NOVEMBER 2000
ISSUE #480
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THE NEW!

73® Amateur Radio Today

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- 80m Fox QRP Tx
- Digital Voltmeter

REVIEWS
- Drake SW1 Rx
- Ten-Tec BFO Kit

COVER
- Hy-Gain TH-7DX
- MFJ-269

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DR-135TP. Two Meters. Features Not Seen Before.

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Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Hancock Rd.
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA

NOVEMBER 2000
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THE NEW! 73 Amateur Radio Today

TABLE OF CONTENTS

FEATURES

REVIEW

DEPARTMENTS

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QRX . . .

Restructuring: General and Extra Class Skyrocket

The number of people who have upgraded as a direct result of restructuring the United States Amateur service has skyrocketed. So says the keeper of the numbers, Fred Maia W5YI.

Maia, who operates the W5YI VEC, says that while the total number of radio amateurs has only increased one half of one percent since restructuring was introduced last spring, in the area of upgrades the numbers are startling. For example: There are now just over 15,000 more Extra class hams than a year ago. That's an increase of a solid 20 percent. And the General class is up by nearly

Continued on page 6

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 Hancock Rd., Peterborough NH 03458-1107. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 Hancock Rd., Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

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SS-10	7	10	1⅛ x 6 x 9	3.2
SS-12	10	12	1⅜ x 6 x 9	3.4
SS-18	15	18	1⅜ x 6 x 9	3.6
SS-25	20	25	2⅞ x 7 x 9⅜	4.2
SS-30	25	30	3¼ x 7 x 9⅝	5.0

MODEL SS-25M

DESKTOP SWITCHING POWER SUPPLIES WITH VOLT AND AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SS-25M*	20	25	2⅞ x 7 x 9⅜	4.2
SS-30M*	25	30	3¼ x 7 x 9⅝	5.0

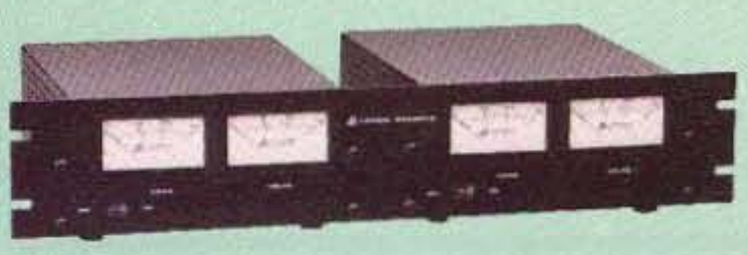
MODEL SRM-30

RACKMOUNT SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25	20	25	3½ x 19 x 9⅜	6.5
SRM-30	25	30	3½ x 19 x 9⅝	7.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M	20	25	3½ x 19 x 9⅜	6.5
SRM-30M	25	30	3½ x 19 x 9⅝	7.0



MODEL SRM-30M-2

2 ea SWITCHING POWER SUPPLIES ON ONE RACK PANEL

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25-2	20	25	3½ x 19 x 9⅜	10.5
SRM-30-2	25	30	3½ x 19 x 9⅝	11.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M-2	20	25	3½ x 19 x 9⅜	10.5
SRM-30M-2	25	30	3½ x 19 x 9⅝	11.0

MODEL SS-12SM/GTX

MODEL SS-10EFJ-98

CUSTOM POWER SUPPLIES FOR RADIOS BELOW

EF JOHNSON AVENGER GX-MC41
EF JOHNSON AVENGER GX-MC42
EF JOHNSON GT-ML81
EF JOHNSON GT-ML83
EF JOHNSON 9800 SERIES
GE MARC SERIES
GE MONOGRAM SERIES & MAXON SM-4000 SERIES
ICOM IC-F11020 & IC-F2020
KENWOOD TK760, 762, 840, 860, 940, 941
KENWOOD TK760H, 762H
MOTOROLA LOW POWER SM50, SM120, & GTX
MOTOROLA HIGH POWER SM50, SM120, & GTX
MOTOROLA RADIUS & GM 300
MOTOROLA RADIUS & GM 300
MOTOROLA RADIUS & GM 300
UNIDEN SMH1525, SMU4525
VERTEX — FTL-1011, FT-1011, FT-2011, FT-7011

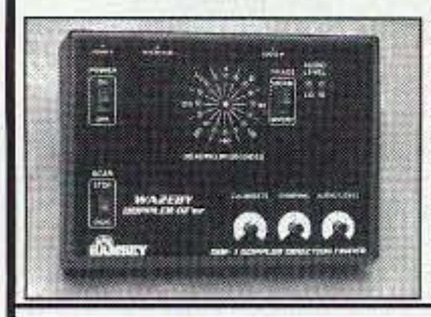
NEW SWITCHING MODELS

SS-10GX, SS-12GX
SS-18GX
SS-12EFJ
SS-18EFJ
SS-10-EFJ-98, SS-12-EFJ-98, SS-18-EFJ-98
SS-12MC
SS-10MG, SS-12MG
SS-101F, SS-121F
SS-10TK
SS-12TK OR SS-18TK
SS-10SM/GTX
SS-10SM/GTX, SS-12SM/GTX, SS-18SM/GTX
SS-10RA
SS-12RA
SS-18RA
SS-10SMU, SS-12SMU, SS-18SMU
SS-10V, SS-12V, SS-18V

*ICS – Intermittent Communication Service

RAMSEY

Doppler Direction Finder



Track down jammers and hidden transmitters with ease! This is the famous WA2EBY DF'er featured in April 99 QST. Shows direct bearing to transmitter on compass style LED display, easy to hook up to any FM receiver. The transmitter - the object of your DF'ing - need not be FM, it can be AM, FM or CW. Easily connects to receiver's speaker jack and antenna, unit runs on 12 VDC. We even include 4 handy home-brew "mag mount" antennas and cable for quick set up and operation! Whips can be cut and optimized for any frequency from 130-1000 MHz. Track down that jammer, win that fox hunt, zero in on that downed Cessna - this is an easy to build, reliable kit that compares most favorably to commercial units costing upwards of $1000.00! This is a neat kit!!

DDF-1, Doppler Direction Finder Kit $149.95

1 GHz RF Signal Generator

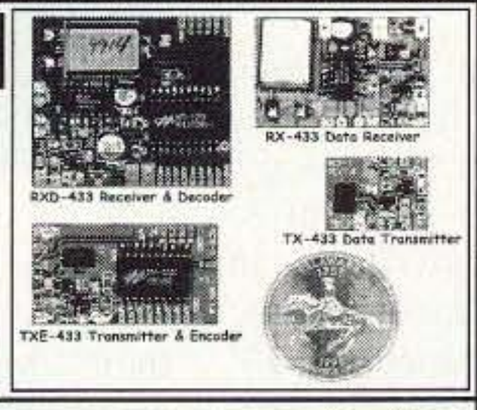
A super price on a full featured RF signal generator! Covers 100 KHz to 999.99999 MHz in 10 Hz steps. Tons of features; calibrated AM and FM modulation, 90 front panel memories, built-in RS-232 interface, +10 to -130 dBm output and more! Fast and easy to use, its big bright vacuum florescent display can be read from anywhere on the bench and the handy 'smart-knob' has great analog feel and is intelligently enabled when entering or changing parameters in any field – a real time saver! All functions can be continuously varied without the need for a shift or second function key. In short, this is the generator you'll want on your bench, you won't find a harder working RF signal generator - and you'll save almost $3,000 over competitive units!

RSG-1000B RF Signal Generator $1995.00

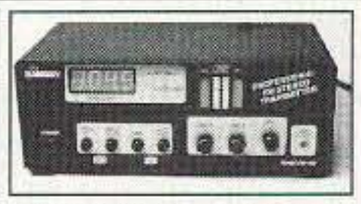
Wireless RF Data Link Modules

RF link boards are perfect for any wireless control application; alarms, data transmission, electronic monitoring...you name it. Very stable SAW resonator transmitter, crystal controlled receiver - no frequency drift! Range up to 600 feet, license free 433 MHz band. Encoder/decoder units have 12 bit Holtek HT-12 series chips allowing multiple units all individually addressable, see web site for full details. Super small size - that's a quarter in the picture! Run on 3-12 VDC. Fully wired and tested, ready to go and easy to use!

RX-433 Data Receiver..... $16.95 TX-433 Data Transmitter..... $14.95
RXD-433 Receiver/Decoder..... $21.95 TXE-433 Transmitter/Encoder..... $19.95



Super Pro FM Stereo Transmitter



Professional synthesized FM Stereo station in easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set freq with Up/Down buttons, big LED display. Input low pass filter gives great sound (no more squeals or swishing from cheap CD inputs!) Limiters for max 'punch' in audio - without over mod, LED meters to easily set audio levels, built-in mixer with mike, line level inputs. Churches, drive-ins, schools, colleges find the FM-100 the answer to their transmitting needs, you will too. Great features, great price! Kit includes cabinet, whip antenna, 120 VAC supply. *We also offer a high power export version of the FM-100 fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped if accompanied by a signed statement that the unit will be exported.*

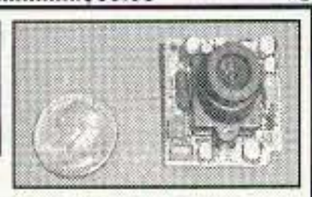
FM-100, Pro FM Stereo Transmitter Kit $249.95
FM-100WT, Fully Wired High Power FM-100..... $399.95

World's Smallest TV Transmitters

We call them the 'Cubes'.... Perfect video transmission from a transmitter you can hide under a quarter and only as thick as a stack of four pennies - that's a nickel in the picture! Transmits color or B&W with fantastic quality - almost like a direct wired connection to any TV tuned to cable channel 59. Crystal controlled for no frequency drift with performance that equals models that cost hundreds more! Basic 20 mW model transmits up to 300' while the high power 100 mW unit goes up to 1/4 mile. Their very light weight and size make them ideal for balloon and rocket launches, R/C models, robots - you name it! Units run on 9 volts and hook-up to most any CCD camera or standard video source. In fact, all of our cameras have been tested to mate perfectly with our Cubes and work great. Fully assembled - just hook-up power and you're on the air! One customer even put one on his dog!

C-2000, Basic Video Transmitter.....$89.95 C-2001, High Power Video Transmitter...$179.95

CCD Video Cameras



Top quality Japanese Class 'A' CCD array, over 440 line line resolution, not the off-spec arrays that are found on many other cameras. Don't be fooled by the cheap CMOS single chip cameras which have 1/2 the resolution, 1/4 the light sensitivity and draw over twice the current! The black & white models are also super IR (Infra-Red) sensitive. Add our invisible to the eye, IR-1 illuminator kit to see in the dark! Color camera has Auto gain, white balance, Back Light Compensation and DSP! Available with Wide-angle (80°) or super slim Pin-hole style lens. Run on 9 VDC, standard 1 volt p-p video. Use our transmitters for wireless transmission to TV set, or add our IB-1 Interface board kit for super easy direct wire hook-up to any Video monitor, VCR or TV with A/V input. Fully assembled, with pre-wired connector.

CCDWA-2, B&W CCD Camera, wide-angle lens $69.95
CCDPH-2, B&W CCD Camera, slim fit pin-hole lens.. $69.95
CCDCC-1, Color CCD Camera, wide-angle lens $129.95
IR-1, IR Illuminator Kit for B&W cameras $24.95
IB-1, Interface Board Kit $14.95

AM Radio Transmitter

Operates in standard AM broadcast band. Pro version, AM-25, is synthesized for stable, no-drift frequency and is setable for high power output where regulations allow, typical range of 1-2 miles. Entry-level AM-1 is tunable, runs FCC maximum 100 mW, range 1/4 mile. Both accept line-level inputs from tape decks, CD players or mike mixers, run on 12 volts DC. Pro AM-25 includes AC power adapter, matching case and bottom loaded wire antenna. Entry-level AM-1 has an available matching case and knob set that dresses up the unit. Great sound, easy to build - you can be on the air in an evening!

AM-25, Professional AM Transmitter Kit..... $129.95
AM-1, Entry level AM Radio Transmitter Kit... $29.95
CAM, Matching Case Set for AM-1..... $14.95

FM Stereo Radio Transmitters

No drift, microprocessor synthesized! Great audio quality, connect to CD player, tape deck or mike mixer and you're on-the-air. Strapable for high or low power! Runs on 12 VDC or 120 VAC. Kit includes snazzy case, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized Stereo Transmitter Kit $129.95

Lower cost alternative to our high performance transmitters. Great value, easily tunable, fun to build. Manual goes into great detail about antennas, range and FCC rules. Handy for sending music thru house and yard, ideal for school projects too - you'll be amazed at the exceptional audio quality! Runs on 9V battery or 5 to 15 VDC. Add matching case and whip antenna set for nice 'pro' look.

FM-10A, Tunable FM Stereo Transmitter Kit..... $34.95
CFM, Matching Case and Antenna Set $14.95
FMAC, 12 Volt DC Wall Plug Adapter..... $9.95

Mini Radio Receivers

Imagine the fun of tuning into aircraft a hundred miles away, the local police/fire department, ham operators, or how about Radio Moscow or the BBC in London? Now imagine doing this on a little radio you built yourself - in just an evening! These popular little receivers are the nuts for catching all the action on the local ham, aircraft, standard FM broadcast radio, shortwave or WWV National Time Standard radio bands. Pick the receiver of your choice, each easy to build, sensitive receiver has plenty of crystal clear audio to drive any speaker or earphone. Easy one evening assembly, run on 9 volt battery, all have squelch except for shortwave and FM broadcast receiver which has subcarrier output for hook-up to our SCA adapter. The SCA-1 will tune in commercial-free music and other 'hidden' special services when connected to FM receiver. Add our snazzy matching case and knob set for that smart finished look!

AR-1, Airband 108-136 MHz Kit..... $29.95
HFRC-1, WWV 10 MHz (crystal controlled) Kit..... $34.95
FR-1, FM Broadcast Band 88-108 MHz Kit..... $24.95
SR-1, Shortwave 4-11 MHz Band Kit $29.95
SCA-1 SCA Subcarrier Adapter kit for FM radio.... $27.95
FR-6, 6 Meter FM Ham Band Kit $34.95
FR-10, 10 Meter FM Ham Band Kit..... $34.95
FR-146, 2 Meter FM Ham Band Kit..... $34.95
FR-220, 220 MHz FM Ham Band Kit..... $34.95
Matching Case Set (specify for which kit) $14.95

RF Power Booster

Add muscle to your signal, boost power up to 1 watt over a freq range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM transmitters, providing radio service through an entire town. Runs on 12 VDC. For a neat finished look, add the nice matching case set. Outdoor unit attaches right at the antenna for best signal - receiving or transmitting, weatherproof, too!

LPA-1, Power Booster Amplifier Kit $39.95
CLPA, Matching Case Set for LPA-1 Kit $14.95
LPA-1WT, Fully Wired LPA-1 with Case $99.95
FMBA-1, Outdoor Mast Mount Version of LPA-1 ..... $59.95

PIC-Pro Pic Chip Programmer

Easy to use programmer for the PIC16C84, 16F84, 16F83 microcontrollers by Microchip. All software - editor, assembler, run and program - as well as free updates available on Ramsey download site! This is the popular unit designed by Michael Covington and featured in Electronics Now, September 1998. Connects to your parallel port and includes the great looking matching case, knob set and AC power supply. Start programming those really neat microcontrollers now...order your PICPRO today!

PIC-1, PICPRO PIC Chip Programmer Kit $59.95

FM Station Antennas

For maximum performance, a good antenna is needed. Choose our very popular dipole kit or the Comet, a factory made 5/8 wave colinear model with 3.4 dB gain. Both work great with any FM receiver or transmitter.

