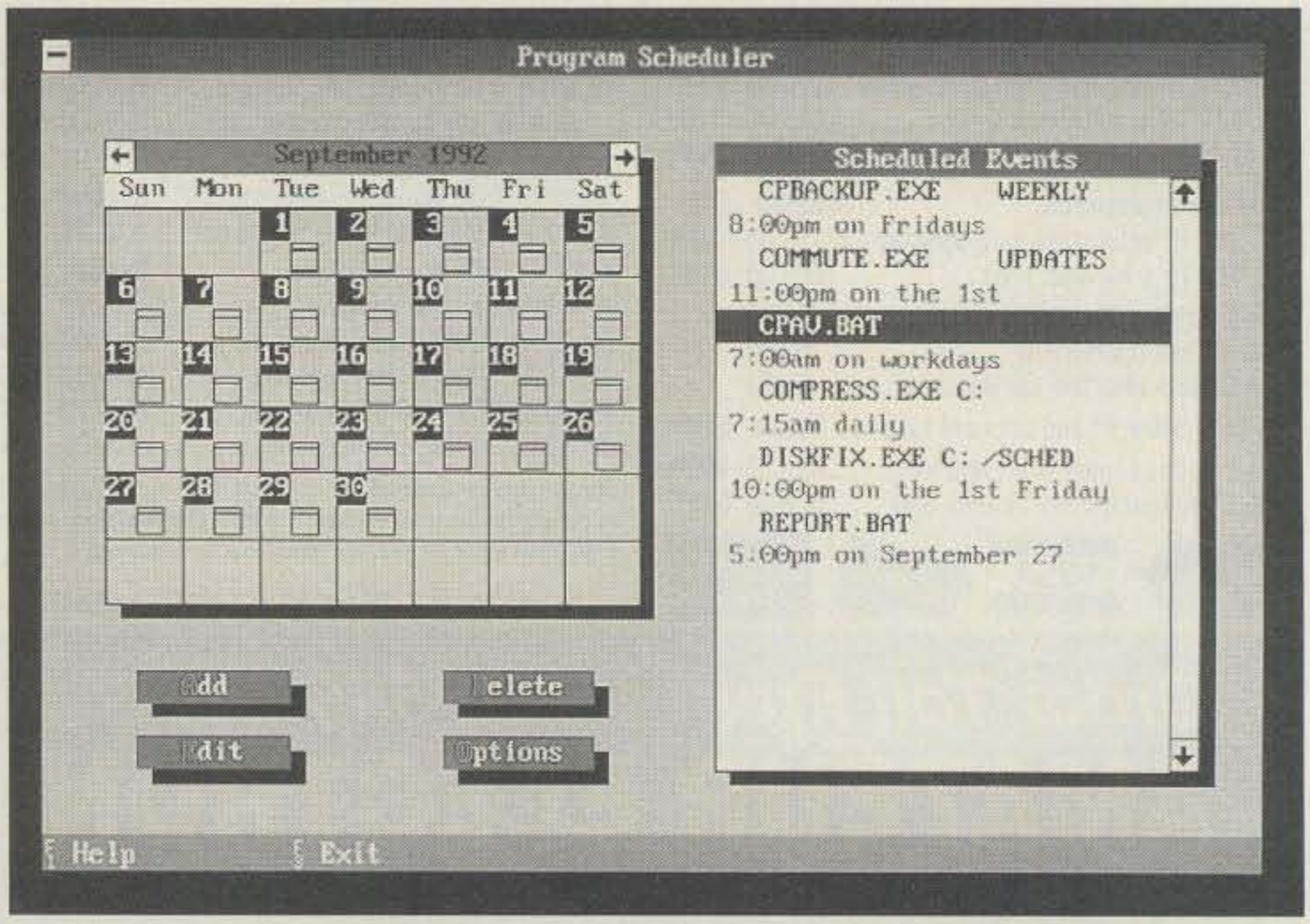
PC-Kwik® Power Pack Update. We've mentioned the PC-Kwik Power Pak utility package in several previous columns, most recently the February and December 1992 columns. To recall, PC-Kwik Power Pak is a fully integrated PC performance enhancement package, one which is targeted especially for DOS users, but which also can be used on Windows-based PCs or PCs that use a combination of DOS and Windows environments. The various Power Pak utilities work intelligently among themselves to conserve and share valuable memory resources.

At the heart of the Power Pak package is the Super PC-Kwik disk cache, reportedly the fastest in the industry. It has the ability to automatically establish a disk cache buffer in conventional, extended, or expanded memory. The most distinctive feature of the whole package is the integrated, intelligent use made of the computer's memory. Power Pak dynamically shares memory among the cache and its other internal programs and with other applications, including Windows.

Now PC-Kwik has released version 3.0, and it's one of the most stable versions—an important characteristic in these days of sophisticated memory management requirements, the sometimes fickle Windows environment, full-disk file compression, and the like. There are significant additions to most of the Power Pak programs, but we won't cover these module-by-module in the interest of space. However, we should note that there's a completely new module in the KwikBoot DOS boot configuration utility which lets you select a system configuration when you boot your PC. Also, there's a brand new set of full-word, Windows-like command line parameters for all of the Power Pak modules. Finally, newly integrated into Power Pak is Power Disk®, a fast disk defragmenter, which also sports a spiffy new graphical interface. Major new features also have been added to the keyboard and screen acceler-



PC Tools Version 8 is the latest and greatest incarnation of Central Point Software's comprehensive disk and file utility package. It includes a wide variety of tools for data protection and recovery, hard-disk backup, file management, desktop organization, performance enhancement, and other tasks. (Photo courtesy Central Point Software, Inc.)



The Central Point Scheduler, part of PC Tools, lets you schedule any program to run without having to monitor the process. This capability is especially useful for lengthy procedures that don't require your presence, such as backup sessions. You can schedule any executable command at the DOS prompt. (Photo courtesy Central Point Software Inc.)

ator modules as well as to the disk cache, which has been optimized so that it processes cache "hits" and "misses" faster than ever before.

For more information on the $129.95 comprehensive utility package, contact PC-Kwik Corporation, 15100 S.W. Koll Pkwy, Suite L, Beaverton, OR 97006 (1-800-274-5945).

PC Tools™ Update. Central Point Software has "done it again" with its PC Tools for DOS, Version 8, a new release of the industry's popular and comprehensive utilities software product.

To sum up the many capabilities and features of PC Tools is difficult. Suffice it to say that it's a powerful group of integrated utilities designed to make computing simpler and faster, and above all, to provide some much-needed insurance against devastating data loss. The new version is integrated in a single, easy-to-use, Microsoft Windows™-like graphical desktop (or shell) which provides complete access to all applications and files, allows simultaneous access to multiple applications, and lets you transfer data among applications.

PC Tools is a comprehensive set of utilities that goes head-to-toe against Symantec's The Norton Utilities™ and The Norton Desktop for DOS™. The package includes such capabilities as hard-disk backup and disaster recovery; Central Point Anti-Virus™, for virus protection; RAM Boost™, an upper memory optimizer; a remote device mapper called DriveMap™, an integrated task switcher; and much more. The new version boasts over 100 enhancements to existing features, including remote computing capabilities; an integrated program scheduler; and a defragmenter that works on high-capacity drives. Like its Symantec competitors, Central Point's PC Tools boasts simple, intuitive interfaces that make routine computer and disk maintenance relatively easy for beginners.

While the new version can't be "all things to all people," which it attempts to be anyway (with perhaps the result being an overly complex product), it certainly makes strides toward becoming the "Swiss Army knife" of PC utilities. All things considered, at $179 suggested retail, PC Tools is a good value. It's an even better value if you own an earlier version, in which case the upgrade price is considerably less.

For more information, contact Central Point Software, 15220 N. W. Greenbrier Parkway #200, Beaverton OR 97006 (1-800-626-2778). A Windows-specific version reportedly is on the way.

More From Didah Publishing. In the March 1992 column we mentioned the ongoing article indexing being undertaken by Rich Rosen, K2RR, who formerly was Editor-in-Chief of *Ham Radio* magazine. Rich initially developed a listing on microfiche of most of the articles that have appeared in the amateur radio and communications-electronics press. Entitled *From Beverages Through OSCAR—A Bibliography 1909–1990 (FBTO)*, the index contains approximately 53,000 single-line abstracts in 92 communications subject areas. It was, and still is, priced at $50 on microfiche.

As we noted previously, Rich now offers the FBTO Bibliography on diskette, a move that was necessary since most folks just don't

like to work with microfiche or microfilm if they possibly can avoid doing so. The computerized Bibliography and several subsidiary magazine databases devoted to individual publications cover *QST* (1945–1990), CQ (1945–1990), *73* (1960–1990), *Ham Radiio* (1968–1990), and the British journal *Radio Communication* (1979–1990). At present, the full *Bibliography* compendium on diskette is $89.95.

In an update letter from Rich, he notes that he's now increased his product line to well over 100 products, a goal he set over a year ago. In addition to the large on-disk database, there also are individual software indexes for *QST, CQ, Ham Radio, 73,* and *RadCom,* which he sells separately for $20 per publication. All of the computer databases can be loaded onto a hard disk for fast searching and retrieval.

Rich also offers more than 40 very reasonably priced specialized subject package hardcopy indexes covering product reviews, antennas, propagation, digital topics, surplus, RTTY, SSB, and other subjects that draw from all of the amateur magazines. Most of these indexes are priced at $10. Rich says that he will develop additional subject matter indexes, depending on feedback on what the amateur fraternity wants.

Besides the hardcopy subject indexes, Rich also offers a group of hardcopy indexes for the same series of electronics and radio publications, similar to, and derived from, the *FBTO Bibliography.* The hardcopy magazine indexes are priced at $10 to $19, depending on the publication being indexed.

For more information on current offerings and prices, contact Didah Publishing, P.O. Box 7368, Nashua NH 03060-7368 (603-878-3628).

Short Bursts

Utilities by Modem. I'm something of a computer utilities nut. Consequently, I'm always looking for a new utility program to try out on my PC. Like many PC enthusiasts, I've found that some of the most treasured utilities are by the staff of *PC Magazine* and made available on their online utility, ZiffNet, which you can access directly or via CompuServe. To obtain the utilities by these two routes, you normally must be a dues-paying member.

If you're not a member, however, you nevertheless can obtain at least the current *PC Magazine* utilities absolutely free from PC MagNet, a ZiffNet service that's hosted by CompuServe. Information on how to download the current utility free of charge is shown in each issue of the magazine, usually in the utilities section. Briefly, to download the utilities, you first must obtain the local CompuServe access number. You do this by dialing 1-800-346-3247 with your modem (using 300 to 9600 bps, 7 data bits, even parity, 1 stop bit, full duplex). At the HOST NAME prompt, enter PHONES. Follow the instructions and note the local access number you find that's closest to you. You also can call 1-800-635-6225 on voice and get the access number by following the menus and instructions.

To obtain the current *PC Magazine* utility programs, dial the local access number you just obtained. At the HOST NAME prompt type CIS, and at the USER ID prompt, enter 60116,1. At the PASSWORD prompt, enter PCMAGUTIL. Follow the on-screen menus and prompts to request and obtain a log-in name, and select and download the current utilities. In practice, I've found that several issues' utilities are posted at any given time, so if you missed one, you may still be able to pick it up later. Bottom line: even though you've accessed ZiffNet via CompuServe, it's not your online nickel you're spending. A neat freebie, but also a good "teaser" to get you to sign up. Indeed, you may want to join CompuServe and/or ZiffNet rather than relying on the freebie log-in method, which offers very limited benefits. If you dial up ZiffNet as we've described, you'll be presented a menu choice for information on signing up (see below).

CompuServe, Ziffnet, and HamNet. Most of us are familiar with CompuServe, the 900,000-plus member Ohio-based utility. It features many megabytes of software in its numerous message and library forums and other accessible areas, but you have to be a member for regular access. For more information on CompuServe, contact them at P.O. Box 20212, Columbus, OH 43220-0212 (1-800-848-8199 or 1-800-848-8990). Several membership plans are available.

As we've seen, you can access ZiffNet through CompuServe. ZiffNet is a specialized online service for PC buyers and users. It brings together several thousand IBM PC and Macintosh freeware, shareware, and PD software programs, plus the *PC Magazine* utilities, in addition to forums, product reviews, and more. Membership in ZiffNet (cost is $2.50 per month) is separate from CompuServe. You can access the service through CompuServe (by typing GO ZIFFNET) or go online directly with ZiffNet if you are not a CompuServe member. Additional information on ZiffNet is available through the CompuServe telephone numbers, above, or each month in *PC Magazine.*

Finally, while we're still logged onto CompuServe, don't forget HamNet, which we highlighted in a recent column. The HamNet Special Interest Group (SIG) is open to all CompuServe users. It's devoted to amateur radio and related hobbies, including shortwave listening and scanning. As such, it's a vast resource of computer software, amateur radio newsletters, information on radio and electronic technical developments, and FCC information.

Online messages and teleconferences are available on HamNet. There's even an online swap shop, and several vendors provide technical support. The HamNet SysOp is Scott Loftesness, W3VS (CompuServe ID 76703,407). HamNet SIG membership is free, but you must be a CompuServe member to access it.

Wrap-Up

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

Overheard: When building something for the hamshack, if there's the possibility of several things going wrong, you can bet that the one which will cause the *most* damage will be the one to go wrong.

73, Karl, W8FX

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YAESU FT-23R-17 (E) • 2m FM HT 2.5w ouput, rotary dial frequency entry, LCD display, 10 memories, scanning, priority. Rugged and weatherproofed. 4⅛"h 2¼" x 1⅜"d, 1 lb ..... **SALE $239.95**
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BY DOUG DeMAW, W1FB

CONSTRUCTION PROJECTS, TECHNIQUES, AND THEORY

Working With Toroids

Perhaps one of the least understood electronics devices is the toroid core. Toroids can be thought of as magnetic cores that are used within inductors for the purpose of increasing the coil inductance. Toroidal coils or transformers have a fixed value of inductance. Slug-tuned coils contain similar core material; however, the inductance here can be varied by positioning the slug core. The inherent nature of the toroid or magnetic donut enables the wound inductor to become self-shielding. This minimizes interaction with nearby inductors and other components. Toroids provide high-Q inductors for narrow-band circuits because fewer turns of wire are needed than for an equivalent inductance wound on an air-core coil form. Furthermore, the same-value toroid inductor is a fraction of the size of its air-core cousin.

The Correct Core Material

Amateurs frequently experience problems with circuit performance when they attempt to use toroid cores with unknown properties. Sometimes surplus dealers will offer a number of toroid cores at bargain prices. Unfortunately, they do not always specify the core permeability (μ_i), and they sometimes neglect to say whether the core is made of ferrite or powdered iron.

Permeability is the key to how the core can be used effectively. Generally speaking, the greater the permeability, the lower the recommended frequency of operation in a narrow-band circuit. Such a circuit must have high Q (quality factor) in order to provide selectivity. The wrong core, even with the correct inductance, can spoil a circuit because of low Q. The Amidon Associates catalog[1] lists recommended operating frequencies for powdered-iron and ferrite cores. The permeability is also listed. Each core has an assigned A_L value, which tells the user how many turns of wire to wind on a given core to obtain a desired inductance. Without this vital information it becomes an exercise in futility to design a toroidal inductor or transformer by the hit-and-miss method. The incorrect core material in slug-tuned coils can also ruin circuit performance.

P.O. Box 250, Luther, MI 49656

Toroid Size

As circuit power requirements increase, so must the size of the toroid core in order to avoid *core saturation*. Small cores can be stacked and cemented together with epoxy glue in order to increase their power-handling ability. This also changes the A_L factor, which means fewer turns of wire are needed. The calculations for correct core sizes are detailed in the Amidon catalog and in the *Ferromagnetic Core Design & Application Handbook*[2] published by Prentice-Hall, Inc. A safe rule of thumb is to not use any core that, while in an operating circuit, becomes hot. Moderate warmth to the touch after sustained operation is okay.

What is Permeability?

Permeability is simply a measure of the comparative ease with which the magnetic flux can be set up in a material. Typically, it is a ratio of the flux density in the material to the flux density in air. The mathematical symbol is the Greek letter μ.

What is Saturation?

Saturation occurs when the rated flux density of the core is exceeded. The core becomes hot and changes permeability. Powdered-iron cores can recover from this abuse and will return to their specified permeabilities. A ferrite core, on the other hand, may never regain its characteristic permeability. In a worst-case situation it may crack or shatter. Flux density is specified in *gauss*. The manufacturer's data sheets contain this information.

Ferrite or Powdered Iron?

Ferrite is a less stable compound than is powdered iron. For this reason ferrite material is seldom used in oscillators that require high orders of stability. The permeability of ferrite changes substantially with variations in temperature. This causes severe frequency drift. Certain powdered-irons are quite stable and are commonly used in oscillators. The Amidon No. 6 (yellow) cores are very stable if the coil is cemented to the core after it is wound. General Cement Polystyrene Q Dope® is my choice for affixing the coil to the core. Two coatings are sufficient. If the turns are allowed to move, there will be a change in inductance, and hence drift.

Ferrite cores are preferred for broadband transformers. This is because the high available permeability in ferrite allows the designer to obtain large winding inductances with very few turns of wire. Basic broadband transformer design will be treated in a subsequent article.

Most broadband transformers must operate efficiently over several octaves of frequency, such as 1.8 to 29 MHz. The ferrite core has a unique property that makes this possible: As the operating frequency is increased, the core tends to become more and more nonexistent, as seen by the circuit. Thus, the core permeability is highly effective at the low-frequency end of the range, which provides the required high inductance or reactance (X_L). As the operating frequency increases, the effective permeability of the core diminishes more and more until only the winding is seen by the circuit. At that frequency the core can be thought of as merely a ceramic coil form. Ordinarily, such a broadband transformer uses a ferrite core with a permeability of 850 to 2000, depending on the design requirements. Most of my broadband transformers are wound on Amidon No. 43 ferrite cores (850 μ_i).

Protecting the Winding

Most ferrite cores are not tumbled as part of the manufacturing process. This means that sharp edges can exist, and they can cut through the enamel insulation of the magnet wire. Ferrite cores are semiconductors, and this means that shorted turns can exist if the bare wire touches the core. A shorted turn destroys the Q of the winding.

There are some preventive measures you can take to avoid abrading the wire. I suspend my ferrite cores on a thin piece of wire and spray them with two coatings of polystyrene lacquer. Larger cores can be wrapped prior to winding them. For this I use Teflon pipe thread tape (two layers), which is available at most hardware stores. Very large cores may be wrapped with 3M glass tape. This is a good material for cores that are used in high-power circuits and as balun transformers.

Fortunately, powdered-iron cores are

tumbled and have smooth edges. Also, most of them are painted to provide a color code that indicates the core characteristics.

Core Nomenclature

The Amidon and Micrometals Corp. toroid cores have assigned numbers that tell us the core size and permeability. For example, a T50-2 toroid has a 0.5 inch OD (T indicates toroid and 50 is the diameter). In a like manner, a T200-2 core is 2 inches in diameter and is made of No. 2 material (red). A typical ferrite core has, for example, a number such as FT-25-43. FT indicates "Ferrite Toroid." The 25 tells us that is has a 0.25 inch OD and that is has a 43 class permeability.

Companies such as Indiana General and Ferroxcube Corp. use different designators. Their catalogs explain the coding.

Checking The Inductance And Relative Q

Few amateurs have access to a laboratory-grade Q meter, which is required to accurately measure unloaded Q and inductance. A grid-dip meter can be used to explore these parameters. Fig. 1 shows pictorially a method I use for learning the toroid inductance and relative Q. The grid-dip meter is coupled loosely to a link that is wound through the completed toroid. A second small link is connected to the first one, to permit sampling the circuit with the meter. A known-value capacitor is then connected across the toroid winding. Resonance occurs when the capacitive reactance (X_C) equals the inductive reactance (X_L). Therefore, we can determine the X_C and know the X_L. Once we know the X_L we can determine the inductance by standard equations.

You should be aware that link coupling to a toroid will shift the effective inductance slightly, but this is not a problem in most amateur work.

An alternative sampling method is to connect the capacitor across the winding (no links are used) and insert the dip-meter coil into the gap between the capacitor leads and the toroid. Normally this provides sufficient coupling to obtain a dip reading. The inductance is not shifted with this technique.

The foregoing methods are essential because of the self-shielding property of a toroid. That is, placing the dipper probe near the coil will not allow enough magnetic coupling to obtain a dip.

Summary

I have attempted to point out the major considerations when working with toroids. Certainly, a comprehensive discussion of these topics would require a book-length treatise. The Amidon Associates catalog and the book referenced in this text are available to those who wish to learn more about toroid design and applications. The major consideration for you is that you select the right core for the job and that it be wound correctly.

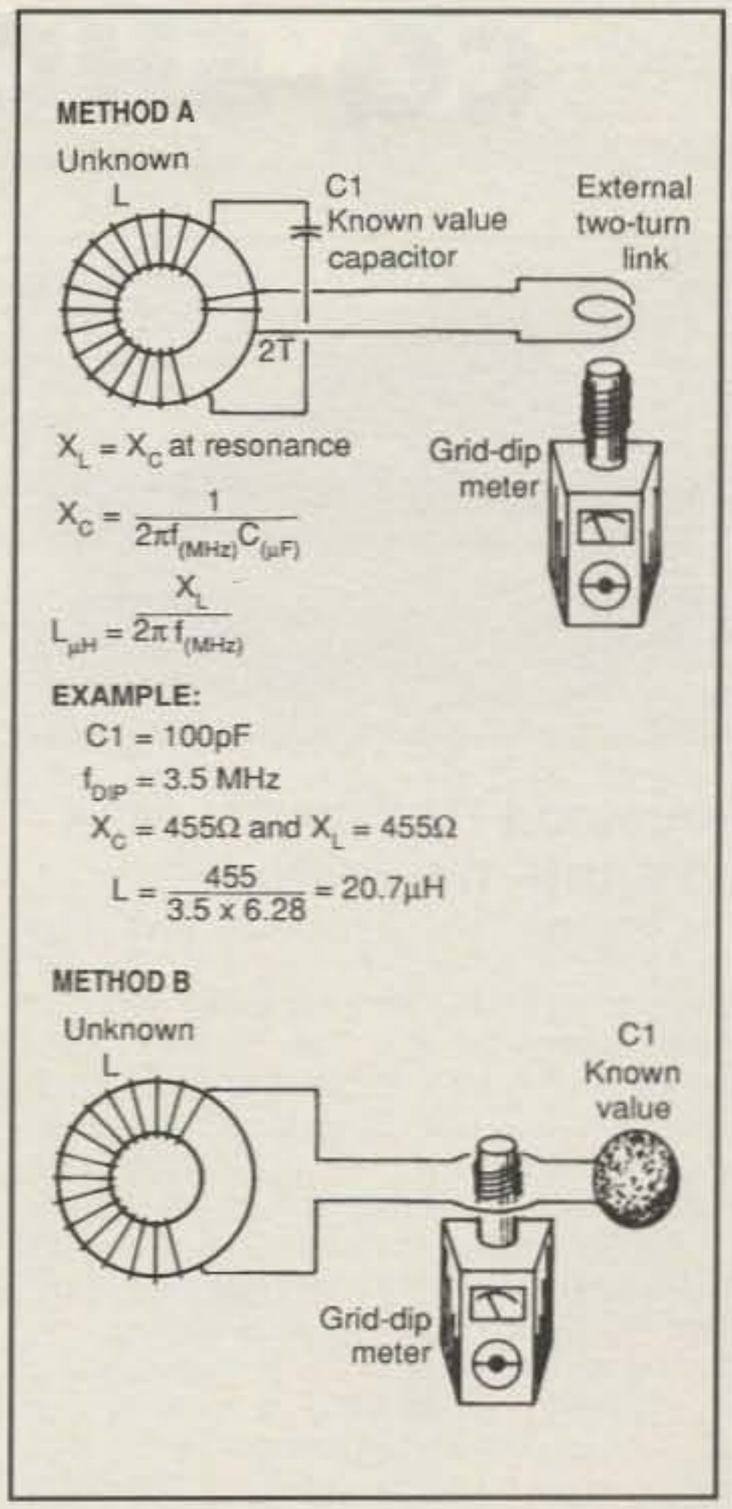

Fig. 1—Two methods for determining the inductance of a toroid coil. A pair of two-turn links and a known-value capacitor are used at A. The dipper coil is placed near or into the external link, and the frequency is varied to obtain a dip in the reading. Couple the grid-dipper to the coil as lightly as possible to obtain a shallow dip. The relative Q is indicated by the coupling needed to obtain a dip. The farther the meter probe (coil) is from the sampling link, the higher the Q. Method B may be used in a like manner. The leads on C1 are left long enough to permit inserting the grid-dip probe to obtain coupling.

References

1. Amidon Associates, Inc., 2216 E. Gladwick St., Dominguez Hills, CA 90220 (310-763-5770).

2. DeMaw, Doug, *Ferromagnetic Core Design & Application Handbook*, Prentice-Hall, Inc., Englewood Cliffs, NJ 07632.

CQ SHOWCASE

Kenwood TM-742A/TM-942A VHF/UHF Transceivers

Kenwood has announced two new VHF/UHF multiband transceivers. The TM-742A is a 144/440 MHz tribander with third band optional, while the TM-942A is a 144/450/1200 MHz triband FM transceiver. (The TM-641A 144/220 MHz transceiver will remain in Kenwood's line for 220 MHz operators.) The transceivers have all the features of the TM-741A and TM-641A with the following enhancements.The units can separate into three parts: frequency display, control panel, and radio chassis. (Separation in this manner requires the optional DFK-3, DFK-4, or DFK-7 remote cable kit.) Also included are dual/triple receive, DTSS pager function built in, direct frequency entry into the VFO using the supplied DTMF microphone, and a new adapter, the MJ-89, allowing the user to connect two microphones to the rig.

The TM-742A band modules are interchangeable with the current UT-Series of band modules for the TM-741A and TM-641A. The TM-742A is priced at $879.95; the TM-942A is priced at $1229.95. For more information, contact Kenwood Communications Corp., P.O. Box 22745, 2201 E. Dominguez St., Long Beach, CA 90801-5745, or circle number 102 on the reader service card.

Dunestar Systems Bandpass Filters

Dunestar Systems' transceiver bandpass filters are designed for use with HF transceivers providing suppression of IMD, phase noise, and harmonics on transmit, as well as protecting the receiver from out-of-band products. Placed in-line between transceiver and antenna or amplifier, they provide band-to-band isolation. They also provide harmonic suppression, reducing or eliminating TVI.

The 500 Series is a 5-band DC remote switched system featuring individually selectable bandpass filters for 80, 40, 20, 15, and 10 meter bands standard (Model 505). The 100 Series are single-band filters of the same design used in the multi-band unit. It is also available in 80–10 meter versions standard (Model 101). The Model 505 multiband filter is $150. The single-band Model 101 is $31.50. Custom frequencies are available in both series. For more information, contact Dunestar Systems, P.O. Box 37, St. Helens, OR 97051 (503-397-2918), or circle number 103 on the reader service card.

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.375"	.058"	.259"	.044	.30
.500"	.049"	.402"	.082	.40
.500"	.058"	.384"	.095	.43
.625"	.058"	.509"	.104	.50
.750"	.058"	.634"	.127	.57
.875"	.058"	.759"	.150	.65
1.000"	.058"	.884"	.202	.70
1.125"	.058"	1.009"	.229	.80
1.250"	.058"	1.134"	.255	.90
1.375"	.058"	1.259"	.283	1.05
1.500"	.058"	1.384"	.309	1.25
1.625"	.058"	1.509"	.336	1.45
1.750"	.058"	1.634"	.363	1.60
1.875"	.058"	1.759"	.384	1.70
2.000"	.058"	1.884"	.416	1.75
2.125"	.058"	2.009"	.443	1.85
6061-T6 EXTRUDED ALUMINUM TUBING				
.188"	SOLID	-	.032	.15
1.125"	.058"	1.009"	.229	.65
1.250"	.058"	1.134"	.255	.70
2.000"	.120"	1.760"	.833	2.35
2.000"	.250"	1.500"	1.616	3.75
2.500"	.120"	2.260"	1.055	2.95
3.000"	.065"	2.870"	.705	1.95
3.000"	.120"	2.760"	1.277	3.50

Texas Towers Aluminum Tubing

Texas Towers has announced their expansion into the aluminum tubing market. Their stock includes many telescoping sizes suited for amateur antenna construction, and specifically for construction techniques made popular by readily available Yagi design software. The drawn tubing is constructed from 6063-T832 alloy (40,000psi typical yield strength). It has a bright finish and is available in 1/8 inch increments designed to telescope. It is available in 6 and 12 foot lengths (6 foot lengths are UPS shippable). Also available is extruded tubing made from 6061-T6 alloy, and it is designed specifically for use in large antenna booms. A smaller solid size is suited for use as elements for VHF and UHF antennas. The extruded tubing is available in 6, 12, and 24 foot lengths.

For more information, contact Texas Towers, Div. of Texas RF Distributors, Inc., 1108 Summit Ave. Suite 4, Plano, TX 75074 (214-422-7306), or circle number 105 on the reader service card.

MATH'S NOTES

BY IRWIN MATH, WA2NDM

WHAT'S NEW AND HOW TO USE IT

An Electronic Load Circuit

This month I would like to pass along a novel circuit I uncovered in a recent copy of the *Engineering Journal*, published by the MAXIM Integrated Circuits people. The circuit is interesting in that it describes an electronic "load resistor" that can be set precisely for any current desired, from 0 to 10 amperes, over a voltage range of 1.2 to 50 volts. Once set, it will only allow that pre-set current to flow through it. This circuit equates to a 0 to 500 watt adjustable power resistor. Such a circuit is ideal for testing power supplies and DC or low-frequency power amplifiers and will find many uses in the shack.

Fig. 1 is the complete schematic. You will notice that a 6 to 9 volt power supply produces a regulated 1.3 volts across IC1, a voltage reference chip manufactured by MAXIM. This constant voltage is applied to R6 through either R4 or R5 through the range switch. R4 and R5 are adjusted so that either 1.000 or 0.100 volts appear at the top of R6 when they are switched in. The arm of R6, which should be a linear 10-turn pot fitted with a 10-turn dial, then provides a precise reference voltage to the non-inverting input of an op-amp. At the same time, the load current through the MOSFET and 0.1 ohm resistor provides the voltage input for the inverting input of the op-amp.

Since the op-amp will only cut off when both inputs are equal, the voltage produced across the 0.1 ohm resistor (load current × 0.1) will rise to the preset value of the voltage produced by R6, but not higher. As soon as it reaches this value, the MOSFET cuts off. As a result, the setting of R6 directly determines the maximum current that can flow. The 1 amp and 10 amp ranges differ only in the amount of voltage that R6 can produce. The overall accuracy is only limited by the linearity and resolution of R6.

