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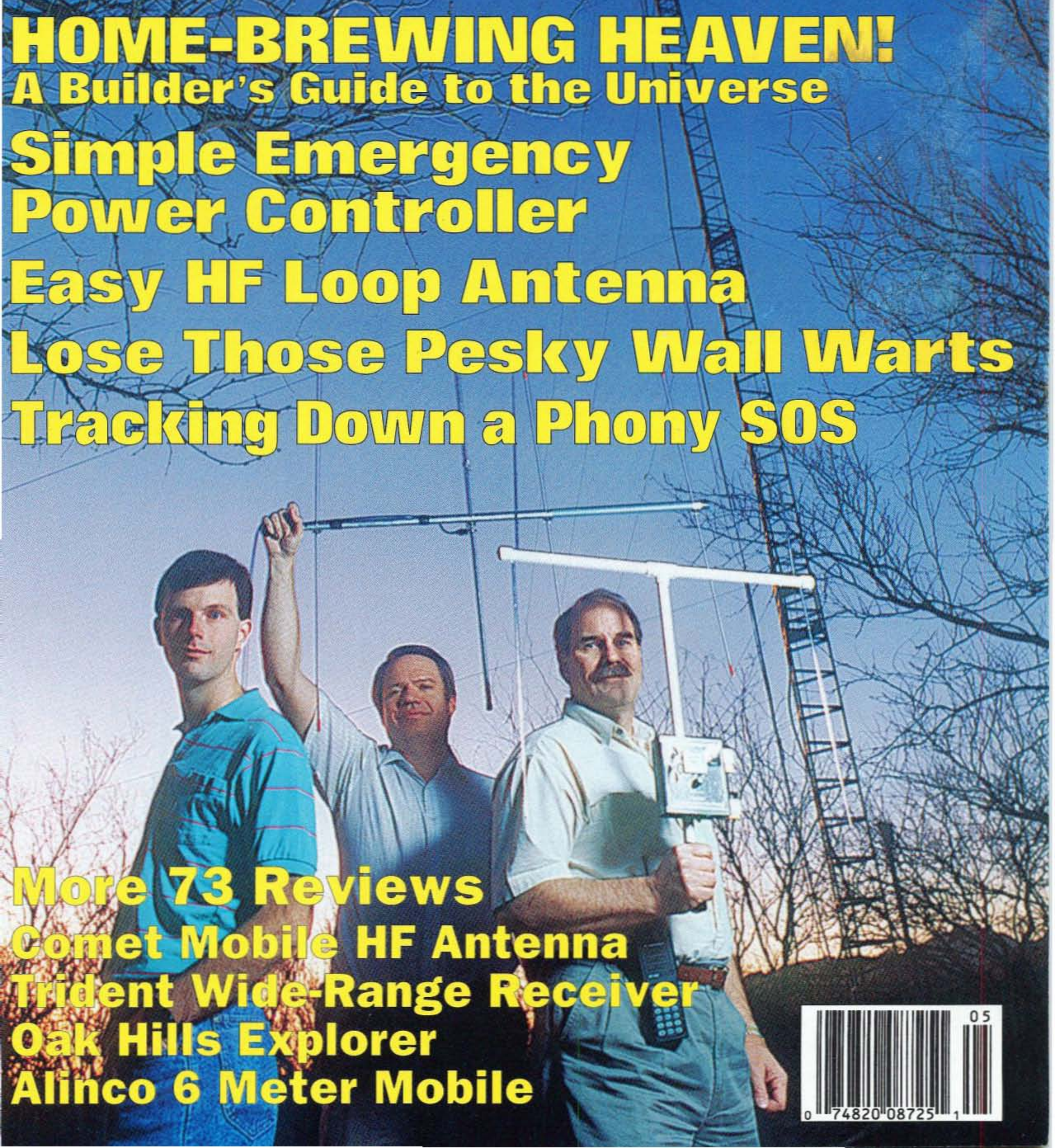

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73 Amateur Radio Today

May 1995
Issue #416

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DEPARTMENTS

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On the cover: Jason Auvenshine N7UGP, Bob Buchanan KA7CC, and Jerry Clark K7KZ home in on what later turned out to be a hoax "emergency" signal. Turn to page 52, "Homing In," for details. (Photo by David Sanders, The Arizona Daily Star. *Reprinted with permission.)*

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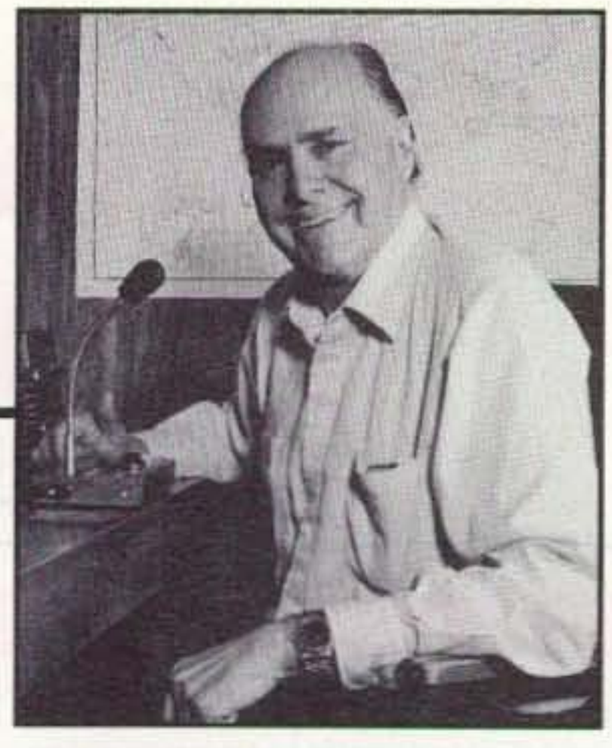
Contract: Uh-oh! By letting your gaze wander to this paragraph, you've just become legally and morally bound to help save the new Senior/Technical Editor's butt. Luckily for you, it won't be difficult. Just send interesting ham-related photos for our Photo Search, as described in QRX (September 1994, p. 8). It's a win-lose situation—your photo might become a cover, and I might be forced to keep this crummy job.—Nuge WB8GLQ

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Preferring the Snail

Former *73* Editor Bill Brown picked up a bunch of stuff about me from the Internet. It came at a fortuitous time. Synchronicity at work. Oh, you haven't read *Synchronicity* by David Peat? Tsk.

I've been under increasing pressure to climb aboard the Internet and at least enjoy the wonders of E-mail. I've been resisting. You can see the heel marks as my so-called friends have been dragging me kicking and screaming into the information age.

I keep telling 'em that I've been there and done that. Well, I have. And, as I read the pile of culch Bill pulled off the Internet, my RAM was refreshed. Oh yes, that's why I have been fighting E-mail.

RTTY, the First E-Mail

It all started back in 1948 when I was working as chief cameraman for WPIX in New York. That's the Daily News TV station. They had no objection to my setting up my 2m rig on top of the News Building, one of the more modest skyscrapers on 42nd Street in midtown. I found an empty room next to the TV transmitter, with a door opening out onto the roof. I bought a 16-element beam from Bill Hoisington W2BAV and set it up on a surplus prop-pitch motor out on a narrow ledge. I was using an SCR-522 I'd converted to 2m. It had an 832 in the final and put out a healthy signal.

The ledge was a little tricky. I wanted to get my beam out in the clear as much as I could, and the best spot for it had me going from the roof area out on a foot-wide ledge with a 30-floor drop on one side and a 15-floor drop on the other. I felt like I was walking a tightrope when I looked down. It was not a good place to be when there was any wind at all.

Wow, was I able to work out from that fantastic location! I had no problem working all of Connecticut and New Jersey. But I wondered what on earth those strange beedle-beedle sounds were I kept hearing up on 147.96 MHz. It turned out to be ham Teletype, which was being promoted by John Williams W2BFD from his radio-TV repair shop in Woodside, Queens. After a couple of visits to John I was busy building my own RTTY terminal. It had around 20 or so 6SN7GTs and not only translated the two tones into printing with a Model 12 Teletype machine, but also had automatic almost everything. It shut down when the signal stopped. It would turn on automatically and copy any message on the RTTY channel. It would even turn on my rig and confirm the receipt of a message with a beep-beep.

I helped John set up the RTTY repeater and this made it so every RTTY operator in greater New York could keep in touch without having to swing their beams.

A Lot Like 75m

But after awhile I discovered what I'd noticed on 75m back in 1946, when I used to talk just about every night with W1MLJ in Barre (VT), W1IF in Peabody (MA), and W1KPL in Jaffrey (NH). It wasn't long before we were just rag-chewing and joking, and little of any importance was being communicated. I wasn't either learning or teaching anything. Finally, it occurred to me, hey, why am I doing this? Why am I wasting my time for hours a day like this?

The excitement of RTTY communications was enough for a while. Then I began to notice that the benefits to me were fading. I enjoyed the technical challenge. I had great fun getting everything working. I had a ball up on 11 meters pioneering RTTY, back when that was an anything-goes ham band . . . which we lost because we didn't use it enough. We weren't permitted to use frequency-shift on the low bands then. I went on 80m with make-break keying instead of frequency-shift, and soon had made the first coast-to-coast contact with Bob Weitbrecht W6NRM, a deaf ham. All this was fun, but the content of the messages I was getting was the same old stuff, with a high boring quotient.

I wanted to help make my transmissions interesting, so I wrote little articles, stored them on punched tape and fed them through my tape reader at 60 wpm to anyone interested. It was a lot like a BBS. That tape experience turned out to be very helpful a couple years later when a RTTY ham gave me an opportunity to work on a Guggenheim Grant on a color organ for the Guggenheim Museum on Fifth Avenue. The color organ programs were all run by punched tape.

My adventure with RTTY turned out to be serendipitous again, for it was through Graham Claytor, one of the NYC RTTYers, that I got the job as Secretary of the Music Research Foundation, where I had the opportunity to work with several of the top psychiatrists, psychologists, and psychoanalysts on the use of music in psychotherapy. I ended up writing a book, *Music For Your Moods*, which the Foundation published. My first book. Just the other day I was looking through a box of badges and buttons and came across the medal I won in high school for music recognition. I also came across a medal from the ARRL for winning the 1947 15th International DX Competition. I'll bet they've stopped sending out medals to contest winners.

Losing My Buttons

I was thinking of adding those medals to the pins and buttons on the *73* baseball cap I've been wearing at hamfests, but then I remembered that no one has ever asked what all the pins are. Well, since nobody has ever noticed, why bother? After all, they're all just my own personal memories. My WWII submarine combat pin, pins and buttons from my high school, college, electronics school, QCWA, OOTC, ARRL 50 years, Boy Scouts, Porsche Club of America, PS199 in Brooklyn, SCCA Competition Driver, 1939 World's Fair, Skin Diver, USS Drum SSN677, Deputy Sheriff Harris County, ITU Conference in Geneva, Erasmus Hall Choral Club, AOPA, Nurburg Ring Racetrack, Royal Jordanian Amateur Radio Society, an old 220 Use It Or Lose It button, and so on. Just an old man's memories and of no interest to anyone else. I'll put the hat up in the attic.

The color organ project was due to another RTTYer. I started a RTTY newsletter in 1951 while I was working at WXEL in Cleveland as a TV director. Well, they had a mimeo machine. That quickly put me in touch with all the other RTTYers around the country. And that eventually got me a RTTY column in *CQ*, which led to my being the editor, which got me to start *73*, after being fired from *CQ*. That's a story I tell every now and then, so I won't refresh your memory with it again.

No Big Bang?

I mentioned Bill Hoisington's beam. After I started *73* Bill moved to Peterborough and wrote endless simple construction articles for the magazine as K1CLL. He was endlessly creative up until his death a few years ago. My recent brush with cosmology, the result of my interest in cold fusion, has brought be up against some most interesting people, some of whom are not at all convinced about that Big Bang theory. Bill wasn't either. He proposed that light just naturally runs down. I published an article by him on the subject.

Well, one problem with cold fusion is that currently-held theories of physics say it's impossible. To true believers in these theories, every one of the experimenters who have been getting anomalous heat are wrong. They must all somehow have made experimental errors. The experimenters, some of whom are getting thousands of times more heat than the "accepted" theory permits, say it's about time to rethink theory.

Troublemakers point out that when light goes through water or glass, it slows down. Well, we know that space isn't empty. It's got a lot of hydrogen and helium, plus debris from past novas. Then there's the 90% or so of invisible something (dark matter) which is exerting a powerful gravitational influence on the galaxies we can see. It might be that all this stuff tends to slow down light and that the red-shift is due to that instead of all the other galaxies flying away from us. That would give us a steady-state universe and would fit in better with calculations in the biological and other fields.

This cold fusion stuff sure is making trouble, and it isn't going away. I'm writing this the day after a one-day cold fusion conference at MIT where I saw some fascinating demonstrations. For instance, one chap explained how to build a gun capable of shooting fairly large projectiles into outer space just by passing an electric current through a small amount of plain water. He showed a quarter-inch metal plate with a hole caused by a blast of water being shot through it.

Well, you're probably not interested in all that stuff. If you're an average ham, you'll be more interested to know that it's snowing right now and that on my morning jog I saw the tracks of several deer, some rabbits, and a bunch of squirrels crossing the road. The snow, which took its sweet time to come, is beautiful.

I was most pleased to meet a couple of hams at the conference who blamed me for their interest in cold fusion. Well, as they pointed out, I was right about the development of cellular phones and computers, so perhaps I'm right again. I haven't seen anything yet that's not encouraging. But then, these new technologies always take a lot longer than I expect to develop. It took microcomputers 20 years to get where I thought they would be in 10. As you watch the computer ads on TV, just remember that old Uncle Wayne tried hard to get hams involved back in 1975. Many of those who did made millions.

One of the MIT undergrads at the cold fusion conference showed us a little glass with a couple of inches of water (40 ml) and a small palladium rod he had been sticking into the glass. He showed us the curves of the excess heat he'd been getting. It took him awhile to get everything right, but now

Continued on page 74

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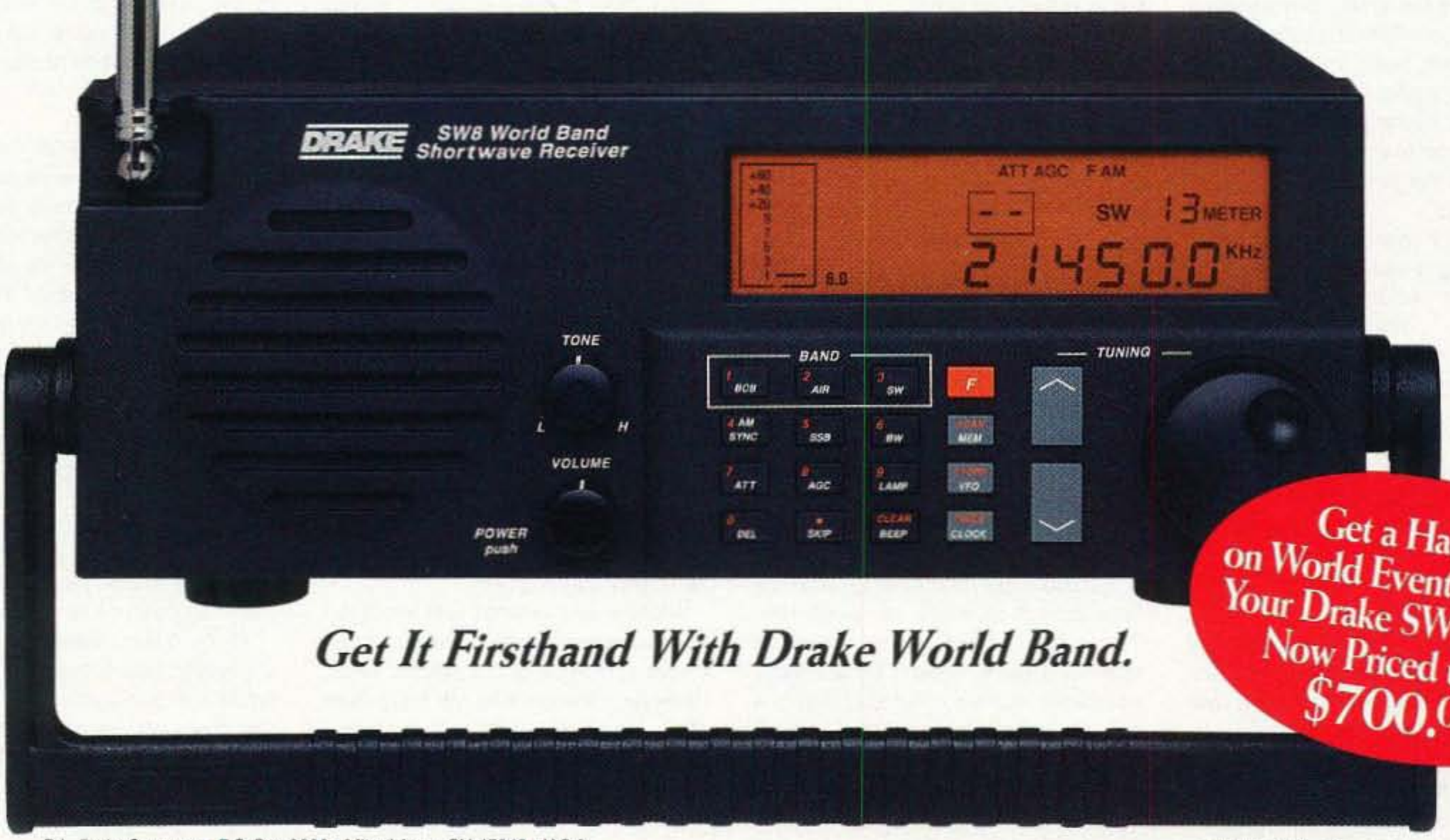

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CIRCLE 147 ON READER SERVICE CARD

LETTERS

Number 2 on your Feedback card

From the Ham Shack

Lionel Barley KBØPZD, Wichita KS Well, I made it back into ham radio. I held WBØHRQ as a General Class operator in the late 1970s. Then I ended up with one of those new-fangled "high-tech/high-pay" careers in the early 1980s. Folks said I needed another college degree in order to be qualified for the work I was already doing, so I went to night school . . . letting my ticket lapse along the way . . . and got a degree in computer science. By that time technology had already made that career obsolete, and I embarked on another "high-tech/high-pay" career. Now, wouldn't you know, that ol' technology just kept a-changing. Scratch "high-tech/high-pay" career number two. Oh indeed, mainframes were just a bit clunky compared to PCs.

Wayne, now I'm on "high-tech-sans-high-pay" career number three. And I am starting to see this one going away. I've been working in industrial and aerospace manufacturing for 20 years. The new PC software coming out is eliminating any need for advanced mathematics, or even to have much of any experience in machining processes. The smarts are in the box rather than in the head of an analyst/programmer. Maybe if I went into business for myself on the side . . . .

Since the company I work for (days) has cut my hours so much, I have had the time to go back and work on getting another ham ticket. I'm back again as a General Class operator, still enjoying CW on low bands just as much as ever. This time I am going after that Advanced license. Heck, I may even get gutsy and try for my Extra. Love those ripplin' dits!

Scott Schram KN4L, Birmingham AL Wayne, your March 1995 editorial about hamming being irrelevant in the face of the Internet is right on target. I'll bet most hams don't realize the amazing things that are already being done . . . I'd like to tell you about one night's activity.

Last night I connected to the Internet by calling a service provider on a 14,400 bps modem (soon to be 28,800 bps . . . and not long after that using ISDN at 128,000 bps). I used Telnet to connect to a "Moo," a text-based virtual reality, and I met some of my friends that I've talked to regularly over the last year. They are located around the U.S., two in Holland, one in Norway, two in Canada, and one in Australia. About 10 of us carried on a discussion about a programming project that we're mutually interested in. The connection is QRM-free, and very close to 100% reliable, 24 hours a day . . . which makes HF hamming into something of a quaint novelty.

After that, I enjoyed a game of "Scrabble" moderated by a distant computer, and my competitors were several thousand miles away. Speaking of games . . . well, virtual reality is here. I then logged onto a Multi-User Dungeon (MUD). Teamed with some of my editorial friends, and wielding our swords, we proceeded to dispatch a number of foul creatures and villains.

Clearly, the Internet will do far more to promote international goodwill than we could ever hope to accomplish with QRM-packed meaningless exchanges of signal reports.

The free exchange of information boggles the mind. I loaded my World Wide Web (WWW) browser, which is a hypertext browser. I just click on the highlighted words, and I'm off looking at the next interesting thing. It's not unlike using the help system in Microsoft Windows, except that the pages you view come from far away.

So I browsed a bit, and came upon a page where someone had hooked a video camera up outside their building in Stockholm, Sweden. I transferred a live photo of the early-morning street there to my computer. Another novelty: I checked the temperature of some guy's hot tub, and the sensor on the Diet Coke can in his refrigerator.

Then I settled down for some serious browsing. I downloaded the entire text of the book *Phantom of the Opera* from the Gutenberg project. I browsed the Louvre museum, and viewed images of Impressionist paintings . . . looked into some protein research articles at Johns Hopkins University . . . listened to some sound clips of Broadway musicals, and checked ticket schedules. With 1.8 million WWW pages, it's already the most fabulous automated library you've ever seen, and it's only beginning to hint at what will eventually be done.

Wayne, I'm a supporter of ham radio . . . every member of my family is a ham—my wife Ruthie KD4BOW, and daughters Crystie KD4WZY and Celsie KD4ZGP. We use 2 meters and 440 as a conventional way to keep in touch. However, ham radio will change as a result of this revolution.

Jim Robb, Danville KS Wayne, I just finished your editorial in the February 1995 issue of *73 Amateur Radio Today.* What a story! I've been "hooked" by the electronics bug ever since a lady gave me a copy of *Boys Life* magazine, on my paper route, 1955. A little article about shortwave listening and a line drawing, 4 x 4 inches, changed my life forever.

I could write on for pages: science fairs, college electronic lab assistance, Texas Instruments, Army airborne radar and GCA, cable TV franchises, computer software development, a computer hardware and service business. Now we are working on a matching grant, for funding, to study some possibly overlooked parameters of tornadoes, which will lead to a small receiver for residents in rural areas to provide automatic warning and also direction and movement, toward or away, from their location.

All of the above because of people like *you.* A big thanks from all of us.

Jerry R. Dunham N7MUX (DU4MUX), Rodeo CA Wayne, I've been reading *73* for several years, since before getting a license, and really did not understand what you were always going on about, as I had never, until last week, operated in the U.S. I have made my home in the Philippines for the last nine years and have only been licensed for six.

For me every contact was interesting, most were DX, and none were the trash you have described. Last week that changed. Since being discharged from the Navy 26 years ago I have been a merchant seaman—an engineer, not a radio officer. Last year I took a job on a coastwise oil tanker engaged in the U.S. West Coast trade. Upon my return from vacation this time I decided to buy a TS-50S and do a little maritime mobiling. The only thing I can say is that if I were ever to live in the U.S. again I think I would fast lose interest in the hobby.

Keep up the good work with *73* and *Radio Fun.* I take my old copies back with me to Legazpi for the few hams there.

Vincent Dolva WØGP, Hawley MN Wayne, I have just finished reading your editorial in the March 1995 issue of *73* magazine. I always look forward to them in each issue. I agree with so much in your writings. This one was especially well done.

On page 73 you struck a chord with me when you mentioned the sorry lot of QSL cards that will be there when one's time comes. Perhaps an incident I experienced a couple of weeks ago may be of interest.

A former high school classmate of '36 sent me a letter in which was enclosed one of my QSL cards dating back to April of 1934. Shades of the past!

She had been browsing through some tables at a Viking Fest in Decorah, Iowa, and one had a collection of postcards from all over the United States. She asked if any were from Hawley, Minnesota, and one of the two was mine!

In pencil I had written on the margin way back then that I had received my license in January. My receiver was a '24 detector and a '27 amplifier. My transmitter was a pair of '45s. Not mentioned was that my antenna was a 160 meter counterpoise.

I follow your writings with interest. I have wondered about sperm damage. I have wondered about electric fields. However, having made my living most of my years as an electronic technician, exposed to very high magnetic fields from high-powered radar sites, I have not noticed ill effects myself. But of course this doesn't mean there aren't any for others, or even for me.

My ham radio interests are more in the area of construction and experimenting. I work only a weekly schedule with an old friend from grade school days via 20 meter CW. I am into packet and other related fields like weather scan, etc.

Thank you very much for your continued efforts toward amateur radio. Keep up the good work.

Alfred L. Pedneau Sr. K5HKG, Alexandria LA Wayne, you are correct in the way that we need younger operators. I very seldom miss the local club meeting on the first Monday of the month. Very seldom do we have any young people there. Most kids these days want to play on a computer or be given something for free. No one gave me a free Novice license in the summer of 1956, and no one has given me anything free since then. I believe you have to work for everything you get.

Keep up the good work, and keep calling a spade a spade. Nowadays someone has to.

Al—There you go blaming the kids for not being interested in amateur radio. That's like a manufacturer blaming the public for not buying his product. Al, you have to sell any product or service and we hams are not *selling. Amateur radio today is an almost unknown hobby. When I lecture college kids on entrepreneurialism I ask for a show of hands of how many know what ham radio is. I get maybe three or four out of a couple hundred, and I've been lecturing at Yale, Rensselaer Polytechnic Institute, Case Western, Boston University, Babson College, and a bunch of others. It isn't the kids' fault, it's the ARRL's for doing its best to keep ham radio a secret hobby for retired old white men, as represented by the League's board which you and the rest of us have elected. And re-elected. And then re-elected again . . . Wayne*

Del Harper KC4ZQP, Portland OR Wayne, I have been a subscriber to *73 Amateur Radio Today* for several years now and I must admit that I find your attitude towards life and creating accomplishments refreshing. I totally agree with you that people should take responsibility for their actions and quit blaming everyone and everything else for their current state of being. I believe that I am the sum of all the choices that I have made during my life to date, and if I have a problem with where I am at or what I am doing, I am the one that I should talk to in order to fix it. I am proud of my accomplishments as well as my screw-ups.

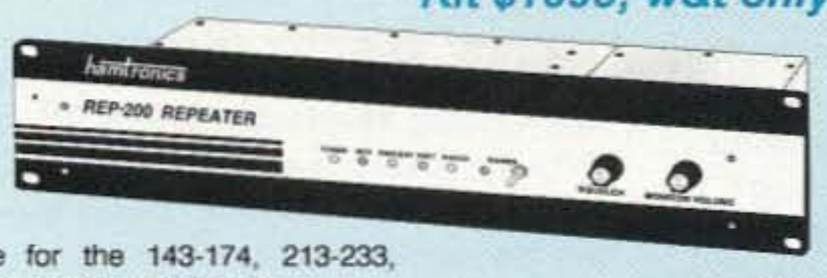
Once again, thank you for all the enjoyable hours learning about the hobby and the field of electronics that you have provided me since I have become a member of the amateur radio community. 73

You get more features for your dollar with the

REP-200 REPEATER

A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

Kit $1095; w&t only $1295!



- Available for the 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service in150 & 450 bands.
- **Six courtesy beep types**, including two pleasant multi-tone bursts.
- **Open or closed access autopatch, toll-call restrict**, auto-disconnect.
- **Reverse Autopatch,** two types.
- **DTMF CONTROL:** over 45 functions can be controlled by 4-digit dtmf command, via radio or telephone.
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- **Change** cw speed and tone, beep delay, tail timer, and courtesy beep type **at any time** by owner password protected dtmf commands.
- **Auxiliary receiver input** for control or **cross linking repeaters**.
- Color coded LED **status indicators**.

NEW **REP-200T Voice Message Repeater.** As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air** and played back at user request by DTMF command, or as a periodical voice id, or both. ..... **kit $1145, w&t only $1395**

NEW **REP-200C Economy Repeater.** Like REP-200, except uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice ID**. ..... **Kit only $795, w&t $1095**

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XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

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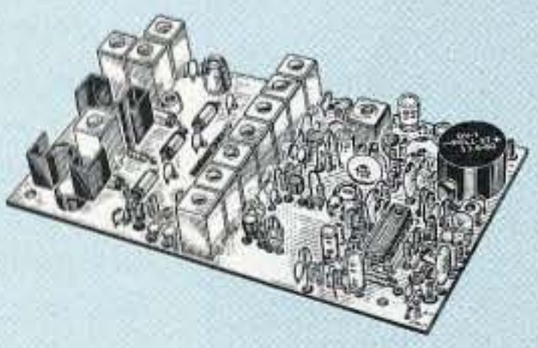
FM EXCITERS: 2W continuous duty. TCXO & xtal oven options. ***FCC type accepted for com'l high band & uhf.***



- **TA51**: 50-54, 143-174, 213-233 MHz .....kit $109, w&t $189.
- **TA451**: 420-475 MHz .....kit $109, w&t $189.
- **TA901**: 902-928 MHz, (0.5W out); w&t $219.

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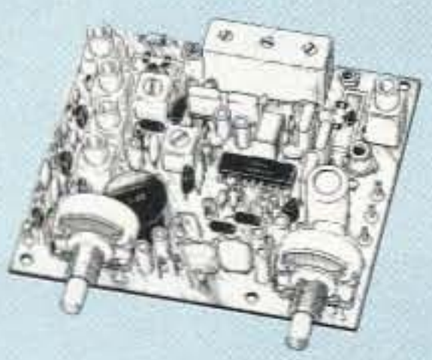


- **R144/R220 FM RECEIVERS** for 143-174 or 213-233 MHz. **Sensitive** front end, 0.18uV, both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; .....kit $149, w&t $219.
- **R451 FM RCVR,** for 420-475 MHz. Similar to above. ...kit $149, w&t $219.
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion, ...$169, w&t $249.
- **R76 ECONOMY FM RCVR** for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res, if selectivity >100dB at ±12kHz .....Kits $129, w&t $219

NEW **R76 MONITOR FM RCVR Kit** for 10M, 6M, 73 MHz, 2M, hi-band, or 220 MHz. IF selectivity 60dB at ±12kHz. Great for monitoring repeaters, amateur calling frequencies, or packet radio frequencies, and for listening to commercial two-way radio, police/fire frequencies, or weather forecasts. **Good starter kit, too;** easy to assemble and align. .....**Kit only $59!**

- **R137 WEATHER SATELLITE RCVR** for 137 MHz. Special if filters tailored for wideband fm. Lowest cost receiver available .....**kit only $89, w&t $149.**
- We also have preamps and receiving converters for 137 MHz, and we carry the *Weather Satellite Handbook* by Ralph Taggart.

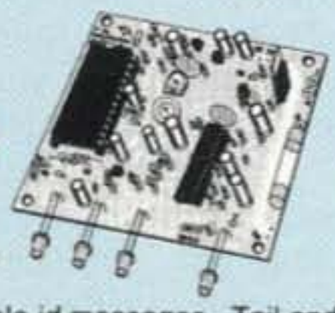
ACCESSORIES

COR-3 REPEATER CONTROLLER. Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifier. .....kit $49

CWID. Diode programmable any time in the field, adjustable tone, speed, and timer. .....kit $59

COR-4. Complete **COR and CWID** all on one board. CMOS logic for low power consumption. EPROM programmed; specify call. .....kit $99, w&t $159

NEW



COR-6. COR & Real Voice ID on one board. Digital ic records up to 20 seconds of your voice. Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter. kit $99, w&t $149

Versatile DVR-1 DIGITAL VOICE RECORDER Module. As a **voice ID'er for repeaters**, records your voice, using the built-in microphone or external mic. Just the thing for **fox hunt** xmtr id! May also be used as a **contest caller** to play back one or more messages through your transmitter at the press of a switch. Used as a **radio notepad,** it can record the audio output of a receiver — up to 20 sec. of anything you might want to recall later. Play back as often as you like through a small external speaker. Extensive manual tells how to use multiple messages and adapt to many applications.

.....kit $59, w&t $99

TD-4 SELECTIVE CALLING Module. Versatile dtmf controller with 1 latching output. Mutes speaker until someone calls by sending your 4-digit tt code. Or use it with a long tt zero digit to alert anyone in club. Also may be used to control autopatch or other single device. .....kit $49, w&t $79

TD-2 DTMF DECODER/CONTROLLER. 16 digits, programmable, toll-call restrictor. Can turn 5 functions on/off. .....kit $89, wired & tested $149

AP-3 AUTOPATCH. Use with TD-2 for repeater autopatch. Reverse patch and phone line remote control are std. .....kit $89, wired & tested $149

AP-2 SIMPLEX AUTOPATCH Timing Board. Use with above for simplex operation using a transceiver .....kit $39

TD-3 SUBAUDIBLE TONE DECODER/ENCODER. Adjustable for any tone. **Especially for repeaters,** with remote control activate/deactivate provisions .....kit $29, wired & tested $59

DATA MODEMS

MO-202 FSK DATA MODULATOR & DE-202 FSK DEMODULATOR. Run up to 1200 baud digital signals through any fm transmitter & receiver. Radio-link computers, telemetry, etc. .....kit ea $49, w&t ea $79

9600 BAUD DIGITAL RF LINKS. **Low-cost** packet networking system, consisting of MO-96 Modem and special versions of our 144, 220, or 450MHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W. CALL.

Low Cost GaAsFET PREAMPS

LNG-(*)

ONLY $59 wired&tested

FEATURES:
- **Very low noise:** 0.7dB vhf, 0.8dB uhf
- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-152, 152-172, 210-230, 400-470, 800-960 MHz.*

LNW-(*) MINIATURE PREAMP

ONLY $29 kit, $44 wired&tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

LNS-(*) IN-LINE PREAMP

ONLY $89 kit, $119 wired&tested

- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**Tuning range: 120-175, 200-240, or 400-500.*

HELICAL RESONATOR PREAMPS

GaAs FET preamps with helical resonators **reduce intermod & cross-band interference** in critical applications.
MODEL HRG-(*), *$80 vhf, $110 uhf.*

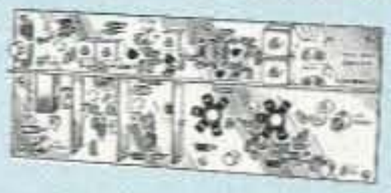
**Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-470.*

RECEIVING CONVERTERS

Low noise converters to receive vhf and uhf bands on a 10M receiver.

- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (to chan 3).
- **Kit less case *$49*, kit w/case & BNC jacks *$74*, w&t in case *$99*.**

TRANSMITTING CONVERTERS



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FCC May Change RFI Rules

The Federal Communications Commission has proposed permitting manufacturers and suppliers of computers and computer peripherals to market their equipment without having to apply for equipment certification. The requirement for FCC approval would be dropped under ET Docket 95-19.

Currently, these devices must conform to FCC certification to ensure that they do not cause interference to radio services, including the ham bands. This certification involves specific measurement data and a detailed product description to be submitted to the Commission's laboratory for review and approval.

The process can take a month or more. The industry estimates that eliminating the wait could save the computer industry some 250 million dollars per year. The FCC described the current regulations as burdensome to manufacturers and says this new procedure would align FCC requirements for personal computers with those "used successfully in other parts of the world."

The streamlined new process would be based on the manufacturer's or supplier's Declaration of Conformity. *TNX ARRL; Florida Skip, March, 1995.*

Bright Future

If you've been procrastinating about upgrading your license class, this will make you really feel like a loser. Pictured on this page is *nine-year-old* Samantha Sanford AA3JS. Samantha passed her Novice exam at age eight on May 3, 1994, gave up TV for the summer and fall, then passed her Extra exam on December 21, 1994, just eight months later!

Samantha enjoys making new friends on CW and SSB, and she loves to ragchew with all the local club members of the South Hills Amateur Radio Club, of which she was voted Junior Select Person for the 1995 term. She is often the net controller for the weekly 2 meter net. She has also been active in Field Day activities and has set up a ham radio exhibit at her elementary school.

Samantha aspires toward the science or engineering disciplines, sparked by her involvement in amateur radio. She offers the following advice for those thinking about taking an amateur radio exam: Study, study, study; practice, practice, practice; then have fun, fun, fun! *TNX Robert Sanford AA3FI.*

Vanity Callsigns On The Way

On February 1, 1995, the FCC released the full text of the Report and Order covering how amateurs may obtain the callsigns of their choice. The system, outlined in last month's *QRX* (April, 1995, page 8), consisting of four "gates," is at the heart of the Commission's plan. The full text is several pages long, and places emphasis on the fair and equitable distribution of vanity calls.

Priority is given to to close relatives of deceased amateurs to obtain their old signs, followed by Extra Class, Advanced Class, and finally, to any licensee. As expected, the fee is set at $70 for ten years. Announcement of when you may apply for a vanity call will be made by public notice, so keep your eye on this space in the next couple of months. The system should kick in as soon as the Form 610-V is available. *TNX W5YI Report, February 15, 1995.*

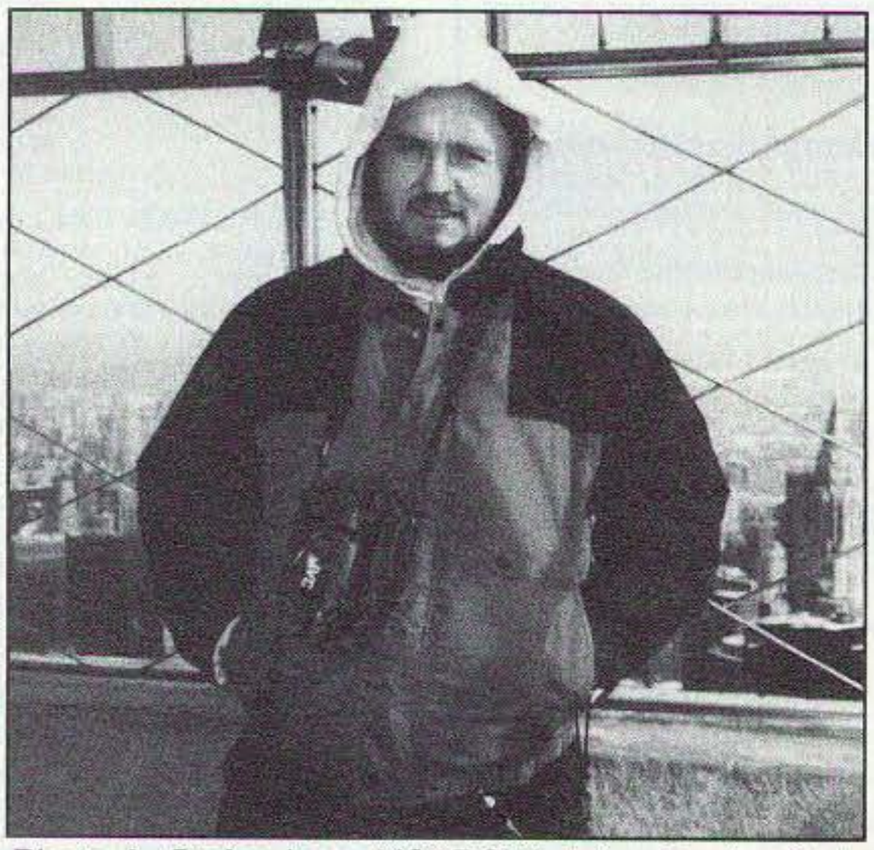

Photo A. Stefan Leca YO8RCW at the Empire State Building's Observatory in New York City. (Photo by George Pataki WB2AQC.)

Photo B. Samantha L. Sanford AA3JS (age 9).

Romeo Zulu Whiskey to QSY

After two years as our Senior/Technical Editor, Charlie Warrington WA1RZW has *seen* the light, and is leaving the staff of *73* and *Radio Fun.* That's because Charlie is moving up the frequency spectrum to *write about* light—he'll be documenting products as a Technical Writer for a leading manufacturer of reflectance and laser devices. Thanks, Charlie, for your dedication and creative energy over the past couple of years!

Mike Nugent WB8GLQ is taking over the position of Senior/Technical Editor here, and we all want to wish Nuge the very best. Nuge will draw on his previous experience as Consulting Editor at *73* back in 1990 and 1991. He has also worked on the publications *Portable 100*, *PICO*, and *pb: Your Powerbook Home Companion.* Welcome aboard Nuge!

More Space Hams

Two more US astronauts have joined the ranks of amateur radio, according to the ARRL, as reported in the *X-mitter.* Both are expected to fly aboard the Space Shuttle Endeavour during an upcoming launch.

Pilot William G. Gregory is now licensed as KC5MGA and Payload Commander Tamara G. Jernigan is now KC5MGF. Both sat for exams on January 19, and were issued callsigns on January 25, thanks to electronic filing with the FCC—a new feature for the Commission. *TNX Penn Wireless Association's X-mitter; ARRL.*

Long Walk

Romanian travelers Lavina Tatar and Stefan Leca YO8RCW are touring the world on foot! The pair left Romania on their "Journey for Peace" August 17, 1992, and have walked across 24 countries so far, wearing out 106 pairs of shoes. On route, Stefan (see photo) has used 16 different callsigns, including TAØRCW, JYØRCW, A45RCW, 7Z1RCW, 9K2RCW—well, you get the idea.

So far they have been received by King Hussein of Jordan JY1, Sultan Qaboos of Oman A45AA, Prince Talal bin Abdulaziz of Saudi Arabia HZ1TA, Prince Titiphan of Thiland HS1LY, and many others. The total trip is expected to end in Romania, taking a total of three years. *TNX George Pataki WB2AQC.* 73

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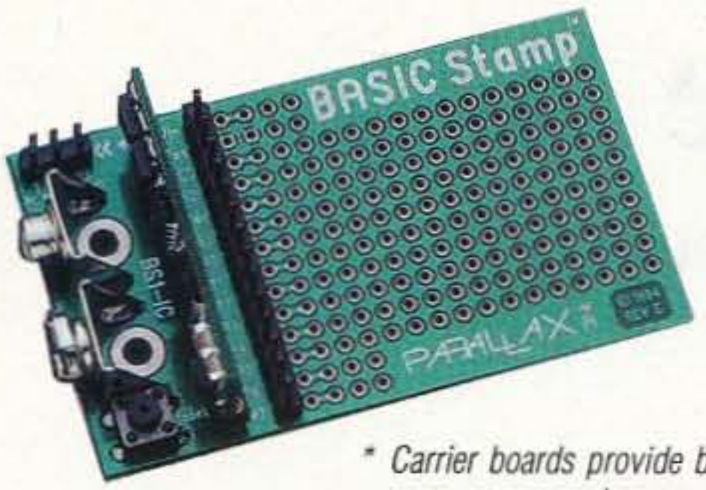
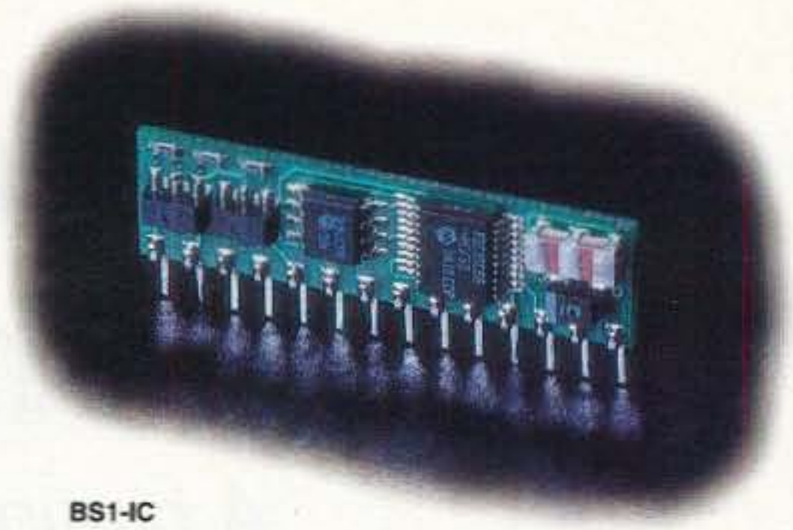
Stamp-sized modules run BASIC



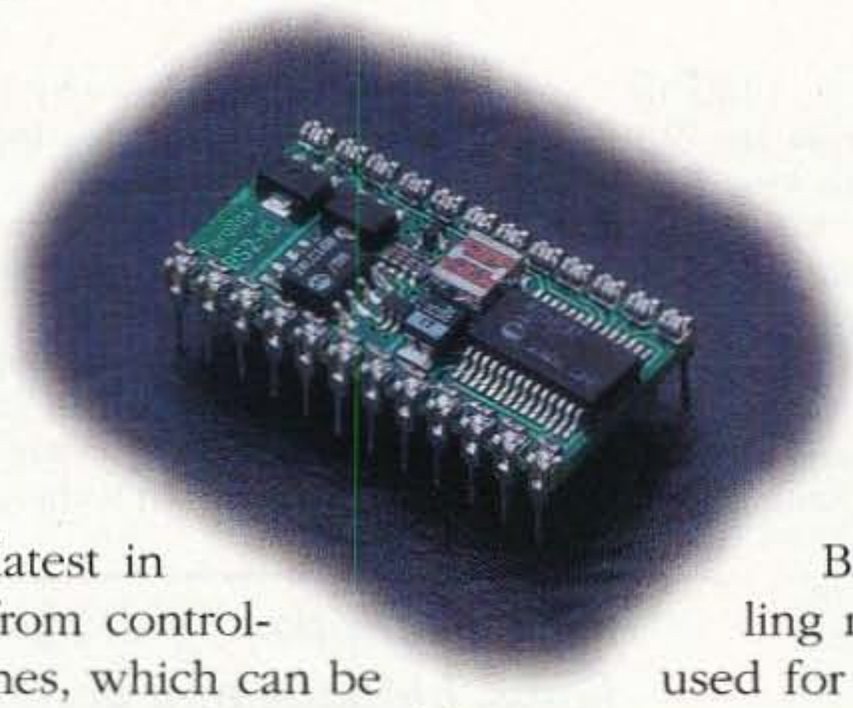
* *Carrier boards provide battery clips, prototyping area, programming connector, and reset button (BS1-IC carrier shown).*

BASIC Stamp I Module (BS1-IC)

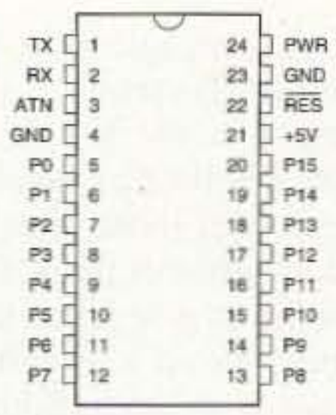
8 general-purpose I/O lines
256-byte program space (100 instructions)
4-MHz clock (2400 baud serial, etc.)
$34, $54 with carrier board*



BS1-IC



BS2-IC



BASIC Stamp II Module (BS2-IC)

16 general-purpose I/O lines
2048-byte program space (600 instructions)
20-MHz clock (9600 baud serial, etc.)
$49, $69 with carrier board*

These new BASIC Stamp modules are the latest in BASIC Stamp computers. They're perfect for numerous applications, from controlling model trains to monitoring factory sensors. They have 8 or 16 I/O lines, which can be used for a variety of digital and analog purposes. And like the original BASIC Stamp, these modules are programmed in BASIC. Our special "PBASIC" language includes familiar instructions, such as GOTO, FOR...NEXT, and IF...THEN, as well as SBC instructions for serial I/O, pulse measurement, and button debounce.

The BASIC Stamp Programming Package contains everything you need to program Stamps using your PC. The package includes our editor software, programming cables, manuals, application notes, and free technical support. The package is available for $99; Stamps must be purchased separately.

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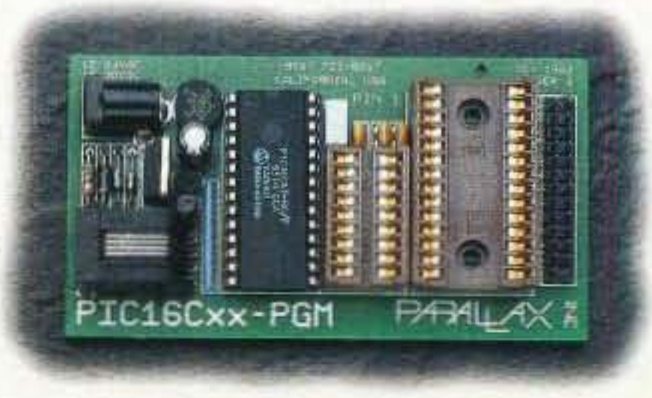

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0395A

Builder's Guide to the Universe

A beginner's guide to home-brewing.

by Mike Bryce WB8VGE

There's no question about it, I like to build electronic kits. From the old Heathkits to the baggie of part kits, I do like the smell of molten solder. But, there's more to ham radio than just stuffing a PC board with pieces parts. I also enjoy designing my own gear from the ground floor. If nothing else, it's a learning experience. I may not know everything there is to know about power MOSFETs, but I sure can tell you how *not* to use them. Ah yes, the utter shock of seeing bits of TO-220 case parts heading your way after the explosion. Great fun!

To me, that's part of our past as radio hams, building and designing our own equipment. I also enjoy the challenge of taking a project from just an idea to a working unit.

"To me, that's part of our past as radio hams, building and designing our own equipment. I also enjoy the challenge of taking a project from just an idea to a working unit."

A Widget

What's it going to be? That's not as easy as it sounds. I've built many a project and not had the slightest idea of what it's supposed to do. I don't have the talent to design a new multiband PLL computer-controlled rig. So, I don't try. On the other hand, I love to play with a new IC that will do strange and wonderful things with just two capacitors and a diode. There's nothing quite like the feeling of conquest I get from making a micro-powered op amp with a 2.5-volt reference diode do its thing.

I try to avoid re-inventing the wheel. Let's face it, there are only so many ways to build an antenna tuner or a field-strength meter. However, you can improve on most designs you may run across or add in features you want.

As a general rule I set many years ago, I try not to get involved with complex mechanical projects. I tried to build a power amplifier for 2 meters using a single high-power tube. The amplifier required a vast array of pipes, pumps, seals, motors and other goodies. After months of working on this project, I tracked down most of the problem to a pair of bad seals. There's not much you can do with a pair of bad seals, so I had them shot. That's why I keep my distance on overly complex mechanical projects.

Design your project around easy-to-find parts. Although the project may be a one-time shot, perhaps someone in the radio club you belong to wants to duplicate it. That surplus warp plasma coil you picked up at the Dayton Hamvention two years ago may not be easy to find. If nothing else, you may need a replacement part for your own use. Perhaps your little project may turn out to be really something special; then by all means you'll need a solid source for all the parts. Who knows, you may want to write up the project and send it to *73* magazine for publication. A project with a parts list naming several sources will always be ahead of the rest on the editor's table. Part sourcing and the ability to duplicate the project should be high on your design list.

Unless the project uses one or two ICs and a handful of parts, it's PC board time. Designing one isn't hard to do, and there are several computer programs made just for laying out PC boards. I find laying out PC boards to be a kind of brain health food for me.

First Steps

You need some sort of a plan for your project. Even God had a plan, and you need one too. It does not have to be fancy, just some thoughts on paper will do. I prefer to use the backs of crane safety report forms myself. They're just the right size for drafting out a circuit.

Next, you'll need to specify how you're going to proceed with your project. I usually start with a block diagram on paper, then expand the blocks by adding bits and pieces of the circuit. We're still talking about just ideas, with no actual circuits being laid out. If I think I will need an NPN switching transistor, I'll draw out the basic idea and then add in the required support parts later.

As the blocks become full of ideas, it's time to do some mental circuit checking. Now is the time to stare into space while your wife yells at you for staying too late at the last hamfest. All this time, while you're catching hell, you're working on the how and why of your project. When things quiet down, smile and say, "You're right dear," and go back for some more circuit design!

After I've worked out most of the circuit in my head, it's time to start building up the circuit in real time. I use a prototype board for all my logic circuits. Perf-board is great stuff, but not for trying out a new digital design. It's a hassle to solder in a part, test, remove and then solder in a new part. If nothing else, the parts you end up removing usually go to the trash can. The prototype board is the only way to go when it comes to digital or analog circuits. It's the fastest way to make changes without heating up the soldering iron.

I don't use this method for testing out RF designs. Instead, I use a hunk of double-sided PC board material. I solder in the parts in a skywire/ugly building fashion. After a few weeks of work, you can really go through the solder this way.

Build in stages. If you're working on a small receiver, then start with one section. Design that section and test it before moving on to the next. You might want to start with the VFO, then the buffers and BFO. After these stages are working, design, test, and refine the audio section and power supply. I use a bench power supply to operate my unit under design. It's much faster that way, since I don't need to rebuild this basic building block.

As I work my way through the project, I usually find my thinking is 180 degrees out of phase. In other words, it don't work. It

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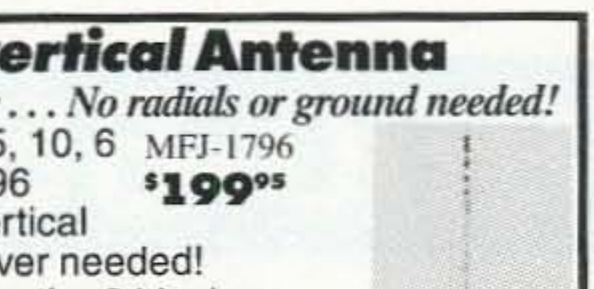

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never seems to make a bit of sense to me why a circuit would work perfectly on paper, only to do the damnedest things in real life. This brings up an important step in building your own gear—the paper work.

Keep Track of Your Paper Work

It's true! You're really not done with any project until the paper work is finished. I have a hard time with this myself. Once the project starts taking form, it's so easy to lose track of the changes made to it. I end up with several dozen versions of the project, having no idea what version worked and what one produced smoke. I've now gotten into the habit of writing down the date and version number someplace on the schematic. This way, I have some idea of what I've been working on.

I start with a large sheet of drawing paper. I build the circuit based on the outline and block diagrams on my cheat sheets. As I assemble the circuit, I test and confirm its operation, then I transfer the details onto this sheet.

After I have the circuit working on the prototype board, I tear it all down and start to rebuild the circuit once more. But this time I use the schematic I created during the testing phase. It goes without saying, I usually screw up somewhere along the way and need to make changes on the schematic. Of course, changing the problem on paper still requires changing the circuit on the prototype board as well.

"I get madder than a Klingon in a room full of Tribbles when I see a PC board with a zillion wires emerging from it."

If all goes as planned, I have a working project on my hands, but I'm not done yet. There are still a few more steps required before I move on to my next idea. As I mentioned earlier, a PC board is the only way to build today. So, if I consider the project worthy of a board, I then start to lay out the basic design of the circuit, again on paper.

I usually have some idea of what and how many types of inputs and outputs the project will require. A keyer, for example, will need at least five wires to and from the PC board. My designs differ from most of the designs you may be used to, as I like to employ some sort of PC terminal block or header. I get madder than a Klingon in a room full of Tribbles when I see a PC board with a zillion wires emerging from it. A terminal block or header makes the board easy to install, use, and repair.

Perhaps the best thing to happen to PC board layout has been the computer. No more cut-and-paste with tape and donuts on plastic. Now, a computer will allow you to lay out a circuit and move one or more traces or pads in seconds. There are PC layout programs for DOS, Windows and the Macintosh. How to use these programs is a bit more than I want to get into right now, but most are easy to learn and use.

After you have your PC board laid out, it's time to make a trip to the local copy or graphic arts shop. Here, I have a larger than

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one-to-one paper copy made of the artwork. A good quality copy machine that will do enlarging will work too. I have the original enlarged as big as I can to fit the paper. Many times I use the "B" size paper, or 11 x 17 inches. If I have a double-sided board, I make the top side of the board in red and the bottom in black. Again, any good copy center or graphic arts shop should be able to do this for you at a fair price.

With the enlarged PC board traces at hand, it's time to get down and dirty. You'll need a highlighter pen or two and a night of reruns on TV. The object is to follow each and every trace you made against your schematic. Check off the components on the schematic as you follow the circuit on the paper. Use the highlighter to mark sections of the PC board you've checked, and those on the schematic as well.

After you have made your corrections, it's time to burn a board. Again, that's a bit more than I want to go into right now, but enough to say it's not at all hard to do. However, I've gotten lazy in my old age, and now send the artwork out for a prototype or two to be made. I don't like to iron and the resist pens are a pain in the butt. Lucky for us, there are several companies that specialize in making PC board prototypes. FAR Circuits (18N640 Field Court, Dundee, IL 60118) will do prototypes at a fair price. Write to find out the finer details.

The price will depend on the size, amount of extras like silk-screening and solder mask, and if the board will be double-sided with plated-through holes. A recent project set me back $300 for two double-sided boards with plated-through holes. This was done by a company that makes large runs of PC boards. They did the work for me but I had to pay for it. Had I gone ahead with a run of the same boards, the cost would have been about $8 each in lots of 100. Even in short runs of 25-50 boards, the price is quite reasonable. It's now possible to have a PC board made for a club project without the club's accountant having the big one.

"Why who knows, I may want to build your version of a time continuum projector for Field Day, and I'll need the plans!"

No matter what route you take, the first board more than likely will have a bug or two. The problem is, you'll never know it unless you build the project on your new PC board! Now this is what I call fun! No matter how many hours I spend checking the paper layout of the PC board, I usually find something screwy with the final project. It may be a case of having a resistor placed too close to an IC or a terminal block hitting a regulator. Or, I've even been known to forget a VCC run to a chip or two. Again, make the necessary correction and have a second board burned. And, again, check the PC board out by building the circuit once more. This time around, everything should be as good as it's going to get.

The final part of the project is writing up some sort of instructions for the project. Do you really think you'll remember what that jumper block does three years from now? Gather all the paper work from the original block diagrams to the final PC board layout and file them away.

While this does seem to be a lot of work for a simple project, it's well worth the time and effort. The ability to reproduce the project is a must for most editors. Why who knows, I may want to build *your* version of a time continuum projector for Field Day, and I'll need the plans! 73

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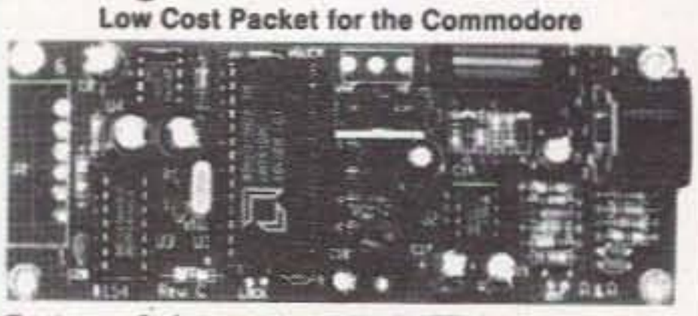

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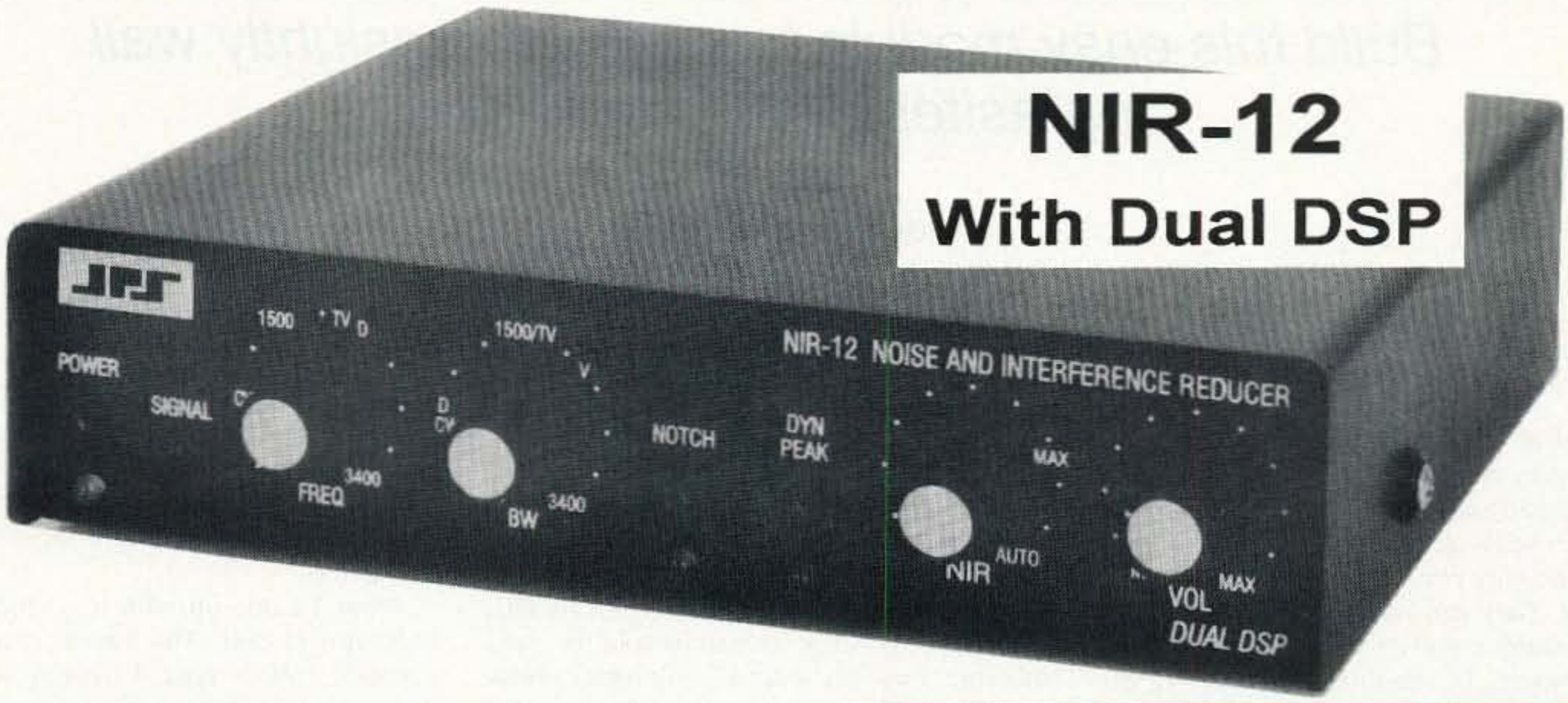

At long last, the most advanced noise reduction/filter unit is now available from JPS. DUAL DSP chips are used in the NIR-12 to provide simultaneous bandwidth filter, noise reduction (2 types) and tone removal. Both Spectral Subtraction (NIR®) and Dynamic Peaking noise reduction methods are included to provide reduction of IMPULSE noises as well as atmospheric white noise. An AUTOMATIC NIR® mode is included to set the noise reduction at the optimum point, based upon the measured Signal-To-Noise ratio of the received signal. A spectral notch filter provides cancellation of multiple heterodynes from tune-ups, adjacent channel carriers, CW, RTTY, or simular signals without interfering with voice signals. The notch filter operates in 5 milliseconds or less. The super-selective FIR filters are continuously variable in both bandwidth and center frequency. Bandwidth is adjustable between 50 Hz and 3200 Hz. The user-friendly front panel gets you operating on the air in the shortest possible time. An internal access to the dual DSPs is provided via RS-232 for experimenters.