TM-100, FM Antenna Kit $39.95
FMA-200, Vertical Antenna $114.95

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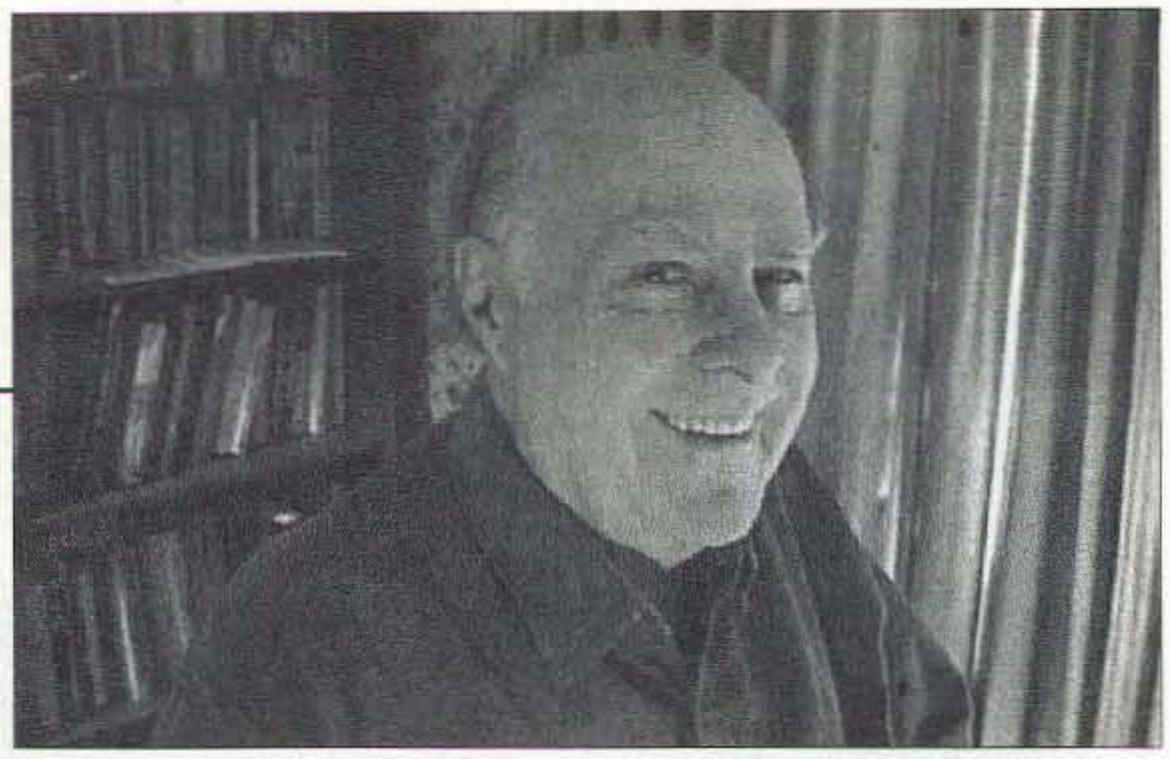

Mired

Some of us are mired in the past, most are mired in the present, and a few raise their mental eyes, looking at the future. Which explains why so few people have been able to take advantage of the opportunities that the future has offered.

We've been through some major technological changes in amateur radio. In the 1920s, we went from spark to CW, with the "Spark Forever" group fighting change to the last ditch. Then came the change from MOPA to crystal control in the early 1930s. On VHF, we went from superregenerative receivers to superhets, and from modulated oscillators to crystal control in the 1940s. Old-timers around Brooklyn still remember Oscar W2KU's half-kilowatt modulated oscillator, which took up a large part of the 2m band in the late '40s.

In the '50s, we had the SSB/AM battle, with W2OY making a memorable nuisance of himself fighting SSB. RTTY made it to the HF bands, despite every dirty trick the ARRL could think of to stop it. They were afraid that RTTY would obsolete their National Traffic System (NTS), which had hundreds of amateurs spending their evenings relaying thousands of inconsequential messages by CW around the country, making like Western Union offices. Well, that was the basis for the American Radio Relay League — relaying. Will someone check *QST* and see if the Brass Pounder's League is still in operation? Maybe one of you historians will write an article about the NTS and BPL.

We've put up some ham satellites, but we haven't gone very far with that technology, so not much has come of it. We tried fast- and slow-scan TV, but we ran into the same problem as commercial TV — a lack of interesting programming. How many *Playboy* pictures do you want to watch slowly scroll down your screen?

In the early 1970s, 2m came alive when NBFM and repeaters got going. Our repeater technology soon attracted the interest of Motorola and GE, bringing the public cell phones, which are now slowly frying the brains of people all around the world.

Computers, first introduced in 1975, had us sending packet messages, and making RTTY possible without having to get an obsolete Teletype machine.

The almost total destruction of the American ham industry and most of the school radio clubs by the ARRL's so-called Incentive Licensing disaster in the mid-'60s may help explain why the development of new communications technologies by hams has gone almost nowhere in the last 25 years. Inventing and pioneering are young man's games, and our source of young hams, the school radio clubs, were killed off by the League. Thanks.

I've discussed several new technologies in my columns which could be very profitably developed, but I haven't seen signs of any readers picking up the ball on them.

2020?

Blow the dust off your word processor and let's see what you predict for amateur radio in the year 2020. Will we have any new modes by then? More ham satellites? Ties with the Internet? Will we still need DXpeditions? Will we even have amateur radio?

Are there any new technologies we can help pioneer?

While I expect to see less and less commercial (and military) interest in the HF spectrum, I'll be surprised if we're not squeezed out of our microwave bands. Between fiber optic systems and satellites, the commercial world is trying to cope with the ever increasing need for communication bandwidth.

It started with smoke signals, then flashing lights and the Pony Express. Then came the telegraph and radio — starting with spark. Now we're sending TV over the Internet!

What bands do you think we'll still have by 2020, and what modes will we be using?

Since amateur radio is no longer of the slightest interest to the military, either as a source of operators or technicians, or even as a way to reserve frequencies for use in time of war, we've lost a powerful ally, while gaining no friends.

Let's see what you can come up with. Yes, please include a disk copy.

Messing with the Green Man

The success of my guesting on the Coast To Coast AM show (the old Art Bell W6OBB show), got me a call from the producer of a show on shortwave station WWCR 5070, out of Nashville. Sure, I'll be a guest, I enjoy being on shows where I can talk about the excitement and adventure that amateur radio can provide.

The show is on from 11 to 12 Saturday nights (EST), so they called me at 11 and I listened to the two hosts, Stan Olochwoszcz N2AYJ and Mark Emanuele N2CBO, waiting to be introduced. Instead, they joked with each other, about things of little possible interest to any listeners. After 15 minutes of this, there was a commercial break and then they introduced me, but I had a hard time getting anything in between their interruptions. Then came another commercial break, after which they opened the phone for callers to ask questions. A few minutes later, the program was over. What a ridiculous waste of time!

I called the producer and told him what I thought of his hosts, and in particular Stan, who just didn't seem to be able to shut up.

A few days later the producer called and asked if I'd come back on the next Saturday night if I could be my own host and run the show. Well, okay, I'll give it a try. He faxed me an outline of the topics he suggested I cover. It looked good to me.

At 11 I was on the phone again, ready to go. But instead, there were Stan and Mark, talking about their RVs for fifteen minutes. Then, after a few commercials, Stan

Continued on page 61

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NEW! RELM® MPV32-A Transceiver

Mfg. suggested list price $515.00/**Special $299.95**

Looking for a great hand-held two-way transceiver? Fire departments depend on the RELM MPV32 transceiver for direct two-way communications with their fire or police department, civil defense agency or ham radio repeater. The MPV32 is our most popular programmable frequency agile five watt, 32 channel handheld transceiver that has built-in CTCSS. This feature may be programmed for any 50 standard EIA tones. Frequency range 136.000 to 174.000 MHz. The full function, DTMF compatible keypad also allows for DTMF Encode/Decode and programmable ANI. Weighing only 15.5 oz., it features programmable synthesized frequencies either simplex or half duplex in 2.5 KHz. increments. Other features include PC programming and cloning capabilities, scan list, priority channel, selectable scan delay, selectable 5 watt/1 watt power levels, liquid crystal display, time-out timer and much more. When you order the MPV32 from CEI, you'll get a complete package deal including antenna, 700 ma battery (add $20.00 to substitute a 1000 ma battery), battery charger, belt clip and user operating instructions. Other useful accessories are available. A heavy duty leather carrying case with swivel belt loop part **#LCMP** is $49.95; rapid charge battery charger, part **#BCMP** is $69.95; speaker/microphone, part **#SMMP** is $54.95; extra high capacity 1000 ma. ni-cad battery pack, part **#BPMP1** is $79.95; extra 700 ma. ni-cad battery pack, part **#BPMP7** is $59.95; cloning cable part **#CCMP** is $34.95; PC programming kit, part **#PCKIT030** is $224.95. A UHF version with a frequency range of 450-480 MHz. part **#MPU32** is on special for $299.95. Your RELM radio transceiver is ideal for many different applications since it can be programmed with just a screwdriver and programming instructions in less than 10 minutes. Programming is even faster with the optional PC kit. The programming instructions part **#PIMPV** is $19.00. Call 1-800-USA-SCAN to order for RELM radios.

Bearcat® 895XLT-A1 Radio Scanner

Mfg. suggested list price $729.95/**Special $194.95**

300 Channels • 10 banks • Built-in CTCSS • S Meter

Size: 10-1/2" Wide x 7-1/2" Deep x 3-3/8" High

Frequency Coverage: 29.000-54.000 MHz., 108.000-174 MHz., 216.000-512.000 MHz., 806.000-823.995 MHz., 849.0125–868.995 MHz., 894.0125-956.000 MHz.

The Bearcat 895XLT is superb for intercepting trunked communications transmissions with features like TurboScan™ to search VHF channels at 100 steps per second. This base and mobile scanner is also ideal for intelligence professionals because it has a Signal Strength Meter, RS232C Port to allow computer-control of your scanner via optional hardware and 30 trunking channel indicator annunciators to show you real-time trunking activity for an entire trunking system. Other features include ***Auto Store*** – Automatically stores all active frequencies within the specified bank(s). ***Auto Recording*** – This feature lets you record channel activity from the scanner onto a tape recorder. ***CTCSS Tone Board*** (Continuous Tone Control Squelch System) which allows the squelch to be broken during scanning only when a correct CTCSS tone is received. For maximum scanning enjoyment, order the following optional accessories: **PS001** Cigarette lighter power cord $14.95; **PS002** DC power cord - enables permanent operation from your vehicle's fuse box $14.95; **MB001** Mobile mounting bracket $14.95; **EX711** External speaker with mounting bracket & ten feet of cable with plug attached $19.95. The BC895XLT comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden factory warranty. Not compatible with AGEIS, ASTRO, EDACS, ESAS or LTR systems. Call 1-800-USA-SCAN.

TrunkTracking Radio

DISTRIBUTOR'S COUPON | EXPIRES 10/30/00 | #000772

SAVE $75 on one BC245XLT

Save $75 when you purchase your Bearcat 245XLT handheld scanner directly from Communications Electronics Inc., PO Box 1045, Ann Arbor MI 48106 USA. Telephone orders accepted. Call 1-800-USA-SCAN. Mention offer CEI2. TERMS: Good only in USA & Canada. Only one coupon is redeemable per purchase and only on specified product.

Bearcat® 245XLT-A TrunkTracker

Mfg. suggested list price $429.95/**CEI price $269.95**

300 Channels • 10 banks • Trunk Scan and Scan Lists
Trunk Lockout • Trunk Delay • Cloning Capability
10 Priority Channels • Programmed Service Search
Size: 2-1/2" Wide x 1-3/4" Deep x 6" High

Frequency Coverage:
29.000-54,000 MHz., 108-174 MHz., 406-512 MHz., 806-823.995 MHz., 849.0125–868.995 MHz., 894.0125-956.000 MHz.

Our new Bearcat TrunkTracker BC245XLT, is the world's first scanner designed to track Motorola Type I, Type II, Hybrid, SMARTNET, PRIVACY PLUS and EDACS® analog trunking systems on any band. Now, follow UHF High Band, UHF 800/900 MHz trunked public safety and public service systems just as if conventional two-way communications were used. Our scanner offers many new benefits such as **Multi-Track** – Track more than one trunking system at a time and scan conventional and trunked systems at the same time. **300 Channels** – Program one frequency into each channel. **12 Bands, 10 Banks** – Includes 12 bands, with Aircraft and 800 MHz. 10 banks with 30 channels each are useful for storing similar frequencies to maintain faster scanning cycles or for storing all the frequencies of a trunked system. **Smart Scanner** – Automatically program your BC245XLT with all the frequencies and trunking talk groups for your local area by accessing the Bearcat national database with your PC. If you do not have a PC simply use an external modem. **Turbo Search** – Increases the search speed to 300 steps per second when monitoring frequency bands with 5 KHz. steps. **10 Priority Channels** – You can assign one priority channel in each bank. Assigning a priority channel allows you to keep track of activity on your most important channels while monitoring other channels for transmissions. **Preprogrammed Service (SVC) Search** – Allows you to toggle through preprogrammed police, fire/emergency, railroad, aircraft, marine, and weather frequencies. **Unique Data Skip** – Allows your scanner to skip unwanted data transmissions and reduces unwanted birdies. **Memory Backup** – If the battery completely discharges or if power is disconnected, the frequencies programmed in your scanner are retained in memory. **Manual Channel Access** – Go directly to any channel. **LCD Back Light** – An LCD light remains on for 15 seconds when the back light key is pressed. **Autolight** – Automatically turns the backlight on when your scanner stops on a transmission. **Battery Save** – In manual mode, the BC245XLT automatically reduces its power requirements to extend the battery's charge. **Attenuator** – Reduces the signal strength to help prevent signal overload. The BC245XLT also works as a conventional scanner. Now it's easy to continuously monitor many radio conversations even though the message is switching frequencies. The BC245XLT comes with AC adapter, one rechargeable long life ni-cad battery pack, belt clip, flexible rubber antenna, earphone, RS232C cable, Trunk Tracker frequency guide, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO, ESAS or LTR systems. Hear more action on your radio scanner today. Call CEI today at 1-800-USA-SCAN to order your BC245XLT radio scanner.

WX/VHF/CB Radios

Have fun and use our CB, shortwave and commercial radios to keep in touch with the world, friends and family.

Cobra 148GTL-A3 SSB CB/SPECIAL	$114.95
Maxon HCB40WX handheld CB with 10 weather ch.	$69.95
Davis 7440CS-A Complete weather station	$419.95
RELM SMV4099W-A 40 watt VHF mobile transceiver	$349.95
Uniden GRANTXL-A SSB CB Mobile	$124.95
Sangean ATS909-A shortwave receiver	$229.95
Sangean ATS818CS-A shortwave receiver	$199.95
Sangean ATS404-A shortwave receiver	$79.95

Radio Scanners

AOR8200B-A wideband handheld scanner/SPECIAL	$519.95
AOR5000B+3-A wideband communications receiver	$2,089.95
AOR3000A-A wideband base/mobile scanner/SPECIAL	$1,049.95
AOR AR16BQ wideband handheld scanner w/ quick charge	$209.95
Bearcat 895XLT-A1 300 ch.TrunkTracker base scanner	$194.95
Bearcat 780XLT Reserve yours now at http://www.usascan.com	
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Bearcat 248CLT-A 50 ch.base AM/FM/weather alert scanner	$99.95
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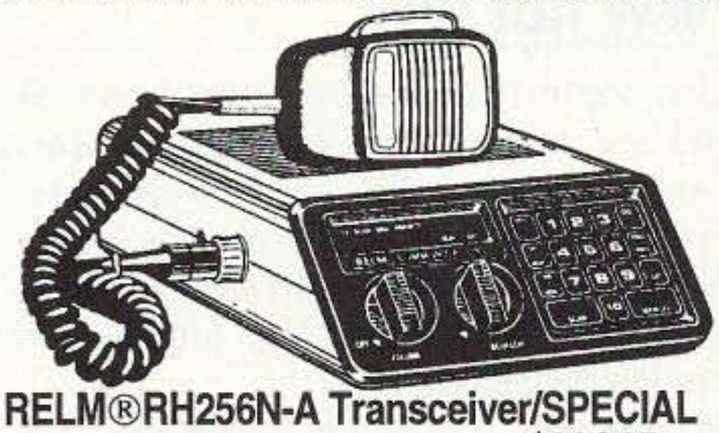
Bearcat 60XLT1-A 30 channel handheld scanner	$79.95
Bearcat BCT7-A information mobile scanner	$149.95
ICOM ICR8500-A2 wideband communications receiver	$1,479.95
ICOM PCR1000-A2 computer communications scanner	$329.95
ICOM ICR75-A2 communications receiver	$664.95
ICOM R10-A2 handheld wideband communications receiver	$289.95



RELM® RH256N-A Transceiver/SPECIAL

Mfg. suggested list price $460.00/**Special $284.95**

Size: 6-1/2" Wide x 10-3/4" Deep x 2-3/4" High

Frequency Coverage: **144.000-174.000 MHz.**

Now...everyone can have their own RELM two-way transceiver and stay in touch with their department. The RELM RH256N is a powerful 25 Watt scanning transceiver that is perfect for law enforcement, fire and urban search and rescue agencies. The RH256N is programmable for up to sixteen different frequencies with selectable CTCSS tones on each channel. Also includes simplex and repeater capability, scan delay and time-out timer. Built-in priority scanner is selectable from the slope-front panel. When you order the RH256N from CEI, you'll get a complete package deal including microphone, vehicle mounting bracket, DC power cords and RELM's two year limited warranty. You can also use the RH256N as a base station if you order our 22 amp 12 Volt DC power supply part **#PS26KX** for $94.95 and $25.00 shipping. VHF transmitting antenna with PL259 connector part **#ANTK** is $29.95. Programming instructions part **#PI256** is $19.00.