In building the circuit, be sure to properly heat sink the MOSFET. It can dissipate a lot of power, and the larger the heat sink, the better. The MOSFET shown is an International Rectifier (IR) device. However, any similar MOSFET can be used. The op-amp is a general-purpose type, the open-circuit gain of which will determine the accuracy of the circuit. The 0.1 ohm 20 watt resistor can be purchased or made from a short length of wire salvaged from an old wire-wound resistor. Current flow from the 6 to 9 volt power supply is minimal, and even a 9 volt transistor-radio battery can be used with good results. If you use the battery, you have the additional advantage of a fully "floating" load.

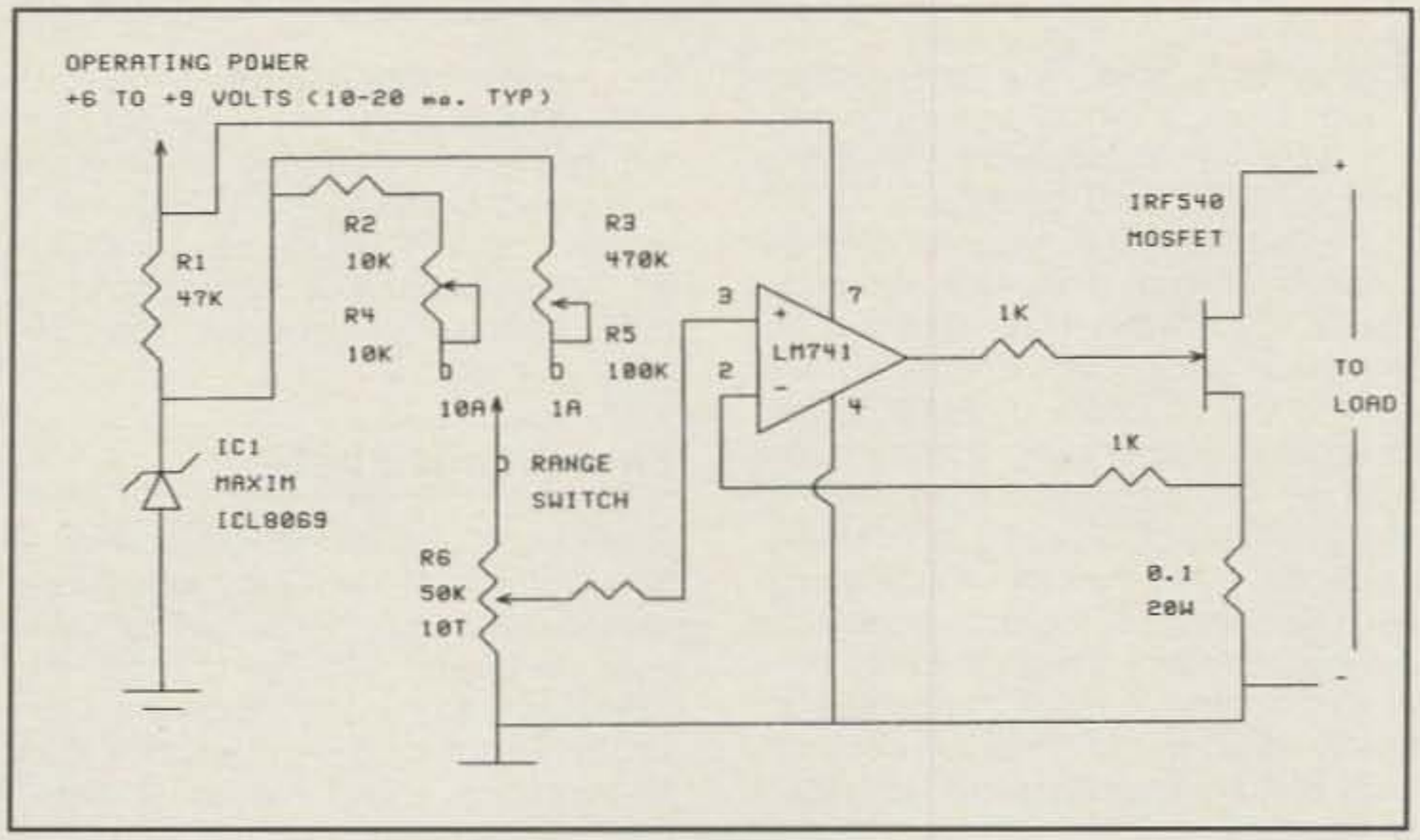


Fig. 1– Schematic diagram of electronic load.

In operation, simply connect the device to be loaded to the MOSFET/0.1 ohm resistor, with the proper polarity, and dial in the current you wish to draw. The circuit will do the rest.

Since the electronic load circuit is basically a constant current sink, it can also be used as a driver for LEDs, relays, lamps, and other devices that must maintain a constant current. Fig. 2 shows how you would use it in this manner. If you do use the circuit as a driver, be sure that you do not exceed the ratings of the MOSFET and power resistor.

See you next month. . . .

73, Irwin, WA2NDM

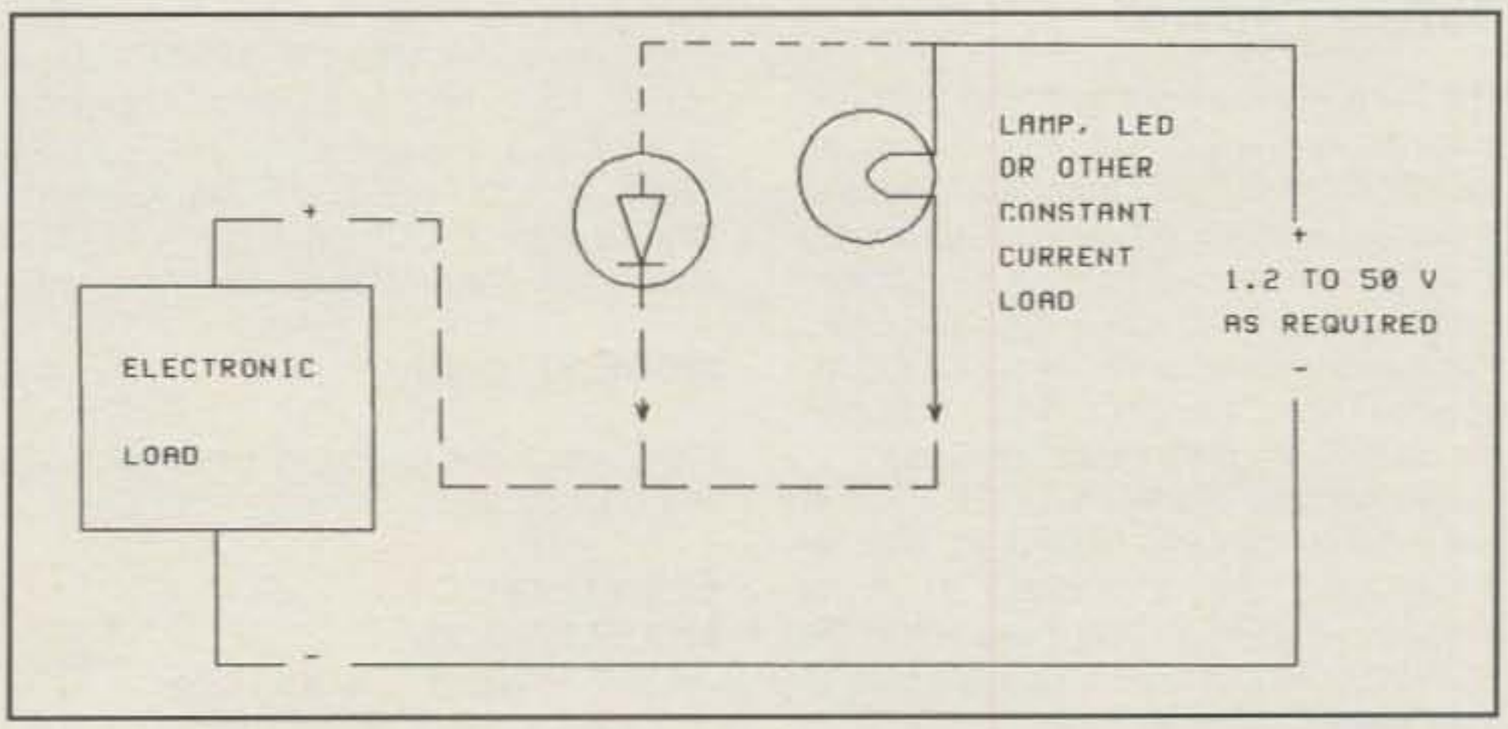


Fig. 2– Using the electronic load as a constant current source. (Note: Current will be constant regardless of input voltage.)

c/o CQ magazine

PACKET USER'S NOTEBOOK

CONNECTING YOU AND PACKET RADIO IN THE REAL WORLD

BY BUCK ROGERS, K4ABT

Digital Signal Processing

For a long time I've reserved my thoughts about digital signal processing. DSP—as it is known by most who design, build, and operate it—is the mode that brought so much excitement a couple of years ago. One of the first issues of CQ Communications' *Communications Quarterly* magazine discussed the attributes of implementing digital signal processing (DSP) into our hobby. The discussion then covered everything from DSP audio in SSB transceivers to every thinkable mode of digital data communications that we use in packet and related modes. Many innovations are taking place throughout our hobby, and most of these are contributions that are directly related to packet radio.

A closer look reveals what we have available for present-day use. Some multi-mode controllers are not totally digital. Some are indeed multi-mode "data" controllers. They may handle a digital mode through a protocol addressing scheme built around several discreet components. What we do have is an application medium that enables an electronic conversion of the source analog signal into a digital output mode similar to the way the present-day packet controller (TNC) functions.

If we cut through all the window dressing surrounding today's digital and data controllers, we can take a realistic look at what is appearing on the horizon as the next step for the digital amateur.

DSP Has Arrived

The system I'm about to introduce here is the technology that is used in the new AEA DSP-2232 Data Controller. This unit is not just another pretty face, for inside this handsome cabinet there lies more horse-power and more digital modes than we've ever seen in a data controller. There is every modem that can be used by today's digital amateur.

The cabinet of the AEA DSP-2232 is not much larger than that of its cousin, the PK-232. To incorporate as many modes in the PK-232 as there are in the DSP-2232 would take a box the size of my "Town Car" trunk.

211 Luenburg Dr., Evington, VA 24550

There are so many features in the DSP-2232 to write about, yet I may not have the time nor the space to cover all the finer points of the AEA DSP-2232 in this month's column. Since space is limited, let's get started describing as many of the features and modes of the DSP-2232 as possible.

First Things First

First I'll give you a brief explanation of how so many modes and modems are placed in the DSP-2232. The DSP-2232 uses software that is burned into EPROMS and placed inside the DSP-2232. This technique opens the door for more advanced modes of digital communications than you may ever be able to use. Table I is a list of modes and modems that were in the DSP-2232 when I received it from the supplier.

Since receiving my DSP-2232, there has been an upgrade EPROM which added the well-defined and welcome HF mode of PACTOR.

PACTOR in itself has already proven to me that it is the most efficient and economical mode to happen to our digital hobby in a long time. I'll have more on the PACTOR mode later.

The DSP-2232 has two ports, and both can be active at the same time. In addition, either port can be operating with a different mode and/or modem than that being used on the other port.

Any modem shown in the list may be loaded or initialized within the DSP-2232 simply by evoking the number of the mode or modes with the "MODE" command. For example, if I want to operate at 300 baud HF packet from RADIO port 1 and at 1200 baud VHF packet from RADIO port 2, I simply type in the following command at the "cmd:" prompt::

MODE 33 <enter>

I will receive the following message from the DSP-2232:

MODEM was 12
MODEM now 33
cmd: *** HBaud now 300/1200

A nice feature of the above modem 33 use would be to have both ports active during contesting so as to view the local VHF DX spotting network on port 2 while actively contacting stations "spotted" on HF port 1. The port identifiers allow us to view both port packets on the same screen, at the same time, thereby enabling simultaneous port connects and communications. There is an easy-to-spot ID that comes in the form of "p1" and "p2," indicating "port 1" and "port 2" packets.

1: RTTY/TOR 170: 2125/2295
2: RTTY/TOR 170: 1445/1275
3: RTTY/TOR 425: 2125/2550
4: RTTY/TOR 850: 2125/2975
10: p1 Packet 300 bps HF 2110/2310
11: p1 Packet 300 bps HF 1460/1260
12: p1 Packet 1200 bps VHF
13: p1 Packet 1200 bps PACSAT
14: p1 Packet 1200 bps PSK
15: p1 Packet 2400 bps V.26B
16: p1 Packet 4800 bps PACSAT
17: p1 Packet 4800 bps PSK
18: p1 Packet 9600 bps FSK K9NG/G3RUH
20: p2 Packet 300 bps HF 2110/2310
22: p2 Packet 1200 bps VHF
23: p2 Packet 1200 bps PACSAT
25: p2 Packet 2400 bps V.26B
28: p2 Packet 9600 bps FSK K9NG/G3RUH
30: RTTY/TOR 170: 2125/2295; p2 Packet 300 bps HF 2110/2310
31: RTTY/TOR 170: 2125/2295; p2 Packet 1200 bps VHF
33: p1 Packet 300 bps HF 2110/2310; p2 Packet 1200 bps VHF
35: p1 Packet 1200 bps VHF; p2 Packet 1200 bps VHF
40: Morse 750 Hz
41: Analog FAX HF
42: Analog FAX APT
43: Analog SSTV
44: DSP data 400 bps OSCAR-13
45: RTTY/TOR 1200 bps ASCII OSCAR-11
46: DSP data Spectrum
50: p1 Packet 1200 bps MSK
51: p1 Packet 2400 bps MSK
52: p1 Packet 9600 bps G3RUH UO22 eq
60: p2 Packet 1200 bps MSK
61: p2 Packet 2400 bps MSK

Table I– The modes and modems that were in the AEA DSP-2232 when it was received by the author. (The number beside each mode listed represents the modem or mode number that can be initialized with the "MODE" command.)

YAESU

FT-1000D / FT-1000
A 200 watt HF XCVR with dual RX, auto-tuner, power supply, and more! Deluxe and standard models are available. An excellent performer ..... **Call**

FT-990 / FT-990DC
A 100 watt HF XCVR with auto-tuner, digital peak filter, and more! The DC model comes without power supply and CW filter. A great radio ..... **Call**

FT-767GX
A 100 watt HF XCVR with auto-tuner, power supply, digital SWR/wattmeter, and more. Three optional band slots for 6m, 2m, and 70cm ..... **Call**

FT-890AT
A 100 watt HF XCVR with CW keyer and auto-tuner. Many other features and its small size make this radio an excellent mobile performer ..... **Call**

FT-736R
A 25 watt all-mode 2m / 70cm XCVR with power supply. Two optional band slots for 6m, 220MHz, and 1.2GHz. A great performer ..... **Call**

FT-747GX
A 100 watt HF XCVR with CW filter. An optional AM/FM module and remote mounting kit make this an excellent mobile HF performer ..... **Call**

FT-5200 / FT-5100
Two 45 watt 2m / 70cm FM radios. An optional remote kit is available for the FT-5200. The FT-5100 has dual in-band RX. Great mobile rigs ..... **Call**

FT-2400
A 45 watt 2m FM mobile XCVR. Built to mil-spec, this radio has a special receiver that allows inter-mod free extended RX (138-174MHz) ..... **Call**

FL-7000	solid state linear	**Call**
FT-290	2m all-mode XCVR	**Call**
FT-411	2m HT XCVR	**Call**
FT-415	2m HT XCVR	**Call**
FT-470	2m / 70cm HT XCVR	**Call**
FT-530	2m / 70cm HT XCVR	**Call**
FT-650	12-6m XCVR	**Call**
FT-690	6m all-mode XCVR	**Call**

Please call for other Yaesu items.

KENWOOD

TS-950SDX
A 150 watt HF XCVR with dual in-band receive, all mode DSP, auto-tuner, power supply, CW keyer, and more! A great HF performer ..... **Call**

TS-850SAT / TS-850S
A 100 watt HF XCVR with DC input. Optional all-mode DSP unit. The SAT model includes an auto-tuner. Both unit are great performers ..... **Call**

TS-450SAT / TS-450S
A 100 watt HF XCVR with DC input. Optional all-mode DSP. The AT model comes with an auto-tuner. Both are excellent mobile performers ..... **Call**

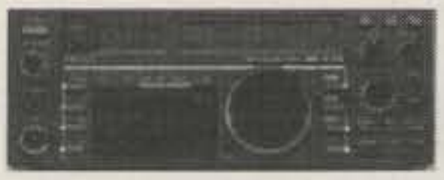
TS-50S
A tiny 100 watt HF XCVR. This radio has all-mode operation, general coverage RX, and much more! The smallest HF rig in the world ..... **Call**

TM-742
A 45 watt 2m / 70cm FM radio. A remote mounting kit offers versatile installation. One optional band slot for 10m, 6m, 220MHz, or 1.2GHz ... **Call**

TH-28	2m HT XCVR	**Call**
TH-78	2m / 70cm HT XCVR	**Call**
TH-225	2m HT	**Call**
TM-732	2m / 70cm mobile	**Call**
TM-241	2m FM mobile	**Call**
TR-751	2m all-mode mobile	**Call**
TS-140	HF mobile XCVR	**Call**
TS-690	HF / 6m mobile XCVR	**Call**
TS-790	2m / 70cm base XCVR	**Call**

Please call on other Kenwood items

ICOM



IC-737
A 100 watt mobile HF XCVR with auto-tuner. Its small size makes this radio popular for mobile use ..... **Call**

IC-728
A 100 watt mobile HF XCVR. Its simple design and small size make it great for mobile use ..... **Call**

IC-2GAT	2m HT XCVR	**Call**
IC-P2AT	2m HT XCVR	**Call**
IC-2SAT	2m HT XCVR	**Call**
IC-24AT	2m / 70cm HT XCVR	**Call**
IC-W2A	2m / 70cm HT XCVR	**Call**
IC-229H	2m Mobile XCVR	**Call**
IC-275H	2m all-mode XCVR	**Call**
IC-729	HF / 6m XCVR	**Call**
IC-735	HF XCVR	**Call**

AEA

Isoloop	HF loop antenna	**329**
PK-232	all-mode TNC	**320**
PK-88	2m packet TNC	**139**

BUTTERNUT

HF-2V	80 / 40m vertical	**149**
HF-5B	10-20m beam	**259**
HF-6V	80-10m vertical	**159**

KANTRONICS

KAM	all-mode TNC	**289**
KPC-3	HF / VHF packet TNC	**119**

Please call for other Kantronics items.

AMERITRON

AL-1500/AL-1200	**2150/1695**
AL-82/AL-80B	**1645/1025**
AL-811/AL-811H	**585/695**

COMET

CA2X4FX/CA2x4MAX	**89/159**
CA2x4MB/CA2x4SR	**64/49**
B10/B10NMO/B20	**29/35/44**

DIAMOND

SG-7500/SG-7900	**75/99**
X-50/X-200/X-300	**95/119/139**
X-500HNA/X-510MA	**200/159**

ASTRON

MODEL	AMPS	ICS	PRICE
RS-20A	16	20	**90**
RS-20M	16	20	**112**
RS-35A	25	35	**144**
RS-35M	25	35	**162**
VS-35M	25	35	**179**
RS-50A	35	50	**219**
RS-50M	35	50	**239**
VS-50M	35	50	**249**

A=Plain M=Meters V=variable DC

MFJ

207/208/249/346	**88/89/179/169**
401/407/422/451	**49/69/119/79**
490/492/493/564	**149/89/129/49**
815/816/817/901B	**79/29/89/59**
910/921/945D/941E	**29/69/89/99**
948/949E/962C	**119/139/209**
971/986/989C	**79/259/299**
1224/1268/1270	**89/119/49**
1278/1284/1289	**249/25/59**
1728/1784/1796	**24/179/155**

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Orion OR-2300 (35 Sq. Ft.)	**945**
Telex HAM IV (15 Sq. Ft.)	**355**
Telex Tailtwister (20 Sq. Ft.)	**420**
Telex HDR300 (25 Sq. Ft.)	**900**
Yaesu G400RC (11 Sq. Ft.)	**219**
Yaesu G500 (elevation)	**229**
Yaesu G800SDX (21 Sq. Ft.)	**349**
Yaesu G1000SDX (23 Sq. Ft.)	**399**
Yaesu G2700SDX (34 Sq. Ft.)	**839**
Yaesu G5400 (az. / el.)	**429**

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- **All steel construction.**
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MA-550	22'1"	55 FT.	10 SQ. FT.	999.00
MA-770	23'10"	71 FT.	10 SQ. FT.	2249.00
MA-850	24'6"	85 FT.	10 SQ. FT.	3489.00
TX-438	22'6"	38 FT.	18 SQ. FT.	919.00
TX-455	21'0"	55 FT.	18 SQ. FT.	1385.00
TX-472	23'8"	72 FT.	18 SQ. FT.	2279.00
TX-489	24'4"	89 FT.	18 SQ. FT.	3959.00
HDX-538	22'6"	38 FT.	30 SQ. FT.	1179.00
HDX-555	22'0"	55 FT.	30 SQ. FT.	2079.00
HDX-572	23'8"	72 FT.	30 SQ. FT.	3559.00
HDX-589M	24'8"	89 FT.	30 SQ. FT.	7119.00

ROHN TOWER

ROHN GUYED TOWER PACKAGES

HEIGHT	25G	45G	55G
50'	849	1229	1549
60'	939	1389	1549
70'	999	1719	2159
80'	1199	1869	2369
90'	1289	2039	2579
100'	1369	2199	2989
110'	1449	2459	3209
120'	1669	2619	3429

Complete with base and top section, guy wire, guy hardware, and anchors. Please call for a shipping estimate.

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AS455G	45/55G rotor shelf	**74.25**
EF2545	25/45/55G ginpole	**375.00**
EFBX	HBX ginpole	**399.00**
HBX40	40' tower (10 Sq. Ft.)	**349.00**
HBX48	48' tower (18 Sq. Ft.)	**469.00**
HBX56	56' tower (10 Sq. Ft.)	**589.00**
HDBX40	40' tower (18 Sq. Ft.)	**429.00**
HDBX48	48' tower (18 Sq. Ft.)	**579.00**
TB3	2" thrust bearing	**75.00**

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13B2/17B2/26B2	**Call**
10-3CD/10-4CD/12-4CD	**Call**
15-3CD/15-4CD	**Call**
20-3CD/20-4CD	**Call**
40-2CD/TEN-3	**Call**
A3S/A3WS/A4S	**Call**
A449-6/A449-11	**Call**
AR-2/AR-6/AR-10	**Call**
AR-270/ARX-270	**Call**
ARX-2B/ARX-22B/ARX-450B	**Call**
CS-28M/CS-147M/CS-220M	**Call**
CS-270M/CS-450M	**Call**
D3W/D40	**Call**
R5/R7/AP8A/AV5	**Call**

Please call for Cushcraft prices.

TELEX / HYGAIN

TH11DXS/TH7DXS	**850/650**
TH5MK2S/EX-14/DX88	**530/410/250**

Please call for Hygain crankup prices.

ALUMINUM

6063-T832 DRAWN TUBING

O.D.	WALL	I.D.	COST
.375"	.058"	.259"	.30/Ft.
.500"	.049"	.402"	.40/Ft.
.500"	.058"	.384"	.43/Ft.
.625"	.058"	.509"	.50/Ft.
.750"	.058"	.634"	.57/Ft.
.875"	.058"	.759"	.65/Ft.
1.000"	.058"	.884"	.70/Ft.
1.125"	.058"	1.009"	.80/Ft.
1.250"	.058"	1.134"	.90/Ft.
1.375"	.058"	1.259"	1.05/Ft.
1.500"	.058"	1.384"	1.25/Ft.
1.625"	.058"	1.509"	1.45/Ft.
1.750"	.058"	1.634"	1.60/Ft.
1.875"	.058"	1.759"	1.70/Ft.
2.000"	.058"	1.884"	1.75/Ft.
2.125"	.058"	2.009"	1.85/Ft.

Available in 6 and 12 foot lengths, 6' ship by UPS, 12' ship by truck/air.

6061-T6 EXTRUDED TUBING

.188"	Solid	----	.15/Ft.
1.125"	.058"	1.009"	.65/Ft.
1.250"	.058"	1.134"	70/Ft.
2.000"	.120"	1.760"	2.35/Ft.
2.000"	.250"	1.500"	3.75/Ft.
2.500"	.120"	2.260"	2.95/Ft.
3.000"	.065"	2.870"	1.95/Ft.
3.000"	.120"	2.009"	3.50/Ft.

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connectors: 1/2" ... **29.00** 7/8" ... **74.00**

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RG-213/U (8267 equivalent	**.39/Ft.**
RG-8X (mini RG-8/U)	**.25/Ft.**
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1/4CCM cable clamp	**.55**
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3/16 preformed big grips	**2.49**
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500D guy insulator	**2.29**
502 guy insulator	**4.49**
3/8EE turnbuckle	**7.95**
3/8EJ turnbuckle	**8.95**
1/2X9EE turnbuckle	**11.95**
1/2X9EJ turnbuckle	**12.95**
1/2X12EE turnbuckle	**13.95**
1/2X12EJ turnbuckle	**14.95**
GAS604 earth screw anchor	**19.95**
5/8X8' copper ground rod	**12.95**
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CARBON STEEL MASTS

WALL	5'	10'	15'	20'
.12	29	55	82	99
.18	49	95	139	179
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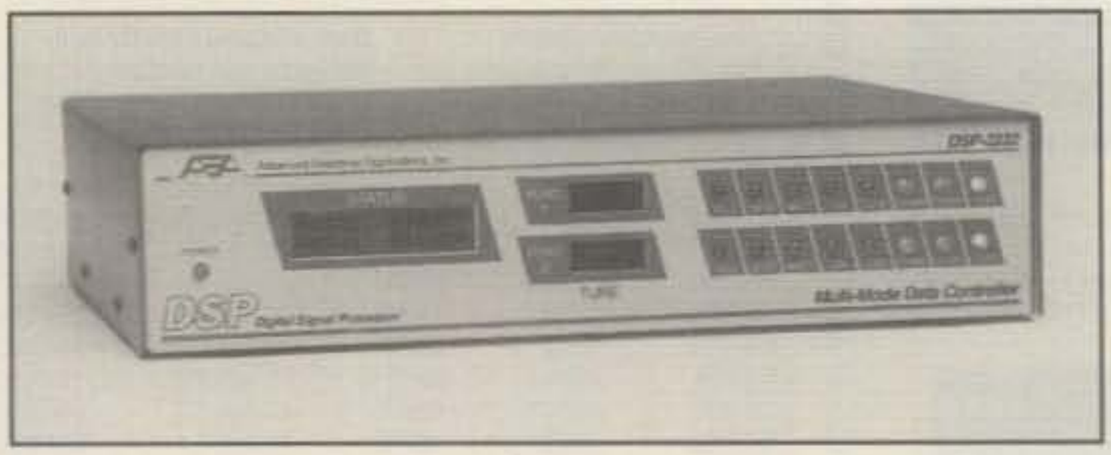

The DSP-2232 multi-mode data controller from AEA.

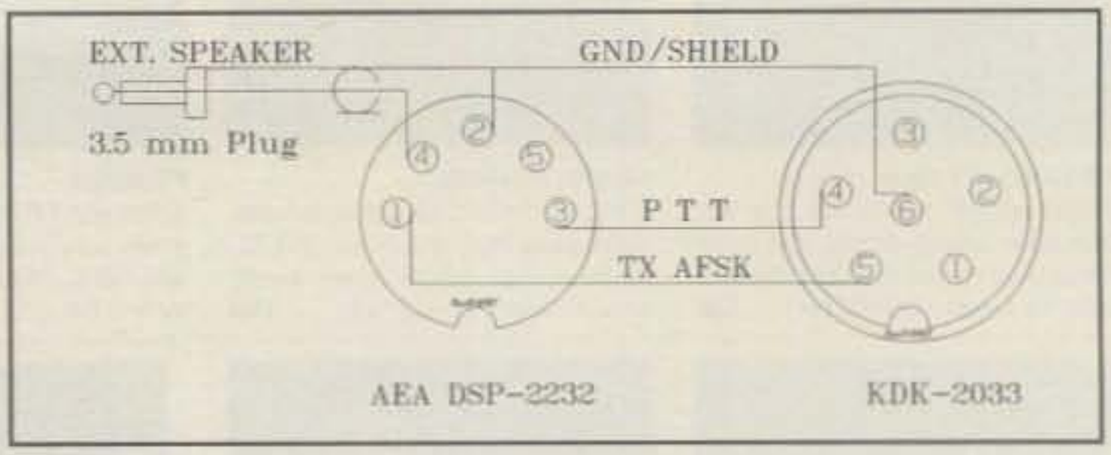

Fig. 1–DSP-2232 to the KDK-2033. Either port of the DSP-2232 can be configured for any VHF mode or protocol. Thus, either port may be used to interface to VHF or UHF transceivers.

To operate with only one port active, the simple solution is to load only one port with a modem. This is a neat feature when you are working an HF DX contest on port 2, and you don't care to be answering calls from stations connecting to (VHF) port 1. This is achieved by loading modem 20, thus leaving port 1 inactive.

This Could Be It

This could be the last data controller we ever need, for the end user can write his or her own "mode code" and install it into the DSP-2232 data controller. This is possible because the digital signal is created with software and burned into the EPROMs and installed as firmware. Get the picture? Yes, that mode can also be added to the DSP-2232.

Although my explanation of digital signal processing is simplified, you may be sure that the concept is more complex than it might appear. My main point is to convey to the reader just how the DSP-2232 is able to contain so many modes and modems in such a small space.

Switch Hitting

Switching between ports and streams is just as easy as the other manipulations of the DSP-2232. First it is necessary to define the character you wish to use as the channel/port switch. This is done by using the "CHSWitch" command to enter the character you wish to use. Since I use the tilde "~", at the cmd: prompt I type and <enter> the following:

cmd: CHSW $7E

The DSP-2232 responds with the following:

CHSWitch was $00
CHSWitch now $7E (~)

To switch from port 1 to port 2 we use the channel switch character. However, there is a method that allows us to define both the port and the channel.

Port 1 has 10 logical channels labeled 0 through 9, and port 2 has 26 logical channels labeled A through Z. Wow! Imagine having 26 connects on port 2 and 10 connects on port 1. If I wish to move from port 1, channel 0, to port 2, channel A, I enter the stream switch character ~, and the "A" together, as follows:

~A <enter>

To return to port 1, and the second channel, I enter:

~1 <enter>

Note: The channels on port 1 are numbered 0 (zero) through 9. Therefore, the second channel of port 1 is number one.

Stay in Touch

It is hard to complete the description of one mode or feature of the AEA DSP-2232 without thinking of another feature that is just as exciting to use. There is always one feature that stands out more than others. Often we see a feature that we like and we ask ourselves, "Now why didn't someone think of that a long time ago?"

