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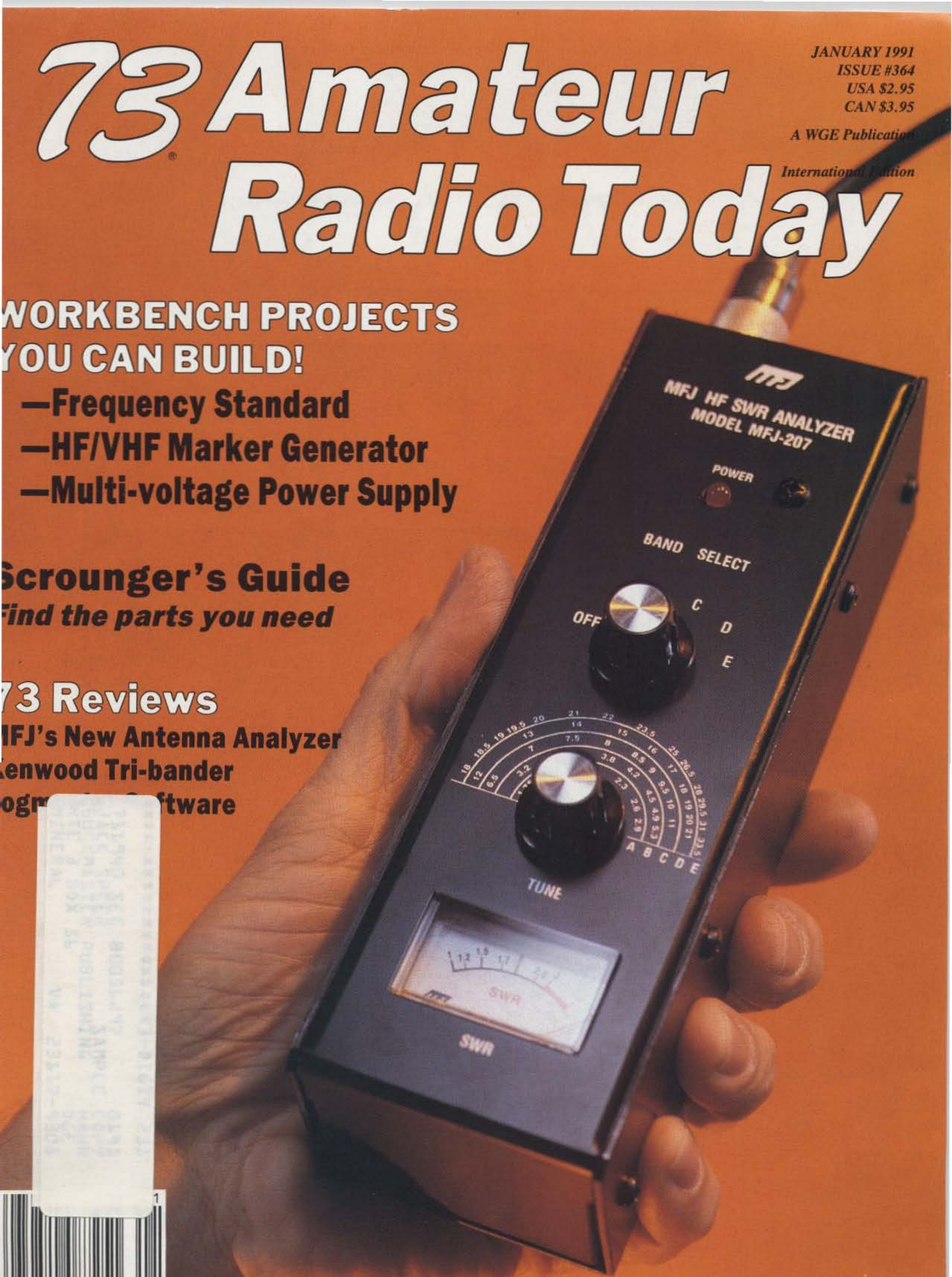

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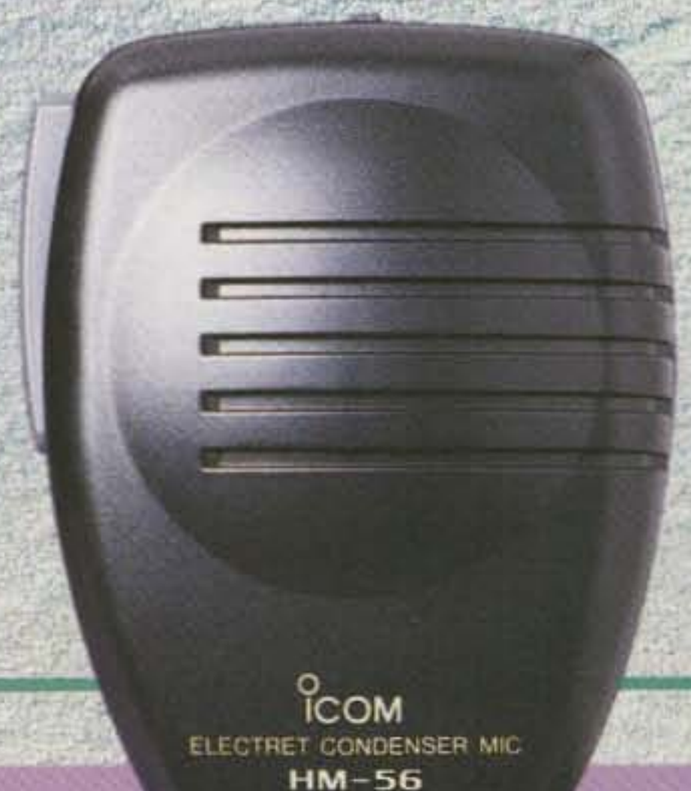

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LETTERS

From the Hamshack

Barry Isbelle KC4IDE, Richmond VA Wayne, I think you are tops! I've been a Tech for a couple years—back after being dumped by ARRL's "Incentive Licensing." The team here in Richmond has graduated 60+ Novices in the last year! Most instructors are Techs. Keep pushing us to give back to the hobby that gives us joy.

John Devon KI6DQ Okay, I'll subscribe! *73* features superior writing and a forward-looking attitude, without forgetting radio's past. Why is there so much "history" between you and the ARRL? And how can ham radio compete against computers and BBSs?

The League? I've been on their case to be more responsive to us members for 40 years . . . and they've been hating me for speaking up for 40 years . . . Wayne

Steve Baumrucker WD4MKQ The Nov. Fire-Ball and QRP articles were both fun and exciting. It is sad that in this age of illogic a man with such reasonable views should be cast as "an unreasonable man" (by himself, no less). Your editorials are consistently stimulating. I give *73* credit for prompting me to start a ham radio club at the local middle school. It is a small contribution, but "the journey of 1000 miles begins with the first step."

Fine, Steve. Now how about some pictures of your club? . . . Wayne

Paul Adams WB5EVO Thanks for your inspiring editorials and a great ham magazine. I've been licensed since 1971, and you've talked me into trying just about every phase from CW to ATV, including RTTY, SSTV, 160m thru 1296 MHz. Next is packet.

It's about time, Paul . . . Wayne

Bill Weir KA7DTN, Flagstaff AZ I've enjoyed your "Never Say Die," construction articles, and columns since the mid '60s. So how come your predictions and opinions always seem right? Most educational! Keep up the great work, gang.

I thought I was wrong once, but I was mistaken . . . Wayne

Tom Maynard, Hinckley IL About 20 years ago as a Novice I remember being amazed by Wayne's audacious attitude toward the ARRL. Now, having achieved enough success, I'm getting back into the hobby and Wayne ain't changed a bit. After trying a few issues of the other ham magazines, it seems as if *73* is the only one worth buying. Thanks, Wayne, for hanging in there and making my return a welcome one.

So stop sniveling and get your ticket . . . Wayne

Jim Blizzard AB4YC, Alabaster AL Keep up the good work! I've been a ham since March 1990, and have been buying your magazine off the newsstand since February. It's fun to read your "Never Say Die" each month.

It's a shame, though, that you have to beg, plead, and scream at hams to get off their amplifiers and get busy sharing this exciting hobby with non-hams. There are so many dimensions to ham radio—something for *everyone*.

Fortunately for me, there is an active group of hams where I work (at the phone company) who are interested in teaching others about amateur radio. That's how I became involved last December.

This fall we're going to have classes for both non-hams and hams interested in upgrading. The class will include traffic handling, packet, RTTY, hands-on CW, QSO practice, DXing and hints, and theory.

Just wanted you to know there are some of us on the go.

Gutless Dweeb 1NERD At the ARRL Forum at Boxborough it was suggested that hams could pass along their used magazines to their local school libraries, hoping kids might get exposed to 'em. Tom (W1 director) said it would be better to just purchase new League materials and donate them. Someone suggested the League should have had a booth at the Eastern States Exposition (a humongous fair), since it is near HQ. Price said no, the hams in California might want them to do the same and they can't be everywhere. So we're nowhere. Instead of being considered, every suggestion was argued and defensively put down with lame rebuttals.

This reader is scared silly that the ARRL may find out who he is, so I've withheld his name. How does the League generate such utter terror?

. . . Wayne

Gene Griggs N3IEW, Milford DE I used your 20 wpm tape and passed the 13 wpm test. I have been preaching your code system. I hope your shake-up of the music business is progressing—it's sorely needed. I spent 3 years on the road as a professional saxophonist and found it's not how good you are, but who you know that gets you the breaks. Love the new look of *73* and read your editorials first. Take care and watch your stress level.

Give me three years to turn the music business around and make it safe for talented performers . . . for a change . . . Wayne

Mike & Linda Simmons WB9CWE/KA9LWE As "900" telephone numbers are getting more popular, we were wondering if *73* might set one up and charge around $5 for a trial subscription. This might attract young Novices.

We're doing this with CD Review, *allowing readers to hear samples of new CD releases and to get a short message from me on what I've been doing. It takes a lot of activity to make a 900 number pay off, and I doubt we could get enough ham calls . . . but we'll set it up and see how it goes as soon as we can.*

. . . Wayne

Ryan Lughermo, Midland MI Uncle Wayne, I need your help again. I acquired an Apple IIc computer, but the way the damned ham industry is, everything is for the IBM. I cannot find software for all aspects of radio. In these days of much-needed youth in the ham ranks, how does a college student paying his own way get into this hobby without paying an arm and a leg? You bet I'm not going to buy an IBM (I can't afford it, anyway!) just to get into ham radio.

People need to stop and think. It's not just the code that discourages youth. How about the cost of everything? I didn't come from a family that bought whatever I wanted. Please voice the opinion to manufacturers if you get the chance. Your voice is much more respected in the ham world than just a 20-year-old college student's. Anyway, if any of your readers has any software for the Apple IIc computer, I need their help.

Keep on writing those great editorials that actually make people think, as it's the part of each issue I read first, even before the table of contents!

My quick scan of CompuServe's HAMNET data libraries turned up a few Apple programs: two CW trainers, two MUF programs, an antenna design program, and a toroid transformer design program. I haven't tried CompuServe's Apple-specific forums, so I'm sure with a bit of digging you'll turn up more.

In general, IBM is where the bucks are, comercially, but it's never stopped people from writing their own software and sharing it with others via on-line information services and BBs. If you see a need, why not fill it?

Nuge's Fearless Prediction: You won't do it!

My experience at Portable 100 *and* PICO *magazines (primarily non-IBM) has been that, while hams are often the most vocal about* wanting *certain programs, they're the least likely to actually* do something *about writing them. If you'd care to prove me wrong, you'd be doing your fellow Apple-type hams quite a favor . . . Nuge WB8GLQ*

Look in "Barter 'n' Buy." There is usually at least one ad for ham Apple software. Then, there's "RTTY Loop." Dr. Leavey WA3AJR has mentioned Apple software in some of his columns. You can contact him by letter or e-mail.

. . . Linda KA1UKM

Mike KB2JNB I recently finished your latest copy of *73 Magazine* and I thought it was great. I was reading the story about kids in ham radio and how much they enjoy it. Being a young amateur myself, I enjoyed reading about kids my age. I'd like to hear more about this in the future.

R.R. De Jongh WB7CPT, Bellevue WA Just a few lines to thank you for *73*, the only real ham magazine left! With the demise of the other New Hampshire offering, and the subsequent substitution of something less than satisfactory, I find that I worry somewhat about *73*. I see a trend in *73* that makes me somewhat uneasy—the "QSTing" of *73*! That is, the increasing number of columns and nontech articles and the reduction of tech and construction articles. I'd hoped that with the lack of competition, you wouldn't have to resort to all that filler, being swamped with tech material. What happened?

I still enjoy your editorials and agree with about 75 percent of them . . .

While we put as many construction articles in 73 as possible, not everyone likes to sit down at the workbench with a hot soldering iron! We like to round out each issue with stories about what people are actually doing with amateur radio. We have special interest columns since there are so many facets of the hobby, and I think you'll find that many of these columns have construction hints and projects in them, in addition to our regular articles. What one person considers filler is another's filling (I prefer strawberry)!

. . . Bill WB8ELK

73 Amateur Radio Today

JANUARY 1991
Issue #364

TABLE OF CONTENTS

Work a Rose Parade float . . . see p. 46.

FEATURES

REVIEWS

Cover by Alice Scofield

Cover: MFJ's new antenna analyzer (the MFJ-207). Photo by Byron O'Brien.

DEPARTMENTS

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Contract: Your fingerprints on this page are sufficient evidence to hold you to this binding agreement: You will make a New Year's Resolution to find at least one new ham in 1991, help him or her get a ticket, and see to it that he or she subscribes to *73 Amateur Radio Today*.

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Your IOU Is Due

Let's see a quick show of hands . . . how many of you have gotten some fun out of amateur radio . . . sometime? Now, one more try . . . anyone actually learn anything of value as a result of the hobby? Come on now, none of that furtive, shifty-eyed, sullen silence baloney, I want to see some hands.

Okay, maybe you haven't done all that much in amateur radio . . . 90% of us haven't. Maybe I haven't been able (yet) to con you into getting out of your rut and trying packet, RTTY, SSTV, QRP, OSCAR or any of the other fantastic things there are to do in amateur radio, but even if you've only taken advantage of 1% of the fantastic electronic feast you have available to you, you have a debt to the hobby and it's now time to call that debt. Your IOU is due.

Yes, I see some of you looking uneasily around, hoping maybe someone else will do what needs to be done. I know what you're saying. You're, sigh, too busy with other things. And after all, hamming is only a hobby. Besides, you're tired. Yes, I know, over half of all licensed amateurs aren't active . . . haven't been in years . . . so what's the big deal?

"All right, already," you're saying about now. Now what does Wayne want me to do? And why, pray tell, should I bother? The hobby has had its ups and downs, but it's still here 45 years after we got back on the air after WWII. So what's the big deal now?

Well, to be truthful, it may be nothing at all . . . just another false alarm. But our gas gauge looks like it's finally running on empty. Maybe it's just broken. Still, if you've been active for very long . . . I've been on the air for 52 years now . . . you know our bands are in the worst mess they've ever been in. And I'm sure you're aware that we haven't contributed much in the way of service or technology to pay for the rent on our bands in the last 25 years.

It takes youngsters to make a revolution. It's always the students who bring things to a head. Alas, we have almost no kids in amateur radio anymore, so all that's left is us old-timers. No wonder we haven't had a revolution yet.

A corporation which so mismanaged its assets as the League has ours would be facing takeover bids . . . or at least a stockholder revolt. If you're a member of the ARRL, you're a stockholder. Say, is Wayne "bashing" the League again? No, not yet, but I may . . . I may.

Three Main Problems

In case your memory is short, let's review what's broken and needs to be fixed. Yes, I know I've written about all this before . . . so what are they? (1) We need to clean up the messes we've allowed to build up on our bands. (2) We need to get serious about attracting young new hams. (3a) A WARC is coming next year in Madrid and we're woefully unprepared to do anything but spend a lot of money sending over League vacationers. (3b) Followed by a Geneva WARC in 1993, for which we're equally unprepared except for ARRL hotel reservations.

Those are the problems. Now, how about solutions? Obviously there isn't much you can do personally about these miseries. There isn't even much I can do as an individual . . . other than try to get as many amateurs as possible to understand what's going on and how to go about fixing things.

The fix is both easy and difficult. The easy part is your voting in new ARRL directors in the next election (they're re-elected every two years). The difficult part is trying to convince hard-core League members that there's anything wrong. Oh, they're aware of how bad our bands are, but they seem to expect the FCC to clean things up, not the League. Self policing? No, they don't think they recall anyone promising the FCC anything like that.

These old birds get upset when someone tries to tell them that the FCC views us as a royal pain. They vaguely recognize on some level that we're keeping commercial interests from using billions of dollars of desperately needed frequencies. But heck, we've always had 'em. They don't like to think about the commercial pressures to provide more radio services. They know that money talks, but haven't really figured out what this means at the ITU or with our government in Washington.

If you're an ARRL member but don't want to "get involved" you can just be sure to not vote for the incumbent director in the next election. If you're a member and feel you owe more to amateur radio than one vote you'll start looking for someone to get behind and run for director. They have to have been a continuous member for at least four years and not be involved with the ham industry. It'll be a plus if they have some business experience, something which is sadly lacking with far too many current directors.

If you're not a member you can try to get your ARRL friends and fellow club members to wake up and smell the mess.

Should you join the League and try to fight from within, as they so highly recommend? You have ten times the power to be heard *before* they get your money. Once they have it, you've lost your leverage. If they show some signs of actually accepting their responsibility to protect our hobby, then they're worth anything they have the guts to charge.

As a 50-year League member I really hate the way they've allowed our bands to deteriorate. For instance, they should have cleaned up the KV4FZ and K1MAN messes long ago. And what happened to their promise to bring in 50,000 new hams?

And how many Third World country leaders have ARRL representatives visited recently in preparation for WARC?

Your vote for a new director in your division will get the ball rolling. It'll let 'em know they have to do more than just spend your money. You demand some service for your dues. You owe amateur radio this for the benefits it's brought to you . . . and for those it's made available, even if you haven't enjoyed them.

What If I'm Wrong?

As the old saying goes, I thought I was wrong once, but I was wrong about that. Let's suppose, though, that this time I'm wrong . . . that our bands are peachy . . . a model of which we can be proud and not one that commercial interests can exploit. Let's suppose that we really aren't just a bunch of crotchety, quarrelsome old men, largely retired, enjoying a fun hobby in our old age, paid for by the general public and preventing them from getting communications services they'd pay billions to get. Let's suppose that we really do have thousands of kids getting licenses, even though we don't see them at hamfests or club meetings, or hear them on the air . . . and they haven't shown up on the FCC statistics.

Let's suppose that the Third World countries, the ones who have the most votes at the ITU, aren't mad at past visiting American and European hams who have flaunted their rules. Let's suppose they are aware of the enormous benefits amateur radio could bring to their country, even though no one has ever mentioned it to them . . . and that they will be happy to give up their claims for shortwave broadcasting frequencies and other radio needs. Let's forget that since their telephone systems are almost nonexistent most businesses have to use radio communications, for which frequencies are desperately needed. I've mentioned all these things many times before and most of you have forgotten them, so one more time should be easy.

Okay, then our hobby is hunky-dory and I'm a gloom and doom curmudgeon for even suggesting the ARRL has shirked its responsibility to manage things. Even so, what's the possible harm if you elect a new director? One maybe with some serious business and marketing experience? Heck, maybe even someone who hasn't been an ARRL official for the last twenty years. What will it hurt?

Now, if that's ARRL-bashing, please advise how you figure that. And have enough guts to sign your call.

Your Biggest Thrill

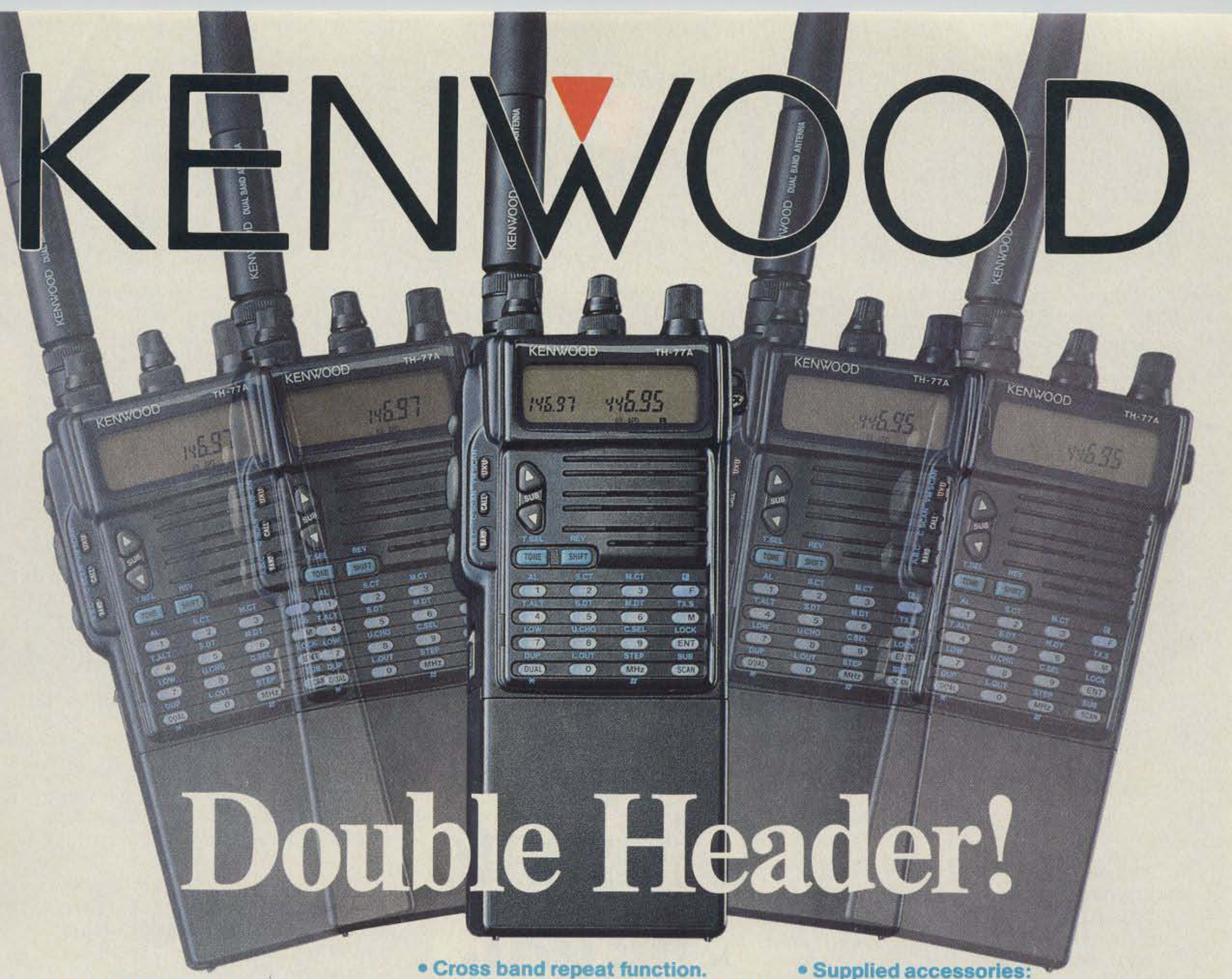
When I asked if you've ever had fun with amateur radio, what came to mind? Think back. What was your most exciting ham experience? I've asked many hams this and gotten some fascinating stories. Now I'm asking you, knowing the *73* readers will enjoy your experience as much as I.

How long should the story be? As long as it takes, but if you run off at the word processor our editors will cut you down to size. If you can send a floppy along with the hard copy, so much the better. Don't forget a picture of yourself too, just in case we think the readers will enjoy your story.

Most of my truly exciting times have been while on DXpeditions. I'll never forget a minute of any of 'em. On my first, to Navassa in 1958, it was one adventure after another. First it was weathering a hurricane at sea . . . then almost crashing on a coral reef . . . then almost getting shot by the Haitian police . . . then having to dive in shark-infested wa-

Continued on page 73

KENWOOD



Double Header!

TH-77A

Compact 2m/70cm Dual Band HT

Here's a radio that deserves a double-take! The TH-77A is a feature-packed dual band radio compressed into an HT package. The accessories are compatible with our TH-75, TH-25, and TH-26 Series radios. Repeater and remote base users will appreciate the DTMF memory that can store *all* of the DTMF characters (*, #, A, B, C, and D) that are usually required for repeater functions!

- **Wide band receiver coverage.** 136–165 (118–165 [AM mode 118–136] MHz after modification) and 438–449.995 MHz. TX on Amateur bands only. (Two meter section is modifiable for MARS/CAP. Permits required.)
- **Dual receive/dual LCD display.** Separate volume and squelch controls for each band. Audio output can be mixed or separated by using an external speaker.
- **Cross band repeat function.**
- **Dual Tone Squelch System (DTSS).** Uses standard DTMF to open squelch.
- **CTCSS encode/decode built-in.**
- **Forty-two memory channels.** All channels odd split capable.
- **DTMF memory/autodialer.** Ten 15-digit codes can be stored.
- **Direct keyboard frequency entry.** The rotary dial can also be used to select memory, frequency, frequency step, CTCSS, and scan direction.
- **Multi-function, dual scanning.** Time or carrier operated channel or band scanning.
- **Frequency step selectable for quick QSY.** Choose from 5, 10, 12.5, 15, 20, or 25 kHz steps.
- **Two watts (1.5 W on UHF) with supplied battery pack.** Five watts output with PB-8 battery pack or 13.8 volts. Low power is 500 mW.
- **DC direct-in operation** from 6.3–16 VDC with the PG-2W.
- **T-Alert with elapsed time indicator.**
- **Automatic repeater offset on 2 m.**
- **Battery-saving features.** Auto battery saver, auto power off function, and economy power mode.
- **Supplied accessories:** Flex antenna, PB-6 battery pack (7.2 V, 600 mAH), wall charger, belt hook, wrist strap, keyboard cover.

Optional accessories:

• **BC-10:** Compact charger • **BC-11:** Rapid charger • **BH-6:** Swivel mount • **BT-6:** AAA battery case • **DC-1/PG-2V:** DC adapter • **DC-4:** Mobile charger for PB-10 • **DC-5:** Mobile charger for PB-6, 7, 9 • **PB-5:** 7.2 V, 200 mAh NiCd pack for 2.5 W output • **PB-6:** 7.2 V, 600 mAh NiCd pack • **PB-7:** 7.2 V, 1100 mAh NiCd pack • **PB-8:** 12 V, 600 mAh NiCd for 5 W output • **PB-9:** 7.2 V, 600 mAh NiCd with built-in charger • **PB-11:** 12 V, 600 mAH OR 6 V, 1200 mAh, for 5 W OR 2 W • **HMC-2:** Headset with VOX and PTT • **PG-2W:** DC cable w/fuse • **PG-3F:** DC cable with filter and cigarette lighter plug • **SC-28, 29:** Soft case • **SMC-30/31:** Speaker mics. • **SMC-33:** Speaker mic. w/remote control • **WR-1:** Water resistant bag.

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TS-950SD

"DX-clusive" HF Transceiver

The Ultimate Signal.

The new TS-950SD is the first Amateur Radio transceiver to utilize Digital Signal Processing (DSP), a high voltage final amplifier, dual fluorescent tube digital display and digital meter with a peak-hold function.

• Dual Frequency Receive Function. The TS-950SD can receive two frequencies simultaneously.

• New! Digital AF filter. Synchronized with SSB IF slope tuning, the digital AF filter provides sharp characteristics for optimum filter response.

• New high voltage final amplifier. 50 V power transistors in the 150-watt final section, resulting in minimum distortion and higher efficiency. Full-power key-down time exceeds one hour.

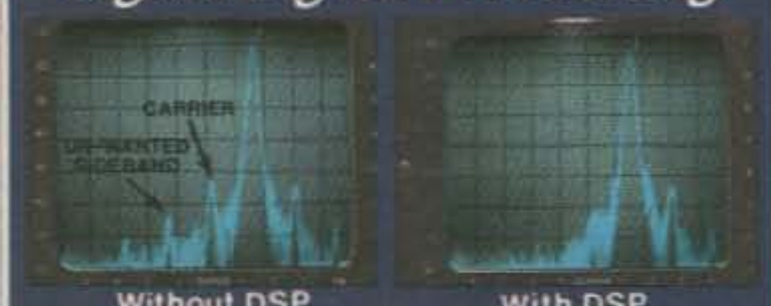
• New! Built-in microprocessor controlled automatic antenna tuner.

• Outstanding general coverage receiver performance and sensitivity. Kenwood's Dyna-Mix™ high sensitivity direct mixing system provides incredible performance from 100 kHz to 30 MHz. The Intermodulation dynamic range is 105 dB.

• Famous Kenwood interference reduction circuits. SSB Slope Tuning, CW VBT (Variable Bandwidth Tuning), CW AF tune, IF notch filter, dual-mode noise blanker with level control, 4-step RF attenuator (10, 20, or 30 dB), switchable AGC circuit, and all-mode squelch.

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications, features and prices subject to change without notice or obligation.

DSP
Digital Signal Processing



Without DSP With DSP

• Digital Signal Processor. DSP is a state-of-the-art technique that maximizes your transmitted RF energy.

• High performance IF filters built-in† Select various filter combinations from the front panel. For CW, 250 and 500 Hz, 2.4 kHz for SSB, and 6 kHz for AM. Filter selections can be stored in memory!

• *Multi-Drive Band Pass Filter* (BPF) circuitry. Fifteen band pass filters are available in the front end to enhance performance.

• Built-in TCXO for the highest stability.†
• Built-in electronic keyer circuit.
• 100 memory channels. Store independent transmit and receive frequencies, mode, filter data, auto-tuner data and CTCSS frequency.
• Digital bar meter.

Additional Features: • Built-in interface for computer control • Programmable tone encoder • Built-in heavy duty AC power supply and speaker • Adjustable VFO tuning torque • Multiple scanning functions • MC-43S hand microphone supplied

Optional Accessories
- DSP-10 Digital Signal Processor *
- SO-2 TCXO* • VS-2 Voice synthesizer
- YK-88C-1 500 Hz CW filter for 8.83 MHz IF*
- YG-455C-1 500 Hz CW filter for 455 kHz IF*
- YK-88CN-1 270 Hz CW filter for 8.83 MHz IF
- YG-455CN-1 250 Hz CW filter for 455 kHz IF*
- YK-88SN-1 1.8 kHz SSB filter for 8.83 MHz IF
- YG-455S-1 2.4 kHz SSB filter for 455 kHz IF*
- SP-950 External speaker w/AF filter
- SM-230 Station monitor w/pan display
- SW-2100 SWR/power meter
- TL-922A Linear amplifier (not for QSK)

* Built-in for the TS-950SD
† Optional for the TS-950S

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QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Photo A. At the 1990 Space Symposium in Houston, Texas, the AMSAT Board of Directors presented Andy MacAllister WA5ZIB with an award for promoting amateur satellite operation through his "Hamsats" column in 73 Magazine. *See his report on the symposium in this issue!*

In February, Time's Up

Last summer the FCC requested 20-meter nets involved in frequency and operating disputes to come up with their own ideas to solve the problem. By late fall, five net managers had responded and others were asking for more time. The FCC set a deadline of February 1, 1991 for those nets to present their ideas and plans. The hope is that the amateurs involved will be able to solve their own problems, otherwise the FCC might be forced to act.

The ARRL states that the three main areas of dispute are resolvable by enforcement of existing FCC regulations. These areas include specific illegal activities: third-party traffic when there is no third-party agreement between countries; malicious interference; and one-way broadcasts which go beyond accepted norms for transmission on the amateur bands. If the amateurs cannot engage in reasonable discussions to solve these matters among themselves, the FCC may be forced to develop and enforce restrictive rules and regulations that would hurt the entire Amateur Radio Service. TNX *B-N-T Bulletin, Vol. 19, Issue 10.*

W1AW Packet BBS

The ARRL has reinstated its packet radio BBS, W1AW-4, after more than a year off the air. The system uses Kenwood radios, Kamtronics TNCs, MSYS multiconnect BBS software, and a Tandy 1000, donated by Tandy.

The system is currently on 145.01 MHz with a backbone for forwarding on 221.05 MHz. The system is primarily for dissemination of ARRL bulletins and will not exchange other bulletins (such as NEBBS or ALLBBS types). Users are requested not to make W1AW their "home" BBS. TNX *Zero Beat*, Nov. '90 issue.

Pays for Itself

MARS is saving soldiers and their families $5.2 million per year, and the Army $31.5 million, according to the U.S. Army Information Systems Command in Fort Huachuca, Arizona. Robert Sutton, Chief of the Army's Military Affiliate Radio System (MARS), says that these statistics, compiled before Desert Shield, could now be higher. Thirty-three Army MARS stations are operating in Saudi Arabia, making about 150–200 phone patches a day. "Army MARS operators have also processed over 4,200 MARSgrams," says Sutton. The MARS network consists of 233 military and 3,800 HF amateur radio stations.

The primary purpose of MARS, dating back to 1925, is to serve as an alternate means of communication during emergencies. For example, in recent years, MARS volunteers participated in emergency communications during both the San Francisco earthquake and Hurricane Hugo. During peaceful times, MARS contributes to the considerably important task of maintaining the morale and welfare of troops and their families. TNX Robert Sutton and Diana Hawkins.

Callsign Changes

It seems there is not a limit to the number of times a licensee can change callsigns, says Ray Adams N4BAQ of the Western Carolina ARS-VEC. A new callsign is available to any licensed amateur for the asking.

The FCC has always had a policy of issuing another callsign in exchange for any callsign the licensee considered obscene. Showing that a callsign is obscene, however, may depend on personal perception and interpretation. To avoid being accused of favoritism, the FCC changed the policy to cover the issuance of a new callsign to any licensed amateur who asked.

The licensee cannot choose what the new callsign will be, however; the block it's drawn from is determined by the class of license the applicant holds at the time of filing. TNX *The Magnolia Report, Vol. III, No. 10.*

Nomadness at WESCON/90

Technological wizard and writer Steve Roberts N4RVE, who has contributed many articles to *73 Magazine* in the past three years, appeared at WESCON/90 in the Anaheim Convention Center last November. Roberts has spent the last seven years combining eclectic technology and interests—ham gear, computers, solar power, bicycles, and a love of writing and traveling—into a working lifestyle of "nomadness." As a high-tech nomad, N4RVE has computed and hammed across America, first from his Winnebiko, and now from the Behemoth, his new recumbent bicycle.

After seven years, Nomadic Research Labs boasts well over 100 corporate sponsors, such as OrCAD, Hewlett-Packard, Apple Computer, and Sun Microsystems. From the Behemoth's computer systems, Roberts does bike-top publishing, word processing, satellite operation, sound editing, and graphics. TNX Kathryn Botsford of OrCAD.

A Ham At Last!

"I'm finally a licensed radio amateur, and one happy ham!" After 25 years in network television, well-known meteorologist Gordon Barnes is on the air. With the help and encouragement of many ham friends, Barnes began studying in the fall of 1989, and received his license in early 1990. His first contact was with Dave Jackson G0EGG in England.

Continued on page 8

Photo B. A MARS operator coordinates a radio net with affiliate MARS members.

QRX . . .

Continued from page 7

Gordon KC4OCA became interested in radio while growing up in Bermuda during World War II. A long-wire and Hallicrafter S-38 receiver kept him and his brother, Pete, informed on world events. Before long, they had raised an antenna farm among the cedars. Says Barnes, "The radio served as an educational device. This is how my brother and I learned about sports . . . they were broadcasting into countries where our men were fighting, and knowing that many foreigners would be listening for the first time, they took time and pride in explaining the game . . . . It was just great!"

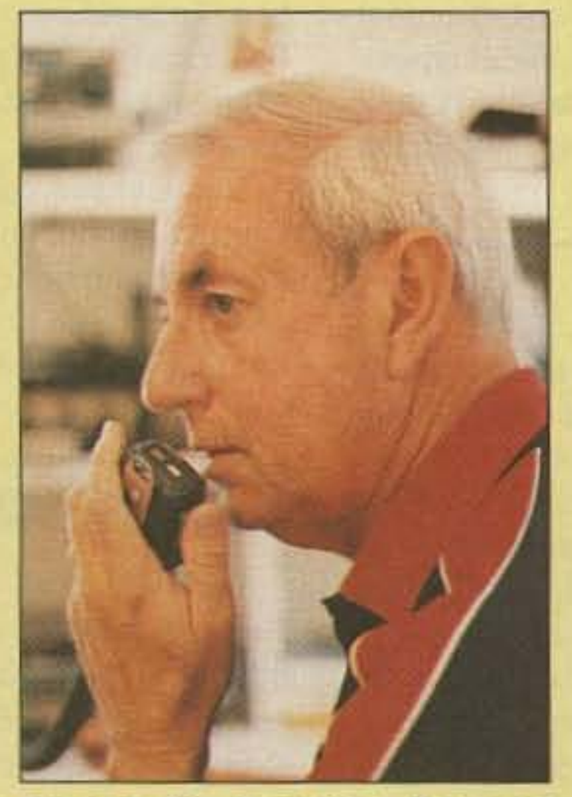

Photo C. Gordon Barnes KC4OCA, a ham at last!

Barnes, who worked with CBS, WUSA-TV, and WFLA-TV, had his own syndicated weather network, and he also served as a weather consultant for many private and publicly-owned companies. A "weatherholic" whose predictive talents show the highest rates of accuracy, Barnes feels that nearly every service and product is affected by the weather. TNX Katherine S. Barnes.

A Tale of Two Stations

Stations WWV and WWVH are both operated by the National Institute of Standards and Technology. They both broadcast the time of day and standard time intervals, maritime storm information, omega reports, and geophysical alerts. Both broadcast AM (DSB) 10 kW on 2.5, 5, 10, and 15 MHz, with WWV also on 20 MHz. WWV is located at Fort Collins, Colorado, and WWVH is located in Kauai, Hawaii. All of WWV's antennas are omnidirectional half-wave dipoles, while WWVH has half-wave phased verticals with a cardioid pattern aimed at the west.

WWV's announcer is male and WWVH's announcer is female. On WWV, there's no tick on the 29th and 59th seconds; on WWVH, it's silent at seconds 00 and 30. Both stations broadcast a 440 Hz tone (the musical note "A" above "middle C"), for chart recorders and other automated devices, once each hour—on WWV, 3 minutes past the hour; on WWVH, 1 minute past the hour.

For propagation forecasts, hams can use the geo-alerts broadcast from WWV only at 18 minutes past each hour and updated every three hours at 0000, 0300, etc. These alerts contain information on the solar flux index measured daily at 1700 UTC in Ottawa, Canada; and the current K-index (distrubance of the earth's magnetic field) along with past and predicted 24-hour activity.

If you can't receive WWV on your rig, you can call (303) 499–7111 anytime and hear the same information. For more information on WWV and WWVH, write The National Institute of Standards and Technology, 2000 East County Road 58, Fort Collins CO 80542. TNX *Kettle Drums, Vol. XVI, Nos. 10 & 11.* Also, the Broward Amateur Radio Club Bulletin of October '90 (Pembroke Pines, Florida) has an excellent article, "WWV Solar Activity Reports," by Wally Orlidge W3PAE.

WARC Proposals

The FCC released its Second Notice of Inquiry concerning possible recommendations it might make at the 1992 World Administrative Radio Conference in February 1992. Before compiling this report, known as General Docket 89-554, the FCC considered comments on frequency spectrum needs from over 50 organizations, including the ARRL, NASA, Motorola, UPS, the Voice of America, and the National Association of Broadcasters. Three recommendations affect amateur radio frequencies that WARC has the power to reassign.

First, the FCC proposes that the amateur radio 40 meter band be shifted to 6900–7200 kHz (international broadcasters would get a separate 7200–7400 exclusive allocation, possibly to 7525 kHz). Second, the FCC proposes that Low Earth Oribiting Satellites (LEOs) use 930–931 MHz uplink and 420–421 MHz downlink. Third, the FCC recommends a satellite/digital sound service that would provide quality, wide-area service for mobile radio receivers; it is looking at 728–788 MHz, 1493–1525 MHz, and 2390–2450 MHz (in the amateur spectrum).

Further changes are probable before WARC '92. At WARC, each nation will have one vote. In the past, FCC recommendations have carried weight with WARC delegates. WARC agreements must be ratified by the U.S. Senate to become effective in the United States. TNX *Balanced Modulator.*

Satellite News

OSCAR-13 may only have two more years to orbit the earth . . . or, according to others, its orbit will correct itself due to factors not entirely known. Many believe AMSAT will come up with a replacement. The 1995 launch date for Phase III for a geosyncronous orbit hamsat, operable 24 hours a day, has been postponed indefinitely due to the high cost of such a mission. AMSAT has sent out a notice via ARRL requesting that, due to inadequate solar panel illumination, the OSCAR 10 transponder not be used until further notice. (Check, as this may have changed by the time this magazine is on the newsstands.) 73

Photo D. Guardian Angel Julio Rivera learns more about ham radio after delivering some last minute pointers to Joe Fairclough WB2JKJ, president of the Radio Club of JHS 22. Last Halloween, the "22 Crew" initiated "SAFE HOME" to escort club members and other youngsters to and from school. They are coordinating the operation on a Manhattan 220 MHz repeater. With Angels for advisers, the Crew will make it safe for hundreds of young people who want to be hams.

High Precision Frequency Standard

Use your TV set as a laboratory standard!

by Gardner Johnson

One of Murphy's laws of electronics is that "no other display looks as convincing as a digital display, no matter how wrong it is." Your handheld or laboratory counter or digitally-tuned communication equipment can easily become an example of this, unless it has been calibrated recently.

The problem is that the precision of such equipment can be no better than the precision of the internal time base. When the time-base frequency drifts, all of the indications or tuning frequencies drift in direct proportion. Almost all counter-type instruments use a quartz crystal-controlled oscillator as the time base, and unfortunately, they do drift with time as the crystal ages. Drift also results from changes in crystal and component temperatures, supply voltage variations, and the aging of other frequency-determining components.

The changes may not be significant for some equipment, such as a digitally-tuned AM radio, but a seven- or eight-digit counter or a VHF communications system is another story! An independent source of precisely known frequency is needed to verify the accuracy of, or to calibrate, the digital equipment. In many cases, the same is needed for analog equipment, such as in calibrating the sweep circuits of an oscilloscope. Better yet, this frequency source should be widely available and cheap.

TV Network Standards

Every color TV receiver tuned to a program originating at one of the four major U.S.A. networks has at least two such frequencies present internally. One of these is the color-burst frequency of 3.57954545454 MHz (3.58 MHz). The other is the horizontal sweep frequency of 15.7342657343 kHz (15.7 kHz). In the early days of color TV, they decided each network would phase-lock these two frequencies to use the 5 MHz output of a rubidium frequency standard at the network's master control station to ensure the desired accuracy of color reproduction. The rubidium standards have a rated maximum frequency drift of one part in 10 to the 11th power per month. In perspective, this is approximately 10,000 times better than the typical received accuracy of the WWV shortwave signals (the equivalent of one second in 31 centuries!)

The remarkable thing about the simple

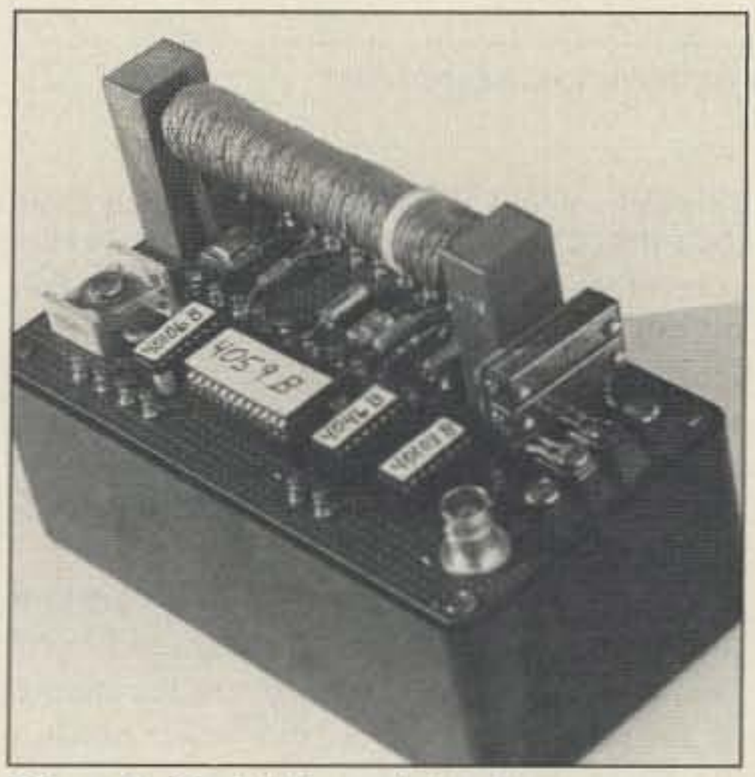

Photo A. The high-precision frequency standard in operation. (place the loopstick near the TVs horizontal output transformer)

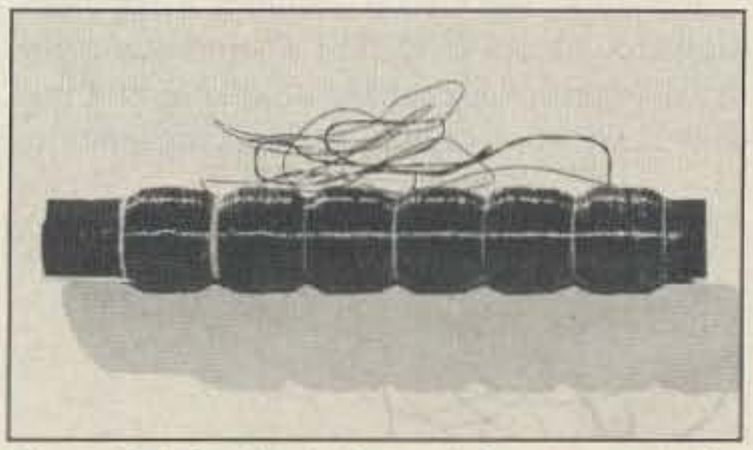

Photo B. The ferrite loopstick antenna is designed for maximum pickup of the TV set's 15.7 kHz horizontal sweep frequency.

equipment shown in Photo A is that by taking advantage of the characteristics of phase-locked loops (PLLs), it creates a one-megahertz calibration signal having essentially the same long-term precision as the network rubidium standards. Adding decade dividers to the unit permits measurement of the frequency differences among the four major network rubidium standards! Since the standards are of unequal ages, they differ by several parts in ten to the 11th power. The only other equipment used to accomplish the measurements, besides an ordinary color TV receiver, was a very well-aged (1965) H-P 5248L electronic counter purchased complete with a time-interval plug-in for $37 at a ham swapmeet.

Programs from ABC, CBS, and NBC are frequently interrupted by locally originated commercials which do not have rubidium frequency standard precision. It's unfortunately necessary to keep one eye (or ear) attentive to their program material so that the interruptions can be excluded from any measurement periods. PTL transmissions are rarely interrupted and maintain a frequency near the mean of the other networks.

Just a PLL

The circuit I'm going to describe is a simple PLL. It picks up a sample of the horizontal sweep signal of a color TV receiver that's tuned to a network program, then phase-locks a voltage-controlled oscillator (VCO) to the sample, using the frequency ratio 4004 to 63. This yields the desired, very precise one-megahertz output frequency.

Figure 1 is a block diagram and Figure 2 is the schematic for the simplified frequency standard. The 15.7 kHz pickup coil is a ferrite loopstick antenna tuned to the horizontal sweep frequency of an operating TV receiver. By picking this signal up magnetically from outside the TV set's cabinet, direct connection to the wiring inside the cabinet is avoided. This is a major safety consideration, as it rules out use of the much weaker 3.58 MHz signal. Many TV receivers have the chassis connected to one side of the power line—you guess which side! The resonant loopstick circuit has a *Q* of over 400, so it also acts as a very effective filter for the undesired signals prominent in or near an operating TV receiver.

The 15.7 kHz signal picked up by the loopstick is an excellent sine wave for eliminating other frequencies, but it's not ideal for operating the digital circuits which follow. The Schmitt buffers square up this sine wave without appreciably loading the tuned circuit, and they drive the CMOS 40103 divide-by-63 stage which follows.

The 40103 divider has eight flip-flops which can be arranged to divide an incoming pulse train by any number from 2 to 255. As used here, it divides the 15.7 kHz square wave signal from the Schmitt buffers by 63 to provide the 249.750249750 Hz (250 Hz) "reference signal" to pin 14 of the 4046 phase detector which follows. 250 Hz was chosen as the reference signal because it's the greatest common divisor of both the high precision 15.7 kHz signal from the loopstick

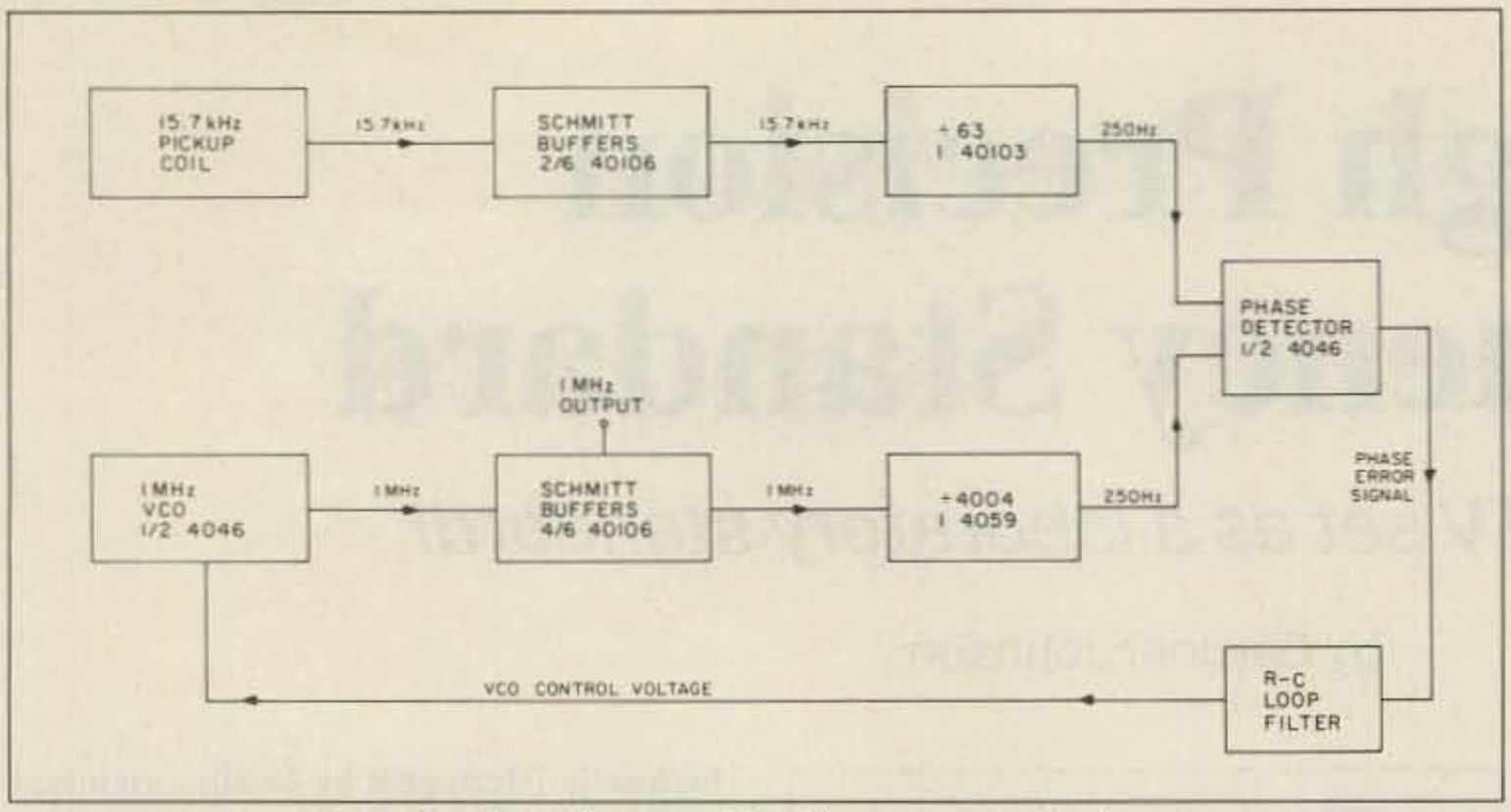

Figure 1. Block diagram of the frequency standard setup.

and the one-megahertz VCO signal that provides the unit's output.

The one-megahertz VCO is one of a number of separate functions physically located on the 4046 phase detector chip. The 4046 VCO is a well-engineered square-wave RC oscillator with useful harmonics up through the shortwave bands. You can make it oscillate at any frequency from less than one hertz to over two megahertz by choosing the proper external capacitor, two resistors, and a control voltage.

The capacitor, C6, and one resistor, R5, determine the frequency of oscillation when the control voltage equals the supply voltage. Resistors R7 plus R8 determine the frequency of oscillation when the control voltage is zero. By varying the control voltage between zero and the supply voltage, you can vary the oscillation frequency linearly, from the lower to the higher of these two frequencies.

For the present application, the capacitor and the three resistors have been chosen to yield an oscillation frequency of one megahertz when the control voltage is equal to half the supply voltage. Any deviation from the desired one megahertz is then corrected by a corresponding change in the control voltage.

The one-megahertz output of the VCO is passed through two Schmitt buffers for isolation, then fed into a 4059 divider. The versatile 4059 IC can be connected to divide an incoming pulse train by any number from 3 to 21,327. Used here, it divides the one-megahertz input from the buffers by 4004 to provide the 250 hertz "signal input" to pin 3 of the phase detector. If the VCO frequency shifts ever so slightly up or down from one megahertz, the 250 hertz signal frequency will increase or decrease in proportion.

Phase detector 2 of the 4046 compares the arrival times of the leading edges of the two 250 hertz signals, and outputs a signal that, after filtering, varies with the fraction of a cycle by which the two leading edges do not coincide. When the edges match perfectly, the filtered DC output is equal to half the supply voltage. If the one-megahertz oscillator drifts lower in frequency, the pulses from the 4059 divider will begin to arrive later, and the filtered DC output of the detector will increase, again in proportion. By applying the filtered output of the phase detector to the control voltage terminal of the VCO, the frequency of the VCO can thus be locked to the frequency of the TV receiver horizontal sweep. Although this part of the operation is analog in nature, it is enclosed within the overall digital loop, which maintains the necessary system long-term precision.

The RC filter performs two important functions. First, it filters out the 250 hertz (and any other) noise present on the output of the phase detector. If this noise reaches the VCO, it would frequency-modulate the VCO output, thereby degrading the short-term accuracy of the output signal. The long-term accuracy, however, would not be affected.

Secondly, the circuit includes a feedback loop around the VCO. This loop requires the usual amplitide and phase stabilization if it is to lock up very rapidly with no tendency to overshoot or oscillate. The simple 4-element filter used here does both jobs well, and a nearby "Hi-Fi" broadcast band receiver can detect no modulation on or near the one-megahertz output signal.