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It's easy to order from us. **Mail orders to**: Communications Electronics Inc., P.O. Box 1045, Ann Arbor, Michigan 48106 USA. Add $20.00 per weather station or radio product for UPS ground shipping, handling and insurance to the continental USA unless otherwise stated. Add $13.00 shipping for all accessories and publications. Add $13.00 shipping per antenna. For Canada, Puerto Rico, Hawaii, Alaska, Guam, P.O. Box or APO/FPO delivery, shipping charges are two times continental US rates. Michigan residents add state sales tax. No COD's. Satisfaction guaranteed or return item in unused condition in original packaging within 61 days for refund, less shipping charges. 10% surcharge for net 10 billing to qualified accounts. All sales are subject to availability, acceptance and verification. Prices, terms and specifications are subject to change without notice. We welcome your Discover, Visa, American Express, MasterCard, IMPAC or Eurocard. Call anytime 1-800-USA-SCAN or 800-872-7226 to order toll-free. Call 734-996-8888 if outside Canada or the USA. FAX anytime, dial 734-663-8888. Dealer and international inquiries invited. Order from Communications Electronics Inc. today and save.

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QRX . . .

continued from page 1

18,000. That's just a bit more than 33,000 upgrades.

Maia notes that the increase in these two license classes is a direct result of the elimination of the 13- and 20-word-per-minute Morse tests. It has also resulted in a diminished number of hams holding the Tech Plus and Advanced class tickets.

Thanks to W5YI, via Newsline, *Bill Pasternak WA6ITF, editor.*

The Internet: WWW not WW

Only one in 20 people around the world are online, and close to 60 percent of Internet users live in North America. This, even though the region accounts for just five percent of the world's population. In Africa, there are a mere 14 million phone lines. That is fewer than are found in either Manhattan or Tokyo.

But even in North America, the Internet is not within the reach of everyone. The research firm Jupiter Communications, Inc., says there are yawning Internet-use gaps in the U.S. between high-income and low-income households, ethnic groups, and age groups. According to Jupiter, sixty percent more white households in the U.S. are online than African-American households, and the elderly account for only sixteen percent of the country's Internet-user community.

While many of these gaps are expected to close in a few years, Internet content is still likely to target well-heeled, well-educated, and mostly English speakers, because of advertising and e-commerce.

Thanks to Internet Futures *newsletter, via* Newsline, *Bill Pasternak WA6ITF, editor.*

Sub Standard

The Port City ARC, located in Portsmouth NH, set up a ham radio station on the USS *Albacore* on Saturday, July 15th, and Sunday, July 16th, to join more than 50 others on military ships now set up as museums in a ham-radio operation dubbed the "Museum Ship Special Event."

This event was to commemorate those men and women who operated radios in the maritime service, as well as the maritime service in general. As noted, the Port City ARC operated a station onboard the USS *Albacore,* reviving her memory and honoring all those who worked and served on this experimental submarine. In fact, the USS *Albacore* is a National Historic Landmark, as well as a Historic Mechanical Engineering Landmark. Visitors to the Port of Portsmouth Maritime Museum and Albacore Park during those two days were able to observe the ham radio operators as they worked with both voice and Morse Code.

A few familiar names among the armada of ships were:

• Submarines — USS *Pampanito,* USS *Torsk,* USS *Croaker,* USS *Cod,* USS *Requin,* USS *Cavalla,* and USS *Drum* (where Wayne Green served during WWII).

• Destroyers — USS *The Sullivans,* USS *Kidd,* USS *Laffey,* USS *Slater,* HMCS *Haida.*

• Cruisers — USS *Salem,* USS *Little Rock,* HMS *Belfast.*

• Battleships — USS *Massachusetts,* USS *North Carolina,* USS *Alabama,* USS *Texas.*

• Aircraft carriers — USS *Yorktown,* USS *Lexington,* USS *Hornet.*

In addition, hams set up stations in and on museums associated with victory ships and freighters, frigates, mine sweepers and mine layers, lightships, sternwheelers, and even a salvage tug.

These ships are located throughout the United States as well as in other countries, including Canada, England, The Netherlands, Denmark, Sweden, Finland, and Germany.

Ham radio operators around the world earned certificates and awards by making contact with the highest number of these ships during that weekend. In addition, hams as well as shortwave listeners were able to request commemorative QSL cards from individual ships. All in all, this special event set a standard that future similar ones will be hard-pressed to meet.

The chief organizer of this event was the USS *Salem* Radio Club in Quincy MA. They operated with the distinguished callsign K1USN.

For extensive details about the Museum Ship Special Event amateur radio operation, see the Web site at [www.ziplink.net/~rcal/salem]. For information about the Port City ARC and its activities, check out the club's Web site at [www.qsl.net/pcarc/] or call (603) 427-1377.

Thanks to Daniel Sawyer W1PIE and the Port City (Portsmouth NH) ARC.

Motorola to Destroy Iridium Satellites

Now there's word that the bankrupt Iridium satellite communications system will be de-orbited and permitted to burn up in the Earth's atmosphere. This as Motorola announces plans to begin the destruction of its failed commercial satellite telephone system.

According to news reports, controllers may have already been given the go ahead to begin the de-orbiting process for the sixty-plus microsats. The exact timetable for the destruction of all of the tiny birds should be announced soon (if not already).

Continued on page 58

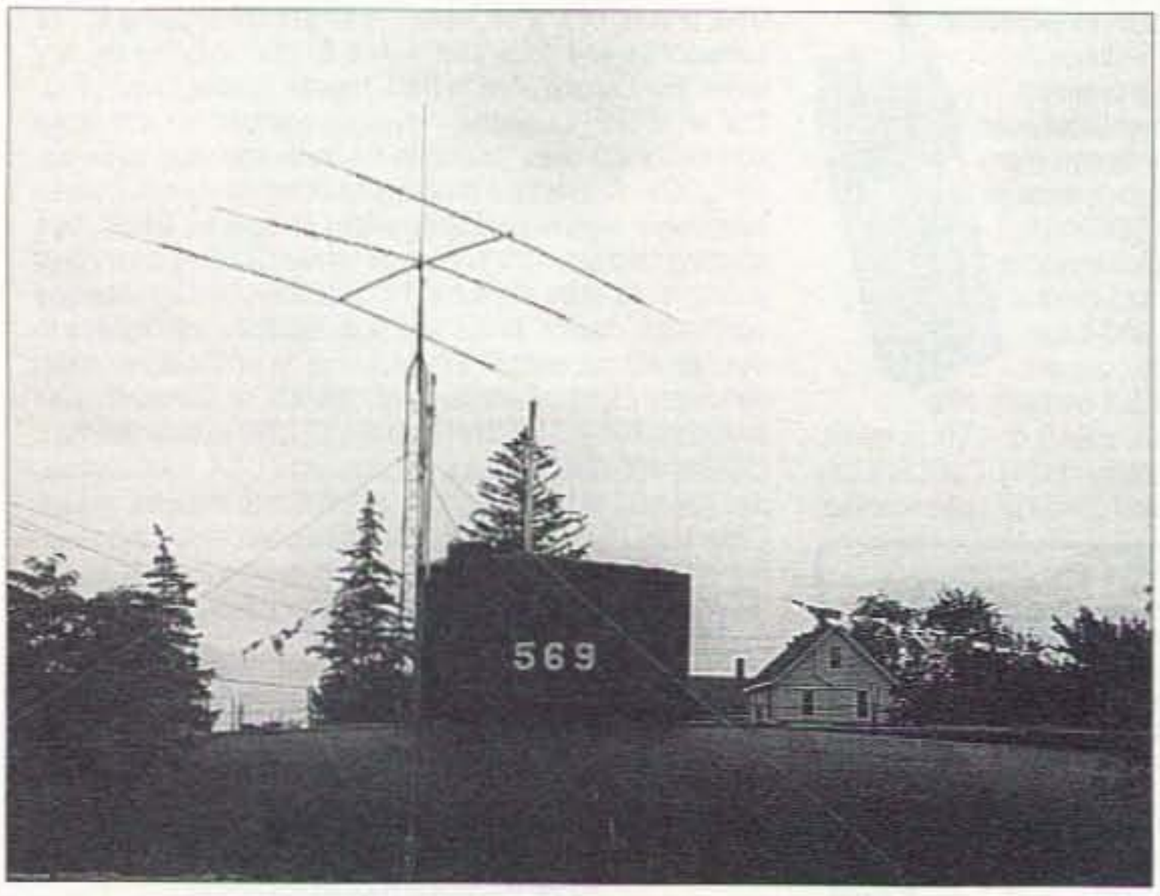


Photo A. *The 20-meter beam was erected near the submarine.*

Photo B. *Paul Schreier AA1MI operated from the sub's radio room. He and four other club members worked the two-day event to rack up 443 contacts under the club call W1WQM.*

MFJ TUNERS

MFJ-989C *Legal Limit* Antenna Tuner

MFJ uses super heavy duty components to make the world's finest legal limit tuner

MFJ uses super heavy duty components -- roller inductor, variable capacitors, antenna switch and balun -- to build the world's most popular high power antenna tuner.

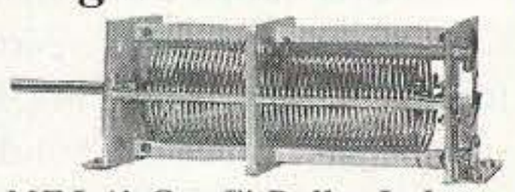
The rugged world famous MFJ-989C handles 3 KW PEP SSB amplifier input power (1500 Watts PEP SSB output power). Covers 1.8 to 30 MHz, including MARS and WARC bands.

MFJ's *AirCore*™ roller inductor, new *gear-driven* turns counter and weighted spinner knob gives you exact inductance control for absolute minimum SWR.

You can match dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave -- nearly any antenna. Use coax, random wire or balanced lines.

MFJ-989C
$359.95

You get everything you've ever wanted in a high power, full featured antenna tuner -- widest matching range, lighted Cross-Needle SWR/Wattmeter, massive transmitting variable capacitors, ceramic antenna switch, built-in dummy load, *TrueCurrent*™ Balun, *scratch-proof* Lexan front panel -- all in a sleek compact cabinet (10¾Wx4½Hx15D in).



MFJ AirCore*™ *Roller Inductor gives high-Q, low loss, high efficiency and high power handling.

MFJ's exclusive *Self-Resonance Killer*™ keeps damaging self-resonances away from your operating frequency.

Large, self-cleaning wiping contact gives good low-resistance connection. Solid 1/4 inch brass shaft, self-align bearings give smooth non-binding rotation.

MFJ *No Matter What*™ Warranty

MFJ will repair or replace your MFJ-989C (at our option) *no matter what* for one year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T*™

MFJ-986
$329.95

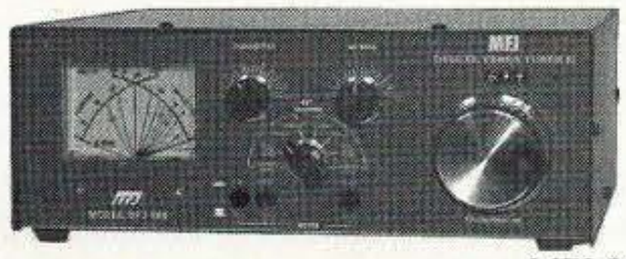
Two knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. 10¾Wx4½Hx15 in.

MFJ-962D *compact* Tuner for Amps

MFJ-962D
$269.95

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. 10¾x4½x10⅞ in.

MFJ-969 300W *Roller Inductor* Tuner



MFJ-969
$199.95

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. 3½Hx10½Wx9½D inches.

MFJ-949E *deluxe* 300 Watt Tuner

MFJ-949E
$149.95

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, 48 position *Precision48*™ inductor, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. 3½Hx10⅝Wx7D inches. **MFJ-948, $129.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

MFJ-941E
$129.95

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek 10½Wx2½Hx7D in.

MFJ-945E HF+6 Meter *mobile* Tuner

MFJ-945E
$119.95

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $4.95,** mobile mount.

MFJ-971 *portable/QRP* Tuner

MFJ-971
$99.95

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x6½x2½ inches.

MFJ-901B *smallest* Versa Tuner

MFJ-901B
$79.95

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-16010 *random* wire Tuner

MFJ-16010
$49.95

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 *6 Meter* Tuners

MFJ-906
$79.95

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $49.95,** Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921 or MFJ-924
$69.95

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

MFJ-922 *144/440 MHz* Tuner

MFJ-922
$79.95

Ultra tiny 4x2½x1¼ inch tuner covers VHF 136-175 MHz and UHF 420-460 MHz. SWR/Wattmeter reads 60/150 Watts.

MFJ-931 *artificial* RF Ground

MFJ-931
$89.95

Creates artificial RF ground. Also electrically places a far away RF ground directly at your rig by tuning out reactance of connecting wire. Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. **MFJ-934, $169.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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LETTERS

From the Ham Shack

G. William Forgey K7KDU, Lynnwood WA. I have been reading your magazine(s) now for over 40 years. From *CQ* to *73* to *VHFer* to *BYTE* to *KILOBAUD*, and like that. You are therefore in large part responsible for my technical education, bad attitude about government boondoggles, contempt for the ARRL "CW Forever" attitude, and tendency toward independent thought. Thank you. I never took the time to similarly thank John Campbell and I regret it. Thankfully, I did manage to let my old friend Don Stoner know how much I had learned from him before he tripped off this mortal coil. But I digress ...

It now seems that about 35 years after most cognizant beings had concluded that the ARRL "CW Forever" crowd were a group of irrational, elitist spoilsports, the FCC has finally come to the same conclusion. And now, to my everlasting amusement, I find that my despised Technician Class ticket, obtained through a volunteer examiner during my pre-1960 Navy days, has metamorphosed into a General Class by act of God. Sorry. Act of FCC. Kafka would be so proud of me.

Don't get me wrong. I love CW. Some of my best friends and relatives use it. But, as I told Stoner years ago, CW is like many other perversions: Best practiced in the dark. Alone.

It was wise of the FCC and ARRL to keep me with my lowly Technician Class ticket from enjoying (if that's the word) the HF spectrum all these years. My congenital disinterest in learning to copy CW at warp speed is obviously a sign that I am unfit, unclean, and perhaps too brain-damaged to be permitted to pollute the precious HF airways. I have had to console myself with the lesser thrills of designing and building communications equipment which ranges in frequency from 160 kHz to 24 GHz, digital toys to enhance my limited intellect (remember the Cosmac Elf?), and start a business or two in my garage.

Imagine, if you will, how vastly different my miserable, unproductive life might have been had I but accepted the wisdom of the ARRL, buckled down, and "got that old code speed up." Hell, I might be, even now, swishing my VFO across some 75 meter net which dares to let people express honest differences of opinion. Or arguing endlessly about just who is actually "on" the net.

I've seen the light, Wayne. I swear that I shall, now that the FCC has seen fit to grant me this HF access in spite of my miserable CW record, make every effort to alter my behavior. I shall never again actually *build* my own equipment. I will prattle endlessly about the details of technology I clearly do not understand. Preferably on some "oldtimers" net. I will strive to convey to all and sundry that I, as an FCC-certified HF operator, am now a member of that elite cadre of hams who knew what it was like in the "old days." You know. Back when ALL hams were true technology experts. When ALL hams could copy 25 wpm. Through summer static. Uphill. Both ways. Through two feet of snow. Sigh ...

How I miss people like K1CLL, W1OOP, W1FZJ, K2ORS and W6TNS. They have been, through your magazines (and others, I admit it), my teachers and mentors.

My interest in amateur radio dates to 1948 when I first built a radio using a MELOMITE radio crystal gleaned from the microtype in the back of a *Boy's Life* magazine. Since that time, I have watched as technology that can only be described as magic (Clark's Law) has been incorporated into everyday life. I've even contributed my share to that trend through my years as a designer. And, like you, I have railed at the idiocy of an entrenched and foolhardy group of elitists who have, through their intransigent and selfish insistence that high-speed CW be used as a criterion to obtain a "real" ham ticket, killed the hobby that I've loved all my life.

The move to de-emphasize CW as a filter into ham radio is certainly long overdue. And, although I hope not, probably too late.

Keep up the good fight, Wayne. We need you NOW more than ever.

Kenneth E. Stone W7GFH, Cherryvale KS. I read with interest the "Cold Fusion, Hot Speculation" food for thought article in the August issue of *73*, and I have given it much thought. My first impression was that it was a misplaced April article. My next thought was wondering if the author put more knowledge into his consultation with physicists and chemists than the article indicated about his knowledge of physiology and metabolism.

The relation between work and food metabolism has been very thoroughly studied for generations from many aspects. There are no magic or mystery energies involved. It is like all other energy balances — straightforward and unambiguous. Consider the "horse sense" item. I don't have the exact figures for the horse, but a couple of ways of looking at it show how wrong the author is. It has been determined that a soldier doing jungle marching will use or expend about 0.1 Kcal per kg per minute. The horse is certainly as efficient as the soldier, and likely more so, so the typical riding horse of 600 kg would expend about 3600 Kcal per hour. That is equivalent to metabolizing only 32 oz of carbohydrates and protein or 14 oz of fat per hour. Looking at it another way, suppose the horse were expending energy at the rate of one horsepower (what else?). That is equivalent to 640 Kcal per hour. That can be obtained from 5.6 oz per hour of carbs or protein or 2.5 oz of fat per hour. It has been found from actual measurements that optimally loaded muscle is 25 to 30 percent efficient, about the same as a gasoline engine. At 25% efficiency the horse would require 22.6 oz. per hour of carbs or protein. This is pretty darned close to the soldier way of looking at the problem. This kind of problem is old hat and there just aren't any mysteries in it! Beware of "horse sense"!

