73 Amateur Radio Today

NOVEMBER 1994
ISSUE # 410
USA $2.95
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International Edition

IT'S PROJECT TIME!

A 440 MHz Antenna for 10 Bucks!

Easy RF Power Meter

Inexpensive Packet Modems

More 73 Reviews

Antennas from:
MFJ and Isotron

Transceivers from:
Alinco, MXM, and Kenwood

11
0 74820 08725 1

Feel The Comfort Of Extended Operations With The IC-T21A!

IC-T21A
VHF FM
Transceiver

IC-T41A
UHF FM
Transceiver

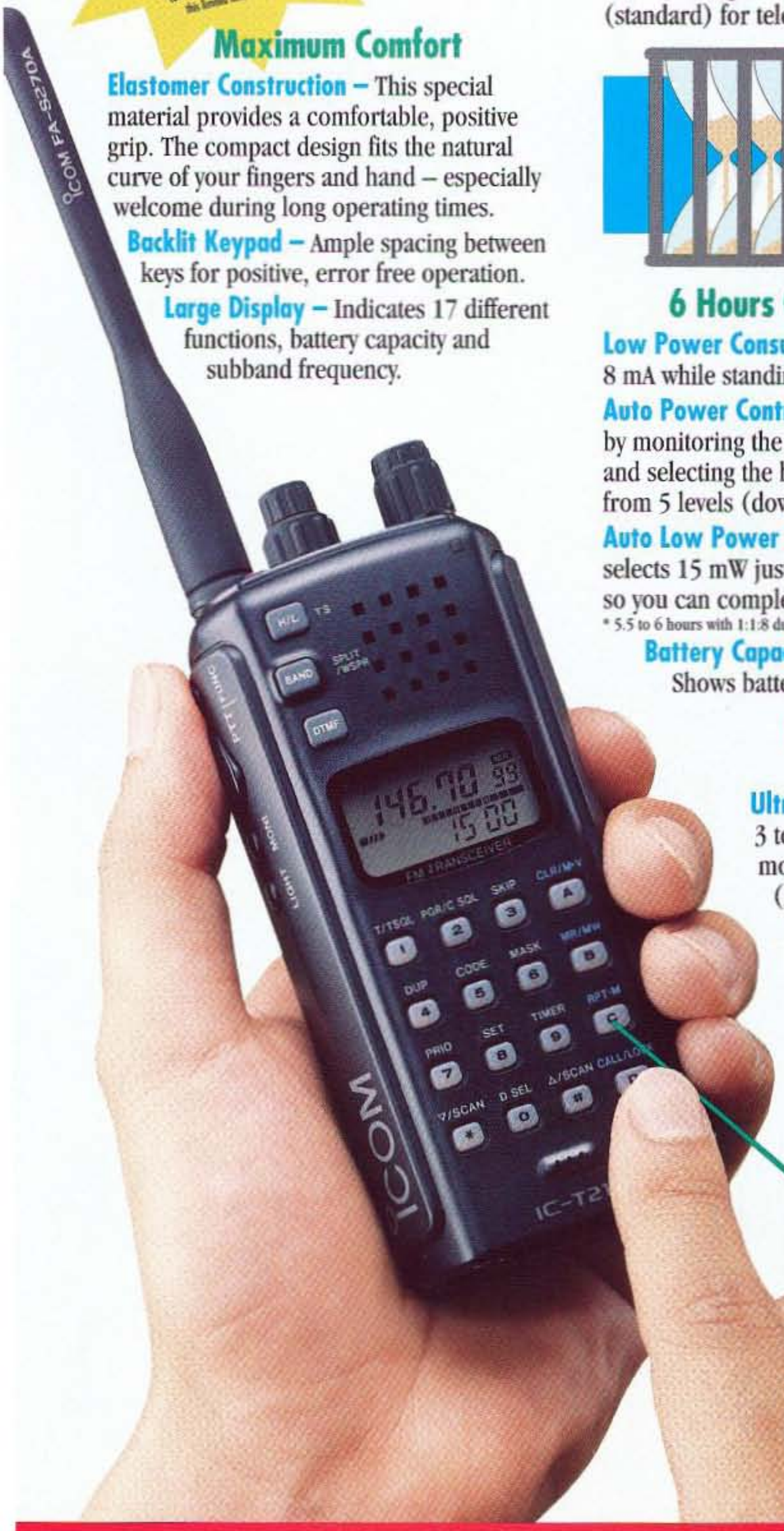
Expand your coverage with a **FREE!** SMA/BNC Connector with every radio purchased!
(See your dealer for details on this limited time offer!)

Maximum Comfort

Elastomer Construction – This special material provides a comfortable, positive grip. The compact design fits the natural curve of your fingers and hand – especially welcome during long operating times.

Backlit Keypad – Ample spacing between keys for positive, error free operation.

Large Display – Indicates 17 different functions, battery capacity and subband frequency.

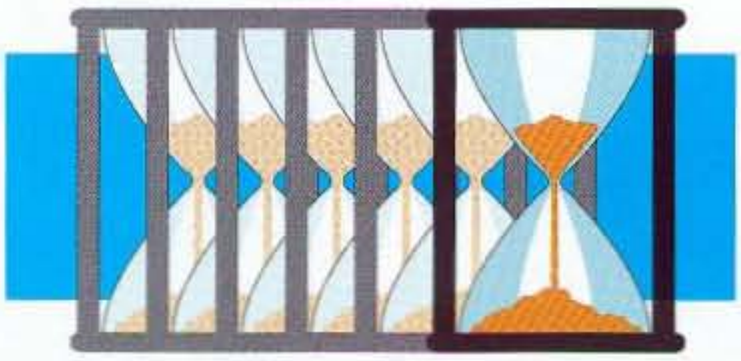


Backlit Keypad!
With 4 selectable levels of contrast!

Full Crossband Duplex Operation

Dual Band Receive Capability – Permits reception of another band (i.e.: 440 MHz on the IC-T21A).

Full Crossband Duplex Operation – Possible with the unique "whisper mode" microphone (standard) for telephone type QSO's.



6 Hours Operating Time*

Low Power Consumption – Consumes only 8 mA while standing by.

Auto Power Control – Conserves the battery by monitoring the repeater signal strength and selecting the best matching output power from 5 levels (down to 15 mW).

Auto Low Power Function – Automatically selects 15 mW just before battery exhaustion so you can complete your QSO.

* 5.5 to 6 hours with 1:1:8 duty cycle (Tx high : RX : Standby)

Battery Capacity Indicator – Shows battery capacity.

New Scanning Standards

Ultra High Speed Scan – 3 to 4 times faster than most other handhelds (33 channels/sec., 12.5 memory ch./sec.).

Bonus Band – Can be scanned while the main band is being scanned (e.g.: 70 cm for the IC-T21A).

6 Priority Watch Modes – Check for other signals while operating on a VFO frequency.

Ultra-Convenient Repeater Operations

Subaudible Tone Scan – Detects, displays *and programs* the tone frequency into the VFO. Permits access to a repeater when you don't know the tone frequency.

Auto Repeater Function – Automatically activates repeater settings (duplex ON/OFF, duplex direction, tone encoder ON/OFF) when the operating frequency falls in the repeater output range.

Repeater Memory – Quickly recall settings of your last worked repeater (RPT-M key).

5 DTMF Memories – Automatically dial your favorite telephone numbers.

Selectable DTMF Transmission Speed – Adjust the IC-T21A/T41A to the capabilities of the repeater (5 cps, 2.5 cps, 1.6 cps, 1 cps).

Powerful 6 W Output Power*

Our newly designed SC-1257 power module provides all the power necessary to reach fringe areas. Accepts 4-16 V input.

* With a 13.5 V DC power source.

Innovative Memory Functions

114 Memory Channels – Store *all* repeater information.

Memory Select Channels – For quick access, up to 30 can be designated Memory Select Channels.

Memory Transfer – Quickly transfers a memory channel's contents to VFO. Useful for searching for signals near a memory channel.

EEPROM – Memory information is retained virtually forever.

And More!

- Includes Flexible Antenna, Belt Clip, Handstrap, Rechargeable Ni-Cd Battery Pack and Charger
- Built-in Pager, Code Squelch, Pocket Beep & Tone Squelch

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CIRCLE 179 ON READER SERVICE CARD

DEMAND THE BEST

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The outstanding abilities of the DR-600T set it apart from every other radio. Features like Wide Frequency Coverage, Excellent Intermod Rejection, Direct Frequency Entry from the microphone, Three Output Power Selections, Autopatch Memories, and 6 Scanning Modes make the DR-600T the radio of choice for demanding users. The Remote Mount Head allows for custom installation in most any vehicle, and also helps to deter theft.

This road-ready rig can also be remote controlled by any radio that transmits DTMF tones. This remarkable feature allows the DR-600T to act as a full-featured Cross-Band Repeater. For added control, a security code can be programmed that will allow control only by the control operator (you).

DJ-G1T

The DJ-G1T 2m HT from ALINCO scores another "First" for Amateur Radio technology. Our new "Channel Scope" feature opens new doors for Ham operators. Now it is possible to visually monitor up to 7 memory channels at once with just a glance at the display.

Also, the Channel Scope feature can be used to show band activity in the frequency domain, much like a Digital Spectrum Analyzer. Hunting for band activity just got easier.

Other outstanding features include 440 Receive, 80 Memory channels, AM Aircraft receive, 5 Autodialer channels, DSQ for private paging, Cross-Band Semi-Duplex, 6 Scan Modes, and Odd Splits on all Memory Channels.

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BRAND NEW FROM ALINCO

The brand new **ALINCO DR-M06T 6-meter VHF FM mobile transceiver** lets you broaden your scope of communication and enjoy sporadic E propagation. Easy programming and compact size are only a few of the outstanding features that bring the excitement of the 6-meter band directly to you. (FCC approval pending)

Super compact size!

5-3/5" (W) x 1-3/5" (H) x 4-3/5" (D)
Operational at 50 MHz – 54 MHz with 10 Watts output.

CIRCLE 67 ON READER SERVICE CARD

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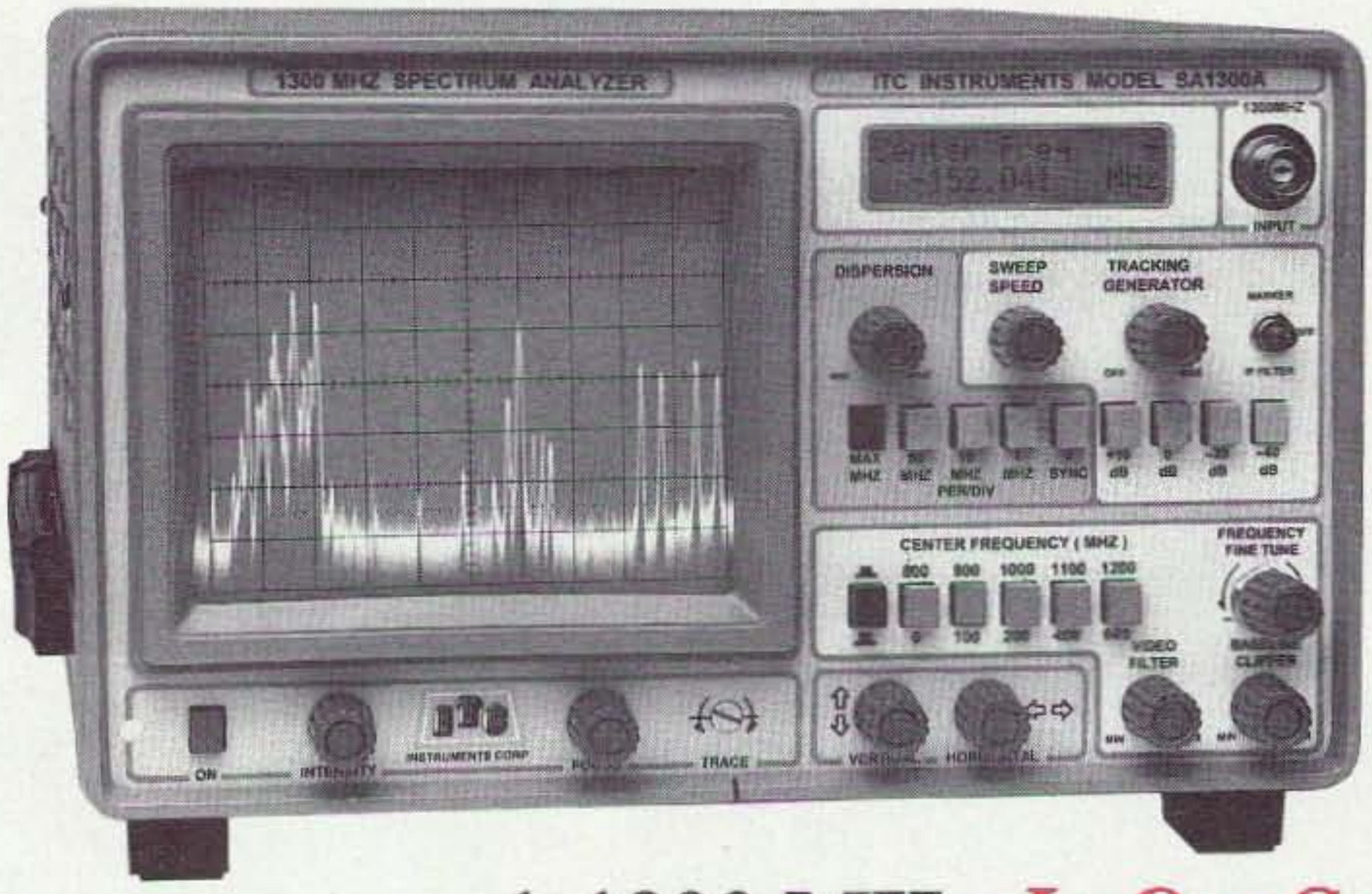
MADE IN THE USA ITC SA500A is a full function Spectrum Analyzer covering all Ham Radio, Two way Radio, TV, & CATV frequencies bands to over 500 MHz. *Add Opt. 3 Narrow Band Filter for only $200 and the SA500A becomes a full range *Pan Adapter /Spectrum Display Monitor** The SA500A Includes Center Frequency Display, 50 MHz Marker Generator, 50 MHz Tracking Generator, -100 dB Dynamic Range, 80dB on Screen, and -100 dBm Sensitivity.



INTRODUCTORY OFFER

SA500A With Center Frequency Display, 500 MHz Tracking Generator plus 50 MHz Marker Generator
ONLY $895.00 *

SA1850S Covers 850 to 1850 MHz in One Sweep, LNB Power Supply, 110/220/12vdc/Battery Operation, Carring Case Center Freq. Display. The lowest cost Satellite Analyzer avalble.
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SA1300B & OPT.s 1, 3, 4, 6
ONLY $1895.00*

SA1800C & OPT's 1, 3, 4, 6
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SA1800C	$1895.00
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OPT. 3 +/- 5KHz Res. B. W. Filter	$350.00
OPT. 4 12 VDC Inverter Adapter	$100.00
OPT. 5 1000 MHz Tracking Generator	$250.00
OPT. 6 7 Digit Center Frequency Display	$300.00

* Note: Introductory Prices for limited time only

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MADE IN USA +/-5KHz Resolution Band Width - 7 Digit Center Freq. Display - 12vdc operation
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25 MHz Dual Trace w/ 3 in 1 TestLab $429.
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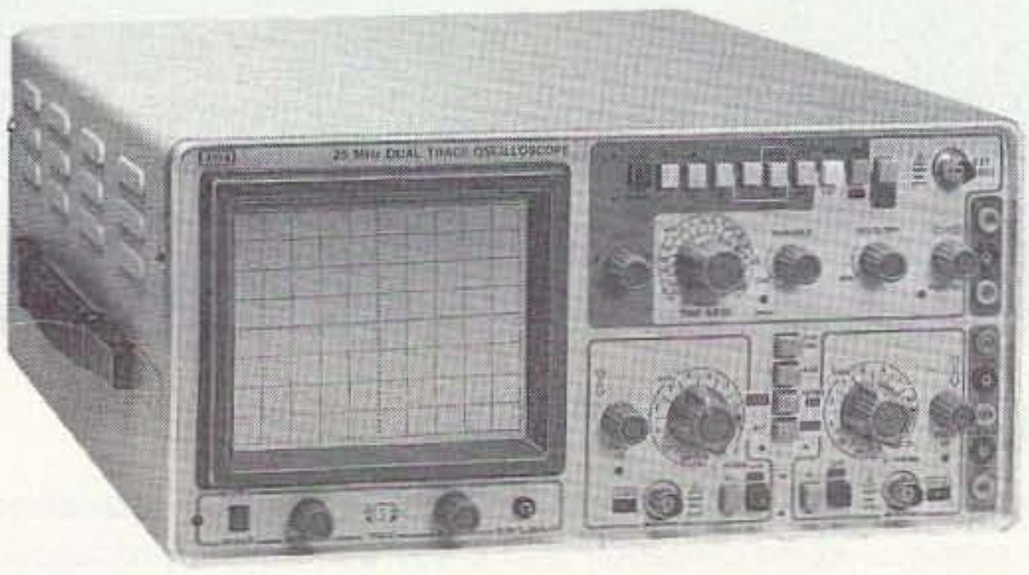

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Dual Component Tester
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+5 / 1A, +/- 12 /.2A
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Rise Time <14 nS
Full TV Trigger TV-H, TV-V
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6" Very Bright 12kV CRT
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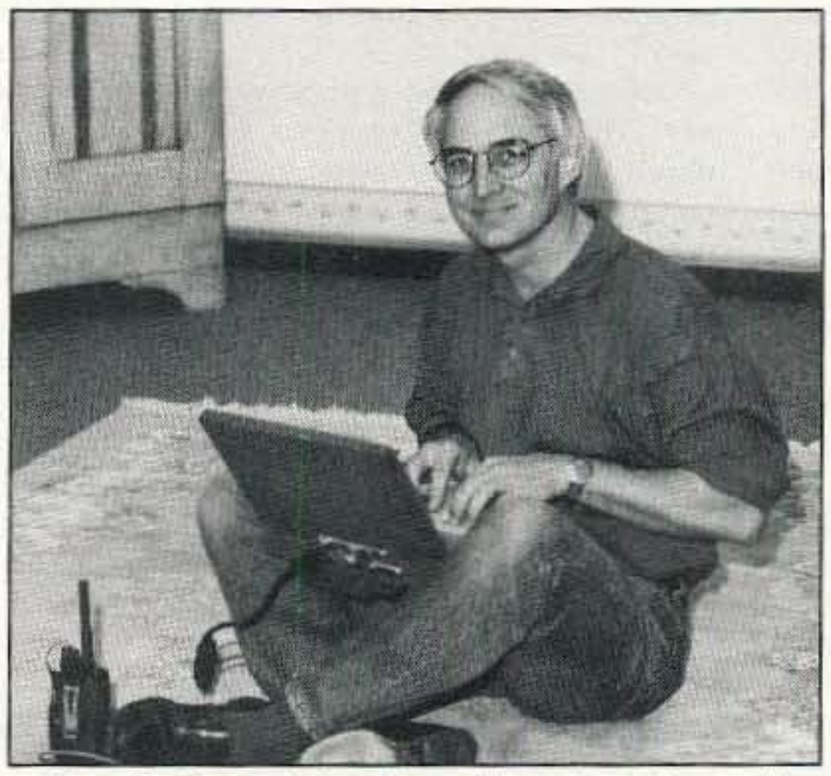

How about a packet modem with a price so low you'll have to sit on the floor to use it? Turn to page 42.

DEPARTMENTS

FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

On the cover: Here is how Jose Rivera KP4FMD camouflaged his Eagle DX-VI Gap antenna, using plastic vine. The antenna is practically invisible from the street. (A one-year subscription extension goes to KP4FMD in the 73 photo search. TNX.)

FB

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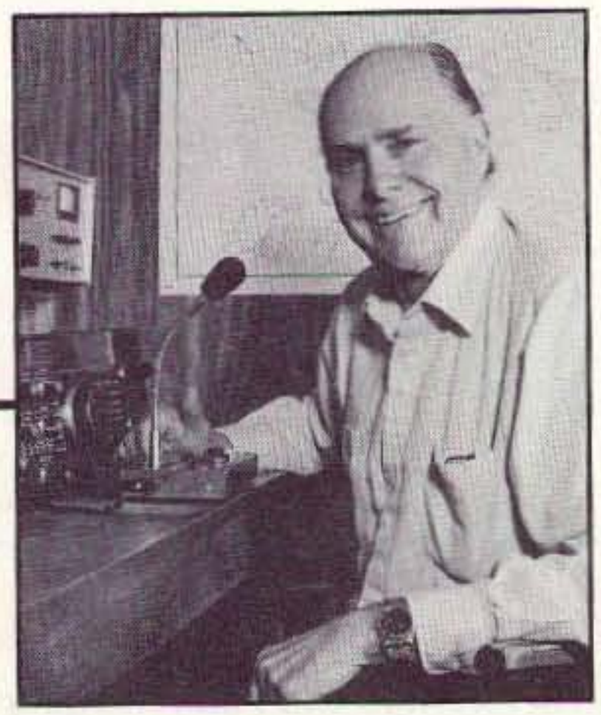
Contract: As a *73* reader, you are hereby ordered to start your ham radio holiday shopping early. You'll find some great gift ideas in these pages, so get into that spirit of the season!

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



When I Started . . .

. . . publishing articles about 2-meter FM and repeaters in *73* back in 1969, I met with massive resistance from the readers. It took about a year, a couple hundred articles, FM symposiums, which I organized around the country, a repeater atlas, and my publishing several books, to get repeaters launched. It takes a bunch of priming to light the fire under the spirit of adventure.

. . . and we have endless adventure available in amateur radio. It was the same thing when I began publishing tons of articles on sideband. Sure, today sideband and repeaters are common, but it took the work of many pioneers to make that happen. And those pioneers had the time of their lives out there on the fringes of the known ham world exploring the then unknown. They're the ones who hacked out the underbrush for our ham highways of today.

The first ham I ever met, as I mentioned in an editorial recently, was Harry Stevenson W1CUN, who was a 10 meter pioneer in my home town of Bethlehem, NH. As a publisher I've had the priviledge of knowing many of the great ham pioneers. Like Copthorn Macdonald, the chap who brought us slow-scan. And Sam Harris W8UKS-W1FZJ-W1BU, who invented the parametric amplifier and helped popularize moonbouncing. And John Williams W2BFD, the father of ham Teletype.

Though I'd talked with him for several years on the air, I first met Sam in 1951 when I moved to Cleveland. Sam had built the cellar for a new home (he and his family were living in it) and a 170' tower. I was working as a TV director at WXEL and was active mostly on 75m. I spent a good deal of time visiting Sam. Then, when he moved to Boston, I stayed at his house several times to talk VHF with him. When I took over as the editor of *CQ* in 1955 I got Sam to do the VHF column.

Sam had a psychological problem. He *had* to have the loudest signal in the world on any band he was on. This made moonbouncing on 2m a cinch for him. I think he was running 12 elements on 20m, just to make sure no one could be louder. He lived way out in the woods in Medfield, far from any neighbors, so his PP-1000-T final amplifiers for each band running who knows how many kilowatts didn't cause much TVI. They did have to shut down the FCC monitoring post in the next town (Millis) when he was operating. He wiped 'em out.

When I set up my station 2,500 feet up on Mt. Monadnock in southern New Hampshire, with an AM kilowatt on 2m and a 336 element beam, I put out a stronger signal than Sam, so that drove Sam not just off 2m, but out of the country. He moved to Puerto Rico and set up to use the 1,000-foot Arecibo dish for moonbounce. He did whatever it took to have the loudest signal in the world.

John Williams was another nut case. He got an exclusive contract to dispose of Ma Bell's retired Teletype machines and sold them to hams pretty much at cost. He developed all the early RTTY circuits. I spent a lot of time visiting him in his radio repair store in Woodside, Queens (NY). He's the one who got me hooked on RTTY, and that was what eventually got me started in publishing. He and I set up the first repeater in New York on top of the Municipal Building, allowing RTTYers for a hundred miles around to work each other on 2 meters.

Then there was Jack Babkes W2GDG, who lived a few blocks from me in Brooklyn. He's the guy who came up with the idea of narrowband FM. I met him in 1946 and immediately started converting my transmitters so I could help pioneer NBFM. Once Jack got the FCC to accept NBFM he went into business with Sonar Radio and made zillions. Today most of our VHF and UHF hamming is via NBFM. Thanks Jack.

Have all of the frontiers of amateur radio been conquered? Not by a long shot! There are endless possibilities for developments. All you have to do is get interested in some subdivision of the hobby and you'll find uncharted territory wide open for anyone with the spirit of adventure.

We're sending gorgeous color photos by slow-scan now, but by applying some of the newer data compacting algorithms and technologies, you could help speed photo communications and improve picture quality. And who knows, you might even have some latent unfulfilled desire to help others have fun doing this and start writing a series of articles for me to publish. Maybe a column. Maybe a book. That's what I did when I got interested in RTTY. First I started a newsletter, then a column in *CQ*, and then a book.

I was very sorry to read my old friend Lloyd Colvin W6KG recently passed away. He and his wife Iris W6QL have been the most prolific DXpeditioners of all time. The only big disappointment for me was that they didn't write much about their adventures. Believe me, every DXpedition *is* an adventure. I've operated from some weird spots, and every one has been exciting.

But then I've known all of the major DXpeditioners pretty well. Don Miller W9WNV, Gus Browning W4BPD, Dick McKircher WØMLY, Danny Weil VP2VB and his Yasme, and so on. I published some great stories of Gus' adventures. Ditto Danny's. Dick, as far as I know, pioneered the concept of signing rare country calls without actually going to the trouble to go to them, a technique which Don later developed into an art form. Like claiming to be on Heard Island while actually operating from north of Vancouver, the antipodes.

If you'd like to get involved with repeaters, we really don't have much need for just another repeater. There's a ton of 'em, and most are only being used a little of the time. But how about setting up a crossband repeater system? In on 2m, out on 6m, 220, 450, 1290, or perhaps 10m, 15m, or 20m, complete with remote tuning and beam turning? Let's get creative! I used to have a ball hooking up 75m roundtables with rare DX on 20m, relaying the round table to the DX station, and vice versa. Yes, that takes two rigs. You mean you don't have two rigs? Lordy!

Between packet, ham satellites, foxhunting, spread spectrum, slow-scan, and so on, there are endless areas for exploration and adventure. How about pioneering a modern counterpart of the Antique Radio Relay League's traffic system. But instead of passing worthless messages at 10 wpm and making endless errors, how about setting up a 25,000 wpm error-free message system which can scan in messages, establish the right routing automatically, and confirm the delivery?

If you decide to be adventurous and tackle something new in amateur radio, I'm going to be very upset if you don't keep a careful log of your adventure and give me a chance to get others excited by publishing it.

One of the airlines has a special on visiting Pacific Islands . . . only $150 per island. I sure wish I had the time to pack a rig and a couple antennas and put some of those rarer spots on the air and liven up our un-sun-spotted bands. I've operated from a lot of rare spots and I'm a skinflint when it comes to travel. It doesn't have to cost a bundle, as anyone who's read my travel adventures will tell you. I've got a few of my trips written up if you're interested in how cheap someone can travel. My *Uncle Wayne's Hawaiian Adventure* last year (24 pages) is $3. My *Uncle Wayne's Trips* to Russia, London, St. Pierre, Munich, Vienna, Krakow, and Prague (52 pages) is $5. My *Uncle Wayne's Caribbean Adventures* (96 pages) is only $7.50. They're available from Uncle Wayne's Bookshelf (800-234-8458). One of these days I'll put them all together into a book.

I almost forgot, my *Submarine Life in WWII* (76 pages) is $7.50. It's not very hammy, but it's exciting reading. And there are still a few copies of my book, *We The People* ***Declare War*** *On Our Lousy Government* for $10. A special thanks to all of you who've bought the book and written to tell me how much you've enjoyed it. Now get busy and start changing things.

There's nothing like taking on a new challenge in the hobby to get your juices going. You'll learn more, and you'll have tons of fun. When I think back over my years of hamming, I think first of the most exciting times. Putting up that repeater antenna on top of the Municipal Building at night, in a snowstorm, on a steep copper roof. Installing a 16-element 2m beam on top of The News building on 42nd Street, where I had to walk on a narrow ledge with a 30-story drop to put it and its rotator in place. Making 10 GHz contacts from on top of a New Hampshire mountain in the freezing cold at night to get a new state. The excitement of operating from Navassa Island and two close calls with death on the trip. Almost getting killed in Kenya by Somali tribesmen while visiting 5Z4ERR. The fun of making the first coast-to-coast 80m RTTY contact. Walking around Peterborough with an HT making 20m DX contacts via a 2m repeater. Working moonbouncers all over the world on 1296 MHz from the big dish at Arecibo. Working my own home station on 20m and 75m from Australia and hearing it S9++ on both bands. Also working it from Beirut, Damascus, Kabul, and Katmandu. Wow!

Continued on page 76

COMET

MODERN, MULTI-BAND ANTENNA SYSTEMS

MOBILE ANTENNA PRODUCTS

Modern, high-performance stations use COMET Antennas, Duplexers, Triplexers and Accessories! COMET products are designed to provide an exceptional level of signal quality and coverage area. Whether operating mobile or from your base station, COMET products make you sound good. No other product line has the selection, convenience, quality and performance!

DUAL-BAND MOBILE ANTENNAS

FL-67S Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 4.5dBi 5/8 wave 446MHz 7.2dBi 5/8 wave x 3	1.5:1 or less	150 watts	4' 11"	Gold Plated PL-259

FL-62S Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 3.5dBi 1/2 wave 446MHz 6.0dBi 5/8 wave x 2	1.5:1 or less	150 watts	3' 5"	Gold Plated PL-259

NEW!

SB-7/SB-7NMO Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 4.5dBi 6/8 wave center-loaded 446MHz 7.2dBi 5/8 wave x 3	1.5:1 or less	70W FM	4' 7"	PL-259 or NMO style

NEW!

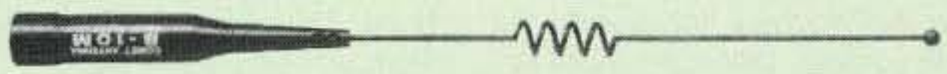
SB-5/SB-5NMO Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 3.0dBi 1/2 wave 446MHz 5.5dBi 5/8 wave x 2	1.5:1 or less	120W FM	38"	PL-259 or NMO style

NEW!

SB-2/SB-2NMO Dual-Band 146/446MHz

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi 1/4 wave 446MHz 3.8dBi 5/8 wave	1.5:1 or less	60W FM	18"	PL-259 or NMO style



NEW!

B-10/B-10NMO Dual-Band 146/446MHz, Cellular Look-a-like

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 0dBi 1/4 wave 446MHz 2.15dBi 1/2 wave	1.5:1 or less	50W FM	12"	PL-259 or NMO style

B-20/B-20NMO Dual-Band 146/446MHz, Cellular Appearance, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi 1/2 wave 446MHz 5.0dBi 5/8 wave x2	1.5:1 or less	50 watts	30"	PL-259 or NMO style

NEW!

SB-25/SB-25NMO Mono-Band 146MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 4.1dBi 5/8 wave center loaded	1.5:1 or less	100W FM	4' 9"	PL-259 or NMO style

NEW!

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HM-P2K: Kenwood Version
HM-P2F: Icom/Yaesu Standard/Alinco/etc.

TRI-BAND MOBILE ANTENNAS

CX-224/224NMO Tri-Band 146/220/446MHz, w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi 1/2 wave 220MHz 3.6dBi 5/8 wave 446MHz 6.0dBi 5/8 wave x 2	1.5:1 or less	100 watts	3'	PL-259 or NMO style

FJ-15S Tri-Band 52/146/446MHz w/Fold-Over

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
52MHz 2.15dBi 1/4 wave 146MHz 4.5dBi 6/8 wave 446MHz 7.2dBi 5/8 wave x 3	1.5:1 or less	120 W FM	4' 10"	PL-259

HF MOBILE AND HT ANTENNAS

HA-4S Quad-Band HF 40/*(20)/15/12/10 Meters w/Fold-Over

NEW!

Wave:	VSWR:	Weight:	Length:	Max Power:	Connector:
1/4 wave	2:1 or less	1 lb. 14 oz.	4' 4"	120W SSB (200W SSB 28MHz)	PL-259

*L-14HS Optional 20 Meter Coil

SH-55 Super Flexible 146/446MHz HT Antenna

Gain & Wave:	Max Power:	Length:	Connector:
146MHz 1.5dBi 1/4 wave 446MHz 3.2dBi 5/8 wave x 2	10 watts	15.5"	BNC

NEW!

CH-722SA High Gain HT Antenna
Gain & Wave: 146MHz 3.0dBi 1/2 wave
446MHz 5.5dBi 5/8 wave x 2
Max Power: 50 watts
Length: 35", 2 sections, 18" each
Connector: BNC

CH-32 Miracle Baby
146/446MHz HT Antenna
Gain & Wave: 0dB 1/4 wave
Max Power: 10 watts
Length: 1.75"
Connector: BNC

DUPLEXERS AND MOBILE MOUNTS

CF-4106K, I, J,
146/446MHz

Band Pass, Ins Loss, Max Pwr.
1.3-150MHz, 0.1dB, 800w PEP
400-540MHz, 0.2dB, 500w PEP
Isolation: 60dB
CONNECTORS:

	4160K	4160I	4160J
Output:	SO-239	SO-239	SO-239
Low In:	PL-259	PL-259	SO-239
High In:	PL-259	N-Male	SO-239

RS-21
Trunk, hatchback, rear door (van, blazer, etc.) mount. Adjustable to virtually ANY angle. Rubber-coated base protects vehicle paint.

NEW!

RS-820
Heavy-Duty, Low Profile Trunk Lip or Hatch Back Mount. Rubber-coated base protects vehicle paint.

WS-1M
Multi-Adjustable Window Clip Mount.
11.5 feet of high quality coax. Gold-plated UHF Conns. for Antennas up to 40" in height.

NEW!

3D4M Standard Cable Assembly
13.5 feet of low loss coax. Gold plated UHF (PL-259/SO-239) connectors.

3D5M Standard Cable Assembly
Same as 3D4M, but 17 feet of coax

CK-5M Deluxe Cable Assembly
13 feet double shielded very low loss coax + 12" RG-188 teflon coax. Gold plated UHF (PL-259/SO-239) connectors.

CK-5M5 Deluxe Cable Assembly
Same as CK-5M, but 17 feet of coax

CIRCLE 54 ON READER SERVICE CARD

LETTERS

Number 2 on your Feedback card

From the Ham Shack

Tony Burton, Calhoun GA Wayne, it was with a great deal of interest and head-nodding that I read your editorial in the June '94 issue of *73*. While I do not yet have my own ham license (I am working on the *&$##!@! code), I do have my GROL from the FCC, and was the ship's MARS officer on my last ship. I've made a lot of patches and sent quite a few MARSGrams.

Let me first say that, technically, I feel that I could sit for the test elements up through at least Technician or even General with little or no preparation. After 12 and a half years as a Navy electronics technician, being a Navy instructor of electronics, almost two years as a satellite communications field engineer, and teaching electronics at both the junior college and high school level, this isn't a problem for me.

And, I do understand the need for my knowledge of the rules and regs. So, I study. But I'm darned if I really understand the need for CW! Oh, sure, I have heard the arguments about how it is the most reliable, last-ditch form of communication to punch through static and so forth, but why make it a *requirement*?

As you so clearly stated, it is an anachronism. It is like requiring hams to be able to calculate the proper biasing resistance values for a particular twin-pentode from memory, without use of a calculator, just in case they ever needed to be able to do it.

After all, most people who send and/or copy code anymore don't *really* pound brass—they tap on a keyboard, and send it out all neat and clean and edited from their PC. And, when copying, they simply read it from the screen of their computer, which is hooked up to their rig. I guess sending and receiving CW *could* be fun. But if it was all that much fun, wouldn't it be something reserved for Extra Class? Even the Navy and other military forces have all but abandoned the requirements for their operators to be able to copy Morse!

So, until the FCC changes the requirements, I will continue to listen to the code prep tapes that WB6NOA has produced. But, considering the trouble I am having with code now, don't expect me to ever get past Technician Plus. At this point, at least, I think I have better things to do with my time.

While I'm on my soapbox, let me address another issue that you brought up—school clubs. I am now a Technology Education teacher at a small rural high school. This is only the second year of the program at my high school, so I am trying to get it rolling.

I told my students about my experiences as a MARS officer, and some of them seemed very interested. So, I began considering the idea of incorporating ham licensing into the curriculum for the second year, which is, appropriately enough, Communications Technology I and II. I felt that if a kid could walk from a semester-long course with not just a letter grade but with a ham license, that kid would have a lot more pride and feelings of ownership in the educational process. But, my budget has been cut by $500 for the coming year, and it wasn't a big budget to begin with.

I wrote letters to some manufacturers, asking them about the possibility of donations, even of old or refurbished equipment. I haven't had any positive answers yet, except for one company which said they would give discounts to educational institutions buying their equipment. I have put notices on a couple of local computer BBSs where I know some hams hang out, asking them for their ideas or donations. No luck yet.

What is it with these companies? Is their business so good that they don't want anything that will (1) build good PR for their company; (2) build a strong association of their product name with these potential hams because it is what the kids use at school (and if you don't think this works, ask the folks at Apple Computer); or (3) encourage the entry of new blood into the ham field? As you said, are they content to simply log in the Silent Keys? It is simple: New users buy equipment. And, even if they buy someone else's used equipment, that means that the previous owner now has the money to buy that new TNC or whatever he has been wanting.

Well, I know I will be setting up my own personal ham shack this fall. I have been doing some extra work this summer to make the money for it (you know what teacher's salaries are like). And, I can tell you for sure, it will be a cold day in Havana when I buy any equipment from a manufacturer that doesn't at least offer reduced pricing to educational institutions.

Tony, you're right about the code. But on getting free gear or discounts, you are like many teachers, short on salesmanship. When you want to sell someone something, you put yourself in their chair and see if you can convince yourself. I'll bet you won't. The ham manufacturers get a wastebasket full of requests for free or discounted equipment every week. A big wastebasket. Every DXpedition thinks a rig and antennas should be donated for the PR involved, as do schools, clubs, a hundred hamfests, a dozen conventions, the handicapped; they all are banging on their begging bowls for handouts. Gets old. You'll get more enthusiasm if your kids have some goals to work for . . . like setting up a club station. It's a challenge to see how much they can do with how little. And then they'll have something they've worked for and can be proud of. The manufacturer's margins are thin in the ham business, and dealers get all bent out of shape if a manufacturer sells direct to the customer. And when they're bent, they talk down the gear and talk up the competition, so being nice guys and giving your group a discount could poison the well for the manufacturer . . . Wayne

Jim Oss AAØPP, Junction City KS Dear Wayne and Phillip Kawa (September 1994 "Letters" column): As a former Coast Guard radioman, I have to say that they had a most effective code-learning method—negative reinforcement; i.e., if you didn't come up to code speed by the weekend, you didn't go on liberty.

Dennis D. Powers AB6QR, Forest Ranch CA I doubt if I can qualify as an "old geezer," as WD9HXH prefers to call CW operators (August 1994 "Letters" column). I guess being only 42 years of age makes me a middle-aged geezer. But I have to wonder if in pointing out that 50 years worth of sending by CW could be accomplished in a mere 3.38 minutes by using "modern technology," he happened to give thought to a couple of minor considerations. First, before you can send out that glorious burst of speedy little megabits you have to do a little typing, which in some cases might take some folks all of 50 years! Secondly, did he ever consider that there are those of us who enjoy a nice, relaxed chat? I would hardly call 473,364,000 words in 3.38 minutes a nice leisurely chat!

The requirement that access to the HF bands is limited to those who have demonstrated at least the ability to pass a 5 wpm CW test is in the best interests of amateur radio. And the requirements for passing higher-speed tests for higher-class licenses serve the same purpose. Ultimately, these requirements help to ensure that those who will be operating in the HF bands will have demonstrated some *commitment* to both themselves and the hobby. For amateur radio to maintain its high standards, we need to ensure that only those who have commitment to both themselves and the hobby are welcomed into our ranks.

Bill Martin N7EU, from the 73 BBS I think the quality of the magazine has really been improving. I enjoy the fact that *73* magazine provides us with a lot of really neat projects for the homebrewers. Very interesting and valuable articles. I really like Mike Bryce's articles and columns about QRP, and his reviews on kits and projects. Keep up the good work.

Gene Shannon, Colorado Springs CO Wayne, I read your blurb on artificial lighting ("Is Artificial Light Making You Sick?") in your March editorial and can't help but make a response to a comment you made.

First, I couldn't agree with you more on your opinion about the results of artificial light on our lives—just like so much else that we use from the artificial realm in our day-to-day living. We, indeed, need to watch the research in this area—assuming we can get some *real* scientific study in the area, and not some of the global warming type of garbage!

I don't want to turn your good magazine into a theological treatise but, in the interest of "fair journalism," a statement in your third paragraph concerning those "intellectually stunted by religious fundamentalism or watching too many sitcoms" deserves discussion. Then you tie that into the evolution theory bit as if it were fact.

I must agree with you that the sitcoms will certainly stunt one intellectually, but I would also add, stunt one emotionally and morally! The real "stinger" to me is how a person of your intellectual prowess can come up with your statement on evolution—as if it were the truth! Even Darwin himself, in his book *Origin of the Species*, was puzzled by the fact that no "transitional forms" had been found. He asked, "Why . . . do we not everywhere see innumerable transitional forms?" (*Darwin on Trial*, Dr. Phillip Johnson, page 47). And today, after more than 135 years of all kinds of research, still no "transitional forms" have ever been found. I'll bet you can even imagine why not. To me, the probability (likelihood) of all creatures having evolved from some "mass of slime" takes much more faith than to believe in a Creator. (The mathematical probability of such occurring is pretty phenomenal as well.)

Back to the artificial light topic—I can only add that I feel that your conclusions concerning the adverse affects on people is having the same results on we who created it as it has on those who believe they evolved. We both need to take the proper precautions. Otherwise, keep up the good work.

P.S.: Do you suppose the increase in crime, drug usage, abortion, and other social ills might be related to the propagation of the "we are animals" syndrome and have no One to be accountable to? I can see a correlation.

Gene, I'm aware of the weaknesses in Darwin's theories, but for the most part they have been proven. On the matter of the lack of transitional forms, I like the Hoyle-Wickramasinghe theory the best, as I've mentioned in my past editorials. I hope you take time to read their books, which are scientific marvels.

As far as a "Creator" is concerned, sure, perhaps. We're just too ignorant so far to know about that other than by speculation (guess). But I've seen no sign yet of a creator who is messing with our lives on a daily basis, or who rewards or punishes. Again, I like the Hoyle approach, which makes a very good scientific case for any Creator (and life itself) probably predating the start of our universe.

Hey, if there is a Creator, how did it get created? Yes, I know, it's turtles all the way down. . . . Wayne 73

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

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- **FCC type accepted** for commercial service in150 & 450 bands.
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NEW **REP-200T Voice Message Repeater.** As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air** and played back at user request by DTMF command, or as a periodical voice id, or both. ..... **kit $1145, w&t only $1395**

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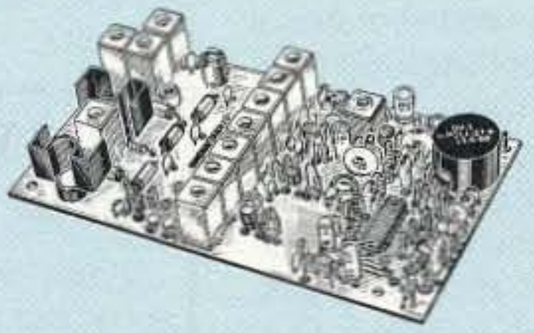
XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

Also available in rf-tight enclosures, and with data modems.

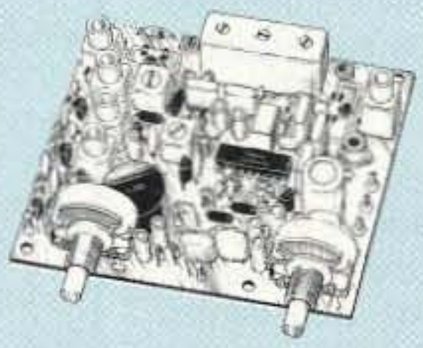
FM EXCITERS: 2W continuous duty. TCXO & xtal oven options. ***FCC type accepted for com'l high band & uhf.***



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

VHF & UHF AMPLIFIERS. For fm, ssb, atv. Output levels from 10W to 100W. Several models starting at $99.

FM RECEIVERS:



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

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

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

ACCESSORIES

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

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

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

NEW

COR-6. COR & Real Voice ID on one board. Digital ic records up to 20 seconds of your voice.

Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter. kit $99, w&t $149

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

Play back as often as you like through a small external speaker. Extensive manual tells how to use multiple messages and adapt to many applications. .....kit $59, w&t $99

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

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

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

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

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

DATA MODEMS

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

.....kit ea $49, w&t ea $79

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

Low Cost GaAsFET PREAMPS

LNG-(*)

ONLY $59 wired&tested

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

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

LNW-(*) MINIATURE PREAMP

ONLY $29 kit, $44 wired&tested

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

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

LNS-(*) IN-LINE PREAMP

ONLY $89 kit, $119 wired&tested

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

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

HELICAL RESONATOR PREAMPS

GaAs FET preamps with helical resonators **reduce intermod & cross-band interference** in critical applications.

MODEL HRG-(*), *$80 vhf, $110 uhf.*

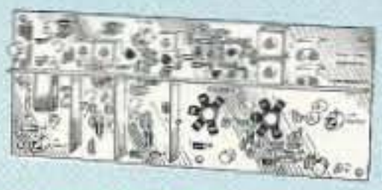
**Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-470.*

RECEIVING CONVERTERS

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

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

TRANSMITTING CONVERTERS



XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 220, 222, 432, 435, and atv. 1W output. ***Kit only $89.*** PA's up to 45W available.

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Marconi's Widow Dead at 94

The widow of Guglielmo Marconi has died at age 94. The Marchesa M. Christina Bezzi Scali died July 15, 1994. The couple was married in 1927. Marconi died in 1937, 10 years after his wedding, at age 63.

The couple is survived by a daughter, Elettra, who was baptized by Cardinal Eugeni Pacelli, who would later become Pope Pius XII. Elettra's Godmother was Elena di Savoia, Queen of Italy.

According to Pat Ciancarini IØKHP, Elettra will continue to work in preparation for "1995, Year of Guelielmo Marconi," the centennial celebration of Marconi's first wireless telegraph. *TNX QCWA News, Vol. 36, No. 9, September, 1994.*

GB2SM Now Obsolete

According to Britain's *Short Wave Magazine*, a shock announcement has come from London's Science Museum that the museum's amateur radio station will officially close down operations on November 7. The comprehensive station, which features satellite fax, and RTTY mode reception capability is now considered obsolete.

Speaking on behalf of the museum, Graham Farmelow, Head of Education Interpretation, said, "The station exhibit no longer reflects the contemporary image of modern communications required by the broader audience attending the museum." The amateur radio station section of the display has used the famous callsign GB2SM for nearly 40 years, and has served as a sort of international ambassador.

The space currently occupied by the exhibit will be turned over to a display relating to data communication superhighways—a phenomenon which was pioneered by hams! The move is seen as a loss to the amateur community worldwide. Comments can be directed to *Sir Neil Cossons, The Science Museum, Exhibition Road, London SW7. TNX Short Wave Magazine, Vol. 52, Issue 9, September, 1994.*

FCC On the Move

The Federal Communication Commission's Washington headquarters will be moving from its present northwest downtown location to southwest Washington, DC after all. An agreement between the General Services Administration and "The Portals" has been reinstated by an appeals court.

The US Court of Appeals ruled that the GSA as the federal leasing agent had improperly terminated the lease in 1991 after FCC officials turned thumbs down on the move. The commission had argued that the leased space was inadequate to accomodate their needs and they did not want to leave the fashionable business area which was more convenient for communications industries representatives.

The GSA has now re-signed the lease with "The Portals" (which is still far from completed) and is scheduled to eventually move all of their administrative offices some two miles south. It could take six to eight years for the move to be completed. "The Portals" is on the Potomac River between the Washington Monument and the US Capitol. The lease will cost taxpayers about $15 million annually for 440,000 square feet—about $34/square foot. Word is the FCC is not giving up the fight to remain where they are. *TNX W5YI Report, Vol. 16, Issue 17, September 1, 1994.*

ORACLE Calls for "No Code—Worldwide"

Manditory Morse Code testing for any class of ham radio license, anywhere in the world, will be a thing of the past if a new campaign succeeds, according to a story in the *Westlink Report*. The Organization Requesting Alternatives by Code-Less Examinations, hopes to make its "ORACLE" acronym a household word by the time of the next World Radiocommunications Conference.

ORACLE is a newly conceived international organization based in Wellington, New Zealand. Its mission is to do away with the requirement for knowledge of Morse Code as a prerequisite for obtaining a ham license anywhere in the world. Rather than working with the various nations' amateur radio societies, ORACLE is bypassing them in favor of national and international regulators. Many of the radio societies are in favor of keeping the manditory code testing, but it will be the regulating bodies who will decide the fate of these exams.

You can contact ORACLE by mail at *Organization Requesting Alternatives by Code-Less Examinations, 90 Campbell St., Karon, Wellington, New Zealand, Att: Bob Vernall ZL2CA. TNX Newsline, W5YI Report, The Vernall Report, and Westlink Report, No. 679, August 31, 1994.*

Russian Space Pact

According to *Newsline*, Russian and American amateurs who flew aboard the space shuttle Discovery on last winter's STS-60 mission benefitted from temporary third party reciprocal operating agreements finalized just before lift off.

On February 3, the US Department of State and the Russian Ministry of Post and Telecommunications each approved the temporary arrangements, which allowed cosmonaut Sergi Krikalev, U5MIR, to contact the House of Science and Technology for Youth in Moscow on February 6. The contact was retransmitted in Russia on HF and VHF, according to the ARRL SAREX Working Group. After the Russian Ministry of Post and Telecommunications and the US State Department approved the arrangements, it was still necessary to obtain a Special Temporary Authorization from the FCC. The ARRL contacted the FCC's Personal Radio Branch, and the STA was granted on February 4. Permanent reciprocal operating and third party agreements between the US and Russia have been bottled in negotiations for several years. *TNX Newsline, Austin Amateur Radio Clubs' AARC/Over, August, 1994.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, 70 Route 202 North, Peterborough, NH 03458. Or you can reach us on compuserve at ppn 70310.775; on the Internet at address 70310,775@compuserve.com; or at the *73* BBS at (603) 924-9343 (2400-9600 bps), 8 data bits, no parity, one-stop bit. News items not published in *73* often find their way into our sister publication, *Radio Fun*, a special monthly magazine for new hams. You can also send news items by FAX at (603) 924-9327. 73

What you missed in *Radio Fun*!

Radio what? *Radio Fun*! You mean you don't read the ham radio magazine devoted to newcomers? Well, why not? In the November issue, you missed "Resistance," the latest in Larry Luchi W7KZE's series of articles on electronic fundamentals. Steve Katz WB2WIK/6 completed his 2-part series on "Mistakes New DXers Make." And Stuart Landau K6YAZ explained "How to purchase the right radio."

Special monthly columns include Joe Carr K4IPV's "Antennas, etc.," Mike Bryce WB8VGE's "Radio Magic," and Michael Geier KB1UM's "The Tech Side." Oh, yeah, and let's not forget Wayne Green W2NSD/1's incomparable "QLF."

Every month *Radio Fun* opens the wide world of amateur radio to thousands of recently licensed hams. How about you? Could you get into a magazine devoted to ham radio newcomers? How about donating a subscription to the kid up the street? To order *Radio Fun* dial (800) 257-2346 to receive 12 monthly issues for only $12.97. Get more fun and excitement out of amateur radio with *Radio Fun*!

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JST-245

160-10 Meters PLUS 6 Meter Transceiver

Fifteen reasons why your next HF transceiver should be a JST-245. . .

1 All-Mode Operation (SSB,CW,AM,AFSK,FM) on all HF amateur bands and 6 meters. JST-145, same as JST-245 but without 6 meters and built-in antenna tuner.

★ JST-145 COMING SOON ★

2 MOSFET POWER AMPLIFIER • Final PA utilizes RF MOSFETs to achieve low distortion and high durability. Rated output is 10 to 150 watts on all bands including 6 meters.

3 AUTOMATIC ANTENNA TUNER • Auto tuner included as standard equipment. Tuner settings are automatically stored in memory for fast QSY.

4 MULTIPLE ANTENNA SELECTION • Three antenna connections are user selectable from front panel. Antenna selection can be stored in memory.

5 GENERAL COVERAGE RECEIVER • 100 kHz-30 MHz, plus 48-54 MHz receiver. Electronically tuned front-end filtering, quad-FET mixer and quadruple conversion system (triple conversion for FM) results in excellent dynamic range (>100dB) and 3rd order ICP of +20dBm.

6 IF BANDWIDTH FLEXIBILITY • Standard 2.4 kHz filter can be narrowed continuously to 800 Hz with variable Bandwidth Control (BWC). Narrow SSB and CW filters for 2nd and 3rd IF optional.

7 QRM SUPPRESSION • Other interference rejection features include Passband Shift (PBS), dual noise blanker, 3-step RF attenuation, IF notch filter, selectable AGC and all-mode squelch.

8 NOTCH TRACKING • Once tuned, the IF notch filter will track the offending heterodyne (±10 Khz) if the VFO frequency is changed.

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

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

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

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

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

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

15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with "silent" cooling system designed for continuous transmission at maximim output.

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CIRCLE 159 ON READER SERVICE CARD

An Average and Peak Reading RF Power Meter

Add this handy monitor to your operating table.

by Marion D. Kitchens K4GOK

Analog meters used as RF power output meters usually show relatively little average power output on SSB, especially as compared to keydown output. This often raises questions about proper equipment operation, especially when the owners' manual specifies "100 watts PEP" and the analog meter is reading considerably less. Too much mike gain and over-driving are often the result, with splatter across the operating band. The true power output during normal, everyday operation is often an unanswered question.

Measuring the peak and average power can be important. Two different rigs were returned to the dealer for replacement because on-the-air reports were of considerably less signal strength than comparable rigs, even though the key-down power was the rated value. Under a similar situation with a third radio, the problem was resolved by using a different type of mike on the radio. These problems originated because the operator's voice frequency content and the radio audio processing were incompatible. Attempts to resolve these problems by measuring power levels with existing RF power meters proved unsuccessful because they were much too slow to follow the audio voice peaks.

The meter described here is designed to answer just such questions and to serve as a routine, everyday operating aid. It employs a remote sensor unit with a separate display that shows both average and peak RF output simultaneously. The output display unit can be used on the operating desk with the sensor unit out of sight under the operating position. The meter is left in the line and thus provides continuous indication that the transmitting equipment is operating normally. Abnormal readings may also indicate high SWR on the coax line.

The meter is easy to build, and uses readily available components. It is simple enough to be built on perfboard. No special, tricky, or sensitive adjustments are required.

Photo A shows the assembled meter with an analog meter and a 10-LED bar display. Average output power is shown on the analog meter and peak power output is shown on the LEDs.