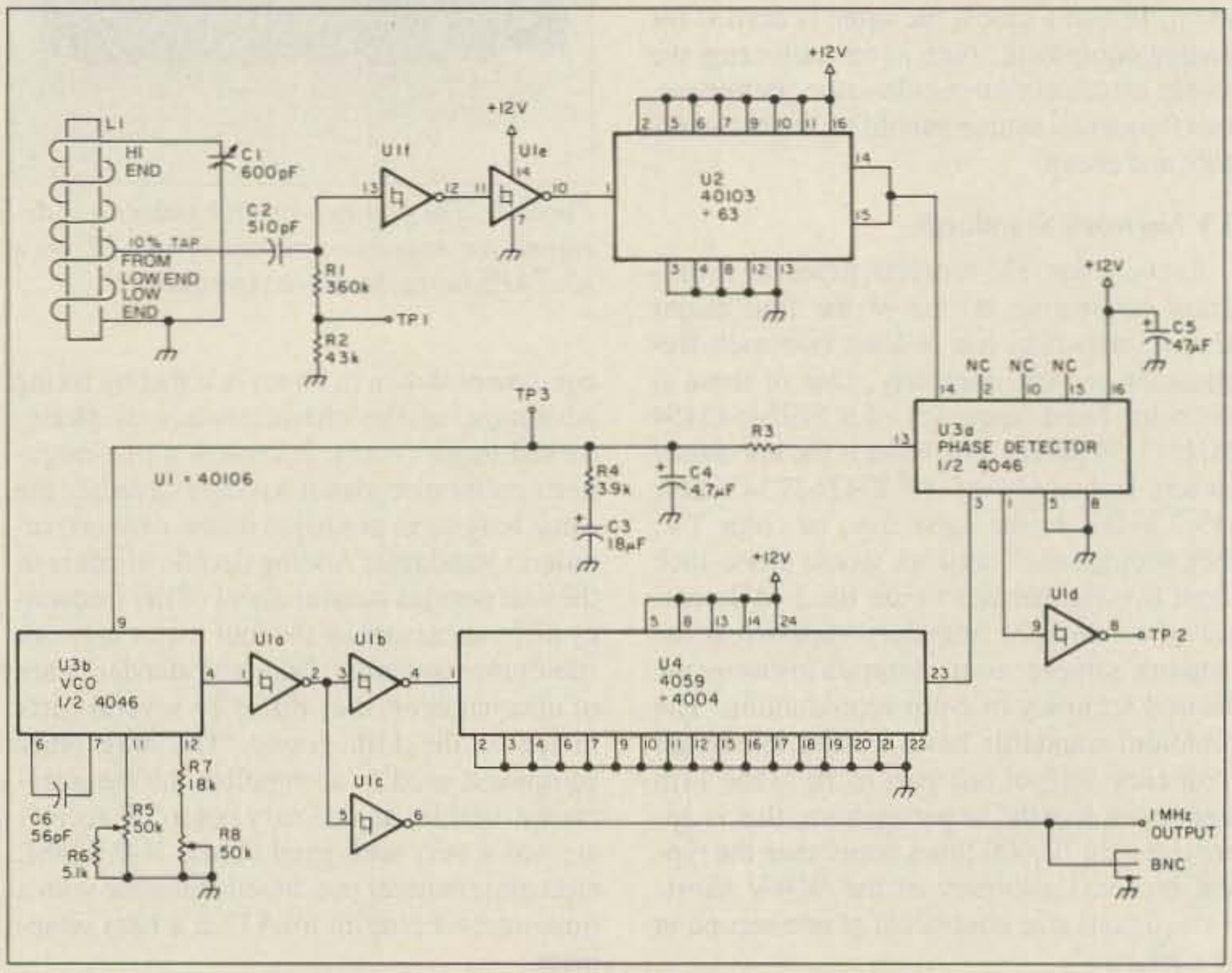

Figure 2. Schematic for the frequency standard.

Building the Circuit

The prototype was built on a leftover scrap of pad-per-hole circuit board, but ordinary perfboard works just as well. I cut the board to form a new cover for a 3" x 6" plastic project box that encloses the wire-wrap connections, and I used turret lugs for mounting the few small parts on the top of the board. The lugs were staked in place, but press-in plastic based terminals are a good alternative.

Parts layout is not at all critical, except that the grounded end of the loopstick should be located near the end of the unit so that you can put it against the back of a TV set, if necessary, for maximum pickup. The loopstick should also be located at least an inch away from other metallic objects, as they may degrade its Q. The loopstick in Photo B is supported by inserting the ends in holes drilled halfway through two phenolic blocks. *[Ed. Note: An etched and drilled PC board is available which should help ease the construction process (see parts list).*

If you decide not to use the PC board layout, you can wire-wrap everything onto perfboard. Wiring is noncritical, except that the RC filter leads should be connected directly to the 4046 socket pins in order to keep the VCO control signal as clean as possible. Wiring was fast and easy, using 30 gauge insulated wire-wrap wire and an inexpensive hand-wrapping wand. One ancient truth was relearned the hard way, however: Never, never, never buy wire-wrap sockets with short two-wrap pins, no matter how high the quality or low the price!

The equipment only requires about 12 mil-

HF Equipment

	Regular	SALE
IC-765 Xcvr/ps/keyer/auto tuner.....	3149.00	**2699**

IC-781 Xcvr/Rcvr/ps/tuner/scope	6149	**5199**

IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	**1399**
PS-35 Internal power supply.....	219.00	**199.95**
FL-63A 250 Hz CW filter (1st IF).....	59.00	
FL-52A 500 Hz CW filter (2nd IF)....	115.00	**109.95**
FL-53A 250 Hz CW filter (2nd IF)....	115.00	**109.95**
FL-70 2.8 kHz wide SSB filter.....	59.00	

IC-735 HF xcvr/SW rcvr/mic.....	1149.00	**969.95**
PS-55 External power supply	219.00	**199.95**
AT-150 Automatic antenna tuner	445.00	**389.95**
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EX-243 Electronic keyer unit.....	64.50	
UT-30 Tone encoder	18.50	
IC-725 HF xcvr/SW rcvr..... *(Special)*	949.00	**799.95**
AH-3 Automatic ant tuner .. *(Special)*	489.00	**379.95**
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Accessories

	Regular	SALE
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PS-15 20A external power supply	175.00	**159.95**
PS-30 Systems p/s w/cord, 6-pin plug	349.00	**319.95**
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal; 751A, etc ...	79.00	
SM-6 Desk microphone.....	47.95	
SM-8 Desk mic - two cables, scan	89.00	
AT-100 100W 8-band auto. ant. tuner ...	445.00	**389.95**
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AH-2 8-band tuner w/mount & whip	758.00	**689.95**
AH-2A Ant tuner system, only .. *(Special)*	559.00	**469.95**
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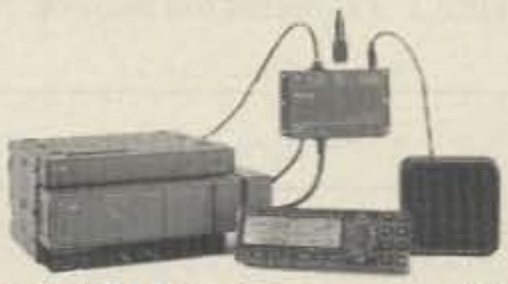

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UX-39A 25w 220MHz unit *(Special)*	349.00	**279.95**
UX-129A 10w 1.2GHz unit	549.00	**499.95**

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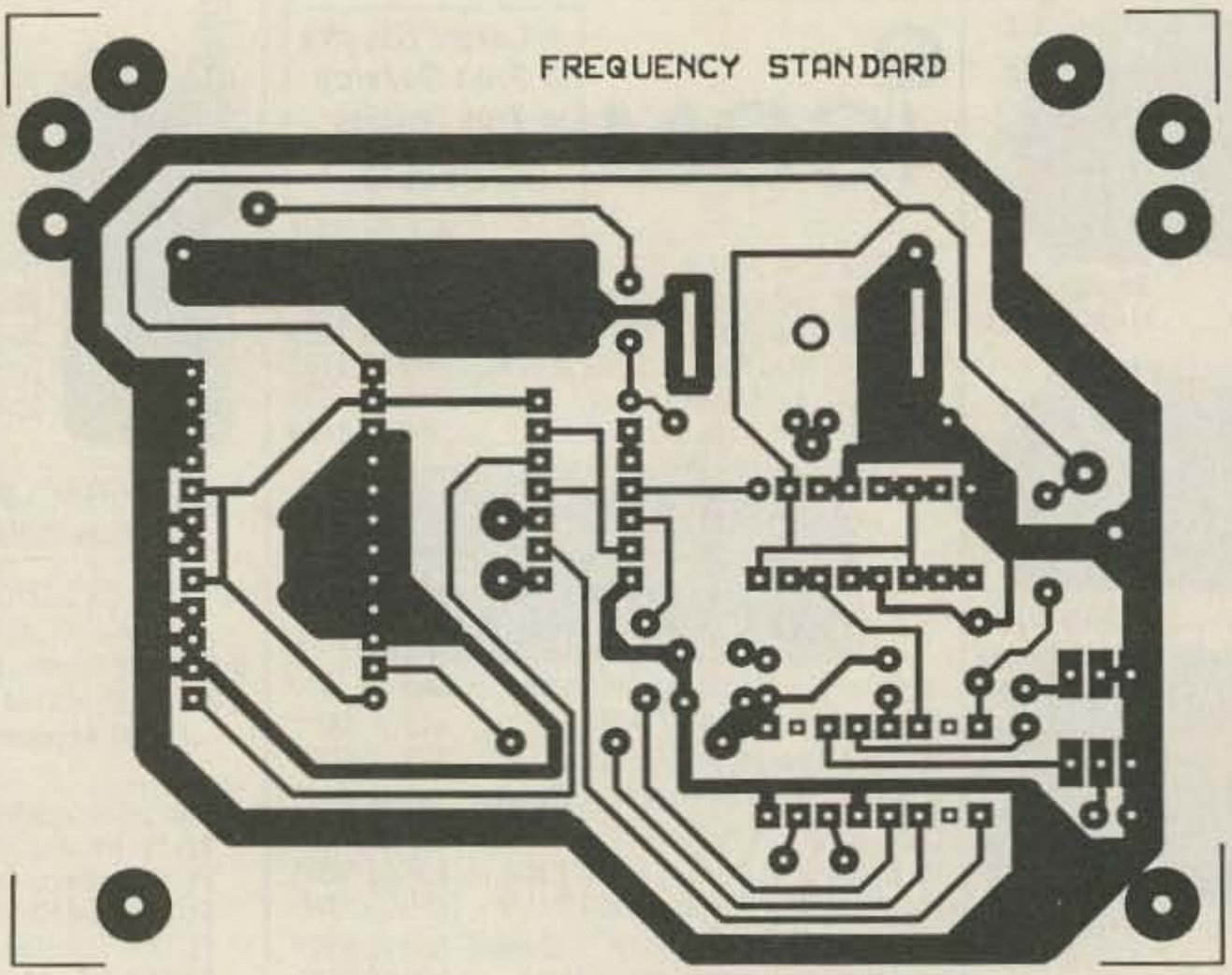

Figure 3. PC board foil pattern.

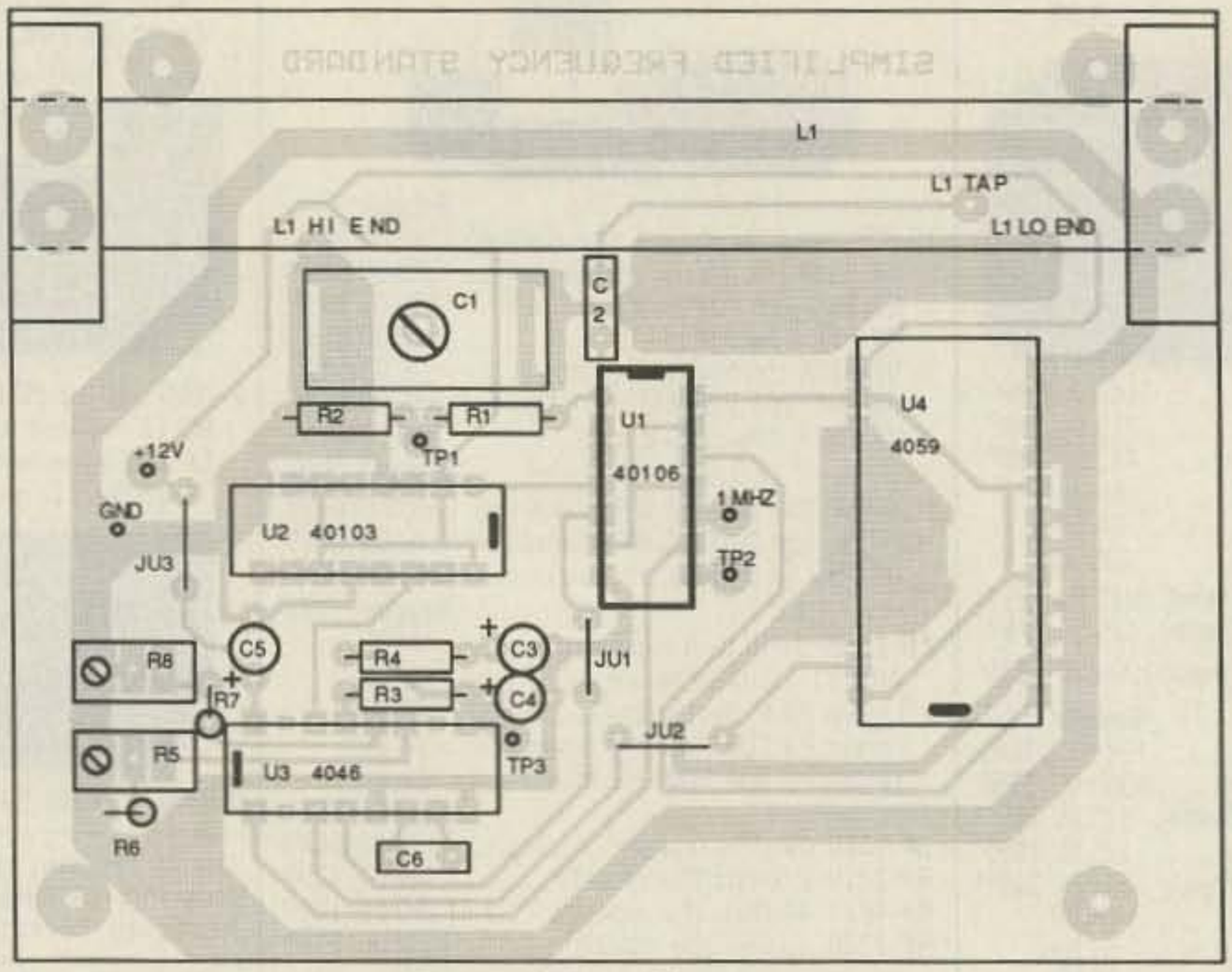

Figure 4. Parts Placement.

Checkout

Recheck your wiring carefully, then apply the 12-volt DC power. If there's no smoke, and power appears only on the correct socket contacts, turn the power off. With the power off, insert the four ICs. To prevent ESD damage, keep one fingertip on the ground terminal while handling the ICs.

Set the two trim resistors at mid-scale and reapply the power. Next, place the unit close to the back of an operating color TV receiver and connect a 50 microampere (μA) DC meter from TP-1 to ground. (Almost any multimeter will serve if set on its lowest voltage or current range.) Adjust the trimmer capacitor for the peak meter indication. The peak will be very sharp due to the high loopstick Q.

Explore the vicinity of the back and sides of the TV receiver with the unit to locate the spot providing maximum pickup. Next, disconnect the sensitive meter and connect a 0–15 volt meter from TP-2 to ground. If the loopstick is picking up enough signal to operate the phase detector, the voltage at TP-2 will be about 0.2 volts.

Excessive loopstick signal could overload the buffer, so slowly move the unit away until the TP-2 voltage jumps to 11.8, which indicates insufficient signal. Move the unit about an inch closer to the point of maximum pickup, and leave it there. You can simplify this part of the checkout procedure if you have an oscilloscope. Connect the scope from the tap on the loopstick to ground, adjust the capacitor for maximum signal, and position the unit for 12 volts peak-to-peak. This gives the design center condition (when using a 12 volt supply), but the unit will operate satisfactorily over a wide range of loop signal strengths as long as the TP-2 voltage remains below half a volt.

The unit should be providing a very good one-megahertz output signal at this point, but the trimming resistor adjustments should still be optimized for the particular 4046 in use, since the VCO sections vary a great deal from one 4046 brand to another. To do this, connect TP-3 to +12 volts with a clip lead and adjust R5 for an output frequency of roughly 1300 kHz. Next, connect TP-3 to ground and adjust R8 for an output frequency of roughly 700 kHz. Refine these initial settings until the two frequencies are equally spaced above and below one megahertz. If a counter is not available, you can measure these frequencies by tuning them in on a broadcast band receiver.

Remove the clip-lead and listen to the one-megahertz signal on the broadcast band receiver. If there is hum modulation, the most probable cause is hum on the output of the power supply. If there is 250 hertz modulation, the loop filter is at fault, possibly due to dried-out or leaky capacitors or ground loops in the filter wiring. A spectrum analyzer is even better than a broadcast band receiver for troubleshooting, but if you have a spectrum analyzer, you undoubtedly need no further suggestions!

The VCO frequency-control voltage at TP-3 is between 2 and 10 volts during normal circuit operation. If the TP-3 voltage drops to a few tenths of a volt, it indicates that the phase-locked loop is not locked. In that case, the uncontrolled output frequency will drop to around 700 kHz. It's good to give the TP-3 voltage a quick check a minute or two before making an important measurement. TP-3 is a very high-impedance point, and leaking loop filter capacitors, or connecting an ordinary multimeter, will result in 250 hertz modulation of the one-megahertz output.

Loopstick Details

The later version of the loopstick antenna as shown in Photo B has lower distributed capacitance and higher Q than the earlier versions. It's wound on an Amidon R33-050-400 ferrite rod core, with ¼" clear at each end for mounting. The remaining 3½" are covered with a single layer of tape to reduce the distributed capacitance between the windings and the fairly conductive core. Since Litz offers no advantages in this application, the wire used was number 30 nylon enamel.

The winding was subdivided into six 300-turn, layer-wound sections in order to reduce the end-to-end distributed capacitance while keeping the turns close to the core. The tap is located 180 turns from the start of the first coil. The measured inductance was 203 millihenries (mH) with a Q of 32 at 1000 hertz and a DC resistance of 35.5 ohms at 25°C.

These values permit the coil to resonate with the largest generally available adjustable trimmer capacitor without need for additional paralleled fixed capacitors. These values also permit taking the output to the buffer from only 10% of the total turns, which reduces the effect of buffer loading on the circuit Q by a factor of 100. Caution! R33 cores are fairly brittle. The completed loopstick is also commercially available if winding 1800 turns of wire is not for you (see the parts list).

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The only data controller **designed from the ground up** to be a true multi-mode, the PK-232's tuning and status indicators work in all modes, not just packet. Make sure the multi-mode you buy isn't just a converted Packet TNC. There's only one number 1!

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The PK-232 MBX includes all authorized amateur digital modes available today...Packet, Baudot, ASCII, AMTOR/SITOR (including the **new** 625 recommendation) and Morse code, as well as WEFAX (receive and transmit). Other features include the PakMail 18K byte maildrop system with automatic normal and **reverse** forwarding, NAVTEX reception, KISS protocol support, binary file transfers and more. Also included is the TDM (Time Division Multiplex) mode for SWLing that few others have. No other multi-mode has all these features.

SIGNAL ANALYSIS.

The first multi-mode to offer SIAM (Signal Identification and Acquisition Mode) was, of course, the PK-232MBX. Indispensible to SWLers, SIAM automatically identifies Baudot, ASCII, AMTOR/SITOR (ARQ and FEC) and TDM signals, then measures baud rate and polarity. Once the PK-232MBX is "locked on" to the signal, a simple "OK" command switches to the recognized mode and starts the data display. You're even ready to transmit in that mode if applicable.
The PK-232MBX makes SWLing easy and fun, not difficult and frustrating.

REPUTATION

The PK-232MBX has helped AEA establish its hard-earned reputation for producing high quality amateur radio products. Anyone can **say** they have a good reputation, so it pays to ask around. Listen on the HF bands and see which multi-mode is getting *used*. You owe it to yourself to get the best possible value for your money. Don't settle for less!

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Parts List

Capacitors

C1	700 pF compression mica trimmer (Circuit Specialists# 4215)
C2	510 pF to 1,000 pF, glass or mica
C3	18 µF, 50V tantalum such as M39003-01/2379*
C4	4.7 µF, 50V tantalum such as M39003-01/2368*
C5	47 µF, 20V tantalum M39003-01/2295
C6	56 pF to 68 pF glass or silver-mica

*20V parts would be satisfactory if of the correct capacitance.

Inductors

L1	200 mH (minimum) ferrite loopstick (see source #7)

Resistors

R1	360k ohms
R2	43k ohms
R3	5.1k ohms
R4	3.9k ohms
R5,R8	50k-ohm/25 turn adjustable trimmer (Circuit Specialists part# 950W50K, Mouser part# 594–64W503 or Digikey part# CEG54)
R6	5.1k ohms
R7	18k ohms

Semiconductors

U1	CD40106B CMOS hex Schmitt trigger
U2	CD40103B CMOS 8-stage presettable synchronous down counter
U3	CD4046B CMOS micropower phase-locked loop
U4	CD4059B CMOS programmable divide by N counter

Note: The "A" versions of all four ICs can be used, but they are more susceptible to ESD damage.

An etched and drilled PC board is available for $6 + $1.50 postage/handling from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

Sources

1. Radio Shack.
2. Amidon Associates, 12033 Otsego St., North Hollywood CA. (For ferrite cores; be sure to request a catalog.) Tel. (213) 763–5770.
3. Circuit Specialists. Tel. (800) 528–1417.
4. Digi-Key Corporation. Tel. (800) 344–4539.
5. Mouser Electronics. Tel (800) 346–6873.
6. Newark Electronics. Tel. (312) 784–5100.
7. Magnetic Component Engineering, Inc., 11379 Playa St., Culver City CA 90230. (Coil winding and completed loopsticks; part no. 74690 will be a duplicate of the loopstick in Photo B. Price is $14.95.) Tel. (213) 398–4761.

PLL Possibilities

The capabilities of the PLL create at least two opportunities. The first is for entrepreneurs to market completed units or kits. The second is for the ex-NBS NIST and the FCC to jointly persuade or require all TV networks to upgrade their color-burst frequencies to cesium beam precision.

Regarding the first, here are some possible design variations:

1. Add a divider chain to make numerous lower output frequencies available. Use synchronous dividers to minimize phase noise. Extend the chain to 0.001 or 0.0001 hertz. Add an FET buffer, a meter, and a switch for monitoring TP-1 and TP-3, and an LED indicator for TP-2.

2. Use a quartz crystal VCO (VCXO) in place of the 4046 RC VCO, again to minimize phase noise. Use a 10 or 100 MHz crystal to facilitate calibration of counters having short sampling periods. Use 74AC or 74F dividers to follow a 100 MHz VCXO. Use a 25 MHz fundamental VCXO and two doublers if the 100 MHz fifth-overtone VCXOs give cost or reliability problems.

3. Start with a TV tuner and IF appendages. The 3.58 MHz color-burst signal can then be phase-locked to a one-megahertz VCO by using 88 and 351 dividers. The lock frequency then becomes 11.3636363636 kHz, which improves PLL dynamic performance and permits still better filtering of the phase detector output. Add decade dividers for the higher VCO frequencies.

Regarding the second opportunity: A dozen dividers added to the unit would provide the long-term precision available to every standards laboratory, research group, business, and individual user in the world for under $100 plus a color TV receiver. Cesium beam standards have a rated precision of one part in 10 to the 12th power, the equivalent of one second in 31,000 years, the world standards of time and frequency. Unlike rubidium secondary standards, they're believed to be free from aging effects.

At the network master stations, the rubidium standards could be replaced with cesium beam standards for about $33,500 each, small change in that world. But there are even less expensive approaches. NIST already maintains a bank of cesium beam standards to control the transmission of WWV. The 60 kHz WWV signal is not subject to the Doppler shift problems of shortwave signals; suitable receiver systems have been available for about $1,800. By phase-locking the rubidium standards to the 60 kHz WWV signal, ten times higher precision can be obtained. A third possibility would be for NIST to supply a pilot frequency for phase-locking via phone lines. A fourth, would be to do the same thing via satellite, and a fifth would be for NIST or another agency to supply the cesium standards to the networks as a service to government agencies, businesses, and even the taxpayers.

The Final Unit

The unit in Photo A was later modified by the addition of a chain of decimal dividers to enable measurement of the difference of the network standards (requires counting 100,000,000,000 pulses). The well-aged H-P 5248L was used in the time-interval mode, counting its own internal 100 MHz clock pulses for a time determined by the 0.001 Hz (or 0.0005 Hz) pulses from the dividers. This circumvents the counter limitation of a 10-second maximum count interval for direct frequency measurement. In the 1000-second interval, it therefore counted 10^{11} pulses. The display shows only the last eight digits of the count, but they are the ones of interest. The time interval plug-in had slightly different delays in the start and stop channels, but they were calibrated out by use of measurements taken at a series of shorter times.

The procedure was to take repeated counts on each of the four network stations in sequence. The differences in the averages for each station thus corresponded to the differences in the frequencies of their rubidium standards. Similarly, any drift in the average of each group of four readings would correspond to the aging rate of the H-P 5248L clock oscillator, although no statistically significant difference was found.

The most impressive thing about the whole effort was the way the data repeated time after time. The total number of PLLs in the overall system, from those in the rubidium standards to those in the measuring system, must have been quite large. The signals from three of the four networks had to travel either 3,000 miles over land, or to a satellite and back, for good measure. The amount of short-term phase modulation of the VCXO must also have been very small, because the overall standard deviation of the 100 trillion count samples averaged about three counts! 73

Gardner Johnson, recently retired from Hughes Aircraft's Radar Systems Division, may be reached at 3744 Wade St., Los Angeles CA 90066.

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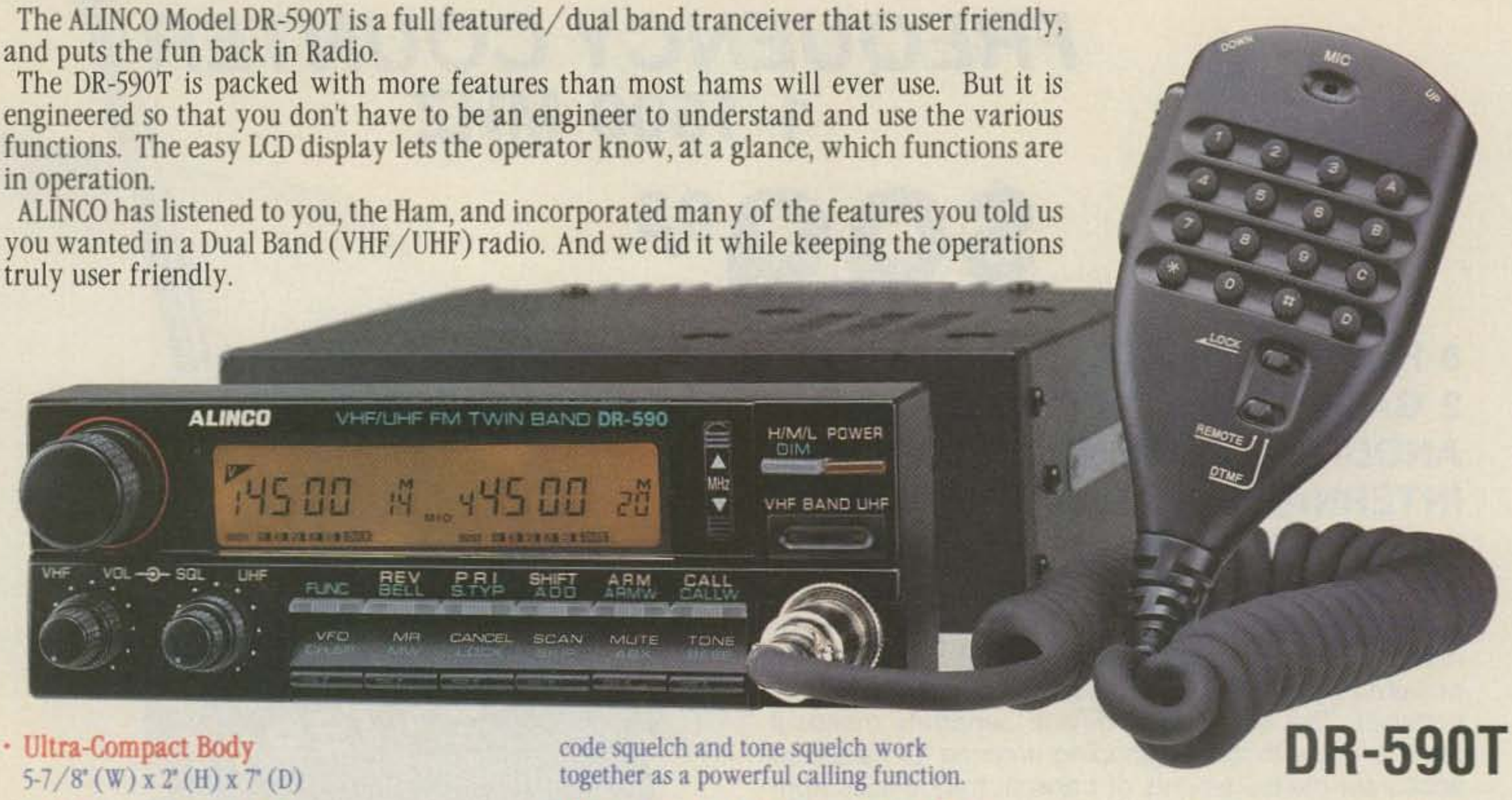

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  5. VHF/UHF Switching
  6. Up/Down by 1 Mhz steps
  7. Setting and Selecting DSQ codes
  8. Setting and Automatic Dialer
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  Memory Scan, Program Scan, ARM Scan, Band Scan, and more Scan.
- **Memory Channels**
  The unit has 28 memory channels, one independent "Call" channel, and 10 ARM memory channels (40 channels in total). You can program set tones, shift frequences, shift directions, and channel steps in each of the 28 memory channels.
- **ARM (Automatic Repeater Memory) Function**
  10 repeater channels can be memorized automatically. While ARM mode is active, scanning stops at vacant channels and pauses, then starts again automatically. This function is useful to find vacant repeaters.
- **ABX (Automatic Band Exchange) Function**
- **Bell Function**
- **Dimmer Function**
  Selectable 2 different brightness of LCD light
- **Three Priority Functions**
  VFO Priority, Memory Priority and Call Priority.
- **Repeater Operation**
  The DR-590T can be used as a cross band repeater.
- **Full Duplex Cross band Operation**
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  5. And Many Other Features

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CIRCLE 67 ON READER SERVICE CARD

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. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

Feedback# Title

1 Letters
2 Never Say Die
3 QRX
4 High Precision Frequency Standard
5 MFJ SWR Analyzers
6 Scrounger's Guide to Recycled Electronics
7 HF/VHF/UHF Marker Generator
8 Parallel Port I/O Board
9 WB2OPA LogMaster
10 TM-941A Triband FM Transceiver
11 Three-Terminal Regulator
12 Rose Parade Mobile
13 ELNEC Antenna Modeling Program
14 Low-Cost Mag-Mount
15 Circuits
16 Ask Kaboom
17 New Products
18 RTTY Loop
19 DX
20 Homing In
21 Dealer Directory
22 Ham Help
23 Barter 'n' Buy
24 73 International
25 ATV
26 Special Events
27 Above & Beyond
28 QRP
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- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• LOW PROFILE POWER SUPPLY						
SL-11A	•	•	7	11	2¾ x 7⅝ x 9¾	11

RS-L SERIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE				
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7

RM SERIES MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

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

RS-A SERIES

MODEL RS-7A

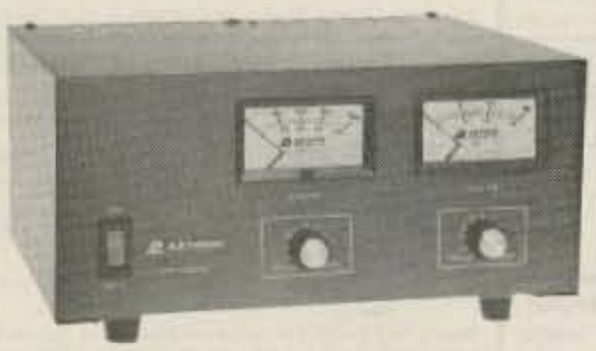
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½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

RS-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

VS-M AND VRM-M SERIES



MODEL VS-35M

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

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

RS-S SERIES

MODEL RS-12S

• Built in speaker

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

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

CIRCLE 16 ON READER SERVICE CARD

73 Review *by Bill Clarke WA4BLC*

MFJ SWR Analyzers

The MFJ-207 HF and 208 VHF portables.

MFJ Enterprises, Inc.
Box 494
Mississippi State MS 39762
Tel. (800) 647–1800; (601) 323–5869
TELEX: 53 4590 MFJSTKV
Price Class: MFJ-207, $100
MFJ-208, $ 90

Have you ever put up a dipole that was pre-cut to an exact length for a specific frequency? Did it work as planned? Or, as in most cases, did you have to make so many trips between the shack and the antenna to check the SWR that you wore a path across the lawn?

Suppose you had a portable device you could take out to the antenna and make SWR tests on the spot? Think your life would be a little simpler?

Well, the folks at MFJ Enterprises—the manufacturer of all those neat make-it-easier-on-the-ham gadgets—have come up with two great boxes for testing antenna SWR. One, the Model 207, is for the HF spectrum of 1.75–30 MHz, and the other, the Model 208, is for the 142–156 MHz VHF user.

Both SWR analyzers are the same size and weight: 7.5 x 2.4 x 2.7 (HWD) inches and less than a pound. Both have an ON/OFF switch, frequency control, an SWR meter, and an SO-239 connector. They operate on a 9-volt battery or an optional (Model 1312) AC adapter. The latter might be fine for use in the shack, but I like the portability of battery operation.

A Test Run

Here at the new QTH of Radio WA4BLC, the antenna system has been slowly growing. Knowing that my wire antennas and VHF vertical are correctly set up (done the old hard way: In the shack—check the SWR, then back out and trim some more on the antenna, and back again), I decided to check the new SWR analyzers.

Using a short piece of RG-8X as a patch line, I connected the MFJ-207 (the HF version) directly to the Double Edged Sword's feedline, selected band B (includes 75–80 meters) and turned the unit's frequency control to find the lowest SWR reading. (The Double Edged Sword Antenna is a dipole system with legs cut for 40 and 75 meters, fed with one feedline.)

Once this reading was made, I tuned the receiver until I heard the 207's signal. The receiver accurately indicated the analyzer's frequency of lowest SWR. I repeated the process on 40 meters. The lowest SWR readings were exactly where they had been set last week.

This was an exercise in rechecking what I had already done (a known product) against the SWR analyzer (an unknown product). As both methods produced similar results, I am satisfied the Model 207 performs as designed.

Out of curiosity, I then connected the device to my Carolina Windom's feedline and tuned to see what would happen. Low SWR was indicated at many points over the HF spectrum. Some were inside the ham bands, others were not. All points were close enough to our bands to allow easy operation with a tuner.

Practical Operation

The test runs were done by tuning the 207's vernier dial, observing the built-in SWR meter, then pinpointing the 207's exact frequency on a receiver. The reason you must check the frequency with a receiver is that the vernier dial on the SWR analyzer is small and covers too broad a tuning range to be really accurate.

Having seen the problem with the vernier readout, MFJ installed an RCA jack labeled RF OUT on the 207 (and 208) to allow direct connection with a frequency counter for a very accurate readout. This is great in the field, where no receiver is readily available.

MFJ's SWR analyzers make proper antenna installation faster and easier.

Finding the SWR

The test run demonstrated how you would find the lowest SWR point for an antenna; however, the 207 can also be used to find an antenna's SWR at a pre-determined frequency. Connect the unit to the antenna being tested, set the vernier dial to the frequency desired (checking with a receiver or counter), and read the SWR.

If you have ever installed a multiband antenna, whether a 5-band vertical or a triband yagi beam, you know how very frustrating it is to keep running SWR checks from the shack. With the 207, you can tell directly from the antenna site (ground level for the vertical or on the tower for the beam) what the SWR will be at what frequencies. Then you can easily make adjustments before you tighten everything up.

Like the idea of tuning up your antenna matching device while not actually being on the air? The 207 can be set to your operating frequency and its signal injected into your tuner. Then you can adjust the tuner until the 207 displays a perfect 1:1 match.

The 207 worked great on my mobile antenna system, which consists of several Hustler resonators (coils) for the 75 and 40 meter bands. I had forgotten which coils were for what frequencies. Using the 207 I was able to quickly identify the lowest SWR points (therefore the operational frequency) of each coil. It is also great for readjusting these ultra-sensitive antenna tips for new frequencies.

VHF Version

The Model MFJ-208 does for 2 meters what the 207 does for the HF band. It is identical in size, although somewhat simpler to operate as there is only one band to be concerned with

on the vernier dial. Tuning indication is more accurate.

It worked splendidly for retouching my 2 meter whips and rechecking my V-2 vertical. Good thing the V-2 checked out OK, as it was already up in the air.

Just for the fun of it, I checked a couple of those famous rubber-covered dummy loads we all use on our HTs. I figured the readings would be similar to real-life HT operation, as the 208 is about the same physical size as an HT (ground plane?). The best SWR a famous gain-style rubber-covered antenna showed was 2.25, and that was at 147 MHz. A very short type showed an SWR of 1.3, but that was above the band by a couple of MHz. A factory variety was on the money for frequency at 146 MHz, but the SWR was 2.3.

These results came as no great surprise and only go to prove a point: I don't think any of the short HT-type antennas do as well as they should be doing. In past lab tests, using very sophisticated equipment, I had reached the same conclusions.

Mobile VHF antennas can get pulled out at the car wash, but the Model 208 will get you back on target quickly.

Likes

Portability. You can use it in the field, your car, or up on a tower.

Readability. The SWR meter is easily read.

Controls. All the controls operate easily.

Cost. The cost is reasonable, even in today's dollars.

Possible Improvements

The vernier dial on the 207 is not very accurate, but use with a counter makes the dial redundant. Additionally, the dial can be moved on its shaft for calibration purposes (which I did). The 208's dial is quite accurate, possibly due to its limited frequency coverage.

The instructions are adequate for operation, but they should have included information about the methods of charting antenna SWR by frequency, and instruction on how to use that information for making antenna adjustments.

Recommendations

Would I recommend the MFJ Antenna analyzers to my fellow hams? Yes, and it is too bad I didn't have them a few weeks ago when I was setting up my antenna system. They could have prevented the new path worn in the grass from the antenna field to my shack's door.

One last comment: These SWR analyzers provide a means of accurately tuning antennas WITHOUT transmitting any signals. In other words, they reduce air pollution, as well as making the hams's life a little easier. 73

Bill Clarke WA4BLC, who has reviewed a lot of equipment for 73 readers over the past years, has a new address. You can now reach him at RD#2 Box 455-A, Altamont NY 12009. Says Bill, "I enjoy reviewing equipment I can get excited about."

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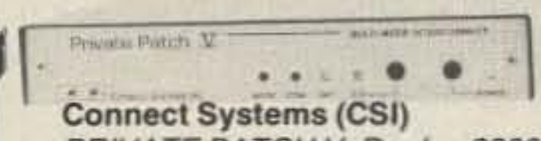

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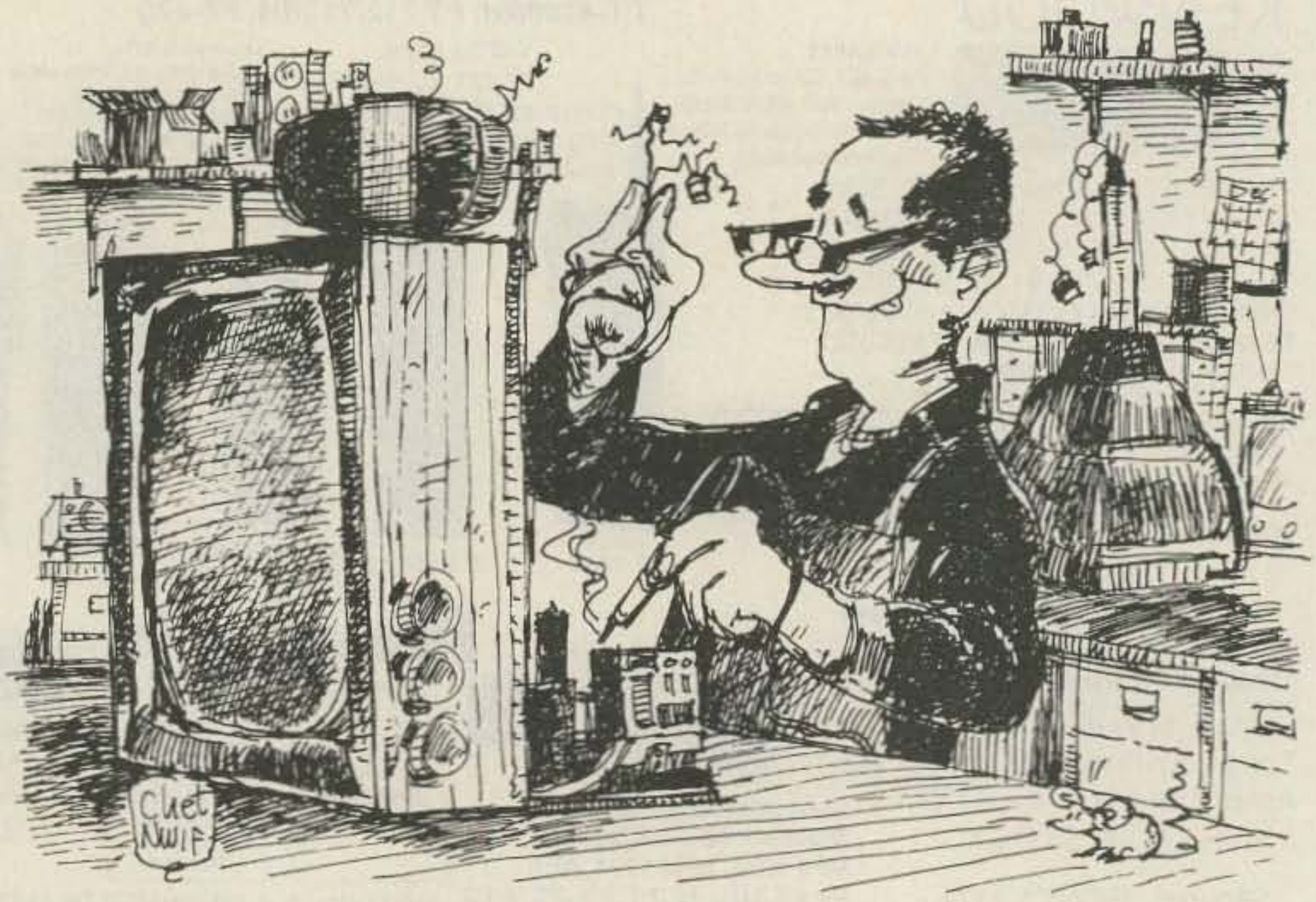
CIRCLE 41 ON READER SERVICE CARD

Scrounger's Guide to Recycled Electronics

Discover a goldmine of inexpensive parts.

by Jack Najork W5FG



Aside from Radio Shack, there are few commercial sources of electronic parts available to the builder or experimenter. Most catalog houses require minimum orders of $20 to $25, which is pretty discouraging to someone who needs just a few odds and ends for a weekend project.

However, if you are willing to do a bit of scrounging and desoldering, you can find an ample supply of parts just about anywhere. We live in a world conditioned to quickly discard anything electronic that is obsolete or doesn't work properly. The trash yards and dumps of America are filled with junked electronic products. The trick is to intercept them before they are carted off. A few words to friends and neighbors will insure that these jewels are held for your pickup. Aside from these "freebies," many items can be picked up at garage sales for a dollar or two. TV sets, radios, hi-fi combinations, CB radios, wireless telephones and car radios all contain parts that can be recycled for ham use. Let me give you some examples of components I've salvaged, modified (if necessary) and used for various projects. Then we'll get to the details of digging them out and identifying them.

From TV sets: ferrite cores and forms for RFI line filters and antenna baluns, slug-tuned RF coils, RF toroids, power supply rectifier diodes, filter caps, potentiometers, resistors, ceramic capacitors, switches, loudspeakers and many useless tubes. Some of the older or larger sets may include a power transformer.

From radios, wireless telephones and hi-fi combinations: ferrite rods, tuning capacitors, more slug-tuned coils and IF transformers, transistors, diodes, small loudspeakers, NiCd batteries and condenser microphones.

My home-brew transceiver sports an RF tuner (modified) that came from an old car radio. Double-balanced mixer and modulator transformers are wound on small ferrite slugs taken from low frequency IF transformers. The diodes came from a wireless telephone, as did most of the transistors used in the audio and IF stages. Some RF coils are wound on toroids made from slices of powdered-iron slugs—more on this later. The RF driver transistor in the transmitter section came from a CB radio, as did the "S" meter, loudspeaker and part of the metal housing. Truly, my junque box floweth over—and yours can also.

TV Sets

Warning: THE PICTURE TUBE OF ANY TV SET IS EXTREMELY HAZARDOUS, regardless of size. If mishandled, the tube can implode, flinging razor-like glass fragments with the force of a small bomb. UNDER NO CIRCUMSTANCES SHOULD YOU EVER STRIKE THE FACE OR BELL OF A PICTURE TUBE. Breaking a tube this way will produce a bomb-like implosion.

RF Coils, Toroids and Such

Unless your set is over 25 or 30 years old, the video IF section will contain 45 MHz slug-tuned coils and the audio section IF 4.5 MHz coils. (The audio coils are identifiable because they have many more turns.) The video coils can be stripped of their windings and used for RF circuits from 1.5 to 50 MHz. Most coils use ¼" diameter slugs which have a hollow hex core for insertion of a tuning tool. You can slice off small segments of these slugs, ⅛" or so thick, and use them as RF toroids. The easiest way to do this is to roll the slug back and forth under a single-edge razor blade or sharp knife. The powdered iron is quite soft and sections readily. Sand smooth the rough edges. Figure 1 shows the approximate inductance vs. turns for sections ⅛" thick. Thicker segments will yield slightly higher inductance, and vice versa. The Q factor of these coils is quite acceptable for most RF work, and I use them for oscillators and front-end receiver-tuned circuits.

Pocket radios, hi-fi sets, cordless telephones and CB radios contain many small, shielded RF and IF coils and transformers. Most sets use the standard 10.7 MHz and 455 kHz frequencies for FM and AM IF circuits, along with 25 MHz and 49 MHz for CB sets and cordless phones. A physical inspection will show the approximate resonant frequency of these devices, i.e. the 455 kHz transformers have many turns wound on small powdered iron bobbins while RF coils are wound on segmented plastic forms. Many of these devices will contain an inner powdered iron cup which fits over the coil form. The cups used for 10.7 MHz transformers and RF coils can also be used as toroid forms.

Figure 1 shows turns vs. inductance for RF cups 10/32" in diameter and 7/32" tall. The data in this figure should be taken as a general guide only. Manufacturers, variations in

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FREQUENCY COUNTERS

CT-70 7 DIGIT 525 MHz

CT-90 9 DIGIT 600 MHz

CT-125 9 DIGIT 1.2 GHz

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated-thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

NEW CT-250 2.5 GHZ

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Rechargeable internal battery pack, BP-4	$ 9.95
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ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	< 25 mV to 500 MHz	8	1 Hz, 10 Hz	$189.95
CT-70	20 Hz–550 MHz	< 50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	$139.95
CT-90	10 Hz–600 MHz	< 10 mV to 150 MHz < 150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	< 25mV to 50 MHz < 15 mV to 500 MHz < 100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	< 25 mV to 50 MHz < 10 mV to 1 GHz < 50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$239.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	< 50 mV	Convert your existing counter to 1.5 GHz		$89.95

SPEED RADAR $89.95 complete kit 5G-7

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes, baseballs, models, runners, or virtually anything that moves. Operates at 2.6 GHz with over ¼-mile range. LED digital readout displays speeds in miles per hour, kilometers per hour, or feet per second! Earphone output permits 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. Kit includes deluxe ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC.
PR-2, wired, includes AC adapter $59.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.
PA-1, 40W pwr amp kit $29.95
TR-1, RF sensed T-R relay kit $ 8.95

FM WIRELESS MIKE KITS

FM-3 SHOWN

Pick the unit that's right for you. All units transmit stable signal in 88–108 MHz FM band up to 300' except for hi power FM-4 that goes up to ½ mile.
FM-1, basic unit ..... $ 5.95
FM-2, as above but with added mike preamp ..... $ 7.95
FM-4, long range, high power with very sensitive audio section, picks up voices 10' away $14.95
FM-3, complete unit includes case, battery, switch, antenna, and built-in condensor mike. Excellent fidelity, very small, kit $16.95
FM-3WT, as above, but fully wired and tested $19.95
SMC, miniature sensitive mike cartridge for FM-1, 2, 4 ..... $ 2.95

MICROWAVE INTRUSION ALARM

A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.
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Neat kit that will produce 25 different classical and popular tunes, plus 3 doorchime sounds. Lots of fun for doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look.
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Case + knob set, CMM-5 . $12.95

PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software. PC board, all necessary parts and full documentation.
Complete kit, PC-1 .... $49.95

LO NOISE PREAMPS

Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.
Each kit $17.95

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A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
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Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!
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Transmit your VCR or TV camera throughout your house. Stable quality signal, tunable Ch 4–6. Accepts standard video and audio inputs.
Complete kit,
JM-7 ..... $14.95

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A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 8–45 ohm speaker.
BN-9 kit $5.95

BROADBAND PREAMP

Very popular sensitive all-purpose preamp, ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation.
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SYNTHESIZED—NO CRYSTALS TO BUY!

$129.95

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Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.
Your choice of bands $27.95
(Specify band: HR-20, HR-30, HR-40, HR-80)
Matching case & knob set, CHR $12.95

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Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.
CW-7 kit $24.95
Matching case knob set, CCW $12.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!
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Matching case & knob set, CAA $12.95

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Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.
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2, 6, 10 MTR, 220 FM RECEIVERS

Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.
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Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!
FM-10 kit $29.95
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Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.
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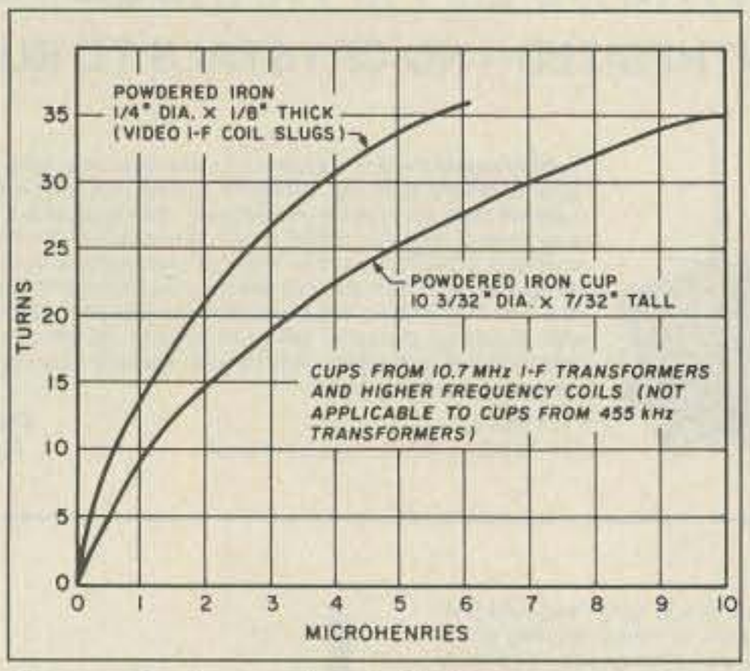

Figure 1. Approximate inductance vs. turns for toroids wound with #30 enameled wire.

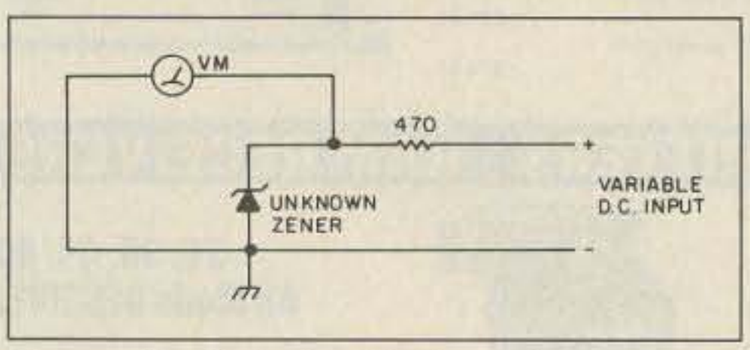

Figure 2. Test circuit for unknown zener diodes. Slowly increase DC voltage input from zero up. DC voltmeter (VM) reading will also increase and then stop at the zener diode's rated voltage.

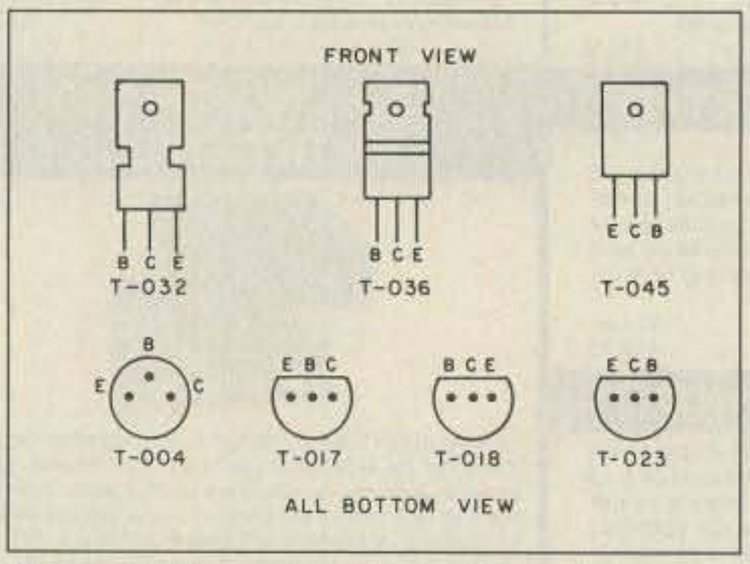

Figure 3. Transistor pin configurations.

material mix, spreading or compressing turns, and wire size can cause considerable variations in inductance. To be sure, use an L-C checker (See "Build This Simple L-C Checker," *Ham Radio*, December 1988 or "The Coil Tester," *73 Amateur Radio*, September 1990).

Cores and cups from 455 kHz transformers will yield very low Q, inefficient coils if used above 2 MHz or so. You can make a rough but effective check of core material with a grid-dip meter, provided the coils for the meter are made of tubing. Insert the slug or cup INTO the meter coil with the meter set to the frequency at which you plan to use the material. If the meter reading rises slightly, stays the same or drops slightly, the material can be used. If the meter reading drops sharply, the material is not suitable. If you are making coils to cover 160 to 10 meters, check the material at around 20 MHz. If it looks OK there it will work 160 to 10, although the circuit Q on the lower frequencies may not be quite as high as found with optimum material. RF designers use much more sophisticated methods, selecting the optimum core material for each frequency segment, conditioned on requirements for circuit Q, thermal stability, etc. (That's why the TS-940 is so expensive!)

Ferrite Slugs and Forms

Your TV set may also contain large, solenoid type coil forms tuned with ¼" diameter, hex-hole ferrite slugs for operation in the horizontal and/or vertical sweep circuits at 15.75 kHz and 60 Hz respectively. Ferrite slugs are more like glass and cannot be easily sliced. They can be used in the same manner as ferrite beads, to suppress RF on wiring. If you need short sections you can try filing or grinding to break off portions, and if you are lucky you will not end up with useless broken pieces as I generally do.

The horizontal/vertical deflection yoke positioned around the bell of the picture tube is wire-wound ferrite. Remove the wire and the ferrite may come apart or be held together with clips. When clipped together (or cemented with epoxy), the bell-like form becomes an effective, toroid type RFI filter form. Winding the AC power cord of your TV receiver or hi-fi set half a dozen turns around this core will prevent RF from getting in (or out) via this route. Ditto for the AC power cord of your transceiver or linear amplifier. For maximum effectiveness, wind on as many turns as the form will hold (or cord length will allow) and anchor them in place with twine or tape. The larger the picture tube, the larger the form, with 25" color sets yielding a form which is almost too large to hide behind a small set.