The energy to climb stairs has been laboratory-measured. For me to climb 2.6 meters would require me to metabolize 2.88 Kcal or 1.39 grams of carbohydrate. My increase in potential energy at the new altitude amounts to 0.49 Kcal. This works out for me to be 17% efficient. This answer is certainly within reason considering optimally loaded muscle may be only 25% efficient. No mysteries!

As for the birds, they don't fly all those miles on a handful of bugs. They store up plenty of fat, and fat has essentially the same fuel value as gasoline or diesel. There are no mysterious energies involved. It is a fact that the oxidation of a fuel, such as a carbohydrate, to carbon dioxide and water yields exactly the same amount of energy no matter whether the oxidation takes place in a flame or slowly in animal metabolism.

As for cold fusion, it seems no one knows whether it does or doesn't work. Whatever the end results, there will not be any mystery to it.

Continued on page 58

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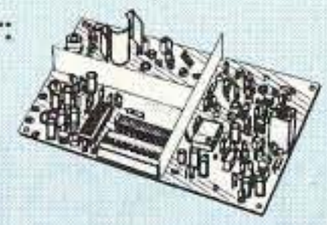

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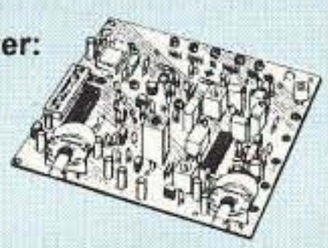

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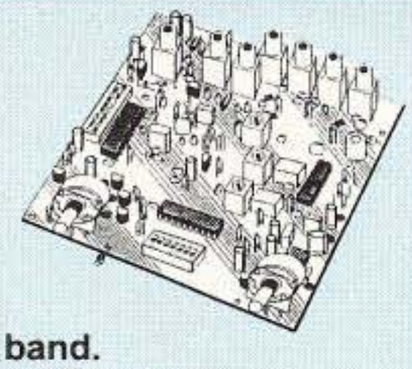

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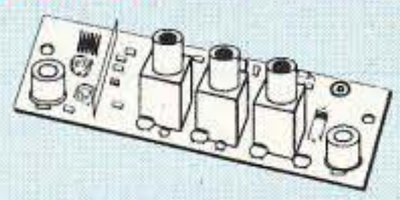

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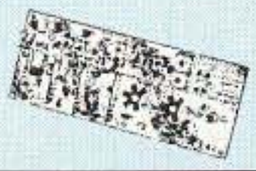

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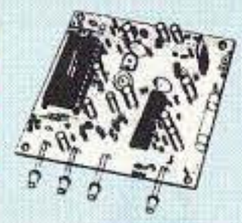

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Build This IP3 Test Set

A receiver's third order input intercept point is more than just a mouthful.

Receivers for shortwave and amateur use need to be able to hear weak signals without creating distortion from adjacent strong ones. In a poorly designed receiver, distortion can completely override and mask out a desired but weak station. One number in a receiver's spec sheet that tells you just how good it is in preventing distortion is the third order input intercept point — IP3. But what does that mean? And how is it measured?

Any circuit handling more than one signal will create some distortion. If two steady radio frequency signals at, say, 14,060 kHz and 14,080 kHz, enter the antenna terminals of a receiver, then by tuning the receiver we can separate and identify these two signals at two points on the tuning dial. However, due to nonlinearities within the receiver's circuits, there will also be weaker signals found at 14,040 kHz and 14,100 kHz. Where did these come from? The two weaker signals are called third order distortion products. If you are trying to listen to a weak station at 14,040 kHz, you might not be able to hear it because the distortion product generated in the receiver itself could be stronger than the station you are trying to hear. No amount of tuning or IF filtering can separate the distortion product from the desired signal. It sits right on top of what you want to hear.

Nonlinearities in the receiver's RF amplifier and mixer circuits create harmonics. The second harmonic of 14,060 mixes with 14,080 to produce 14,040 kHz. Likewise, the second harmonic of 14,080 mixes with 14,060 to produce 14,100. The mixing can occur in the receiver's mixer circuit or even in the RF amplifier. Remember, nonlinear devices make good mixers.

Photo A. *Measuring intercept performance of a receiver.*

Understanding IP3

The top line in the graph of **Fig. 1** shows the output versus input level of a mixer circuit. Mixers have two inputs. In this case, the input on the graph is the signal input. The oscillator

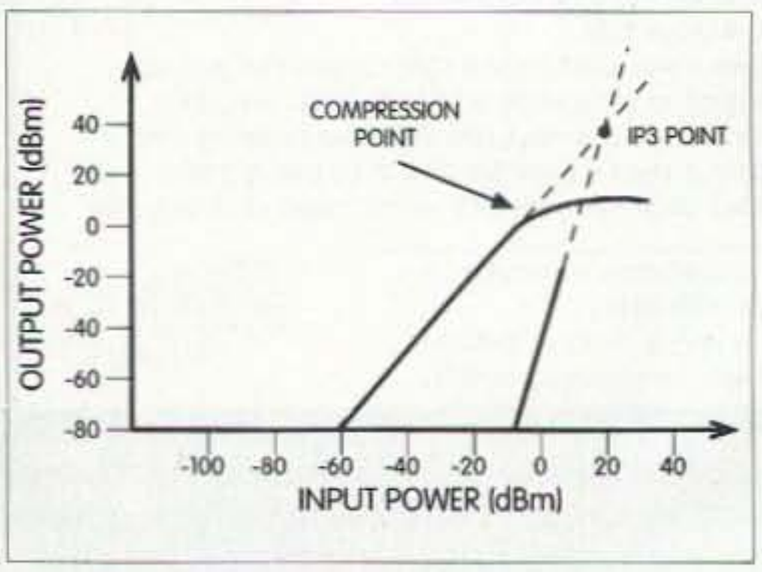

Fig. 1. *Intermodulation graph.*

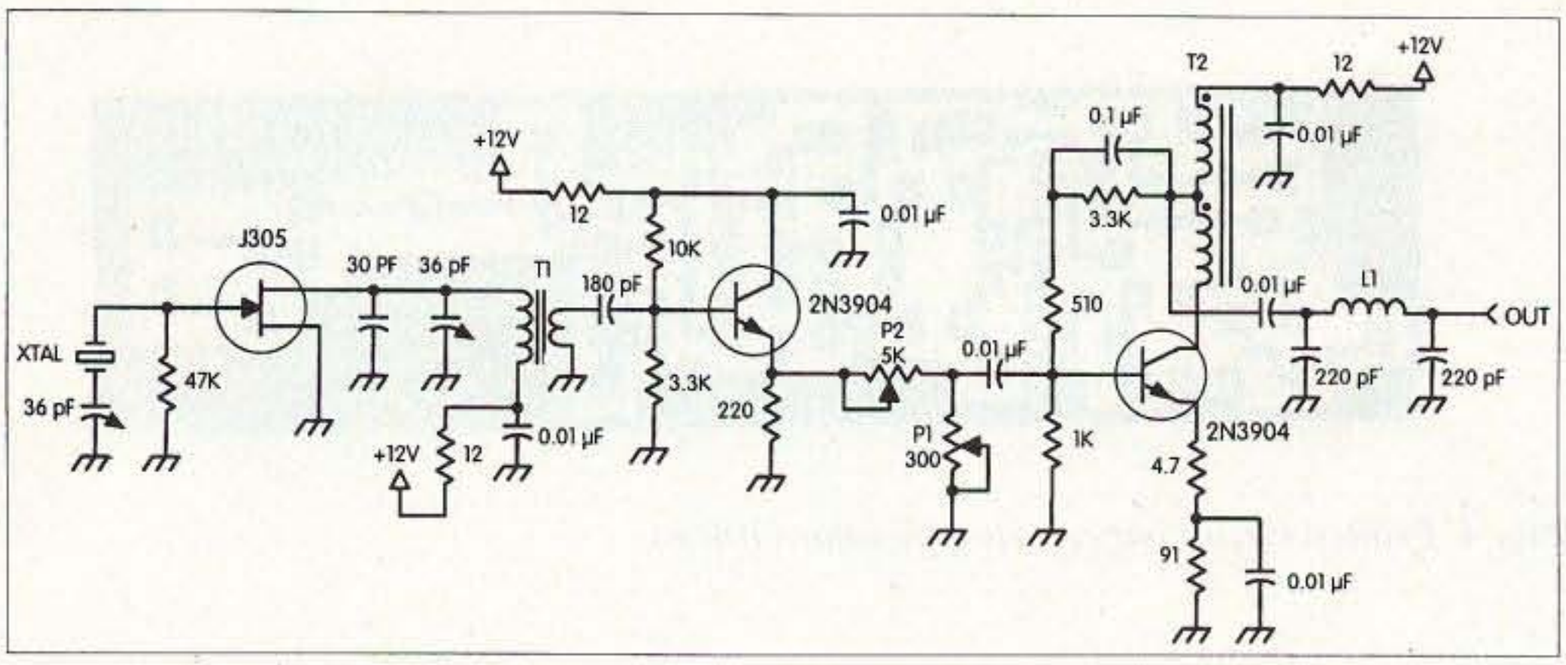

***Fig. 2.** Generator schematic diagram. T1 = primary 21T #22 wire on T50-C core; secondary 3T #22. T2 = 7 bifilar turns #26 wire on FT 23-43 core. L1 = 12T #22 wire on T37-6 core.*

input is held at a constant level. Both scales are measured in units of dBm or power in dB above one milliwatt. We see that the mixer has a gain of 10 dB and can handle signals up to about 10 dBm (10 milliwatts) at the input and then flatten out. The line has been artificially extended to higher levels with dots, but note that the mixer does not operate at the dotted points.

Suppose two equal strength signals are fed into the mixer. Each one has the level shown on the horizontal scale. Then there will be two outputs, each one having a level equal to the vertical scale as read using the top line of **Fig. 1**. In addition, there will be the two weaker IP3 distortion product signals. The level of each IP3 signal at the mixer output is shown by the lower line in **Fig. 1**. You immediately notice that the slope of the lower line is three times that of the upper line. This is the way distortion products usually work. Again the lower line has been artificially extended by a dotted line.

The point at which these two dotted lines cross is called the IP3 point. The corresponding level on the horizontal axis is called the input IP3 level and the corresponding vertical axis level is called the output IP3 level. When a spec sheet does not specifically indicate which, it is usually referring to the input IP3 level.

When comparing two mixer circuits, the higher the input IP3, the lower the distortion products will be. A good mixer has a high input IP3 point. Keep in mind, however, that the mixer is not capable of operating at the IP3 point. It's just a way of comparing two mixers. The mixer can only reasonably handle signals up to the point at which the output flattens out, called the compression point.

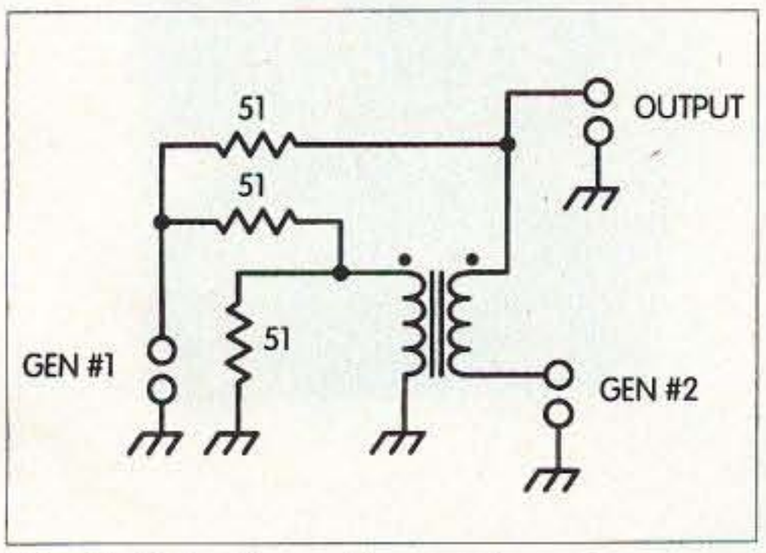

***Fig. 3.** Hybrid combiner schematic.*

How is IP3 measured?

In order to measure the IP3 point of a circuit, you need to inject two fairly strong independent signals into the circuit. They need to be strong enough to create measurable distortion products.

The signals also need to be combined without creating distortion before they get to the circuit under test. One good circuit for producing a signal is shown in **Fig. 2**. A circuit board pattern is shown in **Fig. 4.** Component locations are shown in **Fig. 5** and **Photo B**. A crystal oscillator with a high-Q tank circuit, and low loading on the crystal, generates a clean signal with low phase noise. Inductor L1 has a Q of over 250. See the *Radio Components Handbook* for more information on constructing high-Q inductors. A JFET transistor, J305, is used in the circuit. An MPF102 would be an acceptable substitute.

An emitter follower using a 2N3904 NPN transistor isolates the oscillator

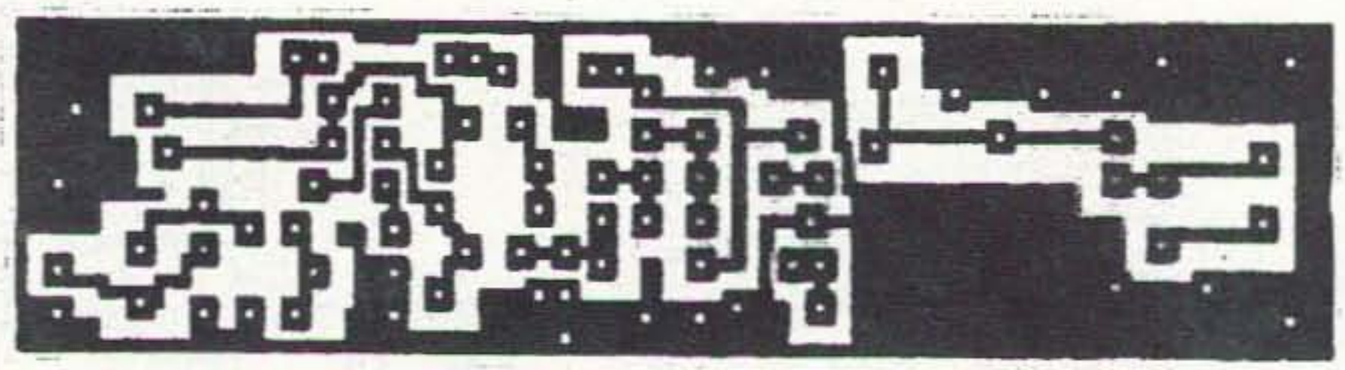

Fig. 4. Printed circuit pattern for generator (100%).

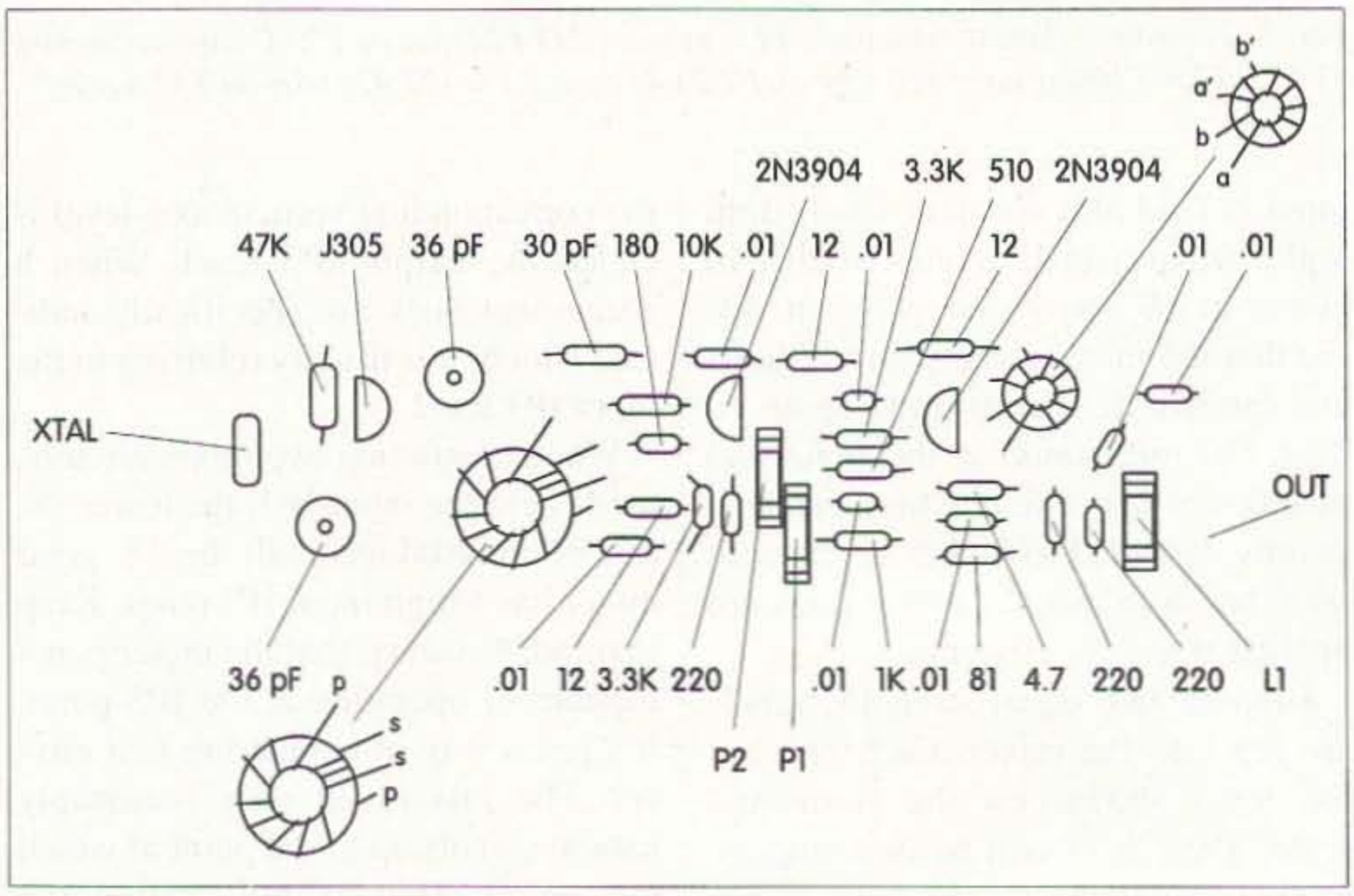

Fig. 5. Generator component locations.

circuit from any load variations that might modulate the oscillator and cause distortion.