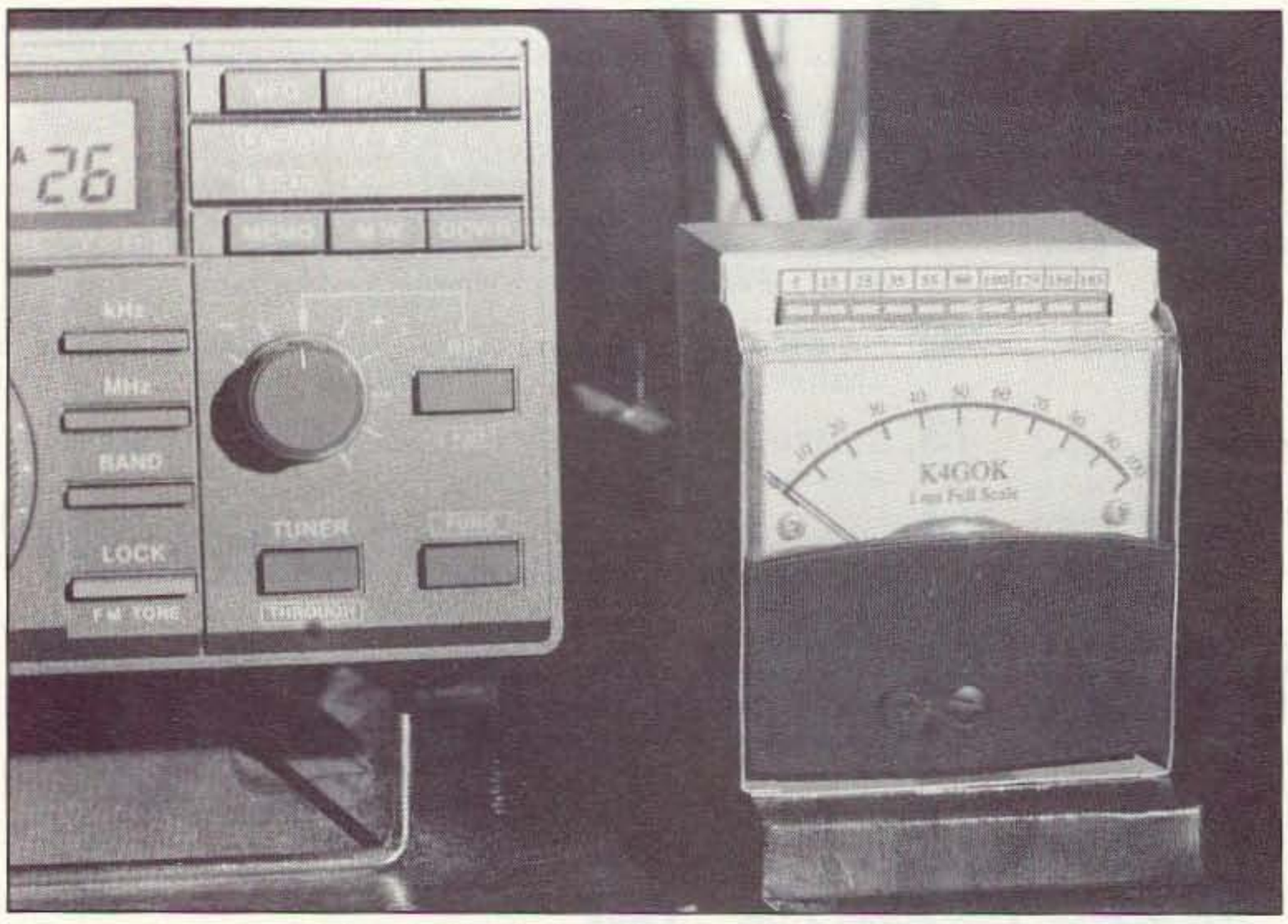

Photo A. The Peak and Average RF Power Meter.

The Circuit

RF is sampled by a resistor divider and rectified in the remote sensing unit. The resulting signal is applied to two sections of an LM3900 op amp. One section of the LM3900 drives the analog meter and the other section drives a National Semiconductor NSM3916 module. The internal damping of the analog meter provides a good measure of the average RF power. The fast response of the LEDs follows voice peaks and provides a good indication of the PEP power. The LM3900 was selected because it operates easily from a single-ended power supply and was on hand in the parts box.

A 100-watt transmitter could drive the analog meter directly, but the op amp allows adaptation to other power levels if desired. In one case it allowed me to use an existing resistor divider located inside the cabinet of a transmitter (32 sheet-metal screws would have had to be removed and reinstalled to make a change to that resistor divider!)

One section of the LM3900 drives the 1 mA meter through a 10k calibration pot. The 10 LEDs are part of a National Semiconductor NSM3916 module purchased at a local hamfest. The second section of the LM3900 drives the NSM3916 module through a second 10k calibration pot. Note the 0.1 cap and 1M resistor connected to the NSM3916 module at pin 6. They provide the correct time constant for easy visibility of the LEDs as they follow the voice peaks.

Figures 1, 2 and 3 show the schematics. Figure 1 shows the display and control circuits; Figure 2 shows the RF sampler schematic. An alternate schematic for the NSM3916 module is shown in Figure 3. The values shown are those used with a transmitter with 100-watt output, and were selected

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

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

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Automatic notch filter

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

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

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

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

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

Adaptive noise reduction

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

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

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

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

Tunable highpass/lowpass filters

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

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

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

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

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

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

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

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

Tunable bandpass filters

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

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

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

You can use *narrower* bandwidths to fight tough QRM because these linear phase filters don't distort signals with unequal time delays.

Even with the narrowest 30 Hz bandwidth, you'll never have a problem with ringing.

One position gives you *two* tunable filters you can use together on one signal. For example, on RTTY, tune one filter to mark, the other to space and set the bandwidth tight for an incredibly sharp RTTY filter.

15 *pre-set* filters -- use factory set or program your own

You can select from *fifteen* convenient *pre-set* filters. Use them for SSB, AM, CW, packet, AMTOR, PACTOR, RTTY, SSTV, WeFAX, FAX or any mode you can think of.

If you don't like our *pre-set* filters, you can program your own -- *an MFJ exclusive!* Save center frequency/bandwidth, lowpass/highpass cutoffs, auto/manual notch and noise reduction --all filter settings-- in 10 *programmable* filters.

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A push-button bypasses your filter -- lets you hear the *entire* unfiltered signal.

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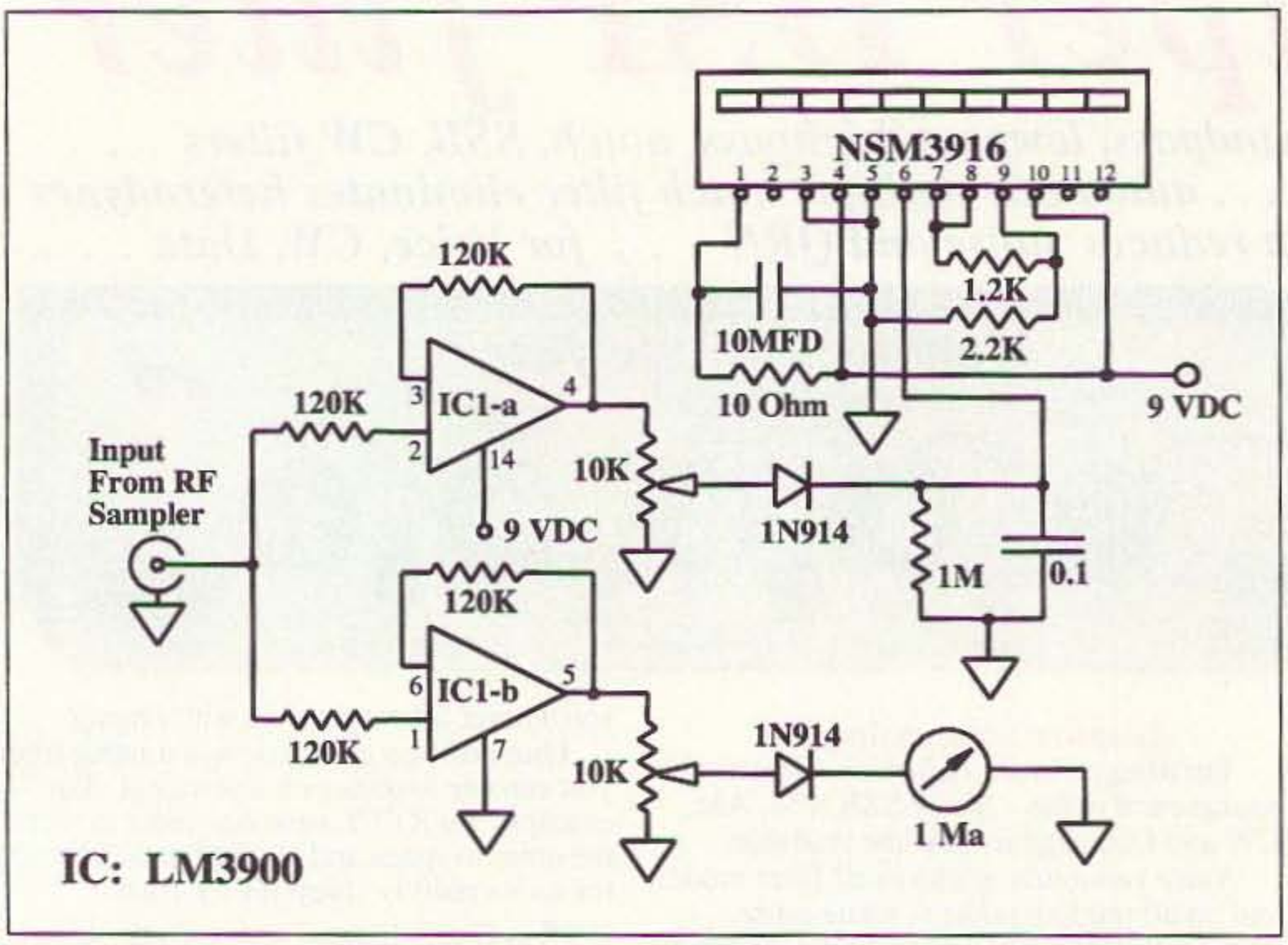

Figure 1. Schematic of the RF Power Meter.

because they were on hand and provided the desired performance. Other values could be substituted for the 120k resistors without problems, as long as both the input and feedback values are the same. The circuit as shown should work well with only a few watts of RF power by adjustment of the calibration pots and an appropriate RF resistor divider in the remote sensor unit. Don't hesitate to make changes in RF sensor box resistors to get the desired performance. And don't be surprised if the resistors used are frequency sensitive. The resistors shown in Figure 2 provide about 100 to 1 voltage division at DC, but about 10 to 1 at 50 MHz, suggesting that some of the "carbon composition" resistors are actually metal film types!

The RFC shown in Figure 2 should be selected for the band in which the power meter is to be used. Use 1 mH for HF, a Z50 for 6 meters, and a Z144 for 2 meters.

Construction

The recommended construction is simple and straightforward. It makes use of the NSM3916 module and perfboard. Fixed resistors are mounted directly on the module to fix the LED brightness and its voltage range. The other components are mounted on perfboard, except the RF sampling divider and RF rectifier diode, which are mounted in the remote sensor unit. The output from the sensor unit is fed to the indicator unit via RG 175 coax cable. The perfboard was mounted directly to the analog meter terminals. The NSM3916 module was mounted to the upper back of the analog meter using double-sided foam tape so that the LEDs are visible over the top of the analog meter.

Calibration

Calibration is best done with a known RF power source and an accurate RF power meter. A relative power scale can be obtained with a variable voltage source and a voltmeter. A Bird wattmeter can be used to measure the output of a transmitter at a known power level, say 100 watts, into a dummy load. (Use a dummy load to prevent QRM on the bands, please!)

First, set the pots to the low end of their range and apply 9 VDC or 12 VDC regulated power to the meter circuit. Next, apply the known RF power (key down) to the input and adjust the appropriate calibration pot for a full-scale reading on the analog meter. Then adjust the other calibration pot so that the #7 LED lights. Switch to SSB and verify that LEDs #8, 9, and possibly 10, light on voice peaks. The calibration pot can be adjusted later to obtain the desired LED display on voice peaks. It is recommended that the adjustment be such that the #10 LED does not light under normal operation conditions so that it can serve to indicate overdriving, or abnormal operation.

Labeling each LED to indicate peak power levels in watts requires a variable RF source or controllable voltage source and a voltmeter. If you have an accurate wattmeter, you can slowly increase the transmitter output, note the power as each LED lights, and label them accordingly.

In the absence of an accurately known RF power source, the meter can be calibrated in a scale showing relative power levels. For example, I recommend that LED #7 be used as 100 watts, and the remaining LEDs be labeled in terms of power relative to that. Using a variable voltage source and voltmeter, connect the variable supply to the input of the display unit, in place of the input from the remote sensing unit. Set the 10k calibration pots to mid-range. Slowly increase the voltage and record the values at which each LED lights. When the #7 LED lights, adjust the correct calibration pot so that the analog meter reads full scale. Calculate the power level for each LED for each of the recorded voltages by using the formula below. First calculate "K" as follows:

$K = 70.71/V_{\#7}$

Then calculate the power for each LED:

$Power = (K \times V_{LED})^2/50$

You can make a label for the analog meter in a similar manner if desired. The analog meter shown in the photo was not calibrated with an RF power scale.

Conclusion

The peak and average reading RF power

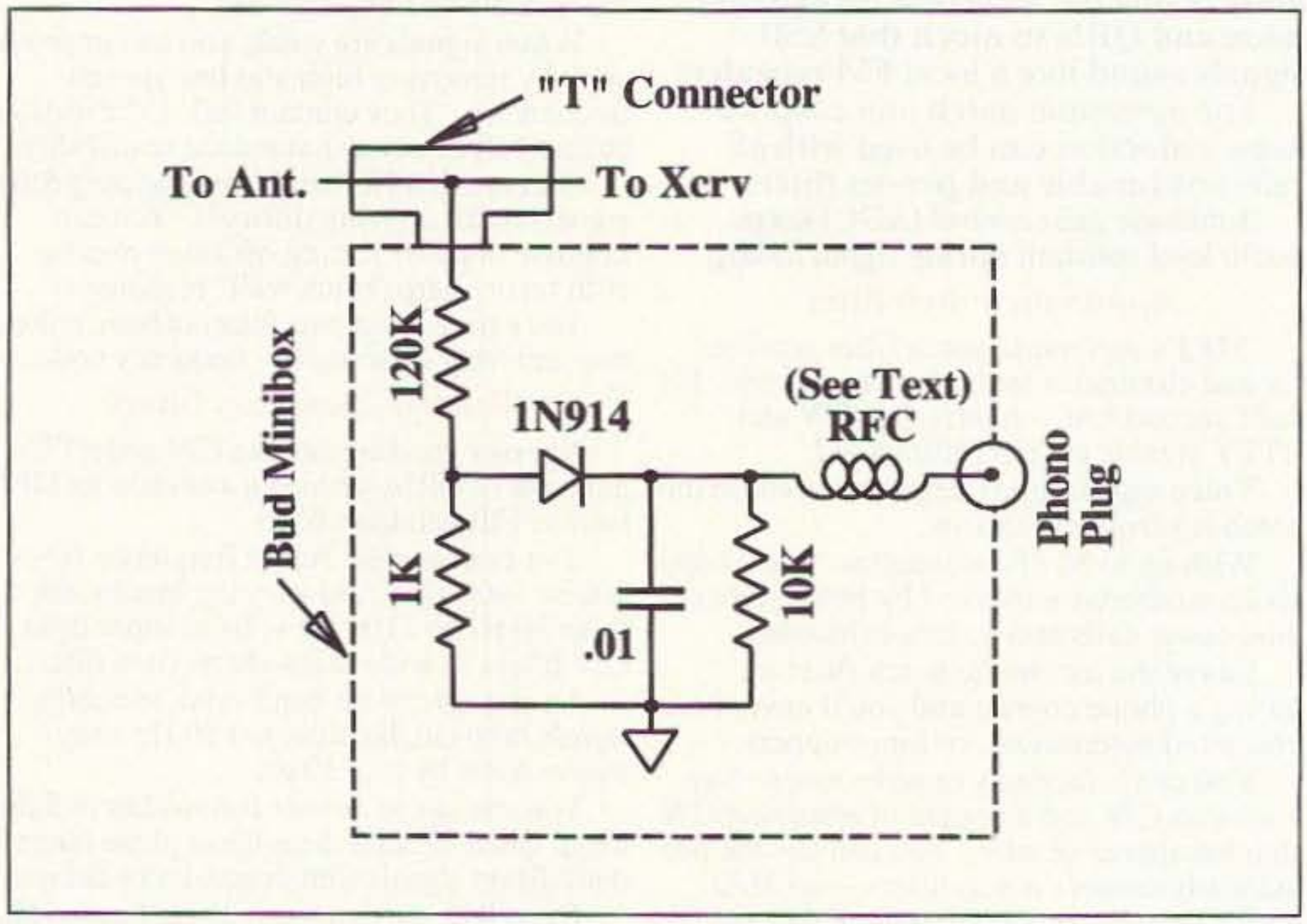

Figure 2. Schematic for the RF Sampler.

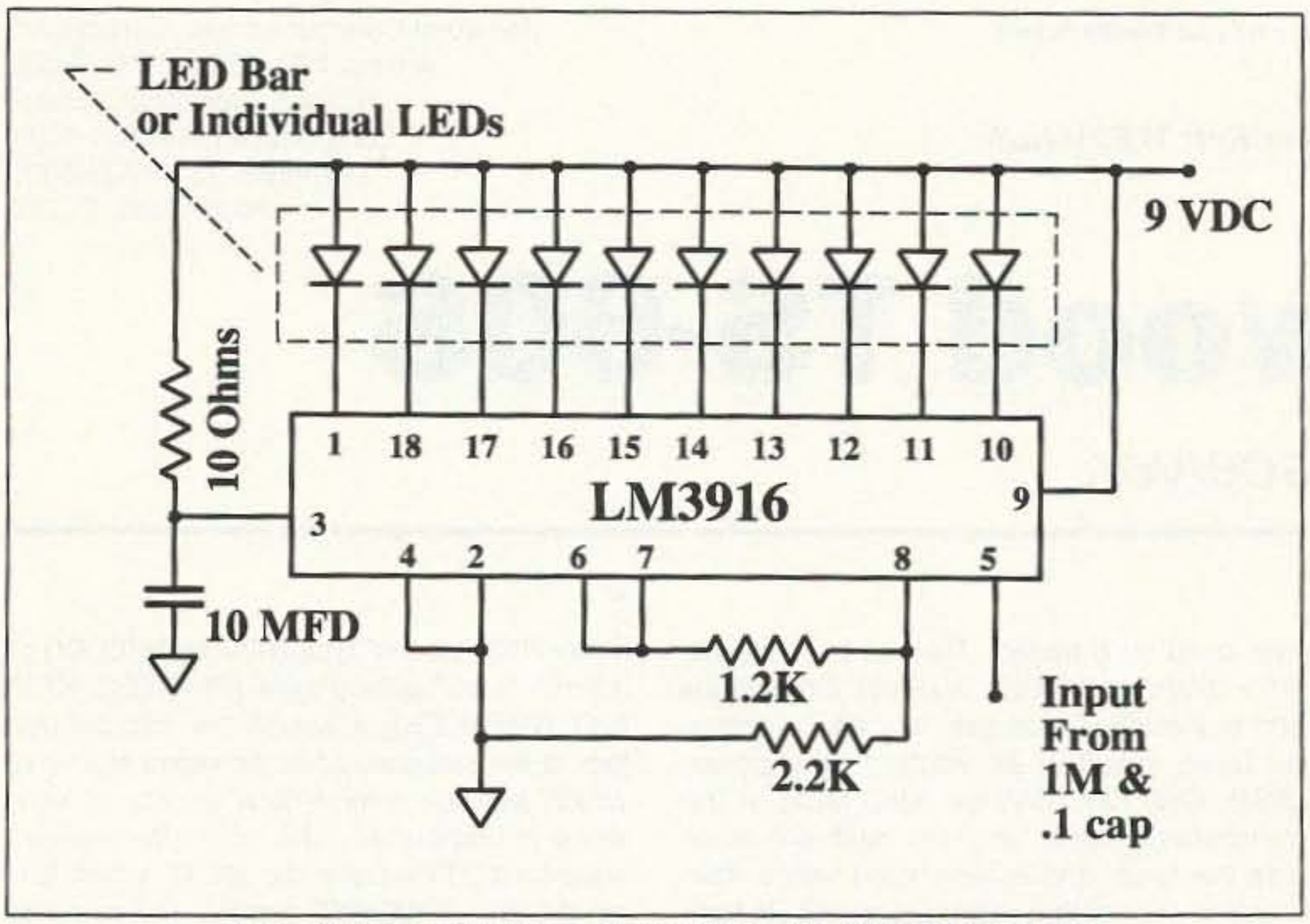

Figure 3. Schematic for an alternative to the NSM3916 module.

meter has been in use at this QTH for many years. It has been a valuable asset and a real "hassle-saver." It has proven reliable and a steady indicator that the solid-state "brick" I use on 6 meters is performing normally.

Readers are encouraged to build this simple power meter and enjoy the comfort of knowing that "all is well" while operating.

Drilled and etched PC boards for this project are available for $4.50 plus $1.50 S&H per order from Far Circuits, 18N640 Field Court, Dundee, IL 60118. Please specify either the NSM3916 or LM3916 module. Artwork for etching your own board is available by sending SASE to *73*. 73

73 Review

Number 5 on your Feedback card

by Steve Katz WB2WIK/6

Kenwood Communications Corporation
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Price Class: $1,210

The Kenwood TS-60S

50 MHz all-mode transceiver.

When Kenwood introduced the TS-50S all-mode HF transceiver a year ago, there were a lot of justifiable "oohs" and "aahs" from the amateur radio world. The TS-50S is the smallest, lightest full-powered (100W output) all-band (160-10 meters) full-featured HF transceiver ever offered to the commercial market. A number of VHF enthusiasts proclaimed, "If only it covered 6 meters, I'd buy this rig in a minute!"

I don't know if Kenwood ever considered trying to add 6 meters to the TS-50S, but they did come up with another solution: the TS-60S, which is the same size and has the same features as the TS-50S, but covers the 6 meter amateur band only. The TS-60S is priced at $1,209.95 (suggested list price), so not every 6 meter user will run out to buy one, but the rig is special in a variety of ways that may make it a good deal for VHFers. And its only serious competition, the Icom IC275H (similarly rated and featured, but covering both 6 and 10 meters), costs even more at $2,021 (suggested list price).

Having been active on 50 MHz since 1966 (Egad! 28 years now!) and having "grown up" with 6 meters from the AM days to SSB and FM repeaters, I feel particularly qualified to review equipment for this band. Already owning lots of 6 meter gear and not wishing to shell out over a kilobuck on an experiment, I was among those who didn't rush right out to buy a TS-60S, but a friend of mine, Chuck Armstrong KD6EQW, did. In fact, when he went to buy one, there was exactly one TS-60S in the entire country that he could find for sale from a distributor, so he bought it immediately, before it disappeared. In speaking with Jon KA6ZBI, the manager of the local HRO store (who is also a 6 meter enthusiast), I found that the rig is so popular he literally can't keep any in stock. This review is based on Chuck's radio, having serial number tag #60100237 (maybe the 237th one ever built?), purchased new in June 1994.

The Rig

The TS-60S is a rugged-looking piece of gear. With few front-panel controls, it appears deceivingly simple, but this is a very sophisticated radio that holds its own with the best equipment ever used on 6 meters. Despite its miniscule (7" x 2-3/8" x 9-5/32", WxHxD) dimensions and tiny exterior heat sink, it is also a powerful radio, rated at 90 watts output power (SSB, CW, FM; 20W on AM). Most of the transmitter's power amplifier heat sink is inside the radio, and is fan-cooled with a thermostatic control that maintains a safe PA temperature at maximum output power. For FM users, the TS-60S features 100 memories—more than anyone could ever need—and standard "PL" CTCSS tones. Programming repeater channels uses the two VFOs and any frequency split is accommodated, from zero offset (simplex) to 4 MHz input/output spacing.

Operation

When you first power up the TS-60S, its display greets you with a friendly "HELLO." The ON/OFF switch has about a one-second delay, preventing accidental punches of the "OFF" button from turning the radio off. The receiver is sensitive, selective and reasonably immune to overload (see Note 1). Because of its diminutive size, input/output jacks are all either RCA "phono" type (ALC and RELAY) or 3.5mm "mini" phone type (PHONES, KEY, EXT SPEAKER), although the microphone jack is the standard-sized Kenwood eight-pin, which will accommodate a variety of Kenwood microphones. The normally-supplied hand-held PTT mike is the MC47, which features both "UP/DOWN" buttons and four programmable priority functions. The supplied microphone sounds excellent on the air and received rave reviews on both SSB and FM from the stations contacted.

Three things initially bothered me about the TS-60S: One, the "fuzzy logic" VFO tuning speed control system, which makes the rig tune faster as you turn the VFO knob faster; two, the lack of a panel-mounted transmitter power output level control; and three, the lack of a panel-mounted mike gain control. I'm not used to radios having variable-rate tuning, and it does take some getting used to. When the dial-drag lever on the TS-60S (located immediately below the VFO main tuning knob) is switched to the "minimum drag" position, it is possible to "spin" the dial across the band. Doing so makes the VFO change frequency very rapidly, much faster than you would think after turning the knob slowly. However, I'll admit it only took me a few minutes to become accustomed to the variable-rate tuning system and, after this initiation period, I liked it.

Photo A. The Kenwood TS-60S all-mode transceiver.

Although I like continuously-variable power output controls on my rigs, it isn't much of a selling point for 6 meter equipment. Most 6 meter users will run the radio "wide open" at full output 99% of the time anyway, as there's no special place in heaven for 6 meter QRPers. (The rig does have three power output levels, controlled by the operating menu, which is easy to get used to.) The "continuous" output control is more useful on HF, and this is a VHF radio. The only time I might want more output level control is when operating at a Field Day station, where there's a special multiplier for stations running 5 watts output power—the TS-60S can only "QRP" down to 10 watts. Oh, well. The Japanese engineers who designed this radio probably aren't aware of U.S. Field Day rules.

The lack of a panel-mounted mike

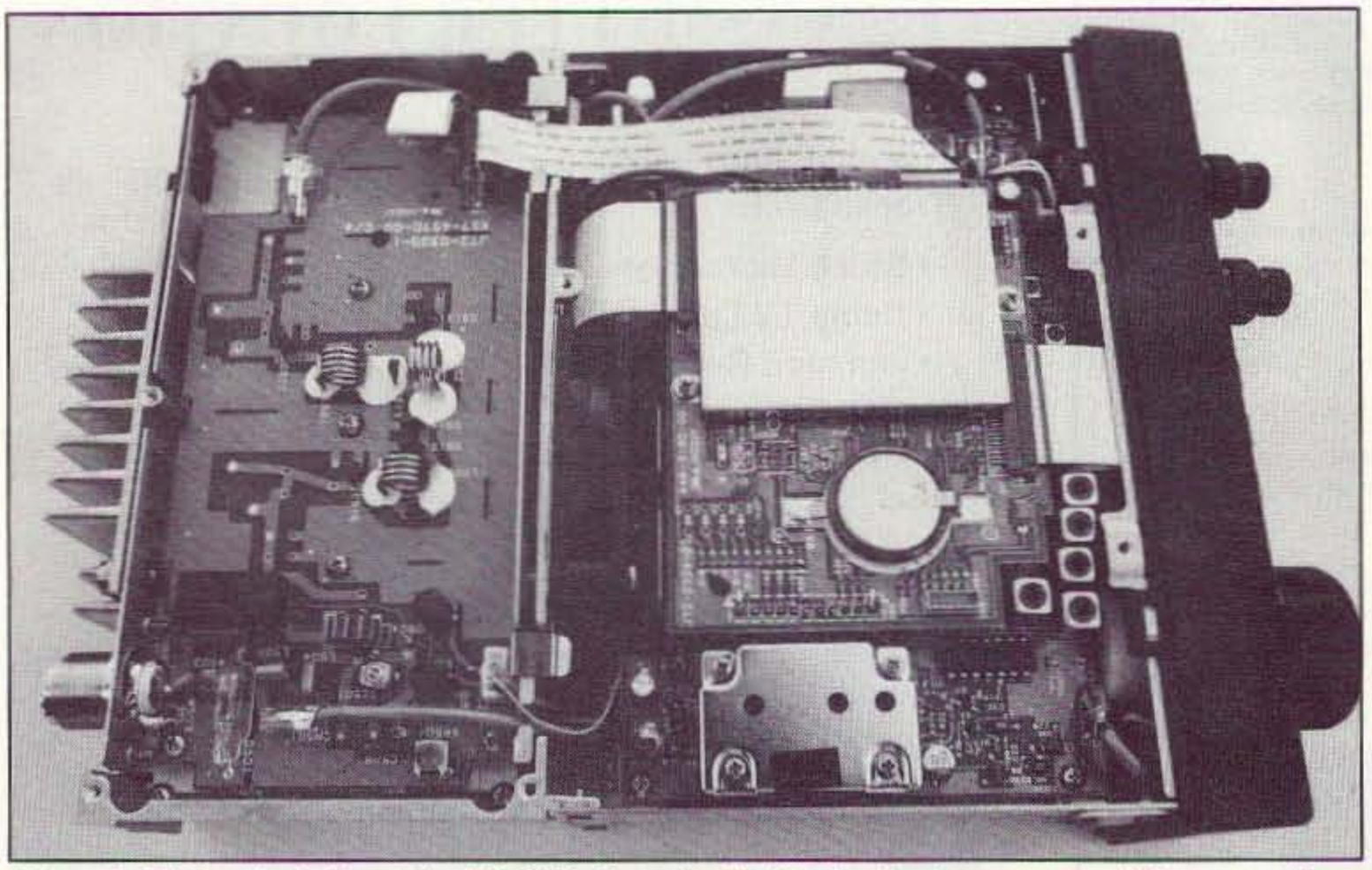

Photo B. The underbelly of the TS-60S. Note the fan's edge in the center, and the output low-pass filter and antenna T/R relay on the output board. The shiny round thing is a 3V battery used for memory backup.

gain control still bothers me a bit. There is a mike gain control, as well as an FM deviation level control, located inside the TS-60S, but you have to remove the top or bottom cover (depending on which one you want to adjust) to make any changes. Considering the variations in operators' voices, this wasn't a great idea; however, one of the 40 menu-addressable functions is "microphone gain High or Low," selected as #66 on "Menu B." Making adjustments using the menus sounds far more difficult than it is. It's so easy, in fact, that once I read the simple description of how to do it, I never had to refer back to the 59-page instruction manual again. That is, except to refer to the "Menu Number" and "Description" of each function, which would be almost impossible to memorize.

Since the TS-60S front panel contains only 24 knobs, controls and switches (a small number compared to most base-station radios nowadays!), only those which must be frequently adjusted are placed there. Obviously, the on/off (POWER) switch, volume (AF) control, squelch (SQL), tuning dial and mode switches (SSB/CW on one button and FM/AM on another) will be most often used. In addition, the TS-60S has panel-mounted receiver incremental tuning (RIT) and IF SHIFT controls, plus switches for its noise blanker (NB), advanced intercept point system and receiver attenuator (AIP/ATT), changing between the two VFOs (A/B), splitting the VFOs (SPLIT), setting the two VFOs to the same frequency (A=B), locking the frequency (F.LOCK), stepping the frequency in MHz increments (MHz), buttons to control both frequency and scanning direction, and menu items (DOWN and UP) activate the scanner (SCAN), entering data to memory (M.IN), entering memory data to the VFO (M>V), switching between memory and VFO modes (M/V), and clearing an operation such as a menu address (CLR). Some of these switches will be infrequently used, except in initial setup, but need to be on the panel to avoid confusion from having to address multiple menu items simultaneously.

The panel switches with more than one label "toggle" between two functions. An example is the AIP/ATT switch which, when first depressed, activates the AIP feature (to prevent receiver overload in strong-signal environments). When depressed again, the same switch activates the attenuator. When depressed a third time, it activates both AIP and ATT. When depressed a fourth time, it turns AIP and ATT off, clearing the system and returning back to normal full-sensitivity receiver operation. Maybe Japan has a lot of 6 meter operators in a small area; I cannot envision ever needing the AIP or ATT here, since the strongest signals I could find did not overload this receiver, anyway.

Menu Functions

Depressing the MENU button clears the frequency display and addresses either MENU A or MENU B, selectable with the front-panel A/B switch (also used to switch between the VFOs). You then spin the main tuning knob to the menu item you want, which is indicated on the left-hand side of the main display panel, then use the UP and DOWN buttons to toggle the features of that menu item. As stated earlier, this sounds more complicated than it is.

For example: Say you want to switch from full power (the default setting) to the QRP 10-watt output level. Press the MENU button, then the A/B button, until the letter "A" appears in the main display, then spin the tuning knob until menu number "00" appears on the left-hand side under the word "MENU." Menu item "00" is the power setting. Push the DOWN button twice, and you'll see the display go from 100 to 50 to 10, indicating you're now set at 10 watts output power. Then push either the MENU button again, or the CLR button, and the radio reverts to normal operation, but now at the 10W power level. This all takes about two seconds—not difficult at all. If you want to program a "PL" tone for repeater operation, you'd depress MENU, then "B," then turn the tuning control to bring up menu item #53, then depress either UP or DOWN to arrive at the right tone frequency (the PL tone frequencies are displayed directly in Hz), then either MENU or CLR, and you're done. I wouldn't do this "on the fly," while driving down the freeway at 55 mph, but it's easy to do while parked, or on the bench at home. Besides these two MENU functions there are 38 others, some of which are almost silly.

Silly menu functions: Five levels of adjustable display brightness (!); CW keying delay adjustable from full QSK (no delay) to 1.8 seconds delay (a real long time) in 10 increments; RIT range (two increments); automatic power off function (turns radio off after a period of non-use); three separate menu items to adjust the beep tones the rig emits when functioning controls; etc. Who cares? But the TS-60S has all these, and many more useful functions as well.

One neat thing about the rig and its MC47 microphone is the ability to program the mike's four "priority" buttons to perform any of 26 functions, all menu-addressable. You could, for example, program the rig so that one of the priority keys controls the rig's output power, and another one controls its mike gain (from High to Low, anyway), thus almost overcoming my initial objections to these items not being on the front panel.

The Manual

The TS-60S instruction manual is typically-Kenwood excellent, with clear, concise explanations of all controls and functions. However, it completely lacks any circuit description and leaves the owner wondering what the heck's inside the rig. There is a two-page "Troubleshooting" guide, but it only points out what should be obvious operator errors and gives no clues about what to do if something in the radio actually fails. I'd really like to see detailed circuit descriptions (e.g., "The received signal passes though a nine-section bandpass filter and is fed to the first RF amplifier, a 40673 MOSFET, before reaching the first RF mixer, a doubly-balanced set of 5082-2800 hot-carrier diodes having an LO injection level of +13 dBm at 70 MHz," or whatever). In the old days, most equipment manuals contained such descriptions, and they helped explain how the rig really worked and helped the user read through the schematic diagram and make sense of the circuitry.

Circuitry

The rig comes complete with schematic diagrams, a set of four-page fan-folded dual-sided sheets that appear complete enough for me to offer this abbreviated description:

The antenna feeds a low-pass filter always in series with the receiver, as well as a 40-60 MHz bandpass filter, and is relay-switched to either a pair of 2SK520 JFETs in parallel (presumably for a high intercept point) as an

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RF preamp, or directly to the balanced JFET RF mixer (four 2SK520s), depending on whether the "AIP" circuit is in use or not. (The "AIP" circuit, when switched "ON," bypasses the RF preamplifier, using switching diodes.) The "ATT" (attenuator), if activated, is relay-switched. There is an intricate array of front-end protective components called a "lightning surge arrestor" circuit, which appears to be metal-oxide varistors in series with small-signal switching diodes to reduce the capacitance of the MOVs. This is a common approach and might help protect the JFETs against lightning transients. The local oscillator injection to the first RF mixer is provided by the PLL UNIT's output which tunes 113.045-133.045 MHz and produces a first IF at 73.045 MHz (this is called "upconverting"; that is, the first IF is at a higher frequency than the received signal input). The tuning range of the PLL is so broad because the TS-60S does feature a 40-60 MHz continuous-coverage receiver, although it can only transmit in the 50-53.999 MHz range.

The first IF is filtered by XF1, a crystal filter at 73.045 MHz, before the signal passes to the second mixer, another pair of 2SK520 JFETs; between the crystal filter and the second mixer is the first IF amplifier, a 3SK131 dual-gate MOSFET, which is AGC-controlled by bias applied to its second gate. This same stage also drives the receiver's NOISE BLANKER circuit, a common pulse-clipper type. The second mixer injection is at 62.35 MHz and also provided by the PLL UNIT, to produce a second IF at 10.695 MHz. This is the last conversion stage used for SSB/AM/CW. The second IF signal passes through either a 5 kHz bandpass filter for AM, or a 2.2 kHz bandpass filter for SSB/CW (or an optional, sharper CW filter), before being amplified by a 2SC2712 bipolar IF amplifier, whose output drives a hybrid integrated circuit product detector system using additional postamplification provided by a pair of 3SK131 MOSFETs and a balanced detector using a pair of HSM88AS diodes. The carrier injection to the product detector is a signal at 10.695 MHz provided by the PLL UNIT.

On FM, the receiver employs an additional conversion stage producing an IF of 455 kHz, standard in the FM industry. This last conversion stage uses an MC3372 integrated FM IF subsystem having its own local oscillator and a 12 kHz monolithic bandpass filter. Thus, on SSB/CW/AM the TS-60S is dual-conversion, while on FM it is triple-conversion. This makes a good deal of sense, considering the FM IF subsystem integration available today, which helps make FM receivers as simple as they are.

The transmitted SSB/CW/AM signal is generated by an integrated circuit balanced modulator, type uPC1037HA, which is audio-driven by the microphone preamplifiers, shaping circuits and a 2SC2712 bipolar buffer amplifier, and has carrier injection at 10.695 MHz provided by the PLL UNIT, the same source as used for product detection in the receiver. The output of the balanced modulator is diode-switched to the same set of bandpass (crystal) filters used in the receiver's second IF, then buffered by another 3SK131 MOSFET which has ALC control by bias to its second gate, before passing to the first transmitter mixer, a pair of 3SK131s having an L.O. injection at 62.35 MHz provided by the PLL UNIT. The mixer's output is bandpass filtered and mixed again by another balanced mixer using a pair of 3SK184 dual-gate MOSFETs having an injection at 123.045-127.045 MHz, again provided by the PLL UNIT. The second transmitter mixer's output at 50-54 MHz is bandpass filtered, buffered by a 2SC2954 bipolar transistor and then fed to the FINAL UNIT for additional amplification.

The FINAL UNIT consists of a "predriver," type 2SC1971, a "drive amp," a pair of push-pull 2SC1972s, and then the "final amp," a pair of push-pull MRF492s or 2SC2879s. (Depending on where you look in the schematics, both part types are called out.) The final's output signal passes through a 54 MHz low-pass filter before reaching the SWR protection circuit and antenna relay. The FINAL UNIT also contains a sophisticated temperature control system which drives the internal heat sink cooling fan. In fact, the comparator circuit which supplies signals to the fan motor drive transistors (three type DTD114EK bipolars) has three separate outputs to drive the fan at progressively higher speeds as the heat sink reaches higher temperatures! Speaking of fans, the one in the TS-60S kicks into operation after only 15 to 20 seconds keydown time at full power. If you transmit longer, the fan speeds up. When operating at full power for any length of time, the fan reaches maximum velocity and creates an audible noise level that might be distracting if the operator doesn't use headphones.

Obviously, this circuit description is an abbreviated overview and doesn't go into much detail, but it offers the technical readers some feel for the rig's circuitry. I enjoy perusing schematic diagrams, taking tips from the "pros" on circuit design. I was gratified that the TS-60S uses discrete, rather than integrated, final output transistors (cheap, easy to replace), and a push-pull output circuit which should practically eliminate any second-harmonic output, leaving only the third harmonic to filter (a much easier task, since it's so far away from the desired frequency).

Table 1.
TS-60S Measurements Taken

Transmitter output power into a 50-ohm load, 13.8 VDC supply:

SSB (peak)/CW/FM		HI 95W	MED 44W	LO 10W
AM		HI 20W	MED 15W	LO 5W

Receiver sensitivity, closed 50-ohm system:

SSB/CW	MDS	<-130	dBm	(<.07 µV)
	10 dB S+N/N	-117.5	dBm	(0.3 µV)
	"S1"	-107	dBm	(1.0 µV)
	"S3"	-104	dBm	(1.4 µV)
	"S5"	-98.5	dBm	(2.6 µV)
	"S7"	-89.5	dBm	(7.5 µV)
	"S9"	-77.5	dBm	(30 µV)
	"+20 dB"	-57	dBm	(300 µV)
	"+40 dB"	-37	dBm	(3.2 mV)
	"+60 dB"	-20	dBm	(23 mV)
	IF BW	2.19	kHz	@ -6 dB
FM	Sqlch threshold	-125	dBm	(.13 µV)
	20 dB NQ	-112	dBm	(0.6 µV)
	"DFQ"	-92	dBm	(6 µV)
	"S1"	-113	dBm	(.5 µV)
	"S3"	-110	dBm	(.7 µV)
	"S5"	-108	dBm	(.9 µV)
	"S7"	-105	dBm	(1.2 µV)
	"S9"	-102	dBm	(1.8 µV)
	"+20 dB"	-97	dBm	(3.1 µV)
	"+40 dB"	-94	dBm	(4.5 µV)
	"+60 dB"	-92	dBm	(6 µV)
	IF BW	5.05	kHz	@ - 6 dB

Blocking dynamic range: Approx 105 dB

Features and Options

The TS-60S comes with a 6-1/2-foot-long DC power cable fused in both leads, using automotive-style cartridge fuses which are inexpensive and readily available (hooray!). It also comes with a mounting bracket, although a better one, model MB-13 (list price $47.95), is available. Other options include a matching heavy-duty AC power supply, model PS53 ($249.95); a high-stability temperature-compensated crystal oscillator reference for the frequency synthesizer, model SO-2 ($179.95); a narrow CW filter, YK-107C ($109.95); a variety of desk-stand microphones (MC60A dynamic $149.95; MC80 electret $104.95; MC85 multiple-output electret with compression control and meter $159.95), and other lesser-used items. I wouldn't buy an accessory speaker for the rig, as its internal top-mounted speaker is loud and sounds great. Unfortunately, the optional CW filter and TCXO are both solder-in, not plug-in, accessories. Oh, well.

The TS-60S "S" meter and power output level meter are of the "bar graph" variety and are quite useful. The bar graph power output level display reads "0 to 10," and provides only relative output power indications. For example, on the unit tested, a display reading of "1" corresponded to 5 watts output; "2" was 10W; about "2.5" was 15W; about "4.5" was 20W; a bit over "7" was 42W; and "10" was full power, which in this case was 95W or so. I was able to achieve all these different output levels by using the menu-driven power output level control and by switching modes between CW and AM (AM always runs less power than CW/FM, regardless of the control setting).

The bar graph S-meter is quite good on SSB/CW and pretty useless on FM, as is the case with most multimode transceivers I've seen. While the receiver's MDS (minimum discernible signal) on SSB/CW was less than -130 dBm (under 0.1 µV), the S-meter doesn't indicate anything until about -107 dBm (1 µV) signal is applied to the antenna jack. Above this signal strength, the meter is surprisingly good. An "S9" signal was 30 µV; "+20 dB/S9" was 300 µV (exactly a 20 dB

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SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

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

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MODEL RM-35M

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

RS-A SERIES

MODEL RS-7A

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

RS-M SERIES

MODEL RS-35M

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

VS-M AND VRM-M SERIES

MODEL VS-35M

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

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

RS-S SERIES

MODEL RS-12S

- Built in speaker

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

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

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change); "+40 dB" was 3.2 mV (again, a 20 dB change); and "+60 dB" was 23 mV (a 17 dB change). As S-meters go, this one is pretty accurate. On FM, all bets are off. "S1" required -113 dBm (0.5 μV), but "S9" was only -102 dBm (1.8 μV), a change of only 11 dB for an indicated 8 "S" points difference (which should be 48 dB or so). On FM, the meter indicating "+20 dB" only required -97 dBm (5 dB more than "S9"), and "+40 dB" required -94 dBm (only 3 dB more than "+20"). S-meter accuracy can be useful (even on FM) for beam steering.

The receiver in the TS-60S is top-notch. Not only did I make bench measurements using a lab-standard signal generator, but I compared the rig with my much more expensive Yaesu FT-736R and its 6 meter module. Results? The little TS-60S held its own very well against the full-sized, base-station FT-736R. There was almost no measurable difference in sensitivity between the two, and extremely weak signals tuned in on both sounded about the same. (I used the XE2UZL beacon in Mexico, which operates around the clock on 50.027 MHz, as a QSB-free standard. When I turn my beam to null this beacon, it becomes a very steady, unwavering weak signal, just above the noise. It's a great reference signal!) The IF filtering in the TS-60S is certainly adequate (rated 2.2 kHz/-6 dB for the SSB filter; measured at 2.189 kHz/-6 dB), but more amazing is the receiver's ability to resist desensitization from strong off-channel signals.

The Author's Experience

I ran this test: I nulled the XE2UZL beacon until it was almost in the noise, registering "S0" on the meter, and barely detectable. Then I introduced a signal offset by 10 kHz, at 50.037 MHz, from my signal generator, essentially in parallel with the antenna connection. I had to adjust the generator's level to -24 dBm, or about 12 millivolts, before I could detect any change in level on the weak beacon. This is a difference in signal strength of more than 105 dB, and the 12 millivolt signal is far stronger than any I've ever come across on the air, including from stations operating only a few miles away. Older-generation 6 meter receivers were never this good.)

The receiver is also almost free of internally-generated spurious signals. The "other side" of the IF filter "shadow" signals are greatly attenuated, and any very strong signals occurring outside the IF passband can likely be rejected further with the IF SHIFT tuning control, which works well.

OK, already: How does it play on the air? Like a champ! As I mentioned, I borrowed the radio for this review. After playing with it for one day, I really didn't want to give it back. But I had to—this was written right in the middle of the peak sporadic-E season (June) and the rig's owner, KD6EQW, was chomping at the bit to get back on the air. Chuck uses a Diamond DP-GH62 collinear vertical base station antenna (vertically polarized, 21' tall, 6 dB rated gain) at about 25' above ground with the TS-60S and has already had a ball with it, working E-skip all over the country with this nominal antenna. He intends to also use it mobile, with either a Larson 5/8-wave 2 meter whip (surprise—these work just fine as a 1/4-wave on six) or an M-Squared "Sqloop" horizontal, omnidirectional antenna on his truck, and should have some great fun doing so.

Two caveats are worth mentioning: First, if you are measuring your vehicle for determining where and how to mount the TS-60S before actually buying one, be aware that Kenwood's published dimensions need clarification. Its "depth" specification is 233mm, which corresponds to about 9-5/32"; however, the rig is really 10-5/8" deep, if measured from the main tuning knob to the rear heat-sink fins. Only the case measures 233mm, but you'll need more space than this for the rig. Second, on the remote chance you'll be using the rig for AM work (as opposed to SSB), be advised this is not a great-sounding AM rig. Like most SSB radios using "low-level" modulation for full-carrier AM, power output for AM work must be substantially reduced from the SSB peak value, and even then, modulation is anything but "broadcast quality." The TS-60S, like many SSB rigs used on AM, produces "downwards modulation," meaning its output power actually drops down on modulation voice peaks. This is remedied to some degree by using the rig in the "medium" or "low" power settings, where it runs 15W or 5W output, rather than the full 20W produced in the "high" setting. Frankly, there's not much AM activity on 6, and if that's all you want a rig to do, a less expensive choice would be an old Gonset G50, Clegg Thor-VI, or some similar—if ancient—high-level modulated AM rig.

Six meters is a great band. It offers a combination of VHF tropospheric and HF ionospheric propagation and might be the only amateur band capable of producing strong-signal contacts from local, direct-wave to 10,000-mile F2-layer DX contacts, with lots of useful propagation in between. WAS, WAC, DXCC are all possible on 6 meters, and maybe WAZ will be someday, too, with increased activity and the return of a solar cycle peak. Best sporadic-E "skip" conditions occur at the beginning of the summer and winter seasons, but the band is known for producing lots of "E-skip" all through the months of June and July (in the northern hemisphere). There's bound to be local FM simplex and repeater activity, too, in most parts of the country. The TS-60S combines a good receiver with a powerful enough transmitter to work most anything right out of the box, and it provides an amplifier keying circuit to interface with an outboard high-powered amp for serious QRO (high powered) work. There are a variety of power amplifiers now on the market, both solid-state and tube type, as well as some excellent 6 meter antennas, to compliment the TS-60S as a serious base station for 50 MHz enthusiasts. 73

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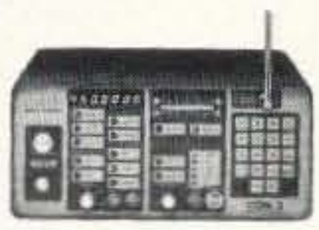

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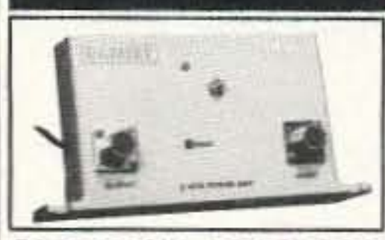

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Add some fun to your club events by having a transmitter hunt! Foxhunting is a craze sweeping the nation, but many clubs are missing out on the action because they lack the expertise or time to develop their own foxhunt transmitter. We set one of our most devious and sneaky engineers to the task of designing an easy to build and use, yet highly capable Foxhunt transmitter. A snazzy microprocessor controller has both preset and programmable transmission characteristics allowing you to easily set the difficulty level from "beginner" to "know-it-all"! The SlyFox, FHT-1, is crystal controlled in the 2 meter band (crystal for 146.52 included) with a power output of 5 watts that is adjustable by the controller.The transmitter is programmed to ID in CW or add our voice option if you really want to aggravate the troops - "Ha ha, you can't find me!" Join the fun, get rid of those stuffy old meetings and picnics, have a foxhunt!

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CIRCLE 34 ON READER SEVICE CARD

440-450 MHz Omnidirectional Antenna

Build this UHF base or repeater antenna for less than 10 bucks!

by Marty Gammel KAØNAN

Recently I was asked to rebuild a UHF repeater antenna that was given to a friend of mine. The design was not one that I was familiar with, but I did rebuild the repeater antenna with the same design that was in the PVC shell. The previous owner had forgotten to use the 95% velocity factor when figuring out his lengths. It matched in free space, but was 21 MHz off when installed in the PVC antenna housing. I had to make all new parts to bring the antenna down into the 70cm ham band. That repeater is on the air and working just fine now.

After rebuilding that antenna, I decided to try my hand at building a cleanly designed antenna with enough gain for base station or repeater use, about 5 dB. The new antenna had to be weatherproof, compact, easy to mount, and easy to build with common tools. The design I settled on was one that I had built for 2 meters years ago. A 20-year-old *ARRL Handbook* was the source of the design I wanted to rework: three half waves in phase, using a half-wave 52-ohm phasing section of coax. I wanted to encase this in PVC pipe to maintain a stable environment.

"Once you have gathered together all the needed materials, you should have a completed, tuned antenna in a couple of hours."

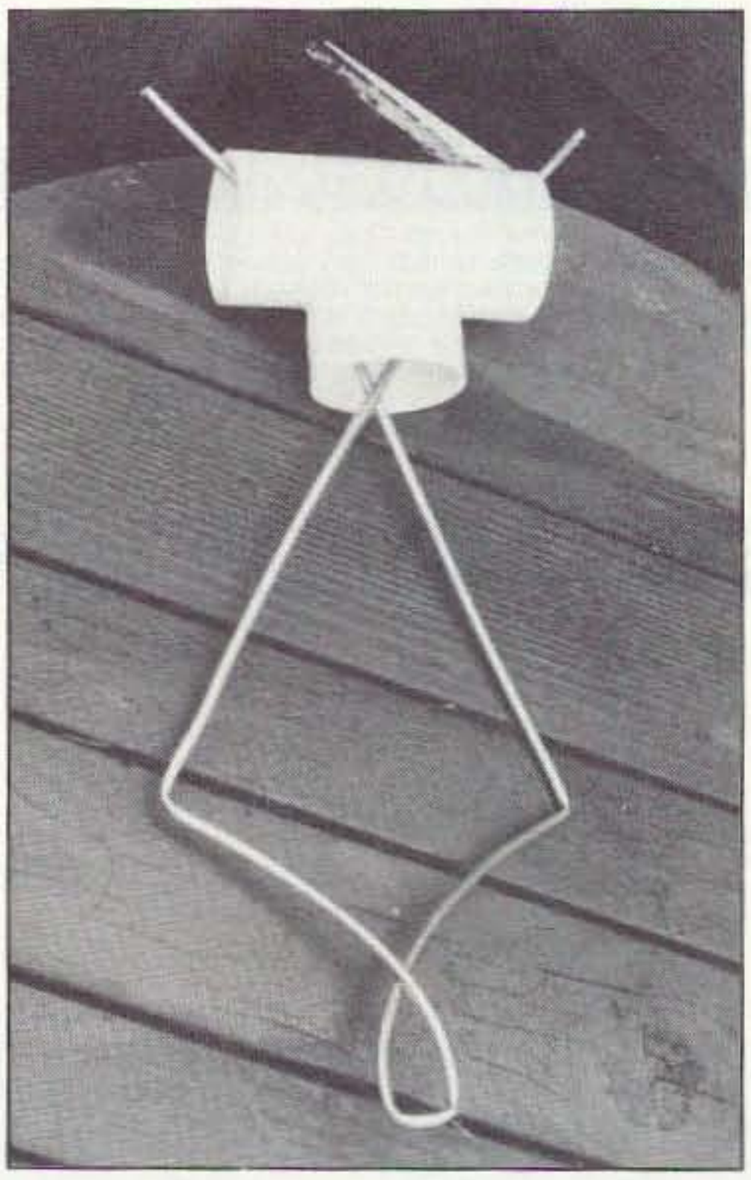

Photo A. Squeeze the copper tubing ends together and insert them through the center opening of the "T" fitting.

Parts

To make this antenna you will need some 1-1/2" i.d. schedule 40 PVC pipe, two "tee" fittings, two end caps, some low-loss RG-8 or RG-213 coax, and some 3/16" copper tubing. You may also want to use some styrofoam (see text below).

I found it would be necessary to enclose the antenna in PVC, based upon my experience with my 2 meter version of this antenna years ago. The copper had turned almost black from chimney gases and exposure to the weather. Also, the lower section of the copper had split from moisture refreezing during a cold, wet winter.

Once you have gathered together all the needed materials, you should have a completed, tuned antenna in a couple of hours.