The horizontal high voltage transformer, generally housed in a separate metal enclosure will also yield useful ferrite material in "U" shaped sections bolted together, forming the transformer core. After the windings are removed the closed form can again be used for RFI suppression, as described for the yoke material.

"Another Balun Design" in *Ham Radio*, May 1982, describes the construction of an antenna balun made by winding six turns of small diameter coax on each opposing leg of the closed form. Another use for this material is the fabrication of a bifilar RF choke used for the filaments of cathode-driven linear amplifier tubes. (See "Hints and Kinks," *QST*, August 1989.)

Transistors and Diodes

Chances are, most of the equipment you salvage will come from the Far East. Although they use our color code on resistors and mark capacitors in English, transistors and diodes are a different story. Most plastic transistors will bear a letter/number identification that has no relationship to our 2N system. Here is the key to their system: Transistors prefixed with A or B are PNP, C and D are NPN, and FETs start with K. Some metal devices may use S followed by the A, B, C or

Continued on page 28

Table 1. Characteristics of the more popular transistors found in imported consumer electronic equipment.

Type	Description		HFE	Gain-BW Product MHz	Outline
A117	1W	PNP-G	200	0.001	T-004
A128	1W	PNP-G	90	1.5	T-004
A473	50W	PNP-S	60	10	T-036
A495	0.6W	PNP-S	100–320	120	T-017
A562	0.6W	PNP-S	100–320	120	T-017
A634	10W	PNP-S	120	150	T-039
A671	50W	PNP-S	60	10	T-036
A673	0.4W	PNP-S	150	200	T-017
C371	0.4W	NPN-S	150	200	T-017
C394	0.6W	NPN-S	100–320	120	T-017
C458	0.6W	NPN-S	100–320	120	T-017
C460	0.4W	NPN-S	150	200	T-017
C535	0.25W	NPN-S	100	1100	T-017
C536	0.4W	NPN-S	400	>90	T-017
C710	0.2W	NPN-S	100	200	T-018
C723	0.25W	NPN-S	100	1100	T-018
C733	0.4W	NPN-S	400	>90	T-017
C763	0.25W	NPN-S	100	1100	T-017
C828	0.75W	NPN-S	250–500	350	T-023
C900	0.2W	NPN-S	250–800	230	T-017
C929	0.65W	NPN-S	50	500	T-023
C930	0.2W	NPN-S	100	200	T-018
C945	0.6W	NPN-S	100–320	120	T-017
C1060	50W	NPN-S	60	10	T-036
C1096	10W	NPN-S	> 85	65	T-032
C1173	50W	NPN-S	60	10	T-036
C1213	0.4W	NPN-S	150	200	T-017
C1237	20W	NPN-S	100	>100	T-036
C1383	1W	NPN-S	>120	200	T-023
C1674	0.65W	NPN-S	50	500	T-023
C1815	0.6W	NPN-S	100–320	120	T-017
C1909	20W	NPN-S	100	100	T-036
C2038	5W	NPN-S	200	250	T-045
D325	50W	NPN-S	60	10	T-036

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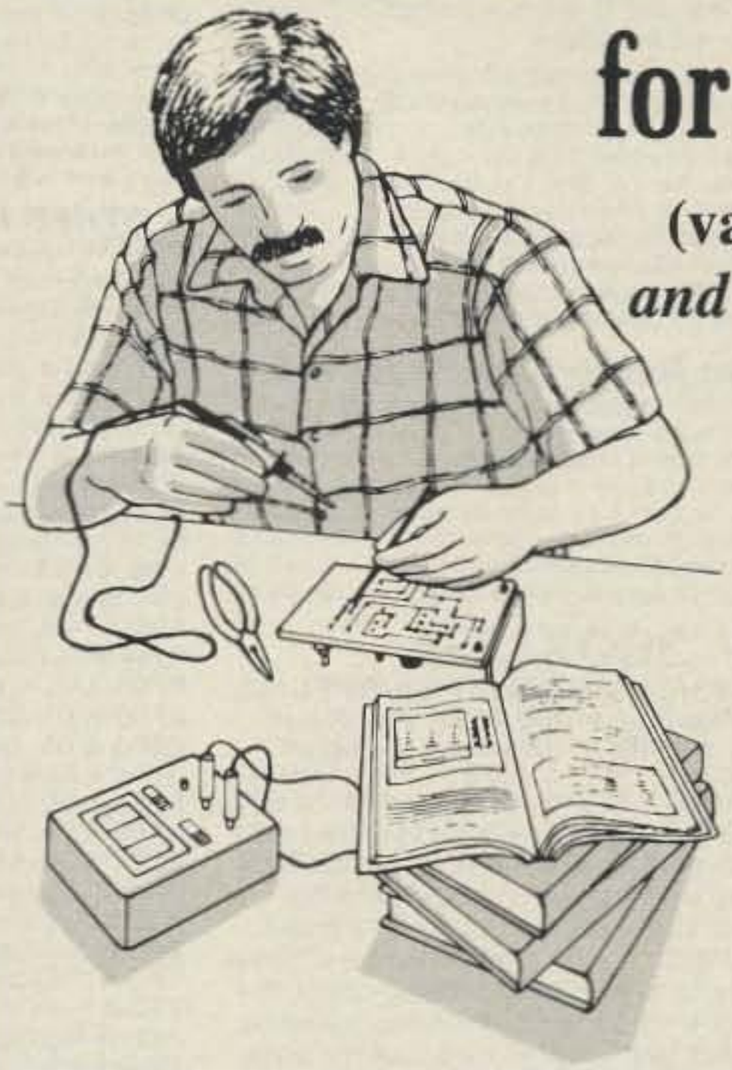

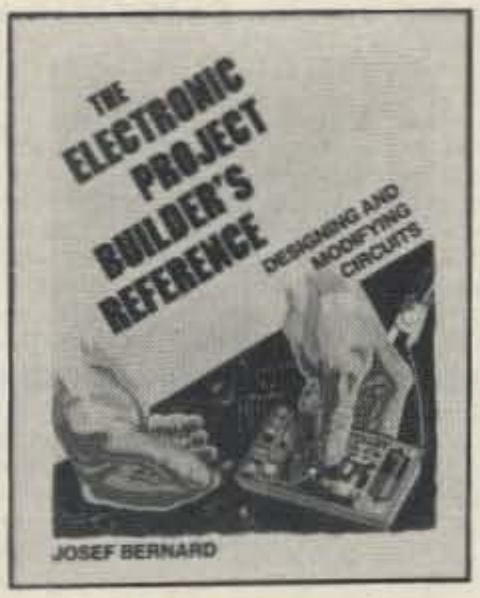

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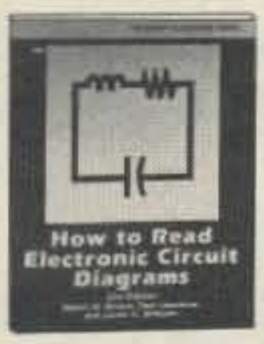

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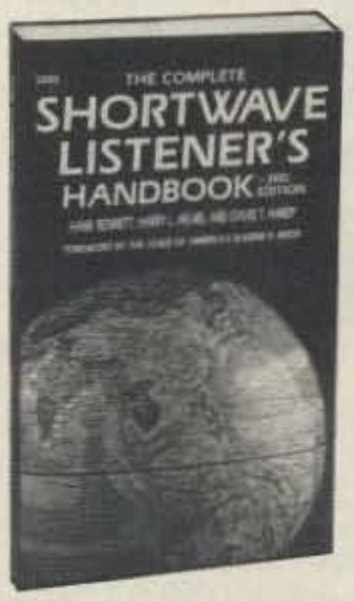

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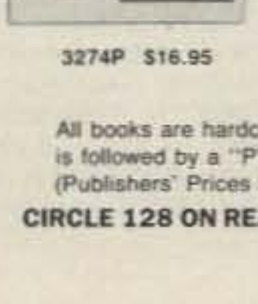

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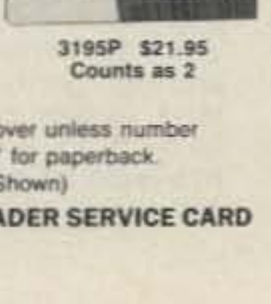

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NEW! Bearcat® 147XL-A

List price $189.95/**CE price $94.95/SPECIAL**
10-Band, 16 Channel • No-crystal scanner Priority control • Weather search • AC/DC
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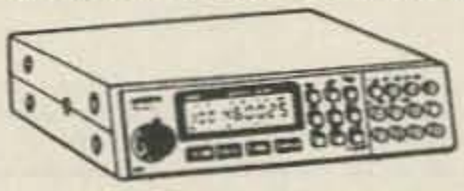

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If you purchase a scanner, CB, radar detector or cordless phone from any store in the U.S. or Canada within the last 30 days, you can get up to four years of extended service contract from Warrantech. This service extension plan begins *after* the manufacturer's warranty expires. Warrantech will perform all necessary labor and will not charge for return shipping. Extended service contracts are not refundable and apply only to the original purchaser. Warrantech does *not* have an extended warranty plan for *handheld* scanners. For mobile or base scanners, CB radios or radar detectors a 1 year extended warranty is $19.99, two years is $39.99 and four years is $59.99. Order your service contract today.

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A60-A Magnet mount mobile scanner antenna....$34.95
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CIRCLE 121 ON READER SERVICE CARD

Continued from page 27

Parts List

C1	1 µF, 10V tantalum (or 10 µF electrolytic)
C2	1 µF, 25V tantalum (or 10 µF electrolytic)
R1	1000 ohm, 5%, ¼W
U1, U2, U4	74LS90 (or 7490)
U3	74LS74 (or 7474)
U5	7805 +5V regulator
XO1	Motorola K1160AA, 6 MHz

A blank PC board is available for $4.75 + $1.50 shipping per order from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

The 6 MHz crystal oscillator module, model XO-600, is available from Short Circuits, P.O. Box 285, Barnegat NJ 08005. (609) 698–3080.

ors, each about eight inches long, and connect one end of each wire to the proper point on the PC board; each output frequency is brought out on a separate wire. On the schematic, mark the wire colors you use, identifying each with the frequency it carries.

Testing, Testing

The pins on the oscillator XO1 should be shortened by ⅛" with diagonal cutters so that the oscillator will seat snugly against its socket. Be certain the square corner on the oscillator package is at pin 1 on the socket. Do not install the other ICs yet.

Apply power, and measure the output voltage of the 7805. It should be between 4.96 and 5.5 for proper operation. Remove power and install the oscillator XO1. Apply power; then, using a frequency counter or receiver, check to see that outputs are available at 6 MHz intervals. Remove power.

Insert U1, 74LS90, in its socket and apply power. As above, check that it provides an output at 1 MHz intervals. Remove power. Insert U2 in its socket and apply power. Check to make sure it provides a 100 kHz signal at the proper intervals. Remove power. Insert U3, 74LS74, check for the 50 kHz and 25 kHz signals. Remove power. Insert U4, 74LS90 and look for the 10 kHz signals.

Caution: Always be sure power is off before inserting or removing ICs. Failure to do so may result in a destroyed IC.

Use a Blocking Capacitor

Apply power to the marker generator. Connect its output to your receiver's input. *Be sure you use a blocking capacitor (0.01 µF)!* Select the desired output frequency and locate it on your receiver. As you zero in on the desired portion of the spectrum, change the marker frequencies as you desire.

If you have followed the layout and schematic accurately, you now have an excellent crystal-controlled marker generator which covers a wide portion of the radio spectrum—and you've spent less than $10. . .even if you bought all the parts new! 73

Continued from p. 24

D and a series of numbers. Later model equipment may use Motorola transistors carrying 9000 series numbers which have no relationship to the ABCD system.

By far the easiest answer to unraveling the specifications for these devices is found in RCA's SK Series Replacement Guide. A second source is Radio Shack's Semiconductor Replacement Guide. Both of these list thousands of semiconductors with specifications and pinouts. If you are unable to get these books, see Table 1 for specifications of the more popular transistors.

You can sort out small diodes with an ohmmeter. In general, germanium types will have a lower forward resistance than silicon. Or, you can pass a small current through them (10 to 15 mA) and measure the DC voltage across the diode: 0.6 to 0.7 volts for silicon and 0.2 to 0.4 for germanium. Zener diodes are sometimes marked with 1N numbers or they may have just a single digit, such as 8, on the body, signifying an 8 volt zener. Otherwise, these can be identified by using the circuit shown in Figure 2.

RF Tuners From Car Radios

Many radios (Collins, Yaesu FT-101, etc.) use RF tuners (also called preselectors) which consist of two or more coils slug-tuned via a front panel control. This type of tuner simplifies multiband frequency coverage because it can cover a larger frequency spread more efficiently and with fewer components than a design using variable capacitors. The same form of inductive tuning is used in most automobile radios. If you are adept and patient, you can convert these to ham band use. The slugs used for the BC band cannot be used for the higher ham bands (3.5 MHz up). If your radio is AM and FM you can take the slugs from the FM section of the tuner (which won't be used) and use them in place of the AM slugs. The "Q" factor on the lower frequency bands won't be quite optimum with these slugs but they will still be very satisfactory.

The BC band coils must be stripped and rewound with 15 to 25 spaced turns to achieve an inductive range of around 1µH to 4µH tuning spread. The tricky (and difficult) part is to wind both coils identically so that the inductances track closely with slug penetration. My version varies from 1.4µH to 4µH and covers 3.5 to 29 MHz in conjunction with band-switched capacitors.

Other Components

Aside from consumer electronic products, many valuable components can be found on scrapped circuit boards sold at hamfest flea markets. I have found boards loaded with VHF power transistors, hot-carrier diodes, miniature relays, etc., for as little as 25¢ each. The law of supply and demand is tilted way over to the supply side because there are not too many of us builders and experimenters around. Join the ranks of the privileged few. 73

An HF/VHF/UHF Marker Generator

Get on frequency for less than $10.

by J. Frank Brumbaugh KB4ZGC

Many hams operate HF as well as the 2m, 1¼m, and 70cm bands, and higher. Most marker generators hams build provide outputs only at 100, 50, and 25 kHz. This is adequate for the HF bands, but it's impossible to identify even a specific 100 kHz marker at VHF and higher. You need harmonic-rich outputs in the megahertz range to facilitate identification at these higher frequencies.

Motorola's K1160AA

The marker generator described here provides square wave outputs at 6 and 1 MHz, and at 100, 50, 25 and 10 kHz. I chose 6 MHz because its harmonics accurately mark 144 MHz, 222 MHz, 420 MHz, many points in the 70cm band, plus 450 MHz. The remaining outputs enable identification of as close as 10 kHz points in between.

The heart of this circuit is a 6.000 MHz crystal oscillator made by Motorola: the K1160AA. Self-contained in a sealed metal can, it fits a 14-pin DIP socket. It operates from a +5 VDC regulated supply and draws 65 mA. Output is a square wave rich in harmonics. It is available from Short Circuits, PO Box 285, Barnegat NJ 08005 for $1.00. The Part Number is XO-600.

See the circuit in Figure 1 and the parts placement in Figure 3. The oscillator and all other parts were obtained from Short Circuits. The filter capacitors and the resistor came from the junk box.

How the Marker Generator Works

A +5 VDC fixed regulator 7805 provides a nominal +5 VDC to the circuit, which requires 100 to 150 mA, depending on the ICs selected. The 74LS chips require much less current. Use a scrap of aluminum to make a small home-brew heat sink.

The oscillator, XO1, feeds a square wave at 6 MHz to U1, 74LS90, which is connected to divide by six. Output is a 1 MHz square wave which is fed to U2, 74LS90, connected to divide by ten. The resulting 100 kHz square wave is fed to U3, 74LS74, which is connected to divide by both two and four, producing square wave outputs at 50 and 25 kHz. The 50 kHz output from U3 feeds U4, 74LS90, connected to divide by five, thus producing a square wave output at 10 kHz.

All outputs are brought out on separate wires. They can be connected through a 1-pole, 6-position wafer switch for convenient selection to an output connector. They may also be brought out to separate connectors. Because a DC voltage also appears on these output lines, you must use a small blocking capacitor when you use the generator with a receiver.

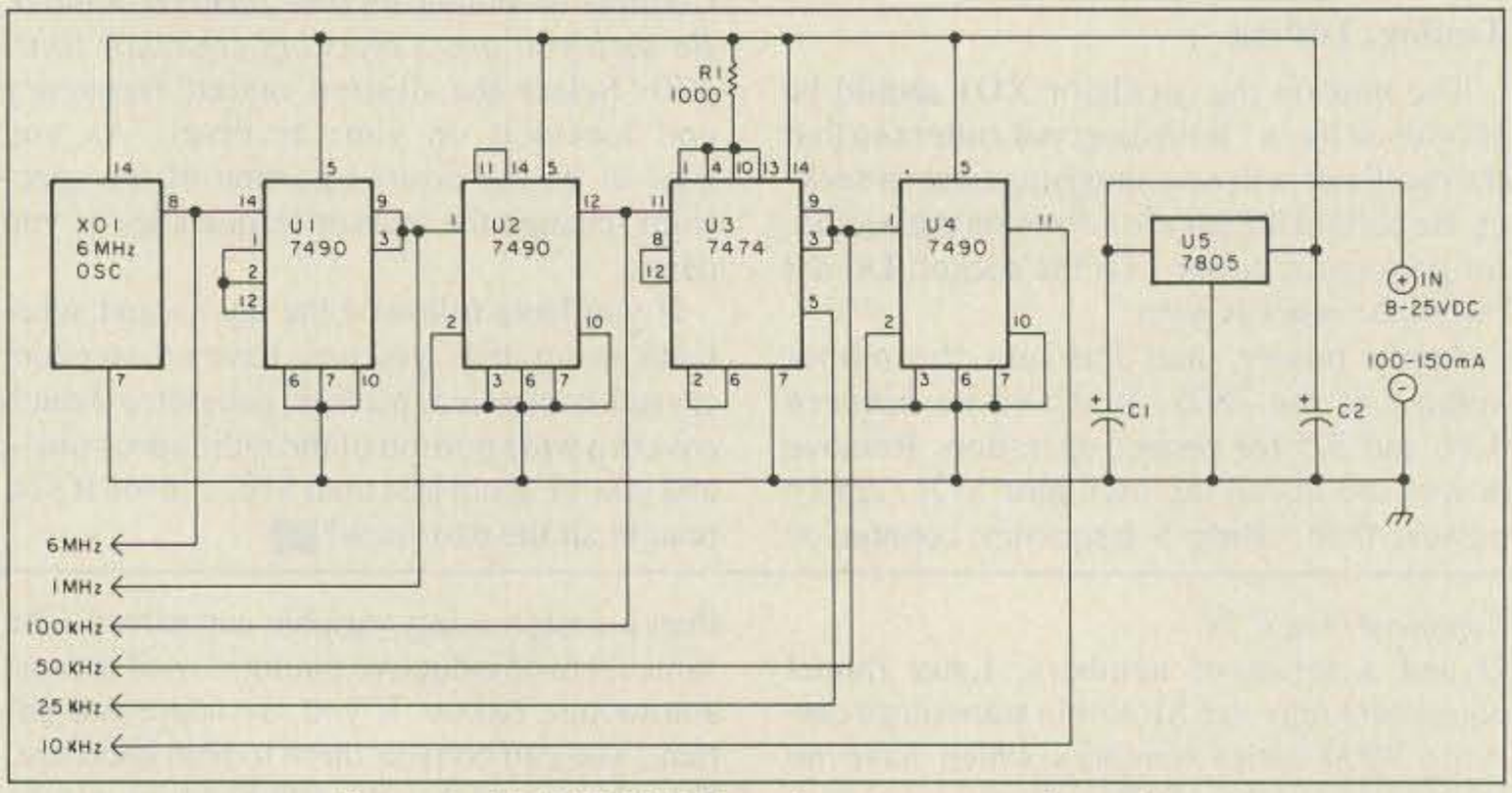

Figure 1. HF/VHF/UHF marker generator schematic.

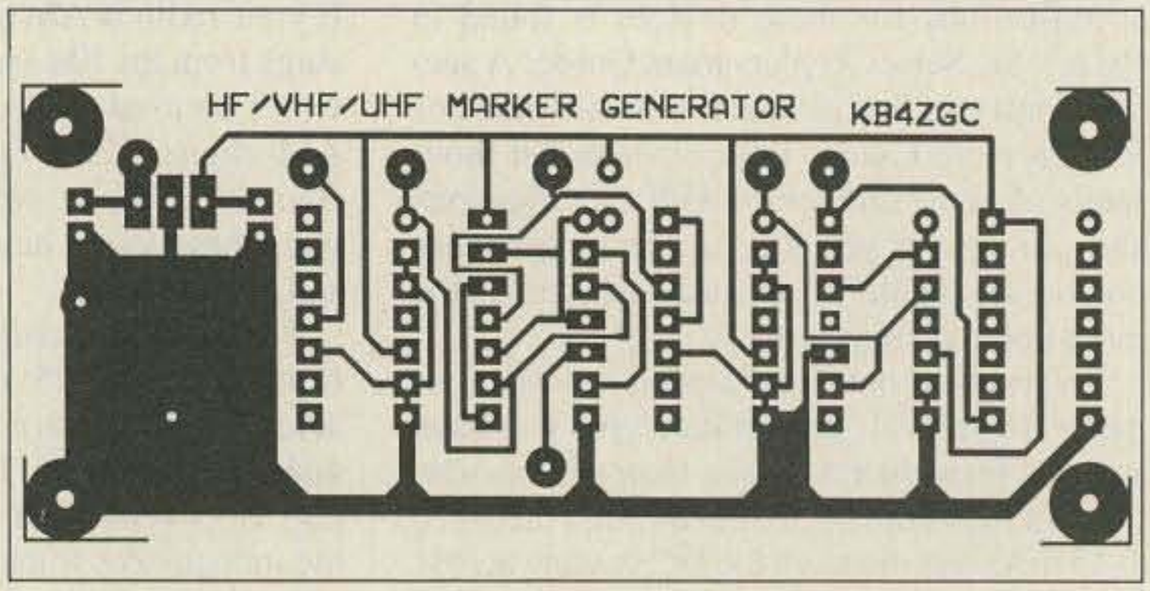

Figure 2. PC board foil pattern.

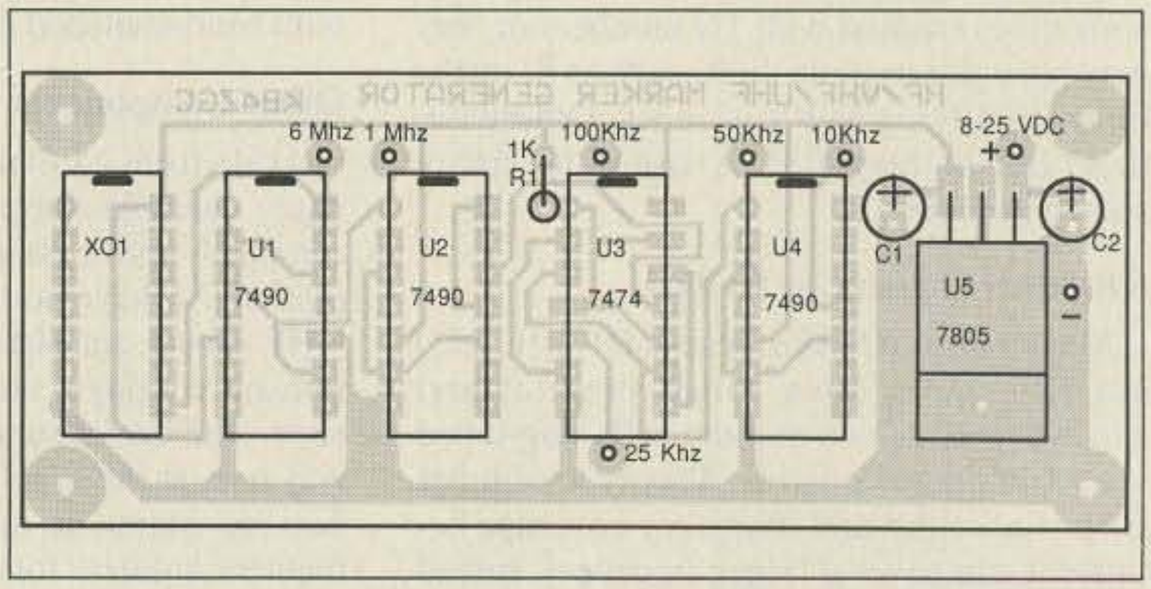

Figure 3. Parts placement.

Construction

Install the IC sockets on the PC board and solder in place. The oval shaped pin on the PC board indicates pin 1 for each IC.

Bend the pins on U5, the regulator 7805, so it will lie flat against the PC board mount, and solder it in place. Through the small hole in the tab of the 7805, drill a hole through the PC board, if desired for later attachment of the home-brew heat sink. You can add the filter capacitors now or later.

Take six insulated wires of different col-

A Parallel Port I/O Board

Control your world!

by Wally Gardiner VE6BGL

If you've recently purchased one of the new IBM PC clone computers for the ham shack, you have probably been wanting to use it to control the coffee pot, the antenna rotator, and who knows what else! This article describes how to use the parallel port, which normally connects to the printer, as an input/output port to control the outside world (see Figure 1).

The parallel port on most clone computers exits the back of your machine in a 25-pin female connector. Table 1 shows the necessary pinouts of the printer port as you face the computer. For our purposes, we can ignore all the other pins on the connector.

The computer sends data to the printer using pins 2 through 9, and with simple programs written in BASIC, we can send data to our interface board the same way. The IBM series of computers are port-oriented, and a port can be addressed easily using the OUT command. This is similar to using the POKE command to store a value in memory. Instead of appearing in memory, the value will appear on the data lines of the specified port. Using LPT2, as an example, the command OUT 632,0 would latch all of the data lines low, while a command OUT 632,5 would set data lines 2 and 0 high. Why, you ask? Binary arithmetic! Examine Table 2.

By OUTputting the appropriate decimal number, we can control which lines on the parallel port will be HIGH (+5 volts) and which will be LOW (0 volts). This even lets us control more that one thing at a time, handy for azimuth and elevation rotators for an OSCAR pass, for example. It can walk AND chew gum!

Customizing the Interface

The remaining problem is to interface the data lines coming from the computer to the real world without causing any mushroom clouds inside the machine. Obviously, we don't want 120 volts zinging around our motherboard! Take a look at the schematic in Figure 2. All this does is buffer the data line pulse by feeding it through a diode and a 1k resistor to the base of an NPN transistor, causing the transistor to act as a switch. Data bits 0 through 3 are connected to larger power transistors and monitor LEDs, and can be used to control high current items such as stepper motors, while data bit 4 is connected to a relay driver.

If the I/O board were connected to LPT2 on an XT, typing a command from BASIC, such as OUT 632,16, would cause the relay to close, while an OUT 632,0 would make it open. The relay in turn could be connected to lights, the coffee pot (through a larger relay to handle the higher current!), your rotator, or the key for your rig! So how about a practical application? Depending on the kind of keying your rig requires, the I/O will key it either through a relay, an optoisolator, or from the transistor. Consult your manual, and if you're not sure, use the relay method.

To test your interface, run the program STEPPER.BAS, Listing 1. The port addresses may have to be changed, depending on your particular machine. When STEPPER.BAS is run, all the LEDs on your I/O board should make like an old-fashioned police scanner, blinking sequentially. If the lights don't blink, troubleshoot!

Note that the port number 632 may also have to be changed depending on your computer. Other numbers to try are 888 and 956. Check the documentation that came with your machine. HINT: If your manual says something like HEX 3BC, and you want to convert that to decimal from BASIC, type: ? &H3BC and BASIC will return a value of 956 decimal.

```
10 CLS
20 PRINT "Program to test LPT2 port"
30 PRINT "**************************"
40 PRINT:PRINT
50 OUT 632,0
55 GOSUB 1000
61 OUT 632,1:SOUND 40,1
65 GOSUB 1000
70 OUT 632,2:SOUND 80,1:GOSUB 1000
72 OUT 632,4:SOUND 160,1
75 GOSUB 1000
83 OUT 632,8:SOUND 320,1
85 GOSUB 1000
90 GOTO 50
999 END
1000 FOR TDLY=1 to 2:NEXT TDLY:RETURN
```

Listing 1. Stepper program.

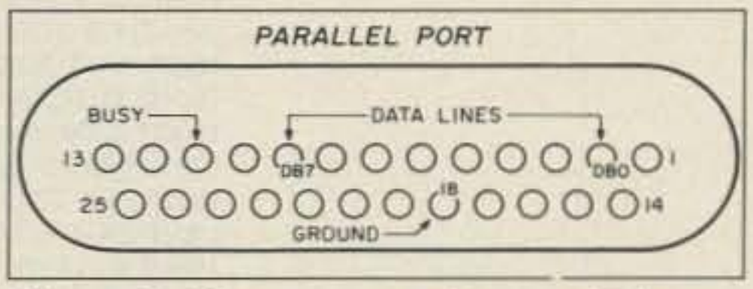

Figure 1. You can use this parallel port, which normally connects to your printer, to control more than one device at a time.

Output Control

Now that your interface has been tested, it's time to do something with it. Enter and SAVE the program MORSE.BAS, Listing 2. This program will allow you to type on the keyboard and send Morse code either through the speaker for code practice study groups, or out the parallel port (Data Bit 0) to control the LED. The LED will blink on and off in Morse, and would make a great signaling device.

If your rig can be keyed by a transistor, the LED can be paralled with an optocoupler, and used to key

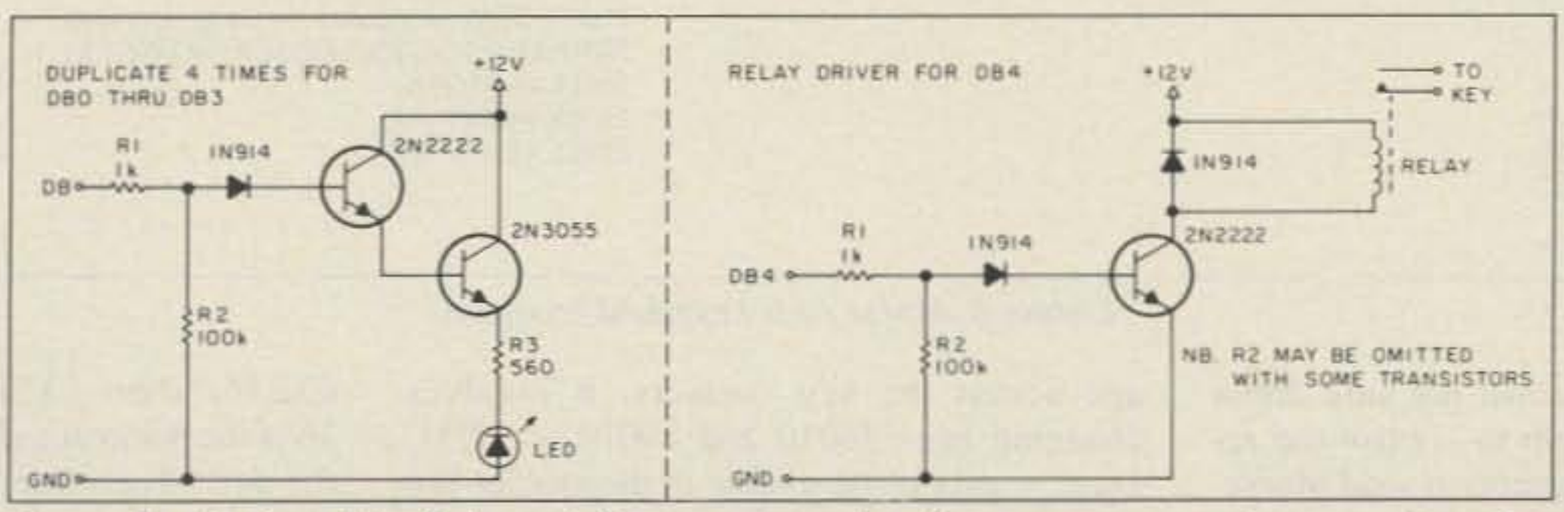

Figure 2. (a) Data bits 0 through 3 are connected to larger power transistors and monitor LEDs. (b) The relay driver for DB4.

```
5 KEY OFF
10CLS
20 REM do title screen
25 FOR LN=1 to 9:PRINT:NEXT LN
30 PRINT "=============================================="
40 PRINT "=       Morse Code Keyboard Program        ="
50 PRINT "=                by                        ="
60 PRINT "=         W.S. Gardiner VE6BGL             ="
70 PRINT "=       Box 2035 High River Alberta        ="
80 PRINT "=============================================="
90 GOSUB 10000:CLS
100 REM get hardware information
105 CLS
110 PRINT "                Hardware Menu"
120 PRINT "              **************"
125 FOR LN=1 TO 5:PRINT:NEXT LN
130 PRINT "       Parallel Port      HEX      DECIMAL"
135 PRINT "       *************      ***      *******":PRINT
140 PRINT "       1) LPT1:           3BCH       956"
150 PRINT "       2) LPT1:           378H       888"
160 PRINT "       3) LPT2:           278H       632"
165 FOR LN=1 TO 5:PRINT:NEXT LN
170 PRINT "Check your system documentation and select 1, 2 or 3
from the menu"
180 INPUT ANS
181 IF ANS=1 THEN PORT = 956
192 IF ANS=2 THEN PORT = 888
183 IF ANS=3 THEN PORT = 632
184 IF ANS>3 THEN GOTO 190
185 GOTO 200
190 PRINT "Please type a number between 1 and 3"
195 GOSUB 10000:GOTO 100
200 REM start of program loop
205 OUT PORT,0
210 CLS
220 PRINT "Would you like sound from the computer? (y/n)"
225 ANS$=INKEY$:IF ANS$="" THEN 225
230 IF ANS$="y" THEN FLAG=1
231 if ANS$="Y" THEN FLAG=1
240 IF ANS$="n" THEN FLAG=0
241 IF ANS$="N" THEN FLAG=0
245 PRINT:PRINT:PRINT
250 PRINT "Instructions: "
255 PRINT "**************":PRINT
260 PRINT " Type a letter on the keyboard and it will be sent to"
270 PRINT "the screen and the parallel port that you selected."
280 PRINT "Hit any key to start the program...."
290 A$=INKEY$:IF A$="" THEN 290
295 CLS
300 REM program loop starts here
310 A$=INKEY$:IF A$="" THEN 310
315 IF A$="1" THEN GOTO 14000
316 IF A$="0" THEN GOTO 15000
317 IF A$=" " THEN GOTO 16000
330 READ J$
335 IF J$="*" THEN RESTORE
340 IF J$=A$ THEN GOTO 400
350 IF J$="*" THEN GOTO 310
360 GOTO 330
400 REM output the data
410 PRINT J$;
420 IF FLAG=1 THEN GOTO 500
430 IF FLAG=0 THEN GOTO 1500
499 GOTO 300
500 FOR N=1 TO 10
510 READ K
520 IF K=0 THEN GOSUB 11000
530 IF K=1 THEN GOSUB 12000
535 IF K=99 THEN RESTORE
540 IF K=99 THEN GOTO 300
550 NEXT N
570 GOTO 300
1500 FOR N=1 TO 10
1510 READ K
1520 IF K=0 THEN GOSUB 18000
1530 IF K=1 THEN GOSUB 19000
1535 IF K=99 THEN RESTORE
1540 IF K=99 THEN GOTO 300
1550 NEXT N
1570 GOTO 300
9000 DATA a,0,1,99
9001 DATA b,1,0,0,0,99
9002 DATA c,1,0,1,0,99
9003 DATA d,1,0,0,99
9004 DATA e,0,99
9005 DATA f,0,0,1,0,99
9006 DATA g,1,1,0,99
9007 DATA h,0,0,0,0,0,99
9008 DATA i,0,0,99
9009 DATA j,0,1,1,1,99
9010 DATA k,1,0,1,99
9011 DATA l,0,1,0,0,99
9012 DATA m,1,1,99
9013 DATA n,1,0,99
9014 DATA o,1,1,1,99
9015 DATA p,0,1,1,0,99
9016 DATA q,1,1,0,1,99
9017 DATA r,0,1,0,99
9017 DATA s,0,0,0,99
9019 DATA t,1,99
9020 DATA u,0,0,1,99
9021 DATA v,0,0,0,1,99
9022 DATA w,0,1,1,99
9023 DATA x,1,0,0,1,99
9024 DATA y,1,0,1,1,99
9025 DATA z,1,1,0,0,99
9027 DATA 2,0,0,1,1,1,99
9028 DATA 3,0,0,0,1,1,99
9029 DATA 4,0,0,0,0,1,99
9030 DATA 5,0,0,0,0,0,99
9031 DATA 6,1,0,0,0,0,99
9032 DATA 7,1,1,0,0,0,99
9033 DATA 8,1,1,1,0,0,99
9034 DATA 9,1,1,1,1,0,99
9036 DATA .,0,1,0,1,0,1,99
9037 DATA /,1,0,0,1,0,99
9038 DATA ?,0,0,1,1,0,0,99
9040 DATA ',0,0,0,1,0,1,99
9041 DATA =,0,1,0,1,0,99
9998 DATA *,*,*,*,*,*,*
9999 END
10000 REM time delay subroutine for program titles
10010 FOR TDLY=1 TO 5000:NEXT TDLY:RETURN
11000 REM sound routine for a dot
11010 SOUND 200,1
11015 GOSUB 13000
11020 RETURN
12000 REM sound routine for a dash
12010 SOUND 200,3
12015 GOSUB 13000
12020 RETURN
13000 REM pause subroutine between letters 1 dit spacing
13010 SOUND 9000,1:RETURN
14000 REM special subroutine to sound a number 1
14005 IF FLAG=0 THEN GOTO 24000
14010 GOSUB 11000:FOR H=1 TO 4:GOSUB 12000:GOSUB 13000:NEXT
H
14015 RESTORE
14020 GOTO 300
15000 REM special subroutine to sound a number 0
15005 IF FLAG=0 THEN GOTO 25000
15010 FOR H=1 TO 4:GOSUB 11000:GOSUB 13000:NEXT H:GOSUB
11000
15015 RESTORE
15020 GOTO 300
16000 REM special subroutine to print a space
16010 PRINT "  ";
16020 RESTORE
16030 GOTO 300
18000 REM output a dit to the parallel port (bit zero)
18010 OUT PORT,1
18020 FOR TDLY=1 TO 300:NEXT TDLY
18030 OUT PORT,0
18040 RETURN
19000 REM output a dash to the parallel port (bit zero)
19010 OUT PORT,1
19020 FOR TDLY=1 TO 900:NEXT TDLY
19030 OUT PORT,0
19040 RETURN
24000 REM subroutine to send a number 1
24010 GOSUB 18000:FOR H=1 TO 4:GOSUB 19000:NEXT H
24015 RESTORE
24020 PRINT A$;
24025 GOTO 300
25000 REM subroutine to send a number 0
25010 FOR H=1 TO 5:GOSUB 19000:NEXT H
25015 RESTORE
25020 PRINT A$;
25025 GOTO 300
```

Listing 2. Morse code keyboard program.

the rig directly. If you are not sure about this, modify the program to control the relay, and use the relay contacts to send Morse. This is mandatory for older tube rigs, and anything else that normally has high voltage across the key contacts. It involves changing lines 18010 and 19010 to ?????. Darn, a quiz in the middle of the article! We want data bit 4, and only data bit 4, to be HIGH, so we would use the command OUT 632,16, where 632 is the LPT2 address and 16 is the decimal value we want to appear on the port. Therefore, lines 18010 and 19010 should both be changed to read OUT PORT,16. [Ed. Note: PORT is the variable

If you always thought a microprocessor-controlled repeater had to be expensive, LOOK AGAIN! You could easily spend this much just for a controller.

REP-200 REPEATER

A premium repeater with autopatch and many versatile dtmf control features at *less than many charge for a bare-bones repeater!*

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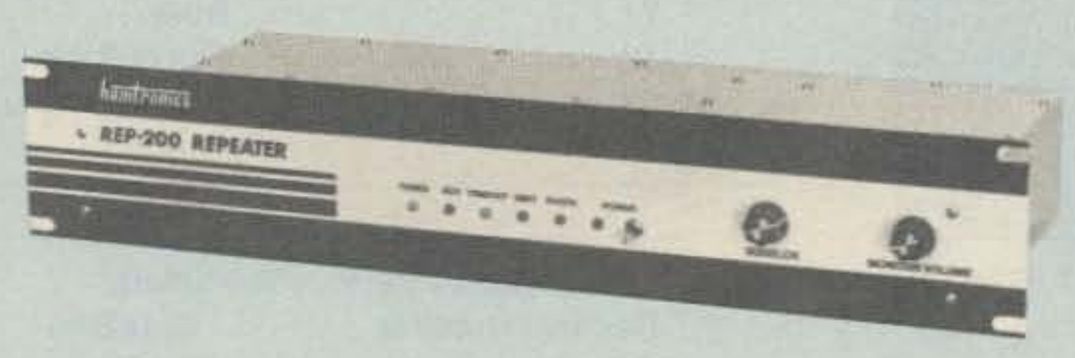
Kit $1095; w/t only $1295!



- Available for the 2M, 220MHz, 440MHz, 902MHz bands. ***FCC type accepted*** *(vhf and uhf commercial bands)*.
- **Rugged exciter and PA**, designed for continuous duty.
- Power output 15-18W (25W option) on 2M or hi-band; 15W on 220MHz; 10W on uhf or 902MHz.
- Accessory add-on PA's available with **power levels up to 100W**.
- **Six courtesy beep types**, including two pleasant, sequential, multi-tone bursts.
- **AUTOPATCH**: either **open or closed** access, **toll-call restrict**, auto-disconnect.
- **Reverse Autopatch**, two types: auto-answer or ring tone on the air.
- **DTMF CONTROL**: over 45 functions can be controlled by touch-tone. Separate 4-digit control code for each function, plus extra **4-digit owner password**.
- **Owner can inhibit** autopatch or repeater, enable either open- or closed-access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr, and other options, including two auxiliary external circuits.
- The cwid message, dtmf command codes, and owner-specified default parameters for cor and cwid timers and tones are burned into the eprom at the factory.
- Cw speed and tone, courtesy beep and tail timers, and courtesy beep type **can all be changed at any time** by owner-password-protected dtmf commands.
- Many **built-in diagnostic** & testing functions using microprocessor.
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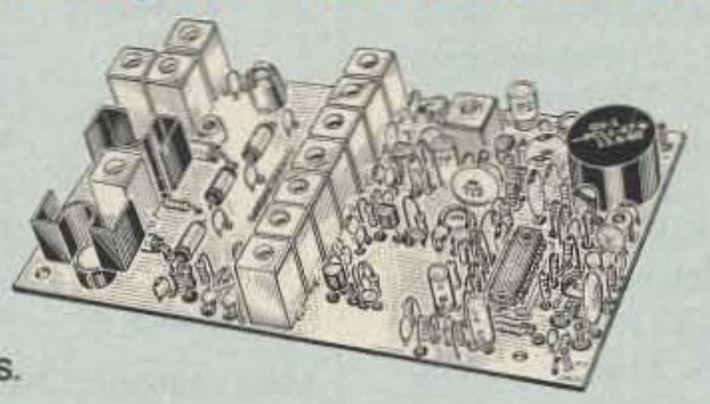
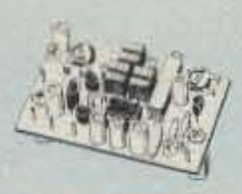


- **TA51** for 2M, 150-174, 220MHz.
- **TA451** for uhf.
- **TA901** for 902-928MHz, (0.5W out; w/t only).
- **VHF & UHF AMPLIFIERS.** For fm, ssb, atv. Output from 10W to 100W. Several models, kits starting at $79.

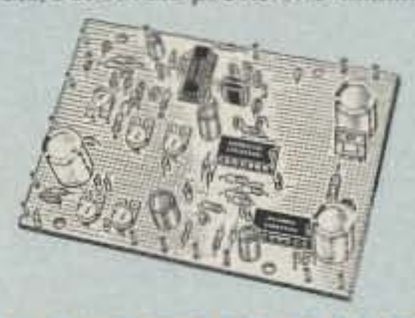
FM RECEIVERS: kits $139, w/t $189.

- **R144/R220 FM RECEIVERS** for 2M, 150-174, or 220MHz. **GaAs FET** front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; afc tracks drift.
- **R451 UHF FM RCVR,** similar to above
- **R901 902-928MHz FM RCVR.** Triple-conversion, GaAs FET front end.
- **R76 ECONOMY FM RCVR** for 6M, 2M, 220MHz, w/o helical res. or afc. Kits $129.
- **R137 WEATHER SATELLITE RCVR** for 137 MHz. Kit $129, w/t $189.

ACCESSORIES

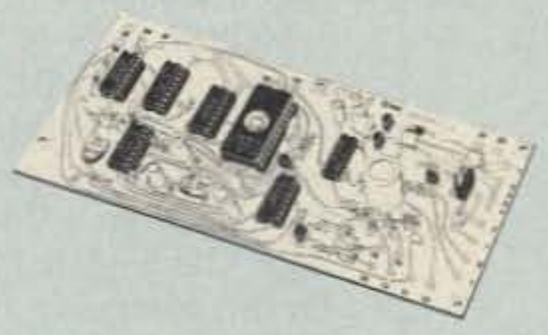


TD-3 SUBAUDIBLE TONE DECODER/ENCODER kit. Adjustable for any tone. Designed **especially for repeaters,** with remote control activate/deactivate provisions $24

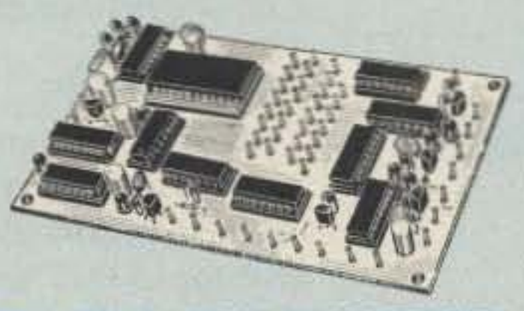


COR-3 REPEATER CONTROLLER kit. Features adjustable tail & time-out timers, solid-state relay, courtesy beep, and local speaker amplifier $49

CWID kit. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 .....$59



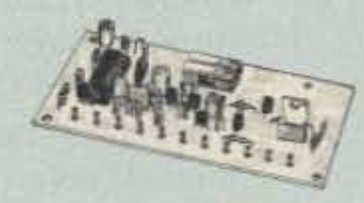
COR-4 kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call $99



TD-2 TOUCH-TONE DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! $79

AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch & phone line remote control are std .$79

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



MO-202 FSK DATA MODULATOR kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. $39

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GaAs FET PREAMPS

at a fraction of the cost of comparable units!

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, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.*

LNW-(*) MINIATURE GaAs FET PREAMP

***ONLY* $24**/kit, **$39** 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, or 400-500 MHz.*

LNS-(*) IN-LINE PREAMP

***ONLY* $79**/kit, **$99** 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.

**Specify tuning range: 120-175, 200-240, or 400-500 MHz.*

HELICAL RESONATOR PREAMPS

Preamps with 3 or 4 section helical resonators **reduce intermod & cross-band interference** in critical applications. **MODEL HRG-(*),** $49 vhf, $94 uhf.

**Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-450, 450-470.*

RECEIVING CONVERTERS

Low noise converters to **receive vhf and uhf bands on a 10M receiver**. Choice of kit with case & BNC jacks, kit with pcb only, or w/t unit in a case.

Request catalog for complete listings.

VHF input ranges avail: 136-138, 144-146, 145-147, 146-148; kit less case $39, kit w/case $59, w/t in case $89.

UHF input ranges avail: 432-434, 435-437, 435.5-437.5; kit less case $49, kit w/case $69, w/t in case $99.

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XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 432, 435, and for atv. 1W output.

Kit only $79. PA's up to 45W available.

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- **For complete info, call or write for FREE 40-page catalog.**
  Send $2 for overseas air mail. For casual interest, check reader service; allow 3-4 weeks.
- **Order by mail, fax, or phone** (9-12, 1-5 eastern time)
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CIRCLE 57 ON READER SERVICE CARD

Photo. Once you've constructed your parallel interface, you're ready to experiment with it.

```
10 REM Program to test BUSY line
20 CLS
30  A=INP(633)
40 PRINT A
50 PRINT " BUSY LINE NOW READS ";A
60 PRINT:PRINT "CONNECT BUSY LINE TO
   GROUND ON PIN 18, HIT  ANY KEY"
65 A$=INKEY$:IF A$="" THEN 65
70  B=INP(633)
80 PRINT "BUSY LINE NOW READS ";B
90 END
```

Listing 3. Input test program.

that indicates the particular port address of your machine.]

MORSE.BAS is written in simple, non-sneaky, generic BASIC, and you should be able to port it to almost anything. I have run the code practice part of the program on everything from a Color Computer to an antique Commodore PET! To adapt it to a different computer involves changing the SOUND and OUT routines to something that your computer can use. For CoCo owners, the program adapts nicely to controlling the serial port, and I would imagine something similar can be done for the Apple and C-64.

Input Detection

So much for getting stuff out of the computer. How do we get data into it? Well, it turns out that BASIC also has a command called INP for INPUT and you can use a line used such as:

1000 A = INP(X)

where X is the port address PLUS one. So X might be 889, 633, or 957, depending again on your particular system. This command will read the status of the BUSY line on the printer port, and return a value of (usually) A=255 if it's LOW, or 128 if it's HIGH. Connect a push button switch between pin 18 (ground) and pin 11 (BUSY) and run the program BUSYTEST.BAS, Listing 3. With the appropriate receive software, you are now all set to automate the CW end of the station.

Practically, however, it has been my experience that the computer between your ears is much better at decoding the 20 meter band than any machine. But you could use the BUSY line with a microswitch to sense when a rotator had reached a point, a gate had been shut, or a window was left open!

For those of you with Rube Goldberg tendencies, use the relay to turn on the coffee pot (OUT 632,16), and a thermistor connected through the BUSY line to detect when it's ready. Automatic microprocessor controlled coffee!

I'm sure you will find your own uses for the board. For those of you who despise typing as much as I do, 5¼" disks are available for $10 U.S. and an SASE. *[Ed. Note: Listings of the three BASIC programs are also available free on the 73 BBS under the 73mag SIG. The BBS number is (603) 525-4438.]* Enjoy! 73

You may contact Wally Gardiner VE6BGL at Box 2035, High River, Alberta Canada T0L 1B0.

Table 1. Printer Port Pinouts

Pin #	Function
1	Strobe
2	Data Bit 0
3	Data Bit 1
4	Data Bit 2
5	Data Bit 3
6	Data Bit 4
7	Data Bit 5
8	Data Bit 6
9	Data Bit 7
10	Acknowledge
11	Busy
12	Out of Paper
13	Printer on line
18	Ground

Table 2. Binary Arithmetic

Decimal Number	Data Bits
	76543210
0	00000000
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
6	00000110
7	00000111
8	00001000
9	00001001
10	00001010
11	00001011
12	00001100
13	00001101
14	00001110
15	00001111
16	00010000

Table 3. The Experimental I/O Interface

Qty.	Part	Description
5	2N2222	NPN transistor
4	2N3055	NPN transistor
4	LEDs	Light Emitting Diodes
6	1N914	diodes
5	1k (R1)	resistor, ¼ watt
5	100k (R2)	resistor, ¼ watt
4	560 (R3)	resistor, ¼ watt
1	LM4	12 volt relay
1	DB25	male connector, 25 pin

Misc. assorted hardware, ribbon cable, perf board, etc.

Notes: Resistor R2 (100k) may not be necessary, depending on the transistor selected. Check the polarity of the LEDs when installing them. Relay contacts must be able to handle the current of the switched device. Don't use a miniature relay to control an arc welder! The relay coil MUST be paralleled by a diode.

Food for thought.

Our new Universal Tone Encoder lends its versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency-just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers' repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
- Separate level adjust pots and output connections for each tone Group.
- Immune to RF
- Powered by 6-30vdc, unregulated at 8 ma.
- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak
- Instant start-up.
- Off position for no tone output.
- Reverse polarity protection built-in.

Group A

67.0 XZ	91.5 ZZ	118.8 2B	156.7 5A
71.9 XA	94.8 ZA	123.0 3Z	162.2 5B
74.4 WA	97.4 ZB	127.3 3A	167.9 6Z
77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
88.5 YB	114.8 2A	151.4 5Z	203.5 M1

- Frequency accuracy, ± .1 Hz maximum - 40°C to + 85°C
- Frequencies to 250 Hz available on special order
- Continuous tone

Group B

TEST-TONES:	TOUCH-TONES:		BURST TONES:			
600	697	1209	1600	1850	2150	2400
1000	770	1336	1650	1900	2200	2450
1500	852	1477	1700	1950	2250	2500
2175	941	1633	1750	2000	2300	2550
2805			1800	2100	2350	

- Frequency accuracy, ± 1 Hz maximum - 40°C to + 85°C
- Tone length approximately 300 ms. May be lengthened, shortened or eliminated by changing value of resistor

Model TE-64 **$79.95**

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CIRCLE 10 ON READER SERVICE CARD

73 Review

by Jeffrey A. Meyer N8AHA and Bill Brown WB8ELK

The WB2OPA LogMaster

A versatile HF logging program for the IBM PC.

Sensible Solutions
P.O. Box 474
Middletown NJ 07748
Price class: $60

The contest is over and you're the lucky op who lost the toss, and gets to organize the logs and send them in to the contest sponsor for credit. UGHHH! Making sense of the log sheets and reading the slop your group calls handwriting can certainly try anyone's patience, especially after hours of screaming phonetics and pounding brass. There must be a better way! Enter the idea of having a personal computer present during the contest to perform your logging, check dupes, and print the results in completed form at the conclusion of the contest.

To help me cope, I began looking for software programs that have the capabilities to make contesting and logging easier. My desires were simple. First and foremost, the software must be easy to understand and have a manual that doesn't resemble "War and Peace." Second, it must be flexible enough to work for different contests as well as provide duping, logging and printing functions. Finally, it must be compatible with my current computer system so that I can spend more money on ham type stuff.

The Sensible Solution

I recently ran across the WB2OPA LogMaster program by Sensible Solutions. This particular program was written specifically for HF logging and contesting, and it works on my IBM PS/2 (or any IBM PC/compatible). I read the manual and really enjoyed tinkering with the program. The inner workings revolve around easy-to-use pop-up windows which guide the user through the various segments of the program: Log, View, Search, Print, Utilities, and Quit. Each segment is well thought-out and extremely easy to learn and use. Aside from the expected Time-Call-Freq-RST-Mode logging functions, the LogMaster includes fields for tracking and reporting CQ zones, ITU zones, states, prefixes, beam headings, starting and ending QSO times, counties and QSL functions. The contents of these various fields as well as the final log can also be viewed, modified and finally printed for contest submissions.

Getting Started

LogMaster runs on an IBM PC or compatible and needs at least 512k of RAM. You need either two floppy disk drives or one floppy drive and one hard drive. Installation is quick and easy. To run the program just enter the command "LM" at the DOS prompt.

Photo A. The LogMaster main menu.

Photo B. Entering your QSO information.

Photo C. Metric conversion pop-up window.

The first time you install LogMaster, you enter the local time zone, latitude and longitude, input power, and the directory path for your logbook file. Thereafter, you go directly to the main menu on start-up.

The main menu comes up with several categories: Log, View, Search, Print, Utilities, and Quit (see Photo A).

Access to each submenu is driven by single keystroke commands. Each command drives a series of pop-up menus which guide you easily through all the features. Hitting the ESC key brings you back to each previous menu.