In this case I've found some of those features in the DSP-2232. One of them is the "marquis" (pronounced "markee"). This is the illuminated LCD window on the face of the 2232 that reads out in clear text the callsigns and other text that is being read by the 2232. In the packet mode the marquis displays the callsigns of connected stations, or stations that are being read by the 2232. To enhance the application of this readout, AEA did not skimp. They conceived the idea and carried it a step further by having the marquis display two lines of text and data, one for each port.

When operating one of the OP modes such as PACTOR, RTTY, CW, or AMTOR, the display presents all the text being received and displays it on the line that represents the associated port. In the case of mode 33, the HF packet station's callsigns are printed on the top line, which is dedicated to port 1, and the VHF "heard" stations are displayed on the second line, which is dedicated to port 2.

Packet Lite

No, this is not a new kind of "lite" beer. It is a new kind of HF packet. That got your attention! Enough with the new kinds of packet. I thought PACTOR was great for HF, and the answer to HF packet that we've needed for a long time, until I came across the mode in the DSP-2232 called "Packet Lite."

What is Packet Lite? Good question. Now I hope I can answer it with the help of AEA.

Packet Lite is, as the name implies, an abbreviated form of packet that is designed as a transparent extension to the AX.25 protocol. With Packet Lite operation the overhead is significantly reduced on all packets that are not sent through nodes and digipeaters. Although Packet Lite does not solve *all* the HF packet problems, it should provide greater throughput improvements over what we now have.

For the record, if you use Packet Lite and you discover a pronounced improvement with HF packet throughput, please contact the AEA engineering department and pass on comments and suggestions you may have regarding the use of "LITE ON/OFF" command.

The first advantage that I see in the use of Packet Lite is in the way it reduces the standard 14 byte address field to only 4 bytes. This reduction in frame length of 10 bytes per frame header can determine whether or not a packet frame makes it through, by reducing the chance of collision with packet data of other on-frequency stations.

The second advantage of Packet Lite is that it reduces the length of the "I" frame. The third and greatest strength, however, is in the manner with which it shortens ACKnowledgement frames. An ACK frame (RR, RNR, and REJ frames) in AX.25 consists of 19 consecutive bytes that must be copied by

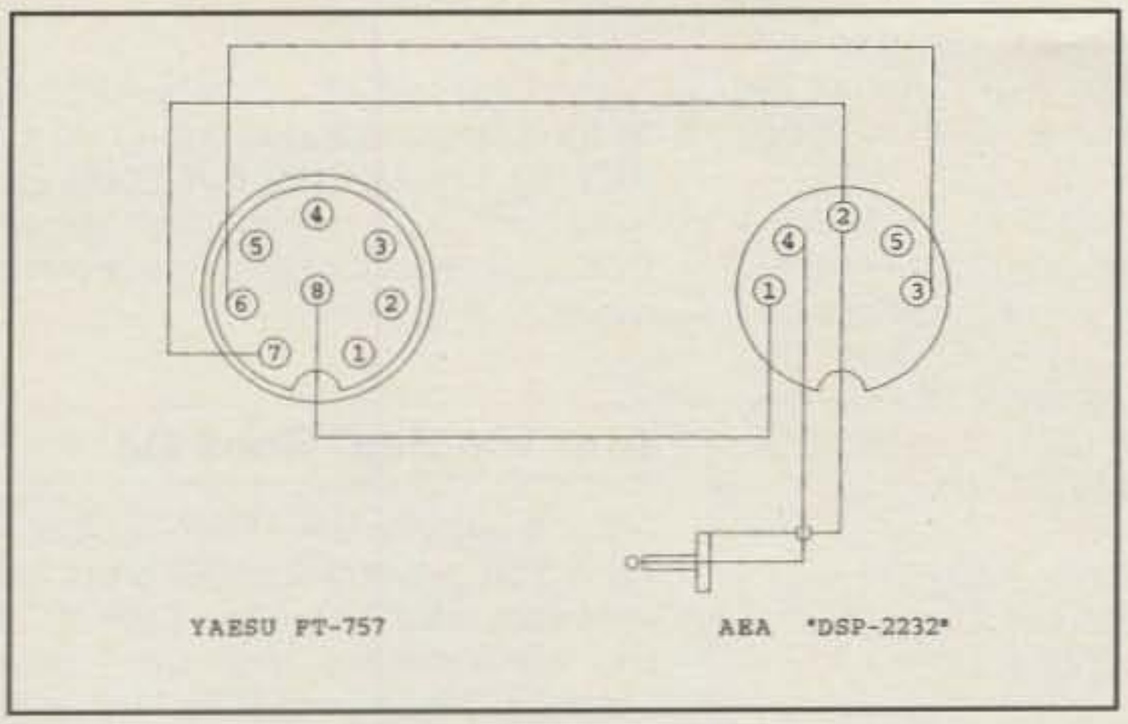

Fig. 2– DSP-2232 port 1 or 2 to the Yaesu FT-757. Either port of the DSP-2232 may be assigned to HF mode(s) and use.

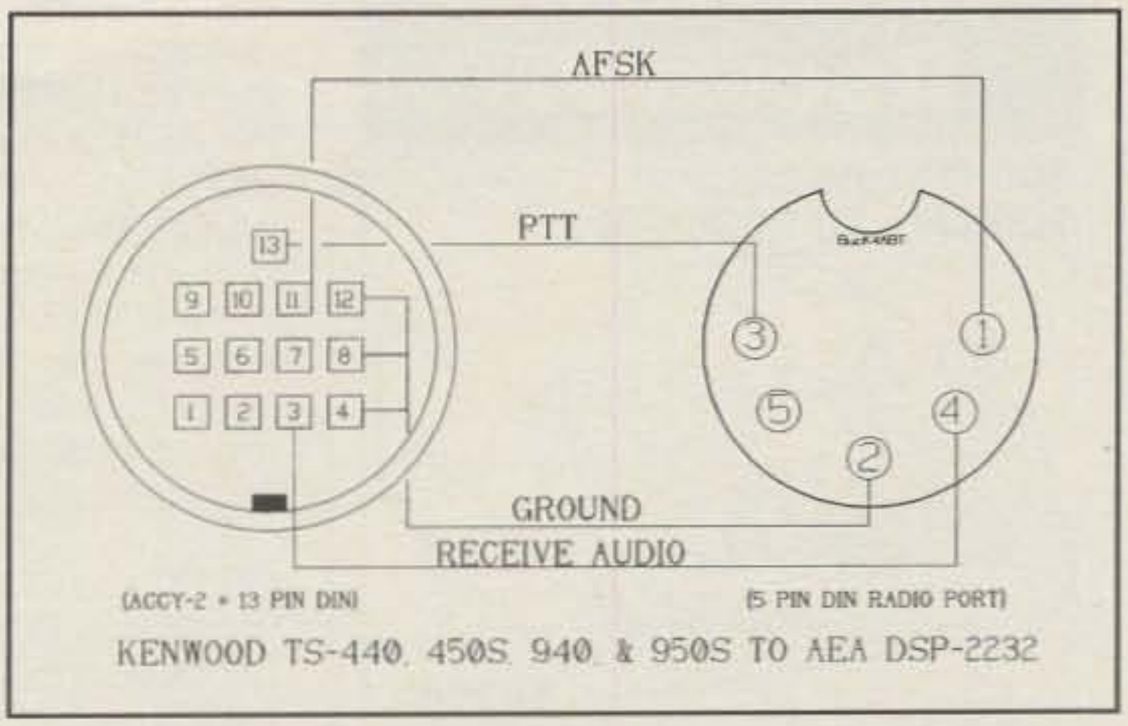

Fig. 3– DSP-2232 to Kenwood transceivers. The DSP-2232 can be configured for HF operation and mode of choice.

the connected station without an error. On HF that is often a problem. To solve the problem AEA has reduced this 19 byte ACK frame from 19 bytes to only 9 bytes, or 47% of the original ACK length.

Although Packet Lite functions only in a direct connect (not via digipeaters), it has a place in the HF packet environment. For those who may have concern about loss of error correction in AX.25, Packet Lite emulates version 2.0 with the RR polling instead of the "I" frames. Packet Lite is not recommended at VHF, as many packet controllers do not recognize the Packet Lite protocol. Observe the 10 minute identification rule when necessary to do so. The same rules apply with AMTOR and PACTOR.

FRICK and FRACK

Okay, so go ahead and laugh. There definitely is a FRICK, and without all the fanfare we are already familiar with FRACK. Both these commands are included in the 2232, and both relate to timing parameters within the packet modem of the DSP-2232.

The 2232 has among the many modems in it, a modem that enables use with the PACSATs and other amateur packet satellite communications. Because of the ability to use some of these modes with meteor-scatter packet operations, AEA has engineered a master/slave connect enable feature into the DSP-2232.

After a meteor-scatter connect takes place, the master station will continually send either "Info" frames (I frames) or polling frames and await ACKs from the slave. The master station is constantly sending packets, while the slave station sends nothing. The only time the slave station sends an I-frame is after it receives a polling frame from the master station.

In normal packet connects the FRACK timer counts downward until it reaches zero (0) and then a poll frame is sent. In AX.25 the FRACK timer counts in units of seconds. However, in meteor-scatter operations a much more refined timer is needed. This new timer is defined as the FRICK, and the timer units are measured in 10 millisecond increments. Use this command only with meteor-scatter connects, and do not use the command (set to OFF is 0) above a zero setting when operating in a roundtable, on a conference node, or in a DX spotting network.

PACTOR

A new approach to HF data communicating, PACTOR opens another means of keyboard-to-keyboard contacts, and at the same time it offers the BBS forwarding nets a faster way to deliver the BBS traffic between forwarding stations than the AMTOR mode once did.

PACTOR was developed in Germany by Hans Peter Helfert, DL6MAA, and Ulrich Strate, DF4KV. PACTOR combines the best features of packet with a few of the attributes of AMTOR. In addition, there were other features added which gave PACTOR the pronounced advantage over other HF modes of digital communication.

PACTOR operates at 100 to 200 baud, depending on HF transmitting and receiving conditions. PACTOR contains a 16-bit CRC to provide an almost error-free mode of operation. It can selectively implement a data compression scheme called "Huffman encoding" to increase the throughput when transmitting text. Another advantage of PACTOR is that it uses an 8-bit word, thus allowing the use of the full ASCII character set. To enter PACTOR mode in the DSP-2232, the command is simple enough. Just type:

PT <enter>

The DSP-2232 responds with:

Opmode was **PA**cket
Opmode now **PACTO**r

The marquis on the DSP-2232 will indicate that you have entered the PACTOR OPmode.

There are two ways you may proceed from this point. I suggest that you use the PTL command, which places the DSP-2232 into the "PACTOR LISTEN" state. To listen or to copy PACTOR (PACTOR LISTEN), type:

PTL <enter>

If you prefer to try a contact instead, you may wish to call CQ. To call CQ use the PACTOR SEND command (PTS). To call CQ in the PACTOR state, type:

PTS <enter>

Use a CQ pattern similar to the one I use, as shown in the following example:

CQ CQ CQ CQ CQ de K4ABT
CQ CQ CQ CQ CQ de K4ABT
CQ CQ CQ CQ CQ de K4ABT
CQ CQ CQ CQ CQ de K4ABT
CQ CQ CQ CQ CQ de K4ABT
(Be sure to include your call sign)

To leave PTSend, enter a Ctrl D. The Ctrl D places the 2232 into the receive condition. However, if you are a fast typist, the transceiver may continue for a brief period until any unsent CQs have cleared the transmit buffer of the DSP-2232. Type PTL at the cmd: to be sure you are in the "listen" state and ready to answer any connects.

PACTOR Connect

The secret of how to make connects with HF Packet, RTTY, and AMTOR was well

kept for some time. That once forbidden method is now made very easy with the PACTOR mode. We can sum the PACTOR connect instruction with one short line.

Let's imagine that you are N7MBA and you are tuning around the 14.065 to 14.075 MHz portion of 20 meters and you saw my PACTOR CQ at 14.068 MHz. Here is an example of what you might see on your CRT, or in the DSP-2232 marquis at 14,068 MHz:

CQ CQ CQ CQ CQ de K4ABT
CQ CQ CQ CQ CQ de K4ABT
CQ CQ CQ CQ CQ de K4ABT
AR K

To establish a PACTOR connect to my station after the "AR K," you may wish to engage in a PACTOR connect to my callsign by typing:

PTC K4ABT <enter>

After a couple of tries the following should appear on your screen:

CONNECTED TO K4ABT:

Another indicator is the DSP-2232 marquis will change from "PHASING" to "IDLE." At this point you are the "Information Sending Station" (ISS), and you may begin typing to me in the following manner:

K4ABT de N7MBA or (your call)

As you may have noticed by now, we identify our stations with our callsign and the callsign of the station with which we are linked. We do this as we exchange transmissions, and/or at 9.5 minute intervals.

Jim, N7MBA, and I continue our PACTOR QSO, and at the point we wish to pass transmission to one another we use Ctrl Z. If I am transmitting and I turn the transmission to N7MBA, I issue a Ctrl Z. This places my station into a state called "INFORMATION RECEIVING STATION," or IRS. We continue this exchange until we are ready to disconnect. After we have exchanged 73, etc., I issue a Ctrl D, which will end our ARQ PACTOR link and place my DSP-2232 into the PACTOR standby state.

Watching a PACTOR connect brings back the same novel feeling that I had with my first CW contact almost 44 years ago, especially if it is initiated by me.

CW ID and PACTOR Standby

Another way to end a QSO would be to force a drop of the link and send a CW ID in the following way:

Ctrl F <enter>

The Ctrl F will allow any buffered data to complete sending and then will send a CW ID. Following the CW ID, the transmitter will stop sending and return to PACTOR Standby and the command mode.

And The Beat Goes On

Getting back to AEA's DSP-2232, at first I was a bit dubious of the $999 price tag. However, after using the DSP-2232 in the many modes that are available inside it, I was impressed by its outstanding performance. The DSP-2232 is a superb performer and has proven to me that quality is still worth the money.

To some there may be a question as to the future of digital signal processing, but I'm convinced that we are seeing the beginning of a great new avenue for digital communications.

To assist the DSP-2232 owners with interfacing to a few HF and VHF transceivers, I've included figs. 1, 2, and 3 for your notebooks. Notice the 5-pin DIN configuration of port 1 and port 2 of the DSP-2232, as it incorporates a format that is familiar to us. The port signal assignments are the same as that of the TAPR TNC-2 and clones. Thus, you may already have the interface wired if your present single-mode TNC to transceiver uses the TNC-2 five-pin DIN connector.

For more information about the AEA DSP-2232, you may contact your AEA dealer. A list of dealers in your area may be obtained from AEA marketing by calling 1-800-243-7388, or by writing to them at P.O. Box 2160, Lynnwood, WA 98036-2160. (In addition, the PACTOR EPROM option is available for AEA's PK-232, PK-900, DSP-232, and DSP-1232 at $75 for all models.)

SouthNet Packet Conference

The 11th annual SouthNet Packet Conference will be held on Friday and Saturday, June 18 and 19, at the Heritage House Hotel and Convention Center, 732 West Oglethorpe Blvd., Albany, Georgia. There will be forums—including talks on high-speed packet backbones and HF PACTOR—as well as awards, VE exams, and more. For more information, call 912-883-7910 Monday through Friday from 9 to 5, or FAX 912-883-5092. Hope to see you there!

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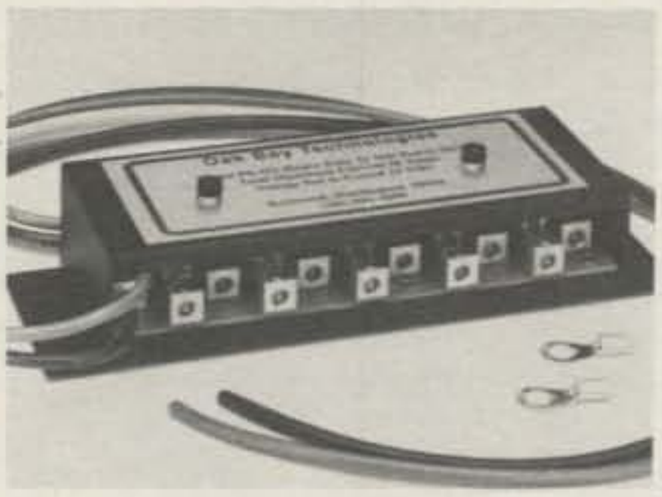

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VHF PLUS

BY JOE LYNCH, N6CL

ALL ABOUT THE WORLD ABOVE HF

The Beginning of the VHF+ Contest Season!

This month marks the beginning of the VHF+ contest season. It offers the VHF+ operator three opportunities for contesting. Two contests are sponsored by the ARRL and one by SMIRK. And next month one more major contest, our CQ WW VHF WPX Contest, creates yet another opportunity to fill in your grid square maps.

While it is true that contests have been underway since the first of the year (the January VHF Sweepstakes and the Sprints in April and May), most VHF+ operators do not get serious until this month. Let's take a serious look at these contests.

The June VHF QSO Party: The first contest this month is also the most popular among VHF+ operators. The VHF QSO Party is scheduled for 1800 UTC 12 June through 0300 UTC 14 June. The exchange is simple: your callsign and your grid square. You can enter one of several categories. You may want to operate from your home as a single op. You may want to operate from a portable location as a single op. You may want to operate from several grid squares during the course of the contest as a Rover. If you choose the Rover category, be aware of the new rule (and definition) regarding Rover operation. From the League's Contest Branch comes the following:

"**Rover:** One or two operators of a single station that moves among two or more grid squares during the course of the contest, and making contest contacts using the same equipment and antennas at each site, will be considered a Rover. Rovers sign 'Rover' on phone and /R on CW after their callsign. The intent of the Rover category prohibits fixed station scores to be included with Rover operations; stations may, however, enter the Rover category with a separate log for Rover activities. All Rovers are encouraged to adopt operation practices that allow as many stations as possible to contact them."

This rule change is in effect for this contest and all other League contests that use the Rover category. If you want to know more about this category, see last month's column to find out how to be a successful Rover, and look later in this month's column for a list of appropriate Rover equipment.

One other note on Rover activities: I received a letter from Jim Smith, WB9EEA, concerning his opinions on the Rover rule controversy, which I will share next month. However, within it he poses the question as to why can't a team include a third person, a non-operator, driver. I asked Billy Lunt, KR1R, at the ARRL Contest desk about this question and he said that he had no problem with the concept. So there you have it. You can use up to three people on your team. Just keep that third person off the air!

P.O. Box 73, Oklahoma City, OK 73101

VHF+ CALENDAR

June 4	Full moon. Very poor EME conditions.
June 4–6	Ham-Com Hamfest, Arlington, TX. See text for details.
June 7	Arietids meteor shower peak 0835 UTC. Very good EME conditions.
June 12	Apogee and last quarter moon. Moderate EME conditions.
June 12–14	ARRL June VHF QSO Party, 1800 UTC 12 June to 0300 UTC 14 June. Many stations will be active from rare grid squares. (See Contest Calendar column for rules.)
June 19–20	SMIRK contest. (See text for details.)
June 20	New moon. Poor EME conditions.
June 20–25	K8WKZ, N8PYD, and N8NQS to rare VE2 grid squares. (See text for details.)
June 26	First quarter moon. Good EME conditions.
June 27–28	ARRL Field Day. (See Contest Calendar column for rules.)

You may want to be a multi-op station or a limited multi-op station. The difference between the two is that as a limited multi-op you operate on only four bands (your choice).

You may also consider operating QRP, whether at home or at a location in the middle of nowhere.

The point incentive is such that the microwave bands become very popular. However, if 6 meters is playing well you may be hard pressed to abandon that band for the juicier point-per-QSO incentives on the microwave bands.

For complete rules see the "Contest Calendar" column or May *QST*. For log and entry forms, send an SASE with two units of first-class postage to the League.

The SMIRK Contest: The popularity of this contest has waned over the years. However, the die-hard 6 meter operators still favor it. This year's contest is scheduled for 0000 UTC 19 June to 2400 UTC 20 June. The exchange is your callsign, grid square, and SMIRK membership number.

If you are not a SMIRK member, you can still participate in the contest because your QSO counts for those competing. However, if you are not a current SMIRK member, you cannot compete for the awards associated with the contest. The 6 meter band is the only one used during the contest and there is only one entry category, single op.

For membership information, send an SASE to Ray Clark, K5ZMS, 7158 Stone Fence Drive, San Antonio, TX 78227. For contest rules and log and entry forms send an SASE to Pat Rose, W5OZI, P.O. Box 393, Junction, TX 76849.

Field Day: This contest began 60 years ago. From its inception it had a VHF emphasis. (It was the intent of the contest to encourage operators of 56 mc gear to test their equipment.) Today it remains as one of the most popular contests in amateur radio.

This year's contest is scheduled for 1800 UTC 26 June to 2100 UTC 27 June. The exchange is your class (how many transmitters you have set up and what category you are entering) and your ARRL section. If you don't know your section, call the section manager nearest you listed on page 8 of any *QST* and he or she will be glad to tell you.

The incentives are plenty. And new this year is a VHF+ incentive. If you are entering the class A or B categories, you can earn an extra 100 bonus points for making 10 contacts (other than packet) on the VHF+ frequencies. Plus, if you set up a station (other than packet) dedicated to the VHF+ frequencies, it will not count toward your total transmitter number.

The *spirit* of the new rule is to activate stations on weak-signal frequencies. Obviously, if you live within a large metropolitan area that has an active FM simplex community, you can accomplish this goal in less than five minutes. The challenge is to work the stations on the weak-signal frequencies. (However, if the bands are open, then the challenge will not be too steep.)

For contest rules see the Contest Calendar column or May *QST*. For log and entry forms, send an SASE with two units of first-class postage to the League.

The CQ WW VHF WPX Contest: Our contest, in its second year of resurgence, is international. Fully 30% of the logs received were from outside North America. The contest is scheduled for 1800 UTC 10 July to 2100 UTC 11 July. Complete rules were published last month. For log and entry forms, send an SASE to CQ Communications, 76 N. Broadway, Hicksville, NY 11801. Send the completed logs to me at P.O. Box 73, Oklahoma City, OK 73101.

Just as in the June QSO Party, there are several categories to enter. New this year is the QRP category, with the restriction of running no more than 25 watts output. I am looking forward to working you in this contest and receiving your log afterward.

VHF+ Contest Strategy

What does it take to make a winning contest station? Well, I will borrow a bit from HF operators, such as my friend, John Dorr, K1AR, plus a lot from the big guns of VHF contesting, such as Dave Hallidy, KD5RO, to give you a picture of what it takes to win. Most of

the advice that follows applies to the general VHF+ contests. However, some of the strategy will also apply to Field Day and, to a lesser extent, the SMIRK contest.

Your Body: How you feel is the most important ingredient for a successful contest station. Have you adequately rested prior to the contest? Even though VHF+ contests almost always allow for getting a good night's sleep (because the bands shut down at night), you still need to be in top shape for the endurance associated with contesting.

What are you eating? Some operators prefer a diet of pasta because it is high in carbohydrates. Some taboos: no caffeine, and that includes chocolate candy; and no sugar (some say even no fruit because of the high fructose content). Both caffeine and sugar are stimulants that, after they wear off, could leave you in an energy crash. Also, don't try any new, especially spicy foods just before the contest. Your digestive track may not let you stay away from the bathroom.

Your Goals: Probably the biggest decision you will make is defining what it means for you to win. It may be tops in the country for your category or it may mean making ten contacts on 10 GHz. Setting your goal and then writing it down helps you focus on what you intend to accomplish during the contest. Always remember: Whatever your goal, if you achieve it, you are a winner.

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

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

Are you going on a trip? Assemble your antennas and towers or masts just as they would be in the field location. There are two important reasons to go through the exercise of setting up everything. One, the obvious, is to make sure everything is working properly. The second is that you, for the most part, will have overcome the learning curve associated with assembly of the station. Thus, the second time in the field will, hopefully, be much easier and faster.

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

Look around your station. Is everything comfortable for you? When you are sitting in your ergonomically correct chair, is everything within easy reach?

Are you using software or paper logs? If software, make sure the computer is working and you thoroughly know the software (don't

Emil Pocock, W3EP, left, and your editor were hosted by Roger Webb, WB4WTC, right, while we were in Charlotte, North Carolina to attend the Charlotte Hamfest. Thanks go to Roger for his excellent hospitality. (Photo courtesy WB4WTC)

try to learn it the night before the contest). If you are using paper logs, make sure you have enough log sheets, dupe sheets, scratch paper, and pencils (yes, pencils, because they erase better when you are trying to fix a busted call or report).

On the Air: VHF+ contests have an entirely different pace than HF contests, which sometimes frustrates HF contest operators who try out VHF. Unless the band is open, you will not get the steady runs that HF contest operators experience. Therefore, it is imperative to move stations through all the bands that you have available. This is not as hard as it seems, because the other operator is just as motivated as you to make as many multiple contacts as possible.

Stay off the calling frequencies. If you have a loud signal, people will come to you. If not, you can go to the loud signal. However, it takes only one station on the calling frequency to ruin it for everyone. Also, when on 6 meters, stay out of the DX window. Reserve it for contacting DX stations only! During the 1987 June VHF QSO Party stations in England were hearing stations as far away as the southwest part of the U.S. but were not hearable because of stateside QRM in the DX window.

Have Fun: This hobby is supposed to be fun. So naturally, contesting should also be fun. Unless you make it fun for yourself, you will find the whole experience frustrating and unfulfilling. Enjoy yourself and write to me and tell me how much fun you had.

QST, CQ VHF Editors Present Joint Forum

Emil Pocock, W3EP, VHF editor for *QST*, and I presented a joint forum at the Charlotte Hamfest over the weekend of 7 March. The major opportunity for both of us was to meet so many amateurs new to the world of the VHF+ frequencies. Additionally, we met with several of our friends who have corresponded with both of us. Finally, we had the good fortune of spending time with each other and sharing our ideas of the future of the VHF+ world, particularly Saturday afternoon and evening after our joint forum. Thanks to the weather, the "storm of the century," the hamfest was shut down for the remainder of the day. (It did open for several hours Sunday, when the weather got a bit better.)

We were graciously entertained by our host, Roger Webb, WB4WTC, who put up with both of us over the weekend. Roger picked us up at the airport, took us into his home, and provided us with an excellent place to relax and get acquainted. I can speak for both of us when I say that we thoroughly enjoyed the hospitality afforded us by Roger.

I cannot fail to mention, however, the wonderful meal that we shared with Ted Goldthorpe, WA4VCC, and his lovely wife, Itice, KB4CSE. It was the highlight of Friday evening.

We really appreciate the Charlotte Hamfest committee extending an invitation to allow us to put on (probably for the first time ever) a joint forum featuring the two editors of the two major magazines in amateur radio.

Because of the success of the forum, Emil has agreed to join me for another joint forum at the Central States VHF Society Conference in July. I will have more details next month concerning the other speakers scheduled for the conference.

On The Air

6 Meters: Trans Equatorial propagation made its presence known during the month of March and early April. From Jack Henry, N6XQ's log is the following: 9 March, LU3EX, and LU2EIO; 12 March, LU2EIO, and VR6JJ; 15 March, ZL4AAA, ZL2TPY, and ZL1THQ; 17 March, ZL4AAA, ZL2QS, ZL2KT, ZL3NE, ZL2AAA, and ZL2ATI; 19 March, VK4BRG, ZL3TIC, and ZL3ADG; 20 March, VR6JJ; 21 March, ZL4AAA; 22 March, VR6JJ; 23 March, VR6JJ; 24 March, TI2NA beacon, VR6JJ, and LU8EEM; 29 March, P43FM; 3 April, VR6JJ; 4 April, J37AV heard weakly while Jimmy was working W4, W5, and W7 stations; worked LU stations; and 6 April,

Because of the "storm of the century," the Charlotte Hamfest was shut down immediately following the Joint Forum by Emil Pocock, W3EP, VHF editor of QST and your editor, thereby negating any possibility of us finding out who was "best." Therefore, we decided that playing a couple of games of pool might determine who was best. Emil won the first game. And in spite of letting him have two shots when he scratched, I still won the second. It was a draw. Consequently, you can draw your own conclusions by reading both our columns. (Photo courtesy WB4WTC)

VR6JJ. Jack also reports that on 29 March VR6JJ and XQØX both reported hearing the XE2UZL beacon 170 miles south of San Diego. Unfortunately, Jack was not home to try a contact with XQØX.

Additional reports: **Pat Rose, W5OZI,** reported that on 22 March he and **Bill Tynan, W3XO/5,** worked VR6JJ. Also, on the same day **Larry Lambert, NØLL,** worked Nob twice, once on CW and once on SSB. The second QSO appeared to be assisted by a meteor burst. All together, as of this publishing date, Nob made over 100 contacts in 40 countries in 5 continents, including 7Q7RM, and station in ZP, PY, and CX. **Juan, TG9AJR,** reports that from 17 March through 21 March stations in ZP were working stations in CN, CT and EH, daily.

Fred Fish, W5FF, reports that he worked LU1VK on 10 March, 11 March, and 13 March. Additionally, he worked LU2EIO, LU8EEM, and LU7DZ on 15 March. **Tom Moore, K5ZXE,** reports that he worked LU1VK at 1925 UTC on 24 March and that he heard W5VY work VR6JJ about an hour earlier. **Richard Kennedy, WA5QCP,** states that he worked LU9EHF, LU3EX, and LU2EIO on 24 March.

Jimmy Treybig, W6JKV, operating as J37AV, had an excellent opening into the southwest and southeast part of the U.S. on 4 April. He worked around 20 stations in W4, W5, and W7 land. Also, on 4 April, **Andy, WD4AFY, Larry Hazelwood, W5NZS,** and a number of other stations in the southeast and southwest worked HC1BI. Additionally, on 4 April, **Roger Webb, WB4WTC,** and others reported CX8BE, LU2EIO, CX4HS, LU3EW, and LU5EMM via the Southeast Packet Cluster.

2 Meters: Jimmy also made between 15 and 20 contacts on 2 meters EME during his stay in Greneda. On 1 March **Chuck Smallhouse, WA6MGZ,** worked FR5DN during a short 15 minute common moon window. Preliminary reports from around the country indicate that the 2 meter Sprint was very successful, possibly owing to the aurora activity the day before.

On 25 February a storm hit Dave Blaschke, W5UN's 48 Yagi array and took it down. By 6 March Dave was operating with 16 Yagis and by 22 March Dave was using 32 Yagis. Dave does not know when, if ever, he will have the array back to 48 Yagis.