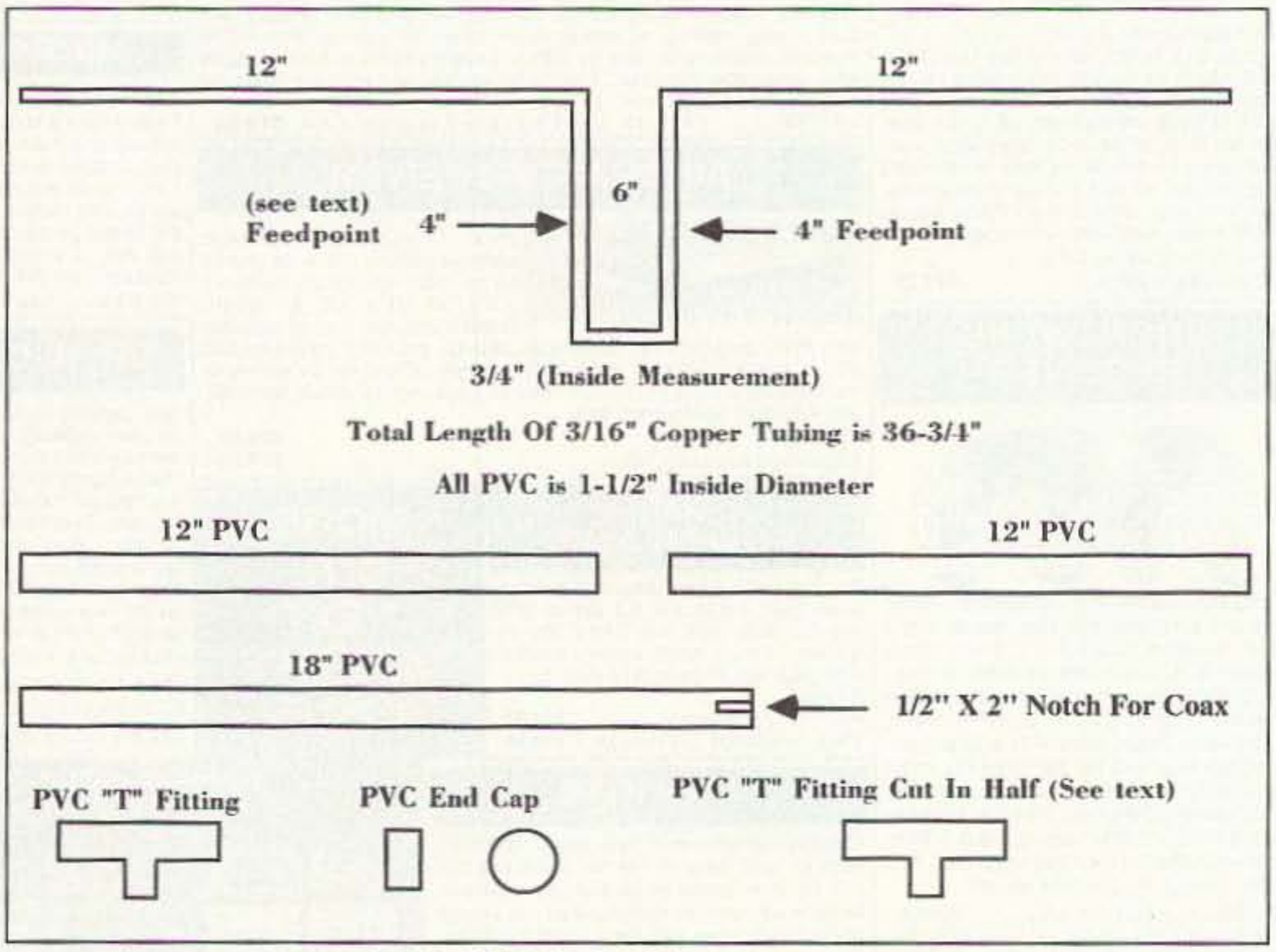

Figure 1. 440-450 MHz PVC base or repeater antenna.

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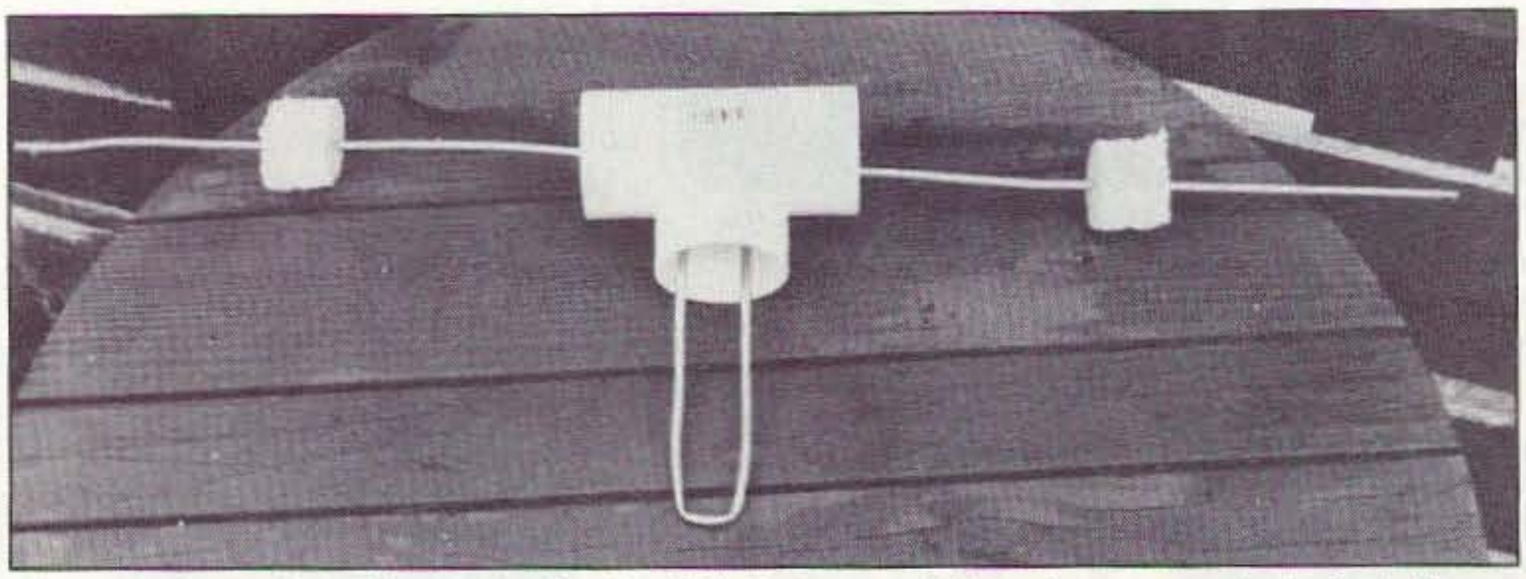

Photo B. Once the tubing is inside the "T" fitting, straighten it out to make it look like an antenna.

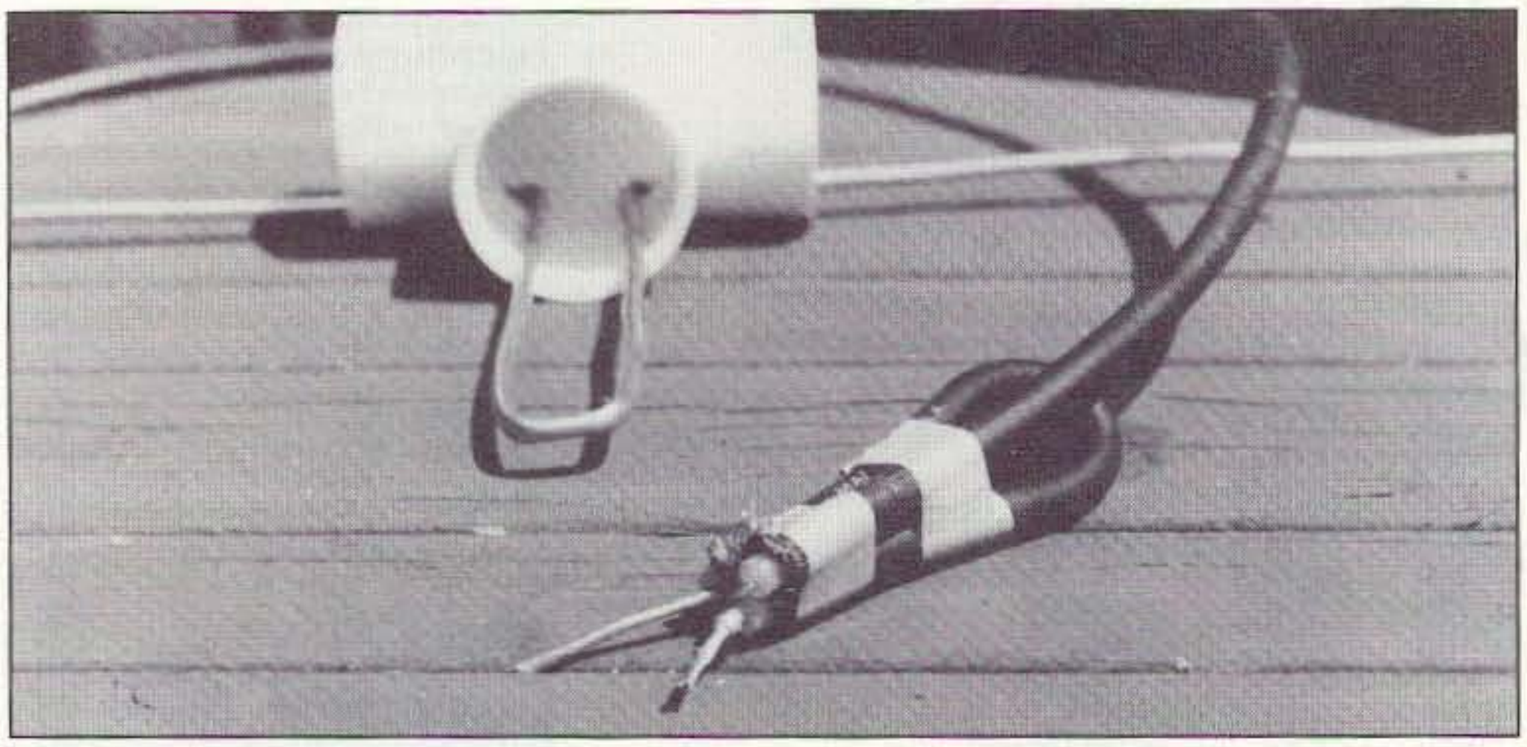

Photo C. Use coax to make the phasing section.

Making the Antenna

First, I cut all the needed pieces of the 1-1/2" PVC pipe to length with a hacksaw. Cut two pieces 12" long for the vertical sections, and one piece about 18" long for the horizontal section that houses the tuning stub.

After cutting the PVC pipe, smooth out the rough edges with sandpaper to help make the assembly process easier.

Now comes the important part! Decide on the portion of the 420 to 450 MHz band on which you want to operate. I chose 438-450 MHz for the repeater and simplex area of the band. When you enclose an antenna in PVC pipe, you must figure in the velocity factor of PVC pipe, 95%, into the formula. This meant that I needed 36-3/4" of copper tubing. This was determined by using the formula for a half wave found in any *ARRL Handbook*: 468 divided by the frequency in MHz = the length. Then you must allow for the PVC pipe by using the 95% velocity factor. $468/F_{MHz} \times 0.95 =$ final length.

Figure 1 shows the proper lengths and configuration to bend the 3/16" copper tubing to make it radiate properly. Use a vise if you have access to one to get nice square, accurate bends. The first section is 12" long, then a 90-degree bend, then a 6" length, then another 90-degree bend. Allow 3/4" spacing on the tuning stub at the center of the antenna. You are now halfway done with the bending process. Bend the other half of the tubing to match the first half of the antenna.

Squeeze the tubing ends together and insert them through the center opening of the "T" fitting (see Photo A). Once the tubing is inside the "T" fitting, you can straighten the tubing out to make it look like an antenna again, as in Photo B. The copper tubing does not have to be perfectly straight.

Now make a phasing section of 52-ohm coax, again using the correct velocity factor for your coax. Using RG-8 foam coax, with a velocity factor of 80%, meant that I needed a piece 10" long. Other types of RG-8 or RG-213 have different velocity factors; some use 66% or 78%, so check your *ARRL Handbook* to determine which one is correct for your coax.

Attach the phasing section to the coax by connecting the shields from both ends of the phasing section to the shield of the feedline stub (see Figure 2). Tape the phasing stub to the feedline stub with electrical tape. Be sure that the phasing stub with coax attached will fit inside the 18" section of PVC pipe. Attach the center conductors to each side of the tuning stub at about 4" from the vertical sections of the antenna. This is the feed point (see Figure 2 and Photos C and D). Bend the ends around the tubing snugly to make the soldering job easier.

Again try inserting the coax with the tuning stub connected to ensure that it will still fit inside the 18" piece of PVC pipe. In one end of the 18" piece of PVC you need to cut a notch wide enough for the coax, and deep enough to clear the "T" fitting about 2" (see Photo D). After the assembly and tuning of the antenna, you will want to caulk the notch in the PVC to give a weatherproof seal.

The Assembly Process

Assemble the complete antenna dry to make sure everything fits properly (see Photo E). During this assembly process, you may want to cut some scrap styrofoam pieces to keep the copper tubing in the center of the PVC pipe (see photos). I used a hole saw, but you can cut the pieces of styrofoam with a knife if necessary. Attach the antenna to a mast with the stainless-steel band clamps. You may want to tape the joints of the PVC together while you do the tuning of the antenna. *Do not glue any of the pieces together until the tuning process is complete.*

Tuning the Antenna

Use an SWR bridge capable of accurate measurements at 440-450 MHz to check the top, middle, and bottom of your desired frequency spread. The feed point should be about 4" from the vertical sections of the copper tubing. Moving the feed point an eighth of an inch will change the match quite a bit. Once you have found the best feed point, solder the coax center conductors to it securely, and tape the phasing section to the tuning stub tightly. Slide this assembly into the 18" section of PVC and check the match again. If it is still good, you can glue the 18" section of PVC to the "T" fitting. Glue the 12" sections of PVC to the "T" fitting, but *do not* glue the end caps yet.

As a final tuning trick, put a small flat-

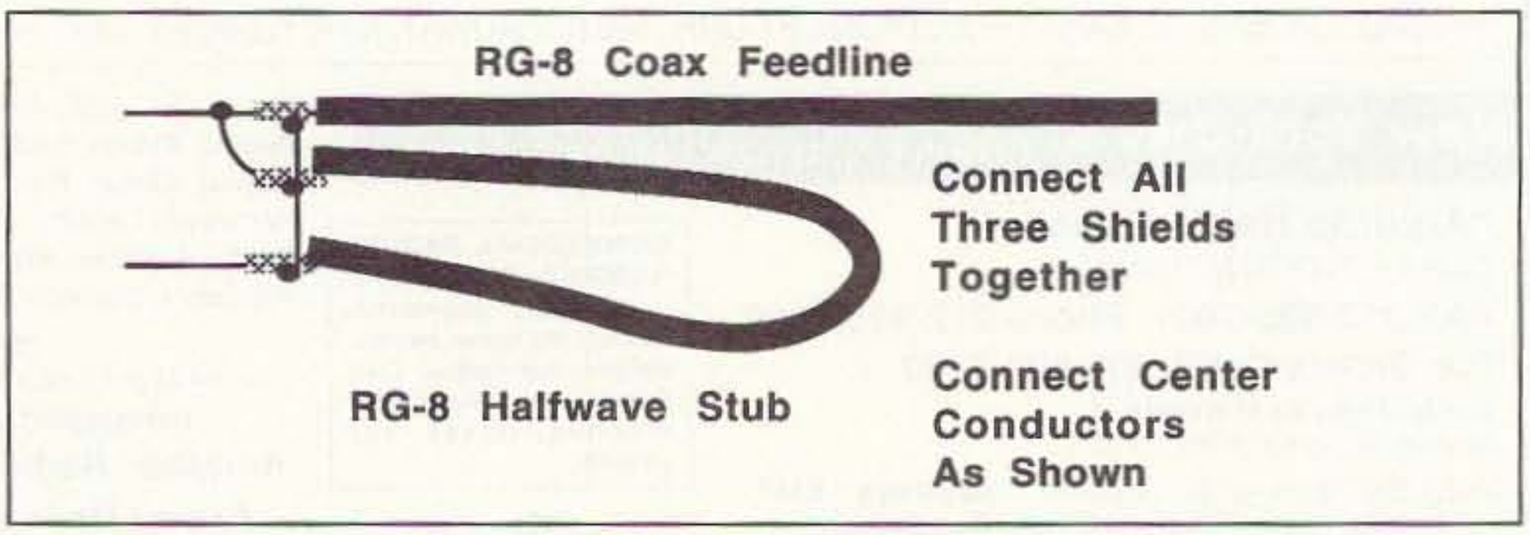

Figure 2. Half-wave phasing section detail.

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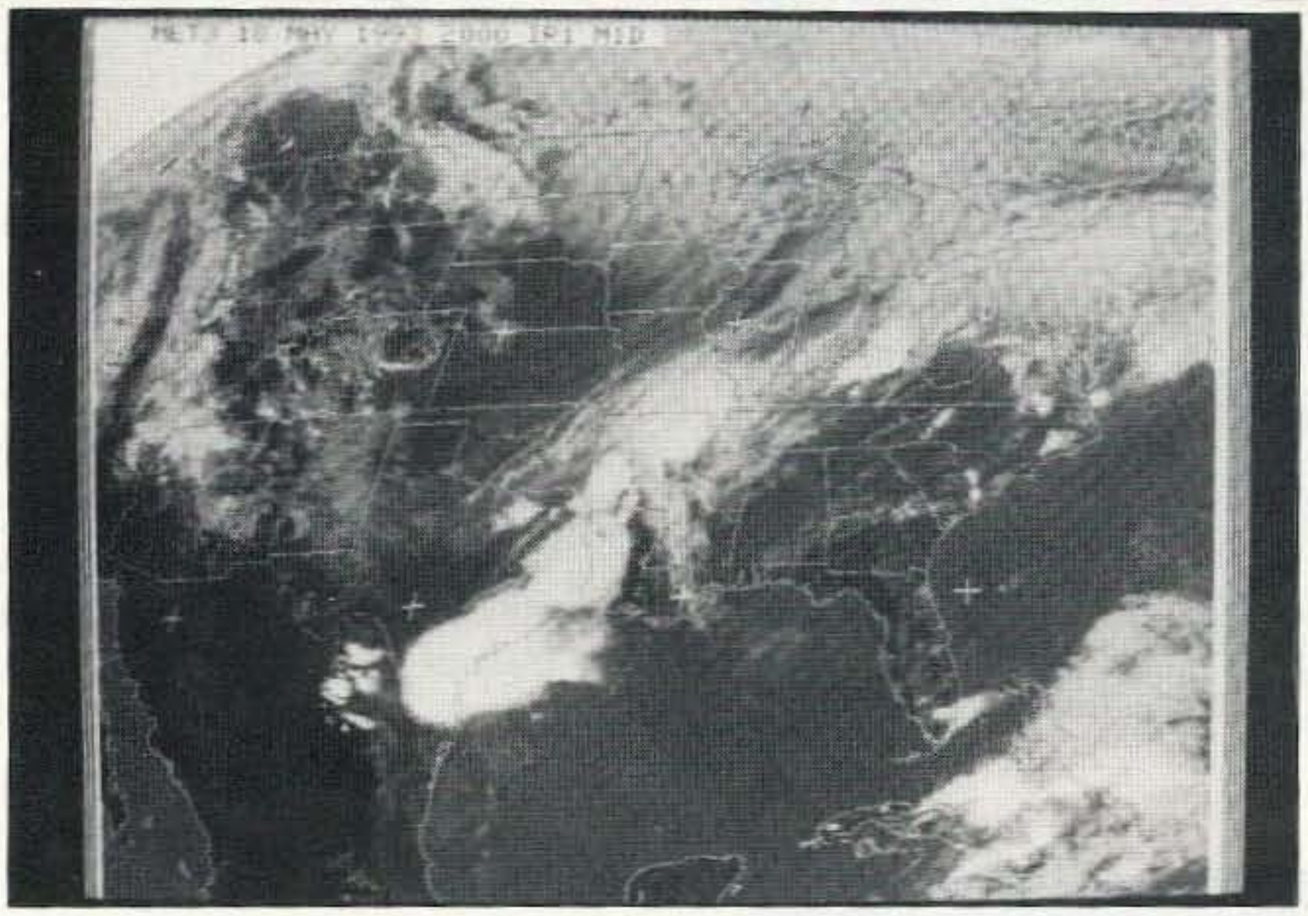

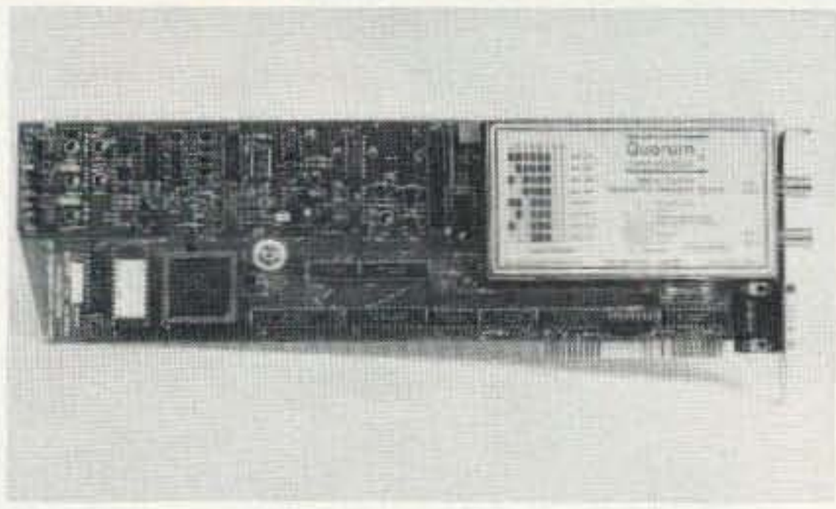

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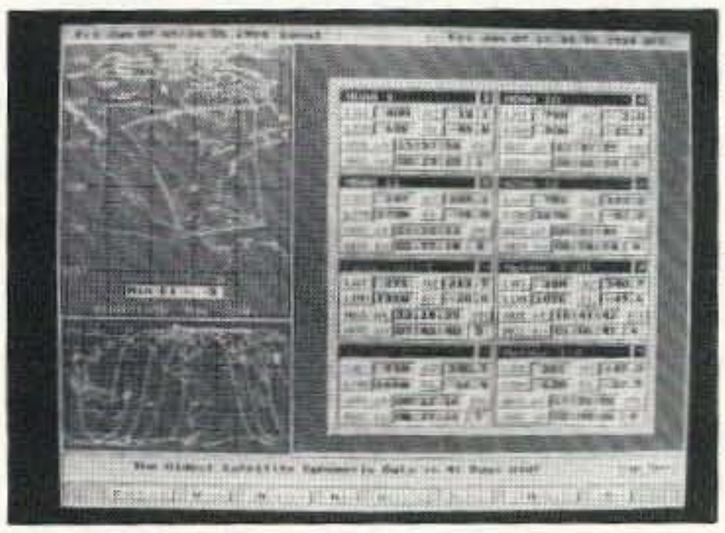

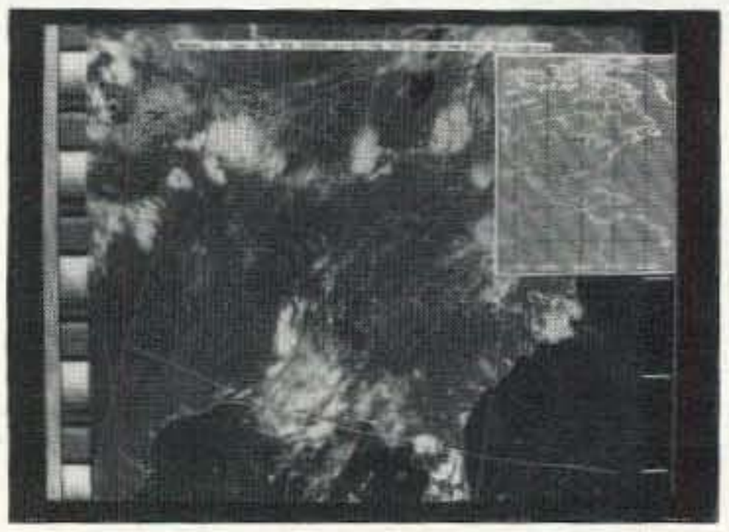

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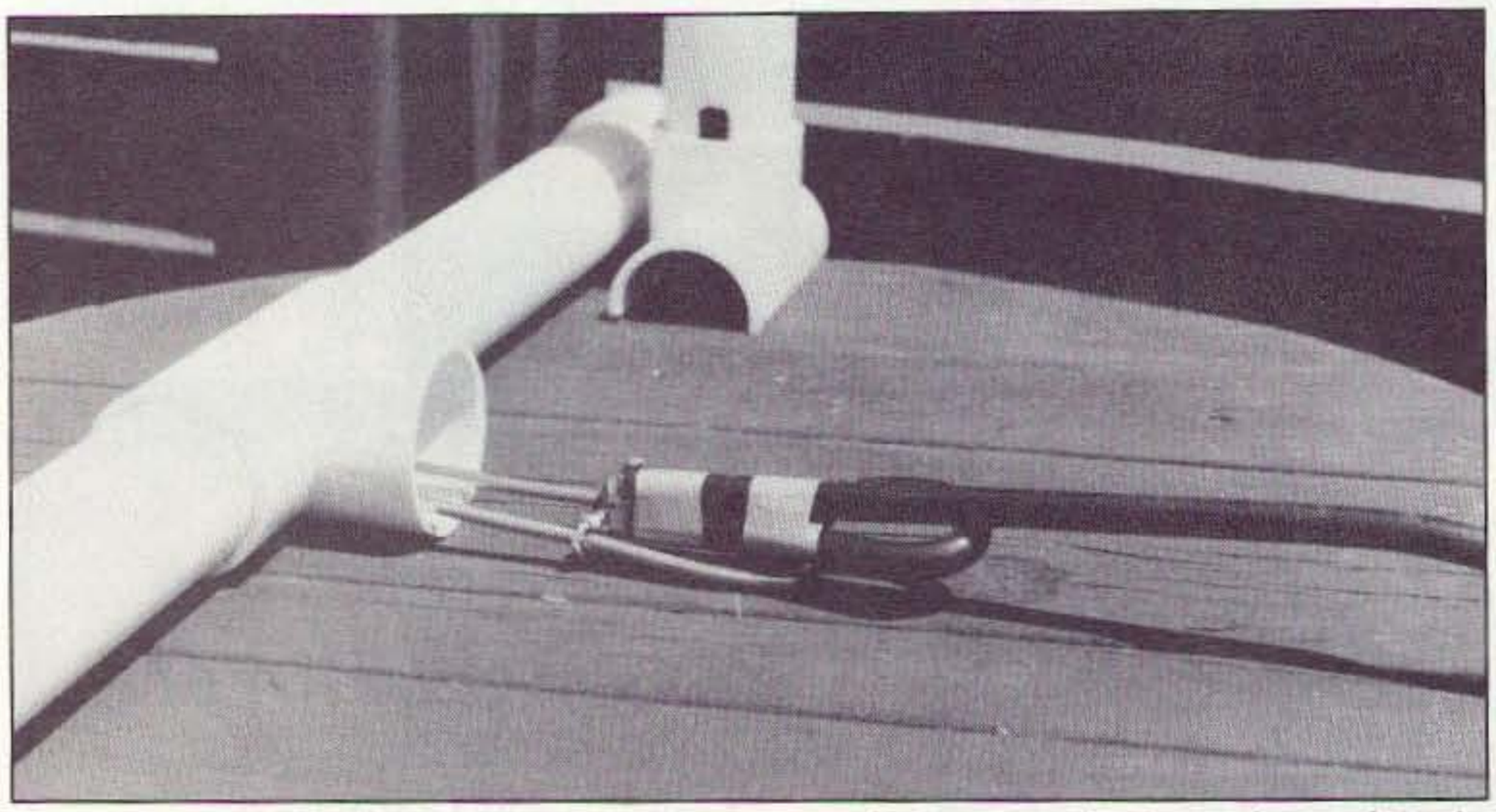

Photo D. Attach the phasing section to the tuning stub (foreground). Notice the notch in the PVC for the coax (background).

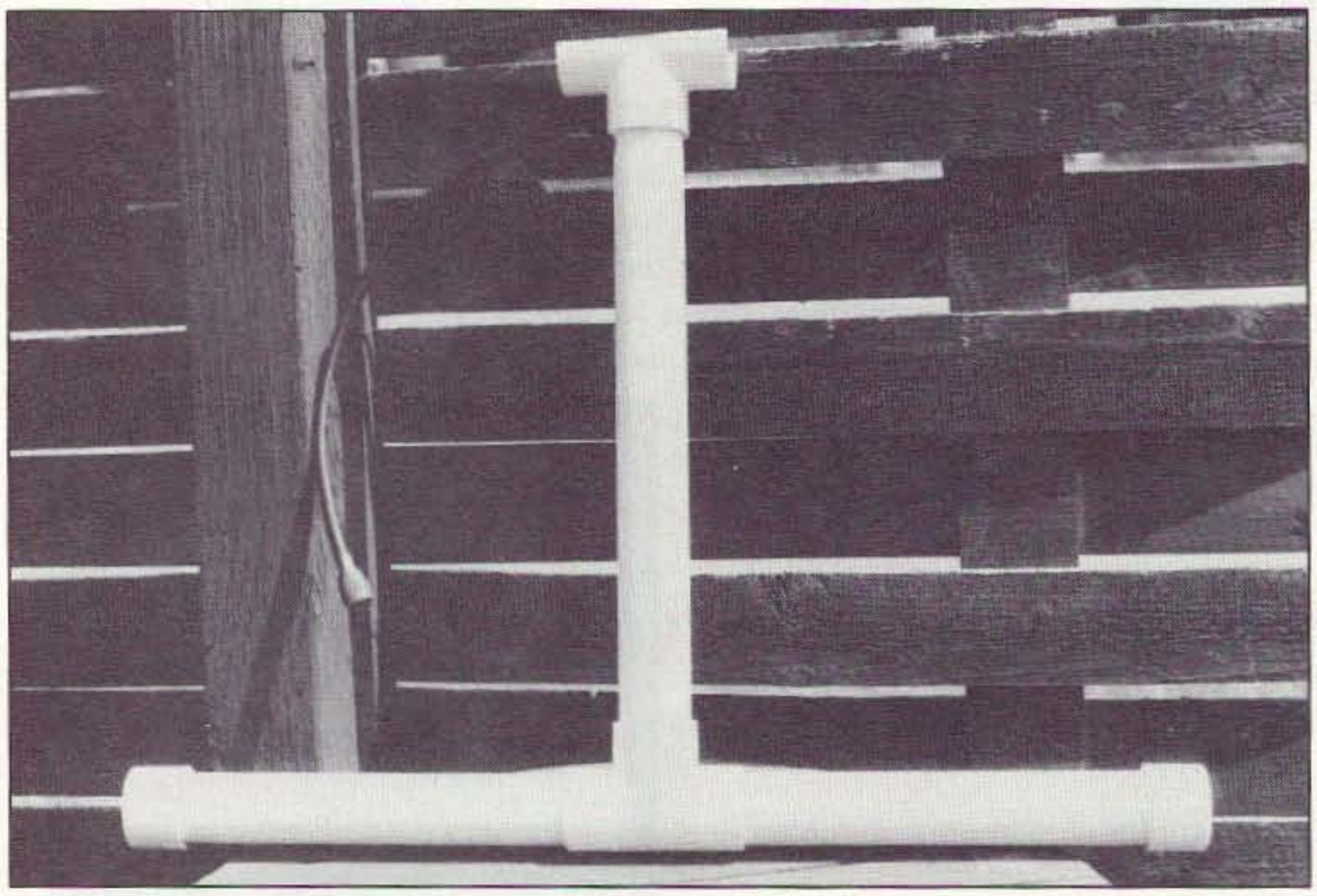

Photo E. The completed 440-450 MHz antenna, ready for mounting.

or pan-head #4 stainless-steel self-tapping screw into each end of the vertical copper tubing to fine-tune the length. Start out with the screws all the way in, and adjust by unscrewing in small increments until you are happy with the match. On my first attempt, I glued the caps on, and had to settle for 1.35 to 1 for the best match. By using the screws to fine-tune you can get 1.1 to 1 or 1.2 to 1 for your final match. On my second try I wound up with a 1.16 to 1 match at 450 MHz, and 1.35 to 1 at 438 MHz.

Final Assembly

When final tuning is complete, glue the end caps on, and glue on the split "T" fitting. Apply some silicone or butyl rubber caulking to the area where the coax goes through the PVC to weather-seal the opening. I used some duct tape on the opening area of the split "T" that seats against the mast to further seal out any bugs or moisture, and to give a cushioning mount to the mast. Attach the completed antenna to your mast or tower leg with the stainless steel band clamps, connect your coax or hardline to your stub, and weather-seal this junction.

"Pay close attention to the formulas used in this project. They make the difference between success and failure."

Builder's Notes

If you can get a match ranging from 1.2 to 1.6 over about 10 MHz, you have achieved success. All joints must be sealed to keep out any moisture. Pay close attention to the formulas used in this project. They make the difference between success and failure. Refer back to the text and the drawings and photos before doing any gluing; PVC glue is fast-setting and permanent (10 seconds). You may want to use a piece of self-sticking rubber non-skid tub tread instead of duct tape to seal the open end of the split "T" fitting. Use the lowest-loss coax or hardline as your main feedline to cut down on losses; feedline losses are quite large at 450 MHz.

Parts List

My sources locally were Builders Square and Hardware Hank Stores for all items needed to make this antenna.

2 pieces	12" long 1-1/2" PVC pipe
1 piece	About 18" long 1-1/2" PVC pipe
2	1-1/2" Tee fittings *Schedule 40 Pressure type PVC*
36-3/4"	Of 3/16" copper tubing, refrigeration type
2	2-1/2" stainless steel band clamps (for mounting)

Styrofoam (to keep copper tubing centered inside PVC)
Duct tape (to seal the open end of the split PVC "T" fitting)

Tools List
PVC cement
Hacksaw
Tape measure
Electrical tape
Vise (optional)
Hole saw (optional)

Materials Cost List

10' length of 1-1/2" PVC pipe	$3.00
36-3/4" length of 3/16" copper tubing	$1.25
2 1-1/2" PVC "T" fittings	$2.00
2 1-1/2" PVC end caps	$1.25
2 2-1/2" stainless band clamps	$1.00
Total materials cost	$8.50

A Review of Formulas Used with the Copper Tubing

At the frequency of use, a 1/4 wave = 6.3" x 6 = 37.8" of 3/16" tubing. The velocity factor of PVC pipe is 95%; 37.8 x 95% = 35.91". I round this off to 36" and add the 0.75" center of the tuning stub to come up with the 36.75" overall length of the tubing.

Formulas Used with the 52-Ohm Phasing Stub

12.6" = a half wave x 0.80 = 10.08" for RG-8 foam; x 0.66 = 8.316" for RG-8A solid dielectric and RG-213; x 0.78 = 9.828" for 9914 Belden foam.

If you have questions about this antenna please write to me, including a #10 SASE: Marty Gammel KAØNAN, 1703 Hewitt Ave., St. Paul MN 55104-1128. I hope that you get many years of service out of this antenna, and I would like to thank John Berglund KØUBA for his help in editing. 73s and happy hamming to all of you who like making your own antennas, instead of just buying whatever the manufacturers decide that we want! 73

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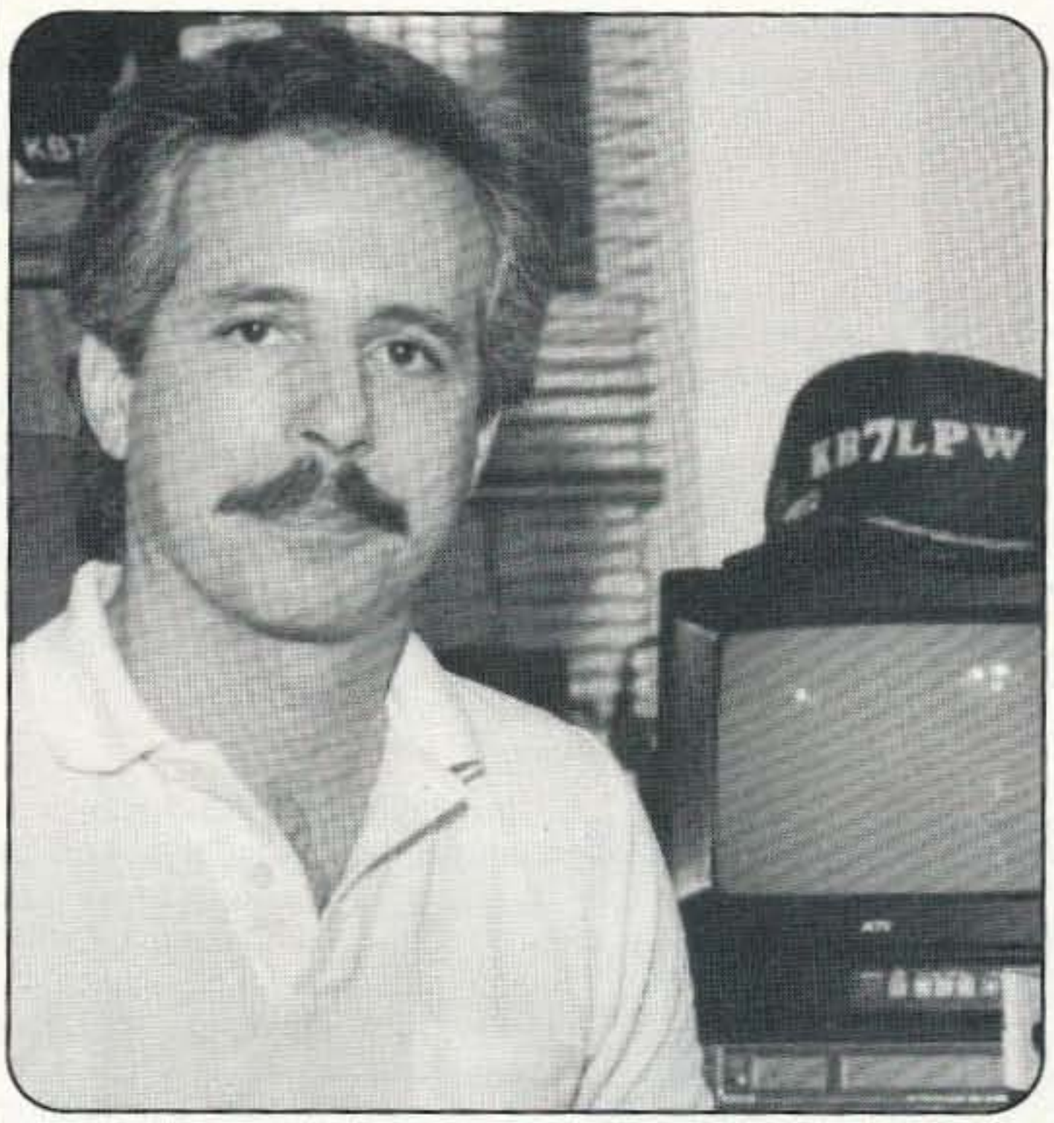

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73 Review

Number 7 on your Feedback card

by Gordon West WB6NOA

Alinco Electronics Inc.
438 Amapola Ave. #130
Torrance CA 90501
Telephone: (310) 618-8616;
Fax (310) 618-8758
Price Class: $269

The Alinco DJ-G1T Handheld

An HT with a built-in spectrum analyzer!

Alinco advertises that their new DJ-G1T 2 meter handheld possesses a unique feature that no other handheld on the market has—*a built-in spectrum analyzer.* Most amazing—what kind of circuitry in a dual-conversion, super-heterodyne receiver could let you look at the VHF band in the frequency domain?

The Alinco DJ-G1T is part of a series of four band-scope transceivers that are offered in Japan—DJ-G10, -G40 (for 440), -Z10, and -Z40; the last two without the touch-tone pad. Alinco USA brings in just the VHF version with the touch-tone pad for now, but indicates that the UHF version with band scope may be just around the corner.

Power

The new Alinco DJ-G1 has the build of a stocky HT—it's not real thin, nor is it real tall. It fits nicely in your hand and is sized at 50mm wide, 116mm high, and 37mm deep. It comes with a 7.2 volt, 700 mAh battery pack that slides up inside the unit like you would load a pistol. Seven volts at 700 mils is a nice balance of 2 watts power output on high, drawing about 980 mA on high power transmit. The pack can give you a quarter-watt output on low power at 375 mils, and on medium power your output is 1 watt at around 750 mils. Power output is easily selected by a "function PO" command on the front panel.

If you absolutely need high power output at 5 watts plus, you can go for the optional EBP-32N 12-volt pack that will consume over 1,500 mA on high power output. If long life is what you need with your handheld, I would recommend the optional Alinco 7.2-volt pack at 1,200 mA, and this should last you the better part of a day. However, this pack and the high-power pack will add additional inches to the bottom of the transceiver. And all emergency communicators should carry the EDH-14 alkaline battery tray, and this tray fits flush with the bottom of the unit for 9 volts at about 4 watts out, and a dramatic improvement over nickel cadmium on how long your batteries will last.

I go into detail about the importance of the right size battery pack because no handheld with any type of fancy display or capabilities is any good with a dead set of batteries. So when you buy any handheld, take a close look at battery voltage, current consumption on transmit, and the milliamp hour capacity of the battery pack that comes with the unit or is sold as an option.

Operation

The Alinco DJ-G1 is a 2 meter transceiver with added 440 MHz receive capabilities. In some parts of the country there are repeater systems that could allow for some crossband options-transmitting on 2 meters, and then cycling back to receive on the 440 band. The 440 receive capabilities will probably perk the interest of scanner enthusiasts that will ask the inevitable question, "Can the set be modified for out-of-band public safety receive?" The answer is, "Yes, by going into the insides of the unit, cutting the red and blue wire loops, and unleashing receive capabilities from 400 MHz all the way up through 511 MHz."

On the VHF side of the transceiver you get wideband receive capabilities from 108 MHz through 174 MHz. But if you plan to hear any aeronautical calls down around 110 MHz to 130 MHz, you need to specifically call up the AM side of the receiver.

1. Push the VFO button to get into the VFO mode.
2. Push the hold function, push "low PTT," and the letter "A" will appear in the screen indicating AM reception.
3. Now write into memory all of your aeronautical receive channels.
4. Cancel out by repeating the above steps to return to FM mode.

Photo A. The Alinco DJ-G1T.

Features

Incredibly, the DJ-G1T comes with 80 memory channels out of the box, and you don't need to buy any memory expansion chip for these 80. Most other handhelds come with about 40 channels; and while this is OK, it's generally not enough for scanner enthusiasts up on 460 MHz.

Now, before I go into the spectrum analyzer "band scope" feature that sets this unit apart from all others, let's explore a few more "features" that are relatively common on most high-quality, single-band and dual-band 2 meter transceivers. Here's what the DJ-G1 offers:

- Auto dialer with 5 memories
- Auto dialer delay programming options
- DSQ for private paging common to other brands of handhelds
- CTCSS encoder built in, with simple plug-in provisions for optional encode/decode board
- Six scan modes
- Odd splits on all 80 memory channels
- CAP/MARS TX capabilities
- Priority watch
- Reverse function
- Momentary or constant backlight
- Backlit keypad (looks great at night)
- Auto power off
- Battery level indicator
- Battery save function
- Programmable scan time
- Programmable scan edge frequencies
- Call channel

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1000 volt tuning capacitors, extra heavy duty inductor switch, Teflon® insulating washers and proper L/C ratio gives you arc-free no worries operation.

You can tune any transceiver, transmitter or receiver with up to 300 watts of RF power from1.8 to 30 MHz.

Lighted Cross-Needle Meter

MFJ's lighted Cross-Needle Meter shows you SWR, forward and reflected power *simultaneously*. It reads both *peak* and average power on 300 or 30 watt ranges.

The meter is illuminated for easy reading in dim light and has an ON/OFF lamp switch. The meter lamp uses 12 VDC or 110 VAC. A *free* AC adapter is included at no extra cost.

Tunes *any* Antenna

The MFJ-949E tunes out SWR on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . nearly anything!

Use coax feed, random wire or balanced lines. Has oversized *heavy duty* 4:1 balun.

Super Antenna Switch

MFJ's 8 position *super* antenna switch lets you select two coax fed antennas, random wire/balanced line or built-in dummy load for use through your MFJ-949E or direct to your transceiver.

MFJ's Cross-Needle SWR/Wattmeter is always active for monitoring forward and reflected power and SWR.

QRM-Free PreTune™

MFJ's *QRM-Free PreTune*™ lets you pre-tune your MFJ-949E off-the-air into a built-in dummy load without causing QRM.

Pre-tuning into a dummy load makes tuning your actual antenna faster and easier.

Full Size Dummy Load

MFJ's 300 watt 50 ohm dummy load makes tuning up your transceiver and pre-tuning your antenna easy. It reduces needless QRM and saves your finals.

You'll find it handy for testing and repairing your rig, setting power level, adjusting your mic gain and more.

The MFJ-949E has a *full size* non-inductive dummy load measuring 3/4 inch diameter by 5 inches. It *easily* handles 300 watts of abusive tune-up power.

Watchout for cheap midget size dummy loads that changes resistance as it heats up -- marginal ones could burn up your rig.

Custom Inductor Switch

The inductor switch is the most likely component to burn up in *any* antenna tuner.

The inductor switch in the MFJ-949E was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner -- it's not a flimsy *plastic* switch made for small signals and wired with *tiny* gauge wire.

Unbeatable Quality . . . built to last

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

Detailed logging scales and legends are *permanently* silk screened on a *real* aluminum front panel and back panel -- it's not merely a plastic decal or glued-on paper strip that can peel off.

Superior construction -- MFJ-949Es use Teflon® insulating washers, counter sunk screws for meter bracket, *real* binding posts, wing-nut for ground post.

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Every MFJ-949E is backed by MFJ's famous one year *No Matter What*™ unconditional guarantee. That means we will repair or replace your MFJ-949E (at our option) *no matter what* for a full year.

Others may give you a *limited* warranty on defects in material and workmanship.

But what do you do if it burns up and they say, "Sorry, your *limited* warranty does not cover that?"

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CIRCLE 86 ON READER SERVICE CARD

I think you get the idea here—nothing was left out when it came to bells and whistles, of which most ham operators will only use a fraction of the unique capabilities of their single-band or dual-band handheld. I tried out many of these features and can report that they all work. No surprise here—although I was pleased to see that the pager function in the DSQ mode is similar to what you might find in Icom, Kenwood, and Yaesu radios, too. This means that your radio will be compatible with a DSQ system, if an enterprising ham has inaugurated one through a local club or repeater organization.

Spectrum Analyzer

This is not the first time I have seen a quasi spectrum analyzer built into an amateur radio communications receiver. I have a little-known Standard radio AX700 receiver that can be switched into a spectrum analyzer with undulating vertical bars going up and down in time with incoming signal strengths on center frequency and a few hundred kilohertz to each side. This is the same idea that Alinco has incorporated into their oversized and very legible LCD display window.

To enter the channel scope mode, get into VFO, hold function, and then push the "8" key for "Search." The conventional left-to-right LCD bar graph for signal strength instantly disappears, and now vertical bars illustrate frequency occupancy on seven ever-changing pedestals. The default value is 5 kHz per pedestal, and this is really too tight to be of much interest in what's really happening on the next channel up or down.

It's easy to change this—get out of the spectrum analyzer mode, get into the frequency step mode, and select either 15 kHz or 20 kHz 2 meter channel separation for your particular part of the country. *Now* this feature gets useful: You can see two channels down and two channels up, for near-channel activity. And if you want even a larger look, go into 50 kHz steps, and now you can see 150 kHz up and 150 kHz down from center frequency.

Out here in Southern California, 146.52, 146.55, and 146.58 are all common simplex frequencies. But repeater pairs are sometimes spaced only 15 kHz apart, so I set my band scope for 15 kHz steps. While operating on 146.550 MHz simplex, I could clearly see the activity taking place below me on 146.520 MHz, and could also see that I still had an open channel to QSY to up on 146.580 MHz without having to go up and take a listen.

While rotating through the frequencies in the band-scope mode, you can watch the signals whiz by on the screen as you tune by them. But it takes the receiver section of this transceiver about a second to finally bring up the audio because of the scanning technique used in the band scope. You could also detect the rather slow five-second scan rate by noticing the audio dropout on the frequency you were listening to, and also watching the slow change in signal strength on those frequencies indicated above and below center frequency. In other words, if you are listening to 146.520, you will see the signal strength of the other station instantly vary because you are on center frequency. But if someone should stop transmitting down 30 kHz, someone who you have been watching to the left of center, it may take three or four seconds before that LCD signal strength indicator drops to zero.

You can also run the channel scope to monitor nine memory channels: four below you, four above you, and the memory channel you are actively listening to. If you are tuned into nine different repeaters, you will see all of their activity on the scope. When any repeater drops out, you will see their LCD signal strength drop. But this drop could be delayed by as much as three seconds due to the scanning technique employed in this channel scope scheme. And just like before, every five seconds, the frequency you are listening to abruptly drops out as the microprocessor quickly whizzes through the channels to refresh the channel scope readout.

In the channel scope mode, your active listening is interrupted every few seconds as if you had a priority watch switched on. This is a bit annoying, but it's the only way that the set can refresh its look at frequencies around you. But if you are looking for activity on up to nine normally quiet repeater frequencies, you can quickly spot it and see which way to turn the dial to get to that activity by watching the scan scope. This is a feature that I liked very much.

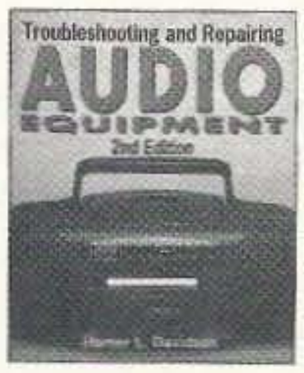
Does the scan scope really mean all that much to the average hand-held radio user? Probably not—but it does look a little bit impressive when you check it out for the first time. After you play with it for a few days, you will see that it is best used for seeing what's happening on four channels down, and four channels up from the present frequency you are tuned into.

It's nice to see a big LCD display. The audio output was also good, measured at around 250 milliwatts. This is adequate when you're holding the unit in your hand, but not nearly adequate if you're trying to pick up a call with the unit worn on your belt and a jacket over it. An external speaker microphone that Alinco offers is a great way to get the most out of the audio output.

I tried my usual torture tests of dropping the unit from a coffee table to a hardwood floor, and the worst I could do was to slightly scratch the convex clear plastic screen. Transmit audio sounded full and clear, and factory deviation was set to 4.5 kHz, just about right for today's crowded bands. VHF sensitivity was relatively hot at about 0.08 microvolts, and the UHF side of the equipment was hot at around .15 µV They are not running a complete separate receiver for UHF, so it's common to find a UHF receive-only capability somewhat close from the TX/RX capability for the band that the unit was designed for. And for public safety monitoring at 460 MHz, you have plenty of sensitivity to spare at .15 µV.

The instruction book is not necessarily glamorous, but it gives you plenty of detail on how to run this unit through its paces. I made several phone calls to Alinco for follow-up information, and all of the gang up there including Taka on the technical bench were more than helpful, spending some phone time with me answering any question that I could come up with. Alinco is not so big that the technicians are isolated from the public—and it's fun to talk with the techs because some of these folks were actually in on the original design work of the equipment in Japan.

So the new Alinco handheld does its job well, with the "spectrum analyzer band scope" both a gee-whiz and something that could be used on the service bench. But if you're out there in the boondocks looking for activity, you'll see it long before you'll hear it in the 50 kHz step mode. That in itself is one great feature on this very unique portable transceiver from Alinco. 73



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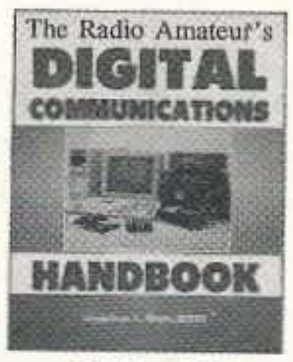

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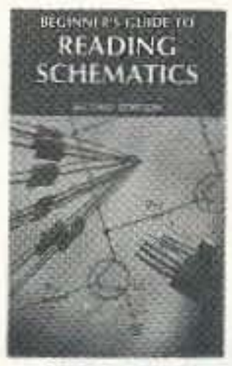

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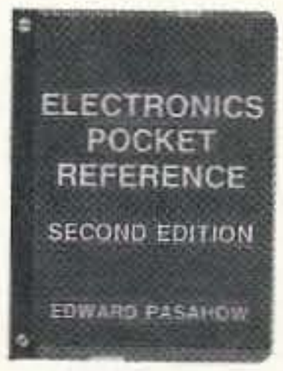

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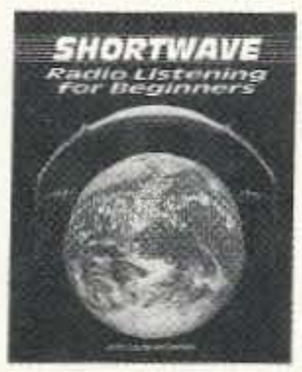

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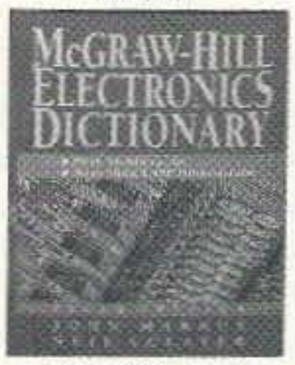

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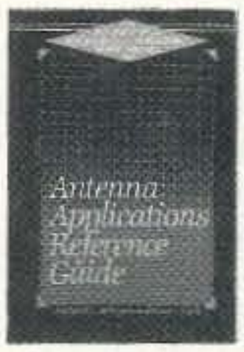

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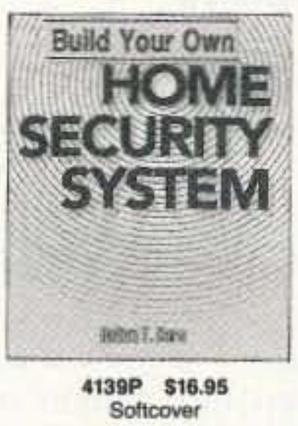

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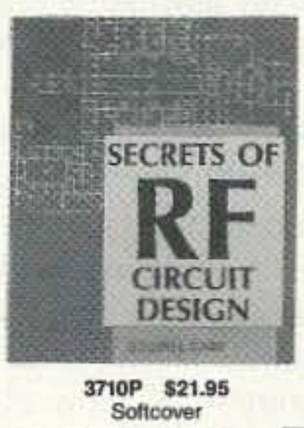

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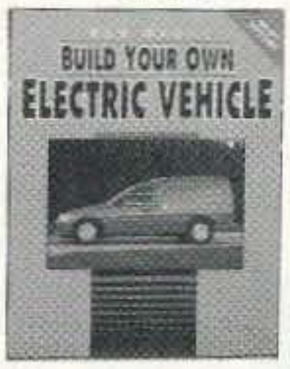

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73 Review

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by Jeff M. Gold AC4HF

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Price: $129.95

The MXM Simple Transceiver

An easy-to-build single-band CW QRP kit.

There are a number of reasons to build a radio from a kit. I get a great deal of satisfaction from talking to hams on a piece of equipment I have assembled myself. The building process itself is often worth the price of the kit (I often say building is cheaper than therapy). And, if you have a problem with a rig, you are much more likely to be able to repair it yourself if it's something you've built yourself.

One of the first kits I ever assembled was MXM Industries' 40 meter transmitter/receiver combination, an inexpensive kit that I picked up at a hamfest. I did not know much about soldering, much less about building a working radio. I made a number of mistakes during assembly and managed to blow up a few transistors in the transmitter, but in the end I had a working radio. I enjoyed building the kit and was very excited when I was able to actually talk to someone on it. The receiver was a VFO-controlled superhet that worked well. The transmitter produced a nice signal, but was crystal-controlled. You also had to manually switch between transmit and receive. Being stuck on one transmit frequency and having to manually switch from transmit to receive made this a seldom-used rig.

What's Included

MXM's new kit provided my wished-for improvements. These transceiver kits are made for a single band to work on CW, and are available for 80, 40, 30 or 20 meters. The receiver is a double-conversion single-signal design and employs dual filtering. The rig features electronic QSK keying and a variable pitch control that can be used for bandwidth control. It puts out approximately 3 watts. The kit comes with a nice printed circuit board, all board parts, air-variable capacitors for main tuning and pitch control, and a very nice aluminum case (I liked the case the way it came and didn't bother to paint it). The kit does not include the potentiometer for volume control (available from Radio Shack for about $1.30, or at most hamfests). It also doesn't come with the jacks to connect the headphones, power and key; many people like to choose their own types of connectors and keep them in their ham shacks.