Logging In

The Log section allows you to enter stations worked into your logbook database. You have two options of entry. The "Manual" selection allows you to enter calls with complete control of the time and date—useful for entering contacts made from contest logsheets, for example. The "Auto" mode automatically enters the date and time for each contact in real-time. The Log entry screen provides a lot of information about each contact, including QSL sent/received status (see Photo B). During the logging process a series of function key commands are available which really enhance an already powerful program.

One of the most useful of these is the "Notepad" function. You can literally write a full page of information describing a contact. When viewing a specific entry in the logbook, you can recall this notepad with just a function key. Other function key commands allow you to update the frequency (if using a computer interfaced radio), enable the QBICSP option (which highlights a contact if you need it for a specific reason), enable an RST-sent serial number for each contact in a contest, do dupe checking while logging, check QSO start and stop time, tag a QSO or do quick a save function (you don't have to step through all of the log entry items). If you have a Kenwood rig with a computer interface, LogMaster will automatically enter your current transmit and receive frequency when in "Auto" mode. Other rigs should be similarly supported in future revisions.

The "Dupe" checking feature is a very flexible function. You can check dupes for callsign, country, state, CQ zone, ITU zone, or prefix. It highlights the call and beeps whenever a dupe situation is encountered. The Tag function allows you to add a specific bit of information to your logged QSO, which you can search for later. For example, if you want to mark all your QRP, RTTY, or AMTOR contacts, you can put a specific tag on them and just list out only your QRP contacts.

Another nice pop-up window is available during the logging process which is particularly useful for foreign contacts. By hitting <Alt-C> you get a metric conversion program (see Photo C)!

Viewing

The "View" menu allows you to sort out your logbook and display it in different ways.

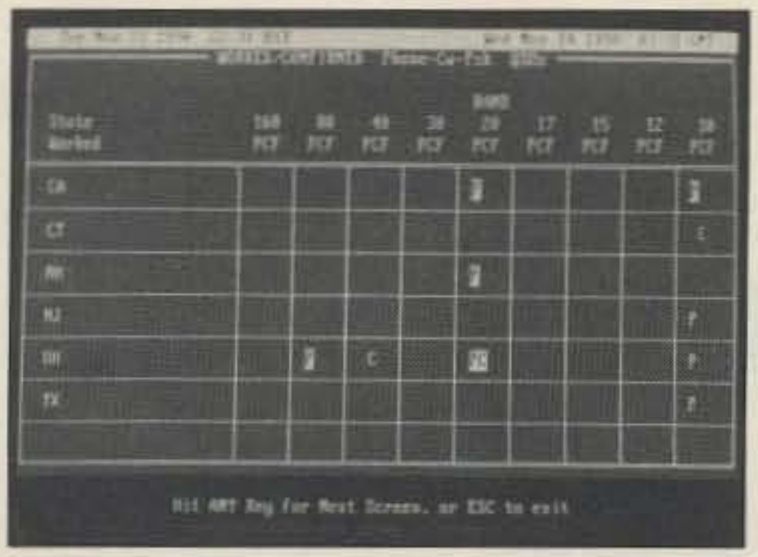

Photo D. Multiband logbook summary.

Utilities

This section allows you to customize the program to your individual specifications. Dupe checking searches can be reconfigured here and you can also select a new file path for different logbook entries (a useful feature for a specific contest entry).

I found the Statistics section particularly interesting. Selecting this submenu allowed me to look at my countries, states, CQ zones, or ITU zones worked. This display quickly gave me a multiband display of my progress in each of these categories (see Photo D). In addition, you can display QSL activity and total QSOs in this manner.

```
**********************************************************************

                    W B 8 E L K    L O G B O O K

**********************************************************************

DATE       TIME   STATION   FREQ      MOD  RST  RST  NAME      S R N T
----       ----   -------   ----      ---  ---  ---  ----      - - - -

11/06/90   23:39  WB2MGP    28.303    USB  59   59   CAROLE    N N N N
11/06/90   23:40  WB6NOA    28.333    USB  59   59   GORDON    N Y N N
11/06/90   23:40  W2NSD/1   14.313    USB  59+  59+  WAYNE     S Y N N
11/06/90   23:41  KA8LWR    14.233    USB  59   59   MEL       N Y N N
11/06/90   23:42  W9AZO     14.230    USB  58   58   JIM       Y Y N N
11/06/90   23:43  K8PYQ     14.230    USB  57   57   LOWELL    N N N N
11/06/90   23:44  WB8MSJ    14.040    CW   599  599  JOE       S Y N N
11/06/90   23:44  KA8WLV    07.040    CW   599  599  JEFF      N N N N
11/06/90   23:45  WB8VNC    28.400    USB       57   DICK      N N N N
11/06/90   23:45  WB9KMO    14.233    USB  56   57   ROD       S Y N N
11/10/90   01:19  N1GPH     28.060    CW             DAVID     N N N N
11/10/90   01:20  WB8MSJ    14.040    CW   599  579  JOE       S Y N N
11/10/90   01:21  KA8LWR    14.233    USB  59   57   MEL       Y Y N N
11/10/90   01:21  WB9KMO    14.233    USB  59   59   ROD       N N N N
11/10/90   01:27  P43T      28.400    USB  59+  59+  TONY      N Y N N
11/10/90   01:28  KA8LWR    03.871    LSB  58   59   MEL       S Y N N
11/10/90   01:33  KA8LWR    28.680    USB  57   58   MEL       N N Y N
11/10/90   01:36  K7IRK     28.636    USB  59+  59+  BOB       N N Y Y
```

Figure. Logbook printout.

You can display the entries sorted by date, country, state, callsign, CQ zone, ITU zone, prefix, tag or QSL sent/received marks.

A note about the record-protection feature: "Protect All Fields" prevents you from changing any entry; "QSL Edit Only" allows QSL status information editing; and Edit All Fields allows complete editing. This feature adds another keystroke when you're looking for log entries, but it helps prevent you from making inadvertant errors!

I found the sorting feature of the LogMaster incredibly useful. I could literally display all of the contacts I made with just one station. If I wanted to list out only my QRP contacts, I used the Tag function.

Searching

Although similar to the "View" menu, the Search area allows you to search for partial search keys. For example, if I wanted to find my QSO with KA8WLV but forgot his suffix, I would search for all calls beginning with KA8 until I found him.

Printing

This menu is handy if you'd like a hard-copy printout of your logbook (see the Figure). You can print out your whole logbook or start from a particular date. Of particular interest to contesters is the "Awards Dupe Sheet". This option prints out your log sorted in callsign order.

Useful Utilities

In addition to LogMaster, you will find two utilities on the diskette. Merge allows you to merge two logbook databases into one logbook.

And you can print your own QSLs! QSL labels and even QSL cards can be printed with this handy utility. It uses your logbook database to print out specific cards right on your printer.

Impressions

I found the WB2OPA LogMaster very easy to use. The versatility of sorting your logbook by different search patterns and the notebook area made it extremely useful. I found that if anything, there were too many categories for each logbook entry. Fortunately, there is a quick save function key. You should also be careful to enter the FULL path for each new logbook, or you could inadvertantly erase a previous log.

I was pleasantly surprised with all of the functions and the ease of operation of the HF LogMaster. I only wish it could be used for VHF/UHF contacts as well. The LogMaster really shines when you consider the time saved in entering and maintaining a logbook, particularly the log sheet paper jam that builds up during a contest. 73

73 Review *by Ron Hranac N0IVN*

Kenwood's TM-941A Triband FM Transceiver

Three for the price of one.

Kenwood U.S.A. Corp.
P.O. Box 22745
2201 E. Dominguez Street
Long Beach CA 90801-5745
Phone: (213) 639–4200
Price Class: $1200

First there were single-band FM transceivers, then came dual-band rigs. Now there's a three-band radio, Kenwood's new TM-941A triple-band FM transceiver that covers 2 meters, 70 centimeters and 23 centimeters. With this one rig you can operate on the 144, 440 or 1200 MHz amateur bands.

Kenwood has managed to squeeze three transceivers into one small package measuring 5.91"W x 1.97"H x 6.89"D. It feels like three transceivers, though, weighing in at over four pounds.

What the TM-941A Offers

The TM-941A is designed for 13.8 VDC operation at a maximum of 11.5 amps (high power transmit on 2m). It comes with several standard accessories, including a mobile mounting bracket, DTMF microphone, DC power cable, an extra fuse, a 56-page instruction manual, warranty card, and an assortment of miscellaneous hardware. Also included is a nice feature that's recently become popular on a number of other mobile rigs: a detachable front panel. With either the optional PG-4K or PG-4L interconnect kit, the transceiver body can be located remotely from the front panel. This is especially handy in some of today's cramped smaller autos, and provides an added measure of security in any vehicular installation.

Three RF output power levels are available on 2m and 70cm: HI output on 144 MHz is 50 watts, MID is 10 watts and LOW is around 5 watts. The power levels on 440 MHz are 35, 10 and 5 watts respectively. Two power output choices are available on 1200 MHz, 10 watts (HI) and 1 watt (LOW).

As shipped from the factory, the TM-941A transmit frequency ranges are 144–148 MHz, 438–450 MHz and 1240–1300 MHz, and modifications for MARS/CAP are possible. Receive coverage on 2m is 118–174 MHz (including AM reception in the aeronautical bands, although the instruction manual makes no mention of this). The 70cm and 23cm receive frequencies are the same as the transmit frequencies, but a modification is available that will expand the reception coverage to 400–475 and 1210–1330 MHz.

The three transceivers are about as separate as is possible in one radio. Kenwood has provided each band with its own volume and squelch control, antenna connection, display

Photo A. The Kenwood TM-941A tribander.

area on the front panel LCD, and external speaker jack. The radio's single internal speaker is common to all three bands, and there is a fourth speaker jack available that can route the three bands' combined audio to a single external speaker. You could conceivably have as many as four external speakers connected–one for each of the three separate bands, and one for the combined audio.

This separate functionality means that you can simultaneously receive on all three bands, and even configure the rig for cross-band repeat operation (I wasn't able to test this feature and there's no mention of how to do it in the instruction manual).

The Features

The TM-941A is packed with all the features and capabilities typical in modern microprocessor-controlled transceivers. Space restrictions preclude a review of all of them (the instruction manual is 56 pages long, not including the schematic and block diagrams), so I'll highlight a few of the major ones that are either standard or are available as options.

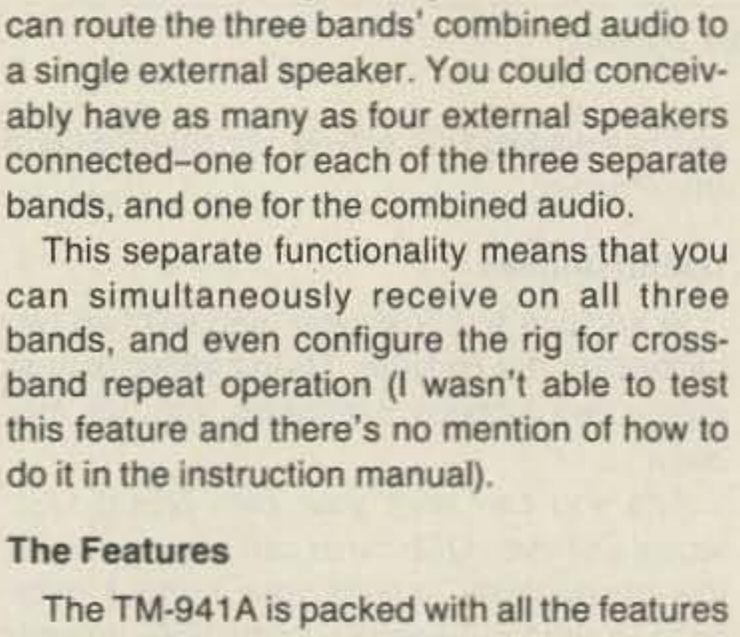

Photo B. Spectrum output from the TM-941A, representative of all three bands' performance. (The photo is of a 2 meter TX signal on a Tektronix 7L14 analyzer.)

CTCSS encoder: There are 38 subaudible tones included, selectable from the front panel. The rig I tested did not have the optional TSU-7 CTCSS decoder, but the module is easily installed in a socket accessible behind the front panel.

Dual-tone squelch system: If the optional DTU-2 module is installed, this function allows what Kenwood describes as selective calling. When activated, the receiver's squelch will not open unless the transmitting station sends a three-digit DTSS code matching what you have programmed in your radio. You can also transmit programmable codes for individual or group calling. The paging function of this option lets you display the three-digit code of the calling station on the front panel display. Seven memories are available for storing your own radio's code, the calling station's code during receive, and group codes or the codes of other stations.

Repeater offsets: Automatic offsets that conform to the ARRL's band plan are standard on 2m, but you can override this and enter your own offsets, if necessary. Offset selection on 70cm and 23cm must be done manually.

Tone alert: This provides an audible alarm to let you know when someone is transmitting on a frequency being monitored. When activated, this function won't actually break squelch to allow you to hear the transmission. It just beeps when a signal is received, and keeps track of the elapsed time of the signal's transmission.

Automatic power off: How many times have you forgotten to turn your mobile rig off after you left the car? Popular in many HTs, this capability in the TM-941A will turn the radio off after two hours and 59 minutes of inactivity.

Time-out timer: If you are on the long-winded side and keep timing out repeaters, this function will be especially useful. You can select 3, 5, 10, 20 or 30 minutes (or OFF for no limit) as the amount of continuous transmission time allowed before the radio automatically switches back to receive mode. A beep will let you know when the rig has reached the limit you've chosen.

Dayton Hamvention®

April 26, 27, 28, 1991

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• Asst. General Chairman, Ross Brown, WA8DQH

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Admission ticket must be ordered with flea market tickets			
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Measurements Made Easy

When *73* contacted me about reviewing the Kenwood TM-941A tribander, I thought it might be appropriate to evaluate a state-of-the-art rig with a state-of-the art test instrument. I called Motorola and obtained one of their new R-2600A communications system analyzers.

The R-2600A sells for a little over $10,000, putting it out of the reach of most hams, but its versatility and many capabilities make it ideal for those involved with two-way radio servicing in the 400 kHz to 999.9999 MHz range. The 33 pound package takes the place of several pieces of test equipment. This all-in-one box serves as an RF signal generator (−130 to 0 dBm), a sensitive AM/FM measurement receiver (2 µV), scanning receiver, spectrum analyzer, duplex offset generator for servicing repeaters, frequency counter, AC/DC voltmeter, oscilloscope, wattmeter (0.1 to 125 watts), signal strength meter, frequency error meter, SINAD meter, distortion meter, FM deviation and AM percent of modulation meter, sweep generator, audio generator and a signaling simulator. This last feature includes the capability of encoding and decoding PRIVATE LINE (PL), DIGITAL PRIVATE LINE (DPL), and single tone sequences as well as multitone sequences including DTMF, two-tone paging, 5/6 tone paging, International Select V, and 20 Tone General Sequence.

The analyzer is based around Motorola's M-68000 16-bit microprocessor, and makes use of digitized screen bit mapping, softkeys and windowing, and permanent storage of common test setups. The R-2600A can even be connected to an external PC or printer.

I was able to conduct almost every test on the Kenwood using the R-2600A. In fact, except for 1200 MHz operation and actual on-air tests, the TM-941A spent most of the rest of its evaluation time connected to the communications analyzer.

Automatic band change: Suppose you have the TM-941A set to transmit/receive on 2m, but you're also monitoring 70cm and 23cm. If you wanted to transmit on, say, 23cm you would have to manually select that band to be able to transmit on it. With the A.B.C. function activated, the radio will automatically do that for you when a signal on another band is received.

Automatic lock tuning: This function is available only on 1200 MHz, and operates somewhat like an AFC. When turned on, the ALT will detect the drift in frequency of either you or the other station and automatically shift the TM-941A's frequency to compensate.

Fixed detect output: The internal microphone connector (it's behind the front panel) is an eight-pin telephone-type jack. One of its pins is labeled RD and can provide receive audio from the selected TX/RX band. By using the CONT SEL function, this terminal will be activated and can be used for packet operations.

Dimmer: The front panel illumination can be set to one of four levels of brightness.

Scanning: Here's where the magic of microprocessors really shines! The TM-941A includes "Band Scan," where an entire band is scanned in the VFO mode. "Programmable Band Scan" lets you scan a range between selected upper and lower frequency limits. "Memory Scan" covers those memory channels that are stored in a band or bank and have not previously been locked out. "Call/VFO Scan" alternately scans the call channel and a chosen VFO frequency, and "Call/Memory Scan" alternates between the call channel and the memory channel last used. "Auto Memory Scan" automatically memorizes a busy frequency (it's stored in an empty channel in bank five) while scanning a band. Kenwood also included two types of scan hold/resume functions: "Time Operated Scan" and "Carrier Operated Scan." In "Time Operated Scan" the radio will stop on a busy frequency for about five seconds, then continue scanning. In "Carrier Operated Scan" mode, the radio will stop on a busy frequency and remain there until the signal is no longer being received. After a two second pause with no signal present it will resume scanning.

Memories: Seven pages alone in the instruction manual are dedicated to the various memory functions available in the TM-941A and their operation. The rig includes a lithium battery to retain the memories when primary power is not available, and you can reset the main memories and VFO memories independent of each other. The radio has 100 memory channels for each band, divided into five banks of 20 channels.

For normal channels, each memory is capable of storing operating frequency, offset, CTCSS tone and status, frequency step, shift status, REV status, DTSS code and status, and last operation paging memory number (with the optional DTU-2). For odd split channels, the same information is stored, except for shift status and REV status. A call channel memory for your favorite frequency is also available for each band.

Adjacent memory banks can be linked to form one larger bank, and all banks can be linked. It's also possible to perform memory consolidation, where memory channels are rearranged to optimize memory scan operations. This rewrites the active memory channels sequentially, from the lowest to highest channel, without any blanks in between. Memory shift will copy the contents of a memory channel to the VFO.

Miscellaneous: Kenwood has included a "Demonstration Mode" that is described in the manual as capable of providing "a short demonstration of the capabilities of the TM-941A." I found that this was not particularly useful, since it doesn't really show how the radio works or how to use it. It's actually not much more than blinking lights and a flashing display that ends with "enjoy your hobby" before repeating all over again. When you cancel this function, the VFO memories are cleared (but not the main memories). Other features include the ability to set the beeps that the radio emits when buttons are pressed to one of eight loudness levels, including OFF; three radio LOCK functions allow disabling all of the microphone buttons (except PTT), the front panel buttons and tuning control, or all controls except the ON/OFF switch, volume and squelch. Frequency step selection includes 5, 10, 15 and 20 kHz on 2m, all of those plus 12.5 and 25 kHz on 70cm, and 10, 12.5, 20, and 25 kHz on 23cm.

In receive mode the radio is specified to draw less than 1.2 amps, and in transmit mode (high power) less than 11.5 amps on 2m, 10 amps on 70cm, and 6 amps on 23cm. F3E (FM) operation is by reactance modulation, and spurious outputs are rated −60 dBc or more on 2m and 70cm, and −50 dBc on 23cm. Maximum deviation is ±5 kHz, and transmitted audio distortion is specified at 3% or less at 60% modulation.

The receivers all use double conversion. The first IF on 2m is 10.7 MHz, 70cm is 21.6 MHz, and 23cm is 59.7 MHz. All three bands use a 455 kHz second IF. Sensitivity for 12 dB SINAD is rated at better than 0.16 µV, and squelch sensitivity less than 0.1 µV. Kenwood specifies −6 dB selectivity at more than 12 kHz on all three bands, and −60 dB selectivity at less than 24 kHz on 2m and 70cm and at less than 36 kHz on 23cm. Audio output is rated at more than 2W (8 ohm load at 5% distortion).

Table 1. RF Power Output Summaries

2 Meter Output Power (Watts)

Setting	144 MHz	146 MHz	148 MHz
HI	45.7	42.6	38.9
MID	11.4	12.0	12.5
LOW	5.2	5.3	5.4

70 Centimeter Output Power (Watts)

Setting	438 MHz	444 MHz	450 MHz
HI	33.8	33.8	32.3
MID	11.2	10.7	10.4
LOW	3.9	3.8	3.8

23 Centimeter Output Power (Watts)

Setting	1240 MHz	1270 MHz	1300 MHz
HI	10.5	10.0	9.5
LOW	0.95	0.95	0.79

Antenna connections are made to the three short cables on the rear of the TM-941A. Female UHF connectors are provided for both 2m and 70cm, and a female N connector for 23cm. The cables for the two higher bands also include plastic boots that slip over the connectors for additional protection (they're not weatherproof, however).

The front panel contains a number of controls to operate the radio. Included are a tuning control knob, volume and squelch knobs for each of the three bands, power ON/OFF, a front panel release button, and 14 other push-button "keys." Many features are controlled by functions embedded in the various keys, accessible by pressing certain combinations of keys. For example, pressing and holding the "F" key for about one second until the key indicator flashes, then pressing the "REV" key, enables the beep volume selection.

The front panel LCD display is quite impressive. It includes separate areas for each of the three bands, and each band display area has its own S/RF meter, on-air indicator, plus a host of symbols for the various functions that may be active on each band. It's possible to completely turn off one or more of the three bands, and doing so will blank the respective area of the LCD after "off" has been displayed for about 10 seconds.

The DTMF microphone supplied with the TM-941A has the standard 16 tones, PTT, UP/DOWN buttons, CALL, VFO and MR (these three duplicate the functions of their counterpart on the radio's front panel), and a PF (programmable function) button. The PF button can be programmed to perform one of 10 transceiver functions, including a MONITOR function that's not on the front panel.

Test Results

Actual power consumption was comfortably less than what Kenwood specifies. At 13.8 VDC, maximum current draw while transmitting on 2m was 9.2 amps (HI), 5.9 amps (MID), and 4.28 amps (LOW). On 70cm the figures were 7.3 amps (HI), 3.78 amps (MID) and 2.71 amps (LOW); on 23cm they were 4.18 amps (HI) and 2.52 amps (LOW). In receive mode on all three bands, the current draw was 940 mA with the cooling fan off and 990 mA with the fan running. One departure from conventional VHF/UHF mobile rigs that I've used in the past is a small fan attached to the rear cooling fins. It comes on during transmission and shuts off automatically after a minute or two in receive mode.

Using the Motorola R-2600A communications analyzer (see the sidebar), 2m receiver performance was found to be 0.15 µV sensitivity for 12 dB SINAD, 0.22 µV for 20 dB quieting, and 0.07 µV for squelch sensitivity. At 1.25 watts audio output, distortion was 1.2 percent. The receiver's performance on 70cm was equally good, with 0.17 µV sensitivity for 12 dB SINAD, 0.21 µV for 20 dB quieting, and a squelch sensitivity of 0.07 µV. At 1 watt audio output distortion was 1.3%. I was not able to make these measurements on 23cm, due to the upper frequency limit of the communications analyzer.

When I measured RF output power, I chose three frequencies in each band—one at the lower end of the band, one in the middle, and one at the upper end. The results are summarized in Table 1.

Photo B shows the purity of the TM-941A's transmitted spectrum. On both 2m and 70cm the only measurable spurious emission was the second harmonic, which was greater than 65 dB down. The Tektronix spectrum analyzer I was using has an upper frequency limit of 1800 MHz (below the second harmonic of 23cm), and within that range I could not find any spurious signals from the 23cm transmitter.

Frequency accuracy on 2m averaged a little more than 300 Hz low, and 1.3 kHz low on 70cm. I didn't measure this parameter on 23cm. Transmitter deviation with normal speech was 3 to 4.5 kHz, with the microphone two to three inches away. On-air signal reports, both simplex and through local repeaters, were rated very good by several hams. (I called up a local 2m ATV net with the TM-941A instead of my usual rig, and received glowing reports there, too.)

Comments

Kenwood has done a nice job with this radio. Squeezing three separate transceivers into one relatively small package was a formidable task, but they did it right. Even the broadband reception capability on 2m produced few problems. I listened to signals in the aeronautical bands, public service bands, etc. and found received quality to be quite good. This kind of design is sometimes susceptible to intermod, though. While monitoring certain 2m ham frequencies, I occasionally heard a paging transmitter sneak through.

The cooling fan is a nice touch; it's not too loud, but it is noticeable in the shack. In a mobile environment, vehicle and road noise easily mask it. I noticed that the radio remains warm to the touch in just receive mode, due to the amount of electronics inside the case. The temperature did not appear to increase significantly while transmitting, thanks to the cooling fan.

Very Few Complaints

I really had trouble finding things I didn't like about this radio. The use of a UHF connector on the 70cm antenna lead is not to my liking, and the demo mode in the radio really serves no useful purpose. Output power on 2 meters in the HI position was a few watts low on the rig I tested, but everything else was right about where it was supposed to be. A couple of items, like AM reception capability on aeronautical frequencies and crossband repeater operation, were not included in the instruction manual but should have been. I also noticed that the front panel latch button didn't always snap into the locked position when the panel was replaced; sometimes I had to manually lock it. The only other thing I didn't like was having to return the radio after the evaluation! The real question, though, is how long before they put this triband technology into an HT? 73

Contact Ron Hranac NØIVN at 466 Pluto Court, Littleton CO 80124.

The Three-Terminal Regulator

Multiple uses in one package.

by E.R. Doubek N9RF, P.E.

Since the three-terminal voltage regulator was first developed to permit local voltage regulation, it has found a place in both commercial and home-built products. With improved regulation, the circuit designer doesn't have to run heavy power leads between the power supply and the load or design for remote sensing at the load. Not only does the three-terminal regulator do a nice job of regulating voltage, it also ensures a lower power supply impedance, which helps to handle transient current spikes. See the table for a list of the most common, low-cost, and readily available three-terminal fixed and adjustable voltage regulators.

Normally, these regulators do not require additional components to generate a regulated voltage. The device is simply placed so its input terminal is connected to a source of voltage at least 2 volts above the regulator's rating as long as you don't exceed 35 volts. At voltages above 35 volts, the unit may be destroyed. The output terminal delivers the voltage corresponding to the ratings shown in the table. The third terminal, GND, is a reference for the regulator. Normally, a current under 10 mA flows in the GND lead. It may be connected to a reference voltage source, the output of another regulator, or to ground.

Advantages of the Regulator

Figure 1 shows possible connections for different uses. If the regulator is located some distance from the power source, a 0.25 to 1.0 µF capacitor may be connected from the input terminal to ground. This improves transient response and helps prevent regulator instability. You can put a capacitor from 0.01 to 1.0 µF from the output terminal to ground to help control the spikes most logic circuits generate. Keep in mind that the source of input power must be capable of supplying a greater voltage than the output of the regulator under a load of at least 1.5 amps. The regulator is internally protected to prevent damage in case the unit becomes too hot or the load too high.

Another reason for using three-terminal voltage regulators is that they protect against shorted components on a circuit board that could be damaged because of insufficient fusing and small printed circuit conductors.

The LM317T voltage regulator, adjustable for voltages from 1.25 to 37 volts, requires a few external components. See Figure 5 for a typical circuit application. It has a line regulation of 0.01%/volt and a load regulation of 0.1%. The ripple reduction is typically about 80 dB, a significant figure.

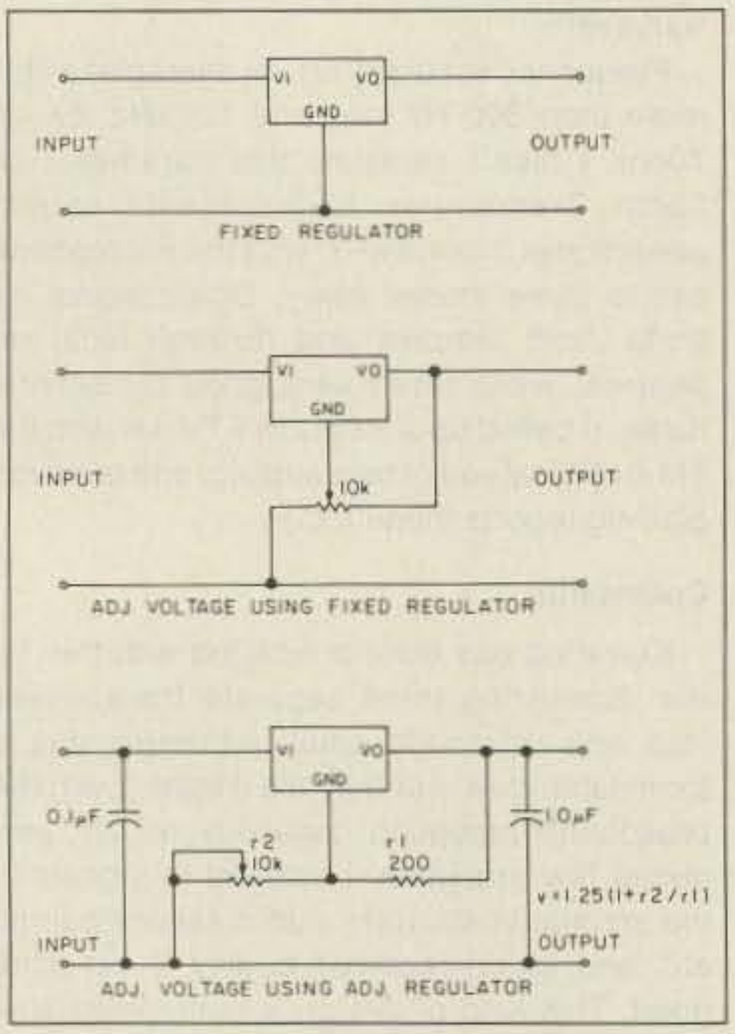

Figure 1. Three-terminal regulators may be fixed or adjustable.

Figure 2. Add a resistor and this connection, and you can use your fixed regulator as a current regulator.

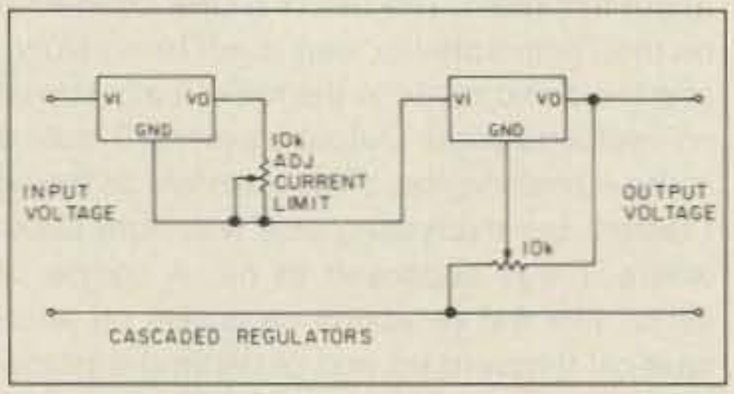

Figure 3. Cascading a current regulator and a voltage regulator adds flexibility and circuit protection.

Regulating the Current

By adding a resistor and the connection shown in Figure 2, the same fixed regulator can be used as a current regulator. With this circuit, you can calculate the value of the regulated current from this simple equation: **R = V/I**, where **R** is the value of the programming resistor, **V** is the value of the regulator voltage, and **I** is the value of the desired current level. With this circuit feeding a lamp load, the life of the bulb can be greatly increased, since the inrush current with a cold filament is limited.

You can also use this circuit for battery charging, when you want to charge at a fixed rate regardless of the terminal voltage to the battery.

This circuit has also been very successfully used as a stable bias source for transistor circuits and as a driver for LEDs. In many cases, the LED output is more easily controlled by regulating the current through the diode instead of controlling the voltage impressed across the diode. This difference may be especially important in circuits for battery operated infrared-emitting devices.

If the resistor is adjustable, the circuit can nicely control the speed of a small DC motor (of the type often used in some instruments) without a large wattage series resistor.

Charge a capacitor from a constant current source and the result is an interesting capacitor ramp generating circuit. The ramp is linear. You can also use this circuit to provide a constant current source for making a 4-terminal resistance measurement.

Continued on page 58

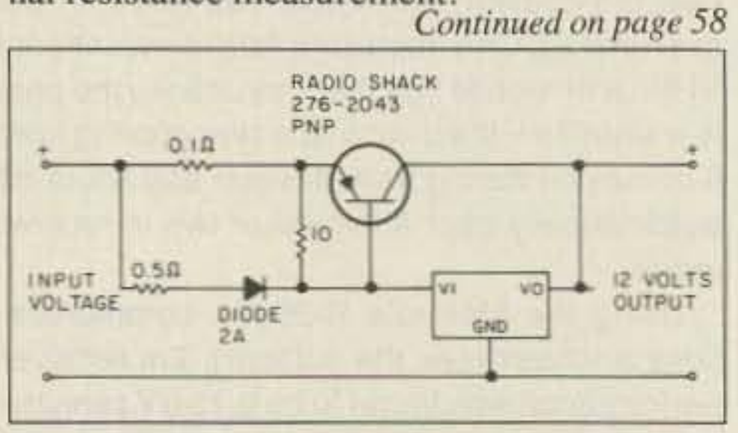

Figure 4. Here's a better way to handle increased current.

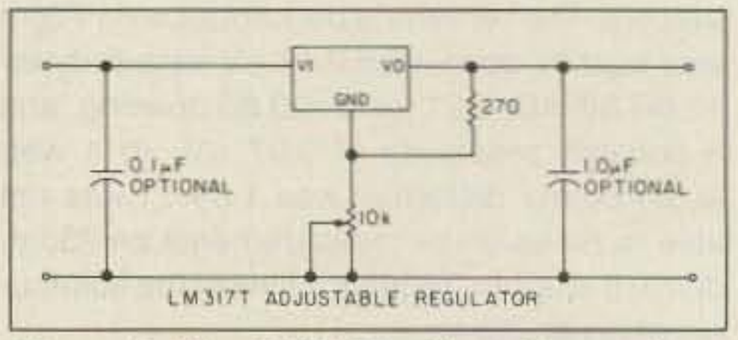

Figure 5. The LM317T adjustable regulator requires some external components.

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The AL-811 covers all HF bands (10/12 meters with easy user mod). There's no compromise on WARC and most MARS bands — you get a 100% rated output.

You can operate the AL-811 on all modes. You get 600 watts output PEP SSB and 500 watts output CW. You even get 400 watts on demanding continuous carrier modes like RTTY, SSTV, FM and AM.

How the low cost 811A tube resists premature failure - even when your amplifier is mistuned

811A tubes resist premature failure in two ways.

First, they're constructed with widely spaced elements that minimize the chance of elements touching and causing a short — even if the plate gets hot enough to melt.

Second, they use a directly heated thoriated tungsten filament cathode that prevents the electron emitting layer from instantly stripping off — even if mistuning causes a sudden, severe current overload.

Indirectly heated oxide cathode tubes (like the $400 3CX800A7) can be rendered instantly-useless if their electron emitting layer is stripped off because of a severe current overload due to mistuning.

The Ameritron AL-811 is excellent for the newcomer because it's tough enough to withstand momentary mistuning. And the tubes are so inexpensive that you can replace one for mere pocket change.

The Ameritron advantage: extra heavy duty power supply that gives you peak performance year after year

The heart of the AL-811 power supply is its heavy duty power transformer with a high silicone steel core weighing a hefty 17 pounds.

A full wave bridge using 52.5 ufd of total capacitance (four 210 ufd, 470 volt capacitors) produces 1500 volts under full load and 1700 volts no load. That's excellent high voltage regulation!

Full height computer grade filter capacitors with screw terminals are used — not short stubby, light duty soldered-in "high technology" capacitors that can't dissipate the heat generated by high current.

The rectifier diodes are rated for a massive surge current of 200 amps. They won't blow even if you accidentally short the high voltage supply.

Wire wound, 7 watt, 50 K ohm equalizing resistors safely protect each filter capacitor — not 2 watt, 100 K ohm carbon composition resistors that can open and cause your filter capacitors to explode or fail.

The Ameritron AL-811 power supply is built tough so you get peak performance year after year.

Tuned input provides excellent load for any rig

A Pi-Network *tuned input* provides a 50 ohm load for your rig. Even fussy solid state rigs can deliver their full drive to AL-811.

Low loss slug tuned coils — tunable from the rear panel — let you optimize performance. High quality low drift silver mica capacitors maintain proper tuning.

Output tank: optimum Q on each band

The low loss pi-network output tank of the AL-811 has been carefully designed for optimum Q on each band and built with quality RF components.

The result is peak performance over each band, wide impedance matching range and exceptionally smooth tuning with efficiencies close to 70%. Even a 3:1 SWR load won't damage the tubes or tank components.

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A quiet fan pressurizes the cabinet with over 20 cubic feet per minute of cool air.

This large volume of air flow keeps the 811A tube temperature safely below the tube manufacturer's rating — even with a key down carrier at 500 watts output.

Two illuminated meters

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

The Grid Current meter continuously checks for improper loading. The other meter switches between high voltage and plate current to warn of abnormal conditions.

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

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73 Amateur Radio Today

HOW TO ENTER

Visit your local participating amateur radio dealer and fill out an Official Entry Survey. Only one entry per month per person. Duplicate entries will be disqualified.

Once every month, we will pick 5 names from every participating retail outlet. * One of these lucky hams will receive that month's prize package, but all of them will be entered in the Grand Prize Drawing, to be held in April 1991.

Visit you local retailer every month to check if your name is on the Ham It Up! Tote Board, which lists all the Grand Prize entrants from that store. While you're there, fill out the next month's Official Entry Survey. Remember, you can enter once every month. You get six chances to win a fabulous prize package and six chances to be included in the Grand Prize Drawing!

After we've given away all of the monthly prize packages, we'll take the Grand Prize Drawing entries (30 from each participating retailer) and give away over $30,000 worth of great ham gear.

*If you are unable to enter at a local retailer, you may obtain an Official Entry Survey by sending an S.A.S.E. to Ham It Up! Sweepstakes, 73 Amateur Radio Today, Forest Road, Hancock, NH 03449. Return the entry survey to the same address, and you will be entered through Uncle Wayne's Bookshelf.

This Month's Prize Package is worth over $1,200.00!

If you're this month's winner, you'll receive an **MFJ Prize Package**, including:

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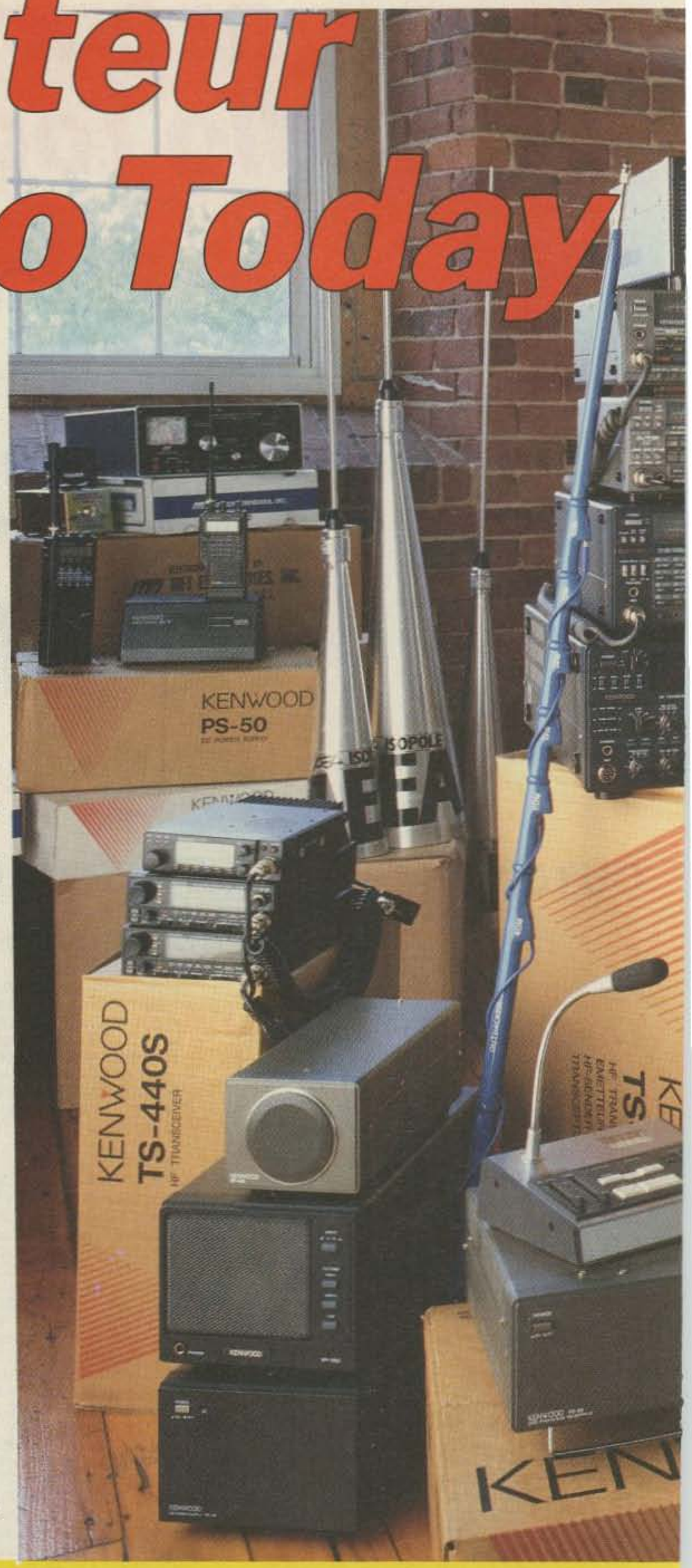

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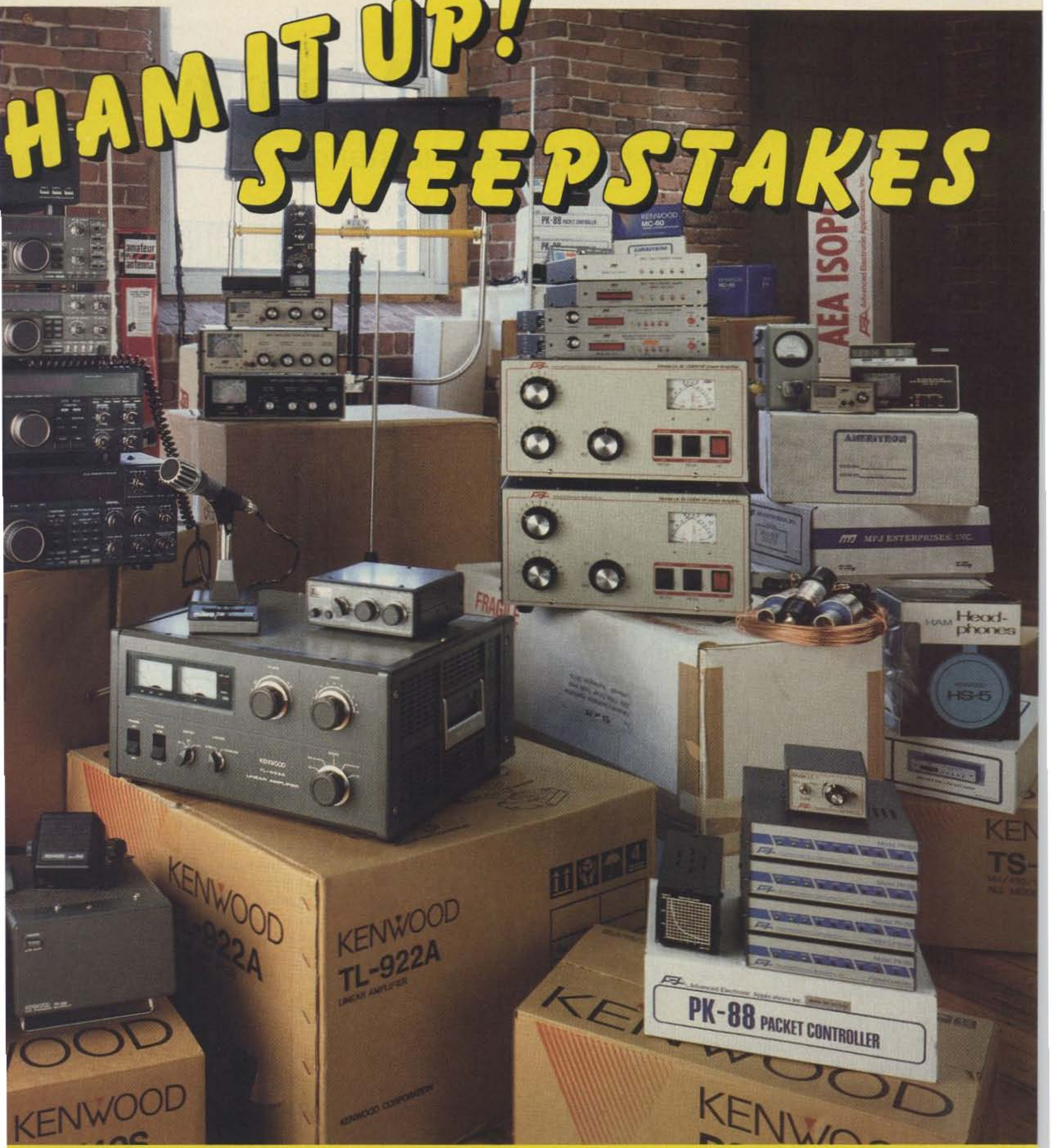

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Rose Parade Mobile

A high-tech HF remote station.

by David R. Corsiglia WA6TWF

The 101st Tournament of Roses Parade provided a unique opportunity for amateur radio to contribute to the 1989–1990 parade theme, "A World of Harmony."

The hundreds of hams who provide communications support to the parade each year were joined this time by Bill Fedde KC6GSD. Bill contacted hundreds of hams by operating a mobile station while riding in a vintage car in the parade. (KC6GSD will again operate Rose Parade Mobile. See the sidebar.) The son of Don Fedde, the 1989–1990 Tournament of Roses president, Bill was seen by the four million television viewers and one million spectators who lined Colorado Blvd. in Pasadena, California, on New Year's Day.

Photo A. Bill Fedde KC6GSD working Rose Parade Mobile. (Next to driver, waving hand.) Notice the headset and whip antenna.

Bill used a concealed hand-held radio broadcasting to an ultra-sophisticated remotely controlled transceiver coming out on 28.333 MHz. These remotely controlled transceivers are connected to a repeater through a low-band, computerized interface controller. Most stations contacted said that Bill's signal was S9+ through the remote station. Many stations contacted in Europe had excellent signal readings.

The TWF Super System

The plan originated when Bill, a recent graduate of Gordon West's Radio School, mentioned to Gordon WB6NOA that he would be participating in the Rose Parade with his father. Gordon had recently joined the TWF Super System, a remote base system with the capability of going in on 440 MHz and coming out on any band from 80 meters to 440 MHz on sideband or FM. With this technology and equipment available to Bill, the serious planning began.

The TWF system has three of these remote systems in operation in the Los Angeles basin. Each station operates with the most up-to-date equipment, giant antenna systems, and kilowatt amplifiers. The station that Bill used for the parade is on a one-thousand-foot hill overlooking the parade route. It uses Kenwood TS-940, 711, and 811 transceivers, and a 4-element KLM tribander on 10, 15, and 20 meters (see Figure 4 and Photo B).

Photo B. David Corsiglia WA6TWF demonstrates the TWF Super System.

As a new ham, Bill had never participated in operating a DX or special event station before. Gordon tutored Bill and conducted mock contesting drills. Even though hundreds of stations called Bill, everyone was courteous and the check in's proceeded in a well-organized manner. Three net control stations helped hold the frequency before the event started and kept a log of all stations heard. Reel-to-reel tape recorders were used to log the whole event so no one was left out.

Bill and Gordon sent press releases to more than 40 news-gathering organizations. The 90 television cameras along the parade route offered on-the-air close-up pictures of the president's car. Bill could be seen next to the driver with his headset on, contacting hams throughout the world.

To counteract the problem of the dual-band hand-held radio running out of power, a 4 Ah gel cell battery was installed and an external power cord was used. A mag mount antenna was camouflaged with flowers by a volunteer group from Holland that decorates the officials' cars in the Rose Parade each year.

The World at Your Fingertips

The brain of the TWF system is a low-band interface controller designed and built by K6QE Systems. This controller allows any mobile operator to control the band, mode, and exact frequency, and also to rotate the antenna to the desired setting from a hand-held radio or mobile using touch-tone commands. Other features include automatic antenna switching and frequency scanning.

The audio is so good that most amateurs contacted through the system don't realize they are talking to someone using a remote transceiver. K6QE Systems had already adapted the controller for the Collins KWM-380 and Yaesu's FT-980 and 767. Now it has adapted the controller for the Kenwood 940.

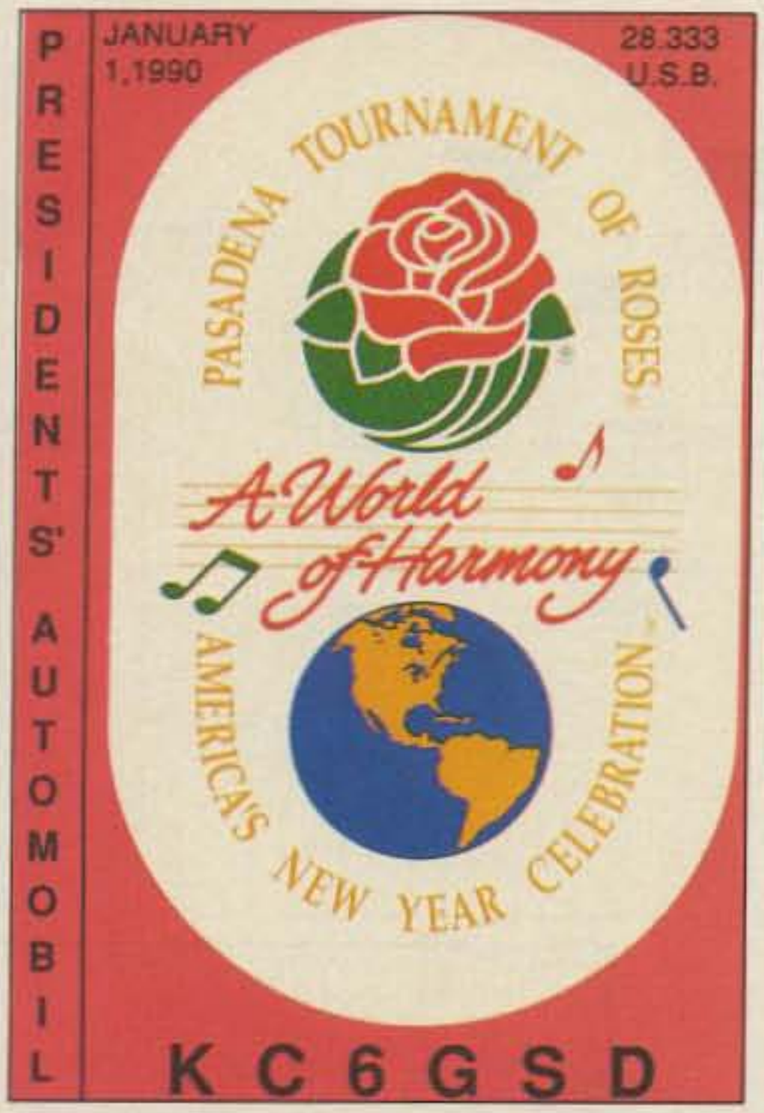


Figure 1. QSL card from 1989-1990 Rose Parade Mobile.

Jim Gilliam, designer of the K6QE Systems' low-band interface, says he is going to standardize the adaptation on the Kenwood radios for future units.

One of the main difficulties with having a computer control a worldwide transceiver is keeping the computer-generated noise out of the receiver. A special set of shielded boxes had to be custom-manufactured to enclose the commercial Micro-Mint computer board.

Repeaters connected to a low-band interface system have allowed many hams in the Los Angeles basin encumbered by antenna restrictions access to a superb worldwide station at their fingertips. They can make rare DX contacts as well as enjoy general rag-chewing.

Nancy Bucher N6XQR is one user of these new remote stations. She says it doesn't make sense for her to invest a lot of money in an expensive HF radio because she lives in a very restrictive town house project and can't put up any decent antennas. So she joined a repeater group that has a low-band interface, and now she can come out on 20 meters, just like the big DXers. Nancy uses only a small hand-held 440 MHz radio.

Dan Fort AA6LM, operating bicycle mobile, talks to hams all over the world on 1 watt. Dan is a member of the TWF Super System which allows him to go into the repeater on 440 MHz and be rebroadcast out on all the HF frequencies using kilowatt amplifiers.

If you have an interest in this technology, please write me at the address given at the end of this article, or call me at (714) 535-5528.

For inquiries on Bill Fedde's operation in the up coming Rose Parade, please write Bill Fedde, 394 Jones St. Ventura CA 93003, or call him at (805) 643-1817.

The Super Station

A hand-held radio plus a repeater with a remote transceiver equals a super station. The remote system Bill Fedde uses for the Rose Parade is part of the new wave of sophisticated repeater systems that are connected to amateur HF radios.

These repeater controllers are very smart and can perform just about any tuning function of the remote HF radio that an on-site human operator can do. For example, Bill can push a few touch-tone buttons on a 440 MHz handheld and come out on 20 meters USB and talk halfway around the world.

Groups of hams around the U.S.A. are pooling their resources and putting up these stations in areas such as industrial parks, where they are unencumbered by antenna restrictions. One such system in Santa Ana, California, is using a Kenwoood TS-940 transceiver. This group was able to erect a 6-element KLM tribander on one tower and a 3-element 80 meter beam on another tower not subject to residential zoning ordinances.

Although many manufacturers make repeater controllers that activate UHF and VHF radios, very few companies at this time sell units that control HF radios. Two companies that do are Engineering Consulting and K6QE Systems, both located in Southern California.

The Engineering Consulting Ultra Comshack 64 line of controllers consists of a series of circuit boards (Figures 2 and 3). You can pick and chose from various boards for the features you want. The basic starter board is $379.95, but a super deluxe system in a 19" rack enclosure with every option would run approximately $2,500.