A final power amplifier circuit is configured using trimpots P1 and P2 to provide an exact 50 ohm output at a level of 6 dBm.

Set for 50 ohm output

Negative feedback in the power amplifier circuit provided by the 510 ohm resistor means that the output impedance is dependent on the input impedance. Trimpot P1 is adjusted first for a 50 ohm output. A higher value of P1 produces a lower output impedance. I used the setup shown in **Photo D**. An MFJ-259 SWR analyzer

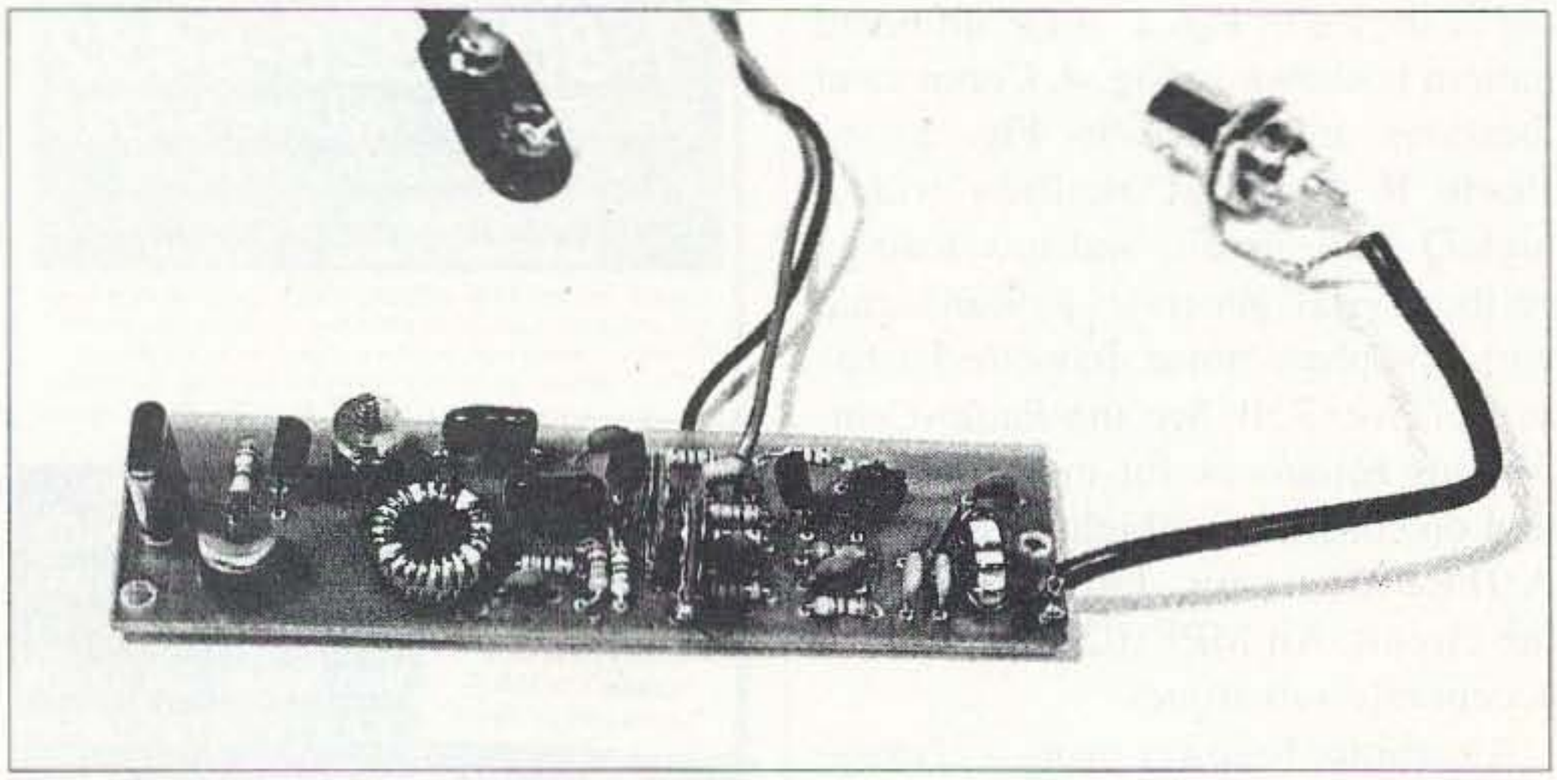

***Photo B.** Signal generator board with components.*

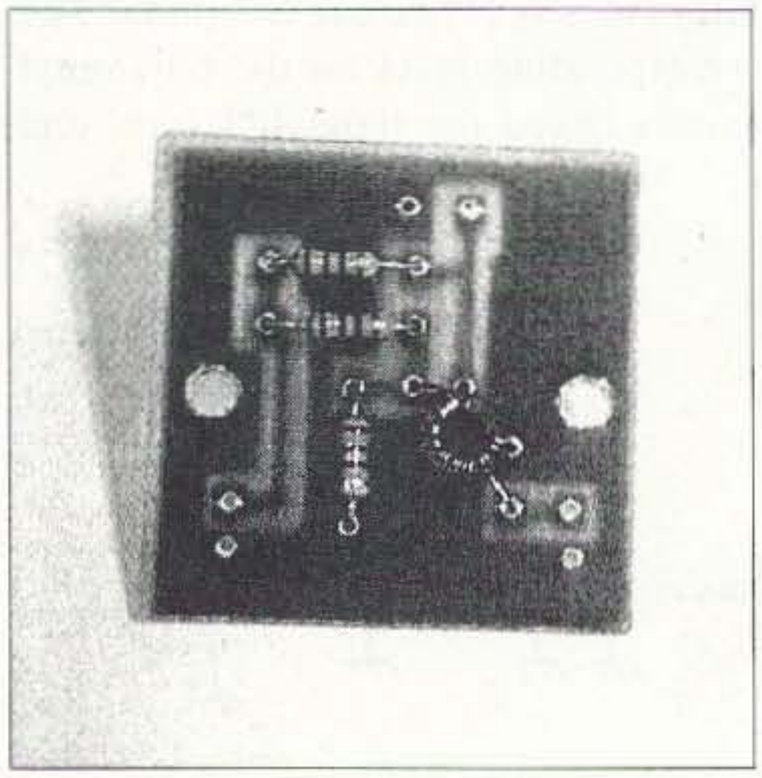

***Photo C.** Hybrid combiner.*

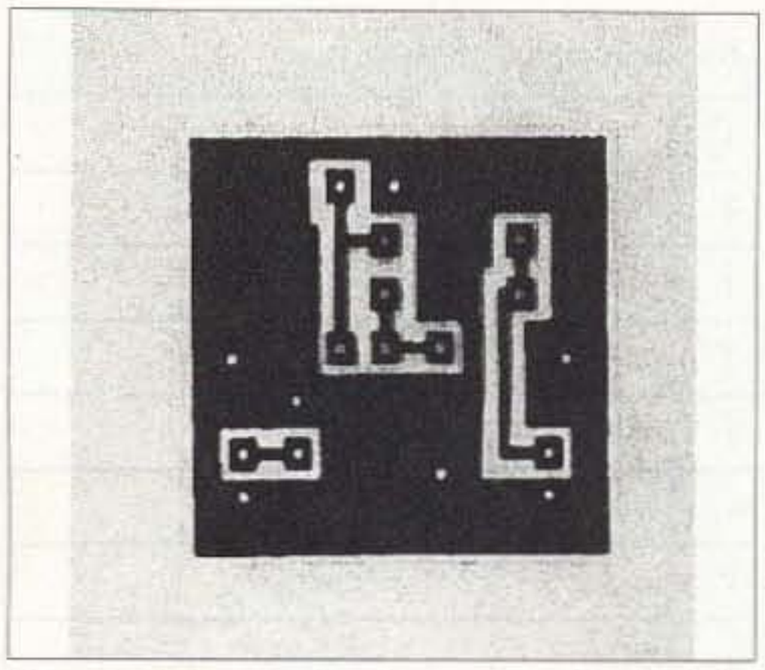

Fig. 6. Printed circuit pattern for hybrid combiner (100%).

set for 14,070 kHz measures the output impedance. Supply voltage must be applied to the power amplifier and emitter follower, but the crystal oscillator

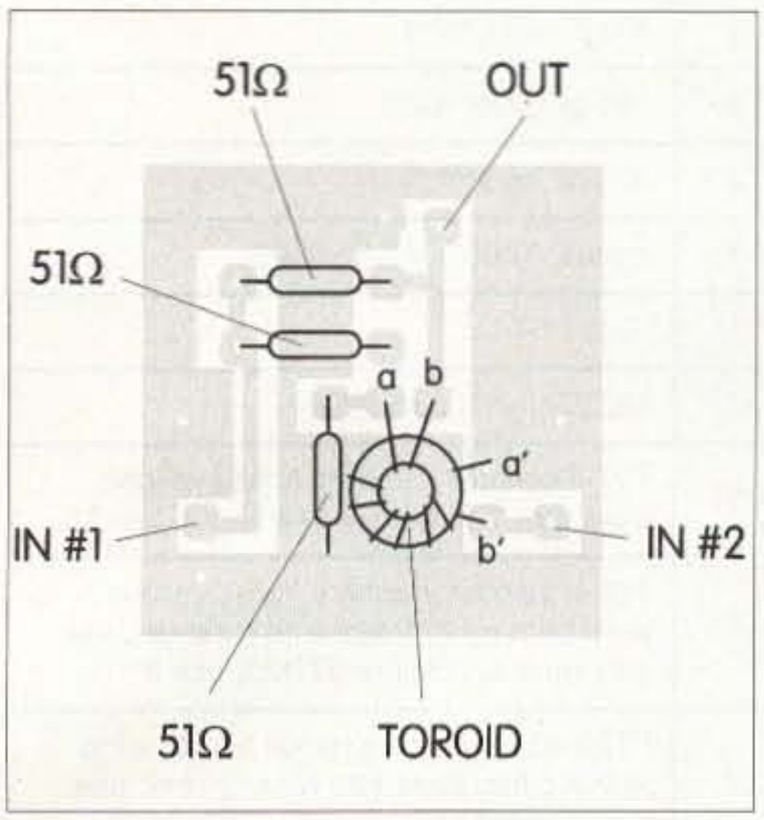

Fig. 7. Hybrid combiner component locations.