Putting It Together

The first page of the instructions says "CAUTION: The MXM Simple Transceiver is a very sophisticated design. It is recommended ONLY for experienced builders." This is probably the only line I disagree with in the entire documentation—I found this a very easy kit to build. However, new builders might need help with the alignment process.

The entire transceiver goes together on a single printed circuit board. The board is very clearly silk-screened and there is an excellent parts overlay. There is also a nice parts list that helps avoid confusion and identify parts. These features make it very easy to locate the correct part and place it in the proper place on the board. I found the single-sided board easy to solder on. It is also fairly easy to remove a part from this board if you should put it in the wrong place or need to replace it.

The directions are not step-by-step, but they are very clear and easy to follow. The first part of the instructions explains in understandable terms the design of each section of the transceiver. If you should have a problem during the final testing, this part of the instructions becomes a valuable tool. The parts overlay shows the underside traces of the board as well as the labeled parts. This is another great aid in finding possible problems. The schematic is very clear and easy to read.

I often find myself doing really dumb things. I will take great care in building a kit. I will carefully align it. But, if it's late I may put the kit away for a while and then do something like hook up the power backwards or put the board on the table on top of small pieces of scrap wire or solder. These things can lead to major smoke. Whether you use them or not, diagnostic aides such as good schematics, circuit descriptions and overlays showing the bottom side of the printed circuit board are worth their weight in gold.

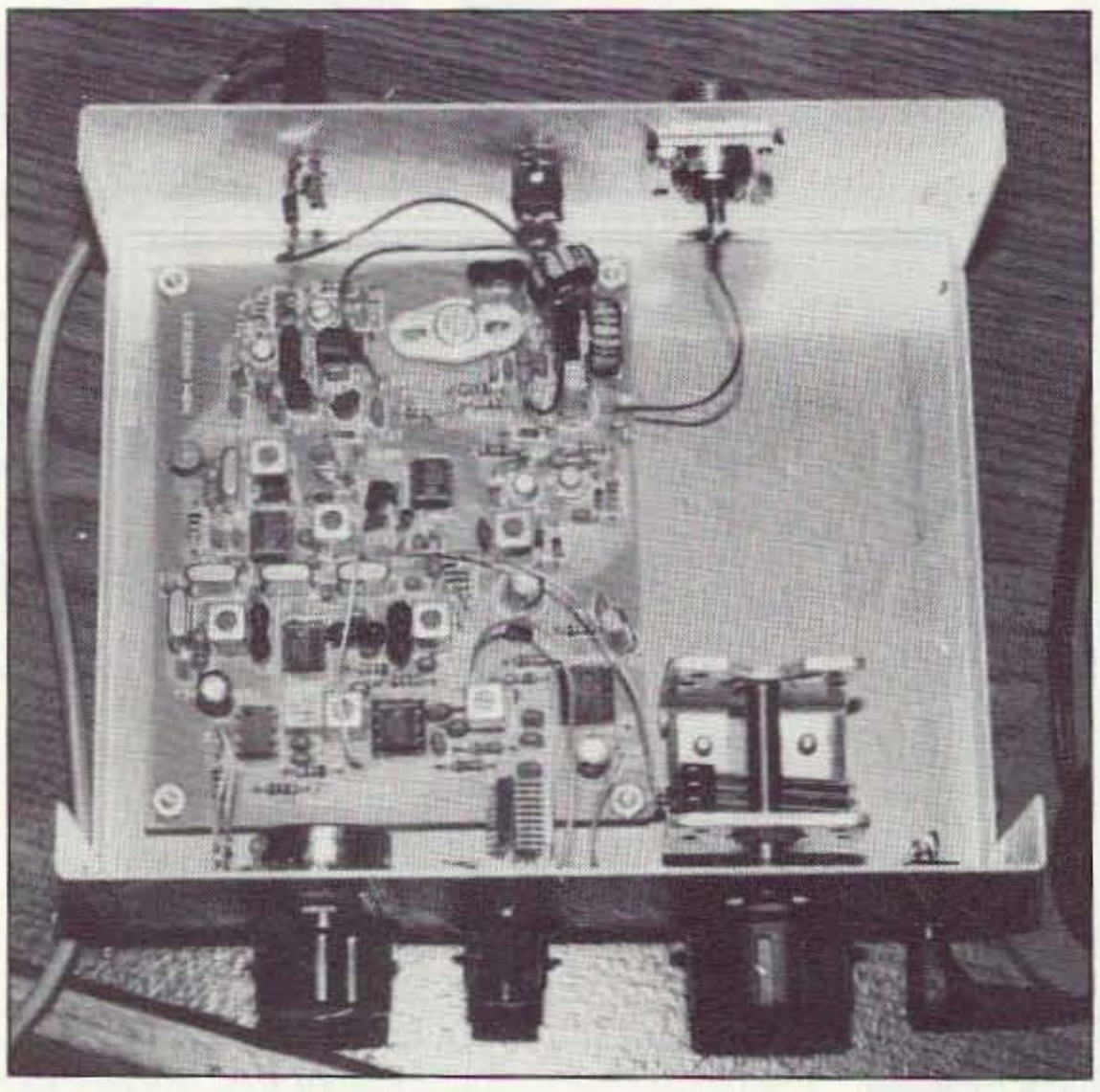

Photo A. The MXM Simple Transceiver.

I really liked the way the construction steps were handled. You build the transceiver in sections and check and align each section before proceeding. This gives you intermediate sources of gratification as well as making it easier to identify problems as you build up the kit.

The instructions are separated into construction and alignment sections. After you build a section of the radio, you go to the appropriate part of the alignment section. The first section you build is the IF. In order to align this section you need a source for a 4 MHz signal.

The directions say you can use the fifth 4 MHz crystal included in the kit for the transmitter to build an oscillator. The instructions refer you to the *ARRL Handbook* if you need circuit details for the oscillator.

I have an MFJ antenna analyzer, which works by injecting a low-level signal into the antenna and then using it to measure reflected power. I find that this piece of test equipment works well as a signal source. You might also find it helpful to have a frequency counter. The alignment instructions provide for checking the frequency at two test points. You can, however, do the alignment without the frequency counter. To tune the IF section you tune a transformer until you hear an audio level which will indicate that the oscillator is operating. You can hook the frequency counter or scope to a test point and measure the frequency, which should be 455 kHz. Next, you tune another transformer to get strong audio output and check the frequency at a different test point. The frequency should be at 4.455 MHz. This adjustment is very precise and may take you a couple of tries to get it right. You are tuning the IF section to detect the 4 MHz signal coming through the crystal filter. The last adjustments are to two more transformers for maximum audio output. These are fairly broad adjustments and should present no problem.

The next section you build is the RF section. You will need a source to generate a signal for the band the kit is on. You can use a separate transmitter/transceiver or other signal source. I once again used my antenna analyzer to provide a signal source. You tune a transformer until you can hear a signal that is in the band the kit was built for, then repeak the other transformers.

The last section you build is the transmitter. You need only tune one transformer in this section to purify the signal and route it to the rest of the transmitter. You can use an oscilloscope and/or wattmeter. If you only have a wattmeter you can tune for the most power output. With a scope you will monitor the waveform of the transmitted signal and get it as clean as possible. You will also need to set a variable capacitor to make sure that you are transmitting and receiving on the same frequency. I always find it easier to use my main station transceiver for this. I transmit with the power level off and no antenna hooked to my main transceiver. I then locate this signal on the receiver I am aligning. Next I transmit with the kit and tune the variable capacitor to bring it right on frequency. I usually repeat this a few times on different frequencies to ensure I have it set correctly. This also allows you to listen to the quality and sound of the kit's transmitted signal.

Once you have done the initial checkout and alignment you are ready to mount the board and controls in the case. It is suggested that you mount the board in the case, making the wider part of the case the front. You then mount the board in the left section and the air variable capacitor for tuning to the left of the case. This will leave plenty of room if you want to modify the rig later by adding an electronic keyer or additional filtering.

Once you have everything in the case, you fine-tune the various stages. To accomplish this you hook the transceiver to a resonant antenna. You again use a nearby 4 MHz signal source and repeak the transformers. The directions are very clear. You will need to follow them step-by-step to get the proper performance out of the receiver and transmitter.

I found my kit went together very easily. I was very pleased with the clarity of the instructions and the quality of the parts. I didn't find myself confused about how to assemble any part of the kit. Sometimes I like building something just for pure relaxation, and this kit really did the trick.

Performance

Once the kit was together and aligned, I was anxious to get it on the air. I hooked the rig up to my main station antenna (a quad). The receiver is sensitive; if the signal is there, you should hear it. One of the features that sets this transceiver apart from other QRP kits is the CW pitch control. The pitch control uses an air variable to control the CW pitch of the incoming signal. The control allows variation of the output frequency of the product-detector oscillator. You can set the pitch to a tone that you prefer. More importantly, this provides variable bandwidth control by moving the injected signal nearer or farther from the edges of the filter's bandwidth. When the band gets noisy or crowded it becomes a useful filter.

My transmitter put out a little over 2 watts. I had no trouble at this power level making contacts. I prefer electronic keying. I find relay-controlled transmit/receive switching can become annoying in some cases. The QSK in this transceiver proved to be effective.

After completing the final alignment procedures I anxiously tuned across the band. Luckily the band was in fair condition. Almost immediately I heard AA1HJ calling CQ. I answered his call. Dave in Newton, New Hampshire, and I had a nice QSO for a short while. He reported I was a 559 but a tad off his frequency. Well, no one is perfect. I went back and redid the variable capacitor tuning. I next contacted Bob N2NQG in Toms River, New Jersey. He was a 599 and reported I was a 569. He was using 100 watts to my 2 watts. I felt I was doing a good job.

The bottom line is that this is one of the least expensive superhet-based kits on the market. It is fun, easy and enjoyable to assemble. Beginners may need some assistance with the alignment, but should be able to meet with success. Once on the air I think you will be happy with the fruits of your labor. 73

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73 Review

Number 9 on your Feedback card

by Jeff M. Gold AC4HF

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The MFJ-1786 Super Hi-Q Loop

A compact multiband HF antenna.

I was anxious to try out the new MFJ loop when I first saw their advertisement. I have both read and heard many heated discussions about small loop antennas. A small multiband antenna that can be set up in minutes or used in places where space is at a premium or antenna restrictions are in effect would be a good investment, if it performed as advertised.

The antenna arrived one afternoon while I was at work. My wife called me to ask what type of monstrosity I had purchased this time, because there was a huge heavy box that had just arrived.

The antenna has a diameter of 36 inches. This means it can fit fully assembled in the back of a small car. It is constructed of thick-walled aluminum pipe. The current carrying joints are welded to increase the efficiency of the antenna. One of the major drawbacks of a small loop is that it can be very lossy. The manual states that the antenna was designed with the intention of keeping the losses down by paying particular attention to the electrical and mechanical construction of the antenna. MFJ claims that by using this design method, the loop should radiate nearly as well as a half-wave dipole (they use the term "full-size dipole" in the manual). To accomplish this goal they use large-diameter thick-walled aluminum pipe for the radiating element, set into shape by a special machine. The joints are heli-arc welded to eliminate resistive pressure connections. For tuning they used a specially constructed (arc-welded) butterfly capacitor which has a lower loss resistance. The antenna is heavy. The materials are good quality, and so is the construction.

Location and Mounting

The manual goes on to explain the radiating patterns, polarization of the antenna, and suggested locations for mounting. You can either vertically or horizontally mount the antenna. If you mount the loop standing up you will get vertical polarization. When mounted vertically, the antenna is directional. The nulls occur perpendicular to the loop's axis.

Mounting the antenna horizontally will result in an omnidirectional horizontally-polarized pattern. The pattern will have a null straight up and straight below the center of the antenna. This will cause the ground reflection to cancel the signal unless the loop is mounted high enough away from the ground or structures that act as ground planes. A small loop is generally quieter on receiving when horizontally polarized. Horizontally polarized loops are not good for ground-wave communications, but work well for medium to long-distance skywave communications.

Where you are able to mount the antenna will also determine how you mount it. If you mount the loop less than 20 feet above a metal roof or other ground plane it probably will not work very well at all. I believe incorrect placement and mounting account for much of the bad reputation the small loop has received.

The loop will operate from 10-30 meters and should tune to 1:1. Tuning is done by an indoor remote control unit. This is a semi-automatic tuner. It has a built-in cross-needle wattmeter with both high and low power ranges. The tuning and control voltages are fed through the coax. This means you don't need to hook up any additional wiring. The remote control can be powered by an optional AC adapter or you can put batteries into the unit for portable use. There is a lamp on/off button to help save energy when using the unit with battery power. Above the SWR/power meter are three buttons: the power button, the hi/lo power range control, and the lamp button. On the right top section on the front panel are a series of four buttons and four LEDs. The right-most section is the Auto Band Select. This is for fast tuning. To its left are the fine-tuning controls.

You can tune the loop in several ways. If you don't know which band the current setting is on you can either go to the topmost setting (10 meters) or bottom setting (30 meters). To go to the top of the tuning range you push the UP button. When the loop is at the top of the tuning range the FREQ UP LED will light and it will automatically stop. This will take up to 45 seconds, depending on what the last setting was. You then key your transmitter with a steady 1-50 watts on the frequency you want to tune, then push the AUTO BAND SELECT "DOWN" button. The loop will tune 'til it is just past the frequency. A beeper will go off and the remote will stop tuning. You then press the "Down" button to turn it off. As you release the FAST TUNE (Band Select) button, one of the FINE TUNE LEDs will be on. It will tell you if you need to fine-tune up or down. You just press the appropriate button and observe the cross needles until you get to 1:1. If you go a little too far, you just press the opposite fine-tune button. This procedure is a lot easier in practice than it is trying to describe it in words. After you have done it once it is a simple procedure. The manual describes the process clearly and completely.

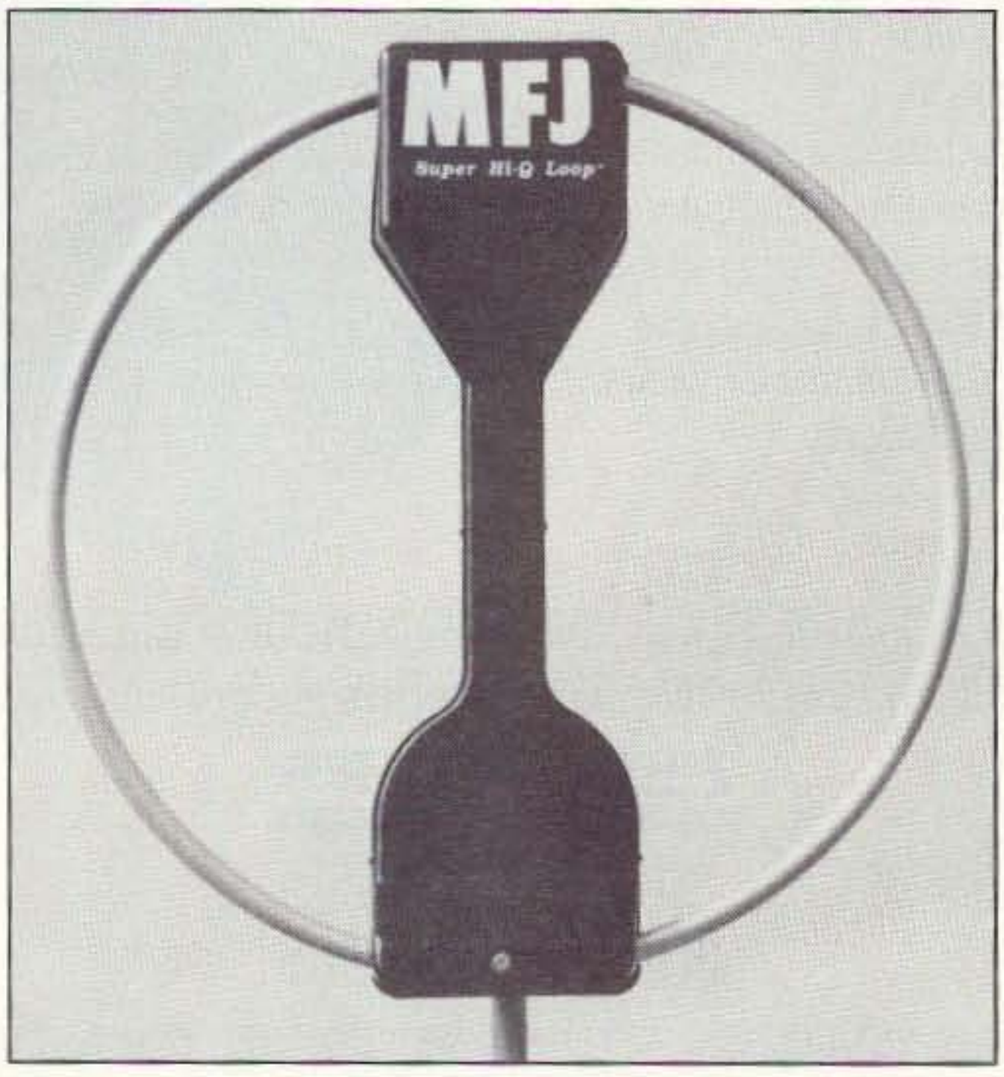

Photo 1. The MFJ Super Hi-Q Loop.

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Photo 2. The MFJ-1786 Remote Control.

I first tested the loop in a horizontal configuration. I kept the installation as simple as possible. I had a spare piece of thick-walled PVC pipe about five or so feet long that I mounted to the antenna. I put the loop over my shoulder and climbed the tower to the roof of the house. I put the loop up at about 22 feet and used the crossbeam of the tower to help stabilize the antenna. I was able to completely mount the antenna on the roof, including feeding the coax out of the house through the shack floor, in less than 20 minutes. I don't recommend this method for permanent installations. The antenna is fairly heavy for its size and the PVC pipe would not be sufficient to hold the antenna over a long period of time. If I were going to leave the antenna up, I would have mounted it higher and replaced the PVC with some real pipe.

I went into the house to test out the new antenna. I opened the manual and went through the initial test procedures. I didn't encounter any problems so I decided it was time for an on-the-air test. I first tried 30 meter CW. I came across W1ZEI/4 calling CQ. I had a nice chat with Brownie in Florida. He was a 539 and I was a 569. I told him I was testing out a new antenna and he reported I was "doing FB." Propagation must have been towards Florida because I next worked Lew in Winter Park, Florida. He was a 579 and I was a 589. He stated "loop doing very good into central Florida." I worked many other contacts.

I had recently finished testing out the new MFJ SSB 20 meter low powered travel radio and decided it would be a good test of the antenna to see how it did with low power on SSB. I tuned the loop to 20 meters. It took about a minute to change bands and fine-tune. I heard a DX station calling with a fair number of North American stations trying to call him. CT1DYX, Pedro in Portugal, was 58 coming into North Central Tennessee and reported I was a 52-55. While on 20 meters I next worked Paul in St. John's, Newfoundland. Again there was a number of stations calling him. He was using the special call VO1IMD to commemorate Marconi's birthday from the site where Marconi first received a transcontinental signal. Paul's home call is VO1HE. We talked for a while and he reported my signal and audio were good. His signal was a 58 and mine was a 56-58. After chatting a while he realized he was supposed to be making as many contacts as possible so I let him go. I also worked Tony KF2QI, in Sayville, New York, with the Travel Radio. His signal was a 59 and reported mine was a 57. We had a nice chat and discussed the operating conditions on both ends. He couldn't believe I was on low power. He said "I am using 300 watts. You have a fantastic signal—says a lot for QRP."

Testing

Our University club brought the antenna along on a recent QRP expedition. We hoisted the antenna up about 30 feet into a tree. We guyed the sides to two other trees. The antenna worked reasonably well in this configuration.

I have very carefully tried to conduct the traditional antenna comparison. I have eight transceivers and four antennas hooked up in a way that I can easily flip a switch or two for comparison of either rigs or antennas. I was very pleased and impressed with the performance of this antenna. The effectiveness of the loop as with all antennas has to do with many variables such as what is near it, what type of ground you have in your area, is there water nearby, how high is the antenna, how high is your QTH, and what the band conditions like. I think data on the theoretical gain of an antenna is important, but there are sufficient variables involved to force you to look at how the antenna will perform for you under your specific conditions. I did in fact do many comparisons. My quad was significantly better, but that would be expected. I tested the loop against my Gap vertical. Depending on the day, band conditions, band and distance from the sending station, the antenna performances varied. The vertical would out perform the loop one time and then the loop would win another. Sometimes the two antennas would perform equally.

Results

Once again I think this antenna was designed for a couple of specific types of application (limited space or portability). Ed Hare KA1CV, ARRL Laboratory Supervisor, stated in May 1994 *QST* (p. 35, sidebar), " . . . I'd done some antenna modeling of small loops using EINEC. I'd learned that a small loop at low heights above ground slightly out performs a half-wave dipole at low angles of radiation (those best for DX)."

For a loop to perform well, it *must* be set up properly. MFJ clearly tells you how to do this in the instruction manual. I found the manual to be very well written. It was complete and easy to understand. The manual includes theory of operation, set up considerations, step-by-step testing procedures and operating procedures.

Another aspect of this antenna is that it is a "HI-Q" antenna. This means there is less noise on receive with this antenna, but the bandwidth for a good SWR is narrow. The tuning takes a little getting used to, but is not difficult. If you move a little bit on frequency you will need to retune the antenna. If you are going to sit on a frequency and call CQ this isn't a problem. If you are going to tune the band or switch bands a lot, you should take this into consideration. My overall impression of this antenna is that *it performed surprisingly well* for its size, especially when you consider that I was operating mainly QRP with the antenna only 22 feet high and hanging slightly off my tower. 73

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I would like to get information and the addresses of manufacturers of amateur radio equipment. I am in the process of setting up a small retail business in the Oklahoma City area to help the amateur community. I am looking for reputable companies that give good service on their equipment. *Glen Collins, 812 Hunter Hill, Oklahoma City OK 73127.*

I need information on a good 2 meter base rig. I do not want a Handi-talki or mobile; I need something that will handle CW, SSB and FM. I also need information as to where I can get a small 20-10 meter beam, as I have limited yard space. Please send replies to *Rev. John J. Kubenski, Sr., 1102 12th Ave. SE, Jamestown ND 58401.*

Does anyone know of any amateur radio software for the Coco III computer? It would not matter if it was just for BASIC, DISK BASIC or OS9 Level I or II. I would like to use my Coco III for WeFax, RTTY, CW and whatever else in radio communications. If you have any leads or information, please help. *David Guess, 121 U.S. 31W Bypass Apt. 6, Bowling Green KY 42101.*

I need to build an inexpensive, grapefruit-sized, mains-operated power supply, 12V (AC or DC) at 60 amps. All help/info/advice gratefully acknowledged. *Alex Funke KC6IWR, 1176 Fiske St., Pacific Palisades CA 90272.*

If anyone has information on modifications that can be made to the "HAL" DS3000 KSR terminal to enhance its operations, especially a mod that could provide an ASCII output as messages are displayed on the screen, please contact *Eric A. Stokes Sr. WA8ZJY, 11415 West Pkwy., Detroit MI 48239.*

NEEDED: Service manual for a HEATHKIT Multi-Speed Servo Chart Recorder Model IR-18M Series 02240. I also need chart paper #445-19 for the same machine. I will pay for copies and postage. Thanks. *John Ellenburg, 6009 Fall Creek Rd., Russellville TN 37860.*

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73 Review

Number 12 on your Feedback card

by Dave Pelaez AH2AR/5

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Price Class: $59.95

The Isotron 40

The neighbors might think it's a futuristic bird feeder, but it's really a compact, horizontally-polarized 40 meter antenna!

Let's face it . . . a 40 meter antenna that is small enough to fit inside a trash bag probably puts out about as much signal as a dummy load, right? Also, if it looks unconventional, it must not work as well as a normal antenna, right? Surprise! Both of these premises are incorrect! The Isotron antenna is an excellent example of one that shouldn't work because it simply doesn't "look" right . . . at least this is what I thought before actually buying one of these antennas. But work it does! Much to my surprise, the Isotron 40 meter antenna has performed so well it has now become a part of my permanent HF installation. As long as the antenna is electrically correct, and laws of physics aren't broken, many unusual antenna designs are possible. And this antenna has proven to be no exception. Let's take a closer look at this extremely compact HF antenna that could be the answer for hams with antenna space limitations.

In business since 1980, Ralph Bilal WDØEJA has actually designed six different Isotrons for 160, 80, 40, 20, 15 and 10 meters. A search for the "textbook" name for these antennas came up "empty." I discovered that Mr. Bilal coined the term "Isotron" to describe his design which is really quite unique.

Construction

I found the instructions provided were excellent. Assembly time is about 40 minutes, start to finish. The only tools that are required are a screwdriver, pliers, and a small wrench. You must purchase a five-foot mast section in order to fully assemble the antenna, as the mast section is not included. There is no need to break out the soldering gun or wire stripper. The SO-239 connector is pigtailed at the factory and the coil assembly is pre-wound, stripped, and tinned. The total part count is 10, and all fastening hardware is stainless steel.

Installation

Wayne would indeed grimace. I decided to mount the antenna for testing in the attic, knowing full well of the E-Fields that would be present (another good reason not to run the amp!). This installation was to keep myself in good graces with the XYL. As we had just moved into a newly-constructed home, I had earlier ruled out putting up a dipole, as the closest "attachment point" for a wire antenna was a transplanted sapling that I had earlier mistaken for a large Texas weed. So up went the Isotron.

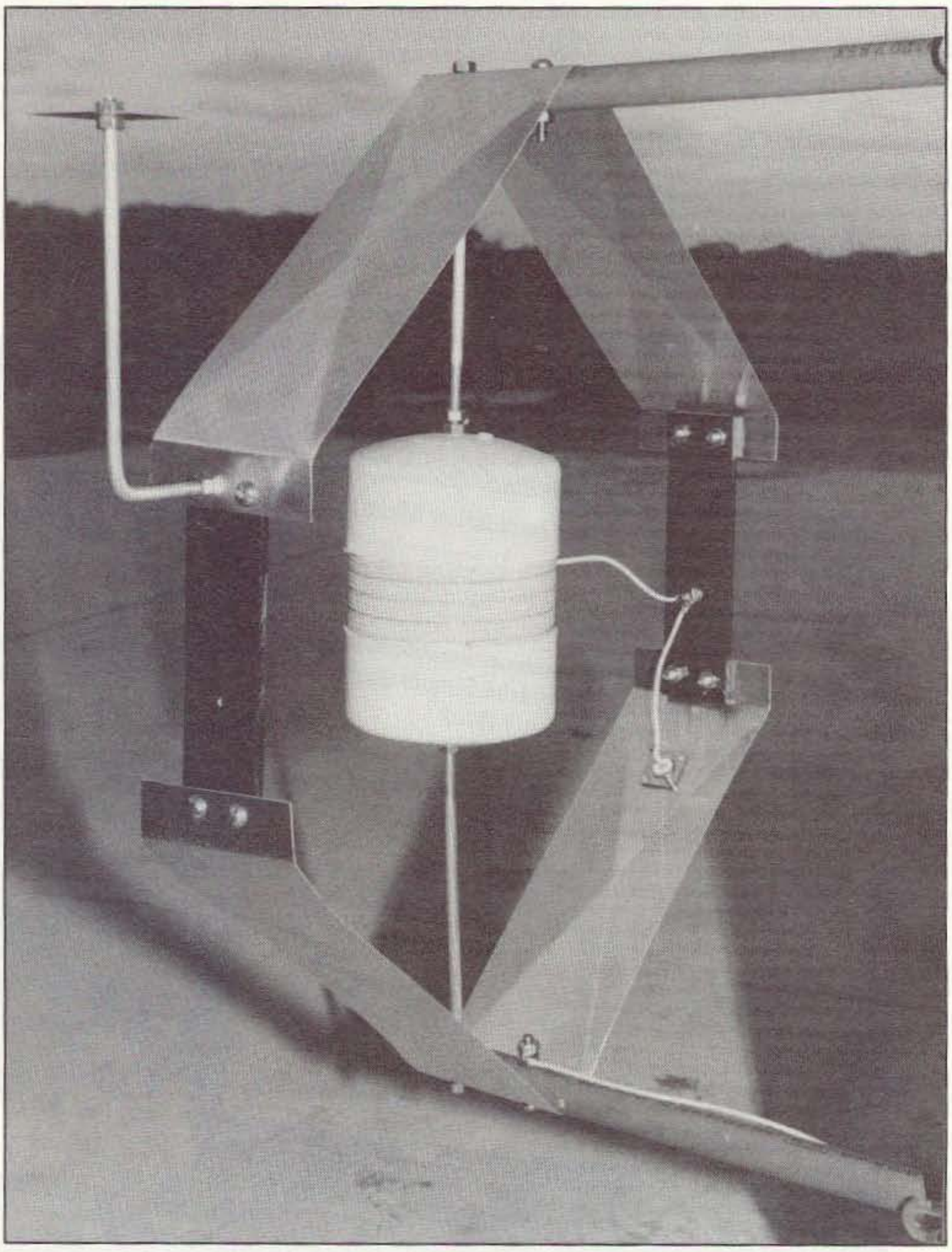

Photo A. The Isotron 40.

Tuning

The most challenging part of the assembly is the tuning of the antenna to find its resonant point. Mr. Bilal has compiled a detailed step-by-step process to make this "black art" less tedious. In fact, the instructions are complete enough so you do not have to rely on a noise bridge to adjust the antenna's resonant point. Tuning this antenna is a matter of pivoting a capacitance hat that is attached to an aluminum rod from the vertical, and past the horizontal, rotating the rod to the "front" of the antenna. The instruction booklet contains some neat tricks and shortcuts on how to arrive at the desired resonant point. These helpful hints are a product of a whole lot of "corporate memory" that greatly assists the new Isotron purchaser in avoiding the potential pitfalls of bringing the antenna to resonance. For in-band utilization, no trimming of the coil is required; however, the instruction manual explains the procedure for trimming the coil if the antenna is going to be used for out-of-band activities (MARS CAP FAA etc).

Once the resonant point is found, you will notice a dramatically steep resonance skirt. In my installation, I have a minimum centered 1.1 to 1 VSWR and a usable 3 to 1 VSWR about 150 kHz up and down the band. More typically, a 250 kHz tuning range can be expected. This "usable" tuning range will vary, depending on the installation environment. An Isotron in the clear, as opposed to one located next to metal attic ductwork, will behave differently. Past the usable range, the VSWR ends up going off the chart very quickly.

Operation

My first perception after tuning the antenna was that I had the transmission line hooked up to an in-the-clear dipole. I listened up and down the band, and the usable bandwidth was very active with many signals. The atmospheric noise level seemed to be a bit quieter than "normal." Frankly, I was expecting to hear only a few of the "big guns" on the band, but I was pleasantly surprised to hear an active band. After one final check of the VSWR, I broke into about a half dozen QSOs. I was also surprised that I could work 'em. This was not expected, especially with my compromise attic installation. I tried another "test" later in the week with some friends who were about 40 miles out (ground wave). It was interesting to note that the station on the other end was experiencing a high noise level due to a distant thunderstorm. He was using a long-wire antenna, and we both were running about 100 watts.

"I've been amazed that we have been able to consistently communicate from Dallas using an attic antenna about the size of a small Texas watermelon."

Up to three different Isotrons can be connected in parallel; however, the manufacturer recommends the utilization of a noise bridge, as mutual coupling causes the overall impedance to become an average of the three antennas, making the tuning process extremely complicated.

How Does it Work?

I have successfully kept an active 40 meter schedule with KK4LW/7 who lives in Fort Collins, Colorado. I've been amazed that we have been able to consistently communicate from Dallas using an attic antenna about the size of a small Texas watermelon. Just remember one thing: The "feed point" does not require the placement of bird seed between the coil and the plates. 73

Adapting Bell 202 Telephone Modems for Packet

Enjoy packet radio with this bargain basement project!

by Robert B. Whitaker KI5PG

If you are the type of person who loves to adapt and modify equipment for amateur radio use, this project is for you. Even if you already have a TNC but you want to experiment with packet modems and software, it will interest you. If you have not yet joined the packet revolution and are looking for an inexpensive way to test the waters, this project may be just your ticket.

Like many other projects, this one started out first as an experiment. I ran across a number of old Bell 202 standard modems that a lady had purchased for a bargain price at an auction of surplus computer gear. She did not know how to use them and asked me if I might be interested in them. They were so cheap I bought them, gambling that they could be modified for use on packet radio. With a little effort and the assistance of my good friend and knowledgeable ham, Harvey Babb WB5MCT, we together made the Bell 202 modems sing happily on 1200 bps VHF amateur packet radio.

Basically, all that is needed to make a Bell 202 modem work on amateur packet radio is a keying circuit and operating software. There are already a number of modem programs for the PC compatibles. Perhaps the most widely used and available program is Baycom, by Florian Radlherr DL8MBT and Johannes Kneip DG3RBU, from Germany (see Note 1). Another very popular packet modem program, Poor Man's Packet, debuted as the cover story and feature article in the August 1991 issue of *73* magazine (see Note 2). PMP was the joint project of Andy Payne N8KEI, who wrote the software, and F. Kevin Feeney WB2EMS, who designed the PMP modem. Both of these fine gentlemen are to be commended for their work. Although the PMP modem and software were designed for use on the PC parallel port, the software can be easily configured to address the PC RS-232 serial port. Table 1 shows the changes required to the PMP.CFG

Photo A. Carefully wire the RS-232 lines between the modem and the computer. The wiring is different from standard modem communications.

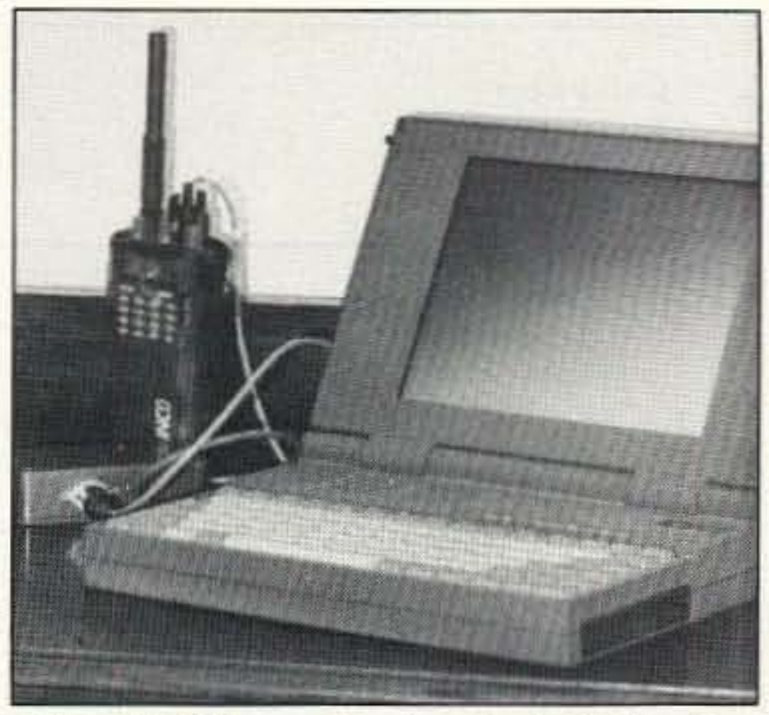

Photo B. The author has installed a Poor Man's Packet modem in a case and added a TTL/RS-232 converter to operate the modem through the PC serial port.

file. The PMP modem can also be adapted from parallel port use to serial port use with the addition of a TTL/RS-232 conversion circuit such as the MAX232 chip and a 7404 hex inverter (see Note 3).

My favorite modem program is SofTNC, written by Andy Payne (see Note 4). It is very similar to Poor Man's Packet (also written by Andy), but it has a couple of features which make it superior to PMP, most notably a keyboard buffer so keystrokes are not lost when a packet is being received. Additionally, SofTNC is already written to address the PC's RS-232 serial port rather than the parallel port.

Keying the Radio

The keying circuit requires the addition of a 2N3904 NPN switching transistor and 10k ohm resistor. The entire wiring diagram, including the RS-232 line connections to the PC, is shown in Figure 1. The software assembles and decodes packet transmissions

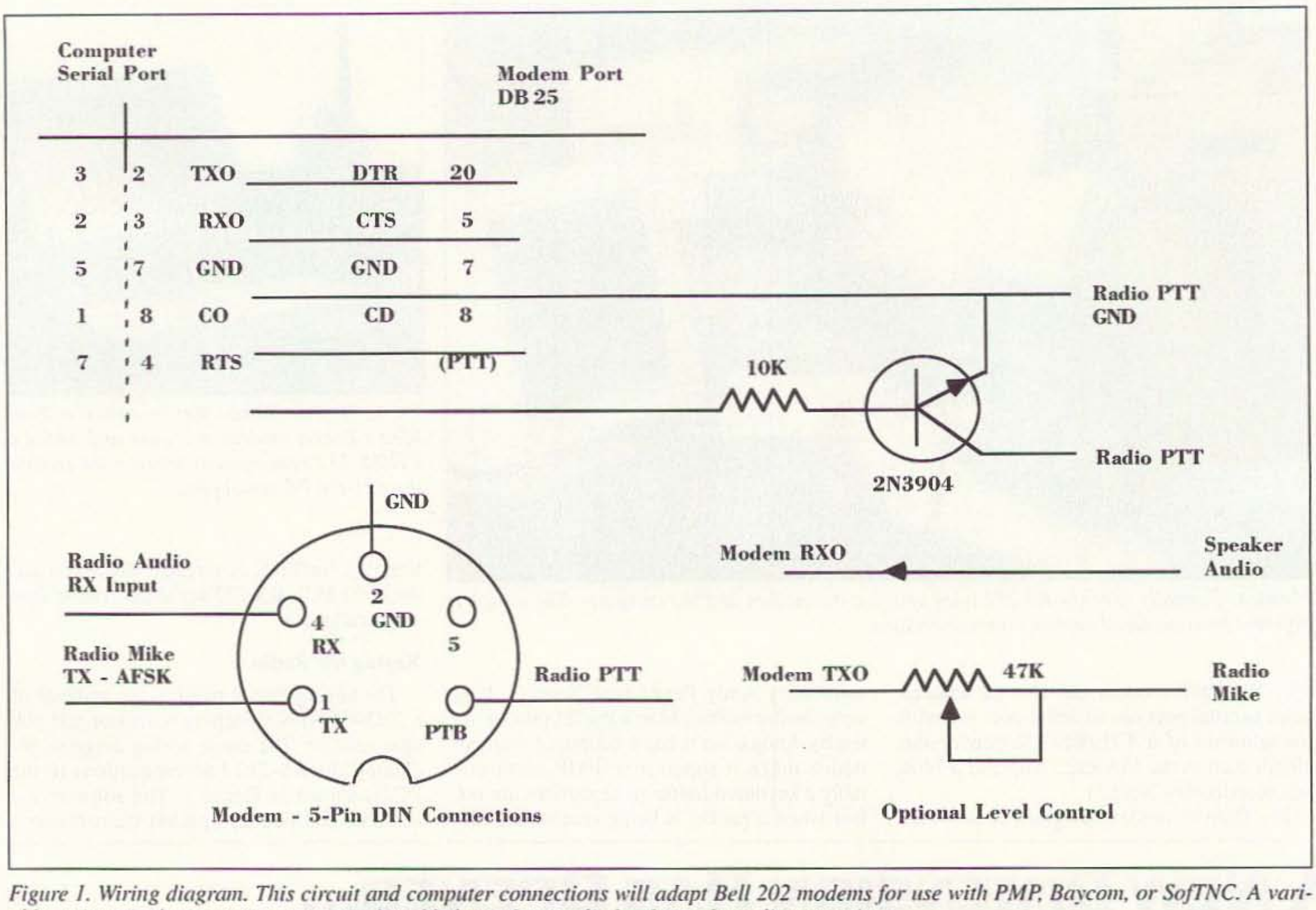

Figure 1. Wiring diagram. This circuit and computer connections will adapt Bell 202 modems for use with PMP, Baycom, or SofTNC. A variable resistor in the transmit output may be added to reduce audio level into the radio transmitter.

by the rapid switching of the serial port's handshaking lines. Be careful to follow the RS-232 port wiring diagram as it is different from normal serial communications! I have built the keying circuit inside the hood of the DB-25 connection cable on a number of modems so that no internal modifications of the modem are even required. On another modem I installed a five-pin DIN jack for the radio connection to the back panel of the modem, like many TNCs.

Either way, the modifications are non-destructive and the modem can still be used in its original configuration if necessary. The keying circuit shown here assumes the radio is keyed by switching the PTT lead to ground. If you use a hand-held radio such as the Icom, Yaesu, or Alinco variety that combine the PTT and microphone lead, you may need to refer to your owner's manual or call your radio's customer support line and ask for special instructions. Many times, all you need to do for these radios is split the PTT/mike line and add a 0.1 uF capacitor to the mike lead and a 1.2k ohm to 3.9k ohm resistor to the PTT lead.

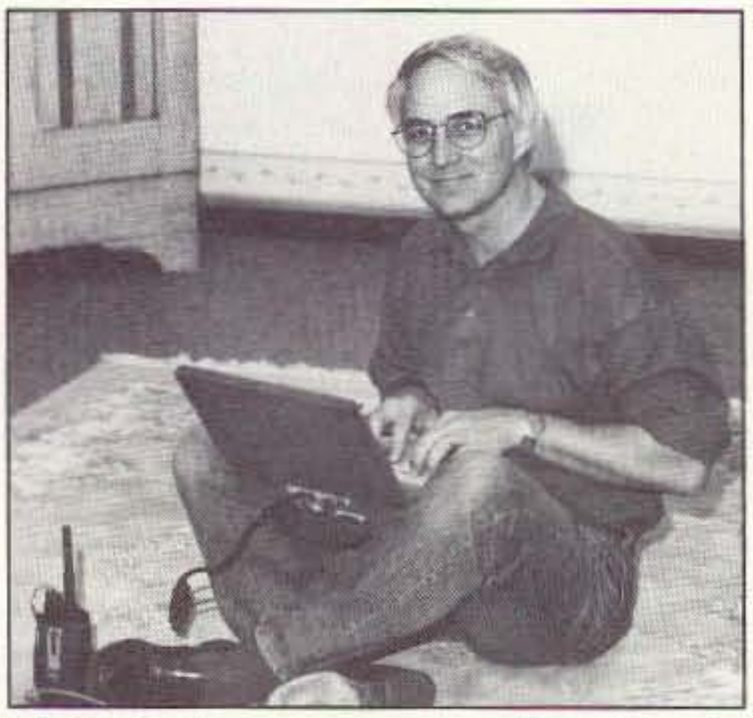

Photo C. If you haven't experienced packet yet, maybe this project will give you a good excuse to try it.

Setting the Modem Configuration Switches

Most Bell 202 modems can be configured for either two-wire or four-wire use as a part of computer system use on dedicated telephone lines. You will need to set the internal switches on the modem as shown in the chart in Table 2 to operate properly. If your modem does not have the same switches or has other switches, try experimenting with different settings until you find a combination that works.

Testing and Troubleshooting the Modem

Once you have your keying circuit, your internal switches set, and your special modem-to-serial-port cable, you are ready to test your new packet modem. Don't be disappointed if it does not work correctly on first try. Often, an internal configuration switch needs resetting or only half of the modem will work on first try. If you can monitor packets on an active frequency but cannot connect to anyone, you probably have a problem with your keying circuit. Conversely, if your modem transmits but cannot connect to anyone, you probably have a problem with the wiring of the receiver circuit. If you have half the circuit working you are halfway home.

One easy way to check problems is to

```
# PTTPORT
    pttport 0x3FC 2 0
# TXPORT
    txport 0x3FC 1
# CDPORT
    cdport 0x3FE 128 1
# RXPORT
    rxport 0x3FE 16
```

Table 1. PMP Software changes: Change the following parameters in PMP.CFG to the values shown below. (This causes the software to address the "handshake" lines on the COM port instead of the Parallel port.) The addresses given are for COM1 serial port. For COM2, change the port addresses from 3FC to 2FC and from 3FE to 2FE.

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Custom inductor switch was carefully engineered to withstand extreme voltages and currents.

Cabinet has *tough* vinyl coating and molecular bonding -- not paint.

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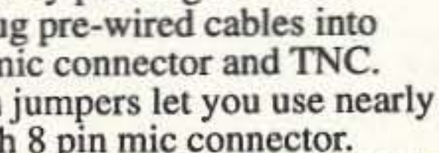

MFJ-1270B *super* TAPR TNC clone has a world wide reputation as *the most reliable packet TNC in the world* -- many work 24 hours a day for years without a single failure!

Fully TAPR TNC-2 compatible, VHF *and* HF operation, *free* AC power supply, new *enchanced* mailbox expandable to 512K with auto/reverse mail forwarding, WeFAX mode lets you print weather maps, optional plug-in 2400/9600 baud modems, KISS interface, MFJ Host mode.

MFJ TNC/Mic Switch

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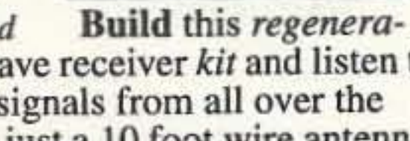

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Just plug pre-wired cables into your rig's mic connector and TNC.

Plug-in jumpers let you use nearly any rig with 8 pin mic connector.

MFJ-1272B, $34.95 /MFJ/TAPR TNC2 clones; **MFJ-1272BX**/PK-232; **MFJ-1272BYV**/KAM VHF/KPC3; **MFJ-1272BYH**/KAM HF Port; **MFJ-1272BZ**/PK-88, $39.95 each.

For 8 pin RJ45 modular phone jack replace B with M in model number above.

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You'll have fun joining worldwide *packet* networks and exchanging *color SSTV* pictures with your buddies around the world. You'll marvel at *full color FAX* news photos as they come to life on your screen. You'll see weather changes on highy detailed *weather maps* in all 16 gray levels. You'll eavesdrop on late breaking news as it happens on *RTTY*. You'll enjoy error free HF QSOs on *PACTOR* and *AMTOR* and receiving packet mail in an *enchanced 32K mailbox*. Want to copy some *CW*? Just watch your screen.

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

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Six position *ceramic* antenna switch has extra large contacts. Flip stand, dummy load, one year *unconditional* guarantee, aluminum cabinet, tough *baked-on* paint, locking compound on nuts/bolts, handles 3 KW PEP, 10⅛x4½x15 in. Meter lamp needs 12 volts. Add $13 s/h.

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No ground or tuner needed.

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

Dual Band Mobile Ant.

Mobile Antenna for 144/440 MHz

MFJ-1724B **$14.95**

MFJ *dual band* magnet mount mobile antenna for 144/440 MHz has 19 inch stainless steel radiator, low SWR. For mobile rigs with SO-239 UHF connector *and* handie-talkies with *included* BNC adapter.

5/8 Wave Mobile Ant.

MFJ-1728/B **$24.95**

Maximum Gain™ 5/8 Wave 2 Meter *magnet mount* mobile antenna has stainless steel radiator, 12 ft coax, low SWR. UHF mobile (MFJ-1728) or BNC handie-talkie (MFJ-1728B) connector.

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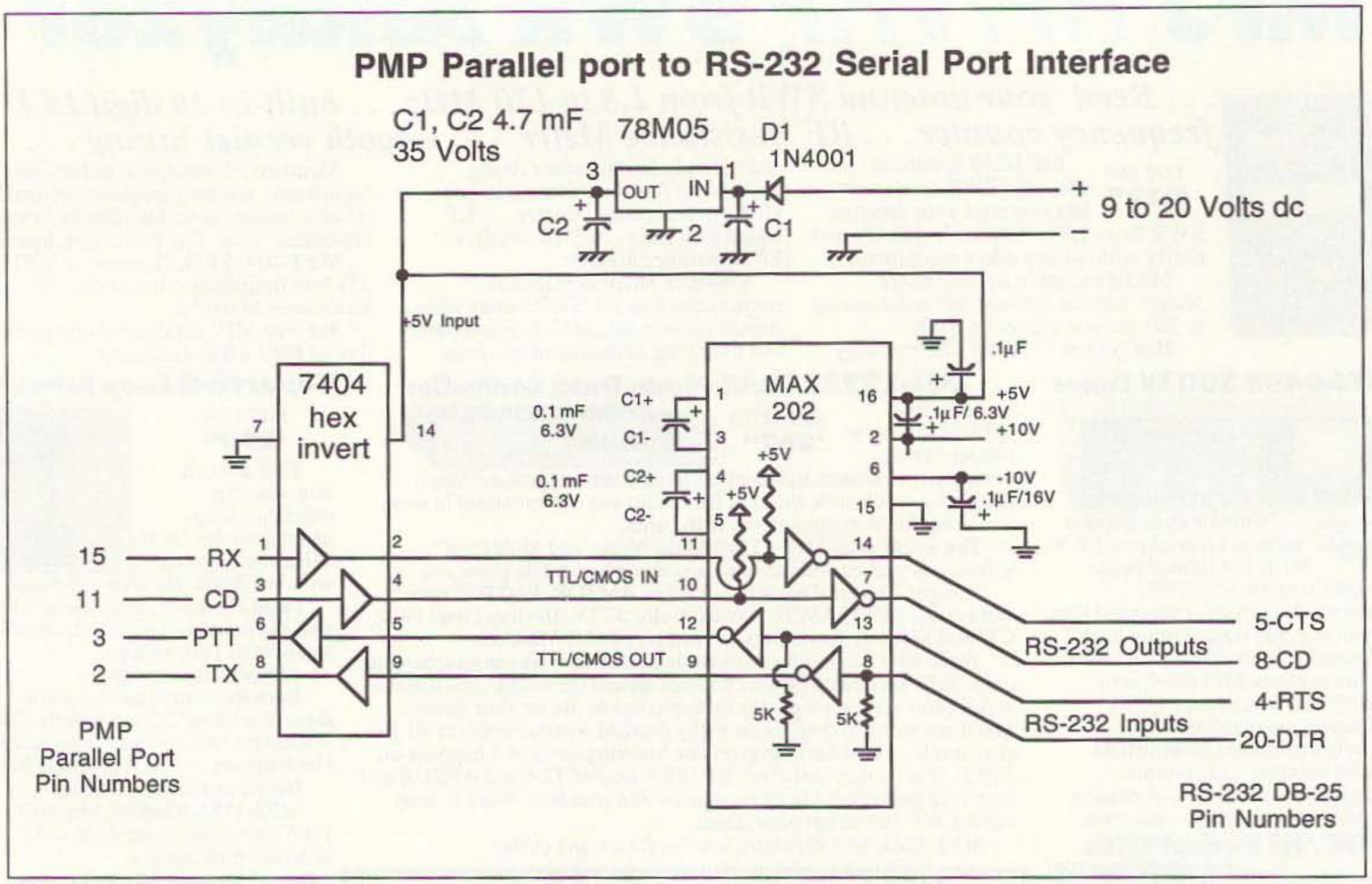

Figure 2. PMP parallel port to RS-232 serial port interface. Note: A MAX232 chip may be substituted for the MAX202 if 10 µF capacitors are used throughout.

monitor your RS-232 lines with either internal LEDS in the modem or an RS-232 line dual-color mini-tester, like the Radio Shack catalog number 276-1401. These handy little devices will help you figure out where to check for crossed or nonfunctioning lines. The chart in Table 3 shows how the LEDS should look during idle, reception, and transmission.

Another good tip is to monitor your transmitted signal. If your signal is too loud or distorted you may need to install a high-value variable resistor (47k, more or less) to adjust (reduce) the output of the modem into your transmitter.

This project is inexpensive, easy, and fun. It shows how easily a standard Bell 202 modem can be modified and used for packet radio. These modems often provide superior transmission and reception to standard TNCs. Even if you do not use this type of modem/software for all your packet activity, it makes a handy backup to your regular packet TNC station. 73

Notes

Note 1. The most current release of the program is version 1.5. I have used only version 1.2 and 1.4. Version 1.2 has a few bugs so try to use version 1.4 or later. Baycom 1.4 is available as shareware. It can be found at many sources and is included on a number of ham CD-ROMs.

Note 2. Poor Man's Packet is available from the authors on disk for $10, and from various sites on Internet. It can also be downloaded from the *73* magazine BBS at (603) 924-9343. PMP is also included on a number of CD-ROMs. Finally, PMP is available from me (Robert B. Whitaker KI5PG, 121 South Main, Suite 205, Victoria TX 77901) for a $2 duplication and handling fee. Please include a formatted blank diskette and a stamped return envelope.

For an extra $3 I will edit the PMP.CFG file to specify your call sign and RS-232 port. Be sure to include this information in your request.

Note 3. A PMP modem can be converted from parallel to serial port use by running the following lines through the MAX232 and 7404 hex inverter:

Parallel Line #		DB-25 Serial Line #
2	to	20 (DTR)
15	to	5 (CTS)
3	to	4 (RTS)
11	to	8 (CD)
18	to	7 (GND)

A full schematic for the TTL/RS-232 conversion circuit is available from the author.

Note 4. SofTNC is marketed as a commercial product by j•Com, which was recently bought out by Ramsey Electronics, Inc., 793 Canning Parkway, Victor NY 14564; phone: (800) 446-2295. It costs about $20.

On/Off	Name
On	Local Copy
Off	2 Wire Select
On	4-Wire Select
Off	Transmit Level= -9 dB
On	Request To Send (Forced On)
Off	Receiver Squelch (On)

Table 2. Modem configuration settings. (Note that your Bell 202 modem may have somewhat different settings than this. If your modem is different, try all the different settings and see which ones work best.)

RS-232 Line #	Idle	Receive
Transmit		
4 (RTS)	low	low	high
5 (CTS)	low	shifting	low
8 (CD)	low	high	low
20 (DTR)	—	—	shifting

Table 3. LED RS-232 activity. This chart shows the relative state of the RS-232 handshake lines during modem states of idle, receiving, and transmitting.

Parts List

Q1	2N3904 or 2N2222	Radio Shack 276-2016
R1	10k ohm	Radio Shack 271-1335
R2	47k ohm (optional)	Radio Shack 271-283 (for TX level)

UPDATES

Number 14 on your Feedback card

CAT 1000 and CAT 300 Repeater Controllers

See the above-mentioned review of Computer Automation Technology's controllers (September 1994, page 26). Bob Schmid WA9FBO of S-COM Industries wrote us to point out that it is illegal to directly connect controllers without FCC Part 68 certification to the telephone jack. Attaching an approved coupler could in some cases be complicated, involving connections to the PC board. Thanks for pointing that out, Bob. Not all controllers are FCC Part 68 certified, so buyers may want to consider this.

Owen Wormser of C3I also took the time to write—to compliment this review and to point out that "C3I" is not the same as "C3I, Inc." C3I is the correct trademark for the company mentioned in the review; the phone numbers are (800) 224-5137 (voice) and (703) 864-1382 (FAX). C3I provides options, products, and services related to the CAT family of repeater controllers. Thanks Owen.

Handy Randy

With reference to the above-mentioned article (October 1994, page 35), Figure 1 should show a wire connecting the coax braid to the bottom of L1. Without this wire, Randy will not be so handy. 73

Number 15 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knights Way Drive
Houston TX 77083-5640

With all the news about the next high-orbit satellite, Phase 3D, and the many digital satellites now in orbit, we often forget the relative simplicity of operation possible through RS-10. For the newcomer just learning about space communications or the longtime hamsat-chaser looking for some easy yet enjoyable contacts via satellite, the Mode A transponder (2 meters up and 10 meters down) of RS-10 is the answer.