Current Conventions

The dates for Ham-Com, the major (10,000 average attendance) hamfest in Arlington, Texas, are 4–6 June. Among the sessions are two presented by North Texas Microwave Society. Among the speakers and their titles are: "Microwaves Can be Easy," by Kent Britain, WA5VJB; "Portable Operating," by Roger Dillion, N5PGH; "How to Build Microwave Transverters," by Al Ward, WB5LUA; "Eleven Band Rover Operation," also by Al; and "VHF/UHF/Microwave," by Bryan Ward, N5QGH. There are actually two sessions, one Saturday and one Sunday, with Sunday being a repeat of Saturday. Also scheduled to appear at the ARRL Forum is Chris Imlay, N3AKD. His topic will be "Antenna Ordinances," something familiar to all hams. Chris is the League's attorney who represents us amateurs and writes all those responses to FCC proposals. He is very sensitive to the wishes of the weak-signal community. Come by the ARRL Forum and afterward say hello to Chris. (I will be covering the convention for this column. I will also hang around the *CQ* and ARRL booths. I will be looking for you at the convention.) Registration is $10.00. Send your registration request to Ham-Com, Inc., 6208 Preston Road, Dallas, TX 75205-1655, or call 214-522-5003 (FAX 214-521-0016). A number of hotels, within easy driving distance, are priced between $29.95 (Motel 6) and $76.00 (Marriott) per night.

Next month I will have full coverage of the Central States VHF Society Conference, to

Are you planning a Field Day operation this year? Perhaps you will work one of the operators at the Lawton-Ft. Sill (Oklahoma) ARC on VHF. New rules give VHF operators the potential for additional bonus points. See text for details. (Photo courtesy KA5YED)

be held 29 July through 1 August in Oklahoma City at the Lincoln Plaza Hotel. If you cannot wait until then to find out more, call me or send me an SASE.

Current Meteor Shower

Between 29 May and 19 June the *Arietids* meteor shower will once again make its presence known. However, because this is principally a daytime shower, observation of it is via the radio. Try north to south paths for the best propagation for this shower. The peak time and day is anticipated to be 0226 UTC 7 June.

FCC Issues Two NPRMs Concerning 902 MHz

The FCC has issued two Notices of Proposed Rulemaking concerning the 902 MHz amateur band. The first, ET Docket 93-59, assigns wind profilers to 449 MHz on a shared basis and seeks input to setting aside the frequency of 915 MHz also for wind profilers. The outcome of this NPRM is that wind profilers will share the same spectrum as (with minimal interference to) repeaters located within this portion of the 70 cm band. For more information on wind profilers, see the April and June 1992 issues of *QST*.

The second, entitled the Automatic Vehicle Monitoring Systems NPRM, deals with the increase in the popularity of automobile tracking. More companies are interested in frequency accommodations. Therefore, the FCC has proposed codifying the frequency spectrum between 902 and 922 MHz (essentially updating temporary rules that have been in effect since 1974). The NPRM spells out certain frequencies that will be used for wide-band equipment and certain frequencies used for narrow-band equipment. Specifically, the spectrum between 902–904 MHz is proposed to be allocated to narrow-band operation. Within the wide-band spec-

trum other users will be required to vacate the frequencies within four years of the implementation of the regulations. This will not be the case in the narrow-band segments, however.

Nevertheless, the question remains concerning what will happen to amateur radio operators' uses of the spectrum. Already, because of the uncertainty of the future of the band for the Amateur Radio Service, most repeater operations in large metro areas have been suspended, along with coordinating of these operations.

As far as the weak-signal operators are concerned, however, this band is ripe for experimentation. Last year Harry, K3HZO, and Paul, WA3NZL, made what is believed to be the first aurora contact on this band. Additionally, Dave Hallidy, KD5RO, and Al Ward, WB5LUA, ran meteor skeds during the *Perseids* meteor shower (but without success). With the anticipation of a meteor storm this year, they are once again planning a meteor contact attempt. Obviously, experimentation is a viable and valuable use of the spectrum. No matter what happens to this NPRM and/or other users or potential users of this band, it is hoped that a portion of it could be set aside exclusively for amateur radio experimental use.

Comment and reply comment deadlines on either petitions were not available at press time. However, it is in your best interest to find out when they are and write to the FCC concerning them, especially the Automatic Vehicle Monitoring Systems NPRM. Let the FCC know of your usage of the band and how the loss of this spectrum will adversely affect your enjoyment of the hobby.

Third 2 Meter DXCC Issued

Kjell Rasmusson, SM7BAE, who is in so many 2 meter EME operators' logs, became the third recipient of the coveted 2 meter DXCC award. He submitted cards for 102 countries. Congratulations, Kjell. It is rumored that there are at least two more very close to submitting, plus several others with 95 or more countries worked on that band. Look for a number of other applications in the next 12 to 18 months.

First 2 Meter EME Was Completed By 2 Yagi Station

Joe, PAØJMV, recently worked Bob Striegl, KA2DRH, in Alabama, for state number 50. While it is a significant operation for a state-side station to complete working all states on 2 meters, Joe did it the hard way by working all of them off the moon and with only two Yagis! What was even more remarkable was that Bob also was running just two Yagis. Joe, with his accomplishment, has proven that not only is it possible to work EME with a marginal station, but attaining challengeable goals is also achieveable. Congratulations, Joe.

Rare Grid Square DM02 Activated

Owing to its being off limits to civilians, San Clemente Island, which lies within DM02, and subsequently the grid square itself have rarely seen any activity since the inception of the VUCC program. (A very few contacts from the grid square have been made by maritime mobile stations.) Imagine the surprise to the Californians when Dave Bostedor, Jr., N8NQS, showed up on the air between 13–15 March.

Dave, who was very reluctant to leave his father, Dave, Sr., K8WKZ, following his operation for cancer, had to go for a business trip. With him he brought 6 meters and 2 meters. On 6 meters he used the SQLOOP antenna and a ground plane. On 2 meters he used a homebrew 4-element beam. In all he made 93 contacts with 77 different stations, giving out DM02 to all of them. His best 2 meter DX was a 500 mile shot to N6KBX, in CM98. All of his 6 meter contacts were into the surrounding grid squares.

Dave says that the California amateurs were a pleasure to work. He states that they worked together to see that everyone who wanted to work him could do so. He is especially appreciative of the assistance of Laddey, N8EWU, Cap, K6UIY, David, KI6FF, and the 2 meter net.

Dave reports that business will again take him to the island, however on very short no-

tice. He plans to take 6 meters and possibly 70 cm on future trips. Hopefully, you will have worked him during one of his trips this summer.

Trips Planned During The June QSO Party

Ron Hammel, KC6WLC, and **Joe Morris, N6RPM,** plan to drive to grid squares CN71 and CN81 and operate as a Rover station. They will first operate from the 11,000 foot level of Mt. Shasta in CN81 and then drive to CN71 later that day. On Sunday they plan to finish the contest from DM04. They expect to be on 6 meters through 23 cm, using both SSB and CW.

Jack Henry, N6XQ, and **Chip Angle, N6CA,** are planning a trip to XE3. If their plans come together, they will be on from either EL51 or EL61, on 6 and 2 meters.

Frank Kelly, WB6CWN, plans to activate DM16 on 2 meters and 135, 70 and 23 cm. He will be at the 9000 foot level in the Inyo Mountains, across from Mount Whitney. He reports that it is an excellent site for working most of the western states.

Gordon West, WB6NOA, will combine his yaghting hobby with amateur radio and attempt to operate from the intersection of CM-93, CM94, DM02, and DM03. He plans operations on 6 and 2 meters, 70, 23, and 3 cm SSB and 3 cm FM. In order to operate from the corner he will use a Magellan 5000-D differential GPS receiver. He reports that it will take almost six hours to arrive at the intersection and he will be listening on 144.170 MHz on the way out. Once there and during the contest Gordon will be working 15 kHz off the calling frequencies.

Terry Baxter, N6CW, is tentatively planning a trip to VP2E, where he will operate VP2E/N6CW. **Ted Goldthorpe, WA4VCC,** and the group who usually goes with him, is tentatively planning to operate form the Outer-Banks in Duck, North Carolina (grid square FM26). They will use the callsign AA4R. Your editor is tentatively planning a Rover operation, with DM94 possibly being one of the grids.

Please note: When you work any one of these or any other expedition, if you need a card, please send the other operator an SASE, as a courtesy. There is a lot of expense involved in setting up an expedition, and return postage is not an additional one these operators need to bear. In fact, some, such as Gordon, will require an SASE for a return card.

Rare Canadian Grids To Be Activated

Dave Bostedor, Sr., K8WKZ, his wife, **Pat, N8PYD,** and his son, **Dave, Jr., N8NQS,** are planning a six-day excursion into VE2 between 20–25 June. While there, they plan to activate several grids on both 6 and 2 meters. As of this writing they anticipate operating from the following: FN16 (2300 UTC 20 June to 0200 UTC 21 June and 1100–1400 UTC 21 June); FN26 (2300 UTC 21 June to 0200 UTC 22 June and 1100–1400 UTC 21 June); FN27 (2300 UTC 22 June to 0200 UTC 23 June and 1100–1400 UTC 21 June); FN17 (2300 UTC 23 June to 0200 UTC 24 June and 1100–1400 UTC 21 June); and FN18 (2300 UTC 24 June to 0200 UTC 25 June and 1100–1400 UTC 21 June). Additionally, while traveling they will attempt to operate on both bands. QSLs go to Dave,Sr., at 8030 Greenes Drive, Jackson, MI 49201. The amount of grids they reach will depend on Dave, Sr.'s stamina (see below). Listen to 28.885 MHz for updates on their plans.

Rover Products

What follows are few products you might consider for your Roving activities.

The AntennaKit: Recently Joe Reisert, W1JR, formed his own company called AntennaCo. His first products are kits of VHF and UHF Yagis, called AntennaKits. The VHF Yagi, model number 140-3, consists of three elements, and the UHF Yagi, model number 400-4, consists of four elements. Each kit comes with complete instructions for you to design and construct your own antenna. The model 140-3 is designed for construction on any frequency between 140 and 300 MHz. The model 400-4 is designed for construction on any frequency between 300 and 500 MHz. Each kit is available for $34.95, plus $5.00, S&H from AntennaCo, Inc., P.O. Box 218, Milford, NH 03055-0218. Obviously, the applications go far beyond Rover use, such as packet, scanners, etc. Additionally, the compactness of these antennas lends them to being packed inside your sleeping bag for your hiking trip to the mountaintop. Joe is a genius in antenna design and you can't go wrong with these products.

Create Log Periodics: Creative Design Company offers two log periodics, the CLP 5130-1 and the CLP 5130-2. The -1 has a frequency range between 50 and 1300 MHz and has a turning radius of around 10 feet. The -2 has a frequency range between 105 and 1300 MHz and has a turning radius of around 5 feet. While not high-gain antennas (10–12 dBi and 11–13 dBi, respectively), they do provide versatility if you are going to operate on more than one band and have limited antenna space. They have VSWR of less than 2.0:1 over their entire frequency spectrum. They are rated for 500 watts PEP and have numerous other potential applications. Do you live in a neighborhood where amateur radio antennas are shunned? Put up one of these antennas and tell your neighbors that it is a TV antenna. Using a nonconductive mast you can mount these antennas vertically. The suggested retail prices are: for the -1, $299.95 and for the -2, $199.95. Check with your favorite dealer for your special price.

Ham Pro Antennas: I previously reviewed the H144-15 (see the December 1992 issue) and was very impressed with its ruggedness. I can highly recommend the antennas that Ham Pro produces as heavy-duty antennas for Rover use. The H6-6 is a 6-element Yagi for 6 meters that has a gain of 9 dBd, a boom length about 15 1/2 feet, and a turning radius of 11 feet. It sells for $200.00, plus shipping and handling. The H144-15 is a 15-element Yagi for 2 meters that has a gain of 13.73 dBd, a boom length of 18 feet, and a turning radius of around 10 feet. It sells for $145.00, plus shipping and ahandling. The H220-17 is a 17-element Yagi for 135 cm that has a gain of 13.53 dBd, a boom length about 19 1/2 feet, and a turning radius of around 10 feet. It sells for $150.00, plus shipping and handling. The H432-24 is a 24-element Yagi for 70 cm that has a gain of 16.14 dBd, a boom length of 17 feet, and a turning radius of around 9 feet. It sells for $145.00, plus shipping and handling.

You can drop these antennas from the top of the van without fear of doing very much damage to them. Additionally, while not actually field tested, their ruggedness indicates a certain level of crash survivability. Should you choose to mount one of these atop your van and then drive into a low overhang, you may not as easily destroy it. For ordering information, contact Ham Pro at 800-879-7569, or write them at 6199 B Warehouse Way, Sacramento, CA 95826. You can also FAX them at 916-381-4332. Incidentally, Ham Pro makes 5-element beams for 144, 222, and 432 MHz, for between $65.00 and $69.00. Contact them for more information.

The SQLOOP: For mobile in motion contacts, the omni-directional pattern of the SQLOOPs makes them ideal. They are available for both 6 and 2 meters. The suggested retail price for the 6 meter model is $97.00, and the suggested retail price for the 2 meter model is $59.00. Check with your local dealer, or call Mike Staal, K6MYC, at 209-432-8873, or write him at M_2 Enterprises, 7660 N. Del Mar, Fresno, CA 93711. Mike also has a complete line of antennas to 1296 MHz, including some really long antennas for 6 and 2 meters. Ask him for his brochures.

Rutland Arrays: Another source of antennas useful for Roving is Rutland Arrays. They have a variety of antennas, beginning with a 4-element 6 meter antenna that sells for $134.95, plus shipping and handling, and ending with a 33-element 70 cm antenna that sells for $223.95, plus shipping and handling. Contact them at 800-536-3268, or write to them at 1703 Warren St., New Cumberland, PA 17070.

Down East Microwave: For a complete line of pre-amps, antennas, and kits for microwave (that is, 902 to 2304 MHz), contact Bill Olson, W3HQT, at Down East Microwave. You can reach him at 207-948-3741 or FAX 207-948-5157. For a free catalog, write to RR1 Box 2310, Troy, ME 04987.

DX Engineering: Bill Sattler, NØXX, of DX Engineering offers three 6 meter antennas suitable for Rover work. For more information and a catalog, call 800-373-0239, or write to 618 Spaulding Avenue, Brownsville, OR 97327. You can also FAX your request to 503-466-5453.

Rotators: The Emoto 201SAX/AAX is a rotator that runs on 12 VDC. The rotation torque is 15 foot-pounds. The brake torque is 110 foot-pounds. The wind load factor is 7.6 square feet and the vertical load factor is 660 pounds. The suggested retail price is $367.00 for the fancier control box and $349.00 for the low-profile control box. Contact your dealer for pricing and availability to you.

Other Radios: The major manufacturers supply a number of radios that will do quite well for Roving.

From ICOM: The 275A/H, a multi-mode radio for 2 meters (actually two models, the "A" model runs 10 watts and the "H" model

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Frequency Coverage	*Default Steps*
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29.000 - 53.995 MHz. (NFM)	5.0 KHz
54.000 - 71.995 MHz. (WFM)	50.0 KHz
72.000 - 75.995 MHz. (NFM)	5.0 KHz
76.000 - 107.995 MHz. (WFM)	50.0 KHz
108.000 - 136.995 MHz. (AM)	12.5 KHz
137.000 - 173.995 MHz. (NFM)	5.0 KHz
174.000 - 215.995 MHz. (WFM)	50.0 KHz
216.000 - 224.995 MHz. (NFM)	5.0 KHz
225.000 - 399.995 MHz (AM)	12.5 KHz
400.000 - 511.995 MHz. (NFM)	12.5 KHz
512.000 - 549.995 MHz. (WFM)	50.0 KHz
760.000 - 823.995 MHz (NFM)	12.5 KHz
849.0125 - 868.995 MHz (NFM)	12.5 KHz
894.0125 - 1,300.000 MHz. (NFM)	12.5 KHz

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Frequency Coverage	*Steps*
29.000 - 53.995 MHz. (NFM)	5.0/12.5/25.0 KHz.
108.000 - 136.995 MHz. (AM)	5.0/12.5/25.0 KHz.
137.000 - 173.995 MHz. (NFM)	5.0/12.5/25.0 KHz.
216.000 - 224.995 MHz. (NFM)	12.5/25.0 KHz.
225.000 - 399.995 MHz (AM)	12.5/25.0 KHz.
400.000 - 511.995 MHz. (NFM)	12.5/25.0 KHz.
806.000 - 823.995 MHz (NFM)	12.5/25.0 KHz.
849.0125 - 868.995 MHz (NFM)	12.5/25.0 KHz.
894.0125 - 956.000 MHz. (NFM)	12.5/25.0 KHz.

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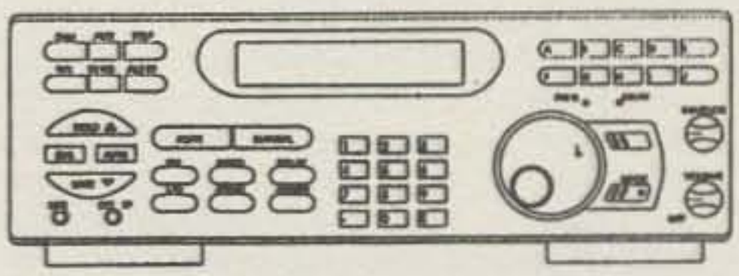

CB/GMRS Radios

The new 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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runs 100 watts); the 475A/H, a multi-mode radio for 70 cm; the 575A/H, a multi-mode radio for 10 and 6 meters; the 1271, a multi-mode radio for 1296 MHz that runs 10 watts; and the 970, a multi-mode radio that operates on 2 meters and 70 and 23 centimeters. Additionally, the 551D, a used radio, is very popular on 6 meters.

From Kenwood: The TS 690, an all-band radio that includes 6 meters; TS 790, a 2 meter and 70 cm radio that is primarily for satellite, but is used for weak-signal work. TR 751, an all-mode mobile radio for 2 meters (that some of the guys are using as an IF for their microwave radios. Additionally, the TS 680, an all-band used radio is used quite often on 6 meters.

From Yaesu: The FT 650, a multi-mode radio that tunes continuously from 24.5 MHz to 56 MHz and runs 100 watts on the amateur bands it covers; FT 736R, a multi-mode radio that is equipped with 2 meters and 70 cm but can be equipped with modules for 6 meters or 135, 70, or 23 cm (maximum two other bands); the FT 690, a multi-mode portable/mobile radio for 6 meters; the FT 290, a multi-mode mobile/portable radio for 2 meters; and the FT 490, a multi-mode mobile/portable radio for 70 cm. Additionally, the FT 726, the predecessor to the FT 736R, is another multi-mode multi-band radio. The FT 680, the predecessor to the FT 690, is an excellent mobile radio. (I wish I had never sold mine!)

10 GHz: For a wideband FM radio at 10 GHz, you can contact Advance Receiver Research, at P.O. Box 1242, Burlington, CT 06013 (203-582-9409). For a narrow-band SSB radio, contact SSB Electronic USA, at 124 Cherrywood Dr., Mountaintop, PA 18707 (717-868-5643).

Bricks: The common term for a low-wattage (150 watts, or less) solid-state linear amplifier is "brick," probably because it usually looks like a black overgrown brick. There are a variety available from three manufacturers. RF Concepts has bricks for 6 and 2 meters and 70 cm. You can reach them at 1202 E 23rd St., Lawrence, KS 66046, or call 913-842-7745, or FAX 913-842-2021. Mirage has bricks that operate on 6 and 2 meters and 70 cm. They have two classes, 150 watt and 300 watt. The 300 watt class requires 28 VDC for power. Contact them at P.O. Box 1000, Morgan Hill, CA 95037, or call 408-779-7363. TE Systems also has two classes of bricks for these same bands. However, their high-power bricks use 13.8 VDC. Contact them at P.O. Box 25845, Los Angeles, CA 90025, or call 310-478-0591, or FAX 310-473-4038. Tokyo Hy-Power also makes VHF and UHF bricks of varying power levels, up to 250 watts. For pricing information, contact the importer, Orion Business International, Inc., 360 W. Bedford Ave., Ste. 111, Fresno, CA 93711, or call 209-432-4155, or FAX 209-261-0226. Some of these bricks are also available through your favorite dealer.

Transverters: Tokyo Hy-Power also makes several transverters. The HX 650 is for 6 meters. Its suggested retail price is $579.00. The HX 240 imports 2 meters and exports five HF bands—3.5, 7, 14, 21, and 28 MHz. The HX 640 imports 6 meters and exports the same five HF bands. The suggested retail price for these two is $399.00. For the microwave bands, you can select from three models offered by SSB Electronic USA. Each will accept up to 10 watts from a 2 meter transceiver and produce one watt output on its designed frequency. For 903 MHz the model number is LT33LP; for 1296 MHz the model number is LT23LP; and for 1269 MHz the model number is LT24LP. The price for each model is $369.95, plus shipping and handling. For more information, contact SSB Electronic USA at the above address.

Hand-Helds: Tokyo Hy-Power also makes a hand-held, model HT 750, that operates on 7, 21, and 50 MHz, with 3 watts on HF and 2 watts on VHF. Its suggested retail is price is $599.00. Again, you can contact Orion, or your favorite dealer. The Mizuho MX-50S is another hand-held for 6 meters. It is among a family of hand-helds that are imported by j-Com. The price is $349.95, plus $5.00 shipping and handling. A wide range of accessories is available. For more information, contact j-Com at P.O. Box 149, Ben Lomond, CA 95005, or call 408-335-9120, or FAX 408-335-9121.

And Finally

Long-time 6 meter enthusiast (and my good friend) **Dave Bostedor, Sr., K8WKZ,** underwent surgery in late March in an attempt to eradicate the cancer that is affecting him. According to doctor's reports Dave still has a way to go.

Dave's accomplishments and contributions to the weak-signal community are numerous. Among the many awards he holds are the first VUCC for 6 meters and the first W8 DXCC for 6 meters. He has encouraged many, many amateurs and potential amateurs as they contemplate the hobby.

Even though Dave continues to face the battle, he intends to travel with his son, Dave, Jr., N8NQS, on the grid expedition this month. (See above for more details.) Additionally, he has set two long-term goals for himself: completing 5B DXCC (it took me seven years, Dave) and building a 6 meter EME array.

A word from you, either a QSL card or a greeting card saying that you are thinking of him, will do much to continue to cheer his spirits. His address is: Dave Bostedor, Sr., K8WKZ, 8030 Greenes Drive, Jackson, MI 49201.

Long-time 6 and 2 meter enthusiast **Russ Patrick, W7IDZ,** became a Silent Key on 19 February. Russ was a bomber captain during WW II and not too long ago retired from the FAA. His presence will be missed on the VHF+ frequencies, especially in the northwest.

This is all the room for this month's column. Thanks go to "West Coast VHFer," "Terrestrial VHF+," and you, who supply the information to make this column a success. Please keep your cards and letters coming. If you can't wait for the mail, call me at 405-528-6625.

Next month we will discuss the CQ WW VHF WPX Contest, more on the Rover rules controversy, the CSVHF conference, and some ideas Emil and I have for reducing QRM during the upcoming *Perseids* meteor shower (storm). Until next month . . .

73, Joe, N6CL

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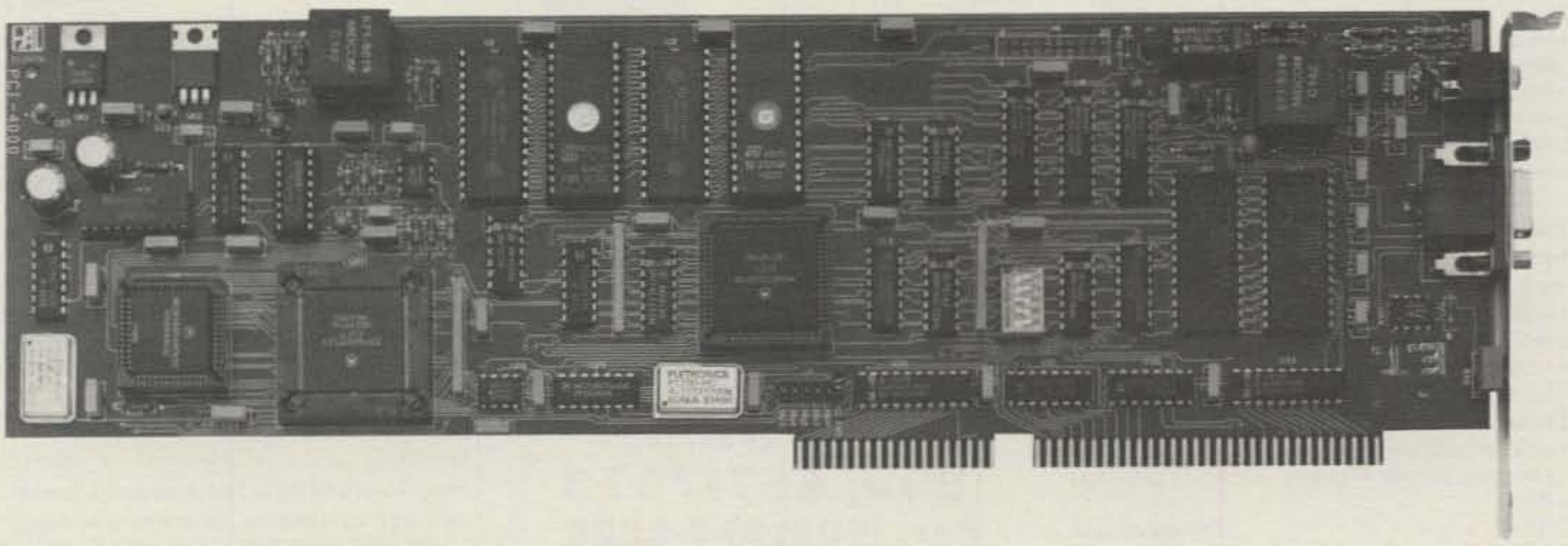

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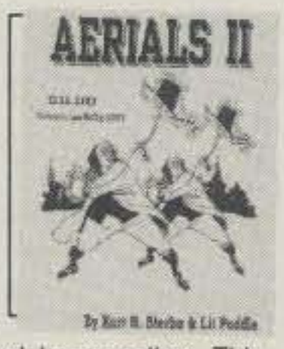

forward by Lew McCoy, W1ICP
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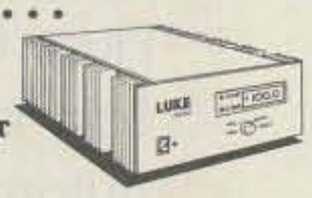

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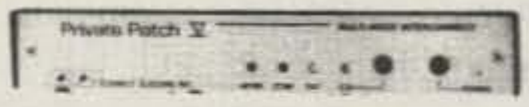

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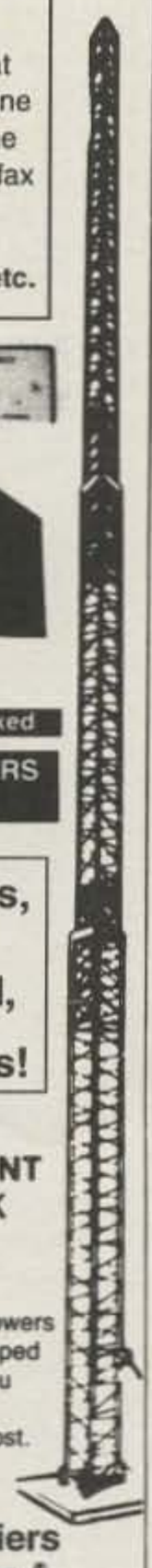

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Radio FUNdamentals

BY BILL ORR, W6SAI

THINGS TO LEARN, PROJECTS TO BUILD, AND GEAR TO USE

Hertz, Lodge, and the "Nuremburg Stove"

The pieces of the drama were all in place. The principles of inductance and electromagnetism were well known. Maxwell had published his famous equations defining an electromagnetic field that could flow through space. Lacking was the ultimate verification that would bind these concepts into a unified whole.

If these waves existed, how could they be generated? If generated, how could they be detected? And if detected, how could they be measured?

In 1888 Heinrich Hertz, a young physics professor at a technical school in Germany, built an electromagnetic wave generator and a detector and proved the existence of the waves.

The Hertz generator (oscillator) consisted of two metallic plates, each attached to a short rod terminating in a polished metal ball. These were connected to the terminals of an induction coil and the two balls brought in close proximity, forming a small spark gap (fig. 1). When voltage was applied to the circuit and the space between the rod ends was made small enough, the air gap was filled with a spark. The spark discharge, combined with the inductance of the rods and the plate capacitances, produced a tuned, oscillating circuit. Hertz calculated that the spark would produce a wave the frequency of which would be about 100 MHz, or a wavelength of 3 meters.

The relationship between wavelength and frequency was important to Hertz. His great problem was generating a wave of such size that he could measure and examine it. His dilemma was that the room available to him was only about 50 feet long and 45 feet wide. It had a 15 foot high ceiling. Along the walls were massive vertical iron roof supports running parallel to the line of the experiment. And quite near the site of the tests was a massive iron stove which warmed the room during the winter months.

What effects did these various large metal structures have on the experiments? Hertz did not worry about these factors at first, but the difficulty of measuring the length of his wave later pointed out the effect of nearby metal objects.

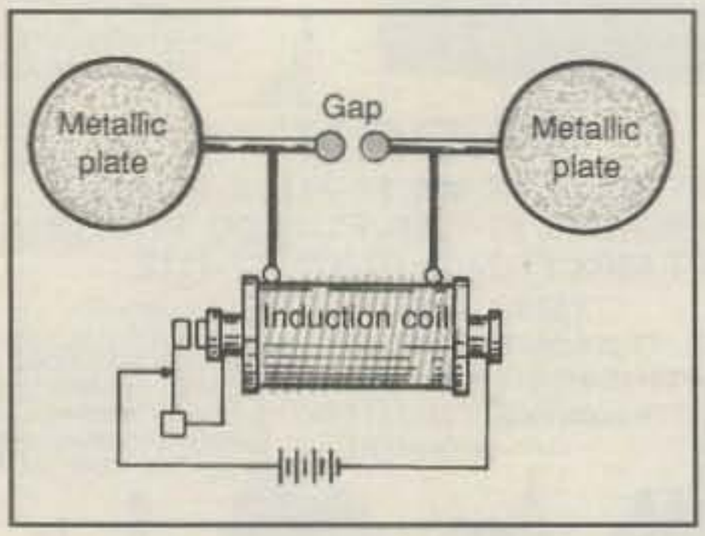

Fig. 1– The Hertz oscillator. By today's standards it is a prolific QRM generator.

Hertz adjusted his test frequency to allow the waves to fit comfortably inside the room. He wanted at least two wavelengths between generator and detector, and he wanted additional space to experiment with wave reflections.

His first experiments showed the wavelength of his oscillator to be about 5.3 meters (56.5 MHz). This wave was too large for his equipment, particularly the movable reflecting surfaces he used, so he trimmed his transmitting dipole and rearranged his equipment, ending up with a wavelength of about 3 meters, or 100 MHz.

Many approximations were made by Hertz in the tests, but the accuracy of Hertz's measurements was quite good. The thrust of the experiment showed that the waves existed and that the speed of wave propagation was approximately equal to the speed of light. However, the presence of the massive iron stove and the metal roof supports, plus the harmonic content of the crude transmitter, prevented accurate measurements of wavelength.