Other fine JPS Amateur Radio products include: NIR-10 Noise & Interference Reducer; NRF-7 General Purpose Noise Reducer & Filter Unit; NTR-1 Wideband Noise and Tone Remover; SSTV-1 DSP Filter for SSTV; NF-60 DSP Spectral Notch Filter. 115VAC/12VDC adapter available

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Wart Remover

Build this easy module to eliminate unsightly wall parasites from your shack.

by Michael Bryce WB8VGE

Most of them are small, black and ugly. Every ham I know of has dozens of them sucking up juice, even when they're doing no work at all. They hide in the most out-of-the-way places, yet they're always in the way. They can suck the life right out of your standby battery banks if you're on inverter power. To top things off, they're expensive to buy if you need one. What are they? They're wall warts—small power supplies you plug into the wall outlets.

Look around your shack. How many wall warts do you have plugged in? Five, 10, or even more? They keep my inverter on all the time and, just like parasites, they suck power from the inverter even though the device they're suppose to be running is turned off.

Every time my wife wants to use an outlet, a wall wart must be removed first. Of course, she always manages to get the one attached to the backup lighting system. After replacing the batteries for that light for the last time, I came up with the "Wart Remover." This simple project will allow you to remove just about all the wall warts from your shack. You can build your own Wart Remover for about $40 or so. It's easy to build and requires no special test gear to adjust.

The basic module will replace up to four wall warts, and you can add on a second module if you want to remove more. If you only have three or less (are you kidding?), you need only build the circuit for your needs. The Wart Remover will replace up to 3 amps worth of wall warts. An extended PC board will hold up to eight regulators, and you can piggyback another extended board for a total of 16 regulators.

A Closer Look at Wall Warts

Most wall warts are nothing more than a small transformer, diodes, and a filter capacitor. In fact, if you rip one apart, you'll find perhaps one diode, maybe two, and a small filter capacitor. They have no active devices inside, such as regulators or transistors. They're sealed up in plastic, making repair almost impossible. When they go bad, you get a new one. With guts like this, most wall warts have very bad voltage regulation and leave plenty of ripple on the DC they do supply. Some wall warts supply only low voltage AC to their loads.

Looking around my shack, the wall warts I have come in several different flavors. They're either in 6-volt DC or 9-volt DC, with some AC-only ones thrown in for good measure. I use my main 12-volt battery bank for all my 12-volt needs, thus I have no 12-volt wall warts.

The Wart Remover

It's simplicity itself. I wanted a project that everyone could build. So, using off-the-shelf parts that are easy to find was my first goal. It also had to be easy to adjust. In keeping with ham radio tradition, it had to be cheap, too.

What I came up with is a stock LM317 regulator circuit. The circuit is a standard constant voltage type. I figured it would be easier on everyone to go constant voltage instead of constant current because of the zillions of different loads wall warts operate.

A PC board is used to speed up the project. In fact, there are two PC boards. The

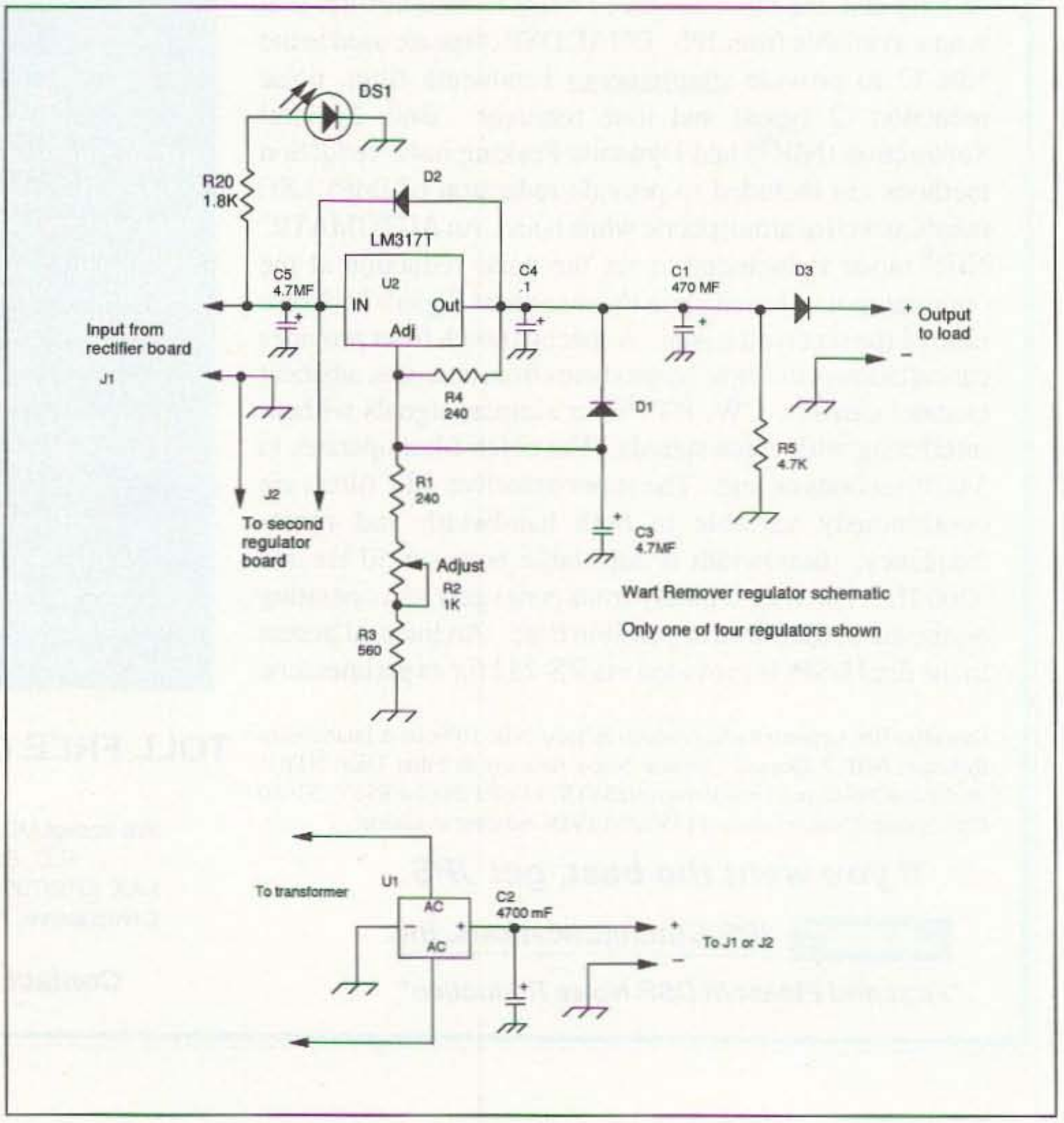

Figure 1. Wart Remover schematic diagram.

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. Please rate each feature or column as "Great," "OK," or "No Way." Mail your responses to: 73 Magazine Feedback, 70 Route 202N, Peterborough, New Hampshire 03458.

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3 QRX
4 Builder's Guide to the Universe
5 Wart Remover
6 Review: Trident TR-1200 Wide-Range Monitor Scanner
7 Review: Oak Hills Explorer Kit
8 6 Meters—The In-Between Band
9 Review: Alinco DR-MO6
10 Review: Comet HA4S
11 A Foolproof Power Controller
12 K4SYU Loop Antenna
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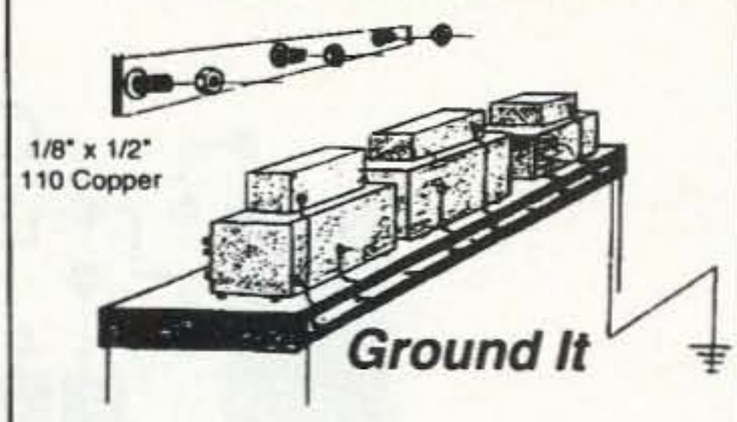

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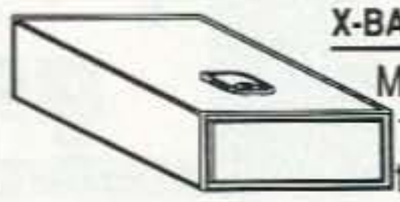
CIRCLE 25 ON READER SERVICE CARD

X-BAND TRANSMITTER



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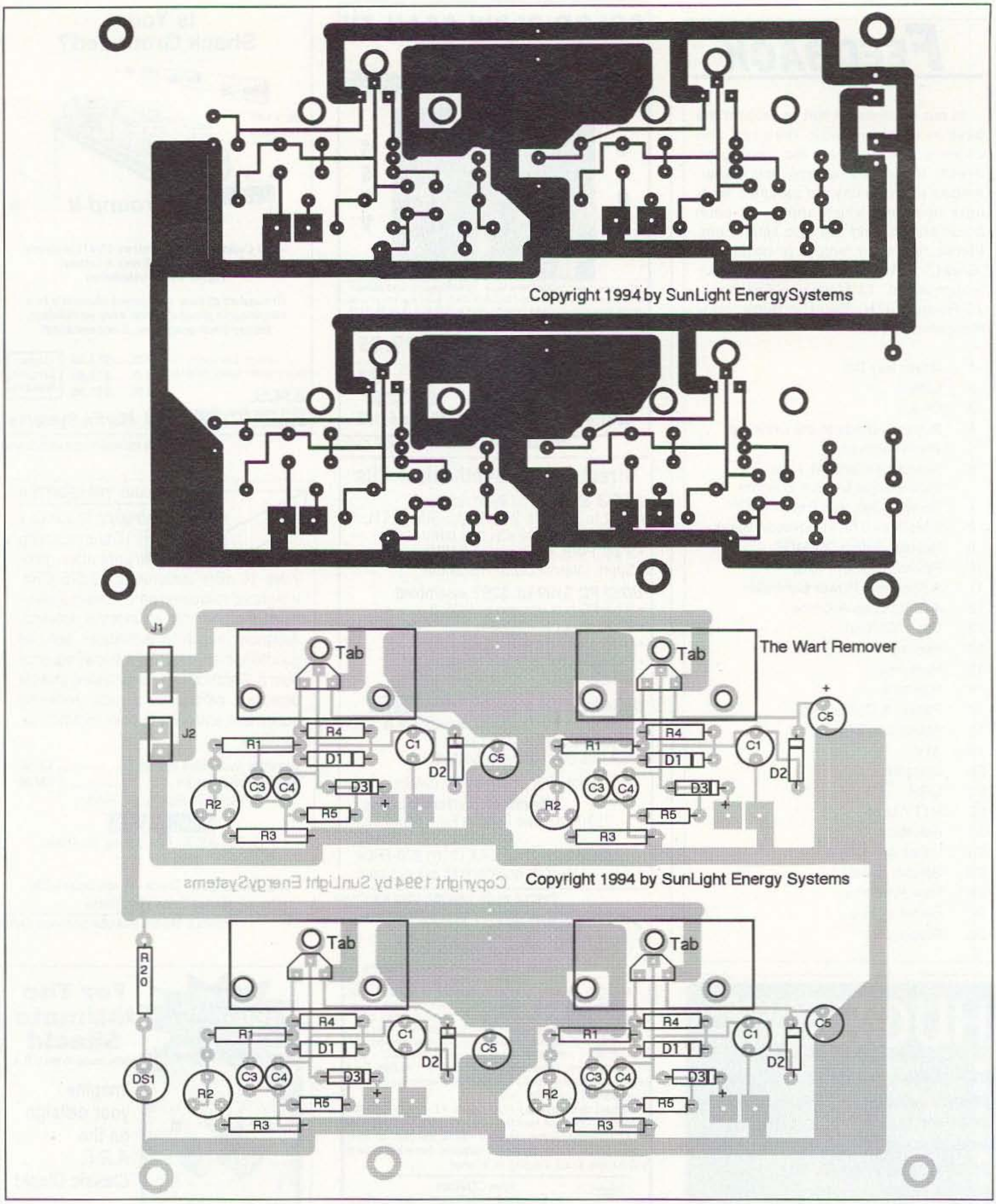

Figure 2. PC board layout and parts placement.

full-wave diode rectifier and filter capacitor mount on one board. This board plugs into the main regulator board holding the LM317 regulators. You can add on a second, or third, regulator board by stacking them. A cable with a plug-on .156 center connects all the boards together. As I mentioned earlier, there is an extended PC board which will hold eight of the LM317 regulators.

Each regulator board will hold four LM317 regulators. Each regulator has its own voltage adjust pot. You can build all four regulators, or only one, adding more on as your needs grow. Since each regulator can supply up to 1 amp of current, the transformer and rectifier/filter board should be able to handle the required current. It's quite possible to have up to 16 amps of current if you add on two extended regulator boards and fully load them down. However, we're kinda lucky on this as the loads wall warts

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SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
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SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

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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

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

RS-M SERIES

MODEL RS-35M

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

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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
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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

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CIRCLE 16 ON READER SERVICE CARD

supply are usually very small. The dead wall warts in my pile had currents ranging from a low of 30 mA to a high of 800 mA, with just about everything else in between. In my first Wart Remover, I settled for a 2-amp rating. That's enough for a 500 mA load on all four regulators.

How It Works

The power transformer supplies the diode/filter board with about 14 volts. Since I did not want to power any of my 12-volt loads from the Wart Remover, the lower secondary voltage from the transformer will help to keep the heat dissipation down on the regulators.

The full-wave bridge rectifier and filter capacitor supplies the regulator board with a source of DC. On the regulator board, resistor R20 limits the current flowing into the "power on" LED. This LED glows whenever the Wart Remover is plugged into the AC mains. There is no "on/off" switch.

Diodes D1 and D2 protect the LM317 from reverse voltage damage from battery-operated loads such as rechargeable lights and radios.

For clarity, only one of the regulators is shown in the schematic of the Wart Remover. Remember, there are four regulators on each regulator board.

The LM317 adjustable regulator is textbook-simple. I added a small load to each of the regulators to keep the LM317 stable under light- or no-load conditions. Each output is decoupled with a 1000 µF capacitor and a .01 capacitor. The smaller tantalum capacitors on the input and output of the LM317 keep the regulator(s) from oscillating.

Each LM317 has its own trimmer used to set the output voltage. Resistors R1 and R3 make fine voltage adjustments a bit easier with the single-turn trimmer. All the trimmers are mounted flat on the PC board so you can adjust the output voltage without standing on your head. If you stack more than one regulator board, you'll find adjusting the bottom board interesting. I have my top regulator board on a hinge so I can swing it out of the way to reach the bottom board. Really, once you set the regulators to their proper voltage, you won't need to mess with them again, unless you want to change the voltage setting.

Assembly

I highly recommend the use of the two PC boards for this project. Yes, you can use just about any method you feel comfortable with to build your own Wart Remover, but the PC board is the way to go. Both PC boards and a kit of parts are available[1].

The main regulator board and the filter/rectifier board are single-sided. A plug with .156 centers connects the filter/rectifier board to the regulator board. On each regulator board is a header, also on .156 centers, to piggyback a second or third regulator board. Remember to keep the total current within the rating of the rectifier and transformer. If you use the PC board set, you can use either plug on the regulator board. The headers have a locking tab making reverse polarity mistakes history.

To avoid confusion when stuffing the PC board, each regulator and its components repeat. For one main regulator board, there will be four R1 resistors, four C1 capacitors, four C2 capacitors, and so on. Each of the four regulators is identical in every way.

Each of the four individual LM317s has its own heat sink. You can use a small hunk of aluminum if you don't want to mess with the ones described in the Parts List. There is no need to insulate the LM317 from the heat sinks, provided each regulator has its own heat sink. A word of caution however: If you use a single long strip of aluminum to heat-sink all the LM317s at one shot, you must insulate them from the heat sink. Apply some thermal goo and fasten them down with 6-32 screws and nuts.

"Be careful when installing the many electrolytic capacitors—they must be installed correctly or you'll smell burned capacitors!"

Be careful when installing the many electrolytic capacitors—they must be installed correctly or you'll smell burned capacitors!

I mounted the two PC boards, transformer and fuse holder on a small sheet of 1/8-inch aluminum. I believe it to be a cut-down 19-inch relay rack panel. A 1/4-inch hole drilled in each corner provides an easy method of mounting the Wart Remover to the wall. This open-air construction also helps keep the LM317s cool by providing natural convection cooling.

The rectifier/filter board has four mounting holes, one at each corner. Or, you can turn the board over and use the hole in the bridge rectifier to hold the assembly. This way, the aluminum mounting becomes the heat sink for the diode assembly. Use some thermal goop here, too.

Safety first! Be sure you include a fuse in the primary of the power transformer. I use a 3-amp fast-blow fuse in an enclosed fuse holder. Again, safety first—use plenty of tape or heat-shrink tubing to fully protect yourself and others from any exposed 110 AC points. My Wart Remover is bolted onto the wall. If you elect this method, too, some sort of safety cage would be a great idea, especially if you have children in the house.

The transformer is not at all critical. You can use just about any 12-volt secondary at whatever current it can deliver. Remember to add up the total current you're going to be using when looking for a transformer. Good sources for transformers are surplus electronic dealers, hamfests, or your buddy's junk box. I built a Wart Remover using a transformer from a defunct VCR! Worked great! In a pinch, Radio Shack carries several that will fit the bill quite nicely.

Of course, you'll need the proper-fitting plug for each load. You could steal the plug, cord and all, from the wall wart, but don't. Instead, wrap it up nicely and put it away in the original box it came from. This way you'll know what it's for a year from now. Radio Shack carries an impressive collection of coaxial jacks. Mouser Electronics also carries dozens of coaxial plugs.

Setup Adjustments

All you really need to do is probe the output of one regulator at a time and set its output voltage. The only precaution here is to set the output of the individual regulator for the voltage required *by the load* and not the open circuit voltage of the wall wart! I have one wall wart listed at 9 volts DC but open circuit voltage read almost 17 volts! If you want to operate your tape recorder and it requires 6 volts, set one of the regulators for 6 volts. It's a good idea to mark what regulator is running what load so you can refer back to it if you need to at a later date.

Adjustment

Plug the transformer's secondary into the rectifier/filter board. Plug the transformer into the AC outlet. Check for about +14 volts at the output of the rectifier board[2]. Unplug the transformer from the AC mains. Now, plug the regulator board into the filter/rectifier board. You can use either plug on the regulator board. Put power to the transformer and you should see the LED glow. Now, all you have to do is set the output of the first LM317 to whatever voltage you desire by adjusting the trimmer associated with that LM317. Then, move on to the next regulator until you have them all set.

The final step is to solder the proper connectors to the PC board. Be sure you have observed the correct polarity of your load! You don't want to cook it because you hooked it up backwards. It would be a very good idea to clearly mark each cable coming from the Wart Remover so you know what is what next month.

Last Words and Precautions

Every wall wart load I've owned states something about voiding the warranty if the device is operated from something other than the wall transformer supplied. If you have second thoughts about powering your $500 walkthing with the Wart Remover, then don't.

If your load recharges its own internal batteries (rechargeable flashlights, HTs, or hand drills), proceed with caution. Many of these loads count on the wimpy regulation of the wall wart to keep from overcharging the batteries.

There's the possibility of cross-wiring some devices, depending on how they are wired internally. I've not had this happen, but there may be times when you would

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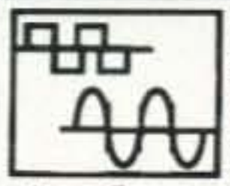

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Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mV steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 mS to 40 hours! Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fi's, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

URC-1 Remote control kit .....**$129.95** CURC Matching case set **$14.95**
URC-1WT Fully assembled URC-1 and case **$189.95**

FM SUBCARRIER DECODER

Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

SCA-1 Decoder kit.....**$27.95** CSCA Matching case set.....**$14.95**
FR-1 FM receiver kit.....**$24.95** CFR Matching case for FR-1 .....**$14.95**

L-C METER

Measure inductors from 10 uH-10mH and capacitors from 2 pF-2uF with high accuracy by connecting the LC-1 to any digital multimeter. Two pushbutton ranges for high resolution readings and we even give you calibration components to assure proper accuracy of your kit! Active filters and switching supplies require critical values, no one should be without an accurate LC meter. For a pro look, add our matching case set.

LC-1 LC meter kit .....**$34.95** CLC case set.....**$14.95**

MOTOR CONTROLLER

Control the speed and direction of any motor. Use our SMD-1 for those nice steppers you see surplus, and our MSC-1 for DC motors. The stepper driver features variable speed, half step rotation, direction and power down mode, can drive most any stepper motor. Our DC driver features pulse width modulation control allowing full motor torque even at low speeds and can drive motors up to 50 VDC @ 10 Amps! Add our case set for a professional assembly.

SMD-1 Stepper kit .....**$24.95** MSC-1 DC motor kit.....**$24.95**
CSMD SMD-1 case .....**$14.95** CMSC MSC-1 case.....**$14.95**

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit **$34.95**
CFM Case,whip ant set.....**$14.95**

DR. NI-CAD CONDITIONER/FAST CHARGER

Quit spending big bucks for replacement battery packs, rejuvenate and condition your batteries for peak capacity. Advanced circuitry has optimized discharge before charge to eliminate memory effect and to condition batteries that have been poorly cared for in the past. Quick charge rapidly brings battery to full charge in less than an hour-just 15 minutes for some types! And "top-off" charge mode squeezes every last bit of energy into each cell for the absolute most capacity. Switch-mode regulator controls constant current charge while being monitored by a negative delta-V system that cuts off the fast charge at the exact point of full charge-batteries are charged, not cooked! Charges NiCads or NiMH packs from 2 to 10 cells (easily expanded) and current capacities up to 10 Amp-hours. Runs on 12 to 15 VDC. Quit cooking your batteries, buying new packs, waiting hours for recharge, get a Dr. Ni-Cad today! Available in money saving kit form or wired and tested with case at a special price. Kit builders: add our matching case set for a snazzy finish.

DN-1 Dr. Ni-Cad conditioner/fast charger kit.....**$49.95**
CDN Matching case set.....**$14.95**
DN-1WT Fully assembled Dr. Ni-Cad with case **$89.95**

SPEED RADAR

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

SG-7 Complete kit.....**$99.95**

STEREO PEAK HOLD BARGRAPH

Finally a dual LED bar graph with a peak hold display! Bar graph displays are neat and eye catching but their speed is their downfall - they just can't capture the peaks. Our kit is like two units in one, a fast display to show the signal and a long persistance display to capture peaks, similar units go for hundreds of bucks! We offer 3 models: Linear for general use, Semi-Log for audio VU meters, and Log for power displays. Dual - for stereo! - 10 segment multi-colored LED display for snazzy, eye grabbing display and easily set ranges for virtually any signals, from voltmeters to audio VU meters to audio power amps to SWR meters. Complete intructions for easy hook-up to most any device. Add our matching case set for a sharp looking unit.

PH-14 Dual Linear bargraph kit.....**$39.95** PH-15 Dual Log bargraph kit ..**$39.95**
PH-16 Dual Semi-Log bargraph kit.....**$39.95** CPH Matching case set **$14.95**

SPEECH SCRAMBLER

Descramble most scramble systems heard on your scanner radio or set up your own scambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a fine professional finish.

SS-70 Scrambler /descramblerkit **$39.95**
CSSD matching case set.....**$14.95**
SS-70WT Assembled SS-70 and case set **$79.95**

CRYSTAL RADIO

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CS-1 Crystal set kit **$19.95**

TOUCH-TONE DECODER

Grab Touch-Tone numbers right off the air, phone or tape. A simple hook-up to any radio speaker or phone line is all that is required to instantly decipher touch-tone phone numbers or codes. A 256 digit memory stores decoded numbers and keeps its memory even in the event of power loss. An 8 digit LED display allows you to scroll through the memory bank to examine numbers. To make it easy to pick out number groups or codes, a "dash" is inserted between sets of digits that were decoded more than 2 seconds apart. A "central-office" quality crystal controlled decoder is used allowing rapid and reliable detection of numbers at up to 20 digits per second! For a professionally finished look, add our matching case set. Start cracking those secret codes tomorrow with the Tone Grabber!

TG-1 Tone Grabber kit.....**$99.95** CTG Matching case set **$14.95**
TG-1WT Fully assembled TG-1 and case.....**$149.95**

DIGITAL VOICE RECORDER

Chatterbox digital voice storage unit will record your message of up to 20 seconds. Time is split up into four 5 second blocks which can be played separately or cascaded for longer messages. An LED display shows message location and current mode for easy operation. Nifty built-in interfaces allow simple connection to transmitters for automatic keying when the PTT is initially closed or after it is released. You can even loop your rig's mike through the Chatterbox. For contest or fun use, the CB-1 can drive an external speaker. Includes a built-in electret mike. For that finishing touch, add our matching case set.

CB-1 Voice recorder kit.....**$59.95** CCB Matching case set **$14.95**

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connect a tape recorder to a radio via a patch cord. If the radio chassis is at "+" voltage and the recorder is at "-" voltage, things would become interesting. I've not had this happen as most of the "+" ground devices are insulated from the common ground. Check to be sure before assuming everything is at the same potential.

You can supply the regulator board directly from a 12-volt supply such as your main rig's power supply. When you power up the rig, all the external loads will also come up. You can also use a 12-volt battery to power the Wart Remover, too. Don't forget to install a fuse in the supply line in either case.

If you need some low voltage AC, steal it from the rectifier/filter board. There are two pads on the board just for that purpose. Remember to keep track of the total current being pulled from the transformer.

Even though there is not enough voltage for the regulators to provide +12 volts, you can still delete a 12-volt wall wart if the load current is not too high. You should be able to set one LM317 at 12 volts and draw 100 mA or so from it before the voltage drops too low and the IC falls out of regulation[3].

If you need to set the output of the regulator to a real low DC voltage, say, 3 volts, you may need to play with the values of the resistors in the voltage divider.

I don't know if adding a fuse for each output would be worth the time and effort. An LM317 will shut down during a short circuit condition. The LM317 will also shut down if it overheats.

Last Page

I hope you have as much fun as I did in designing the Wart Remover. It's fast, simple, and fun to build. Even easier to use! Of course, now that you have all those open wall outlets, think of all the new rigs you can get! 73

Parts List

R1	240	
R2	1k trimmer	Mouser #531-PTC10V-1K
R3	560	
R4	240	
R5	4.7k	
R20	1.8k	
D2	1N4002	
D3	1N4002	
D4	1N4002	
C1	470 mF	
C3	4.7 mF	
C4	.1 mF	
C5	4.7 mF	
U1	LM317T adjustable regulator	Mouser #511-LM317T
BR1	6-amp bridge diode	Mouser #333-BR61
DS1	Red LED	Junkbox
Heat sink		Mouser #567-7-371-BA
J1	2-position .156 terminal housing	Mouser #538-09-50-3021
J2	2-position .156 terminal housing	Mouser #538-09-50-3021
J3	4-position .156 terminal housing	Mouser #538-09-50-3041
J4	4-position .156 terminal housing	Mouser #538-09-50-3041
Friction lock PC headers		Mouser #538-26-48-1246 or DigiKey #WM4602-ND
Crimp terminal for terminal housing		Mouser #538-08-0106

Mouser Electronics: 1-800-346-6873
Digikey Electronics: 1-800-344-4539

Notes:

1. A complete set of PC boards, the filter rectifier and one main regulator board, and all parts (except for the transformer), is available for $45 from SunLight Energy Systems, 2225 Mayflower NW, Massillon, OH 44647. Board set only $15 from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

Extended regulator board $26 from FAR Circuits.

2. The actual output from the filter rectifier board will be determined by the transformer used.

3. Using a higher-voltage transformer and changing out the two resistors in the voltage divider will allow for full 1-amp current at 12 volts.

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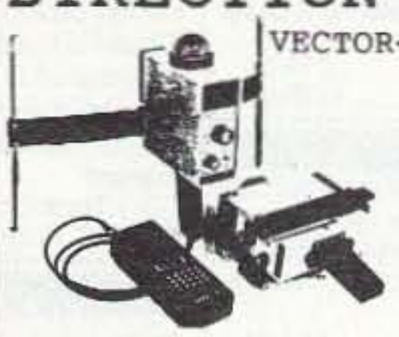
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The Trident TR-1200 Wide-Range Monitor Scanner

Listen to the world with this compact little unit.

It's lightweight, compact, has a thousand channels, and can tune around the world. I am describing the TR-1200 model scanner from Trident. This is not just a typical police scanner—this hand-held radio will pick up all sorts of things that are of interest to the amateur. The TR-1200 covers from 500 kHz up to 1300 MHz in three different modes: AM, FM wide, and FM narrow. The modes can be selected independent of the receive frequency. Scan and search steps range from 5 kHz to 995 kHz. There are 10 memory banks with 100 channels per bank. There are also 10 search ranges that can be saved in memory. Power is provided by four supplied NiCd AA cells or a furnished 12 VDC power pack.

My first impression of this radio was, "Wow, this is light for its size." The unit tilts my postal scale at just 11 ounces without batteries, and its dimensions are just 6-3/4" by 2-3/4" by 1-1/2". The Trident TR-1200 is *very* similar to radios sold under the nameplates A.O.R., Fairmate, Camnis and Yupiteru.

My first lesson using the Trident was not to misplace the user's manual. Although programming the radio can be mastered, it takes some practice and some double-checking the manual. The TR-1200 has many bells, whistles, and various functions. However, they are not easily memorized, and having the manual handy during operation was usually necessary. After logging in on one of the more popular on-line computer services I learned that other users shared this opinion. In fact, several users of these radios have created wallet-sized and full-sized function sheets to carry with them.

So what does the TR-1200 have to offer the average ham? The Trident will tune to every amateur frequency below microwave, from the long wavelength 160 meter band at 1.800 MHz through the 1240-1300 MHz amateur band. The tuning knob on the top of the radio makes it very easy to tune up or down a few kHz at a time for fine-tuning. One drawback for the ham, however, is that single sideband mode reception is not available in this model. What this means is that below 29 MHz there is limited amateur traffic that the TR-1200 user will be able to monitor. Only traffic that is in the AM mode is intelligible. Of course, the majority of traffic here is SSB or CW. If you want to pick up SSB or CW, you either have to add a BFO or look to another radio. Trident is now offering a model that includes a BFO, by the way.

Scanning

Scan banks can be scanned individually or in groups. For example, banks 2, 3 and 4 are programmed for fire; and banks 5 and 6 for the big NASCAR race. You may certainly scan all groups at once, but this means potentially scanning through 1,000 channels.

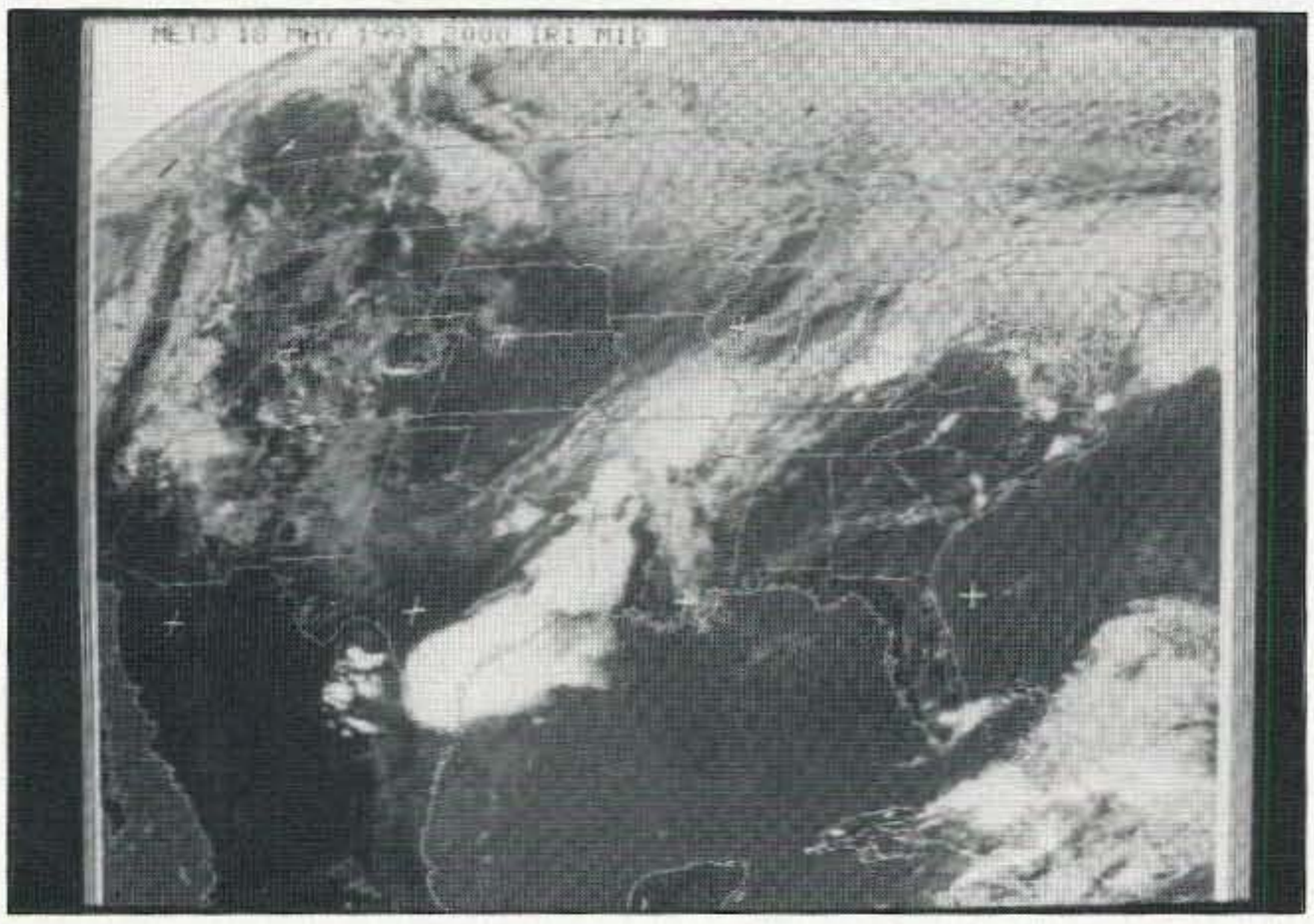
While the casual user may have difficulty filling two or three banks of 100 channels, the seasoned scanner buff can find ways of filling 1,000 channels, although it takes some effort.

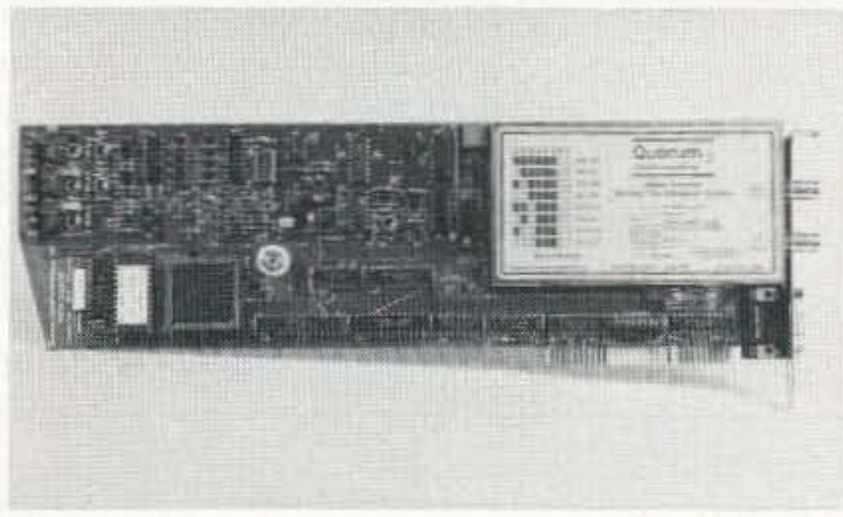
Scan Bank	Use
1	Local towns—police, fire, hospitals and local government for towns within 20 miles.
2	Fire departments low band—33 MHz and 46 MHz fire services.
3	Fire departments VHF high band—154 MHz fire services.
4	Fire departments UHF band—460-485 MHz fire service.
5	Race track frequencies.
6	Police—locals and State Police/Sheriffs for all six New England states.
7	Amateur 29 MHz and above.
8	HF/shortwave/medium wave (AM) stations.
9	Wife's favorite FM and TV station audio.
0	Research, including Federal Government and 800 MHz.

Table 1.

Photo A. The Trident TR-1200 wide-range monitor scanner.

Explore The World of Quorum Wefax





Wefax Explorer

Integrated Wefax / APT Receiver and Scan Converter with Qfax software.

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QFAX Features

- *GOES / Meteosat Wefax Reception*
- *NOAA / Meteor APT Reception*
- *HF Nafax Reception*
- *Dual RF ports for geosync and polar reception under software control*
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- *Contrast, Brightness, 3D effect, Sharpen, Smooth, Noise, Histograms and other image processing*
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- *2 7 day programmable schedulers*
- *Automatic digital gain lock in ALL modes, PLL clocking*
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- *Automatic Temperature Calibration*
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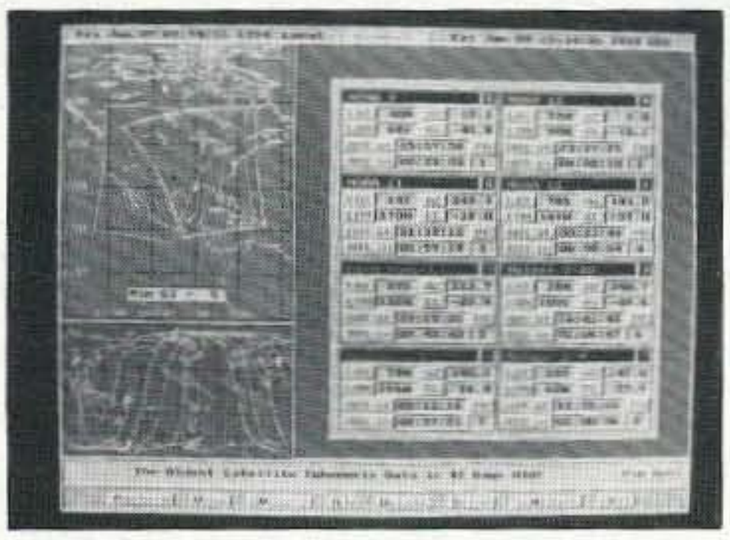

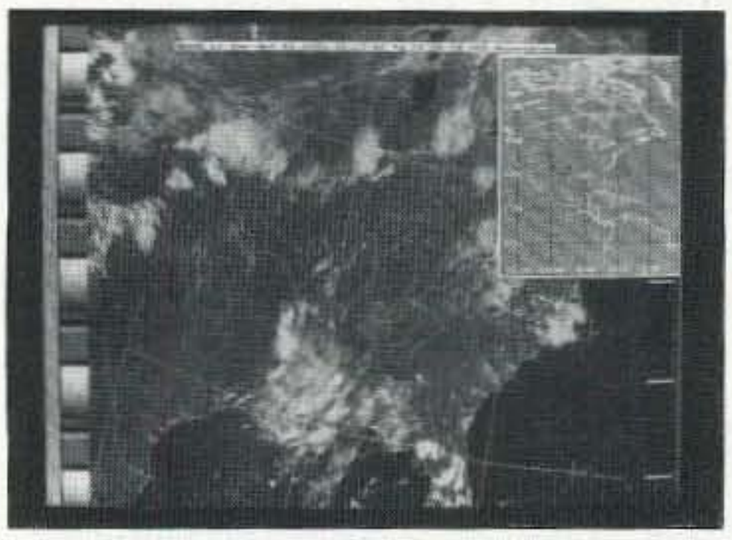

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CIRCLE 257 ON READER SERVICE CARD

Search Bank	Range	Search Step	Mode	Use
1	33.440-33.980 MHz	20 kHz	FM narrow	Low band 33 MHz fire
2	46.060-45.500 MHz	20 kHz	FM narrow	Low band 46 MHz fire
3	44.780-45.460 MHz	20 kHz	FM narrow	New Hampshire State Police
4	462.550-462.725 MHz	12.5 kHz	FM narrow	General mobile radio service (non-business)
5	146.400-147.400 MHz	15 kHz	FM narrow	2 meter amateur
6	88.100-107.900 MHz	200 kHz	FM wide	FM broadcast
7	118.000-136.000 MHz	25 kHz	AM	Commercial/private aircraft
8	225.000-400.000 MHz	50 kHz	AM	Military aircraft
9	153.770-154.445 MHz	15 kHz	FM narrow	Local fire department
0	460.025-460.500 MHz	25 kHz	FM narrow	Boston MA police

Table 2.

33.00 MHz	FM narrow	.25 µV
44.00 MHz	FM narrow	.20 µV
54.00 MHz	FM narrow	.43 µV
146.00 MHz	FM narrow	.27 µV
156.00 MHz	FM narrow	.35 µV
166.00 MHz	FM narrow	.35 µV
408 00 MHz	FM narrow	.98 µV
450.00 MHz	FM narrow	.75 µV
460.00 MHz	FM narrow	.50 µV
470.00 MHz	FM narrow	.60 µV
490.00 MHz	FM narrow	.75 µV
856.00 MHz	FM narrow	.35 µV

Table 3.

Table 1 shows how I filled the 10 banks. Not all 100 channels need to be programmed in each bank. Unprogrammed channels are not scanned.

I do not actually scan banks 8 and 9, as these services have a constant signal that would halt scanning. For these banks I use the direct access to channel feature to select the desired channel.

Search Banks can be set up slightly differently. See Table 2.

Sensitivity specs were measured on an IFR Model 500A communications analyzer. See Table 3.

Note how some frequencies are much more sensitive than others. In some areas the radio seemed hot sensitivity-wise. In other areas the radio provided less sensitivity. Actual field usage replicated bench testing. I realize that covering such an enormous chunk of frequencies is probably achieved with some compromise. However, some of the sensitivity drop-offs occurred in ranges where I find some interesting listening and researching. Hams may note the 408-450 MHz and 6 meter sensitivity as well. The scan and search rates are both approximately 20 channels per second.

The user's manual states that the supplied antenna was not intended for shortwave or broadcast band reception. I did find that many stations in the 49 meter band were still easy to hear with this rubber duck. Substituting a long piece of wire stuck in the BNC antenna jack as suggested by the user's manual provided a great number of stations for listening. This is enticing to the shortwave listener who enjoys the standard broadcast fare in the AM mode.

The user's manual is quite detailed. It appears to be written by an individual or individuals who genuinely want the user to understand how to use the radio. In some cases fewer words could have adequately described the functions. The manual I received with the radio appears to be a preliminary version, as some of the paragraphs were incomplete. *[Manufacturer's Note: This has now been corrected.]* The paper and ink used

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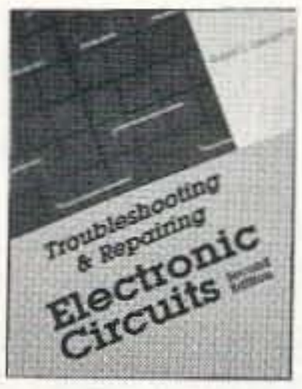
CIRCLE 152 ON READER SERVICE CARD



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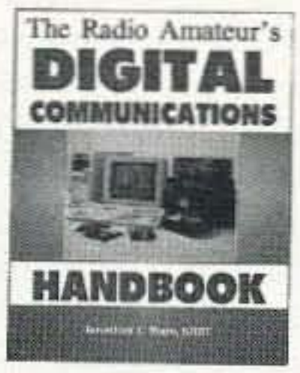

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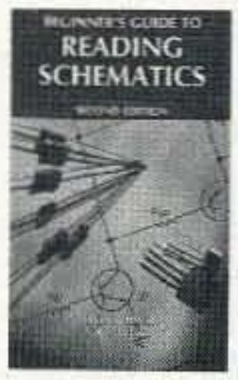

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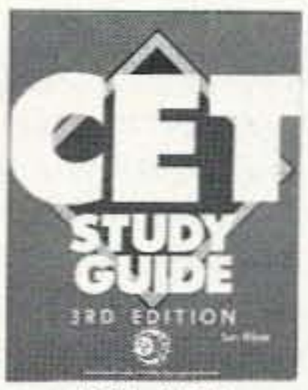

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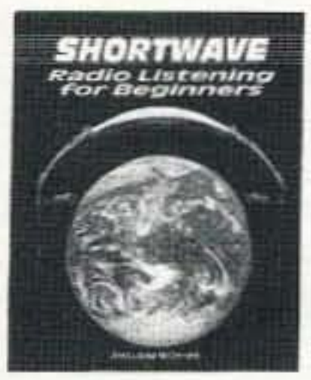

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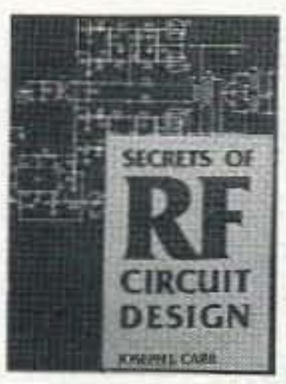

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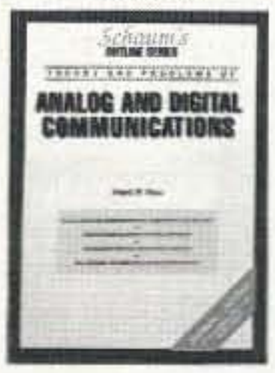

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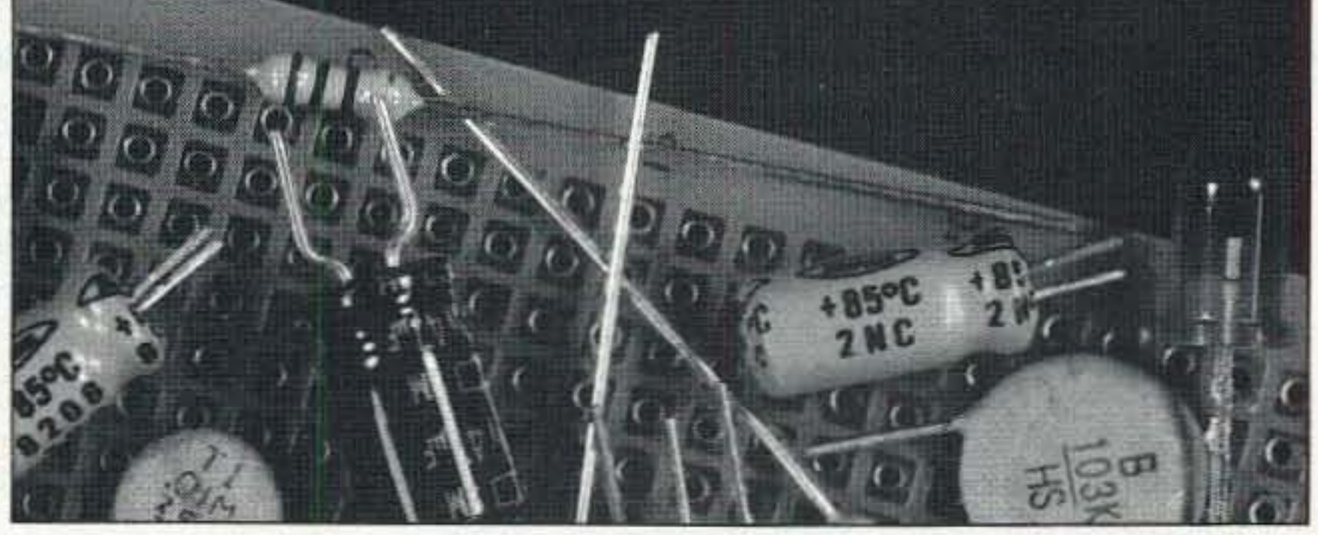

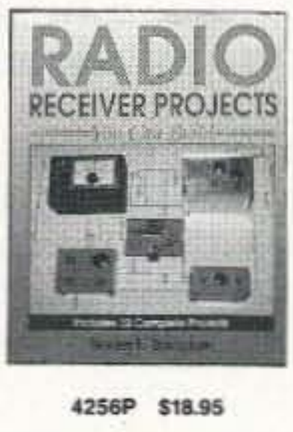

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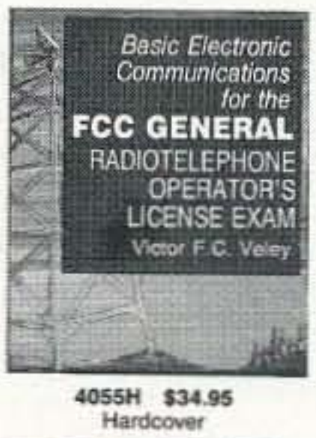

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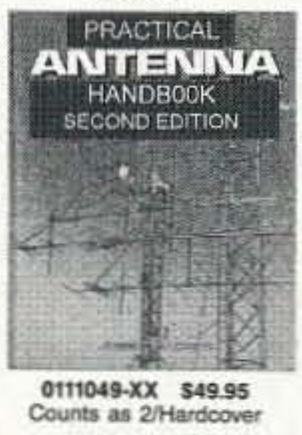

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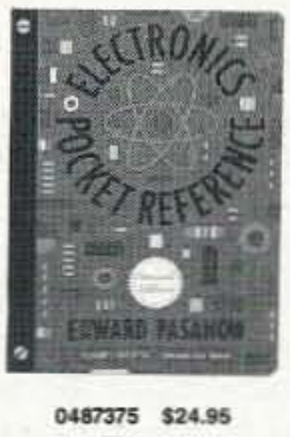

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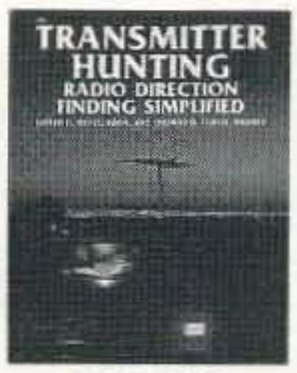

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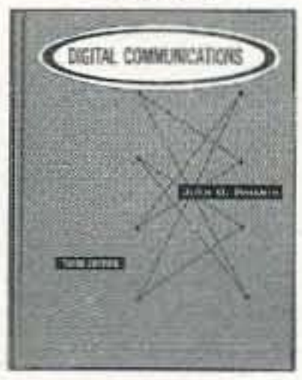

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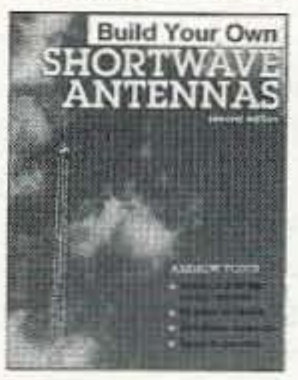

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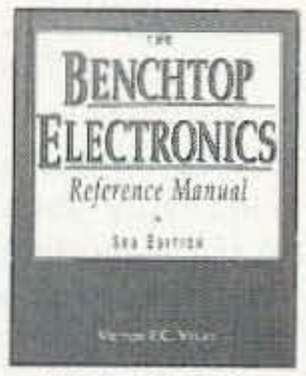

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in the printing of the manual were of low quality. After walking for about 10 seconds in a snow shower with the manual exposed, the ink on the cover and an inside page ran considerably.

Speaker Audio

As with virtually all hand-held radios, I found the speaker output to be only sufficient in situations with little or no background noise. It was inadequate in situations such as at fire scenes or driving in a car. While showing the radio around at a party, I had to pull people into a separate room to clearly hear the radio traffic. Turning the volume knob beyond two-thirds of full range didn't seem to help.

Features and Accessories

Rubber ducky antenna, which looks exactly like a Yaesu dual-band rubber ducky. This antenna performs well on VHF high band (144-174 MHz) and UHF (440-470 MHz). However, as with most rubber ducks, performance is poor on VHF low band.

Batteries—four factory-provided NiCd rechargeable cells. Their performance was fair compared with brand-name NiCds. As with all NiCds supplied with electronic gadgets, a lengthy initial charge of about 14 hours was necessary.

AC power adapter for charging and listening to radio. This performed well.

DC/car cigarette lighter plug. This performed well.

Earphone—your standard monaural earphone.

Carrying strap.

Belt clip. I did use this.

Vinyl case. The majority of the front of the case is of clear vinyl through which all keys are easy to access. The case actually took some fairly abusive treatment and came through surprisingly well.

Keys, knobs and switches.

Tuning knob placed within easy reach on top of the scanner. This is particularly useful for fine-tuning stations in bands with nonstandard channel spacing. I found the tuning knob particularly useful in the HF bands.

Keyboard lock. Located on the front panel, it has a raised lip around it. This handy button will lock all other keyboard buttons. I use this feature when I'm at a fire scene fiddling with my camera and I don't want to accidentally change the setting on the radio.

Display backlight. Pushing this button turns on the well-illuminating backlight for the display for about six seconds. I did find its usability a little irritating. I find that six seconds is not always adequate time for programming in the dark. Holding the button in will not keep the backlight illuminated. Pushing the button before the backlight goes out will extinguish the light. Having illuminated keys would be a plus.

"In order to keep the comparison as fair as possible I used the supplied rubber duck antenna for both the Trident and my own scanners."

Comparison

The Trident TR-1200 is a near clone of the A.O.R. AR1000XLT, less 800 MHz cellular radio phone coverage.

I found it necessary to evaluate the TR-1200 using two different criteria. One was using the radio by itself on a weekend stay in coastal Maine. Since this area was relatively untried turf for my monitoring, I did not have any major expectations of what I should be hearing. The TR-1200 was fun to use once all the desired frequencies were entered into the many channels and search groups. It performed admirably in the presence of my relatives, although they were a bit befuddled by the steps necessary to program the radio. I was satisfied with its ability to hear police and fire departments for 40 miles up and down the coast using just the rubber ducky. AM broadcast band reception, however, was dismal, even with a very long piece of wire as an antenna. TV and FM broadcast stations in the region all came in well. The AM civilian aircraft band did not receive much until I got within five miles of the Portland, Maine, Jetport.

At a major shopping mall I attempted to seek out the mall's security channel. Having been inside the mall, I determined that security/maintenance was using UHF handie-talkies. My confidence in my ability to program search functions without the manual was dealt a blow, as it took me a good 10 minutes of button-pushing to get things right. In less time than it took me to find the correct function key pattern I had found the Maine Mall frequency.

The second criterion I used was side-by-side comparison with three other radios I own. This was a somewhat unfair comparison, since it took three radios to compare to this one Trident. The radios I used were a Realistic 2006 base scanner, a Regency HX1000 hand-held scanner, and a Yaesu FRG-7 communications receiver. Compared to other radios I own, the TR-1200 does more than any one of them alone. However, in many cases the TR-1200's performance is less, in common coverage areas, than the other radios'. In order to keep the comparison as fair as possible I used the supplied rubber duck antenna for both the Trident and my own scanners.

Overall Impressions

It's fun to listen to, but a minor challenge to master. The biggest plus: My spouse likes to use it. My biggest dislike: It needs more scan banks, with fewer channels per bank. For the price it is tough to match the coverage of the Trident TR-1200. 73

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You get MFJ's *tunable* FIR linear phase filters that minimize ringing, prevent data errors and have "brick wall" filter response with up to 60 dB attenuation just 75 Hz away.

***Only* MFJ gives you *5 tunable* DSP filters. You can *tune* each lowpass, highpass, notch, and bandpass filter including optimized SSB and CW filters. You can *vary* bandwidth to pinpoint and eliminate interference.**

***Only* MFJ gives you 5 *factory* pre-set filters and 10 *programmable* pre-set filters that you can customize. Instantly remove QRM with a turn of a switch!**

You get MFJ's *automatic notch filter* that searches for and eliminates *multiple* heterodynes.

You also get MFJ's advanced *adaptive noise reduction*. It silences background noise and QRN so much that SSB signals sound like a local FM repeater.

The *automatic* notch and *adaptive* noise reduction can be used with *all* relevant tunable and pre-set filters.

***Automatic gain control* (AGC) keeps audio level constant during signal fading.**

Automatic notch filter

MFJ's *automatic* notch filter searches for and eliminates *multiple* heterodynes. It's *milli*-second fast -- interfering CW and RTTY signals are also eliminated.

Voice signals aren't degraded because the notch is *extremely* narrow.

With up to 50 dB attenuation, you'll copy stations otherwise masked by heterodynes, miss fewer calls and be less exhausted.

Leave the *automatic* notch filter on during a phone contest and you'll never hear unwanted heterodynes of tuner-uppers.

You can *selectively* remove tones. Say, you're on CW and a couple of annoying CW stations appear nearby. You can use the *two* manually *tunable* notch filters -- *an MFJ exclusive* -- to completely knock them out.

Adaptive noise reduction

Turning on *noise reduction* silences background noise. Noisy SSB, FM, AM, CW and Data signals become readable.

Noise reduction works in all filter modes and on all random noise -- white noise, impulse noise, static, ignition noise, power line noise, hiss and atmospheric noise.

The LMS algorithm gives you up to 20 dB of noise reduction. Noise reduction is adjustable to prevent signal distortion.

Reducing random noise reduces fatigue, especially when the band is noisy.

Tunable highpass/lowpass filters

For Voice and Data, nothing beats MFJ's exclusive *tunable* highpass/lowpass FIR linear phase "brick wall" filters.

You can *tune* the lower cutoff frequency 200 to 2200 HZ and the upper cutoff frequency 1400 to 3400 Hz.

Signals *just 75 Hz* away literally disappear -- they are reduced a *thousand* times, 60 dB!

Unlike other filters, speech clarity is not reduced by envelope distortion caused by unequal time delay.

By adjusting the highpass and lowpass filters you can create *custom* filters for Voice, Data and other modes.

When signals are weak, you can improve copy by removing high and low speech frequencies. They contain little information but are full of noise that reduce readability.

On crowded HF bands, overlapping SSB signals make copying difficult. You can improve copy by slicing off some overlap with razor sharp "brick wall" responses.

You can also highpass filter out hum, pulses, rasp and other irritating low frequency noise.

Tunable bandpass filters

Narrow band signals like CW and RTTY jump out of QRM when you switch in an MFJ *tunable* FIR bandpass filters.

You can *tune* the center frequency from 300 to 3400 Hz. And *vary* the bandwidth from 30 Hz to 2100 Hz -- from super tight CW filters to wide razor-sharp Data filters.

As you narrow the bandwidth, interfering signals drop out, because, just 60 Hz away, they're down by over 50 dB.

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73 Review

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The Oak Hills Explorer Kit

Build a fun, inexpensive and high quality CW rig.

Ham radio is a great hobby. There are always new frontiers to explore and new things to learn. Of all the thrills I have had with the hobby, the greatest has been firing up a rig I built myself and then actually getting to talk to someone on it. The excitement seems to be there every time. I have many commercial and kit-built rigs on my bench. The commercial rigs seem to sit for long periods of time while the ones I have built get all the use.

I always wanted to build radios. When I was a teenager I remember dreaming about building a Heathkit. I didn't have anyone to help me get into the hobby, so the dream sat idly for years. After getting my ham license and then using commercial equipment for a year, I decided it was time to build something. By the time I got to order, Heathkit was just going out of the kit business. I was fortunate enough to have access to the Internet (worldwide network of computer networks) and posted a message that was heard around the world, asking if anyone still had an un-built HW9. I wasn't really sure what QRP was, but this was the only listing for a kit that I might be able to afford.

I finally found an un-built HW9 kit from a ham who knew a friend who had purchased a few of them at the Dayton Hamfest. I sent a money order and waited (although not too patiently.) When the kit came I unpacked it slowly and was a little overwhelmed by the number of parts. I read through the instructions in the front of the very thick manual.

"Today, I still get this excited about building kits even after building about every kit on the market."

I did manage over a long period of time to assemble all the parts very carefully. The big day finally came. Heath was very good about including a couple of pages of tests to do before you actually put any power on the kit. This can save many a project from damage. My HW9 passed all these tests, so it was time for the power-on tests and alignment procedures. I carefully hooked up the power and very nervously turned on the power supply. I almost jumped back, expecting fire and explosions. I was so happy that it didn't burn up that I let out a scream that about scared my wife and son out of their socks. Today, I still get this excited about building kits even after building about every kit on the market.

Photo A. The Explorer kit in progress.

I would not recommend a kit that is this involved for a first project. To pick a project, you need to decide whether to build a transmitter, receiver, transmitter/receiver combination or transceiver. To learn more about the way things work, you may want to start building the individual station parts and then put them together to form an operating station.

An important consideration is the type of receiver that is incorporated in the kit. The two types that are in most of the kits are Direct Conversion (DC) and Superheterodyne. The DC receivers are simpler to build but have some limitations. With a DC the receiver picks up signal energy from above and below a given frequency equally well. For instance, if you are tuning a station that is on 7.040, as you tune up the band the signal will get stronger until you reach a point where it seems to disappear. This is the center frequency or "zero beat" frequency. As you tune immediately past it the signal will once again become strong and then begin to weaken. If there is much noise on the band from other stations (QRM), the noise can seem worse than it really is. The DC receiver can also become overloaded from commercial AM broadcast stations. This doesn't mean that this type of rig can't work well, but you will need to get used to tuning in a signal using a DC receiver. An advantage of this design is that the rig can be made very small and lightweight and can be sold for a very reasonable price. If you are planning to use the rig for portable or backpacking use, this may be a good choice.