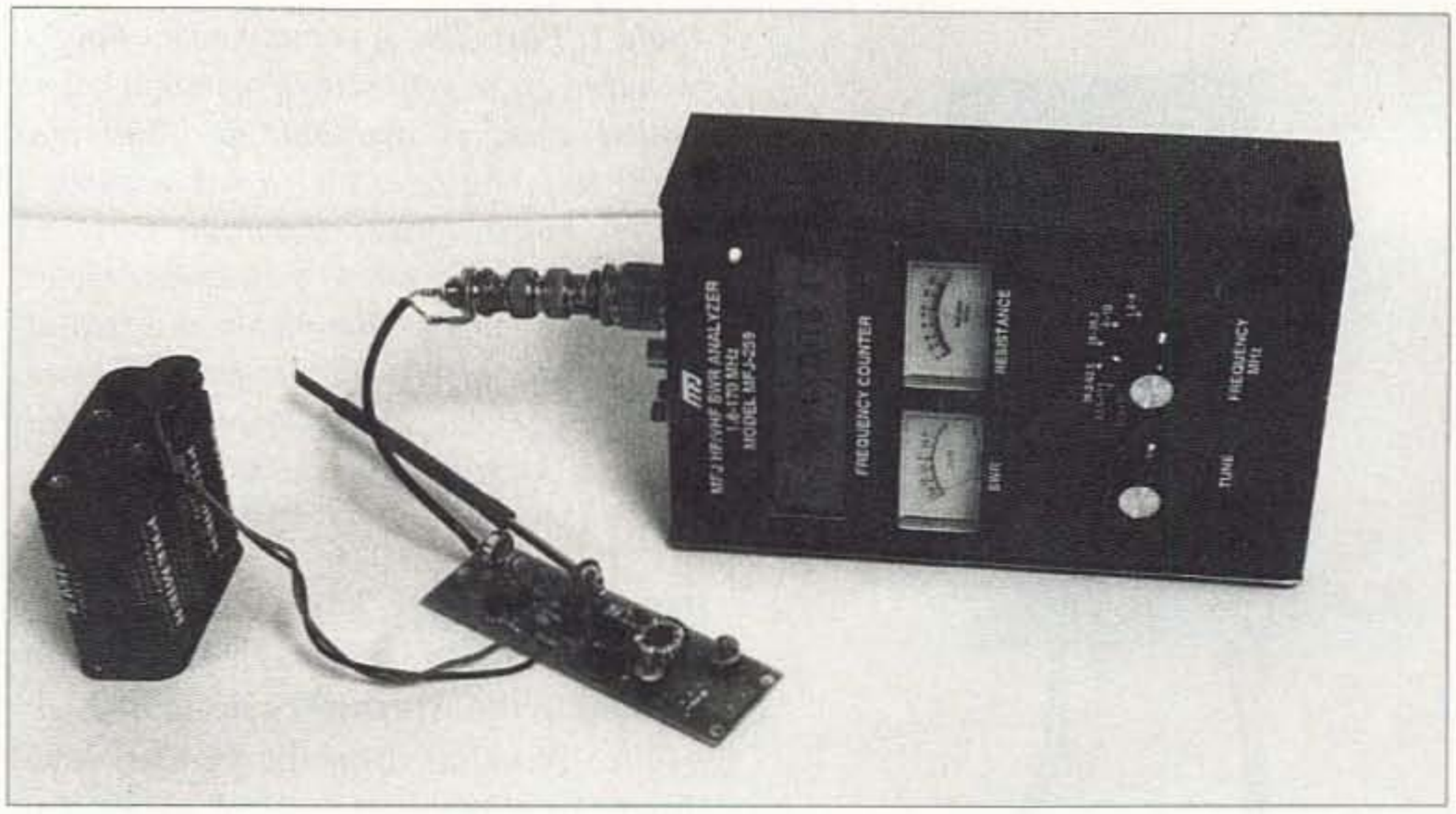

***Photo D.** Setting the output impedance.*

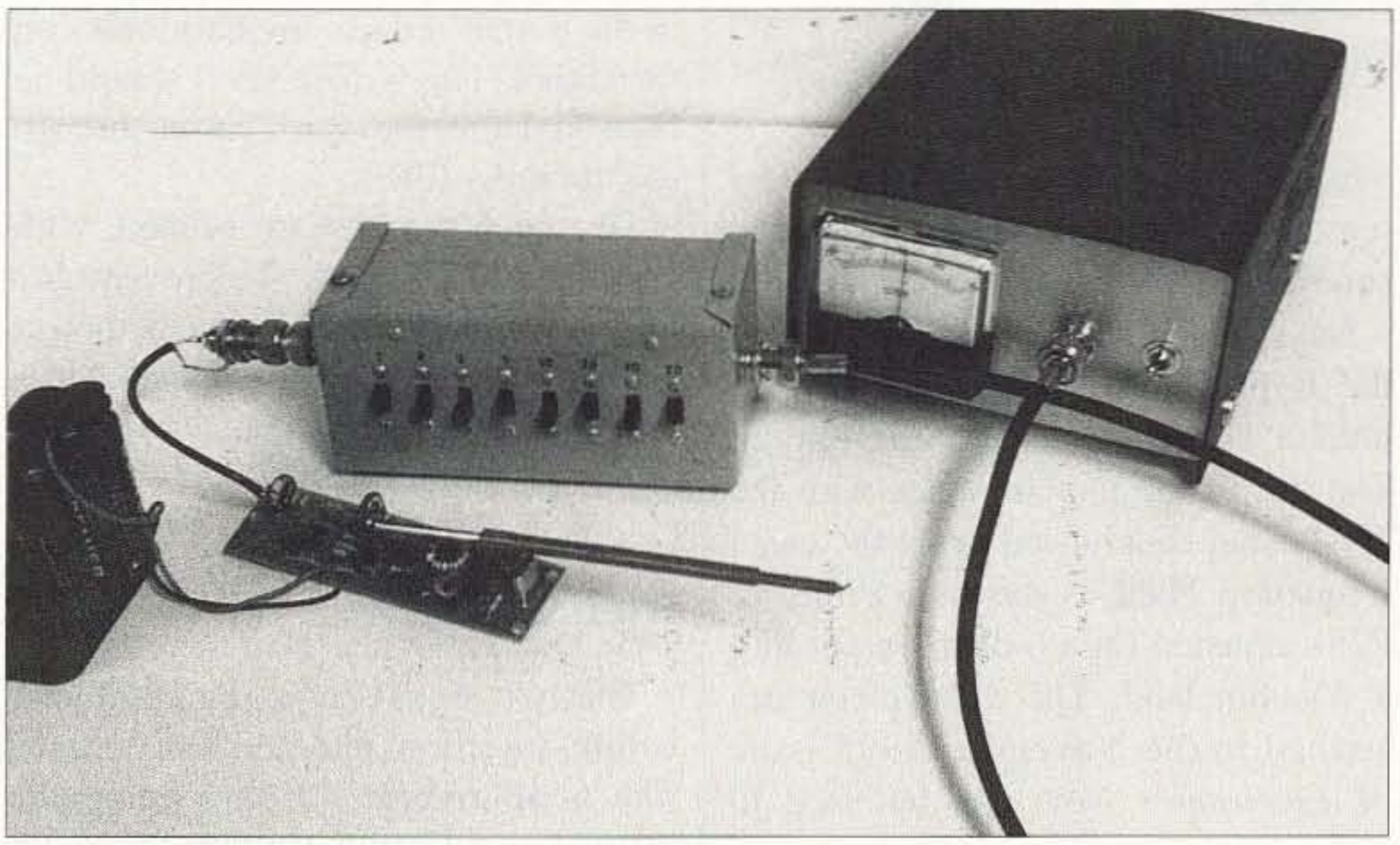

***Photo E.** Setting the output level.*

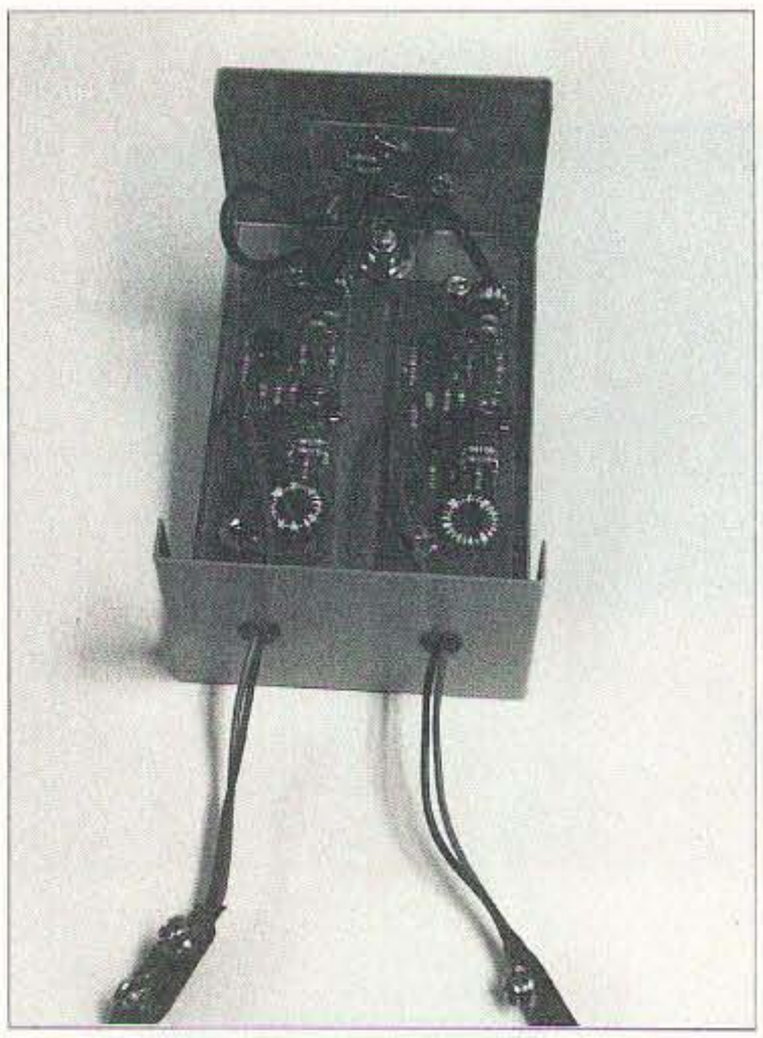

Photo F. Circuit boards mounted in box.

must be disabled. You can disable it by removing the crystal or by temporarily shorting the crystal leads together.

Next, insert the crystal and adjust the 36 pF trimmer in parallel with T1 until a signal appears at the output. The 36 pF trimmer in series with the crystal can be adjusted to set the exact frequency. Then, as shown in **Photo E**, P2 is adjusted for a 6 dBm output into a 50 ohm load. The dBm meter described in the November 1995 issue of *Electronics Now* can be used to measure the level. You will also need a step attenuator, such as the one described in the April 1999 issue of *Electronics Now,* to drop the 6 dBm level down to where the dBm meter can read it. Note that a 50 ohm low-pass filter L1 and the two 220 pF capacitors in the output reduce any harmonics on the signal. The 6 dBm level should be measured after the signal passes through the low-pass filter.

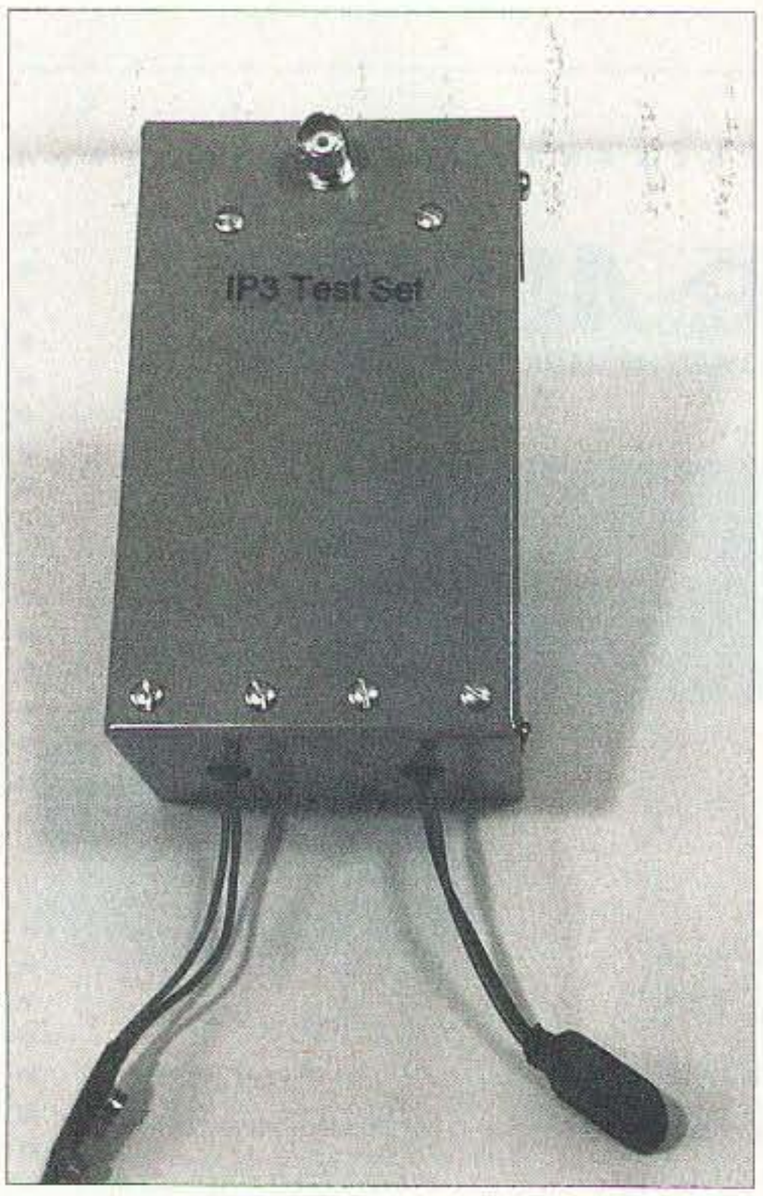

Photo G. Completed test set.

Two such circuits are needed, with crystals 20 kHz apart. To prevent any interaction between them via the power supply, it is best to power them separately using battery packs. Two packs of eight AA cells each, as shown in the photos, is satisfactory.

Hybrid combiner

The two signals must be combined before injection into the test circuit. The 6 dB hybrid 50 ohm combiner using a ferrite transformer shown in **Fig. 3** works well. A circuit board is shown in **Fig. 6**. Component locations are shown in **Fig. 7** and **Photo C**. Note that this circuit must be fed with two 50 ohm sources and be terminated with a 50 ohm load. Both generators must be powered on for the levels to be correct. Each signal will be at 0 dBm at the output.

Building the test set

A complete test set consists of two generators and a hybrid combiner. All three can be included in a single shielded box as shown in **Photo F**. For those who prefer, a complete kit is available. See the parts list, **Table 1**. The completed IP3 Test Set is shown in **Photo G**.

Making the measurement

Photo A shows a typical test setup. A step attenuator is used between the IP3 test set and the receiver to be tested. In the photo, the receiver is my Kenwood TS-830S transceiver. An old

Table 1. Parts list. A complete kit of parts, including two generators, combiner, and drilled case, is available for $60 plus $4.50 shipping from Unicorn Electronics, Valley Plaza Drive, Johnson City NY 13790; (800) 221-9454; [www.unicornelex.com]. Kits for the dBm meter and step attenuator are also available from Unicorn. A set (3) of etched and drilled circuit boards for the IP3 test set is available for $10.

For each signal generator:	
1	4.7 Ω
3	12 Ω
1	91 Ω
1	220 Ω
1	510 Ω
1	1k
2	3.3k
1	10k
1	47k
1	300 Ω trimmer
1	5k trimmer
6	0.01 µF disc ceramic
1	0.1 µF monolythic
2	36 pF trimmer cap (purple)
1	30 pF silver mica
1	180 pF silver mica
2	220 pF ceramic
1	crystal, 14060 or 14080 kHz
1	J305 FET
2	2N3904 NPN transistor
1	T37-6 powder iron core (small yellow), wind with 12T #22 wire (orange), use 7"
1	T50-6 powder iron core (large yellow), wind primary 21T #22 wire (orange), use 15"; wind secondary 3T #22, use 3"
1	FT23-43 ferrite core (small black), wind with 7 bifilar turns #26 wire (green), use two, 5" each
1	Circuit board
For the hybrid combiner:	
3	51 Ω
1	FT23-43 ferrite core (small black), wind with 10 bifilar turns #30 wire (small orange), use two, 7" each
1	Circuit board
For the case:	
1	Hammond 1411N utility box, 5 x 3 x 2.2"
1	BNC chassis mount connector
2	1/4" grommets
2	Battery snaps
8	4-40 pan head machine screws 3/8" long
24	4-40 hex nuts

Input IP3 (dBm)	Rating
>10	Outstanding
0 to 10	Very good
–10 to 0	Good
–20 to –10	Fair
<–20	Poor

Table 2. *Rating 1990s-era receivers.*

product review in *QST* lists an average IP3 at 14 MHz as –9 dBm.

Connect up the batteries and locate the two crystal oscillator signals. These signals will be extremely strong and you will need to switch in some attenuation to get a reasonable reading — say S9 levels for the distortion products. The two input signals will be much stronger. Now tune to one of the IP3 distortion product frequencies and note the signal level on the receiver S-meter. Tune back to one of the crystal oscillator frequencies and switch in additional attenuation until the signal level is the same as the distortion product signal was. IP3 is then calculated from:

IP3 = Original Signal Level + 0.5 x Additional Attenuation

The original signal level is 0 dBm minus any attenuation you started with on the step attenuator. Note that this procedure measures input IP3 but not output IP3.

For my measurements of the Kenwood receiver, I used 36 dB attenuation to produce two distortion signals at S7 on the receiver's signal strength meter. Then, tuning to one of the generator frequencies, an additional 52 dB was required to reduce this signal to S7. From the previous equation, then:

IP3 = –36 + 0.5 x 52 = –10 dBm

which agrees approximately with the ARRL's average of -9 dBm.

From my experience, I would use the chart in **Table 2** to rate 1990s-era receivers. Even very good older receivers will fall further down on the chart.

With this test set, you can make accurate IP3 measurements of your receiver's distortion performance. Good luck with the building and with the measuring!

Further reading

"Build a Step Attenuator," *Electronics Now,* April 1999, pp. 34–37; correction, June 1999, p. 7.

"dBm Meter," *Electronics Now,* November 1995, pp. 112–113, 158–159.

Ladder Crystal Filters, John Pivnichny N2DCH, MFJ, Starkville MS, 1999.

"Product Review: Kenwood TS-830S," *QST,* May 1981, pp. 38–40.

Radio Components Handbook, Guido Silva I2EO, MFJ, Starkville MS, 1998.

73

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Inside Digital TV/VCR Tuners

Part 3: Data receiver for testing.

The discussion on digital TV/VCR tuners is in seven parts with the first part covering the two types of digital tuners and their requirements. A short discussion was provided regarding how the synthesizer is used within the tuner for controlling the local oscillator (VCO). Part two discussed the data transmitter that I built to control and study the digital tuner.

While building the data transmitter to be used in controlling a digital tuner, it became obvious that a method was required to "observe" and test the data transmitter. The solution was to develop a data receiver that would drive a series of LED's displaying the tuner's data control bits sent by the transmitter. Sending data into a digital tuner is illusive because the tuner normally provides no direct feedback of "what's happening." Although the receiver isn't a necessary part of the test and data set, it provides visual feedback to the operator of what has been sent to the digital tuner.

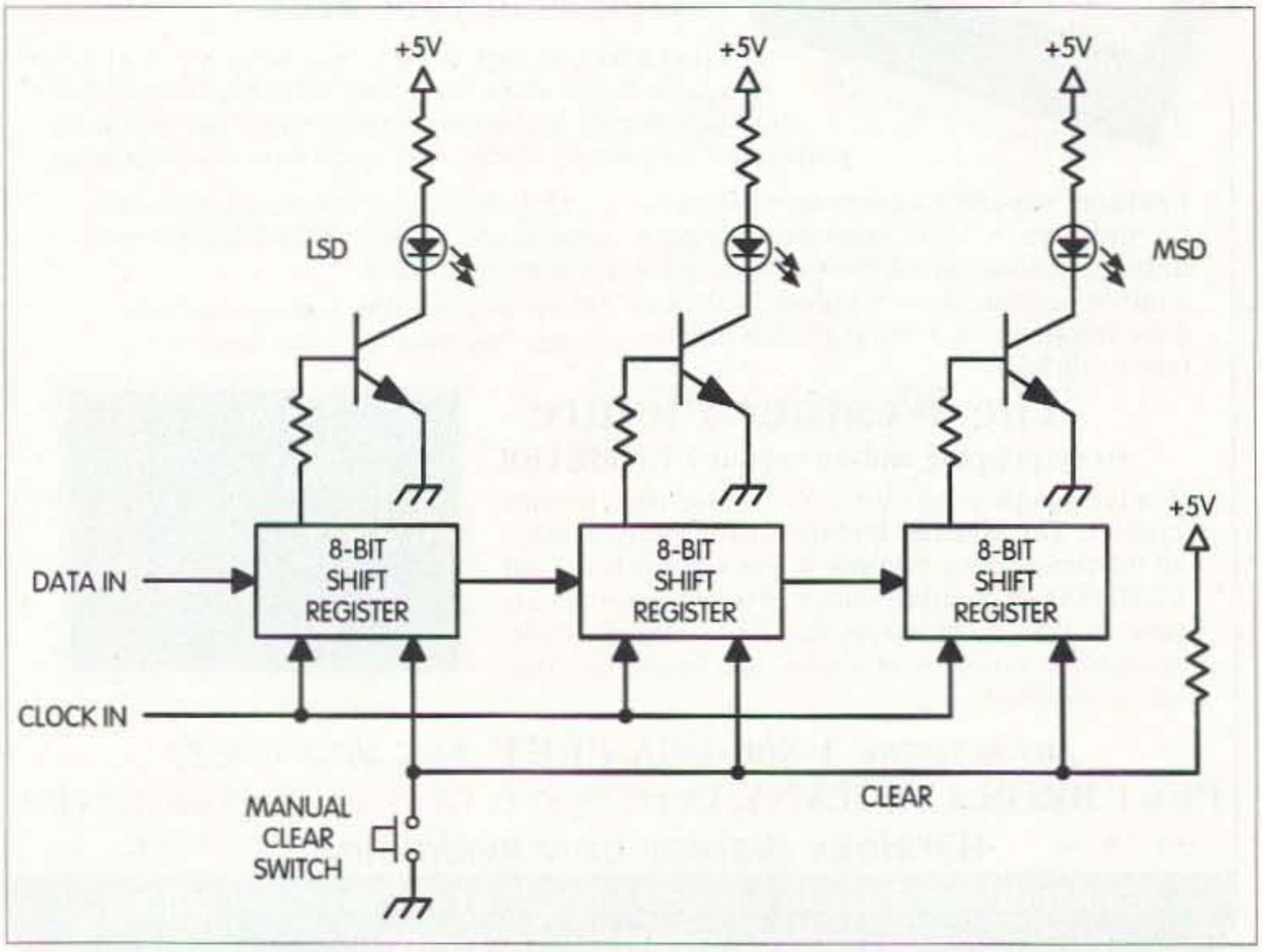

Fig. 1. *Block diagram of the data receiver. Each shift register drives eight LEDs.*

The theory behind the data receiver is shown as a block diagram in **Fig. 1**. Data flow through the circuit is shown by the arrow pattern. Data from the transmitter is clocked into three cascaded shift registers having 8 bits each. Each of the 24 register bits has an output that drives an LED indicating the status of the register bit. Only one LED driver is shown in the figure, but there are eight identical drivers for each register bit in the actual data receiver. Displayed data in the registers is cleared manually with a push-button.