In addition, Hertz noted the puzzling fact that the electromagnetic wave was propagated a little slower along a conducting wire than it was in air. Unfortunately, the decrease in velocity of propagation was about the same order of magnitude as the experimental error. Yet, there it was.

Hertz was successful in proving the validity of Maxwell's equations. His measurements of frequency and wave length were suspect, since when he measured wavelength, he was measuring the strongest signal present, which was not the only one generated by his crude spark transmitter. And he made a lot of assumptions about the resonant circuit of his oscillator, later proven to be incorrect. Nevertheless, he accomplished his aim: proving that electromagnetic waves existed and could be detected and measured.

Hertz gave no thought as to the practicality of his discovery. The idea that

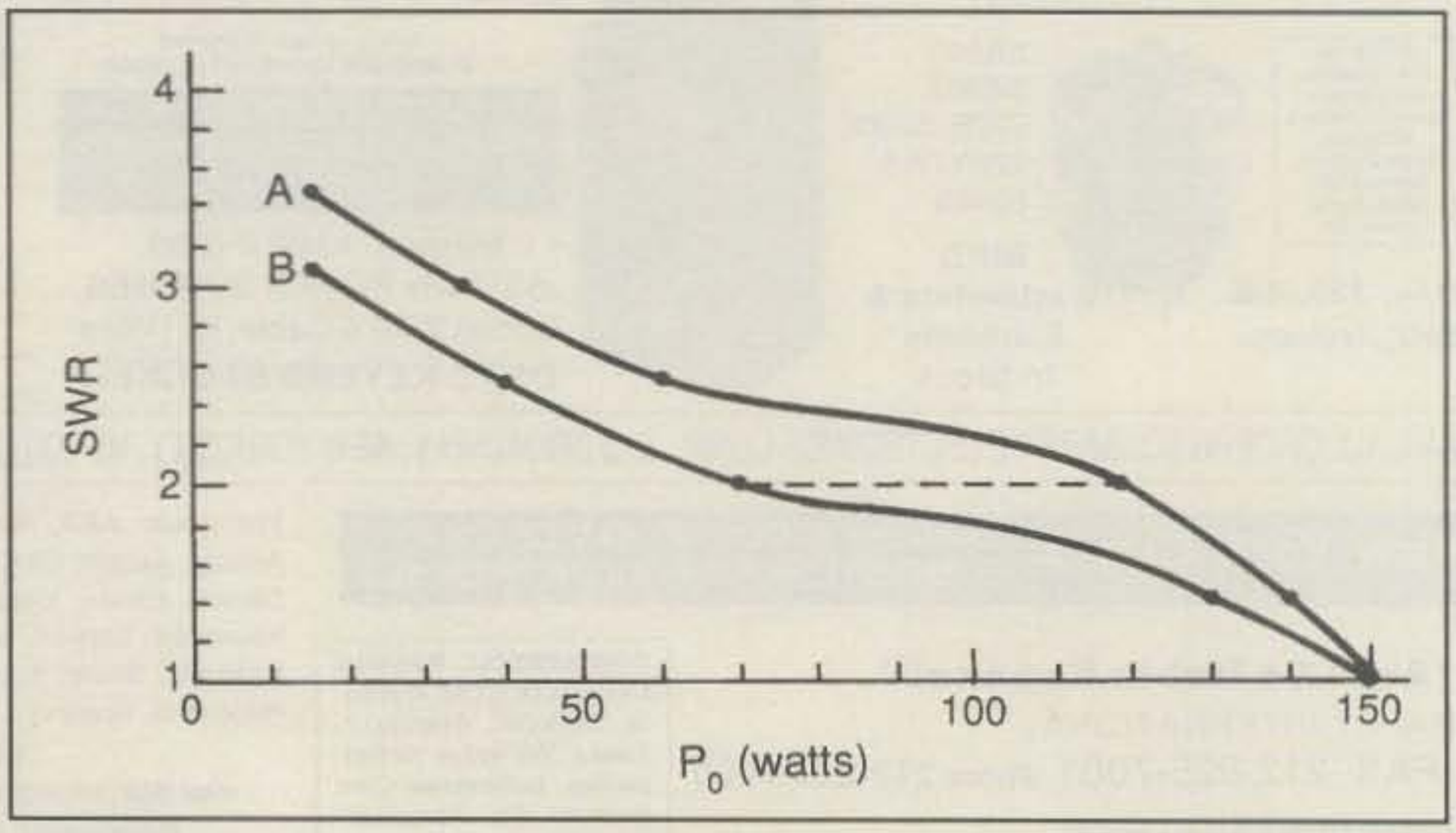

Fig. 2– Power output versus SWR. Plot A indicates a positive reactance load at 7 and 28 MHz. B indicates the effects of a negative reactance load at 28 MHz.

48 Campbell Lane, Menlo Park, CA 94025

waves could be put to commercial use apparently never crossed his mind. His choice was to follow pure science instead of a technical career.

Hertz's pioneering work came to a tragic end in 1894, when at the age of 36 he died of blood poisoning.

Oliver Lodge: He Came in Second

About the same time Hertz was conducting his experiments in Germany, Oliver Lodge, a physicist at the University of Liverpool (England), designed a system of generating and detecting electromagnetic waves. Unlike Hertz, Lodge did not use an induction coil. Rather, he generated waves by means of discharges from Leyden Jars (capacitors). And unlike Hertz, Lodge measured his operating wavelength with a set of wires, the forerunner of today's open-wire transmission line. The wires were nearly 100 feet long, and his radiations were measured at about 5 MHz. He had generated the waves and detected them, but he did not radiate them into space.

With a little more determination and a more forceful nature, Lodge might have completed his experiments and announced his discovery before Hertz did. But the problems of setting up his laboratory and other distracting influences led the genial Lodge to dally, and as a result he went down as a secondary player in the fascinating story of the early radio experiments.

It is interesting to contemplate that neither Hertz nor Lodge, nor their scientific contemporaries, realized the practical implications of their discoveries. It was not until 1892 that a British physicist, William Crookes, wrote of the possibility of using electrical vibrations through the "ether" to send messages.

Finally, in 1894 a young student of Professor Augusto Righi of Bologna, Italy turned his amateur curiosity from physics and chemistry to experiments that Righi was conducting with a Hertz oscillator. The student's name was Guglielmo Marconi. He grasped the idea of sending and receiving messages by wireless waves. After a pause he burst upon the scene, and the world has never been the same since. But that's a different story!

The SWR Meter: Friend or Foe?

A casual listener to the amateur bands hears a lot of talk about SWR measurements, and there are plenty of SWR graphs in magazine antenna articles extolling the SWR performance of a particular antenna. In addition, many mod-

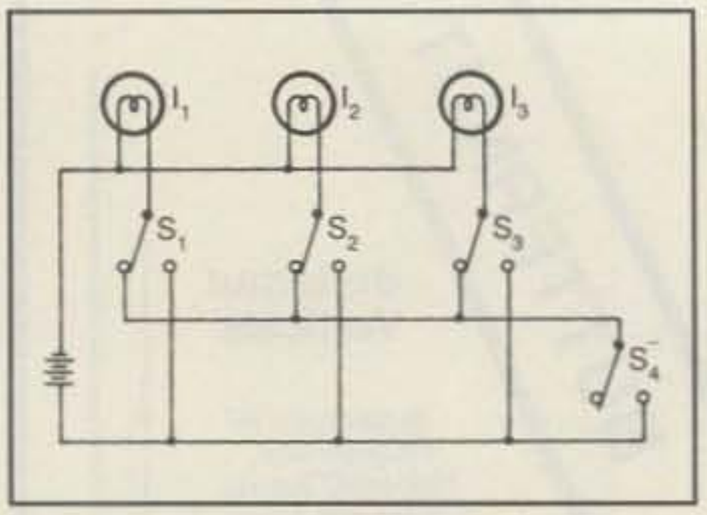

Fig. 3– Here the switches are shown in the "off" position.

ern rigs have a built-in bar-graph SWR meter. And if you read the advertisements in the amateur magazines, you'll see a plentiful supply of SWR meters on which to spend your money! You might get the idea that the SWR meter is an indispensable piece of gear and a vital addition to the shack!

The SWR Meter Environment

In previous articles I've pointed out that the SWR meter actually measures the SWR of the antenna system as a whole, not just the antenna itself. That is to say, an SWR reading in the shack is revealing the SWR on the feedline at the end of the line. This reading is a function of the feedpoint impedance of the antenna, the line loss, impedance "bumps" in the line caused by mechanical joints, and any spurious RF coupling between the field of the antenna and the shield of the coax line. Thus, the SWR reading at the shack may or may not bear a resemblance to the actual SWR measured at the antenna feedpoint.

So what? Why should a high value of SWR upset the experimenter? Many amateurs spend hours diddling with their antennas to reduce the SWR from, say, 1.7 down to 1.2 and then work harder to get the SWR down to 1.1 or less. Does all this effort make their signal louder, or does it make them more capable of hearing weaker signals? Hardly. In most cases, such an exercise is a waste of time.

SWR and The Modern Transceiver

Where the SWR does play an important part in proper station operation concerns the match between the antenna system and the transmitter. Back in the "good old days" most transceivers had tubes in their final amplifier and an adjustable pi-network output circuit. (Remember the "Tune" and "Load" controls?) Many of those rigs could accommodate SWR values as high as 4:1 or even 5:1, depending upon the transmitting frequency. The modern solid-state rig, on the other hand, has a fixed-tuned, broadband output network designed to work into a 50 ohm load. As the SWR on the feedline rises, and the load departs from 50 ohms, the transceiver compensates by shutting itself down in order to protect the output transistors. The higher the SWR, the less the power output!

Shown in fig. 2 are examples of shutdown in a modern transceiver. At 7.0 MHz an SWR of 2:1 drops power output from 150 watts to 120 watts. An SWR of 2.5:1 reduces output to about 60 watts and SWR of 3:1 results in a paltry 35 watts output.

Now look at the situation at 28.6 MHz. This is more complicated. The power output versus SWR ratio varies depending upon line reactance. With a mismatch having positive reactance, the power output curve resembles that occurring at 7.0 MHz. With a mismatch having negative reactance, the shutdown curve is much more sensitive to SWR. Compare the curves at SWR of 2:1. More than 50 watts power output is provided on a positively reactive load as compared to a load having negative reactance.

These results are for a single test of one transceiver. How does your transceiver respond to a reactive value of SWR? The results probably will be different from this examination, but you get the idea.

As far as the tube-type rig goes, high SWR is not an important factor. However, for the solid-state rig, a high-value SWR may mean the difference between full output or almost no output. That's not nice.

What the SWR Meter Doesn't Tell You

Let's take an example of an antenna having a feedpoint resistance at resonance of 16.7 ohms (not an uncommon value for a multi-element Yagi). The antenna is fed directly by a 50 ohm line. We'll assume there is no unwanted coupling between the line and the antenna. Using an RF impedance bridge, the resistance and reactance are measured along the line at 1/16-wave intervals (Table I). For 20 meters that's a distance of about 4.3 feet. The results are read out in terms of resistance and reactance, both expressed in ohms. *(The values given in this problem are taken from the excellent book Reflections, by Walt Maxwell, W2DU, published by the ARRL. The example is on page 12-2 of the book. Thanks, Walt!—ed.)*

The theoretical SWR on the line is the

ratio of line impedance to resonant feedpoint impedance; in this case 50/16.7, or SWR = 3:1. And, assuming the line is lossless, that's what a good SWR meter at the station end of the line will indicate.

The RF impedance bridge, however, reveals a more complex picture along the line. Note that if the line is a quarter or three-quarters wavelength long, the impedance at the measuring point is 150 ohms. But at the one-eighth and three-eighths points, the impedance is complex; a reactance term is present. The impedance at these points is 30 ohms plus or minus a reactive term of 40 ohms.

Based upon these observations, how could I improve my transmitter loading on 10 meters? I could only achieve about 35 watts output at the resonant frequency of the antenna. At this point the indicated SWR was 2:1. I didn't want to fiddle with the antenna. As a test, I added 3 feet to the transmission line, right after the SWR meter. The line from the operating position to the antenna now was 3 feet longer than before. Power output of the transceiver went up from 35 watts to 70 watts. The SWR remained constant at 2:1. I then added an extra 2.5 feet, making the transmission line 5.5 feet longer than the original length. Bingo! The transceiver went up to full power output of 120 watts! Again, measured SWR was still 2:1. The SWR meter wasn't any help to me in this situation, but the power output meter on the transmitter was vital.

The Poor Man's "Antenna Tuner"

Well, this suggests a quick and easy answer to the problem of poor loading on any one band. One solution is to buy an antenna tuner. The cheap and dirty solution is to vary your feedline length until you obtain maximum transmitter output. Purists may frown on this scheme, but it is a case of making the prevailing situation work for you and not against you. I made up a selection of short coax lengths with PL259s on each end and splice them in and out of the main transmission line for optimum loading as the occasion demands. The lengths are 1 foot, 2 feet, 4 feet, and 6 feet. These four cables solved all my loading problems at 40 meters and above.

And now we have two helpful pieces of information at hand. First, the transceiver protection circuit may have a different shut-down response on one band than it does on another. Second, the shut-down response is a function of both SWR and the reactance of the load the transmitter "sees." By juggling coax line length, I can find a particular value of load reactance that provides me with the greatest possible output power for a given value of SWR. In effect, I'm moving along the transmission line, finding the "sweet spot" that permits the highest level of power output.

The "sweet spot" on the transmission line obviously changes from band to band. That is, a different line length may be optimum for different bands. That will have to be determined by experiment. With a little luck, you'll find a line length that will provide satisfactory power output on your favorite bands. Forget about the SWR meter. Just go for maximum power output under your normal operating conditions. It's amazing what a few feet of coax will accomplish!

The "Dead Band" Quiz

Only KE3CR was clever enough to know that Clyde McCoy's recording on a Decca record, "Tear It Down," was an ode to a folding Murphy bed! Congratulations, Giles.

Plenty of savvy readers knew that the little bit about "clocks striking thirteen" came from George Orwell's famous book *1984*. They knew a lot about George, too, whose real name was Eric Blair. Kudos to the following: K1XA, G4CYB, KA7OBU, K4ADJ, KB5YC, KL7CMN, W1AIM, W1XH, KB7DRO, KB2OPO, K5RA, K1RD, W7IV, WB3CQA, and AA3BO. Well done, guys.

The quiz about the three lamps and four switches brought forth plenty of circuit buffs who knew their onions: WB9NOO, NØRTK, WØCC, N2INN, K5RA, W7HR, KL7CMN, KØCJ, KB5VIE, WN2SQC, WA5JCI, N1NTY, WA2YFS, KØARA, W9PVD, K1RD, and WB2LJW. The circuit, as given in the July 1957 *QST*, is shown in fig. 3.

73, Bill, W6SAI

BILL'S BASICS

BY BILL WELSH, W6DDB

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Amateur Radio Callsign License Plates—Conclusion

This segment concludes the three-part article on amateur callsign license plates.

Ohio: Department of Highway Safety, Bureau of Motor Vehicles, Special Plates Division, P. O. Box 16521, Columbus, OH 43266-0020 (614-752-7800). No initial additional fee. Additional annual fee is $5. Applicant must possess a valid FCC license, and a copy of it must accompany the application. Applicant must own or jointly own the vehicle, or it may be a leased vehicle. Just one set of plates per amateur. Amateur plates may be used on passenger vehicles and non-commercial trucks or motor homes. AMATEUR RADIO is imprinted on these plates.

Oklahoma: Motor Vehicle Division, Special Tag Section, 2501 Lincoln Boulevard, Oklahoma City, OK 73194-0007 (405-521-2468). Initial additional fee is $2 and annual additional renewal fee is $2. Applicant must possess a valid Technician or higher FCC license, and a copy of it must accompany application. Applicant must be an Oklahoma resident, and must own the vehicle in which the amateur equipment is installed. One set of amateur plates per applicant. When/if one's license becomes invalid, the amateur plates must be surrendered. Amateur plates may only be used on automobiles and personal trucks; they may not be used on commercial vehicles or motorcycles.

Oregon: Department of Transportation, Motor Vehicles Division, 1905 Lana Avenue NE, Salem, OR 97314 (503-378-6957; FAX 503-378-5146). Additional initial fee is $7.50, which consists of a $5 special plate fee and a one-time $2.50 plate manufacture fee. No additional biennial renewal fee. Plates are valid two years. Applicant must possess a valid FCC license, but a copy of it does not have to accompany the application. DMV Form 735-231 is an Application for Amateur Radio Call Letter Plate. These plates may be used on passenger-plated vehicles (including pickups and vans) and on motor homes. Except for Beaverton, it seems to be legal to use headsets while operating a vehicle in Oregon.

45527 Third Street East, Lancaster, CA 93535-1802

Bob McAuliffe, N2QXI, took this picture of his brother (N2QXH, Patrick) during his first contact (QSO). These brothers are members of the Knickerbocker Radio Club, which helped them get ready to pass the licensing examination. Robert Styler and Cap Dieul, KA4RPS, provided the help and inspiration that was needed. The South Shore Amateur Radio Club administered their examinations. Bob and Patrick live in Franklin Square, New York.

Pennsylvania: Department of Transportation, Bureau of Motor Vehicles, Special Tags Unit, P.O. Box 8293, G-100 Transportation and Safety Building, Harrisburg, PA 17122. Initial additional fee $20. No additional annual renewal fee. Replacement fee also $20. Vehicle must be registered to the applicant, or jointly to the applicant and her/his spouse. Applicant must be a Pennsylvania resident. One plate per applicant. Multiple plates (-2, -3, etc.) available to amateurs owning more than one vehicle. AMATEUR RADIO is imprinted on each plate. Slash available through zero, if zero is in callsign. Motorcycles, trailers, and vehicles with gross weight exceeding 9000 pounds are not eligible for an amateur plate. Copy of valid license required with application.

Rhode Island: Department of Transportation, Division of Motor Vehicles, Office of the Deputy Director, State Office Building, Providence, RI 02903. No additional fee; just $30 standard registration fee or $60 for a two-year renewal. Two plates issued. Amateur plates are not issued to Novices. Applicant must own vehicle. Plates must be surrendered if license becomes invalid.

South Carolina: Department of Highways and Public Transportation, Division of Motor Vehicles, Registration and Reciprocity, P.O. Box 1498, Columbia, SC 29216-0022 (803-737-1084). Additional fee of $1 over regular registration fee, plus $1 additional annual renewal fee. Applicant must own vehicle. Applicant must possess a valid FCC license. If FCC license becomes invalid, plates must be surrendered. Application must be filed between May 1st and July 1st. Amateur plate may be transferred to another vehicle owned by the amateur. Amateur plates become valid November 30th.

South Dakota: Department of Revenue, 118 West Capitol Avenue, Pierre, SD 57501-2080 (605-773-3541). Additional fee is $10, plus $10 renewal sticker fee. Amateur plates must be displayed and installed on the vehicle and regular plates must be kept in the vehicle. Applicant must own vehicle. If FCC license becomes invalid, amateur plates must be surrendered. If vehicle is sold, amateur plates must be surrendered. Applicant must possess a valid FCC license, and a copy of it must accompany application, plus renewal application. Amateur plates may not be duplicated. Applicant must own vehicle.

Tennessee: Department of Safety, Title and Registration Division, Andrew Jackson State Office Building, Nashville, TN 37242-0300. No additional amateur plate fee. Applicant must own or lease vehicle. Applicant must possess a valid FCC license, and a copy of it must accompany application. Applicant must provide proof of membership in ARES or RACES. Amateur plates may be attached to private passenger cars and motorcycles. Multiple sets (-2, -3, etc.) of callsign plates may be issued to amateur owning more than one vehicle. EMERGENCY is imprinted on amateur plates. Amateur plates must be surrendered if FCC license becomes invalid, or if vehicle is sold/transferred.

Texas: Department of Transportation, Division of Motor Vehicle Titles and Registration, Austin, TX 78779-0001 (512-465-7611). Additional initial fee of $2, plus $1 annual renewal fee. Affidavit of continued mobile station operation required for renewal. Applicant must be a Texas resident and must own vehicle. Applicant must possess a valid FCC license, and a copy of it must accompany original applicant and renew-

al application. Applicant must regularly operate the amateur radio station installed in the vehicle. Amateur plates may only be used on passenger and light commercial motor vehicles with a carrying capacity not exceeding 2000 pounds. Applicant may transfer amateur plates between her/his vehicles. RADIO OPR is imprinted on these plates.

Utah: Motor Vehicle Division, State Fairgrounds, 1095 Motor Avenue, Salt Lake City, UT 84116 (801-538-8300). Additional initial fee $5, with no additional annual renewal fee. Applicant must be a Utah resident and must own the vehicle. Applicant must possess a valid FCC license and must attach a copy of it to application. RADIO is imprinted on these plates.

Vermont: Agency of Transportation, Department of Motor Vehicles, Registration/License Information Unit, 120 State Street, Montpelier, VT 05603-0001 (802-828-2000). The additional initial fee is $20. Applicant must file a Safety Organization Special Plate Application. Applicant must have a valid FCC license, and a copy of it must accompany application. Slash is available through zero, if a zero exists in the callsign.

Virginia: Department of Motor Vehicles, P.O. Box 27412, Richmond, VA 23269-0001. Initial additional fee $1. Additional annual renewal fee is $1. Applicant must be owner (or co-owner) of vehicle. Applicant must possess a valid FCC license. Just one set of amateur plates is issued to one amateur per year. Mobile station must be installed in vehicle bearing amateur plates. If equipment is not operable, or if it has not been operated at least 90 days, the amateur plates must be surrendered. Amateur plates may be used on private passenger vehicles, pickup trucks, and panel trucks with a gross weight not exceeding 7500 pounds. AMATEUR RADIO is imprinted on these plates.

Washington: Department of Licensing, Specialized License Plates, P.O. Box 9043, MS-PB-01, Olympia, WA 98507-9043 (206-753-0668 or 1-800-228-9847). Additional fee is $10 (passenger vehicles or trucks) or $8.50 (campers, motorcycles, or trailers). Transfer fee is $5. Applicant must be a Washington resident. Applicant must be vehicle owner or co-owner. Applicant must possess a valid FCC license, and a copy of it must accompany the application. Plate manufacture time is about 6 to 8 weeks.

West Virginia: Department of Transportation, Division of Motor Vehicles, Capitol Complex, Building 3, Charleston, WV 25317. Additional fee $5, and transfer fee is also $5. Applicant must own vehicle. Applicant must possess a valid FCC license, and a copy of it must

accompany application. All amateur plates expire July 1st.

Wisconsin: Division of Motor Vehicles, 4802 Sheboygan Avenue, P.O. Box 7949, Madison, WI 53707-7949 (608-266-3041). Additional initial fee $10. No additional fee at renewal; just the regular renewal fee. Applicant must own vehicle. Applicant must possess valid FCC license, and a copy of it must accompany the application. New plates issued every 7 years. Plates expire January 31st. Amateur plates can be used on automobiles, station wagons, and motor homes. They may also be used on dual-purpose motor homes and dual-purpose farm trucks having a gross weight not exceeding 8000 pounds, plus farm trucks with gross weight not exceeding 12,000 pounds. Amateur may transfer callsign plates to another vehicle she/he owns. AMATEUR RADIO is imprinted on these plates.

Wyoming: Department of Transportation, Licensing Section, P.O. Box 1708, Cheyenne, WY 82002-9019. Thirty dollar fee for one vehicle; initial fee only. Applicant must own vehicle. Applicant must possess a valid FCC license, and a copy of it must accompany the application. License plate term is five years.

Conclusion

Compare related information between your state and other states. You may find that your state has requirements and/or charges that are not in line with those of other states. If so, you could help our amateur radio service by initiating corrective actions in your state.

The most obvious need for a change in state regulations involves the class of license one must hold to be allowed to get amateur radio callsign license plates. Novice and Technician licenses are now issued with ten year maximum valid periods,and they are renewable. There is no doubt in my mind that callsign plates should be available to all classes of American amateurs.

Some states require an operable amateur radio station to be continually installed in vehicles which display callsign license plates. Amateurs make too many equipment changes to meet this requirement at all times. In addition, many of us do no leave equipment installed in our vehicles at all times; we move gear in and out of vehicles to meet our needs.

Several states now offer the slash (diagonal) through the zero in one's callsign to distinguish it from the letter O.

If you are willing to help update and complete this list, please verify/obtain the following data items:

1. State's issuing agency, address, and FAX/phone numbers.
2. Additional initial fee for callsign plates.
3. Additional annual renewal fee for callsign plates.
4. Application deadline.
5. Expiration date of plates.
6. Is applicant required to be a state resident and/or to own vehicle to which plates are to be attached?
7. Is applicant required to hold a minimum grade of license, such as General?
8. Is applicant required to be a member of an organization such as ARES, MARS, or RACES?
9. Does the vehicle with the amateur plates have to be equipped with an operable amateur mobile station?
10. What requirements exist regarding the transfer or sale of a vehicle from the amateur?
11. What method applies to transferring an amateur's callsign plates between vehicles she/he owns? What fees apply to such a transfer?
12. To which types of vehicles may one attached callsign plates?
13. Are additional (-2, -3, etc.) sets of callsign plates available? If so, at what cost?
14. How long does it take to have callsign plates manufactured and delivered?
15. Does an amateur enjoy special privileges (such as wearing a headset) when driving a vehicle with amateur plates mounted on it?
16. Is any special working (such as AMATEUR RADIO) imprinted on callsign plates?

If you know corrective and/or additional information, please send it to my California address, which is shown on the first page of this article.

Last but not least, I thank the amateurs who provided some of the information that has been included in this article. They include Vernon G. Dameron, K1DRN; John C. Hennessee, KJ4KB; Carl W. Hickman, KA5DAV; Glen Johnson,WB2MPK; John Kent, AA2DY; and Luther W. Lipford, Jr., KB4MIL.

Photographs Wanted

Photographs of new amateurs in their shacks provide introductions to a few of the newer licensees. Photograph size is unimportant, but good definition, contrast, and subject matter are important. Color pictures can be used, but black-and-white photographs are preferred. Operating activities and achievements, plus a self-introduction, are needed with each picture. Send an SASE if a picture must be returned. A free one-year *CQ* subscription (or renewal) is awarded to the one amateur whose picture I select as the winner for the month. If you are a subscriber, please enclose the mailing label (or copy) from your latest *CQ* issue. One award is made each month, no matter how many photographs are printed. DX amateurs, who frequently work the American Novice bands, are also urged to submit photographs.

73, Bill, W6DDB

The WPX Program

SSB

2363.....EA5GKE 2366.....N5KUC
2364.....WBØYEA 2367.....N1CC
2365.....N1IR 2368.....VU2JJQ

CW

2774.....S52FB 2775.....N1CC

Mixed

1594.....N1CC 1596.....K2OP
1595.....KT5Y

Award of Excellence: LU1DOW, N1IR

Award of Excellence 160 Meter Bar: HA8XX

Mixed: 450 N1CC, KT5Y, K2OP. 500 KB2R, N1CC, KT5Y, K2OP. 550 N1CC. 600 N1CC, WWØE. 650 N1CC. 700 N1CC, WK3Z. 750 N1CC. 800 N1CC, JN3SAC. 850 N1CC, JN3SAC. 900 N1CC, JN3SAC, IN3PEE. 950 IV3CVG, N1CC, N7JB. 1000 I5AFC, N1CC, WA3GNW, 1050 I5AFC, N1CC, 1100 N1CC. 1150 N1CC. 1200 N1CC. 1250 WN4KKN. 1300 W9IAL. 1350 I1WXY. 1400 I1WXY. 1450 I1WXY. 1500 I1WXY. 1550 I1WXY, JA1-29784. 1600 JA1-29784, I1WXY. 1650 VE1RJ, I1WXY. 1700 KBØG, VE1RJ, I1WXY, SM6CST. 1750 KBØG, I1WXY, SM6CST. 1800 I1WXY, SM6CST. 1850 IK2ILH, I1WXY. 1900 IK2ILH, I1WXY. 1950 I1WXY. 2000 I1WXY. 2050 I1WXY. 2100 I8RFD, I1WXY. 2150 I8RFD. 2500 I8RFD. 2550 I8RFD. 2950 W2FXA, I2PJA. 3000 I2PJA. 3050 I2PJA.

SSB: 350 KC5AC, N1IR, N5KUC, N1CC, AA4UF, VU2JJQ. 400 KC5AC, N1IR, N1CC, AA4UF, VU2JJQ. 450 KC5A, N1IR, N1CC, AA4UF, VU2JJQ. 500 KC5AC, N1IR, N1CC, AA4UF, VU2JJQ. 550 IK6JYY, N1IR, KT1H, N1CC, AA4UF, VU2JJQ. 600 N1IR, KT1H, N1CC, AA4UF, VU2JJQ. 650 N1CC. 700 N1CC, SM6CST, N7JB. 750 N1CC. 800 N1CC. 850 K9ICH, EA3EJI, WN4KKN, KA9MOM, WA4PMF. 900 EA3EJI, WN4KKN. 950 EA3EJI. 1150 I3ZSX. 1200 I3ZSX. 1250 KC9DS. 1300 K2EEK, JR4NUN. 2950 I2PJA. 3000 I2PJA. 3050 I2PJA.

CW: 350 N1CC. 400 N1CC, CT4UW. 450 N1CC, CT4UW. 500 FE1JUD, N1CC, CT4UW. 550 FE1JUD, N1CC, EA2CKP, CT4UW, N7JB. 600 FE1JUD, OK1DCE, N1CC, CT4UW. 650 FE1JUD, IK3PVD, N1CC. 700 FE1JUD, IK3PVD, N1CC. 750 FE1JUD, IK3PVD, N1CC, KL7UR. 800 FE1JUD, WB5MTV, IK3PVD, N1CC, KL7UR, DJ4VP. 850 FE1JUD, JF3ARM, DJ4VP. 900 FE1JUD, LA3GI, JE3ARM, DJ4VP. 950 WN4KKN, DJ4VP. 1000 JG2LGM, DJ4VP. 1050 IK2ECP. 1100 IK2ECP. 1250 IK3GER. 1300 IK3GER. 1350 I8RFD, KBØG. 1400 I8RFD, KBØG, HP1AC. 1450 HP1AC. 1500 HP1AC. 1550 HP1AC, VE1RJ. 1600 HP1AC, VE1RJ, SM6CST. 1650 G4SSH, SM6CST. 3400 WA2HZR.

10 Meters:	DJ4VP
15 Meters:	FE1JUD, N1IR
20 Meters:	FE1JUD, N1IR, WK3Z
40 Meters:	I1-21171
80 Meters:	WK3Z
Asia:	FE1JUD, DL3ECK, DJ4VP
Africa:	DL3ECK
No. Amer.:	FE1JUD, DL3ECK, JN3SAC
So. Amer.:	EA3EJI, DL3ECK
Europe:	FE1JUD, DL3ECK
Oceania:	DL3ECK

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, VE3FXR, N4MM, KC7EM, ZS6BCR, CT1YH, IV3PVD, KA5RNH, ZP5JCY, F1HWB, KC8PG, NE4F, VE3MS, K9LJN.