Unlike the single-channel FM operation available with AMSAT-OSCAR-21 and AMRAD-OSCAR-27, the Mode "A" linear transponder of RS-10 provides a more relaxed environment for satellite activity. RS-10 has been using the 2 meter uplink receiver in conjunction with the 10 meter downlink transmitter for many years since launch on June 23, 1987, from the Plesetsk launch complex in the former USSR.

The pre-launch designation of RS-10 was BRTK-10. This is a Russian abbreviation for "Equipment for Amateur Radio Satellite Communication." The ham components are an integral part of COSMOS 1861, a Soviet navigation satellite. As long as the larger spacecraft is operational and has power available for the amateur radio gear, RS-10 will be on the air. Although RS-10 has other modules including a 15 meter receiver and a 2 meter transmitter, these units are not in use. The 2 meter transmitter tends to interfere with COSMOS 1861 and the 15 meter receiver of RS-12 provides enough Mode "K" (15 meters up and 10 meters down) activity without using RS-10. Duplicate equipment incorporating slightly different frequencies is also on board COSMOS 1861 in the form of RS-11, which is held in reserve pending any RS-10 failure.

RS-10's orbit is described as low-altitude, circular, near-polar and non-sun-synchronous. It has an altitude of nearly 1,000 kilometers, giving a period, or time for one orbit, of 105 minutes. The inclination is 82.9 degrees. This means that it passes very close to the earth's poles as it orbits. An inclination of 90 degrees would travel directly over the poles. Some satellites have orbits that are sun-synchronous. They come over the same general areas each day at the same time and are usually oriented to stay in sunlight as much as possible. RS-10 does not. On a given day it may be traveling from south to north during evening hours. A month later the local passes will have shifted earlier into the afternoon. In this example, morning passes from north to south will have shifted in a similar fashion.

Photo A: Andy Mironov RK3KPK and his family in Moscow. Andy operates the RS-10 command station RS3A.

For most RS-10 enthusiasts there are between four and six passes a day ranging in duration from 10 to 17 minutes each. The maximum range between two stations wishing to make contact through RS-10 is about 6,700 kilometers for normal line-of-sight propagation. For East Coast U.S. stations, contacts into Europe are possible. For others, most of the North American continent is available.

Finding RS-10 is easy with any computer tracking program. Many simple programs for satellite tracking can be found on ham radio BBSs. More sophisticated programs can be purchased from organizations like AMSAT, The Radio Amateur Satellite Corporation (850 Sligo Ave., #600, Silver Spring MD 20910-4703), or R. Myers Communications (P. O. Box 17108, Fountain Hills AZ 85269-7108).

The RS-10 Mode "A" uplink passband goes from 145.860 to 145.900 MHz, with a corresponding downlink of 29.360 to 29.400 MHz. The 40 kHz of bandwidth allows many stations using CW or SSB to make contacts on discrete frequencies without bothering other nearby users. The transponder is like a wideband linear repeater.

Equipment

Station equipment for RS-10 operation can be very simple. Some users have beam antennas and sophisticated satellite rigs, but most do not. A modest yet functional setup includes some form of 10 meter receiver or transceiver capable of SSB and CW. An outside dipole makes a good antenna. For the 2 meter uplink, a multimode transceiver is best, but not always necessary for CW operation. Many 2 meter FM rigs can be used for CW, although some have excessive chirp when keyed via the microphone line with a code key. A quick on-the-air experiment with another station equipped for 2 meter SSB reception or operating through the satellite transponder will provide a good test.

Most omnidirectional 2 meter antennas perform well on the uplink when used with 10 to 25 watts. Stations with 2 meter beams should avoid running excessive power. A few watts to an array used with the high-orbit satellites is quite enough for solid contacts through RS-10. While a simple quarter-wave ground-plane antenna may do well, other designs worthy of note include the turnstile, Lindenblad and quadrafilar helix antennas.

As with all hamsats, emphasis should be placed on station upgrades to the receive side. Older 10 meter rigs may require a preamp for satisfactory reception. A home-brew MOSFET unit or commercial GaAsFET device will do equally well for 10 meter work. Some newer rigs already have excellent front ends. A preamp may do little

Photo B: A QSL card from the RS command station RS3A in 1991.

Photo C: RS-10 ROBOT QSL for a contact made three days after the satellite's launch in 1987.

more than bring up the noise level.

Different types of receive antennas may perform better than the dipole in some locations. Having a dipole, a vertical and a horizontal loop connected through a coax switch is a method employed to pick the antenna with the best reception during portions of a pass. At the horizon, the vertical may have a better signal while the horizontal loop may be optimum when the satellite is overhead.

The telemetry beacon on 29.357 MHz provides both information on satellite health and a good signal to monitor to tell when the satellite is within range. Data on decoding the telemetry can be found in the ARRL publication *The Satellite Experimenter's Handbook* by Martin Davidoff K2UBC or *Decoding Telemetry from the Amateur Satellites* from AMSAT by G. Gould Smith WA4SXM. Both books are available from AMSAT at the address noted above or via phone: (301) 589-6062.

RS-10 has a computerized ROBOT autotransponder that will issue contact serial numbers when correctly called using CW on 145.820 MHz. The corresponding downlink is 29.403 MHz. To make a contact with the ROBOT, first ensure that the uplink signal is properly centered in the ROBOT's receiver. This is done by transmitting a carrier on 145.820 while listening on 29.403. Move the transmit frequency a few kHz up and down 'til a steady tone is heard on the 10 meter frequency. Then call the ROBOT with the best CW you can generate using the following sequence: RS-10 DE WA5ZIB AR. Use your own callsign and send the "AR" as a continuous di-dah-di-dah-dit. The best speed to use is 15 to 20 words per minute. If the ROBOT got everything correctly it will respond with your call, a short message and a serial number. Sometimes the RS-14/A-O-21 CW beacon which transmits on 145.822 MHz can be heard through the RS-10 ROBOT channel when within range of RS-10.

QSLs for ROBOT contacts are available through DF4XW or Andrey Mironov RK3KPK. Cards to "Andy" should be sent to: ul.V-Voloshinoj, d.11, kv.72, station Perlovskay, 141014, Moscow region, Russia, C.I.S.. Andy operates as RS3A at the RS Command Station in Russia. The equipment there consists of a 100 watt uplink transceiver that feeds a ground-plane antenna. The downlink receiver is an older variety called an R250M2. It has 20 tubes and weighs about 95 kilograms. A three-element yagi is used for downlink reception.

RS-10 also has a special channel that operates like the ROBOT frequency for CW, but without the computerized autotransponder. The uplink is 145.850 MHz with a downlink of 29.350 MHz. Sometimes when the main transponder is off, single-channel CW contacts can still be made via this special frequency pair.

"It's a great way to get involved with satellite communications with little effort but very satisfying results."

If you have never made a contact through RS-10, give it a try. It's a great way to get involved with satellite communications with little effort but very satisfying results. If you have been chasing exotic modes on other hamsats, come back and check the activity on RS-10. It's a great change of pace and brings back memories of what it was like to work through AMSAT-OSCAR-6 over 20 years ago when Mode "A" was the only amateur transponder in the sky.

Other publications from AMSAT that can provide more useful information on RS-10 include *The RS Satellites Operating Guide—RS-10/11 and RS-12/13* by G. Gould Smith WA4SXM and *How to Use the Amateur Radio Satellites—Fourth Edition* by Keith C. Baker KB1SF. 73

Number 16 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
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Falls Church VA 22003

AM BCB QRM? Try a Loop Antenna!

This month we are going to take a little different tactic, and in the process serve both our ham and SWL readers. Several months ago we looked at the issue of dealing with AM broadcast band (540-1700 kHz) interference to high frequency ham band receivers.

A couple of readers wrote to me and wanted to know how to deal with AM BCB interference while listening to distant stations within the AM BCB. As a result, we're going to talk about loop antennas this month. The same techniques, usually with fewer turns on the loop, also work on 160 meters, 75/80 meters and 40 meters . . . all crowded bands with problems similar to the AM BCB case.

One of the big frustrations of the AM broadcast band (BCB) DXer is the terrific QRM interference from thousands of North American, Caribbean, Central and South American, and even European (when conditions are right) stations. The 5 and 10 kHz heterodynes from co-channel, split-channel and adjacent channel stations can be deafening. If your receiver is not up to the highest performance levels, then the problem is even more noticeable: The front-end overloads and performance goes down the drain. The traditional response to large numbers of co-channel and adjacent channel interfering stations is the directional antenna. On the HF shortwave bands (and higher) it's relatively easy to build a yagi or quad beam to give pretty good directivity. Heck, even an ordinary half-wavelength dipole has a pair of nulls (one each off either end), so it has a "figure-8" pattern. One of the nulls can be positioned to reduce the signal level received from the undesired station. Rotatable dipoles are even possible for the mechanically inclined. But on the AM BCB, which runs from 540 kHz to 1,700 kHz, that half-wavelength dipole is 275 to 870 feet long . . . hardly practical for anyone owning less than a Texas farm!

So, enter the small loop. There is an antenna that provides a figure-8 antenna pattern, is easy to construct, and can be installed inside the house (although outside might be better). The small loop antenna is a marvelous creature (a small loop has an overall length less than 0.2λ). Figure 1 shows the basic form for the loop. This version is square, but round, hexagonal and octagonal shapes are also possible. The square loop is generally easier to construct, however. Dimension "A" in Figure 1 is the length of each side of the loop, while dimension "B" is the depth of the winding (both expressed in inches). The depth dimension can be either flat-wound (i.e. all turns in the same plane), or depth-wound. Although one expert tells me that the depth-wound version is superior, I was unable to tell the difference in some practical side-by-side tests that I performed one weekend not long ago.

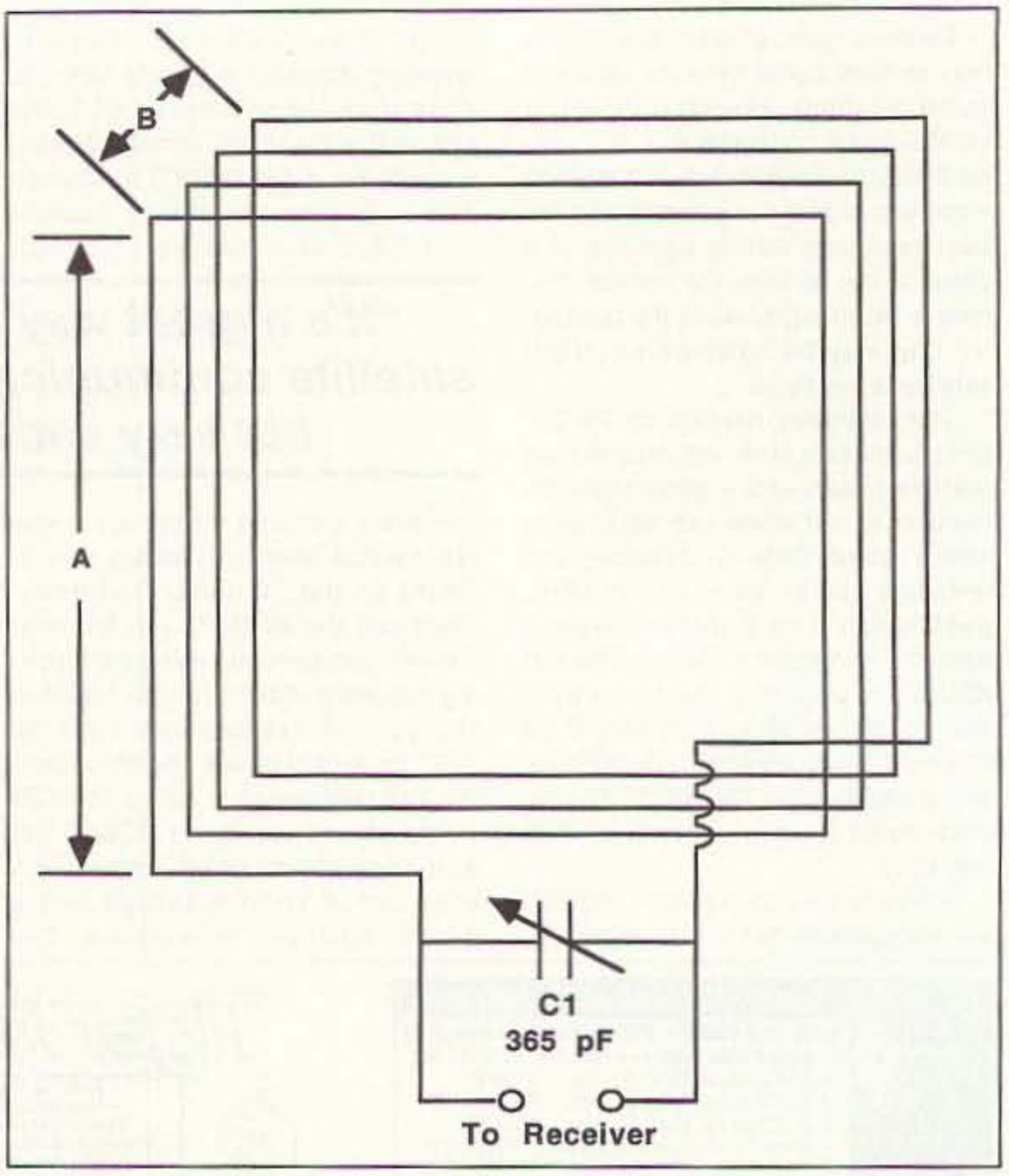

Figure 1. Schematic of the square loop antenna.

For a practical AM BCB antenna, the dimensions that I used were 24" square by 1" deep. There are 14 turns of wire in the AM BCB loop. For lower frequencies use more turns, and for the lower shortwave bands use fewer turns. Either experiment with the number or use the Antiers software to calculate the parameters.

There are two ways to wind the loop. Use either enameled magnet wire or insulated hookup wire (#22 for either type) to make the turns. Or, if you prefer, use 14-conductor computer ribbon cable to make the loop. Cross-connect adjacent wires so that a continuous circuit is formed (see the detail shown in Figure 2).

Some people connect the loop directly to the receiver through a piece of coaxial cable. One side of the loop (e.g. "A") is connected to the shielding outer conductor, while the other side is connected to the coax center conductor. Unfortunately, untuned loops are not terribly efficient, so this arrangement produces a very low output signal level. The output can be boosted 100-fold by the simple expedient of tuning the loop with capacitor C1 (Figure 1). An ordinary single-section AM broadcast variable (365 pF, 380 pF, 400 pF, etc.) will tune the entire AM BCB plus some. Suitable capacitors can be found in the catalog of Ocean State Electronics (POB 1458, 6 Industrial Drive, Westerly, RI, 02891; 1-401-596-3080). Keep in mind that the capacitance of the coaxial cable can be rather large, especially for long runs of cable, and it adds to the capacitance of the circuit.

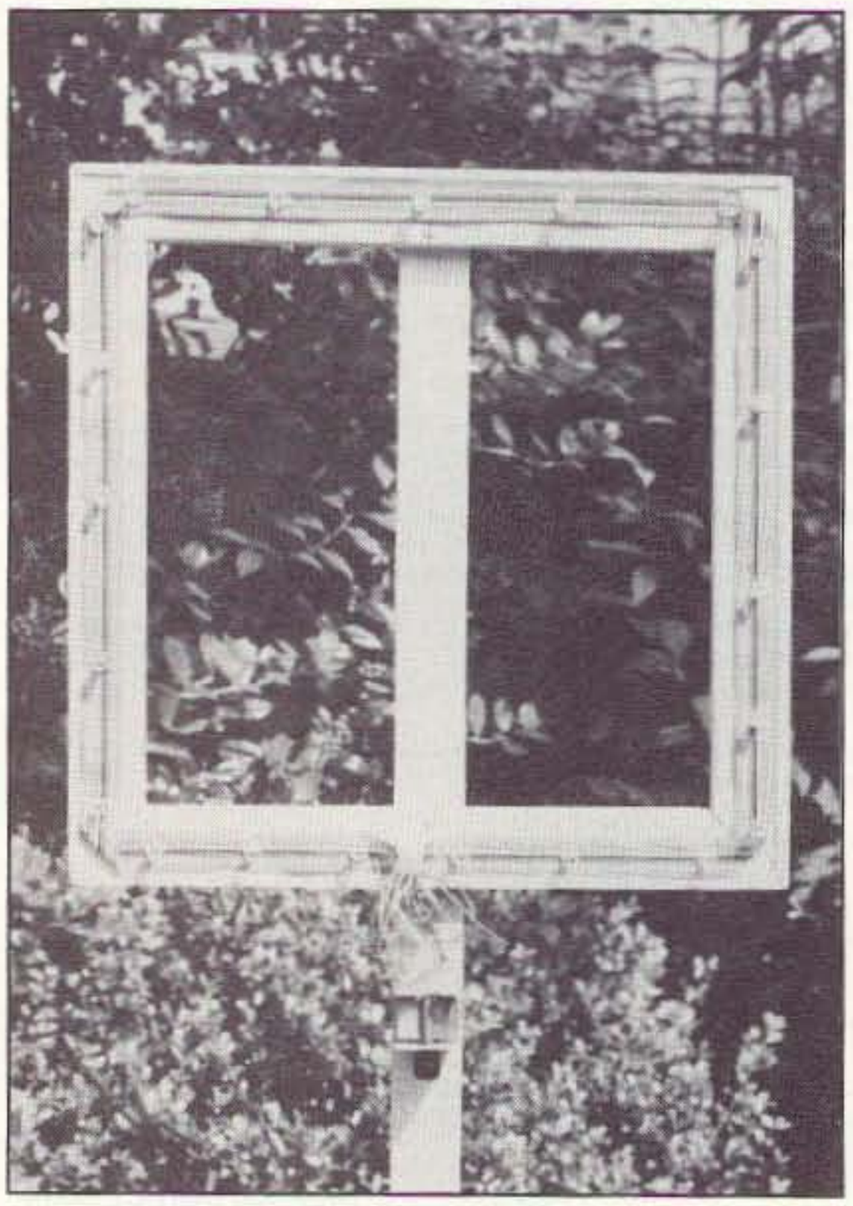

Photo A. A home-brew square loop.

Photo B. An embroidery-hoop loop.

A Better Approach to Loop Design

A second approach to loop design is shown in Figure 3. In this antenna, there are two concentric loops. The resonant loop is the same as discussed above in Figure 1, but without the electrical connections to the receiver and transmission line. A coupling loop is used to connect to the transmis-

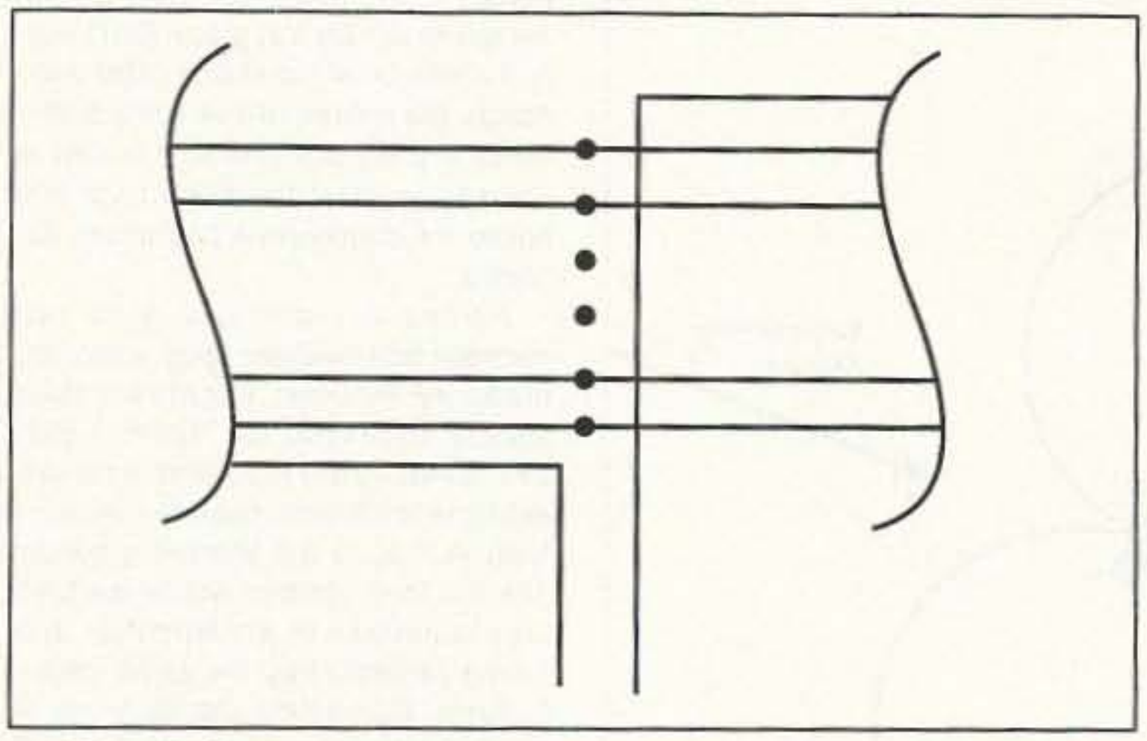

Figure 2. Cross-connection scheme when computer ribbon cable is used.

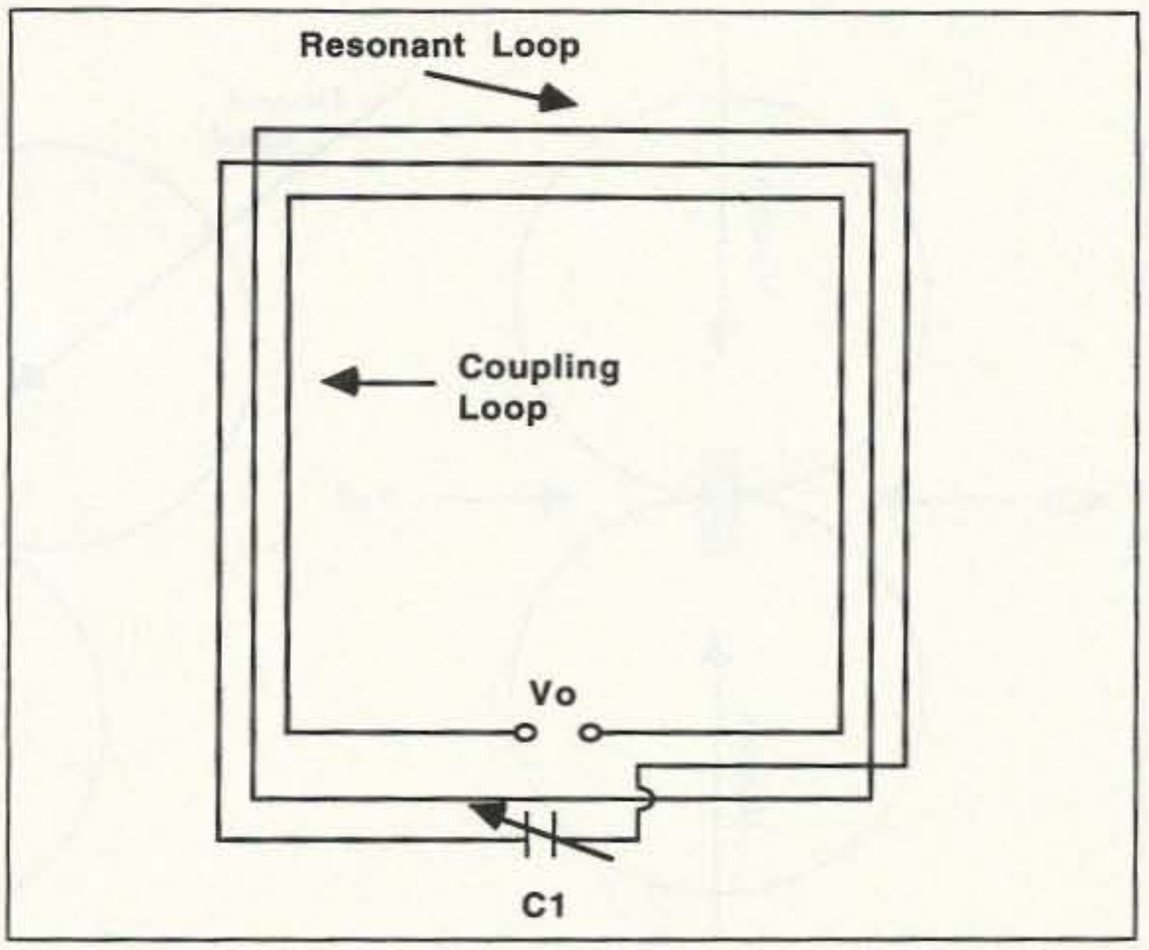

Figure 3. Use of a one-to-two-turn coupling loop improves performance of the loop antenna.

sion line instead. The coupling loop is one or two turns of wire wound with the resonant loop. If you use computer ribbon cable, then use 16-conductor cable instead of 14-conductor. Use 14 conductors, cross-connected as per Figure 2, for the resonant loop. The coupling loop is made from two adjacent turns (cross-connected) from one edge of the cable.

Using the Small Loop

The pattern for an ideal loop is shown in Figure 4A. It is the standard figure-8, similar to the half-wavelength dipole. Note, however, that the nulls are broadside to the loop, not off the ends. The maxima are off the ends instead.

Figure 4B shows one way to use the loop. Keep in mind that the point is to increase the signal-to-noise ratio (or, actually, the desired signal-to-undesired signal ratio). It is in the SNR improvement that better reception becomes possible. Position the null in the direction of the undesired station, even if it costs a little bit of gain in the direction of the desired signal. The idea is to reduce the level of the undesired signal as much as possible. You don't need to know where the undesired station is located—it is only necessary to rotate the loop until the dirty, smelly, bad guy is nulled.

Some people report that the physical location of the loop is sometimes important. My home has a split-foyer design, and I used the loops on the main floor, half a level above ground grade. But a friend of mine, who likes to listen to a distant country music show by skywave on Saturday night (The Grand Ol' Opry), tells me that it works a lot better on his basement floor than upstairs. The reason, I suspect, is that the levels of the interfering signals are lower, or possibly there is a skywave angle of arrival issue involved. At any rate, there is enough variation to make it interesting to do some experimenting with location.

Some Loop Examples

Two of my home-brew loop antennas are shown in Photos A and B. The version in Photo A is flat-wound of computer ribbon cable. Note that the cable is folded over at each corner in order to turn the corner. The cable is held to the wooden frame by thumbtacks. These tacks do affect the operation of the loops, according to good theory, but the effect was so minimal that I didn't notice anything. The wooden frame is made from picture framing stock purchased at a hobby and crafts store. This material comes in 12" to 48" lengths, and is beveled 45 degrees on each end, with a tongue and groove joint to allow a solid junction between the pieces. A little carpenter's glue on each joint, and a few hours under clamping (with a vise or C-clamp) made the frame very solid.

The support for the frame was made from a piece of 1X2 lumber stock. Other people have used 1" dowels and broom handles for this purpose. The 1X2, however, makes it easy to attach the capacitor, a small piece of perfboard, to make electrical connections between adjacent conductors (if com-

Photo C. Two commercial loops: 1) square; 2) loop-stick.

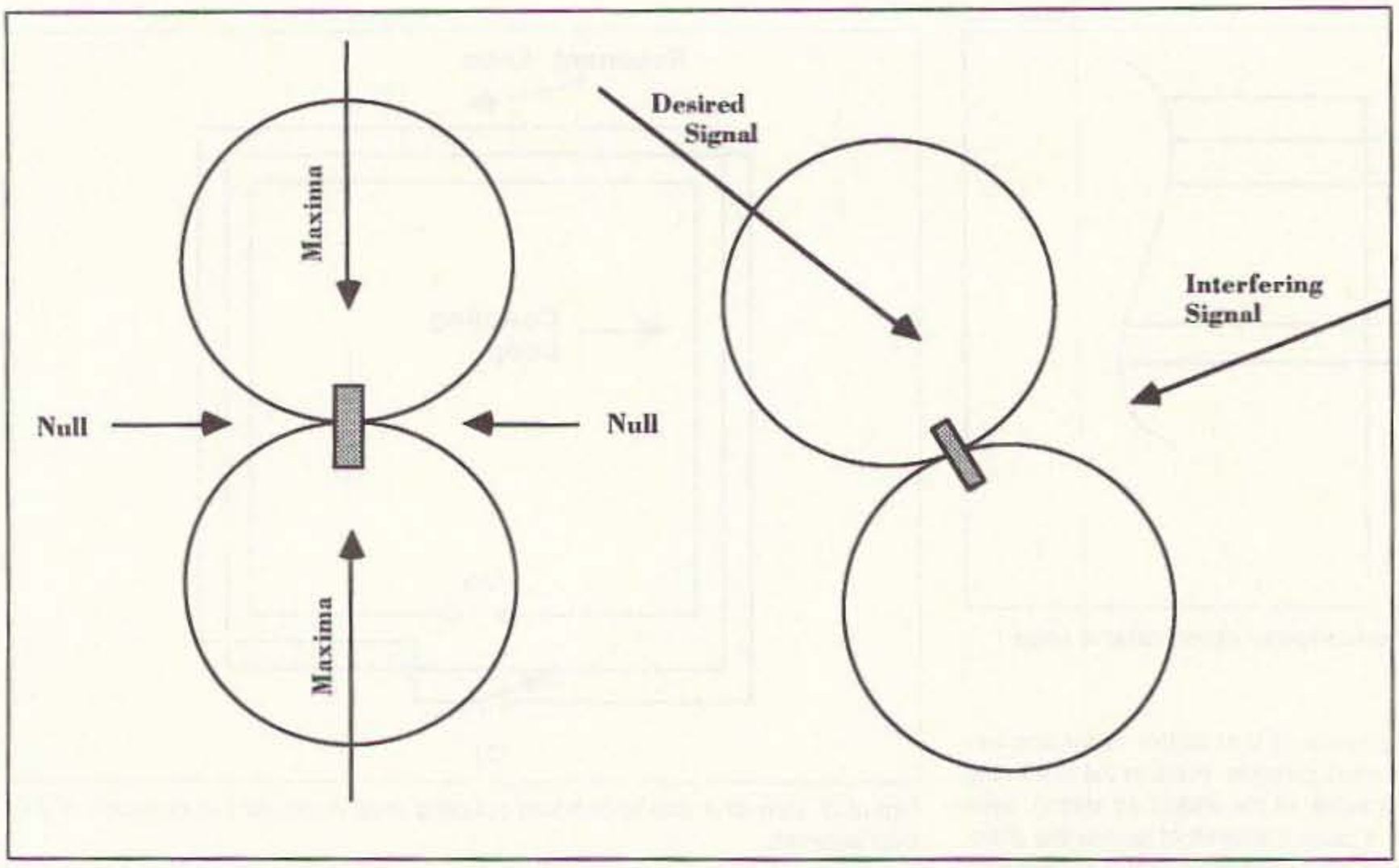

Figure 4. A) Azimuthal pattern of the loop (shown from above). Note that the nulls are broadside to the loop winding. B) Use of the loop's nulls to reduce an undesired signal.

puter ribbon cable is used), and so forth. If you want to make a better antenna than is shown here, put the capacitor and connection block inside a shielded aluminum box. A plastic knob is used to tune the capacitor, regardless of the construction method.

The loop antenna shown in Photo B is a clever little design made from an embroidery hoop. Those hoops consist of an inner and outer circle that fit together. The outer loop is split at one point, and is fitted with a screw and wing nut to permit adjustment when cloth is placed in between the inner and outer pieces. When making the loop antenna from computer cable, place the ribbon cable between the two pieces of the hoop, and then tighten the screw to hold it in place. Don't worry if a little bit of the ribbon cable overhangs the edges of the embroidery hoop. A utility box (metal is better) is used to support the hoop loop and house the connections and tuning capacitor.

Photos C-1 and C-2 show two commercially available loop antennas, made by Palomar Engineers (Box 462222, Escondido, CA, 92046; 1-619-747-3343). Both loop elements are available in different frequency versions from VLF up to the shortwave bands. The box they interface with is the LA-1 loop amplifier (a preamplifier and tuning capacitor) by the same manufacturer. Consulting the catalogs of most shortwave receiver dealers will show other brands of loop antenna as well.

Conclusion

The small loop antenna performs the function of nulling low frequency shortwave and AM BCB interference quite nicely. They are easy to build, and easy to use. Additional types of loop, as well as some unusual applications, are found in my book *Joe Carr's Receiving Antenna Handbook* (HighText Publications, 1-800-247-6553). The Antlers (MS-DOS) software is $20, and the Antlers for Windows is $30. Contact me at P.O. Box 1099, Falls Church, VA 22041 if interested. 73

BULLETIN

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Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
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Just before the holiday season begins, let's get into some reader mail and tie up some loose ends.

HW-9 Modification

First out of the mail bag is an interesting modification for the Heath HW-9 transceiver. This modification comes from Gerald Fortier W7JXQ. Gerald writes the following:

"The HW-9 Transceiver by Heathkit is a very fine little rig. After all the modifications were added over the years, It still didn't seem to have the sensitivity I thought could be had. It seems Heath did not incorporate an RF amplifier in this rig.

"At first I didn't see how I could add a preamp and get it out of line when keying the transmitter. A study of the schematic provided the answer. Diodes D301 and D302 are biased on the +R voltage during receive, by a positive voltage at the anode. That voltage is absent during transmit, and the diodes block any RF to the receiver's first IF and the rest of the receiver.

"Locate C302 on the schematic. (See Figure 1.) You will find it standing on end, near T301. Now, carefully cut the lead of C302, leaving it long enough on both sides to tack-solder short wires to. (See Figure 2.) This will be your input and output connection to install the preamplifier. Figure 1 is the schematic for the preamp. Use a 2N5179 or any other low noise high frequency NPN transistor you may have. The circuit is small and lightweight. I just used point-to-point wiring on a 1" x 1-1/2" piece of perf-board. All resistors are standing on end for maximum circuit density. The RFC can be anything from 22 µH to 1 Mh; its value is not critical.

"Oh, yes, with the power off, and using an ohmmeter, measure to ground each side of the C302 capacitor's clipped wires. One side will go to ground (through T301); make sure this is the "output" of the preamp. The circuit will give you about 12 dB of gain and the S-meter really responds now! The noise floor (quiet) remains the same on my HW-9.

"Try it! If you have any trouble, you can always connect the leads to C302 back together. But, check your wiring first. This circuit really works great for me."

Since I no longer have an HW-9, I can't speak about the performance of this modification. If you are interested in doing more modifications to the HW-9 and HW-8, there are still some copies of the *HW-8 Handbook*. They're $11 and that includes shipping. They're available from me at the above address.

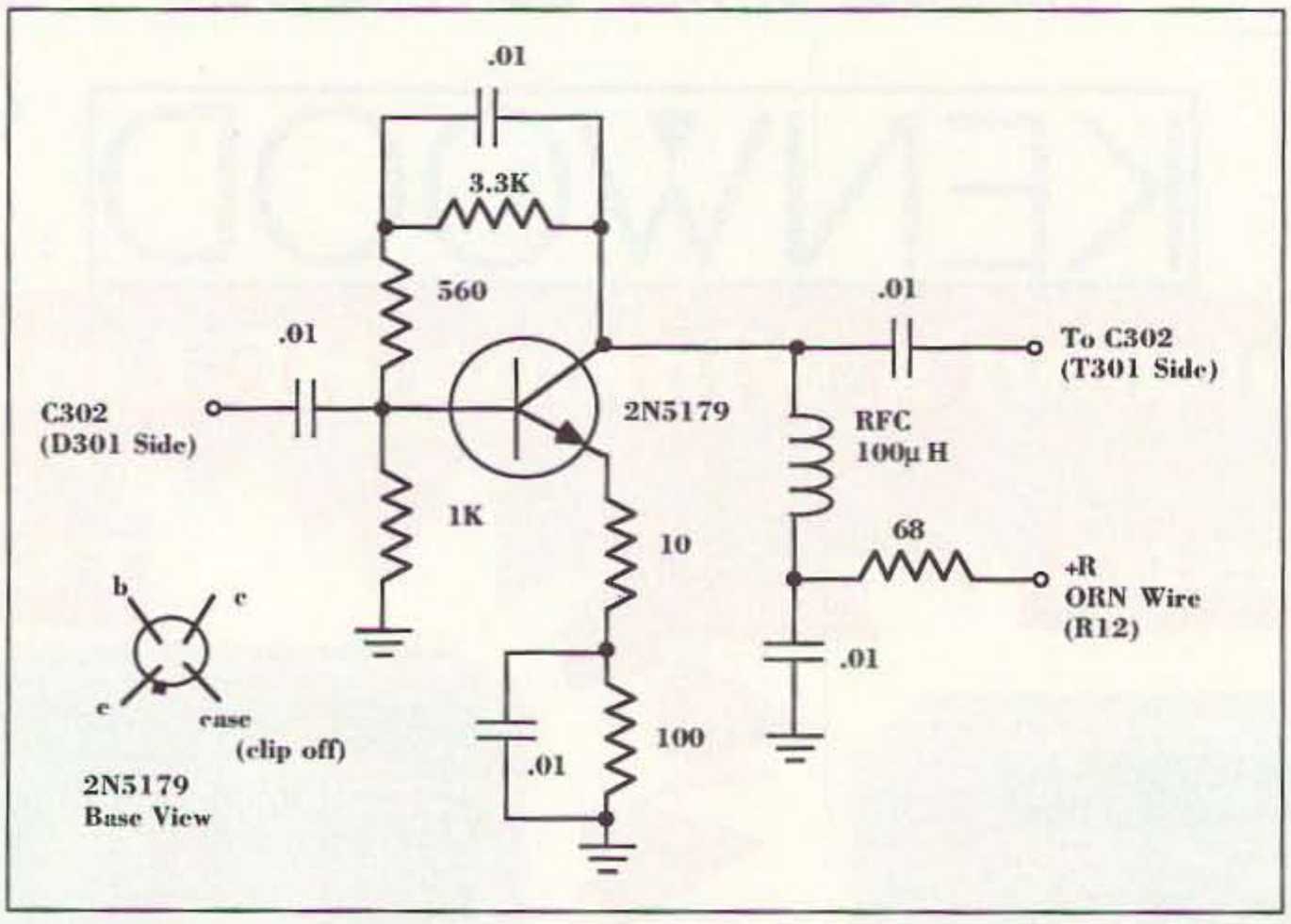


Figure 1. Preamp schematic.

30 Meters

One of my favorite bands for CW is 30 meters. It's a great combination of 40 and 20 meters. Best of all, there's no SSB on the band to get in your way. It's a CW and digital operator's delight!

I happened to pick up a copy of the Northwest QRP Club bulletin and noticed a really interesting 30 meter transmitter. What makes this rig so slick is the way the frequency is controlled.

A VXO is used to control the frequency, but with a twist. In this rig, the crystal is operated at 5 MHz and is doubled to the final output to 10 MHz. The crystal used is an easy-to-obtain 5.0688 kHz computer crystal.

Instead of the usual transistor oscillator, a transistor array IC is used, a CA3086. A third twist to the VXO is the use of several coils in series with the crystal. At first, it would seem to be an easier method to use only one coil, instead of several, but that's one of the reasons why we can get a VXO spread of 35 kHz!

Another feature that is *unusual* is the use of a power MOSFET in the PA. The MOSFET will generate a rather hefty 3 to 4 watts of power. That's more than enough juice to work worldwide on 30 meters.

As in most QRP transmitters, after the frequency doubler the rig operates straight through. On 30 meters, we have a really slick way of making the tuned circuits easy to build and adjust—use 10 MHz IF cans!

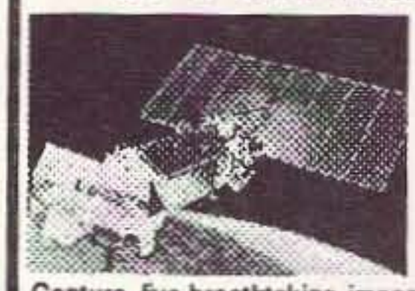
Other features of this rig included a spot switch, provision for receiver muting, and antenna switching. The rig's keying is very good.

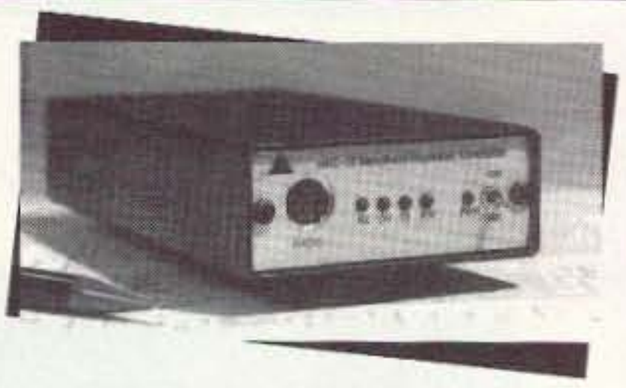
This rig is very different from most of the transmitters we have seen in the past. The VXO is contained within the transistor array IC. The output of the VXO is tuned by one transformer. The output is then routed to the driver, and then to the power MOSFET PA. A trimmer pot sets the bias of the MOSFET. The bias is set with your voltmeter, not with a scope.

Of course, the best part of this transmitter is it's available for $30 from Dan's Small Parts, 1935 South 3rd West #1, Missoula MT 59801.

I built up one of these rigs and found it went together quite easily. In fact, it's one of the best kits I've seen from Dan. The instructions take you to one stage and then another. You build up one stage, say the VXO, and then test it before moving on to the next. This way, by the time you get to the PA, you'll be 100 percent sure you'll have a working transmitter. If you can't get one of the stages to work, there is no need to proceed to the next until you have found the trouble.

After all the stages are assembled on the PC board, the only adjustment is the bias to the power MOSFET. A quick tweak of the trimmer is all it takes.





I'm very much impressed with the way the little transmitter performs. Although band conditions were rather poor, I was able to work just about anything I could hear. I used my old Drake R4B for receiving. One of my QSK boards did all the T/R switching. Although the rig comes with an electronic T/R switch, I choose to use my system.

With 3 watts of RF going to the antenna, the PA gets slightly warm to the touch. A small heat sink is necessary to protect the device from overheating. The heat sink is not provided with the kit. Radio Shack sells one for about a buck that works just fine. A hunk of aluminum would work just as well, too.

On my unit, I was able to get about 30 kHz worth of VXO spread. That's not bad at all for one crystal. In fact, it covers just about all the CW part of 30 meters. On the higher end you'll find some packet, AMTOR and perhaps some RTTY, but most of the CW is on the lower end.

With the build and test-as-you-go instructions, this is a perfect beginner's kit. Of course, you should be able to tell one end of a diode from the other and know basic soldering skills before you start. Other than that, it's an easy kit to build and get working. You'll have a lot of fun with this rig on 30 meters.

Have you built one of the NN1G rigs? I have and will have a complete rundown on this guy in an upcoming issue. But, there have been some reports of an unstable transmitter. From the Internet, I picked this up from Daniel Wee, who has fixed the problem. Daniel writes the following via Internet:

"Here are the mods I did to fix the TX section for the NN1G. There are 2 primary requirements, properly tuning the 2 IF transformers on the TX board is critical.

You will need:

a) 36 pF capacitor
b) Some ferrite beads, small ones
c) SWR and watt meters
d) >20 MHz scope (probably optional)

"First of all, determine if you have the problem as mentioned in previous mail. If you do, read on.

"Connect your antenna, not a dummy load, to a working rig. Tune the antenna to resonate at 20m if it's a multibander. Use an ATU if you have one. Once you know your antenna is resonant AND matched at 20m, connect your NN1G to it and note your SWR. Do not retune the ATU since it is already resonant. If you see an SWR exceeding 2:1, then you are likely to be having the same problems as I did.

"Take the ceramic 36 pF and cut one leg to about 3mm and tin it. Look at the second driver transistor (2N2222), the one closest to the PA transistor. Tin the top of the transistor after cleaning it. Solder the shortened lead of the 36 pF capacitor to the top of the transistor. Now, slip a couple of ferrite beads over the other lead. I noticed that I needed a few to cut down the spurs to a reasonable level. Tin one of the corners of the IF transformers and solder the longer lead of the capacitor to it, effectively grounding it.

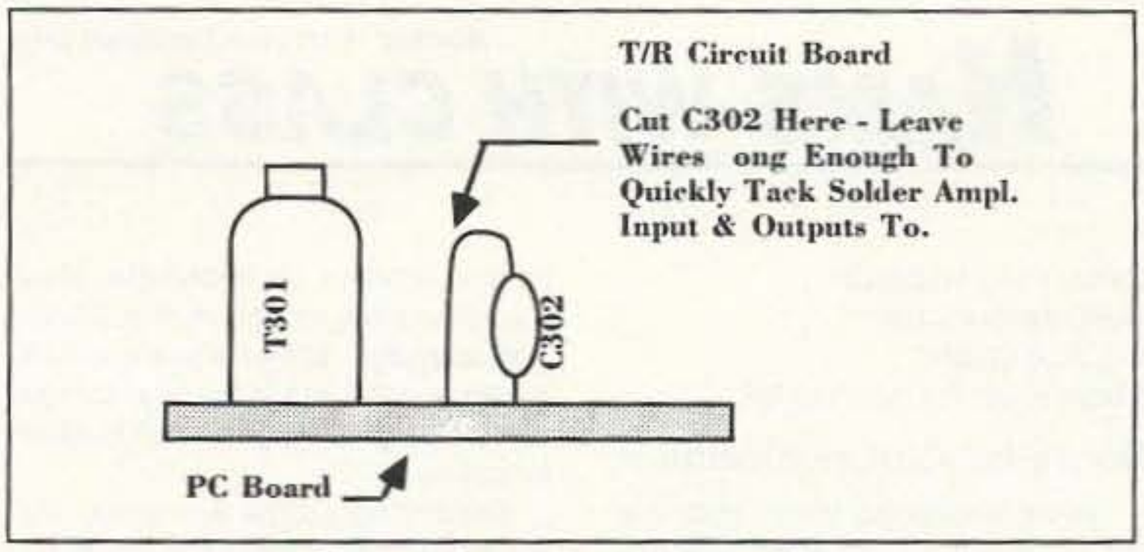


Figure 2. Connecting the preamplifier.

"Now you should see a much lower power output. In my case, I cut some tracks at the bottom of the board and put ferrite beads on the base connections of the driver transistors' bases, but I think this is unnecessary.

"Retune the IF transformers for a minimum SWR reading. This should take some time. Then turn the audio volume all the way down. There should be no more sharp clicking when keyed. Instead, there should be a 'gentle' click with no hiss. Try this out throughout the band to see if instability occurs. If it does, retune the IF transformer for more stability.

"If you have a scope, put it to the output at the antenna. Remember, until now, *no* dummy loads. Be sure to have a flat SWR if possible, as in my case, or at least the lowest possible. Key down and adjust the transformers for the most sinusoidal waveform. Do not get greedy for amplitude. Go through the band to see if the waveform is stable. You should be using a scope of more than 20 MHz for this purpose.

"Finally, when all is set, remove the scope. Remove the antenna and leave it disconnected. Key down, you should hear a clean sidetone, no hissing noise. There you have it. Keep leads as short as possible at all times." 73

Number 18 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
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Staten Island NY 10313-0006

Nonverbal Communications

Before introducing Morse code into the classroom for my sixth, seventh, and eighth graders, I set the stage for having some real fun by doing some activities that emphasize nonverbal communications. First, we brainstorm different methods that people use to communicate. The spoken or written word is not the only method that humans have devised to exchange messages or thoughts.

The children discuss the need for other means of communicating. People who speak different languages; blind, deaf, or mute people; or folks in emergency situations are often in need of unique ways to communicate. Most youngsters will recognize that Braille, sign language, smoke signals, dance, music and art are ways that people can exchange feelings, thoughts, or information.

Depending on the age group you are working with, there are lots of fun activities to do to make the children appreciate the value and creativity involved in nonverbal communication. Most young children are aware that boats often use an international system of flag signals. The various colors and patterns form different messages and function like a language. A flag divided into a red and yellow triangle means "Man overboard!" Perhaps your class would enjoy making up their own signals along with corresponding designs to go with it. They can make flags and have the class try to decode their messages. Play a game where no one may speak; they may only get information from their classmates by learning the meanings of their own coded language.

Photo B. Eighth-grader Nicole Spitale KB2OJA, eighth-grader Molly Horne, and seventh-grader Yolanda Tammaro KB2PYH help set up materials for practicing code.

Many of the older children have seen movies where ships send Morse code to convey information. We discuss the on/off principal used in digital technology such as computers and CDs. The kids often point out the use of smoke signals or flashing a shiny mirror or flashlight with the on/off principle.

Photo A. Sixth-grader Mike enjoys building projects in our nonverbal unit.

In our intermediate school in Staten Island, New York, the seventh graders are introduced to simple circuits. There are numerous construction projects you can use with the class so they can practice Morse code. Kenny Mann, who conducts numerous science workshops for teachers, uses the following activity successfully with kids in the middle grades:

Materials: two DD batteries, or two D batteries and two battery holders, #22 electric wire, 1.5 volt light bulb, light bulb holder, and a single-pole switch.

Procedure: Have the students set up the materials in series by connecting the wire to the positive pole of one battery and from there to the negative pole of the second battery. Complete the circuit via the switch and the light bulb in its holder, ending at the negative pole of the first battery.

The bulb will light up. When the switch is opened, the circuit is broken and the bulb is switched off. By moving the switch back and forth, students can make the bulb go on and off at will.

After you've taught the letters of the code, have the children send brief messages to each other. I use the buddy system in my classes. Some of the children use code practice oscillators, some use the light bulb circuit, and others use flashlights.

Have a chart showing the symbols for the dry cell/battery, the light bulb, open and closed position of the switch, and the wire. Next, have them draw a diagram of the circuit they set up. Once they know the symbols, they'll have fun reading the diagram—which is another way of communicating without words.

After a unit on nonverbal communicating, most of the children agree that it's fine for sending brief messages, but nothing beats a one-on-one conversation for expressing moods or emotions.

With the start of a new school term, think about including at least one new unit or activity into your classroom. No matter what subject you teach, it's more fun for everyone when the teacher is excited and stimulated. Be sure to upgrade your materials and expand your repertoire each term. Write to me so we can share any new ideas you are using this term that are successful. Have a great school year! 73

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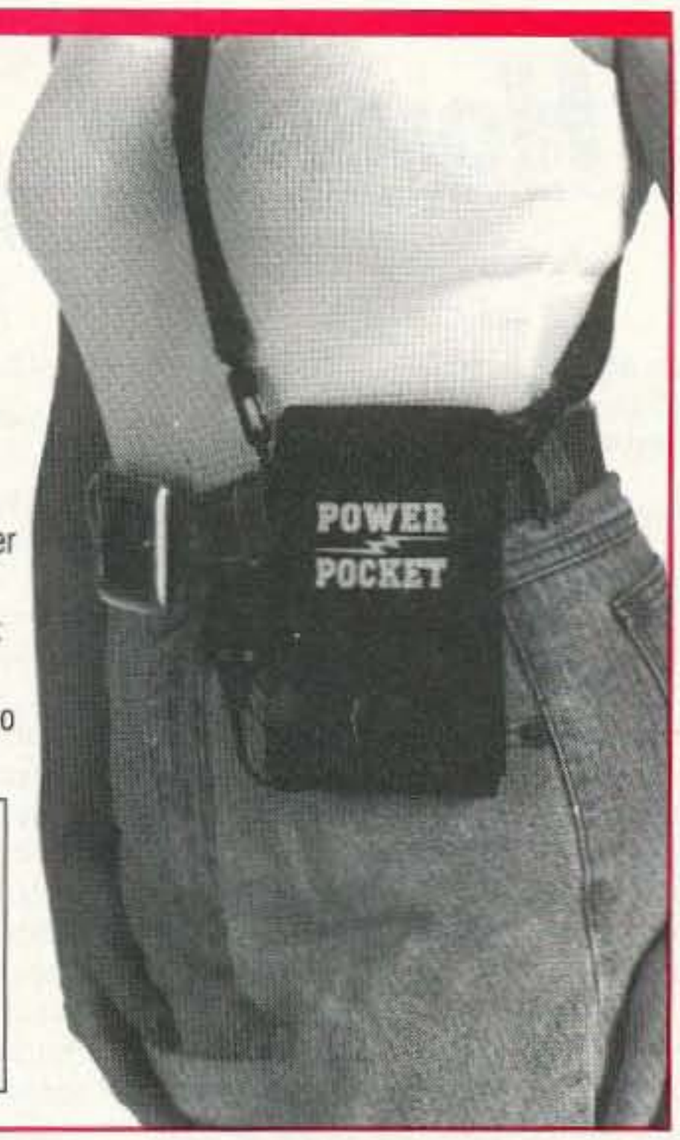

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Testing Motron's Transmitter Fingerprinter

According to many hams, Southern California has a reputation for being the repeater-jamming capital of the world. As someone who has traveled and talked to many repeater owners and users, I think that reputation is undeserved. The sad truth is that you can find examples of illegal repeater use in big cities and small towns everywhere.

With hundreds of coordinated 2 meter repeaters between Santa Barbara and the Mexican border, hams here can be proud that only a handful have ongoing problems with jamming, bootleggers, and unidentified transmissions. The rest are full of friendly and helpful hams who seldom face these problems.

Of course, there are occasions when nets and round tables on even our "cleanest" repeaters are brought to a halt by carriers, tones, and cuss words. When a phone call goes out to a radio direction finding (RDF) team, the job is not easy if there are many perpetrators in scattered locations. It would be a huge help to be able to separate and identify which transmissions come from which source.

Just Like Snowflakes

We all know that every human is unique and can be identified from all others by differences in the skin patterns on the fingertips and DNA in the cells. These methods require the person to submit to examination or testing. When this is not possible or desired, a voiceprint can be done from a distance, without the knowledge of the subject, at the cost of greater uncertainty.

Similarly, every radio transmitter is unique. You cannot read the serial number on its nameplate from a distance, but you can identify it by analyzing, with sufficient precision, the characteristics of its signal. Differences in signals, however slight, are always present due to differences in individual parts and the randomness in factory testing and tuning techniques.

You may have heard reports of unique transmitter "signatures" and a technique called "fingerprinting" to identify rigs used for illegal activities and to apprehend their owners. What these reports usually leave out is the fact that this technique was invented by a ham and such equipment is now available for purchase.

A Sleepless Experimenter

When I spent nine months on assignment in Seattle back in 1972, the city's most popular repeater was run by Phil Ferrell W7PUG, an engineer at The Boeing Company. Today, this repeater is as popular as ever, Phil is K7PF, and he has retired to work on his own pet projects.

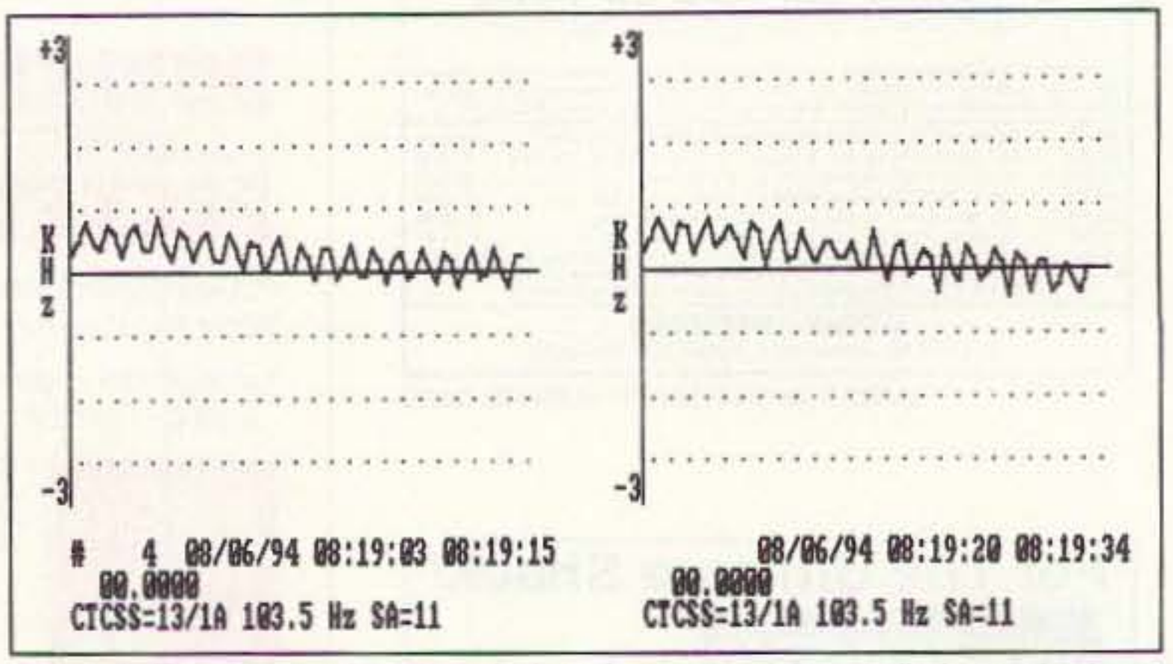

Figure 1. Two consecutive transmissions from a crystal-controlled repeater transmitter. Subaudible tone modulation (CTCSS) is plainly visible. TxID-1 computes and displays the CTCSS frequency below the trace.