The circuit for the receiver, shown in **Fig. 2**, uses three cascaded 74HC164 shift registers. Again, TTL 74164 ICs were used in the initial design, and they worked just fine — that is, until certain data patterns appeared that would glitch and turn off portions of the display. The use of the 74HC164 solved the problem without further error. Troubleshooting of the glitch condition failed to show up where the problem was occurring, but use of the 74HC164 part resolved the problem.

The 74HC164 was selected for the receiver application because it is a serial-data-in and a parallel-data-out

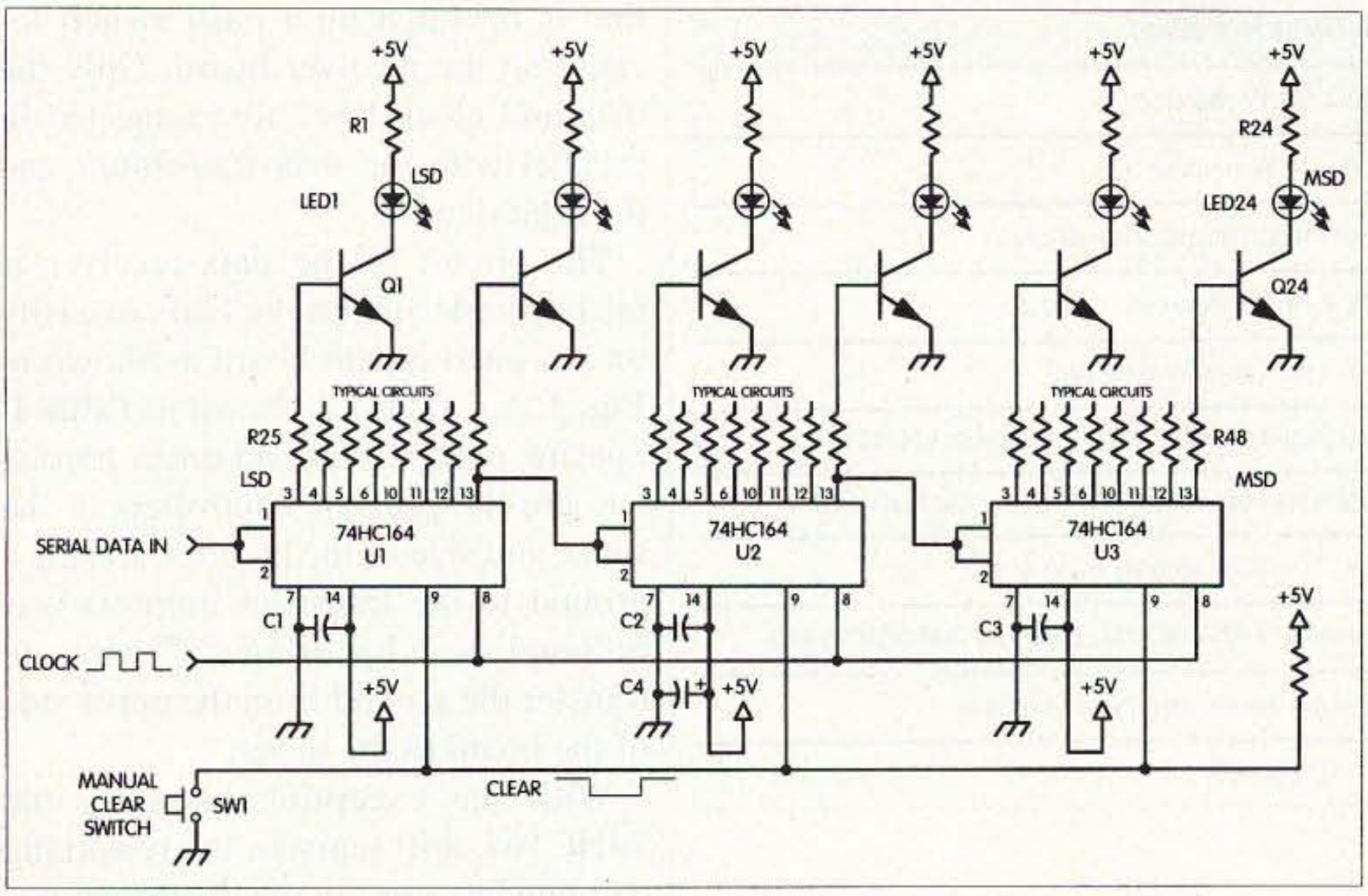

Fig. 2. 24-bit serial data receiver. Displays data sent to a digital TV/VCR tuner.

shift register. A "1" bit at a register location creates a HIGH on the respective output pin of the register.

Then, to drive an LED, a switching transistor was used as an LED driver. While in operation, it's interesting to watch the data bits move through the registers as the appropriate LEDs illuminate, making it clear to the user as to what's happening relative to the data being sent to the tuner.

Packaging

With twenty-four output circuits driving twenty-four LEDs, the mechanical space requirement for them became extensive. In order to reduce the LED crowding, the narrow flat LED package was chosen for the receiver project. TO-92 packaged transistors were selected for the LED driver application because they would stack close together. I used the equivalent of the 2N4401

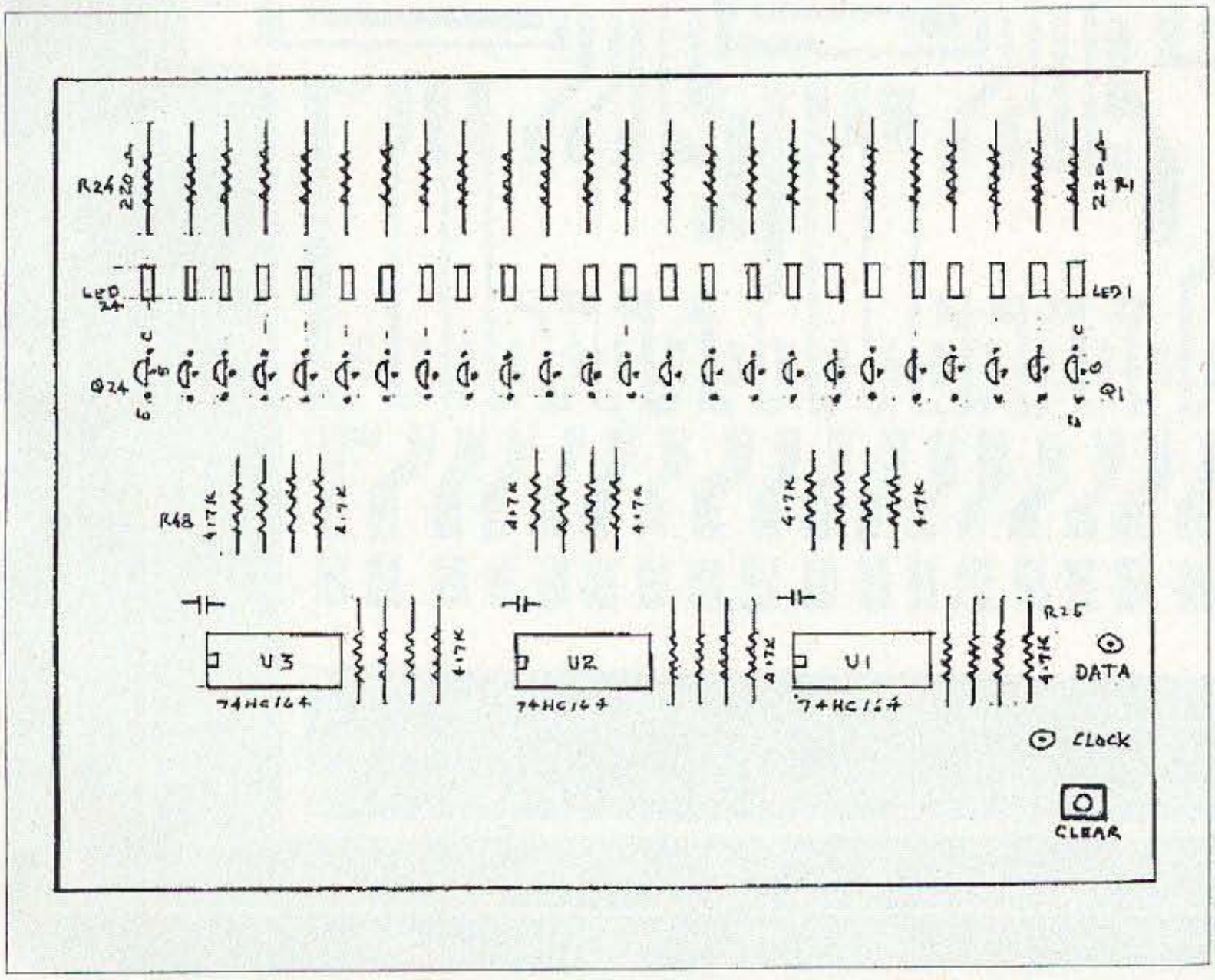

Fig. 3. Component placement for the data receiver.

Parts List for the Data Receiver	
R1–25	220Ω 1/4 W resistor
R25–49	4.7k 1/4 W resistor
C1, 2, 3	0.01 µF 50 V ceramic capacitor or equiv.
C4	100–500 µF 16 V radial capacitor or equiv.
LED 1–24	Rectangular LED (color is optional)
	Red: Mouser 606-CMD 57123, Digi-Key P437-ND (Panasonic LN242RP)
	Green: Mouser 606-CMD 54123, Digi-Key P438-ND (Panasonic LN342GP)
Q1–24	2N4401 or equiv. TO-92 or smaller case size
U1, 2, 3	74HC164 8-bit shift register: Mouser 511-M74HC164, Digi-Key 296-2097-5-ND
SW1	SPST momentary push switch, any type available
Misc.	IC sockets

Table 1. *Parts list for the data receiver.*

device as an LED driver, but almost any NPN transistor should work well in this application as long as it will fit the mechanical spacing available.

Because the "received" data is to be retained in the display, the CLEAR line is operated by a push switch located on the receiver board. Only the data and clock lines are connected in parallel with the data transmitter and the digital tuner.

The circuit of the data receiver is fairly simple and can be laid out easily on a printed circuit board as shown in **Fig. 3.** A parts list is shown in **Table 1.** Spacing of the LEDs and driver transistors are the primary controllers of the space and size of the board. Carrying a ground to the transistor emitters was accomplished by using "Z"-wires to transfer the ground from the upper side of the board to the lower.

With the exception of using the 74HC164 shift register, the remaining components used in the project appear to be noncritical as to value. I used IC sockets on my receiver board to allow switching of chips during trouble-

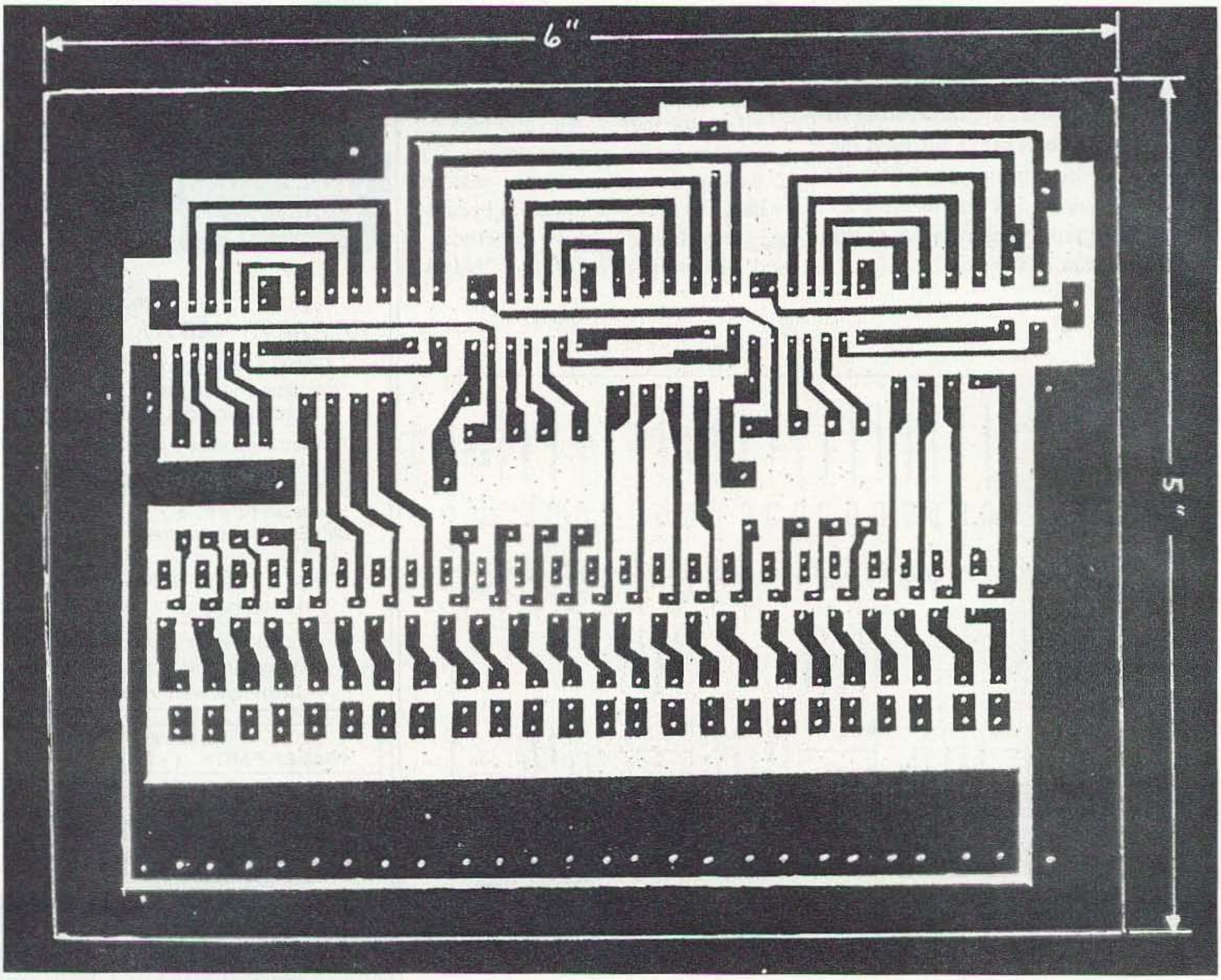

Fig. 4. *PCB top foil side.*

shooting. No apparent problems are introduced through the use of the sockets.

I used discrete resistors on my receiver board, but with a board design change it would be possible to use resistor packs. Some board real estate would be saved with the use of R-packs, should board size be of concern.

All of the logic is on the circuit side of the board, leaving the top side of the board for ground plane. Some power circuits and jumper wires are carried on the top side of the board for convenience.

A small momentary push switch is installed on the top side of the receiver board and is used for resetting the display when it is deemed desirable. Resetting of the display has no effect on the data sent to the tuner, as that is strictly under the control of the data transmitter.

What's next

Part four in this series on digital TV/VCR tuners will discuss how the tuner is to be controlled and tested. The fifth part will provide a BASIC program that may be used for the decimal to binary number conversion, since the tuner responds to a binary number format. Parts six and seven, the last sections of this series, will provide a simple technique for making printed circuit boards. 73

What happens if you get scared half to death twice?