After building many kits, I recommend a good single-signal transceiver kit with a stable VFO (after your rig warms up initially it

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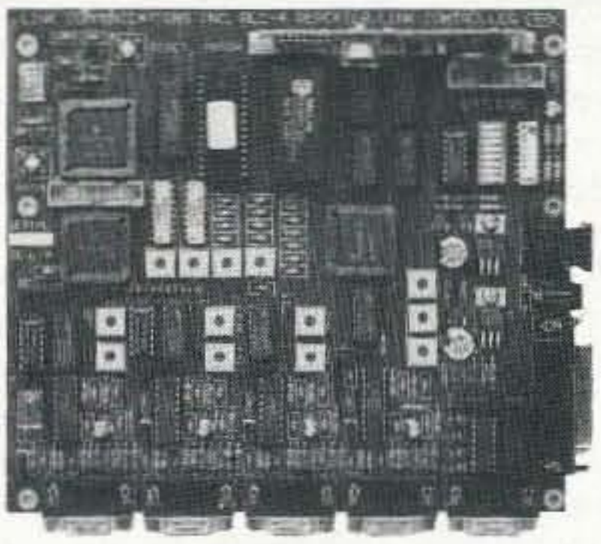

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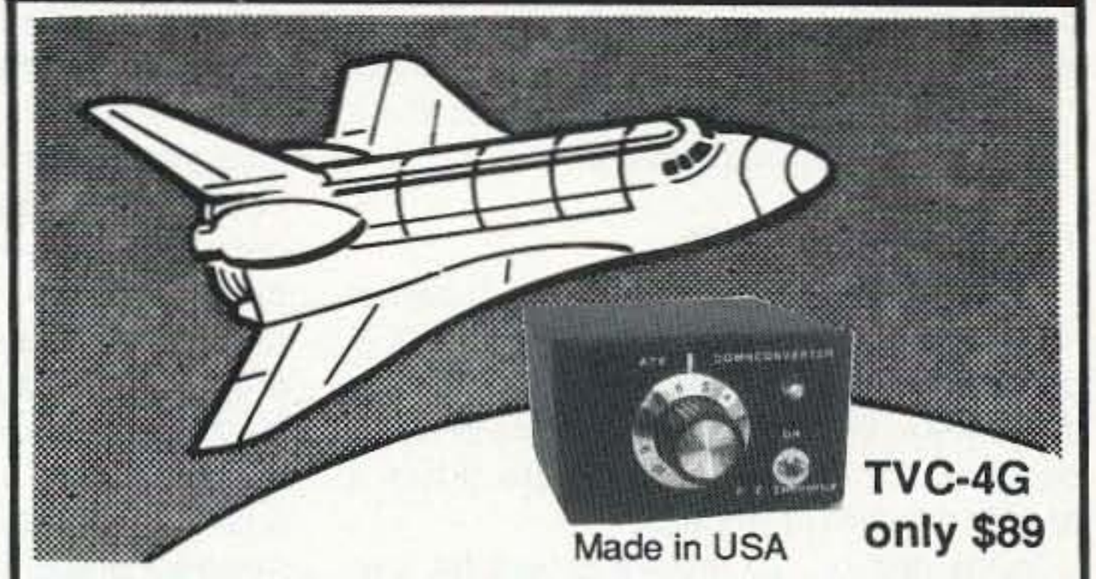

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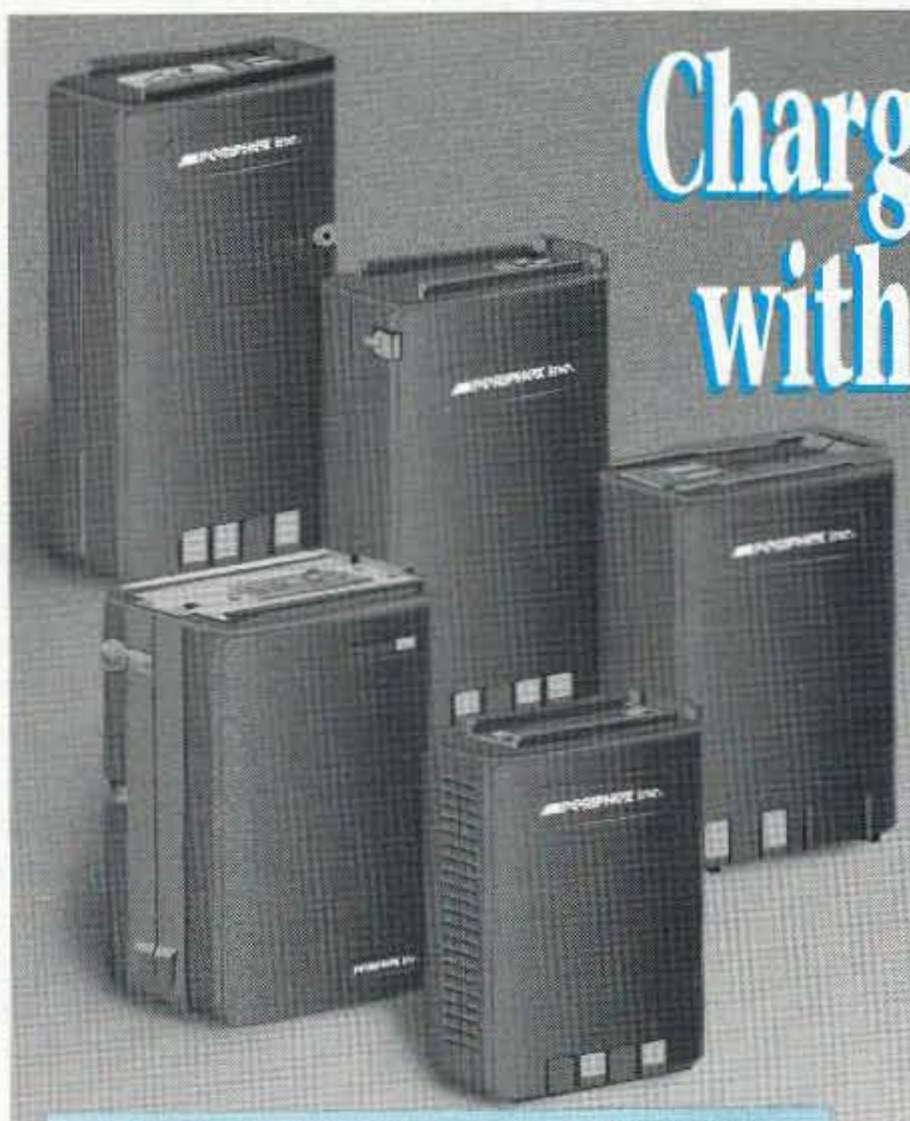

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CIRCLE 68 ON READER SERVICE CARD

will remain on the same frequency without drifting). The Explorer from Oak Hills Research makes an excellent beginners' project. I have had a great deal of success with Oak Hills Research kits and have built about everything they have produced.

The Oak Hills Explorer

The Explorer is a single-band superhet transceiver for 80, 40, 30 or 20 meters. Depending on the time of year or the time of the day you like to operate, any one of these bands is a good choice. Each band has a slightly different personality.

In my opinion, 20 meters is best for low-powered DXing and a little harder to rag-chew; 30 meters and 80 meters are both good rag-chewing bands; and 40 meters can have some good DX and some good rag-chewing—it's usually pretty busy and it is easy to find someone to talk to on it.

The Explorer kit has a very stable VFO circuit with a vernier dial that provides 100 kHz of coverage (50 kHz on 30m). The rig has an RIT circuit that provides +/- 1.5 kHz of range. The radio also has a four-pole crystal ladder filter, an AGC circuit, a sidetone oscillator with level control, and an excellent solid-state QSK circuit. My rig puts out a solid 3 watts of power. The rig draws 50 mA on RX and 450 mA on TX.

This kit has only one printed circuit board. It is double-sided with plated-through holes and the solder side is solder-masked to help prevent solder bridges. The two main problems new and old builders have are that they accidentally get solder on the board, causing a connection that isn't supposed to be there, or they put a part in the wrong place. The board that comes with this kit makes it easy not to get solder bridges, and the silk-screening is of such good quality that it really helps you get the parts in the right place.

The third thing that really helps eliminate building problems is the excellent, clear instructions that come with the kit. There are step-by-step instructions and very nice diagrams. There are no wire jumpers on the board, which is a nice feature. Many beginning kit builders find it hard to wind coils. All the coils come nicely pre-wound, packaged separately and clearly labeled. There were many details in this kit that made building a real pleasure.

Building the Kit

If you are a new builder there are some tips on building you should keep in mind. You should be careful when you open the box. There may be pieces or instructions that are hidden in the protective packing. It isn't much fun to accidentally throw away parts that you will need to complete your project.

The first thing to do is read the instructions and see if they sound like they will be easy to follow. The Oak Hills instructions are some of the best I have ever come across. They have a section that gives good soldering tips and tips that will help make building the rig more fun.

The instructions call for you to check and ensure that all the parts have been included. I first check off all the parts and label them on a piece of paper and stick the wires of the components through the paper. This gives me a chance to make sure all the parts have been included, familiarizes me with the parts, and gives me a double-check about putting the correct parts in the right holes on the board. I check the parts once while I am going through the check-off list and then again before I place them on the board. This helps eliminate one of the two biggest errors in kit building: putting a part in the wrong place on the printed circuit board. While I am sorting parts that are small and hard to identify, I use a lighted magnifying glass (Radio Shack 63-848). I put about five parts on the circuit board at a time, then solder all the leads and clip the ends close to the board.

"It was a real pleasure after a hard day of work to let my mind relax and just sit down and build."

For IC chips I usually place each socket on the board, one at a time.

I have some soldering suggestions as well. Use only good rosin core solder and use a soldering iron that has a nice thin pencil tip and is 25 or 30 watts. Oak Hills Research recommends 25 watts, but I use a 30-watt iron for all my building. Make sure the tip of the iron is pointed and clean. I have also found that having desoldering braid (Radio Shack 64-2090) is helpful if you put a part in the wrong place or accidentally solder things together (a solder bridge). When soldering plated-through boards, a desoldering tool (Radio Shack 64-2120) is very helpful. The key to soldering is how and where to hold the soldering iron. Hold the soldering iron at about a 45-degree angle and make sure you are heating both the hole and the wire from the component. Take the solder and have it in your opposite hand from the iron and on the opposite side of the hole from the soldering iron. Allow the heat from the iron to cause the solder to melt. Don't take the solder and let it flow off the iron as many people do. If you allow the solder to flow off the iron and not heat the whole soldering joint the component may not really be electrically connected to the place it is supposed to be, or it may be partially connected and break after some period of time. The two most common causes of kit failure are incorrect part placement and cold soldering joints.

Many good kits suffer from instructions that are not exactly easy to follow. I followed the instructions provided with this kit. I didn't find anything confusing or ambiguous. It was a real pleasure after a hard day of work to let my mind relax and just sit down and build. I took my time with this project because I knew that my work schedule was real tight, and it is much harder to find and fix a building error than to build it right in the first place.

Even though I took my time, I found that this project went quickly. I guess my only complaint with this kit was that it was such a pleasure to build that I missed having the project to look forward to after work once I completed it.

Aligning the Rig

The fateful moment had arrived. There were no more building instructions left, only testing and alignment. To align the rig you will need a voltmeter, a QRP dummy load, a QRP wattmeter, a frequency counter and preferably a commercial station rig. You may get by with less equipment, but I recommend doing the alignment almost exactly as explained in the instructions. If you are a new builder and don't feel comfortable with this procedure, or don't have the necessary equipment, you can send your rig to Oak Hills and they will align it for $30.

It is suggested that you apply power and let it warm up for 30 minutes before doing any alignment. Putting power on a newly completed rig is both exciting and anxiety provoking. Even if you are a careful builder, it is always possible that you left a tiny solder bridge or put two or more parts in the wrong place on the printed circuit board. I had a kit that I very carefully assembled. I got ready to power it up and put it on my work bench. I had checked the solder side of the board with a magnifying glass a number of times while building, and then again when I completed the kit. I didn't know it at the time, but some solder remains were on the bench and formed a solder bridge. When I applied power there was a sizzle and smoke. This time I carefully cleaned the bench, and made sure I had a clean piece of paper between the bench and the board. I used a bench power supply and turned the amps down way low on first power up to try to cut damages to a minimum in case of a problem.

The moment of truth was at hand. The wires were in place, the power supply was turned down, and it was time to turn on the rig. I turned the Audio Frequency (AF) control to power on the rig. The red power indicator on the front panel of the rig glowed a very pleasing red. I waited without breathing for a few seconds and didn't smell any smoke or hear anything that sounded like components exploding. I smiled a very self-satisfied smile.

The first part of the alignment involves connecting a frequency counter and adjusting a capacitor and coil to get the VFO on frequency and get it to provide 100 kHz coverage. With the 20 meter rig I did something slightly different. I was only interested in using from 14.000 to 14.070. I did the adjustments using this range instead of the 100 kHz range suggested. The advantage of this was that I was able to get the dial that indi-

cates frequency on the rig to be fairly exact. If I am to have a schedule with someone on 14.026, I am now confident that we will be on the same frequency. I found it very hard to try to do an accurate adjustment for the entire 100 kHz, but above 14.070 are the digital modes and I wasn't really concerned about the dial reading accurately in this range.

The next thing you do is adjust a variable resistor to the specified voltage using a voltmeter. This was a very easy and quick adjustment. Next, you hook up an antenna to the rig and adjust the sidetone note with a variable capacitor. Once again, this was quick and easy.

To get the receiver adjusted you adjust two coils for maximum signal strength by listening to the rig with headphones. These were broad adjustments on the kit I built and very easy to do.

When tuning the transmitter you should hook up a dummy load. There is a variable resistor to adjust the power output level and then one variable capacitor that you just turn until you observe maximum power output on a QRP wattmeter (or listen on a station rig that does not have an antenna connected to it.) You next adjust a trim capacitor while listening to your station rig until you hear a nice mellow tone of about 700 Hz. The final adjustment is a resistor for the sidetone level. The entire alignment did not take me very long. The only part that took some time was getting the VFO so that the dial reads the frequency fairly accurately.

On The Air

With a good kit I really enjoy the two parts involved: building the kit and then operating it. Well, the building went very well and I couldn't have asked for anything more to be done to make the building experience more pleasurable. It was time to see if it really worked. I took the rig over to my operating bench with the cover still off (in case I needed to make any last-minute adjustments). I tuned around the band and the receiver sounded great. It is very quiet and seems to be sensitive to weak signals, as well as able to do a good job at separating out signals.

I heard someone calling CQ. It was CT3FT. I gave him a call and he came back immediately. It was Cedric on Madeira Island. This was very exciting for me and a real good sign that the rig was functioning well. Next I had a nice long QSO with W6PTL, Mac in Porterville, California. He reported "signal is fine here." I sat there and easily made contact after contact. My rig puts out 3 watts when powered with 13.8 volts and 2 watts when powered with 12 volts. The QSK is solid-state and works great. I have really enjoyed operating this rig.

The Bottom Line

The bottom line is that I feel this kit is a real bargain at $129.95. And, it was fun both to build and to operate. You can easily make many contacts using this rig with a battery and a wire antenna. 73

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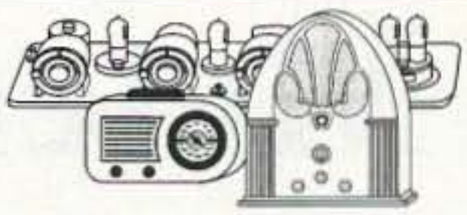

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CIRCLE 184 ON READER SERVICE CARD

6 Meters— The In-Between Band

Excitement for all license classes.

by Gordon West WB6NOA

No-code Technicians are discovering a "secret" band of frequencies that few people talk about these days during the sunspot cycle low: the 6 meter band from 50 to 54 MHz. This band is available to no-code Technician Class license operators, and higher grade licenses, with no restrictions on emissions, power output, or frequencies within the band. In other words, as a no-code Technician, you have the same privileges on 6 meters as an Extra Class operator would have!

The 6 meter band is divided into a band plan as adopted by the American Radio Relay League and recognized by the Federal Communications Commission. The band plan reserves certain frequencies for FM and repeaters, with the bottom portion of the band reserved for CW and SSB weak-signal operation. There are also plenty of frequencies reserved for packet communications.

Getting started on the 6 meter band using FM for simplex and repeater communications is a great way to meet "the gang." Once you get on the air on 6 meters, you will find special 6 meter clubs whose only interest is pioneering the 6 meter band. Go to a club meeting and get a list of all of the local 6 meter repeaters in your area, and see how far 6 meters propagates compared to what you're presently getting for 2 meter range direct and through repeaters.

Compared to 2 meters, 6 meter simplex gives you better range in the mountains and over hills. The longer wavelength is less attenuated by hills and trees, so you may find a remarkable increase in communications range on 6 meters versus what you have been enjoying on 2 meters.

Working through 6 meter repeaters is similar to 2 meters—50 to 75 miles is common.

But get set for the fireworks when the band opens up on 6 meters this summer. During the summer months, invisible ionized dense patches of "E-layer clouds" will drift from the West Coast to the East Coast, sometimes opening up your simplex and repeater communications to beyond 1,500 miles! One minute you're working through your local repeater in town, and a few seconds later during the summer months another repeater in another city a thousand miles away begins to override your local repeater, and a distant station acknowledges your call up to 1,500 miles away.

Even though we are at the bottom of Solar Cycle 22, the summertime Sporadic-E 6 meter band openings will continue to occur independent of the solar cycle. And it's a guaranteed event—during May, June, July, and August, the 6 meter band "opens" for Sporadic-E FM and SSB communications over distances up to 1,500 miles. This summer, I predict the band will open up at least two or three days every week. In the morning hours, listen for stations coming in from the East. In the afternoon hours, listen for stations coming in from the West. The best time to talk "skip" is a few hours after local sunrise, mid-afternoon, and during an evening peak around 7:00 p.m. local in the direction of the west. During lunchtime, you can expect stations to come in this summer from Canada, as well as South America.

Your antenna considerations are simple—home-brew your own 54" ground plane with 54", 45-degree downward-sloping radials, and feed it with good coax, or consider one of the excellent collinear 6 meter base station antennas from Diamond or Comet. For mobile installations, an old state police 54" whip works nicely on 6 meters—or if you have the bottom half of a Hustler fold-over HF mast, you will find it works dandy as a quarter-wave whip on 6 meters.

If you have a base-loaded 2 meter mobile antenna, unscrew the loading coil and screw in a 6 meter coil with the appropriate yard-long whip. 73

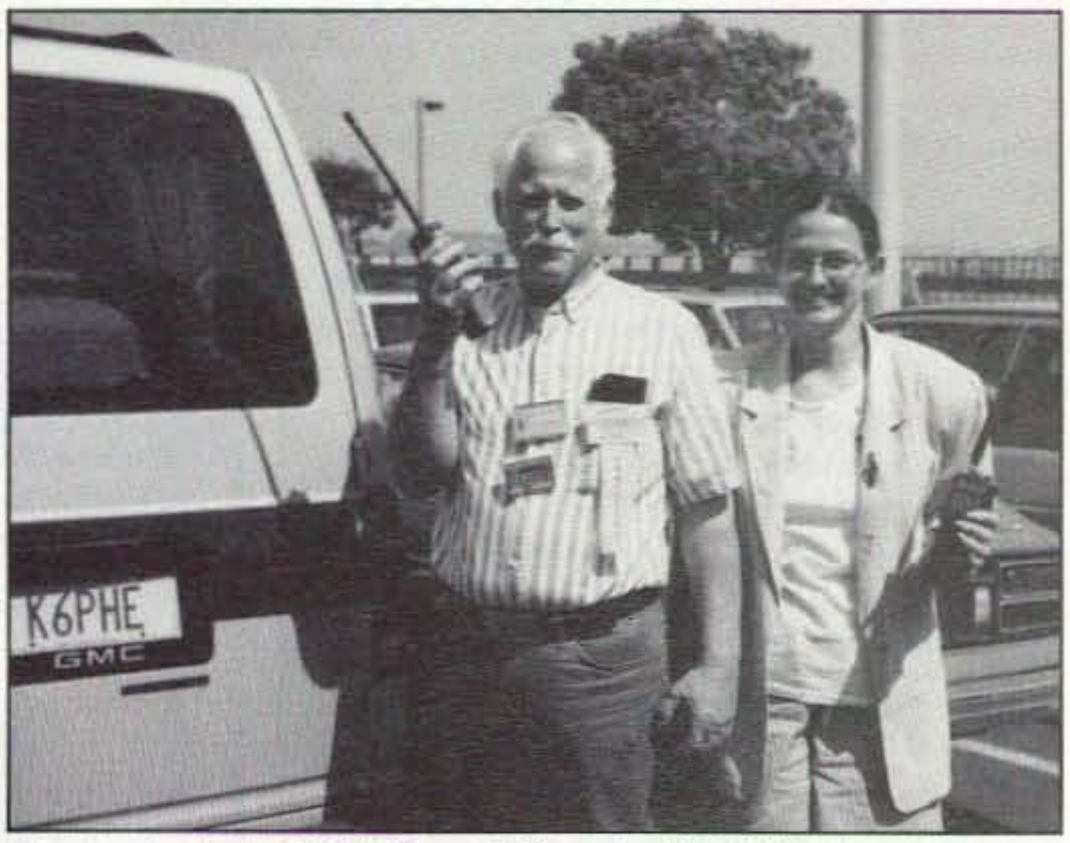


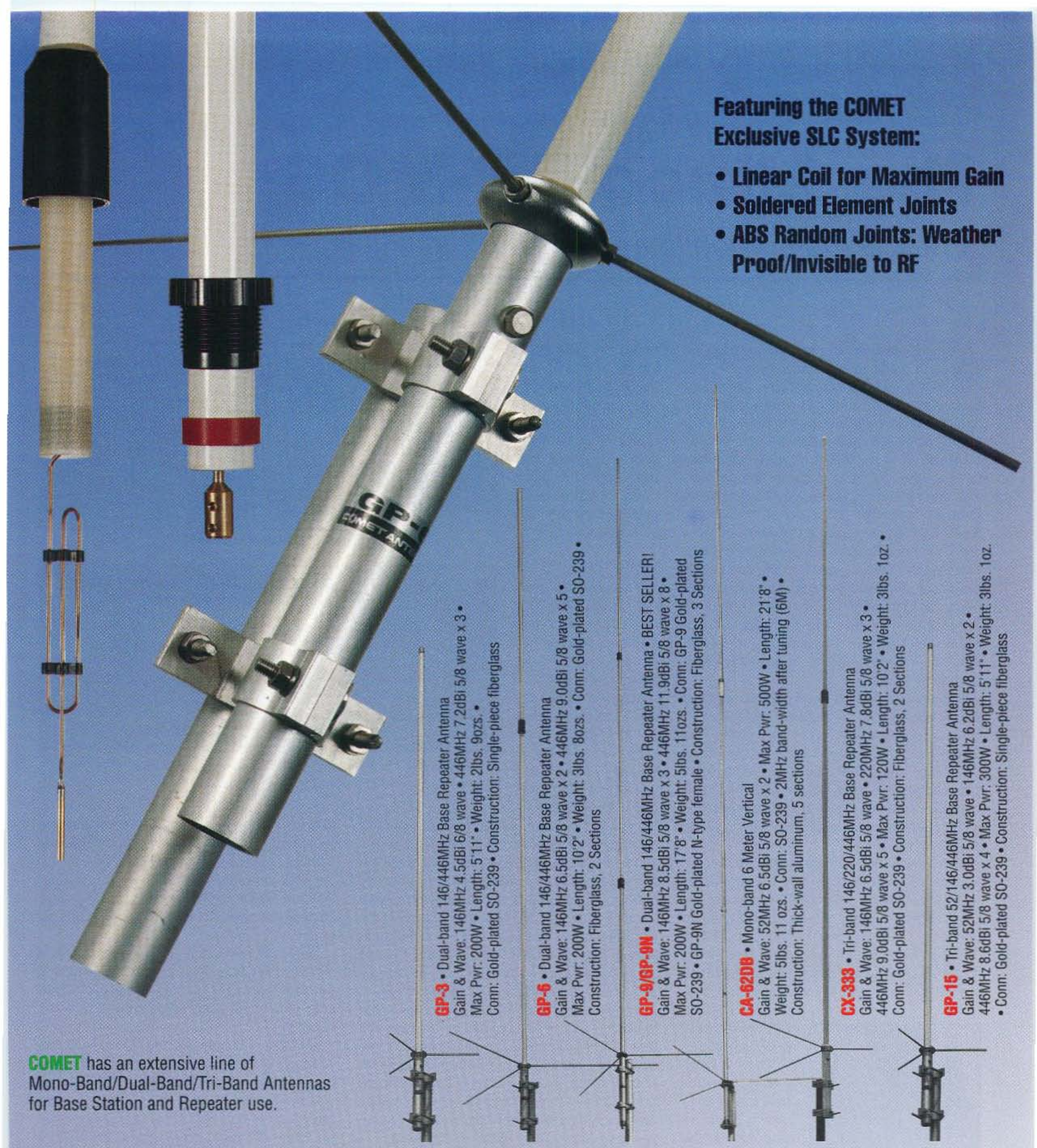
Photo A. Bob K6PHE and Gracie KK6CG Hastings run handhelds in Southern California. They love the excitement of 6 meter FM!

ARRL 6 Meter Wavelength Band Plan, 50.0-54.0 MHz

MHz	Use
50.100-50.300	SSB, CW
50.100-50.125	DX window
50.110	SSB calling frequency
50.300-50.600	Non-voice communications
50.620	Digital/packet calling frequency
50.800-50.980	Radio control 20 kHz channels
51.000-51.100	Pacific DX window
51.120-51.480	Repeater inputs (19)
51.120-51.180	Digital repeater inputs
51.620-51.980	Repeater outputs (19)
51.620	Digital repeater outputs
52.000-52.480	Repeater inputs (23)
52.020, 52.040	FM simplex
52.500-52.980	Repeater outputs (23)
52.525, 52.540	FM simplex
53.000-54.480	Repeater inputs (19)
53.000, 53.020	FM simplex
53.1/53.2/53.3/53.4*	Radio control*
53.500-53.980	Repeater outputs (19)
53.5/53.6/53.7/53.8*	Radio control*
53.520	Simplex
53.900	Simplex

*Optional, local choice

From *Gordon West Amateur No-Code Plus Book*, Master Publishing, Inc.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Gain & Wave: 146MHz 4.5dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 •
Max Pwr: 200W • Length: 5'11" • Weight: 2lbs. 9ozs. •
Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass
GP-6 • Dual-band 146/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2 • 446MHz 9.0dBi 5/8 wave x 5 •
Max Pwr: 200W • Length: 10'2" • Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 •
Construction: Fiberglass, 2 Sections
GP-9/GP-9N • Dual-band 146/446MHz Base Repeater Antenna • BEST SELLER!
Gain & Wave: 146MHz 8.5dBi 5/8 wave x 3 • 446MHz 11.9dBi 5/8 wave x 8 •
Max Pwr: 200W • Length: 17'8" • Weight: 5lbs. 11ozs. • Conn: GP-9 Gold-plated
SO-239 • GP-9N Gold-plated N-type female • Construction: Fiberglass, 3 Sections
CA-62DB • Mono-band 6 Meter Vertical
Gain & Wave: 52MHz 6.5dBi 5/8 wave x 2 • Max Pwr: 500W • Length: 21'8" •
Weight: 5lbs. 11 ozs. • Conn: SO-239 • 2MHz band-width after tuning (6M) •
Construction: Thick-wall aluminum, 5 sections
CX-333 • Tri-band 146/220/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave • 220MHz 7.8dBi 5/8 wave x 3 •
446MHz 9.0dBi 5/8 wave x 5 • Max Pwr: 120W • Length: 10'2" • Weight: 3lbs. 1oz. •
Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections
GP-15 • Tri-band 52/146/446MHz Base Repeater Antenna
Gain & Wave: 52MHz 3.0dBi 5/8 wave • 146MHz 6.2dBi 5/8 wave x 2 •
446MHz 8.6dBi 5/8 wave x 4 • Max Pwr: 300W • Length: 5'11" • Weight: 3lbs. 1oz.
• Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass
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73 Review

Number 9 on your Feedback card

by Gordon West WB6NOA

Alinco Electronics Inc.
438 Amapola Ave., #130
Torrance CA 90501
Telephone: (310) 618-8616
Fax (310) 618-8758
Price Class: $459

The Alinco DR-MO6

A new 6 meter mobile transceiver.

Alinco Electronics has just introduced their new 6 meter mobile transceiver DR-MO6 with built-in CTCSS tone encode, and an incredible 100-memory channel capacity straight out of the box to memorize your local and all-country 6 meter repeater and simplex channels. Use the ARRL repeater directory for memorizing 6 meter repeater frequencies, and don't be surprised to see different offset frequencies for different parts of the country. Most of the country uses a -1.6 MHz split, but the Columbia Region 6 Meter Association, representing Washington, Oregon, and British Columbia, uses an input/output spacing of 1.7 MHz, giving them 60 repeater pairs and up to 25 simplex channels. The 6 meter national FM 6 meter simplex frequencies are 52.525 and 52.540, and California operates FM simplex at 50.3 MHz.

The tiny Alinco does it all with 10 watts of FM power output. We actually measured 12 watts of power output when our vehicle was running and the input voltage was 13.8 VDC. The Alinco transceiver also ran extremely cool because of all the fins on the heat sinks, and we were surprised to see a transceiver this small keep its temperature down during long periods of transmit.

The Alinco DR-MO6 also uses a dual-conversion receiver, and here in L.A. it's really necessary to keep out image frequencies and other nearby signals. We measured receiver sensitivity at 0.1 microvolts at 12 dB SINAD—16 dBu. Power output was judged "very loud" at 3 watts from the top-mounted speaker. A typical speaker jack allows you to remote-mount a speaker in extremely noisy vehicles.

Photo C. The full-featured Alinco 6m mobile microphone.

The Alinco mike incorporates up-and-down keys to zing through the channels, or to review memorized channels. If you hold down the button, it launches the radio into scanning. There is a lock key on the front of the mike that you can engage with your thumb to cancel the effects of pushing the up or down button. Very handy—select the frequency of choice off of the mike, click on the lock button, and you won't need to worry about accidentally jumping off frequency.

Photo A. The Alinco DR-MO6.

Photo B. The new Alinco 6 meter radio was easy to operate with its logical layout of buttons and sub-functions.

Operation

The operation of the transceiver is straightforward—you don't even need to plow through the instruction manual. The function-shift allows you to program 1.6 or 1.7 MHz duplex operation, or for that matter, any split on any one of the 100 channels. The reverse button lets you listen in on the repeater input frequency to determine proximity to another station on the input. We liked the speed of the microprocessor when turning the big frequency knob to zip through the channels. We have tried other 6 meter FM sets and found that the microprocessor unlocks during a rapid spinning of the channel knob. This means you can zip through active frequencies without discovering they are actually in use. With the Alinco, a moderate tuning of the big knob allows you to quickly hear what's happening on many different frequencies without the synthesizer going out of lock. This is a good feature for those of us that like to spin the knob looking for activity! But with any microprocessor-controlled radio, spinning the knob too fast may cause you to overlook weak signals on the band.

We judged the Alinco squelch as typical of most other transceiver squelch circuits—hard squelch. Weak stations will chatter the squelch, and there is not enough hysteresis in the squelch to keep it open for a weak signal coming in and out of reception to stay on the air with the squelch circuit open. I opened up an old Commtronix 6 meter radio that has been sitting around my shack for the past 15 years, and discovered a simple improvement to make to the squelch circuit on my present Alinco by adding several tantalum capacitors to keep the squelch open during weak-signal reception. The only disadvantage after my modification was a rather long squelch tail after a strong signal disappeared on receive. But for weak signal reception, the long squelch tail kept the squelch from chattering closed.

The LCD readout was a big improvement over my old Commtronix FM rig that used dull, hard-to-see LEDs. At nighttime, the Alinco LCD panel had plenty of brightness from the backlights.

But best of all with the new Alinco is its 100 channels of memory. While you wouldn't *think* that you need 100 channels on 6 meters, you really should stuff in at least 40 to 50 repeaters, in and out of your area, to get set for when the band opens. With the built-in CTCSS, reading over the ARRL repeater directory will give you a good idea of what tones to put into what channels, and what channels to scan for activity when the band opens up this summer.

The bright display and easy to use features make the new Alinco an inexpensive way to get on the fabulous 6 meter bands, where skywave DX to the no-code operator may be an every-week occurrence this summer—from 50 MHz to 54 MHz, the 6 meter band is full of surprises. 73

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

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

The inductor switch is designed for high RF voltages and currents--it's not a *plastic* switch made for small signals and wired with *tiny* gauge wire.

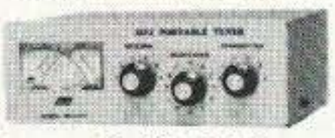
Each MFJ-949E cabinet is chemically treated and has a new tough scratch-proof *vinyl* cladding -- not paint that can scratch or chip off. You won't find a tougher, longer lasting finish anywhere.

MFJ's *versatile* 1.5 KW Tuner

MFJ-962C $229.95

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

MFJ's *portable/QRP* Tuner



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

MFJ-971 $89.95

MFJ's *super value* Tuner

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The new MFJ-941E gives you a 300 watt PEP tuner with *lighted* Cross-Needle Meter that covers everything from 1.8-30 MHz for an incredible $109.95.

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

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

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

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

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

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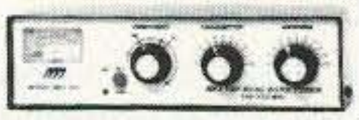
MFJ's *VHF or UHF* Tuners

MFJ-921 or MFJ-924 $69.95



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

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CIRCLE 86 ON READER SERVICE CARD

73 Review

Number 10 on your Feedback card

by Barry Kennedy N2PNG

The Comet HA4S

A mobile HF antenna.

NCG/Comet
NCG Companies
1275 North Grove Street
Anaheim CA 92806
Telephone: (714) 630-4541
Fax (714) 630-7024
Price Class: $199
Optional 20 meter coil—$39

Ever since the introduction of several small HF transceivers there has been a huge influx in the amount of HF mobiling. It is now very easy for anyone to throw a rig in the car and operate on those long road trips. Choosing the right antenna can be the hardest part of the whole installation. With so many different makes and models available, deciding what is best suited for your needs can be confusing and difficult.

With so many of us driving small cars today and living in urban areas, the size of the antenna can be a problem. Several months ago I noticed the Comet HA4S pictured on the cover of *73* magazine. What a neat-looking antenna—small, and having the ability to fold over like some of the fancier VHF/UHF antennas. Finally, it's a small antenna that you don't have to take off the car to pull into the garage.

It is important to understand that any mobile antenna is a compromise. There is no mobile antenna that is as efficient as a yagi or a quarter-wave vertical with elevated radials. I have found that generally the bigger antennas tend to be more efficient and have a greater bandwidth. You gain a small size with many HF mobile antennas, but you tend to lose bandwidth and efficiency. I was curious to see how well the Comet HA4S performed compared to some of the larger antennas that I have used.

The Comet HA4S

The HA4S is considerably smaller than most HF mobile antennas, measuring only 4'4" tall and weighing just over a pound. It is rated to handle 120 watts SSB. The HA4S comes standard with four bands: 40, 15, 12, and 10 meters. Each band is a separate coil that attaches to a mast, similar to the Hustler antennas. An optional coil can replace one of the existing ones, adding the 20 meter band. The 40 meter coil screws into the top of the mast while the other three coils screw into a circular hub just below the 40 meter coil. The coils slope downward, making the antenna appear somewhat like a discone. Comet thoughtfully includes a wrench for proper tightening of the coils to the mast. The assembly of the antenna was extremely easy and straightforward—it took all of about three minutes to complete.

The connector on the end of the mast is a standard UHF male (PL259). Most antennas use the heavier duty 3/8" threaded mount. The reason for this is that the bigger the antenna is, the greater the windload is going to be, and the 3/8" is just a stronger mount capable of handling much larger loads. After flipping through my catalogs I found that several manufacturers make heavy-duty mag-mounts as well as rail and lip mounts, with the UHF female, that are more than capable of handling the HA4S.

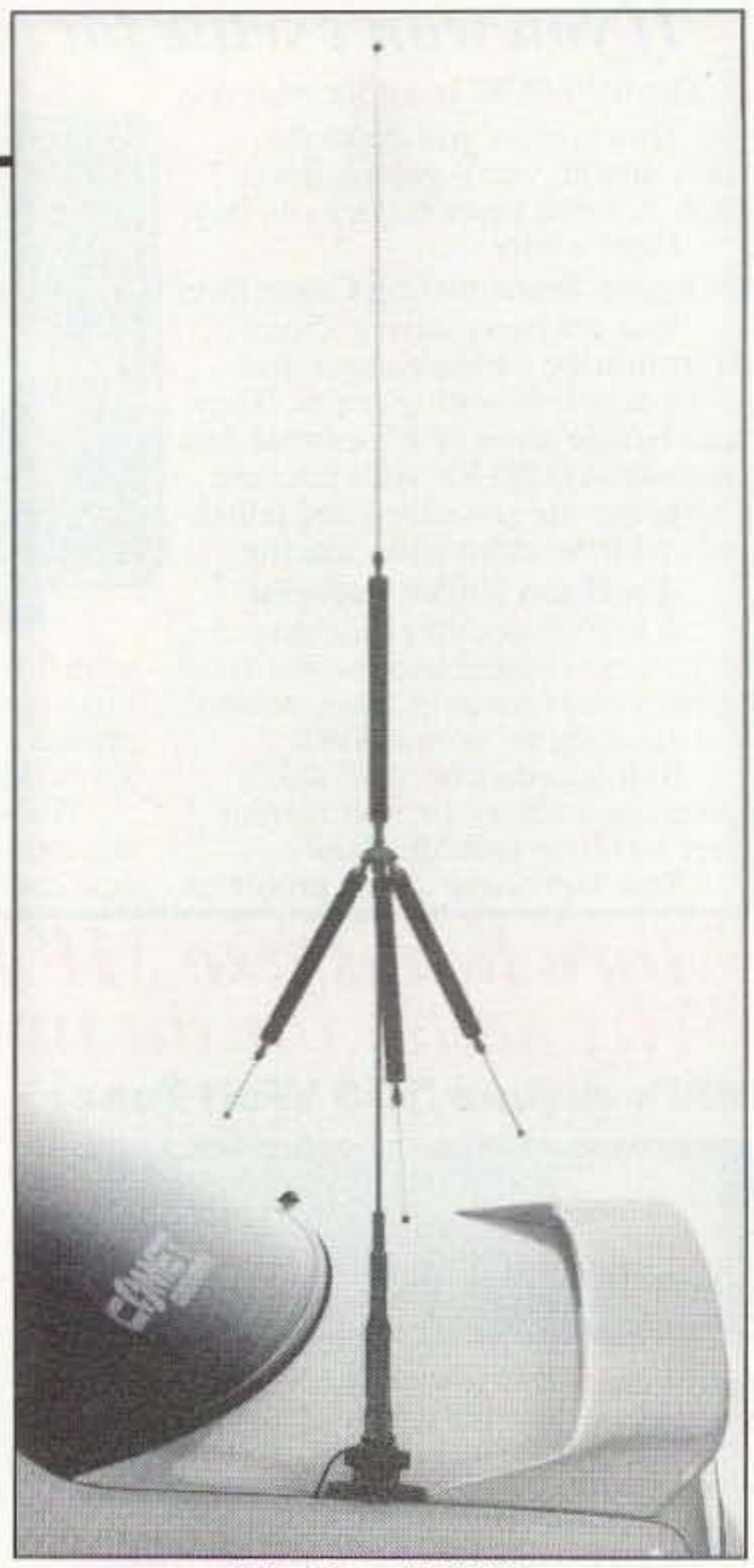
The mast on the HA4S folds over just like some of the fancier VHF/UHF antennas. This is a great feature: no more taking the antenna on and off each time you pull into the garage. To lower the antenna, unscrew the collar surrounding the fold-over hinge, lift the mast out of the socket, and it will fold over to the side. To right the HA4S, pull the antenna vertical and back into the socket and tighten the collar, locking it back into place.

Tuning the HA4S

As I mentioned, the use of coils and traps limits the bandwidth of an antenna somewhat, and is not as efficient as using a full-size antenna. Comet claims that the antenna will resonate in any 46 kHz section of the 40m band with a 2.0:1 SWR or better. Bandwidth for each frequency range increases up to 660 kHz with a 2.0:1 SWR or better in the 10m range. To adjust the antenna to resonate in the desired segment of the band, you lengthen or shorten the whips on the coils. By making the whip slightly longer you lower the center frequency. Let's say I want my HA4S to resonate between 14.180 MHz and 14.220 MHz. I would first go to my center frequency, check my SWR, and adjust my whip accordingly until minimal SWR is obtained. This can be done by transmitting low power into the antenna and checking the measurements on your meter. I use an MFJ-259 SWR analyzer, an invaluable tool for tuning antennas or any other type of antenna work. It doubles as a frequency counter and an SWR bridge, allowing me to check the exact SWR of any frequency I specify. This tells me where my antenna is resonant and allows me to do this without the use of my transceiver. It is very important that you make sure you have good ground connection from your antenna to your car. A bad ground is often the cause of many problems, such as a high SWR.

I had no problem adjusting the coil for 10, 12, 15, and 20 meters. I picked my center frequency and adjusted the whip for the minimal SWR, then checked 20 kHz either side and found the SWR to be fine.

On 40 meters I had to trim the whip slightly before I was able to resonate the antenna above the CW portion of the band.



The Comet HA4S.

Performance

Most of my tests were conducted on 20 meter SSB, due mostly to propagation. Overall, I was impressed. The HA4S performed like a champ. On my drive back to college I was hearing strong signals from both W6 and W4 land. I worked EA3OT without any difficulty, and received a 57 report. Soon after, I was chatting with some guy in northern Florida with a 59 signal. I also made contacts on the other bands as well as 40 meter CW.

It is important to remember that this antenna was more than likely designed for the Japanese amateur, with small size and versatility in mind. In getting the nice small package, you lose bandwidth, making the HA4S fairly frequency selective once you have set your center frequency. If you try to operate outside the 20 kHz on either side of the center frequency you will notice a rapid increase in your SWR. However, if bandwidth is not your biggest concern and getting a small, excellent mobile antenna that has some unique features is, then the HA4S will do the trick. 73

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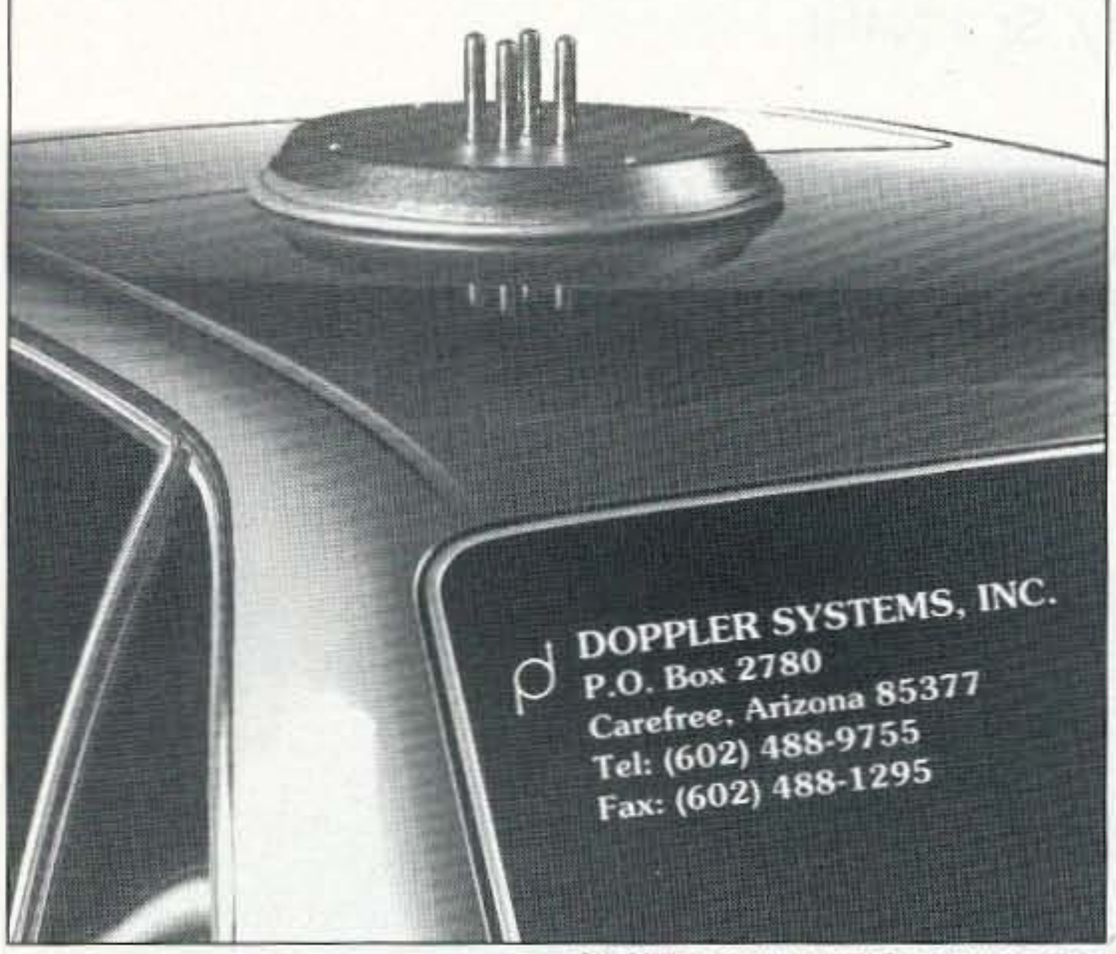

CIRCLE 13 ON READER SERVICE CARD

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- Low distortion, low impedance, adjustable sinewave output: 0 to 4 volts peak to peak.
- Crystal controlled for high accuracy.
- Transmitter PTT output (to key transmitter while ID is being sent), is an open collector transistor that will handle 80 VDC at 300ma.
- Field programmable with SUPPLIED keyboard.
- Confirmation tone to indicate accepted parameter, plus tones to indicate programming error.
- All programming is stored in a non-volatile EEPROM which may be altered at any time.
- Message length over 200 characters long.
- Trigger ID with active high or low.
- Inhibit ID with active high or low. Will hold off ID until channel is clear of traffic.
- Generates repeater courtesy tone at end of user transmission if enabled.
- Double sided tape and mounting hardware supplied for quick mounting.
- Operating temperature range, −30 degrees C to +65 degrees C.
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Programmable Features

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- *Front porch delay interval from 0 to 9.9 seconds.*
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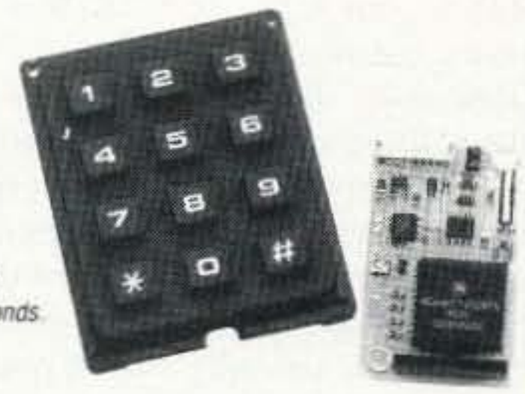

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programming keyboard included

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A Foolproof Power Controller

Be prepared when the commercial power shuts off.

by Charles M. Seay, Sr. KN4HL

What happens to your community repeater when a storm or accident causes a loss of commercial power? The answer is that your repeater is useless unless you have a battery backup supply or a generator. Generators are expensive and have to be manually started unless they have a battery starter. Deep-cycle marine batteries are great for repeaters that draw 10 amps of current or less. The problem arises when the commercial mains go dead. The control operator or owner must manually switch power sources, as most repeaters are not located where the owner or control operator lives.

I found the answer to this problem with the "Foolproof Power Controller." This project consists of a relay which is engaged when the commercial mains are supplying power to the repeater and automatically switches over to my deep-cycle marine battery when commercial power stops. I have incorporated a two-color LED into the schematic to indicate visually from which power source the repeater is being supplied power. The parts list for this project is as simple as possible, with all the parts available from your local Radio Shack: a small aluminum case, four resistors, one two-color LED, a DPDT relay, one relay socket, one roll of red 18 ga. hookup wire and one roll of black 18 ga. hookup wire.

The most important thing in the construction of this project is to maintain the correct polarity so as not to damage any transistors in the repeater. Fuses can be added to the unit for additional protection if you wish.

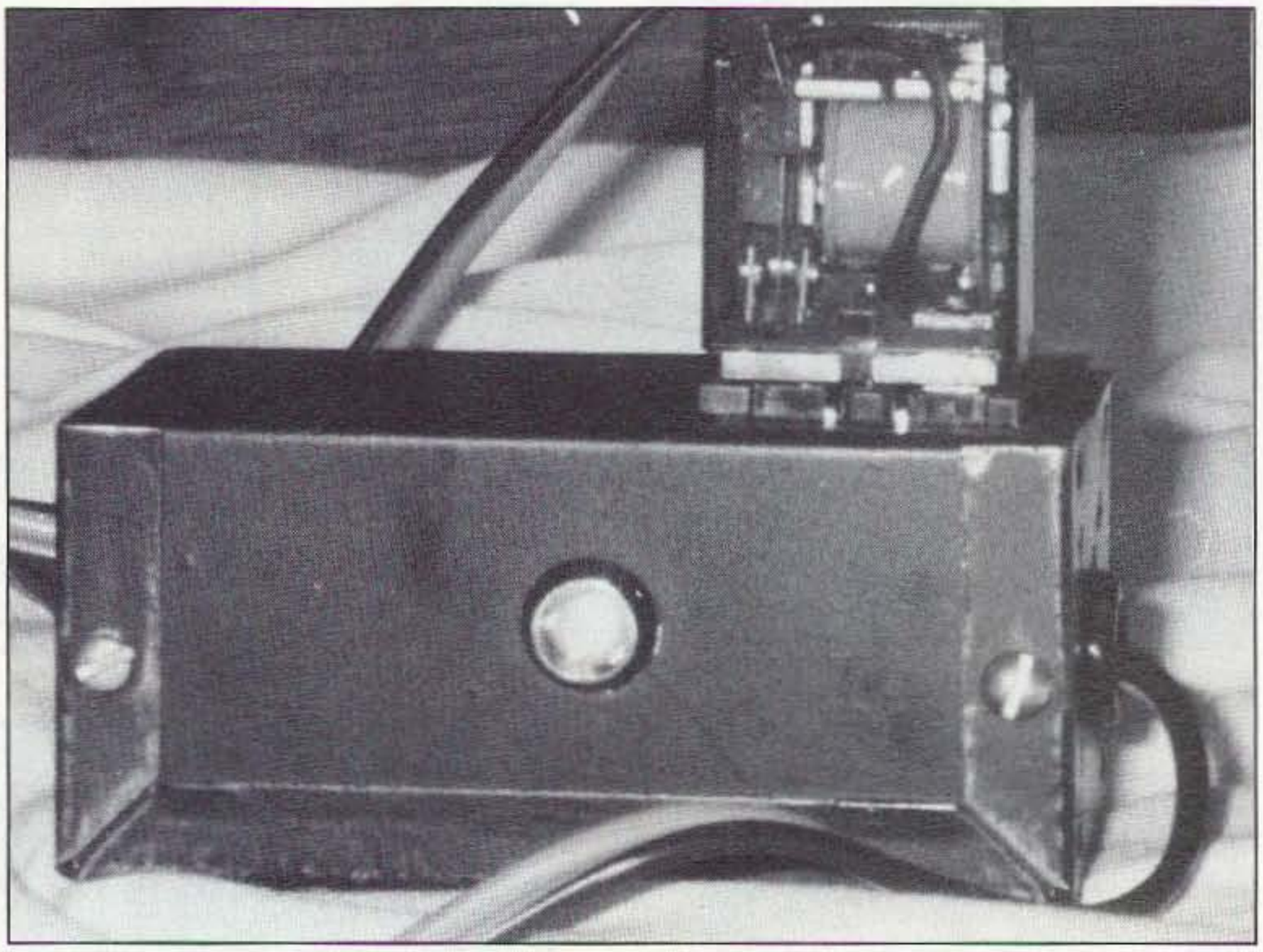

Photo A. The completed controller showing relay, case and LED.

Construction

The relay socket is mounted in the aluminum case so that the relay receives proper cooling and the exposed wiring will be totally enclosed in the case. The LED can be mounted where it can be easily seen; location is not important.

After the relay base is mounted, cut a length of red hookup wire that will reach from the positive terminal of your 13.8-volt power supply to pin 8 of the relay base with a jumper from pin 8 to pin 4 of the relay base. Cut an equal length of black hookup wire that will reach the negative terminal of your power supply and connect this to pins 7 and 3 on the relay socket. Now cut a piece of red hookup wire that will reach from the positive terminal on the battery and connect the other end to pin 2 on the relay socket. Cut a piece of black hookup wire that will reach from the negative terminal on the battery to pin 1 on the relay socket. Two equal black and red pieces of hookup wire should be cut that will reach from the relay socket to the power supply terminals on the repeater. Connect one end of the red hookup wire to pin 6 of the relay socket. Connect one end of the black hookup wire to pin 5 on the relay socket. The basic wiring of the relay socket is now complete and the unit will

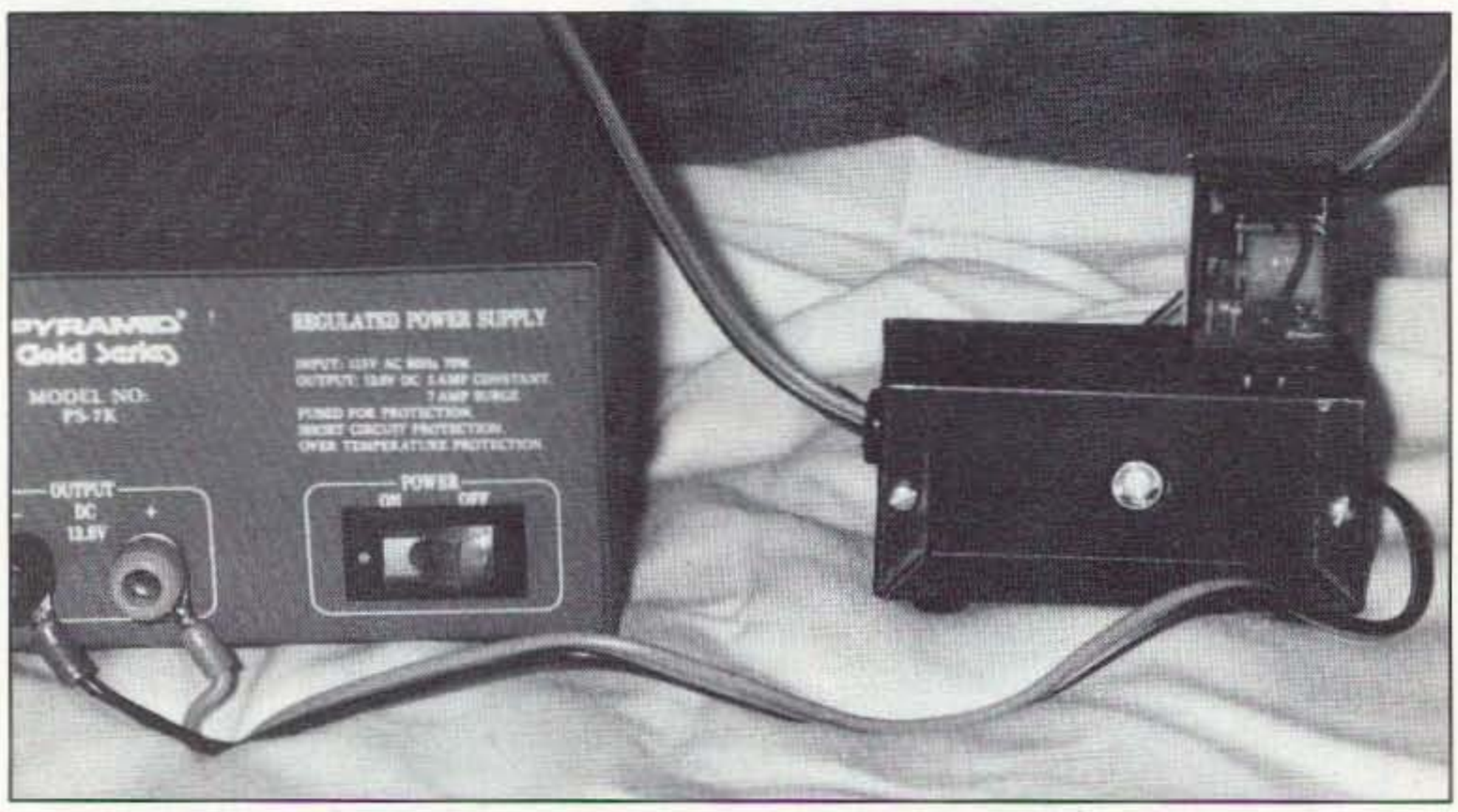

Photo B. The "Foolproof Power Controller" connected to the 13.8-volt DC power supply.

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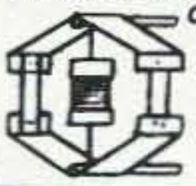

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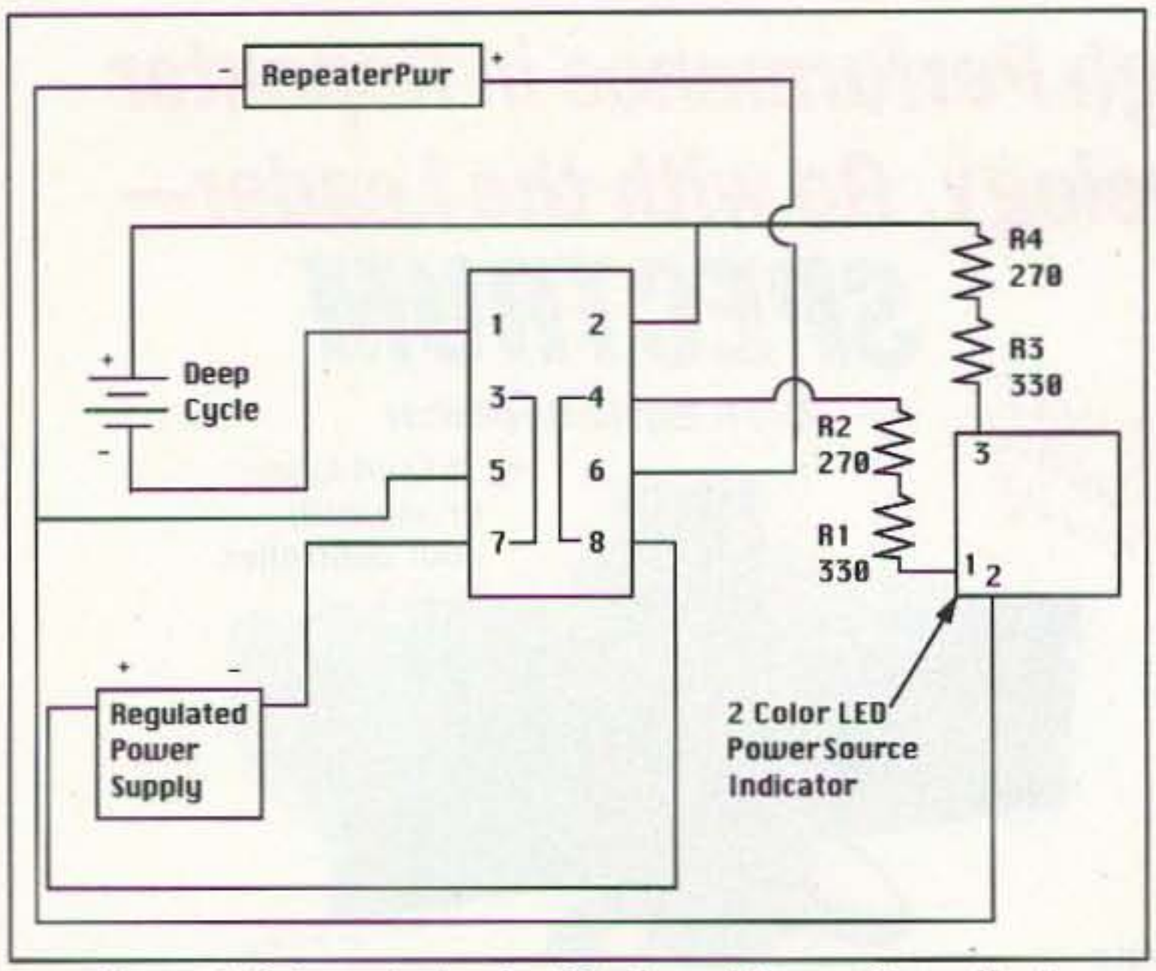

Figure 1. Schematic for the "Foolproof Power Controller."