The Ultra Comshack 64 will work with most computer-controlled radios on the market today. A combined dual-remote control system allows two transceivers to be controlled at the same time. For example, one for for HF and another for VHF. The control operator has tremendous capabilities to remotely change any parameter of the station, such as length of phone call, time-out timer,

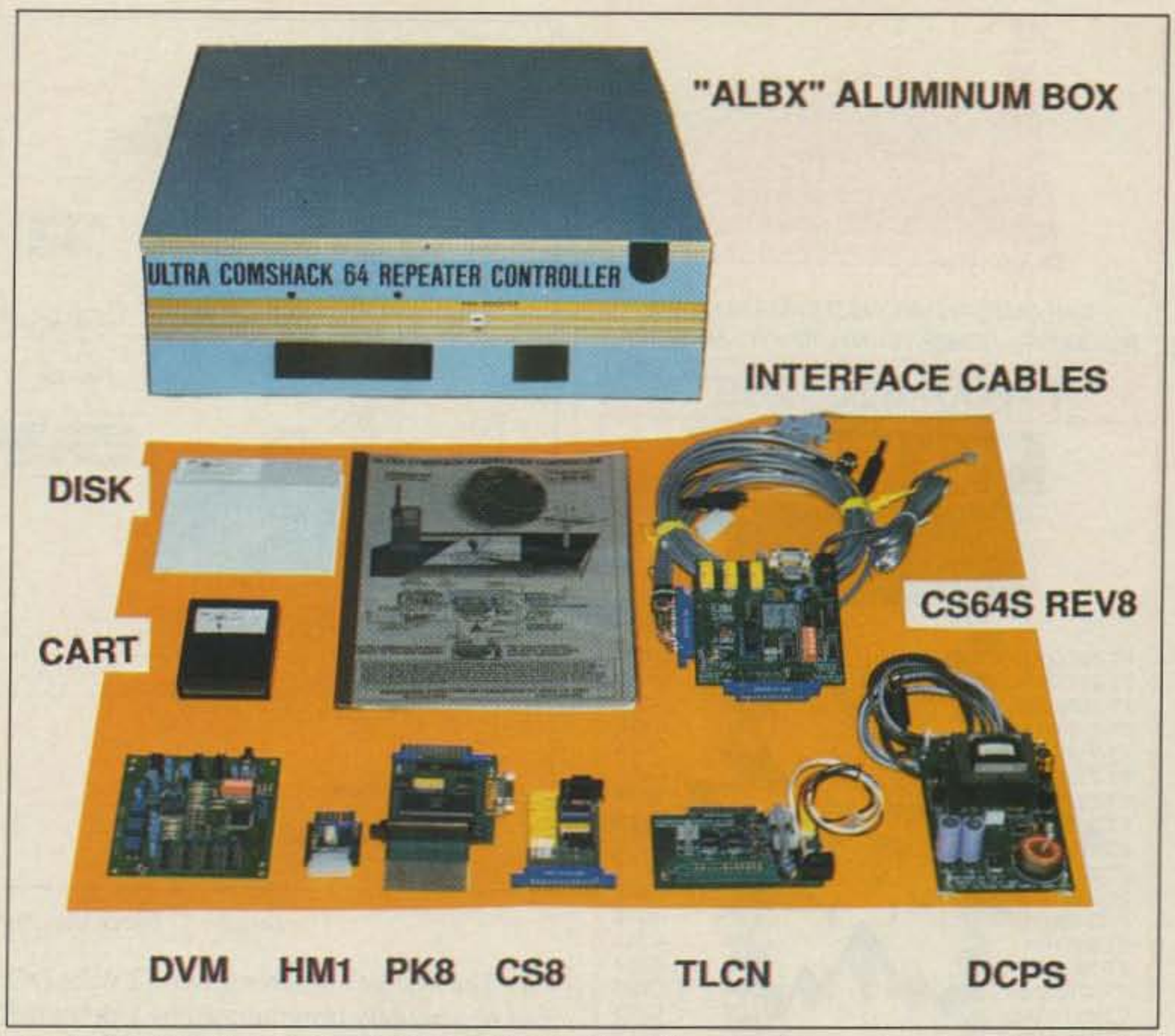


Figure 2. Ultra Comshack 64 Repeater Controller with some of the various boards available.

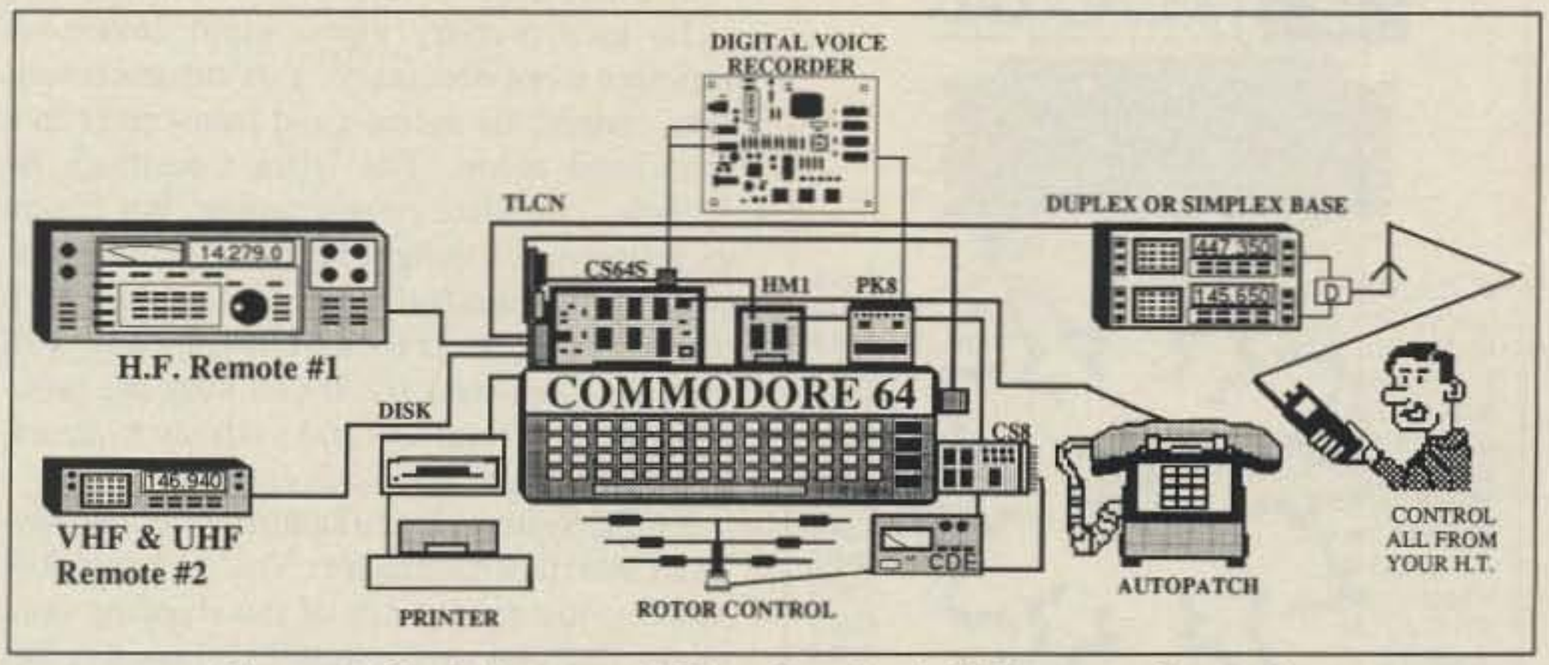


Figure 3. Block diagram of Ultra Comshack 64 Repeater Controller.

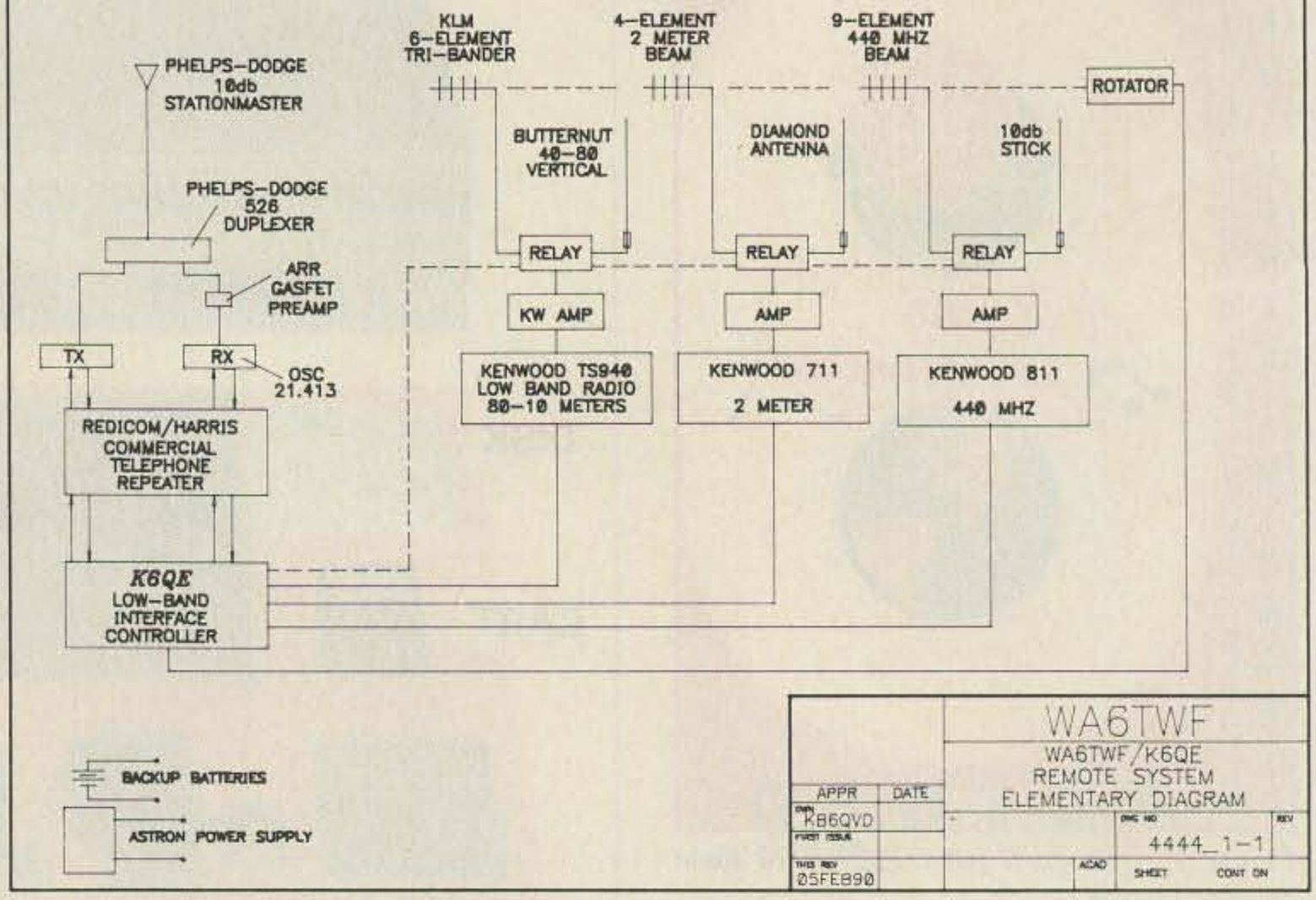


Figure 4. Block diagram of the TWF Super System.

etc. The system, which runs on 12 volts DC, can be remotely programmed by touch-tone, packet, or modem.

The Ultra Comshack 64 can use any FM radio as a primary input/output device. A repeater is not necessary. You can use a simplex channel or a dual-band transceiver in a crossband mode. The Ultra Comshack 64 includes complete programming, but it's an experimenter's delight because you can custom-tailor hundreds of commands with macros. You can truly have it your way with an Ultra Comshack 64. If you want one thousand autodial numbers and a talking S-meter, you can have it. The list is endless!

K6QE Systems manufactures a deluxe low-band interface controller. This is a turn-key system; just take it out of the shipping container and hook up the supplied plug-in cables to your transceivers. You can have up to five transceivers. There are also cables for the repeater and a rotator control box. Turn it on, and you're on the air.

The unit has a voice storage command feedback system that sounds so real you would swear that a human voice is speaking to you. The controller will not let the user transmit out-of-band accidentally, and it knows USB is normally used on 20 meters, although it can be forced to LSB. The K6QE low-band interface uses a built-in commercial micro-mint computer. The unit operates off of 110 volts AC and works only with the Kenwood line of radios (TS-940, 911, 811).

Features Common to Both Units

Both units have a telephone accounting system which allows individual access codes for each user. The control operator can request a hard copy printout via modem of the past month's telephone activity including, but not limited to, the number dialed by each access code, length of call, date, and time. Both units also have full low-band remote functions you can access from any touch-tone phone. For example, you could be at work pretending to be on an important business phone call and really coming out on 20 meter USB, working that rare DX contact you would have missed otherwise.

Both manufactures supply excellent documentation and a 90-day warranty. K6QE Systems offers a one-hour VHS video on their system, and on remote bases in general. The $39.95 charge for this tape is refundable if you purchase the unit.

Comshack users can tune in to the Comshack Remote Base Net that meets Sundays 1100 PST on 14.275. Bob Blumenkranz NI6R is net control.

For more information about the Comshack system contact: Engineering Consulting, 583 Candlewood St., Brea CA 92621, tel. (714) 671–2009; for information about the K6QE controller contact: K6QE Systems, 2180 W. Crescent Ave., Suite F, Anaheim CA 92801, tel. (714) 991–1439.

KC6GSD Goes One Better

This year Bill Fedde KC6GSD will be working Rose Parade Mobile again, but from a parade float this time. Bill has arranged to hitch a ride on the Rand McNally float, and he will be able to make contacts throughout the journey down the Rose Parade route.

Alinco Corporation has donated a DR-590T dual-band mobile transceiver with remote tuning head for this special station. This type of radio was needed because of the limited mounting facilities on board the float.

Bill wants to have complete access to the tuning controls of the radio so he can switch from 2 meters simplex (144.330) for working local spectators with their hand-held radios, to 440 MHz to access a K6QE systems remote station to come out on 28.333 MHz.

Gordon West WB6NOA is helping Bill with a special headset for the parade. A dual--

Work a Rose Parade Float!

This year the Tournament of Roses will have a "super station" operator (KC6GSD) on board one of the floats, so be sure to tune in to 28.333 MHz and talk directly with the station yourself. "Alinco is working closely with David Corsiglia WA6TWF to set up the right type of equipment for this operation, so our signal into the remote base on UHF should be very loud and clear," says Gordon West WB6NOA.

Classroom comments usually go like this: "Right, Gordo, you're telling me this handheld is reaching all the way to a station in Japan—sure, tell me more . . . ."

To the newly licensed amateur radio operator, capabilities of remote-based operation are best summed up by one student who said, "Amazing, simply amazing!" And it is. How many times have you walked down a busy street, chatting on your handheld, in QSO with a station thousands of miles away? The remote base makes this all possible.

The "WA6TWF super system" also provided Gordon West ham class students with 10 meter code practice covering all of Southern California and, on most evenings, blanketing the entire central states and East Coast with rock-solid signal strengths.

Every Monday evening between 6 p.m. and 8 p.m. Pacific Time, an on-the-air code class is offered on 28.333 MHz. Simply dial up 28.333 and tune down a few kilohertz until you find the familiar sounds of a Morse code class on the air. But unlike Morse code generated for on-the-air practice, Gordon West narrates on the same frequency that the code is being sent on. And since the code is sent at 28.333 in the Novice code and voice portion of the band, narration is indeed practical and possible.

Gordon West, recent ARRL "Instructor of the Year" award recipient, best known for his humorous code and theory training tapes, says, "We will send code for about three minutes, then ask any student on 10 meters for a read-back. It really gets everyone involved. And when conditions are just right, it's not surprising to get a read-back from stations down in South America or as far west as New Zealand.

"This unique style of code class also allows me to stop and answer questions students may have. Nowhere else on the dial can anyone find this type of 'two-way' code class, and I think we have hundreds of one-way listeners, too, tuning us in on the UHF band with their programmable scanners."

West uses an equalizer and audio system to combine both modulated CW and voice. The code is generated by a Bencher paddle tied into an AEA Morse Machine, and the MM-3 may also take code directly from a Radio Shack Model 100 lap-top computer. The MM-3 has the latest revision which allows the computer-generated input to be sent at 15 or 18 wpm character rates. The ARRL uses 18 wpm character weighing, where most other examination teams use the more traditional 15 wpm character weighing. Either way, the MM-3 or Gordon West on the paddles can easily handle both types of CW.

A Kenwood 721 transmits the voice and modulated CW on the 440 UHF band to a repeater 60 miles away on the Palos Verdes Hill. The repeater retransmits the voice and code on UHF, and also feeds the big Yaesu base station. Via the WA6TWF remote-base system, the base station may be remote-controlled to transmit on 10 meters, and also to listen on 10 meters, to feed the received student responses back down on the UHF link. This allows West to monitor both 10 meters locally and 10 meters from the remote base. A 70-foot tower and tribander, located at an altitude of 1400 feet above sea level, commands a signal that can be heard in the Los Angeles basin as well as thousands of miles away. Beam heading is generally to the east, but if enough students are calling in from Australia, New Zealand, and Japan, the beam may be remote-controlled to the west.

"The system works terrific—about the only thing that causes us a problem is a nearby military radar installation that puts a buzz on the UHF link. And from time to time we have someone come on the 10 meter band to inform us that our CW sounds a little strange. After we let them know it's modulated CW coming from a UHF link, the 10 meter operator can get the idea of what's going on, and generally stays tuned in.

"And it's our guests tuning into code practice that makes everything really work well—many times guests will transmit their own version of code practice, and our students love it. We welcome everyone to not only listen, but to take part in this 2-hour code class, on the air," says West.

West occasionally uses the WA6TWF remote base for his Tuesday morning contact with the "CQ All Schools Net" found on 28.303 MHz (every Tuesday and Thursday at 12:30 p.m. EST). He links up with Carole Perry WB2MGP, and the coast-to-coast stations provide schools all over the country with a look into ham radio in live operation.

It's best summed up, as one of Gordo's students has said before, "Amazing, just awesome amazing!"

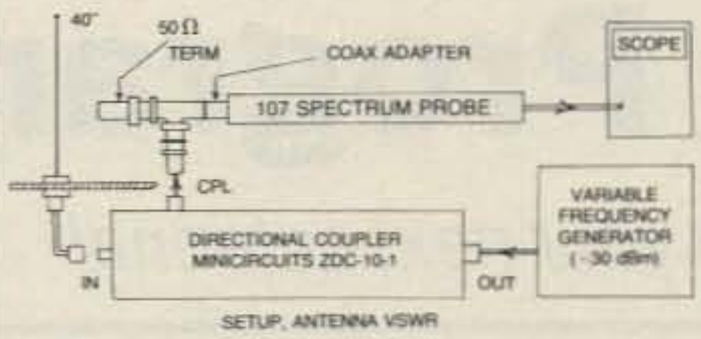
band antenna will be camouflaged in the flowers of the float.

A commemorative QSL will be available to anyone who hears or works Bill. For your QSL, send a self-addressed stamped envelope to: 102 Tournament of Roses (KC6GSD), 391 South Orange Grove Blvd., Pasadena CA 91184.

So on January 1, 1991, New Year's morning, turn your radio to 28.333 MHz and give KC6GSD a call. Bill will be detailing his progress down Colorado Blvd. Turn on your TV, also, because he will point out when he is in front of the TV Cameras. 73

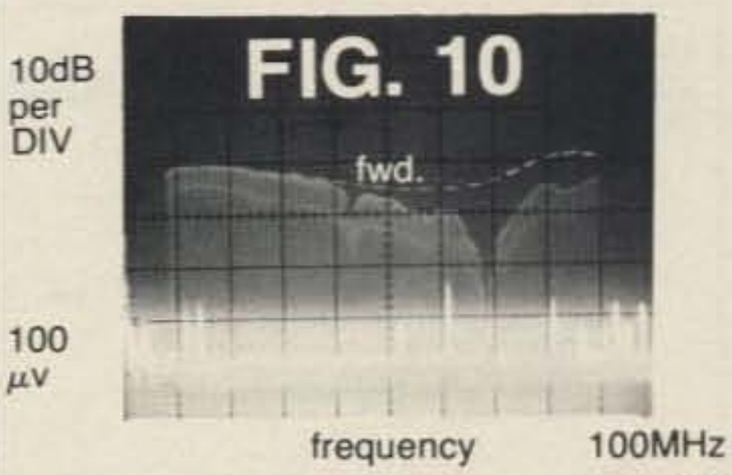
David R. Corsiglia WA6TWF, 858 Lenz Drive, Anaheim CA 92805. (714) 535-5528.

evaluating an
ANTENNA (MATCH)
FIG. 9



SETUP, ANTENNA VSWR

FIG. 10



The degree of match between a 50 Ω source and an antenna is obtained with the set-up illustrated in fig. 9. The tuning, Q, and reflection loss are available. The CPL output with either an open or direct short on IN is plotted as the fwd line in fig. 10. Then the cable to the antenna is attached, and the scope photo of fig. 10 results. The difference between these lines is desired. The scope indication of "37 dB" forward, "12 dB" reverse, indicates the reflected loss is down 25 dB at 68 MHz; (1.1 VSWR) 1/320=0.3% of the applied power is reflected or about 99.7% of the available power is radiated (or at least absorbed) by the antenna. Conversely, 99.7% of the received power is applied to a 50 Ω receiver. Since the probe can "see" a low level, only a low radiated signal is required. The discrete lines are signals received by the antenna. The logarithmic response allows evaluation of good matches.

73 Review *by Bill Clarke WA4BLC*

The ELNEC Antenna Modeling Program

Let your computer design your next antenna!

ELNEC
Roy Lewallen W7EL
P.O. Box 6658
Beaverton OR 97007
Price Class: $50 postpaid. Specify whether or not your computer has a coprocessor.

The wind is blowing and the rain is pelting the old radio room window, but today I am going to design and test a new antenna. Of course I'm not going out in that wet weather to do antenna work. And, I'm not even going to cut a wire or solder a connection.

How, you ask? Simple, I'm going to model my newest antenna idea on a computer. How about that, folks—a use for a ham's computer other than packet!

Enter MININEC by J.C. Logan and J.W. Rockway of the Naval Ocean Systems Center, a comprehensive antenna modeling program. Roy Lewallen W7EL has used the fundamental computation portion of this program to produce ELNEC, an antenna modeling program for the IBM-PC computer and its clones. Roy began writing ELNEC over two years ago for his own purposes, saw its value to other hams, and introduced it to the public in May 1990.

The ELNEC Program

ELNEC is a computer program for the modeling and analysis of radio antennas. Basically, modeling consists of the generation of the antenna's far-field pattern (radiation pattern). This includes gain, which can be plotted in the typical ARRL-type grid style or presented in tabular form. (The latter is for folks who don't have graphics capabilities.)

If for no other reason than using ELNEC, get a graphics card and monitor for your computer. The first time you use it will more than pay for this cost. After all, you can get an "el cheapo" board and monochrome monitor for under a hundred dollars.

Features

ELNEC is user friendly. It uses a menu-based system that is easy to understand and interact with.

All outputs of ELNEC can be printed, giving you a hard copy of your efforts for later use and analysis. ELNEC's features include the ability to analyze forward gain, front-to-back ratio, beam width, 3 dB pattern points, side lobe information, SWR (50 or 75Ω systems), voltage, current, impedance at source points, and current distribution along the wires.

A unique feature is its TOTAL pattern generation. A total pattern is a combination of the vertical and horizontal components of the radiation pattern, and shows exactly what you may expect in real operation.

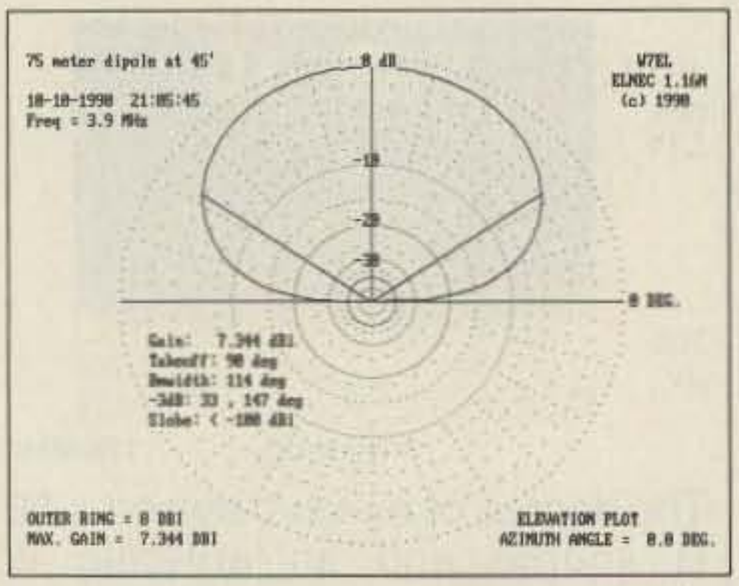


Figure 1. This 75 meter dipole at a height of 45 feet shows a typical elevation pattern. Note the straight lines within the pattern—they are from the ANALYSIS feature and depict the 3 dB beam width. Printed just to the lower left of the pattern's center is the analysis showing beam width information. Specifically, the −3 dB points of 33 and 147 degrees. Note that the pattern is labeled in the upper left corner for future reference.

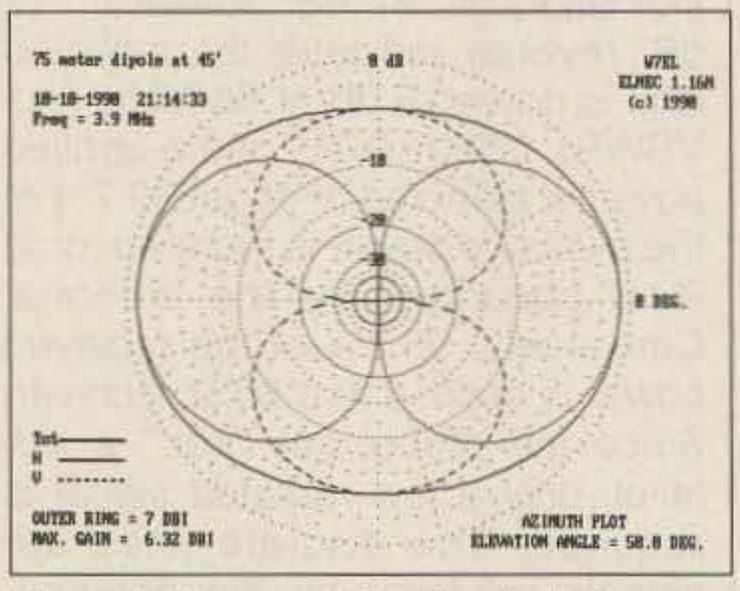


Figure 2. The same 75 meter dipole in a combination plot showing horizontal, vertical and total patterns. They are based on an elevation angle of 50 degrees, taken from within the 3 dB beam width of Figure 1. Of particular importance is the TOTAL pattern, a combination of vertical and horizontal fields.

Simple and complex antennas can be modeled, as can structures such as towers and walls, and the surrounding ground characteristics can be introduced. The combinations of these factors can produce surprisingly accurate far-field patterns.

Although most types of antennas can be modeled, program coding limitations of MININEC cause some minor limitations shared by ELNEC and other MININEC-based systems. Specifically: Closely spaced wires such as transmission lines are difficult to model (however, they are possible); you cannot determine the efficiency of a ground radial system; and impedances given for horizontal antennas lower than 0.2 wavelengths will not be correct. However, far-field patterns will be accurate.

A Small Package

ELNEC comes in two forms, one for the computer with a math coprocessor, and the other for the poor folks like me that have no coprocessor. Installation in either case is a snap. Just make a backup of the original disk and use that backup as your operating disk. Of course, as there is no copy protection used in ELNEC, you can install the system on your hard drive.

The program's documentation file is located on the distribution disk and should be printed and read **BEFORE** you try to use ELNEC.

ENSETUP is a short set-up program that allows some parameters to be modified during installation. These specifically include printer type, file paths, date format, and color selections.

Included in the instructions is a "test drive" to lead you through what ELNEC can do. It is based upon a 20 meter dipole 30 feet in the air. These instructions run for several pages in the manual and will allow you to touch and feel that dipole in every conceivable manner via ELNEC.

After the test drive is completed, you will probably wish to proceed with antennas of your own design.

Roll Your Own

All antennas designed for ELNEC are based on straight wires (of any size definable) placed on a three dimensional grid (X, Y, and Z three dimensional axes). Loops and circles are modeled as combinations of many straight wires. Using graph paper will aid you during the first few tries, which will show you how really easy antenna modeling is.

Let's take a dipole as an example. A good starting point would be the dimensions, which in this case are going to be cut for 3.9 MHz, and the height will be 45 feet. Using the XYZ grid, start at 0,0,45 (meaning in the center of the imaginary or real graph paper at a height of 45 feet). Next, enter the end of the dipole as

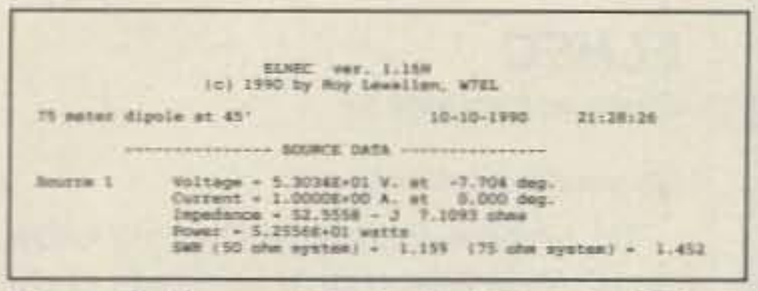


Figure 3. Source data for the 75 meter 45-foot-high dipole shows voltage, current, impedance, power, and projected SWR.

0,120,45 (notice the antenna is 120 feet long and goes from the center of the graph towards the top). The feedpoint would be entered as the source in the form of a percentage from one end of the wire to the feedpoint, in this case 50%.

Now select the type of plot you want for the dipole, azimuth or elevation, and press ENTER to calculate (see Figures 1, 2, and 3).

Observations from Use

Most of my modeling has been over what ELNEC refers to as "real ground." This allows you to customize the ground parameter of the program with your actual ground conditions (conductivity, etc., as referenced in the *ARRL Handbook*). Modeling can be done over perfect ground or in free space. I prefer to see what the real world operation of the antenna will be, so my modeling is over real ground.

While using ELNEC, and similar programs, I have found they all spit out gain figures that are extremely enticing to the uninitiated. For example, look at Figure 4 (20 meter, 3-element beam at 70 feet) and you will see the gain figures in the lower left corner. Pretty impressive, huh? Don't you believe it! That 12.88 dBi can be very misleading, just as the claims of some antenna manufacturers can be misleading.

ELNEC bases its gain figures (as do the antenna manufacturers) on dBi, decibel gain relative to an isotropic source. These figures are as theoretical as is the isotropic source, but they do provide a standard point with which to compare antennas.

For a real look at what this beam antenna can do, model a simple dipole at the same location (height) for use as a reference. Next, check the dipole's gain of 7.63 dBi (Figure 5) against that of the beam (12.88 dBi). The difference will be the expected improvement using the beam versus the dipole. Of course, that gain is only exhibited in specific directions, as shown in the pattern of Figure 4.

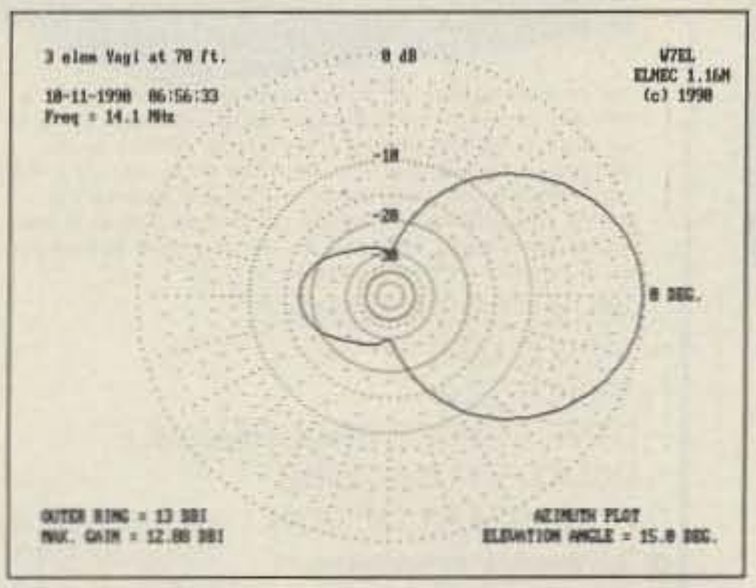


Figure 4. Total pattern of a typical 3-element yagi cut for the 20 meter band. Note the gain figures and angle of the plot.

Remember, the object of a directional antenna is to concentrate your signal (received and transmitted) to planned horizontal and vertical directions.

All-Purpose Antenna

In the hunt for the illusive all purpose antenna, I always think of the center-fed zepp. The version modeled here, using ELNEC, is 60 feet on either side of the feedpoint and is horizontal at 45 feet in the air. It is fed with 450Ω ladder line.

On 75 meters the antenna behaves as a dipole. However, as the frequency is increased, there is some directional gain.

The 17 meter plot of the zepp (Figure 6) shows how the directional pattern appears at 15 degrees elevation, which is excellent for DX. Of course, the pattern can be oriented to favor any specific geographical area simply by moving the antenna's azimuth position.

Other antennas, such as the Carolina Windom from the Antenna Works and the G5RV,

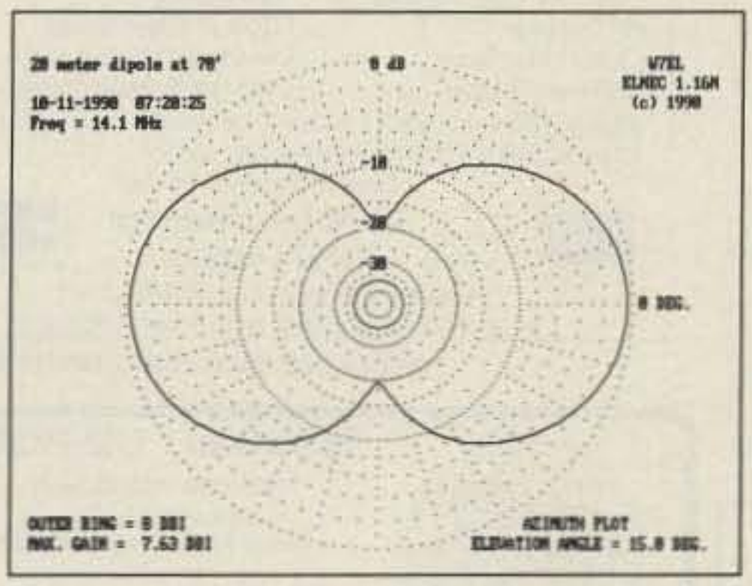


Figure 5. A dipole can be used as a standard of comparison when modeling experimental antennas and will tell you immediately if you are winning or losing the battle. Note the gain figures and angle of the plot. The dipole is placed at the same height as the beam it is being compared with.

exhibit similar pattern characteristics and are excellent for use on all bands.

An Experimental Antenna

In my personal search for an antenna for 75 meters that would reach from my New England QTH into the far southeastern part of the U.S., I designed a directive array using a dipole at 40 feet with a sloping 75 meter delta loop 20 feet behind it. The loop is 88 feet on each of its three sides and is fed in the center of the section that parallels the dipole. The parallel (to the dipole) section is at 35 feet and the far point is at 10 feet. Figure 7 shows the resulting plot at 50 degrees elevation (the plot holds from 40 through 60 degrees). Compare the plot and figures with Figure 2.

This antenna is still theoretical, as I have yet to put it up. Such is the problem of moving from one QTH to another.

Likes

1. ELNEC is considerably faster in operation than similar programs I have used in the past.

2. Print drivers are included in the ELNEC system, making "screen dumps" unnecessary for printing hard copies.

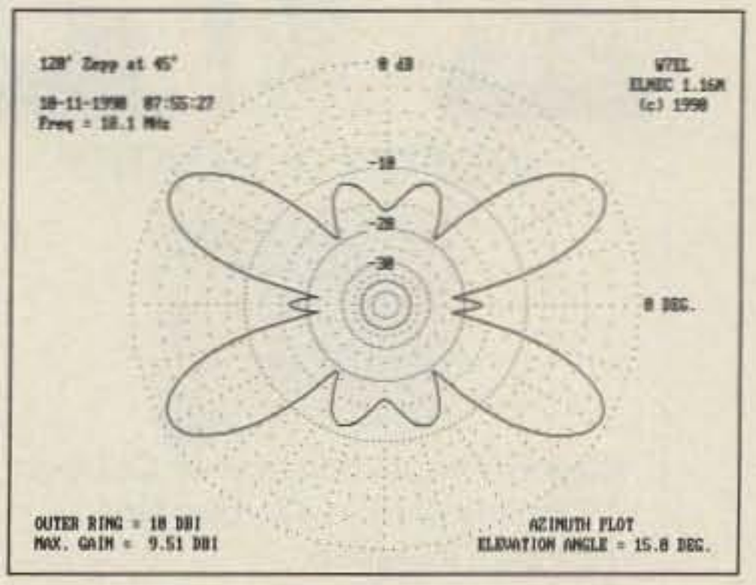


Figure 6. The zepp as it appears on 17 meters (a dipole cut for 17m would produce a similar plot as Figure 1).

3. There is no copy protection (see comments later in this article).

4. The guarantee is "like it or leave it." If you're not satisfied with the program, your money will be refunded.

5. On an EGA or VGA color display you can select the colors that will be used to display various patterns (horizontal, vertical, total, etc.). CGA and monochrome displays offer no color option with ELNEC.

6. The ANALYZE feature of ELNEC quickly determines beam widths and 3 dB directional (horizontal and elevation) limitations.

7. Minor changes to parts of an antenna's description do not require complete recalculation by ELNEC.

Dislikes

1. ELNEC, in the version tested, does not save plots to files. You have to recalculate each time you wish to review a specific antenna. I make printed copies of each design, so this isn't a major inconvenience.

2. The times to complete calculation estimates (shown on the screen) are not accurate.

Copy Protection

ELNEC gets a big "Thumbs Up" for NOT being copy protected! Although it is copyrighted material, the purchaser may make copies for backup use only.

For my personal applications, I find programs that use any form of copy protection to be a nuisance at least, and disastrous at worst. Being able to make workable backup copies of purchased software is very important, as disks do crash and programs do get destroyed.

Continues on page 54

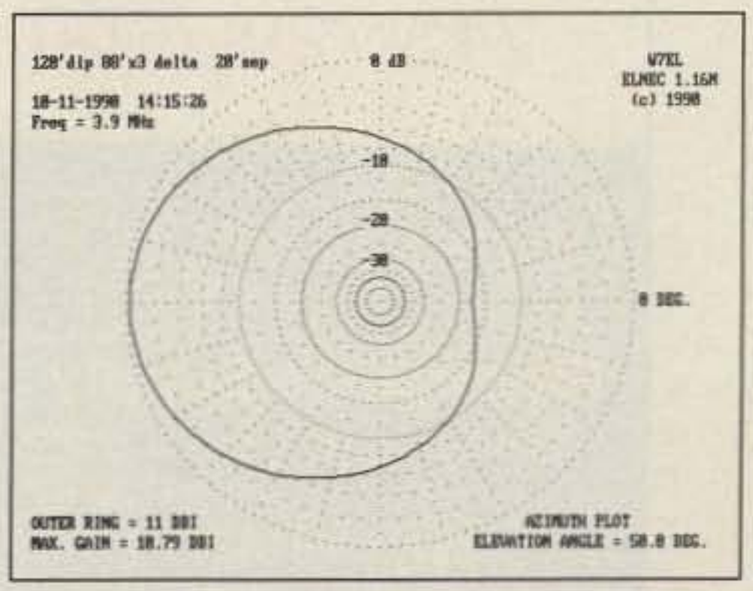


Figure 7. The 50 degree plot for the 75 meter dipole and delta loop combination.

ELNEC

Continued from page 53

Recommendations

Do I recommend ELNEC to my fellow hams? Yes! After testing hundreds of designs, I do recommend ELNEC. However, I also offer these caveats:

ELNEC, and other complex antenna programs, require a reasonable understanding of expected RF patterns and basic antenna design. They cannot be expected to answer all antenna questions within the first few hours of operation.

Additionally, when you begin designing antennas you will find yourself making many changes and more and more calculations. The result is that you will be spending more time on the computer and less time on the radio. You will be conspicuous by your absence from the bands. 73

Contact Bill Clarke WA4BLC at RD#2 Box 455A, Altamont NY 12009.

Low-Cost Mag-Mount

Plus a complete mobile antenna system.

by Phil Salas AD5X

For less than $25, you can have a mag-mount antenna base with low-loss coax, a 144/450 MHz dual-band antenna, a 13″ 10 meter antenna, and a half-wave 825–890 MHz cellular antenna. How?

Recently I was looking through an electronics parts catalog (Marlin P. Jones & Associates, tel. 407–848–8236) and found high power ferrite toroid magnets with attached steel base plates for use as magnetic mounts for mobile antennas. They were only $2.75 each. I'd been wanting a mag-mount base with BNC connector so that I could attach my HT antenna to it while mobiling. This looked like a good foundation at a good price. Constructing the mag-mount led to antenna experimentation and construction.

Magnetic Mount Construction

See the Parts List for the parts you can order from Marlin P. Jones & Associates. You'll also need to buy an 8-32 x ⅜″ brass screw and two ⅞″ copper pipe caps, for a total of less than 50¢, from your local hardware store. The two pipe caps are shown in Figure 1(a). One has a ⅞″ outside diameter and the other has a ⅞″ inside diameter. One will slip inside the other.

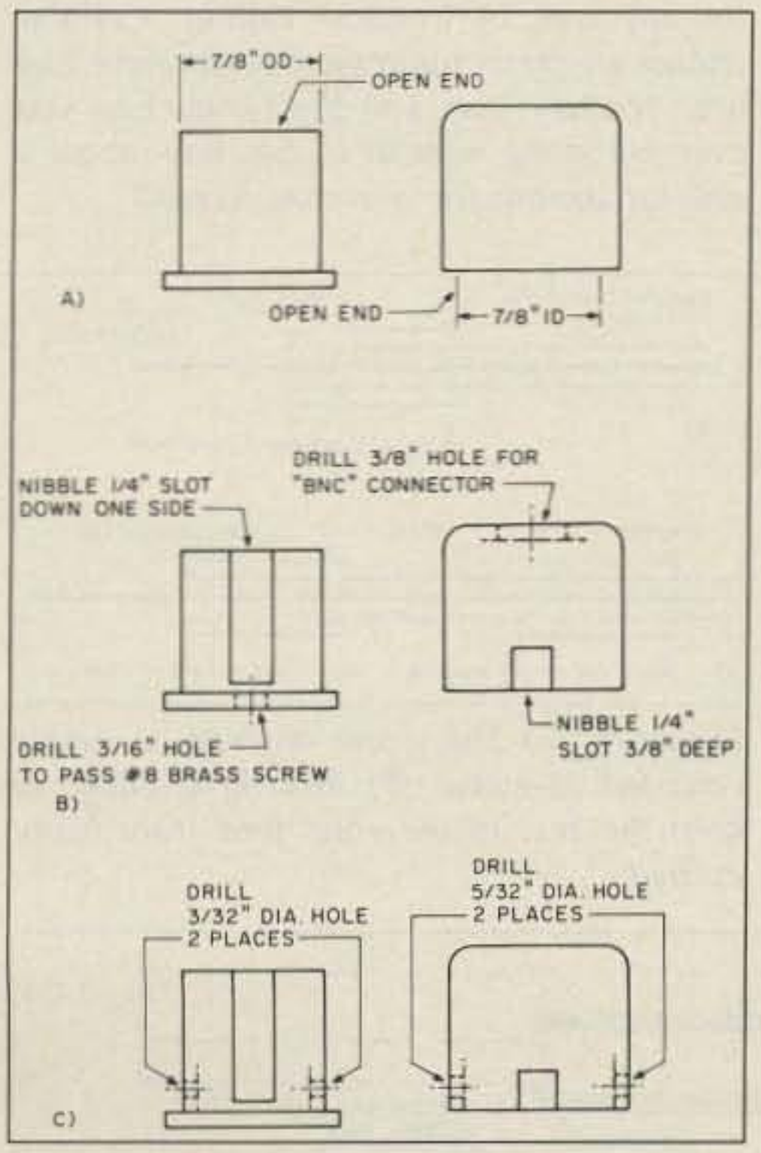


Figure 1. Steps in constructing the mag-mount.

Nibble a ¼″ slot ⅜″ deep in the larger pipe cap as shown in Figure 1(b). Nibble a ¼″ slot all the way down the side of the smaller pipe cap. Next, drill a ⅜″ diameter hole in the center top of the larger pipe cap for the female BNC connector, and a 3/16″ diameter hole in the center of the bottom of the smaller pipe cap for the #8 brass screw. Insert the brass screw so that its head is inside the pipe cap, then solder it in place. Be careful not to get solder on the outside threads of the screw.

Now drill two 5/32″ holes near the bottom of the larger pipe cap, as shown in Figure 1(c). Slip the large pipe cap over the smaller pipe cap, align the slots, and mark positions for two holes in the smaller pipe cap. Remove the larger pipe cap and drill two 3/32″ holes in the smaller pipe cap.

Insert the female BNC connector in the ⅜″ hole in the top of the larger pipe cap, attach its mounting screw, and tighten in place. Now strip ½″ off one end of a 14-foot length of RG-8M coax cable. Unravel the braid and twist and tin the braid and the center conductor. Refer to Figure 2(a). Rest the coax cable in the slot in the larger pipe cap and see where you can make the braid come in contact with the outer shell of the BNC connector. Tin the connector shell at this point. Now solder the center conductor of the RG-8M cable to the center conductor of the BNC connector. Tin the connector shell at this point. Now solder the center conductor of the RG-8M cable to

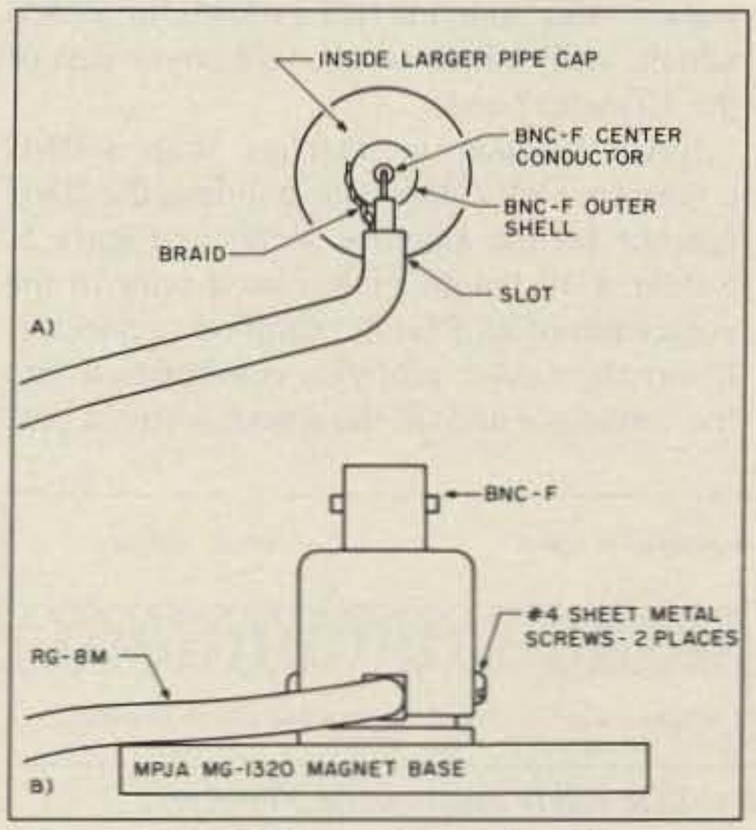


Figure 2. Installing and securing the coax to the mag-mount.

the center conductor of the BNC, and solder the RG-8M shield to the outer shell of the BNC.

Now slip the larger pipe cap (with the RG-8M cable attached) over the smaller pipe cap, and push them together so that the small holes in the base are in line. Screw two #4 x ¼″ sheet metal screws through the holes and tighten. Finally, pass the brass screw threads through the magnet base and tighten in place with a #8 lockwasher and nut, as shown in Figure 2(b).

To finish the assembly you need to attach the BNC crimp-on connector to the other end of the RG-8M cable. You'll find that the stranded center conductor of the RG-8M cable is too big to fit into the center pin of the connector. Just cut off all but three strands, then insert these strands into the center pin and solder them in place. Crimp the outer shield collar in place, as in Figure 3.

I used a hot glue gun to seal up the gaps in the base where the coax cable exits from the

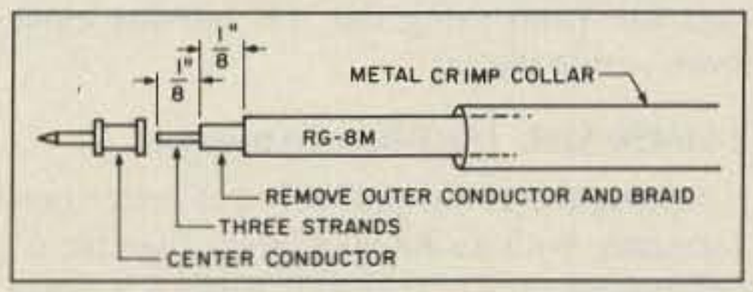


Figure 3. Crimp the outer shield collar in place, and you're finished.

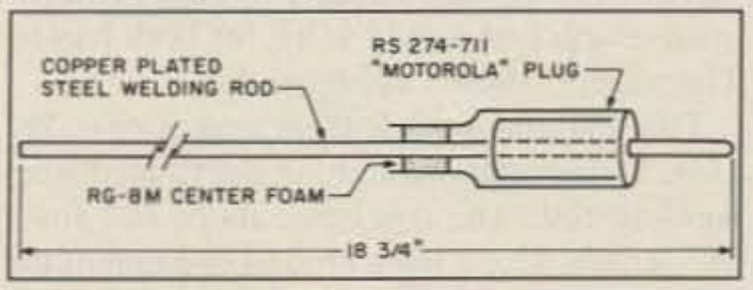


Figure 4. Dual-band 2 meter/450 MHz whip construction.

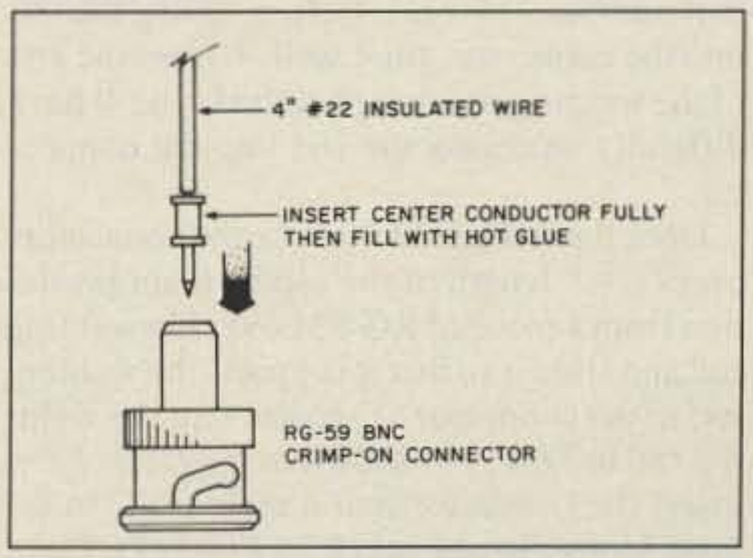


Figure 5. BNC adapter for the 10 meter antenna.

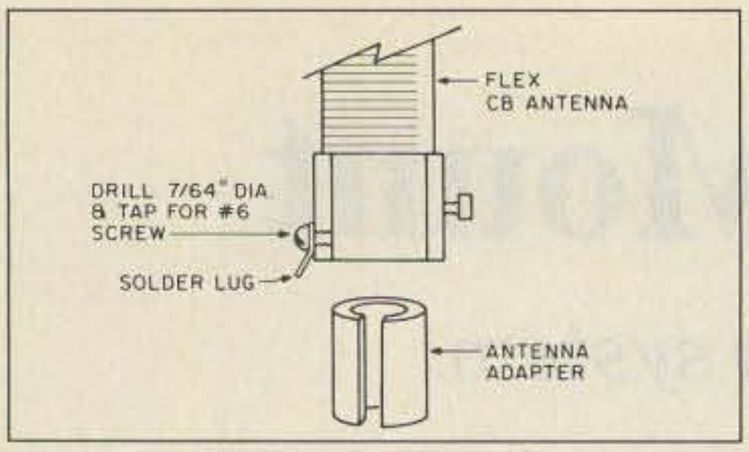


Figure 6. Modification of the CB walkie-talkie antenna mount. Drill a 7/64" hole close to the bottom of the antenna base and tap it for a #6 screw.

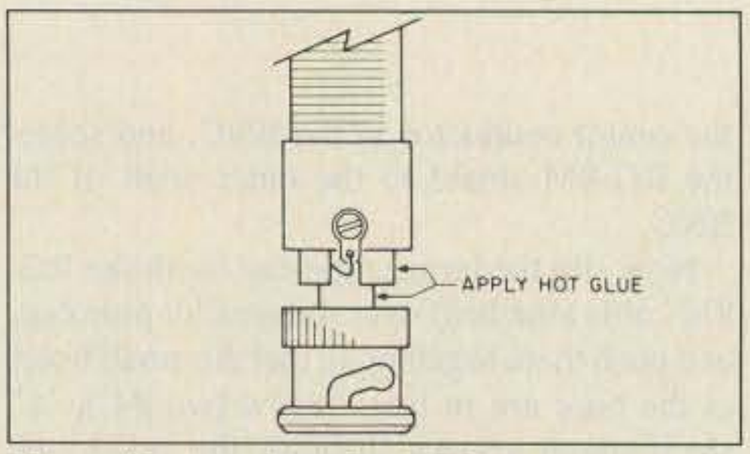


Figure 7. Attaching the BNC connector to the 10 meter mobile antenna.

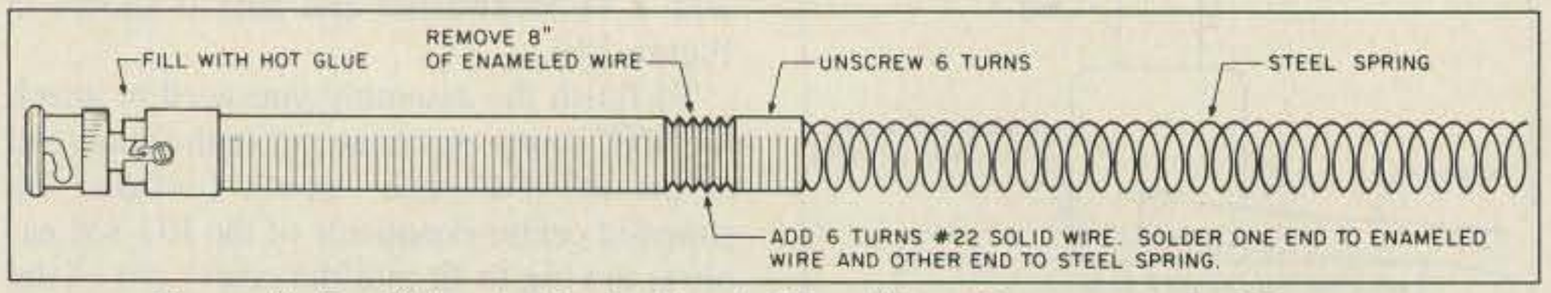


Figure 8. Modifying the Radio Shack CB walkie-talkie antenna for 10 meters.

copper caps. I also put a bead of hot glue around the lip between the two copper caps.

Your mag-mount base is now complete. You can attach your HT antenna to this base and get significantly better performance than you can from using the HT antenna alone from within the car.

144/450 MHz Dual-band Antenna

I thought I could probably get better performance with an antenna larger than the 6" antenna on my FT-727R HT. Since a ¼-wave antenna at 2 meters should be close to a ¾-wave at 450 MHz, I decided to find a compromise length that would work for both bands. The result is shown in Figure 4.

This antenna is made from a piece of 0.09" (3/32") diameter standard copperplated steel welding rod. The rod costs about 20¢ for a 36" length. Use a file to round one end of the rod so that it will slip into a Motorola-type automotive radio connector (Radio Shack part number 274-711). Before sliding the rod into the connector, tin it well. Unless the end of the welding rod is well-tinned, you'll have difficulty soldering the rod into the connector.

Once the rod is soldered into the connector, press a ½" length of the center foam insulation from a piece of RG-8M over the welding rod and slide it so that it supports the welding rod in the connector as shown. Cut the welding rod to 18¾", as shown in Figure 4. Now insert the connector into a male BNC to female Motorola adapter (RS# 278-117). Place a piece of ½" heat shrink tubing over this assembly and heat it. When it has cooled, you will have a rugged antenna assembly.

With these dimensions, the antenna has less than 1.5:1 VSWR at 445 MHz, and less than 2:1 at 146 MHz. You can vary the length slightly if you wish to favor one band over the other, but you'll find negligible improvement in performance. In any case, performance will be significantly better than with the HT antenna alone.

13 Inch, 10 Meter Antenna

I have a converted CB rig in my car for 10 meters. Naturally, I wanted a small antenna for this rig, one that would be secure at high-way speeds, so that I could attach it to the mag-mount. Radio Shack sells a flexible CB walkie-talkie antenna (RS 21-980, for $7.95) which, with a little work, will cover part of the 10 meter band.