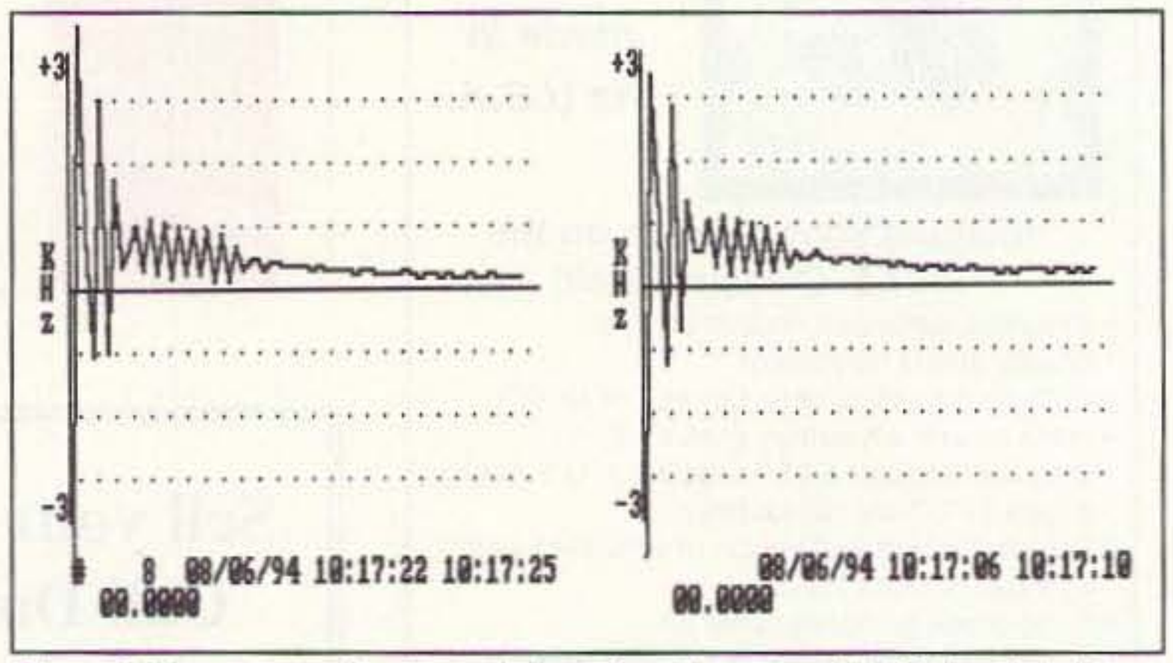

Figure 2. Two consecutive transmissions from the same FT-530 handie-talkie on the same frequency. Except for the ringing duration, the fingerprints are almost identical.

In the mid '80s, when unidentified signals appeared on the Seattle repeater Phil decided to fight back by using his knowledge of signal analysis. He reasoned that most of the offending transmitters were owned by licensed hams and could be identified by comparing their signals to those of regular and occasional repeater users.

The first design challenge was to figure out what signal characteristics to look at. "I had heard FM transmitters come on the air on top of one another," says Phil. "There would be a heterodyne with a chirp or quickly warbling tone at the beginning, as the phase-locked loop (PLL) settled on frequency. I researched PLL theory, which goes into a branch of math involving Gilbert transforms. That wasn't helpful, so I tried looking at it as a low-bandwidth FM phenomenon."

After some experimentation, his transmitter fingerprinting scheme took shape. It takes 2,048 instantaneous frequency samples at 100 microsecond intervals at the beginning of a transmission, then averages and filters this data to display and record 64 super-samples of frequency versus time.

"Amplitude and multipath don't have much effect," says K7PF. "It's a robust technique and works under almost all conditions. Even on signals of -120 or -125 dBm, when the audio is almost unintelligible, the low bandwidth of the system gives a pretty decent fingerprint."

Photo A. All you need to take transmitter fingerprints is a suitable receiver and a computer with the TxID-1 hardware and software installed. Not shown is an optional tape recorder for documenting audio and fingerprints simultaneously.

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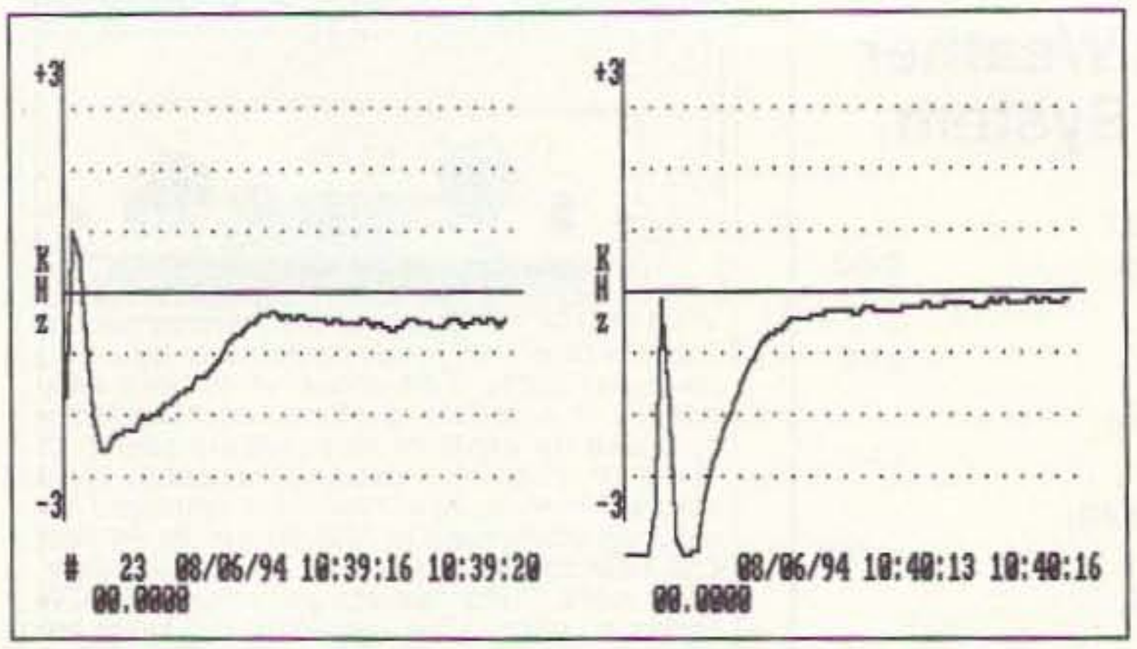


Figure 3. These two HTX-202 transceivers were bought at the same time, but have distinctly different fingerprints. They were set for the same power level on the same frequency.

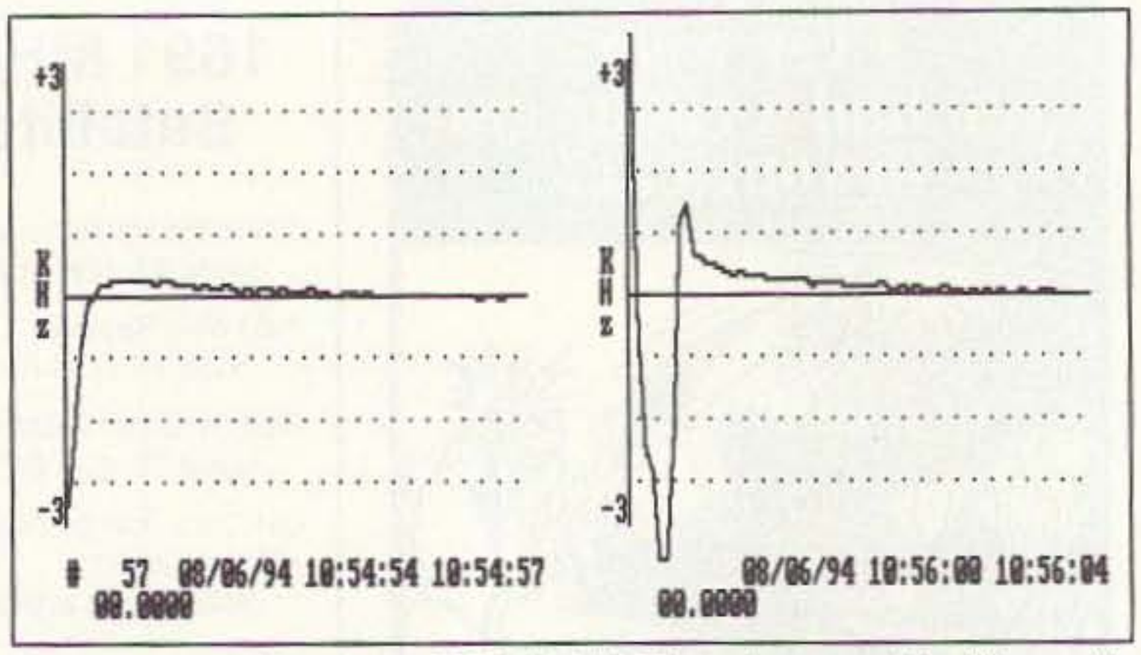


Figure 4. In a rapid-exchange QSO, this TH-78A produces consistent fingerprints like the one at left. If the rig sits for a few moments until the battery-saver feature activates, the next transmission looks like the trace at right.

There were distinctive characteristics on every radio he tested, even those of the same model. "I was showing the system at a club meeting and a husband and wife stood up," he goes on. "They both had brand-new Alinco handhelds with adjacent serial numbers. He told me flat out he thought they would have identical fingerprints. I was standing there kinda sweating and said, 'Well, I don't think so, but we'll take a look.' I finished the talk and got to the demonstration time and they immediately leaped to their feet. We checked the rigs and they were like chalk and cheese, totally different.

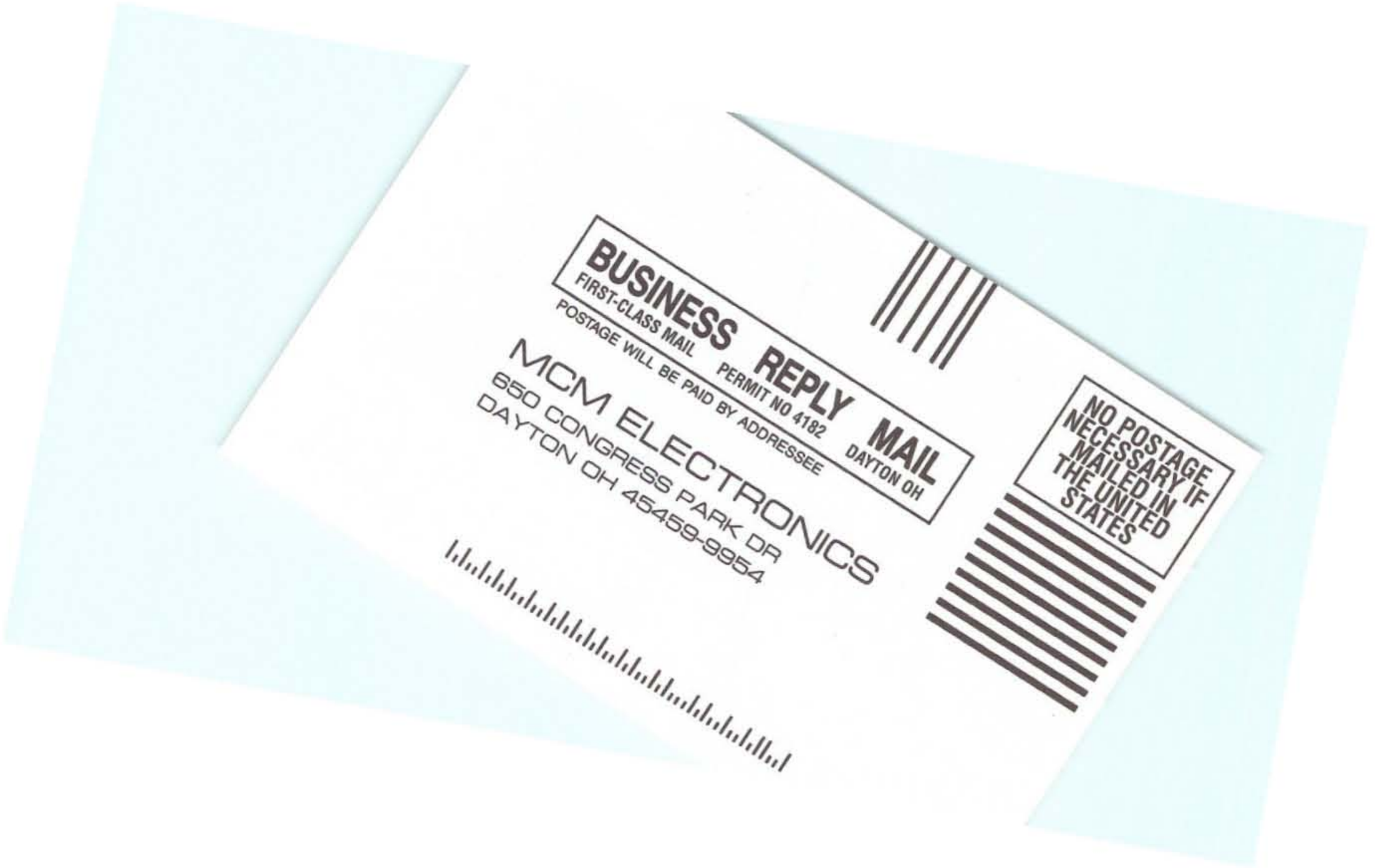
"A small percentage of rigs have two or more fingerprints. Theoretically, there are two predictable routes for PLL lockup. It's unlikely a given radio would be set up so it could take both routes, but it can happen." A rig's fingerprint may change slightly as you tune different parts of the same ham band. Dual- and multiband VHF/UHF rigs have completely different prints on each band.

K7PF soon realized he had a marketable signal identification system. "In a rare moment of greed, I ran it past the Boeing patent staff," he says with a chuckle. "That turned out to be a good move." Transmitter fingerprinting is now patented and assigned to Boeing, who sees to it that nobody makes commercial use of this idea without compensating Boeing and K7PF for it.

Next, FCC heard about fingerprinting and asked for some of Ferrell's equipment to evaluate. About this time, Don Moser AA7Y of Motron Electronics heard about the system at the Sea-Pac ham convention. K7PF showed AA7Y his breadboard and they worked out a deal for Motron to manufacture the circuit boards for Ferrell's FCC contract and to market the finished product, called the TxID-1, to the public.

Dozens of 78s

Phil's description fingerprinting made sense to me, but I was a bit skeptical at first about just 64 supersamples providing positive identification of like-model transmitters. For a rigorous test, I decided to take TxID-1 to a meeting of the 78's Amateur Radio Club. This group was formed to teach the arcane art of programming the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Kenwood TH-78A handheld to new purchasers. Dozens of TH-78s and other HTs would be there. Could TxID-1 display the unique features of many rigs of the same type?

Motron's TxID-1 system consists of the data acquisition and control board that plugs into the expansion slot of an IBM PC or compatible computer, an interface board, and a PC software program written by George Hadley N7SNI. TxID-1 connects directly to the receiver's discriminator and includes its own fast squelch circuit for uniform timing.

For this experiment, I mounted the main board in WB6UZZ's Compaq Portable 286 PC and connected it to a Bearcat BC210XL scanner (Photo A). The interface board (Photo B) plugs into the TxID-1 main board and has connections for receiver discriminator (mandatory) and AGC (optional). The BC210 is easy to adapt to TxID-1. There is plenty of room inside, RCA jacks mount readily on the steel rear panel, and its discriminator tap-off point is easy to locate.

Discriminator polarity and voltage swing differ among receiver models. To ensure that TxID-1 accurately displays the instantaneous frequency, you must calibrate the discriminator frequency-versus-voltage curve in 1 kHz steps. I used a TS-700A VFO-controlled rig and a VHF frequency counter to get the data for the BC21ØXL passband in about

minutes.

With this data, running OPAMP.EXE (supplied on the program disk) calculates values of two resistors to set gain and polarity of the input operational amplifier on the TxID-1 board to match your receiver. I ran the program, found the resistors in my junkbox, and soldered them to the supplied component header in less than 15 minutes. Note that the whole procedure must be done over if you change receivers.

I tested version 1.15, the current software revision, which is menu-driven with single-character commands. It supports the Microsoft Mouse, but not Windows. A 486 with fast hard drive and VGA/EGA monitor provides best performance, but a compatible with 512K memory, CGA graphics, and a floppy drive will do.

I tried to enter the frequency to be displayed in the fingerprint disk file, but the entry was not accepted. AA7Y says this is a software bug that will be fixed in the next revision. That is why all the plots in this review show 00.0000 on the frequency line. The first signal I fingerprinted was a crystal-controlled repeater output (Figure 1). Most repeaters have continuously running oscillator stages, so there is no PLL hunting.

Immediately following the 200 millisecond sample period, the program displays the fingerprint on the left side of the screen, along with the detected CTCSS frequency, if any, and the signal amplitude, if receiver AGC input is provided. From that point until the transmission ends, it decodes and displays any DTMF digits received and determines the maximum deviation of voice and DTMF modulation. The display also includes the date and exact time of transmission start and stop.

A new fingerprint is produced each time a transmission begins. Of course, prints of repeater users must be made on the input frequency, as fingerprint data does not pass through the repeater. If you accidentally set the receiver to the output frequency, you will see the print of the repeater transmitter, not the user.

With the MOVE command, you can put the fingerprint of your choice on the right side of the screen for comparison with incoming prints on the left (Figure 2). The COMPARE command (not shown in the figure) overlays the print from the right side onto the print on the left, in different colors if you have a color monitor.

When COMPARE is commanded, the program automatically calculates a figure of merit for the difference in the two overlaid prints. "It subtracts the corresponding values of each supersample, with a maximum allowable difference value of 2 kHz each," says N7SNI. "The 64 difference values are each squared, then all are averaged."

Perfect correlation would give a mean-square difference of zero. That rarely happens, but most rigs have only small differences between transmissions, whereas prints of non-identical rigs usually show much higher difference numbers. The difference value is 4 for the two transmissions of Figure 1, and 9 for those of Figure 2.

By selecting the appropriate program mode, some or all fingerprints can be stored on disk. They can also be recorded on audio tape. Using a stereo tape deck, you can simultaneously log user fingerprints and audio on the left and right channels. The manual says the program will turn on your recorder at the start of a transmission and delay the audio until it comes up to speed, but I did not test this feature.

I spent much time using the ANALYZE feature, which allows comparison of fingerprints stored in one or more disk files. You can also put an annotation line on the prints and edit them down into a master file. The MOVE and COMPARE functions work perfectly with disk-stored prints, but there are minor program bugs in storing and display of the DTMF and deviation data.

The Acid Test

So how did TxID-1 do with different rigs of the same model? Very well! Most times, the differences were obvious, as shown in Figure 3. The mean-

square numeric value in the COMPARE mode for these two prints is 179.

TH-78s and other Kenwood rigs settle on frequency much faster than other brands, so they were harder to tell apart. But it was still possible to find differences, usually in the final frequency after PLL settling. (Of course, this value might be affected by such factors as temperature fluctuations in the transmitter and/or receiver, so care must be used.)

For fast-settling rigs, it would be desirable to eliminate the 2 millisecond delay between squelch activation and start of the print. Phil says he is working on a firmware upgrade that will store data to allow "looking back" before the squelch opens, to the exact start of transmissions.

A few HTs had wild variations in consecutive-transmission fingerprints, which turned out to be caused by near-dead batteries. Features such as a rig's battery saver also cause changes in its fingerprint (Figure 4). Then there was one rig at the meeting that seemed to have an unlimited number of prints that were similar, but with definite differences. I compared 10 prints from this rig and found only 7 out of the 45 possible comparisons had mean-square difference numbers less than 100. To avoid giving aid and comfort to potential troublemakers, I will not reveal the make and model. Fortunately, other rigs of this type at the meeting did not have these variations.

Parting Shots

Learning to use the TxID-1 is fairly easy and intuitive, but I can only give the manual a grade of C. It has plenty of detail to help you connect to receivers and recording gear. There are advanced topics such as command-line parameters and script files. But information on how to analyze and compare your prints is hard to find. For instance, there is no help in interpreting the mean-square difference function in the COMPARE mode and no explanation why the CTCSS frequency readout often gives false indications.

Motron's telephone support was very good, and I was able to get some added information on the program by reading the large (50K) help file on the program disk. Don Moser of Motron says a new manual is coming, along with Revision 2 of the software. It will fix all the known bugs. Also in the works is a remote access feature. You will be able to put TxID-1 on the receiver at your mountaintop repeater and downlink fingerprints via phone or packet radio.

I would like to see some other improvements in the software, such as a hard copy printout function. For the figures in this article, I used the computer's "PRINT SCREEN" key with a dot matrix printer after running the "GRAPHICS" command from DOS. There should also be an faster and easier way to start and stop the fingerprinting function without exiting to the MONITOR menu.

It would also be great if TxID-1 could be programmed to automatically search your database of known user transmitters and select the closest print or prints in it when your repeater is keyed up. This would be a faster way to identify "kerchunkers." Also, how about a way to automatically alert the operator when a particular rig comes on the air? This would be especially valuable when someone's transceiver is stolen. Don, Phil, and George say they are working on such features.

At $699 plus $8 shipping for the complete TxID-1 hardware and software package plus the cost of the computer and receiver, the Motron fingerprint system won't find its way into the average ham shack. However, it is well within the budget of many repeater clubs and is certainly a worthwhile addition to the arsenal of repeater councils and interference committees.

From its introduction, TxID-1 has had steady sales to government, amateur, and commercial purchasers. But according to AA7Y, many customers don't want the fact that they own TxID-1 to be public knowledge. "Nonsense!" says K7PF. "A system like fingerprinting does no good unless people know about it. A ham from Victoria, British Columbia tells me that the TxID-1 is like having a shotgun by the door. It never needs to be used, but everybody knows its there just in case."

TxID-1 is not sold at ham stores. It is available only from Motron Electronics, 310 Garfield Street, Suite 4, PO Box 2748, Eugene OR 97402, (503) 687-2118. 73

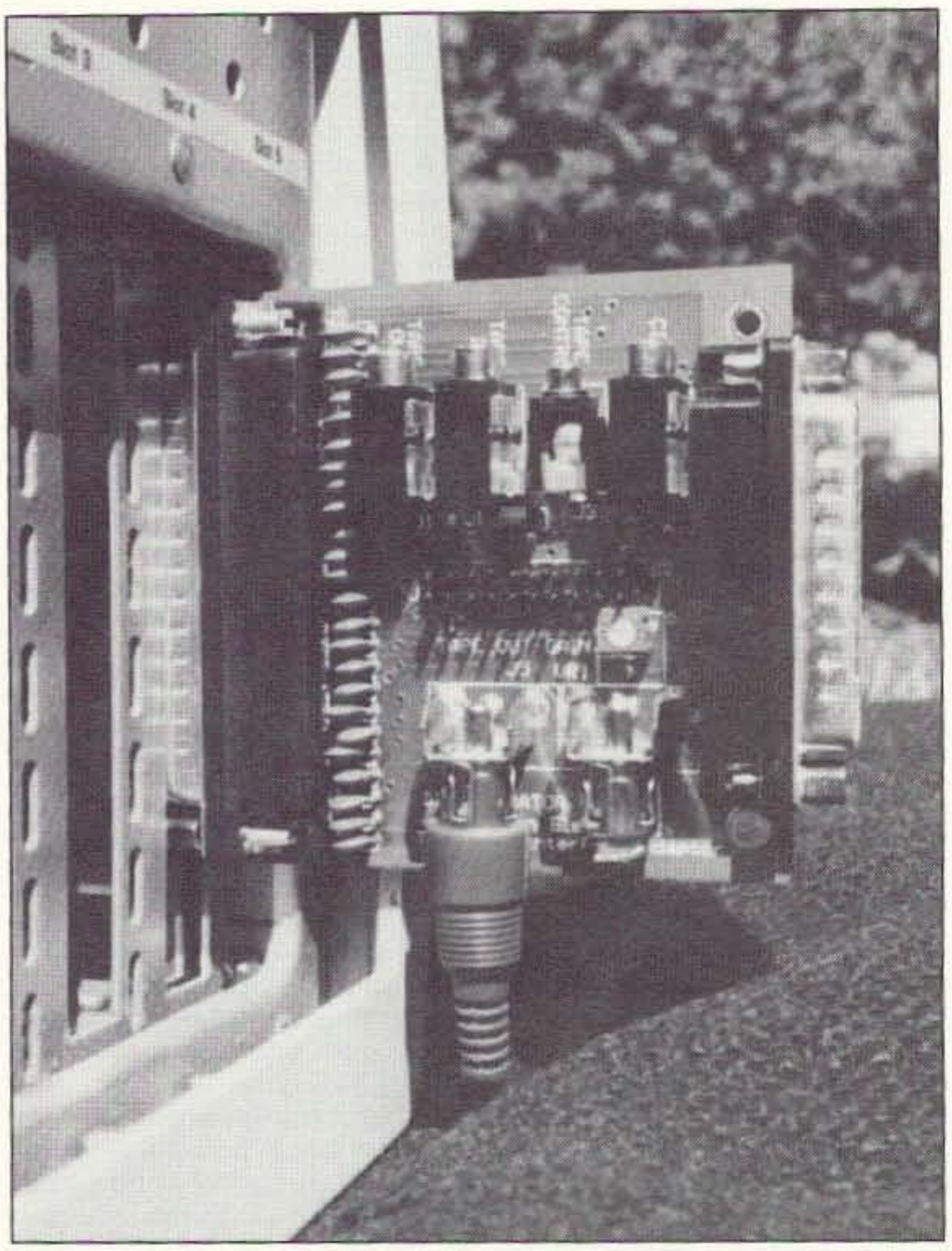

Photo B. The IA-1 Interface Adapter board has jacks for receiver discriminator and S-meter input, plus tape recorder on/off and audio. It attaches to the TxID-1 Transmitter Identifier board mounted inside the computer. The unused DB25 connector is for optional RS-232 control of AR-3000 receivers.

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Peterborough NH 03458

The Hog Fence Antenna

Two months ago I wrote about the Hawg Amp. It turns out that members of the Big Shanty Repeater Group in Atlanta, Georgia, have an antenna project that makes the perfect companion for the Hawg Amp. Designed by Kip Turner W4KIP (based on an old *ARRL Handbook* design called the parabolic plane) and modified by David Rice KD4SHH, this antenna is easy to build and is a great performer. They call it the Hog Fence Antenna (also known locally as the Hawg Fence) for the basic building material that forms the reflector. Depending on your location, hog fencing is usually available from most hardware or farm supply stores and is very inexpensive. The hobby tubing and brass stock for the driven element can be found at hobby, craft or hardware stores.

This Big Shanty Repeater Group has been actively distributing plans for this antenna (as well as a description of their ATV repeater) to area hams to help encourage interest in ATV around the greater Atlanta region. The response has been very encouraging as many local hams have built the Hog Fence and found it a quick and effective way to view the activity on the BSRG ATV machine.

Once you've rounded up a roll of hog fence and the necessary brass parts (see the Parts List), you're ready to start assembly of the antenna.

Driven Element

Cut a piece of 1/32"-thick brass plate to a dimension of 1" by 2.5". Drill two 1/8" holes in the center of the plate exactly 3/16" apart (see Figure 1 for driven element details). The 3/16" spacing is critical for proper spacing of the tuning stub. Make sure that the spacing is exactly 3/16" edge to edge.

Next, bend the 1/8" x 36" brass welding rod in the center. Bend the rod into a "U" shape while maintaining the proper 3/16" gap between the two 7.5" sections of the rod.

Before making the last two bends on the welding rod, slip the rod through the two holes in the brass plate. *Do not* solder it yet, just make sure it has a tight fit to facilitate future adjustments.

Now bend each end of the welding rod so that the "U"-shaped section is 7.5" long and the vertical sections are 6" long each.

Cut two 12" lengths of 5/32"-diameter brass tubing and slip them over the ends of the welding rods.

Feedline Assembly

Strip the end of the 3-foot length of Teflon coax cable as shown in Figure 2. Solder the center conductor to the upper section of the U-shaped rod and solder the braided shield to the lower section. Be careful not to melt the insulation on or inside the cable. Secure the cable to the lower section of the U-shaped rod with a black nylon wire tie (use the black wire ties for UV resistance). Now install your coax connector on the other end of the cable.

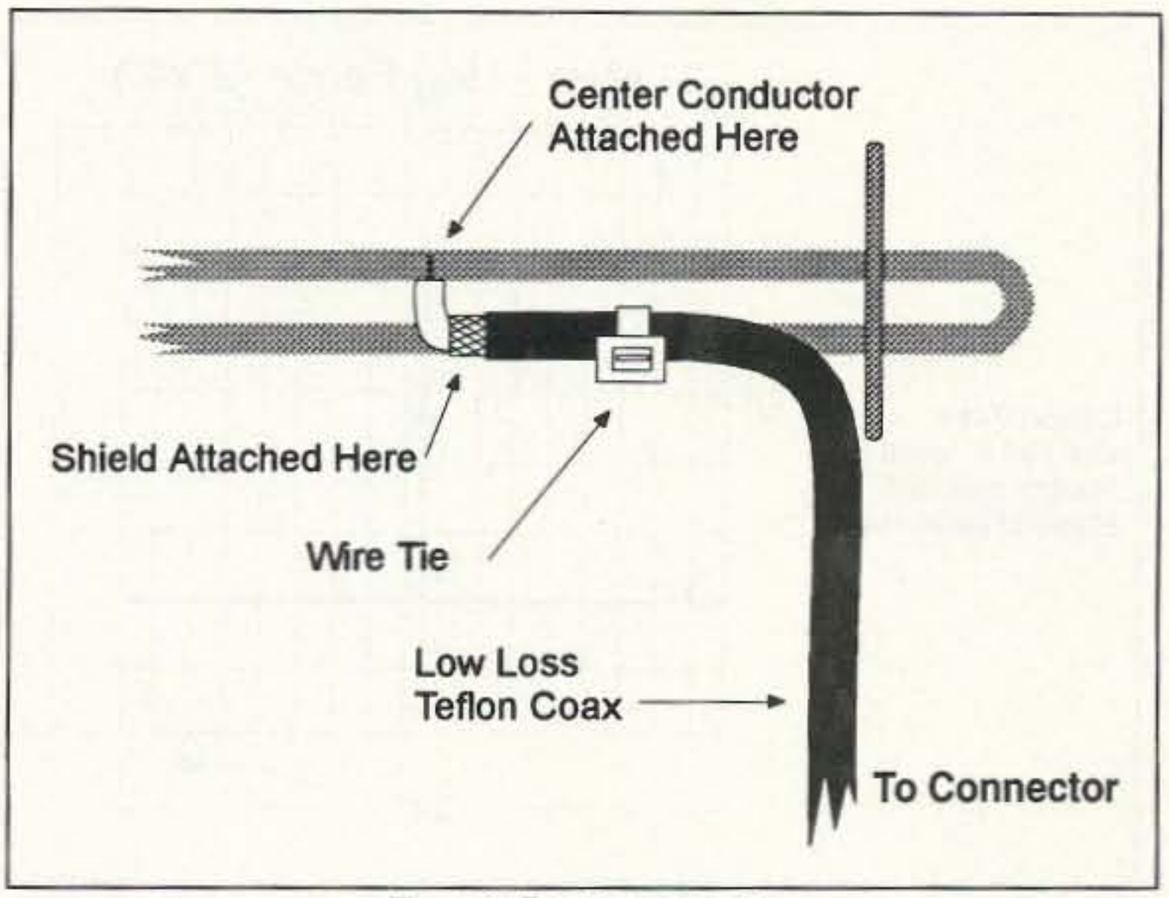


Figure 2. Feedline assembly.

Final Assembly

Solder or braze the brass plate (and driven element) to the section of the Hog Fence as shown in Figure 3. Be careful not to damage the coaxial cable by allowing it to be heated excessively. Note that the openings in the fence are to be positioned with the narrow direction running vertically (i.e. in line with the driven element).

Use plenty of black nylon wire ties to attach the two 36" pieces of copper tubing to the rear of the fence. Bend the fence into the described parabolic

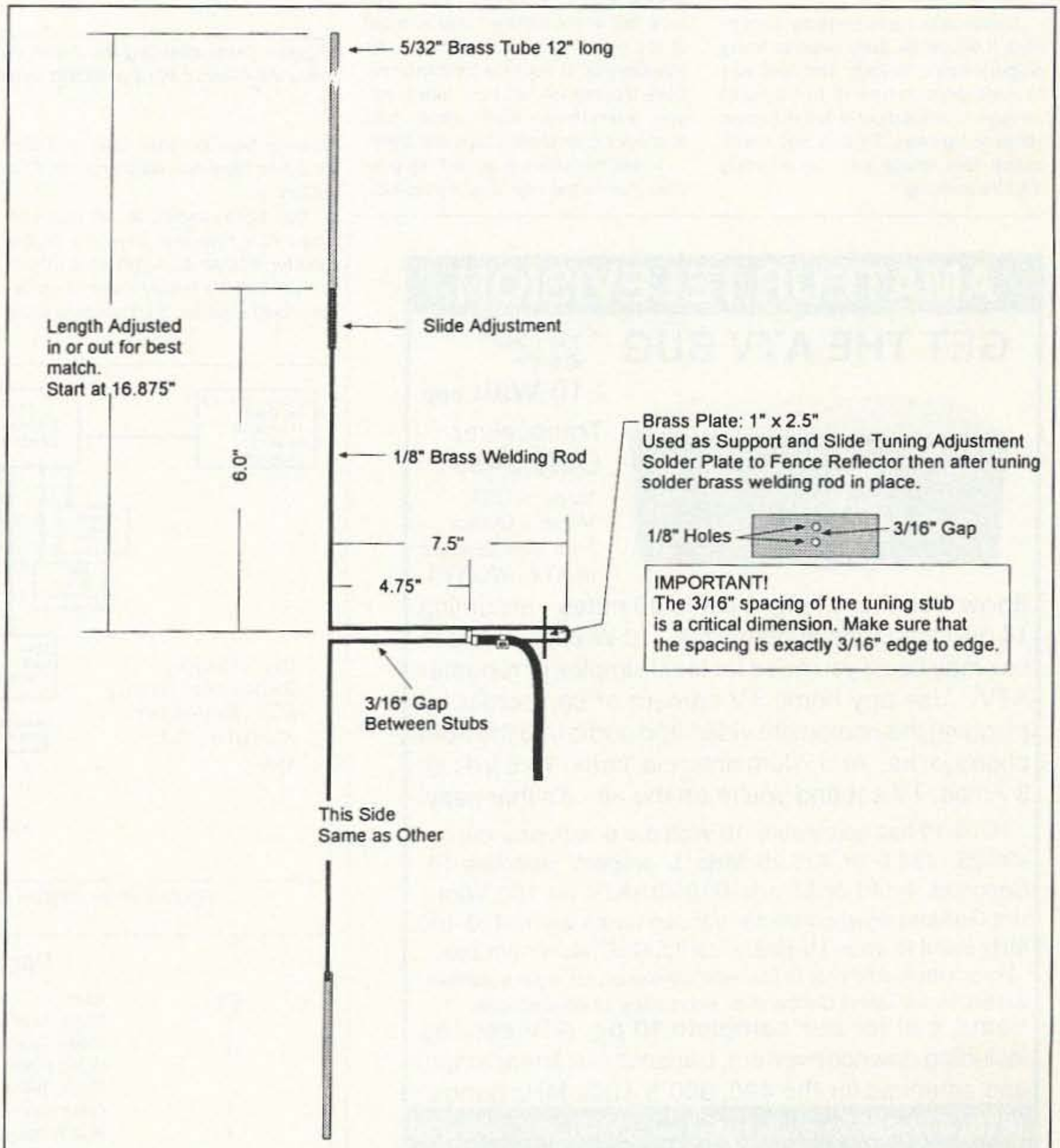


Figure 1. Construction details of the Hog Fence antenna's driven element, mounting plate and tuning stub. The brass support plate is first soldered to the fence reflector. Solder the brass welding rod to the brass plate only after final tuning is complete.

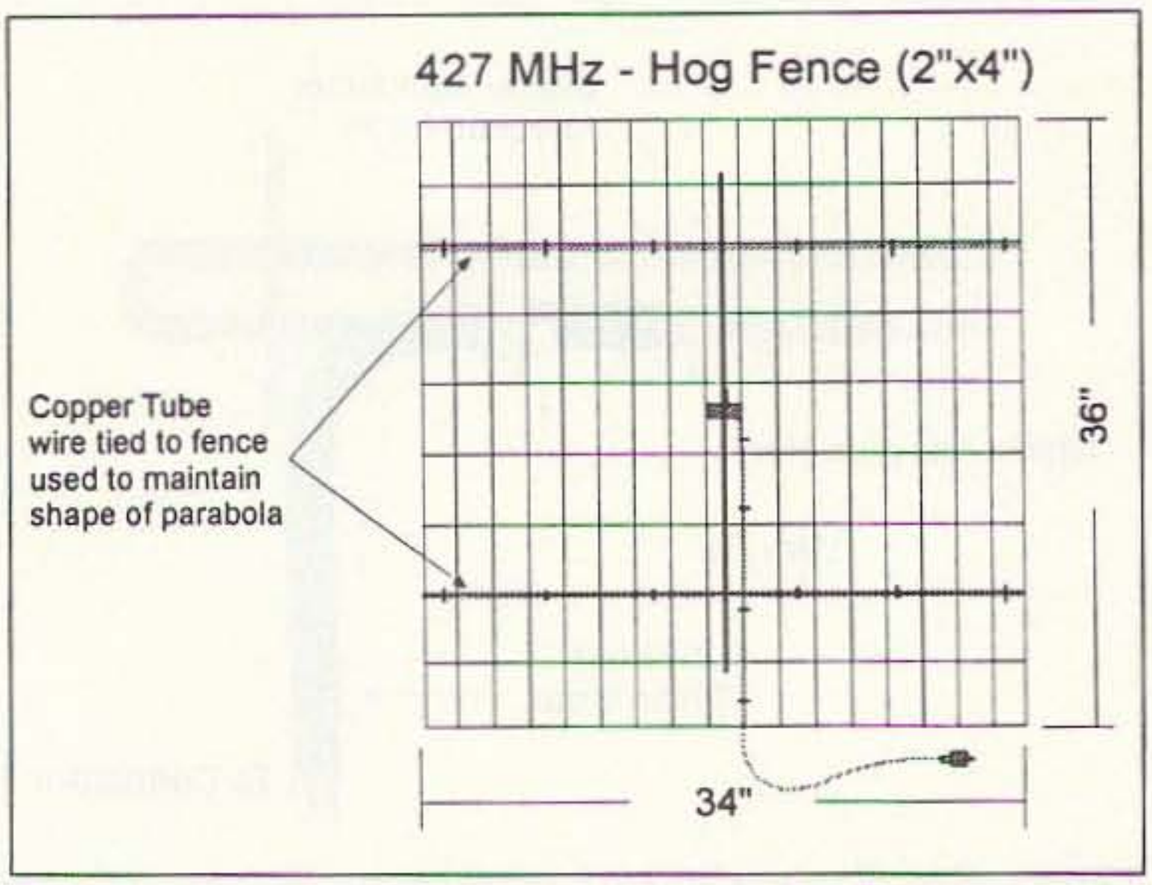


Figure 3. Final assembly of component parts of the Hog Fence antenna. The copper tubing is wire tied to the hog fence reflector to maintain parabolic shape.

shape using the measurements shown in Figure 4.

Go Hog Wild!

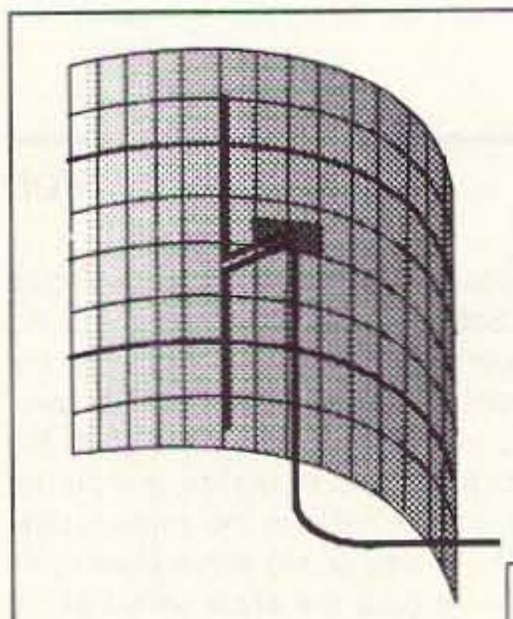
If your antenna is correctly assembled, it should be fairly close to being properly tuned already. The best way to tune an antenna is to transmit through it and adjust it for minimum reflected power. This is not really critical here unless you plan on using it for transmitting.

To tune the antenna, slide the two 5/32" pieces of brass tubing on the ends of the U-bent rod to the suggested lengths (see Figure 1). Now slide the entire element into and out of the brass plate. Use these three adjustments to optimize performance. Once the antenna has been tuned, solder everything into place and re-check the parabolic shape and SWR.

Install the antenna as high as possible (above the tree tops if possible), use the best low-loss coax you can find and have fun watching the ATV action.

The BSRG invites you to tune into their ATV repeater if you're in the greater Atlanta area. Watch for them on 427.25 MHz (easily received on cable-ready channel 58). They hold a net every Thursday night at 9 p.m. using the 146.655 (-600) repeater or the 147.345 (+600) repeater for the talk frequency and invite all to join in and watch the fun.

Thanks to Ralph Fowler N4NEQ, David Rice KD4SHH and Kip Turner W4KIP for the above information. 73



Parabolic Curve Dimensions

X	Y
2"	.16"
4"	.64"
6"	1.44"
8"	2.56"
10"	4.0"
12"	5.76"
14"	7.84"

"HI KIP"

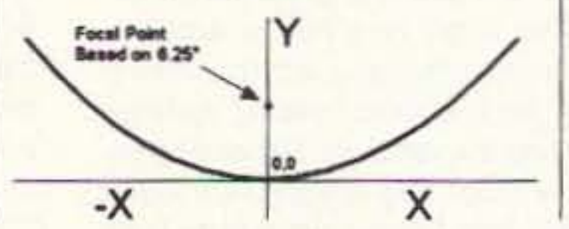


Figure 4. After attaching the driven element and the copper tubing to the fence, bend the reflector into a parabolic shape using these parabolic curve dimensions.

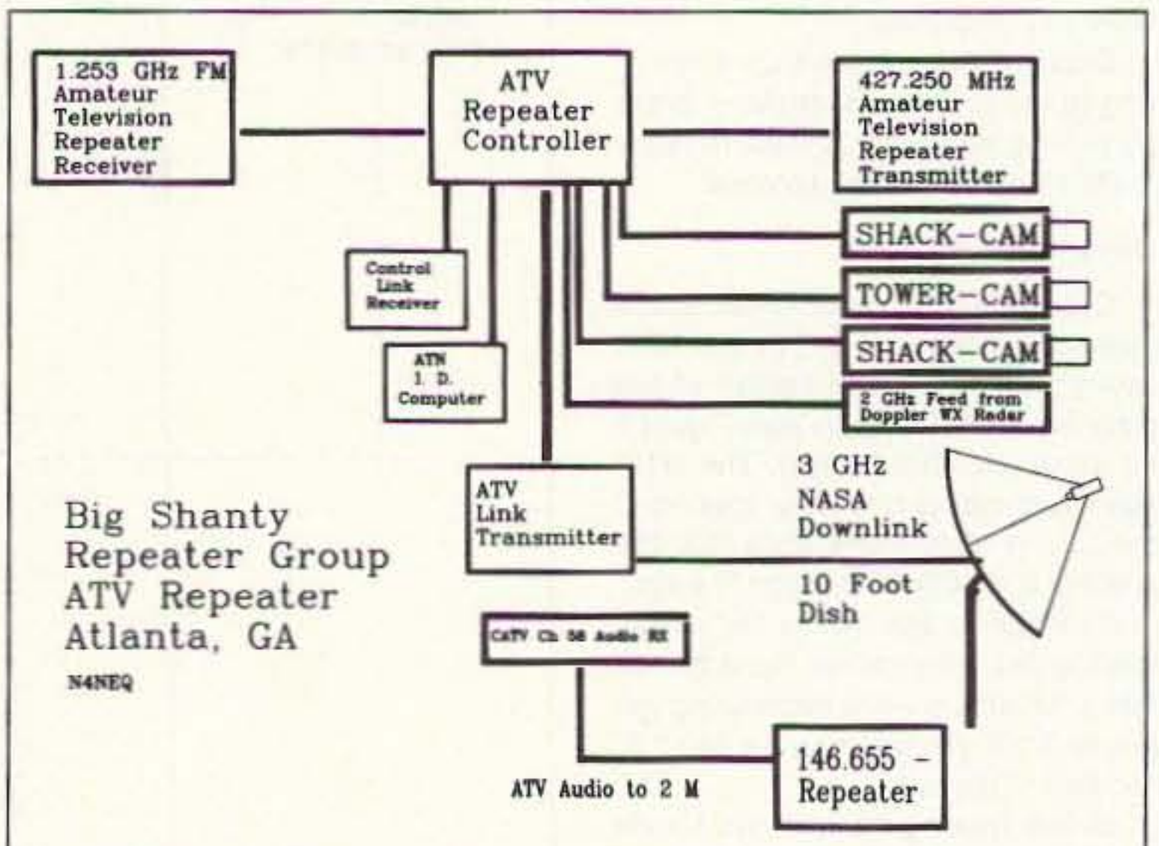


Figure 5. Block diagram of the BSRG's ATV Repeater.

Parts List

Qty.	Item
1	Brass Welding Rod, 1/8" dia. x 36"
2	Brass Tubing, 5/32" dia. x 12"
1	Brass Plate, 1" x 2.5" x 1/32" thick
1	Coax, Teflon or low-loss, 3-foot long
1	Coax connector (your choice)
1	Hog Fence (2x4 pattern), 34" x 36"
2	Copper Tubing, 3/8" dia. x 36"
20	Black nylon wire ties

Number 21 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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Crystal Oscillators and Frequency Standards

Building on last month's column covering frequency measuring equipment, I want to cover crystal oscillators, especially the frequency-standard type of oscillators. In equipment today, ranging from the very basic VFO-controlled HF transceivers to the more sophisticated transceivers on the market, all are controlled by some form of crystal oscillator, if only a 100 kHz calibrator in the most modest of rigs.

The heart of any system rests in its ability to determine frequency, or at least allow the operator of the system a means of knowing where you are in respect to frequency. After all, if you don't know where you are, how can you make easy contacts with others? Some very simple QRP rigs can operate without a sophisticated receiver dial mechanism, but they do have the provision for setting frequency approximately by "NETTING" the transmitter frequency to the receiver. In these very simple and compact systems, the transmitter is crystal-controlled and probably shirt-pocket-sized, with very few frills incorporated.

The heart of the entire system is a CW transmitter that is crystal-controlled at the operating frequency. For stable design, the crystal oscillator needs some basics to ensure good clean operation, including voltage regulation of the battery supply voltage, usually 12 volts. It's a good idea to regulate down to a much lower voltage to ensure good headroom for the voltage regulator. This allows the battery to run down but still have the voltage regulator functioning at this lower voltage. The oscillator does not see any voltage change. Usually 7 to 10 volts is chosen for the oscillator-regulated supply voltage.

Other considerations include using a circuit for the crystal oscillator that does not try to run a high crystal current and draw maximum power out of the circuit. High current in the oscillator circuit is counterproductive, and just heats things up, making for unstable circuitry and possibly a fractured crystal. It is better to run crystal oscillators at very low power and current draw, with loose coupling. This allows the following circuits to do the work once the oscillator is doing its job. The oscillator stability improves when other stages do the heavy work, amplification and isolation. Usually these stages are called buffer amplifiers.

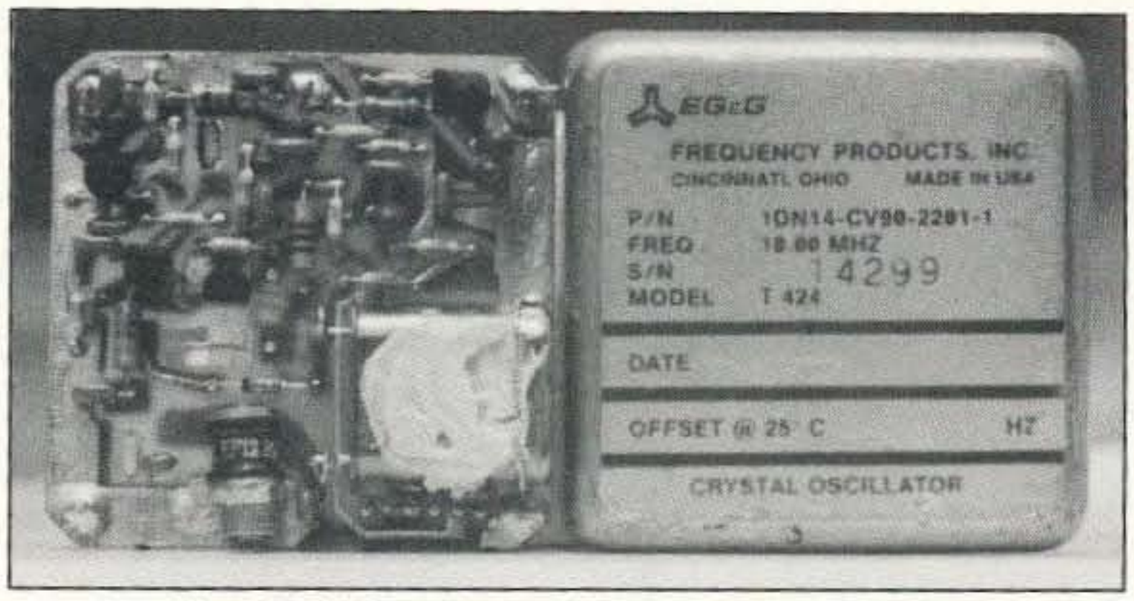


Photo A. TCXO oscillator: 10 MHz, temperature controlled.

Let's take an example from an HF transceiver and see what kind of stability is required for good operation and how it applies to crystal oscillators. In this example I will use a worse-case scenario at maximum frequencies. Let's assume our rig is operating at 30 MHz and the main oscillator is a synthesizer deriving its main clock from an onboard crystal oscillator. This onboard oscillator could be at almost any frequency from 1 MHz to 5 or 10 MHz, or even at an odd frequency such as 3.579545 MHz (TV chroma crystal).

In any case, let's assume the basic stability of the crystal to be 1 Part Per Million (1 PPM). In the 30 MHz transceiver described above, that would make the system frequency error at 30 MHz about 30 Hz—not bad for an HF rig. Even if the error were in the 300 Hz range it would fall in the SSB passband of operation and would not be noticeable.

I checked several HF rigs that were manufactured in the last 10 years and found a frequency disparity between the digital frequency display dial and the actual frequency, an average error of 400 Hz between the three rigs tested. This certainly proves that for 30 MHz or lower operation, a semi-modern rig is quite accurate for HF operations, and that is without any calibration since the rigs were new some 10 years ago.

Now you can see we have added another stability factor: crystal aging. As time goes on, all crystals need to be reset as even the most ultra-stable crystals and exotic circuitry do indeed drift

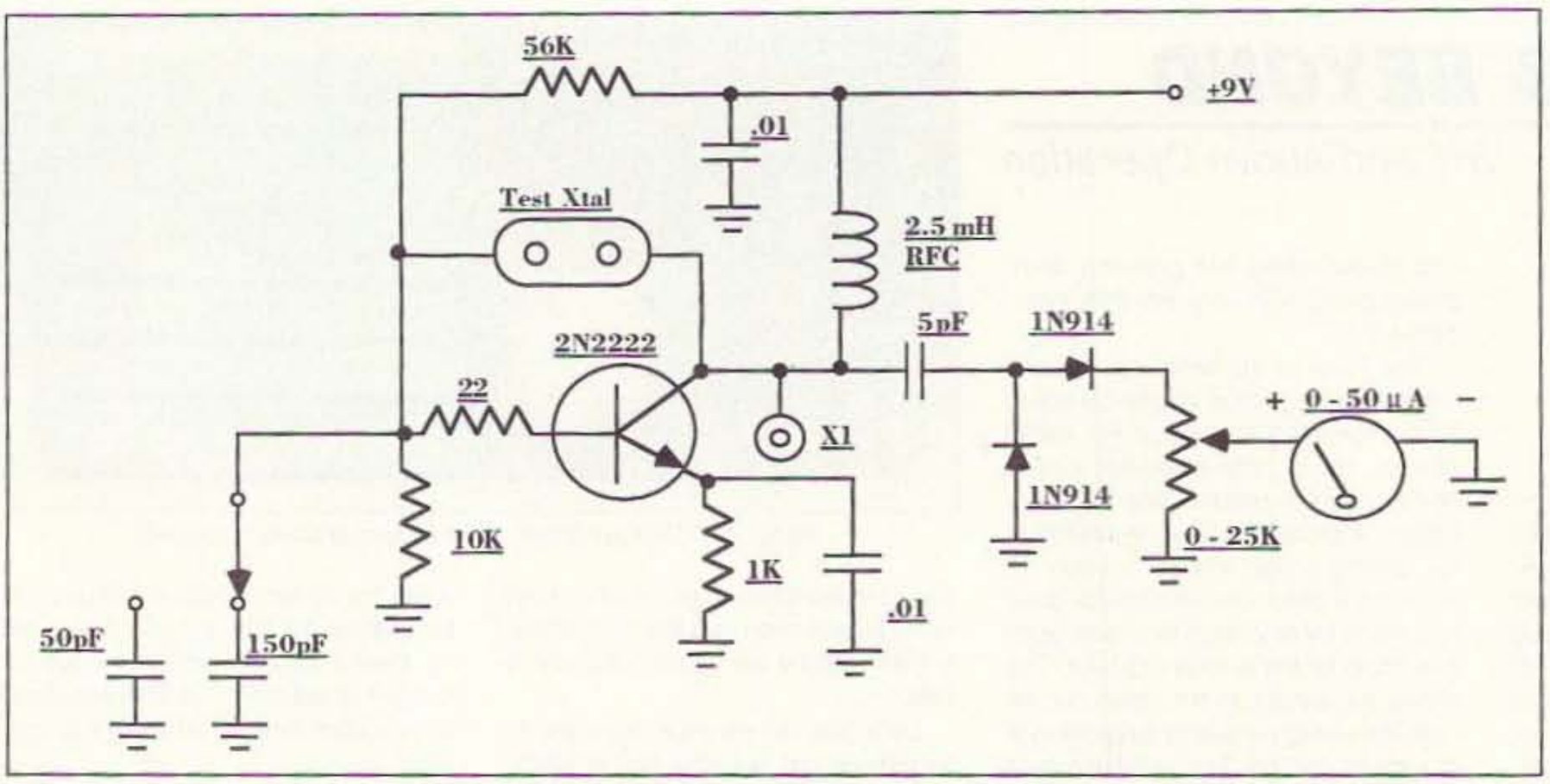


Figure 1. Sample crystal test oscillator. Diodes: 1N4148 or 1N914; RFC: not critical value; X1: connector for 6" antenna wire, providing RF to the receiver for testing/monitoring.

due to aging. This might not seem much at the present level of discussion but it does happen. New crystals seem to age (change frequency) faster than older (burnt-in) crystals. The change is quite small in comparison to the 1 PPM we have been talking about, and in most cases need not concern you at all in the context of the HF scenario above. Basically, look at aging as a point of interest in very high-stability oscillators/standards. Note that periodic calibration is required in all applications to maintain very accurate conditions.