Award of Excellence Plaque Holders with 160 Meter Endorsement: 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, K9QFR, NXØI, G4BUE, LU3YL/W4, I4EAT, WB4RUA, VE7WJ, N4NX, DEØDXM, VE7IG, K9BG, I1EEW, AB9O, CT1YH, IV3PVD, KA5RNH, ZP5JCV.

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," 880, CR13, Clovis, NM 88101-9511 USA.

Most IOTA DXpeditions make do with the simplest equipment, such as this trap vertical antenna of I2YDX/DU6 pictured here on Caluya island (OC-125) in 1991. (VE3XN photo)

grouped together under a single IOTA designation. For example, most of the Florida Keys (except for the Dry Tortugas) are grouped under NA-062. Finally, islands that aren't off shore by at least a minimum distance at all times don't count as IOTA entities. The existing directory not only lists those islands that already count for IOTA, but also includes potential IOTA entities, simply waiting for a valid operation to be added to the list. While there may be a few New Ones for IOTA that are not included in the directory, IOTA beginners should stick to the IOTA entities in the existing list. There are plenty of potential targets on that list.

Once you have the current IOTA directory in hand, you can start your IOTA award quest by determining how many separate DXCC countries that are islands you have confirmed. There are more than 100 such IOTA entities, so if you have an extensive DXCC QSL card collection, you may already be eligible for the basic IOTA award. Next look for QSL cards that specifically mention the IOTA designation on the card. As the popularity of the IOTA program has

The WPX Honor Roll

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with CQ Master Prefix List. Scores are based on the current prefix total regardless of an operator's all-time count. Honor Roll must be up-dated annually by addition to, or confirmation of, present total. If no up-date, file will be made inactive. Lifetime Honor Roll fee is $4.00 (U.S.) for each mode, with no fee for additions.

MIXED

4441	9N2AA	2914	N4MM	2628	9A2NA	2203	HAØIT	1905	DK5AD	1737	G4OBK	1497	W7CB	1241	TF1MM	1004	HP2CWB
4434	F9RM	2904	YU1AB	2609	YT7DX	2202	HAØHW	1868	N2AIF	1701	NV9S	1485	YBØTK	1229	KSØZ	915	W4USW
4038	K2VV	2863	WA8YTM	2561	SM7TV	2174	I2EOW	1860	K2OLG	1688	W9IL	1484	K5IID	1214	W9IAL	904	WKØB
3430	EA2IA	2862	W2FXA	2557	HA8XX	2163	K2POF	1856	YU1GR	1681	KS4S	1483	PY2DBU	1178	K7LAY	902	JN3SAC
3323	K6JG	2852	W9DWQ	2549	N2AC	2147	K5UR	1855	W8UMR	1674	S51NU	1471	WB3DNA	1165	K9BQL	851	VE7CBH
3231	VE3XN	2801	KØBLT	2546	YU7BCD	2142	I1WXY	1835	WE2L	1640	W3KH	1461	S58MU	1164	CT3CU	840	VE32OMM
3210	K6XP	2797	ZP5JCY	2530	HAØDU	2141	YU4EXA	1819	W6OUL	1638	VE1RJ	1417	IØAOF	1160	KØIFL	813	WT3W
3106	N6JV	2772	PAØSNG	2525	K9BG	2133	3A2LF	1797	VE3MS	1632	W8CNL	1405	DF4ZL	1146	N7JXS	780	VE6MBX
3101	N4NO	2762	KA5W	2449	IT9QDS	2097	S53EO	1789	YU7RU	1628	WB8ZRL	1342	KA5TQF	1133	N6IBP	770	N3KR
3025	I2PJA	2752	I1EEW	2435	K9AGB	2052	KL7AF	1785	DF6EX	1624	WB2ABD	1335	AI6Z	1125	WØIZV	755	CT1EEB
2996	N9AF	2709	IN3ANE	2384	N4UU	2052	W4UW	1768	HA5NK	1589	K5DB	1325	KC7V	1122	K7KBN	720	EA3CWK
2983	W4BQY	2707	IT9TQH	2339	UA3FT	1979	I2DMK	1762	WB4RUA	1548	LA7JO	1298	KI3L	1118	G4SDJ	711	WK3Z
2965	PY1APS	2704	W1BWS	2301	KF2O	1956	K8LJG	1749	KBØG	1532	CT1YH	1282	LU8DY	1061	HB9DDZ	640	JR3TOE
2927	SM3EVR	2674	YU7SF	2287	K9QFR	1946	N6JM	1741	SM6CST	1504	CT1QF	1267	NJ1T	1032	I1ZQD	635	JA4DUD
2924	I2UIY	2655	I6SF	2274	SM6DHU	1911	WB2YQH	1740	WA1JMP	1499	IK2ILH	1266	I2EAY	1025	NH6T		

SSB

4320	F9RM	22460	OZ5EV	2098	W9DWQ	1794	CT1AHU	1510	CT1UE	1269	I2DMK	1135	OE2EGL	1003	DF4ZL	800	KF7IO
3895	IØZV	2437	WØYDB	2087	K9QFR	1758	4X6DK	1510	KF7RU	1266	KS4S	1117	FE6FNA	976	I8ZYW	781	GØFWG
3448	K2VV	2429	NJØC	2086	I8KCI	1712	KC8YM	1509	YU7SF	1258	I8WYD	1112	WA3FKF	962	VE3MS	764	WT3W
3392	ZL3NS	2421	N4NO	2065	WF4V	1703	WE2L	1443	KAØZFX	1239	DK5WQ	1098	IK2AEQ	958	IK2DUW	755	CT1EEB
3242	VE1YX	2407	I2EEW	2046	9A2NA	1700	EA2AOM	1392	IT9JKY	1227	KBØC	1092	KA5TQF	951	KB4HU	751	EA3EQT
3031	K6JG	2405	F2VX	2004	EA3AQC	1689	CT1BY	1392	KE6KT	1226	IKØEIM	1091	TF1MM	948	HP2CWB	750	NM5Y
3015	I2PJA	2403	I8YZP	1994	YU7BCD	1686	SM6DHU	1367	N2AC	1206	W5ILR	1081	K8MDU	917	KK5P	728	CT1ZW
2917	WD8MGQ	2395	PAØSNG	1993	CT4UW	1654	IK5ACO	1360	K8LJG	1199	K3IXD	1063	CT4RH	899	AI6Z	693	CE5FSB
2833	K6XP	2390	KA5W	1969	KF2O	1645	IK8GCS	1350	LU8DY	1188	EA9LZ	1062	NG9L	869	DK7NP	683	AA4UF
2730	CT4NH	2337	I4CSP	1956	I2EOW	1600	KL7AF	1335	EA1AK	1187	CT1BWW	1044	WB6SRK	860	EA1JO	678	SM6CST
2676	ZP5JCY	2319	HA8XX	1892	LU8ESU	1592	N4UU	1327	CT1DIZ	1174	I3ZSX	1038	WB6GFJ	844	CP1FF	643	JR3TOE
2622	N4MM	2303	EA8AKN	1886	W4UW	1586	HAØIT	1317	N2AIF	1162	HP6AYV	1036	K9BQL	836	KA9MOM	618	VE1RJ
2612	IT9TQH	2282	W4BQY	1871	PY4OY	1581	IN3QCI	1310	LU7HJM	1162	G4OBK	1035	IT9SVJ	831	NH6T	612	JA4DUD
2525	I2UIY	2274	WA8YTM	1850	K5RPC	1580	CX6BZ	1305	WN5MBS	1153	K5IID	1034	HA5HK	831	IT9JPK	603	HB9DDZ
2521	EA2IA	2159	I5ZJK	1840	K5UR	1545	N6FX	1301	K2EEK	1152	W5AWT	1019	KC7V	814	KE7UH		
2481	I6ZJC	2105	WA4QMQ	1811	KD9OT	1536	K2POF	1278	IK2DUU	1141	W6OUL	1016	5Z4BP	811	KØIFL		

CW

3447	K2VV	2401	I6SF	1985	IKØADY	1668	HAØIT	1523	G3VQO	1327	DJ1YH	1138	I2EAY	923	DF4ZL	787	PY4WS
3323	WA2HZR	2400	K6XP	1866	G4UOL	1627	SM6CST	1506	N2AIF	1324	G4OBK	1133	JA9CWJ	917	EA6AAK	760	EA2CIN
3084	N6JV	2340	W4BQY	1790	EA7AZA	1618	K2POF	1504	I7PXV	1308	S58MU	1118	KS4S	908	KC7V	758	4X6DK
2835	VE7CNE	2320	N2AC	1772	KA7T	1608	N6FX	1490	OZ5UR	1306	LA8XG	1102	IK2ECP	907	K5IID	754	KA5TQF
2674	N4NO	2311	W9DWQ	1745	9A2NA	1599	KL7AF	1461	ZS6EV	1305	W5AWT	1047	K9QFR	900	3A2LF	749	VE3OMM
2666	IT9TQH	2209	LZ1XL	1721	IT9VDQ	1596	HA8XX	1442	K8LJG	1304	VE3MS	1036	KA1CLV	864	W4UW	710	HB9DDZ
2577	PY4OD	2169	WA8YTM	1715	W8IQ	1576	S51NU	1442	KBØG	1280	IK3GER	1013	WB8ZRL	847	JN3SAC	688	N5GFX
2495	EA2IA	2054	KA5W	1700	K5UR	1569	W1WAII	1408	HA5NK	1193	NJ1T	1004	AH6JF	827	WB5MTV	659	TF1MM
2495	K6JG	2042	YU7BCD	1681	SM6DHU	1567	VE1RU	1405	CT1YH	1151	ZP5JCY	952	W9IAL	794	LA7JO	630	AA6WJ
2491	W3ARK	2035	N4UU	1678	TI4SU	1556	SMØAJU	1398	VS6UW	1141	LU2YA	944	FE1JUD	789	KL7UR	617	DK6NP
2407	YU7LS	1965	N4MM	1673	G4SSH	1555	W9PWM	1357	W6OUL								
2406	YU7SF	1940	I2UIY	1671	I2DMK	1536	KF2O	1341	I1EEW								

grown, more DXers are putting any appropriate IOTA reference number on their QSLs. Next review your card collection for anyone giving his QTH as an island. You may have to locate a detailed atlas to determine the appropriate IOTA designation.

You can then begin actively chasing IOTA entities on the air. A good place to start is the IOTA nets on the weekend. Try 14260 kHz at 1300Z on Saturday, and 21260 kHz at 1300Z on Sunday. These two frequencies, plus 28460 kHz, are the standard IOTA frequencies. IOTA DXpeditions usually operate on or near these frequencies, even outside the weekend nets.

Next check out the IOTA DXpeditions announcements in the regular DX newsletters and on the air (W1AW, etc.). These usually provide a few weeks' warning of upcoming operations so that IOTA chasers can plan to make at least one contact with the island.

Both IOTA chasers and IOTA DXpeditioners will be especially active July 24-25 this year for the first-ever IOTA Contest. The complete rules are in John Dorr's Contest column; however, here are the basics. The contest runs 1200Z Saturday July 24 to 1200Z Sunday, July 25 on SSB only; 80, 40, 20, 15, and 10 meters only. Exchange signal report, consecutive serial number beginning with 001, and IOTA reference number, if you are operating from an island. Work stations in DXCC countries other than your own for 5 points, or 15 points if the contact is with an IOTA island. Multipliers are IOTA reference numbers, per band. (The full, detailed rules are available from "The DX Bulletin," P.O. Box 50, Fulton, CA 95439 for a business-sized, self-addressed, stamped envelope.) Many IOTA DXpeditioners will be planning their annual IOTA trips for this weekend, so this should be an excellent time to work dozens of relatively rare islands. And maybe you'll want to plan a IOTA DXpedition of your own that weekend. In any case, you will quickly find yourself caught up in the IOTA chase, logging island contacts, and watching for IOTA DXpeditions. And it won't be long before you'll be planning your own IOTA DXpedition, perhaps to an all-time New One!

Summer DXpeditions

Mary Lou Brown, NM7N; Alice, N4DDK; Elizabeth, VE7YL; and Nellie, XE1CI will stage an all-YL DXpedition to St. Pierre and Miquelon FP, June 22–29. They plan to assemble and operate two complete stations with 24 hour a day activity on CW, SSB, and RTTY. They may even try to get on the amateur satellites. Following the St. Pierre operation, Alice and Mary Lou will continue on to the Sept-Iles region of Quebec, which is in the relatively rare CQ Zone 2. They'll operate **/VE2** from July 4th or 5th, depending on transportation, through the 9th.

Duane Traver, WV2B, will operate as **WV2B/CY9** from St. Paul Island off the coast of Nova Scotia, Canada, July 9–12, weather permitting. His wife, Sheila, will accompany him and also will operate, if she receives her stateside license in time. Most of their operation will be on SSB, concentrating on 40

Some IOTA DXpeditions are major operations, such as the May 1991 Ouessant Island (EU-065) DXpedition. From left: F1DUX, F6AUS, F9IE, F6FVY, F6BFH, F1DLC, F1LGQ, F5JY, and F1JOT.

meters in the evening. Duane will try the new bands July 9th and 12th, and be available in the IARU HF Championship contest July 10–11. Most operation will be split frequency, with Duane listening 5–10 kHz up. He admonishes, "I will ignore partial callsigns if I can copy a complete call." As it is with *every* DXpedition, DXers should *always* transmit their complete callsign, not just a few letters. QSL via Duane's home address: 99 Oregon Hill Road, Lisle, NY 13797. Duane is a county hunter, and will operate on the 14336 kHz County Hunter's Net on the way to and from Nova Scotia. He also requests that QSLers make sure that their county is indicated on their QSL card.

5 Band WAZ

As of February 28, 1993, 352 stations have attained the 200 zone level.

New recipients of 5 Band WAZ Award with all 200 zones confirmed:
W3UM

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)	W8SEY, 199 (26)
K6YRA, 199 (34)	N7RT, 199 (34)
PY7ZZ, 199 (34)	VE7AHA, 199 (34)
KØCS, 199 (34, 40m)	W1FZ, 199 (26)
AA4KT, 199 (26)	IK2GNW, 199 (1)
K7UR, 199 (34)	W9CH, 199 (26)
K9EL, 199 (26)	ACØM, 199 (34)
NAØY, 199 (26)	SM6AHS, 198 (12, 31)
VE7DX, 199 (34)	K1ST, 198 (19, 26)
WØPGI, 199 (26)	4X6DK, 198 (4, 6)
W2YY, 199 (26)	UA3AGW, 198 (1, 12)
W9WAQ, 199 (26)	KL7Y, 198 (34, 36)
K6EID, 199 (34)	VO1FB, 198 (19, 27)
IK8CNT, 199 (12)	S59VM, 198 (3, 6)
W1JR, 199 (23)	W6TC, 198 (34, 37)

The following have qualified for the basic 5 Band WAZ Award:
WØYDB, 171 Zones

Endorsements:
K4PR, 194

812 Stations have attained the 150 zone level as of February 28, 1993.

Applications and reprints of the latest rules may be obtained by sending a self-addressed stamped envelope (75 cents) size 4 ¼ × 9 ½ to the WAZ Manager, Jim Dionne, K1MEM, 31 De Marco Rd., Sudbury, MA 01776. Applicants should include sufficient postage for safe return of their QSL cards. The processing fee for all *CQ* awards is $4.00 for subscribers and $10 for non-subscribers. 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).

Upcoming Conventions

The Radio Society of Great Britain has changed the dates of the 1993 HF Convention. It is now scheduled for Oct. 8–10 at the Beaumont Conference Centre, near London's Heathrow Airport. For more information, send an addressed envelope to the HF Committee, P.O. Box 599, Hemel Hempstead, Herts HP3 0SR, U.K.

And the Guanajuato Radio Club in Mexico is sponsoring the 33rd National Congress July 15–17, in Guanajuato, in Central Mexico. The host hotel is the Hotel Real de Minas, phone 91-473-2-14-60, or FAX 91-473-2-15-08, c/o Seronita Araceli Mares. For more information on the convention, contact the radio club at Apartado Postal 164, Guanajuato GTO, CP 136000, Mexico.

Notes From All Over

A couple of readers have inquired about the significance of receiving QSL cards in envelopes with the corners snipped off. No, this is not the US customs people sneaking a peek at your QSL. In some countries, especially Japan, there is a separate postage rate called "printed matter." This lower-cost rate is used to send publications and other non-personal mail. To permit the postal authorities in the foreign country to ensure that

The WAZ Program

Single Band WAZ

10 Meter SSB

452 .....XE1VIC 453 .....JH1FSF

12 Meter SSB

6 .....JR2KDN

15 Meter SSB

437 .....EA3CWK 439 .....JR9OPJ
438 .....WA6YOO 440 .....JH7HJL

20 Meter SSB

916 .....EA2KL

80 Meter SSB

61 .....JR2KDN

15 Meter CW

242 .....JG1DUN

17 Meter Mixed

17 .....BV2TA

WNZ

53—10 Meter SSB.....N6ZWC

ALL Phone

616 .....EA3CWK

RTTY

41—20 Meters....WA4MCZ

All Band WAZ

SSB

4039 .....VE1UK 4044 .....YV5IVB
4040 .....NX5C 4045 .....IK4HPU
4041 .....EA3CWK 4046 .....OH1BV
4042 .....EA5ZR 4047 .....VY2YT
4043 .....KD7GQ

CW/Phone

7317 .....JL1HDH 7322 (CW).....DL5HBS
7318 .....IKØQBI 7323 (CW).....HP1AC
7319 .....I1SLI 7324 .....JA2ACI
7320 (CW) .....HB9BHV 7325.....JA2NOQ
7321 (CW) NZ7W

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).

there is no personal mail enclosed, the mailer snips off a corner of the envelope. Since a QSL card may be considered "old news" and not personal mail, in some countries such cards may be returned by the "printed matter" rate. Hence, the apparently mutilated envelope.

In a far more bizarre situation, several readers have reported getting a QSL card for **4U1ITU** in a unique fashion. A QSL card sent to DF8AN was apparently returned marked "repour, zuruck." The back was marked "refuse." However, inside the envelope was not only the return envelope, but also a

CQ DX Awards Program

SSB

1998	N4VRR	2003	WBØYEA
1999	W8AXI	2004	KN4ZT
2000	KO4GN	2005	DL1RDP
2001	YB8GH	2006	KA4RAW
2002	KQ4GC		

CW

873	4X4VF	875	AB4NS
874	K4IQJ	876	W5OG

SSB Endorsements

320	YU1HA/327	320	WD8PUG/321
320	K4MZU/327	320	WS9V/321
320	DJ9ZB/327	320	W6NLG/320
320	K2FL/327	320	IK8GCS/320
320	WB1DQC/327	320	W5LLU/320
320	XE1AE/327	310	KF5AR/319
320	WA4IUM/327	310	WA6DTG/318
320	W9DWQ/327	310	YV5IVB/314
320	K2TQC/327	310	K4LR/313
320	K5OVC/326	300	G4NXG/M/305
320	W4EEE/326	275	KA4RAW/296
320	W4UW/326	275	WA8AXI/293
320	EA2IA/326	275	WA5SUE/291
320	L9BWQ/326	275	KD9CN/284
320	AI8M/325	275	YV1JV/282
320	KZ4V/325	275	K2EEK/280
320	WB3DNA/325	250	N6CFQ/250
320	VE2PJ/325	200	VE1RJ/239
320	KA3HXO/325	200	N4VRR/223
320	SV1ADG/325	200	HP2CWB/221
320	W2CC/324	200	WBØYEA/200
320	OE2EGL/323	28 MHz	W8AXI
320	K8YVI/322	Mobile	W8AXI

CW Endorsements

320	K2FL/327	310	W1WAI/317
320	YU1HA/327	310	N7MC/317
320	K1MEM/327	310	W5OG/315
320	K2TQC/327	310	KUØS/310
320	DL1PM/326	300	WB5MTV/309
320	W9DWQ/326	300	KA7T/302
320	K9BWQ/326	300	AA2X/300
320	WA4IUM/325	275	YV5ANT/294
320	KZ4V/323	275	N4OT/284
320	DL3RK/323	275	W3HQU/276
320	W7ULC/321	250	K7JYE/266
320	KZ4V/325		

Total number of active countries is 323. 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.

QSL Information

3V8AS to IK5GQM
3XØHLN to IK2OPZ
4J4GC to UG6GAW
4K2MAL to UA4RC
4K2OKV to UA9MA
4K2RRC to I1HYW
4N4CR to SM5AQD
4N5RB to YU5XTC
5H3OH to OH2BAA
5H3RA to JA3PAU
5R8DG to F6FNU
5R8DJ to DL7FT
5T5CJ to W4BAA
5T5SN to FD1RUQ
5Y4FO to KB4EKY
6FØS to AA7FM
6O/G3KOX to G3KOX
6W1QB to DK3NP
7Q7CM to N2AVR
7Q7WW to KD6WW
7Q7ZZ to JA1UMN
7Z1IS to OE6EEG
8P9BU to KU9C
8Q7ZL to DK3ZL
9J2AS to JH3RRA
9K2GS to WB6JMS
9K2MU to 9K2AR
9K2USA to K8EFS
9K2ZZ to W8CLN
9Q5US to DL3KBH
9V1XE to DL4DBR
9X5SW to DL1HH
A22GH to G3KMQ
A35QC to JF1WQC
A41KL to N7RO
A71AL to OE6EEG
C6AHJ to AA2Z
C91J to W8GIO
CR3DIG to DJ8OT
D68FT to DL7FT
EA9UK to EA9LZ
EL2SM to SM3HLL
ET2A to WA2NHA
EX9DZ to UF6DZ
FG4FR to F6FNU
FG5FZ to F6FNU
FH5EJ to F6EBA
FK8GJ to F6CXJ
FM2GO to FB1MUX
FM3DW to W3SNK
FO5BI to F6HSI
FW1FM to F6HUJ
FY5YE to W5JLU
H27W to 5B4WN
H44IO to DL7VRO
H44VU to DL4YAH
HC8A to WV7Y
HC8J to WV7Y
HC8N to AA4BT
HH2Z to KA9RLJ
HKØ/AA5AU to KA6V
HKØOEP to HKØNZY
HP1XBH to W4YC
HSØZAA to KM1R
HZ1AB to K8PYD
J28BG to FD1RRH
J28BM to K1SE
J37K to W8KKF
J41WPX to SV1FH
J5UAI to NW8F
J68DA to YT1AD
J68DQ to YU1RL
J76EK to N6EK
JD1MAO to JA1GUC
JW7FD to LA5NM
JW9MAA to LA7SP
JW9VDA to LA9VDA
JY4ØVJ to DL1VJ
JY9VC to DK9VC
JY9ZK to KA5ZMK
KH6/N3KEG to KB3TS
KH8/DL7VTK to Y23UO
N9OQS/T5 to WN2R
OA4CWR to K3JXO
OD5/SP7LSE to SP7EJS
OD5WS to YO9FVU
OHØMAM to OH2MAM
OM3LA to OK3LA
OM3WW to OK3WW
OX3EW to KB5LRO
OX3MZ to OZ1KHZ
P4ØAA to AA4NC
P4ØJ to WX4G
P4ØMR to VE3MR
P4ØNA to DL6NA
P4ØX to N6BT
P4ØZJ to DL6NA
PJØB to WA2NHA
PJ9JT to W1AX
PYØFM (1993) to PY5CC
RAØFA to KM6ON
RO4DA to SP9HWN
RT4UA to DK1RV
SØ1A to EA2JG
SØRASD to EA2JG
S21ZG to SP5IUL
S21ZM to SP5IUL
S51DX to YU3HR
S52AA to YT3AA
S57AL to YT3SW
S57BU to YU3BU
S57DX to YU3BQ
S57MM to YU3EA
S57MX to YU3MX
S57OM to YU3QM
S58WW to YU3HP
S59DBC to YU3DBC
S59EIJ to YU3EIJ
S59UN to YU3ZV
S59VM to 4N3AA
S59ZA to YU3XU
S59ZZ to YT3HM
S79FIB to SMØFIB
S79MD to FD1ITD
S79MST to G4IRG
SZ9A to SV9AKI
T3ØDS to DJ9ZB
TA3AK to DL5YCQ
TA3PB to DL5YCQ
TI4CF to TI2CF
TN1AT to F6FNU
TR8LC to FD1PYJ
TZ6RM to K5UK
UA8TAB to I8KUT
UC2LBF to DL1GWS
UF6FDS to UF7FWA
UI8GA to DL1GWS
UJ8JI to IK3HHX
UN7LC to IØWDX
UN9LM to UL7LAH
UO5ODA to FD1JOE
USØU to K8YSE
V29SW to DL1HH
V31DX to KA6V
V31RA to KO4KM
V31RO to JH1ROJ
V73C to OKDXA
V7A to OKDXA
VK9LM to DJ5CQ
VK9LS to JA2NQG
VP2E/WB9HRO to WB9HRO
VP2MLD to KC4DWI
VP2V/W7YS to W7YS
VP5P to WB3DNA
VP5VDY to WB9HRM
VP8VN to G4GLZ
VQ9AC to WN8O
VQ9WM to K7IOO
XQØX to CE3ESS
XT2BW to WB2YQH
XU2ZP to LA2ZP
XU7VK to HAØHW
XX9TFN to DK9FN
Y88POL to Y32WN
ZA1J to I2MQP
ZA1W to HB9BGN
ZB2JL to N5OKR
ZD8DEZ to GØDEZ
ZD8DX to WB2K
ZD9CQ to ZS6SA
ZF2SM/ZF8 to KQ2I
ZF2TN to OH6ZS
ZL7AA to ZL2AL
4JØQ to P.O. Box 50, Riga 226010 Russia
4M7I to I2CBM, P.O. Box 4, 27029 Vivevano, Italy
4N5FK to P.O. Box 45, Kocant, Macedonia
5B4ABR to P.O. Box 568, Nicosia, Zypern, Cyprus
5X1A to P.O. Box 3316, Kampala, Uganda
6W1PZ to P.O. Box 2053, Dakar, Senegal
7X2FK to P.O. Box 105, Rouiba 35300, Algeria
8P6AA to ARSB, P.O. Box 814/E, Bridgetown, Barbados
9X5AB to Bernhard Ahlborn, Box 420, Kigali, Rwanda
A35KB to Kevin Burke, P.O. Box 1, Nuku'Alofa, Tonga
A42A to P.O. Box 981, Muscal, Oman
ET3JR to Jacques Leleizour, P.O. Box 1464, French Embassy, Addis Ababa, Ethiopia
FK8FR to P.O. Box 2319, Noumea, New Caledonia
FO4DL to Daniel Leduc, P.O. Box 14262, Arue, Tahiti
FR5AI/G to P.O. Box 49, St. Francois, Reunion, Via France
FR5GM to A. Dufour, P.O. Box 1222, St. Denis f-97400, Reunion
HKØNZY to P.O. Box 951, San Andres, Colombia
PZ2AW to E. Lie A. Young, P.O. Box 4224, Nickerie, Suriname
TA3D to P.O. Box 963, Izmir, Turkey
TA8C to P.O. Box 13, Gaziantep, Turkey
TR8YA to P.O. Box 511, Port Gentil, Gabon
V51BG to P.O. Box 2177, Windhuk, Namibia
YI1DZ to Diya, P.O. Box 7361, Baghdad 12216, Iraq
YI9CW to P.O. Box 11, Warsaw 93, Poland

4U1ITU QSL card! The US$2.00 sent with the card was missing. The outer envelope was neither cut nor torn, so it must have been steamed open. DF8AN has been using this unique method to avoid the high cost of German postage for at least a year, as readers mentioned receiving 4U1ITU cards from a 1991 operation in a similar fashion. One reader felt that this violated DXCC ethics, and protested to the DXCC desk, to no avail.

Bill Kennamer, K5FUV, the ARRL's DXCC Specialist, explained that the DXCC desk did not feel that this was a violation of DXCC Rule 12 (ethics) because the DXers had received their QSLs cards from DF8AN without any requirement for additional payment. (Several of the readers who reported receiving their cards in this unorthodox manner agreed. They had their cards; what difference did it make how they got them?) Bill said this appeared to be a case of mail fraud against the German postal system, but not a DXCC problem. He did say that the DXCC desk would send a letter to DF8AN asking him to stop this practice, if they heard from more than the one DXer who complained.

DF8AN is apparently adept at opening and resealing envelopes. "A real professional job," is how one DXer describes the returned envelope.

If you received your 4U1ITU card in this manner and feel the practice should be nipped in the bud, drop a line to that effect to the DXCC desk. Meanwhile, perhaps the German postal service should have a talk with DF8AN. And maybe 4U1ITU should deny future operating privileges to DF8AN. What do readers think of this situation?

Abu Ail deleted. The ARRL Awards Committee has unanimously agreed with the DX Advisory Committee's recommendation to delete the Abu Ail Islands A15 from the DXCC countries list, effective March 31, **1991**. The Abu Ail islands in the Red Sea were added to the DXCC countries list in 1971, following an operation of **ET3ZU/A**. They were considered a separate DXCC

country because the islands were controlled by the Red Sea Lights Company, a multi-nation consortium that operated the lighthouses on several of the islands at the narrow mouth of the Red Sea. This put the islands on a separate status from the surrounding countries of Yemen, Ethiopia, and Djibouti. Because the Red Sea Lights Company was not an actual government, it didn't have a specific prefix assigned by the International Telecommunications Union (ITU). Thus the operators from the Lights used a variety of different callsigns, such as FL8OM/A, J20/A, G5ACI/AA, and finally A15AA-AC. However, in early 1991 the Red Sea Lights Company dissolved, as the nations in charge of the company declined to continue funding it. Nearby Yemen took over the task of maintaining the vital navigational lights. However, the change in status of the "government" of the islands led to their removal from the DXCC countries list. *(Thanks to Bill Kennamer, K5FUV, and "QRZ DX" for this information.—ed.)*

Possible Mellish Reef DXpedition: An international group of DXers has formed a team with the plan of activating **Mellish Reef VK9M** this fall. This expedition is scheduled for mid to late September 1993. The operators include Bill, VK4CRR; Harry, VK2RQ/VK2BJL; Steve, P29DX/G4JVG; Murray, WA4DAN; and Jack, KB7NW, who will captain the yacht *Banyandah* on yet another Pacific DXpedition. Jack captained the *Banyandah* on the successful 1982 Mellish Reef/Willis Island DXpedition among others. Harry, VK2RQ/VK2BJL, is a veteran of two previous Mellish Reef DXpeditions, including the one in 1982.

The group plans to have three to four stations operational around the clock during the eight-day stay on the reef. Operations will be on 160 through 6 meters, utilizing mono-band Yagis on the higher bands, and a combination of verticals and wire antennas on the lower frequencies. Legal-limit amplifiers will be used.