Since we have to interface with a BNC connector, let's start with building the BNC adapter for the antenna. Refer to Figure 5. Solder a 4" length of insulated wire to the center pin of an RG-59 crimp-on connector. Insert the center pin/wire combination into the connector and fill the sleeve with hot glue to keep the center conductor pin firmly in place.

Referring to Figure 6, drill a 7/64" hole close to the bottom of the antenna base and tap it for a #6 screw. Use a 6-32 x ¼" screw to attach a solder lug to the base at this point. The plastic antenna adapter is supplied with the flexible CB antenna.

Refer to Figure 7. Slip the plastic antenna adapter over the BNC connector and bend the center conductor wire down along the antenna adapter slot. Slip the flexible antenna base over the antenna adapter and tighten the thumb screw on the antenna base to hold the assembly together. Solder the wire to the solder lug on the base. Finally, use a hot glue gun to hold everything firmly in place.

Now for the antenna modifications. Using a sharp knife, split and remove the entire insulating outer cover of the antenna. Refer to Figure 8. Unsolder the enameled wire from the base of the steel spring. Unwrap 8" of the enameled wire and cut it off. Spread the remaining enameled wire over the full length of the nylon rod and hold it in place with electrical tape. Keep the wire tight. Now carefully unscrew the steel spring six turns. Solder a piece of #22 bare copper wire to the end of the enameled wire and wrap this wire along the threads in the nylon base that was exposed when the spring was unscrewed. Solder the other end to the base of the steel spring. Now it's time to adjust the antenna.

Mount the antenna on the roof of your car, using the mag-mount. This antenna is pretty narrowband, so I'd recommend optimizing it for a 200 kHz spread. In my case, I optimized it for the 28.3–28.5 MHz range. Using an SWR meter, check the SWR at the low, mid, and high end of the frequency range you want. This is the only antenna requiring an SWR meter.

The antenna should still be resonant too low in frequency so you'll see your lowest (though still high) SWR at the low frequency end. Now unsolder the wire at the base of the steel spring and screw the spring in ¼ turn. Resolder the wire (after clipping off the excess) and check the SWR. Keep doing this, using no more than ¼-turn increments until you're able to center up the SWR over the frequency range you're interested in. That is, you should have the lowest SWR at your center frequency and the SWR at the edges of your frequency band should be about the same. In my case, I was able to achieve a 2:1 SWR at 28.3 and 28.5 MHz, and a 1.5:1 VSWR at 28.4 MHz.

Finally, use pieces of ½" and ⅝" heat shrink tubing to cover the entire antenna. I also used a blob of hot glue to seal the top end of the antenna.

This antenna works surprisingly well. I can reliably work all over the U.S. and occasionally even make international contacts. It's tough competing with high power and big antennas when trying to work DX, but occasionally I get lucky.

Cellular Antenna

Why would a ham need a cellular phone? Well, you can reliably make and receive calls no matter where you are. Also, it is necessary for any type of business calling. Cellular phones are pretty impressive performers, and once you have one, you don't know how you ever got along without it. So, how about a cellular antenna for your mag-mount?

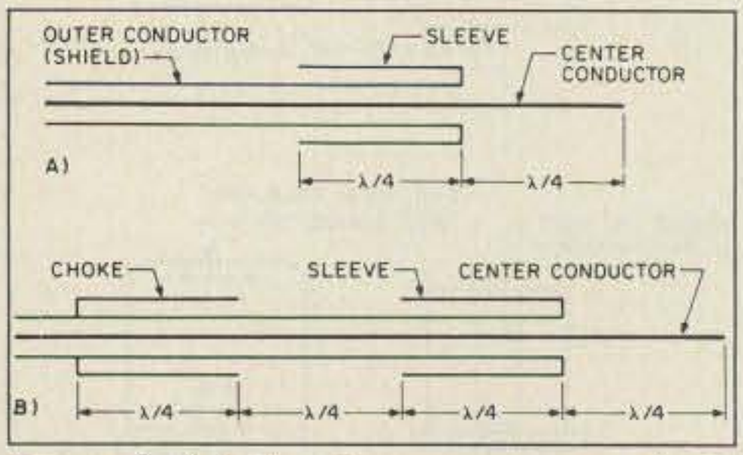


Figure 9. (a) The sleeve antenna, a simple coax-fed ½-wave. (b) Making a choke to keep the rest of the coax feed from being excited.

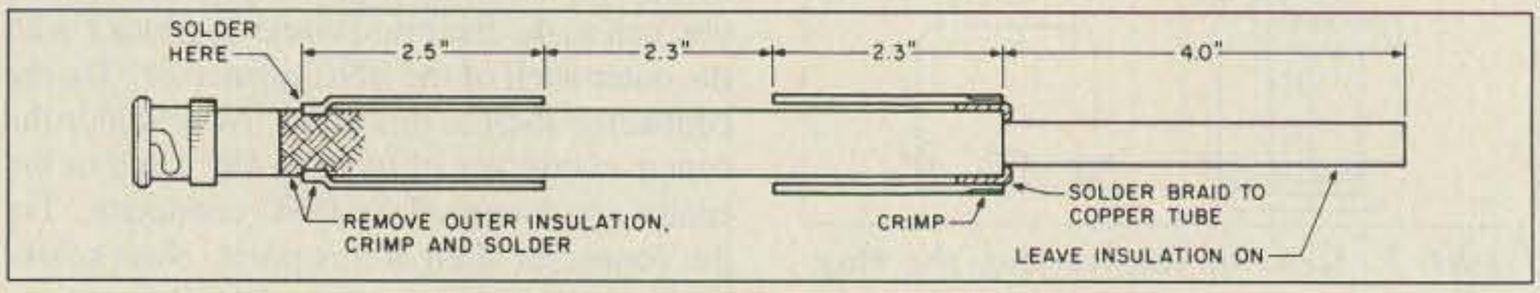


Figure 10. A cellular antenna—for hams!

Mag-Mount Parts List

Cat. #	Qty.	Description
MG-1320	1	Ferrite Magnet
RC-0561	3	Crimp BNC/RG-59
RC-0507	1	BNC-Female Panel Mount
3142-HE	2 ft.	½" Shrink Tubing
3143-HE	2 ft.	⅜" Shrink Tubing

The total for the above was $8.70. MPJ&A has a minimum order of $10. I recommend you buy two extra RG-59 crimp connectors. Marlin P. Jones & Associates, tel. (407) 848–8236.

The cellular frequencies cover 825–845 MHz and 860–895 MHz, approximately. The cellular phones transmit in the low end of the band and receive the cellular base stations transmitting in the upper end of the band. I decided to build a ½-wave antenna for this band.

The sleeve antenna is a simple coax-fed ½-wave antenna. See Figure 9(a). Basically, it's no more than a ¼-wave whip with the image provided by the ¼-wave sleeve folded back over the coax cable. By placing another ¼-wave sleeve a ¼-wave away from the open end of the sleeve, you make an excellent choke that keeps the rest of the coax feed from being excited by the signal and causing pattern degradations. See Figure 9(b).

I designed the antenna for the center of the cellular band (859 MHz). The antenna lengths are calculated as follows:

1/4 wave @ 859 MHz = 2952/859
= 3.5 inches

The velocity factor for RG-8M coax is 0.66, so:

1/4 wave (adjusted) = 0.66 x 3.5 = 2.3 inches

I constructed the antenna as shown in Figure 10. Obtain a one-foot piece of ⅜" diameter copper tubing from your local hardware store and cut 2.3" and 2.5" lengths of this tube. Cut a 12½" length of RG-8M coaxial cable. Remove 4" of the outer insulation from one end. Unbraid the outer conductor braid, trim it to about ½" and fold it back over the remaining outer insulator. Slip the 2.3" long copper tube over the braid as shown, crimp it in place with an F-type TV connector crimping tool, and solder the lip of the tube to the braid.

Now, remove 1.6" of outer insulation from the other end of the RG-8M and slide the 2.5" copper tube over this end till the two copper tubes are separated by 2.3". Crimp the end of the 2.5" long tube over the bare outer shield and solder as shown. Attach an RG-59 crimp-on connector to this end of the cable. Finally, cover the antenna with ½" heat shrink tubing and shrink it to provide a nice looking, rugged cellular antenna. I also sealed the top end of the center conductor and the interface between the center conductor and the sleeve with hot glue.

I optimized the SWR for transmitting in the lower portion of the band—that's why the center conductor whip is longer than a ¼-wavelength. With the dimensions shown, I achieved better than a 1.5:1 SWR in the 825–845 MHz end of the band.

Well, there you have it—enjoy your new car-top creations. 73

You may reach Phil Salas AD5X at 1517 Creekside Drive, Richardson TX 75081.

Cable Comparisons

Freq.	RG-58 loss/100 ft.	RG-8M loss/100 ft.
50 MHz	4.0 dB	2.2 dB
100 MHz	5.3 dB	13.0 dB
200 MHz	8.0 dB	4.6 dB
400 MHz	12.0 dB	7.5 dB

RG-8M, at 25¢ per foot, is only a nickle a foot more than RG-58. RG-8M low-loss, 52-ohm cable is significantly better than RG-58, and it has the same dimensions as RG-59 (so you'll find use for the extra RG-59 crimp BNC connectors). You can obtain RG-8M at Radio Shack, part number 278-1328.

Continued from page 40

Fixed and Adjustable Voltage Regulators

LM317T	1.5–37 volts	1.5 amps	40 volts input max.*
7805	5 volts	1.5 amps	35 volts input max.
7812	12 volts	1.5 amps	35 volts input max.
7815	15 volts	1.5 amps	35 volts input max.
7824	24 volts	1.5 amps	40 volts input max.

These regulators can be used over a temperature range of 0 to 70 degrees Celsius. The current ratings may vary, depending on manufacturer and degree of heat sinking. Other units available from suppliers cover voltages from 2 to 24 volts.

*Input/output differential voltage limited to 40 volts max. The LM317T is an adjustable voltage regulator that requires a few external parts. See Figure 5.

If you cascade a current regulator and a voltage regulator, the current regulator acts as a very small value of resistance until all the current limit is reached. At values of current under the preset current limit, the voltage regulator simply operates normally. The combination of the two devices makes an excellent all-purpose power source offering the ultimate in flexibility and circuit protection. See Figure 3 for an example of how these two regulators may be cascaded.

Handling Increased Current

This circuit is a natural for the creative experimenter who needs a flexible power source for his experiments. The only thing to remember is that you cannot adjust the voltage to a value lower than the value of the regulator. This limitation, present in many commercially available supplies, is not a serious problem.

In fact, you won't have any serious problems with these regulators as long as you remember to properly heat-sink them. I have seen these units paralleled in an effort to increase current capacity, but I don't recommend it. If they have a small resistor in series with the output of each unit, you can parallel them, but voltage regulation worsens, even though power is divided more equally. A much better way to handle the problem of increased current is shown in Figure 4. Use a series pass transistor in conjunction with the three-terminal regulator.

Try a few experiments with these devices, and when you design them into your circuits, they will give your projects that little edge. 73

Ed Doubek N9RF, P.E., may be reached at 25 W. 062 Wood Ct., Naperville IL 60563.

Number 15 on your Feedback card

CIRCUITS

Great Ideas From Our Readers

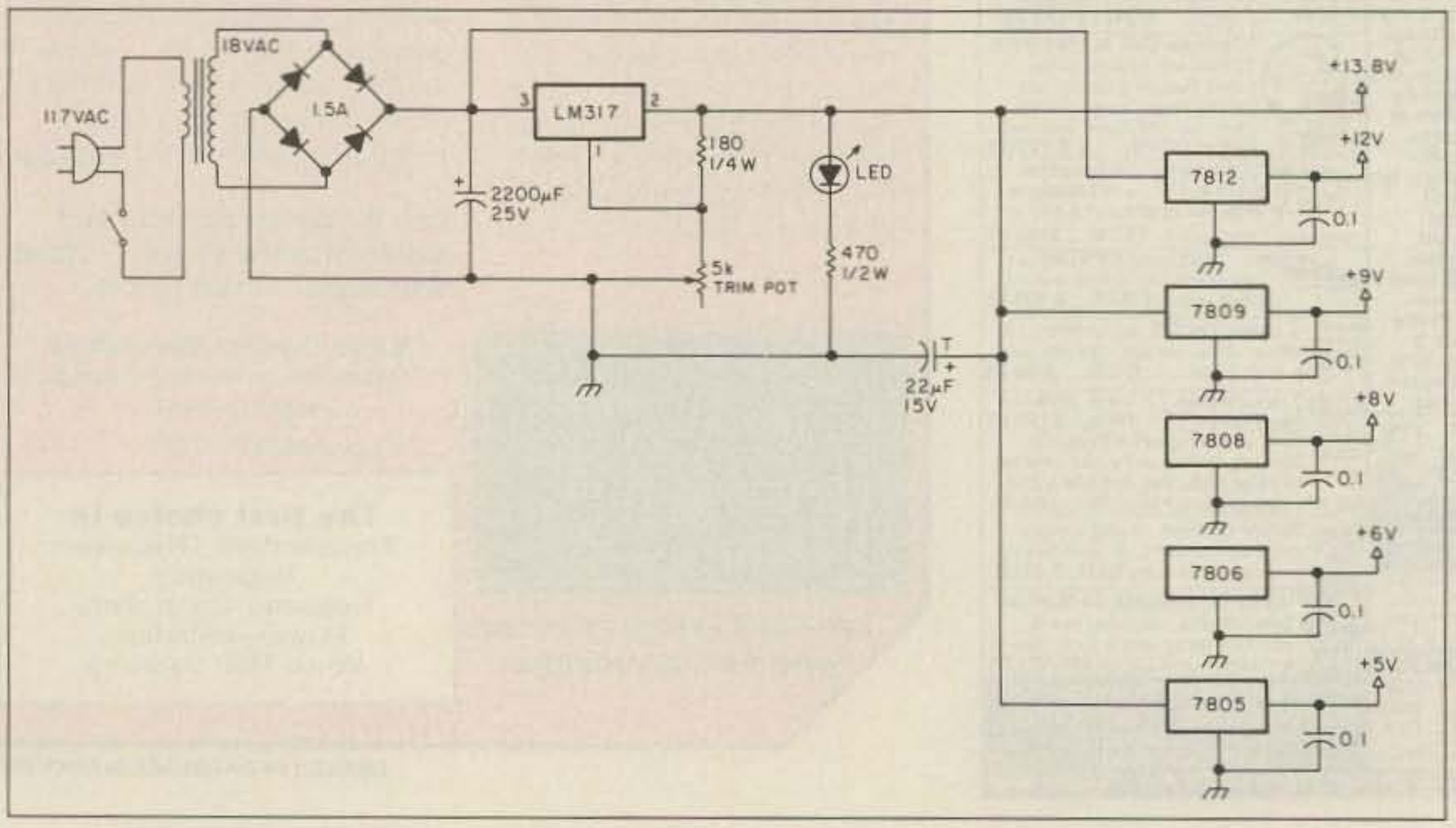
Regulated Voltage Distribution Box

Not only do most hams have numerous gadgets which devour 9 volt batteries, they also have pocket radios, TV sets and table radios that use batteries. The most common voltages needed are: 4.5, 6, 7.5, 9 and 12 volts. Battery types needed include AAA, AA, C, D and 9 volt types. Batteries can be expensive, and often the size that you need is not on hand when you want it.

The gadget shown in Figure 1 solves this problem for all time. Any small transformer with a secondary of 18 to 24 volts AC at an ampere or more, a 1.5 ampere bridge, a few thousand microfarads of filter capacity, and an LM317 variable voltage regulator, forms the heart of this unit. The LM317 is set to provide +13.8 VDC output. Fixed regulators of 12, 9, 8, 6 and 5 volts provide the remaining output voltages. Output of the LM317 is bypassed by a 22 µF 15V tantalum capacitor, which will also bypass the inputs to all fixed regulators except the 7812, which is fed from the input of the LM317. All fixed regulators have their outputs bypassed by 0.01 µF monolithic capacitors. All outputs are self-protected and will deliver up to one ampere.

Although the LM317 and most fixed regulators are readily available from Radio Shack and most mail order sources, the 9 volt regulator (7809) is available only from *Short Circuits, P.O. Box 285, Barnegat NJ 08005.* They are sold four for $1. LM317T regulators from the same source cost 35¢ each. Type 7805, 7808 and 7812 regulators from Short Circuits are also four for $1. They have other fixed and variable regulators at similar prices, but do not carry the 7806 at this writing.

Use 5 volts for 4.5 volt equipment, and 8 volts for 7.5 volt gear. The slight voltage differential will not cause any harm. However, the 9 volt output will probably see the most service in the shack!



J. Frank Brumbaugh KB4ZGC
Buffalo NY

Number 16 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael J. Geier
% 73 Amateur Radio Today
WGE Center
Forest Road
Hancock NH 03449

Finishing Up and Moving On

At last we're ready to wrap our ongoing topic up! So, let's finish our stage-by-stage troubleshooting now.

Mike amps: These amplify the mike's signal enough to drive the modulator. In FM rigs, they often will contain compressors, in order to keep the modulation from deviating outside the legal ±5 kHz bandwidth. (In SSB rigs, of course, the ALC feedback from the finals can prevent overmodulation.) FM amps may also incorporate low-pass filters, especially if the rig is to be phase-modulated (see below).

The usual problem with a mike amp is that it is dead altogether. Occasionally, one may work but be weak. These amps typically are ICs in walkies, but may be transistors in HF rigs. Troubleshoot as with any low-level amp, looking for a loss of signal at the output and working back until it appears. By the way, a common cause of mike amp failure in HF rigs is severe RF feedback. The voltages induced by the transmitter into the amp can be enough to blow the semiconductors. If you've had a feedback problem and then suddenly lose your audio, check the mike amp first! You could save hours of troubleshooting frustration later.

RF feedback itself is not a mike amp problem. It is usually caused by a poor station ground or by having the antenna too close to the rig. It may also occur when a mismatched or preamplified mike is used. If you're getting bad distortion or squealing on transmit, try running into a dummy load. What, you don't have one? No comment. But try reducing your output power as much as possible. If the trouble goes away, your mike amp is fine. (By the way, the RF power or drive control on many rigs, especially the tube-output kind, affects only CW and AM. Often, the only gain control in SSB is the mike gain pot! Try turning it down until the power output meter barely moves.)

Modulators: These are much like the mixers we explored in previous columns. They have two inputs and one output. One input, of course, is the audio to be modulated. The other is the carrier. In AM and SSB, the modulator is likely to be a ring of diodes, just like a balanced mixer. When the circuit is perfectly balanced, DSB is generated. (Subsequently, one sideband is clipped off by the sideband filter to make SSB.) For AM, the ring is deliberately unbalanced to allow the carrier through.

FM is another story. Modulation is accomplished by swinging the carrier's frequency back and forth in step with the audio signal. In one scheme, a carrier oscillator is varied directly, through the use of a varactor diode. This can result in very high-quality FM, but it is hard to do, because the oscillators are nearly always crystal-controlled, and therefore hard to swing enough for decent modulation. In synthesized rigs, which most are nowadays, it is possible to insert the audio into the VCO's control loop. As long as the PLL's loop filter is fairly slow, it will not notice the audio and will not try to correct for it. Thus, the VCO will wiggle back and forth in frequency. Voilà, FM. In this case, the modulator may be no more than a transistor in a basic amplifier configuration.

Another popular FM scheme is phase modulation. It's especially common in rigs which multiply an oscillator's frequency several times to get to the actual operating frequency or to something high enough to heterodyne against another oscillator. Phase modulation is simple. You take a fixed oscillator and feed its output into a tank circuit comprised of a coil and capacitor in parallel. The cap, however, is a varactor diode. When audio is applied to the varactor, the changes in its capacitance will cause the tank circuit to shift the phase of the oscillator's signal back and forth. The only difference between phase and frequency shift is that the former occurs within one cycle. In other words, it is just smaller. When the signal is multiplied way up to the operating frequency, the shift is also multiplied, so it appears as if full frequency modulation has occurred. The drawback to this simple technique is that the modulation is nonlinear. For a given amplitude (level) of modulating audio, as its frequency rises, the rate of modulation (amount of frequency swing) also rises! Left alone, this would result in very tinny-sounding, ugly audio at the receiver. The cure is to insert a low-pass filter in the mike amp which reduces the amplitude of the audio as its frequency rises, thus exactly counterbalancing the modulator's rising effect. In practice, the two never exactly track, so phase modulation doesn't produce the quality of true FM. Nonetheless, it is a widely used technique because it is cheap and easy to do. Besides, the audio is good enough for communications use, which is never intended to be hi-fi anyway.

A CW modulator is basically a switch, usually made from a transistor. In order to make nice, clickless keying, though, it usually incorporates some capacitors and diodes, or other nonlinear time constants, so that it can turn on and off gently and at slightly different rates. That way, the carrier doesn't come on and off abruptly. A few milliseconds on each end is typical. If you can't key the rig, and the key or keyer is working and properly connected, the keying transistor is probably open. If the rig stays keyed all the time, it is probably shorted. If it keys and then locks up, check for RF feedback the same way as for a mike amp. Usually, that's the problem in this situation.

Some keying circuits can get surprisingly complex, with several transistors and perhaps some ICs. This is because some rigs require sequencing of various stages in order to avoid injuring their own circuits. For instance, the antenna may need to be disconnected from the receiver before the transmitter comes on. In any event, look for large shifts of voltage (a few volts or more) between the keyed and unkeyed states in each stage. If the shift disappears or becomes very small, you're near the trouble.

By the way, all of this applies only to all-solid-state rigs. If yours has tube driver and finals, the keying circuit can be quite different, and may involve dangerous high voltages.

Carrier oscillators: These are just local oscillators, exactly like the kind used in receivers. They may be crystal-controlled or be driven by the synthesizer. The distinguishing characteristic is that the frequency will be a few kHz different for USB than it is for LSB. The idea is to use the same SSB filter for both modes, and to approach it from either end of its passband. Oscillator crystals are a heck of a lot cheaper than SSB filters! If you suspect the oscillator is not working, try changing modes.

If it works on one sideband but not the other, suspect the defective one's crystal or its associated trimmer capacitor. If the oscillator is dead on both sidebands, the active element (transistor, FET, etc.) is the most likely culprit.

ALC circuits: These are much like receivers' AGC circuits, except that the input is a sample of the transmitter's RF output, and the circuit controls the power going into the finals. If your ALC meter doesn't work, and your transmitter puts out full power but overdrives, check here first. Most likely, you'll find an open transistor or RF sampling diode. If your transmitter is weak or close to dead, be sure it isn't being clamped off by a shorted ALC transistor before you spend big bucks for new finals.

RF power amps: This is tricky. Solid-state finals operate with high current, as much as 20 amps for a 100-watt rig. Circuit inductances can transform some of this into fairly high voltages (up to 200 or more volts) and that can be dangerous to work with, especially because the frequencies are RF. **DON'T** assume that, just because the radio runs on 12 volts, it is safe no matter where you stick your finger. You may be in for a nasty surprise.

The usual symptom of RF power amp trouble is very low or no output in transmit. People tend to blame the finals the way they used to blame the picture tube in a dead TV- it's dead so it must be the finals. Although replacing finals is very easy, it is also expensive. A pair of RF output transistors may cost you $80 or more. So, be absolutely sure you need them before you waste your money. Is RF getting to their inputs? Is the driver stage working? Often, the driver will go but the finals will be OK.

Or the finals will go and take the driver with them! Test all the transistors before you chuck them. By the way, low output, say 60 percent, is most likely not caused by bad finals. They are not like tubes—they don't weaken with age. I have seen leaky transistors reduce output, but it is rare and other symptoms, like severe distortion, should also be present.

OK, so the finals are indeed bad and you want to replace them. Before you do, ask yourself: What blew them? They rarely go by themselves. If you know why they went (shorted antenna coax, etc.), great. If not, check everything you can to be sure you won't blow the new ones. Nearly all solid-state rigs have some kind of SWR protection circuit, consisting of a reverse power detector near the transmitter output and a signal amplifier which limits the power going into the finals when the SWR goes above a preset limit. It's kind of like a receiver's AGC circuit, except that its input is from reverse power caused by high SWR. Check the detector diode and the amplifier transistors, especially if you suspect that high SWR killed your finals.

In HF rigs, changing the finals is easy. Buy a new pair, either from the radio's manufacturer or from a parts house. Always buy HF finals in pairs, even if one of yours looks OK. If their characteristics are not fairly well matched, they may not work well together, and may fail prematurely. Besides, if one failed, the other may be subtly damaged and getting ready to go. If it does, it may ruin your new one anyway. Install the new parts as you would any power transistors, and don't forget the thermal heat sink goo—it's an absolute must, except in cases where dry-type insulators are used. To be sure, just look at the originals. HF power amps are usually wideband, and don't require any trimmer adjustments. Most likely, you'll have to set the base bias. Consult the rig's service manual for the proper procedure. Failure to set the bias will probably result in poor operation and short-lived transistors.

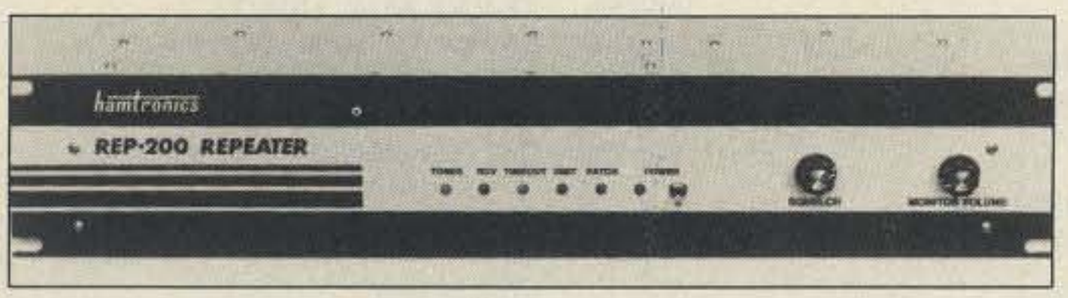
In VHF and UHF rigs, the situation is quite different. First, there is usually just one final or a large power IC. Also, these amplifiers are tuned to operate over the band of interest, and replacement of the discrete variety requires adjusting various trimcaps and perhaps a few coils. The rig's service manual should detail the procedure, but you may find that it requires expensive equipment to do it right. The IC variety, however, is usually easy to change, and generally has few or no adjustments surrounding it.

Well, I think we've finally wrapped this mini-series up. Next month, something completely different! See you then. 73

Number 17 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier



PRODUCT OF THE MONTH

HAMTRONICS, INC.
REP-200 Repeater

The microprocessor-controlled REP-200 Repeater is a successor to the popular REP-100 Repeater. It provides autopatch, two types of reverse autopatch, six types of courtesy beep, and a DTMF decoder/controller with over 50 functions. Until now, the REP-200 was available only wired and tested because of the complexity of building and testing the controller module. Now Hamtronics has made it available in kit form, with the COR-5 controller module prewired, programmed, and tested, for only $1095.

All of the repeaters are available for the 2 meter, 220 MHz, 440 MHz, and 902 MHz ham bands. (The 902 MHz version costs a little more.) For more information, call or write for a free 40-page catalog, and ask for the "supplement for repeater kits." Contact *Hamtronics, Inc., 65-F Moul Rd., Hilton NY 14468-9535; (716) 392–9430, FAX (716) 392–9420.* Or Circle Reader Service No. 201.

JENSEN TOOLS INC.

The new 1991 *Master Catalog* from Jensen Tools is a complete source of tools, tool kits and test instruments for service and repair of electrical and electronic devices. This 232-page catalog features 11 pages of unique new tools and accessories for bench and field service, including new ergonomic tools, soldering/desoldering stations, a solderless terminal kit, circuit testers, probes, new products for static control, cleaning accessories, and more.

To order this free catalog, contact *Jensen Tools Inc., 7815 S. 46th St., Phoenix AZ 85044; (602) 968–6231, FAX (800) 366–9662.* Or circle Reader Service No. 203.

ELECTROSOFT

Electrosoft has introduced a CW keyboard program and interface kit for IBM-compatible computers having a serial port running on MS-DOS. The program and kit provide a convenient alternative to using a keyer if a computer is already in the ham shack. CW operators will be pleasantly surprised how the quality of code and ease of operation exceeds that of any keyer.

The program was designed using assembly language, resulting in an impressive, snappy response to each command. Operators will breeze through their first QSO because a HELP key displays all commands on the screen instantly any time help is needed. The speed may be adjusted from five to 100 words per minute, and the dot/dash ratio from 21% to 45%. Messages may be temporarily stored in any one of 10 200-character buffers, or may be permanently stored on disk. A REPEAT function will repeat CQs or beacon messages indefinitely. Contesters will enjoy the automatic serial number that can be incremented or decremented and inserted into a message. A CW sidetone may be turned off or on as needed. The interface kit is easy to build even for novices, and it usually requires about one hour to complete.

The program and interface kit is $50; the program alone is $25. For more information contact *Electrosoft, P.O. Box 1462, Loveland CO 80539.* Or circle Reader Service No. 205.

ZCo Corporation

73 gets lots of requests for information on Macintosh software for hams. ZCo Corporation is one source. Their catalog offers 11 programs for ham radio operators. This selection includes programs for theory and code training, mapping, logging, satellite tracking, and contesting.

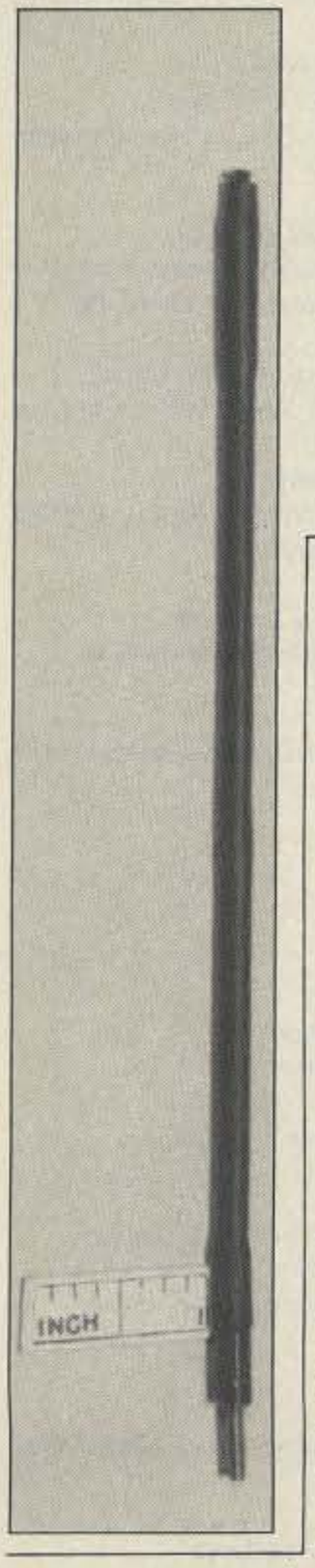
For a copy of the catalog contact *ZCo Corporation, P.O. Box 3720, Nashua NH 03061; (603) 888–7200, FAX (603) 888–8452.* Or circle Reader Service No. 206.

INTERFLEX

Packet GOLD 1.2, a new software terminal program for the PK-88 and PK-232 controllers from InterFlex Systems, makes multiple connects easy. It uses a "next session" queuing system to take you to the next session with incoming text. With its continuous monitoring feature, you'll know what's happening on the channel at all times. Many functions provide additional support for multiple connects, including text search, cut/paste facility and connected station list.

Binary file transfers can be initiated at either the source or the receiving station. An integrated setup facility lets you customize the program to your needs. Put in "Quick-Connects" for point-and-shoot selection of frequently called stations. An integrated text editor allows you to edit text cut from any screen, or while editing a file.

This program is available for $60 (CA residents add 6.25%) from *InterFlex Systems Design Corporation, P.O. Box 6418, Laguna Niguel CA 92607-6418; (714) 496–6639.* Or circle Reader Service No. 207.



STATIC BUSTERS INC.

Static Busters Inc. has introduced their new Precipitation/Corona static device: the AS-1, a static discharge wick. The AS-1 will provide a path for electrons or static charge dissipation on towers and antennas of all types, and will reduce significantly or eliminate corona noise and precipitation static. During p-static or corona charging conditions the discharger can improve the noise level up to 20–30 dB or more, depending on the frequency.

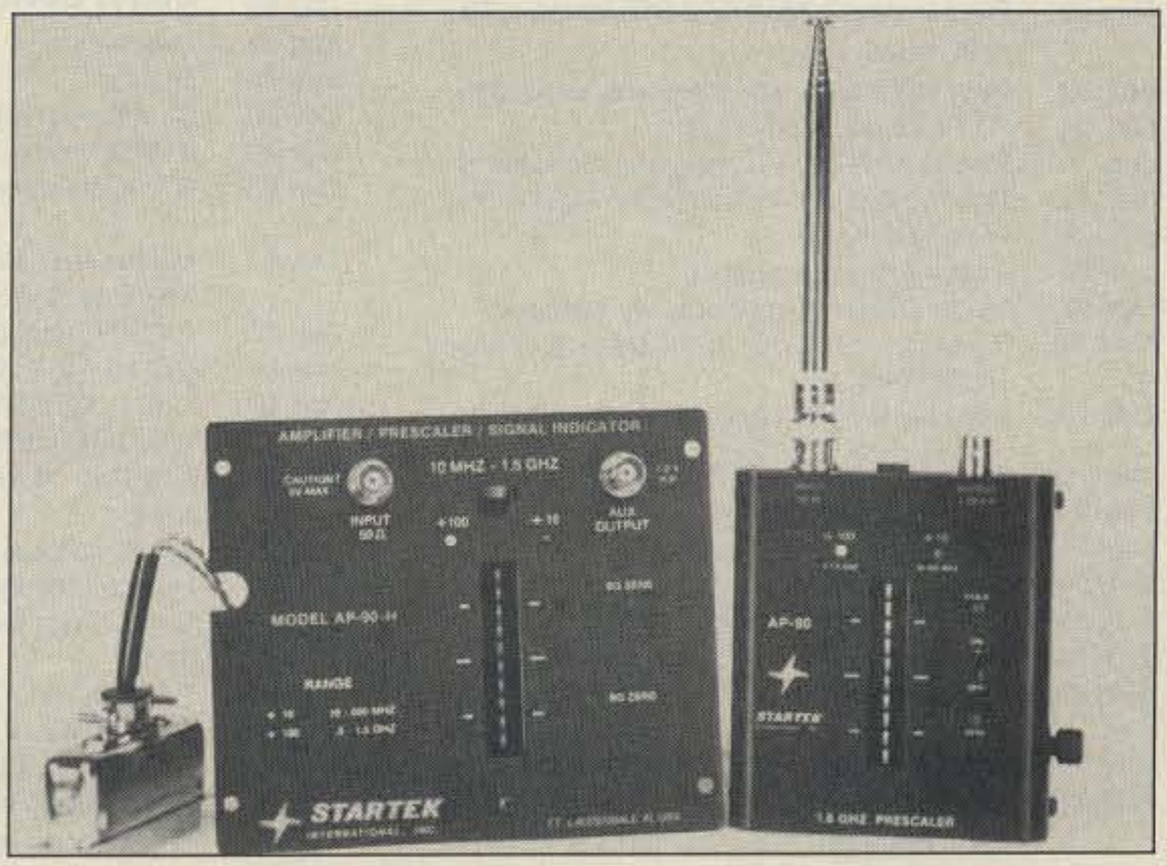
The discharger (AS-1) is priced at $12.95 (plus $1 shipping & handling). Contact *Static Busters Inc., 3535 Sheperdsville Rd., Elizabethtown KY 42701; (502) 769–2244.* Or circle Reader Service No. 202.

STARTEK INTERNATIONAL INC.

The Model AP-90 Amplifier-Prescaler from Startek International Inc. can extend the range of any frequency counter capable of measuring to 16 MHz or higher, to 1600 MHz or 1.6 GHz. Two MMIC amplifier stages produce a superb sensitivity threshold of typically 1–5 mV RMS. The AP-90 also provides a 10-segment LED bar graph indicating the relative strength of the input signal. There are two overlapping ranges, 10 to 500 MHz/divide-by-10 and 300 to 1600 MHz/divide-by-100.

A special panel mount version, Model AP-90-H, is available as a custom plug-in accessory for the Hewlett-Packard 5245L/M, 5246L and 5248L/M counters. The AP-90-H has two-stage amplification of the input signal (rendering superb sensitivity over the entire operating range), a switch-selectable prescaler, divide-by-10 or divide-by-100, and an RF signal strength LED bar graph.

The Model AP-90 (including AC adaptor) is priced at $160; the AP-90-H is $180. When purchased from the factory or an authorized distributor, the AP-90-H has a one-year limited warranty to the original purchaser covering parts and labor if the unit should fail after proper usage. Startek International also makes 1500 MHz hand-held frequency counters, prices starting at $100. Contact *Startek International Inc., 398 NE 38th St., Ft. Lauderdale FL 33334; (305) 561–2211, (800) 638–8050, FAX (305) 561–9133.* Or circle Reader Service No. 204.



Number 18 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

RTTY Loop XIV:7

Over the 14 years this column has run, the one single question I have received more often, time and time again, is a version of, "Did you cover this before, and if so, when?" So, from time to time, I have offered an index of past columns to help with locating topics covered. Several of you have suggested that I take the time to publish just this index, suitably updated, to help all of our readers. I herewith humbly comply.

This is a complete index to "RTTY Loop" from the beginning, organized by month and year. Now you know where to find the material that you're looking for. Getting copies of these articles will be up to you. I used to provide copies for a nominal fee, but the pressures of my job and family have cut into the time required for that. If you need reprints, contact *73 Amateur Radio Today*, WGE Center, Forest Road, Hancock NH 03449. Enclose a check for $3.00 for the first copy of an article and $1.50 for each additional copy.

Next month, we'll look at what some of you have been saying! As always, I look forward to your comments, suggestions, and criticism. Just pen a line to me at the above address, or e-mail it to me on CompuServe at 75036,2501, or on Delphi via MARCWA3AJR. Any way you send it, I look forward to reading your thoughts about "RTTY Loop"! 73

RTTY Loop Cumulative Index

Mo./Yr.	Topic(s)
Jun 77	RTTY glossary
Jul 77	Basic digital transmission
Aug 77	Modulation techniques
Sep 77	Model 15/19 RTTY interfacing
Oct 77	- no column -
Nov 77	- no column -
Dec 77	Terminal unit basics
Jan 78	FSK - AFSK circuits
Feb 78	Basic RTTY operation on the air
Mar 78	Data storage I; Model 19-ST6 hookup; TV video input
Apr 78	Data storage II; paper tape and audio tape
May 78	RTTY art and tapewriting
Jun 78	Receiving RTTY via computer: flowcharts
Jul 78	Receiving RTTY via computer: 6800 program
Aug 78	Bias distortion
Sep 78	Teleprinter maintenance
Oct 78	Model 28 wiring; mods of July's program
Nov 78	Tuning aids: oscilloscope; Kenwood R599/T599
Dec 78	Looking at tape; Yaseu FT-101B on RTTY
Jan 79	Test equipment for RTTY; USOS for Model 28
Feb 79	Matrix encoded RTTY
Mar 79	UART; clock and buffer gates
Apr 79	Logic to read diode matrices
May 79	Mystery circuits; odds and ends
Jun 79	Transmitting RTTY via computer: flowcharts
Jul 79	Transmitting RTTY via computer: 6800 program
Aug 79	Double space for Model 15/19; weather freqs.
Sep 79	Hexadecimal numbers; silent RTTY biblio; station wiring
Oct 79	Commercial RTTY freqs.
Nov 79	Weather and press codes
Dec 79	Silent RTTY biblio II
Jan 80	Getting into RTTY—1980 style
Feb 80	Where get a machine? TU to FSK optoisolators
Mar 80	Old home-brew TUs x 4
Apr 80	More home-brew TUs
May 80	ASCII code
Jun 80	History of "RTTY Loop"; three more TUs
Jul 80	HAL ST-6; Twin Cities TU
Aug 80	RFI question; Flesher TR-128 mod; RTTY Journal
Sep 80	Book review: Ferrell's *Guide to RTTY Freqs.*; RTTY Tuning Ind; Jameco Kybd
Oct 80	IRL FSK-1000 TU
Nov 80	Odds and ends; audio tape RTTY storage
Dec 80	Creative RTTY gift ideas
Jan 81	Update: Jameco Kybd; UART for VIP computer
Feb 81	Review: Microlog ATR-6800, Part 1
Mar 81	Review: Microlog ATR-6800, Part 2
Apr 81	TTL to polar conversion
May 81	Review: freq. counter; 60 mA Loop to TTL
Jun 81	Publicity; shift-pot circuit
Jul 81	RTTY via SWTPC 6800 MP-C card
Aug 81	Book review: *World Press Freq.*; Epson MX-80
Sep 81	Update March '79 column; FSK vs. SSB; AMRAD repeater
Oct 81	Another shift-pot circuit; glass RTTY biblio
Nov 81	RTTY signal vs. SSTV signal; define "bauds"
Dec 81	Wohl soldering irons
Jan 82	FSK-500 TU review; loop schematic
Feb 82	Abrams program for CoCo; Model 33 hookup
Mar 82	ASCII to Baudot: general principles
Apr 82	Talking RTTY program: flowcharts
May 82	Talking RTTY program: 6800 source; USOS
Jun 82	- no column -
Jul 82	Flowcharts; split screen for GIMIX 6800
Aug 82	- no column -
Sep 82	RTTY receive for MITS 680b computer
Oct 82	RTTY art contest winners
Nov 82	Computer sampling of RTTY pulses
Dec 82	Asst. RTTY gift ideas
Jan 83	RTTY program development; odds and ends
Feb 83	Kantronics "Interface"; overview of RTTY codes
Mar 83	How to get published; membrane keyboards
Apr 83	Sound insulation; Apple Super-RATT; Lo voltage loop
May 83	- no column -
Jun 83	Optoisolators, tuning toroids; Ferrell's *Guide*
Jul 83	8080 vs. 6800 vs. 6502 architecture
Aug 83	- no column -
Sep 83	Letters
Oct 83	Commercial equip. on RTTY; parts sources
Nov 83	AMTOR code
Dec 83	RTTY shopping spree
Jan 84	Mailboxes; SCATS repeater; Kantronics Interface to VIC
Feb 84	AMTOR note; other odds and ends
Mar 84	VIC-20/AIR-1; CP-1; Hamtext, Amtorsoft
Apr 84	CoCo NEWRTYCW; Timex/Sinclair info; VIC/C-64; baud info
May 84	ASCII to Murray converter; NEWRTYCW review
Jun 84	April's mistake; newcomers' questions
Jul 84	Hamfest thoughts; odds and ends
Aug 84	Communication conventions; Northern Radio parts
Sep 84	Types of ASCII? XR-2206 AFSK generator
Oct 84	Optoisolators, reed relays, MOV; Kaypro RTTY; Model 33
Nov 84	Heath HD-3030 interface
Dec 84	RTTY shopping spree
Jan 85	Mailbox listings; HD-3030 update
Feb 85	Klingenfuss books; RS-232 vs. ASCII
Mar 85	110 baud CoCo; RTTY Loop
Apr 85	Basic packet; PBJ CC-Bus
May 85	NE-565 PLL front end
Jun 85	Looking back; PBJ WordPak; odds and ends
Jul 85	XR-2211 TU
Aug 85	XR-2206 AFSK; LSMFT?
Sep 85	Cheap RTTY; shift pot again
Oct 85	RTTY for TI-99/4A
Nov 85	RTTY for Apples
Dec 85	RTTY for VIC/C-64; shopping spree
Jan 86	RTTY for IBM PC; odds and ends
Feb 86	Super RATT for Apple; RTTY for CoCo; guide to utility stns.
Mar 86	Crystal shifter
Apr 86	Teletype Model 33 interfacing
May 86	Letters: CoCo, teleprinters, C-64/VIC, Apple, misc.
Jun 86	CoCo WordPak; press freq. list
Jul 86	TRS-80 Model 100 RTTY; Hal ST-5 interfacing
Aug 86	- no column -
Sep 86	Apple/Galfo update; guide to FAX stations
Oct 86	Model 100 RTTY update
Nov 86	BMK RTTY review for CoCo; more on Galfo
Dec 86	ST-5A computer interface; schematic compression; odds and ends
Jan 87	Apple Super RATT; Model 33 interface board
Feb 87	CR delay with CoCo; COMMPRO for TRS-80 Model 4
Mar 87	Kantronics UTU to Apple, PC, VIC, C-64, CoCo; Timex update.
Apr 87	C-64 RFI; CoCo questions
May 87	YARP program for Atari ST; MODEM MGR for Apple II
Jun 87	RTTY.BIN for CoCo
Jul 87	RTTY1-1.BIN for CoCo
Aug 87	Review: AEA PK-232
Sep 87	Books: *Digital Novice* and *Packet Radio Handbook*
Oct 87	PK-232 critique; big FAX freq. list
Nov 87	PK-232 response; AMTOR notes
Dec 87	Neophyte questions; FAX errata; shopping spree
Jan 88	Disk version RTTY.BIN for CoCo
Feb 88	FCC computer acceptance: Class A vs. Class B
Mar 88	Simple Amiga terminal; a bit on the KAM
Apr 88	- no column -
May 88	Odds and ends; Where is RTTY found?
Jun 88	Teleprinter models; WWV info; more on RTTY.BIN for tape
Jul 88	CPR program for PClones
Aug 88	AEA PC-Pakratt program; Amiga COMM program; other teleprinters
Sep 88	- no column -
Oct 88	Newcomer helps; odds and ends
Nov 88	Raising an antenna with bow and arrow
Dec 88	AMTOR
Jan 89	Book review: *Digital Communications with Radio Amateurs*
Feb 89	- no column -
Mar 89	RTTY Loop Survey
Apr 89	- no column -
May 89	- no column -
Jun 89	Simple demodulator
Jul 89	- no column -
Aug 89	Simple AFSK generator
Sep 89	RS-232 to TTL converter
Oct 89	- no column -
Nov 89	Survey results; readers' thoughts
Dec 89	- no column -
Jan 90	Simple RY generator, basic TTY signal
Feb 90	DFI VC-1000 digitizer
Mar 90	Assorted terminal and com program list
Apr 90	MFJ-1292 digitizer
May 90	- no column -
Jun 90	Prodigy review
Jul 90	Kenwood-TNC connection; ICOM-Amtor modification
Aug 90	RTTY cross display
Sep 90	Robot Research, MFJ updates
Oct 90	Neophyte confusion
Nov 90	Loop supply; Windows 3 problems; PICON
Dec 90	ICOM computer control

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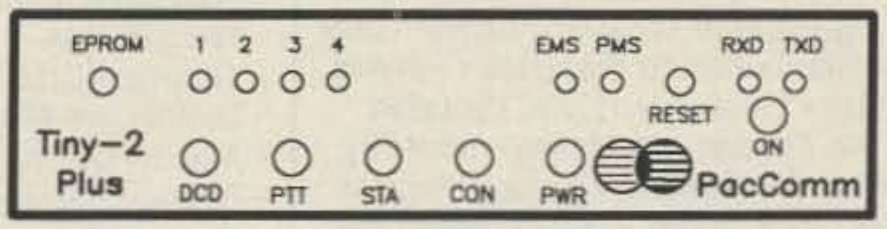

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S. Georgia and the S. Sandwich Islands

In October we were very disappointed to learn that the DXpedition to South Georgia and the South Sandwich Islands had been postponed. Tony WA4JQS, organizer of the DXpedition, told me that the DXpedition had been postponed, not cancelled. With the Middle East crisis causing an increase in fuel prices, Tony explained, the shipping company had to put a hold on shipping traffic in the Antarctic area. The fuel expense alone for the DXpedition charter had increased by more than $40,000.

Equipment and supplies will be stored until the DXpedition becomes reality. All expenditures have been paid by the team members themselves, and all donations are safe in a bank account. Tony also noted that other possibilities are being investigated. The South Sandwich Islands remain on the inactive list, but there is at least one station currently active from South Georgia Island. Gordon VP8CDJ has been active since late last year, but he leans towards DX nets and does not operate CW. Gordon's QSL manager is GM4KLO.

Wanted: Adventurer, Sailor, CW Op

In June of 1991, Doug VE7NH intends to leave VE7 aboard his 30-foot sailboat for an island-hopping journey across the Pacific, stopping at some of the more rare DX spots. If permission is obtained, he'll operate from each. His list of DX stops includes Palmyra Island, Kingman Reef, Rotuma, Christmas Island, Mellish Reef, Willis Island, Norfolk Island, Kermadec Island, and Campbell Island.

Doug is looking for a sailing companion competent with CW who is willing to share costs and help sail the boat. The sailing companion need only participate in part of the trip. Contact Doug at the following address: Doug Brabner, 1429 Williams Ave., North Vancouver, BC V7L 4G1, Canada (or on 14025, 18071, 21025, 24900 or 28025 kHz). All inquiries will be answered.

Thailand

According to John K9EL who travels to Thailand several times each year, it is not true that any visiting ham can operate a RAST (Radio Society of Thailand) club station. If you are planning to visit Thailand, John suggests that you write to Sombat HS1BV at his *Callbook* address well before the visit. Prior arrangements must be made, and operating permission is not guaranteed. HF operation in Thailand is on a temporary basis, and is subject to change at any time.

Other active stations in Thailand include HS0AC (was HS0SM) at the Science Museum in Bangkok; HS0B, RAST club station in Bangkok; HS0AIT (was HS0A) located at a university about an hour's drive from Bangkok. QSLing to the HS bureau is not reliable. QSLs for Thai stations should be sent to the published QSL manager or as directed by the operator. Individual operators of club stations can often manage only their own QSOs. Confirmations of HS0AIT contacts is difficult at this time.

John has attempted a lot of 80 and 40 meter activity from Thailand, but he reports that the noise in Bangkok is just unbelievable. Commercial stations operate at will, and there is significant interference from nearby countries where the amateur radio bands are not protected. John passes along his thanks to everyone who has sent contributions with their HS0E QSL requests. These donations help to improve the station equipment at HS0E.

QSL Notes

9M2AX, 9M8AX and 9M8XX. JA5DQH was the QSL manager for these stations, but he is currently active as HI8A and will be in the Dominican Republic for one to two years. Ross 9M2AX asks that all QSLs for these stations be sent to him: Ross E. Tanaka, F7, Menara Impian, TMN TAR 60000 Ampang, Kuala Lumpur, Malaysia.

SM0KCR is the QSL manager for LU2BC, 7S8AAA, SM0OIG/YN, SM0OIG/LU, HT3A, H71A, SM0MT and SK0UX has a new address: PO Box 1441, S-18314 Taby, Sweden.

CI0GI Grosse-Ile. The ARRL's DX Advisory Committee (DXAC) has voted not to recommend that Grosse-Ile become a separate DXCC country. The vote was unanimous. The ARRL Awards Committee makes the final decision about DXCC country matters and is expected to echo the no-vote. The island, located in the St. Lawrence River near Quebec, was activated during late July 1990 by a group of operators from Quebec. 73

QSL Routes

3C1EA	via EA4CJA
3D2JH	via KF7PG
4K0ADS	via RW3AH
4X6TT/5B4	via 5B4SA
5Z4DU	via KE4DA
6W1QB	via DK3NP
7J1ADJ/JD1	via KB1BE
9H1FBS	via N5APW
9H3KE	via PA0PAN
9M2AX	via 9M2AX (see QSL Notes)
9M8AX	via 9M2AX (see QSL Notes)
9M8MKS	via 9M2FH
9M8XX	via 9M2AX (see QSL notes)
A41JV	via KJ4GK
C53GS	Box 274, Serekunda, Gambia
CN2BB	via DF4VS
CS9M	(CT3) via DL9XY
CT3FF	via I0WDX
CW0W	via CX4CR
DA1MF	direct only: Mark Foster HHD 32d AADCOM, CMR 525 APO NY, NY 09175 USA After Dec. 1, QSL to his home call, NW4Y
DJ9RY/CT3	via DJ9RY
FT5XA	via F6ITD
HB0/HB9NL	via HB9NL
HF0POL	via KB6GWX
HK0AZW	Box 120, San Andres, Colombia
IS0YUJ/IM0	via IS0YUJ
IZ8SGV	via IK8IPL
K1EFI/VP9	via K1EFI
L3D	via LU6DTS
OR0OST	via ON6BY
P7U (?)	Kim, Box 17, Pyongyang, North Korea
PJ7RR	P.O. Box 431, St. Maarten, Dutch West Indies
PJ8MM	via K1MM
PQ5C	via PY5CC
R6L	via UZ6LWZ
RH0E	via UH8EA
RH3W/RA4CG	via RA4CG, Box 3, Rtishchevo 412010, U.S.S.R.
RQ9W	via UQ1GWW
RY8B	via RB5AA's *Callbook* address
S01A	via EA2JD
SM0KCR	Has a new address (see QSL Notes)
TJ1BD	Box 1185, Douala, Cameroon
TR8JL	via F6IXI
TV1L	via F1LBL
UH1W/UA4CIC	same as RH3W/RA4CG
V51P	Box 9080, Windhoek, Namibia
V51SW	via G1IOV
VE1MQ (NA-68)	via VE1BTT (his previous call)
VP2EBN	via KA3DBN
VP8CDJ	via GM4KLO
YJ8AB	via KC4MJ
YZ90S	via YU2AKL
ZD7VC	via WT8S 1990 *Callbook* address
ZD8PJ	Box 3, Ascension Island
ZL150A	CW via ZL1AMO; SSB via ZL1AAS

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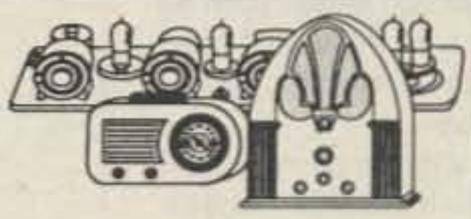

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World Class Hiding

Transmitter hiding can provide as many surprises as transmitter hunting. Most of the time the surprises add to the fun. Last month I presented construction plans for the Fox Commander, which remotely controls the audio and on/off timing of your hidden transmitter. The only things left to add on that topic are a few general precautions to help avoid some not-so-pleasant surprises.

Smart hidden transmitter operators take no chances—they **check out the setup well ahead of time and take back-up gear** if they have any. There is nothing worse than being out in the boonies and discovering five minutes before the hunt is to start that the gear won't work.

At least one day before the hunt, set up your remote-controlled hidden T system in your back yard and give it a thorough run-through to discover any incompatibility between the various pieces of gear. Does the third harmonic of the 2 meter hidden T fall close to the 70cm remote control frequency? If so, your remote control range may be very small. Check it.

What about interference from the high-power hidden transmitter to sensitive CMOS circuitry in the tone box? This problem can be particularly bad on 10 and 6 meter hunts, but it could happen on any band. The usual RFI suppression techniques (chokes and capacitors) will cure the problem, but it's vital to find out well before hunt time.

Is the supply current drain what you expected? Check to see what happens as your big 12-volt battery discharges down to less than 11 volts. Does everything keep running, with just a reduction in RF output power, or does some item of gear "lose its brains"?

Murphy Lurks

Even if you are convinced that you have found the perfect hiding place, one which will foil the hunters and "spread 'em out," you'll probably have nagging doubts. What if they all get exactly the same bearing, take the same route, and arrive at the same time? What if conditions change and they can't hear the signal at the start point? What if someone put up a new fence or gate and you can't get back to that great hiding spot you found last weekend? Murphy loves foxhunting because he can foul things up for hunters and hiders alike.

Two years ago, WA6OPS and I put on an 8 p.m. hunt that was sure to be an "all-nighter," even though we were only 11 miles from the start point. To get to the spot, you had to find a dirt-and-gravel path that went along a railroad track for about a mile and a half, then up over a hill and down into a canyon on a fire access road.

The only vehicle entrance to the railroad path was next to a bridge, with a steep drop-off that made the turnoff nearly impossible to see at night. Other roads led up to the railroad tracks, but they were closed with high construction fences.