Let's go back to the HF system error scenario, assuming a 400 Hz offset from indicated frequency (I call that excellent for HF operation). So what's all the excitement about being off frequency? Well, when this kind of error is measured at higher frequencies it can become out-of-hand in short order. If we transfer the same error, 400 Hz at 30 MHz, to 148 MHz, it becomes almost 2.5 kHz. That's one-half the FM bandwidth for standard operations, and begins to become a gross error. If the same factors are applied to 450 MHz or even 1.2 GHz the error starts to become quite unmanageable. We know that these errors are not present in our modern systems at 450 or even at 1296 MHz. How is that accomplished? Well, these systems use a tighter frequency standard (clock) for the PLL synthesizer internal to the system and systems that do not use frequency multiplication, which increases error.

These tighter frequency controls are present on almost all of the modern-day synthesized systems for almost any frequency today. Now, how does this compare to home-built oscillators using surplus crystals, or test evaluations of older commercial oscillators purchased on the surplus market? Let's use price as a beginning equalizer and see where that leads us. Aside from individual quartz crystals, either surplus or new, installed into home-constructed oscillators, the output frequency can vary quite a bit. How much depends on the circuitry of the oscillator and how it interfaces with a crystal and its series and parallel parameters and load capacitance.

If the crystal is surplus, not much is known about its particular characteristics (as described above). Construction with these components can be fun but will need tweaking, and possibly a different type of circuit to make the crystal operate on the exact marked frequency. In other words, plugging a crystal into a standard oscillator will make it oscillate but not at its specific frequency. For that

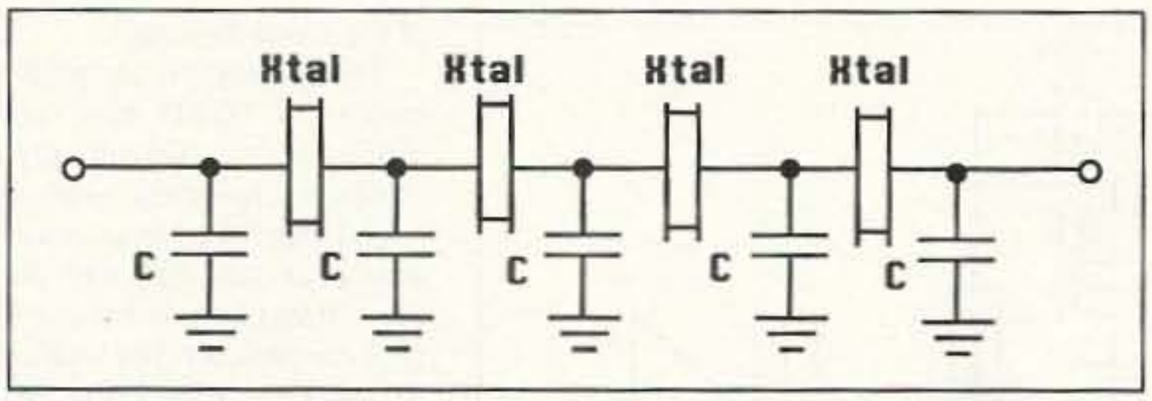


Figure 2. Crystal ladder filter, constructed from four matching crystals. Capacitor values are approximately 15 to 30 pF.

to take place, both the crystal and the circuit have to be in concert with each other. See Figure 1 for a standard-type test oscillator to evaluate a crystal's functioning.

Crystal-matching for a filter application is done with a signal generator and a special piece of equipment called a vector voltmeter. This vector VM notes phase changes in respect to frequency, which is varied for this test. In this way you can match the exact characteristic of the series and parallel resonances of each crystal under test.

A simpler test setup is to use the simple oscillator shown in Figure 1 and listen on a receiver where the crystal oscillates and without readjusting anything but the receiver. Test other crystals of the same marked frequency. When you find a bunch of these, some measure of assurance is a given that these crystals are of nearly identical frequency. Use the receiver frequency for this match test of the tested crystals. Put the crystals in a row according to receiver frequency. When you have a bunch of crystals of the same characteristics, use them for the filter. The other crystals are good, but not matched. Try this test and you will see the frequencies of the crystals vary quite a bit. See Figure 2 for a typical crystal ladder filter.

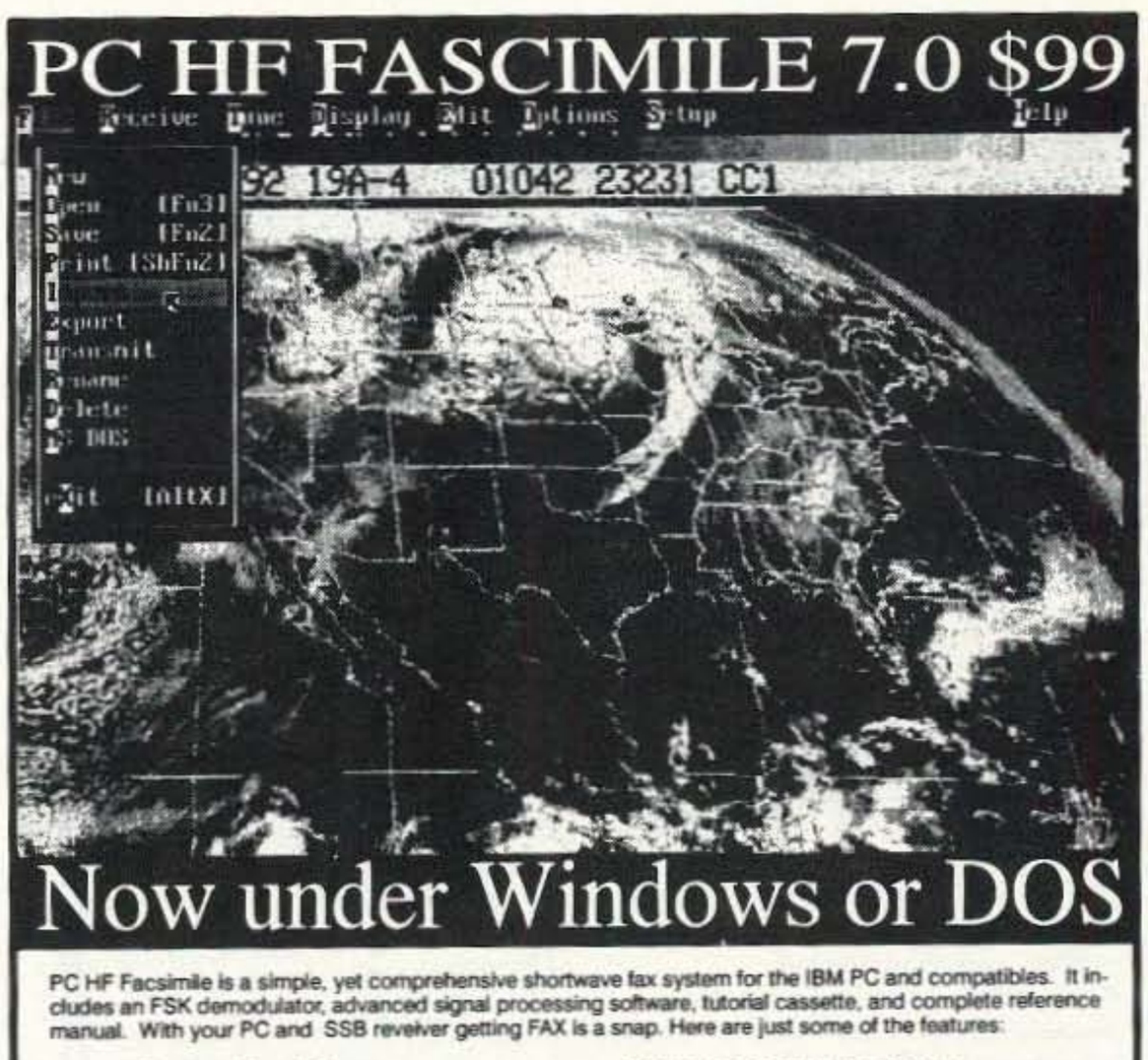
Other types of oscillators include "PUT UP," as I call them, or complete oscillators and crystal assemblies. These units comprise a complete oscillator, including the crystal, and are assembled into a package. The simplest and most inexpensive is the TTL IC-chip-socked oscillator. This device has no external calibration, is powered by +5 volts, and can be inserted into a 14-pin IC socket for use. They cost less than $5 each new and I have found them in surplus, removed from PC boards, for about 25 cents each. Specific frequency of these is almost endless, especially in surplus. Mouser Electronics lists these oscillators from 1 MHz to 64 MHz, with about 25 stock frequencies. The stated accuracy is +/-50 PPM, or 1 kHz at 10 MHz. That's not too bad, considering that new it costs less than $5. A 30 MHz oscillator connected into a 10 GHz detector mount makes a "BOOMERANG" for testing a 10 GHz wideband FM system. See Figure 3 for the BOOMERANG construction details.

The next oscillator models that have become available through surplus take a big jump in accuracy. They differ in several ways from the free-running non-adjustable TTL type unit just described. Most of these units are designed around two different circuit concepts for stabilized operation. Both methods incorporate lightly-loaded multi-stage circuits with tight voltage regulation to minimize external effects on oscillator stability. This type of circuit has adjustment capability to trim to an exact frequency by external means. Most are mechanical screwdriver adjustments, but some can have external voltage/varactor type control.

These two types of oscillators differ in how control is applied to the entire unit to maintain a high state of accuracy. The first type uses an oven-type heater to heat the entire crystal and oscillator circuit to a fixed regulated specific temperature. This temperature is far above ambient room temperature and is usually somewhere near 125 to 140 degrees F. The crystal and its associated components are selected for operation at this fixed temperature. This circuit is referred to as an "Oven-Controlled Crystal Oscillator," or OCXO. As such, the oven circuitry requires a lot of current to warm the entire unit, bringing it to proper operational temperature.

Fast warm-up oscillators' current could be 24 volts at 1 amp before the thermostat kicks in and throttles the current back to, say, 1/2 amp or so. An oven circuit can be a power transistor with lots of current to generate heat, coupled to a heat sink (the oscillator compartment), or resistance wire-wound over the oscillator's inner case. Both produce heat to the OCXO circuit. High-quality OCXOs can cost from $300 to $1,150 for 0.1 PPM or better oscillators. Prices vary, with costs about 10% of new for surplus oscillators. See Photo B for a sample OCXO.

Where to find high-accuracy OCXOs? Well, almost all surplus military test equipment uses a very high-quality oven-controlled oscillator as the main system clock. Sure, they do draw a lot of power from the supply, but when you are plugged into 110 mains it is just another trade-off in circuit design. The designs vary quite a bit. I have opened up about 20 different models from about half as many manufacturers, and the circuits vary wildly. Some of the very expensive types utilize several ovens for premium temperature stability. The idea here is to have a very slow warm-up



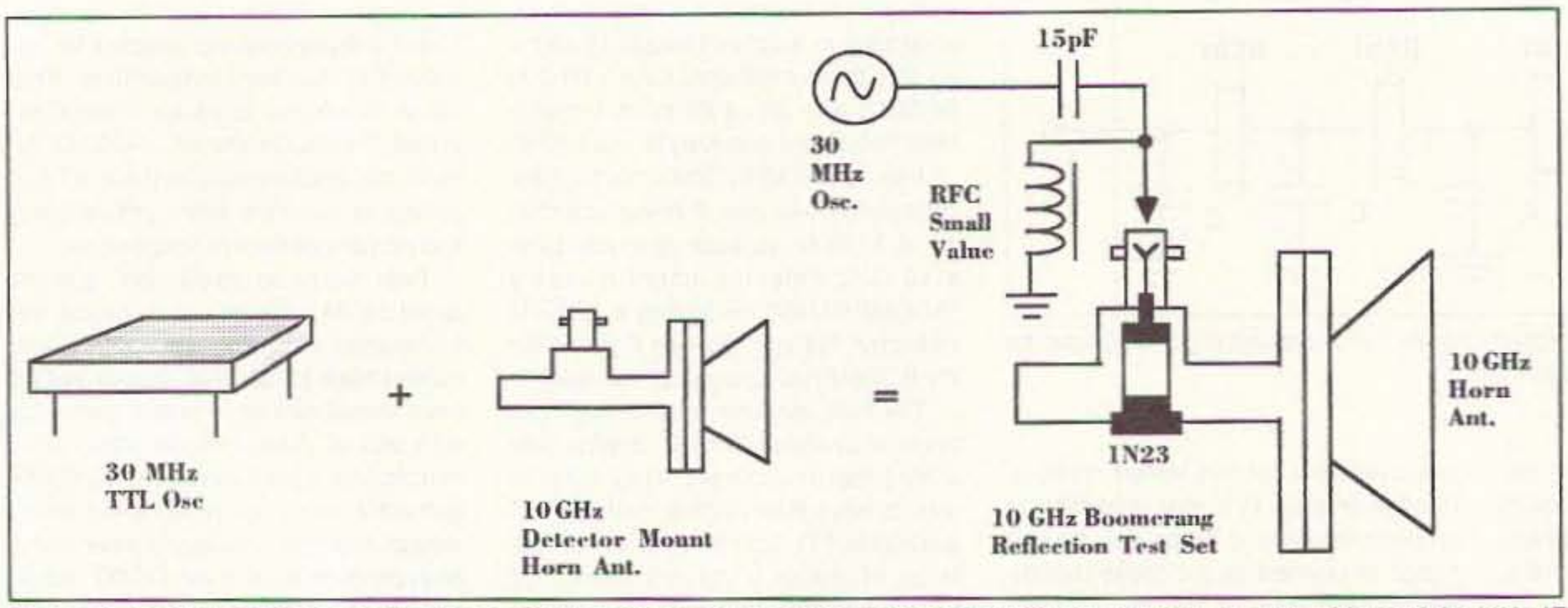


Figure 3. 10 GHz BOOMERANG using a 30 MHz oscillator. A 10 GHz BOOMERANG test set for use with wideband 30 MHz IF systems, providing enough signal to a transmitting 10 GHz system.

cycling oven controlling the internal oscillator circuit. This entire circuit oven and oscillator is then insulated from temperature changes with a styrofoam package and this is contained within another oven-controlled circuit The result is a more precisioned heat cycle with the oven-within-an-oven concept.

The principle of the dual ovens is like the dual-door system that you find in the snow belt. The main door to the outside opens to a second door which is the main door for entry into the building or home. The idea here is that the main door does not open to the cold outside, but to a second door, minimizing heat loss in the winter months. The dual oven works on much the same principle: one heat coil to assist the other coil, for minimum temperature change.

TCXO Oscillators

A TCXO differs in circuit operation from an OCXO in that it does not have any oven-type control circuitry. How it controls the crystal vs. temperature is different. The TCXO circuitry uses variable components in connection with thermistors to make circuit adjustment as temperature varies. The process is much like a VFO and varactor capacitor circuit. As the VFO now is varied, so is its frequency. In the TCXO oscillator the thermistor is much like the VFO in this application. The varistor varies its resistance, following temperature to make appropriate control voltage changes to maintain frequency accuracy vs. temperature changes. It's more complex circuitry, but it has many benefits over an OCXO. They are small-sized, and operate at low current. The cost for a TCXO runs about $300 new; in surplus, something under $50. For those interested: I have a purchased a limited quantity of these oscillators and will make them available; see the end of this article for details.

The low current consumption of a TCXO can run around 50 mA. Circuits are temperature-rated over a large temperature range, usually over 100 degrees or more, depending on the quality of the oscillator. The oscillator shown in Photo A is the TCXO that I use in my portable 10 GHz station. Its accuracy over a large temperature variation is 1 PPM. Over a much narrower range of temperature (70 to 90 degrees F) or so, it is capable of much better stability, somewhat better than 0.1 PPM for short-term stability. Photo A shows a defective oscillator assembly removed from its case. It's placed next to a complete unit. The TCXO is 2" square and 1/2" high. The defective oscillator shown had a shattered crystal, probably from rough handling. I eventually put it to use as part of a crystal test oscillator.

The stock TCXO uses three transistors, one voltage regulator, three thermistors, and one Johanson variable frequency-setting capacitor. The thermistors are thermally bonded to the crystal for maximum sensitivity to the crystal's temperature changes. The Johanson variable capacitor is quite expensive (about $13 single quantity), and as such is a very accurate capacitor. It is

part of the consideration and accuracy of this type of oscillator.

With regard to both the TXCO and the OCXOs just described, most units available are small compared to a soda-pop can. By comparison, an OCXO would be about half a can, and the TCXO would be 1/8th of a can in size. Moving into the arena of the next higher accuracy standard makes size comparison pale by contrast to a soda can. Frequency standards of higher accuracy can be small but are "UNOBTAINUM" on the surplus markets. What do show up are the Frequency Electronics Incorporated (F.E.I.), Seltzer, and a few other types. Most are relay-rack mounted for 19" bays, and weigh in at about 15 to 20 pounds. The F.E.I. standard weight is 20 pounds, and has a small package profile 8" high, 4" wide, and 18" long.

The package is a self-contained oscillator with multiple oven control for the crystal oscillator. It has an on-board transformer-isolated regulated power supply, and a secondary power DC battery emergency operation. The emergency battery power is 24 volts at 2-1/2 amp capacity. The front panel has provisions for monitoring status of all the individual ovens and battery voltages in addition to oscillator output at various frequencies such as 100 kHz, 1 and 5 MHz. The part I was holding out on is that the accuracy of this "OVEN CONTROLLED BEHEMOTH" is 1 millihertz at 5 MHz. That equates to 0.0002 PPM, or a few parts in 10 to the 10th decimal place. Provision for calibration maintenance is provided by a 10-turn counter dial to adjust for portions of 10 to the 10th part adjustment for very accurate calibration.

For short-term stability it can be adjusted a little tighter in accuracy, but to accomplish this I would have to phase-track over a much longer time period, days instead of 10 to 12 hours. The effort involved and the benefits derived did not seem worth it at this time. I am not trying to go into rocket science or predict what will be an exact frequency with minimum error; gold-plating in this case is better left to the back of a watch than my frequency counter.

The battery operation in these standards is nice, especially when the AC power is removed. The batteries take over if there is nothing happening and operation continues for about six hours or so. A nice feature is the ability to use the batteries in a planned operation to assist in the calibration of other amateurs' frequency counters or standards. To do so, just unplug the standard (battery operation starts) and drive over to the other amateurs' locations. When you get there, re-plug into AC power to charge the batteries and take your time to recalibrate at this new location. As far as the F.E.I. standard is concerned, it never left AC power—as long as the batteries last, accuracy is maintained.

I tested this several times to see how well our "Traveling Clock" would hold accuracy with battery operation, and was pleased to see that there was no change at all. Even when we experienced some harsh movement of the case, it tipped over in my station wagon on a trip to the grocery store. On the second trip it was treated a lot better—it got to ride on the rear seats with a seat belt holding it down. I only have one of these jewels and don't want to try the "DROP TEST" at this time.

Well, I hope this gives you some idea of what to expect in the line of frequency calibration and what type of accuracies to expect from your frequency counters and various oscillators you might happen to find in the surplus market. To obtain surplus standard oscillators, check out used broken frequency counters. A surplus military counter with a functioning high accuracy standard, even though "crunched," should allow you to at least remove the standard and discard the rest. Keep your eyes open, and good hunting.

As always, I will be glad to answer questions concerning this and other aspects of our hobby. For a prompt reply please send an SASE. Concerning the TXCO 10 MHz oscillators, I have a limited quantity available for $40 each plus $3 shipping (U.S.). I do run into a few higher accuracy types from time to time and will source them for you. Call for details. To order a TCXO oscillator send requests to Chuck Houghton, 6345 Badger Lake Ave., San Diego CA 92119. Well that's it for this month. Next month we'll get into simple microwave test equipment that can be home constructed. 73's Chuck WB6IGP. 73

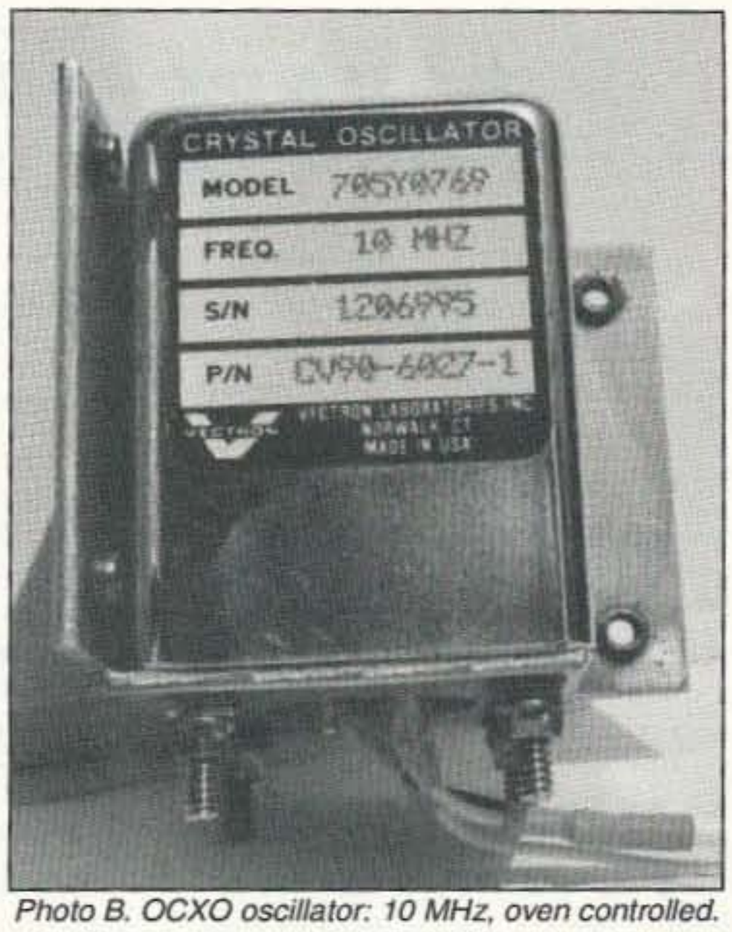


Photo B. OCXO oscillator: 10 MHz, oven controlled.

Number 22 on your Feedback card

ASK KABOOM

Your Tech Answer Man

Michael J. Geier KB1UM
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70 Route 202 North
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The Shack Brain

If your ham station consists of more than an HT, you know that computers have become important in this hobby. Heck, even if your station *is* an HT, you may be using a computer for packet operations. There's just no getting around it: Computers are moving ever closer to being the centerpieces of our stations. Some hams complain about that idea, valiantly resisting the notion that it isn't just about radio anymore. Others, though, are having a blast with the new technology and making hamming more interesting than it ever was before.

Of course, it's still about radio! These days, though, that doesn't mean just yacking on 20 meter SSB or 75 meter AM. Now we have SSTV, packet, RTTY, AMTOR, PACTOR, automated CW, satellite, and who knows what new modes soon to come. For all of this stuff, a computer is either helpful or essential. Let's take a look at how to integrate a computer into your shack.

Ham on a Budget

Sometimes I think that's what I should call this column! Thanks to my own lean financial situation (I'm a musician—need I say more?), my focus very often is on how to do the most with the least cash outlay. And yes, that's what I'm aiming at here: You can put a computer in your shack without breaking your bank account.

Eenie, Meenie . . .

But what to pick? Do you really need the latest 486 or PowerMac monster boxes? That depends. If you want to run Windows, you really need at least a 386, and a 486 is a very good idea. But is that essential? Not really. You can run piles of great software without Windows. Then you won't need four megs of RAM and a real fast machine. Suddenly, all those computers and motherboards at the hamfests start looking quite interesting!

If you've been to one in the last five years, you must have noticed that computer gear is at least as visible as radio gear, and often more so. It seems like you just can't get away from it! Aisle after aisle, you see hard drives, interface cards, monitors, printers and even complete computers. Far and away, the IBM-compatible hardware rules the roost. Oh sure, you'll see some Commodore 64s, Apple IIs, and even some old, unrecognizable stuff. Not that many years ago, the Commodore was *the* machine to ham with, but today the IBM format dwarfs them all by quite a bit. Not only is most of the cheap hardware of that type, but most of the newer ham software is for the IBM PC, too. So, Mac lover that I am, I really must recommend that you go with an IBM-compatible for hamming, especially if you want to do it on the cheap. There is a substantial amount of Mac ham software, but bargain hardware is still hard to come by, unless you want a really tiny, old machine that won't run too many of today's programs. And you're not likely to get a hard drive. The reason is simple: The clone market has created lots of castoffs of slightly outdated IBM-type machines, while the Mac market, wholly owned by Apple, has updated much more slowly. The only Macs I ever see at hamfests are the old 128Ks and 512Ks with single-sided floppy disk drives, and there just isn't that much you can do with them.

So, we're back to the issue of what kind to get. If you have plenty of money, go with the biggest, best machine you can. But remember, this is the "ham on a budget" column, so I'm going to describe how I did it, all for well under $100.

What's a 286??

As I mentioned, if you're not going to run Windows, you don't need a huge machine. I picked up a 286 with a 20-meg drive and a color VGA monitor, all for $40. At the time, I thought it was an extraordinary deal, even though the machine didn't work. Since then, however, I've seen a bigger one, with a 40-meg drive, more RAM, etc., for the asking price of $100. So, perhaps that's what 286s are going for these days. If so, they're quite a bargain.

What can you do with a 286? Just about anything non-Windows you can do with a 386 or even a 486, only a little bit slower. But before I go into the computer's application, let me describe what it took to make it run, so you'll get an idea of what you might come up against, should you decide to go this route.

The computer basically worked, but it would randomly crash and lock up. After checking the obvious things like connectors, I noticed that three ROM ICs on the motherboard were in sockets. Having run into bad connections with sockets on my old Apple IIs, I pulled the chips and cleaned the pins. And it worked; no more crashes. The hard drive worked fine, although I think

I just got lucky on that; old hard drives generally are to be viewed with suspicion. Other than a blown fuse in the power supply, which used the switched AC socket for the monitor, the computer had no other problems. But, if it had, I wasn't too worried because, at the last hamfest, I'd seen piles of functional 286 motherboards going for $5 each! 386s were under $50, and there were even some 486s around $100.

The monitor was another story. The seller told me he'd replaced the horizontal output transistor a few weeks earlier, but the set had died again. When I opened it up, sure enough, the problem was a blown horizontal output. A new one, bought for $2.50 at the next hamfest, worked but ran awfully hot. When you can't touch the heat sink, you know a transistor is too hot. Hmmm, the characters at the right side of the screen were squished together a bit . . . the scan wasn't linear. A bit of probing and a little trial and error turned up a leaky electrolytic coupling cap at the base of the transistor. No wonder it was running so hot—its bias must have been way too high from the added DC coming from the previous stage. That would explain the distorted scan, too. A new cap from my junque box fixed it all up, making the transistor run at about 1/4 the temperature and unscrunching the scan.

Set 'Er Up

So, now I had a perfectly usable computer. What to do with it? Actually, it wasn't hard to decide that, because I'd bought the thing with hamming in mind. It went right into the shack, which is actually a shelf unit by my bed (I'm a lazy ham). OK, time to connect it all up. Here's how it came out:

Packet I use my HT as a base station, with a little switch box which gives me the choice of normal voice operation, with RX audio from an external speaker, or packet. For packet I use the software TNC called Poor Man's Packet, which came from an article in *73* a few years ago. The modem is home-brewed and built into a connector shell, plugged into the computer's parallel port. It doesn't get much simpler or cheaper than that.

RTTY A hamfest-procured MFJ- 1224 RTTY/CW interface connects to a serial port. Their RTTY/CW software completes the picture. The RTTY works quite well, copying signals down to about S-1. The CW receive decoding is not great, but then I've never seen a computer do too well at that; the code was designed for human decoding and doesn't lend itself well to machine processing. Heck, I need to keep my copying skill up anyway, so I don't really mind. But for sending, it works fine. I'm not yet on AMTOR, but I have seen advertised a program which will do it on a simple interface like this one, without a multimode controller. One of these days I'll try it and let you know how it works.

SSTV Here's where a computer really shines. Right now, I'm using the Pasokon SSTV Explorer, which is a receive-only package that connects to my second serial port. Even with the comparatively primitive VGA card I got with the computer, it works great. It's a real blast watching the color pictures roll in on 14.230 and 14.233, and I'm hoping to get the full TX/RX system one of these days.

Rig control I'm not doing that yet, but I would like to set it up. It would be great to store lots of frequencies in memory, skip around the bands, have direct frequency entry, and get all the other neat things available with computer control of the transceiver. I need CAT software for my FT-747GX (or some other Yaesu radio, as long as the software is in BASIC so I can modify it for my rig). If anybody has any public-domain or shareware programs to do that, please let me know.

Logging I'm not a contester, but I may get into logging one of these days anyway. There are lots of programs around, and it sure does take the hassle out of keeping accurate records of contacts.

Atlas Any general-purpose atlas program can be quite useful and lots of fun. Talking to Botswana? Take a look at where it is, pull up some statistics about its people, and you have the making of a conversation much more interesting than the usual "5 by 9, next station please" QSO. That is, of course, if all those wallpaper-obsessed DXers will let you actually talk to the DX operator.

Beam headings If you have a directional antenna, a beam-heading program will let you know where to swing the aluminum. As a dipole op, I don't need this. Ahhh, someday, perhaps.

Satellite Not my bag (yet), but computers are pretty essential for satellite work. The tracking programs tell you where and when to aim your antenna, and some hams even make the computer do the aiming for them, keeping the bird down the boresight as it moves across the sky.

Math and electronics If you homebrew, work with microwave gear, or do any other fairly technical stuff, a computer can be a tremendous help. There are shareware programs for antenna design, resonant circuit calculations, you name it.

All Together Now

As you can see, a computer in your shack can make a big difference. If you do go with a fast 386 or a 486, you probably can multitask, which means you can run several of these applications at the same time. For general computing, multitasking seems a bit silly to me. After all, we humans usually need to do just one thing at a time anyway. But, for hamming, multitasking can really be great. Imagine running your logging, rig control and SSTV programs at the same time, while monitoring and storing packet traffic in the background. That, however, is asking too much of a 286. Also, it requires wiring everything up so that there are no hardware conflicts, which is not presently the case in my system; if I tried to run, say, packet and the RTTY interface at the same time, they'd get in each other's way because the power for the packet modem comes from the same serial port which drives the RTTY box, and some of the lines are shared. Oh well, that's hamming on a budget!

Well, I hope you've enjoyed this deviation from our usual theory and troubleshooting topics. If you're already computing in the shack, consider trying some new modes and exploring more of the options your computer offers. If you haven't taken the digital plunge, I heartily recommend it. Oh yeah, before I forget . . . I picked up an old NEC PC-8201A laptop. Anybody got a book or any info on it? Thanks, I appreciate the help. Until next time, 73 de KB1UM. 73

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Number 23 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
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N. Swanzey NH 03431

Notes from FN42

I am sorry to report that our Hambassador to the Canary Islands, Woodson Gannaway N5KVB/EA8, has left the Islands for four years of study in the United States. We will miss his wonderfully descriptive reports of the Canaries. Best wishes go out from us at 73 to Woodson and his family. Thank you for a job well done!

Congratulations to Phil Weaver VS6CT, Hambassador to Hong Kong, for his selection as president of the English Language Amateur Radio Communication Society. Good luck during your time in office. I know the Society is in good hands.

A special welcome back to Mahmoud Idera-Abdullah EL2CE, Hambassador to Liberia, after a long communications absence from 73. We're glad to have you back, Mahmoud!

There's much news from these Hambassadors, as well as other reports. Let's get to it.—73, Arnie N1BAC.

Roundup

Belgium/Egypt: *From the Support to The Amateur Radio Service (STARS) News:* Africa Telecom 1994: Abdi A41JT and his Omani friends, together with Ezzat SU1ER and his crew, made the STARS participation in Africa Telecom 1994 a great success. The ROARS delegation flew into Cairo with some 400 kg of "luggage," containing a complete HF and VHF amateur station, antennas, digital equipment, etc. Ministers of all the participating countries visited the IARU stand, some of them wrote some personal remarks on a QSL card. Also, His Excellency, President Hosni Mubarak, paid a visit to our booth. Thousands of leaflets were handed out to passers-by and Abdi also arranged for some suited T-shirts and caps for the operators.

The special event station SU1STAR operated daily from 0800 'til 1900 and made some 5,000 contacts in all modes. The visit of the MPTT staff of Egypt and several other African countries was considered a big success to the region. They were briefed clearly on amateur radio, and they promised in return that they would support the amateur service in their respective countries.

South Africa: *From the STARS News:* The South Africa Radio League (SARL) has secured the franchise to set and administer the Amateur Radio Examination. This will come into effect in November 1994. The HAREC syllabus has been accepted and will be used as the basis for the examination. The SARL will offer the examination to Lesotho, Swaziland, Botswana, Namibia, Zambia, and other African states where English is the official language. This will greatly reduce the cost that students have to pay for examination fees. The fee for the SARL examination is 40 Rand ($13).

Switzerland *From the International Telecommunication Union (ITU) Newsletter:* The ITU Council adopted unanimously a resolution authorizing the Government of National Unity of South Africa to resume its full participation in the conferences, meetings and activities of the Union with immediate effect. The Chairman of the Council, Mr. Souleymane Mbaye (Senegal), informed the entire membership of the Union.

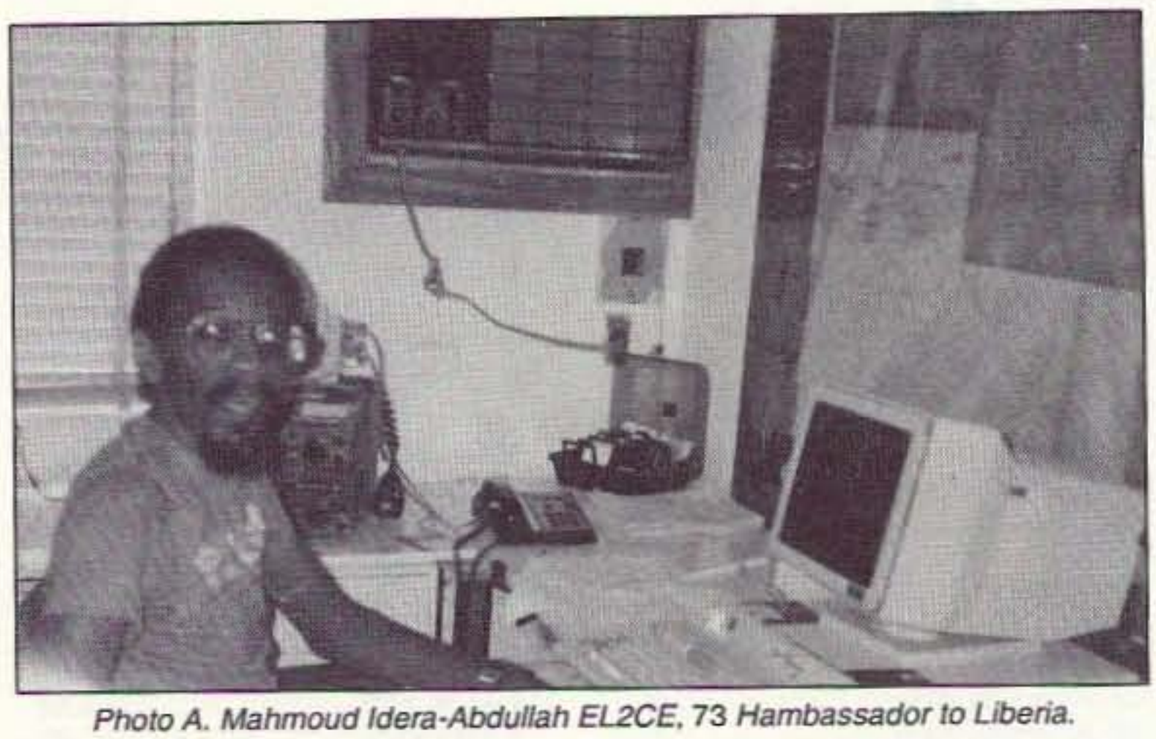

Photo A. Mahmoud Idera-Abdullah EL2CE, 73 Hambassador to Liberia.

CANARY ISLANDS SPAIN

Woodson Gannaway N5KVB/EA8
5402 Spicebush
Madison WI 53714
USA

HOLA, one last time from Echo Alpha Ocho land.

The crew at the Radio Club of Las Palmas is still on course and maintaining a good head of steam. I was able to visit them last week after a lapse of 9-10 months (just about the age of our little bundle of joy—funny how that works). Catching up on things, I found out that the only general ham radio store in the area had closed. Now the club was about ready to take up the slack by opening a "mini" store at the clubhouse on September 10. The event will be complimented by a flea market.

Pity I won't be able to make it as I'll be back in the States by then. This will be my last report from the islands I've grown to know and love so well; really more the people than the islands themselves. The scenery is spectacular and varied but the true value of any place is in its people. These people have given me a great deal!

But now it's time to study for four years and then go overseas again. Planning to return to the same place is usually unrealistic.

Often you don't realize what you've learned. I was on a visit back to the States and on my way to visit some friends when I came to a group of young men talking around some cars. There wasn't quite enough space to pass, so I stopped and waited. They noticed me and kept on talking. After a couple of minutes waiting I thought, I've been living and driving in Europe and no self-respecting CAnary would let this stop him. I can squeeze through there. And so, with a borrowed '75 Bonneville (it'll pass anything on the road except a gas station) and all, we drove through with maybe an inch to spare on either side. Instantly the young mens' nonchalance turned into appreciative whistles. They loved it!

Our little girl is Canary, never mind that her parents both have U.S. passports. She was born here. We wanted to do that, to give her to Canaries. Now she'll always have a special place in the heart of any Canary Islander. And we'll continue to speak Spanish to her so that she will grow up bilingual. There are not many things in life that are actually important, but things like this are. And, of course, she'll go with me when I visit the Hispanic neighborhoods where we'll live. Her first visit to a blacksmith shop was when she was two weeks old. She slept peacefully through the hammering two feet from her in her Snugli carrier. A friend coined an appropriate term: "4-wheel-drive kid." I like that.

I've enjoyed my years as a correspondent for *73* magazine. I hope you readers have enjoyed them too. We'll see what's next.

73—Best wishes—Hasta siempre, Woodson N5KVB/EA8.

DOMINICAN REPUBLIC

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[Continued from October] One of the newest attractions of Santo Domingo is the beautiful Faro a Colon, or Columbus lighthouse. Completed in 1992 and inaugurated during the commemoration of the 500th Anniversary of Columbus's arrival, the memorial houses the remains of Christopher Columbus. The enormous cross-shaped building projects a powerful beam of light into the skies over Santo Domingo. When the clouds are configured right, the sign of the cross hovers over the city. It is very beautiful. While the project was completed in 1992, I was amazed to find (in our club house) HI8 QSL cards from the 1930s bearing images of the structure. Dominican hams of 60 years ago had seen the sketches for the planned memorial and had incorporated them into their QSL designs. I guess it's not surprising that hams would have been intrigued by a structure that sends a beam into the heavens!

Besides the above address and packet, I can also be reached on-line at INTERNET: 74537.1100@compuserve.com. 73 from HI8!

HONG KONG

Phil Weaver VS6CT
President E.L.A.R.C.S.
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Hong Kong
Packet: VS6CT @ VS6XMT.HKG.AS

Since the last report from Hong Kong, you will no doubt have started to hear the new prefix of VR2. This has become necessary with the changeover of the administration (not the government; that will still remain an independent body within H.K.) of Hong Kong from Britain to China which will take effect from 1 July 1997, and the need for a different callsign. The VS series is assigned to the British Commonwealth. The reason for this is that Hong Kong will remain as an independent territory, as a Special Autonomous Region (SAR), and as such will retain its separate "country" status from China. In the meantime, all new amateur station licenses issued since December 1992 by the Office of the Telecommunications Authority (OFTA) have been issued with the VR2 prefix. Existing holders of the VS6 prefix will be allowed to retain the use of either VS6 or VR2 until the final moment. Many of us, myself included, will continue to use the VS6 as we have a large investment in QSL cards already printed.

Another major change has been the introduction this year of an "Authority to Operate" (ATO). This is in addition to the station license (valid for one year), which is still being issued, and will in the future cover the station and its equipment whilst the ATO is issued, on production of a proper certificate of a pass in the appropriate examination or a reciprocal from another country, and is valid for five years. This means that a visitor to Hong Kong, in the future, who wishes to operate from Hong Kong using someone else's station can obtain an ATO on arrival from the

OFTA, and this will be valid for five years. If he is not going to become residential, the call assigned will be "VR2/home call." Upon production of a Hong Kong Identity card, he can claim a full VR@ . . . call for the class of license he is entitled to.

There are considerable advantages to the new system: It will mean that a visitor gets a five-year ATO instead of just one year, as previously, and he will not have to obtain a station license unless setting up his own station.

The English Language Amateur Radio Communications Society continues to thrive and our annual dinner this year will be held again at the Royal Hong Kong Yacht Club on Thursday, December 8. The cost will probably be about US$45, including all drinks and many door prizes. If you are planning to be in town around that time you would be very welcome to join the party, but do let me know in advance so that a seat can be reserved. If you have any queries concerning the above, drop me a packet or facsimile with your inquiry and I will endeavor to help. *[Tel: 852-887-6366; Fax: 852-887-6992]*

LIBERIA

Mahmoud Idera-Abdullah EL2CE
C/O UNDP Liberia
P.O. Box 1608
New York NY 10163-1608

I am sorry that I have been unable to correspond with *73* since my acceptance as Hambassador to Liberia and the submission of my first contribution. Things really got hot around Monrovia, as civil war was spreading throughout the country.

After more than three-and-a-half years of fighting and total breakdown of the government and society, things are slowly getting back to normal. Here in Monrovia, life is quite improved and is gradually normalizing.

The last three months of 1992 were really rough! This turned out to be the most threatening period of life throughout the entire three-year period of the civil conflict. Monrovia, where most of the amateur radio operators reside, was hit by the heaviest fighting probably ever seen in the 145-year history of the country as rebel forces tried one final attempt to overrun the capital and take full control. Up to that point, the rebels had controlled about 95% of the country, leaving only Monrovia under the protection of the West African Peace Keeping Force—ECOMOG. It was during this period that the radio amateur community, which had just started to regroup itself, had to discontinue their operation within the amateur radio service. For the first time in the long-protracted conflict, the Interim Government banned ham operations for security reasons. Some members of the national radio society, after threat of getting their equipment confiscated, packed their gear away.

At the present time, the Liberian Radio Amateur Association, the country's only national radio society, is trying to rebuild ham radio operation, while the entire country starts its rebuilding process. The amateur radio service will be a major factor in the overall rebuilding and reconstruction process. We, as hams, can play a major part.

[Welcome back! Mahmoud reports that his Liberian address (PO Box 20-4262, 1000 Monrovia 20, Liberia) is still good, but regular mail has a long way to go before service gets back to what it was before the war. If the correspondence is important, use the New York address previously listed.—Arnie]

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. HaNeger 85530

SATELLITE/TECHSAT NEWS: Assi 4Z7ABA has provided the following details on the Techsat project: The Haifa Technion University-built satellite is planned to be launched on a Russian rocket in April of next year. Its orbit will be at the altitude of about 1,000 km and sun-synchronous, meaning that it will fly over the same areas in the world at the same times daily, similar to U.K.'s Surrey University's UoSAT OSCAR 22. The microsat will have aboard a mailbox for radio amateurs working on FSK at 9600 bps and on AFSK at 1200 bps, compatible with conventional VHF FM terrestrial packet operation. The downlink will be on 70 centimeters with uplink channels on 2 meters.

For the past half year, a BBS has been operating terrestrially, imitating the functioning of the Techsat mailbox, and has been giving hams the opportunity to accustom themselves to working full-duplex using the software needed for the Pacsats.

In addition to its ham payload, the bird has planned an earth-photographing camera using a newly-developed picture compression logarithm. It will have, as well, a horizon-measuring detector which will aid the bird in facing earth.

It will be stabilized by magnetorquing electro-magnets that will allow the satellite to align itself with the earth's magnetic field. In the Technion, the magnetorque system was successfully tested with the satellite suspended on a wire, and within three hours it stabilized itself.

For the first half-year after its deployment in space, Techsat will be closed to the public for testing and experiments, which will not take place on amateur frequencies. Afterwards, the BBS should be open for the enhancement of the worldwide satellite packet system.

AN OPEN LETTER TO 4X1RU: After seven years of running a tight ship, Jim 4X1RU stepped down from running the 4X VHF-HF Packet Gateway, which provided a great service to packet hams worldwide as a clearinghouse and main relay station at the junction of three continents. Avi Esterson 4X6UA wrote the following tribute.

"Dear Jim: As you prepare to close down RUBBS and all the associated services, I want to thank you for having given all of us the opportunity to participate in the worldwide packet network through your fantastic operation. I know you ran the station with dedication and skill, putting in countless hours to make it one of the most efficient and well-thought-out HF forwarding stations in the world, making the worldwide network what it is today.

"I know you suffered frustrations, arguments, the idiocy of us the users, and for my share in that I apologize—I hope that ultimately these negative aspects were not the straw that broke the camel's back, but rather that you are moving forward to other interests for positive reasons.

"Your dedication and skill will be sorely missed by all of us who benefited so much from your efforts, and the packet world will be that much poorer for the loss of them. I am sure I speak for packeteers worldwide when I offer my heartfelt thanks. 73 de Avi 4X6UA."

A LETTER FROM 4X6VT: [Corrinne Juday 4X6VT, possibly the world's first YL SysOp, has taken over the HF-VHF Packet Gateway station for Israel. At writing time, the gateway is functioning smoothly, providing the ISRNET VHF Packet BBSs in Israel with a reliable flow of bulletins and mail to and from the outside world. Her letter is written in the midst of the trials and tribulations of learning the ropes.] With the computer connected to the gateway, I have no way of writing articles. Hi! I want you to know though that 4X1KT Gateway Kiryat Yam, in Memory of Zvi Pomer, is on the air and runs like clockwork. Many thanks to all who gave a hand to make it happen, especially Mike, my youngest, handling the computer part and in constant contact with Jim 4X1RU, who is keeping an eye on us from the distance "aiding and abetting." Hi!, the smooth transition from Herzlia to Kiryat Yam.

The Pomer family came to visit the station and were greatly moved and impressed seeing the familiar callsign 4X1KT appearing on the screen at regular intervals. 73, Vee Tee (Corrinne).

P.S. Please note the wholehearted consent to the use of the 4X6ES club station's Cushcraft antenna when not in use for the club from the sponsors WB2MEW Sy and Margy Saslow of New York.

70 CENTIMETRES GAINING AMATEUR OCCUPANCY: To date, many UHF frequencies are now occupied and being used for Techsat, packet BBS and links, and repeaters. It looks like the immediate threat to the band from commercial interests has been thwarted, but the lesson has been learned, and the band is now being more intensively used. *[Does the threat sound familiar to U.S. hams?—Arnie]* 73

NEVER SAY DIE

Continued from page 4

The early sideband days were an adventure. So were the early NBFM days. And slow-scan, moonbouncing, satellites, 10 GHz, and so on. There isn't one minute of my operating from over 50 countries I'll ever forget. Sitting there in the summer palace near Amman with King Hussein, working the pileups on 20m. Working slow-scan from his downtown palace.

How about QRP? A million or so Japanese are having fantastic times on the low bands with 10 watts. Try it. Keep a log, and let me know how much fun you're having. You can thank me by getting me another subscriber. If every reader recruited one more reader we'd double *73*'s circulation and you'd be getting twice as fat a magazine every month. No, the editorials won't be any longer. I'm too busy with *"Cold Fusion,"* and a couple dozen other projects. Like my recording studio, five record labels, a CD sampler program for independent record companies, brokering the making of CDs and cassettes for these indies, and stuff like that.

Then there are at least 50 books stacked up that I want to read. When I run across something outstanding I try to make it available through Uncle Wayne's Bookshelf so you can enjoy it too. I should try harder to get you to check out some of the music I have available . . . it's fabulous. Just as smoking takes an equal time off your life, I suspect that listening to good music will add an equal time for you. No, don't smoke while you're listening to even it out.

Now get off your duff and get adventurous. Pick some aspect of hamming and have at it. And please don't forget to let me know how you make out. I'm interested in your successes and your failures. Remember, nothing ever works right the first time . . . that's why it's an adventure. Buy a kit. Try packet. And the next time you buy some ham gear, keep a log and write about it for me. Share your adventure.

Chicken Little . . .

. . . is at it again. I hear that one of our competitors is busy telling people (for the nth time) that *73* is going out of business. They wish. Sure, I had an employee try to put us out of business so he could start a competing business. That's not the first time that's happened. I remember when Jim Fisk W1DTY, who I'd entrusted to be the general manager and editor while I was on a lengthy DXpedition, made a major effort to put *73* out of business. When he walked out one day, saying he had a job with a test equipment company, I discovered that he'd done some serious mischief. For instance, he hired away most of my staff to work for him as the editor of *Ham Radio*, convincing them I'd be out of business soon. He randomly cancelled several thousand of our subscriptions. He stopped all renewal notices from being sent out for several months, losing us thousands of subscribers. He rejected all submitted articles and then the writers got a letter from *Ham Radio* magazine saying they understood an article might be available, and they were in the market for articles. He bragged to my assistant editor that he was putting me out of business and offered her a job. She stuck with me.

This was the chap that I brought in from California as an assistant editor, even paying for his moving. Then I gave him the down payment for a beautiful home on nearby Lake Monomonock, and paid him well. He talked my editor into leaving and got that job, plus general manager. Fortunately Kayla, my assistant editor, stuck with me, and my draftsman who did the schematics moved in from Missouri so he could work night and day to get schematics done for the magazine. Since Jim left us with not one article for the next issue I had to call friends and get stuff in a hurry.

It was a tough battle, but we got the next issue out on time. Then we had to go over the old subscription records and re-enter the thousands of cancelled subscriptions, one by one. Yes, Jim called our advertisers told them that we were folding, so many stopped advertising.

History, with some differences, is repeating itself. This time *73* is doing fine and it was my CD manufacturing brokering and music publishing businesses that were attacked. Naturally this all happened at the same time as I was getting *"Cold Fusion"* started, so an opportunist tried to grab that publication in the confusion.

I had to stop making trips to music conferences and my DXpeditioning and get back to work. I replaced my CFO and general manager with me, took over as the editor of *73* and *"Cold Fusion,"* put *Music Retailing* on hiatus, and got to work seeing what I could do to start selling a few tons of CDs that were sitting in my warehouse. For instance, I've got a bunch of samplers which I'll be giving away for the cost of packing and shipping. These samplers were made from the top-rated tracks from CDs we've manufactured for independent record companies, so the music is fabulous. I don't know any better way to sell music than to get people to listen to it with these samplers. Since I've started the sampler program the sale of independent music has increased by over $800 million a year, so I think it's helping.

My brokering business is going strong, despite the effort to sink it, so if you ever need any CDs or cassettes made, have I got a deal for you!

My New Ham Shack

I got pretty depressed a couple of years ago when someone broke into my ham shack and stole just about everything. Since then I've made do with an Icom 735 and a vertical. It's a great little rig, but not many stations come back on my first call. It's a whole different world from operating with a kilowatt and a big beam on a 70-foot tower.

So I've cleaned out a room in the barn across the road from my house for a new ham shack and I'm shopping around for a new tower. The DX is pretty crummy these days with the sun-spot cycle in the doldrums, but I am hearing some nice stuff coming through now and then, so I need a big signal. With so much to do I can't afford to trade my time for signal strength. In addition to running my businesses on a day-to-day basis I've got all those books I'm anxious to read.

When you hear me, give me a call and I'll tell you about the time I made that Moscow contact via OSCAR-7. Then I'm going to want to hear what you've done besides make the pileups deeper and the frustration level higher. I want to hear about your adventures in amateur radio.

In Retrospect

There are two times of the year when we tend to stop and think about how we're doing in our lives. Two milestones, or are they millstones? One is our birthday and the other is the New Year. We might do better if we took time more often to contemplate our progress in life and perhaps reset our compasses.

The birthday, as we get older, is mainly another milestone on the way to the grave. It reminds us how fast time passes and how little we're accomplishing. The New Year is a second reminder, usually complete with promises to ourselves to do better (called resolutions).

So here's Wayne, mulling things over as a result of another birthday. I certainly had a more eventful 71st year than I expected, with a few good things happening, and some real miseries. I found that I'd "retired" more than I should. I was having fun giving inspirational talks to musicians at music conferences around the world, going on mini-DXpeditions and getting in some diving in the Caribbean and the Hawaiian Islands, and researching the problems our country is having with crime, education, and health care, and proposing creative solutions. Meanwhile I let others do most of the running of my businesses and personal finances, trusting them and believing the financial reports I was getting.

Bad move. Thinking back, every serious problem I've had in business has resulted from my trusting people. Part of my problem is my lack of interest in money. If you've read any of the stories of my adventures you know I'm cheap. Mmm, let's make that *thrifty.* Just as I have never had much interest in making money, neither have I had any desire to waste it. When I start a new project I try to set it up so it'll make a profit and thus be able to grow . . . and perhaps finance yet another entrepreneurial business that I think is needed.

I hate being tied down with the day-to-day management, so I try to find other people to handle the details, with me being available for advice when they have problems. Then, via weekly meetings and financial reports, I keep track of how things are doing and where my help may be needed. What I haven't protected myself from is two key employees conspiring to put me out of business.

I won't bother you with the details, but it'll sure make an interesting chapter or two for a book.

The most annoying aspect is that this has interrupted my plans for seeing if I can turn out a daily radio program which people will enjoy. I think people will be interested in the history and potential for amateur radio, in the latest medical news on AIDS, cancer, and so on, on ways we can cut taxes, cut prison costs, reduce crime, reestablish family values, eliminate welfare, generate more jobs, promote a new NRA (Never Reelect Anyone) program, and actually reduce the deficit. I think they'll enjoy my picks on the best in new music releases, the more interesting books, the best places to travel, the reality and potential for cold fusion . . . you know, like my editorials.

These are some of the things I talk about at hamfests, where everyone seems to enjoy it. Say, if you are involved with a radio station, would you be interested in giving such a program a test run? It could well be that there isn't much interest in new ideas, books, and music. Or maybe I could give Limbaugh some competition.

But first I've got to find someone to help me keep all my businesses going so I'll have the time to do a radio show. I'll bet I can get us that million new hams we need to make sure we don't lose our bands if I can have a try at it. I'll be needing some tapes of your more interesting rare DX contacts, so set up a recorder and start making some tapes just in case, and be sure to ask for permission to record when you get a hot one. And I'll be needing letters from you about your adventures in amateur radio. Testimonials.