Applications for funding are being mailed to all DX foundations and clubs. This letter is part of a grass-roots campaign to get the word out and to appeal to interested DXers worldwide to help support this very difficult undertaking. A substantial deposit has already been made on the yacht *Banyandah*. Generators, antennas, masts, fuel, coax, tents, etc., will need to be purchased. The estimated cost for this DXpedition is approximately U.S. $30,000. If you would like to support this DXpedition, we would like to hear from you. Any contributions will be appreciated and used for the non-personal expenses on the DXpedition.

Any donations, questions, or additional information requests should be directed to Murray Adams, WA4DAN, or Bill Horner, VK4CRR, at the addresses listed below. Checks should be made out to the "1993 Mellish Reef DXpedition." In the event the DXpedition is canceled, all monies will be returned. Please enclose an SASE so we can mail you an update before we depart for Mellish Reef. Please pass the word to all your DXer friends. Thank you!

Mailing addresses: Murray D. Adams, WA4DAN, 1993 Mellish Reef DXped, 403 East 14th Street, Greenville, NC 27858; or Bill Horner, VK4CRR, 1993 Mellish Reef DXped, 26 Iron Street, Gympie QLD 4570, Australia.

QSL Notes

QSL Good Guy: F6CYV, QSL manager for **TK5A**, has returned a voluntary donation of $1.00, and included a preprinted form with QSLs, explaining that the self-addressed, stamped envelope (SASE) provided was sufficient to return the card direct. Wouldn't it be wonderful if more DXers and QSL managers would follow this fine example!

QSL the 1992 WPX CW and 1993 ARRL CW contest operation of Cayman Island club station **ZF1A** via KT6V.

QSL the **T31AF** Canton Island by Karl Hille, DL1VU, via Rainer Kuhnberger, DL2MDZ, Friedrichstr. 10, W-8662, Helmbrechts, Germany. QSL Karl's operation as **T30CT** via Karl's home address: Goethestr. 3, W-8172 Lenggries, Germany. QSL cards will be printed after Karl returns to Germany in a few months. "Donations are never expected but always welcome."

Here's yet another reminder that the 1993 *Callbook* address for Antoine Baldeck, **F6FNU** is his summer address, and should not be used. Send *all* QSL requests for stations managed by F6FNU via B.P. 14, 91291 Arpajon Cedex, France. Remember to include a tip in addition to return postage.

QSL **HC8A** operations since 1990 via Betsy Townsend, WV7Y, P.O. Box 644, Spokane, WA 99210. (HC8A is a reissued callsign; operations prior to 1990 have different QSL routes.)

QSL **RAØFA** on the Sakhalin Island via Mike Jakiela, KM6ON, P.O. Box 286, Poway CA 92074.

Getting QSLs from **Cuba CO** is difficult for US amateurs, because of the mail embargo between the two countries. Fernando J. Muguerza, XE2FL, has offered to help with Cuban QSLs; contact him at Apartado 91, 66200, San Pedro Garza Garcia NL, Mexico.

QSL the Philippine station **4F3AAL**

via Ed Schneider, AA7AN, 6502 Wildcat Drive, Cave Creek, AZ 85331.

CO2MA reports that the **T434R** QSLs from the end of 1992 are ready to be sent out. QSL via the 1992 Callbook address of CO2MA.

QSL Rado Skrajnar, **S59ZZ**; Srecko Ribic, **S52FW**; Jan Vaupotic, **S53JW**; Roman Markrab, **S57WW**; Silvo Knuplez, **S52OX**; and Denis Farkas, **S57ZO** via P.O. Box 1, 69240 Ljutomer, Slovenia, Europe.

The QSL cards for the 1992 CQWW SSB of **J68DX, J68AL, J68AP, J68MR,** and **J68WZ** are due out soon, according to Wayne Yoshida, KH6WZ.

WD6DZV, QSL manager for **P29KH** and **HKØEHM,** does not accept cards via the bureau, according to the "D" sorter for the W9 bureau. Try direct.

Bob Winters, **KD7P**, leaves Guam this summer. Any QSL requests after July 15 should be sent via his father: Frank Winters, P.O. Box 1585, Snhomish, WA 98291.

QSL Ross Tharenou, **SV5BOP**, direct to: P.O. Box 22, Lardos 85109, Rhodes Island, Greece. Ross says he has a problem with the Greek bureau, and receives cards only once a year.

TU2FU/F was a pirate operation; *don't* QSL via NTØW.

TL2RR is another pirate; *don't* QSL via OH2AC.

QSL **9A2WV, YU2WV,** and **5NØ/YU2WV** via operator Vladimir Pavlica's address: P.O. Box 312, 51000 Rijeka, Croatia.

QSL **TG9AJR** either direct to Juan Carlos Munoz R., P.O. Box 329 I, Guatemala City 01907, Guatemala, or via QSL manager WA1ECA. (IØWDX is *no longer* TG9AJR's QSL manager.)

QSL **RF5FF/RO6, RB5FF/ER1, ROØF, ERØF,** and **RYØF** via QSL manager Robert Schwiegerhausen, DF8BK, Goebenstr. 7, D-2800 Bremen 1, Germany.

Tom Victor Segalstad, LA4LN, has a new address: P.O. Box 15, Kjelsas, N-0411, Oslo, Norway. Tom handles QSLs for **G5BLT, GM5BLT, J37ZF, JW4LN, KH6/LA4LN, KH8/LA4LN, OHØ/LA4LN, OY/LA4LN, LA4LN/TF, LC1J, XE1ISC,** and **8P9CR.** Operations by Tom's wife LA2SR QSL via this new address: **G5BPQ, J37ZG, OHØ/LA2SR, OY/LA2SR, LA2SR/TF.**

QSL **UL7FCW, UL7FCG, UL7FEC, 7P8AK, ZS6AHB,** and **ZS6AS** via John Rouse, KA3DBN, 2703 Bartlett Lane, Bowie, MD 20715.

QSL Bosnia-Hercegovina stations **4N4, KRS, LJ, EKK, K, QSO, SOS, EZE, EAM, EKC, ESP, DNO, SGG, OE, DEJ, W, AA, GJK, DXZ, ENO, SVR, ESG, EDK, CB, WXX, DMO, HB, ESM, EVC** via Mehned Avdibagovic DJØQJ, Friedrichrodaerstr 67b, W-1000 Berlin 46, Germany. Donations toward equipment for 4N4 operators would be appreciated.

Controversy swirls around the handling of QSL requests for the **VU7SF/VU7API** Laccadives operation. Those DXers who misinterpreted the QSL route of Philip Ollapally, W2XP, as a QSL manager sent only a US SASE. Since the QSL cards were to be mailed from India (W2XP is a mail drop only), many of these 29¢ SASEs were returned with a note asking for more money. Many DXers who received this note were incensed that their valid SASE had been used to request more money, when it could have been used to post QSLs drop-shipped back from India. Since the VU7SF/VU7API operation has *not yet* been accepted for DXCC credit, we suggest DXers hold off on QSLing until more information is available.

QSL **YIØEP** via W8MEP, as the former QSL route is now a Silent Key.

WB6JMS asks that any remaining QSL requests for XF1C on Cedros island be sent to him soon, so that he can close out the logs. However, Jim states that he is not the QSL manager for the 1993 WPX SSB operation of XF1C, from the Gulf of California.

73, Chod, VP2ML

WASHINGTON READOUT

REGULATORY NEWS IN THE WORLD OF AMATEUR RADIO

BY FREDERICK O. MAIA, W5YI

Where Things Stand! A Rundown on Important Amateur Radio Rulemaking

We routinely follow all FCC rulemaking that impacts the Amateur Service. Right now we are tracking a multitude of potentially new regulations that the Federal Communications is considering for the Amateur Service. We thought you would be interested in them and their status.

Permissible & Prohibited Amateur Communications (PR Docket 92-136)

Background: This rulemaking got its start nearly two years ago when the FCC suggested permitting "other than regular" amateur communications on the amateur bands. Historically, amateurs have been restricted to emergency, technical, and non-business personal communications. The Commission has been overwhelmed in recent years with a profusion of requests from the amateur community to deviate from the established communications content rules permitted in Part §97.113. Basically that rule bans all communications with "business" substance of any type.

Amateur radio was never intended to be a communications service to assist public safety and other government agencies, or for things such as logistical support for parades and other events, classroom instruction, ordering supplies for remotely located organizations, supplying news to the media, selling amateur gear, rebroadcasting non-amateur communications, or for expediting the personal and club business of ham operators. In fact, these communications are specifically outlawed from the amateur bands. Still, the FCC gets dozens of requests to permit this type information to be handled on amateur frequencies.

Discussion: In trying to find a way to accommodate the steady stream of these requests, the FCC initially thought that perhaps a system of communications priorities might allow amateurs to more fully participate in non-amateur communications. Initially, three types or levels of amateur communications were suggested: Priority, Primary, and Secondary.

Those communications which involve emergencies and disasters where the safety of life and property are at stake would be "Priority." Primary communications would be the currently authorized amateur communications. The transporting of all other non-amateur information would be Secondary.

The FCC also remarked that perhaps amateurs might even be permitted to discuss any type of personal and business communications on the amateur bands as long as their communications service was not sold. They listed three possible exceptions: Morse code practice and information bulletins where the operator might be compensated as an employee, and classroom instruction where the teacher was paid.

The challenge is how to write a simple, easy-to-understand rule that allows an expansion of amateur communications without throwing open amateur frequencies to those who would exploit them commercially. The Commission asked for recommendations from the American Radio Relay League.

National Volunteer Examiner Coordinator, P.O. Box 565101, Dallas, TX 75356-5101 (817-461-6443)

Status: The ARRL responded in January of last year by agreeing that the FCC should indeed relax the no-business communications rule and legalize more types of communications. They suggested that amateur radio operators should be permitted to conduct communications for themselves or for others that " . . . could reasonably be furnished alternatively through other radio services" as long as they did not do so " . . . on a regular basis."

The League also felt that all " . . . communications for hire or for material compensation direct or indirect, paid or promised" except classroom instruction, telegraphy practice, and information bulletins should be outlawed. Surprisingly, the League's proposal did not address the use of amateur radio spectrum for personal business use, a key component of the FCC's original proposition. The Commission repeatedly mentioned the possibility of using amateur radio to conduct personal business, such as for ordering a pizza or making a hotel reservation, on the amateur air waves!

Exactly a year ago the FCC released its long-awaited Notice of Proposed Rulemaking (NPRM) to change the "Prohibited Transmissions" rule §97.113 in the Amateur Radio Service. What the Commission did was to basically adopt the ARRL-suggested communications guidelines. The public comments had a cutoff date of October 1.

The ARRL did not define what "on a regular basis meant" in their proposal and that drew a big response from the amateur community. Many amateurs did not want retention of their amateur ticket premised on a term that would be subject to wide interpretation. In their reply comments the League referred to their " . . . on a regular basis" term by saying that a " . . . degree of rigidity . . . does not properly belong in the content rules for the Amateur Radio Service."

Probable Conclusion: This entire proceeding has now gone through all of the required avenues of the Administrative Proceeding Act which defines how our government must change rules. And everyone is waiting with baited breath for the final rules from the Commission, which could come any day now. The FCC schedule calls for the "no business" amateur radio communications rule amendment sometime around mid-year 1993. Well, it is now mid-1993!

The results of this proceeding could be very far reaching indeed! Public comments have suggested that the matter is very complicated and many issues were raised. One thing for certain, however, the new government guidelines are certain to increase the importance and value of amateur radio to everyone. And that is good.

Our guess, and it is strictly a guess, is that amateur radio will be relaxed to the point where it becomes more or less a personal and public communications service. It appears certain that the present restrictions on the content of amateur communications will be eased, since everyone involved is in favor of some form of relaxation. The big question is, of course, to what degree will the "loosening" reach. It might be that just about any kind of communications will allowed on the amateur bands as long as amateurs don't market (sell) their communications capability as common carriers. Remember, that

concept was originally brought up by the Commission some two years ago!

Folding Novice Into The VEC System (PR Docket 92-154)

Background: The FCC makes no bones about the fact that they are very pleased with how the VEC program has been going. Up until 1984 the FCC spent hundreds of thousands of dollars maintaining and conducting the Amateur Service's license examination program. The government said it was costing them $7.26 to administer an amateur radio exam to a person. Using that figure, it would have cost the government nearly a million dollars to examine applicants for amateur tickets last year. Under the VEC system this cost is shifted away from the taxpayer.

There are actually two examination programs in the Amateur Service. Novices are still tested informally by two volunteer examiners. The Technician through Amateur Extra Classes are tested under the VEC System which uses teams of three accredited volunteer examiners (VEs) to conduct the examinations. The VEs are managed by a volunteer-examiner coordinator (VEC) who acts as the link between the FCC and the volunteer testing community. They also develop all of the examination questions, including those for the Novice class. Since all VEC System examination teams are known, it is a relatively simple administrative job to keep the VE teams up-to-date.

Discussion: In February 1992 both the ARRL-VEC and W5YI-VEC, which account for 85% of all VEC testing, asked the FCC to also include Novice Class testing under the VEC System. Errors are less frequent in the VEC System. Novice applications have an error rate that approaches 10%. VEC System applications have less than 1% errors. Error handling is not only costly to the government, it also slows down license issuance, since the applications must be returned for correction.

The data on the Novice system is also incomplete, since the FCC has no idea how many people fail the exam, unlike the VEC System where the passing rate is closely monitored as one of its vital signs. Having only one testing system would also simplify the application Form 610 by eliminating the separate certification section and Novice instructions. And the safeguards in the VEC System minimize the potential for fraud.

The single biggest advantage, however, is that the Novice level volunteer examiner will be kept current on test questions and procedures, since their identities will be known. Such is not the case right now.

Status: On July 1, 1992 the FCC adopted a Notice of Proposed Rulemaking which looked toward consolidating the two testing programs. "Our experience with the VEC System and with the current Novice examination system indicates that the VEC System is the superior system," the FCC said. "The informal ad hoc Novice system is inefficient and susceptible to various irregularities." The Commission pointed out that all Novice examinations are currently being administered in the VEC System as a part of other classes of operator licenses.

The FCC proposed to include the responsibility for the preparation and administration of Novice Class operator license examinations under the VEC System with the same conditions that apply to the four higher classes of licenses. These conditions include requiring each VE to be accredited by a VEC, three VEs for the administration of an examination, coordination by a VEC of each examination session, issuance of a Certificate of Successful Completion of Examination (CSCE) to every examine who scores a passing grade on an examination element, and expense reimbursement to the testing community. That means a test fee. Public comments closed on October 9th; reply comments a month later.

CIRCLE 67 ON READER SERVICE CARD

Probable Conclusion: Some commenters said that bringing the Novice testing program under the VEC System would reduce examination opportunities for newcomers. The League replied that there is no statistical evidence to support that claim. Actually, the Technician Class is now far and away the entry path of choice into amateur radio for beginners, and their testing at VEC sessions has not adversely impacted their numbers. Quite the contrary. The number of new Technician Class amateurs is skyrocketing!

A few amateurs also believed that Novices might not be able to travel to existing VEC System test sessions. Actually, General Class examiners in every community could establish VEC System test sessions of their own. The W5YI-VEC also suggested that General Class VEs be authorized to conduct Technician Class examinations, since this examination requires more examiners and would more positively impact the General Class VE, some of whom might feel they are losing testing privileges.

This rulemaking is also due out any day now, and the odds are that the FCC will be adopting their NPRM as proposed.

VHF/UHF Rules Changes To Affect Novices (PR Docket 92-289)

Background: The American Radio Relay League requested in two rulemaking petitions that a new subband be created at 222.0 to 222.15 MHz for weak-signal and experimental communications, and that Novice frequency privileges be extended to the entire 222 to 225 MHz band. The ARRL believes that the weak-signal subband should be decided by regulation rather than local frequency coordinators. Dr. Michael C. Trahos, KB4PGC, also petitioned the FCC to allow Novices to be control operators of repeaters at 222 and 1270 MHz.

Discussion: The FCC combined these three petitions and said that they believed they all had merit. A Notice of Proposed Rulemaking was issued last December adopting the three proposals. The comment period closed on February 23, reply comments on March 23.

Status: The FCC is now analyzing the input from the public. Repeater users are up in arms over the possibility that repeater spectrum which is used by thousands may be reduced to allow for experimental and weak-signal work by a relative handful. And there is an objection to inexperienced Novices being allowed to operate repeaters. There seems to be little opposition, however, to Novices having access to the entire 1.25 meter band.

This item is being handled by Monty DePont, attorney in the FCC's Washington, DC Personal Radio Branch. He said it will be "summer" before final action takes place on this matter.

Probable Conclusion: A *Report and Order* adopting the matter as proposed is anticipated.

New Novice and Technician Question Pools (Elements 2 and 3[A])

Background: Section §97.523 of the FCC rules for the Amateur Service requires that "All VECs must cooperate in maintaining one question pool for each written examination element. These question pools must contain at least ten times the number of questions required for a single examination. Each question pool must be published and made available to the public prior to its use for making a question set." That's the law. The VECs Question Pool Committee began reviewing all Element 2 (Novice) and Element 3A (Technician) examination questions last summer.

Discussion: All examinations questions and multiple choices for all five written Amateur Radio operator license tests are revised on a four-year cycle. The amateur community participates in this process by submitting their recommendations for examination topics and questions. Novice and Technician are reviewed together, since they are the sole requirement for the new no-code Technician license. Volunteer examiners must begin using the new questions in their examinations every July 1st.

Status: The Question Pool Committee determined and released the new Element 2 and Element 3A question pools into the public domain last December. They contain approximately 15% less questions. There were 719 questions in the previous pools; only 620 in the current set.

A list of all questions in the new Element 2 and 3A pools is available from The W5YI Group, P.O. Box 565101, Dallas, TX 75356 for $3.50 postpaid (VISA, MasterCard call 1-800-669-9594 toll free).

Most license-preparation publishers have agreed to have their new Codeless Technician study manuals available in the publishing marketplace during May 1993. The new Gordon West "No Code Plus" manual with answer explanations is available from The W5YI Group for $9.95 plus $3.00 at the above toll-free number.

Probable Conclusion: The newly revised Element 2 and 3(A) question pools must be used in all Novice and Technician written examinations administered after June 30, 1993. All VECs and VEs will use exactly the same word-for-word questions, multiple choices, and answers. The Novice examination has not yet been included under the VEC System, so General Class amateurs and higher who wish to examine the Novice Class should obtain the needed testing materials from any VEC. (You can telephone our VEC office during business hours at 817-860-3800.)

The next question pool to be revised will be the General Class. The QPC will begin working on these questions shortly and will release a new Element 3B question pool by year end. The new General Class questions must be used effective July 1, 1994. New Advanced Class questions take effect on July 1, 1995; Amateur Extra Class on July 1, 1996.

Licensing of Visiting Foreign Amateurs (PR Docket 92-167)

Background: This rulemaking suggests a novel licensing scheme whereby all foreign licensed amateur radio operators temporarily visiting the United States would be able to operate their amateur radios for up to 60 days. The FCC issues about 2100 one-year reciprocal permits annually to amateurs from the countries whose governments have signed reciprocal agreements with the United States.

The only way an amateur from a country that does not have the reciprocal agreement can get on the air is to pass the exams. Both of these procedures are time consuming.

Discussion: A new rule being considered would complete the whole process during one quick visit to a VEC System exam session. It would work like this: VE teams would determine the extent of a foreign ham's operating privileges and determine how this most closely corresponds with U.S. privileges. A 20-question multiple-choice test on FCC rules and regulations (pass rate 90%) would then be administered to the visiting foreign amateur. A VE team issued CSCE (Certificate of Successful Completion of Examination) would validate immediate 60-day operation. The VECs would keep track of these authorizations by maintaining a database of all 60-day temporary operating permits.

Status: Comments closed on this NPRM on October 26th, reply comments on November 30th. Some of the comments indicate that VE teams might have a difficult time deciphering the operating privileges granted by a foreign amateur ticket, most of which are in an unfamiliar language. On the other hand, hundreds of reciprocal operating permits are currently issued to foreign amateurs annually by the Commission.

The FCC in Gettysburg also has the same problem, but manages to issue the permit anyway. Even if a foreign license cannot be fully understood, the FCC has a Part 97 regulation that covers the situation. The rules governing the issuance of a reciprocal permit (see §97.107) state that the " . . . operating terms and conditions [of a reciprocal permit are those] issued by the alien's government . . . not to exceed the privileges of an Amateur Extra Class operator license."

The FCC is still reviewing the comments on this one, and final Commission action is not anticipated until June or July.

Probable Conclusion: The chances of this rulemaking becoming law appear slim, since the ARRL is on record as opposing the procedure. They would rather see the United States work toward a common licensing program of radio amateurs throughout the world.

Privatizing Commercial Radio Operator Examinations (FO Docket 92-206)

(FO stands for Field Operations Bureau, rather than PR, Private Radio.)

Background: Because of budgetary constraints, the FCC asked for and received legislation authorizing it to delegate the examination of commercial radio operators to non-government organizations. Currently, there are eight types of commercial radio licenses and two types of endorsements. The newest class of license is the Global Maritime Distress and Safety System Radio Operator's license.

Discussion: Actually, this proceeding started in the Field Operations Bureau (FOB) since it was they who administered the examinations. Last fall, the responsibility for Commercial Radio Operator examinations was transferred to the Private Radio Bureau and PRB has now assumed control of the rulemaking. The Notice of Proposed Rulemaking asked the public for their views on how such a private sector program should be structured.

Status: The comments and reply comments have now been analyzed by the PRB. On January 14th the FCC issued a Report and Order transferring the handling of all future Commercial Radio Operator license examinations to the private sector.

The FCC's new Commercial Radio Operator testing program will be directed by private groups known as Commercial Operator Licensing Examination Managers (COLEM). A COLEM, the commercial counterpart of the Amateur Service's VEC, will be certified once they enter into a Memorandum of Understanding with the government in much the same manner as VECs. The FCC's new Commercial Radio Operator examination program is patterned after the successful VEC System in the Amateur Service.

Probable Conclusion: Meanwhile, the FCC has discontinued their semi-annual testing of Commercial Radio Operators and has established an interim testing plan for individuals who, by Commission Rule, must have a Commercial Radio Operator license for employment.

These individuals may apply for a special examination at one of the FCC's field offices by presenting a letter from an employer stating that he or she are to be employed in a position that requires a Commercial Radio Operator license.

The FCC had received approximately 1800 applications for the February 1993 Commercial Radio Operator examinations which were canceled. The FCC has adopted a one-time interim examination procedure for these applicants which permits applicants or Commercial Radiotelephone licenses to be examined by other commercial operator licensees with an equal or higher class license.

A sealed envelope containing the examination will be forwarded to the applicants for this purpose. The examiner must sign and return a certification sheet, answer sheet, and exam-

ination back to the FCC within 60 days. Special Commercial Radiotelegraph examinations will be administered at FCC Field Offices if requested by applicants who filed an application prior to March 19th.

The FCC said it expected to have private examination sessions available to the public on a regular basis in the summer of 1993.

Special Callsign System

Background: According the FCC, the most asked question is "How can I get a specific callsign?" As it is now, you can change your callsign, but you cannot get a specific combination. A ham's license information is kept for two years beyond expiration in the FCC's database. This is to provide a grace period for those who forget to renew their expired licenses. The two-year grace period was added when the FCC started issuing licenses for ten-year terms. At one time, the operator portion of the license had a five-year grace period.

In 1989 the FCC terminated in a proceeding that looked into whether a custom-assigned callsign system could happen using private-sector support. The FCC concluded that such a system would be too costly. Some amateurs offered to pay for callsigns, but the FCC does not have authority to charge a fee for the amateur service license.

Discussion: On October 23rd the FCC was hand-delivered a letter from the American Radio Relay League seeking to implement new legislation which provides for tax-exempt organizations authorized by the FCC to provide military-recreational and amateur radio club callsigns.

The ARRL wants to issue radio club callsigns from a dedicated callsign block such as from WC#BAA through WC#ZZZ. The League asked that they be designated as the exclusive club and military recreational station callsign administrator.

Status: Eyebrows were raised a year ago when the Voice of America Amateur Radio Club was issued the special callsign K3VOA in commemoration of VOA's 50th anniversary. Their previous call was K3EKA. The special callsign assignment was ordered by FCC Chairman Alfred Sikes, who probably was not aware of the furor it would cause.

There may be hope, however, that someday the general amateur population may be able to request an amateur callsign of their choice.

Probable conclusion: At the Annual VEC Conference held in Gettysburg, Pennsylvania last year, Ralph Haller, Private Radio Bureau Chief, told the assembled VECs that "Software is being written as I speak that will permit the FCC to accommodate requests for special amateur callsigns within the next three years, although the target date is less." There will be a fee attached to the special callsign which Haller hopes " . . . can go to Gettysburg to finance the service."

We checked on the status of a new computer system that is in the process of being implemented in Gettysburg and found that it is due to come on line within six months! We will probably be hearing more about special callsigns shortly!

Automatic Control of HF Packet

Background: Several amateur stations have been operating high-frequency digital communications under a Special Temporary Operating Authority (STA) for more than five years! The one-year authority has been extended five times. The American Radio Relay League has now proposed permanent rules governing HF data operation under automatic control.

Discussion: The current rules do not permit automatic networking below 50 MHz, and third-party traffic must use the AX.25 packet protocol. The big concern about HF packet is the potential for "robot" stations to interfere with HF amateur band operation. HF packet appears to work well, and "tons" of messages move along the network.

It was agreed that any HF packet operation should be conducted on specific subbands rather than being allowed on

entire bands. A compromise plan to permit semi-automatic control was criticized as unworkable and unacceptable by HF packeteers.

Status: An IARU (International Amateur Radio Union) Region 2 General Assembly meeting produced an HF band plan with provided for automatically controlled data communications. These segments, which include all bands between 80 and 10 meters, provide for all digital modes, including new Clover and Pactor systems. Any HF data operation outside these segments must be under local control.

Probable Conclusion: The FCC has not yet issued a Notice of Proposed Rulemaking, but it is anticipated that they will do so shortly.

Packet Message Forwarding (PR Docket 93-85)

Background: Early in 1991 several amateurs were cited for unknowingly and automatically retransmitting an anti-war packet message supposedly originated by another politically active amateur. The message urged amateurs to vote against the Persian Gulf war by telephoning "900-44-NO WAR" to tell President Bush "NO WAR." It wound its way through several packet stations before being killed.

Discussion: The Commission believed that the message was a prohibited communication in that it advanced the business interests of "The Coalition to Stop U.S. Intervention in the Middle East." Furthermore, "900" phone calls almost always generate revenue, which presented the likelihood that this also might be a fund-raising scheme being promoted on the amateur bands.

Status: The FCC action faulting amateurs for automatically retransmitting questionable messages they did not originate caused immediate havoc in the ham community. Under the current rules each amateur licensee is fully responsible for assuring that the contents of every transmission from his or her station comply with the rules. Many said the amateur high-speed packet network would have to shut down, since there was no way thousands of messages passing through a mail switch could be reviewed by a human control operator one by one.

Probable Conclusion: The Commission now agrees that message screening of automatic data systems is difficult and diminishes the advantage of high speed. It has now issued a Notice of Proposed Rulemaking that would establish a compliance policy of holding the licensee of the station originating a message and the licensee of the first forwarding station accountable for the transmission of prohibitive communications. Under this approach, amateurs who only retransmit messages within a high-speed message forwarding system would not be responsible for the messages they forward or their stations retransmit unwittingly.

It will be a while before the Commission takes final action on their NPRM, but its chances of final approval appear good.

Spectrum Sharing— Wind Profilers, AVM, and Such

Background: The electromagnetic radio spectrum is a precious natural resource, and one which is limited. There is just so much to go around. Today we live in an age of exploding wireless technology, and the need for radio frequencies far outstrips the supply. Wireline and fiber-optics can effectively carry just about unlimited point-to-point communications. Delivery by radio waves is necessary when hard-line tethering is impractical.

Since just about all of the usable radio spectrum has been assigned to different uses, the only way new emerging technology and uses for radio can unfold is to share common radio wavelengths. All amateur bands at the UHF and higher frequency are shared with other services. We must get used to the fact that we are simply tenants in an apartment house and must get along. If we don't, eviction is a distinct possibility.

Discussion: The FCC has proposed new sharing partners for amateur radio in the 70 cm and 3 cm amateur bands. Wind profilers are ground-based radars which measure wind speed and direction in real time. Currently this is accomplished by airborne balloons called radiosondes, which must be released manually. We share the 420–430 MHz amateur band with the government, and they want wind profilers at 449 MHz. The FCC had little choice but to go along with the proposal.

The 33 cm ham band at 902–928 MHz is used very little by amateurs. The FCC has suggested that a new Location and Monitoring Service (LMS) be located in that band. One of the uses of LMS is for automobile vehicle monitoring (AVM), the electronic counting of vehicles. Spectrum allocation rules say that amateur radio is secondary to AVM use at 33 cm. This means we can't interfere with the service.

Status: Both matters are at the Notice of Proposed Rulemaking stage. The NPRMs were issued almost simultaneously during mid-March. It will be some time before the comments are analyzed and the path of action determined.

Probable Conclusion: It appears almost a certainty that these proposals will be adopted. The spectrum needs of both of these new services have been under study for many years.

Packet at 219–220 MHz (PR Docket 93-40)

Background: Since narrow-band business channels and amateur communications are not compatible, the FCC divided the 1.25 meter amateur band in 1990 into two exclusive segments. Land mobile got 220–222 MHz, amateurs 222–225 MHz. The loss of the shared access to 220–222 MHz was a hard blow to the amateur community, since they were in the process of establishing a high-speed inter-city packet network on the spectrum.

The FCC said they would entertain a proposal for replacement spectrum to relocate these networks if a way could be found to coexist with current users.

Discussion: After extensive testing, the American Radio Relay League filed a petition with the FCC seeking shared access to the 216–220 MHz band which is used by a variety of radio services. Primary users are maritime inland waterway communications and a new Interactive Video and Data Service (IVDS) which will link viewers with TV stations. The FCC agrees, however, that additional frequencies are needed for amateur wideband packet networks.

Status: The FCC has now released a NPRM proposing to allow amateurs to construct their backbone packet networks in the 219–220 MHz band. They chose not to permit shared access between 216 and 219 MHz due to possible interference to TV channel 13 at 216 MHz and the new IVDS.

The Commission believes that amateurs possess the necessary expertise to design their network so as to avoid interference to other services and to resolve any interference that may inadvertently occur.

Amateur stations operating within 50 miles of a maritime coast station must obtain written approval from maritime station. Amateur packet stations between 50 and 150 miles of a maritime station must notify the station in writing of their planned operation at least 14 days in advance. Amateur transmitter power is limited to 50 W PEP.