Just 45 minutes after the start, a set of headlights topped the hill, and we were found, followed soon by the rest of the teams. Curses! The construction workers had opened up the fence in the intervening week since we discovered the spot. Moral: **Recheck the area of your site just before hunt time.**

Watch out for propagation changes. About a year ago, WA6TQY hid a 2 meter flea-powered rig on a hillside in Rancho Palos Verdes, carefully positioned to be shielded from the Diamond Bar starting point. Just as expected, the initial signal was very weak, and propagated by reflections from the mountains to the north of the start point. Many hunters took off toward the mountains, just as a bank of low clouds began to come in from the ocean.

As this marine layer blanketed the start point, the few teams remaining noticed a big change as they rotated their beams and quads. In addition to the weak signal from the mountains, there was now also a much stronger signal from the southwest. Those that followed the southwest signal went straight to Palos Verdes, where they found the fox.

It took the marine layer to propagate the signal over the intervening hills in a direct path. WA6TQY's skulduggery was the victim of a change in the weather, and the teams that spent a few extra minutes plotting their bearings got a lucky break.

Hunts to Remember

Everyone has his own idea of what constitutes the ultimate hunting challenge. To some, it's long distance. Any 2 meter hunt over 200 miles, such as the Los Angeles area hunts that have ended in Arizona or Nevada, surely must be world class.

To others, there has to be more than one transmitter to hunt. RDF enthusiasts from the Phoenix area brag how they can bag four, five, or more foxes in a single evening.

A combination of long distance and multiple T's certainly could be world class. Last September, AF6O and N6MI scattered four transmitters in the Mojave Desert. The first was 56 air miles north of the start point. Each successive fox was about 35 air miles farther east. The shortest road mileages between them were much greater, of course, and there were plenty of signalreflections from the

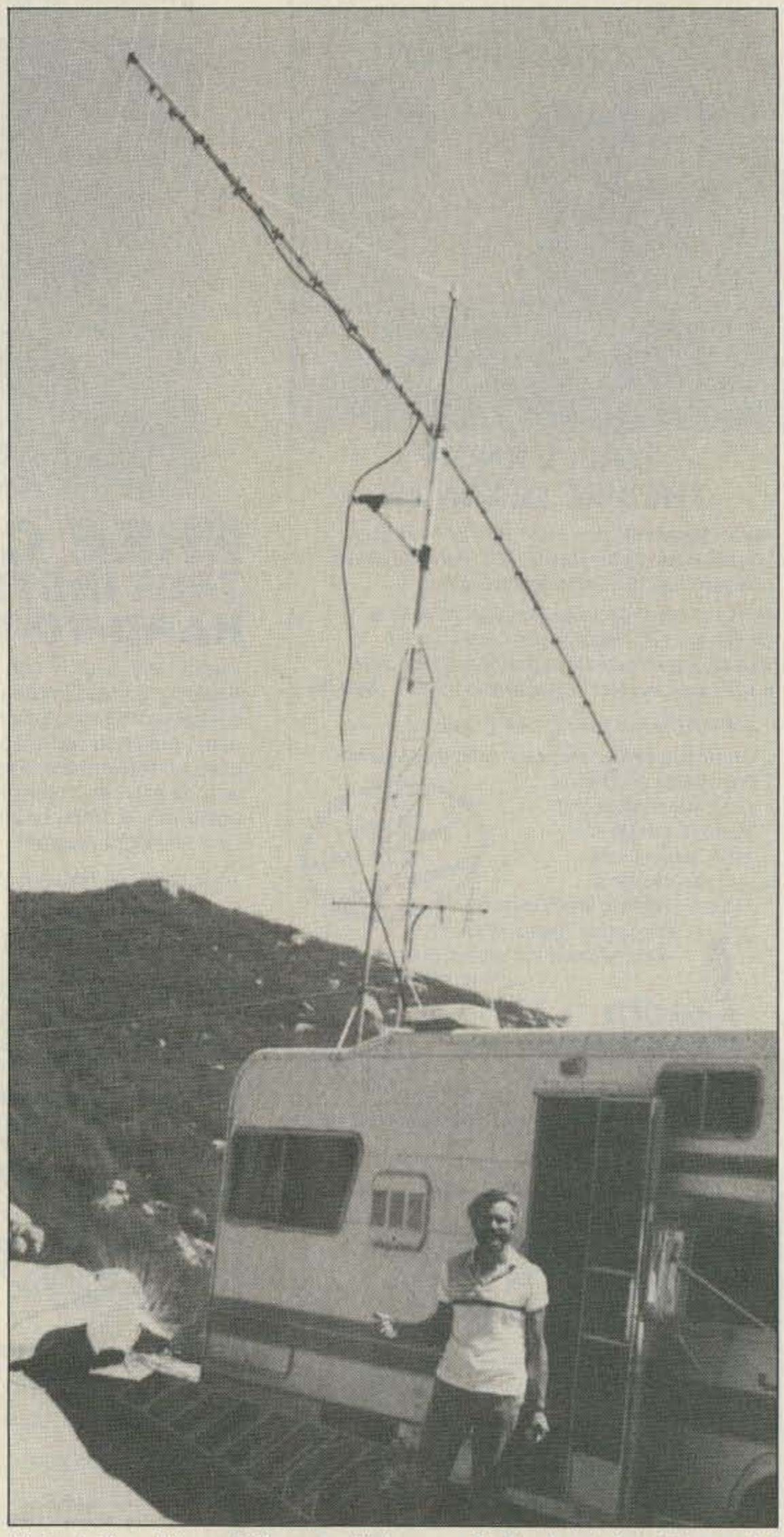

Photo A. Tom Wilson AJ6L can smile because his hard work in setting up this hidden station paid off in a successful T-hunt at the 1990 ARRL Southwest Division convention.

Photo B. Teresa Ashley N6UZH and her mother, Jo KB6NMK, are overjoyed moments after finishing "in the money" in a world class mobile hunt.

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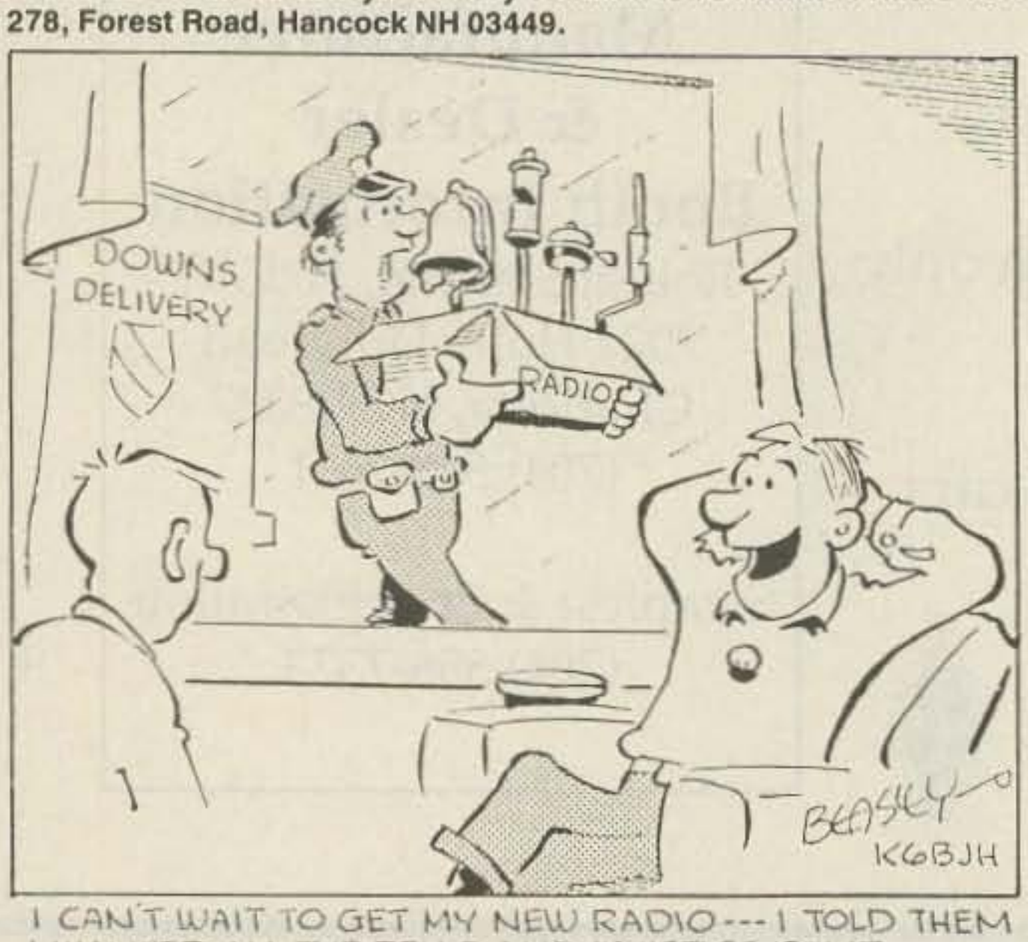

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surrounding mountains.

Only four of the 10 starting teams found all four transmitters. Winners Deryl Crawford N6AIN and Tom Ritchie N6FBH put 383 miles on the odometer and took almost 16 hours to complete the hunt. The highest mileage among those who found all four was over 660 miles! You will know you have put on a great hunt when the hunters keep talking about it on the local repeater for days.

The annual ARRL Southwest Division convention almost always includes a world class transmitter hunt to close the festivities on Sunday afternoon, usually with some valuable prizes. The convention T-hunt committee has a tough job. The hunt must be a challenge to experienced hunters, but not intimidating to newcomers. It must not appear to give unfair advantage to locals, who have hunted frequently near the convention site.

Tom Wilson AJ6L went to a lot of effort to put on the T-hunt for the 1990 Southwest Division gathering in San Diego last August. Tom hid at the end of a four-mile-long dead-end road down a creek emptying into San Vicente Lake. The end point overlooking the lake was well-shielded from the start point, but it was line-of-sight to the Silverwood and Mil Pedra Wildlife Sanctuaries and a nearby Indian reservation.

To make sure he splattered signal all over those places, and to be audible at the start, Tom needed a "killer" setup. He used a 20-element yagi on a crank-up tower, fed by hardline from a 500-watt amplifier using a pair of 4CX250 tubes (Photo A). Power for this setup came from a generator on the side of the embankment. Even with all this, it took a beam or quad to hear the signal at the beginning.

Eighteen cars, trucks, and vans competed for cash prizes in this event. Teams that did this hunt right never left pavement, but those that went to the sanctuaries or reservation were in for a long, dusty afternoon of dirt-roading. The super-strong signals there made them think they were very close, even though Tom was actually over two miles across the lake by air, and over 20 miles by road.

Jerry Gastil K6DYD from San Diego drove the winning vehicle, assisted by N6WKT, N6WKS and WB6DTA. The mother-daughter team of Teresa Ashley N6UZH and Jo Ashley KB6NMK from the Escondido area hunt group came in second (Photo B). Time was the only factor in determining the winner.

Planning is already under way to provide an unforgettable hunting challenge for the 1992 ARRL National Convention at the Marriott Hotel near Los Angeles International Airport. The Fullerton Radio Club is in charge of T-hunts for this convention, and welcomes your ideas. Send your thoughts to me and I'll forward them. Also, I would love to hear about your hiding experiences, whether world class or not. I'll share the best ones in this column. 73

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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?

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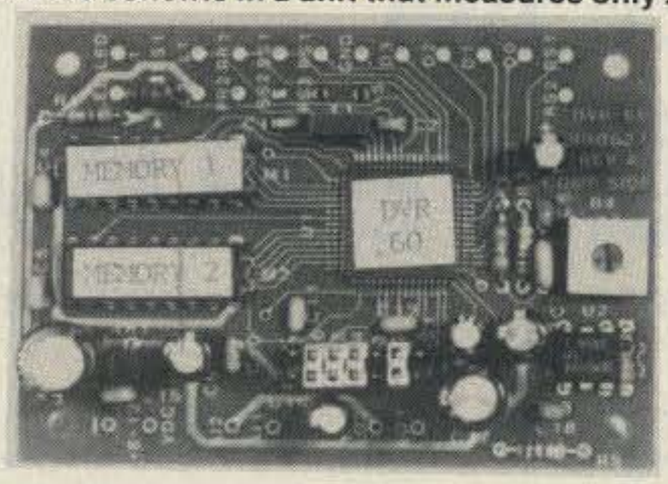

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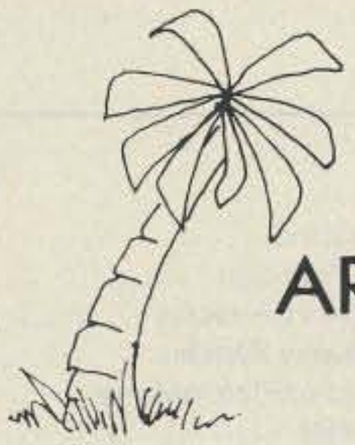

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The ICOM IC-2SAT includes a variety of other features like convenient scan functions, priority watch, memory masking, memory transfer, tone squelch and so much more. Battery packs and a battery case, chargers, headsets and a wide selection of other options are also available.

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•	Amateur Electronics Supply	11*
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135	Antennas West	50
138	Antennas West	65
5	Antennas West	17
90	Antennas West	54
89	Antennas West	60
236	Antennas West	63
•	Antique Electronic Supply	50
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•	Associated Radio	69
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243	AXM, Inc.	54,60
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76	Radio Engineers	17
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34	Ramsey Electronics	23*
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95	Sensible Solutions	49
188	SGC, Inc.	79
85	Smith Design	51
244	Software Systems	69
250	Software Systems	49
183	Spectrum International	83
247	**Startek**	**15**
232	TE Systems	20
124	Texas Bug Catcher Antenna	32
•	The Ham Center	81
117	The Pouch	51
150	The Radio Works	81
115	The RF Connection	60
246	**The Signalcraft Company**	**28**
62	TNR	20
•	Tropical Hamboree	71
•	Uncle Wayne's Bookshelf	86,87
•	Universal Amateur Radio	60*
120	Van Gorden Engineering	83
104	Van Iderstine & Sons, Inc.	63
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•	VHF Communications	83
191	W & W Associates	41
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Continued from page 4

ters to retrieve a dropped antenna . . . then running out of water on a desert island.

Then there was the morning I worked W7IMW/C7 in Tiensin, China, who was coming in S1 running 10 watts AM to a long wire on 20m. Wow! Or the night I worked all states on 75m. Or the weekend I worked 100 countries on 20m SSB. Or operating JY1 from the palace in Amman.

It was amateur radio that got me into the Navy as an electronic technician and paved the way for me to almost get killed a dozen times in a submarine. You sure learn about yourself when depth charges are dropping all around and you're not at all sure you're going to get out of this one.

Would an affair with a gorgeous Tech (a YL, thank you) count as a ham experience? That's one chapter in my memoirs you won't want to miss! Heh. I wouldn't trade a top listing on the Honor Roll for that one.

So let's see what you can come up with. Who knows, if I get enough interesting stories I might be able to publish 'em all in a book. How'd you like to have your story in a book?

Yes, double-space it. We'll clean up the grammer and speling. Please don't use those torn spiral-bound notebook pages you usually send in, okay?

High Tech Council

The New Hampshire High Tech Council, which I joined several years ago, is now interested in my project to get all New Hampshire schools to include an eight year course, grades 5–12, on the fundamentals of electronics, communications and computers. I suggested this some time ago, but it wasn't until the current economic downturn in New Hampshire that the timing seemed right.

The whole Boston and southern New Hampshire area bet far too heavily on minicomputers. It isn't as if I hadn't warned 'em that microcomputers would eventually clobber minis . . . and then mainframes. Well, they're doing it now and the result is that Data General, DEC, Prime and Wang are on the skids, with no real hope for long term survival. Alas, these huge employers are passing along their inability to cope with progress to the nearby communities.

I remember trying to convince the president of Centronics, in Hudson, New Hampshire, then the largest manufacturer of printers, that micros called for a whole new generation of printers. He scoffed. Now his plant is making pancake turners and the Japanese are making our printers.

Will we be able to convince the governor that a technically educated work force is the best answer for the future of New Hampshire? We're going to try.

The fallout for amateur radio will be, I estimate, at least 2,000 new amateurs a year, just from New Hampshire alone. We have about 20,000 youngsters in each grade, so if we can get this course into the schools, complete with ham, computer, science fair and other such clubs, I think we can get at least 10% of the kids sold on hamming. I'll let you know how we do with this.

It'll take several years for the project to produce a work force large enough to attract new high tech businesses to New Hampshire. In the interim I have a sneaky plan for a radio/computer project which could get the state back on even keel within a year or two.

If they do get my education project going, New Hampshire is going to be needing a technical university. I'd like to have RPI help develop this since I'm involved with the school. I talked with the president recently and he's game. This could be a perfect opportunity to start a new no tuition engineering university. Let's see, if we can start fifth graders now they'll be entering college in 1999. This could provide New Hampshire with technicians by 1999, engineers in 2002 and scientists in 2004.

ARRL Bashing?

Did you ever try to talk with a drug addict? If you have any friends who are alcoholics, you know that they protect themselves from reality by denial until the situation is beyond being ridiculous. This is the way drugs work, including cigarettes, cocaine, crack, gambling, and so on. Denial.

My recent prescription for saving amateur radio via getting the ARRL to do what needs to be done has resulted in a few ARRL-holics accusing me of bashing the League. Let's put this into perspective.

I'm not "against" the ARRL, any more than a doctor is against a person when that doctor diagnoses a case of cancer and recommends an operation. Diagnosis isn't criticism. As a doctor of entrepreneurial science, I'm in a unique position to diagnose the situation and prescribe what needs to be changed for the health of the League.

So cut out the "bashing" baloney, notice that you're into denial, and let's start curing the patient instead of attacking the messenger.

73

VE7LBM

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The New Orleans Amateur Radio Association.

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73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey, NH 03431

Notes from FN42

HAPPY NEW YEAR! As I am sitting in the Dungeon (my shack) I reflect on the past year and all the fun things that I have done, plus all the wonderful things that hams around the world have been doing or are planning to do. I certainly wish that I could attend many of the conferences, meetings, or just generally good times that are happening, but alas, I cannot. I sometimes wonder how Wayne does it, but he is a natural go-getter and no moss grows under his feet.

I am very happy to report that Wayne has been recruiting Hambassadors for the column. Harris Abdullah 9M6HF is the latest, and you will see his first installment in this month's column. Thank you, Wayne, from all of us.

What will the new year bring? I hope it brings complete world peace, better understanding between countries and individuals, and prosperity for all. I do know that the staff at 73 Magazine *will be striving to continue the excellence that* 73 *is known for, and that this column will bring you all the news from around the world.—Arnie N1BAC*

Roundup

Spratly DXpedition. *[This press release ended up in my box from an unknown source.]* The recent Spratly DXpedition was a major success, despite various problems. Romeo Stepanenko 3W3RR and a team of Soviet operators contacted over 43,000 stations worldwide in April–May of 1990. Many people and organizations banded together to donate funds for that trip and made it possible. However, there are still many amateurs who would like a shot at Spratly for a new one, phone or CW.

Romeo, well-known to the Vietnamese, can obtain a passage to the Islands on very favorable terms. His new expedition will take him *[or has taken him]* and one Vietnamese assistant to Spratly island for a week-long operation.

Donations will be greatly appreciated for this effort. They can be submitted to: Ed Kritsky NT2X, Box 300715, Brooklyn NY 11230, USA. If the total amount needed, $5,000, cannot be raised, all contributions will be returned to their donors.

Switzerland *From a press release of the International Telecommunication Union (ITU).* Taking advantage of new technologies available in the field of information retrieval, the ITU is now publishing the International Frequency List (IFL) on CD-ROM (compact disc—read only memory). The computer readable edition is an improved version of the existing IFL on microfiches.

From the first edition of the "Berne List" published in 1928, to the latest edition of the IFL produced on paper, the number of frequencies increased from 1,700 to about 1,100,000, representing an increase in the number of pages from 24 to over 6,000! This led the Union to cease the publication of the list on paper and to adopt microfiches as from 1985. The CD-ROM list is yet another step to make this publication more flexible and useful than ever.

The CD is used with the CD-Answer information retrieval software delivered on the accompanying diskette. You can access information by frequency, country code of station location, notifying administration, class of station, station name, geographical coordinates, or geographical area and region code. It also enables users to process any extracted subset of the database in local application systems.

Photo A. Famous Taiwanese ham BV2A/B, Tim Chen (in the middle), visited the Tokyo International Amateur Radio Association (TIARA) booth at the annual Harumi Ham Fair last August. With Tim, left to right, are TIARA Technical Advisor Ed Coan 7J1AAE; member VU2ST, Ali; President Frank Striegl 7J1AAL; and member Motoi Kawatsu JK1PNY.

Photo B. Father Marshall Moran (in the middle), world famous as 9N1MM, receives 10 Novice study guides from TIARA for his students in Nepal, where he has been promoting amateur radio for 35 years. Father Moran was in Tokyo last September at the invitation of the Japan UNICEF Ham Club. Also present (left to right) are Andy Clark 7J1AAD, TIARA President Frank Striegl 7J1AAL presenting Father Moran with Tune in the World, *and Brother Albert Heinrich 7J1ACI.*

Send inquiries to: I.T.U., General Secretariat, Sales Service, Place des Nations, CH-1211 Geneva 20, Switzerland.

MALAYSIA

Harris Abdullah 9M6HF
P.O. Box 13329
88837 Kota Kinabalu
Sabah Malaysia

Greetings from Malaysia. Amateur radio is alive and growing in Malaysia. Malaysian Amateur Radio Transmitters Society (MARTS) has been doing a tremendous job in promoting the hobby through participation in social and sports activities.

In 9M8-land, interest in amateur radio was generated when Special Event Station 9M8STA went on the air in August 1989 for three days. The first amateur satellite communication from Eastern Malaysia was made through this station. And this year, 9M8 hosted the Annual SEANET Convention held in Kuching from November 10–12.

Sabah, 9M6, has 29 licensed hams, but only eight can be heard on the HF bands on a regular basis. 2 meters is also active, and a repeater, 9M6RGK, has been installed at an altitude of 9,000 feet on Mount Kinabalu. At this height, the repeater's coverage extends as far as the northern part of V85-land, Brunei. The repeater was home-brewed by 9M6MA. It is easily accessed from Kota Kinabalu, about 40 miles away. The Sabah Amateur Radio Society represents the interest of the local ham population in 9M6.

There are many SWLs in Malaysia. Most have been able to pass the RAE Part I Examination (Theory and Regulations) but the main stumbling block is Part II, CW. Part I consists of multiple choice questions on theory, practice of radio communications, and the local regulations covering the hobby. Part II tests the ability of the candidate to receive and send messages in Morse code at 12 wpm.

Presently, there is only one class of license available. However, plans are underway to amend the regulation to provide for Class B (VHF only). This requires passing Part I of the exam only. Another change that may come soon is the lowering of the minimum age requirement from 18 to 16. The examinations are conducted twice a year in June and December by the Department of Telecommunications. Amateur radio licenses are valid for a year, and the fee is M$20.00 per year for fixed/mobile/portable operations.

Malaysia does not have any reciprocal licensing agreement with any other country at the moment. Hams who intend to operate while visiting the country need to submit an application form at least two months ahead of the arrival date, to allow time for processing. The issuance of a temporary license will be at the discretion of the licensing authority.

If you intend to operate from 9M2, write to MARTS, P.O. Box 10777, 50724 Kuala Lumpur, Malaysia for assistance. For 9M8 and 9M6, write: 9M8FH, Festus Havelock, P.O. Box 203, 93702 Kuching Sarawak, Malaysia, and 9M6HF (myself, address above).

The main problem hams face in Malaysia is the high customs duty levied on amateur radio equipment. MARTS is constantly working to have this reduced or removed for the sake of the amateur radio community. Importing an HF rig is costly, almost double the purchase price of the equipment. This is why there are not many licensed hams active on the HF bands.

SPAIN

Woodson Gannaway N5KVB/EA
Apartado 11
35450 Santa Maria de Guia
(Las Palmas de G.C.)
Islas Canarias, Espana

Hello again from the Canary Islands. I am very happy to provide a translation of an article printed in a local newspaper about the hams in the province of Las Palmas (the islands of Grand Canary, Lanzarote, and Fuertaventura). Alfonso Hernandez, President of the Union de Radioaficianados de Espana (URE), provides the narrative for the reporter.

In the province of Las Palmas (the islands of Grand Canary, Lanzarote and Fuertaventura) there are approximately 800 ham radio operators, 650 of them on Grand Canary. On Lanzarote there are two local branches (in Teguise and Arrecife), and another on Fuertaventura. In all, there are 1,730 hams in the Canary Islands.

The URE was created before the Spanish Civil War, and then it disappeared. It began anew 27 years later, in 1963. Before the movement, there were only a few licenses, but they were easy to obtain. Quite different from the situation we saw later; although thanks to our "dean," Jose Callero, people kept up their interest, and began transmitting again when it was allowed.

In 1980 things began to settle down, and in those times, Las Palmas province had about 80 hams. New rules and tests were put into practice in 1983. In Las Palmas the URE chapter was changed to the form it has today, with its own jurisdiction, instead of being a branch of the Madrid office.

There is no average Canary ham. The strongest interest comes from young adults between 20 and 40 years old. There are older people too, but they have more problems in passing the tests.

Equipment normally costs around 500,000 ptas ($5,000), including installation of a multiband antenna. But at any rate, you don't need a rig to be a ham. You can become a club member and use the club callsign. Membership dues in Las Palmas are $60 a year.

In Las Palmas there is a packet repeater and two 2-meter repeaters. There is a 2 meter repeater on both Lanzarote and Fuertaventura.

Our ham services are largely emergency services, such as requests for medicine. We are constantly asked to search for medicine in all parts of the world; above all, this is a humanitarian service and not limited to our country's borders. When someone asks you to get medicine and you go to the trouble to get it and send it, and then they tell you that this has helped save a life, this makes you very happy. I think that it is things like this that a ham is proudest of.

To become a ham one must pass a series of tests that cover four areas: operating the equipment, basic electronics, pertinent Spanish law, and Morse code. The club offers classes to prospective hams. After passing these tests the ham receives a callsign prefix of "EC." He stays at this level for a minimum of 6 months while making 75 contacts (25 national and 50 international). Then he can test for "EA," the highest license category. If he wants to enter the "EB" class he has only to pass a written exam (no code). This class allows limited use of the VHF bands.

Until next time, 73 from the Islas Canarias. 73

Number 22 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 525–4438, 8 data bits, 0 parity, 1 stop bit. Thank you for your cooperation.

Wanted: a Morse code trainer program for the Apple IIe to help boost a new Novice to 13 and 20 wpm. *T. Francis, Rt. 2 Box 336, Leonard TX 75452.*

I am looking for any info on KLM Electronics Echo II, 144 MHz transceiver. I will copy or pay for copy and postage. Contact *Rick Bogdan KA1UDX, 136 Samoset Ave., Hull MA 02045 or KA1UDX @ NS1N.MA.USA.NA.*

Elmer wanted! I have an FT-707, and study code on computer. I have books, but learn best by listening and doing. Please respond. Thank you. *James E. Fiuren, PO Box 2394, White City OR 97503. (503) 826–5190.*

I cannot locate a company called the Dentron Radio Corp., and I need circuit diagrams or operating manuals for the ant. tuner Dentron Jr. Monitor, Serial #6207. I will pay any cost involved. *Ray Terrill ZL1AAR, 3F Faith Bullock Pl., New Lynn, Auckland 1207, New Zealand.*

Can anyone tell me anything about a Zenith PM-1 cable system used for scrambling? Also, I'm looking for a copy of a book called *The Ten Meter FM Handbook*, by Bob Heil. It has been out of print for about 5 years. I will pay copying charges for this book. *Bret Singer N3IHM, PO Box 1015, East Stroudsburg PA 18301.*

I am interested in SSTV, but have no idea what kind of equipment I need, where to get it, or how much to spend. Any help I could get would be appreciated. I operate a TS-820 for HF (barefoot), and have a 3-element tribander. *Kevin Webster N1EPU, 1564 Byam Rd., Cheshire CT 06410.*

Needed: Info on full break-in CW. Does the B&W tube type break-in device still exist or does anyone have anything simpler to use with separate transmitter and receiver? *Bill Pierce, 142 South Keystone Ave., Sayre PA 18840.*

I need the manuals (including schematics) for Lafayette Signal Generator TE-20. *Meyer Minchen AG5G, 4635 SW FWY, Houston TX 77027. (713) 622–6161.*

I'm looking for information about parts or service for a Wilson WR-500 antenna rotator. Thank you. *Sam M. Barrett WA5RPP, PO Box 141, Presque Isle ME 04769.*

ATV

Number 25 on your Feedback card

Ham Television

Bill Brown WB8ELK
%73 Amateur Radio Today
Forest Road
Hancock NH 03449

W1BHD–ATV Pioneer

While visiting the Boston area, I decided to drop by and visit Mel Dunbrack W1BHD, also known as the "Grandfather of ATV." At 84½ years of age, he is still active on ATV in the Malden, Massachusetts, area. Mel built his first ATV station in 1948 and was one of the first ATVers on the air in the world. One of the first known ATV demonstrations (non-mechanical) was an eight-mile contact between W2USA at the New York World's Fair and W2DKJ/2 at the New York Daily News Building on September 27, 1940 (see *QST*, November 1940). This demo inspired Mel to construct his own station. In the '40s, things such as TV sets, and particularly TV cameras, were a little hard to come by (at ANY price!). Mel set out to homebrew his very own TV camera and converted a RCA oscilloscope to operate as a TV receiver!

From Spark Gap to Video

Mel started out in amateur radio with a spark gap transmitter he constructed in 1917. His interest in ATV was first sparked during the '20s when he saw the ads for the Jensen mechanical TV system (anyone still have one of these?). He worked in the electronics field starting out at AMRAD and eventually working at James Millen Company. If you've ever owned one of Millen's grid dip meters, Mel probably had a hand in building and testing it!

During 1948, three TV stations started up in the Boston area. WBZ-TV started broadcasting on June 9, 1948, WNAC-TV came up on June 21, 1948, and by November 20, 1948, W1BHD-TV was on the air! Mel wrote the FCC about identifying his TV signals. He received permission to add the "-TV" suffix to his call.

Photo A. Mel Dunbrack W1BHD with his omni-horizontal portable ATV antenna.

Photo C. From Spark to Video. The W1BHD 1948 vintage TV camera can be seen in the background.

Soon Mel had a following of several local hams watching his test patterns and live demos. If you think it's tough to stir up ATV activity in the '90s, just think of the hard road that Mel had to follow in the late '40s! Mel's eventual goal was to stir up a *riot* of ATV activity. To help achieve his goal, he started up the first ATV newsletter in 1951, called the "American Amateur Television Associates." In his first few months he had nearly 30 members (see the list).

After years of stirring up new ATV activity, he was instrumental in helping Tony K1VTE get the Malden ATV repeater up and running in the mid-'70s. He also had one of the first 2 meter FM repeaters operational in New England (WR1AAA—the "Skunk Hollow" machine).

Mel is an active member of the ECAT group (East Coast Amateur Television, Inc.). Although he is blocked by a hill from the current repeater site in N. Andover, Massachusetts, he still enjoys operating simplex ATV from Malden. Give him a call on the 145.29 repeater and help him start another ATV riot!

Backpack ATV

While at this year's Boxborough, Massachusetts, hamfest, I was treated to quite a variety of portable ATV activity. The ECAT group (East Coast Amateur Television, Inc.) had an impressive booth which received the transmissions from several backpack ATV stations scattered about the hamfest grounds. Seen hoofing it were Jerry N1FFX (see Photo E), Bob WA1WVJ, W1ELX, Lynn W1NRE and at least one or two others. The ECAT group had even arranged for a tethered blimp ATV station, but high winds and rain put an end to those plans.

If you're planning a trip through the Boston area, look for the ECAT group on the 145.29 (−600) repeater in N. Andover. The KA1AFE ATV repeater is located at the same site as the 2 meter machine on top of Boston Hill north of the greater Boston area. The input is on 434.00 MHz or 911.25 MHz and the output is on 421.25 MHz (both vertically polarized). Activity nights are on Wednesdays and Sundays around 8 p.m. 73

Active ATV List–1951

(From the American Amateur Television Associates newsletter)

W1BHD	PA0VT
W1MUX	G3CVO
W9DDG	W4MS/W4RE
W2LMP	W3MLN
W6JDI	W5MSB
W6QT	W6OFU
W6VSV	W3NDB
W6UOV	W5ANR
W6WCD	W4GFF
W6RXW	W4LRG
W6VQV	W1QVF
W6MTJ	W1HDQ
W6AQV	W2UTH
W6WGM	W8DMR

Photo B. The W1BHD ATV museum/hamshack.

Photo D. Image Orthicon tubes anyone?? (The W1BHD hamshack)

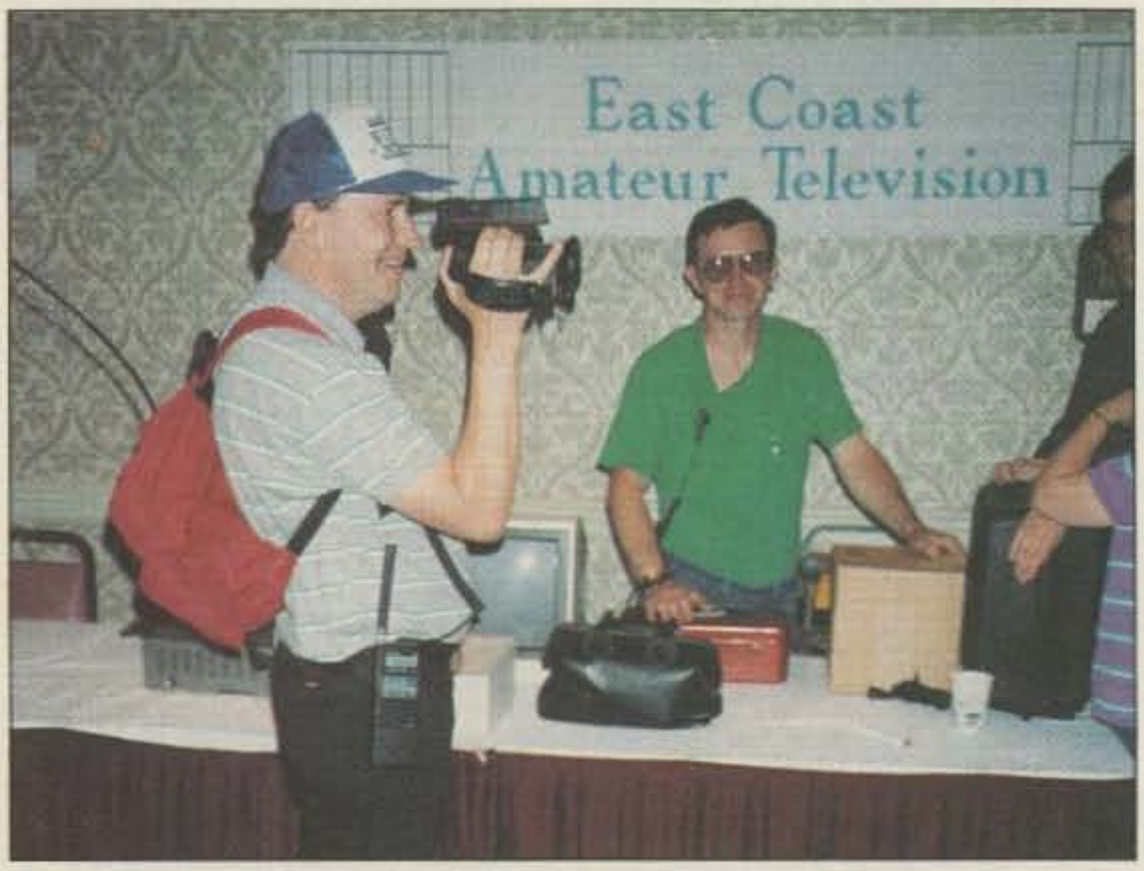

Photo E. Jerry N1FFX demonstrates his backpack ATV station in front of the ECAT booth (Ed KA1AFE behind booth).

Number 26 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the March issue, we should receive it by December 31. Please provide a clear, concise summary of the essential details about your Special Event. If your announcement arrives here too late to be included in the magazine, it will be entered in the /HAMFESTS SIG on our BBS, (603) 525–4438. 8,0,1.

DEC 30

SOUTH BEND, IN A Hamfest Swap & Shop will be held at the Century Center by the Repeater Valley Hamfest Committee. Tables: $5/5' round; $15/8' x 2.5' rectangular; $20/8' wall locations. Talk-in on 6.52, 99-39, 69-09, 34-94, 145.29. Contact *Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616. (219) 233–5307.*

JAN 12

WESTBORO, MA The MMRA Flea Market, sponsored by the Minuteman Repeater Assoc., Inc., will be held at the Westboro Senior High School from 9:30 AM–2 PM. Admission is $2, or $1 after 1 PM. 6' x 6' vendor spaces $5 in advance, $10 at the door; with table & chair—$10 in advance, $15 at the door. Floor space with table and chair will be guaranteed only when paid for in advance. Vendor space requests should be sent by Jan. 1, 1991, to: *1991 MMRA Flea Market, PO Box 2282, Lexington MA 02173.* Talk-in: 449.925, 223.94, and 146.61 MHz. Contact *Andy Morrison N1BHI at (508) 481–3878* or *Ralph McNall WB2DCL at (508) 366–2404.*

JAN 19

MONTEREY, CA Winterfest 91 Demonstration and Flea Market will be sponsored by the Naval Postgraduate School ARC at The Monterey Fairgrounds, Salinas Room, from 8 AM–3 PM. Admission is free. For info, contact *Pat at (408) 649–4444 (days)* or *Doug at (408) 663–6117 (evenings).*

JAN 20

YONKERS, NY The Metro 70cm Network will sponsor an Electronics Fair/Giant Flea Market at the Lincoln High School from 9 AM–3 PM, rain or shine. Free parking. Admission $4. VE Exams. Tables: $15 for the first and $10 for each additional, $1.80 per foot. Pre-registration deadline is Jan. 10, 1991. For tables at the door: $20 all tables, $2.50 per foot. Contact: *Otto Supliski WB2SLQ, 53 Hayward St., Yonkers NY 10704. (914) 969–1053.*

JAN 26

GALLATIN, TN The 300 Repeater Ham Festival will be at the Gallatin National Guard Armory on Highway 25 East of Gallatin. Set-up begins at 6 AM. Open to the public from 7 AM–2 PM. Walk-in testing. Tables are 1/$5, additional $2.50 each. Bring extension cords. Talk-in on 147.84/.24 from 5:30 AM. Contact *Bill Ferrell N4SSB, 1120 Douglas Bend Rd., Gallatin TN 37066. (615) 452–3962.*

CRYSTAL RIVER, FL The 11th annual Citrus County Hamfest, sponsored by the Sky High ARC, will be held in the National Guard Armory on Seven Rivers Dr., starting at 9 AM. Admission $4 until Dec. 20, and $5 thereafter. XYL's free with OM. Free parking. Vendor set-up from 3–5 PM Fri. and 7–9 AM Sat. 120V AC available at no charge. Users must provide plugs, cords and tape for attachment to floor where cords cross aisles. All exhibitors and helpers must purchase admission tickets. Parking for self contained RV's. Outdoor fleamarket spaces $5. Indoor tables $8 each. All tables are 30" x 8'. Chairs provided. Make checks payable to *Sky High ARC* and mail to: *SHARC Hamfest, 9 S. Davis St., Beverly Hills FL 32655.* Send SASE for mail return or pick up tickets at the door.

ARDEN HILLS, MN Those interested in microwave operations are invited to attend a meeting at the Satellite City radio store at 10 AM. Free admission. Contact *Jerry Jensen (612) 888–6187.*

JAN 27

VILLA PARK, IL The Wheaton Community Radio Amateurs will hold their 24th Mid-Winter Hamfest from 8 AM–3 PM at the Odeum Exposition Center. Handicap accessible. Tickets $5 in advance with triple prize stubs, $6 at the door. All Flea Market tables reserved. Call *(708) 231–2428.* Talk-in on 145.39/.79, 224.14/2.54, 444.475/9.475. For commercial space, call *(708) 629–8889* or *FAX (708) 629–7098.*

COLUMBIA, PA The Columbia Area ARC will sponsor a Hamfest at the Columbia Markethouse from 8 AM–3 PM. Set-up at 6:30 AM. Admission $3. Tables $5. Free parking. VE Exams. Talk-in on 146.715/.115. Contact *Hamfest Committee, Columbia Area ARC, PO Box 574, Columbia PA 17512. (717) 684–5603.*

FEB 2

ST. CATHARINES, ONT. The Niagara Peninsula ARC Inc. will hold its 13th Annual Big Event Ham-fest/Dinner-dance at the C.A.W. Hall. Admission $3, tables $12 commercial and $5 non-commercial. Talk-in on 147.24/.84. For info please write *N.P.A.R.C. Inc., PO Box 692, St. Catharines, Ontario L2R 6Y3, Canada. (416) 562–4891.* Dinner-dance tickets available only in advance.

SPECIAL EVENT STATIONS

JAN 5–6, 12–13

RIO de JANEIRO, BRAZIL The Hunting Lions in the Air Contest, is sponsored by Lions Clubs International and coordinated by the Rio de Janeiro Arpoador Lions Club (Brazil). The CW portion of the contest will be held from 1200 GMT Jan. 5–1200 GMT Jan. 6. The Phone portion of the contest will be from 1200 GMT Jan. 12–1200 GMT Jan. 13. The contest commemorates the birthday of Melvin Jones, founder of Lionism. Its main objective is to create and foster a spirit of international understanding and cooperation among Lions and ham radio operators through worldwide communications. Bands permitted are 80, 40, 20, 15 and 10 meters, Phone and CW. For Phone: Calling: CQ...Hunting Lions in the Air, followed by callsign; Exchange: RST report, prefix and a sequential QSO number. An operator who is a member of a Lions, Lioness or Leo club shall indicate the word "Lion" and the name of the club. If possible, identify the district. The Rio de Janeiro Arpoador Lions Club members and the Melvin Jones Memorial Radio Club members will add the words "Arpoador" and "Melvin," respectively. For CW: Calling: CQ...Test Lions, followed by callsign; Exchange: RST report, prefix and a sequential QSO number. An operator who is a member of a Lions, Lioness or Leo club must indicate the letter "L": The Rio de Janeiro Arpoador Lions Club members and the Melvin Jones Memorial Radio Club members will add the letters "LA" and "LM," respectively. Make one log for each mode (CW and Phone). Clearly indicate the category (single operator or clubs and associations with multiple operators). Enter callsign, the band, the report and sequential number of QSO—both received and sent. QSO's in the different bands but in the same mode should be indicated in the same log. Logs must be mailed by Feb. 15, 1991, via airmail, to: *Contest Committee of Rio de Janeiro Arpoador Lions Club, PO Box 2155, Rio de Janeiro 20011, RJ., Brazil, South America.* Also, write to this same address for info about points and awards.

JAN 15–21

DULUTH, MN Duluth area hams will operate KBØDAV (Dogs After Victory), to commemorate the Eighth annual John Beargrease Sled Dog Marathon. Beargrease Amateur Radio Coalition (B.A.R.C.) provides a safety net for the health and welfare of the mushers and dogs during the 500 mile wilderness race. Operations will be on-going throughout the race, SSB and CW 10 through 80. For QSL send QSL and SASE to *BARC, PO Box 500, Duluth MN 55801.*

Number 27 on your Feedback card

ABOVE AND BEYOND

VHF and Above Operation

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

Gunn and IMPATT Devices

What is the difference between a diode and a Gunn diode? Why does an IMPATT (impact avalanche and transit time) diode check out like a diode, and a Gunn diode fail this test? This month we'll explore the internal characteristics of microwave diode oscillators, which will help you determine whether a device is still alive or a dud.

Most devices picked up at swap meets are in the realm of a trust relationship, as detailed testing isn't possible. But most cavities that appear from time to time at flea markets can be tested with simple equipment to help you determine the status and type of microwave device.

I have experimented with most of the microwave diodes available, and I try to pass on what I have learned in the process. The first rule is to look in the technical book section (621 division) of your public libraries. Using this privilege can save you lots of bucks. If you can't locate material there, you might want to check the nearest college library. I find myself continually looking for new material covering old ground. It helps explain what is going on, as it's simple when you can visualize the different devices.

The Basic Diode

The basic diode has one junction, a positive (P) and a negative (N) block of silicon. When you connect an ohmmeter across the diode (positive lead of ohmmeter to positive terminal [anode] of the diode, and negative lead to the negative terminal [cathode] of the diode), current will flow. The current is controlled by the voltage of the ohmmeter's battery and the meter/diode resistance. Some meters are better used on the times 10 scale, since the times 1 scale can supply more current, and could damage devices like detector diodes. See Figure 1 for the basic test circuit.

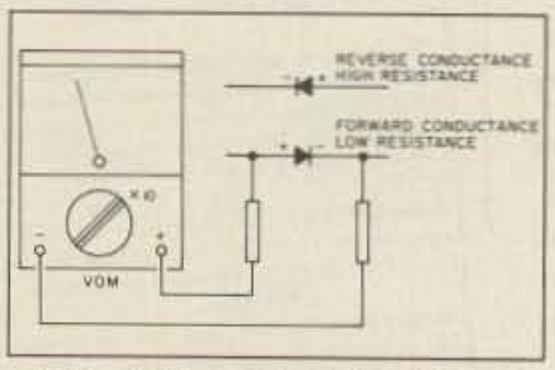

Figure 1. The basic diode test circuit.

When using the ohmmeter for testing a device, first note the reading in the forward biased direction, then reverse the meter leads. The reverse reading should be 20 times greater, or more, for a good diode. Some devices will indicate open or infinity on your ohmmeter. This is OK. The point is that the diode in conduction measures low resistance, and in reversed polarity, is very high or open to the meter circuit. This is a simple test for rectifiers, zeners (below reverse breakdown voltage), and similar devices. These devices can handle larger currents, such as the high currents the meter might apply to them.

Applying this type of test, you can destroy some microwave devices, since some junctions of transistors, especially FETs, can be punctured by the meter's voltage. If the device is a bi-polar transistor, you can get away with it, but be careful of the voltage and the amount of current that the meter supplies. Check the battery in your meter and its polarity in reference to the meter leads. It helps when the positive battery voltage in the ohmmeter test is on the red or positive side.

Don't use the highest meter scale. Stay on the times 10 scale to limit current. I use a Triplett model 630, 20k ohms per volt, to do my tests. On the X-10 ohms scale it uses a 1.5 volt battery for tests. This is my swap meet and general purpose meter.

IMPATTs and Gunn Oscillators

Let's get into the innards of the microwave devices and find out what makes IMPATT and Gunn diodes different. The basic difference lies in the materials used to construct each device. Both devices produce microwave oscillations at various power levels and are quite compact compared to the older tube systems they replaced.

The Gunn device is constructed of a triple layer of "N" type semiconductor, actually a very thin wafer a few microns thick (the actual Gunn surface). This active Gunn element is sandwiched between two "N" blocks of material allowing a bonding surface to the very thin Gunn material. As such, the Gunn device does *not* have a diode junction. Because the Gunn's three-piece construction consists of only one type of material, "N" type, it doesn't test like a normal diode. Why it is called a diode (implying two elements, anode and cathode) eludes me.

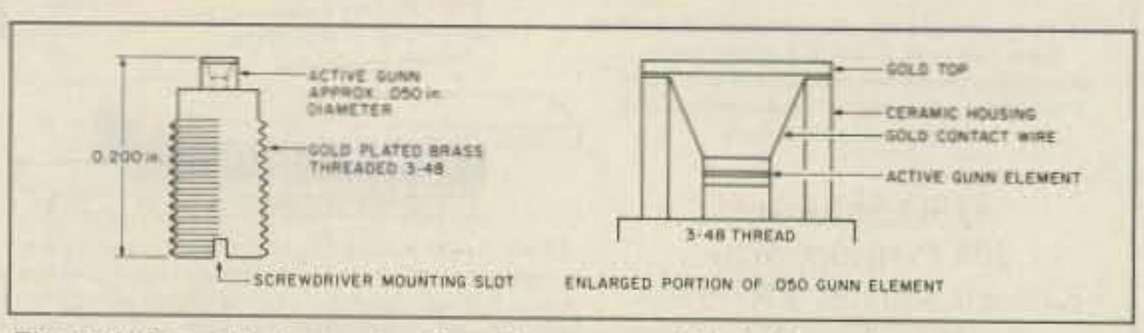

Figure 2. Gunn diode construction. Frequency of diode determined by thickness of Gunn diode wafer. A thick wafer indicates 6 GHz, a thin wafer indicates 10 GHz.

Testing a Gunn device with the ohmmeter will show a dead short of about 2 to 3 ohms in either direction. The problem is that this may be a good Gunn device! Reversing the meter leads won't help; you'll get the same reading. Remember I said the device has no diode junction and is constructed from a single (triple-layer sandwich) block of "N" type semiconductor material. What is required is some means of observing microwave operation in a cavity to check for microwave operation. See Figure 2 for the Gunn's structure. (Note: The Gunn device can operate using strip lines, but efficiency is very low, about 2%.)

The Gunn device is a bulk semiconductor (solid) that causes the DC electron flow through the material to bunch in clumps of electrons. These clumps or bundles of electrons represent pulses of current in a resonant cavity, and comprise the microwave period, or resonant oscillations. Cavity operation of Gunn diodes is the most efficient method used today to produce high power units.

I visualize this bunching effect by picturing ten thousand BBs rolling down a plank. Due to collisions and other factors, some electrons (BBs) slow down, while others speed up. The result is that they vary in speed, and bunch up at a rate that is the resonant frequency of the cavity. This output power obtained at microwave can vary from a few mW to over half a watt.

Gunn devices are voltage-fed, meaning they can have all the current they want to draw from the supply at a particular voltage. Please note that Gunn devices are polarity sensitive. They will not work with reversed polarity and most likely will self-destruct under this condition. If you have an unknown device, try it. You have a 50–50 chance of being correct. Most are positive, but a few are negative. If you have several surplus devices, check the circuit they came from for clues as to voltage polarity. If none are available, try them and hope for the best.

A sure giveaway of a shorted Gunn occurs when you apply DC power and it acts just like a 6/32 screw—a real ZERO dead short. A good Gunn will test like a a 2-ohm short, but when used in a cavity, it will only draw a certain amount of current, depending on the power rating of the device and its ohmic considerations. Some 100 to 200 mW devices draw 400 to 800 mA at 10 to 14 volts. A typical 10 mW device draws about 130 mA.

Gunn devices can test (ohmic) good, but not produce RF in a cavity due to poor cavity design or just a stubborn Gunn device. I have observed several troubles with Gunn devices, such as no RF output, shorted, and just plain cranky oscillators.

Testing Gunn Devices

With the Gunn device in a cavity, apply about 6 to 7 volts DC, taking note of the current which should be near normal for the power level of the device. At very low voltages the current might be excessive. Watch for microwave output and slowly raise the voltage towards 10 volts. Keep an eye on both the current and microwave output. The device will oscillate near its point of negative resistance. If it does not, make adjustments to your cavity circuit while watching for microwave output. Voltage should be set at or near 10 volts, but not higher for cavity adjustments. Once operation is OK, you can reduce the voltage to 5 to 7 volts and make a chart of the voltage vs. current readings. Your curve should look something like mine in Figure 3.

For brave souls who wish to determine the maximum voltage of their Gunn device, increase voltage slowly until there is no further increase in microwave output. Do not increase voltage above this point. Further voltage increases will result in device destruction. In most devices, the maximum voltage that can be used safely varies from 9 to 12 volts. You are TICKLING THE TAIL OF THE DRAGON AT THIS POINT. I do not recommend maintaining this voltage level for more than a short time. Back the voltage down about 1 volt.

I have destroyed many good devices by pushing this limit, and they don't give you a second chance. Keep the voltage at the setting for peak RF out or slightly less, and you will be OK.

IMPATTS Diodes

IMPATT diodes differ from Gunn diodes in that they have a diode junction and can be tested with an ohmmeter. They test just like a normal diode, checking for good front to back ratio. IMPATTS are current-fed, and as such are limited by a series resistor in the maximum amount of current they can draw. The power supply required for IMPATT diodes is much higher than that required for Gunn devices. IMPATTs require about 75 to 100 volts DC and current is usually limited to about 35 mA.

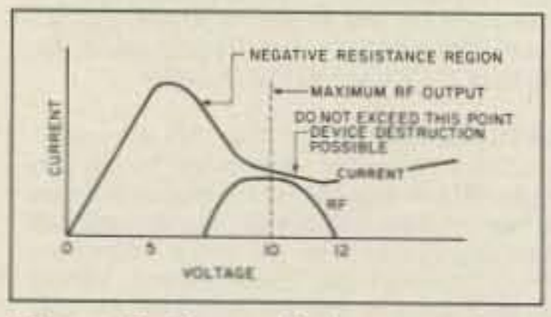

Figure 3. Gunn diode current vs. voltage curves.

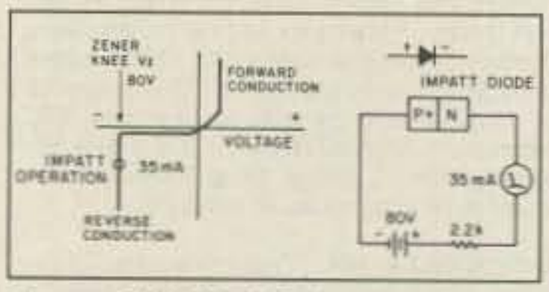

Figure 4. IMPATT diode operation. The IMPATT diode resembles a zener diode curve of operation. It operates in an avalanche current limited mode with 80 volts reversed biased at about 35 mA. IMPATT case style is identical to that of a Gunn device.

As noted, IMPATT stands for IMpact Avalanche Transit Time. Sounds like electrons doing their thing, rolling down the plank. However, the effect is part of an avalanche breakdown and the transit time of electron flow in the device (similar to zener action). It has to be controlled partly by device construction and by limiting current to a safe value. If current was not limited, the device would run away instantly and self-destruct. The breakdown regions of a zener and an IMPATT diode are nearly identical. Zeners can be made to operate as IMPATTs, but not all of them will function as IMPATTs, and those that do will be very inefficient.

I have several IMPATT oscillators, and they are very fussy compared to Gunns. Designing circuits with IMPATT devices can be very touchy, as several circuit designers demand tight guidelines in limiting substitutions between devices. They work well, but are critters unto themselves, and are not very design-forgiving. I have had poor luck replacing a defective IMPATT with surplus devices. However, using the IMPATT sources as they came from surplus, I have found them well-suited for beacon operation. This is due to a higher cavity *Q* and resultant frequency stability. If you want an IMPATT system I recommend you obtain a good commercial new or surplus device.

The surplus unit we found was manufactured by Raycon, part #10000-104-02, and provided 100 mW output at 80 volts/35 mA. N6IZW's beacon on Mt. Helix in San Diego County was based on this unit. The 10 GHz beacon, in use for over two years now, has worked well. The high *Q* cavity of the IMPATT oscillator helps minimize external influences, making the oscillator less sensitive to frequency pulling. Temperature, humidity, drafts, and the environment are all hostile to beacons, not to mention constant operation. The enclosure used to protect this beacon is a short section of plastic sewer pipe fully containing the oscillator and waveguide slotted antenna.

Mailbox Comments

Albert KC2MI of the Oneonta ARC in Oneonta, New York, writes that several club members would like to get started with microwave experiments, as that part of the radio spectrum is new to them. He reports that they were given several Gunn oscillators with defective devices. Albert is looking for 24 GHz equipment to place several stations in operation on that band as well. His address is RD #2, Box 325, Oneonta NY 13820.