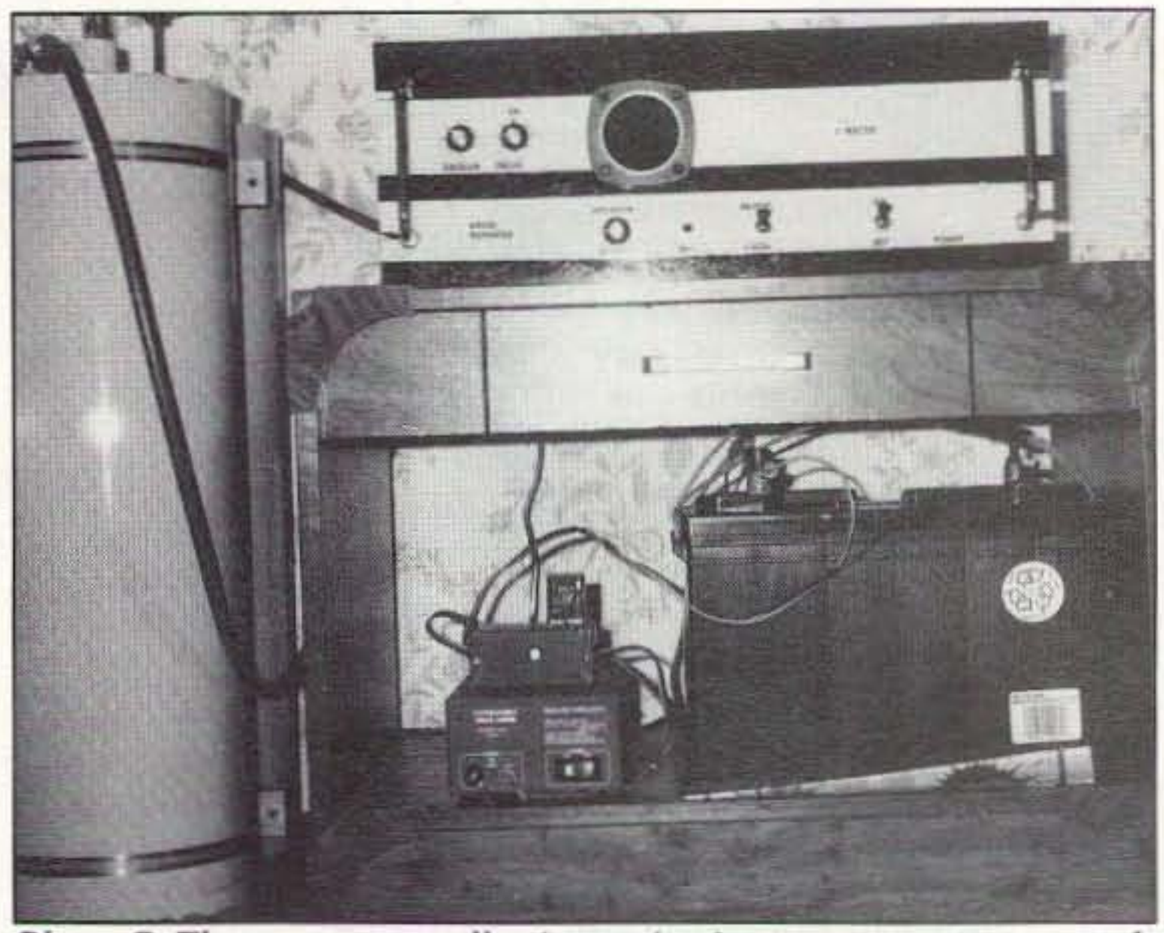

Photo C. The power controller in service in a repeater system, ready when commercial power fails, to switch instantly to the emergency battery supply.

operate correctly. However, you would not have any indication which power source is operating the repeater.

Mount the two-color LED into the cabinet of the case where it can be seen easily. Connect the center or long post of the LED to pin 5 of the relay socket. Connect pin 1, the shortest post of the LED, to pin 4 of the relay socket through two resistors (270- and 330-ohm resistors in series). Connect pin 3, the next shortest post on the LED, to pin 2 on the relay socket through two resistors (270- and 330-ohm in series). When in operation the LED will display green when operating from your regular 13.8-volt power supply and orange when operating from the deep-cycle battery. When commercial power is lost, the relay will switch to the battery automatically.

Before hooking this unit to a repeater, connect this controller to the proper post of the power supply and to the battery. Connect a multitester to the black and red hookup wires that go to the repeater, carefully observing polarity with the meter set to read at least 30 volts. The LED should be glowing orange without the power supply turned on. Turn on the power supply and the LED should glow green. If you unplug the power supply, the LED should again return to orange and voltage should still be present to the multitester.

Stick-on rubber feet can be added to the case after construction to keep the unit from sliding around.

This unit has worked for me for several months during short commercial power outages. It will keep your repeater operating and useable.

This unit can be adapted to control the power source of radios other than repeaters. The main limiting factor is the current-carrying capacity of the relay contacts and the size of the hookup wire.

The total cost to construct this project is less than $25. 73

Parts List

Quantity	Item	RS#
1	Case 2-3/4" x 2-1/8" x 1-5/8"	270-235
1	Relay	275-218
1	Relay socket	275-220
1	Dual-color LED in panel holder	276-025
2	270-ohm resistors	271-1112
2	330-ohm resistors	271-1113
1 roll	Black 18 ga. stranded hookup wire	

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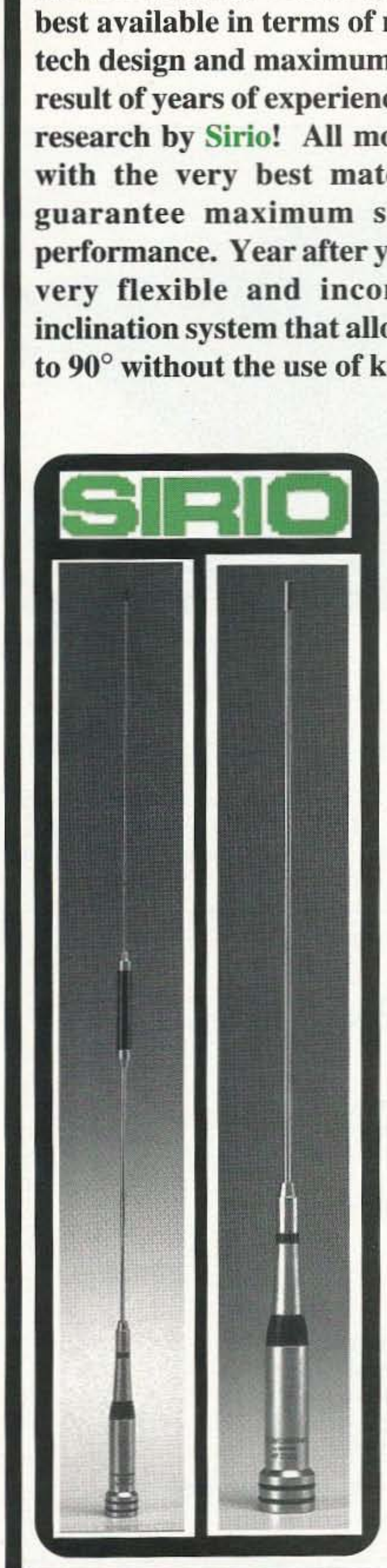

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K4SYU Loop Antenna

A compact, portable HF solution.

by Everett James K4SYU

Why a small *loop*? Why not a dipole or a quarter-wave vertical? The answer is size and versatility. The loop is small and inconspicuous. It can be set up on the porch of a condominium or used as a portable antenna for Field Day or used as an emergency antenna in case the wire antennas blow down.

The loop will not replace your favorite yagi or other gain antenna, but if you are restricted, as many hams are, to using inside antennas and are getting poor results, then this loop is just what you are looking for.

Let's look at what this small loop antenna has to offer:

1. It requires no radials (no external wires).
2. It requires no ground connection (reduced RFI).
3. It requires no antenna tuner (simplified tune-up).
4. It exhibits less noise than a dipole or quarter-wave antenna.
5. It is somewhat directional (also has good nulls).
6. It helps eliminate harmonic radiation (high Q).
7. It is multiband (quick and easy band change, five bands).
8. It is fairly efficient (good things do come small).
9. It is portable (can fit in the trunk of a car).
10. It is inexpensive and easy to build. (Need I say more?)

Are you interested? Then read on.

Theory

You all know that the loop antenna has been used for many years as a direction-finding antenna. In that type of service it made use of the sharp nulls off each side of the loop, but off each end is a nice fat lobe shaped like a doughnut. It is this large lobe structure that makes the loop so interesting to radio amateurs.

In theory, the loop antenna can be looked at as a single-turn parallel-tuned circuit not unlike the tank circuit. The opposite sides of the loop act as a pair of spaced antennas carrying RF currents of opposite polarity. The two RF currents tend to cancel each other out perpendicular to the plane of the loop. The magnetic radiation will be maximum off each end of the loop. As the loop readily accepts energy at its resonant frequency, it is only necessary to add an RF coupling device to transfer energy to and from the loop via a coaxial cable.

You know that the portion of the loop next to the capacitor has very high voltage, but if we go to a point halfway around the loop which is about the center of a corresponding one-turn coil, we reach a zero voltage point. This point, for all practical purposes, is neutral. It is at this point that the coaxial shield is attached.

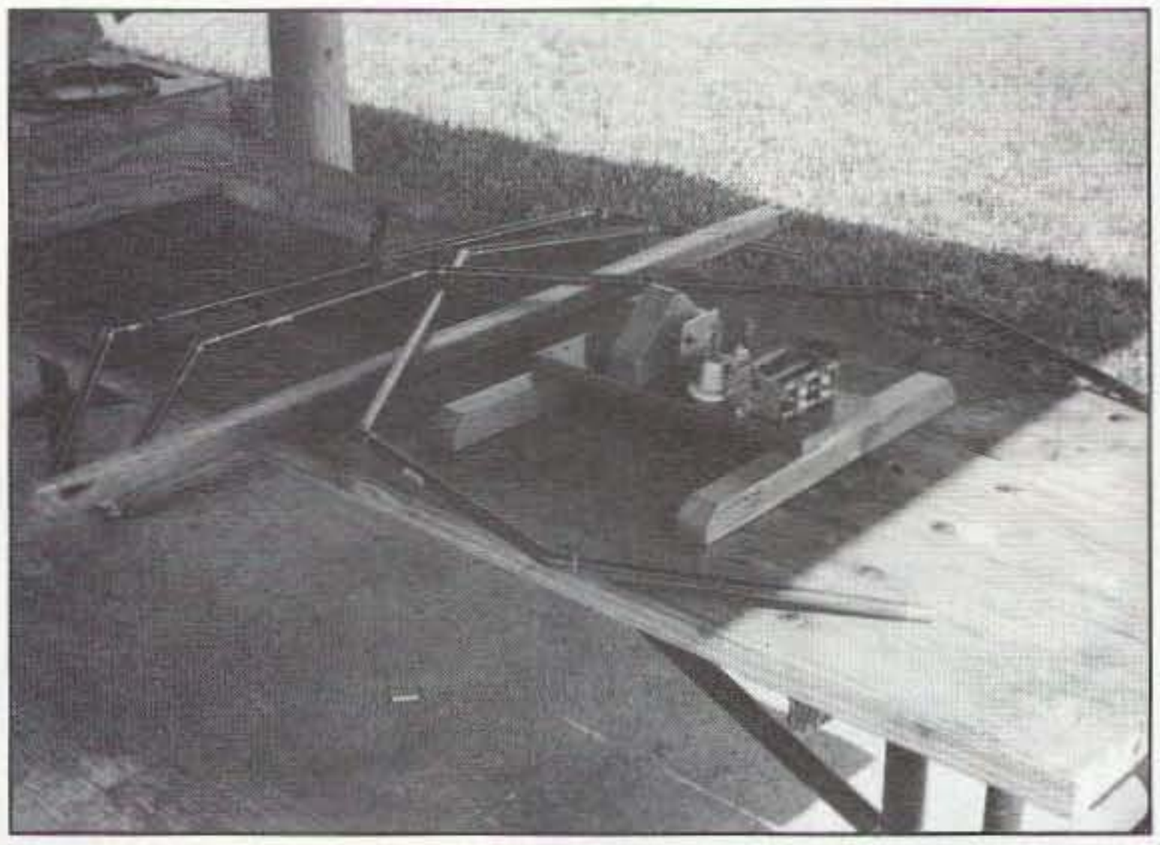


Photo A. The loop antenna in pieces before assembly. Assembly time is about five minutes.

The coaxial center conductor is connected to a number 12 wire which is separated slightly from the loop and connected at a point approximately 10 percent of the loop circumference away from the neutral point. This is very similar to the old-time method of using a tapped coil for impedance matching.

It is interesting that a reasonable match can be obtained on all five frequency bands using this simple matching device, without having to move the tap.

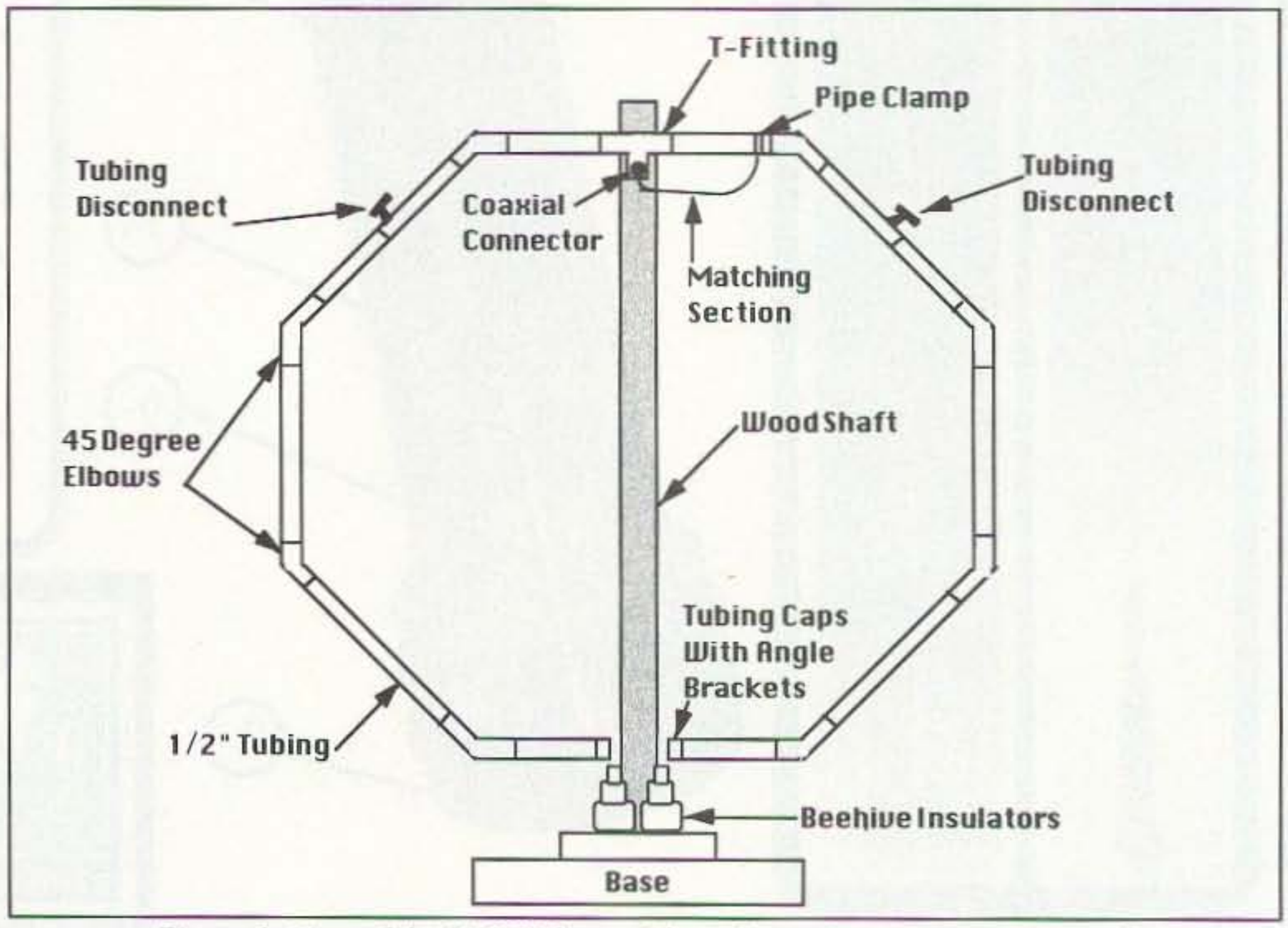
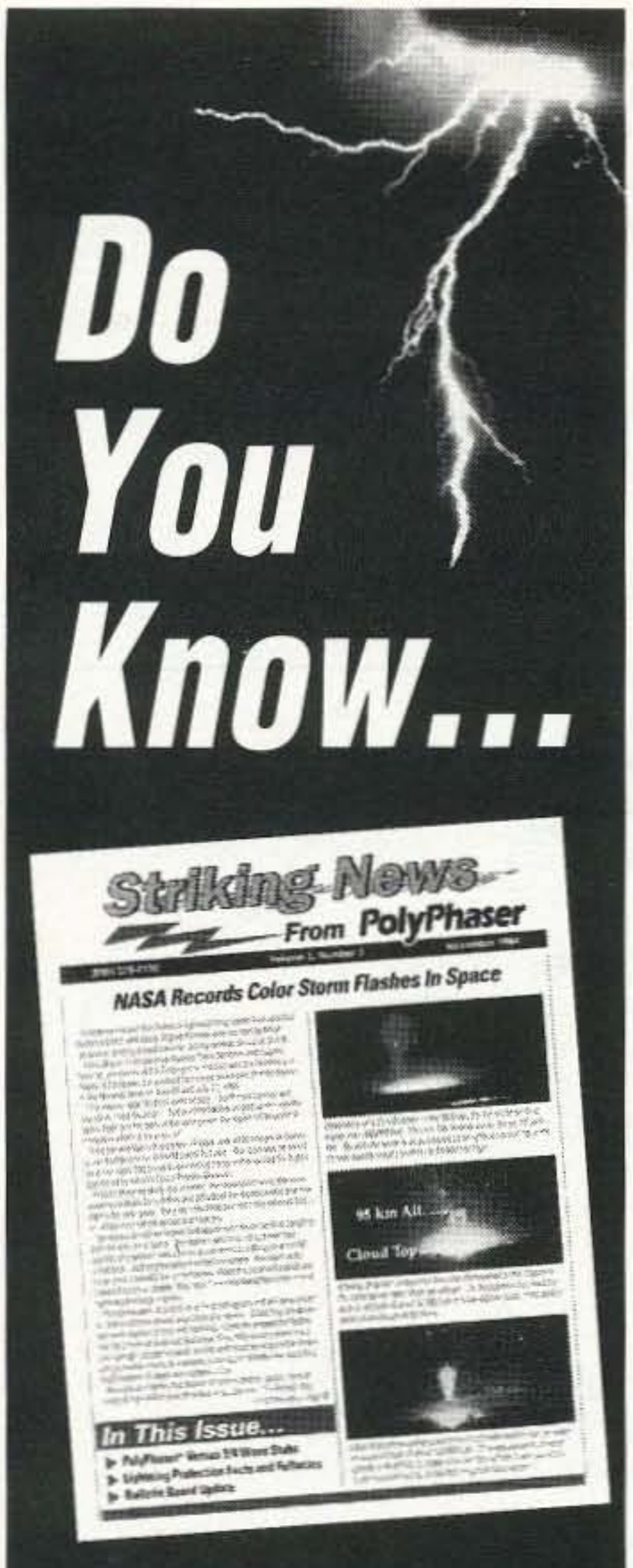


Figure 1. View of the K4SYU loop without the tuning capacitor mounted.



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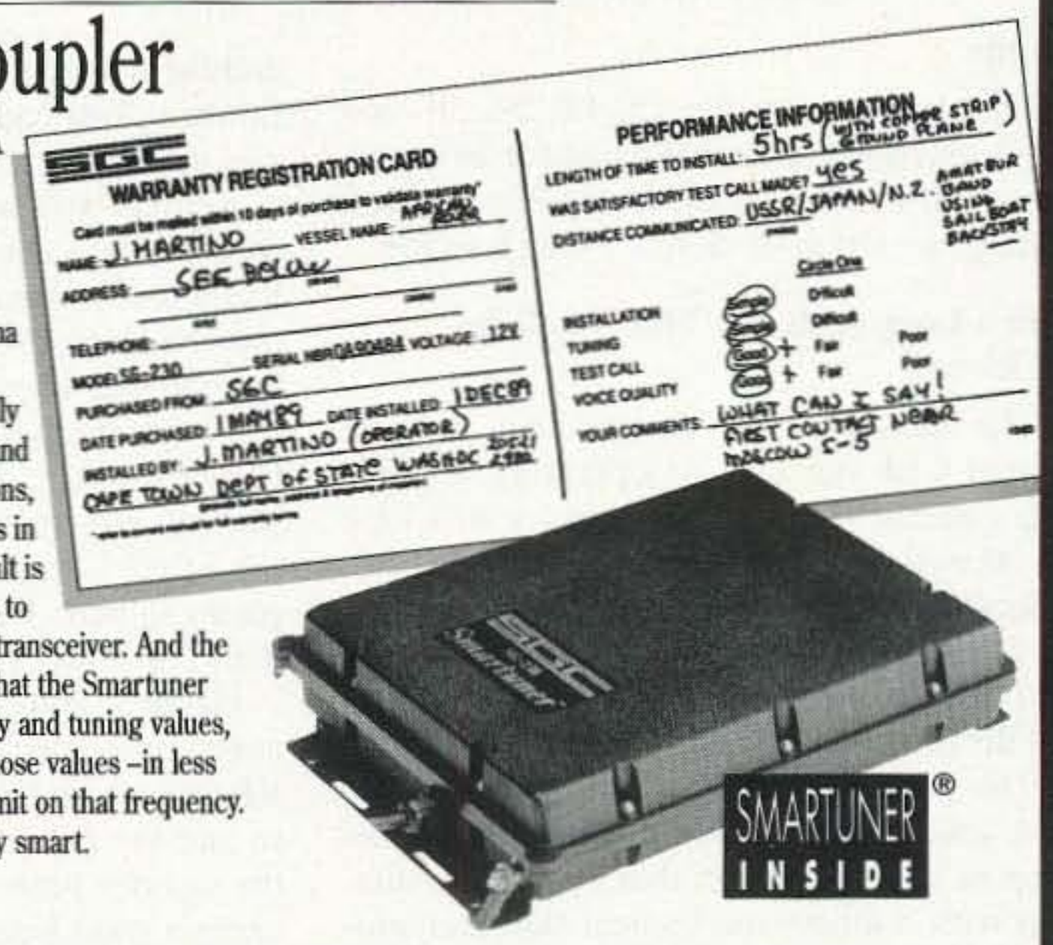

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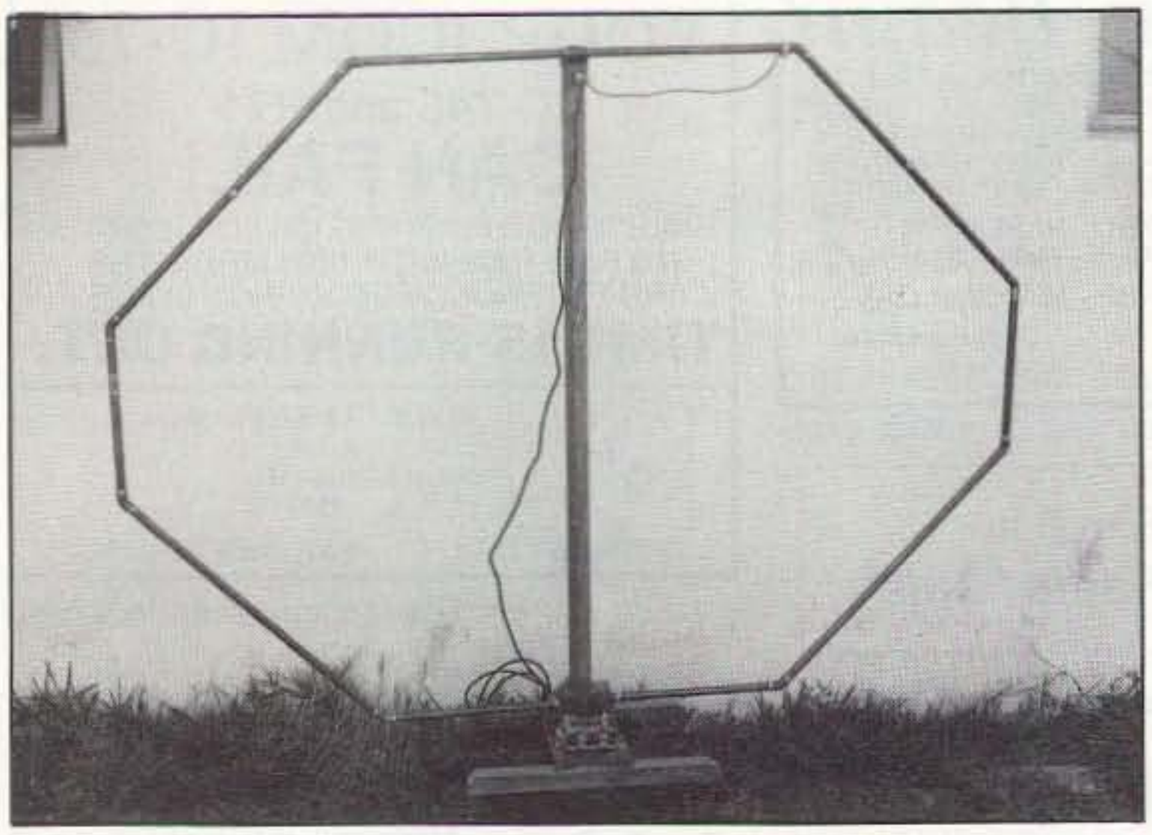

Photo B. The loop antenna, showing the matching section and coaxial cable feed point at the top.

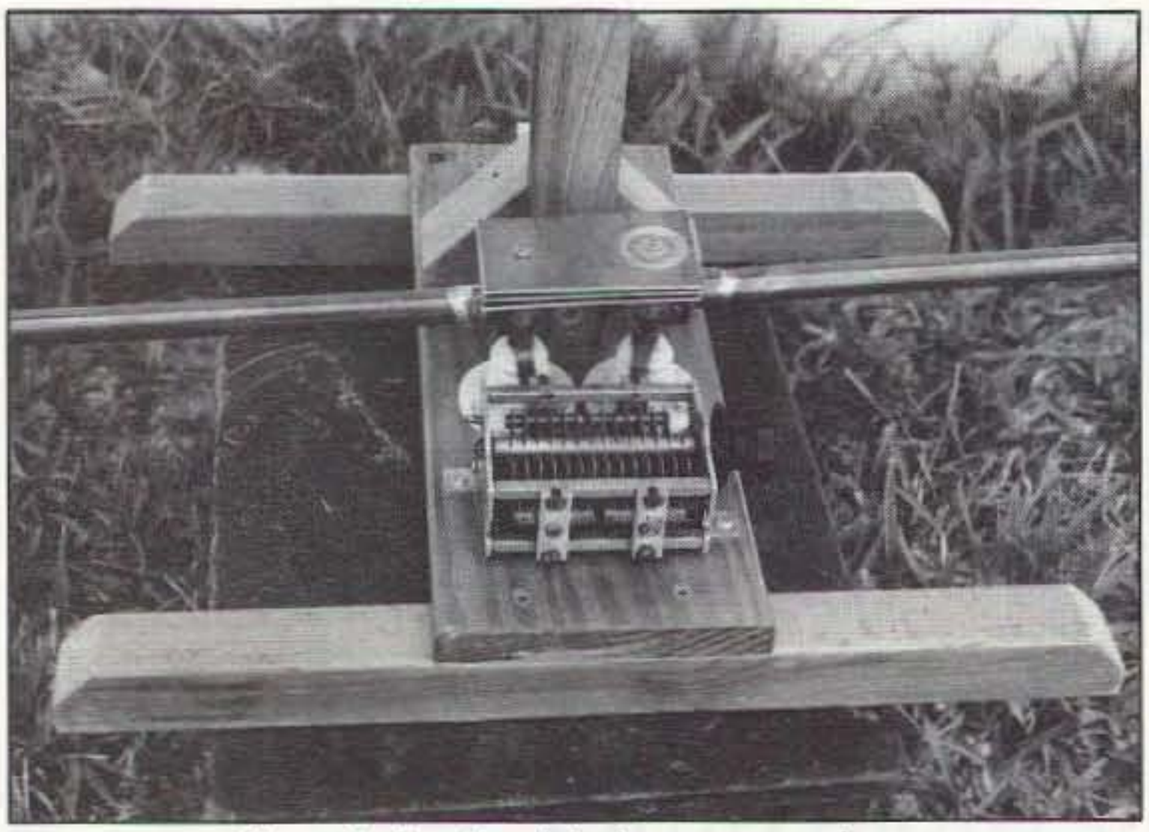

Photo C. Details of the loop antenna base.

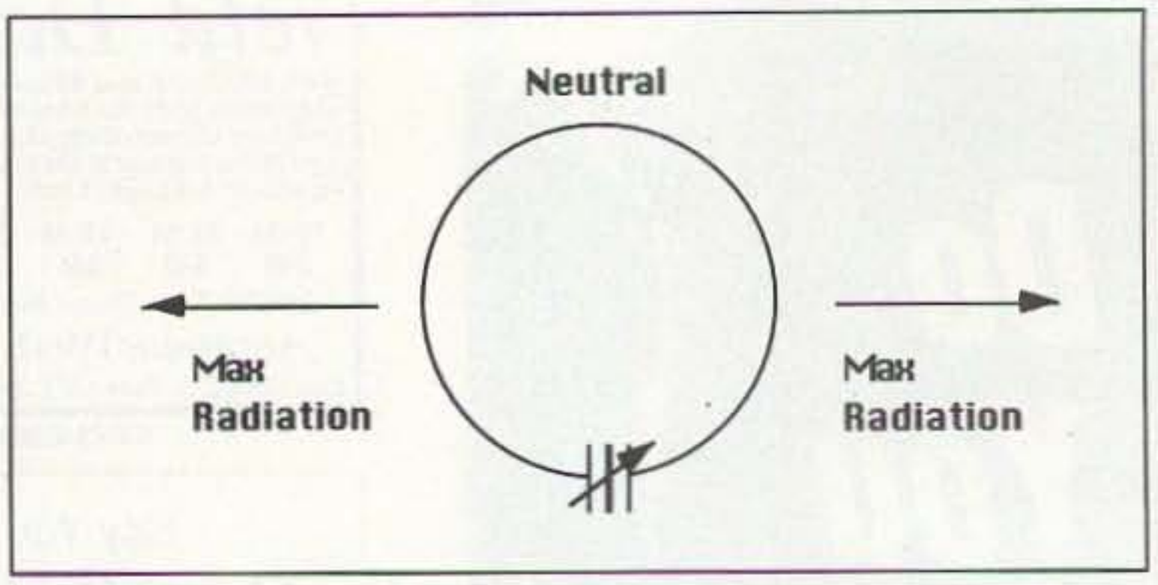

Figure 2. The loop's radiation pattern.

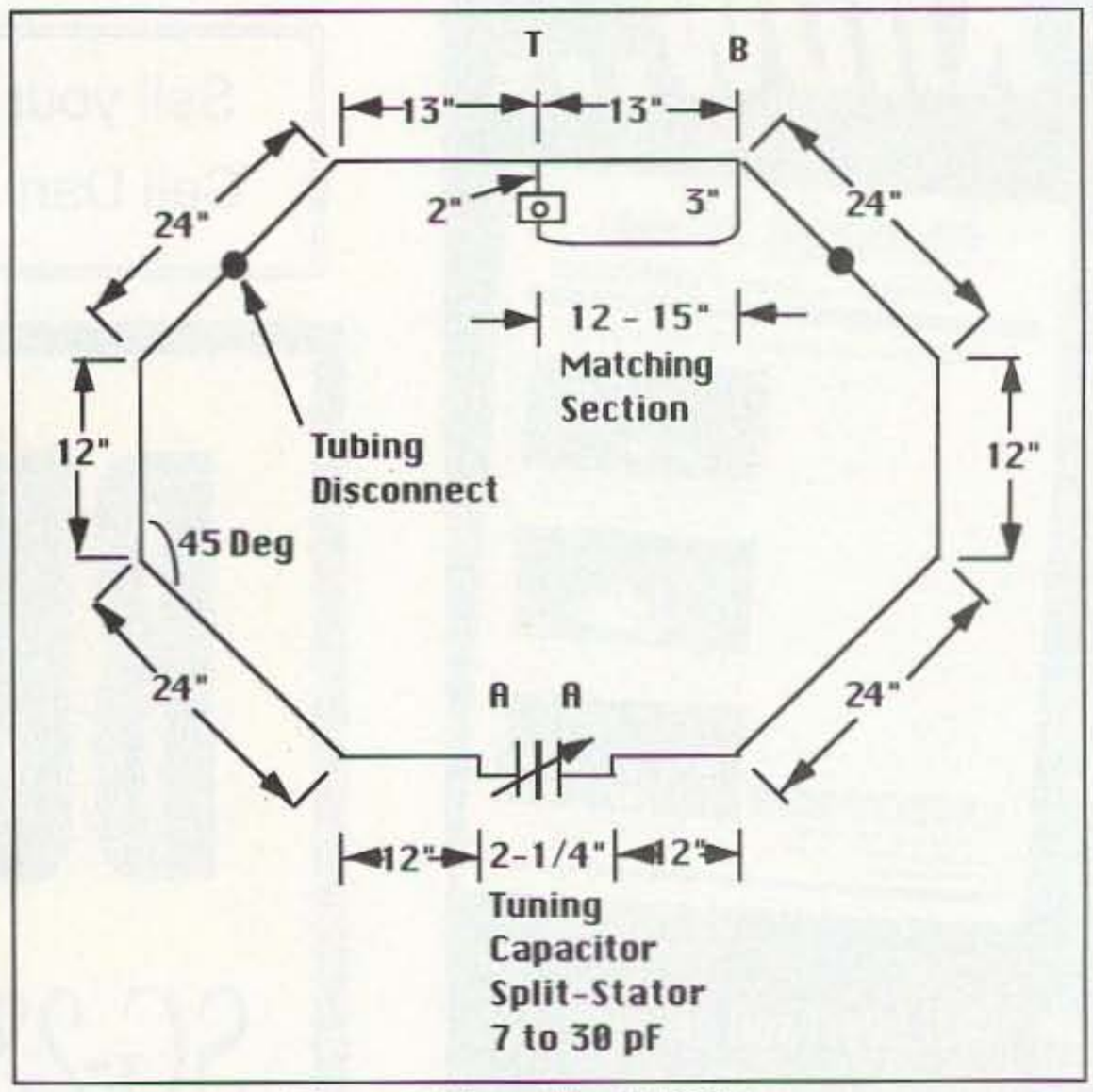

Figure 3. Plan of the K4SYU loop.

Bands

This loop covers the 15, 17, 20, 30, and 40 meter bands. That is not bad for an antenna which can be set up on a table top and take up not much more space than five feet.

Can a Loop Antenna This Small Be Efficient?

The answer is yes. This antenna was designed with the idea of operating it QRP. The calculated maximum gain for this loop on 20 meters is approximately 3.2 dB above isotropic. It also has nulls of approximately 12 dB off each side. Calculated losses below 100% efficiency are 0.13 dB for 21 MHz, 0.4 dB for 14 MHz, and 3.2 dB for 7 MHz.

The good news is that this loop will not cost you a bundle. The construction of this loop is simple enough that any radio amateur with ordinary mechanical skill and simple tools can build it. How about cost? I would estimate that the cost would be less than 35 dollars. Not bad for a five-band antenna! It could be even less if you have a good junk box. The half-inch hard drawn copper tubing and fittings cost me $11 at the local plumbing supply shop. The variable capacitor and beehive ceramic insulators were obtained at a hamfest for a few dollars, and the wooden stand was made out of scrap lumber. You can make yours real fancy if you desire.

You say you want a loop antenna but you do not want to be confined to QRP? Look no further; this small loop will handle power outputs up to 100 watts peak. The tuning capacitor that I am using is a medium-power transmitting type with 0.075-inch spacing between plates. The two stators are in series through the rotor, which gives a plate spacing of 0.15 inches but cuts the effective capacity in half. This spacing will handle more than 10k volts of RF.

Using a split-stator capacitor with each stator connected to one end of the loop, the RF voltage on the rotor and frame is near zero and the frame can be attached directly to the wooden base. The capacitor can be tuned using a good bakelite knob as shown in Photo D. Of course, if you want, you may add a motor drive. I do not recommend using a non-split-stator capacitor as the rotor will be at a high RF potential and there is a danger of RF burn. The inductance of this loop is approximately 5 µH. If you have a capacitor and you know its value, just use the formula

$$F = \frac{10^6}{2\pi\sqrt{LC}}$$

to find your frequency coverage at maximum and minimum capacity.

Tune-Up

The tune-up is very easy. First, select the band on which you wish to operate, then resonate the loop. When the loop is near resonance the received noise level and signals will peak.

You could operate with this tune-up but you probably would not get maximum power transfer. I recommend that you use a VSWR meter in the transmission line. Set the VSWR meter for reflected power, reduce the drive level at the transceiver until reflected power is mid-scale or less, then adjust the loop tuning capacitor for minimum return power. Increase power and re-adjust again for minimum. You should now have maximum power transfer for that segment of the band as allowed by your loop bandpass. Tune-up should not take much more than a minute if your rig is located near the loop antenna.

High Q and Bandpass

The high Q of the loop will work both for and against us. It will help reduce the received noise and it will attenuate harmonic

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The New Alinco DR-610T Dual Band Mobile Transceiver

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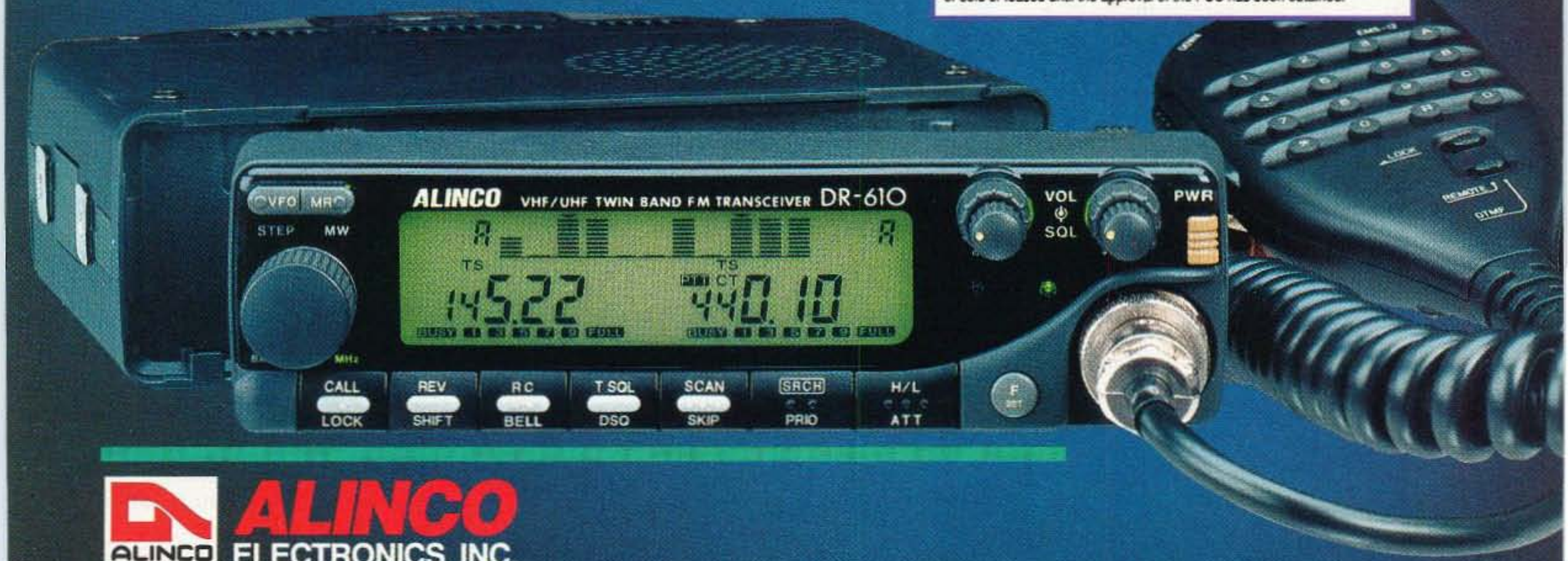
Features

- ✻ Frequency Range
- ✻ Receive: 108.000 – 173.995 MHz (AM, FM)
  420.000 – 470.000 MHz (FM)
- ✻ Transmit: 144.000 – 147.995 MHz (FM)
  438.000 – 449.995 MHz (FM)
- ✻ Multiple Scan Functions
- ✻ Priority Function
- ✻ Mono Band Dual Receive(VxV) (UxU)
- ✻ 5 Channel Scope levels
- ✻ 50 CTCSS Tones, Encode standard, Decode available with the optional accessory EJ-24U Tone Squelch Unit.
- ✻ S-meter Squelch
- ✻ RF Attenuator
- ✻ APO (Automatic Power Off)
- ✻ TOT (Time Out Timer)
- ✻ 1200/9600 bps packet capable (GMSK type TNC required)
- ✻ AM Aircraft RX Standard (No modification required)
- ✻ Full Duplex with odd split operation
- ✻ Sub-band Mute function
- ✻ 3 Power Output Levels (VHF/UHF Independent)
- ✻ DSQ (Digital Squelch)
- ✻ Beep function
- ✻ Key lock function
- ✻ Built-in Duplexer
- ✻ Remote Microphone Control Application
- ✻ Bell Function
- ✻ Tone Burst Function
- ✻ LITZ Function
  (The US First Emergency Alert Monitoring Feature)
- ✻ MARS/CAP Modifiable (Proper FCC licensing required)

This device has not been approved by Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased until the approval of the FCC has been obtained.



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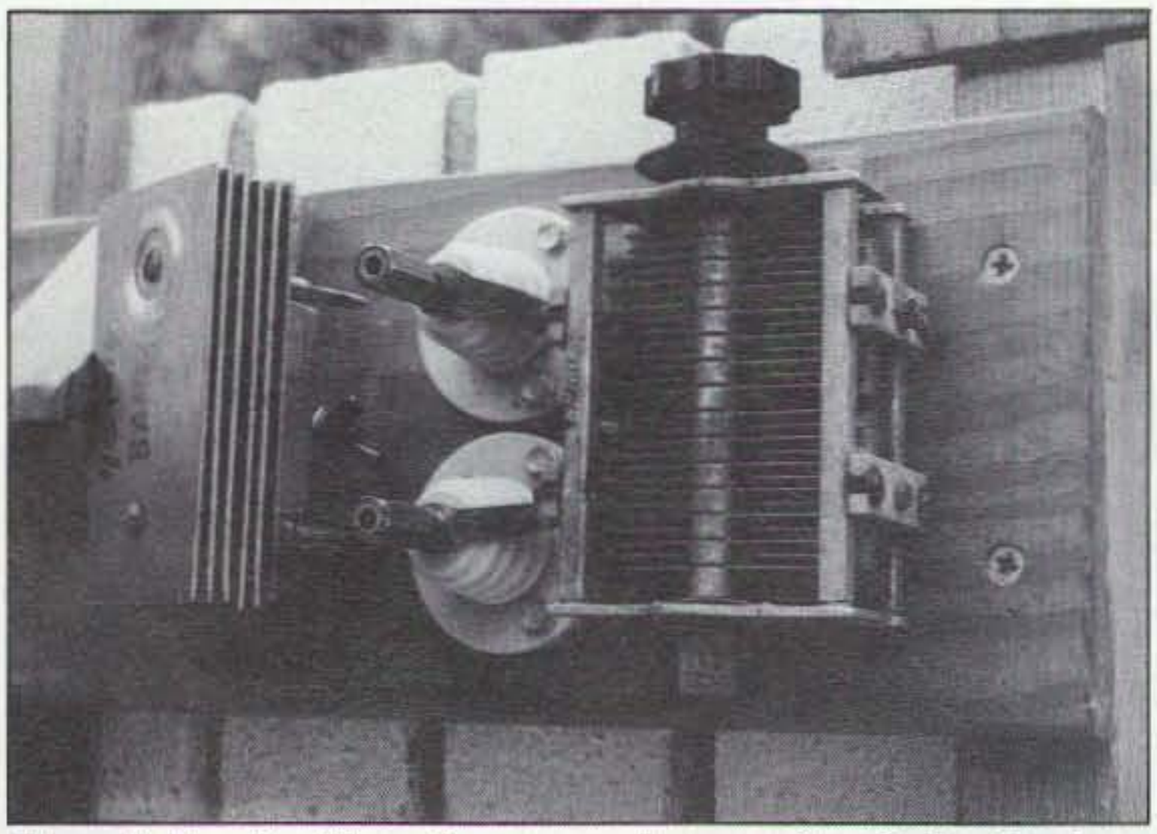

Photo D. Details of the split-stator tuning capacitor, the beehive insulators, and the plug-in 40 meter capacitor.

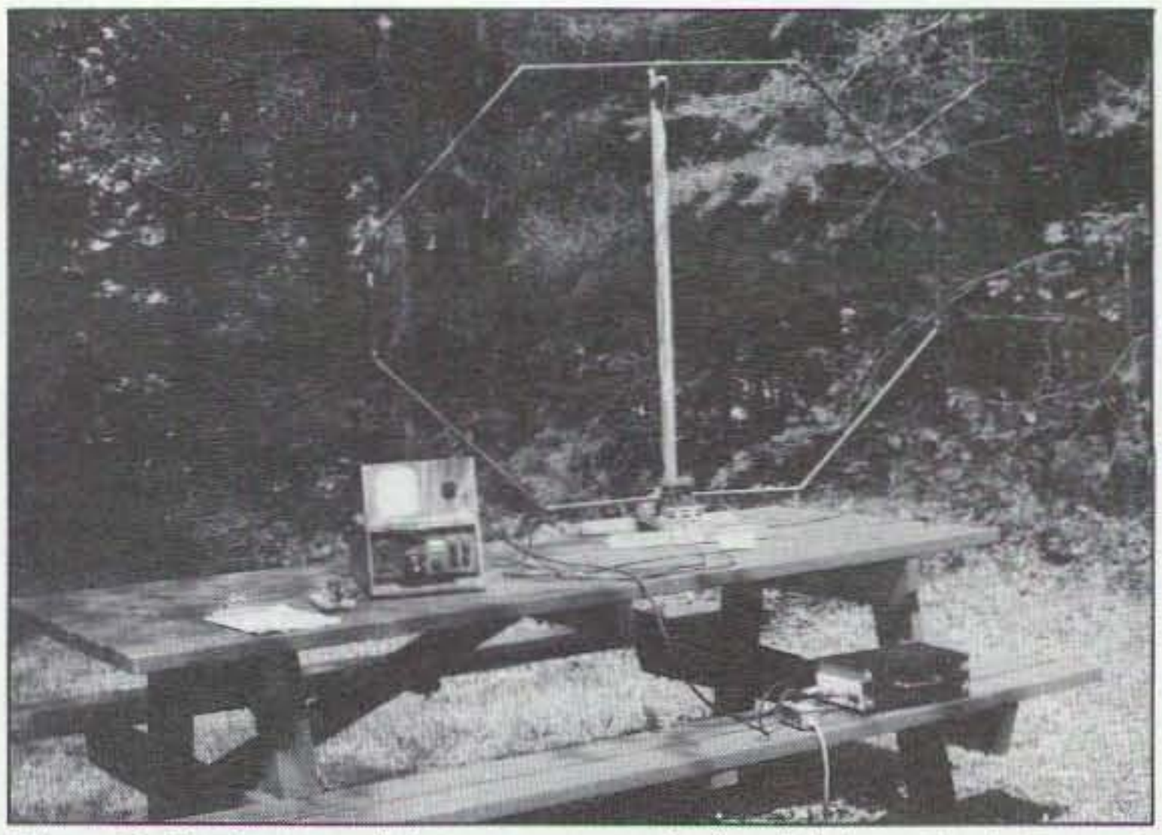

Photo E. The loop and rig set up on a picnic table in a North Georgia park.

radiation. It will not allow us to move up and down the band without re-resonating the loop to the new operating frequency.

The following bandpass figures were measured using this loop:

Band	Bandpass
15 meters	138 kHz
17 meters	Not measured
20 meters	57 kHz
30 meters	23 kHz
40 meters	15 kHz

These bandpass figures indicate the limits between 2.5:1 VSWR points for each band. It is easy to see that as the frequency decreases the bandpass becomes smaller, the tuning of the loop becomes more critical and the efficiency also decreases.

I haven't encountered any problems thus far in manually tuning this loop, as the loop is operated next to the transceiver. If the loop is to be operated at a location at a distance from the rig, then a motor drive mechanical tuner will be required.

Construction

As you can see in Figure 3, the loop antenna is octagon-shaped, but is a little shorter than it is wide. This was done in order to provide clearance from the ceiling when operated from a tabletop.

About 16 linear feet of half-inch hard-drawn copper tubing is required. Using a tubing cutter or hacksaw, cut the tubing to the lengths shown in Figure 3. Clean the portions of the tubing to be soldered, using emery cloth. Also clean the interior of all fittings. Make two copper angle brackets and attach them to the two copper pipe caps with self-tapping screws. Clean the caps and brackets for soldering.

Lay the parts out flat on a concrete floor. Use acid soldering flux on all joints and assemble the loop. Use wooden blocks to raise the loop above the level of the floor, keeping it flat for soldering. Use a propane torch and heat the fittings one at a time. Use lead-tin solder, the same as is used in radio work. The solder will be drawn into each joint when hot enough. You may wipe excess solder off using a damp cloth if you wish.

Note the position of the copper T-fitting (Figures 4 and 5) at the top of the loop. It is used as the upper support, as it fits into a hole in the vertical support shaft.

When all of the tubing joints are soldered the loop should look like the plan drawing in Figure 3. The loop will be rigid and have no loose joints. Make a vertical wooden shaft 1-1/2" x 1-1/2" x 52" long.

Make a 14" x 18" wooden base as shown in Photo A. Make a wooden support for the vertical shaft to hold it at right angles to the base.

A copper bracket is required for the SO-239 coax fitting. It may be screwed or soldered to the copper T-fitting as desired. Mount the beehive insulators on the wooden base along with the split stator capacitor. Fasten parts down with wood or sheet metal screws using brack-

ets as needed on the capacitor frame.

Make connectors out of copper strip to go between the insulator tops and the capacitor stators. Try to have these connectors as short as possible.

The loop as presently set up will cover the 15, 17, and 20 meter bands. In order to resonate it on the 30 and 40 meter bands, additional capacitance must be added in parallel with the existing split-stator variable capacitor. This is done by attaching two banana jacks to the top of the beehive insulators. Fixed plug-in capacitors can then be added in order to work the 30 and 40 meter bands.

Construction of the Fixed Capacitors

The fixed capacitors are made of double-sided copper printed circuit board using air as a dielectric. The printed circuit board is cut into plates which are stacked in such a way as to make a high-voltage capacitor.

Figure 6 shows the size and shape of the fixed capacitor plates. Three plates are used for the 30 meter capacitor; six for the 40 meter capacitor. The approximate capacity of the 30 meter capacitor is 30 pF; 75 pF for 40 meters.

All plates are cut with a large pair of tin snips.

The plates are then stacked and holes drilled to accept two 6-32 screws. Remove the copper from around the hole on one end of each plate. As we are using double-sided printed circuit board, the copper must be

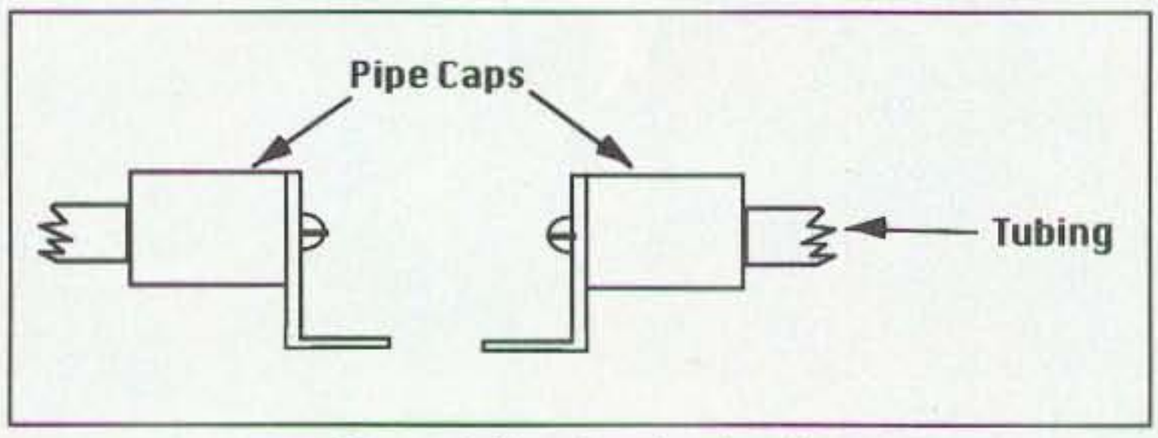

Figure 4. Base bracket detail.

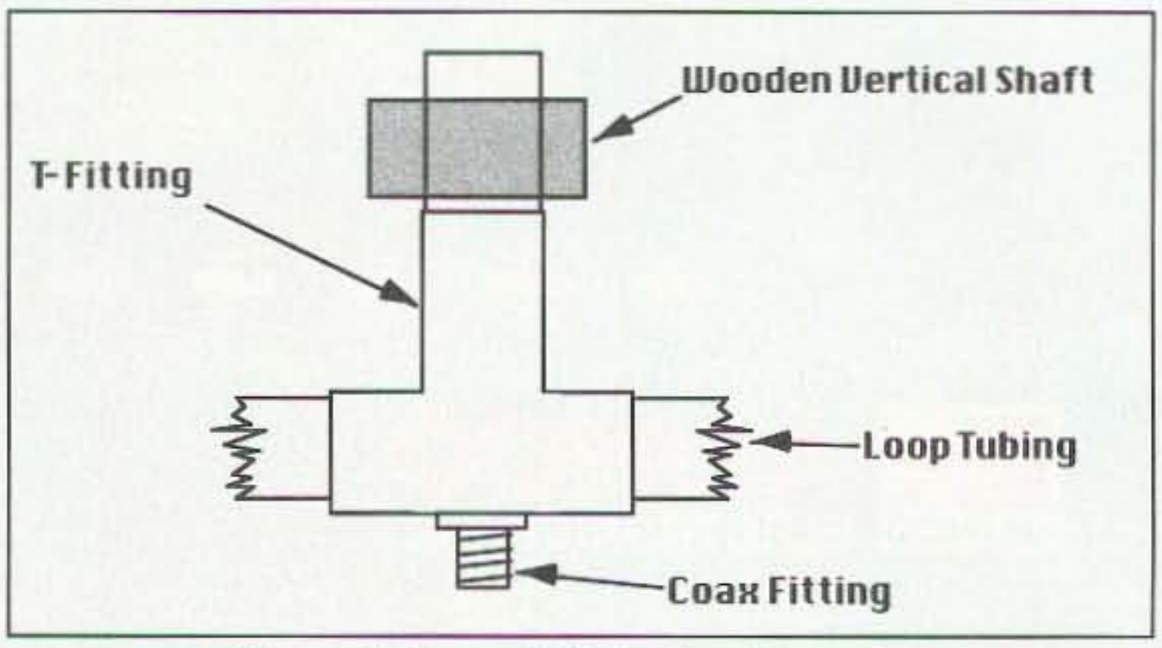

Figure 5. Copper T-fitting detail, top view.

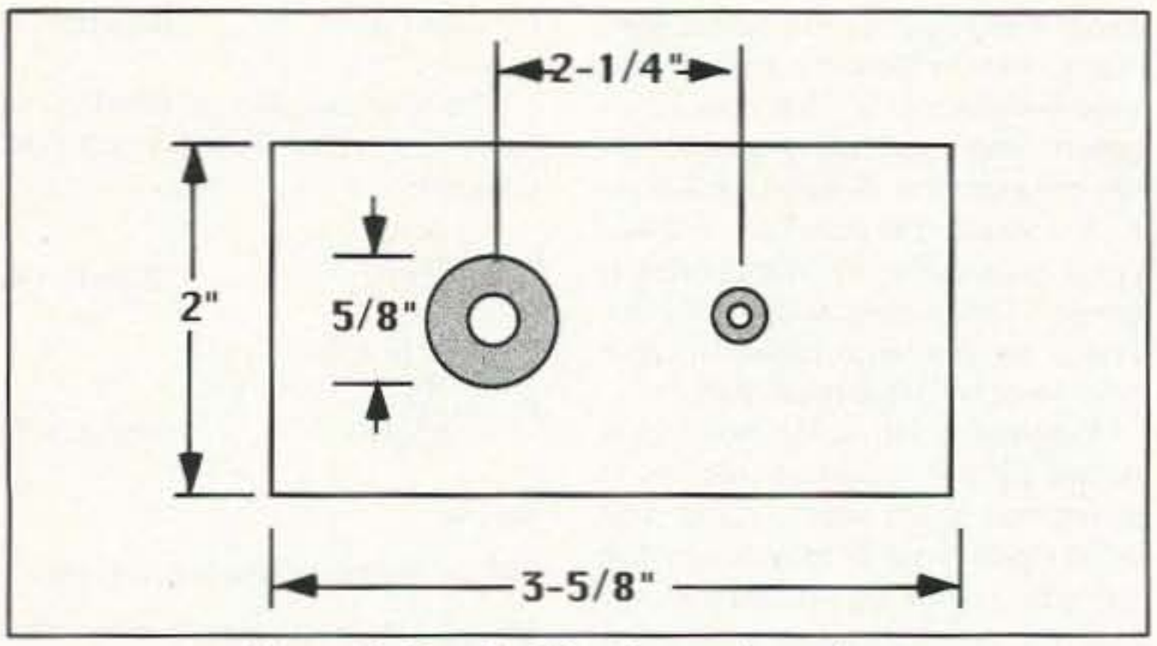

Figure 6. Detail of fixed capacitor plates.

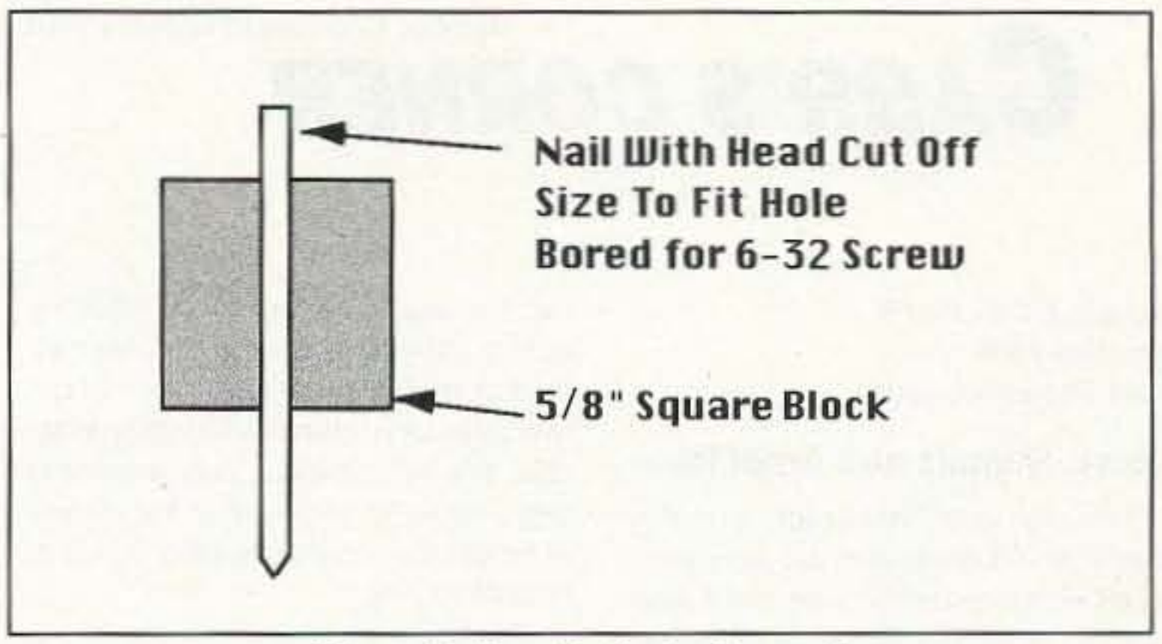

Figure 7. Detail of grinding tool.

removed from around the same hole on both sides. This can be done quickly by grinding the copper away using a homemade tool in an electrical drill or drill press (Figure 7).

Fasten a small strip of emery cloth to the grinding tool, passing the nail through the emery cloth. Insert nail in one side of the printed circuit board in the drilled hole, and rotate the tool using an electric drill. The copper will be removed quite rapidly.

Stacking the Capacitor Plates

Referring to Figure 8, you can see that on the left-hand terminal plates 1 and 3 are connected while the right-hand terminal is connected only to plate 2. A common 6-32 nut is placed on the screw between each plate and on top of the stack of plates. This gives a spacing of about 0.1 inch.

Loop Antenna Tubing Disconnects

For those radio amateurs who intend to use the loop as a portable antenna or frequently move it from one place to another, it can be equipped with tubing disconnects. The loop will then break down into three sections of no more than four feet in overall length, which will allow it to be easily carried in the trunk of a car. The tubing is cut at the two tubing disconnect points. A brass insert is made with a good fit to the interior of the tubing. It is soldered into one section and, with the loop assembled, a hole is drilled through the mating tubing section. The brass insert is then tapped for a screw thread. A 6-32 or 8-32 screw, as available, can be used to secure the sections of the loop together and make a good mechanical and electrical connection.

A word of caution: This loop concentrates very high levels of magnetic radiation and should be kept away from people and metal objects, both of which will absorb energy. This could cause a hazard.

Conclusion

For the past six months, I've used this loop antenna every Tuesday in a mini-Field-Day operation to make contact on schedule with W2GUM in New Jersey on 20 meter CW. Signal reports have frequently been S9, even with poor band conditions. Some of the contacts were made using QRP. The setup as shown in Photo E is portable from a park in North Georgia. My rig is a Ten-Tec Argosy. Its output is either 5 or 50 watts, depending upon whether I want to operate QRP. The antenna has helped make many contacts on 15, 20, 30, and 40 meters. Most of the operation has been portable battery-powered from a city park in Melbourne, Florida. The loop has also performed very well on DX contacts.

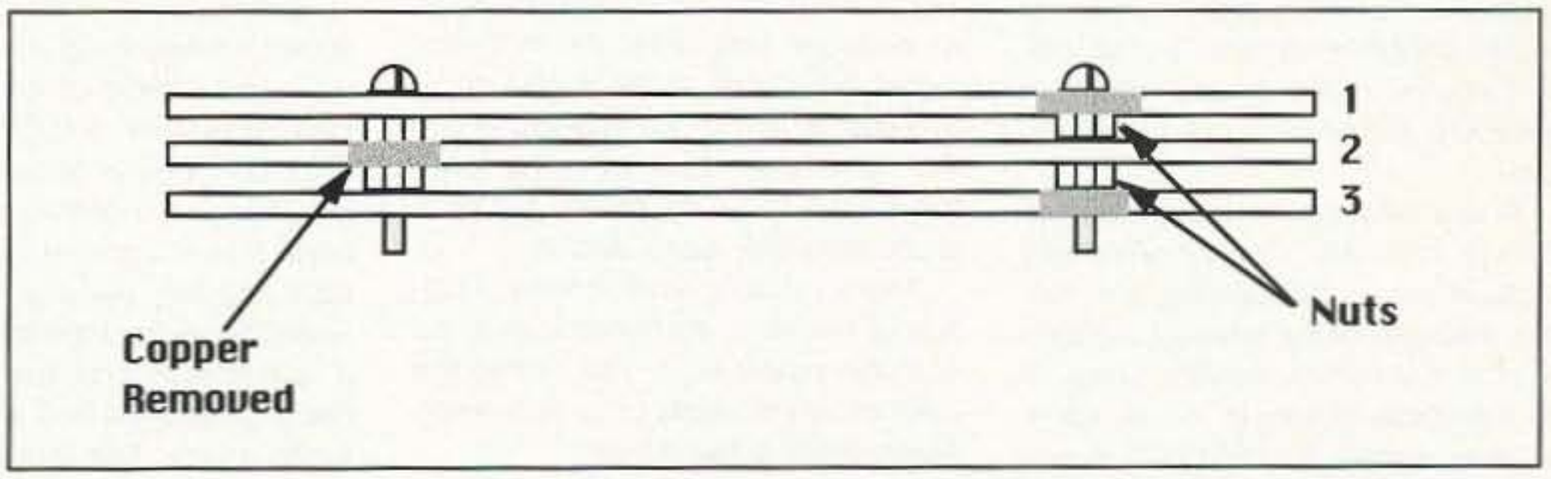

Figure 8. Stacking the capacitor plates.