Probable Conclusion: This one also has a very good chance of becoming law, since it has been thoroughly coordinated with the present users of the 219–220 MHz band. It will be at least a year, however, before the FCC will be able to take final action, since the matter must go through the required public comment process. 73, Fred, W5YI

PROPAGATION

BY GEORGE JACOBS, W3ASK

THE SCIENCE OF PREDICTING RADIO CONDITIONS

As Expected, Sunspot Numbers Continue to Decline

The present solar cycle, the 22nd observed since accurate records have been kept, reached peak intensity during July 1989 with a smoothed count of 159. The cycle had a secondary peak 148 in February 1991. Since that date Cycle 22 has been declining steadily towards a minimum value, which is expected to occur by 1997.

The Royal Observatory of Belgium reports a mean sunspot number of 90.5 for February 1993. Daily values ranged between a high of 134 on February 8 and a low of 22 on February 1. February's mean value results in a 12-month running smoothed sunpot number of 84 centered on August 1992.

A smoothed sunspot number of approximately 60 is forecast for June 1993.

The Dominion Radio Astrophysical Observatory of Canada reports an adjusted mean value of 139 for the February 1993 10.7 cm solar flux level. This results in a smoothed value of 139 centered on August 1992. A level of approximately 105 is expected during June 1993.

Fig. 1 graphically depicts progress to date of sunspot Cycle 22 in terms of sunspot data and 10.7 cm solar flux values. This data has been prepared by Hirman and Greer at the Space Environment Services Center, NOAA, Boulder, Colorado. Note the close relationship between the cyclic behavior as determined by telescopically recording sunspots and the cyclic behavior as determined from radio measurements of solar flux.

Sunspots have been observed telescopically for more than 300 years, and daily records are available since the mid-18th century. Today sunspots are observed telescopically each day by a worldwide network of solar observatories. While the telescope at each participating observatory is calibrated against a standard, results can vary between observatories, since the measurements strongly depend on observer interpretation and experience and on the stability of the earth's atmosphere above the observing site. To compensate for differences, the daily international number is computed by the Royal Observatory of Belgium as a weighted average of measurements made from the network of cooperating observatories.

Shortly after the end of World War II, scientists found a relationship between radio energy emitted by the sun in the microwave range and sunspots. A worldwide network now measures this energy, called *solar flux*, on about a dozen different frequencies ranging from approximately 245 MHz to 15.4 GHz, or approximately between one meter and one centimeter in wavelength.

The solar-flux measurements are made at each observatory at the same local time each day. The measurements are more consistent, considerably less variable, and more objectively determined between observatories than is the case with telescopic viewing of sunspots. However, unlike the more than 200 years of unbroken daily telescopic observations of sunspots, continuous daily solar flux records go back to only February 1947.

In North America the Dominion Radio Astrophysical Observatory of Canada, located at Penticton, BC, provides daily solar flux measurements made at 2800 MHz, or 10.4 cm.

11307 Clara Street, Silver Spring, MD 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for June 1993

	Expected Signal Quality			
Propagation Index.....	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 12, 15, 21	**A**	**A**	**B**	**C**
High Normal: 1, 8, 11, 16, 18, 22, 28	**A**	**B**	**C**	**C-D**
Low Normal: 2-3, 6-7, 9, 14, 17, 19-20, 23-24, 27, 29-30	**A-B**	**B-C**	**D**	**D-E**
Below Normal: 4-5, 10, 13, 25	**B-C**	**C-D**	**D-E**	**E**
Disturbed: 26	**C-E**	**D-E**	**E**	**E**

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

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

C—Fair opening, signals between moderately strong and weak, varying between 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 good (B) on June 1st, good-to-fair (B-C) on the 2nd and 3rd, fair-to-poor (C-D) on the 4th and 5th, good-to-fair (B-C) on the 6th and 7th, etc.

June Propagation

Typical summertime ionospheric propagation conditions are expected on the HF bands during June. With the sun at its highest point in the northern sky, solar absorption is expected to be at a near seasonal peak in the northern hemisphere. This should mean considerably weaker signals during daytime DX openings. On the other hand, much improved conditions are expected during the early evening hours and through the period of darkness. This is a normal summertime condition—better DX conditions during the period of darkness than during the daylight hours. However, there should also be ample opportunity for some good DX openings during the daylight hours as well.

Thunderstorm activity peaks during the summer months, and this is expected to result in considerably higher static levels on the HF bands during June.

With a moderate level of solar activity expected this summer, DX conditions should be somewhat reduced from what they have been for the past several summer seasons.

Despite a seasonal decrease in DX propagation on 10 and 12 meters, some fairly good openings should be possible during June to southern and tropical areas. Expect the band to peak for DX openings during the late afternoon hours.

The best daytime DX bands during June should be 15 and 17 meters. Worldwide openings should be possible, but conditions will be best towards southern and tropical areas. Expect the band to peak for DX signals during the late afternoon and early evening hours. Due to the increase in solar activity, DX should be possible on this band well into the evening hours.

While DX openings to one area of the world or another are forecast almost around the clock on 20 meters, optimum conditions are expected during the early evening hours, with good conditions throughout the entire period of dark-

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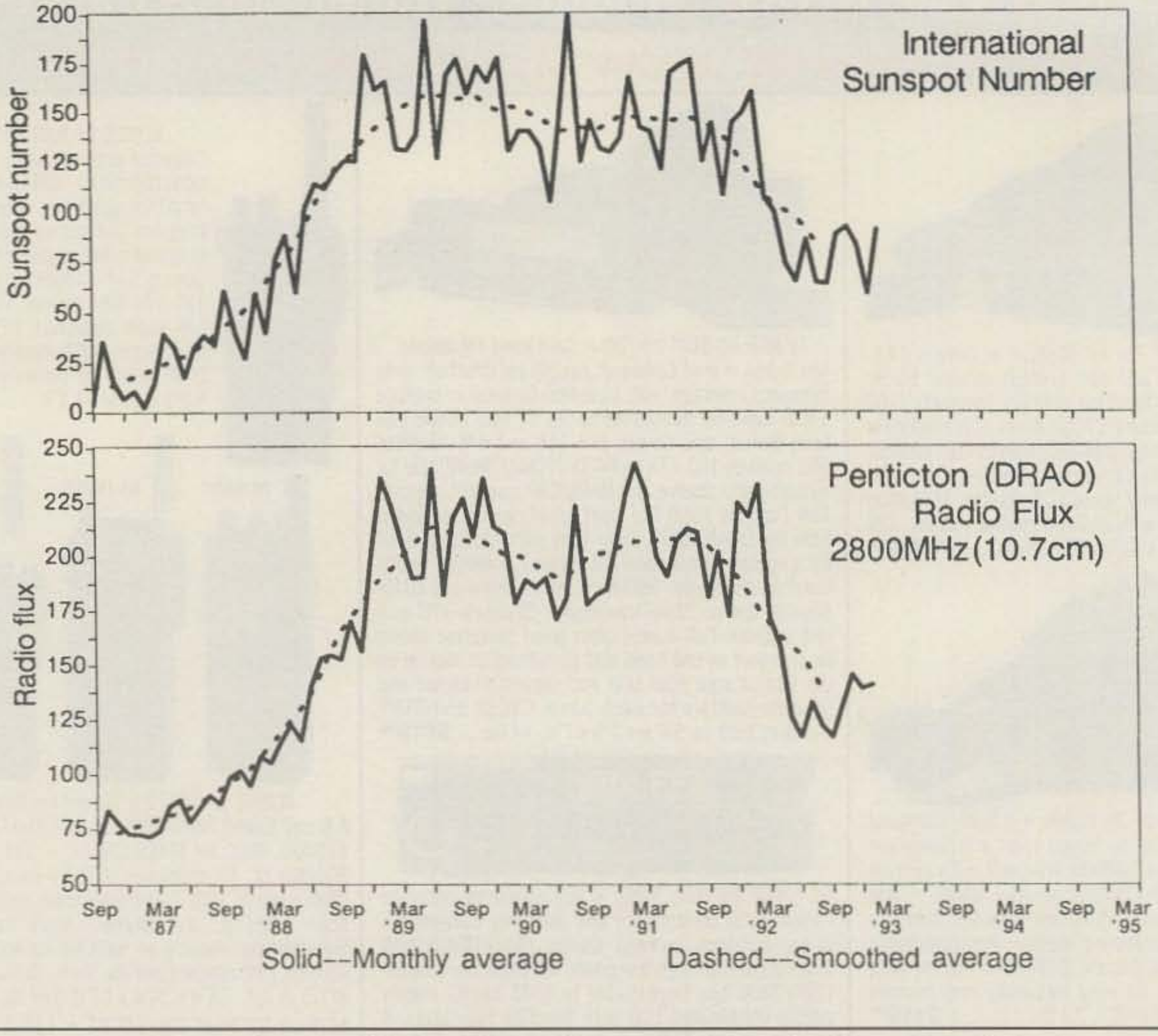

Fig. 1– Progress of sunspot Cycle 22 since its birth during September 1986.

ness. During June and the summer months expect 20 meters to be the best DX band during the nighttime hours. This also results from the increase in solar activity, and while it may take some getting used to, the signals will be there on 20 meters from sundown to sunrise from all areas of the world, and often with exceptionally strong signal levels!

With fewer hours of darkness and a sharp seasonal increase expected in the level of static, DX conditions on 30 and 40 meters are not expected to be as good during June as they were earlier this year. Nevertheless, the bands should open to many parts of the world from shortly before sunset and remain open to just after sunrise, often with exceptionally strong signals. These should be good DX backup bands to 20 meters during most of the period of darkness.

The shorter hours of darkness and seasonally high static levels are expected to adversely affect DX propagation on both the 80 and 160 meters bands during June and the summer months. DX openings to some areas of the world are forecast for 80 meters during the hours of darkness, but signals will often be weak and noisy. Not much DX is expected on 160 meters until the fall, but an occasional opening may be possible during the hours of darkness.

Plenty of good short-skip openings are expected on the HF bands during the month. For distances less than 250 miles, try 80 meters during the day and 160 meters at night. For openings between 250 and 750 miles, 40 meters should be best during the day and 80 meters at night. Twenty meters should be optimum for openings during the day between 750 and 1300 miles, with 30 and 40 meters best from sundown to midnight and 80 meters from midnight to sunrise. Between distances of 1300 and 2300 miles use 20 meters during the day and 30 and 40 meters at night. Frequent short-skip openings, resulting from sporadic-E propagation, are also expected on 10, 12, 15, and 17 meters over distances between approximately 600 and 1300 miles. Fifteen and 17 meters should open over longer distances, up to 2300 miles, during the afternoon hours.

This month's *CQ* Propagation Charts contain DX predictions for the period of June 15 through August 15, 1993. Short-Skip Charts for June for openings between 50 and 2300 miles and from Hawaii and Alaska appeared in last month's column.

VHF Ionospheric Openings

Sporadic-E propagation increases considerably during June and the summer months, and this is expected to result in fairly frequent 6 meter short-skip openings over a range of 1000 to 1400 miles. During periods of widespread and intense sporadic-E ionization, two-hop 6 meter openings may occasionally be possible up to distances of approximately 2500 miles.

An occasional sporadic-E opening on 2 meters can occur, particularly when ionization is very intense, over distances between approximately 1200 and 1400 miles.

While sporadic-E propagation can occur at any time, hence its name, it is most likely to take place between 10 AM and 2 PM and again between 6 and 10 PM local daylight time.

Meteors from the *Herculids* and *Scor-*

HOW TO USE THE DX PROPAGATION CHARTS

1. Use chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4, and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9, and 0 areas; the Western USA Chart in the 6 and 7 areas; and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 meters) for a particular DX region, as shown in the left-hand column of the charts. An * indicates the best time to listen for 160 meter openings.

3. The propagation index is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of days during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual dates on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. Appropriate *daylight* time is used, not GMT. To convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts CW, or 1 kw, PEP on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 dB gain above these reference levels, the *propagation index* will increase by one level; for each 10 dB loss, it will lower by one level.

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

June 15–August 15, 1993
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

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

Time Zones: CDT & MDT (24-Hour Time) CENTRAL USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	*Nil*	15-18 (1)	05-06 (1) 06-08 (2) 08-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-22 (3) 22-00 (2) 00-02 (1)	20-23 (1) 23-01 (2) 01-02 (1) 22-00 (1)*
Northern & Central Europe & European USSR	*Nil*	13-17 (1)	05-06 (1) 06-09 (2) 09-15 15-18 (2) 18-21 (3) 21-00 (2) 00-01	20-00 (1)
Eastern Mediter-ranean & Middle East	*Nil*	15-18 (1)	13-16 (1) 16-18 (2) 18-22 (3) 22-00 (2) 00-01 (1) 07-09 (1)	21-23 (1)
Western Africa	16-18 (1)	10-13 (1) 13-15 (2) 15-17 (3)	14-15 (1) 15-16 (2) 16-18 (3)	20-00 (1) 22-00 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina, & Uruguay	12-14 (1) 14-16 (2) 16-18 (3) 18-19 (1)	08-09 (1) 09-11 (2) 11-15 (1) 15-16 (2) 16-17 (3) 17-20 (4) 20-22 (3) 22-23 (2)	11-16 (1) 16-17 (2) 17-18 (3) 18-02 (4) 02-04 (3) 04-07 (2) 07-09 (3) 09-11 (2)	20-21 (1) 21-22 (2) 22-02 (3) 02-04 (2) 04-05 (1) 22-03 (1)*
McMurdo Sound, Antarctica	*Nil*	16-20 (1)	17-19 (1) 19-23 (2) 23-01 (3) 01-03 (2) 03-05 (1) 07-09 (1)	02-05 (1)
Eastern & Central Africa	16-18 (1)	13-15 (1) 15-16 (2) 16-17 (3) 17-18 (2) 18-19 (1)	15-17 (1) 17-18 (2) 18-21 (3) 21-23 (2) 23-01 (1)	20-23 (1)
Southern Africa	10-12 (1)	09-10 (1) 10-12 (2) 12-13 (1)	22-00 (1) 00-03 (2) 03-07 (1) 13-15 (1) 15-17 (2) 17-19 (1)	21-22 (1) 22-00 (2) 00-01 (1) 22-00 (1)*
Central & South Asia	*Nil*	10-12 (1) 18-21 (1)	17-19 (1) 19-22 (2) 22-03 (1) 05-07 (1) 07-09 (2) 09-10 (1)	*Nil*
Southeast Asia	*Nil*	10-12 (1) 19-22 (1)	04-07 (1) 07-09 (2) 09-10 (1) 22-23 (1) 23-01 (2) 01-02 (1)	03-05 (1)
Far East	*Nil*	10-15 (1) 18-20 (1) 20-22 (2) 22-23 (1)	05-07 (2) 07-09 (3) 09-10 (2) 10-12 (1) 20-22 (1) 22-00 (2) 00-02 (3) 02-03 (2) 03-05 (1)	04-05 (1) 05-06 (2) 06-07 (1) 04-06 (1)*
South Pacific & New Zealand	18-20 (1)	13-16 (1) 16-18 (2) 18-20 (3) 20-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	17-19 (1) 19-23 (2) 23-01 (4) 01-05 (3) 05-07 (2) 07-09 (4) 09-11 (2) 11-13 (1)	23-01 (1) 01-03 (2) 03-05 (3) 05-07 (2) 07-08 (1) 01-04 (1)* 04-06 (2)* 06-07 (1)*
Austral-asia	17-20 (1)	14-15 (1) 15-17 (2) 17-19 (1) 19-20 (2) 20-21 (3) 21-22 (2) 22-23 (1)	22-00 (1) 00-01 (2) 01-05 (3) 05-07 (2) 07-09 (4) 09-11 (2) 11-12 (1)	01-03 (1) 03-07 (2) 07-08 (1) 03-06 (1)*

Caribbean, Central America & Northern Countries of South America	10-13 (1) 13-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	07-09 (1) 09-10 (2) 10-11 (3) 11-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	02-05 (2) 05-07 (3) 07-10 (4) 10-11 (3) 11-13 (2) 13-16 (3) 16-22 (4) 22-02 (3)	19-20 (1) 20-23 (4) 23-00 (3) 00-03 (2) 03-05 (3) 05-06 (1) 20-21 (1)* 21-23 (2)* 23-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	12-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	07-08 (1) 08-10 (2) 10-14 (1) 14-16 (2) 16-19 (4) 19-20 (3) 20-22 (2) 22-23 (1)	14-16 (1) 16-17 (2) 17-18 (3) 18-23 (4) 23-02 (3) 02-05 (1) 05-07 (2) 07-10 (1)	20-21 (1) 21-22 (2) 22-02 (3) 02-03 (2) 03-05 (1) 20-03 (1)*
McMurdo Sound, Antarctica	*Nil*	15-16 (1) 16-19 (2) 19-21 (1)	17-19 (1) 19-23 (2) 23-01 (3) 01-03 (2) 03-05 (1) 07-09 (1)	03-06 (1)

Time Zone: PDT (24-Hour Time) WESTERN USA TO:

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

Month	1986	1987	1988	1989	1990	1991	1992	1993
Jan.	—	18	58	142	151	148	124	*71*
Feb.	—	20	65	145	153	148	115	*69*
March	—	22	71	150	152	147	108	*66*
April	—	24	78	154	149	147	103	*64*
May	—	26	84	157	147	145	100	*62*
June	—	28	94	158	144	145	97	*60*
July	—	31	104	159*	141	146	91	*58*
Aug.	—	35	114	158	141	146	84	*56*
Sept.	12	39	121	157	142	145	*82*	*54*
Oct.	13	44	125	157	142	142	*79*	*53*
Nov.	15	47	130	158	142	138	*76*	*52*
Dec.	16	51	138	153	144	132	*73*	*51*

*Table I– Progress of sunspot Cycle 22 and predictions for the remainder of 1993. Predicted values are shown in Italics. *denotes peak of Cycle 22.*

	20-21 (1)	18-19 (3) 19-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	23-00 (3) 00-03 (4) 03-05 (3) 05-06 (2) 06-08 (3) 08-09 (2) 09-13 (1) 13-15 (2) 15-17 (1)	01-05 (3) 05-06 (2) 06-08 (1) 01-04 (1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-13 (2) 13-15 (1) 15-17 (2) 17-18 (1)	09-11 (1) 11-14 (2) 14-16 (3) 16-19 (4) 19-20 (2) 20-21 (1)	18-01 (4) 01-03 (3) 03-05 (2) 05-08 (3) 08-11 (2) 11-14 (1) 14-16 (2) 16-18 (3)	19-21 (1) 21-23 (3) 23-04 (2) 04-05 (1) 20-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	13-15 (1) 15-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	08-11 (1) 11-16 (2) 16-17 (3) 17-19 (4) 19-20 (2) 20-21 (1)	14-16 (1) 16-18 (2) 18-19 (3) 19-23 (4) 23-01 (3) 01-02 (2) 02-05 (1) 05-07 (2) 07-10 (1)	20-21 (1) 21-00 (2) 00-02 (1) 02-03 (3) 03-04 (2) 04-05 (1) 02-04 (1)*
McMurdo Sound, Antarctica	*Nil*	17-21 (1)	16-18 (1) 18-19 (2) 19-24 (3) 24-03 (2) 03-07 (1)	00-06 (1)

*Indicates best times to listen for 80 meter openings. Openings on 160 meters are also likely to occur during those times with 80 meter openings are shown with a Propagation index of (2) or higher.

**Indicates best times to listen for F-2 layer openings on 6 meters.

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.

piids showers are likely to enter the earth's atmosphere during the first half of June. Although classified as minor showers, some meteor-type propagation should be possible on the VHF bands between June 3 and 5, when both showers should peak in intensity.

Trans-equatorial (TE) scatter openings are expected to fall off considerably during June, but a rare opening on 6 meters may be possible between 8 and 11 PM local daylight time on long north-south paths which cross the geomagnetic equator at an approximate right angle. TE openings, if they are to occur at all, will favor locations in the southern tier states.

While very little auroral activity is expected during June, some may occur during periods of radio storminess. Check the Last Minute Forecast at the beginning of this column for those days in June which are expected to be Below Normal or Disturbed. These are the most likely days on which auroral activity may occur.

73, George, W3ASK

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10M BOOKS: "The Ranger Cookbook" (AR3300, AR3500) $15; "The Uniden Cookbook" $20, "Uniden Updates" (supplements) $12; "The RCI Handbook" $20. Inquiries: LSASE! Bud Stacey, KC4HGH, P.O. Box 907, Satsuma, AL 36572.

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IMRA-International Mission Radio Assn. helps missioners—equipment loaned; weekday net, 14.280 MHz, 1:00-3:00 PM Eastern. Sr. Noreen Perelli, KE2LT, Fletcher Street, Goshen, NY 1 0924.

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PSE QSL! An Expert's Guide to Amateur Radio QSL'ing. By CQ's Bill Welsh, W6DDB. Every imaginable facet from designing to ordering to filling them out to filing them. Card sources, postage usage, bureaus, much much more. $9.95 + $2 s/h ($3 foreign) from Tiare Publications, P.O. Box 493, Lake Geneva, WI 53147. Visa/Mastercard welcome. US $ only.

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R-390-A SERVICE: Module repair and alignment to complete remanufacture, new front panels, knob sets, VFO calibration, new filter capacitors, tubes, squelch modification, 20 years expert service, 2-week turnaround, very reasonable, any condition accepted. Call 419-726-2249.

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Advertiser's Index

(continued on page 147)

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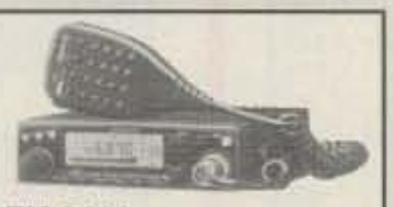

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More Punch!

Our dynamic **Speech Compressor** increases transmitter output signal strength, to punch through crowded bands and less-than-perfect conditions.

More Clarity!

All other radios in this price class use double conversion circuitry. ICOM uses **Triple Conversion** to improve in-coming signal quality and suppress interference.

More Speed!

Band Stacking Register snaps you back to the last frequency you were on — for contesting, multi-banders. **Direct Digital Synthesis** means fast digital T/R.

More Selectivity!

You won't find **PassBand Tuning** at twice the price! PBT lets you narrow the IF passband width, to zero in on just the signal you want to hear.

IC-728 HF All-Band Transceiver

More of what you buy a radio for! The entry-level IC-728 lets you *hear and be heard* better than any other transceiver in its class... because if offers high-performance features previously available only on higher-priced models.

IC-729 HF All-Band Plus!

The NEW IC-729 offers every features of the IC-728, **plus 6-meters, AM/FM, and a tone encoder!*** It's like getting the best 6-meter radio for approximately $300! *Attention NoCoders: the IC-729 means you can learn on the best, then expand your world as you upgrade your license!*

**optional UT-30 required*

Now Available!
The AT-160 Antenna Tuner

Fast, compact, simple & smart, the CPU-controlled AT-160 matches your 160M-10M antenna in less than 3 seconds, even when switching bands! Designed as a component, it lets you customize your station. The compact AT-160 mounts directly to the transceiver, forming one integrated unit, automatically controlled from the transceiver.

For more information, call
1-206-450-6088

ICOM America, Inc., 2380-116th Avenue N.E., Bellevue, WA 98004

All stated specifications are subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 728493

ICOM
Experience the Quality

FT-2400 Military Spec'd TOUGH

NOTHING COMPARES...

Whether you're roughing it on the tortuous dirt roads of the Baja 1000 or through the big city canyons, the ruggedly designed FT-2400 is built to take the abuse. In fact, the FT-2400 is the first and only amateur radio to be awarded a MIL-STD-810 rating for the shock and vibration. That's why Yaesu is the official radio of the Nissan off-road race teams.

Exceptional features are packed into the FT-2400 such as: **■ LCD Display — the largest display available on any 2 meter mobile ■ Alpha Numeric — for entering names or callsigns ■ Backlit DTMF Microphone — for making autopatch calls safely at night ■ 31 Memories ■ Odd Splits — on any memory channel ■ 3 Selectable Power Level Outputs — 50, 25 and 5 watts or user select ■ Advance Track Tuning (ATT) — eliminates big city intermod ■ Automatic Display Dimmer — 4 levels ■ FM Modulation — for true voice clarity ■ DTMF Selective Paging (optional).**

Other features include: Wideband receiver coverage 140-174 MHz RX, 140-150 MHz TX • CTCSS encode built-in and selectable from the front panel • Five scanning functions: Band Scan, Limited Band Scan, Memory Scan, Memory Channel Lock-out with Selectable Scan Stops and Priority Scans • One piece die-cast construction with extra large heat sink • Automatic Repeater offset • Programmable call channel.

Options: DTMF coded squelch and paging (requires FRC-6 paging unit) • CTCSS Decode Unit (FTS-17A).

If you're serious about affordable communications, you'll want the FT-2400. Contact your Yaesu dealer today.

YAESU

Performance without compromise.℠

One-Year Limited Warranty on all Amateur Radio Products.
Specifications subject to change without notice.

Passed MIL-STD-810
Shock and Vibration Test

NEW

FT - 7400 UHF VERSION
NOW AVAILABLE

SHOWN ACTUAL SIZE

"The FT-416 comes in black – or gray!"

"New sculpted design, built-in VOX, back-lit DTMF pad, Yaesu's "Straight A's"! Wow!"

"Yaesu did it again!"

FT-416/816
2-Meter/70cm Handheld

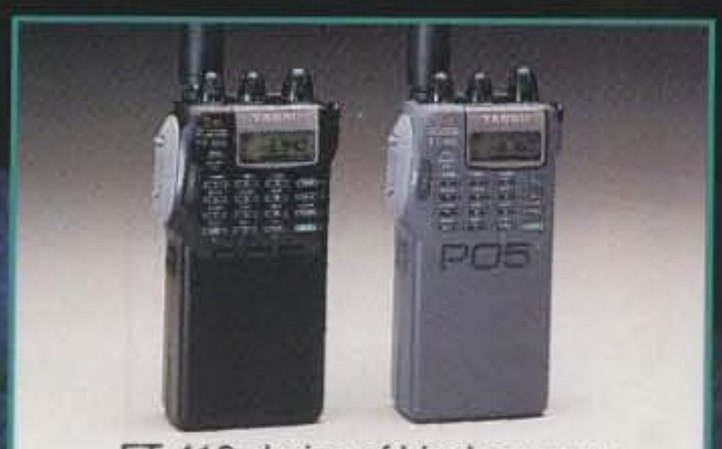
- Frequency Coverage
  FT-416:130-174 MHz RX
  140-150 MHz TX
  FT-816:430-450 MHz RX/TX
- 41 Memories (Odd splits on any channel)
- 4 TX Power Levels
  w/FNB-25 2.0, 1.5, 1.0, 0.5W
  w/FNB-27 5.0, 3.0, 1.5, 0.5W
- CTCSS Encode/Decode
- ATS, Automatic Tone Search
- ATT, Advanced Track Tuning
- ABS, Automatic Battery Saver
- APO, Automatic Power Off
- Direct 12V DC Input (5 Watts Output) 5 Watts w/FNB-27 Battery
- Back-lit Keypad and Display
- DTMF Paging and Coded Squelch
- Built-in VOX
- **Accessories:**
  Compatible with most FT-530 and FT-415 Series accessories. Selected batteries in gray.

In great design "form follows function." Only then does breakthrough design evolve. Our new generation of HTs exemplifies this with the exciting FT-416.

An industry first, a choice of colors – traditional black or new-age gray, and a dynamic ergonomically sculpted case that fits your palm like a friend's handshake are only the beginning. New ridged Control Knobs with numbered VOL insure perfect tuning. And, there's a new molded PTT with functions so perfectly aligned they respond to the slightest thumb flex.

Packed with features, the FT-416 has built-in VOX, four-way scan, the largest, brightest DTMF key pad in its class and Yaesu's famous "Straight A's": ATS – Automatic Tone Search, ATT – Advanced Track Tuning, ABS – Automatic Battery Saver and APO – Automatic Power Off. And, Power Output up to 5 Watts.

During testing amateurs found this newest evolution in design remarkably unique. "You have to try it to believe it!", they said. So we invite you to do just that. Contact your Yaesu dealer today and find out what true evolution in design means to you.



FT-416 choice of black or gray
FT-816 black only

SPECIAL INTRO. PRICE SEE YOUR DEALER FOR DETAILS.

YAESU

*Performance without compromise.*SM

The newest evolution in design.

FT-890AT
Compact HF Transceiver

- Automatic Antenna Tuner Hybrid High Speed Design Covers 160-10 meters
- I.P.O. Intercept Point Optimization
- DDS-Direct Digital Synthesis
- F.S.P. Frequency Shift Speech Processor
- General Coverage Receiver 100 KHz to 30 MHz
- Pass Band Shift and 30db Notch Filter
- Noise Blanker with Adjustable Pulse Width
- Built-In Iambic Keyer
- 32 Memories plus 20 VFOs
- FM Repeater Operation Automatic 10 Meter Repeater Offset w/Selectable CTCSS Encode
- All Mode Squelch
- DFCS-Duct Flow Cooling System
- **Accessories:** Contact your Dealer for full details.

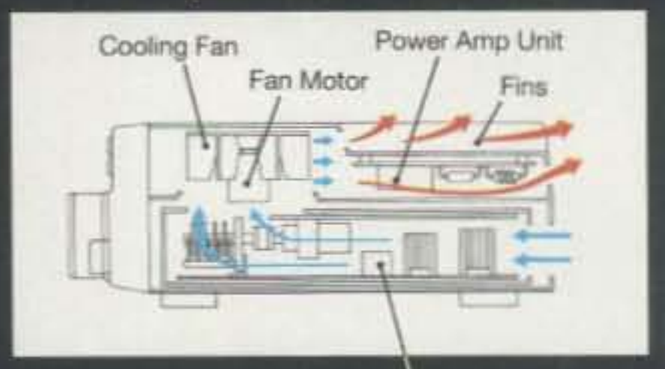
Field days and contesting are challenging. We built the FT-890AT for times when you need the high performance of a base station – like the FT-1000 – but the practicality of a compact, rugged mobile. In fact, the FT-890AT is the mobile version of the FT-1000. Designed to be the world's smallest HF with a built-in antenna tuner, its superior receiving performance is a direct result of FT-1000 technology.

Since field work is demanding, the front panel has been simplified. Seldom used VOX controls are on the back. For faster TX/RX switching, the FT-890AT has two direct digital synthesizers (DDSs). With its unique duct flow cooling system, die-cast aluminum upper case and heat sink, the FT-890AT can't be beat for superior field work and DX-peditions.

Not just a "field" radio, with the optional FP-800 AC Power Supply, MD-1C8 Desk Mic and YH-77ST Headphones you've got a performance-plus base station loaded with features and affordably priced.

To see what that means for you, contact your Yaesu dealer today.

Duct Flow Cooling System (DFCS)
Rugged aluminum top panel heat sink and internal thermally switched fan draws air through the heart of the transceiver.



Built-in Antenna Tuner
Tunes most antennas 160-10 meters.

YAESU
Performance without compromise.℠

Usually if a rig is this loaded, the price is too.

DVS-2 (Optional)
Digital Voice Recorder
with 16 seconds of memory
each on RX and TX.

Specifications subject to change without notice. Specifications guaranteed only within amateur bands.
Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.