Lyle Patison VK2LU is planning a talk on "starting out on 10 GHz" to amateurs "down under" at a local radio club. Lyle says he's been interested in 10 GHz operation for many years, and has a wideband unit (20 mW), and a narrowband transceiver (SSB, CW, NBFM) with 1 mW of output power. This unit injection locks a 30 mW oscillator for the final amplifier. The injection lock is accomplished using a circulator, and the resultant SSB output is quite good. He uses a 20-inch dish with a Cassegrain feed. He also runs a local beacon on 10.368270 GHz with 12 mW output that has EPROM identification.

Lyle's narrowband gear was homebuilt mainly from modified English designs. He is trying to get more activity on this band in Australia, hoping that talks at the local radio clubs will perk up interest.

Ace K5AR would like more information on toroidal transformers and spike reduction for the power supply project (see the August 1990 issue of *73*). I haven't found the answer in surplus on the transformers yet, but the spike reduction can be limited by the addition of a 0.1 µF cap and a series 5 ohm resistor from drain to ground. You might have to vary the capacitor value somewhat for maximum spike suppression. Observe on a scope and adjust the capacitor trimming for your switching rate.

I still have Gunn devices available for 6 and 10 GHz with 50 mW devices priced at $5 each, and devices up to 100 mW for $10 each postpaid. Additionally, I am looking for photo-multiplier tubes for use in a laser communications system that I'm building. Of particular interest are the types that use the top of the tube for input. Any help in locating the photo-multiplier tubes would be appreciated. When the system is in operation, I will publish full details on its construction.

As always, I will be glad to to answer any questions related to our VHF/UHF microwave bands or similar topics. Please send an SASE for prompt reply. 73's Chuck WB6IGP 73

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QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Getting on AMTOR

Aside from the usual New Year's resolutions, such as losing weight and quitting smoking, here is one resolution you just have to see through: QRP AMTOR. Last April I treated myself to a new AEA PK-232 multimode controller, vowing that someday I'd give AMTOR a try. Well, that is exactly what I did, and I can say without question that QRP and AMTOR is a hard combination to beat.

I'm not going to try to explain AMTOR from the protocol level up, but rather share some good on-the-air experience I've learned through trial and error. Some of my mistakes might help others get on the air with AMTOR.

What You Need to Operate AMTOR

First, you'll need one of the multimode controllers. I picked the PK-232 because of the vast amount of software written just for it. You have your choice of the PK-232, the KAM all-mode, or the MFJ-1278 terminal unit. All of these are excellent and will work just fine for AMTOR. Besides the controller, you'll also need a computer or terminal unit. I opt for the computer, as you can operate dedicated software to really enhance the operation of the multimode controllers.

Some software programs are written just for a specific controller. In most cases, you can't use a program written for the PK-232 and expect the software to work correctly with an MFJ controller. Both MFJ and Kantronics offer specific software for their controllers. There are also third party software companies selling programs for any controller. Sometimes you can find outstanding software for a controller on a local BBS. CompuServe's HamNet has a huge data library full of programs for multimode controllers.

If you don't have a computer, that's all right, too! A dumb terminal will work, but you'll have to put up with the lack of specialized software. This means you won't be able to use split screens to separate transmit text and receive text. The dumb terminal will allow you to communicate to the multimode controller, and that's all.

Your Rig and Power Supply

You'll also need a radio that will operate full QSK break-in. Many of the newer rigs will do just that, but check carefully beforehand. I've used Ten-Tec rigs (both the Argosy and the Argonaut 509) and have had no trouble at all running AMTOR. In most cases, you can't use the break-in VOX; it won't switch fast enough for AMTOR. And, although this doesn't apply to QRP, if you run an amplifier, be sure it will also operate at full QSK.

Since AMTOR is almost 100% key-down (depending on your mode, FEC or ARQ [see next paragraph]; FEC mode IS 100% key-down, while ARQ is not, but it still demands a lot from the power supply), power supplies will be taxed to their limit. Make sure you have a good supply of cool air flowing around the transceiver and its power supply. Keep things cool, and you'll save yourself a lot of problems.

AMTOR Modes

AMTOR has two basic modes: FEC and ARQ. These are also called Mode B for FEC and Mode A for ARQ. Without getting into the why and wherefore of either mode from a protocol standpoint, all you need to know is this: To call CQ, use FEC or Mode B. This is a simple forward-error-correcting control for sending each character twice. FEC is used to call CQ, or for net operations and even for bulletins. FEC sounds very much like RTTY. In fact, after a while, you'll be able to tell by the sound of the FEC signal whether or not a station is calling CQ.

Mode A, or ARQ, is a synchronous system transmitting blocks of three characters at a time. ARQ has the characteristic chirp-chirp sound that makes AMTOR stand out on the bands. It is in this mode that you need full QSK for proper AMTOR operation. After you have called or answered a CQ, switch to ARQ mode. (To make life easier, if you call CQ and someone answers you, the controller will automatically switch over to ARQ, assuming the other station answers you in ARQ.)

This has been a very simple look at AMTOR. To get on the air and start making contacts is really quite easy. Be sure to get all the proper plugs connected to the multimode controller and the radio. This includes the microphone and audio out to the controller. Most AMTOR is on 20 meters, and in lower sideband, so you'll have to switch to the proper sideband if you want to start off with the right foot. On the Ten-Tec rigs, I have to choose the proper sideband by setting the MODE switch to SBPR. Also, with the Ten-Tec Argosy, the digital readout will now be off by about 2.5 kHz. Keep this in mind when trying to dial up a BBS on AMTOR.

From either the software or a dumb terminal, if you're using one, you'll have to include a SELCAL. This identifies your station. You *must* have a SELCAL, or AMTOR won't work! SELCAL is simple to add to the controller's memory. In most cases you drop your second letter and number from your call. For example, my call is WB8VGE and my SELCAL is WVGE.

With this out of the way, we can start. As I said, most of the AMTOR activity can be found on 20 meters, from about 14.070 to about 14.082, give or take a few kHz.

If your software will allow it, make up a CQ buffer or text file. Use the standard 3X3 call, but be sure to include your ARQ SELCAL! If you don't, no one will be able to sync up with your station. After you have a file or buffer, go to FEC and send the file. Your transmitter will come on-line, and you'll be in 100% key-down. After the file has run out, switch to standby mode and wait to see if you get an answer. If you do, you'll know instantly. The transmitter will start switching on and off very fast, and you'll be able to see what the other station is saying on the monitor.

If you get no response from your CQ after a while, tune up and down the band and look for a solid RTTY-like tone. This is an FEC. On the PK-232, tune until both the right-most and left-most LEDs are as brightly lit as possible.

The tuning indicator on the PK-232 leaves a lot to be desired, but after a while you can get the hang of it. When the FEC signal is tuned in properly, the controller will switch from standby to FEC. At this point, you should see something on the monitor. Look closely for the stations's SELCAL. When the station goes to standby, switch to ARQ and send *his* SELCAL. Your transmitter will start switching on and off, asking for the other station's SELCAL. When the two sync up, you're connected. At this time you can chat to your heart's content.

Perfect Copy at QRP

At this point, more than likely you're wondering what all this has to do with low-power communications. Well, with AMTOR, you get 100% perfect copy at very low power levels. I've had two-hour QSOs with DX stations running no more than one watt RF output! Of course, there were a lot of Repeat Requests (RQs) between the two stations, but we did manage to type away.

Running QRP AMTOR is slick! Things might slow down, but you can still hold a QSO. There are several things you should try to remember. First, since AMTOR generates 100% perfect copy on both sides of the QSO, you don't need to repeat anything! Don't ask "How's the copy?" when you know it's 100% perfect on AMTOR. LEARN HOW TO TYPE. Nothing is worse than talking with someone who can't type. Now this does not mean you have to do 80 words per minute, but you should do better than the 'ol hunt-and-peck method.

I also found out that you you can't adjust anything while AMTOR is running because of the rapid on-and-off switching of the transmitter. So be sure the SWR is correct, the power level is where you want it, and the audio gain is correctly set. I tried to adjust the antenna tuner while operating AMTOR. No way!

If you have not tried AMTOR QRP, you're really missing out on some great times. Give it a try. You won't be disappointed!

Coming Soon

Before we run out of space this time, I want to mention that I've got several really useful projects lined up for the upcoming months. The first project will be a universal T/R sequencer. This unit will control all the switching requirements that the active QRPer might need. The T/R controller will handle just about anything you can throw at it. I'm using mine for T/R controlling of an old Drake R4-B receiver and a host of home-brewed transmitters.

There are ample inputs for up to six different keying methods. These can include a straight key, bug, electronic keyer, and even a computer. All inputs are isolated from the transmitter/receiver circuits. You can adjust the T/R delay from the front panel as well as the internally generated sidetone. A separate T/R relay switches the antennas from a remote location. The entire circuitry requires 12 volts at 40 mA.

Best of all, all parts, and I mean ALL parts, can be purchased new from Radio Shack. The photos show two versions of the controller I use: One for the shack and the other for the workbench. Everyone should have one of these in the shack. Sure saves frustration when testing and building QRP transmitters. So get ready and heat up the soldering iron for next month. 73

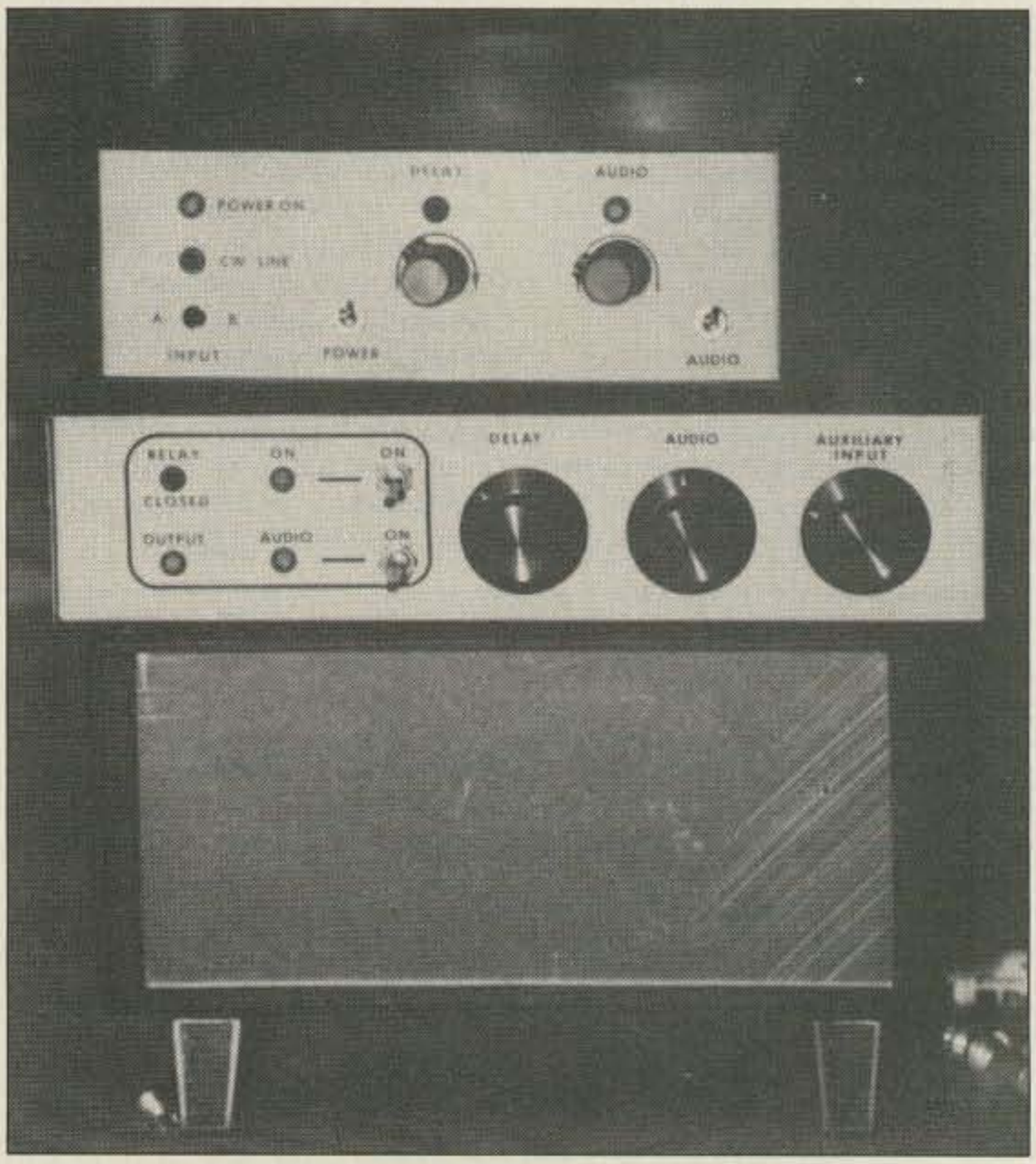

Photo A. Version one of the T/R controller every ham shack should have—next month's project!

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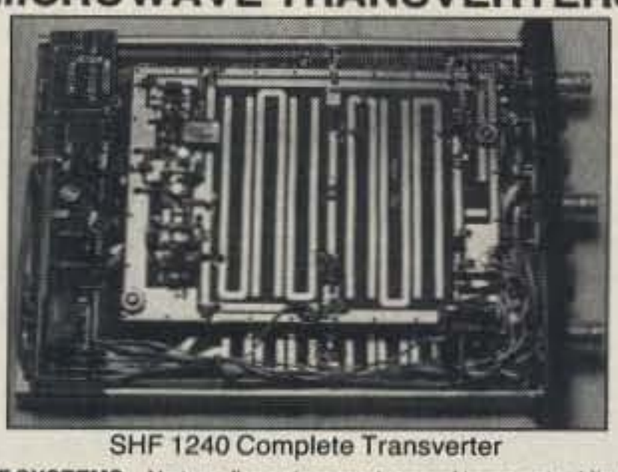

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Ham Homeroom

Through a wonderful twist of fate, this term I wound up as the homeroom teacher for the top 8th grade class at Intermediate School 72 in Staten Island, New York. I was excited at the prospect of working with a group of gifted youngsters, but I was especially delighted to see the familiar names on the class register. Many of the children had been in my 7th grade ham radio program last year. Imagine my delight in learning that almost 50 percent of my homeroom students were licensed amateur radio operators!

What a year we've been having! By 7 a.m. many of the youngsters are at the classroom door, eager to get into the shack. For 45 minutes every morning the young hams are busy swapping stories about their contacts of the night before, and looking up addresses in my callbook.

While I'm busily tending to the duties of a homeroom teacher, I delight in looking toward the station and seeing the kids having a ball on the radio. Almost every morning they greet the local hams on the 2 meter repeaters, and then move over to 10 meters and 20 meters. Inevitably, they get caught up in an interesting QSO, and they're still engrossed when the first period bell rings. I must admit I find it very difficult to admonish them about this.

Fortunately, their first period teacher understands the "pull" of the radio with these youngsters, and kind of looks the other way because he knows the kids are with me at the ham shack. One of the benefits of having a successful ham radio program in a school is that the staff and administration become aware of the value of the program to the entire school. The children who have been in the ham radio program are always contributing interesting anecdotes and information to their social studies and science classes. There is a tremendous respect and appreciation by other teachers who know what the program can offer to the children.

Novice Follow-Up

It has been a real treat for me to be part of the follow-up for these newly licensed operators. Very often we lose the Novices after the course is over because they lose contact with a ham who can continue to work with them. By having them "under my wing" in the homeroom after they've gotten licensed, I can provide more follow-up activities for them and help steer them into the waiting arms of the local clubs.

The ham radio setup in my room allows the children to meet with each other and to have fun making contacts together. Some of these students don't have a radio at home yet. Since they've been given a chance to use the school equipment every morning, they've begun to realize how much fun getting on the air can be. Anyone who deals with youngsters knows that having fun is a contagious activity. Always try to provide the environment and ingredients in a learning situation for the children to enjoy themselves and feel good about what they're doing. Amateur radio can provide you with all the components needed to make every child feel special.

It's a good lesson for all of us to remember that it's important to provide the next step for Novices. Getting licensed is only the beginning.

What We Enjoy

While speaking to these highly motivated, terrific kids one day, I asked them what they enjoyed most about amateur radio. Perhaps you can share their responses with other youngsters.

Mary Alestra KB2IGG: Age 12, Extra Class. "There's no doubt about why the kids in our ham radio class at school are bright-eyed and perky in the morning. We all look forward to starting the morning with a contact on the air. All of us love the warm, welcoming good morning we receive from our many ham friends on the local repeaters. It's also a real thrill for us to make a contact overseas with a country we've been learning about in our social studies class.

"Many of the things we learn each morning at the school ham shack are helpful to us in setting up our shacks at home, and in learning how to operate properly and courteously. I also love meeting other kids on the 'CQ All Schools Net' and becoming pen pals with many of them.

"Here at Intermediate School 72 we know how to get going in the morning: eat a good breakfast and get ready for a great contact to start the day."

Mike Mikos KB2JNB: Age 12, Technician Class. "Ever since I received my license I've made some exciting contacts. My rig is a Uniden HR-2600 putting out 25 watts into a Cushcraft AR-10. Some of my best DX contacts have been with Germany, Japan, Spain, Madeira, Portugal, Austria, Africa, Panama, England, and Italy.

"But one of my most memorable contacts, even though it wasn't a new country, was when I talked to a Cub Scout group in New Jersey. I loved talking to the kids and answering their questions about ham radio. I really hope I got some of those boys interested in the hobby.

"I've had my license for seven months and I haven't gotten tired or bored at all. I really enjoy it and I'm sure I will continue to have fun in the hobby for many more years."

Nicole Macellari KB2KXO: Age 12, Novice. "The first time I got on the radio was in Mrs. Perry's homeroom class. I was so scared. But Mrs. Perry stood right next to me and introduced me to Lionel KA2VBL on the air. He was so friendly and so nice that I forgot my nervousness and just enjoyed myself. I feel more confident every time I get on the radio now.

"Ham radio has been a help to me in many of my school studies. I recently had an interview for the Japanese Student Exchange Program at our school. I know that the fact that I had an FCC license was very impressive to the interviewer. I can now see why so many people are proud to be hams. Ham radio is fun for me, and I plan to upgrade soon."

Shaun Gartenberg KB2JNW: Age 13, Novice. "Ham radio is one of the most interesting and fun hobbies I have. There are so many people I've gotten to know on my ham radio. I really enjoy DXing on 10 meters. I find it very exciting reaching foreign countries.

"My father is also a ham. Many times we talk to each other when he leaves the house. Also, one of my best uses of ham radio takes place in school in Mrs. Perry's classroom. In case I've forgotten a book at home, I can call my father right from Mrs. Perry's ham shack. The other kids like to watch me when I do this. Ham radio is a great hobby for kids!"

Jared Greenberg: Age 13. "For the last two years at my school, I have not been able to get into the ham radio class. Fortunately for me, my homeroom class this year has many other students who have gotten their licenses, and my homeroom teacher teaches the ham radio course.

"When I first came into the classroom, I saw a lot of equipment in the back of the room which looked very complicated to operate. It seemed interesting, especially since the other kids were always talking about it with Mrs. Perry. As the days progressed, I watched everyone as they used the equipment. It seemed like fun.

"A few days ago, Mrs. Perry invited me to the radio and began showing me how some of the equipment worked. She suggested I speak with a friend of hers on the air to see if I liked it. I remember how great I felt when the person I spoke to told me he liked the way I sounded on the air. Now I understand why people love speaking on the radio so much. With Mrs. Perry's help, books, cassettes, and lots of determination, I hope to obtain a license so I can speak on my own, as well as more often. I think I've found another hobby."

As teachers, we must never forget the enormous influence we exert on the lives of the children we see every day. Imparting knowledge is but one of the important things we do for our kids. Providing the environment for growth, both socially and academically, is imperative. Set up a ham shack where youngsters can operate and have fun together, then just stand back and enjoy watching the fruits of all your hard labors. It's what teaching is all about.

I recently saw the following article (see the sidebar) in a teaching magazine and cut it out and hung it over my desk at school. Please share this with other instructors and educators. It says it all. 73

All I Ever Really Needed to Know I Learned in Kindergarten

by Robert Fulghum
reprinted from *Kansas City Times,* Sept. 17, 1985

Most of what I really needed to know about how to live, and what to do, and how to be, I learned in kindergarten. Wisdom was not at the top of the graduate school mountain, but there in the sandbox at nursery school.

These are the things I learned: Share everything. Play fair. Don't hit people. Put things back where you found them. Clean up your own mess. Don't take things that aren't yours. Say you're sorry when you hurt somebody. Wash your hands before you eat. Flush. Warm cookies and milk are good for you. Live a balanced life. Learn some and think some and draw and paint and sing and dance and play and work every day some.

Take a nap every afternoon. When you go out into the world, watch for traffic, hold hands, and stick together. Be aware of wonder. Remember the little seed in the plastic cup. The roots go down and the plant goes up and nobody really knows how or why, but we are all like that.

Think of what a better world it would be if we all—the whole world—had cookies and milk about 3 o'clock every afternoon and then lay down with our blankets for a nap. Or if we had a basic policy in our nation and other nations to always put things back where we found them and cleaned up our own messes. And it is still true, no matter how old you are, when you go out into the world, it is best to hold hands and stick together.

Some of the students in my homeroom, left to right: Gabriel KB2KYF, Marc KB2KYJ, Shaun KB2JNW, Naomi KB2JRH, Nicole KB2KXO, Wendy KB2KXV, and Mary KB2IGG.

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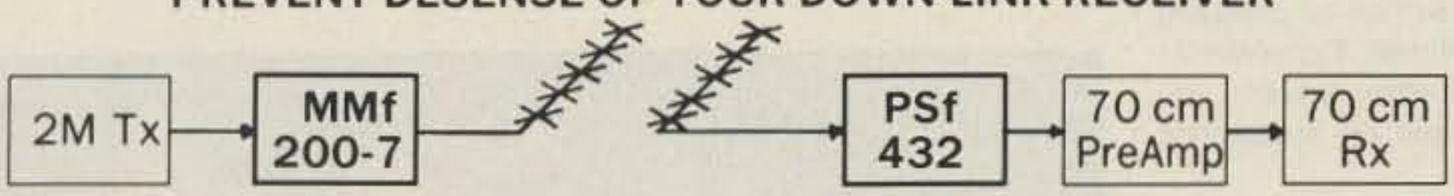

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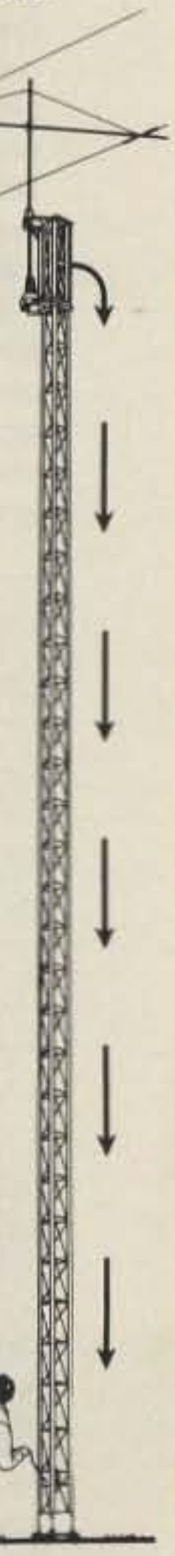

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Space Symposium 1990

Over 225 enthusiastic AMSAT supporters escaped the daily grind and "normal" ham radio the weekend of October 19–21, when the Johnson Space Center Amateur Radio Club in Houston, Texas, hosted the 1990 Space Symposium and AMSAT General Meeting. It was a great success, with the largest attendance since Los Angeles in 1984.

During the three-day period, 22 papers were presented on topics ranging from introductory information on getting started with amateur satellite activity, to scientific studies of AMSAT-OSCAR-13's orbital decay and microsat stabilization methods.

Most symposium papers were presented at the JSC Visitor's Center on Saturday, October 20, while the Friday and Sunday talks took place at the King's Inn adjacent to the space center.

AMSAT'S Future

Since the launch of four Microsats in January 1990, the amateur satellite community has been concerned about the direction AMSAT will take in the next several years. Funding for the ambitious Phase 4 geostationary satellite program has not materialized. AMSAT North America has not begun any new programs beyond software development for the current hamsats.

Phase 4 satellites would be long-life, stabilized amateur communications platforms at 22,000 miles out over the equator. The design, construction, launch, and orbital maintenance needs of a spacecraft of this type exceed the current resources available to AMSAT-NA.

Photo A. Allan Fox N5LKJ (one of Houston's AMSAT Area Coordinators) won the grand prize, an ICOM IC-275A, at the AMSAT Annual Meeting.

Dr. Karl Meinzer DJ4ZC of AMSAT-DL (Germany) presented a report on the Phase 3D Project supporting a new-generation, high elliptical-orbit, long-life hamsat. Although he did not submit a paper for *Proceedings*, he had an article, "Radio Links to Phase 3D," published in the May 1989 issue of *73 Magazine* in which you'll find many of the concepts of a high-power version of our currently operational A-O-13. Phase 3D could provide 6 to 15 dB better performance than A-O-13 from the VHF to microwave frequencies anticipated for the onboard transponders. A 6 dB improvement on our current Mode B (70cm up and 2 meters down) A-O-13 system would mean less antenna on the outside or no amplifier on the inside of a typical ham shack. For the higher frequencies with as much as 15 dB gain over current systems, signals could be heard and transmitted with small helix antennas or simple balcony-mounted yagis. This would be an advantage for those hams confronted with antenna restrictions or limited space.

Many experiments and transponders have been proposed for the new satellite. The communications equipment may range in frequency usage from 29 MHz to 10 GHz. Popular transponder configurations like "B" (70cm up and 2 meters down) and "L" (23cm up and 70cm down) would be supported, in addition to possible modes yet undefined. Experiments could include a camera, radiation and impact sensors, and an ionospheric experiment.

Participants in the new program would be from many countries. Countries currently represented include the U.S., Germany, Italy, Japan, South Africa, Australia, Hungary, and Yugoslavia. Others may join later.

Dick Jansson WD4FAB was prominently involved with the development of the Phase 4 concept and its physical design. His presentation, "The Phase IV Project—A Transition to Phase 3D," showed how AMSAT can apply much of the technology created for Phase 4 over the last three years to the Phase 3D program proposed by AMSAT-DL.

The cost for a Phase 3D satellite would be almost as much as for the Phase 4 satellite, but it would be shared internationally. Rather than go alone, with no funding, the AMSAT Board of Directors voted to discontinue Phase 4 efforts and support worldwide endeavors to make Phase 3D a reality.

The Decline of OSCAR-13

An item of exceptional interest and study has been the decline of A-O-13's orbit. The October 1990 "Hamsats" discussed findings on the eventual reentry of the satellite. Dr. Tom Clark W3IWI arrived at the AMSAT Space Symposium armed with charts, data, and some intriguing slides showing the mechanics of the situation in great detail. Using some very powerful computers, Tom was able to project different orbital scenarios into the future.

The current situation shows that the changes to A-O-13's orbit will cause the perigee or low point of the orbit to decline into the upper reaches of the atmosphere after 1995. Very small changes to the initial conditions of the launch or kick-motor firings could have had a dramatic effect on the orbit. One situation Tom described would have allowed A-O-13 to achieve a somewhat stable orbit with minimal perigee decline. Another possibility would have brought A-O-13 back to Earth within a few years, around 1992—much earlier than anyone would have guessed.

The Microsats

Many of the papers presented per-

Photo B. Gil Carman WA5NOM operates the hamsat station permanently located in the Visitor's Center.

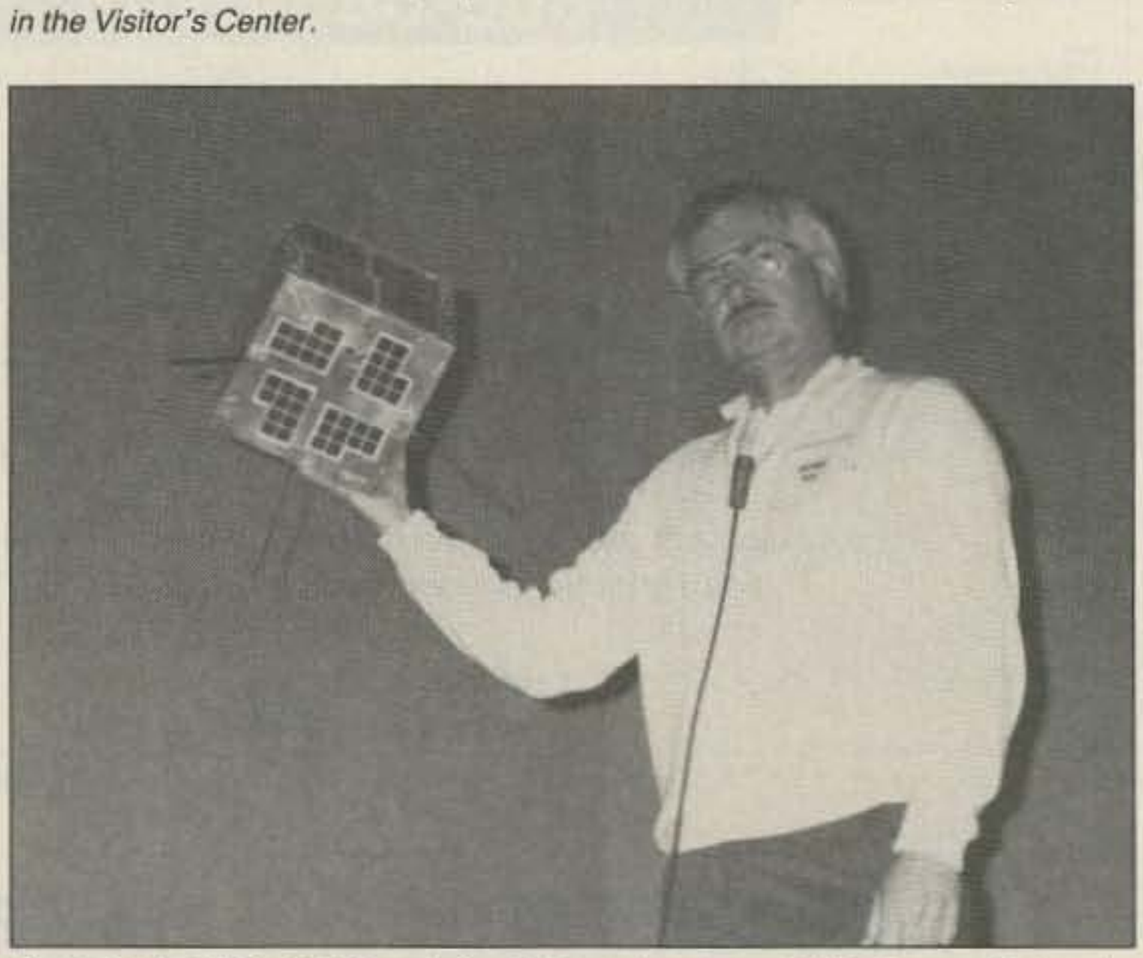

Photo C. Jim White WDØE explained Microsat motion, stabilization, and telemetry at the Space Symposium.

Photo D. Lou McFadin W5DID of the JSC ARC, and ham astronaut Jay Apt N5QWL of STS-37, with SAREX gear ready to go.

Photo E. Bill KB7KCM demonstrates antenna deployment of ADSAT to those at the AMSAT Space Symposium.

tained to the current state of the four Microsats launched in January 1990. The Microsats include AMSAT-OSCAR-16 (PACSAT), DOVE-OSCAR-17, WEBER-OSCAR-18 (WEBERSAT) and LUSAT-OSCAR-19. Much of the flight software has been difficult to develop, but the satellites are doing very well physically.

AMSAT V.P. Engineering Jan King W3GEY discussed the "In-Orbit Performance of Four Microsat Spacecraft." All design parameters of the program were met or exceeded.

A typical Microsat weighs 10 kilograms, generates 6 watts per orbit from its solar array, transmits a 2.4-watt output signal, rotates once per minute along its "vertical" or "Z" axis and stays at a cool 0.2 degrees Celsius.

Jim White WD0E addressed the issue of satellite stabilization, motion, and telemetry. Using a Microsat model, he showed how the satellites move and rotate relative to the Earth during each orbit. He also explained the importance of monitoring telemetry and described which parameters were measured onboard the spacecraft. Jim conveyed an in-depth understanding to the audience of how the Microsats move and function in orbit.

Steve Jackson WD8QCN, Chris Williams WA3PSD, and others from Weber State University explained the WEBERSAT camera experiments, the micro-meteor impact sensor, 1265 MHz video uplink receiver, horizon sensors, light spectrometer, and video flash digitizer.

Many digitized packet pictures have been received and displayed by enthusiasts, but the other experiments have not had the same level of publicity till now. As the students and staff at WSU gain more experience with the camera system, the pictures will improve and time will be allocated for work on the satellite's diverse functions.

David Liberman XE1TU presented a rather technical paper co-authored by Dr. Arcadio Poveda of the National Autonomous University of Mexico (UNAM). The paper and presentation described a Microsat project involving meteor-scatter radio propagation. While meteor scatter has been used by hams and others for communications between terrestrially-based stations, it has not been observed from the vantage point of satellites. Such a study will provide an opportunity for the UNAM to participate in a future Microsat project.

SAREX

It is hoped that by the time this is printed, STS-35 will have completed its mission with Ron Parise WA4SIR using packet and voice from orbit. Ron talked to the symposium attendees about the goals of his flight and the progress to date.

Lou McFadin W5DID brought the hardware for the Shuttle Amateur Radio EXperiment (SAREX) slated for launch with STS-37 in the spring. Two ham astronauts on STS-37, Jay Apt N5QWL and Ken Cameron KB5AWP, were available to talk with symposium participants about the mission. Lou's paper in the *Proceedings* provided real insight to the many challenges encountered in the course of satisfying NASA requirements to get a payload on the shuttle. The documentation requirements have produced a bookcase full of material just for the simple voice and packet station of STS-35. With the addition of SSTV and FSTV equipment for STS-37, the requirements were even more stringent. The SAREX volunteers have provided many hours of effort on the project. SAREX is a continuing project as long as we have hams on shuttle flights.

Additional Projects

During the weekend, the AMSAT Board of Directors considered many future amateur satellite experiments.

The work by AMSAT-Italy on ITAMSAT, an advanced Microsat, has passed the drawing-board stage with a nearly-completed flight-test model. Alberto Zagni I2KBD and his group have improved the original Microsat computer design. A launch in 1992 or 1993 is expected.

Other programs under study, or now entering the design phase, include SEDSAT-1/OSCAR, ADSAT, the Solar Sail, and efforts by AMSAT-Australia to work on a Microsat of their own.

SEDSAT would be an amateur radio device as a part of the Small Expendable-Tether Deployer System slated for a Delta-2 launch in a few years.

ADSAT stands for Astronaut-Deployable Satellite proposed for a shuttle mission. The project, conceived by

Photo F. Dick Jannson WD4FAB holds Phase IV helix antennas for 13 and 23 cm.

Bill Clapp KB7KCM at Weber State University, has also been called pizzasat due to its similarity to an extra-thick pizza box with an antenna.

The Solar Sail efforts of the World Space Foundation need a communications and control system that could be designed by AMSAT along with a ham radio transponder system.

AMSAT Australia has just begun early design efforts, but has the capability to produce a Microsat.

You can find details of these projects and others in *Proceedings of the AMSAT 1990 Space Symposium*, available from AMSAT for $20.00. Write to: AMSAT-NA Headquarters, 850 Sligo Ave. #600, Silver Spring MD 20910-4703, or call (301) 589–6062.

AMSAT members can get the particulars of AMSAT programs and organizational changes from the minutes of the Board of Director's meeting as published in *The AMSAT Journal*. 73

Photo G. (Left to right.) AMSAT Director Tom Clark W3IWI reported on A-O-13's orbital changes and decline. AMSAT President and Director Doug Loughmiller KO5I fielded questions with Dr. Karl Meinzer of AMSAT-DL on the next generation of high-orbit amateur spacecraft. AMSAT Director Bob McGwier N4HY described both the AEA and TAPR DSP modems.

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15S003 • **Communications Satellites (3rd Edition)**
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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 sent at 13 wpm and spaced at 5 wpm. Code groups are entirely random characters sent in groups of five—definitely not memorizable!

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RANDOM OUTPUT

David Cassidy N1GPH

The Big Lie

This month, I was going to continue with last month's topic: getting young people excited about amateur radio. I got about halfway into a column suggesting different ways to make amateur radio exciting to kids, but my mind kept returning to the same thought: "Why write about getting kids excited about ham radio when the root problem goes much deeper. Why not just talk about the REAL problem?"

Here it is. The single biggest reason why there are not more young people involved in amateur radio in the United States is that the vast majority of active licensed radio amateurs do not want more young people involved in amateur radio.

That's right, folks. Mr. John Q. Ham doesn't want to share his ham bands with kids. Judging by their actions, most hams are doing everything they can to keep anyone under the age of 21 from getting involved in amateur radio. In fact, most hams don't want ANY new hams. . . of any age.

Now, before the regular group of goofballs gets out their crayons and scrawls me nasty letters, let me say that yes, there are many individuals and groups of hams who are actively involved in recruiting youngsters for amateur radio. I mentioned a few of them last month. Yes, there are a few hams who do not have a prejudice towards kids, and they're doing great work. Unfortunately, these folks are a tiny minority of active hams.

The vast majority of our fellow radio amateurs do not want more youngsters in this hobby. Do you need proof? Bring a youngster to a radio club meeting. Go ahead. Do it. Then stand back and watch the outpouring of indifference showered upon this youngster by the members of this club. I've seen it with my own eyes, and I would be willing to bet that out of 20 club meetings there would be maybe one or two where someone would actually approach the child and welcome him to the club (that is, if the kid could stay awake long enough to get through the reading of the minutes of the last meeting, the 45 minute discussion about the purchase of $50 worth of coax, and the 20 minute argument about where to hold the club picnic this year).

You want more proof? Listen to any active repeater in any populated area. What happens when the sound of a young voice is heard? Hey, most hams in this country won't even answer a call on a repeater from another adult. The sound of a young voice must cause paralysis. Again, don't take my word for it. Next time you're in an area where nobody knows your callsign, pass the mike over to a young person and have them use your callsign to announce that they are monitoring. Nine times out of ten you'll hear silence, even on the most populated repeater in the area.

Hey, it's not only kids who get snubbed as newcomers at club meetings and on repeaters. I've sat through entire club meetings where not one person has asked me my name or whether or not I was a ham. Nothing! And yet, if you ask everyone at that meeting what the single biggest problem facing amateur radio is, you will probably get a unanimous response: growth. We can talk all we want about increasing the number of hams, but the evidence shows that we don't want any more hams.

Hell, the editor of another ham magazine recently admitted that he wasn't thrilled when his neighbor expressed an interest in becoming a ham. He asked his readers to tell him why he wasn't thrilled at the opportunity to share this great hobby with a neighbor. I'll tell him why. Could it be that he doesn't want any new hams living on his block, causing TVI, calling him up to ask for advice, borrowing his old equipment and having the fun that he's been having? God forbid, this neighbor might have a few grandchildren, or perhaps he works with the Boy Scouts or some other youth organization. What if this neighbor got his ticket and decided he was going to become an elmer for (gasp!) kids?

Ya' know. . . I'm a pretty tolerant guy. There are few things in this world that can get me really steamed. Most of them revolve around bigotry and dishonesty in all their various forms. That is why I am sick and tired of the amateur community giving lip service to increasing our ranks. It's a boldfaced lie, folks, and it's about time we stopped telling it to each other.

If we keep talking about getting more people—kids and adults—interested in amateur radio, why is it that we mostly do everything possible to keep people away? Until we come to grips with this elitist, bigoted attitude, any discussion of *how* to interest others in amateur radio is pointless.

Last month I suggested that with all the other high-tech marvels competing for a young person's attention, perhaps amateur radio was considered old news. What was magic to me as a twelve-year-old in the pre-computer era is low-tech to today's twelve-year-old computer hacker. But maybe the problem isn't getting the magic back into amateur radio. Maybe the problem is getting the magic back into radio amateurs.

Getting The Magic Back

Last month I asked you if you remembered the excitement you felt when you made your first QSO. For most of us, it was probably a CW contact on the Novice portion of one of the lower bands. Do you remember your first DX QSO? Was there someone there to help you get your ticket? Did someone hold your hand and walk you through what was then a strange, wonderful and frightening new world?

Amateur radio can be just as strange, just as wonderful, and just as frightening to a newcomer in 1991 as it was to you in 1940 (or 1950, or 1960, or 1970). Young or old, the excitement of that first QSO can be every bit as magic to a new Novice using a TS-440 as it was to you on an HW-16.

Have you lost that feeling of magic? Has ham radio become boring for you? Are you spending less and less time behind the rig and more and more time in front of the TV? Maybe you need to find that magic again, too. The best way to re-spark your own interest is to share it with someone. Pick out a few young people and share amateur radio with them. Make it fun. Build some antennas, put together a QRP rig or drag out that old boat anchor. Take a few youngsters on a mountaintopping expedition or camping trip. The next time your neighbor is standing on his lawn and staring up at your antenna, invite him in to see what's at the other end of that tribander.

If your radio club meetings are something you force yourself to attend, instead of the highlight of your month, find one other person who agrees with you and stage a coupe. Throw out the old men and invite the local Girl Scout troop to a meeting (that oughta' shake 'em up).

Plan a hands-on demo booth at your local mall. Yes. . . Hands-on! Let visitors to the booth actually sit behind the microphone and make a contact. Make sure to have RTTY for the shy folks. Don't forget a packet demonstration. Go out and actually solicit new hams. Are you retired? How about setting your station up at a local elementary school? All you have to do is ask. Talk to a science teacher and volunteer to demonstrate packet via satellite. Any teacher worth her tenure will jump at the chance to demonstrate what they're teaching.

If the magic has gone out of amateur radio for you, you can't blame anyone but yourself. Amateur radio is just as exciting as it ever was. You've just got to find someone to share it with. 73

Number 32 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

January 1991 is not expected to be a stellar month for DX, with less than half of the days ranking only good or good-to-fair (see the calendar). Seven days will be downright poor, with the remainder trending poor-to-fair or fair-to-poor. Many alignments are taking place this month that will keep the ionosphere disturbed, and the magnetic field unsettled to active. Solar flux may be trending downward during part of the month as well, which won't help matters a lot. However, watch WWV carefully for trends on an hourly or daily basis for an upwardly moving solar flux and a downwardly moving "A" index. Let's hope February will be better.

The 80/75 and 40/30 meter bands should provide some good, low-noise activity in the U.S., Canada, and South/Central America, but DX will depend on a relatively quiet magnetic field. On the poor days, however, don't despair, since trans-equatorial skip and over-the-poles signals will be present. The polar paths will be weak and full of echoes, whereas the trans-equatorial path will provide stronger signals, sometimes even on poor days.

The 160 meter band ought to be good for much of the month, so watch the calendar for the good and fair days. The 20/18 meter and 15/12 meter bands will suffer the most along with 10 meters this month, so don't expect miracles. Perhaps in February we'll see some improvement, and March ought to get us back on the road to good worldwide DX conditions on all bands. Let's wait and see. . . de W1XU 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	20	20	–	20	20	–	10	–	15
ARGENTINA	15	15	15	15	–	–	–	–	10	10	10	15
AUSTRALIA	15	15	–	–	20	40	20	20	15	–	20	15
CANAL ZONE	15	20	20	80	–	40	–	10	10	10	10	10
ENGLAND	40	80	80	80	40	–	–	15	15	15	20	40
HAWAII	15	20	20	20	20	40	40	–	15	–	–	15
INDIA	–	20	20	–	–	–	20	15	–	–	–	–
JAPAN	15	20	–	20	20	–	20	20	–	10	–	15
MEXICO	15	20	20	80	–	40	–	10	10	10	10	10
PHILIPPINES	15	–	–	–	–	–	20	20	15	–	–	–
PUERTO RICO	15	20	20	80	–	40	–	10	10	10	10	10
SOUTH AFRICA	20	40	–	–	–	–	–	–	10	10	15	20
U.S.S.R.	–	–	–	–	–	–	15	15	20	–	–	–
WEST COAST	15	15	15	40	40	40	–	–	15	10	10	10

CENTRAL UNITED STATES TO:

ALASKA	15	15	–	–	20	–	–	20	–	–	–	–
ARGENTINA	20	20	20	20	20	–	–	–	–	10	15	15
AUSTRALIA	10	–	–	–	–	40	40	20	15	15	15	15
CANAL ZONE	20	20	15	80	40	40	–	15	15	15	15	15
ENGLAND	40	80	80	80	–	–	–	15	15	15	15	20
HAWAII	15	20	20	20	15	15	40	20	–	15	–	15
INDIA	20	15	20	–	–	–	20	20	–	–	–	–
JAPAN	15	15	–	–	20	–	–	20	–	–	–	–
MEXICO	20	20	15	15	40	40	–	15	15	15	15	15
PHILIPPINES	10	15	–	–	–	–	–	–	20	20	–	–
PUERTO RICO	20	20	15	15	40	40	–	15	15	15	15	15
SOUTH AFRICA	20	20	–	–	–	–	–	–	10	15	15	15
U.S.S.R.	–	40	40	20	20	–	–	15	10	20	–	–

WESTERN UNITED STATES TO:

ALASKA	*	*	–	–	–	–	40	40	–	–	20	15
ARGENTINA	10	15	20	15	15	20	–	–	–	15	10	10
AUSTRALIA	10	20	20	–	–	–	40	–	–	15	–	–
CANAL ZONE	20	15	15	15	15	40	–	–	15	10	10	15
ENGLAND	–	–	–	40	40	20	–	–	15	15	20	20
HAWAII	15	15	15	20	–	40	40	–	–	15	10	10
INDIA	–	15	20	–	–	–	–	–	20	–	–	–
JAPAN	**	**	–	–	–	–	40	40	–	–	20	15
MEXICO	20	15	15	15	15	40	–	–	15	10	10	15
PHILIPPINES	10	15	–	–	–	–	–	–	20	20	20	15
PUERTO RICO	20	15	15	15	15	40	–	–	15	10	10	15
SOUTH AFRICA	20	20	20	–	–	–	–	–	–	10	15	15
U.S.S.R.	–	–	–	40	20	20	–	–	15	20	–	–
EAST COAST	15	15	15	40	40	40	–	–	15	15	*	*

*Notes: The bands shown are likely to represent the highest frequency available to the desired areas at the time shown. Work from there to a lower frequency band when the higher frequency band is not open. (1) Rare, and only on a "good" day. Blank spaces (---) mean the path is not workable at that time. *15/10/20. **10/15/20.*

JANUARY 1991

SUN	MON	TUE	WED	THU	FRI	SAT
		1 P–F	2 F–G	3 G	4 G	5 G
6 G	7 G	8 G	9 G–F	10 F	11 F	12 F
13 F	14 F	15 F	16 F–P	17 P	18 P	19 P–F
20 F	21 F	22 F–G	23 G–F	24 F	25 F	26 F
27 F–P	28 P	29 P	30 P	31 P		

Hold Your Own.

FT-411E/ 811/911

Compact FM Handhelds

The lightweight and compact FT-411E offers superb operating convenience and an incredible array of features. Such as,

- **49 Memories**
- **2 Independent VFOs**
- **Built-in CTCSS (Encode/Decode)**
- **Automatic Power Off (APO)**
- **Programmable Channel Steps**
- **Backlit Keypad and Display**
- **10 Memory Auto-Dialer**
- **One-Touch Instant Recall of Favorite Channel**
- **Built-in VOX**
- **10 Battery Saving Sampling Rates**
- **PTT/Keypad Lock**
- **Includes:** CSC-35 Vinyl Case, NC-28B 117 VAC Wall Charger, Belt Clip and FNB-17 Ni-Cad Battery.
- **Accessories/Options:** FNB-12S (5 Watts) Battery, MH-12A2B Label Speaker/Mic, MH-18A2B Mini Earpiece/Mic, NC-29 Desktop Quick Charger and NC-33 Desktop Gang Charger.

Specifications

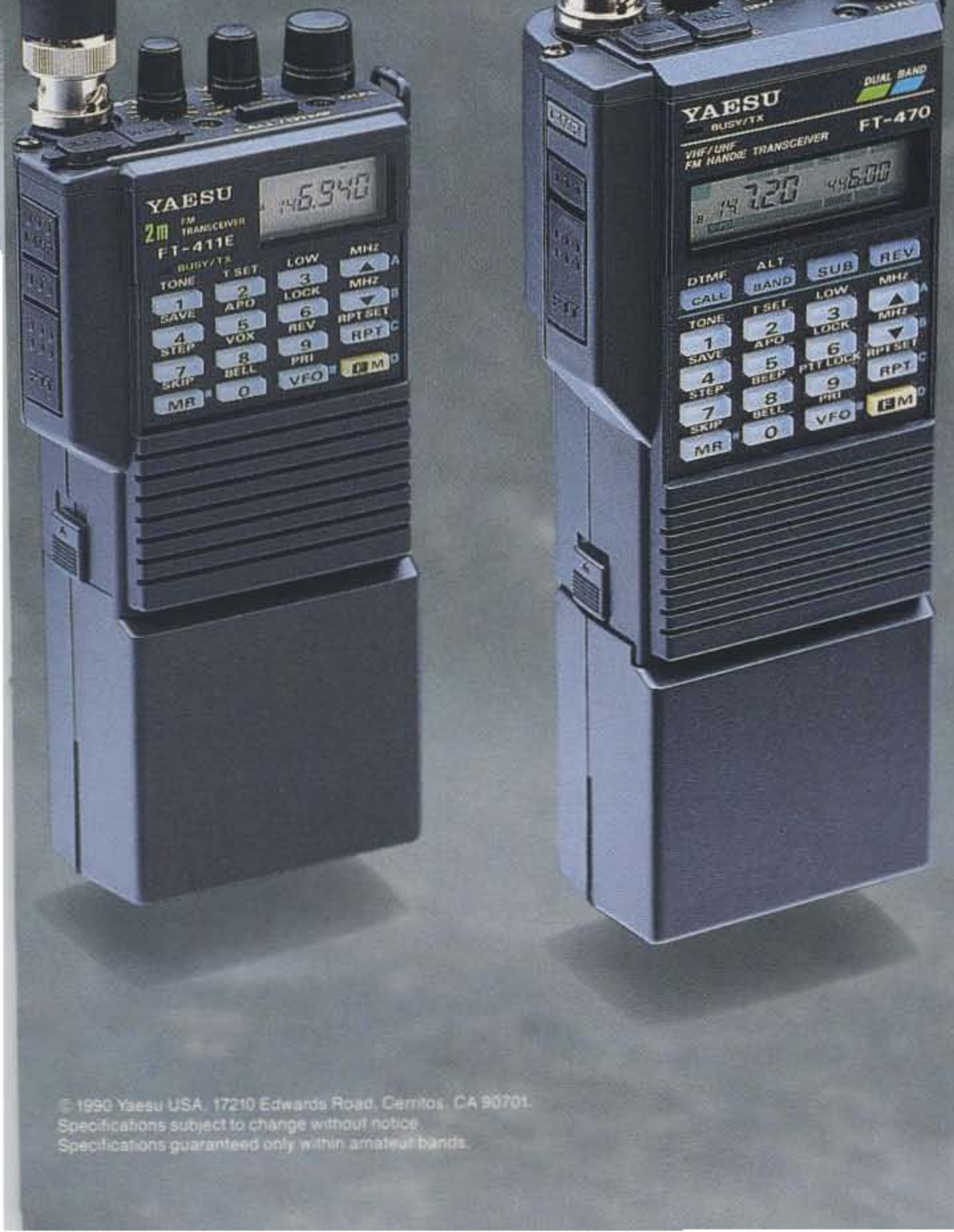
Frequency Range: RX: 130–174 MHz, TX: 144–148MHz(FT-411E); 430–450 MHz (FT-811); 1240–1300 MHz (FT-911)

Power Output: W/ FNB-17: 2.5 Watts (FT-411E); 2.0 Watts (FT-811); 1.0 Watt (FT-911) — W/ FNB-12S: 5.0 Watts (FT-411E); 5.0 Watts (FT-811); 1.0 Watt (FT-911)

Channel Steps: 5, 10, 12.5, 20 & 25 kHz

Case Size: 2.2(W) x 5.0(H) x 1.3(D) in.

Weight (Approx.): 13.4 oz. (FT-411E); 13.4 oz. (FT-811); 15.2 oz. (FT-911)



FT-470

Compact Dual Band 2m/70cm FM Transceiver

Compact . . . Powerful . . . Economically Priced. The FT-470 provides "true" Dual Band Operation so you can transmit on one band while monitoring or scanning on the other band.

Plus these features:

- **42 Memories**
- **2 Independent VFOs**
- **Built-in CTCSS (Encode/Decode)**
- **Automatic Power Off (APO)**
- **Programmable Channel Steps**
- **Backlit Keypad and Display**
- **10 Memory Auto-Dialer**
- **10 Battery Saving Sampling Rates**
- **PTT/Keypad Lock**
- **Includes:** CSC-43 Vinyl Case, NC-28B 117 VAC Wall Charger, Belt Clip and FNB-17 Ni-Cad Battery.
- **Accessories/Options:** FNB-12S (5 Watt) Battery, MH-12A2B Label Speaker/Mic, MH-18A2B Mini Earpiece/Mic, NC-29 Desktop Quick Charger and NC-33 Desktop Gang Charger.

Specifications

Frequency Range: RX: 130–180 MHz, TX: 144–148 MHz (VHF); 430–450 MHz (UHF)

Power Output: W/FNB-17: 2.3 Watts (144 & 430 MHz) — W/FNB-12s: 5.0 Watts (144 & 430 MHz)

Channel Steps: 5, 10, 12.5, 20 & 25 kHz

Case Size: 2.2(W) x 6.0(H) x 1.3(D) in.

Weight (Approx.): 14.8 oz.

YAESU

Performance without compromise.℠

KENWOOD

We just made the competition obsolete

No competition class transceiver is even in the same ball park as the TS-850S

You'll find a superior intermodulation dynamic range of 108 dB throughout the entire 100 kHz to 30 MHz range.

Kenwood's TS-850S is the only transceiver to feature Digital Signal Processing (DSP) – in both transmit and receive modes (with the optional DSP-100). This feature provides such greatly enhanced signal purity and richness that you'll want to experience it, to fully appreciate it.

Other advanced technology in the TS-850S includes 10 Hz step dual VFOs, multi-mode scanning, full and semi break-in CW, superior interference reduction, keyer, dual noise blanker, 100 memory channels, and RIT/XIT. Microphone supplied.

The Kenwood TS-850S. All band. All mode. One year warranty.* In a class by itself!

Key options

DSP-100 Digital Signal Processor. **AT-300** 160 -10 m external antenna tuner. **AT-850** 160 -10 m internal antenna tuner. **DRU-2** Digital recording unit. **IF-232C** Computer interface. **PG-2X** DC cable. **PS-52** Power supply. **SO-2** TCXO. **SP-31** Matching external speaker. **VS-2** Voice synthesizer. **YG-455C-1** 500 Hz CW filter for 455 kHz IF. **YG-455CN-1** 250 Hz CW filter for 455 kHz IF. **YK-88C-1** 500 Hz CW filter for 8.83 MHz IF. **YK-88CN-1** 270 Hz CW filter for 8.83 MHz IF. **YK-88SN-1** 1.8 kHz SSB filter for 8.83 MHz IF.

KENWOOD U.S.A. CORPORATION
COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 E. Dominguez Street
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*Kenwood meets or exceeds all specifications. Contact your dealer for a complete listing of specifications and accessories. Specifications are subject to change without notice. Complete service manuals are available for all Kenwood transceivers and most accessories. *One year warranty in the U.S.A. only.*

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