We have a small QRP club, and two other members, W4MPT and N4MPD, have built loops from these plans. Both are very happy with the results.

My recommendation is, try it, you will like it.

For more information see the Ted Hart W5QJR article in the June 1986 issue of *QST*. I would like to thank Burt Bittner KØWQN for his suggestions and computer tab-outs modeling this antenna. For loop theory, see *Electronic and Radio Engineering* by Terman. 73

Parts List

8	Copper elbows 1/2" dia.
1	Copper T-fitting 1/2" dia.
2	Copper end caps 1/2" dia.
14-1/2'	Hard-drawn copper tubing, 1/2" dia.
1	Coaxial connector, female type SO-239
2	Beehive insulators
1	About 2' of No. 12 solid copper wire
1	2" x 4" copper flashing
1	Tuning capacitor, split-stator type*
1	Wooden base, 1" x 6" x 14"
2	Wooden legs, 1-1/2" x 1-1/2" x 18"
1	Wooden vertical shaft, 1" x 1-1/2" x 51"
1	Double-sided circuit board, 3-5/8" x 18'**
1	Banana jacks**
4	Banana plugs with 6-32 threaded ends**
4	Brass screws, 6-32, 1" long**
18	Nuts 6-32 to fasten plates**
1	Hose clamp, small, stainless steel

* Note: The split-stator capacitor which I used was made by Cardwell, and was removed from a plug-in unit from a surplus SCR 188 MOPA transmitter. The capacitor was not split-stator and it measured about 30 to 130 pF. The stator was supported by four insulators attached to the frame. I drilled and filed through the center of the bars holding the stator plates. I removed the center stator plate and made two separate stator sections with 3/16-inch spacing between the stator bar sections.

** Note: If you have trouble finding the banana plugs and the double-sided printed circuit board, a transmitting type variable capacitor may be substituted and may be connected to the loop using battery clips. The variable capacitor should have a maximum capacity of about 100 pF. It does not need to be a split-stator type.

If this substitution is made, then all ** items may be omitted.

Number 13 on your Feedback card

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Noise, Signals and Amplifiers

Although gain, bandwidth and the shape of the passband are important amplifier characteristics, we must also concern ourselves about circuit *noise.* In the spectrum below VHF, man-made and natural atmospheric noise sources are so dominant that receiver noise contribution is trivial. But at VHF and above, receiver and amplifier noise sets the performance of the system.

At any temperature above Absolute Zero (0° K or -273° C) electrons in any material are in constant random motion. Because of the inherent randomness of that motion, however, there is no detectable current in any direction. In other words, electron drift in any single direction is cancelled over short time by equal drift in the opposite direction. There is, however, a continuous series of random current pulses generated in the material, and those pulses are seen by the outside world as a noise signal. This signal is called by several names: *thermal agitation noise, thermal noise* or *Johnson noise.*

It is important to understand what we mean by "noise" in this context. In a communications system the designer may regard all unwanted signals as "noise," including man-made electrical spark signals and adjacent channel communications signals, as well as Johnson noise. In other cases, the harmonic content generated in a linear signal by a non-linear network could be regarded as "noise." But in the context of amplifiers and receivers, "noise" usually refers to thermal agitation noise.

Amplifiers and other linear networks are frequently evaluated using the same methods, even though the two classes appear radically different. In the generic sense, a passive network is merely an amplifier with negative gain or a complex transfer function. We will consider only amplifiers here, but keep in mind that the material herein also applies to other forms of circuits as well.

Amplifiers and receivers are evaluated on the basis of *signal-to-noise ratio* (S/N or "SNR"). The goal of the designer is to enhance the SNR as much as possible. Ultimately, the minimum signal detectable at the output of an amplifier is that which appears above the noise level. Therefore, the lower the system noise, the smaller the *minimum detectable signal* (MDS).

Noise resulting from thermal agitation of electrons is measured in terms of *noise power* (P_n), and carries the units of power (watts or its sub-units). Noise power is found from:

$$P_n = KTB \qquad \text{(Equation 1)}$$

Where:
P_n is the noise power in watts (W).

K is Boltzmann's constant

(1.38 x 10^{-23} J/°K).

B is the bandwidth in hertz (Hz).

Notice in Equation 1 that there is no center frequency term, only a bandwidth. True thermal noise is *gaussian,* or near-gaussian, in nature, so frequency content, phase and amplitudes are equally distributed across the entire spectrum. Thus, in bandwidth limited systems, such as a practical amplifier or network, the total noise power is related only to temperature and bandwidth. We can conclude that a 20 MHz bandwidth centered on 200 MHz produces the same thermal noise level as a 20 MHz bandwidth centered on 400 MHz or some other frequency.

Noise sources can be categorized as either internal or external. The internal noise sources are due to thermal currents in the semiconductor material resistances. It is the noise component contributed by the amplifier under consideration. If noise, or S/N ratio, is measured at both input and output of an amplifier, the output noise is greater. The internal noise of the device is the difference between output noise level and input noise level.

External noise is the noise produced by the signal source, so is sometimes called *source noise.* This noise signal is due to thermal agitation currents in the signal source, and even a simple zero-signal input termination resistance has some amount of thermal agitation noise.

Both types of noise generator are shown schematically in Figure 1. Here we model a microwave amplifier as an ideal "noiseless" amplifier with a gain of *G,* and a noise generator at the input. This noise generator produces a noise power signal at the input of the ideal amplifier. Although noise is generated throughout the amplifier device, it is common practice to model all noise generators as a single input-referred source. This source is shown as voltage V_i and current I_i.

Noise Factor, Noise Figure and Noise Temperature

The noise of a system or network can be defined in three different but related ways: *noise factor* (F_n), *noise figure* (NF) and *equivalent noise temperature* (T_e); these properties are definable as a ratio, decibel or temperature, respectively.

Noise Factor (F_n): The noise factor is the ratio of output noise power (P_{no}) to input noise power (P_{ni}):

$$F_n = \left[\frac{P_{no}}{P_{ni}}\right]_{T = 290^\circ K} \qquad \text{(Equation 2)}$$

In order to make comparisons easier, the noise factor is always measured at the standard temperature (T_o) 290° K (official room temperature).

The input noise power P_{ni} can be defined as the product of the source noise at standard temperature (T_o) and the amplifier gain:

$$P_{ni} = GKT_oB \qquad \text{(Equation 3)}$$

It is also possible to define noise factor F_n in terms of output and input S/N ratio:

$$F_n = \frac{SNR_{in}}{SNR_{out}} \qquad \text{(Equation 4)}$$

which is also:

$$F_n = \frac{P_{no}}{KT_oBG} \qquad \text{(Equation 5)}$$

Where:

SNR_{in} is the input signal-to-noise ratio.

SNR_{out} is the output signal-to-noise ratio.

P_{no} is the output noise power in watts (W).

K is Boltzmann's constant

(1.38 x 10^{-23} J/°K).

T_o is 290 degrees Kelvin (°K).

B is the network bandwidth in hertz (Hz).

G is the amplifier gain.

The noise factor can be evaluated in a model that considers the amplifier ideal, and therefore only amplifies through gain G the noise produced by the "input" noise source:

$$F_n = \frac{KT_oBG + \Delta N}{KT_oBG} \qquad \text{(Equation 6)}$$

Where:

ΔN is the noise added by the network or amplifier.

All other terms are as defined above.

Noise Figure (NF): The noise figure is a frequently used measure of an amplifier's "goodness," or its departure from "idealness." Thus, it is a figure of merit. The noise figure is the noise factor converted to decibel notation:

$$NF = 10\ LOG(F_n) \qquad \text{(Equation 7)}$$

Where:
NF is the noise figure in decibels (dB).

F_n is the noise factor.

LOG refers to the system of base-10 logarithms.

Noise Temperature (T_e): The noise "temperature" is a means for specifying noise in terms of an equivalent temperature. Evaluating Equation 1 shows

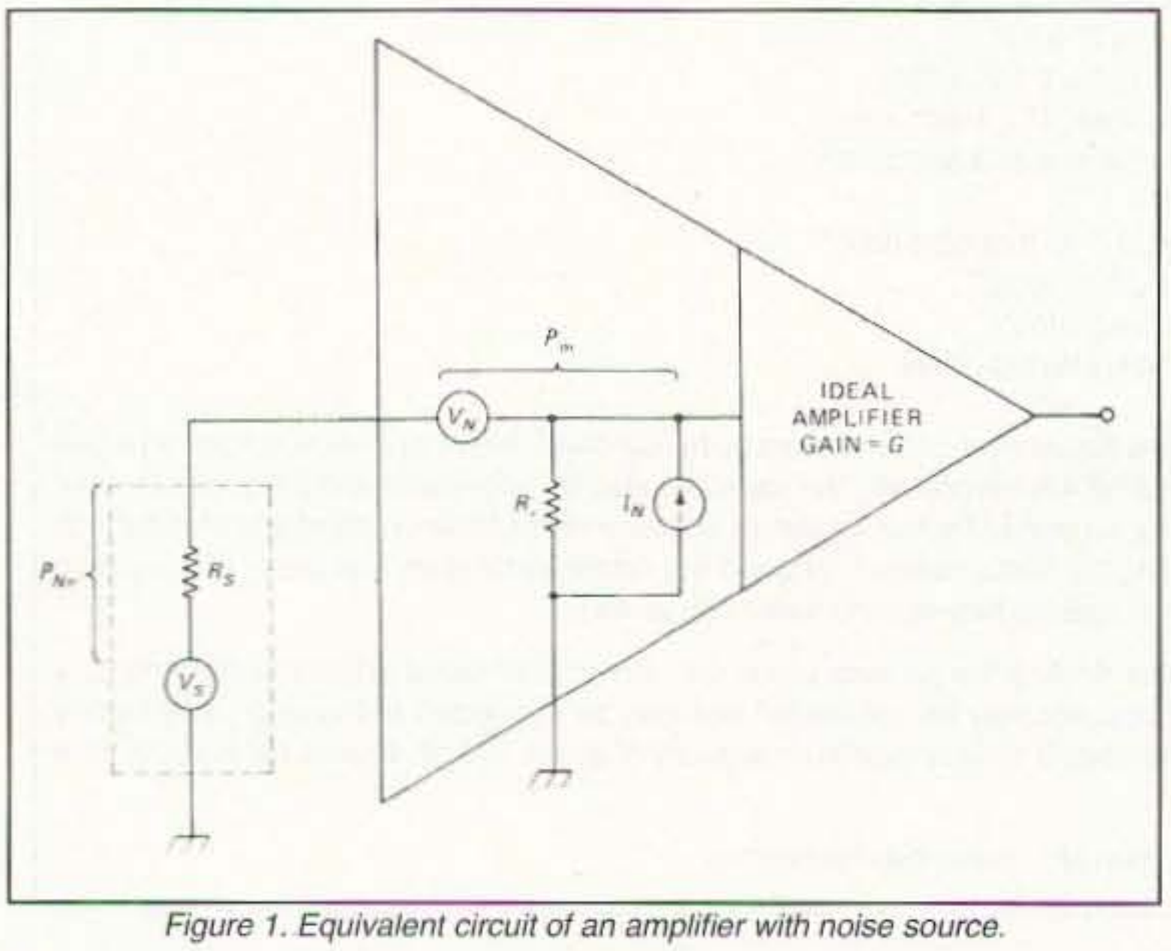

Figure 1. Equivalent circuit of an amplifier with noise source.

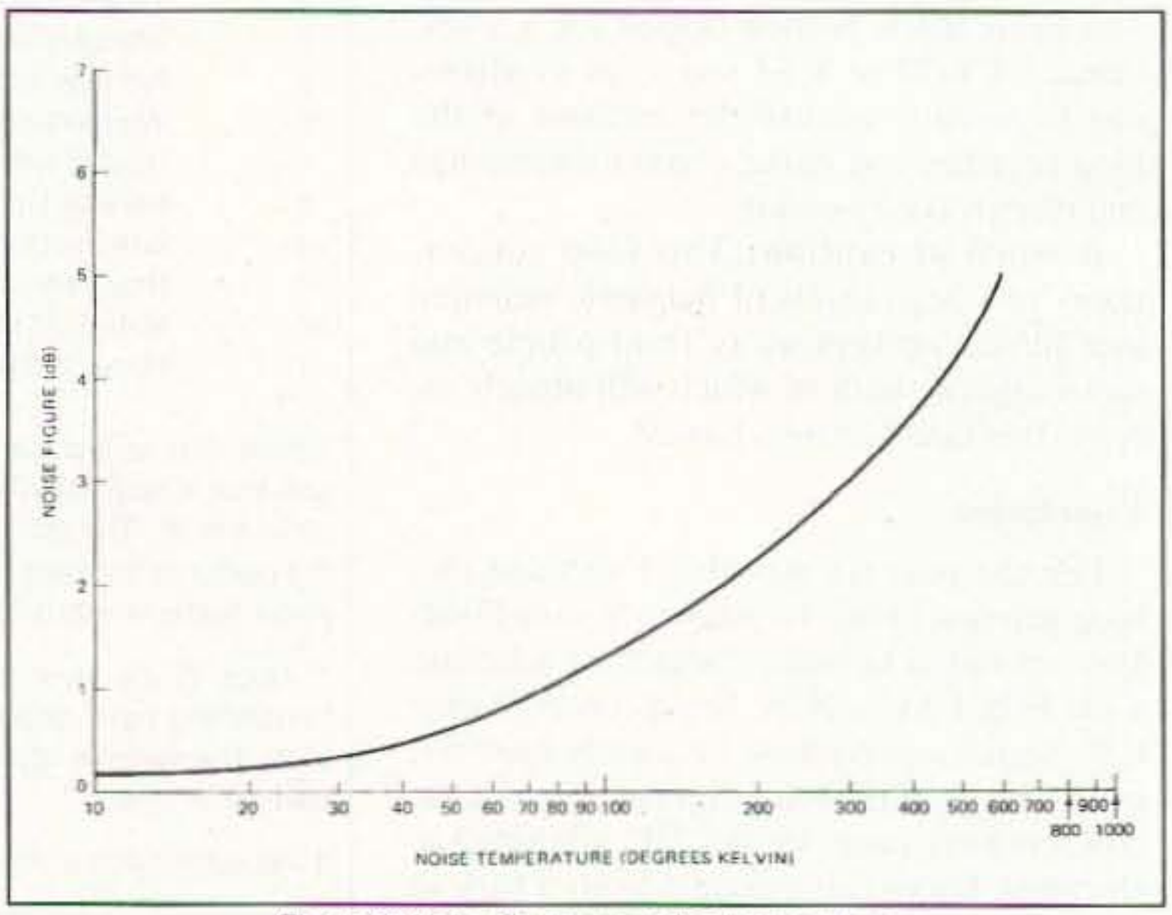

Figure 2. Noise figure vs. noise temperature.

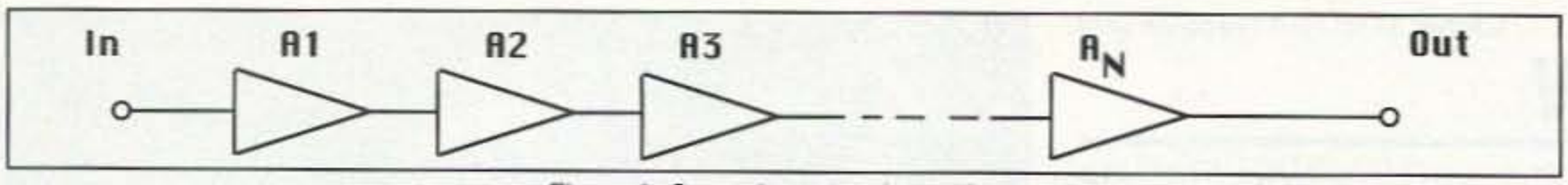

Figure 3. Cascade chain of amplifiers.

that the noise power is directly proportional to temperature in degrees Kelvin, and also that noise power collapses to zero at the temperature of Absolute Zero (0° K).

Note that the equivalent noise temperature T_e is not the physical temperature of the amplifier, but rather a theoretical construct that is an *equivalent* temperature that produces that amount of noise power. The noise temperature is related to the noise factor by:

$$T_e = (F_n - 1)\, T_o \qquad \text{(Equation 8)}$$

and to noise figure by:

$$T_e = \left[\text{Antilog}\left(\frac{NF}{10}\right) - 1\right] KT_o \qquad \text{(Equation 9)}$$

Now that we have noise temperature T_e, we can also define noise factor and noise figure in terms of noise temperature:

$$F_n = \frac{T_e}{T_o} + 1 \qquad \text{(Equation 10)}$$

and,

$$NF = 10\ LOG\left[\frac{T_e}{T_o + 1}\right] \qquad \text{(Equation 11)}$$

Noise figure and noise temperature are roughly graphed in Figure 2.

The total noise in any amplifier or network is the sum of internally generated and externally generated noise. In terms of noise temperature:

$$P_{n(total)} = GKB(T_o + T_e) \qquad \text{(Equation 12)}$$

Where:

$P_{n(total)}$ is the total noise power.

All other terms are as previously defined.

Although the equations tend to show absolute equivalence and convertibility between F_n, NF and T_e, there is sometimes a bit of confusion regarding proper practices for optimizing an amplifier with regard to matching the input and source resistances. There is an optimum source resistance for minimizing input noise power. There is also an optimum source resistance for maximum power transfer to the amplifier (source resistance equals amplifier input resistance). Unfortunately, the two optimum resistances are rarely the same. While impedance matching is useful, some common tactics are not.

A tactic used by some designers is to modify the source resistance by adding a series or shunt resistance to the circuit to bring the total source resistance seen by the amplifier to the optimum value for noise figure reduction. Unfortunately, while this tactic improves the *apparent* noise factor, it actually deteriorates output signal-to-noise ratio. In the case cited, the noise contributed by the added resistor (KTBR) increases input noise to a point that dominates and masks amplifier internal noise. While that tactic appears to improve F_n, it actually does not affect F_n at all, but it does deteriorate output signal-to-noise ratio (SNR_{out}).

Noise in Cascade Amplifiers

A noise signal is seen by a following amplifier as a valid input signal. Thus, in a cascade amplifier (Figure 3) the final stage sees an input signal that consists of the original signal and noise amplified by each successive stage. Each stage in the cascade chain both amplifies signals and noise from previous stages, and also contributes some noise of its own. The overall noise factor for a cascade amplifier can be calculated from *Friis' noise equation. (See Figure 4.)*

$$F_n = F1 + \frac{F_2 - 1}{G1} + \frac{F_3 - 1}{G1\,G2} + \frac{F_4 - 1}{G1\,G2\,G3} + \ldots + \frac{F_n - 1}{G1\,G2\,G3 \ldots G_{n-1}}$$

or, in terms of noise temperature:

$$T_n = T1 + \frac{T_2 - 1}{G1} + \frac{T_3 - 1}{G1\,G2} + \frac{T_4 - 1}{G1\,G2\,G3} + \ldots + \frac{T_n - 1}{G1\,G2\,G3 \ldots G_{n-1}}$$

Figure 4. Friis' noise equation.

Where:

F_n is the overall noise figure of N stages in cascade.

T_e is the overall noise temperature of N stages in cascade.

F1 is the noise factor of stage-1.

F2 is the noise factor of stage-2.

F3 is the noise factor of stage-3.

F_n is the noise factor of the nth stage.

T1 is the noise temperature of stage-1.

T2 is the noise temperature of stage-2.

T3 is the noise temperature of stage-3.

T_{n-1} is the noise temperature of the *(n-1)th stage.*

G1 is the gain of stage-1.

G2 is the gain of stage-2.

G3 is the gain of stage-3.

G_{n-1} is the gain of stage (n-1).

As you can see from Equations 13 and 14, the noise factor or noise temperature of the entire cascade chain is dominated by the noise contribution of the first stage or two. Typically, high sensitivity microwave amplifiers use a low noise amplifier (LNA) stage for only the first stage or two in the cascade chain because that stage dominates all the rest of the chain. 73

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If you or your club are looking for a way to make money at your next hamfest, here it is! A few months ago we offered back issues of *Radio Fun* which could be sold at hamfests or other club events. We got cleaned out in short order. That's good because the back issues are far more valuable in ham shacks for reference use than in our warehouse.

Now we've got some *73* back issues which we've saved long enough. How'd you like to set up a table and sell back issues for $1 each? Send $50 for a box of 100 assorted back issues and make a fast fifty bucks profit. Two boxes could net you enough in a few minutes for a very nice new antenna. How many boxes do you need? These won't last long, so decide right now, not next week.

The hamfest season is coming fast, so send a check or credit card number to *73* Premiums, 70 R202 N, Peterborough NH 03458-1107, or call 603-924-0058 and ask for Sheila. Fax 603-924-8613.

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HOMING IN

Radio Direction Finding

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Good Deeds, Good Fun, and Goodwill

For most of us, Sunday, January 29, was a day to have a party at home and watch the Super Bowl. For search/rescue crews and a handful of hams in southern Arizona, it was a test of patience and skills in radio direction finding (RDF).

The night before, a signal had appeared on a non-ham VHF public service repeater south of Tucson. A boy calling himself "Leo" said that he was part of a group lost in the Madera Canyon area north of Nogales. One of the boys had an injured leg, he said. Many agencies, including the Santa Cruz County Sheriff's Department, Santa Cruz County Emergency Services, and the Arizona Department of Public Safety, had responded in full force. The search was called off Saturday night when Leo stopped talking, but he was back on the air again Sunday morning.

By now, officials suspected a hoax. They could not hear the signal on the repeater input. It would be quite unlikely for a civilian to be carrying a radio for this emergency service repeater while hiking, and the signal showed no sign of deterioration due to battery depletion. Furthermore, Leo's answers to questions were vague and sometimes conflicted with earlier statements.

At this point Mac McWilliams, Director of Santa Cruz County Emergency Services, called the Civil Air Patrol. He knew that CAP has equipment and manpower to track emergency beacon signals. (See "Homing In," April 1994.) Bill Croghan WBØSKW of CAP told McWilliams that his agency's RDF gear is specialized for aircraft distress frequencies and thus not usable for this search. Bill then began to call people that he knew could help—ham radio transmitter hunters.

Practice Pays

Every week at El Con Mall in Tucson, about a dozen hams meet for an RDF contest, usually called a foxhunt or T-hunt. In their cars, trucks and vans equipped with RDF gear, they attempt to win by being the first to find the "hidden T" or to find it with lowest

Photo A. Kevin Kelly N6QAB came from Thousand Oaks, California, to be individual winner of the 1991 foxhunt in Portland, Oregon.

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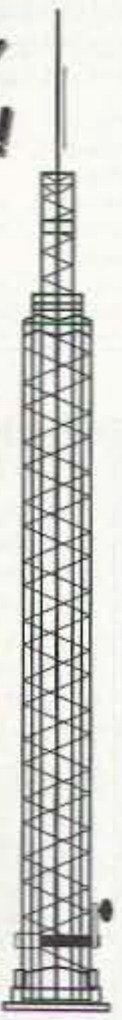

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odometer mileage, depending on the rules set by the hider for that hunt. Typically, two hams form a mobile team.

As a regular Tucson T-hunter, Jerry Clark K7KZ was one of the first to be called by WBØSKW. Jerry immediately phoned his hunting partner Bob Buchanan KA7CCC and began to install his doppler RDF set in his car. "I called the Santa Cruz County Sheriff's Department using a cellular telephone and we were patched through to the deputy in charge of the search," says Bob. "He suggested that we meet at the top of Mount Hopkins."

Bob and Jerry headed in that direction, agreeing that if they found a trackable signal before getting there, they would start RDFing at that time. "We met the deputies near the bottom of Mt. Hopkins Road," KA7CCC continues. "Up to that time we had not heard the direct signal. The deputy got the boy to talk to him through the repeater. We were still unable to hear him on the input, so we concluded that he was nowhere in the search area.

"On a hunch, we decided to drive south towards Nogales and then, if necessary, up through Patagonia and Sonoita. The deputy continued to coax information from the boy and he obliged with numerous transmissions. As we approached Rio Rico, we started to get a strong, unambiguous signal."

At the same time, another team of T-hunters began looking for Leo. Jason Auvenshine N7UGP and Faber Tunison N7ZAZ had also been alerted by WBØSKW. They headed south toward Madera Canyon, listening on their doppler RDF set and also trying to hear the weak 151 MHz signal with their 2 meter beam.

"The directional pattern was not great out of band, but the yagi did well enough to let us know he was south and got us into doppler range," Jason says. "The deputy in the field did a heck of a job communicating with the boy and keeping him on the air. I could tell he was struggling with it."

The two teams continued, unaware of each other's efforts. At 7:30 p.m., Jason and Faber had to stop hunting due to a previous commitment. Moments later, Jerry and Bob pulled up in front of the boy's house, just as the transmissions abruptly stopped.

"We went about two miles to an easy place to rendezvous and called by cell phone to inform the authorities what we found and where they could meet us," says Jerry. "A bunch of deputies showed up, and then an agent from the FCC. I got into the Sheriff's car and Bob got into a car with one of the emergency service workers and we led them to the house."

Three young persons, ages 18, 14, and 13, were arrested and later released into the custody of their parents. "The 13-year-old was doing the transmitting," Jason says. "He was alone in his room when caught, with an eight-channel commercial handheld radio and its charger, which was apparently from a home burglary. The other two teens had been actively involved earlier. The 13-year-old's parents were there and appeared to not be aware of the transmissions."

As you can imagine, the heroic hams received wide acclaim. The County's Board of Supervisors and Emergency Services Department presented Jerry and Bob with plaques. *The Arizona Star* wrote an excellent account of the caper and the usefulness of hams' T-hunting activities. "And a local TV station did an interview," says Jerry. "It was from the angle that if you perpetrate a hoax like this, you're going to get into a lot of trouble."

According to K7KZ, "The agencies were upset because the kids' activities had endangered all the residents of the county by tying up all their resources. They intend to charge them with felony endangerment." KA7CCC adds that two State Patrol helicopters in the search had been forced to land at some very precarious locations on the mountain, risking lives of the crews. He says that there may be attempts to recoup expenses of the search from the family and that the FCC may impose stiff fines.

N7UGP says that ongoing T-hunt experiences made the bust possible. "It was just a matter of following the doppler right to him. On some of our hunts, the hider will do tricks like using a yagi with horizontal polarization and aiming at the mountains to get multiple reflections. When you get a real one like this, it's usually easy."

"Our group has been holding hunts for two to three years now, more or less once a week," says Jason. "We've tracked down a couple of interference sources of the ham nature a couple of times, and we also have ties to people in the CAP who search out locator beacons for downed aircraft (ELTs). For a while, in addition to running hidden transmitters in the ham bands, we would also put a dummy ELT on the test frequency (121.6 MHz) at the hiding site for the CAP RDFers. We would call up the local FAA to say we were going to be doing a drill and get permission.

"I wish we would have had some ready-made organization for events like this, perhaps a telephone tree to call people. I think a lot of time and money on the part of the Sheriff's department could have been saved if we had been able to get our act together and leave Tucson sooner. The Sheriff wants to talk to us about this."

Commendations to all of these Tucson hams for their eagerness to serve. Also, thanks to Nick Ross KO6QD for bringing this story to my attention.

Spanning the Globe

Even though T-hunters in the USA often serve the public like the Arizona hams I just told you about, and despite the fact that some California all-weekend hunts require 300 or 400 miles of driving to find all the transmitters, we still are not considered world-class RDFers by the rest of the world.

In most countries, cars and fuel are relatively expensive, so they aren't likely to be used by the average ham for hobby purposes. Mobile foxhunting can be found only in the USA, England, Australia, and Japan. Everywhere else, it's an on-foot sport, done for its physical fitness benefits. Eastern European schools include it in physical education programs, including hams and non-hams alike.

If you go to a former Soviet Union country, you probably won't hear voices on the 2 meter band. You can count the Russian cities with VHF repeaters on the fingers of one hand. But wherever you go in that part of the world, there is a good chance you can hear the MCW transmissions of a 2 meter foxhunt. Just like other amateur athletes, European and Asian foxhunters like to get together for national and international championships. To this end, a standard set of foxhunt rules has been developed by an International Amateur Radio Union (IARU) committee.

A championship foxhunt course comprises five transmitters in a hilly wooded area. The foxes are spaced such that the round-trip distance to

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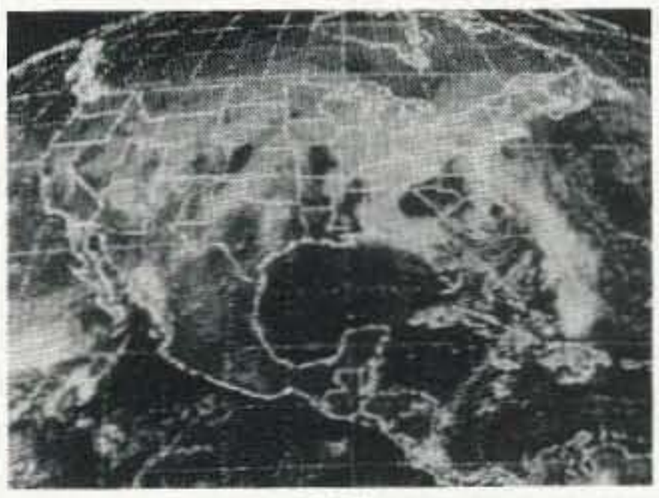

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I recently bought a military-type VHF receiver at a sale. There was no manual for it. The following information is on the name plate: "VHF Receiver Model R950R-3 Serial #1 AF 30(635)905 Radio Receptor Co., Brooklyn, NY General Instrument Corp." I believe this set was made in the 1950s. I need a manual and/or schematic for this rig. Do you know where I may be able to acquire one? I will appreciate any information or advice on this. *John J. Weyrauch, Aldrich Rd., R.R.4 Box 416, Norwich NY 13815-9419.*

WANTED: Schematic diagram, parts list, manual, or whatever you may have for a MONARCH Model HAM-2 solid state, 4-band communications receiver. I will pay for original or copies. All replies answered. *Joseph Rubin WB4CBJ, P.O. Box 211-A, Cortez FL 34215.*

I need the schematic and service manual, (or address where I can get these items), for BEARCAT BC 250. I will pay for expenses. *Jim Sampson, PSC Box 1388, APO AE 09720-9998.*

each one in numbered sequence and back to the start/finish line is 5 to 12 kilometers. Each fox transmits for one minute, in sequence, on the same frequency as the others. Smart competitors take bearings on all five foxes as they come on, knowing that if they miss a fox bearing, they must wait four minutes to hear it again. A continuous transmitter on a different frequency at the finish line helps hunters find their way home once they have found all five foxes and marked their cards with the unique punches at each one.

International rules divide competitors into separate categories for seniors (males 18 to 40 years), juniors (boys under 18), women (any age—nobody asks!) and "old-timers." Seniors must find all five foxes. Hunters in the other three categories need find only four. The non-mandatory fox is different for each category, giving different total course lengths.

Two meter foxes use AM with tone modulation. There is also a separate contest in all four categories on 80 meters at a different time. This makes for a total of eight individual and eight team (country) medal sets awarded in gold, silver, and bronze at a championship meet.

The most recent World Foxhunting Championship was last September in Sodertelje, Sweden, about 40 miles south of Stockholm. Lars Nordgren SMØOY reports that there were entrants from Australia, New Zealand, Japan, China, Britain, and South Korea, plus nine Scandinavian countries and nine ex-Soviet block countries. Weather was sunny for only the first half of the 1994 80 meter hunt, then rain set in. It rained throughout the 2 meter hunt, too.

Rules state that hunters must return to the start/finish line within three hours or be disqualified. The record time of an American foxhunter on a course like this is 74 minutes to find all five foxes. Tchermen Gouliev, long considered the "master of radiosports" in Russia, finished the 2 meter course in 47 minutes, 43 seconds, but he didn't win. Janos Orosi of Hungary beat him by five seconds to become the current World Champion Foxhunter. Tchermen and Janos are in the "old-timers" category and had the same placements in the 80 meter event. Russia, Hungary, Slovakia, Ukraine, and the Czech Republic dominated the meet, dividing up the individual and team first places in all categories.

European Foxhunt Championships (for IARU Region 1) are scheduled for September 6-10, 1995, near Bratislava, Slovakia. Australia will host the next IARU Region 3 Championships in 1996. The next World Championships will be in 1997, country not determined yet.

Where's the USA?

It's time for RDFers in North and South America to get involved with world-class foxhunting. Lars and other organizers want to see hams from the USA at upcoming championships. We are going to need lots of practice and competitive experiences. How about putting on a radiosport-type foxhunt at your club's next picnic or barbecue in the park? Maybe the next Foxhunting World Champion is in your town, just waiting to be discovered.

To my knowledge, only one formal international foxhunt has ever been held on US soil. It was put on by the Friendship Amateur Radio Society (FARS) of Portland, Oregon, in May 1991. FARS is the result of a Sister Cities arrangement between Portland and Khabarovsk, a similar-sized city in Asiatic Russia.

The hams of Khabarovsk received a delegation of Portland amateurs in 1989 for a series of radiosporting events, including a European/Asian style foxhunt. Portland reciprocated by putting on the second Friendship Radiosport Games (FRG) in their city two years later (Photo A). See the September 1991 "Homing In" column and "Showdown in Portland" in the November 1991 issue of *73 Amateur Radio Today* for my firsthand reports on FRG-91.

Victoria, BC, Canada, another Khabarovsk sister city, hosted the next FARS gathering in 1993 (Photo B). Now the Games were becoming an international event, with hams from the USA, Russia, Japan, and Canada in attendance. See the October 1993 "Homing In" column for all the details of FRG-93.

This year, it's the Russians' turn to host the Games again, and you're invited. FRG-95 is by no means a World Championship, just an opportunity for hams across the world to get together for camaraderie and radiosports. If past Games are any indication, there will be only one foxhunt, on 2 meters. It will not be broken into categories of contestants. Expect men, women, boys, and girls to compete on equal footing. Average age of the Russian team last time was 40, and you won't be up against any Olympians.

This year's Games are scheduled for August 11 to 13, but the FARS excursion to Khabarovsk encompasses two full weeks of sightseeing and cultural events, beginning August 4. You will stay in the homes of Khabarovsk's hams, just as they stayed at homes in Portland and Victoria. The organizers hope to attract competitors from the USA, Canada, Japan, India, and China.

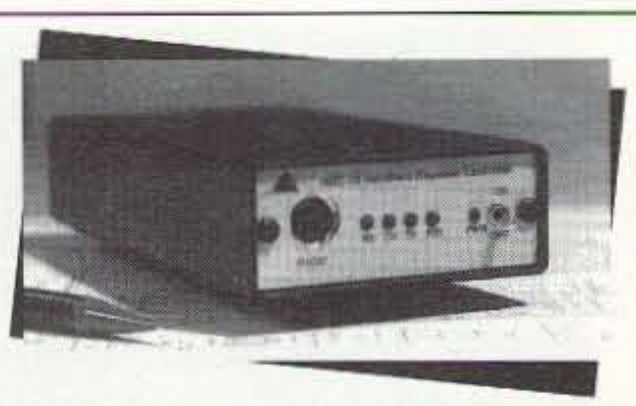
Although it is an important commercial hub on the Amur River, Khabarovsk is a city of simplicity. According to *Alaska Airlines Magazine*, "The shops are small and simple, the streets filled with people toting bags, pulling carts. An essential center of family activity is the small gardens that surround each home. Every square foot of earth within the fences is planted with something."

Khabarovsk is less than 500 miles from Sapporo, Japan. The group's cost for transportation to and from Russia (departing and returning from Seattle) will be about $1200 per person. Other expenses will run about $250 per person. Waivers and financial aid may be available to those deemed by FARS to be official US delegates.

For hams who love transmitter hunting and international travel, this is an excellent opportunity. If you are truly interested in being a part of FRG-95, get started on your passport preparations and write to Rene Berblinger KX7Z at FARS/Portland, PO Box 13344, Portland, OR 97213. Rene is assembling the US delegation and will submit your name to get your Russian visa issued. Don't delay—paperwork must be done well in advance of travel.

Let me know your plans also. Remember, my new Internet address is simply HomingIn@aol.com. My CompuServe ID is 75236,2165. If you don't have E-mail, write to the address at the beginning of this column. 73

Photo B. Alex Savin UAØCDX of Khabarovsk took individual honors at the FRG-93 foxhunt in Victoria, British Columbia.



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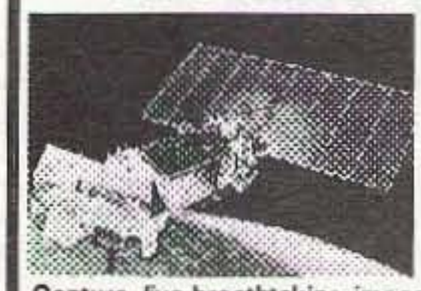

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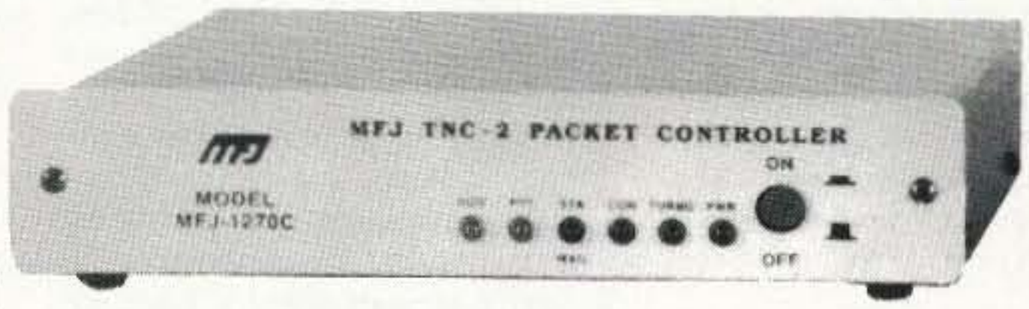

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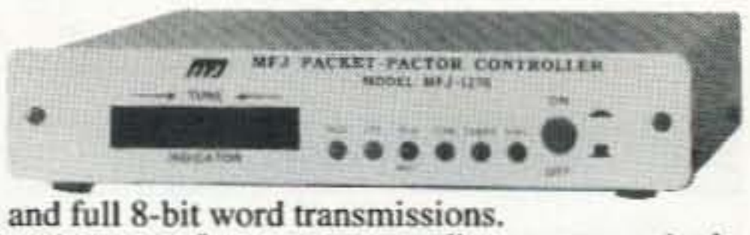

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Mexico, Israel and Russia

Two new hamsats were scheduled for launch on March 28th. UNAMSAT-1 from Mexico and TECHSAT-1 from Israel may now be in orbit. Launch was to be from the Plesetsk facility in Russia. Both satellites are of the digital variety, but offer some unique features that set them apart from the current digital fleet.

UNAMSAT-1

Built at the Universidad Nacional Autonoma de Mexico, by the PUIDE (Programa Universitario de Investigacion y Desarrollo Espacial) group, UNAMSAT-1 is a microsat clone with a fascinating experiment in the TSFR slot. The first microsats were launched from French Guiana five years ago. They are small cubes, 25 cm on a side, weighing about 10 kg each, with five stacked modules. Four of the modules contain standard components common to all, including a 2 meter receiver, battery charge regulator, computer and a 70 cm transmitter. The fifth module or slot has been called the TSFR, or "This Space for Rent."

The UNAMSAT-1 TSFR consists of a 100-watt radar transmitter on 40.997 MHz. It sends short pulses and then listens for echos from ionization trails caused by meteors as they burn up in the atmosphere. The returning echos are digitized by the onboard computer and downlinked as data files on 70 cm for study. The 41 MHz transmitter is licensed by Mexico according to the ITU (International Telecommunications Union) frequency allocation listings.

The goal of the experiment is to identify meteors that have velocities greater than 72 km/sec. This is the solar system escape velocity. Meteors traveling faster are from outside our system. To identify these meteors, detailed spectrum analysis is performed on the downlinked data. Velocities and trajectories can then be determined.

The radar transmitter consists of a crystal-controlled exciter running 220 mW and a high efficiency (92%) power amplifier. Modifications were made to the standard satellite power supply to provide the current necessary for the pulse transmitter. A switching power supply charges a bank of tantalum capacitors to 40 volts DC. The satellite's power supply usually only provides 10 volts. The transmitter's power amplifier operates from the charged capacitor bank for the duration of a radar pulse. The bank is then recharged between pulses without straining the 10-volt supply line.

The radar receiver has a GaAsFET (Gallium-Arsenide Field Effect Transistor) front end to a double balanced mixer, bandpass filter, IF (Intermediate Frequency) amplifier, phasing network and summing amplifier. The mixer samples the crystal oscillator to obtain true Doppler shift information on incoming signals. The output of the receiver is sent to a 68HC805B6 microprocessor for analog-to-digital conversion. The results are then sent to the satellite's main CPU (Central Processing Unit) for encoding and subsequent transmission to the ground.

Both the receiver and transmitter share the same antenna, a canted dipole, through a hybrid circuit that provides sufficient signal isolation. The antenna supports on the microsat were braced to support the larger elements needed for 41 MHz.

The TSFR of UNAMSAT-1 represents a significant accomplishment. The radar system with controller were all packed into one module, and it works. Ground tests in the fall of 1994 performed better than expected. Meteor reflections were detected, digitized, stored and sent as files by the satellite. Programs will be available after launch to aid interested amateur enthusiasts with decoding endeavors.

UNAMSAT-1 also has the usual store-and-forward capabilities of the other microsats. Operation is at 1200 bps (bits per second) using FSK (frequency-shift keying) on any of the uplink frequencies: 145.831, 145.851 or 145.871 MHz. The downlinks are also 1200 bps but use PSK (phase-shift keying) on 437.206 or 437.064 MHz.

The eight students from UNAM involved with satellite construction, and program manager David Liberman XE1TU, traveled to Russia in early March to prepare for launch. The Plesetsk launch site is about 700 km north of Moscow.

TECHSAT-1

Built at the Technion in Haifa, Israel, TECHSAT-1 is Israel's first amateur radio satellite. The spaceframe shape is similar to a microsat, but has nearly eight times the volume and weighs in at 50 kg, five times that of UNAMSAT-1. TECHSAT-1, also known as Guerwin-1, has backing from academic and commercial interests in addition to the active participation of AMSAT-Israel.

The satellite has a three-axis stabilization system using computer-controlled electromagnets. Early tests at the Technion proved the magnetorqueing system to be quite effective. Complete stabilization of the spaceframe was achieved within three hours. In orbit the satellite will be pointed earthward at all times. A horizon sensor will aid the magnetorqueing control process.

One reason for the orientation system is to keep the onboard camera aimed properly. Like previous UoSATs and Kitsats, TECHSAT-1 will take snapshots of the earth for downloading to stations on the ground. A new algorithm for image compression will be used. Current files from the other imaging hamsats run about 300 KB each. TECHSAT-1 will precompress the data to make smaller files for transmission to earth.

The radio communications components of TECHSAT-1 are digital. It will run 1200 bps PSK like other microsats, but will also be capable of 9600 bps FSK like UoSAT-OSCAR-22, Kitsat-OSCAR-23 and -25. Store-and-forward, multi-user operation will be the primary amateur radio activity. Of the 20 watts available to the payload, 10 will be required for housekeeping circuitry.

In addition to the usual 2 meter uplinks and 70 cm downlinks, TECHSAT-1 will also carry a 23 cm receive system. The four 2 meter uplinks are 145.850, 145.890, 145.910 and 145.930 MHz. The 23 cm uplinks include 1269.700, 1269.800, 1269.900 and 1269.950 MHz. The two downlink frequencies are 435.225 and 435.325 MHz. For those who have dusty 1.2 GHz satellite rigs (since the loss of Mode L on AMSAT-OSCAR-13), there may soon be a great reason to get back in the microwave transmission business.

The Orbit

The launcher for both satellites is to be a Russian START rocket. The proposed orbit is 670 km in altitude and not sun synchronized. The inclination is estimated at 75.4 degrees with very little eccentricity. Coverage will be similar to UoSAT-OSCAR-11. TECHSAT-1 and UNAMSAT-1 will have orbits about 100 km lower than U-O-22. For ground stations, this means four to six passes a day, 9-13 minutes in duration. For analog transponder satellites this is low and reminiscent of Shuttle chasing, but for digital satellites it's enough time to collect up to 400 KB of data at 9600 bps on every pass.

Waiting

Unlike RS-15, which was available for amateur use within hours after launch, the new additions to the hamsat group will not be released until ground control stations have fully tested the onboard systems.

Testing UNAMSAT-1 may take a few weeks. After launch, the team from Mexico is scheduled to travel back to Moscow. There they are to do initial spacecraft checkout from the Moscow Aviation Institute. Later, they will return to Mexico City to complete the process. The radar experiment will be of prime interest to the satellite builders. It is a first for amateur radio satellites and has great potential.

Early reports from Israel indicated that the ham radio operation of TECHSAT-1 would be delayed for up to six months after launch. Recent information from Haifa now states that the delay may be three months or less. Testing of all the experiments may take some time. Frequencies outside the amateur bands will be used for these tests. When the satellite is finally released for amateur use, a certain portion of its time will be spent in commercial and academic service. A schedule is expected.

Both the Israeli and Mexican teams are interested in reports from hams monitoring the telemetry in the early days of the new hamsats. If no delays occur, they should be in orbit now. Telemetry reports for UNAMSAT-1 can be sent to XE1TU@amsat.org via the Internet. Techsat-1 reports go to 4X6EM@tx.technion.ac.il.

More Information

Late-breaking hamsat news can always be found on the HF AMSAT nets, via packet and on the Internet. Another source is the Houston Area AMSAT Net. This net meets every Tuesday night at 10 p.m. Central Time on the 147.10 MHz WD5BDX repeater. It is also uplinked to Telstar 302, transponder 21, 5.8 MHz audio subcarrier. From there the net is retransmitted on VHF and UHF repeaters around North America. It can also be heard on 160 meters AM on 1860 kHz. Check-ins from remote (non-Houston) locations are by phone and everyone has a great time. See you on the net. 73

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Well, here I am again. Thanks to all who wondered where I went, I am glad to know I was missed. Life here has been chaotic for the past few months. It included the birth of son number two, Dov Zalman, who spent a week in the hospital at 10 days old. Not to worry, he is a fat healthy baby today. A touch of pneumonia and about $12,000 in medical care later he is back to normal. Many other things have been going on here—some of them even ham-radio related.

IndyGate

Soon, Indianapolis (my home town) will have its first AMPRnet (the amateur radio portion of the Internet) gateway. This machine will link hams with ordinary 2m packet stations to the world via the Internet. Those that install and learn to use TCP/IP software—such as the JNOS version of Phil Karn's KA9Q NOS, which will power the gateway—will get an even more powerful connection. By the time you read this, IndyGate should be on the air. Next month, I will tell you exactly how you can get involved in TCP/IP over amateur radio—and, finally, how you can definitely get the JNOS software and documentation.

"Even for most of those who use the Internet with ham radio, just what a gateway does is a mystery.

What is a Gateway?

Even for most of those who use the Internet with ham radio, just what a gateway does is a mystery. To have some understanding of what a gateway does, you'll need to have a mental picture of how TCP/IP works. TCP/IP, which stands for Transmission Control Protocol/Internet Protocol is a "suite" of rules and programs that let computers exchange data on the Internet. For the sake of our discussion here, we only need to consider the structure of an IP "frame."

A frame in networking is a package of data, which has a "header"—the first part of the frame—containing data needed to handle the frame. Sometimes, frames are referred to as "packets." This is not technically correct, but it is common usage. Packet radio gets its name because of its use of packets—AX.25 is a "packet switched" protocol—but even there packet and frame have distinct meanings. Suffice it to say that people usually mean frame when they say packet.

Frame headers contain different information, depending upon the protocol they adhere to. But, in any case, where the protocol is designed to allow more than two "nodes" (amateur stations in our case) to communicate, the header must contain "addressing" information. This leads us to a convenient analogy—a letter. Think of the frame as an envelope. You are all familiar with the "protocol" for addressing a letter. On the frame (envelope) you include addressing information. The destination address (in the center of the envelope—and nowhere else if you want that letter delivered), and the origination address (return address in the corner). This information is placed in particular spots, and the Post Office looks there to find where to send the letter, while the recipient looks at the return address to reply.

In the data frame case, the header is laid out in a particular order: the first x bytes are destination, the second x bytes are sender, etc. The machine looks at the header and figures out where the frame should go. The letter inside the envelope is the data you want to send, and the IP frame has a "field" (a specified portion of the frame) to handle this as well.

Now with this picture—more or less—firmly fixed in your mind, think about this: What if you were afraid that people seeing your letter's envelope could tell who you were sending mail to? I know this sounds a little paranoid, but let's put it in ham radio terms. What if there were somewhere you could send a letter, so that when your letter arrived it was immediately opened and read on the (ham radio) air? What if the receiving station made no distinction about where the letter came from, instead just assumed that if it arrived at that address it must be OK to read on some amateur frequency?

Well, now you can see that you might want the address of this mythical location secret—to prevent unlicensed individuals from operating amateur transmitters. Well, you say, why can't they just check if the letter is from a ham? Good question—but it would take too long. Too many hams, not enough time. So what can we do to make this arrangement safe from non-licensed individuals who might want to access it? One thing is to hide the address of the station that broadcasts received messages. Just how can we manage to address an envelope in such a way that it will get where we want, but not let anyone reading it know where that is?

Encapsulation

One of the features of the AMPRnet that keeps it safe from non-ham access is called encapsulation. This technique is really very simple, and can be explained by continuing our Post Office analogy. What we do is get a ham to agree to receive mail for the transmitting station. When the mail is received there, he can check it against a much smaller list of hams authorized to mail letters to him. In other words, he is able to authenticate the fact that the sender is a ham, because the ham has registered himself prior to the mail being sent. Not all hams, mind you, just the ones he is willing to handle traffic for. He is our "gateway" to the transmitting address. Now, he is not responsible for delivery to just one address that can handle ham traffic, but for many sites all over the world. How can he tell where your traffic should go?

"The point is, when amateur traffic moves on the Internet proper, it is hidden inside 'normal' Internet traffic."

Opening the Envelope

When the mail arrives at the gateway address, the other envelope (frame) is opened and discarded. Make a guess about what is inside before you read on. If your guess is another envelope, you are right! This envelope, though, is addressed to our transmitting station and is hand-delivered by hams sworn to secrecy about the real location (address) of our transmitter. When the envelope (frame) arrives at the transmitter site, it is opened and processed.

If you understood that, you understand encapsulation and why we need gateways. Traffic on the Internet is visible to many people for various reasons. You cannot be sure who will see where your data is going. If the actual address of a radio-connected amateur resource became known, it might lead to the use of a transmitter by an unauthorized person. So we use IPIP encapsulation; that is, we wrap an IP frame destined to a ham address in an IP frame headed for a "normal" Internet address. The machine at the "normal" address detects that the frame is encapsulated, and extracts the amateur frame from inside. It then sends the frame on the "private" amateur network by delivering directly to the appropriate address. The point is, when amateur traffic moves on the Internet proper, it is hidden inside "normal" Internet traffic. This is, of course, not the only security on the AMPRnet. It would not be sufficient.

The Great Internet Survey

The time has come to make a survey of Internet use by readers of this column. I have two goals in mind. One is to see how many of you are using the Internet, and how. The other is to compile a list of ISPs (Internet Service Providers) from across the country so I can answer the many queries I get concerning getting connected. The questions are in the sidebar on this page. E-mail the survey information to N1EWO@IQUEST.NET. Make the subject of your message: *73* Internet Survey. You do not need to reproduce the questions, just put the number in front of your answer.

Thanks for taking the time to complete the survey. I hope to hear from you soon. 73 de N1EWO 73

Internet Survey

1. What is your call?
2. Do you run TCP/IP on your packet station?
3. If yes to 2, which software/version?
4. What is your AMPRnet address? (or "none".)
5. What is your name?
6. What is your Internet mail address?
7. Who is your Internet provider?
8. What is the monthly cost for a SLIP connection? (or "don't know".)
9. On a scale from 1 to 10, how would you rate the service you have received?
10. Would you recommend your provider to a friend?
11. What is the provider's service area?
12. What is the Internet provider's E-mail address for information?

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Help start kids on their way toward high-tech careers by getting them hooked on hamming. The biggest obstacle to a ham license in the past has been the code. Now, with this new miracle system, this is just not even a minor problem. No longer will there be the slightest stress when taking that stupid code test that the ARRL Board of Directors has forced the FCC to continue to use as the primary method for keeping newcomers away from the hobby.

With the success of America in the next century dependent on our ability to provide high-tech career workers to deal with the information highway and the computerization of the workplace, amateur radio provides a fun way to ger kids interested in leaning about technology. It beats the heck out of Nintendo and Sega, which teach nothing. It even beats sports, which provide a good living for a handful of stars and disappointment and poverty for the losers.

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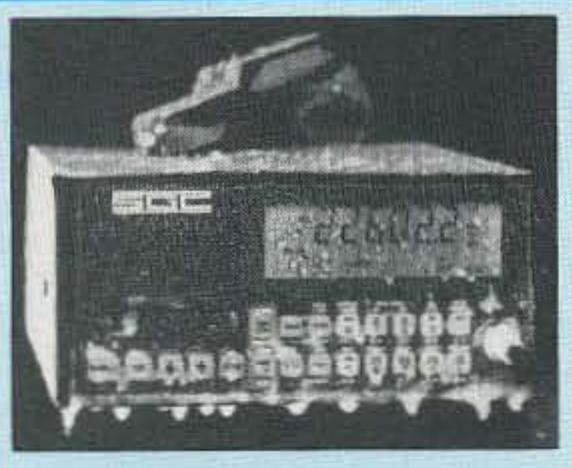

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ABOVE & BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119

SWR Primer for VHF Through Microwave

SWR? Sure, you say, I know how it works. A low SWR makes everything work just fine. But as frequency increases are we still comfortable with different measurement techniques at these higher frequencies? I am sure we are all familiar with matching antennas to minimum SWR in the low VHF-to-UHF frequency ranges (146 to 450 MHz). I am presuming that you have similar amateur-type SWR measuring equipment to what I use for frequencies below 500 MHz. When used above their intended frequency range of operation, these instruments give readings that are highly suspect, or even give gross errors. What then are the acceptable types for different frequencies of operation?

The basic SWR meter used in these descriptions is a Swan Electronics dual SWR bridge that I obtained many years ago. It was intended for operation in the 2 to 150 MHz frequency range. The circuitry for this type of meter is shown in Figure 2. For the time being let's describe a single meter device and its circuitry. The basic bridge is balanced with two coupler arms, one going left and one going right in respect to the termination resistors.

Both parts are connected to diodes for RF rectification and the outputs of the diodes are bypassed to ground with a capacitor. The detected RF at this point is converted to DC and is displayed on a small mA meter for measurements. For best results, each arm of the bridge should be matched exactly, not only in construction but in component part selection.

Well, now you have this SWR meter and you want to know just how good your meter is. What can be done to prove how good and to what frequency its measurements are accurate? What instruments do we use to make sure the simple SWR bridge is even telling us the truth? This and other questions are the topic for this month's column. First a little set-up discussion on SWR.

SWR

The benefit of having devices perform with minimum SWR is the same at any frequency of operation. A good match between equipment that is connected together determines how much power is delivered to a load and not wasted. If we are off (mismatched), lots of power can be wasted in an improper impedance match. SWR does not only apply to the transmitter and antenna system, but to interconnects between circuit modules like mixers and RF preamplifiers as well.

In electronic circuitry most circuits are interconnected with 50 ohms because it is convenient and easy to use. Coaxial cable is available for this impedance to make interconnects simple, with appropriate connectors. Having the input and output of a device matched to 50 ohms allows an easy transfer of other replacement units or simplifies trouble-testing, as all devices, including the test equipment, are the same impedance: 50 ohms.

Usually these modules are formed together into a much larger circuit all interconnected to form a converter or system. Using circuitry in this fashion, compared to a single large circuit integration, might be nice in commercial applications, but in amateur systems we never seem to reach the final stage of perfection. We are always modifying our circuitry to suit our changing needs. Without interconnects this modification would be nearly impossible.

Modules that are part of an entire system lend themselves to easier repair. In most amateur microwave systems this is the method of construction instead of a single monolithic structure for a microwave transceiver. I like to refer to this type of construction as "Microwave Building Blocks."

Matching or minimizing SWR improves circuit operation and reduces excess loss. In some applications it is desirable to make a wide frequency matching circuit. This type of match or load is usually done in its simplest form, a "T"-type attenuator. This is constructed with three resistors in a "T" configuration, and forms a bulk forced resistive matching scheme to terminate a device. To test this match, an SWR meter of some sort is needed and measurements need to be made to test the circuitry. So much for modules; let's get into the meat and potatoes of just what is going on with SWR measurements and how to test your SWR meter at different frequencies.

SWR meters, bridges, or directional couplers are all the same in principle, the difference being in the frequency they are made to operate at. Almost all units employ an internal diode to detect a portion of *directionalized RF power*. The output of this detector feeds a calibrated indicator to determine circuit performance. Did I say an SWR meter or bridge is similar to a directional coupler? Yes; you bet. However, the directional coupler is only a portion of an SWR meter system and normally it can be used for other things. If you look at a schematic diagram of an SWR meter circuit, the portion of the RF pickoff is actually formed by a *directional coupler* sampling the RF. See Figure 1.

The description in Figure 2 is applicable to either single or dual SWR meters or directional couplers. Many SWR meters utilize two diodes to provide detection and display to two different indicators at the same time, one for forward power and the other for reflected power. One half of the circuitry is used when only a single meter is used with a reversing switch, as shown in Figure 1. By using two direc-

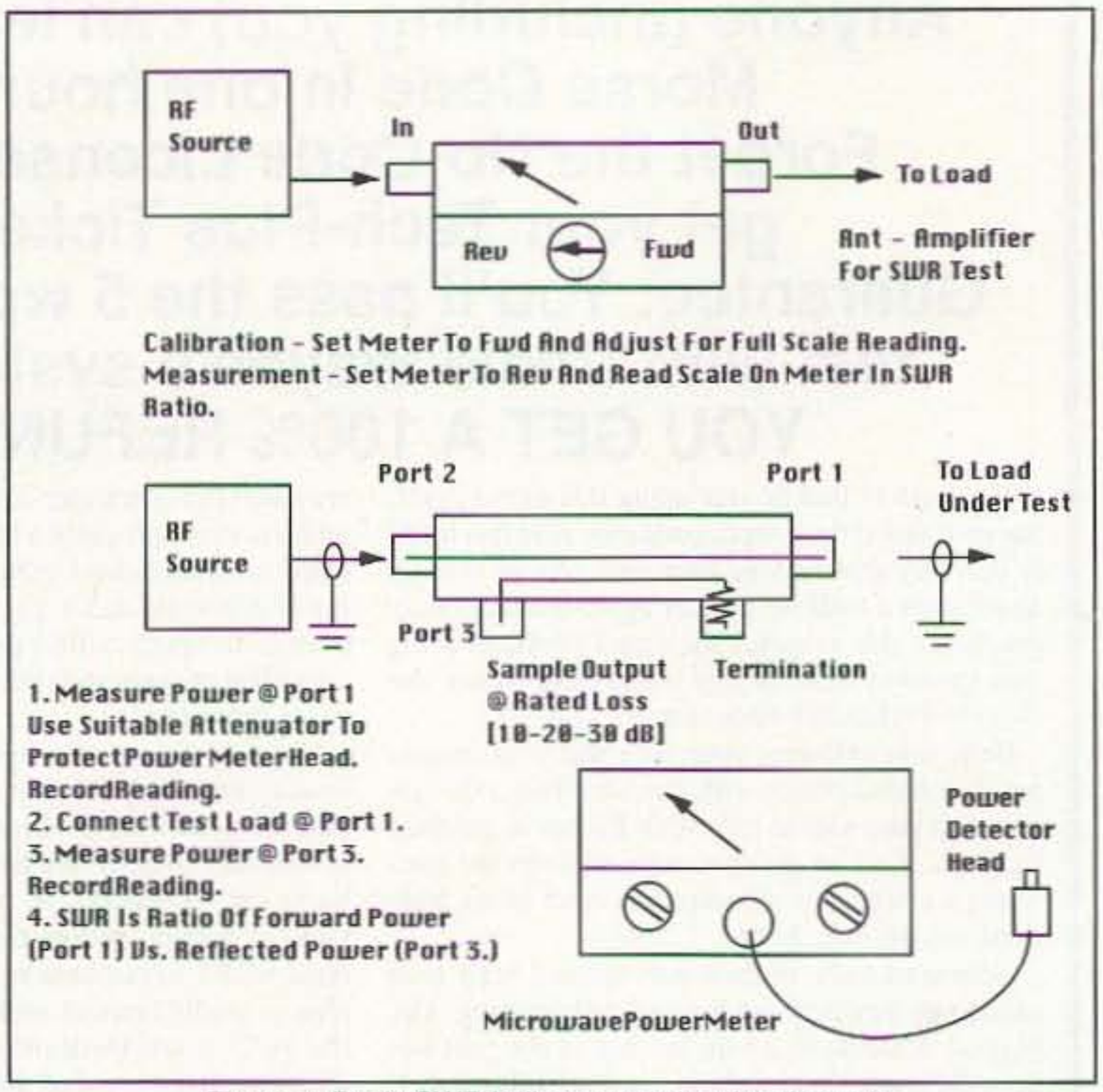

Figure 1. Basic SWR indicator vs. directional coupler.