With a million new hams, mostly young, I believe we'd be back in business developing new communications modes and generating the scientists, engineers and technicians we're going to need to keep America ahead of the rest of the world in technology. And with digital techniques, we might not have any more interference than we do right now. Maybe a lot less.

Like suppose we digitize speech and just send the phonemes. This would allow us to compact the data enormously. Computers can generate some fairly good sounding speech these days. Heck, we could specify how we want it to sound and have it come out with just about any kind of an accent. That should be able to cut our transmission time down by at least 90%, allowing nine times as many contacts to take place. Well, it was just a thought. Probably never happen. 73

Number 24 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 January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events File Area #11*** *on our* ***BBS (603-924-9343)****. for listings that were too late to get into publication.*

NOV 5

SULPHUR SPRINGS Hopkins County ARC & RAILS will co-sponsor the Northeast Texas Fall Hamfest, 8 AM-2 PM at Hopkins County Regional Civic Center. Setup Fri. 7 PM-9 PM; Sat. 6 AM-8 AM. Talk-in on 146.68- (151.4) and 444.825+ (151.4). VE Exams at 1 PM. Fall meeting of the Board of Directors (Texas VHF-FM Soc.). *Contact Hopkins County ARC, c/o Nathan Bailey, 1510 San Jacinto, Sulphur Springs TX 75482. Tel. (903) 885-3555 after 7:30 PM Central time.*

NOV 5-6

ODESSA, TX The West Texas ARC will hold their 11th annual Odessa Hamfest Convention at Holiday Inn Convention Center, 6201 East Business I-20. Times: 8 AM-5 PM Sat.; 8 AM-2 PM Sun. Setup 4 PM-10 PM Fri., and 8 AM Sat. For details, call *Robert Jordan N5RKN, (915) 335-7980 eves.*

NOV 6

CARTHAGE, MO A Hamfest will be presented by the Carthage ARS at Memorial Hall, Oak & Garrison Sts. Time: 8 AM-2 PM. Talk-in on 147.42 simplex. Please pre-register for tables. VE Exams. Amateur Radio Gear. Computers. For info call *Jim Dixon WX0J, (417) 358-4126.*

CONCORD, NC The Cabarrus ARS Hamfest/Swap Meet will be held at Cabarrus County Fairgrounds, 8 AM-4 PM. Flea Market. Dealer setup 3 PM-10 PM Sat., 6 AM Sun. VE Exams, all classes, code and no-code, (walk-ins accepted) Register 8:30 AM 9 AM Sun. at the Cabarrus County Bldg., EOC Room, 745 Cabarrus Ave. (adjacent to the Fairground). Bring original and copy of license, any credit certificates, ID. Also bring $5 registration fee payable to the Charlotte VEC. Talk-in on 146.655/.055. For general info, call *Jeff Parker WA1KXI, (704) 933-7238. Dealers, call Bill Hickok WD8SAS, (704) 788-2873.*

NOV 11

FAIR LAWN, NJ The Fair Lawn ARC will hold an Auction from 7:30 PM-11 PM on the Club grounds at 1256 River Rd. Free admission. No VE Exams. Talk-in on 146.790(-). For details, contact *Gary KB2LCA, (201) 791-3841, Fri. eves only.*

NOV 12

MYRTLE BEACH, SC The Grand Strand ARC will sponsor their 2nd annual Hamfest/Computer Show at the Myrtle Beach H.S. from 9 AM-4 PM. VE Exams at 9 AM sharp. Talk-in on 147.120(+). Call *Robert Battle, (803) 236-2887; Gordon Mooneyhan, (803) 293-3839; or write GSARC, P.O. Box 2135, Myrtle Beach SC 29578-2315.*

PLYMOUTH, MA The Mayflower ARC will host its 4th annual Flea Market at the Plymouth Memorial Hall Bldg. in Plymouth Center (RT3A), from 9 AM-3 PM. Dealer setup at 8 AM. Talk-in on 446.625 and 146.685. Contact *Jon WS1K, (508) 746-0162; or Jim NM1F, (508) 747-2224 eves.*

NOV 13

BRANFORD, CT The Southcentral Conn. ARA will hold its 15th annual Flea Market at the Branford Intermediate School, 185 Damascus Rd. Sellers 7 AM; Buyers 9 AM. VE Exams. Reservations no later than Nov. 1st, none by phone. For info, call *Brad, (203) 265-9983,* 24 hrs. For reservations, SASE to *SCARA, P.O. Box 705, Branford CT 06405-0705.*

NOV 19

BILLERICA, MA An Amateur Radio and Electronics Auction will be held 11 AM-4 PM at Bull HN, 300 Concord Rd. Talk-in on 147.12(+). Setup at 9:30 AM (no junk, please). Buyers admitted at 10 AM. Sponsors: Bull HN 1200 RC and Waltham ARA. Contact *Eliot Mayer W1MJ, (508) 851-0183; Email 73210.3104@compuserve.com.*

HOLLAND, MI The 4th annual Westshore Hamfest/Computer Expo will be held by the Holland ARC at Holland Christian H.S., 956 Ottawa Ave. Time: 8 AM-Noon. Setup Fri. 8 PM-10 PM; Sat. 6:30 AM. VE Exams: registration at 8:30 AM, testing at 9 AM. Contact *Westshore Hamfest, c/o Joe Campbell N8TGX, 10413 Northfield Dr., Holland MI 49424. Tel. (616) 772-4928 (after 6 PM).*

SOCORRO, NM The 1994 Socorro Hamfest will be co-sponsored by the Socorro ARA, the Tech ARA, and the City of Socorro. This event will be held 9 AM-5 PM at Finley Gym. ARRL VEC VE Exams for all classes; registration 11 AM-12 Noon, exams at 12 Noon, walk-ins welcome. Call *Kalman AJ5B, (505) 835-5225.* Talk-in on 146.68(-). Flea Market. Demonstrations. Non-Ham Activities. For Hamfest details, call *Dave N1IRZ, (505) 835-1218.*

NOV 19-20

FT. WAYNE, IN The Fort Wayne Hamfest/Computer Expo will be sponsored by the Allen County AR Tech. Soc., and will be held at the Allen County Memorial Coliseum on U.S. 30 in Ft. Wayne. Doors open at 9 AM both days. Setup is Fri. eve. and Sat. morn. Flea Market. Forums. VE Exams. Ladies Events. Con-

tact *John Rufner KB9BNI, (219) 483-6305 (tables); Don Gagnon WB8HQS, (219) 484-3317* (info); or write to *ACARTS, P.O. Box 10342, Ft. Wayne IN 46851*

TAMPA, FL The Florida Gulf Coast ARC will present the ARRL 19th annual Suncoast Amateur Radio and Computer Convention, Sat. 9 AM-5 PM; Sun. 9 AM-3 PM. Place: Florida Expo Pk., in the "Expo-Hall" (formerly Florida State Fair Grounds), Interstate 4 and US-301. VE Exams Sun. 10 AM at The Sheraton Hotel. Bring the $5 fee, your original license, your original CSCE certif. and a copy of each; plus 2 forms of ID (one with a photo). Form 610 will be provided. Walk-ins welcome. No reservations needed. Flea Market. Forums. More. Talk-in on the KC4HAZ Rptr System, 146.94, 223.98, 442.275, and 51.72. Back-up will be the KC4QHM Rptr on 147.105. Flea Market contact: *Jean, 1556 56th Ave N., St. Petersburg FL 33703; Tel. (813) 525-5178 (after 6 PM).* Commercial vendors, contact *Bill Smith, 4402 Henderson Blvd., Tampa FL 33629. Tel. (813) 837-4533.*

NOV 26

EVANSVILLE, IN Vanderburgh County Fairgrounds will be the location of the 2nd Annual E.A.R.S. Evansville Winter Hamfest. Festivities from 8 AM-2 PM Central. Flea Market. Commercial Dealers. Talk-in on EARS Rptr Net.; Evansville 145.150(-); Vincennes 146.925(-). Contact *Bev KA9PDG, (812) 479-5741;* or write *EARS, 1506 S. Parker Dr., Evansville IN 47714.*

DEC 3

NORTH OLMSTED, OH The North Coast ARC Fall Hamfest will be held at St. Clarence Church, 30106 Lorain Rd., 8 AM-2 PM. Setup at 0600 AM. Vendors purchasing four or more tables may set up Fri. eve. 7 PM-10 PM. Reservation payments must be received (with SASE) by Nov. 26th. Send to Dan Sarama KB8A, 15591 Rademaker Blvd., Brook Park OH 44142. Call *Dan Sarama KB8A* at *(216) 267-5083*, or connect to the *NCARC Packet BBS, "C NO8M"* on 145.73. *Dial (216) 779-6350* and use the commands: D *NCARC/HAMFEST.LOC* and *D NCARC/HAMFEST.INF*. Talk-in on 145.29 and 224.76 Rptrs.

DEC 4

HAZEL PARK, MI Hazel Park H.S., 23400 Hughes St., will be the location for the 29th Annual Swap and Shop sponsored by the Hazel Park ARC. Admission $4, tables $13 (check must be sent, no reservations by phone). Talk-in on 146.64(-) (DART). For info, tables, tickets, write to *HPARC, Box 368, Hazel Park MI 48030.*

SPECIAL EVENT STATIONS

OCT 30-NOV 19

MODBURY NORTH, AUSTRALIA The North East RC (Adelaide, Australia) will operate Station VI5AGP for the Tenth Adelaide Grand Prix. Operation will be from Oct. 30th-Nov. 19 on HF and VHF. To obtain an award, contact the station and receive a sequence number. Send $5A or 5 IRCs, quote the sequence number, QSL info, and your return address. The award features the late Arton Senna. Write to *North East Radio Club, P.O. Box 36, Modbury North 5092, Australia.*

OCT 31-NOV 1

BREVARD, NC The Transylvania County ARC will operate Station KD4ZY, from Transylvania County NC. Time: 2100Z Oct. 31-0100Z Nov. 1. Frequencies: 7.234. 14.295. 21.365. and 28.335 SSB; and 146.52 FM simplex. For a certificate, send a legal size or 9"" x 12"" SASE to *Willis B. Casey KD4ZY, 116 Campbell Dr., Pisgah Forest NC 28768.* Operation will be from the Devil's Courthouse on Blue Ridge Pkwy., weather permitting.

NOV 5-7

WICHITA, KS The Wichita ARC will operate W0SOE from the Wichita Boathouse. The Station will commemorate the world's first all female yacht racing team aboard the America 3. Operation will be on the final day of the World Cup yacht races. Time: Nov. 5th, 10 AM-5 PM; Nov. 6th, 1 PM-5 PM. Freqs. include lower portions of General phone subbands on 20 and 15 meters, and Novice phone subband of 10 meters (propagation permitting). QSL with SASE to *KD0AY, 1603 Fairview, Wichita KS 67203.*

NOV 11-20

PALMDALE, CA Several SE stations will be sponsored by the Northrup Grumman ARC to commemorate the union of the Northrop and Grumman ARCs. Operating: M-F local lunchtime, Sat & Sun 8 AM-8 PM localtime: EST (WA2LQO) Great River and Bethpage NY; CST (W9RSU) Rolling Meadows NY; and W6VPZ Hawthorne; W6VPZ/6 Pico Rivera, and W6VPZ/6 PMD Palmdale CA. Freq.: Top 25 kHz on Novice and General Bands (SSB and CW) 80-10. Contact four of the 6 NGARCs. For a QSL, send contact numbers and QSL with a 9"" x 12"" SASE (for a parchment certificate) to *Cam Harriot, LL824/4c, 3520 East Ave. M, Palmdale CA 93550.*

NOV 12

VIC., AUSTRALIA The Australian Ladies' ARA will sponsor a contest from 0001 UTC-2359 UTC. Object: YL works everyone, OMs and Clubs work YLs only. Phone and CW. Bands to be used are 3.5, 7, 14, 21, and 28 MHz only. Freqs.: 28.380/.410, 21.170/.200 and 21.380/.410, 14.250/.280, 7.070/.100, 3.560/.590. Procedure: Phone: call "CQ ALARA CONTEST." CW: YLs call "CQ TEST ALARA," OMs call "CQ YL." For further rules and details, contact *Mrs. Marilyn Syme VK3DMS, P.O. Box 91, IRYMPLE 3498, VIC. AUSTRALIA.*

NOV 26-27

WHITMAN, MA The Whitman ARC, Inc. will operate WA1NPO at Plimoth Plantation in Plymouth MA to commemorate Thanksgiving Day. Freq.: 3.970, 7.270, 14.270, 18.140, 21.370,24.970, and 28.370. Operation will be 1400Z- 2100Z both days. For a 7 1/2"" x 10"" Certificate with the Mayflower II in the background, send an SASE to *Whitman ARC, P.O. Box 48, Whitman MA 02382.* 73

Number 25 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

November propagation does not look very promising. The sunspot number continues to drop toward minimum (expected sometime in '95-'96) and autumn equinox conditions are trending toward winter conditions and maximum hours of darkness for the year. The *best* days for propagation are likely to be the 5th-8th, 14, 15, and 25th-30th. The *worst* days appear to be the 2nd, 3rd, 10th-13th, 17th, 18th and 21st-24th.

General Conditions this Month

10 and 12 meter bands: Occasional F2-layer openings to the tropics during daylight hours. Morning and afternoon hours likely to be open on Good or Fair-to-Good days.

15 and 17 meter bands: Fair-to-Good DX openings on Good days, particularly from noon to sunset. Band closes shortly after sunset. Some short skip during daylight hours.

20 meter band: This will be your best band for DX opportunities, and DX to all areas of the world during daylight hours on Good days. Peak conditions an hour or two after sunrise, and again during early afternoon hours. Sporadic E/short skip out to 2,000 miles during daylight hours on Good days. Not much after dark.

30 and 40 meter bands: Late afternoon and early evening openings to the east (Europe and Africa) on Good days. Openings to Asia, the Pacific and the Far East should peak before sunrise. Daytime short skip to about 1,000 miles and nighttime short skip to 2,000 miles on Good days.

80 and 160 meter bands: Eighty meters should provide excellent openings after dark, peaking for DX around midnight and again just before sunrise. The low static levels of winter will be a big help. Short skip during daytime to 500 miles and up to 2,000 miles after dark. One-sixty will be closed during the daytime, but will open after dark with short skip up to 1,500 miles. DX to the east peaks around midnight, and to other directions before sunrise, local time, on our top band. Be prepared.

In spite of the conditions as outlined above, or perhaps *because* of these conditions, seasoned DX operators should be alert to sudden openings of short duration, and will often call CQ when the band appears "dead," with surprising results. Grey-line DXing is always possible where the darkness path to various areas of the world from the USA exists. Usually, about a half hour before dark to a half hour after, and a half hour before sunrise to a half hour after, will provide good grey-line DX opportunities.

When using the chart accompanying this report, be aware that the days marked Good, Fair or Poor, or trending between these values, may actually occur a day or so before or a day or so after the days shown on the chart, as forecasting is not as precise as we would like it to be. There are always surprises, so it's very important to closely monitor "conditions" on WWV at 18 minutes past any hour for the latest reports of the solar flux and Boulder K and A values. These, together with the charts here, will be a big help to your DXing efforts. W1XU. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20						20					15
AGENTINA	20	40A	20	40					10		20A	20A
AUSTRALIA	20	40A		40	40	20	20	20		20	15	15
CANAL ZONE	40A	40A	40	40	40		20	20A	10	15A	20A	20
ENGLAND	40	40	40	40				15	20A	20		
HAWAII	20	20				20	20			15	15	15
INDIA						20	20	20				
JAPAN	20					40	20				15	15
MEXICO	40A	40A	40	40	40		20	20A	10	15A	20A	20
PHILIPPINES							20					
PUERTO RICO	40A	40A	40	40	40	20	20A	15A	15A	20A	20	40A
SOUTH AFRICA	40	40A	20					15A	15A	20A	20A	20A
U.S.S.R.	20	20					20	15			20	20
WESTCOAST	20A	20	40	40	40	40	40	20	15	15A	15A	15A

CENTRAL UNITED STATES TO:

ALASKA	20				40	40	20	20			15	15
ARGENTINA	20	40	40	40						15A	20A	20A
AUSTRALIA					40	40	20	20	20		15	15
CANAL ZONE	40	40	40	40	40	20	20	15	15A	15A	15A	15
ENGLAND	40	40	40	40				15	15	20A	20	20
HAWAII	20	20	20	40	40		20	20		10	10	15
INDIA	20	20					20	20				
JAPAN	20					40	20	20				15
MEXICO	40	40	40	40	40	20	20	20	20	15A	15A	15
PHILIPPINES	20A	20					20	20			15	15
PUERTO RICO	40	40	40	40	40	20	20	20	20	15A	15A	15
SOUTH AFRICA							10	15A	15	20A	20A	20
U.S.S.R.							20	20A	15	20	20	

WESTERN UNITED STATES TO:

ALASKA	20A	20A	20			40	40	40A	20	20	20	20A
ARGENTINA	20A	20	40A	40						15A	15A	15A
AUSTRALIA	20A	20A	20	20	40	40	40		20	20	15	15
CANAL ZONE	20	20	40A	40A	40			20	20A	15A	15A	15A
ENGLAND			40					20	15	20A	20	20
HAWAII	15	20A	20A	40A	40	40	40	20	20	20		15A
INDIA	20A	20A						20	20			
JAPAN	20A	20A	20			40	40	40A	20	20	20	20A
MEXICO	20	20	40A	40A	40			20	20A	15A	15A	15A
PHILIPPINES	15			20		40	40		20	20		
PUERTO RICO	20	20	40A	40A	40			20	20A	15A	15A	15A
SOUTH AFRICA	20							20	20	15	20	20
U.S.S.R.			40	40				20A	15A	10	20	20
EAST COAST	15A	20	40	40	40	40	40	20	15	15A	15A	15A

A=Next higher frequency band may also be useful. G=Good, F=Fair, P=Poor.

NOVEMBER 1994

SUN	MON	TUE	WED	THU	FRI	SAT
		1 F-P	2 P	3 P-F	4 F-G	5 F-G
6 F-G	7 G	8 G-F	9 F	10 F-P	11 P	12 P
13 P-F	14 F-G	15 G-F	16 F-P	17 P	18 P	19 P-F
20 F-P	21 P	22 P	23 P	24 P-F	25 P-F	26 F-G
27 G	28 G	29 G	30 G			

Number 26 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, *73 Magazine*, 70 Rt. 202N, Peterborough NH 03458, and get set for the phone calls.

The deadline for the December classified ad section is October 13, 1994.

ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios. $9.95 each, ppd USA. Send to: **ALLABOUT BOOKS**, Dept. S, P.O. Box 22366, San Diego CA 92192. BNB200

CUSTOM MADE-HAND TOOLED leather products with your initials, name, call letters. Photo's & estimates available. Key rings, wallets, belts, purses, hanging signs, specialty items. GREAT GIFT. **LEATHER & WEST,** 67 Causeway Rd., West Swanzey NH 03469. (603)352-6256. 9-4 pm. M-F ET. BNB215

SUPERFAST MORSE CODE SUPEREASY. Subliminal cassette, $12.00. LEARN MORSE CODE IN 1 HOUR. Amazing supereasy technique, $12.00. Both, $20.00. Moneyback guarantee. Free catalog: SASE, **BAHR-T7,** 150 Greenfield, Bloomingdale IL 60108. BNB221

ROANOKE DOPPLER PC BOARDS $49.95 ea. **AB5CK**, 6721 Rolling Hills Dr., North Richland Hills, TX 76180. BNB240

WANTED: AUDIO EQUIPMENT. Tube, Solid State, McIntosh, Marantz, Tannoy, EV-Patricians, Western Electric, Nakamichi preferred. John, (410)465-2699. BNB268

KPC-3 WINDOWS TERMINAL PROGRAM User friendly Split Screen, 400 line Scrollback Buffer, Save & Send files easily, 3D Command Buttons, $29.95 or SASE for FREE details. **COMTREK** P.O. Box 4101, Concord NH 03302-4101. BNB271

QSL SAMPLES- 50 cents. **SAMCARDS,** 48 Monte Carlo Dr., Pittsburgh PA 15239. BNB275

DWYER WIND SPEED INDICATOR only $55.00 plus $4.00 S/H. For home or office. Accurate, low-cost, practical. Roof mounted pickup. Send check or M.O. to: **RAD-MON COMPANY,** Dept A, Box 751, Marathon NY 13803-0751. (NY Residents add Sales Tax) BNB285

ATTENTION HAMS! Subscribe to *6-50 Worldwide for Six Meter Enthusiasts*, *DX Digest for DX Chasers*, or *The Novice/Tech Report*. Call (817)694-4047 or FAX (817)694-2522. BNB292

COMMODORE 64 REPAIR. Fast turn around. **SOUTHERN TECHNOLOGIES AMATEUR RADIO,** 10715 SW 190th Street #9, Miami FL 33157. (305)238-3327. BNB295

KIT BUILDERS— NEW, SYNTHESIZED qrp Transmitter/Transceiver, the ARK4. Full Transceiver Kit w/case only $199.95. One board, no wiring, top quality components & PCB. GUARANTEED TO WORK. For info send SASE; Call/Write to order: **S & S ENGINEERING**, 14102 Brown Road, Smithsburg MD 21783; (301)416-0661. BNB304

WANTED: Electron Tubes, ICS, Semiconductors. **ASTRAL,** P.O. Box 707ST, Linden NJ 07036. Call (800)666-8467. BNB307

KENWOOD AUTHORIZED REPAIR. Also ICOM, Yaesu. **GROTON ELECTRONICS,** Box 379, Groton MA 01450. (508)448-3322. BNB310

UNIQUE INDOOR/OUTDOOR ANTENNA gives 30 dB gain on 160m-10m. Plans: $6.95. **BOB CHRISTIE AA2KE,** 215-28 Spencer Ave., Queens Village NY 11427. BNB319

GMRS: ALTERNATIVE TO CB AND HAM RADIO. Great for traveling, camping or other family use, 2ed. Send $3.00 to: Neiferd, KG8EP, 2695 Haystack Dr., Colorado Springs CO 80922. BNB326

PROGRAMMABLE COUNTER— Works with ANY VFO Rig! Get a digital display for your rig, 100 Hz resolution. You can read the tuned frequency directly, no need to calculate offsets. Counts to 40 Mhz, up OR down. Counter Kit, $69.95; Kit w/case, $99.95; Assembled w/case, $139.95. GUARANTEED TO WORK. For info send SASE: Call/write to order: **S & S ENGINEERING,** 14102 Brown Road, Smithsburg MD 21783; (301)416-0661. BNB334

Continued on page 81

Number 27 on your Feedback card

NEW PRODUCTS

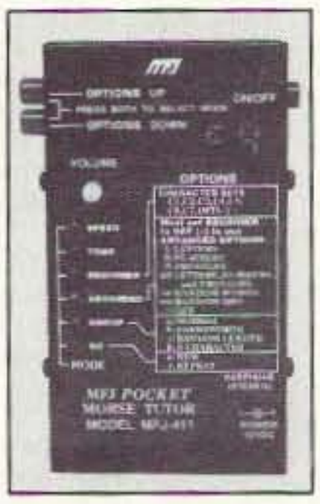
Compiled by Charles Warrington WA1RZW

MFJ ENTERPRISES

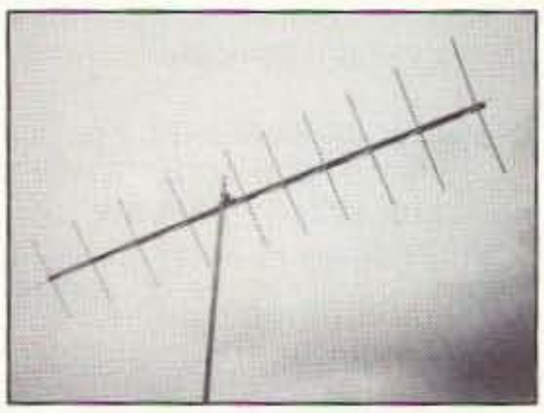
Here comes an excellent opportunity for you to learn or to perfect your Morse code skills! The MFJ-411 Personal Morse Code Tutor will take you from zero to expert speed, from beginner to Extra Class, utilizing a custom code practice technique.

The Random QSO Mode allows you to start by practicing plain English QSOs to get you ready for the FCC exams; the Word Recognition Mode allows you practice copying entire words—just like the pros on 40 meters!

You can take the 411 anywhere—it measures only 3" x 1-1/8" x 5-1/2". The Tutor runs off a 9V battery or from the optional MFJ-1312B 110V adapter. You can use it with the built-in speaker or with earphones.



The MFJ-411 Personal Morse Code Tutor is priced at $79.95. For more information or to order contact your favorite dealer or *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; (601) 323-6551, or (800) 647-1800.* Or circle Reader Service No. 201.



LIGHTNING BOLT ANTENNAS

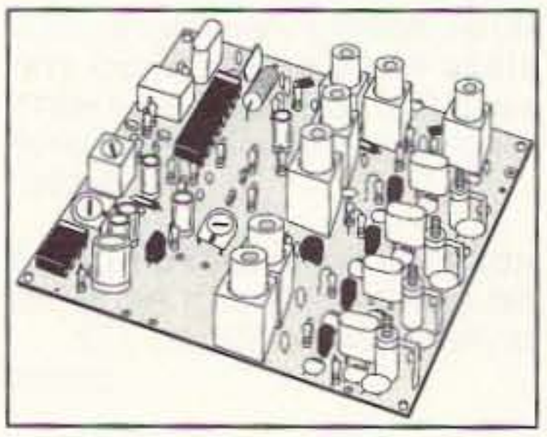
Lightning Bolt Antennas has added two new 10-element quad antennas to their product line. The 2 meter quad has a measured gain of 14 dBd. It is equipped with a 12-foot filament-wound Fiberglas boom and solid 3/8" Fiberglas spreader arm rods. These spreaders are slotted on the ends so the wire elements pop on with tension—they hold tight. A 220 MHz version is also available.

These antennas come complete with stainless steel hardware and an aluminum boom-to-mast bracket. They are priced at $99.95 for either model. For more information or to order contact *Lightning Bolt Antennas, Rd. 2, Rt. 19, Volant, PA 16156; (412) 530-7396.* Or circle Reader Service No. 204.

HAMTRONICS

If you are looking for an inexpensive, but very effective wideband FM receiver for 137 MHz weather fax reception, the new R138 Receiver from Hamtronics may be the answer. Because a wide IF bandwidth is required in this type of receiver for good quality reception, many conventional receivers and scanners are unsuitable without modification.

The R138 Receiver is crystal controlled; it has four channel oscillators, which allow you to select a particular satellite by simply grounding the appropriate control line by an external switch. Crystals are available for all the popular satellites and simply plug into sockets. The receiver also has very good sensitivity, typically 0.2 µV.

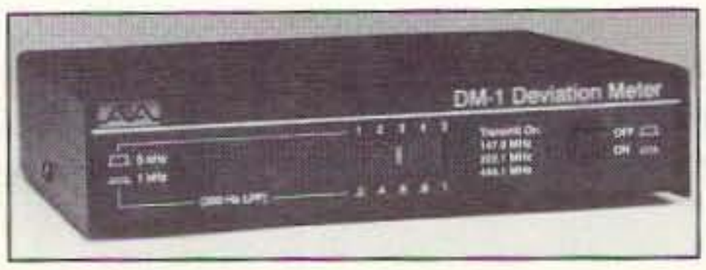


The kit price is $99, or wired and tested for $169. For more information, catalogs, or to order contact *Hamtronics, Inc., 65-D Moul Rd., Hilton, NY 14468-9535; (716) 392-9430, FAX (716) 392-9420.* Or circle Reader Service No. 206.

JAN CRYSTALS

JAN Crystals is now offering a line of Temperature Controlled Crystal Oscillators (TCXOs). JAN's TCXOs maintain a very stable frequency as ambient temperature changes, making them ideal for use in FM modulators, pulse code modulators, video cameras, measurement systems, portable radios, and a host of other projects.

The oscillators operate in a frequency range of 10 to 20 MHz and provide frequency stability of ± 2.5 ppm over a temperature range from -30°C to 75°C. Complete specifications and further information is available by contacting *JAN Crystals, P.O. Box 60017, Fort Meyers, FL 33906-6017; (800) JAN-XTAL.* Or circle Reader Service Card No. 207.

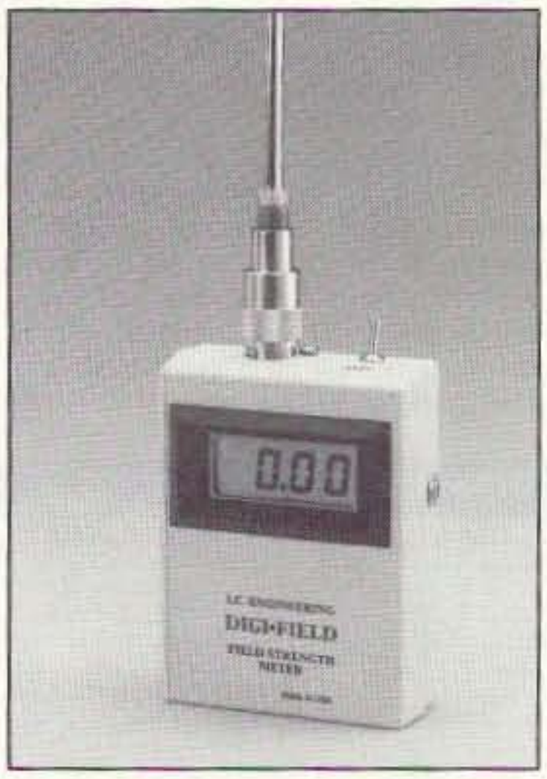


ADVANCED ELECTRONIC APPLICATIONS

The new AEA DM-1 Deviation Meter is designed for measuring the deviation of FM transmitters operating in the 144, 220, or 440 MHz amateur bands. "The people using 9600 baud TNCs will benefit most from the DM-1," explained AEA's Kevin Cox, "because correctly setting deviation for 9600 baud packet operation is nearly impossible to do by ear." The DM-1 allows you to easily set deviation, eliminating excessive retries, increasing data throughput, and increasing channel efficiency.

The DM-1 has crystal controlled tuning, providing for stable measurement without the need for manual tuning. It comes with a 10 segment LED bar display, and has an external output for digital or analog meters.

The AEA DM-1 Deviation Meter is priced at $169. For more information or to order visit your favorite dealer or contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; (206) 774-5554, FAX (206) 775-2340.* Or circle Reader Service No. 202.



I.C. ENGINEERING

The DIGI-FIELD Digital Field Strength Meter from I.C. Engineering has a frequency response of DC to 12 GHz, making it useful for preliminary susceptibility compliance measurements. Model A has a sensitivity of 150 nanowatts at 100 MHz and Model B has a sensitivity of 2 nanowatts. The new Model C combines the sensitivity of Models A and B.

The DIGI-FIELD 3-1/2 digit display is an easy-to-read feature of this compact, lightweight, 9V battery-powered unit. It can be used with an external antenna or with its own movable telescoping antenna. A low battery indicator and detector output jack are standard. Typical calibration curves in dBm and volts/power conversion charts are available.

The DIGI-FIELD Model C is priced at $139.95. For more information or to order contact *I.C. Engineering, 16350 Ventura Blvd., Suite 125, Encino, CA 91436; (818) 345-1692, FAX (818) 345-0517.* Or circle Reader Service No. 203.

SESCOM

Home-brewers can keep the RF from getting into or out of their latest project with an RF tight, hot tin-plated steel box from SESCOM. The new SB series of RF Shielded Steel Boxes allow the designer to eliminate the typical spillover of unwanted signals. The boxes come with individual dividers and the lids can be soldered to the case.

Eleven sizes are stocked, ranging from 2.1" x 1.9" x 1.0" to 6.4" x 2.7" x 1.1" and are priced from $4.50 to $13.20. For more information, to request a 1995 catalog, or to order contact *SESCOM, Inc., 2100 Ward Drive, Henderson, NV 89015-4249; (702) 565-3400, FAX (702) 565-4828.* Or circle Reader Service No. 205.

COMTREK

ComTrek, a new Windows terminal program for the Kantronics KPC-3, is a user-friendly software program for packet radio communication. It features split screen, 400 line scroll back buffer, user programmable auto connect and macro screens, save-to-file and print screens, on-line editor, and many other features. Files can be uploaded from disk, or directly from the editor.

The ComTrek program is full color or gray scale and has 3D command buttons across the top of the screen for the most often used commands. This is the latest software program from ComTrek for anyone using a KPC-3 who has an IBM or compatible computer running Windows. The price is $29.95, shipping included (within the US). For more information or to order contact *ComTrek, P.O. Box 4101, Concord, NH 03302-4101.* Or circle Reader Service No. 208.

BARTER 'N' BUY Continued from page 79

RCI-2950/2970: New modification manual including Power increase. Clarifier modification. Modulation increase. Operating hints, and more. Parts included. Only $20.00 ppd in U.S. (Missouri residents add $1.15 tax). **SCOTT**, P.O. Box 510408, St., Louis MO 63151-0408. (314)846-0252. Money Orders or C.O.D. BNB340

HR2510, RCI2950, CONNEX 3300, COBRA 148, GALAXY SATURN, plus many more kits to increase your modulation, $19.95. **(800)536-0109.** BNB350

Icom R-9000 Receiver, 4 months old, orig. box, under manufacturer warranty, 100 kHz-2 GHz. **Collin B. Anderson,** (H) 703-524-5530; (W) 703-697-4712. (I work 2 p.m.-11 p.m. M-F ET. BNB360

QSL CARDS — Standard and custom. Your ideas or ours. Excellent quality. Foil stamping available. Many designs and type styles. Catalog and samples $1.00 refundable. **WILKINS**, Dept. A, Box 787, Atascadero CA 93423. BNB370

CALLSIGN WRISTWATCH - Free details. **KC6UEC,** 9438 Broadway, Temple City CA 91780. BNB379

NEW 5 Watt CW SUPER-HET SINGLE BAND TRANSCEIVER KIT. Available in 20M, 30M, 40M, 80M. $69.95 plus $3.75 S/H. (Catalog-2 Stamps). **DAN'S SMALL PARTS & KITS,** 1935 South 3rd West #1, Missoula MT 59801. BNB385

CW'ers, USN FLAMEPROOF KEY, new, packed 1955, $59 (shipping included). Collectors, 15 pages, mostly telegraphic, refundable $2.00 plus 2 Stamps. Joseph Jacobs, 60 Seaview Terr., Northport NY 11768. BNB393

IT'S BACK! The return of the HW-8 Handbook! Second printing. Modifications for the Heath QRP rigs. First class mail $11. DX add $4 for air mail shipping. **Mike Bryce, WB8VGE,** 2225 Mayflower NW, Massillon OH 44647. BNB404

47 FOOT ANTENNA WORKS ALL BANDS. Only $40.00 ppd in 48 states. Fully assembled, not a kit. Superb results! Satisfaction guaranteed 100%. SASE for catalog and information sheet. **THE ANT FARM,** P.O. Box 3196, Wescosville PA 18106. BNB409

ULTIMATE CONSTRUCTION directions for inexpensive project to determine accurate beam direction for DX from your QTH. For plans send SASE and $5.00 to: KA1EHG/1, Box 11, North Bridgton ME 04057-0011. BNB417

MAHLON LOOMIS, INVENTOR OF RADIO; (patented 1872) by Thomas Appleby. (Copyright 1967). Available from **JOHAN K.V. SVANHOLM, N3RF, SVANHOLM RESEARCH LABORATORIES,** P.O. Box 81, Washington DC 20044. Please send $25.00 donation with $5.00 for S&H. BNB420

BROWNIES QSL CARDS SINCE 1939. Catalog & samples $1 (refundable with order). 3035 Lehigh Street, Allentown PA 18103. BNB430

BUTTERNUT ANTENNAS, NEW—in box. (2)HF6-VX, $125.00; (2)HF5B, $200.00; (2)HF2V, $110.00; (1)HF7VX, $150.00. (210)435-6190. BNB435

RADIO DOCTOR VIDEOS for Repair and Alignment of HF Transceivers. Reviewed by Gordon West, January—*73 Magazine*. Videos for popular KENWOOD, YAESU, and ICOM. ORDERS: **(800)788-1416** MC/VISA. **Catalog: SASE** (2 stamps): **RADIO DOCTOR,** 710 Teague Dr., Kennesaw GA 30144. BNB442

FREE...Ham Radio **Gospel Tracts:** DX Contact and Christian Helps, SASE: N1GDP, RAR-OFC, P.O. Box 8, Harmony ME 04942. BNB443

SKED-ALARM A Windows based alarm to track your radio schedules. Keeps up to 5 skeds with dual-digital clocks in UTC/local time/date. Records Time/Date/Frequency. Send $22.50 check or M.O. to: **SOFT-SPARKS SOFTWARE,** 2601 Cartwright Rd., Suite D-306, Missouri City TX 77459. (Include Name and Call. Texas residents include state tax.) BNB446

ICOM IC-736 RAFFLE: One hundred tickets ONLY at $30.00 a piece. Drawing to be held at 1 p.m. on December 23 at the RC of JHS 22 in NYC. Tickets/Questions - WB2JKJ, RC of JHS 22, P.O. Box 1052, New York NY 10002. Phone (516)674-4072, Fax (516)674-9600. This will go fast, ACT TODAY. BNB455

COMPUTER PRINTER RIBBONS BY MAIL High quality, low cost. Black or color. Tell us your needs. Free quote. **HARCLY,** P.O. Box 830, Coquille, OR 97423. BNB457

COLLINS RX 75S3C, Wing, Serial 10494. Needs some work. Excel physical condx. $200; **TX32S3,** Wing, Serial 12704. Needs some work. New finals. Excel physical condx. $250; **PWR SPLY** 516F-2, Wing, Serial 15842, $75 (with 32S3, $50); **STN CTRL** 312B-4, Wing, Serial 54818. Excel condx. $100; **XTAL PAK** (16 missing) $75. Entire package for $600. U pay shping. **ERIK SHAFER** (801) 771-5613. BNB470

DACRON ROPE, WHY RISK FAILURES with aerial supports? Strong, high UV resistant, non-stretch Military Type black DOUBLE (unlike our competitors' single) braided Dacron. 3/32": $.06/ft., 3/16" (770 lb. test): $.11/ft., 5/16": $.16/ft. **DAVIS RF CO. 24 HOUR ORDERS:** (800)328-4773. BNB557

HF TRANSCEIVER, IC-781, mint, in Box, only used 10 hours, manuals included, $3,700.00. Mike, (408)227-7460 after 6 p.m. BNB590

WANTED: Western Electric tubes and other tube audio equipment. (800)251-5454. BNB615

MODIFICATION REPORTS HR2510, RCI 2950, Ranger 3300/3500—frequency, RF power modulation, RIT, etc., $10 ea. or $25 for all three. Four-hour video on VCR. Repair $19.95. Send to **JACK FISHER,** POB 612, Oceano CA 93445. BNB620

DUPLEXER TUNING GUIDE. A complete booklet showing step-by-step instructions on tuning all types of duplexers. Included is theory of operation, detailed diagrams and much more. Send $9.95 plus $2.50 s&h to **RGM PUBLICATIONS,** 533 Main Street, Hillsboro NM 88042. For faster service using a major credit card call (505)895-5333 and order today. 30 day money back guarantee. BNB635

SATELLITE EQUIPMENT Best $$$ USA. (800)851-6534. BNB640

VHF-UHF-SHF Large SASE. **VHFer,** P.O. Box 685, Holbrook AZ 86025. BNB660

QSLS—ELEGANT, AFFORDABLE. Samples $1 (refundable with order). **AACO,** Dept. S411, 1639 Fordham Way, Mountain View CA 94040. BNB670

FOR SALE Icom IC-2SAT, IC-W2A, PK-88 Laptop computer, personal autopatch, Epson Printer. Anthony Nota, (201)284-1105. BNB675

HAM RADIO REPAIR- All makes and models. Fast, Professional Service. **AFFORDABLE ELECTRONIC REPAIR,** 7110 E. Thomas Rd., Scottsdale AZ 85251. (602)945-3908. BNB700

ROSS' $$$$ NEW NOVEMBER (ONLY) SPECIALS. SAVE TIME AND MONEY HAVE MODEL NUMBER AND MANUFACTURER READY WHEN YOU CALL OR WRITE. KENWOOD PB-10, $40.00; PB-12, $50.00; TS-50S, call; AEA, call; ALINCO, call; YAESU FT-900AT, $1332.00; FT-416/25B, $255.00; SC-1 $139.99; ICOM W-21A, $313.50; 47A, $390.00; 707, $700.00; MFJ 104, $11.90; 249, $165.00; 815B, $50.00; 949EY, $120.00; AMERITRON ALS-600, $1080.00; Bencher, call; BUTTERNUT, call; CUSHCRAFT 13B2, $94.00; 4218XL, $155.90; A-3WS, $250.00; A-1483S, $31.50; TELEX HY-GAIN, call; RF CONCEPTS, call; MIRAGE, call; LARSEN, call; 500 ft. RG-213, $150.00. LIMITED TIME OFFERS. LOOKING FOR SOMETHING NOT LISTED OR HARD TO FIND? CALL OR WRITE. OVER 9000 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. Preston. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. **ROSS DISTRIBUTING COMPANY,** 78 SOUTH STATE, PRESTON ID 83263. (208)852-0830. BNB707

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HAM RADIO REPAIR—Prompt service. **ROBERT HALL ELECTRONICS,** 1660 McKee Rd., Suite A, San Jose CA 95116. (408)729-8200. BNB751

GET YOUR "FCC COMMERCIAL GENERAL RADIOTELEPHONE LICENSE". Electronics Home Study. Fast, inexpensive! "Free" details. **COMMAND PRODUCTIONS,** D-174, Box 2824, San Francisco CA 94126-2824. BNB761

WANTED: HAM EQUIPMENT AND OTHER PROPERTY. The Radio Club of Junior High School 22 NYC, Inc. is not only the Big Apple's largest Ham club but also the nation's only full-time, non-profit organization, working to get Ham Radio into schools around the country as a theme for teaching using our EDUCOM-Education Thru Communication-program. Send your radio to school. Your donated amateur or related property, which will be picked up or shipping arranged, means a tax deduction to the full extent of the law for you as we are an IRS 501 (c) (3) charity in our fourteenth year of service. Your help will also mean a whole new world of educational opportunity for children around the country. Radios you can write off, kids you can't. Enjoy the coming holiday season by helping someone else and yourself. Please, write-phone-or FAX the WB2JKJ "22 Crew" today: The RC of JHS 22, P.O. Box 1052, New York NY 10002. Telephone (516) 674-4072 or FAX (516) 674-9600. Young people, nationwide, can get high on Ham Radio with your help. Meet us on the WB2JKJ CLASSROOM NET: 7.238 MHz. 1200-1330 UTC and 21.395 MHz. 1400-2000 daily also at the ARRL CT State Convention Oct. 9. BNB762

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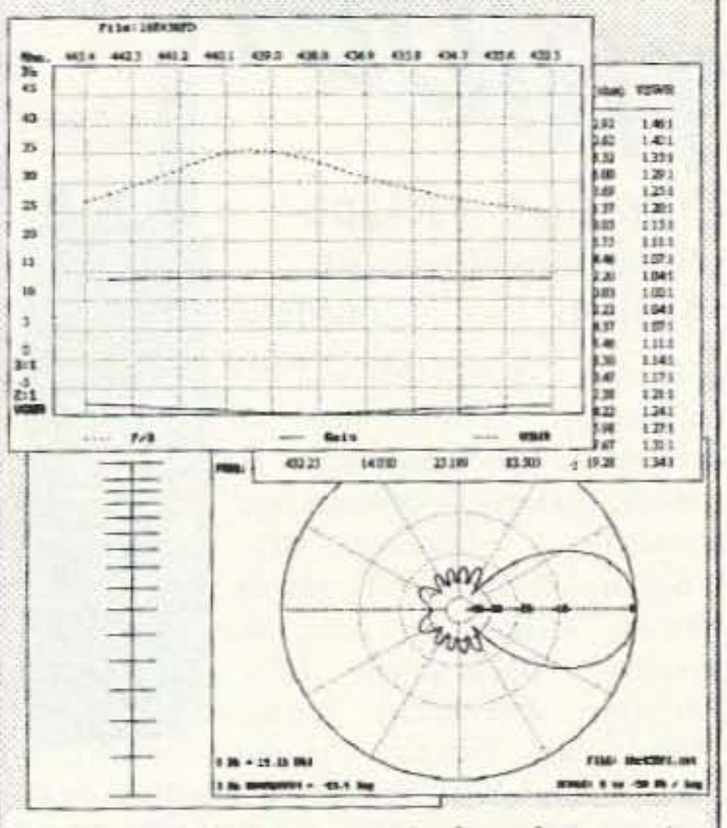

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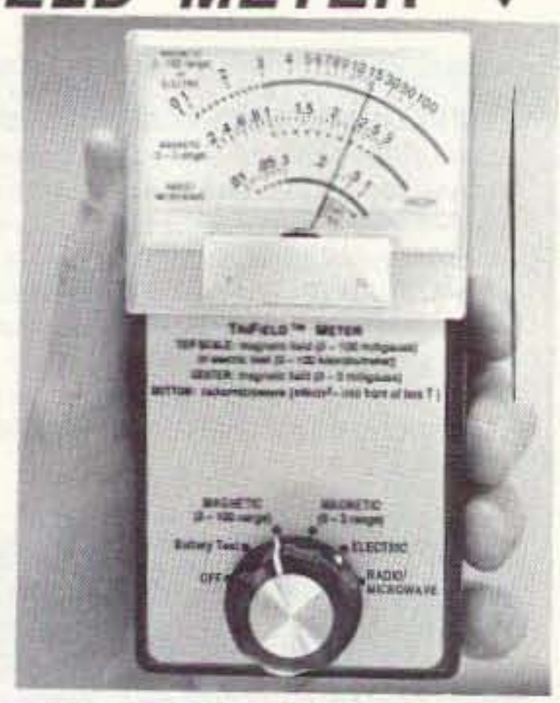

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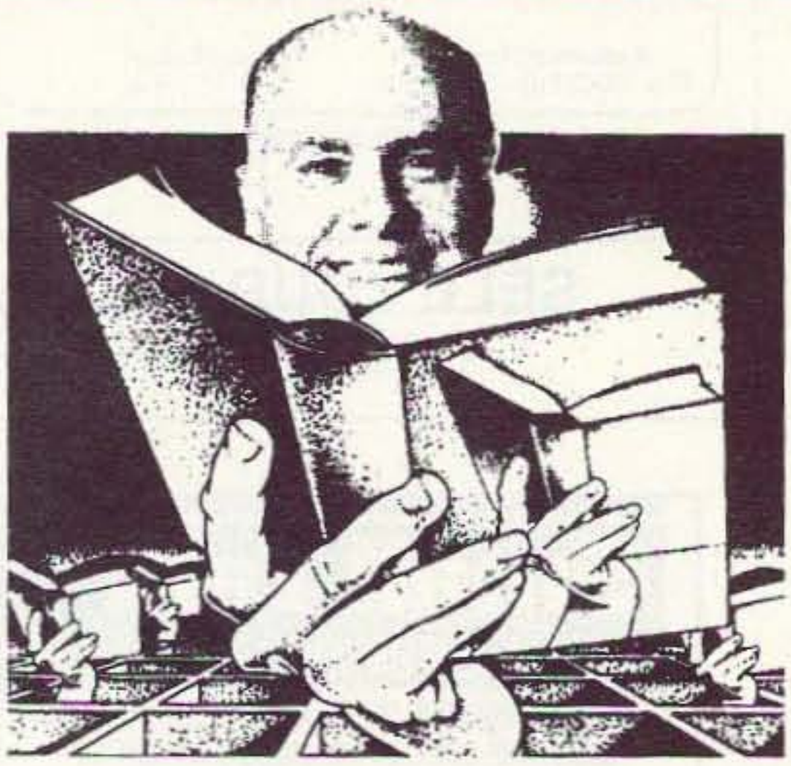

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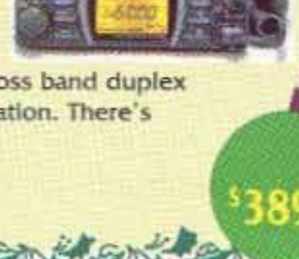

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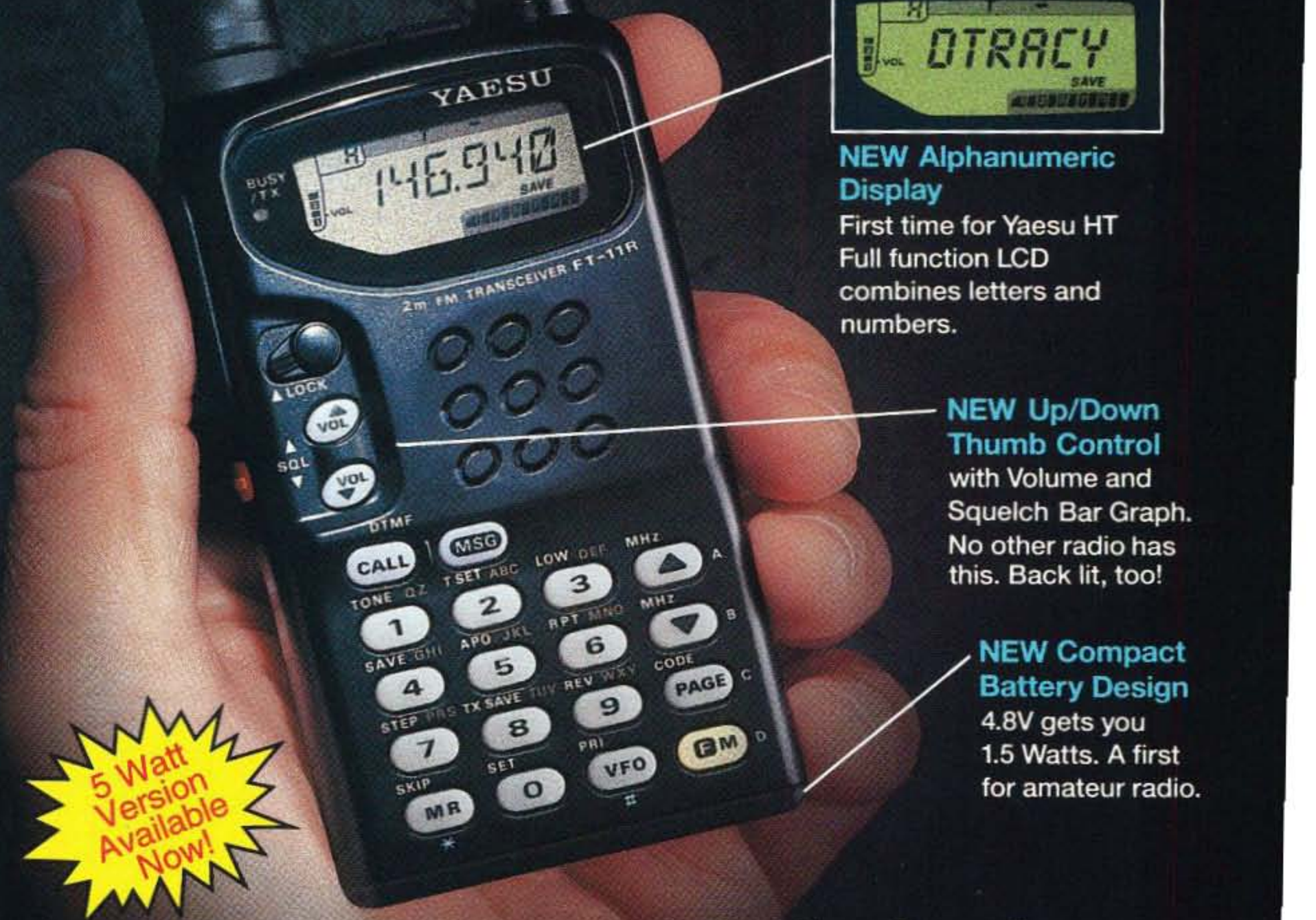

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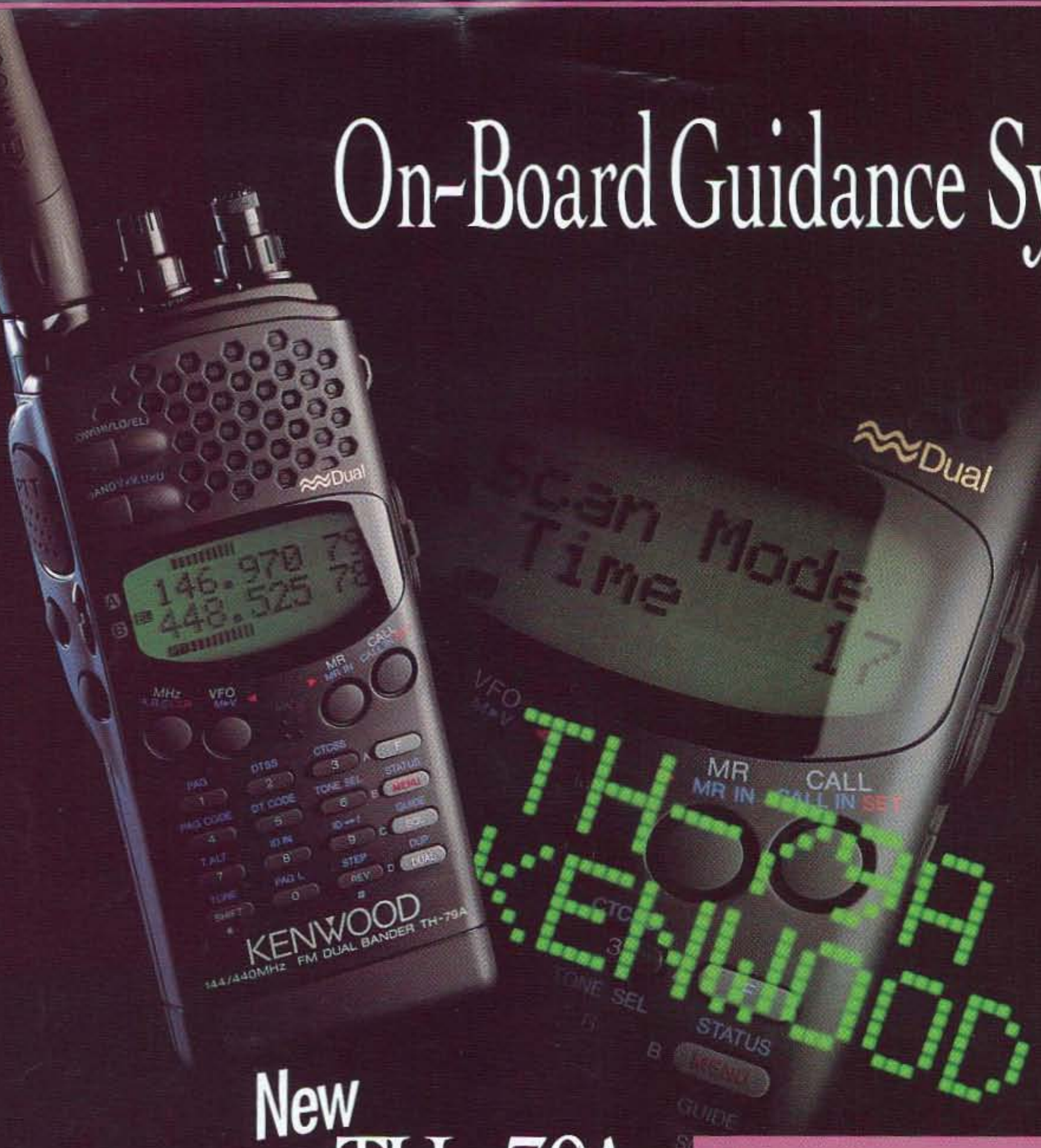

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