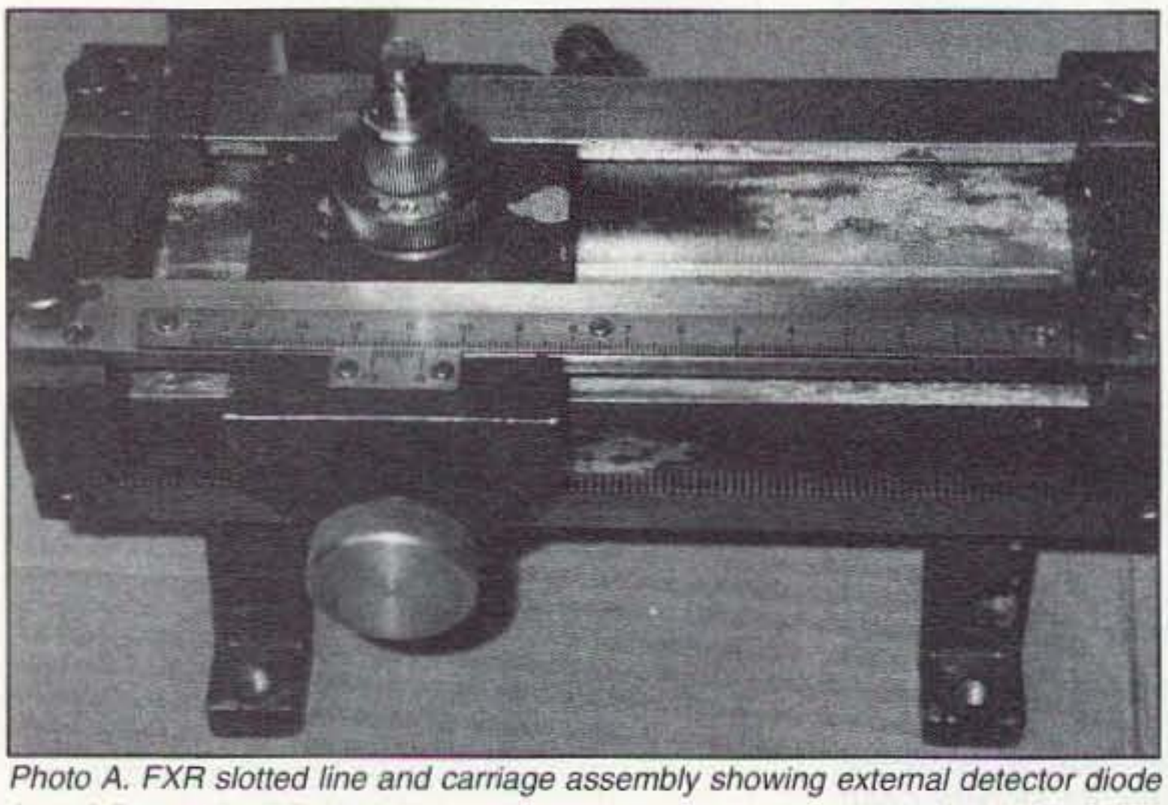

Photo A. FXR slotted line and carriage assembly showing external detector diode (coaxial) used for RF detection.

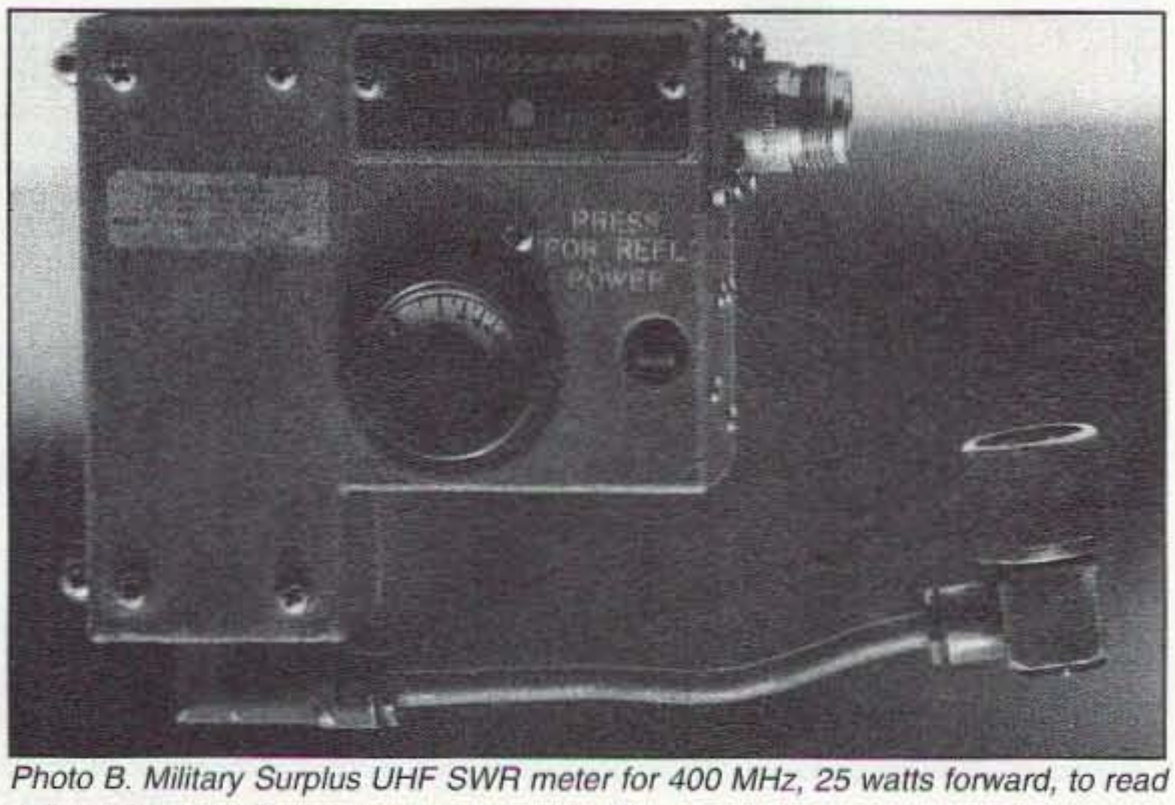

Photo B. Military Surplus UHF SWR meter for 400 MHz, 25 watts forward, to read reflected push reflected power button (black).

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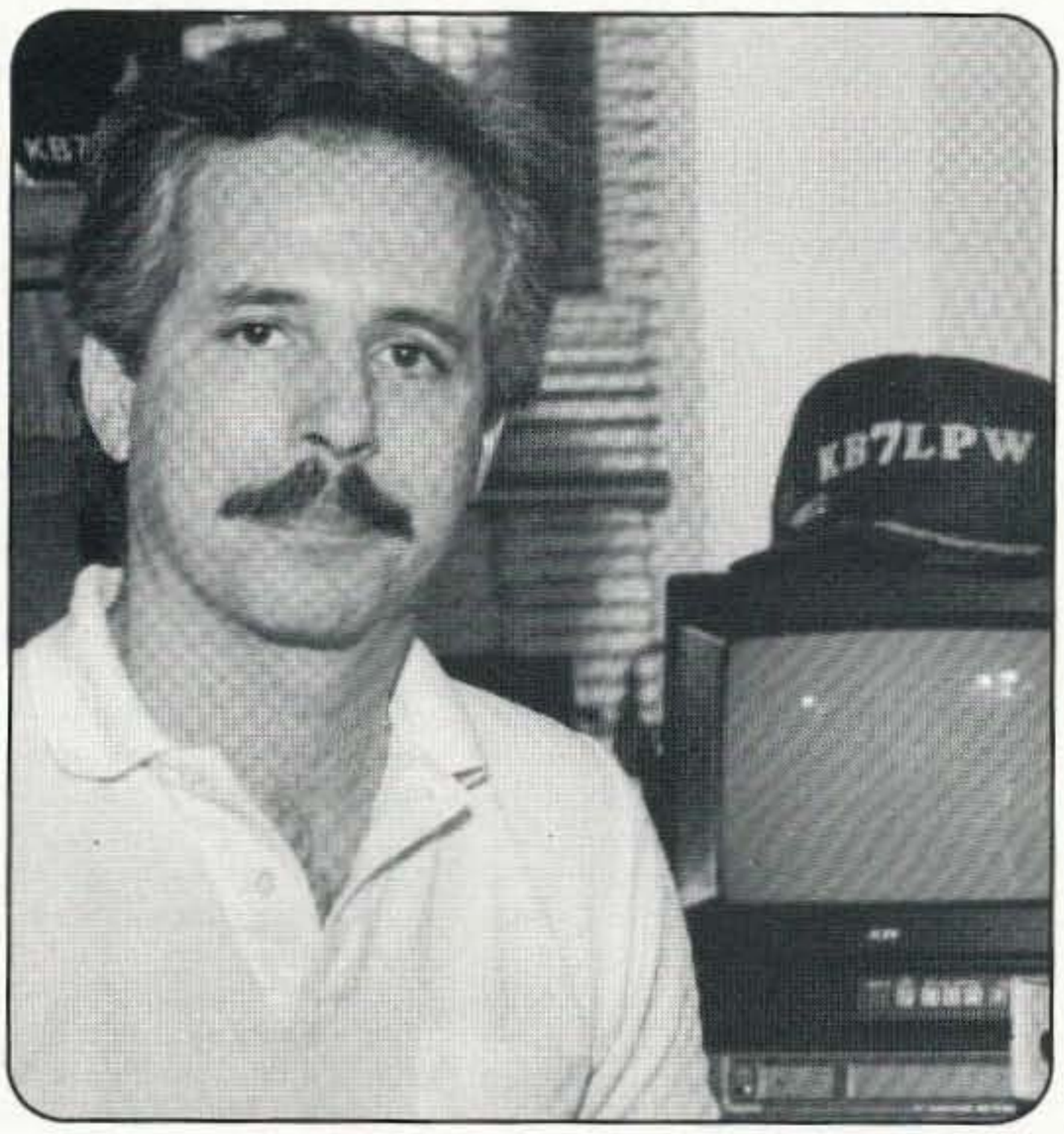

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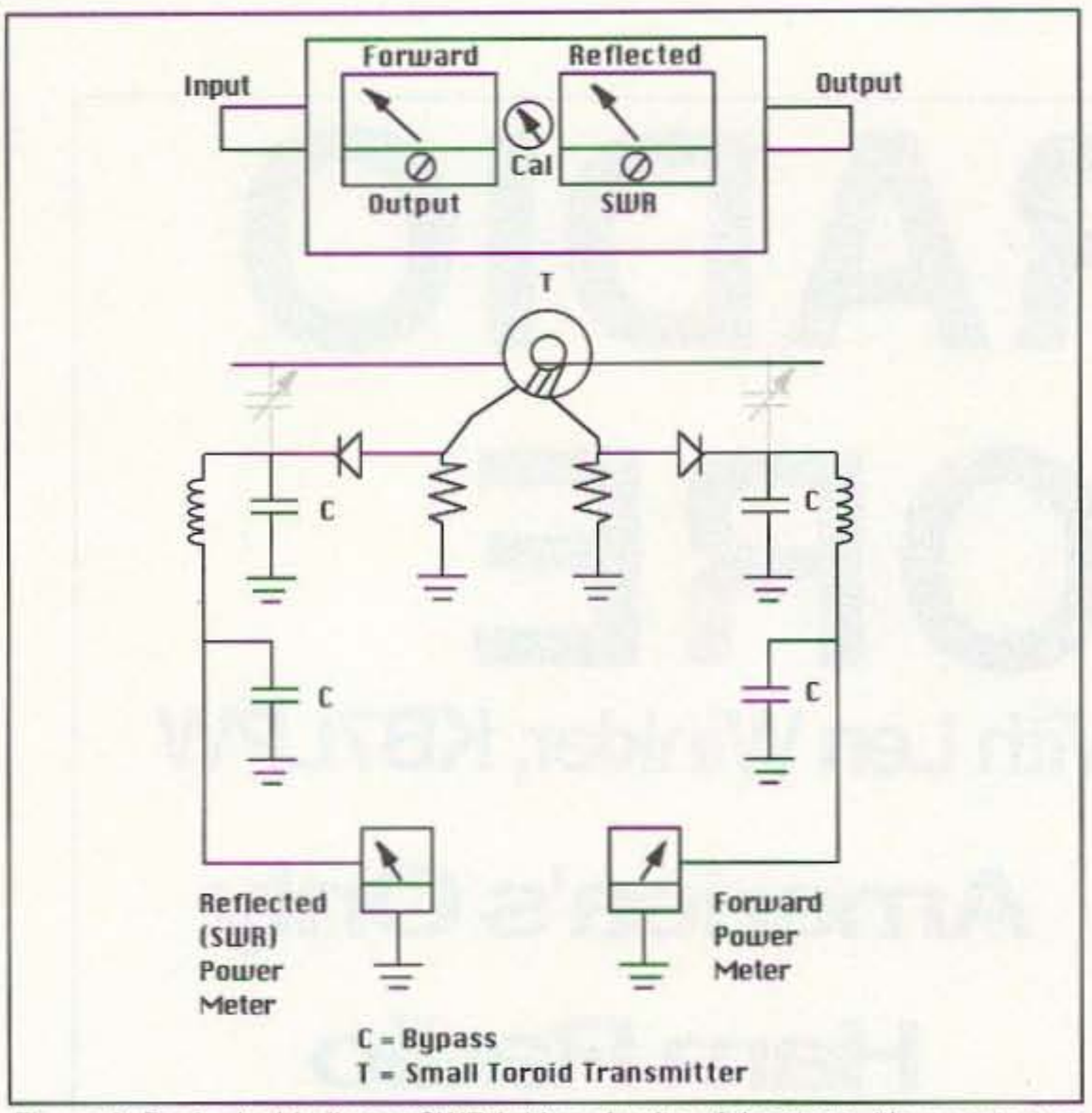

Figure 2. Basic dual indicator SWR bridge circuitry. Advantage: It's easy to use. Disadvantage: It's limited to low-frequency use only (not usable above 200 MHz).

tional couplers connected as in Figure 3, the operation is the same as a similar lower frequency dual-metered SWR meter.

The directional coupler shown in Figure 3 has three ports: 1, 2, and 3. Port 1 is usually the input; Port 2 is the output; and Port 3 is the test or coupled port. When RF is applied to Port 1 it flows to Port 2 with very minimal loss. It's essentially a direct section of coaxial cable or waveguide in the very high microwave frequencies. The power is coupled into a branch arm of Port 3 through a small slot in the outer shield between Ports 1 and 2, and the termination and Port 3. The amount of coupling available at the sample port (Port 3) is indicated on each coupler and expressed in a dB loss factor like 10 or 20 dB. The coupled loss is determined by the opening (size) of the slot coupling both transmission lines. "The longer the slot length the lower the frequency of the directional coupler" is a basic rule. It's kind of like looking at two pieces of coax cable connected together with a hole in each shield and the two cables joined (insulated) at the common opening in the shields for cross-coupling.

If we assume a 10 dB directional coupler, forward power measured at Port 3 will be 10 dB less than the actual power that is applied at Port 1. If the load at Port 2 is a good match, little or no reflection will feed back into Port 2 from the termination at that port. If power does feed back (poor SWR) it will be absorbed in the termination at the end of Port 3 and not interfere with the forward power in the coupler. (The coupler in this example is normal, not reversed.) The basic concept to remember is that *the directional coupler has directionality,* the ability to discriminate between forward and reverse power.

Let me state that again another way. If power is fed at the same end as the termination on a single directional coupler (Port 1), the termination end of the coupled arm will not see forward power but rather a detector connected at the opposite end (Port 3) *will only see forward power.* Now reverse the above coupler and add a second directional coupler to the first setup to form a forward and reflection coupler. Let's look at what is happening on the first coupler. The same rule applies to both couplers with the exception that the first coupler is reversed.

When forward power flows (second coupler) from Port 1 to Port 2 there is very little loss (0.3 dB). Power from Port 1 couples into the directional arm of Port 3, all forward power minus coupling loss flows into Port 3. All other power is output to the load or antenna at Port 1. As far as coupler 1 is concerned (Figure 3), just the reverse is true. Because the main feed is on Port 2 to Port 1, Port 3 will only see reflected power.

Now the magic—because the directional coupler is directional. Any power that is not absorbed in the main load, an antenna termination or whatever, in Port 1 of coupler 1 (Figure 3) will be reflected back towards Port 1 and is coupled into Port 3. At Port 3, coupler 1 power measured there will be only reflected power components less the coupling loss. With the forward power known you can calculate your SWR ratio using the just-calculated reflection power and obtain the SWR with this directional coupler method.

Now that we have gone through this directional coupler magic, have I tricked you from the basic SWR meter circuit? No way. Take a look at the circuitry as it was developed, using a slow, meticulous, hopefully lucid thought pattern. Doesn't the circuitry look quite a bit like the basic SWR meter circuit found in the simple SWR meter for 2 meters using two inductors and individual diode detectors? Of course, the meters and detectors are missing, but the circuitry is the same, just adapted to different frequencies.

The reason we don't see directional couplers at lower frequencies is that if they were made with transmission lines they would be *too large.* Normally, transmission line directional couplers are used from 1,000 MHz to well over 24,000 MHz. Just observe the frequency of use marked on each coupler, along with its coupling loss and decide if it can be useful for your needs. A basic rule of thumb: large couplers, low frequency; small couplers, high frequency.

Calibration of SWR Meters

How, then, do you check an SWR meter to see if it is telling you the truth? There are two ways. One is to duplicate different mismatches with carbon resistors to cause an SWR meter (reflection) to indicate, and the other is to make an SWR reading on the SWR meter itself. First, let's use the carbon resistors to calibrate the meter scale of an SWR meter reflected power meter scale.

With a 50-ohm dummy load or 50-ohm resistor of suitable power capability there should be a perfect or 1:1 SWR reading, indicating a perfect match, or minimum SWR. Now, if we replace the dummy load with resistors of different values we can simulate a different amount of SWR reflected power and read the same on the meter if all is operating well. For a 2:1 SWR, use a 100-ohm termination; for 3:1, use 150 ohms; and for a 1.5:1 SWR, use a 75-ohm resistor. Each time set forward power to full scale and then read reflected power readings.

If you want, for fun, do an SWR on the SWR meter by placing it in line with a termination on the output and making an SWR reading on the SWR meter. See if the meter circuitry is a good match to 50 ohms and does not upset the transmission line by having a poor SWR by itself. In commercial use we term this: "What is the return loss of the device (SWR meter)?" A return loss of better than 20+ dB is considered very good. What does return loss signify? Well, it's just another way of stating what the SWR of the component or device is. A 20 dB return loss is the same as an SWR reading of 1.2 to 1. That means that the device (SWR meter) is not capable of resolving to finer measurements of less than 1.2 to 1. See Table 1 to compare return loss to SWR measurements.

If a single directional coupler is used for forward measurements and then reversed to read reflected power, dissimilarity in different couplers can be eliminated. The single type of meter is most accurate in that only one diode and the same circuitry is used to make both readings, so the chance of difference in circuitry is minimum to each reading.

With a two-diode or two-meter indicator, two different circuits are calibrated to display readings. Imbalance or differences in unmatched diodes will give erroneous results. The dual circuitry should look and be electrically "twins" to provide meaningful readings. These units are not calibrated as time goes on—they're relied on as is. They might be just fine, but to be sure, check them.

There is little difference between making an SWR reading at 2 meters and at a microwave frequency. In each case, some form of test configuration of the test setup must be used. The biggest problem between VHF and microwave SWR meters is cost. The SWR meter for use at 2 meters is quite

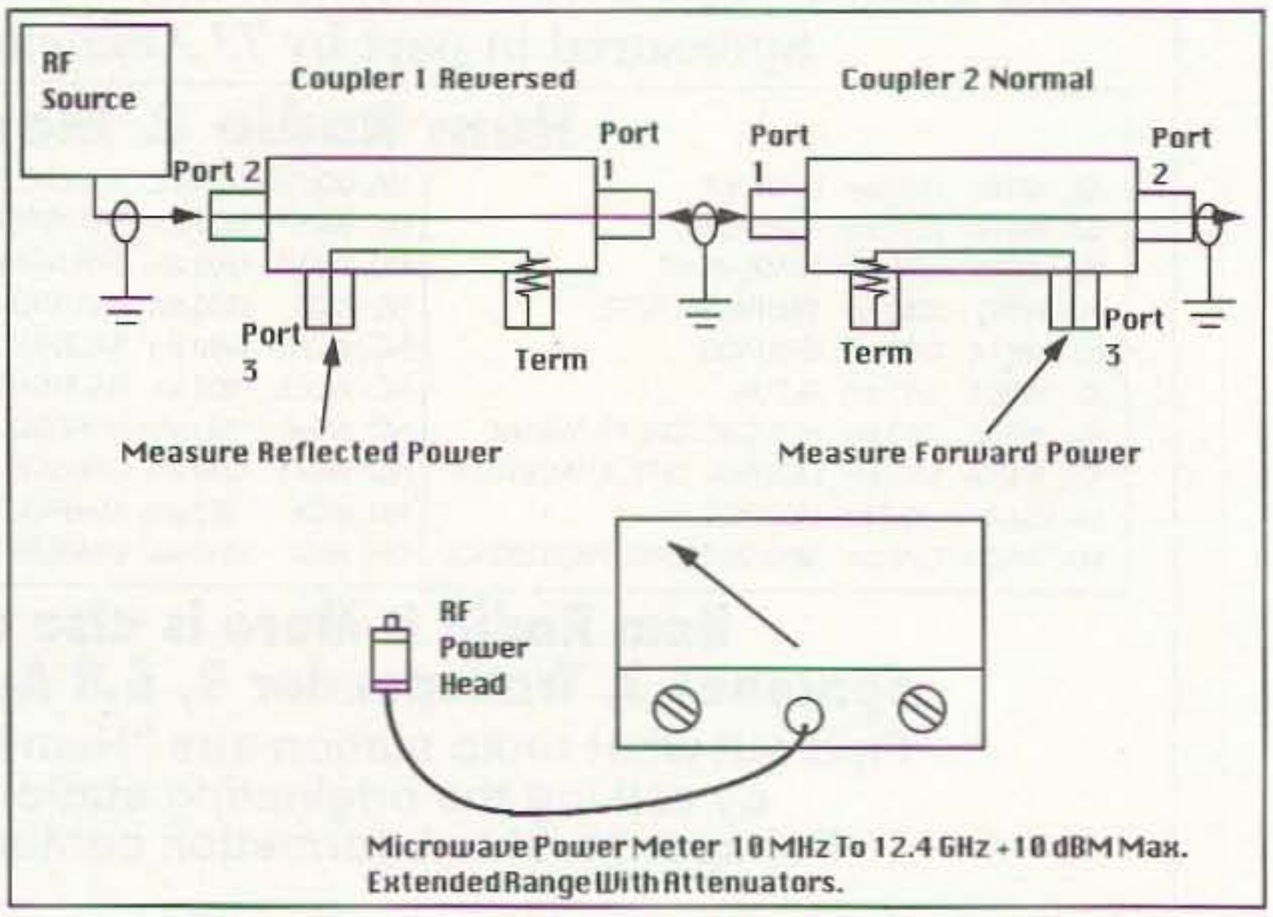

Figure 3. Two directional couplers used for SWR measurements.

inexpensive compared to a microwave SWR system because of simple bulk supply and use. Manufacturers can sell more SWR meters for VHF than they can for microwave use.

The circuitry used in a VHF SWR meter is somewhat large compared to a microwave SWR meter. With a VHF device at 146 MHz, a quarter wavelength is about 19 inches long. Circuitry should be a small fraction of this wavelength factor to be effective. Remember, it's OK to use square corners and make long wire runs at 80 meters; however, the same type of construction at 2 meters is a death sentence, and at microwave death was a hundred years ago.

The same analogy applies to a comparison between 2 meters and 1296 MHz. As frequency increases circuit size and interconnections to the RF circuitry must decrease, keeping it small in relation to the wavelength factor (2 meters/146 MHz = 20.27 inch, 3/4 cm/1296 MHz = 2.28 inches). As you can see from the two quarter wavelengths being compared there is almost a 10 to 1 difference in wavelength factors for component selection.

Errors can jump up when components used in construction become large compared to the wavelength factor. For example, a good selection (component size considerations) for 1296 MHz would be to select a chip (leadless) resistor rather than a 1/2-watt carbon composition to terminate a circuit. The difference between the two resistors is the leads of the 1/2-watt resistor, which at 1296 MHz becomes reactive and looks like an inductor in series with the resistor element.

Low frequency SWR meters can use these components with little detriment and perform quite well. As frequency increases, more expensive component parts are required to be able to make accurate measurements.

Return loss is like SWR, a ratio of forward power to reflection power, and is expresed in dB. The reflection product is the power bounced back from the load due to mismatched impedances at the load. If everything is perfect (assuming no loss or reflections in the SWR bridge), all power from the source will be absorbed in the load after passing through the SWR bridge. Now, the world is not perfect and some loss does exist in the bridge. What these imperfections cause in respect to the perfect condition is the reflection of some RF power back to the source. How much depends on how good or poor the match is.

In commercial calibration the return loss measurement is usually made with directional couplers and level-sensitive sweep oscillators to test the device in question. In most amateur applications a directional coupler operating at the fixed frequency of operation will produce accurate single-frequency readings.

Mail Box Comments

Jack Lindauer WA6EFM wants it to be known that he is putting together a Swan 250 6 meter transceiver users' group. He wants to exchange information on the use of this specific transceiver, including modifications and basic information. To contact Jack, write or call: 18881 Brymer Court, Northridge, CA 91326; (818) 831-0515.

I just received a brief letter from Marcelo Bonotto Chrispim, Curitiba PR Brasil. Marcelo states that he is an avid reader of *73* and of this column, but is having a very difficult time obtaining information, articles, and products and components for microwave ham-band construction projects. Marcelo is interested in building oscillators, synthesizers, preamplifiers and mixers. Components he is interested in include Teflon PC board and SMA connectors, in addition to newsletters and products that are available for the amateur microwave enthusiast.

This letter points out to me very strongly that we in the U.S. live in a land of abundance. It's probably not the abundance that we pictured, but when we think of what we have available in comparison to other amateurs in the world, and what great efforts they go through to assemble components and material for a project, I think they deserve a very big compliment for their love of amateur radio and construction in general. Sure, we can go to the local Radio Shack and listen to the sales counterperson say, "Microwave, what's that?" but still material is fairly easy for U.S. amateurs to obtain.

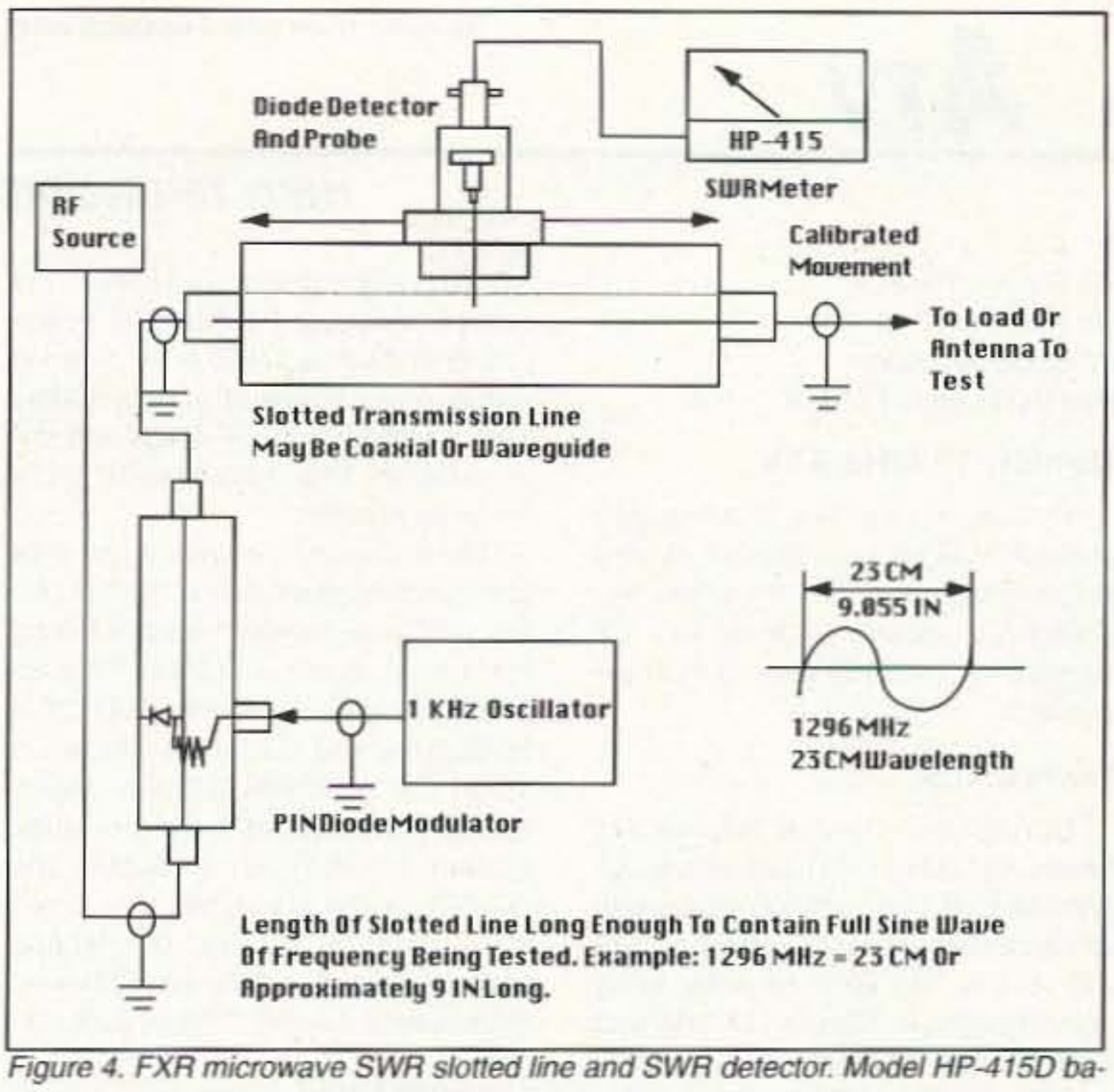

Figure 4. FXR microwave SWR slotted line and SWR detector. Model HP-415D basic setup with HP pin diode modulator. Slotted line method of SWR measurement.

In response to Marcelo's query I have sent him information on some of the kits and PC boards that I have available, in addition to the names of other manufacturers and microwave groups that publish newsletters to keep us informed about our amateur activities in the microwave realm. Included is the North Texas Microwave Society, c/o Wes Atchison WA5TKU, Rt. 4 Box 565, Sanger, TX 76266. Dues are $12 a year and they issue a newsletter six times a year.

In response to many queries on surplus material that I have available, here is a short list of microwave related items: Qualcomm synthesizers for 2.6 GHz that can be converted to run PLL with a 10 MHz clock from 2.1 GHz to 2.6 GHz in 2.5 MHz step sizes, output power +8 dBm, cost: $15 each; Qualcomm multipliers 2.x GHz times 5 normally to 13.1 GHz, mod to times 4, will multiply synth at 2.555 GHz (x4) to 10220 MHz power output +7 dBm, cost: $15 each; 1 watt FET amp PC board at 14 GHz mod to 10368 MHz, -5 dBm in, produces 1W out with retuning board, cost: $25 each; 12 GHz receiver mod to three-stage preamp at 10 GHz, cost: $12 each, old style; new style RF preamp less mods will operate at 10 GHz w/27 dB gain 3 Nf, retuneable to 1.1 dB Nf, cost: $30 each. Prices are plus postage ($3 min.); sales tax for California destinations.

Well, that's it for this month. As always I will be glad to answer questions concerning this month's topic and related amateur microwave subjects. Please send an SASE for a prompt response. 73 Chuck WB6IGP. 73

SWR Reading	Return Loss
1:1	66 dB
1.1:1	26 dB
1.2:1	20 dB
1.3:1	17.7 dB
1.4:1	15.5 dB
1.5:1	13.9 dB
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Danish 10 GHz ATV

This month I'd like to bring you some ATV news from Europe. A very active group from Denmark has accomplished some remarkable ATV DX contacts on the 10 GHz band this past summer.

The First Test

During the Danish Microwave Week (mid-June 1994), numerous stations were set up over the region with voice contacts being made on 10, 24, 47, 76 and 145 GHz. In order to try something new, Bjarne OZ1UM and Soren OZ3VC brought along equipment for 10 GHz ATV. The transmitter consisted of a frequency-modulated DSO (directly on 10.4 GHz), followed by a 500 milliwatt power amplifier stage (sound was transmitted with a 5.5 MHz subcarrier). To receive the picture, they used a modified downconverter from a satellite TV receiver with a noise figure of approximately 1 dB followed by an IF stage and demodulator. The dishes used were made by Procom.

The first tests were made just prior to the activity week over a 19-mile (31-km) path with excellent results. During the actual event (6/12/94) they attempted a contact between OZ1UM in Spodsbjerg and OZ3VC in Skagen, a distance of 129 miles (209 km). Unfortunately, conditions were not good enough to establish a contact and OZ3VC moved his station to a closer site at Trehoje on Mols. This time, a very successful ATV contact was made over a 56-mile (90-km) path.

The Long Haul

On July 7th OZ1UM and Steen OZ9ZI made a new attempt at establishing an ATV contact from Skagen to Spodsbjerg. For a talk-back frequency, 10 GHz SSB was used. Although the OZ1UM team at Spodsbjerg had to work with an open waveguide (no dish) on their voice station, the SSB contact was made with an S-6 signal level on both ends. At approximately 20:30 local time, the ATV signal was received for the first time. At first there was considerable QSB, but at around 2100 signals became stable. At this time they changed directions and sent pictures from Skagen to Spodsbjerg to make a two-way QSO. According to Steen OZ9ZI, it was a very fascinating experience watching OZ1UM, OZ3VC, OZ5DI and OZ1JLA appear on his monitor in full color with the Spodsbjerg lighthouse in the background while he was sitting on the sand dunes in Skagen nearly 129 miles (209 km) away! *TNX to Steen OZ9ZI for the above info.* 73

Photo A. (l to r): OZ5DI, OZ1JLA and OZ1UM operate the 10 GHz ATV station at Spodsbjerg.

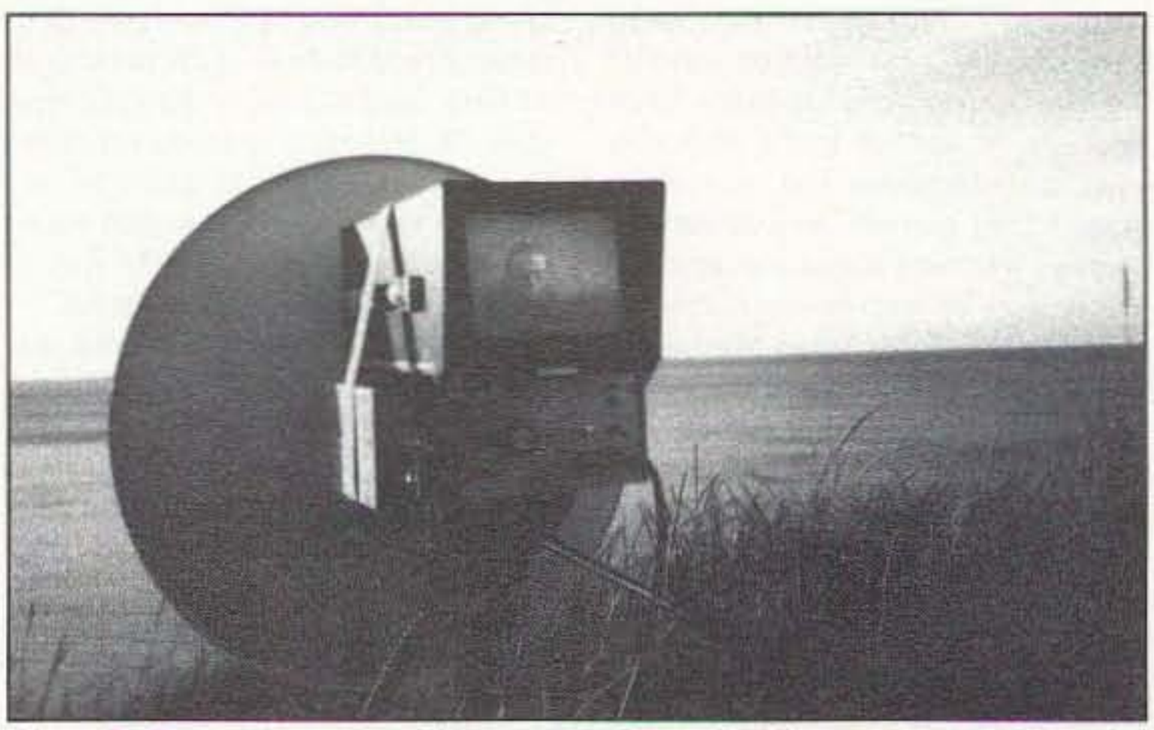
Photo B. The group at Spodsbjerg watch Steen OZ9ZI appear on their monitor over a 129-mile (209-km) path.


Photo C. The Spodsbjerg crew is shown as received in color by Steen OZ9ZI at Skagen. Photo by Steen OZ9ZI.

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UPDATES

PTT Control From Receiver Audio

With regard to the above mentioned article, which appeared in the January 1995 issue of *73 Amateur Radio Today*, a correction has been pointed out by Ken NØITL. The LED in the schematic was inadvertantly shown in reverse. However, the LED is correctly shown on the FAR Circuits printed circuit board and on the PCB artwork. The schematic appears on page 32. Thanks to Ken for his sharp eyes.

Also—do not substitute small signal type diodes (914 or 4148 types) for the specified 1N4001 diodes. The small signal type diodes have considerably lower conductivity threshold voltages than the iN4001 types, and their use will cause the units to operate improperly. 73

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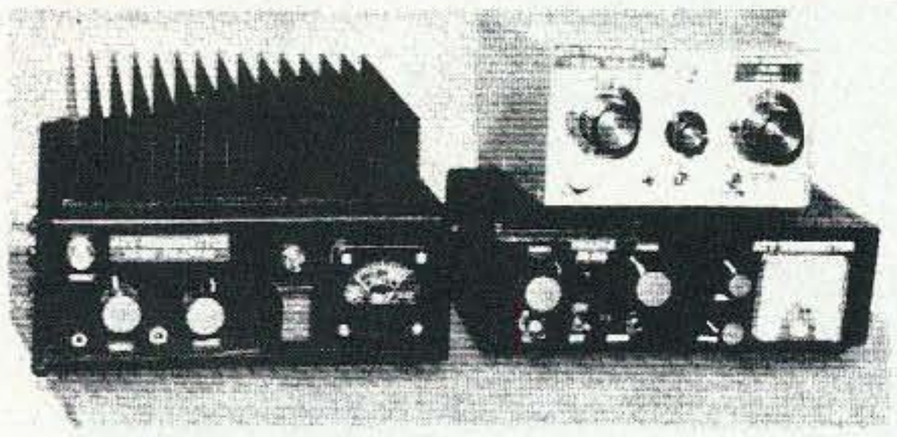

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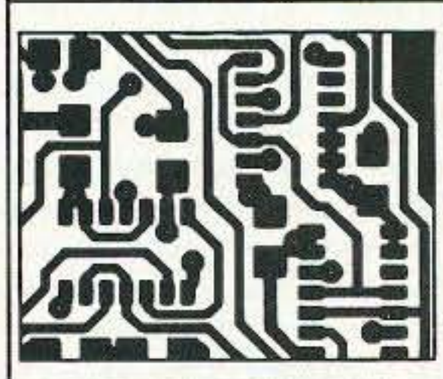

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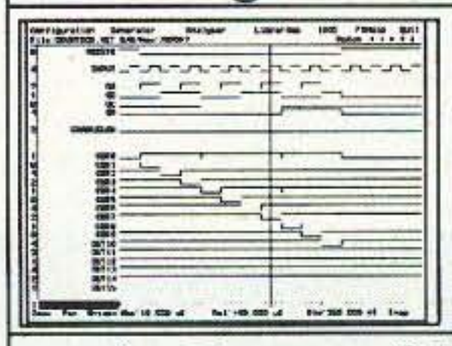

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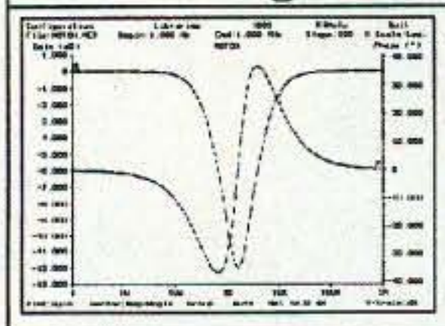

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Low Power Operation

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Massillon OH 44646

There's been plenty of new projects to keep the soldering irons burning late at night. This month, we'll look at a very popular 40 meter transceiver by Dave Benson N1NNG. This rig first appeared in *The Quarterly*, and Dave has given the nod to reprint it here. I'm not going to go to deep into the hows and whys of this rig, but rather take a look at putting it together and putting it on the air.

Originally designed for 20 meters, the rig can be modified to work on 40 and 30 meters as well. I just happen to enjoy 40 CW, so that's the band I chose.

The rig uses a superhet-designed receiver for single signal reception. It is not a direct conversion receiver. The transmitter is full QSK using electronic switching and no relays. The transmitter will produce about 1.5 to 2.0 watts output, depending on supply voltage and frequency. Transmitter control is by a variable capacitor/tuned circuit VFO instead of the varactor scheme of the NorCal transceiver.

The rig is made up of two small PC boards. One contains the receiver, while the other contains the transmitter/mixer and QSK components. The rig will drive a small speaker with enough volume to be useful in a small room. There's a sidetone that monitors your keying.

I brought the rig in kit form from Dan's Small Parts. Write to Dan for more information about this project. You can get just the PC board, the full kit, or specialized parts for the transceiver. (Dan's Small Parts, 1935 South 3rd West #1, Missoula, MT 59801.)

Dan uses a lot of surplus parts in this kit. It takes a bit longer to figure out the strange markings on some of the parts, mostly the capacitors. Some of the parts won't fit the board as they should. I tossed those guys in the junk box and used my own parts that did fit the board.

Assembly

Assembly is typical of a baggie of parts kit. I decided to build this rig in a box big enough to handle some extra goodies down the road. I have plans for a small 5-watt amplifier stage, an S-meter, and perhaps a digital readout for the VFO. The ultra-miniature stuff-it-in-a-box rage is not going to happen this time. The cabinet is steel and aluminum, with a sub-chassis for added strength. In fact, this cabinet was made by the now defunct Dentron Electronics. This cabinet used to hold a small multiband QRP rig called the Station One. It covered 80, 40 and 15 meters, used a direct conversion receiver and sported a digital readout. I had one of the few prototypes ever built and, like a dummy, sold it at a hamfest years ago.

As it worked out, I was able to use many of the holes already punched in the rear apron. These included the SO-239 chassis mount and holes for 1/4 key jack and headphones. Two smaller holes were put to use supplying power to the transceiver. In this case, five-way binding posts are used. They are not my connector of choice for power, but why drill more holes? The rear apron is 1/8" tempered aluminum. The front panel is made of .062 aluminum. The top and sub-chassis are made of cold rolled steel.

Because there's a lot of activity going on inside the chassis, several aluminum shields were installed. One is placed between the transmitter and receiver board while a second shields the 5-watt amplifier section. I plan to use some sort of digital readout, so a third shield will be added to keep noise from the digital section out of the receiver.

I added a small PC board to the rear of the transceiver to drive the S-meter. It's an audio-derived circuit from one of Doug DeMaw's books. It drives a small edgewise 200 µA meter. It's more bells and whistles than anything else, although it does make it easier to center a signal in the bandwidth of the receiver. I backlight the meter's face for that professional look, using a grain of wheat bulb. The bulb also serves as a "power on" indicator.

Since this rig uses a variable capacitor for tuning the VFO, the capacitor must be mounted very carefully. I used a small block of Teflon machined out to fit the oddly-placed front mounting holes. The variable capacitor from Dan's Small Parts has an internal vernier drive. That's one less piece of hardware that needs to be installed. If you don't have this type of capacitor, then you'll need to add some sort of drive reduction gearing. The tuning capacitor is driven directly from a single knob without a coupler or additional reducers.

A very common mistake made when working with a VFO is using a small-gauge wire between the tuning capacitor and the rest of the VFO circuit. As this wire moves around by movement of the rig, the frequency changes. In my transceiver, I use a very short, very stiff piece of copper wire. It's a hunk of number 12-gauge wire from some Romex cable. Twisting of the case does not produce any noticeable movement of the VFO. I also used a rather unusual method of sealing the VFO components to the PC board.

Stability of the VFO may be impaired by the physical movements of parts on the PC board. Normally, a

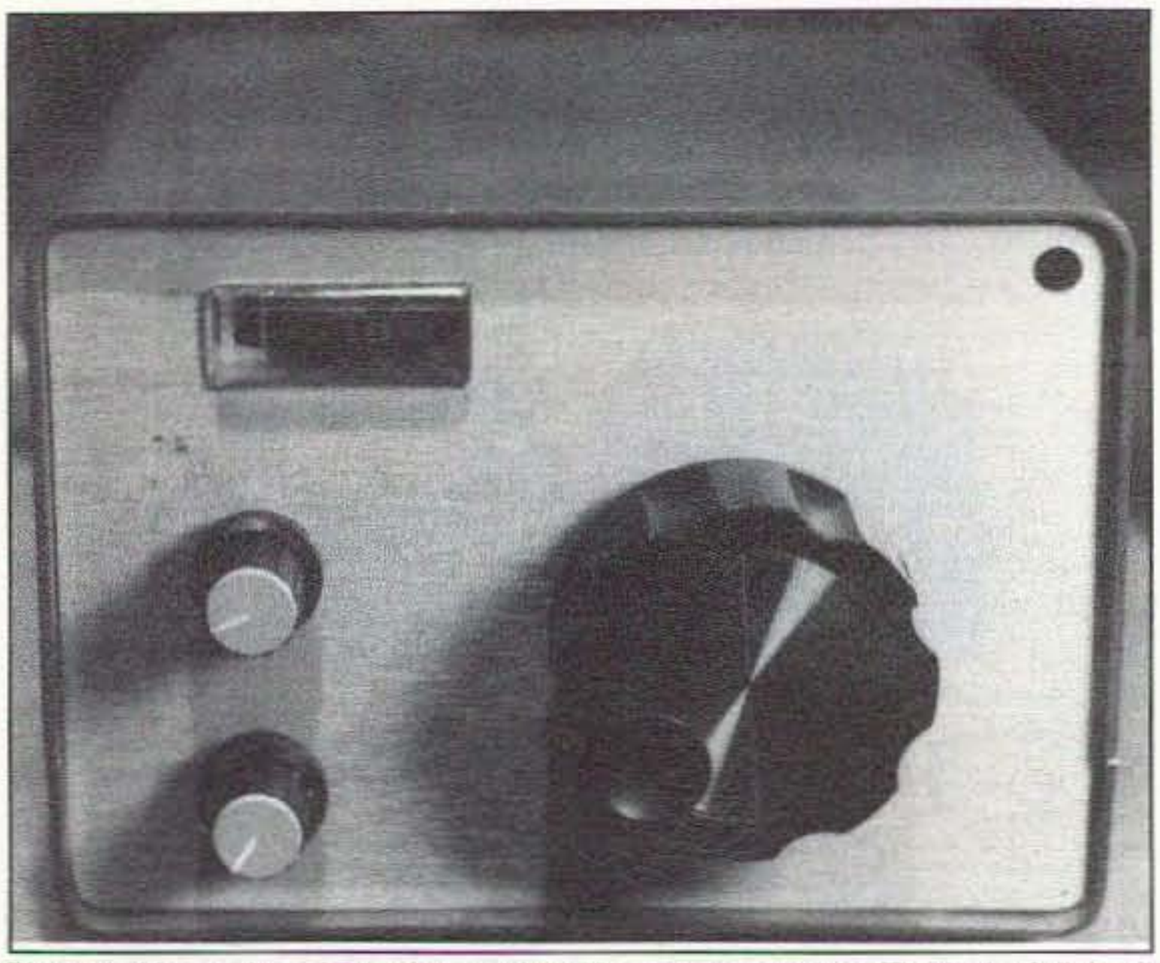

Photo A. My version of Dave's superhet 40 meter transceiver. The lack of dial calibration means a digital readout to be added later.

"Originally designed for 20 meters, the rig can be modified to work on 40 and 30 meters as well."

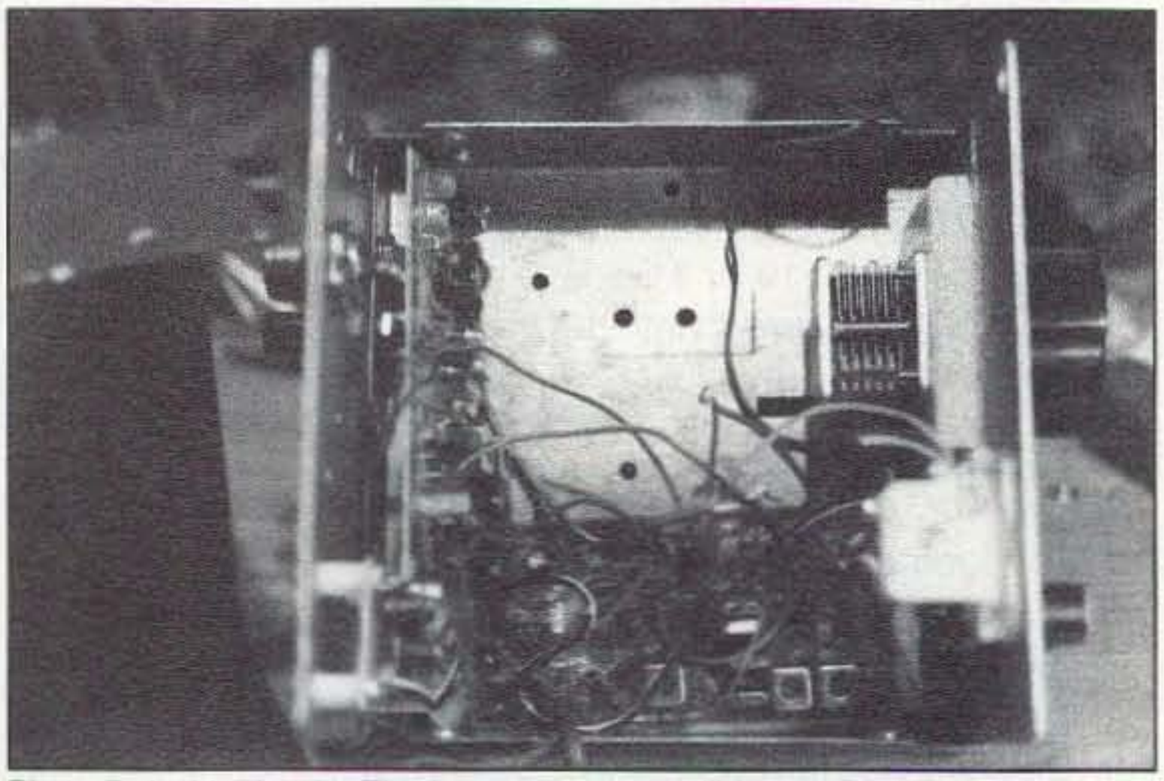

Photo B. Inside the rig. The large open area will house the 5-watt PA and the digital circuit for the display.

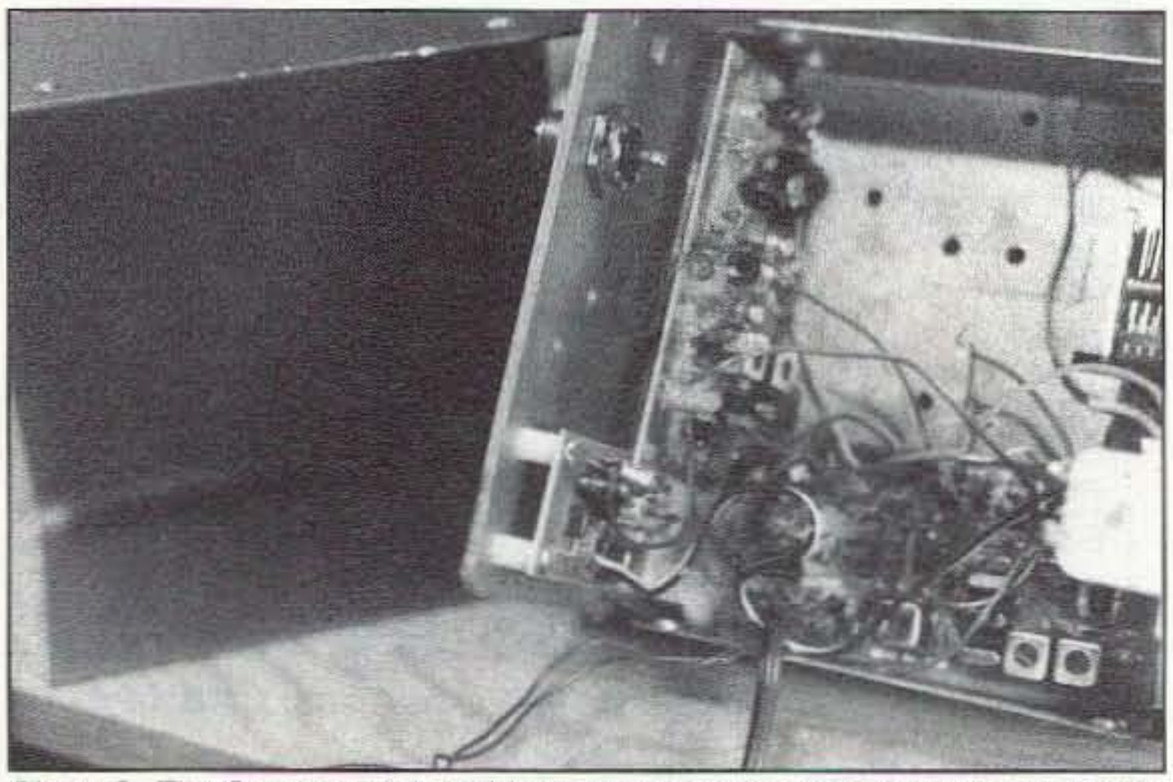

Photo C. The S-meter PC board is mounted on the rear of the rig. Notice the SO-239 antenna connector also on the rear apron.

good glob of coil dope is applied to the capacitor on the circuit board. Having long run out of that stuff, I heated up the hot glue gun and applied a glob on the parts that needed it. So far so good. The heat from the glue did not seem to hurt the parts, and they sure don't move around on the PC board!

To keep everything as secure as I could, I mounted all the PC boards with 3/8" long threaded metal standoffs. They keep the boards secure and provide ample grounding. A heavy solder tinned copper braid connects all of the circuit boards to a common ground.

Changes to the Circuit

I did do some minor changes to the basic circuit. I added a brute force RF gain control between the receiver board and the QSK circuit on the transmitter board. Dave designed the rig without an AGC, so you must ride herd on the volume control. Under very strong signals, that's not enough to keep the receiver from overloading. The RF gain control then works its magic.

After assembling the kit, I was unable to bring the receiver to life. Everything seemed to work, but I could not hear anything at all. After a few calls to Dave, some heavy-duty troubleshooting and a bit of luck, I found the trouble. In the first stage, two tuned stages in the front end, there are two 47 pF capacitors used to bring the two coils to resonance. In my kit, the capacitors supplied were 470 pF. Equally useful, but hardly interchangeable. After working on the front end, I found 68 pF worked as well as the 47 pF capacitors. Now that the front end was tuned, signals could be heard, but they weren't very loud.

This trouble was traced to a misplaced resistor between the BFO and the audio amplifier switch. The MOSFET audio switch was never turned completely on, greatly reducing the gain of the receiver. Check these two areas if your transceiver refuses to come to life. Just to be sure, I replaced the MPF-102 MOSFET with a prime component instead of a surplus device.

Audio can be enhanced with this rig by enclosing the speaker in some sort of cabinet. I used a plastic top from a spray paint can to form a seal against the back of the speaker. It's amazing how much better the audio sounds after such a simple fix. The plastic top is held in place with a couple of globs of hot melt glue. I use a two-prong plug and jack so I can disconnect the speaker from the rig if need be. When using headphones, an open circuit 1/4" jack automatically disconnects the internal speaker.

The Transmitter

I found the transmitter the least troublesome to get running. With the power supply sitting at 13 volts, the little guy will do about 2 watts into a 50-ohm load.

But, watch out—you have the two transformers used for mixing the VFO output to the transmitter's oscillator. It's very easy to get the two transformers to peak at the wrong frequency. In my case, I easily produced several watts at 8 MHz instead of 7 MHz.

Only after looking at the output with a scope and frequency counter did I see the trouble. A retuning of the two stages put the rig right on the desired output.

I never did like using homemade dials for my rigs; I plan on using the PC-1 counter from S & S Engineering to display the operating frequency. An RCA-type jack installed on the rear apron brings the output of the VFO to the counter. I plan to add the counter internal to the rig later on. By reading the VFO's frequency, I'll have a poor man's version of digital readout.

Adding an RIT is possible, but alas, I've not attempted it. If you want complete details on adding RIT to this transceiver, send me three first-class stamps and I'll send you several sheets of modifications, and of course the RIT circuit.

The RIT comes from Roy Gregeson W6EMT, who also made several changes to the basic circuit. Perhaps the most important one is changing the configuration of the 1350 IF amplifier. It's too involved to present here, but I'll include it with the RIT modification. Basically, it requires cutting several traces around the 1350 and adding some components. The result is supposed to be astounding. I did this modification early on, and found the 1350 went into oscillation at the blink of an eye. This is caused by too much gain in the IF stage. But, make a note that I did the modification before I found the trouble with the front end tuned circuits.

This is an enjoyable project, but it's not for the first-time builder. The instructions from Dan's Small Parts are very limited, but not as bad as a Kanga kit. You should have burned up several soldering iron tips before taking on this project.

When you're done, however, you'll have a real smooth operating QRP transceiver on your hands. I really enjoy making QSOs with this transceiver. I plan on working Field Day using this rig. I'll let you know how I make out. 73

"I plan on working Field Day using this rig. I'll let you know how I make out."

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New Software

One of the frequent foci of this column is software available for the amateur desiring to run one of the digital modes—that is, RTTY, AMTOR, packet, or the like—with a computer. This may, or may not, include one of the popular multimode controllers as well.

I received an E-mail message a bit ago, which took me to task. Jim Jaffe WA2VOS wrote, in part:

"I am fairly active on RTTY (PACTOR) and have been using this mode since late 1976. When my CP-1 conked out back in 1989 I went to a PK-232, and with the Apple IIe computer suddenly found that I was out of luck with AMTOR, as there was no software out there to support the Apple and this new mode! As luck would have it, I got my hands on a PC, and someone gave me (copies of existing programs, which did not satisfy him).

"During that time a new face appeared on the Ham Horizon, namely Gary Johnson KF7XP, who is the author of XPWARES and who has written supporting software for all the TNCs on the market, including the German PTC units. So now we have a program that fully supports the ANSI color commands, contains a full-blown stand-alone log book, and support for (several brands of amateur radio directories). Not only did Gary write software and re-write it over and over again to rid it of those nasty critters we call bugs, but he also maintains a BBS and an FTP site on the Internet so that I can download all the latest wares for distribution as well as our overseas fellow hams who have Internet access as well. Gary responds to mail, requests complaints, critiques and sometimes instantaneously re-writes software to accommodate our needs. I have made well over 4,800 contacts using my PK-232 since 1990, when I began keeping the electronic log. As far as I know, Gary's software is the only one that offers a log conversion program that successfully converts any electronic log book to his logging format. His program operates in the Host mode, which (others) do not."

Somewhat stung, I surfed onto the Internet, using my handy-dandy AOL interface, and dropped Gary a note. His response was:

"I have no problem at all with you reviewing the software or adding it to the disk collection. There are several programs on the FTP site for the KAM, AEA and PTC type controllers. All programs have the same basic features, just optimized for the different controllers. There is also an external logging program that interfaces to the software. It is called XPLOG. Several of the menu options in the MISC menu are tied to the external logger. 73, Gary KF7XP"

Now that I have whetted your appetite, let me tell you about these programs. As Gary said, there are several "flavors" of XPCOM. They all include, though, the following features:

- Pull-down menus.
- Custom operation with the AEA PK-232, KAM, MFJ-1278 and PTC.
- Mouse compatibility.
- One-key brag file and text operation.
- External interfacing to the user's favorite text editor.
- Offers full PACKET, AMTOR, FEC, PACTOR, BAUDOT, GTOR, TOR, GTOR Monitor and CW modes. (TOR, GMON and GTOR in XPKAM only.)
- Full use of the HOST mode for the AEA PK-232 and KAM. Pseudo-Host Mode operation for PTC controllers.
- Simplified command structure for the MFJ-1278.
- Intuitive on-line help system.
- Quick-Connect feature for packet.
- Real time and background printer support.
- Built-in logging, with auto search.
- Macro support. TYPEOVER Macros, allows you to insert text macros into ANSI files without destroying the picture.
- Multi-Window ANSI color support for GTOR, PACTOR, packet and ASCII. (VT100 emulation.)
- Radio interface for most transceivers that support computer control.
- Direct Buckmaster, SAMS and QRZ! *Callbook* interface.

Now, as to the varieties. XPCOM Version 1.55 supports AEA (Host Mode) and MFJ-1278 controllers, including dual TNC Support. XPDUAL supports AEA (Host Mode) PK-900 and DSP 2232 controllers. XPKAM supports Kantronics KAM and KAM+, including GTOR and PACTOR, and built-in GTOR Monitoring without the need for external programs! The AEA and Kantronics versions also support multi-connect operation with XP Windows, and multiple ASCII file transfer in packet mode. And, finally, XPPTC is available for the Paccomm PTC and SCS PACTOR controllers.

Each of these programs is supplied separately, as shareware, with a $39 registration.

As Jim and Gary indicated, there is also an external logging program, XPLOG. Briefly, this is a versatile logging program that can operate as a stand-alone program or from XPCOM, including name/QTH browsing, antenna heading assistance, and more. Together, this is one complete package.

Just to put any other questions to rest, these programs should run on almost any PC-compatible system, requiring any of the 8088/86/286/386/486 series, 512K memory (640K recommended), a monochrome, CGA, EGA, or VGA display, and an optional Microsoft-compatible mouse. Multimode controllers supported include the AEA PK-232 or MFJ-1278 for XPCOM, the AEA PK-900 or DSP-2232 for XPDUAL, the Kantronics KAM or KAM-plus version 6.0 or later firmware for XPKAM, and SCS or Paccomm PTC controller with version 2.00 or later firmware for XPPTC.

There are at least two ways to obtain this software, presuming you do not have a buddy with the disk, or have the material on a local BBS. You can log onto Internet, at ftp.indirect.com, under the /pub/software/hamradio/xpware directory, and download the material directly. Alternately, you can send for the latest additions to the "RTTY Loop" Disk Collection, disks 9, 10, and 11, which contain all the programs and documentation discussed above.

Composition Software Question

Just to change the subject, how about a question to you all? This from Richard, WA1SKQ, who writes, via AOL:

"Just a quick question, perhaps you can help steer me in the correct direction. I've been running PACTOR for quite some time, and during the past year, I have been using a PK-900 running off a 486DX and PcPakratt for WINDOWS. All nice stuff, and no complaints. With the 900 and other TNCs coming on line, more and more folks are transmitting graphics . . . great stuff to copy, but a bear to create. I'm finding plenty of ANSI files on a variety of on-line services, many on AOL, but have more interest in composing my own. A ham friend sent me a program called THEDRAW. He had billed it as capable, but not user friendly, and I'm forced to agree. Though I can generate some interesting color graphics for use in AMTOR, it's a real chore. Is this the way of ANSI graphics, or is there some software out there that makes composition a bit less of a chore? Thanks for your help, and keep up the good work."

Well, Richard, I was going to suggest THEDRAW myself, as I started to read your letter. I use that program to create ASCII/ANSI screens for my medical software. I will leave it open to the readers, though, to suggest more "user-friendly" software. I just happen to like THEDRAW.

For those who may have come in late, any or all of the disks in the "RTTY Loop" Software Collection remain available. To obtain a list of programs, just drop me a self-addressed stamped envelope to the address at the top of this column, or send E-mail to one of the addresses below, and I'll send along the list forthwith. Each disk in the series can be yours by sending a 3.5" high density disk, $2 in US funds per disk, and a self-addressed mailer with sufficient postage to me, along with a note telling me which collection you would like.

Of course, I always welcome comments or questions. Those vital E-mail addresses are: CompuServe 75036,2501; Delphi MarcWA3AJR; America Online MarcWA3AJR; Internet MarcWA3AJR@aol.com. Such a comment turned me onto the software highlighted this month. Who knows where your question will send me? I look forward to it, just as you look forward to next month's "RTTY Loop"! 73

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Tough dual-band antenna for the travelin' man or the condo dweller. Hang-anywhere style and extra range can save life in an emergency.

James H. Gray W1XU

During my years of traveling around the eastern United States on business or vacation, I often wished I had a small, inexpensive and easy-to-use antenna to match my little hand-held 2 meter radio. Occasionally I had an HF rig in the car, but more often it was the little 2 meter radio which was useful and fun. On long road trips it alleviated boredom, kept me awake and almost always assisted me to find a motel, restaurant, or other ham's QTH. On such trips the mobile antenna was fine until I needed more range from the motel.

When I traveled by plane, the rig was the handheld with no amplifier. It had only a small telescoping whip that I could extend to about 19 inches. If I happened to be close enough to a repeater in a large city, that was fine and I managed to "work" the locals in spite of low power and a minimal antenna.

But there were occasions when there was no local repeater, or when I was inside a steel-and-concrete building. At such times I wasn't able to make any contacts at all and had to resort to dull tedious television programs before going to bed.

If you face similar problems when traveling light and by air, you know how it feels to be alone among the many.

The Pico Solution

Today, the travelin' man has a ready solution to the problem: a neat antenna produced by Antennas West and called the "Pico-J." It meets all the requirements set forth in the first sentence. Pico means "small," as in "picofarad," and "J" stands for "J-pole," the well-known low-angle, omnidirectional vertically polarized antenna—just what's needed for 2 meters.

Antennas West's Pico-J offers some features not found in the usual J-pole. For example, the feedpoint is already found and matched for you, and the antenna is small and light—so much so that it can be rolled up and slipped into a small eyeglasses case. It looks like a sleek black ribbon 55 inches long. A six-foot small-diameter coax feedline comes off the bottom. Its gold-pin BNC attaches directly to your radio.

A small loop at the top may be slipped over a curtain rod or a nail or any other suitable projection. But, if by chance you don't happen to find a suitable support, Antennas West thoughtfully provides a small suction cup with an embedded hook that can be slapped up on a window or any smooth surface, and presto!—you're on the air!

Pico-J is completely weather-sealed and could be hung outdoors if you wish. Otherwise, you can hang it in a closet or a doorway; in fact, anywhere that is convenient and where your signal won't be blocked. The extra reach provided by this beauty could save life in an emergency, and is always useful when just plain chatting with the locals.

Your Pico-J stretches range, improves reception, reaches far-away repeaters, and saves your battery pack.

The measured VWSR is less than 2:1 between 142 and 150 MHz—ideal for CAP, MARS, and other services near the 2 meter band—and is a very beautiful 1:1 at 146 MHz. Not bad, eh?

Best of all, considering the benefits, is the price: $19.95 for the 2 meter model, $26 for the 2m/70cm dual bander, both complete with the soft vinyl case to store your Pico-J when it's not in use.

On a recent trip I tucked Pico-J into my briefcase, right next to the handheld. No, I didn't even use the "duckie" or the telescoping whip because I had all I needed in this one neat antenna. Maybe you'll find the same.

–condensed from ***RadioFun***

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I have just returned from a trip to China, Hong Kong and Hawaii. I didn't get to do any hamming in China, and, as far as I could tell, the whole subject was one not very familiar to the average Chinese. (Then again, the average American these days is in pretty much the same boat.) In Hong Kong, I visited uncountable numbers of electronics shops—there are at least two on every street in Kowloon. It's Kaboom heaven. They're very much like the ones in New York, though, in that they make the prices up, and I do mean up. These, however, expect you to bargain. Many prices were much higher than here in the States, but some were lower. The most interesting aspect of those stores was that just about every one of them had ham gear in the window! I saw lots of Icom HTs, many Standards and a few Kenwoods. No Yaesu stuff at all. I even saw a few Icom HF rigs, along with antenna tuners and high-current DC power supplies. Can ham radio be that big over there? I don't think so. In fact, I never saw any mention that this equipment was for amateur radio. The HTs were billed as VHF and UHF, usually with no description of frequency. Most of the VHF sets were on 2 meters, but some were not, and I have no idea what frequencies the UHF gear was on. There were signs in several ships warning that use of the radios was illegal in Hong Kong, which suggested to me that, once the buyer left the area, he was pretty much on his own. In other words, I think people in Asia buy these things and just use them, without benefit of license.

Before you go salivating over the idea of getting great deals on HTs via mail-order, I must tell you that the prices were higher than they are here. Oh well. By the way, that cute little Standard 2 meter HT that runs on two AA cells was available in UHF over there, so I wouldn't be surprised to see a 440 version here one of these days.

I had the use of a dualbander HT in Hawaii, and I tried to use it to say a few alohas to the local hams. I met with little success. I heard QSOs, and I put out a number of "listenings," but I managed to engage in only one conversation, and that one was a round table which never got back around to me. I was bringing up repeaters just fine, but it seemed that nobody wanted to talk. I don't want to go and impugn Hawaiian hams, though, so I'll just assume my signal wasn't strong enough or something. Hawaii was one of the most beautiful places I've ever seen, and the people I met were extremely friendly, so I hope to go back and try some more hamming one of these days. I'll let you know more when I get there!

Piling Up

While I was away, some mail started piling up, so I thought I'd take this opportunity to answer a few letters. Here goes:

Dear Kaboom,

Recently, my Kenwood TS-450S has developed an RF-like hum during CW transmit. All my antennas and ground system seem fine. The only remaining suspect components are my Astron RS-35M power supply and the transceiver itself. The radio appears to be operating fine on receive, and tune-up into the dummy load appears normal except for the appearance of the hum and a slight oscillation which shows up on the digital metering. Prior to this problem, the power supply had gone into crowbar protection mode before resetting after shutdown and restart. Any ideas?

Signed,
Hummin' the AC Tune

Dear Hummin',

I think you hit the nail on the head with your last clue. Why did the supply go into crowbar protection? The usual reason is too much voltage at the output. It sounds very much like you have a shorted regulator transistor in the power supply. Measure the voltage while the rig is in receive; your rig should be drawing about one amp, which should keep the power supply in proper regulation. If your measurement exceeds the supply's ratings by much, and I suspect it will, there's your answer. Also, if you have a scope, check the DC line with the scope set to AC coupling and the sensitivity high. If you have more than the rated 60-Hz ripple, that's another clue your regulator is gone.

Dear Kaboom,

I have noticed that both of my HF rigs, which come from different manufacturers, throw a large RF pulse out the antenna jack on initial keydown. I can see it on meters and on my oscilloscope. My concern is how it may affect my Ameritron AL-80B amplifier and other equipment. The amp's manual expressly describes this phenomenon, and warns not to underload the amp to reduce power, as this could cause extremely high energy levels in the plate and grid circuits.

This worries me, as it causes output pulses measurable at over 1.5 kW PEP, and the amp is only rated at 1 kW. The pulse remains even if I have the amp set at much less than maximum rated output power, forcing momentary illegal operation. Plus, it exceeds some of my equipment's power ratings. Is there any solution to this mess?

Signed,
Zap

Dear Zap,

This is a tough one. The RF final amp stages in HF rigs use negative feedback to control themselves. They're just like the ALC loops used with external amps, only these are internal to the radios. In order for them to control anything, the negative feedback loops must have something to control! In other words, the output must go high enough to let the ALC build up its voltage and squeeze it back down. In the audio world, the time lag between cause and effect results in something called TIM, or transient intermodulation distortion. In effect, it's just what you're describing: a huge overshoot before the circuit acts. For that reason, most high-grade audio gear uses little or no negative feedback. Unfortunately, there's no easy way out of this problem in the RF world. Most hams probably just ignore it but, you're right, it does lead to quick bits of excessive and illegal power. All the amp manufacturer seems to be saying is to let it happen, because trying to prevent it by underloading the amp will cause all that input power to damage the amp's grid circuits. I seriously doubt that the momentary pulses will damage anything else, simply because they're so short. But they are technically illegal, and I applaud you for caring. Still, I have no answer for how to prevent it, except perhaps to use an attenuator between the radio and the amp. Naturally, you'll need a big one that can handle your rigs' output power, and it sure will limit your total output. It's an ugly solution at best. If any reader has a real solution, please let me know and I'll be glad to send it along. By the way, I've seen this problem too, and it once caused some trouble for me. I never did solve it.

Dear Kaboom,

I'm an electronics experimenter who frequently uses "junk box" parts. In December's column, you started describing the Japanese format for marking capacitors. I have lots of caps with such markings, and I need to convert the values into the American format so I can use them. Could you please explain the system?

Signed,
Perplexed

Dear Perplexed,

Sure. Essentially, all Japanese capacitors are marked in picofarads, which is 10 to the -12 power. The first two numbers are the value, and the last is a multiplier, kind of similar to the system used with resistor color codes. For instance, a cap marked 102 is 10 with two zeros, or 1000 pF. Now, 1000 pF is the same as .001 µF, because 1000 X 10 to the -12 equals .001 x 10 to the -6. If all that calculation is too annoying, just remember it this way: 105 is 1 µF, 104 is .1 µF, 103 is .01 µF, 102 is .001 µF, and so on. So, a 152 would be .0015 µF. And, a 473 would be .047 µF. If you make a little chart, you'll never have trouble with this.

Well, I think that about does it for this month. Next time we'll get into a new topic and answer a few more letters. Until then, 73 and aloha de KB1UM. I sure do miss those papayas!

73

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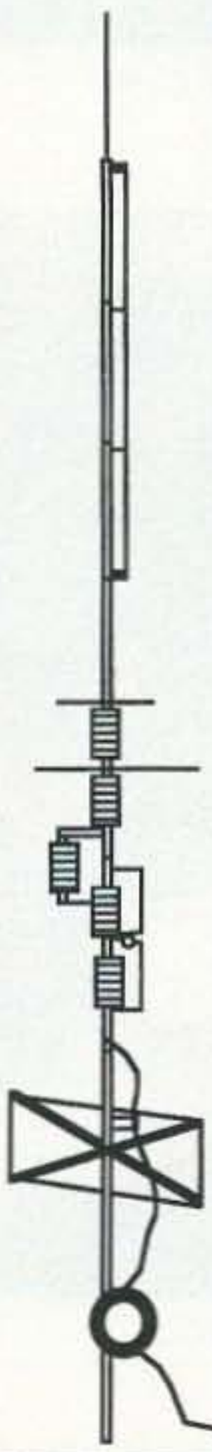

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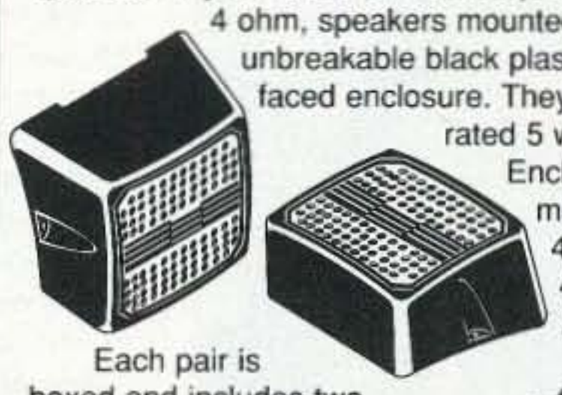

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A Salute to West Point

This past summer I was invited by Captain Curtis Carver to speak to potential members of the West Point Amateur Radio Club, W2KGY. I am familiar with the incredible scenery in Orange County, New York, and welcomed a chance to visit that region again.

A visitor cannot help being impressed with the breathtaking views of the Hudson River, especially as seen from a ham's vantage point—the roof of Bartlett Hall. The grounds of the United States Military Academy at West Point are truly beautiful. It is an open base to visitors, and had over three million guests last year. West Point is Orange County's primary tourist attraction. In fact, it is New York State's third most popular attraction, ranked behind New York City and Niagara Falls.

Captain Carver is N2XJF and he is the OIC (officer in charge). It was with great pride that he escorted me on a tour of the facility. He explained that CARC (Cadet Amateur Radio Club) was founded in 1928 and is sponsored by the Department of Electrical Engineering and Computer Science. It receives administrative support from that department.

The club station is currently outfitted with the latest communications equipment. These include:

- Yaesu FT-736 satellite earth station
- Icom IC-781 all-band shortwave transceiver
- Kenwood TS-440S All band shortwave transceiver
- Icom IC-290 all-mode 2M transceiver

The station has two computer systems, including a system being installed to provide a 24-hour mail processing and forwarding node and BBS.

The club station currently has equipment to operate HF and VHF, SSB, FM and CW, as well as digital modes such as RTTY and packet. The club has a satellite station for the VHF/UHF bands, and high-power amplifiers for the HF bands, making worldwide communications possible nearly any time.

The annual operating budget and funds for new equipment are provided by the Directorate of Cadet Activities. These funds are the result of the generous donations of former graduates through the Association of Graduates.

I thoroughly enjoyed my visit to the Point and to the amateur radio club. There were approximately 15 cadets in attendance for my presentation. There are many clubs and activities competing for the time of these hard-working cadets. My impression was that the young men who came to the meeting were genuinely interested in pursuing the hobby. Captain Carver promised to keep me posted as the cadets got licensed.

On a follow-up visit to West Point in the fall, the president of CARC, Scott Kirkland, escorted a fellow teacher from my school and myself on a tour of the areas I had missed before. We were especially interested in seeing how the classrooms were set up. Teaching on an intermediate school level, my colleague and I enjoyed hearing about the teaching methods and curriculum aids used with these highly motivated cadets. It was a fascinating and informative experience.

The children in my amateur radio classes are looking forward to setting up skeds with CARC. That should be fun for everyone!

For more information about the amateur radio station at West Point, contact the Department of Electrical Engineering and Computer Sciences, United States Military Academy, West Point, NY 10996, or call (914) 938-2200. 73

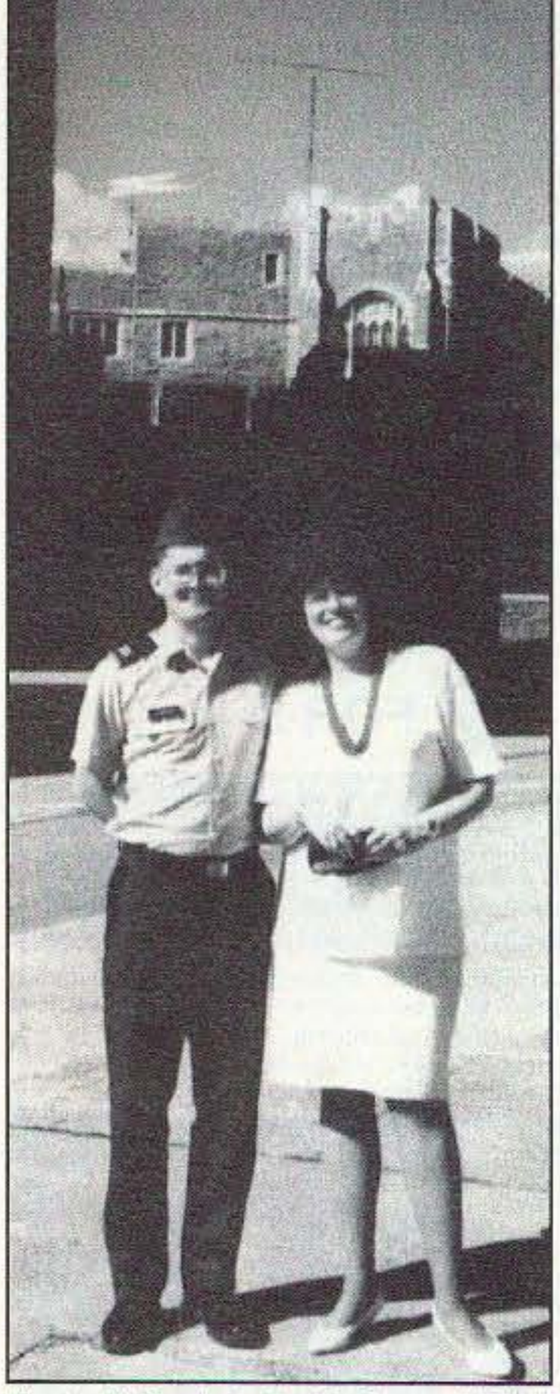

Photo B. Captain Curtis Carver N2XJF with Carole Perry WB2MGP, in front of Bartlett Hall.

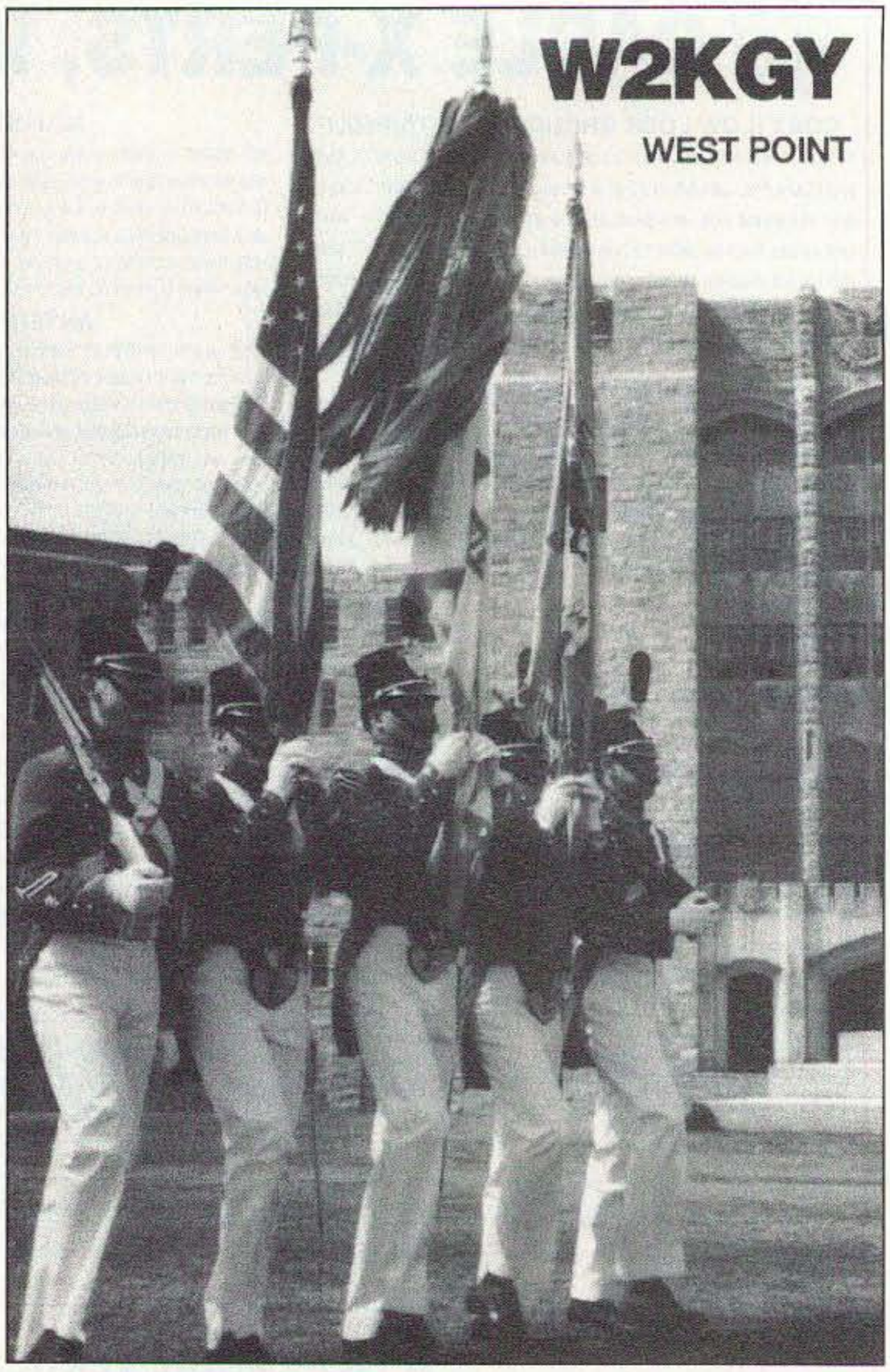

Photo A. QSL card from West Point Amateur Radio Club.

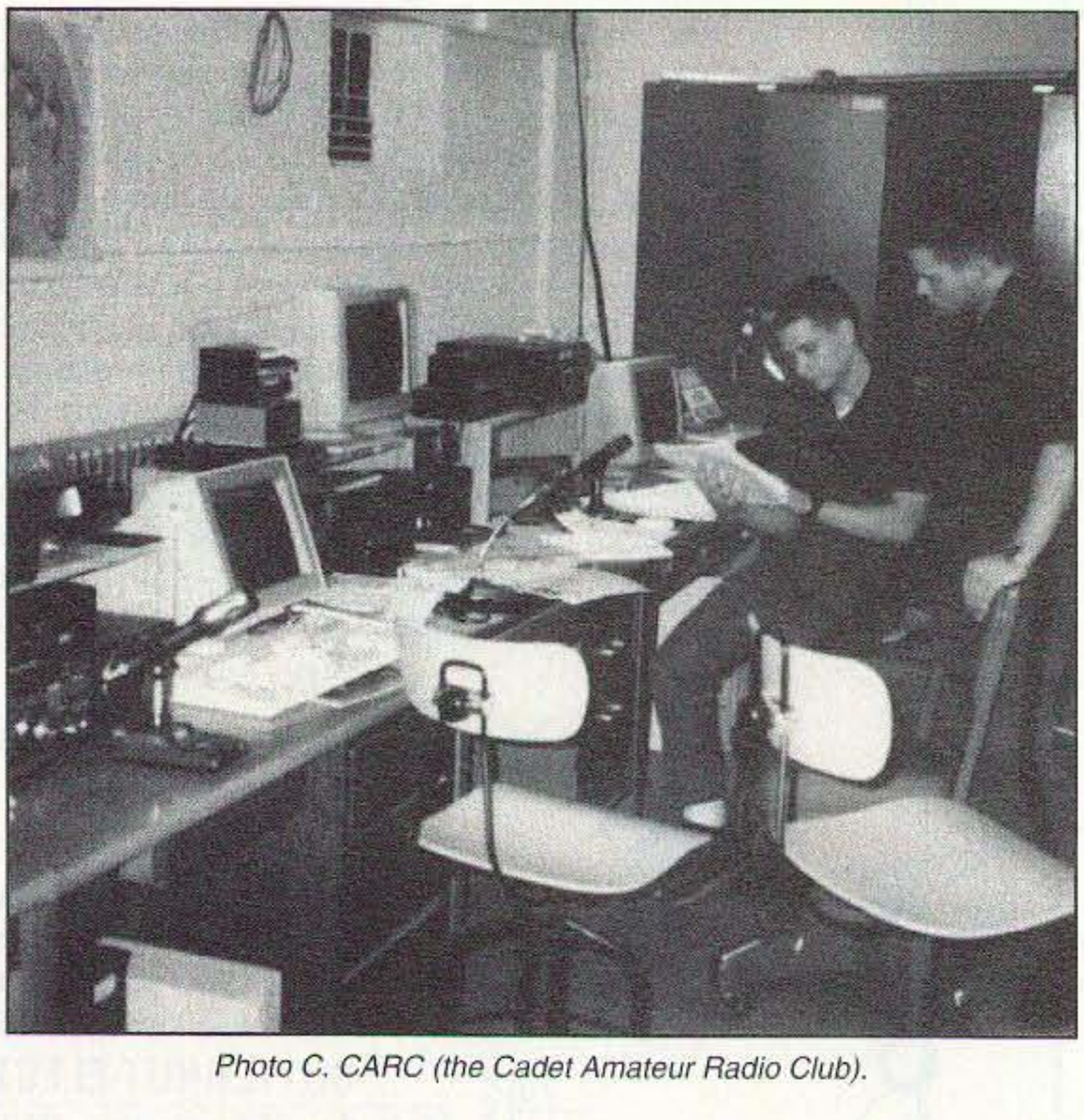

Photo C. CARC (the Cadet Amateur Radio Club).

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Continued from page 4

he's able to fire it up and get heat every time. A whole lot of heat. Thousands of times more heat than is available via any chemical reaction known to man or scientists.

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So, while I'm not having to sit here reading endless E-mail, I'll spend my time trying to manage my businesses, reading a ton of books, talking with people brighter than me on the phone, writing wise-apple editorials, and generally trying to entertain you and get you thinking. What do you know about fermions, baryons, muons, gluons, pions, sub-quarks, tachions, bosons, leptons, and so on?

And if I were to be available via E-mail, what kind of stuff would you send me? Why not use fax? That way, when you run across a newspaper clipping or obscure magazine article you think I ought to see, you could send it to me immediately. Oh, if you do fax, none of those damned cover sheets, understand. My secret fax number is 603-588-3205. Please don't tell anyone.

The ARRL Fought RTTY

Why did the ARRL fight so hard and long to keep RTTY off the low bands? There were two basic reasons. The most important one was that the League's name was the American Radio Relay League. That stemmed from the first ham communications via spark, when radio signals wouldn't go very far. Thus, in order to cover any distance, operators had to relay messages. And so when the club started, it was a message relaying club.

When CW was developed this continued with the development of their national traffic handling net organization, the Brass Pounders League, and so on. For many years thousands of hams originated unimportant messages and relayed them all around the country via the traffic nets, imitating Western Union and Postal Telegraph. Only slower and with far more errors. Well, it was something for hams to do with their spare time. And it was fun.

So when RTTY came along around 1948 it was seen as a serious danger by the League. Imagine, a network of RTTYers relaying messages at 60 wpm with no errors, and all done automatically. I set up a RTTY station in a VIM store on 42nd Street in New York and relayed thousands of messages from the general public for Christmas in 1952 to our servicemen overseas. Check your back issues of *CQ* for a picture of me on the January 1953 cover (with hair) with Bill Halligan of Hallicrafters, Faye Emerson, and her husband Skitch Henderson. While you're digging through your magazine museum you might enjoy reading my old RTTY columns in *CQ*.

By the way, I ran so much traffic through my RTTY station that I made the ARRL's BPL for that month. I kept everyone busy sending thousands of Christmas messages to our overseas servicemen all around the world.

The ARRL also automatically fought every rule change proposed to the FCC that they didn't originate. This was their way of trying to maintain total control of the hobby. Fortunately they seldom won these fights.

When I became the *CQ* editor in January 1955 I visited the FCC and found that everyone in the amateur radio division really hated the League and their arrogant legal counsel, Paul Segal, who was not even a ham.

The ARRL eventually lost their fight to prevent RTTY on the lower bands and activity started growing rapidly. When I started my RTTY column in 1951 there were only about 200 active teletype hams. Somehow I seem to get involved in these new technologies early on.

I started pushing repeaters when there were only a hundred or so in use. Now there are around 8,000 or so, just in the US, plus some spillover into the commercial market with cellular telephones. And I started *Byte* just five months after the first microcomputer was put on the market by MITS. The first CDs came to the US in 1982 so I started *Digital Audio* in 1983. I started *"Cold Fusion"* last year, while the technology was still in the test tube. Well, it's still in the lab, but it'll be breaking out soon.

Ham Radio Broadcasting

With more and more amateurs getting het up over Baxter's seemingly endless ego-gratification broadcasting on the ham bands, perhaps it's time to look back over the history of this aspect of our beloved hobby. It's coming on to 60 years that I've been involved with hamming, so as probably the oldest living editorial-writing ham, maybe I can put this mess into perspective. This is not a pretty story, so fasten your seat belt.

When I first got involved with amateur radio we had one main ham broadcasting station: W1AW. They were on daily with bulletins and code practice transmissions. The transmissions were all automatic, so the bottom line was that the ARRL had their own private frequency in each of the ham bands. If you happened to be making a contact on their frequency when schedule time arrived, you were crunched.

What few amateurs knew was that the ARRL was using paid operators for W1AW, even though this was completely illegal according to the FCC rules. The FCC was well aware of this, but turned a blind eye.

The last time I visited ARRL HQ they had a gorgeous line of commercial transmitters, with everything computerized so that the operator could sit there and just watch the bulletins being broadcast on all bands completely automatically.

Though I've been an ARRL member for nearly 60 years, I haven't listened to a W1AW broadcast since the 1930s, so I have no idea of what frequencies and times they are broadcasting. I think the last time I heard W1AW was when they were chasing us off 160m on December 7th 1941. I was on the air the day we were shut down, and back on the day 2-1/2 meters was opened in 1945.

In the 1930s there was no restriction against ham broadcasting, so every now and then, mostly on 160m, some ham would get on and play records for a few hours. This eventually ticked off the FCC monitors, with the result that the Commission passed a rule prohibiting us from transmitting except for the purposes of two-way communications. I think that was dumped on us in January 1939, as I recall.

Naturally, as with virtually every new FCC regulation, there were unintended ramifications. The FCC monitors interpreted this new rule as also prohibiting us from relaying other ham stations. Until that time networks of four to eight low-powered stations would get together on 160m, with half the stations on the high end of the band and the other half on the low end, all transmitting and receiving at the same time, making it so four to eight of us could just sit there and talk as if we were in a room together. Duplex operation. Those who remember those days will tell you how much fun it was. If you run into Walt WA6BMG, who used to be W2LBF, right around the corner from me in Brooklyn, ask about it.

So here we are 60 years later, still making stupid one-way transmissions. That's crazy. Sure the telephone started out that way, but they quickly invented duplex—so why haven't we? Not that it's very difficult. There are any number of ways we could do it, several of which I've discussed in past editorials. Nothing has happened. To which I say phooey.

Thirty years ago I set up one whale of a ham station high up on Mt. Monadnock. It was a corker! I had big rigs on the VHF bands, with a kilowatt AM rig on 2m and a 336-element beam which poked an S-7 signal down into North Carolina under even the worst propagation conditions. It was set up by the *73* crew and they did most of the operating in their personal time. No one was paid to operate, and we made no bulletin broadcasts or anything like that. It was just for fun.

The next thing I knew the labor board was all over me, claiming that the station could not legally be operated by any employees unless they were paid at least the minimum wage. I pointed out that this was completely illegal according to the FCC regulations. They pointed to W1AW. That was the first time I knew that the W1AW operators were being illegally paid. That's when one of the labor board people mentioned that the original complaint had come from the ARRL. Well, this was at the time when I'd started the Institute of Amateur Radio, which had the League very concerned. They seemed willing to spend whatever it took to put the IoAR out of business. Ask any old-timer about WARN, the Washington Amateur Radio News, which I was told was funded by the ARRL, and which seemed completely dedicated to attacking the IoAR.

The main purpose of the Institute was to provide legal funds to help amateurs fighting lawsuits which could affect us all. It was never intended to supplant any service the ARRL was providing. The IoAR did indeed fund several such suits and helped win some major ones. The hams involved were amazed when they discovered that the ARRL would not help cover their legal expenses when fighting tower and other such important cases.

The secondary aim of the Institute was to keep Congress aware of the services amateur radio was providing. This, again, was not being done by the ARRL. I had no interest in duplicating anything the League was doing, but the mere existence of the Institute was viewed by the ARRL as a danger which had to be eliminated.

I probably would have continued the IoAR had it not been for my first divorce. That really did a job on me emotionally. Yes, of course I should have known better, but when love comes in, reason flies out the window. So I found myself married to a very disturbed woman and spending tens of thousands of dollars on psychiatrists. This culminated when she threatened suicide and her doctor ordered me to put her in the state mental asylum.

I'd been publishing a VHF magazine (*6up*), a contest magazine (*5-7-9*), and a club newsletter editor's magazine monthly, printing them myself on a press which was set up in my garage. I was also putting together kits of parts to help the readers build our construction projects. So when the divorce hit, complete with the loss of my 1-1/2-year-old daughter Tully, I lost my steam. I folded the three small magazines, tried several times to hire hams to run the parts business, and turned the running of the Institute over to one of the directors. The new Institute secretary quietly cleaned out the sizable treasury I'd sent him, and that was the end of the Institute.

I started traveling to get my spirits up. In 1965 I visited hams in the Caribbean and went diving around the British Virgins and at Curacao. I made a trip to Sweden, Åland, Finland, Yugoslavia, Hungary, and Geneva. In 1966, with two other hams, I went on an African hunting safari, and then on around the world, getting on the air from all kinds of rare spots. Like Nepal, New Caledonia, Tahiti, Fiji, Kenya, Damascus, Afghanistan, Iran, and so on. When I got back, reinvigorated, and ready to move ahead, I found that the hams I'd left to run the magazine three months earlier had almost killed it. It was in a real mess.

It didn't help that the entire ham industry had collapsed in 1964 and 1965 as a result of the ARRL's so-called "Incentive Licensing" proposal to the FCC. That's the one that put 85% of the ham stores out of business in one year, 90% of the ham manufacturers, and closed down around 90% of the ham clubs.

The chap I'd left as the assistant publisher and editor had rifled our cash and done everything he could to put us out of business so he could help start *Ham Radio*. I'll tell you about that some time.

Baxter

So here we are in 1995 and we have two major ham broadcasting stations, W1AW and K1MAN. I've never listened to K1MAN, so all I've heard are tapes sent to me by angry hams who wish Baxter would stop what they perceive as his virtually endless ego-puffing baloney which ties up about 10

kHz of several ham bands for hours a day.

The more serious downside of this is that the irritated hams are turning in frustration to the FCC and even to Congress to try and stop what they see as an egomaniac from his endless self-promotion on our ham bands. I hope this won't burst any bubbles of optimism in your mind if I point out that the FCC Commissioners don't know beans about amateur radio, and don't care. Thus, if we make ourselves a nuisance over Baxter we could easily trigger the normal government response to problems: get rid of the complainers. Shoot the messenger.

Unfortunately we have no bullet-proof vest for amateur radio. Even a casual look at our regulations will tell you that the basis and purpose of amateur radio is pathetically out of date. We are permitted to keep our billions and billions of dollars of ham bands just because we've always had 'em and the FCC has never had an occasion to rethink why we exist.

I'm getting more and more letters from readers who are pointing out that QSOs via the Internet provide inexpensive interference-free solid contacts anywhere in the world. These contacts make amateur radio look like we are still using smoke signals. These contacts are generating international friendships faster than the ARRL's DX-CC is destroying them by forcing hams in rare countries off the air to avoid the hordes of QSL hunters.

Yes, we're still of use in some emergencies, but cellular telephones are rapidly putting us out of business in this area too. I've tried for years to get hams to develop high-speed message handling systems for use in emergencies, but many of the ARRL traffic nets are still poking along at 10 wpm or so, and messing up messages. Modern communications technology can throughput more words in a few hours than every amateur who has lived has transmitted in the last 80 years. But that's not good old-fashioned CW technology.

We are of no further use in time of war either as operators or technicians. Modern equipment is modular, so all anyone has to do is plug in replacement modules until the equipment works again. Most technicians today don't have to have a clue how anything works. Engineers? We're turning out a record low of them from our colleges. Indeed, over 50% of the graduating engineers from our colleges are foreign students.

One of the last things we want to do is irritate the FCC or Congress. So what can we do about some of the crazies we've let into amateur radio? Obviously the code test has totally failed us as a filter for crazies. Indeed, most of our more serious problems seem to be caused by Extra Class hams.

Okay, if we can't turn to the FCC or Congress to get hams like Baxter out of our hair, what can we do? How can we handle situations like this ourselves?

One group has semi-organized to fight fire with fire. They transmit on K1MAN's frequency (3975) on 75m for hours at a time on Sunday evenings, doing interviews with such Baxter unfans as Bill Pasternak and Hap Holly. I recently participated via phone patch and WO4TA for a two-hour stint. We had call-ins with comments and questions from as far as Boulder (CO). I could get addicted to that. It almost got me to thinking about putting up a tower, hanging a couple 75m dipoles from it, and dusting off my Henry 2K. That's the setup which used to put an S9 signal into Australia on 75m.

I've been thinking in terms of producing some 90-minute tapes to sell at hamfests where I haven't been invited to talk, and to see what I can turn out in the way of a syndicated broadcast band talk show, with me reviewing interesting books I've read, some of the better new CDs, and discussing proposed solutions for our social problems. Oh, I'll be pushing kids to get involved in ham radio too. That's one part of my proposed solution to our lousy school system.

While I was in Florida recently doing a report on the first patented cold fusion device, I came across a small audio mixer and cassette recorder. It was just what I've been looking for, so I snapped it up and brought it home. What would happen if I made tapes of things of particular interest to hams and sent them to maybe 20 participating hams with good solid kilowatt signals for regular broadcasts? Baxter is on 14,275, so we could take over 14,285 on 20m and 3985 on 75m.

And then the next chap with an itch for self-promotion could get a group of big signal hams to broadcast his stuff on 14,295, etc. I'll bet we could run ham bulletin nets all the way up to 14,315, perhaps wiping out the sludge on 313. We might even keep on going to 14,345!

Of course this would set up a desperate need for ham information to keep all these ham info broadcast nets going. I'll probably have to organize an information system which would deliver via the Internet.

We can even send music over these ham broadcast networks now. Digital audio is just data, and perfectly legal to transmit. Only when you get it you have to feed the data into a compact disc player instead of a computer, though most of the new computers have this fuction built in, making it easier. We can also send pictures and graphics via either slow-scan, fax, or some other protocol.

So, what do you think? Should we get upset over Baxter taking over 10 kHz on our bands for his gratification? Do any of you tune in and listen to him every day? Is he providing a valuable service? Is it more valuable than using his channel for regular contacts? And what do you think of Baxter sending notices to hams refusing to get off *his* channel a notice of felony? What do you think of the FCC fining him thousands of dollars and him refusing to pay?

Shall I start making tapes?

Work Ethic

Every time I read about the vaunted American work ethic I give an annoyed grunt. I've seen it at full

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strength all my life.

For instance, back during the early part of WWII while I was going to college I spent the summer working for G.E. in Schenectady (NY) testing transmitters for the Army. The old BC-191 and BC-375 kluges. That was my first job and it was my introduction to the American work ethic. And mind you, the whole country was fired up to produce for the war effort.

What I found was a bunch of people who were proud of thinking of better ways to waste time and do as little as possible. The Army called it "gold bricking," but the "workers" at G.E. felt they were beating the company when they figured a better way to put in their time without doing anything.

They really hated me. The people on the assembly line put the radios together and then a half dozen of us technicians would test them to make sure they were within specs, then we'd calibrate them. The other techs were taking their own sweet time, turning out four or five rigs a day. I worked up a head of steam and turned out a dozen or so a day. I had a contest with myself to see how many I could do.

The other techs got so angry with me actually working that they sabotaged some of the rigs I'd calibrated and then complained to the supervisor. Oh, oh, I was in trouble when they weren't calibrated right. I took a closer look and saw where the dials had been changed from my settings. I showed the supervisor where, when they were set, I'd marked them with red glyptol, indicating that the rig was in perfect calibration. Other than being threatened with arm breaking if I didn't slow down, I had no more problems.

Shortly after that I decided to join the Navy. There I found that, like the Army, gold bricking was a matter of pride in the Navy. Only those too dumb to get out of working had to work. I never subscribed to that philosophy. I picked the kind of work I wanted to do and loved doing it. I kept the radios, sonars, and radars on my submarine in top shape. While we were on war patrols I designed and built circuits to improve my equipment.

So here we are with a work ethic that isn't what we brag about. Employees in big companies, government, and the military are busy seeing how little they can do and get paid well for. They think people who actually have to work are dumb. These people generally do not make good employees for smaller companies, where individual productivity is important.

Management

While I'm trashing big companies and the military, let me also include management. When you are in a management position in a big company you have to be very careful and not make waves if you hope to be promoted. The same goes for government and the military.

If you have creative ideas, these will make waves and you will be frozen in your job or fired. Ideas come from troublemakers. You get to the top by never being controversial, and that means never expressing an idea. The result is that big businesses, government bureaucracies, and the military are being run by the survivors of this weeding-out process. This is why we so seldom see any intelligent admirals or generals, and why so many heads of big businesses are so dumb. Just look at how stupid GM chairman Smith was when faced with Perot.

Yes, there are some exceptions. But not many. I've met too many bigwigs and found very little hiding under their wigs. I'll tell you some time about when the president of Texas Instrument refused to listen to me and cost his company at least $50 billion dollars. I tried to get An Wang to recognize the changes microcomputers were going to make so his company could come out a winner. He said I was wrong. As did the president of Data General. And the president of Centronics, then the largest maker of computer printers in the world. Now the building is being used to make pancake turners.

The chairman of Tandy refused to listen, so I put my advice in my editorial, just to be on record. Sure enough, if he'd made the change I suggested, I believe Radio Shack would have made billions more in sales and would have been able to hold their 40% share of the market instead of dropping off the charts.

It wasn't that I was any genius, it's that I knew where the computer market was heading and these captains of industry didn't. I'd done my homework and they hadn't.

The Genius

Yes, I admit to being a genius. I'm sure someone will stab me with that admission by taking it out of context. If you remember, Edison said that genius was 99% perspiration and 1% inspiration. Or was it 90-10? Anyway, I'm the perspiration type of genius. I find that the more I read, talk with people, and so on, the more I tend to know. Pretty soon I know more than 90% of the people in that field. I usually stop at around 90% and make do because the next 9% can take a lifetime. I just like to know more than almost anyone else. That's fine.

Genius has little to do with brains or IQ. As one of the founders of American Mensa back in 1960, I've met thousands of Mensans. High IQs, yes. Successful in life or in business? Seldom. For the most part they are a bunch of snobby losers. Many of the early members were much more interesting, but they got fed up and dropped out. Success doesn't take much brain power. It doesn't even take much education. What it takes is persistence. So I read and read. I do my best to meet interesting people and talk with them. That's one reason I'm having so much fun in the cold fusion field, where I've found creative people who are fascinating to know.

Do you think it's time yet to fix our school system so it teaches the old-fashioned work ethic? 73

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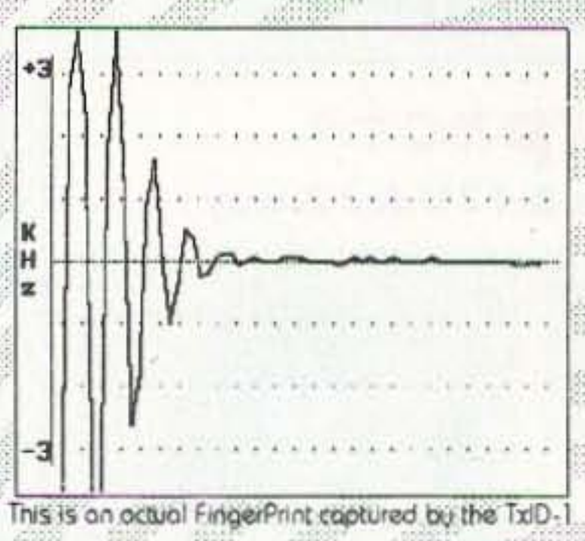

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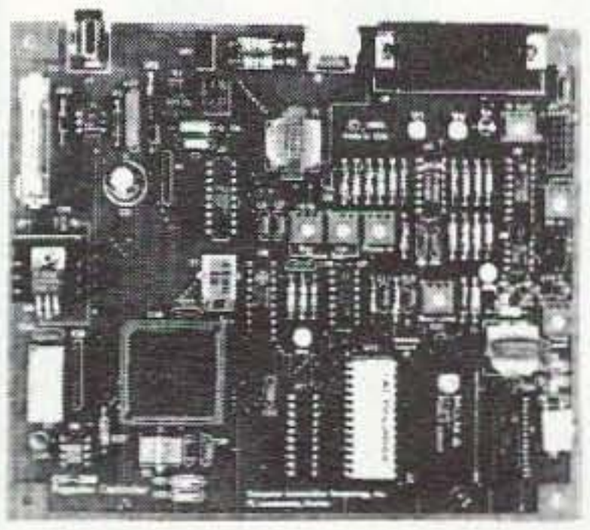

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MAY 6

CLEVELAND, OH Nat'l Expo's Electronics Fair (Hamfest/Computer Show/Flea Market) will be held 9 AM-3 PM at Emidio & Sons Center, 48 E. Bath Rd. & Old Rt. 8, State Rd., Cuyahoga Falls/Akron OH. Setup at 7 AM. Contact *Nat'l Expo, Inc., 30799 Pinetree Rd., Cleveland OH 44124. Tel. (216) 442-1776,* or *(216) 292-7744.* Reservation deadline is Apr. 25th. Please send an SASE w/payment. You may also pay by credit card; FAX info to *(216) 442-1776;* or *(216) 292-7746.*

ETOBICOKE, ONT. CANADA The Skywide ARC will host their annual Spring Hamfest/Flea Market 9 AM-1:30 PM at the Westway United Church, 8 Templar Dr. Vendor set-up 8 AM. Talk-in on 146.985 Rptr., Direct: 146.52. Contact *Gary Westhouse VE3NIT, (416) 233-2669;* or *Maury Scott VE3TEY, (416) 231-1816.*

MAY 6-7

AMARILLO, TX The Panhandle ARC will hold their Golden Spread Hamfest at the campus of T.S.T.C., just east of the airport, between I-40 and Hwy. 60. Talk-in on 146.940/.660. VE Exams Sat. Contact *Jerold R. Mc Cown, P.A.R.C. VP, P.O. Box 614, White Deer TX 79097-0614.*

MAY 7

LISBON, OH The Triangle ARC Hamfest will be held at Columbiana County Fairgrounds, 8 AM-3 PM. Talk-in on 146.70/.805 and 224.66. Contact *Dick Sisley K8JKB, 1218 Northside Ave., East Liverpool OH 43920-1642. Tel. (216) 385-1245; Packet: Rodney N8WML @ KB8JNM#EOH.OH.USA.NA.*

MAY 13

MANITOWOC, WI The Lakeshore Hamfest, Electronics & Computer Swapfest will be held at Manitowoc County Expo. Doors open at 8 AM. Setup Fri. night, May 12th till 10 PM., or early Sat. morning. VE Exams. Contact *Glen, (414) 684-7096, anytime;* or *Red, (414) 684-9097 days.* Talk-in on 146.61(-) or 147.03(+). VE Exams for all classes at Silver Lake College (Hwy 151). Test registration closes at 9 AM. Please make checks payable to Mancorad Radio Club and send w/SASE to *P.O. Box 204, Manitowoc WI 54221-0204.*

SPRINGHILL, LA The North LA/South AR Hamfest will be held at the Civic Center, North Main St., 8 AM-2 PM. VE Exams. Swap Tables. Talk-in on 147.165 and 146.730. For info and reservations, write *N5NSX, 605 5th NE, Springhill LA 71075. Tel. (318) 539-4167.*

MAY 14

HAGERSTOWN, MD The Antietam Radio Assn. will present "The 1995 Great Hagerstown Hamfest" at Hagerstown Jr. College Athletic and Rec. Center, 8:30 AM-3 PM. Tailgate Spaces available on a first come-first served basis. For Flea Market spaces and info, call *Fred Bailey N3HTN, (301) 416-8079;* or *(301) 714-0688.* VE Exams by the Mountain ARC VEC. Pre-reg. appreciated. For Exam info, call *(304) 289-3576.*

LAUREL, IA The C.I.R.A.S. will hold a Hamfest at Marshalltown Comm. College (on Hwy 14), 8 AM-4 PM. Reg. for VE Exams 10 AM-Noon; testing starts at 11 AM. Contact *C.I.R.A.S., P.O. Box 184, Laurel IA 50141.*

MEDINA, OH The Medina County Comm. Center, 735 Lafayette Rd., is the location for the "Medina County Hamfest '95." The Medina 2 Meter Group, Inc. will sponsor this event 8 AM-1 PM. Ham, Computer, and Electronic Equip. Mobile Check-in on 147.63/.03 K8TV/R. Contact *Medina Hamfest Committee, P.O. Box 452, Medina OH 44258. Tel. (216) 725-4492, 10 AM-5 PM.*

WHEELING, WV The 18th annual Wheeling Hamfest/Computer Show will be held at Wheeling Pk., Rte 40. Setup at 6 AM. General admission 8 AM-3 PM. Flea Market. Contests. Banquet. World's largest telegraph key. Contact *TSRAC, Box 240 RR 1, Adena OH 43901. Tel./FAX (614) 546-3930.*

MAY 19-21

ROCHESTER, NY The 61st annual Rochester Hamfest/Computer Show, combined with the Atlantic Div./NY State ARRL Conv., will be held at Monroe County Fairgrounds, Rte 15A and Calkins Rd. Radio and comm. equip., computer equip., and supplies. Setup Fri. May 19th at 6 AM. Indoor exhibits open at 8:30 AM each day. Hotel accommodations at the *Marriott Thruway Inn, (716) 359-1800.* Mention "Hamfest" when making reservations. Send ticket requests to *Irv Goodman AF2K, 515 Drumm Rd., Webster NY 14580.* Make checks payable to Rochester Hamfest. For info, call the Rochester Hamfest office, *(716) 424-7184* during weekday business hours. For a brochure, call or write: *Rochester Hamfest, 300 White Spruce Blvd., Rochester NY 14623.*

MAY 20

CADILLAC, MI The Wexaukee ARC will hold their annual Hamfest and Eyeball QSO at the Cadillac Middle School starting at 8 AM. Talk-in on 146.98. For

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info on tables, contact *Dan KE8KU, (616) 775-0998,* or *W.A.R.C., P.O. Box 163, Cadillac MI 49601.*

COLORADO SPRINGS, CO The Pikes Peak RAA will hold a ham radio Swapfest 8 AM-3 PM at Liberty H.S., 8720 Scarborough Dr., off Research Pkwy. Talk-in on 146.97/.52. For general info, call *Harv Hunter WA3EIB, (719) 597-8964.* VE Exams start at 9 AM. Bring current license (orig. & one copy), picture ID, and a check for $5.90. For info, call *Rick Brown KD0SU, (719) 531-9423.* Send SASE with a check payable to PPRAA to *Harv Hunter WA3EIB, 1437 N. Chelton Rd., Colorado Springs CO 80909. Tel. (719) 597-8964.*

EPHRATA, PA The Ephrata Area Rptr. Soc. will hold their 10th annual Hamfest starting at 8 AM at the Ephrata Sr. H.S., 803 Oak Blvd. Talk-in on 145.45. VE Exams. For advance reservations and info, write to *E.A.R.S., Inc., Clearview Ave., Ephrata PA 17522;* or call *Tom K3RZF at (717) 336-2514, after 6 PM.*

FESTUS, MO The Jefferson County ARC will hold a Cavefest, rain or shine, starting at 7 AM. Set-up Fri., May 19th, Noon-11 PM; Sat., May 20th, 4 AM-7 AM. Cave provided by Russ Bauman. Electronic/Radio/Computer Swapfest. VE Exams by pre-reg. Talk-in on 147.075, 224.040 and 442.500. For reservations, send payment with SASE to *Herb Metts, P.O. Box 232, House Springs MO 63051. Tel. (314) 671-0667.*

FORESTDALE, RI The Rhode Island Amateur FM Reptr. Serv., Inc. will hold their annual Spring Auction/Flea Market at VFW Post 6342 on Main St. The Flea Market opens about 8 AM. There will be an auction 11 AM-3 PM. Talk-in on 146.76. Contact *Rick Fairweather K1KYI, 144 Parkview Dr., Pawtucket RI 02861;* or call *(401) 725-7595, 7 PM-8 PM.*

PADUCAH, KY The Paducah ARA will hold its ARRL Major Event "Dukefest" at the Cherry Convention Center starting at 8 AM. Setup at 6 AM. Flea Market; Reserve tables early. Forums. VE Exams. Contact *David Fraser KQ4IU, 5715 Blandville Rd., Paducah KY 42001. Tel. (502) 554-7999.* Talk-in on 147.060.

MAY 20-21

DAYTON, OH Trade Show Productions, Inc. will hold the Cincinnati Computer Fair at Cincinnati Gardens, 2250 Seymour Rd., Cincinnati OH. Time: Sat. 10 AM-5 PM; Sun. 10 AM-3 PM. For booth sales and info, call *(513) 263-3378.* Make checks payable to *Trade Show Productions, Inc.,* and mail to *Mark Hanslip, 143 Schloss Ln., Dayton OH 45418.*

MAY 21

CAMBRIDGE, MA A Tailgate Electronics/Computer/Amateur Radio Flea Market will be held 9 AM-2 PM at Albany and Main Sts., by the MIT Radio Soc. and the Harvard Wireless Club. For reservations and info, call *(617) 253-3776.* Mail advance reservations before May 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082.* Talk-in on 146.52 and 449.725/444.725 pl 2A, W1XM/R.

WOODBURY, NY A Hamfest will be held at Briarcliffe College, 250 Crossways Pk. Dr., 9 AM-3 PM, by the Long Island Mobile ARC. VHF Tune-up Clinic. VE Exams 9:30 AM-10:30 AM. Talk-in on 146.25/.85. No advance tickets or tables. For more details, call *Neil Hartman WE2V, (516) 462-5549,* or *Mark Nadel NK2T, (516) 796-2366.*

MAY 26-28

TULSA, OK Maxwell Convention Center, Exhibit Hall A, W 7th St., between Denver Ave. & Houston Ave., is the location for the 1995 Green Country Hamfest & ARRL Oklahoma State Convention. Flea Market. Banquet ($20 advance reservation required). VE Exams Sat. & Sun. Forums. Storm Spotters meeting sponsored by the Nat'l Weather Service. ARRL meetings. Activities for non-hams. Talk-in on 146.88. Open autopatch on 145.27 during the event. Special hamfest discount at Double Tree Hotel across the street. Write to *Green Country Hamfest, Inc., P.O. Box 470132, Tulsa OK 74147-0132.* Dealers call *Charlie, (918) 241-4214.* For general info, call *(918) 272-3081; leave msg.* Also E-mail:*Merlin WB5OSM via Compuserve 73564,1063.*

MAY 27

DURHAM, NC The Durham FM Assn. will hold its 21st annual Hamfest/Computer Show at the South Square Shopping Mall, Highway 15-501 South and Chapel Hill Blvd., 8 AM-3 PM. Setup at 6:30 AM. VE Exams at 10 AM, pre-reg. requested. Exam contact is *Dave Snyder N2MLU, 600 S. Churton St. #64, Hillsborough NC 27278. Tel. (919) 644-8681.* Talk-in on 147.225(+600) and 145.45(-600). For Flea Market info, contact *Rodney Draughon KD4KMI, RT 4, Box 205, Rougemont NC 27572. Tel. (910) 364-7420.*

MAY 27-28

CASPER, WY The Wyoming State ARRL Hamfest will be sponsored by the Casper ARC Inc. Location: The Parkway Plaza, just off Interstate 25 and Center St. Banquet Sat. night. For details, contact: *C.A.R.C. Inc., W7VNJ, P.O. Box 2802, Casper WY 82602;* or *Steve Spier N7JUO, 3511 Swanton Ave., Casper WY 82604, Tel. (307) 265-6575;* or *Jim Boyer N7VLM, 2904 Meadow Dr., Casper WY 82604. Tel. (307) 237-0744.*

MAY 28

BALTIMORE-WASHINGTON, MD The Maryland FM Assn. will hold their annual Memorial Day Hamfest at the Howard Co. Fairgrounds, MD RT #144, West Friendship MD, from 8 AM-3 PM. Table reservations paid in advance only. Contact *Melvin Seyle WA3KZR, 15809 Pointer Ridge Dr., Bowie MD 20716. Tel. (301) 249-6147.* Talk-in on 146.76, 224.76, and 444.00.

CHICAGO, IL The Chicago ARC will hold its annual Hamfest at DeVry Inst. of Tech., 3300 N. Campbell, 8 AM-3 PM. Setup at 6 AM. Talk-in on 147.255(+), 444.825(+). Outdoor Swapfest. For


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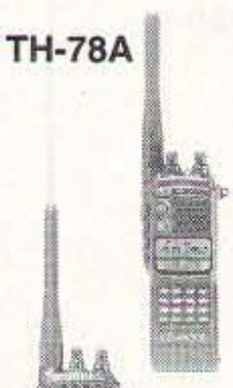
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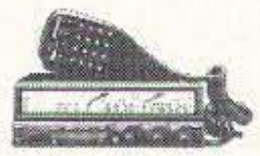
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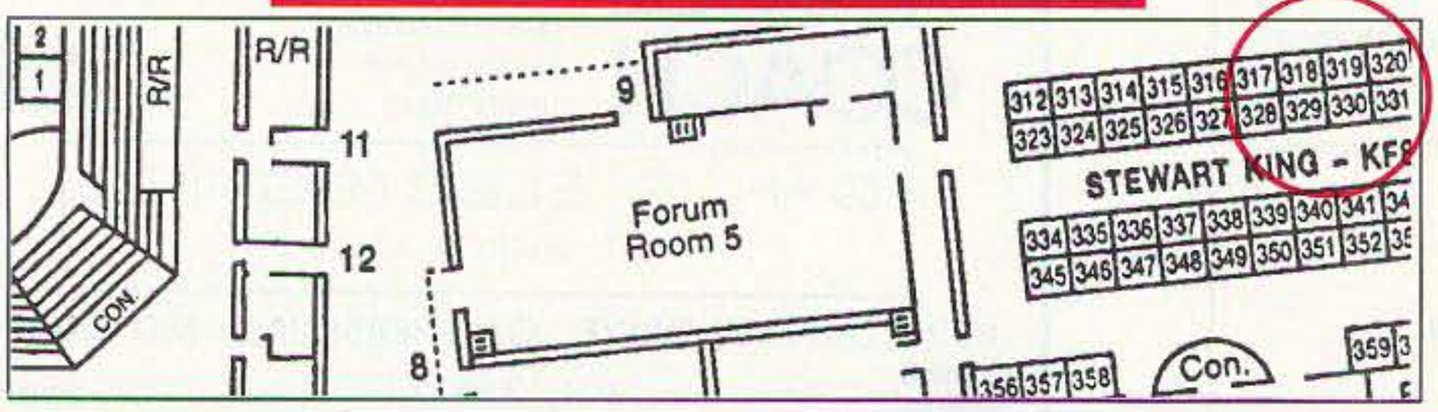

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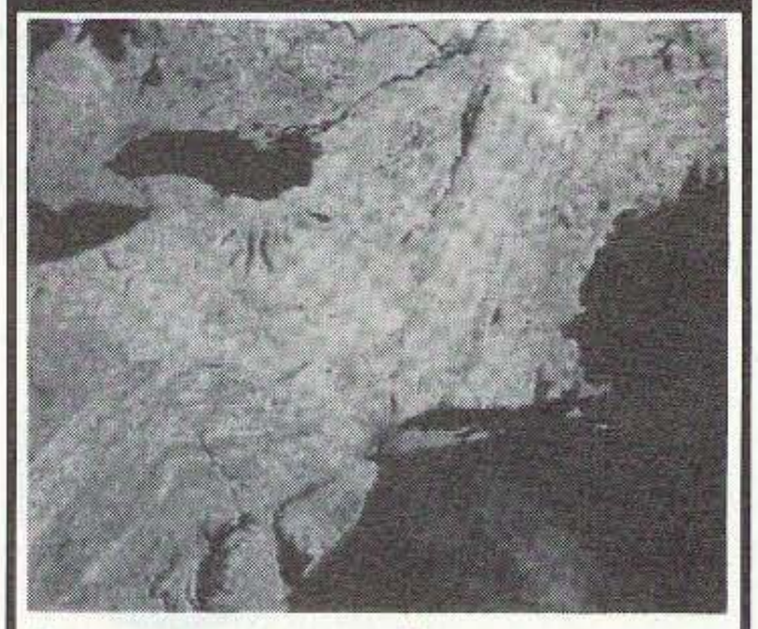

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SOREL-TRACY, QUEBEC, CANADA The Quebec Hamfest will be held in Sorel-Tracy at the Curling Club. For more info, write to *Club Radioamateur Sorel-Tracy, C.P. 533, Sorel, Quebec J3P 5N6, Canada.*

JUNE 3

GRAND RAPIDS, MI The annual IRA Hamfestival will be held at the Hudsonville Fairgrounds, 5 mi. west of Grand Rapids. Doors open at 8 AM. Setup at 6 AM. VE Exams at 8:30 AM, walk-ins only. Talk-in on 147.16 link Rptr. system. Book reservations early. Contact *Tom KA8YSM,* or *Kathy KB8KZH, (616) 698-6627;* or write to *IRA, 562 92nd St. SE, Byron Center MI 49315.*

KITCHENER, ONTARIO, CANADA The 21st annual Central Ontario Amateur Radio Fleamarket will be held at Bingeman Pk., 1380 Victoria St. North, starting at 8 AM. Setup at 6 AM. Talk-in on 146.97(-) and 145.21(-). For tickets and tables make checks payable to Central Ontario Amateur Radio Fleamarket, and send to *Ted Eaton VE3GJE, 102-21 Woodlawn Rd., E., Guelph Ontario N1H 1G6, Canada. Tel. (519) 823-1027. Packet: VE3GJE@VA3RWP. #SWON.ON.CA.NOAM. Internet:eeaton @uoguelph.ca.*

TEANECK, NJ The Bergen ARA will hold its annual Spring Hamfest at Fairleigh Dickinson Univ. Technical Seminars. ARRL Forums. VE Exams; call *Bob Neukomm, (201) 427-3568 before 10 PM.* For Hamfest info call *Jim Joyce, (201) 664-6727.*

WILMINGTON, NC The 3rd annual Ham Radio/Computer Equip. Seafest will be held by the Azalea Coast ARC at Trask Coliseum at UNCW, 9 AM-3 PM. Talk-in on 147.180(+). VE Exams by ARRL-VEC; walk-ins welcome. Bring picture ID, copies of certificates and current license. Testing is scheduled for 10 AM; for info contact *Sam Franklin KB4IL, (910) 791-0484.* For general info, contact *A.C.A.R.C., P.O. Box 4044, Wilmington NC 28406. Tel. (910) 686-4325 nights.*

JUNE 4

BUTLER, PA The 41st Breezeshooters' Hamfest will be held 8 AM-4 PM on the Butler Farm Show grounds. Talk-in on 147.96/.36. To reserve Flea Market tables, send check for $15 per table and an SASE to *Rey Whanger W3BIS, 5530 Cove Run Rd., Cheswick PA 15024-9451.* For General info call the *Breezeshooters' Hotline at (412) 828-3694.*

CONTOOCOOK, NH A Flea Market will be held by the Contoocook Valley Radio Club, 8 AM until ?? For details call*(603) 224-3899,* or *(603) 746-4817.* Talk-in 2m 146.895(-) or 146.94(-), and 52 simplex.

PRINCETON, IL The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds, starting at 6 AM. Flea Market. Camping. Talk-in is on 146.355/.955. Contact *Bruce Burton KU9A,* or *Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Tel. (815) 795-2201.*

SPECIAL EVENT STATIONS

MAY 6

CHANCELLORSVILLE, VA The Mt. Vernon ARC will operate NJ4F from "no man's land" on the original battlefield, to commemorate the 132nd Anniversary of the Civil War Battle of Chancellorsville. Operation will be in the General portion of the 40 and 20 meter phone bands. For a certificate, send QSL and SASE to *MVARC, P.O. Box 7234, Alexandria VA 22307 USA.*

KEYPORT, WA The North Kitsap ARC will operate WO7B 1600Z-2400Z to commemorate the opening of the Mines and Torpedoes exhibit at the Naval Undersea Museum. Operation will be in the lower end of the 40, 20, 15, and 10 meter bands. For a QSL, send QSL and SASE to *Robert J. Tomas N7KTP, 38119 Vista Key Dr. NE, Hansville WA 98340 USA.*

MAY 6-9

FLOYD, VA The Foundation for Amateur Internat'l Radio Service (FAIRS) will operate KK4WW, US5WE, UA4LCQ, 8R1WD and S21AM in their own countries 1400Z May 6th-1400Z May 9th, to celebrate the 4th Anniversary of FAIRS. Operation will be in the General portion of 40, 20 and 15 meters. For a certificate, send QSL and a 9" x 12" SASE to *FAIRS, P.O. Box 341, Floyd VA 24091 USA.*

MAY 7-21

HOLLAND, MI The Holland ARC will operate K8DAA to celebrate Tulip Time. Operation will be in the lower portion of the General 20 and 15 meter subbands, and at 28.400. For a certificate, send QSL with call signs worked, and a 9" x 12" SASE to *Barbara Siebelink N8NXA, 6418 Otis Rd., Saugatuck MI 49453 USA.*

MAY 20

KODIAK ISLAND, AK The US Coast Guard ARC will celebrate Armed Forced Day by operating KL7HKX in the General class bands. Look for operators on the 20m band on 14.260 (IOTA frequency). To receive the Coast Guard ARC QSL card, use the following QSL info: *S/A/S/E please or via ARRL Bureau, United States Coast Guard ARC KL7HKX, P.O. Box 190421 USCG, Kodiak AK 99619-0421 USA.*

MAY 20-21

SAN BERNARDINO, CA The Citrus Belt ARC will operate W6JBT 1700Z May 20th-1700Z May 21st, to commemorate the Civilian Conservation Corps. activity in the San Bernardino Nat'l Forest 62 years ago. W6JBT will operate in the General portion of the 80 to 15 meter phone, Novice 10 meter phone subbands, and 2 meter packet. For a certificate, send QSL and 9" x 12" SASE to *W6JBT, P.O. Box 3788, San Bernardino CA 92413 USA.*

MAY 20-22

OAK PARK, MI The 1995 Michigan QSO Party will be sponsored by the Oak Park ARC. Operations will be 1800Z Sat., May 20th-0300Z Sun., May 21st; and 1100Z Sun., May 21st-0200Z Mon., May 22nd. Frequencies: CW - 1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125. Phone - 1855, 3905, 7280, 14280, 21380, 28480. Contact *Jeffrey Albrecht N8WRY, 16193 Locherbie, Beverly Hills MI 48025* regarding logs; or *Oak Park ARC, 14300 Oak Park Blvd., Oak Park MI 48237 USA,* for rules.

MAY 22-27

VAN ALSTYNE, TX Amateur astronomers/Hams representing the southwest region of the Astronomical League will be operating Station K5GH at the 17th annual Texas Star Party. Operation will be +/- QRM: 28365, 21365, 14265 and 7265. SSTV and CW contacts on request. For an astronomical theme QSL card, send QSL/SWL report and SASE to *K5GH-TSP, 2619 Bordeaux, McKinney TX 75070 USA.*

MAY 27-28

CLARE, MI The Clare County ARES/RACES group AA8KP will operate 1200Z-0000Z to commemorate the 11th Wildlife Festival of Clare County. Operation will be in the lower portion of the General bands 15—80 and Novice 10 meter voice. For a certificate, send QSL and a 9" x 12" SASE to *Clare County EC, P.O. Box 262, Farwell MI 48622-0262 USA.*

SUMTER, SC The Sumter ARA will operate their annual Iris Festival Station, KQ7E, from the world famous "Iris Gardens," 2 PM EDT on the 27th-2 PM EDT on the 28th. Listen for them on the Lower 30 kHz on the General portions of 75, 40, 20, and on 28.300 thru 28.500. For a certificate, send $1 to *The Sumter ARA, P.O. Box 193, Sumter SC 29150 USA, ATTN: Special Event.*

VICKSBURG, MS The Vicksburg ARC will operate N5QDE in conjunction with the Reenactment of the Siege of Vicksburg Civil War Battle. Operation will be in the General phone portions of 40, 20, 17, and 15 meters, and 28.465. For a special QSL card, send QSL and SASE to *Ed Magruder, 2485 Warrenton Rd., Vicksburg MS 39180 USA.*

MAY 29

ELGIN, IL The Elgin ARS will operate W9IKN to commemorate the annual running of the Valley Fox Trot 10 mi. race. Operation will be 1200Z-1700Z in the lower portion of the General subbands, on SSB and CW. 6 meters SSB, propagation permitting. For a certificate, send QSL and Business size SASE to *E.A.R.S., P.O. Box 1351, Elgin IL 60123-1351 USA.*

JUNE 4

PLYMOUTH, CT Radio amateurs in Plymouth will operate designated stations to celebrate the bicentennial of the Town of Plymouth. A limited number of special certificates are being made available by the *Bicentennial Committee* to commemorate the contact. Operation will be in the General portions of 160, 80. 40, 20, 15, and 10 meters as propagation allows. QSL with an SASE to *K1EM, P.O. Box 12, Pequabuck CT 06781 USA.* Include a shipping container large enough to hold the 9 1/4" x 13 3/4" certificate, or a No. 10 business envelope for a folded certificate; along with sufficient return postage.

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Word is spreading fast- "Nothing matches the KRP-5000 for total performance and value. Not GE, not even Motorola."

RF performance really counts in tough repeater environments, so the KRP-5000 receiver gives you 7 helical resonators, 12-poles of IF filtering, and a precise Schmitt trigger squelch with automatic threshold switching. The transmitter gives you clean TMOS FET power.

Enjoy high performance operation with remote programmability, sequential tone paging, autopatch, reverse autopatch, 200-number autodial, remote squelch setting, status inputs, control outputs, and field-programmable Morse messages.

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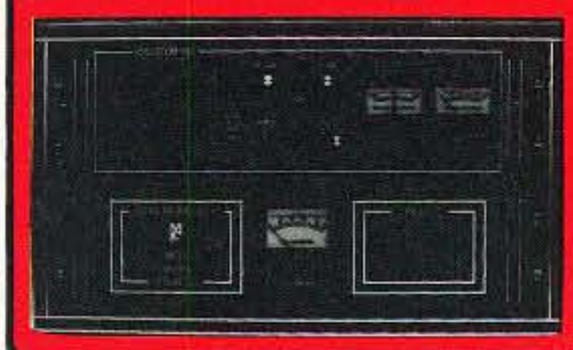

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NEW PRODUCTS

Compiled by Mike Nugent WB8GLQ

BOYD ELECTRONICS

Boyd's new RW Series receivers offer an excellent means of setting up a low cost station for QRP operation on 20, 30, 40, and 80 meters.

True superheterodyne direct conversion receivers, they provide excellent frequency stability, with no drift during operation.

The single circuit board features the NE602 mixer IC, popular among amateur receiver builders. An easily adjustable two-stage input preselect filter reduces out-of-band and harmonically related signals, and with an approximate 0.1μV sensitivity, even the weakest CW, SSB, and AM signals can be heard. An input RF GAIN control following this filter reduces overloading from strong nearby stations.

A six-pole audio bandpass filter with a low frequency cutoff of 250 Hz and high frequency cutoff of 2 kHz reduces hum and low frequency noise, and provides good station separation. The LM380 audio amplifier IC assures excellent audio quality and up to 2.5 watts of audio power when used with an 18V power supply.

The receiver oscillator is isolated by a buffer amplifier and provides an external counter for monitoring the receiver's frequency.

The circuit board and front panel adhesive decal are designed to be used with the Radio Shack 270-253 cabinet. Cabinet, power supply adapter, knobs, power switch, connectors, and hardware are not supplied but are available from Radio Shack.

For more information, contact *Boyd Electronics Co., 1998 Southgate Way, Grants Pass, OR 97526; (503) 476-9583.* Or circle Reader Service No. 201.

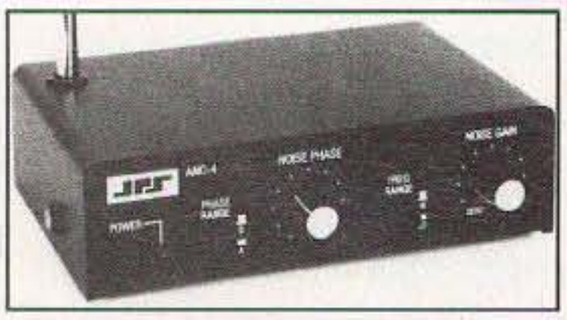
MICROTEK

Ever wish your Ramsey FX146 2 meter radio had some commercial-rig-style bells 'n' whistles? Well, with the RC2 Radio Controller add-on from Microtek, it will.

It'll have a 12-button keypad, 7-segment LED display, 20-channel memory, fast scanning (100ms/channel), direct entry of any frequency from 140.000 to 179.995 MHz, and the ability to set standard repeater offset with the push of a button.

The RC2 comes with a 68HC11 microcontroller board that plugs into the radio's PLL socket, a display board that houses the display, keypad, status LEDs, and a new front panel. The only wiring needed is +12V, GND, CD (carrier detect), and PTT, all of which are easily tapped off the radio. The RC2 uses the radio's original volume and squelch controls, and mike and speaker jacks. The main board and display board connect via a 26-conductor ribbon cable, and everything is designed to fit into the original case.

The price is $110 plus $4 S&H (VA residents add sales tax). For more information, contact *Microtek, RR3 Box 4361, Bumpass, VA 23024; (703) 872-7020.* Or circle Reader Service No. 205.



JPS COMMUNICATIONS

From JPS Communications, Inc. comes the new ANC-4 Antenna Noise Canceller. Installed at your receiver/transceiver's antenna connector, this RF device cancels locally generated noise (power line noise, computer/TV noise, electrical noise from local machinery, etc.) from signals received by a primary antenna.

By removing the noise before it gets into the receiver and affects the receiver's AGC circuits, it allows reception of signals well below the noise level induced by the interference.

It works by detecting the local interference signal, matching its amplitude but reversing its phase, thereby cancelling the interference. Front panel controls provide phase and amplitude adjustment, for extremely deep cancellation of the offending signal.

The unit works with any receiver/transceiver with up to 150W PEP output power. A built-in RF detector automatically bypasses the unit whenever transmit RF is detected. (For use with a high power linear amplifier, the unit must be installed at the lower RF level of the transceiver, if transmitting is anticipated.)

The ANC-4 connects between the main station antenna and the receiver/transceiver's antenna connector. A short wire antenna and a short collapsible whip are supplied with each unit to act as a noise pickup antenna. If no main station antenna is available, the ANC-4 can function as an active antenna by plugging the noise antenna (or a longer wire antenna) into the noise antenna jack and using the NOISE GAIN control to increase the antenna output. The unit requires 12VDC @ 300 mA. Adapters are available from JPS.

For more information, contact *JPS Communications, Inc., PO Box 97757, Raleigh, NC 27624-7757; (919) 790-1011, FAX (919) 790-1456.* Or circle Reader Service No. 202.

TELEX COMMUNICATIONS

Telex introduces the DCU-1 Pathfinder, a state-of-the-art Digital Control Unit for Hy-Gain antenna rotators. Designed to be used with the Ham IV and T2X Tailtwister, it is also backwards compatible with any 8-wire Hy-Gain rotator, such as the Ham II or Ham III.

Featuring digital bearing readouts to 1 degree, motor slowdown and eight-second automatic brake delay, it also offers automatic calibration and selectable center of rotation.

Six programmable memory presets let you program favorite beam headings, highly desirable for contesting, DXing, and VHF/UHF work. You can easily re-set the memories at any time.

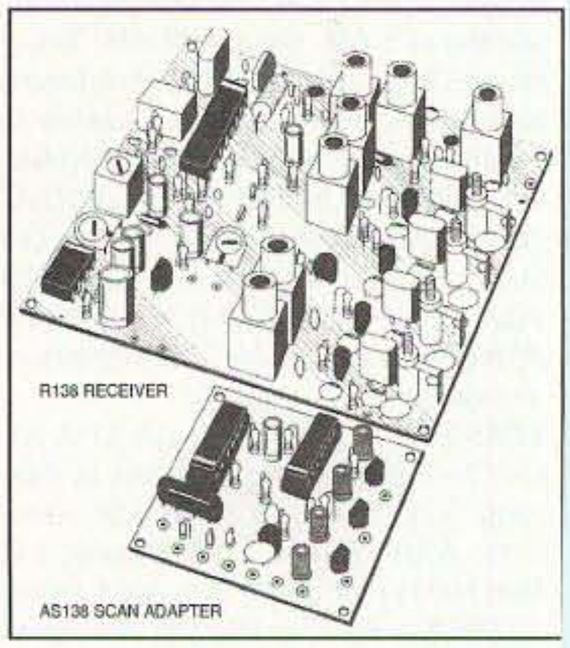
RS-232 compatibility allows rotator control from your computer, and a serial pass-through capability lets you connect your radio, terminal TNC, modem, etc., to this serial port. A 60-line BASIC control program comes with the manual, and a free information package for software developers is available from the factory.

The DCU-1 and rotator are available in both 110 VAC and 220 VAC versions, operating on 50/60 Hz.

Suggested retail price for the T2X (DCU-1 and T2X Tailtwister) is $799.99, for the Ham IV-D (DCU-1 and Ham IV) $749.99, and the DCU-1 by itself is $519.60. Interested amateurs should contact their favorite Hy-Gain dealer for price and availability information.

For more information contact *Telex Communications, Inc., PO Box 5579, Lincoln, NE 68505; (402) 467-5321, FAX (402) 467-3279.* Or circle Reader Service No. 203.

HAMTRONICS



It is well known that Hamtronics, Inc. makes a very effective wideband FM receiver module for 137 MHz weather fax reception. The new R138 Receiver now has a companion accessory, the AS138 Scan Adapter Module.

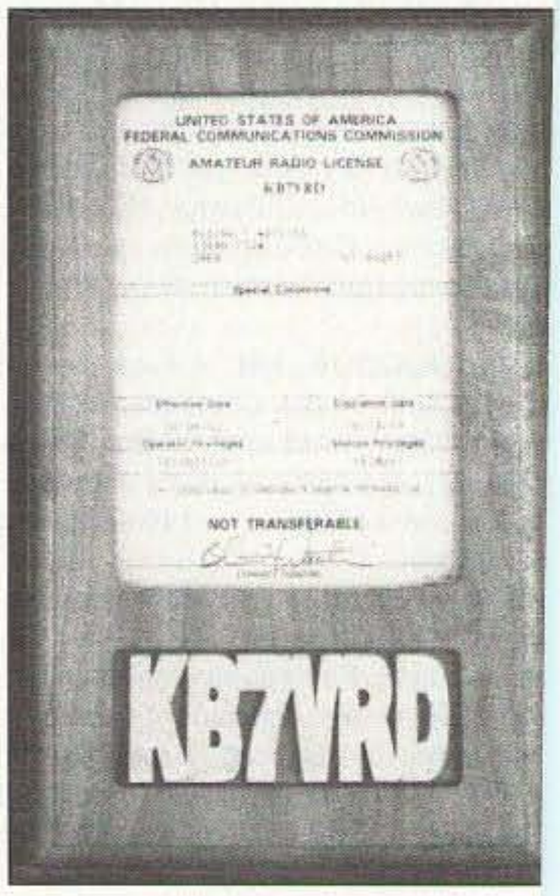
The crystal-controlled R138 Receiver has four channel oscillators. You select a particular satellite simply by grounding the desired control line with an external switch. Crystals, available for all the common satellites, simply plug into sockets on the board.

The new AS138 Scan Adapter lets you monitor the various weather satellites while you're away from the shack. Consisting of a small PC board, it continually monitors the receiver, scanning the four channels. If it hears an active satellite overhead, the scanner stops on that channel and turns on a relay. The relay can be used to activate a tape recorder, letting you play back the tape into your demodulator unit whenever you have the time to reproduce the satellite images on your computer.

At only $129, the R138 Receiver kit is quite a bargain. It is also available wired and tested for $189. The AS138 Scan Adapter Module is $39 in kit form, $69 wired and tested. Channel crystals are only $12 each, making this channelized approach much less expensive than synthesized receivers, even if you need to buy several crystals for the satellites you want to hear. And you'll get a lot of satisfaction doing the assembly yourself.

For more details, contact *Hamtronics Inc., 65-F Mould Rd., Hilton, NY 14468 9535; (716) 392-9430, FAX (716) 392 9420.* Or circle Reader Service No. 206 Please tell them where you saw this announcement.You will receive a complete data sheet, including preamps and helical resonator filters for the 137 MH band. They also have copies of the *Weather Satellite Handboook.*

SHACK ATTACK



Display your amateur radio license in style, with this Callsign License Plaque. Handcrafted from alderwood and hand-finished with two coats of polyurethane gloss for a beautiful, natural appearance, this handsome dark wood plaque is a great way to meet FCC Section 97.3 station license requirements while enhancing the looks of your shack.

This 7.25" x 12" plaque includes a 5" x 7" clear Plexiglas cover for your license, cardboard backing, self-leveling picture hanger hardware, and—of course—your callsign inset below in large 2" pine letters.

The Callsign License Plaque is available for $19.95 plus $3.50 S&H. For more information, contact *Shack Attack, 1394 N 770 W, Dept. 49, Orem, UT 84057-5903; toll-free (800) 573-7388; E-mail: kb7vrd@aol.com.* Or circle Reader Service No. 204.

Number 27 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Joyce Bocash, *73 Magazine*, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

The deadline for the July 1995 classified ad section is May 11, 1995.

ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios. $9.95 each, ppd USA. Send to: **ALLABOUT BOOKS**, Dept. S, P.O. Box 22366, San Diego CA 92192. BNB200

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INCREDIBLE DX SITE for individual or ham club in Northern Virginia. ONE OF A KIND!! Fully furnished 2 bedroom cabin with 40' x 15' deck overlooking Shenandoah Valley. 3.5 acres MOL on top REPEAT on top of Blue Ridge at 2100'. Convenient, easy access, one hour west of DC & Dulles Airport. Half down, will finance balance. Serious Buyers only. **DICK KD4ATB**, 813-347-5444. BNB235

1995 Nationwide Hamfest List & News Letter. $5 ppd. "Hamfests '95" **Box 607, Hatboro, PA 19040** **BNB245**

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Continued on page 82

Number 28 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

Special Forecast This Month

Ma Nature seems to have conspired this month to make every weekend of the month Poor (P) or Fair (F) or trending to either of these conditions. Blend that with the general movement away from Spring Equinox (good) to Summer Solstice (poor) for the HF bands, and you have a mix that will conspire to make you really work for the DX. Add to that gloomy outlook the rapid decline of Sunspot Cycle 22 to its expected nadir at the end of this year or early in '96, and you have "band conditions" that haven't been so bad since the last Cycle 21 at about this time in its progress.

However, that doesn't mean there won't be any DX at all . . . it just means you'd better sharpen your skills in these areas: weak-signal copy, careful listening at *all* times, and close attention to WWV and their forecasts at 18 minutes after each hour. I use the 10 MHz frequency because of its convenience and the usually good signals here.

On the *plus* side, you may well find Sporadic E propagation on some days as high as 10 meters, with strong skip signals suddenly fading. Also, even on a dead-sounding band, you ought to give at least one or two CQs, as results could be very surprising.

For this month, those who are retired, or have weekdays available, will do better than those who can operate only on weekends. Don't give up . . . better times are ahead . . . but you may have to wait a few years.

10 and 12 Meters

Occasional F2 openings to the Southern Hemisphere during daylight hours. The bands close at sunset.

15 and 17 Meters

Consistent openings to Africa and Latin America, and short skip to about 1,000 miles during daylight. Bands close at sunset or shortly after.

20 Meters

Your best band for DX to all areas of the world between sunrise and well past sunset, and short skip to 2,000 miles during daylight hours.

30 and 40 Meters

Good DX from slightly after local sunset to just before local sunrise. Signals from the east peak between sunset and midnight, and from all other areas between midnight and sunrise. Daytime short skip to 1,000 miles, and nighttime skip to 2,500 miles.

80 and 160 Meters

Good DX from sunset to sunrise on nights of low atmospheric noise, and skip to 2,000 miles or so. Requires vertical transmitting antennas and horizontal (preferably Beverage) antennas for best results on receiving. Little, if any, daylight activity on 160, but some on 80 meters. 73

MAY 1995

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G-F	2 F	3 F-G	4 G	5 G-F	6 F-P
7 P	8 P	9 P-F	10 F	11 F	12 F-P	13 P
14 P-F	15 G	16 G	17 G	18 G	19 G-F	20 F
21 F	22 F-G	23 G	24 G-F	25 F-P	26 P	27 P
28 P-F	29 F-G	30 G	31 G			

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WESTCOAST			80	80	40	40	40	20	20	20		

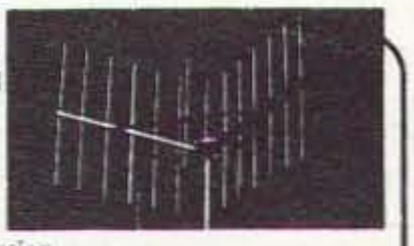
CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

CornerBeam?



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  - Software contains monitor function with optional disk logging of all DTMF activity.
  - Software supports detailed printing of all setup parameters.
  - Simple serial interface to com1or com2 of a PC for downloading setups *(setup download parts included).*
  - The last setup downloaded is saved to disk in-between setup sessions.

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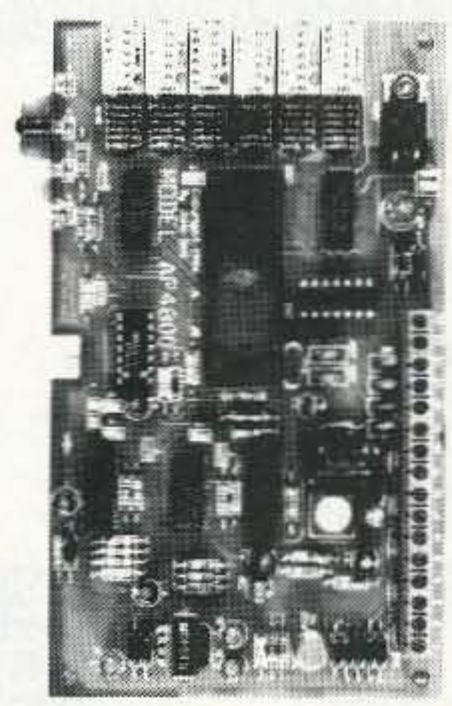

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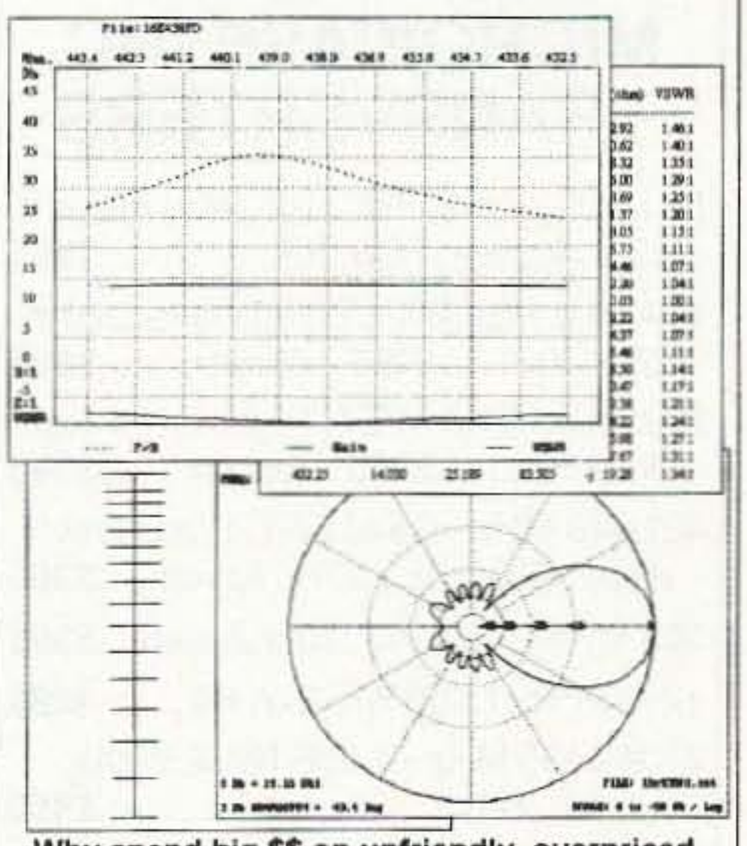

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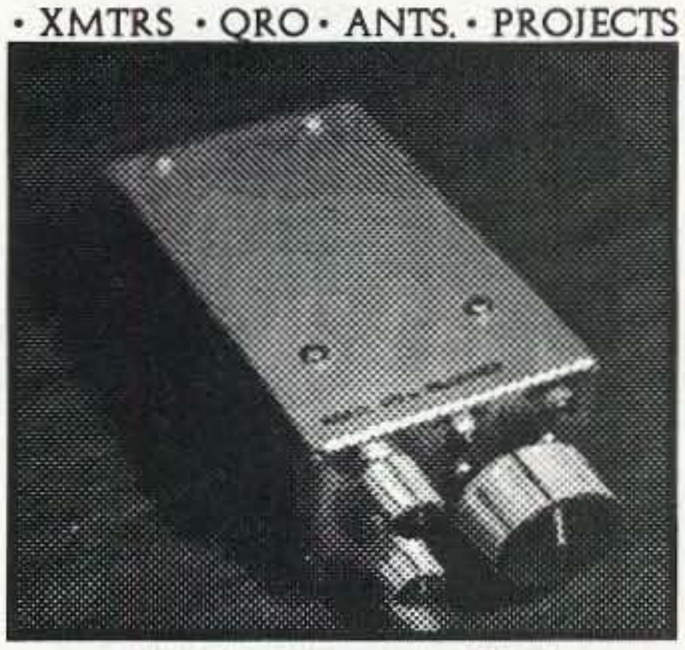

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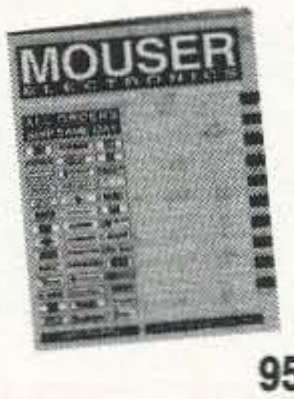

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RS-1 **The Amateur Radio Mail Order Catalog and Resource Directory, 4th Edition** is the most comprehensive source book for electronic parts, software, and equipment targeted at the radio amateur or serious electronic hobbyist anywhere! Plus a wealth of "value-added" reference material all in 262 pages. 4th Edition clearance at only **$8.95**. (was $16.00)

TAB2701 **Transmitter Hunting** *by Joseph Moell and Thomas Curlee* Radio direction finding simplified. **$19.95**

UE202 **RTTY Today** *by Dave Ingram* Modern guide to amateur radioteletype. **$8.95**

TP002 **The World Ham Net Directory** *by Mike Witkowski* New—2nd edition. Introduces the special interest ham radio networks and shows you when and where you can tune them in. **$9.50**

WGP87158 **1995 North American Callbook** The 1995 North American Callbook lists the calls, names, and address information for 500,000+ licensed radio amateurs in all countries of North America. **$35.00**

MMH24 **Radio Handbook, 23rd Ed.** *by William I. Orr W6SAI* 840 pages of everything you wanted to know about radio communication. **$39.95**

WGP1234 **1995 International Callbook** The new 1995 International Callbook lists 500,000+ licensed radio amateurs in the countries outside North America. It covers South America, Europe, Africa, Asia, and the Pacific area (exclusive of Hawaii and the U.S. possessions). **$35.00**

W5GWNV **No-Code Video, Manual, Part 97 Rules** Learn how to be a ham radio operator. **$29.95**

AR4092 **Your RTTY/AMTOR Companion** invites you to explore the world of HF digital communications. If you've never operated RTTY or AMTOR before, this book is written expecially for you! You won't find complicated technical jargon here. Just information you can use right away. You'll discover how to . . . Assemble your own RTTY/AMTOR station . . . Use RTTY and AMTOR to talk to amateurs throughout the world . . . Compete in RTTY/AMTOR contests . . . Hunt for digital DX. **$8.00**

AR3754 **Radio Frequency Interference—How to find it and fix it.** Interference problems are challenging, but curable. With the techniques in this book, you can help restore electronic peace in your neighborhood. **$15.00**

DOV41 **Basic Electronics** *Prepared by the Bureau of Naval Personnel* Covers the important aspects of applied electronics and electronics communications. **$12.95**

DOV76 **Second Level Basic Electronics** *Prepared by the Bureau of Naval Personnel* Sequel to Basic Electronics, thorough treatment of the more advanced levels of applied electronics. **$9.95**

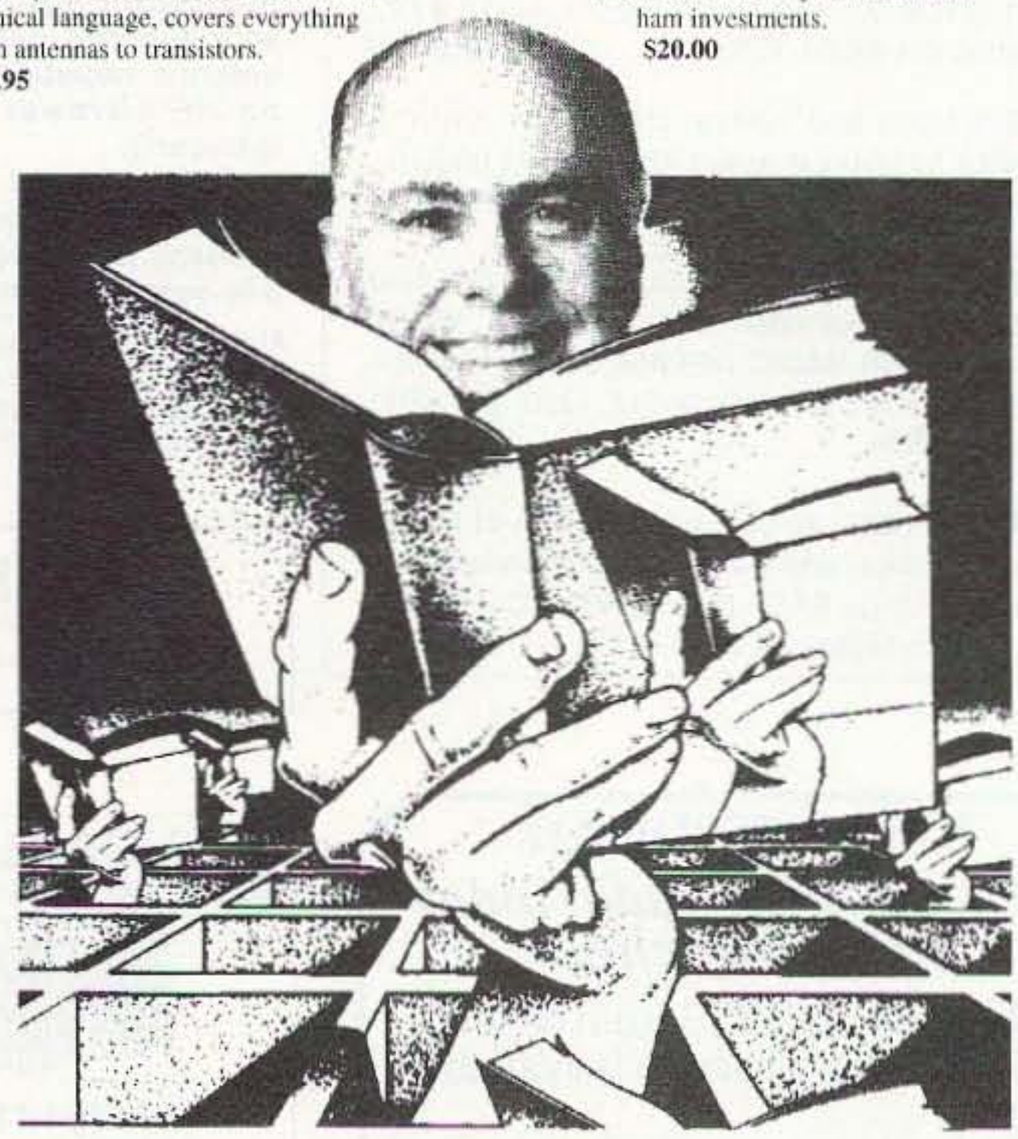
20N096 **How To Read Schematics (4th Ed.)** *by Donald E. Herrington* Written for the beginner in electronics, but it also contains information valuable to the hobbyist and engineering technician. **$19.95**

WLSWOCP **Radio Operator's World Atlas** *by Walt Stinson, W0CP* This is a compact (5x7), detailed, and comprehensive world atlas designed to be a constant desk top companion for radio operators. **$17.95**

TAB37109 **Secrets of RF Circuit Design** *by Joseph J. Carr* Written in clear non-technical language, covers everything from antennas to transistors. **$21.95**

DP919 **73 Magazine Index 1960-1990** A complete index to every article published in *73 Magazine* through 1990. IBM software **$20.00**

TAB11065-1 **Mastering Radio Frequency Circuits** by Joe Carr, 411 p. If you're interested in learning about radio components and circuits, this book is great! Plus there are a ton of simple circuits you can build. It explains how circuits work, about test equipment, receivers, the works. This will take a lot of the mystery out of how radios work...the easy way. This will be one of your better $20 ham investments. **$20.00**



SHORTWAVE

NBPAW94P **1995 Passport to World Band Radio** *by International Broadcasting Services, Ltd* You'll get the latest station and time grids. **$19.95**

07R25 **The RTTY Listener** *by Fred Osterman* New and expanded. This specialized book compiles issues 1 through 25 of the *RTTY Listener Newsletter*. Contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. **$19.95**

09S42 **The Scanner Listener's Handbook** *by Edward Soomre N2BFF* Get the most out of your scanner radio. **$14.95**

CRBSM1 **Scanner Modification Handbook, Vol. 1** *by Bill Creek* provides straightforward step-by-step instructions for expanding the operating capabilities of VHF scanners. **$17.95**

CRBSM2 **Scanner Modification Handbook Vol. 2** *by Bill Creek* Here it is—a companion to Vol. I. In fact, Vol. 2 has a section that provides improved approaches and updated techniques for the mods in Vol. 1. There's 18 new exciting modifications for popular scanners. **$17.95**

TAB 339643 **Tuning In To RF Scanning** From Police to Satellite Bands. Bob Kay. 150p 1994, Tab Books. This is a wonderful book for the VHF-UHF scanner listener. It explains about the various radio bands, antennas, the laws, and lists frequencies for every imaginable service . . . including the Secret Service, FBI, military, IRS, prisons, Fish & Wildlife, McDonald's order windows, nuclear search teams, railroads, Russian satellites, Treasury Dept., wireless microphones for concerts, and so on. **$14.95.**

07A66 **Aeronautical Communications Handbook** *by Robert E. Evans* Exhaustive, scholarly treatment of shortwave aeronautical listening. **$19.95**

AR4025 Beyond Line of Sight. Shows how hams pushed forward the discovery of the propagation modes that make VHF DX possible: tropo, sporadic-E, aurora and auroral-E, meteor scatter, F-Layer propagation, transequatorial propagation and earth-moon-earth. **$12.00**

TAB 447748 **The Shortwave Listener's Q&A Book**—Everything you need to know to enjoy Shortwave Listening. Choosing receivers, accessories, antennas, frequencies, and getting QSLs. SWL is an exciting hobby . . . that's what got me interested in hamming . . . Wayne. **$12.95**

SOFTWARE

GGTE Morse Tutor From beginner to Extra Class. Code from 1 to over 100 words per minute. Standard or Farnsworth mode. Create your own drills. Exams conform to FCC requirements. 5 1/4" floppy for IBM PC, XT, AT, PS/2 or compatibles.

GG52/5 Morse Tutor 5.25" Disk	**$19.50**
GG31/2 Morse Tutor 3.5" Disk	**$19.50**
GGADV5 Gold Edition 5.25" Disk	**$29.95**
GGADV3 Gold Edition 3.5" Disk	**$29.95**

W5GWHO **Ham Operator Education Package Software**, Novice—Extra for PC's, contains both 3 1/2" and 5 1/4" disks. **$39.95**

W5GWNSW **No-Code Ham Radio Software Package for PC's,** contains both 3 1/2" and 5 1/4" disks. **$29.95**

Lanze Code Programs—(Available on 5 1/4" * disk.) Inexpensive complete study guide code programs for both the C64/128 Commodores and the IBM compatibles. Programs include updated FCC questions, formulas, schematic symbols, diagrams, and simulated (VE) sample test.

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PC5066 **Digital Logic Gates and Flip-Flops** *by Ian R. Sinclair* A firm foundation in digital electronics. Treats the topics of gates and flip-flops thoroughly from the beginning. **$18.00**

PC5113 **Electronic Test Equipment Handbook** *by Steve Money* A guide to electronic test equipment for the engineer, technician, student and home enthusiast. **$18.00**

PC5007 **Practical Digital Electronics Handbook** *by Mike Tooley BA* Contains nine digital test gear projects. Digital circuits, logic gates, bistables and timers, microporcessors, memory and input/output devices. $14.50

WAYNE'S PICKS

WG2 **The Million Dollar Video** Explains how just about any company can increase sales by over a million dollars through the sneaky (aka intelligent) use of promotion. Explains in detail how you can get tons of free advertising. Uncle Wayne shows you how to beat the system. **$39.95**

"SEEK YOU" by The Ham Band—The titles include "Always on the air", "On the Monday Evening Grayline", "Radio Widow", "The Trip to Dayton", "The Contest" and seven more. Ham radio CD includes experiences that radio hams go through. This is an extremely entertaining CD and will strike a chord with any radio ham, SWL or XYL—an ideal present! **SYCD $15 SYTAPE $10.**

IB8657 **Dumbing Us Down: The Hidden Curriculum Of Compulsory Schooling.** *by John Gatto* If you enjoyed "Declare War", you'll enjoy this also. A Wayne Green recommended reading. **$9.95.**

ARRL BOOKS

AR1995 **ARRL 1995 Handbook (71st Ed.)** Features: added DSP, improved treatment of Pi and Pi-L, all new all-digital-logic, plus lots more. **$30.00**

AR1086-4 **ARRL Operating Manual (4th Ed.)** Information on how to make the best use of your station, including: interfacing home computers, OSCAR, VHF-UHF. **$18.00**

AR3657 **QRP Notebook** *by Dave DeMaw W1FB* Presents construction projects for the QRP operator. **$10.00**

AR3207 **W1FB's Design Notebook** *by Dave DeMaw W1FB* Filled with simple practical projects that can be built using readily available components and common hand tools. **$10.00**

AR0402 **Solid State Design** Good, basic information, circuit designs and applications; descriptions of receivers, transmitters, power supplies, and test equipment. **$12.00**

AR4173 **Now You're Talking! All You Need To Get Your First Ham Radio License (2nd Edition)** A complete study guide for the Technician and Novice written exam. Practical information every beginner needs is written clearly and simply and in small doses. **$19.00**

AR4718 **ARRL Repeater Directory 1994-1995** 19,000+ listings with digipeaters, bandplans, CTCSS (PL(TM)) tone chart, frequency coordinators, ARRL special service clubs, and beacon listings from 14 MHz to 24 GHz. **$6.00**

AR3398 **The DXCC Companion** *by Jim Kearman KR1S* Spells out in simple, straightforward terms what you need to be a successful DXer. **$8.00**

AR1250 **Log Book**—Spiral **$3.50**

AR3177 **The ARRL Spread Spectrum Source Book.** From a deceptively simple beginning, a group of experimenters set out to develop first theoretical and later practical systems for spread spectrum communications. This book consists of articles, papers and government reports that document the process whereby amateur spread spectrum progressed from the drawing board to the airwaves. **$20.00**

AR2960 **Transmission Line Transformers (2nd Ed.)** *by Dr. Jerry Sevick W2FM1* Practical designs and specific information on construction techniques and sources of material. **$20.00**

AR3851 **Hints and Kinks** Ideas for setting up your gear for comfortable, efficient operation. **$10.00**

ARRL **License Manuals** Complete FCC question pools with answers.

AR4181 **Technician Class**	$ 6.00
AR4688 **General Class**	$12.00
AR3274 **Advanced Class**	$ 8.00
AR3282 **Extra Class**	$ 8.00

AR3185 **The Satellite Experimenter's Handbook, (2nd Ed.)** *by Martin Davidoff K2UBC* Expanded and revised. Focusing on satellites built by and for the international radio amateur community. **$20.00**

AR2030 **Your Gateway to Packet Radio (2nd Ed.)** Tells everything you need to know about this popular new mode. **$12.00**

AR4645 **Satellite Anthology** The latest information on OSCARs 9 through 13 as well as the RS satellites, the use of digital modes, tracking antennas, RUDAK, microcomputer, and more! **$10.00**

AR4483 **Weather Satellite Handbook (4th Ed.)** *by Dr. Ralph Taggart WA8DQT* Expanded and revised to reflect today's weather-fax satellite technology. **$20.00**

AR4653 **Companion Software for Weather Satellite Handbook** 5 1/4" MS-DOS Floppy. **$10.00**

AR2083 **Complete DX'er (2nd Ed.)** *by Bob Locker W9KI* Learn how to hunt DX and obtain hard-to-get QSL cards. **$12.00**

AR3762 **Your QRP Operating Companion** No special rigs or expensive equipment to enjoy the excitement and challenge of low-power operating. **$6.00**

AR3169 **QRP Classics** Compilation of ARRL publications on building receivers, transmitters, transceivers, accessories. **$12.00**

AR4270 **FCC Rule Book** A must for every active radio amateur. **$9.00**

AR0356 **Morse Code: The Essential Language** *by L. Peter Carron, Jr. W3DKV* Expanded and revised in its 2nd edition. How to handle distress calls heard not only on the hambands but on maritime and aircraft frequencies. **$6.00**

AR3983 **Understanding Basic Electronics** An ARRL book. 314 big pages. This explains everything very simply: the math, DC, AC, transistors, even tubes (wow!). Dirt cheap at $17. Isn't it about time you understood the fundamentals? **$17.00**

ANTENNAS

AR4114 **Low Profile Amateur Radio** For the Ham who lives where antennas are frowned upon. From hiding your antenna to operating with low power. This books tells you how to get on the air using these tehniques, and others,without calling attention to yourself. **$8.00**

UE220 **The Easy Wire Antenna Handbook** *by Dave Ingram K4TWJ.* All of the needed dimensions for a full range of easy to build and erect "sky wires." **$9.95**

WGP87034 **All About Cubical Quad Antennas** *by William Orr and Stuart Cowan* "The Classic" on Quad design, theory, construction, operation. New feed and matching systems. New data. **$11.95**

TAB 3270P **Practical Antenna Handbook**—Second Edition, 1994, Joseph Carr; Tab Books. This 560-page book is a real treasure. Sarts with the fundamentals of antenna and feedline theory, explains about propagation of all kinds, and then provides a ton of easy antenna construction projects. Covers antennas and feeders for all bands. The explanations are simple and well illustrated, with some math, where it's unavoidable, but it won't bog you down. It even has the ZL-Special antenna, which I've used on 20m with some spectacular DX-ing success. A low angle of radiation and made it so I could always work the rare stuff first . . . Wayne. **$26.95.**

AR4734 **ARRL Antenna Book** The new 16th Edition represents the best and most highly regarded information on antenna fundamentals, transmission lines, design, and construction of wire antennas. **$30.00**

AR0194 **Antenna Compendium Vol. 1** Materials on verticals, quads, loops, yagis, reduced size antennas, baluns, Smith Charts, antenna polarization. **$10.00**

AR2545 **Antenna Compendium Vol. 2** Covers verticals, yagis, quads, multiband and broadband systems, antenna selection. **$12.00**

AR2626 **Companion Software for Antenna Compendium Vol. 2** 5 1/4" MS-DOS floppy. **$10.00**

AR4017 **Antenna Compendium Vol. 3** More verticals, yagis, quads, plus loops, arrays, mobile, direction finding, controlled currents, computerized, installation, overloads, plus 40 new articles for beginner's to advanced. **$14.00**

AR4661 **Antennas and Techniques for Low-Band DXing** can be your ticket to low-band success. Drawing on the experiences of successful DXers and the author's own considerable experience, John Devoldere, ON4UN, shares the tips and techniques that can make the difference between a station that takes part in a contest and one that wins it! **$20.00**

AR3819 **Physical Design of Yagi Antennas** *by David B. Leeson W6QHS* provides the tools here to design and build robust Yagi antennas, using sound mechanical engineering principles. You need no longer fear the consequences of wind or ice storms on your antennas. With this information, you can build or "beef up" existing Yagis. **$20.00**

AR2618 **W1FB's Antenna Notebook** *by Dave DeMaw W1FB* Get the best performance out of unobtrusive wire antennas and verticals. Build tuners and SWR bridges. **$10.00**

WGP87107 **All About Vertical Antennas** *by William Orr* Comprehensive coverage of amateur communications. **$11.95**

WGP87042 **Beam Antenna Handbook** *by William Orr and Stuart Cowan* Everything you need to know about beam design, construction, and operation. **$11.95**

WGP87077 **Simple, Low-Cost Wire Antennas For Radio Amateurs** *by William Orr and Stuart Cowan* All New! Low-cost, multi-band antennas; inexpensive beams, "Invisible" antennas for hams in "tough" locations! New data. **$11.95**

AR2200 **Antenna Impedance Matching** *by Wilfred N. Caron* Most comprehensive book written on using Smith Charts in solving impedance matching problems. **$20.00**

AR0410 **Yagi Antenna Design** A *Ham Radio* series polished and expanded by Dr. Lawson. **$15.00**

AR2995 **Reflections** will help dispel the half-truths and outright myths that many believe are true about transmission lines, standing waves, antenna matching reflected power and antenna tuners. **$20.00**

AR3118 **Reflections**—Software for IBM 5-1/4" **$10.00**

UHF/VHF/PACKET

ARTSCI **U.S.Repeater Mapbook** *by Robert Martin* The Guide for traveling radio amateurs. **$9.95**

TP001 **The Basic Guide to VHF/UHF Ham Radio** *by Edward M. Noll* Provides a first rate introduction to the 2.6 and 1.25 meter bands as well as 23, 33, and 70cm. **$6.95**

AR3959 **Your Packet Companion** Perfect for the packet newcomer. **$8.00**

AR3878 **Your VHF Companion** Explore the fascinating activities on the VHF bands, FM and repeaters, packet, CW & SSB, Satellites, ATV, transmitter hunting and more. **$8.00**

03R02 **RTTY Today** *by Dave Ingram K4TWJ* Most comprehensive RTTY guide ever published. **$8.50**

BOOKS FOR BEGINNERS

TAB4354 **The Beginner's Handbook of Amateur Radio, Third Edition** *by Clay Laster W5ZPV,* 395 pages. Wonderful book for newcomers. It is basic and well illustrated. Even if you have all the other ham handbooks, you'll still find this one useful. **$22.00**

W5GWNC **Technician Class License Manual: New No-Code** *by Gordon West* This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. **$9.95**

XTAL-1 The Crystal Set Handbook by Phil Anderson WØXI. Want to give a kid an exciting present? Or maybe yourself? Crystal sets are alive and fun. Here's a whole book packed with crystal set circuits that anyone can build. Now start saving those oatmeal boxes, okay? 133 pages **$10.95**

WAYNE WRITES

WG1 **We The People *Declare War* On Our Lousy Government**—360p soft cover. This is Wayne's report explaining what the major problems are facing both New Hampshire and the country, and proposing simple, inexpensive solutions: a simple way to have government departments happily cut their expenses by 50% within three years; how to cut the cost of incarcerating prisoners by over 90%; how to end welfare; how to reduce the deficit; how to cut medical costs and improve health care; how to cut school costs and improve schools. An absolute steal at **$13**.

WG4 **20/20 Foresight**—Twenty 16p updates on the **Declare War** book—320p. Further proposals for solving critical American problems, such as a new approach to financing small businesses, how to finance Russia and other countries and make a profit doing it, the real dope on bioelectromagnetics, a new kind of polytechnical university, a new electronics technology, why Africa is in such a mess, why Perot bombed, how to have tuition-free universities, a plan for making Congress turn honest, etc. Plenty more. Ridiculously priced at **$10**.

WG5 **Submarine Life in WWII**—60p. Wayne's story of his adventures on the USS Drum SS-228 on five war patrols in the Pacific in 1943-45. What's it really like on a submarine when you're being depth charged? And what's the day-to-day life on a submarine like? Did you see the movie Das Boot? Exciting stuff and only **$7.50**.

WG6 **Uncle Wayne's Caribbean Adventures**—96p. Wayne's adventures scuba diving all around the Caribbean, visiting ham operators, and sightseeing. If you're interested in how to travel economically, you'll get some great ideas from this. He starts out with his "Diving, the Wimp Sport." You'll love the visits to 11 islands in 21 days trip. A measily **$7.50**.

WG7 **Uncle Wayne's Travels**—52p. Wayne travels to Russia, London, Aspen, St. Pierre, Munich, Vienna, Krakow, and Prague without it costing nearly as much as you might think. Cheap for you too, at **$5.00**.

CODE TAPES

73T05 **"Genesis" $5.95 5 wpm**—This beginning tape, takes you through the 26 letters, 10 numbers, and necessary punctuation, complete with practice every step of the way.

73T06 **"The Stickler" $5.95 6+ wpm**—This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are set at 13 wpm and spaced at 5 wpm.

73T13 **"Back Breaker" $5.95 13+ wpm**—Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per.

73T20 **"Courageous" $5.95 20+ wpm** Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per.

73T25 **"The Mind Boggler" $5.95 25+ wpm** Fiendishly generated by kindly old Uncle Wayne for hams with a strong need for self punishment. Once you've conquered 25 per let Unk know if you need a 50 wpm tape.

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Channel scope lets you see what's happening before you key the mike or break squelch. This plus the features Alinco makes standard, are yours in a great package.

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IC-Z1A

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KENWOOD

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TH-79A(D)

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73-005

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IC-736

Here's the H.F. rig you've been holding out for! It features a full 100 watts output from 160 meters through 6 meters with a built in antenna tuner and power supply, VOX, PBT, RF Gain, 101 memories and more provides you with the latest features and fun.

$1979.95

IC-2GXAT

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High power & compact design set a new performance pace. This new HT offers 40 memories, Die cast case, CTCSS. It's fresh and exciting from Icom.

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YAESU

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FT-1000

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FT-990

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FT-900/AT

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The FT-900/AT is a revolutionary HF transceiver which answers the call for a truly practical mobile radio. its unique remote-head construction allows installation where no other transceiver can be mounted. 100 watts, 100 memories, dual VFO's, IF Notch and many more features.

• FT-900

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• FT-51/38 $509.95

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FT-840

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This new transceiver delivers the fun and performance you're looking for while staying on a budget! It has 100 watt output, 100 memories, DDS, IF Shift FET front end and a general coverage receiver.

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FT-5100

SAVE $50 MORE

This dual band mobile features 100 memories, cross band repeat, lighted keypad, built-in duplexer and a small footprint. Dual watch capability rounds out this 50/35 watt VHF/UHF transceiver. Packet ready.

$619.95

FT-2500M

SAVE $30 MORE

This new 2 meter mobile borrows its ruggedness from the FT-2400H while adding great new features such as advance track tuning, time out timer, A.P.O., 9600 bps option, 31 memories, the new "omni-glow" LCD display and more!

$359.95

FT-530

SAVE $50 MORE

The newest member of the dual band family. This handheld sports auto tone search, 82 memory channels, automatic power off, built-in VOX, dual in-band receive feature, built-in cross band repeat function and much more.

$449.75

Authorized Factory Warranty Center

We offer factory authorized warranty service for Icom, Kenwood and Yaesu. We service all makes and models. Our customers may send any product requiring service to us, and we will handle it for them. This is a one-stop service that keeps our customers having more fun than hassle in this hobby. If you need a custom cable for packet and don't have time to make it, let us do it for you. C.A.P. & M.A.R.S. mods are also available at reasonable rates to authorized hams only.

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

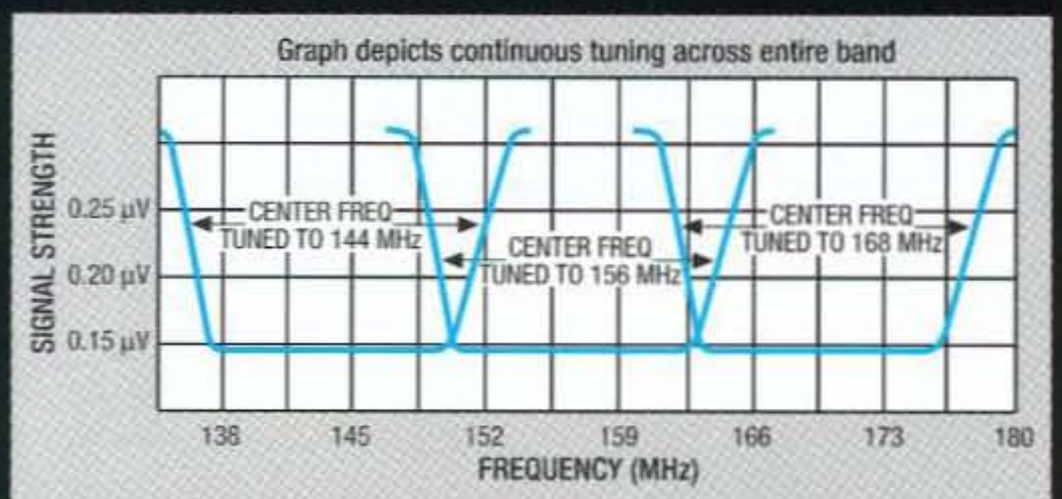
Advanced Track Tuning, Mil Spec, true FM. All in one radio!

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

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

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

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



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

Specifications

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

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

*FT-2500M

YAESU

Performance without compromise.℠

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

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

"This Advanced Track Tuning practically eliminates intermod!"

"Yaesu did it again."

$30. OFF SEE YOUR DEALER FOR DETAILS LIMITED TIME OFFER.

FT-2200/7200

Just 5.5"W x 1.6"H x 6.5"D, the FT-2200/7200 radios are designed to fit into today's more compact cars with ease.

SPECIFICATIONS • Frequency Coverage: FT-2200 RX: 110-180 MHz, TX: 144-148 MHz. FT-7200 RX/TX: 430-450 MHz. • Wide Receiver Coverage: 110-180 MHz • AM "Aircraft" Receive: 110-139 MHz • Built-in DTMF Paging/Coded Squelch • Selectable Channel Only Display • 10 Memory DTMF Auto Dialer • Backlit DTMF Mic • Power Output 50/20/5 Watts (FT-7200 35/15/5 Watts) • 50 Memory Channels • Remote Operation w/ Optional MW-2 • CTCSS Encode Built-in • Optional Digital Voice Storage System. Accessories: See your authorized Yaesu dealer.

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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.

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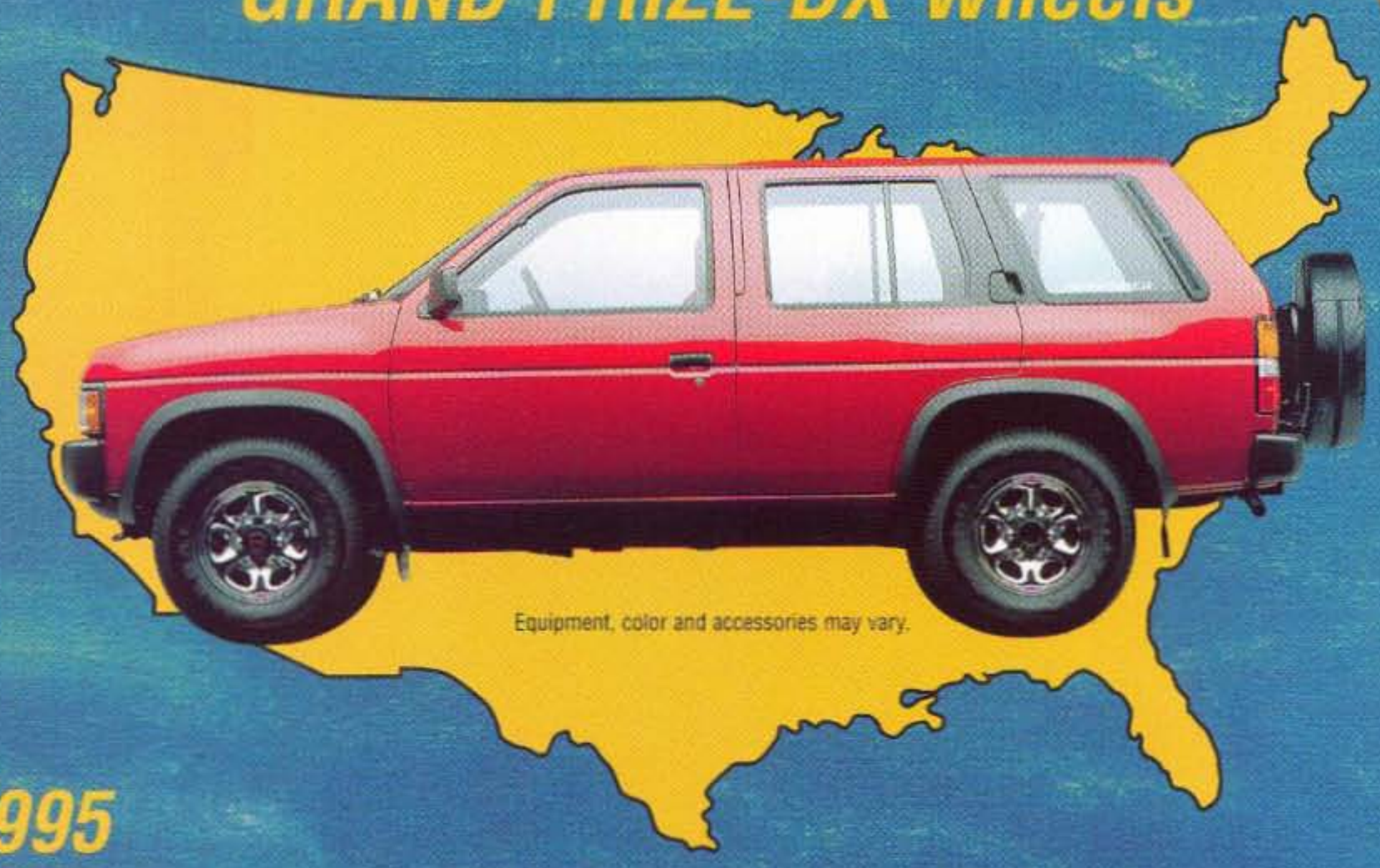

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Custom equipped with: Kenwood TS-50S, Kenwood TM-742A, Kenwood KRC-601 Cassette Player/Receiver with CD-MD Changer Control and KDC-C603 Multiple CD Changer

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TS-50S TH-79A(D) TM-733A

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