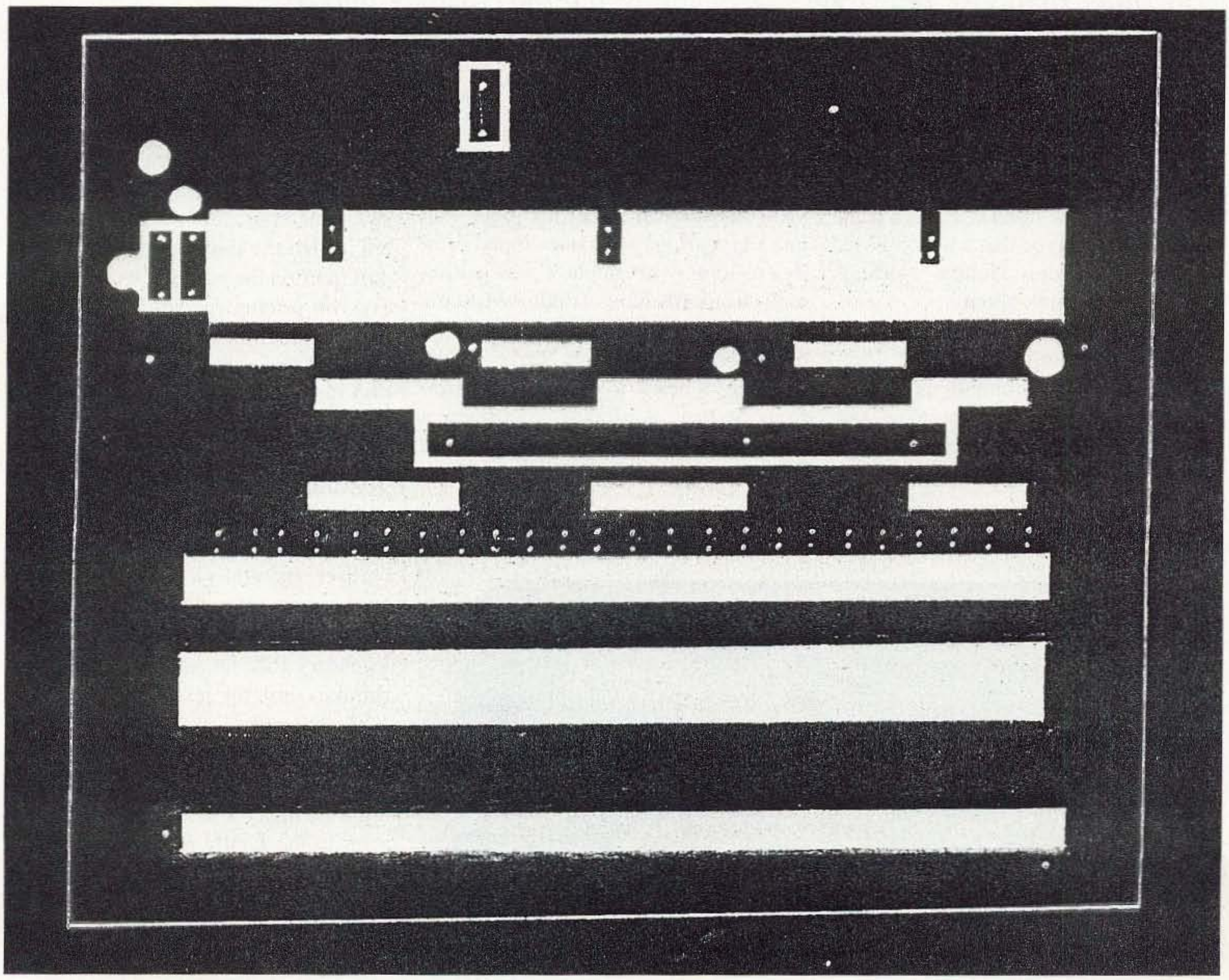

Fig. 5. PCB bottom foil side.

73 Review

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73 Tests the Drake SW1 Receiver

Contact your dealer now to get one while you can.

My first exposure to shortwave listening came during the summer after I graduated from elementary school. My dad gifted me with a Zenith Transoceanic Portable Shortwave Radio, and my summer before beginning high school was spent at my aunt's home in a small Wisconsin town called Platteville. Platteville had a year-round population — not counting the cows — of about 2,000, and was the home of one of the University of Wisconsin's colleges specializing in education. The students added maybe another 1,000 or fewer souls to the town, and trust me, there was nothing to do, other than visit old Ozzie's farm and watch the cows get milked.

Today, on the other hand, Platteville has changed, grown up so to speak, and hosts the training camp for the Chicago Bears football team. The town is still on the small size, not a great deal to do, so maybe that's why it hosts the Bears' training facility. Nothing but football to think about.

But that summer, it was nothing but shortwave listening on my mind. I listened from early morning to what must have been early the next morning, and logged many stations in as many foreign countries as I could count. I learned from a local ham how to make out QSL or SWL cards and get verifications from these countries, which made the local postman somewhat more than just a bit curious as he questioned Aunt Bea as to why her nephew was getting mail from Moscow (Radio Moscow that is). The bug had bitten, and one night, probably actually early in the morning, I heard a short news update from Sydney, Australia, concerning a flash flood which had destroyed the wool warehouses and their entire stock of wool. At breakfast a few hours later, I related the story to Uncle Harry who just so happened to be a wool broker, and some hours later he came home to tell us that the East Coast boys tried to pull (pardon the pun) the wool over his eyes on pricing for wool. Seems that they claimed they could get the wool cheaper from Sydney. Uncle Harry told them fine, try to get it, then call me back. The rest is family history.

For years, I've wanted a quality shortwave receiver to replace the venerable Zenith, and recently I came across an advertisement from a *73* advertiser (naturally), Universal Radio [www.universal-radio.com]. They were offering a receiver, AM only, from the legendary R.L. Drake Company [www.rldrake.com] for less than $200. The XYL feigned sleep as I ordered the unit, and three days later a small box arrived. As you can see from **Photo A**, it's a compact and attractive addition, even to the family room. But I'm like most Hams I know, and appearance is secondary. How well would it perform, and what else could I do to make it even better? **Table 1** lists the technical specifications of the SW1.

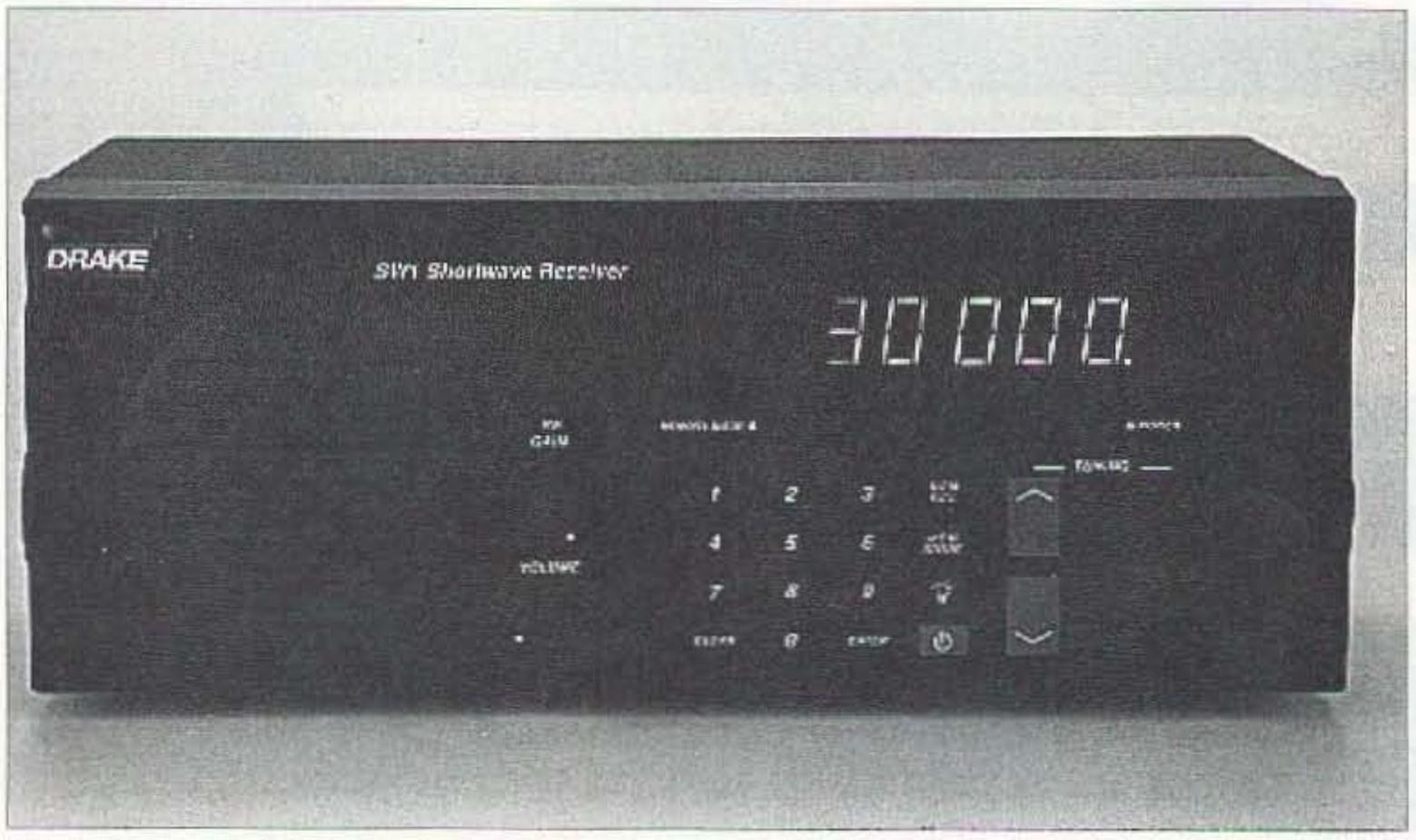

Photo A. *Drake SW1 shortwave receiver.*

Frequency range, AM only	100–30,000 kHz
Sensitivity (10 dB S+N/N) (1000 Hz, 30% mod.)	Less than 2.0 µV typical
Readout accuracy	To nearest 1 kHz
Selectivity	5.5 kHz min. at –6 dB
IF frequency	1st IF: 45 MHz 2nd IF: 455 kHz
Step sizes	1 kHz with tuning knob 5 kHz with up/down buttons
Antenna inputs	SO-239 coax connector 50 ohms Screw terminals 50 ohms
Headphone jack	1/8-inch stereo/mono type (monaural reception only)
AC adapter	Supplied
Wall transformer	Input 120 VAC 15 W Output 12 VDC @ 830 mA (max.)
DC power requirements	12 VDC @ 400 mA nominal
Size	Width: 10-7/8 in.
	Height: 4-3/8 in.
	Depth: 7-5/8 in. (includes front knobs and rear panel connectors)
	Weight: 4.7 lbs.

Table 1. *Technical specifications.*

The one thing that jumped out at me was the standard second IF of 455 kHz — not that this was unusual, but rather knowing that the small BFO kit I'd purchased from Ten-Tec would make this a general-coverage as opposed to an AM-only receiver. Besides, the schematic showed that the two sets of antenna connectors were common, or in parallel, so that I could couple the BFO to the screw terminal and my station antenna (receive only) to the SO-239.

Another added goodie which I hadn't seen since my military days was an NE-2 neon bulb across the antenna terminal to ground. Most if not all military receivers had this feature; in case of static electric discharge across your antenna (and maybe even a brief lightning strike), the charge would "turn on" the neon bulb and conduct the charge 'harmlessly away' from your sensitive equipment. To be honest, I have never seen it happen, or for that matter the bulb turn on, but theorywise, it should work — and besides, it's a cheap form of extra insurance.

The receiver itself was a joy to operate. The small manual essentially told you everything you needed to know to operate the receiver and how to program the memory channel list with your favorite frequencies so that a single keypad entry would take you directly to Radio Moscow, or the BBC, or HCJB in Quito, Ecuador, with ease. Frequency selection was made by either direct keypad entry or by using the tuning knob and the up and down buttons. The tuning knob increases or decreases the frequency in 1 kHz steps, and the up/down buttons increment the displayed frequency in 5 kHz steps. In fact, for the most part, the receiver responded much in the same way as my current transceiver in the receive mode, minus the CW/SSB and FM capabilities.

Our antenna was a longwire, approximately 110 feet in length, going from the rear of our house to a large tree about 35 feet in the air in an unused area of the yard. The wire was brought into the basement by drilling a small opening in the caulking compound surrounding our furnace vent pipe. This technique may or may not be suitable to your location. We have one of those super-energy-efficient gas furnaces with a handful of heat exchangers, so that the old metal vent pipe is now replaced by a 3-inch diameter plastic pipe, and at full blast the air coming out is just barely warm. After snaking the antenna wire lead inside, it was connected to a length of RG-58 coax, and the shield of the coax was grounded to the copper cold water pipe after first verifying that there was a conductive path from the pipe before the water meter, to the pipe after the water meter. The cable was then run into the den, terminated in a PL-239, and connected to the SW1.

Actual use and comments

Once I got used to the small size of the receiver, I found it to be quite sensitive. I was able to easily find and listen to many of my old favorites such as the dramas on the BBC, and I could readily pick out the fading in, then out of Radio Moscow — some things never change. The real challenge was to find stations — or more accurately where they can be found. In my early days as a lad, there were directories of shortwave stations with their frequencies and times of broadcast. As I recall, *Popular Electronics,* to mention one magazine, had a shortwave listening column with updates, time changes, and schedules. I'm going to have to surf the Web a bit, I suspect, as these sorts of information seem to have gone from the more hobby-based magazines into a sort of limbo.

Considering the reasonable cost, the small footprint on my already crowded desk, and the pure pleasure of listening to a good British murder mystery where my imagination takes the place of the digital TV broadcast upstairs, I can't think of a better way to while away the hours when I am not on the air. Besides, I can now brag that my shack includes a genuine R.L. Drake receiver, and with the addition of an outboard BFO, it's now a general coverage receiver.

What's ahead for me and my SW1? Probably a new antenna system. The recent article in *73* on the loop antenna has me thinking, and my tape measure measuring, to see exactly where and how large a loop I can build. Our recent unpleasantness in the form of an ice storm is still with us, and I want an antenna that will be able to withstand climatic disasters and at the same time provide me with hours of listening pleasure. I have at least half the equation, the Drake SW1 receiver — now all I need to do is improve upon my antenna.

As we were going to press, Drake announced that the SW1 would be discontinued. I am told that Universal Radio still has a considerable stock, as, I would expect, do other dealers, and

Continued on page 58

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A BFO for Your SW Rx

With a $10 Ten-Tec kit.

Ever since I graduated from elementary school back in the days when the air was clean and sex was dirty, shortwave listening has had a special place in my heart. My graduation gift way back then was a Zenith Transoceanic portable radio (weighed in at about 25 pounds), complete with a huge battery, earphones, and vacuum tubes.

For those of you not familiar with the term vacuum tubes, think transistors or integrated circuits, surrounded by a glass envelope and requiring awesome amounts of electricity to operate. You could tell when the receiver was on, especially at night, when its inner workings doubled as a night light, also known as the vacuum tubes glowing. But that was then, and now is obviously somewhat later. The vacuum tube has given way to a minute device called an integrated circuit, and the costly shortwave radio can be yours for as little as $39.95 at your local mass merchandiser discount house.

Like the Internet, shortwave listening brought the world to your door. In a single day, you might hear news from dozens of countries, fine music and mysteries from the BBC in London, and even the current propaganda from what was then, and still is, Radio Moscow. Today, the listening fare is similar and even more diverse, with the opportunity to learn about other countries and maybe even a foreign language or two.

But this is a ham magazine not a travelogue, and for many of you shortwave listening is not the central point in your day. You are interested in a cheap receiver that will let you monitor a band or two, and listen for WWV time hacks and the like. Sorry, Charlie: The bulk of the inexpensive shortwave radios on the market today are AM only, and they don't receive SSB or CW signals — that is, unless you can find a way to introduce a tone using something all old receivers had, the BFO (beat frequency oscillator).

Naturally, adding this circuit has to be: (1) simple, and (2) cheap. We aren't going to take sides — real home-brewers versus appliance operators or other such feuds — but rather present a simple and cheap circuit that can be added to virtually any shortwave radio available today which does not have SSB or CW capabilities. In fact, Ten-Tec actually has available a kit of all of the parts and a predrilled, etched PC board; it sells for less than $10 plus shipping. Without getting too technical, it's a given that most, if not all, modern radio receivers have an (IF) intermediate frequency of 455 kHz, and if we can create a "beat frequency" using a small oscillator very near this IF, we will be able to receive both SSB and CW signals.

The circuit shown in **Fig. 1** uses a standard 455 kHz IF transformer and its internal capacitor to form what is called a traditional Hartley oscillator with transistor Q1 and associated parts. The oscillator relies on the center tap of the IF transformer coil; the other winding is shown as not connected and is not used. The frequency of the oscillator is varied over a wide range by turning the slug adjustment inside the IF "can." In theory, this would be a one-time adjustment and should only require changing if you are using the BFO with another receiver — if then.

The potentiometer is used to "fine tune" the oscillator during actual use, and varies the voltage applied to two ordinary silicon diodes, D1 and D2, which actually take on the role of a varactor (a voltage variable capacitor). This fine tuning function allows you to adjust the pitch of CW signals or the clarity of SSB signals. A zener diode sets the operating voltage at 6.8 volts and ensures a reasonable frequency stability during operation from voltage sources of 8–15 VDC.

Test and hookup

The best way to test your BFO is

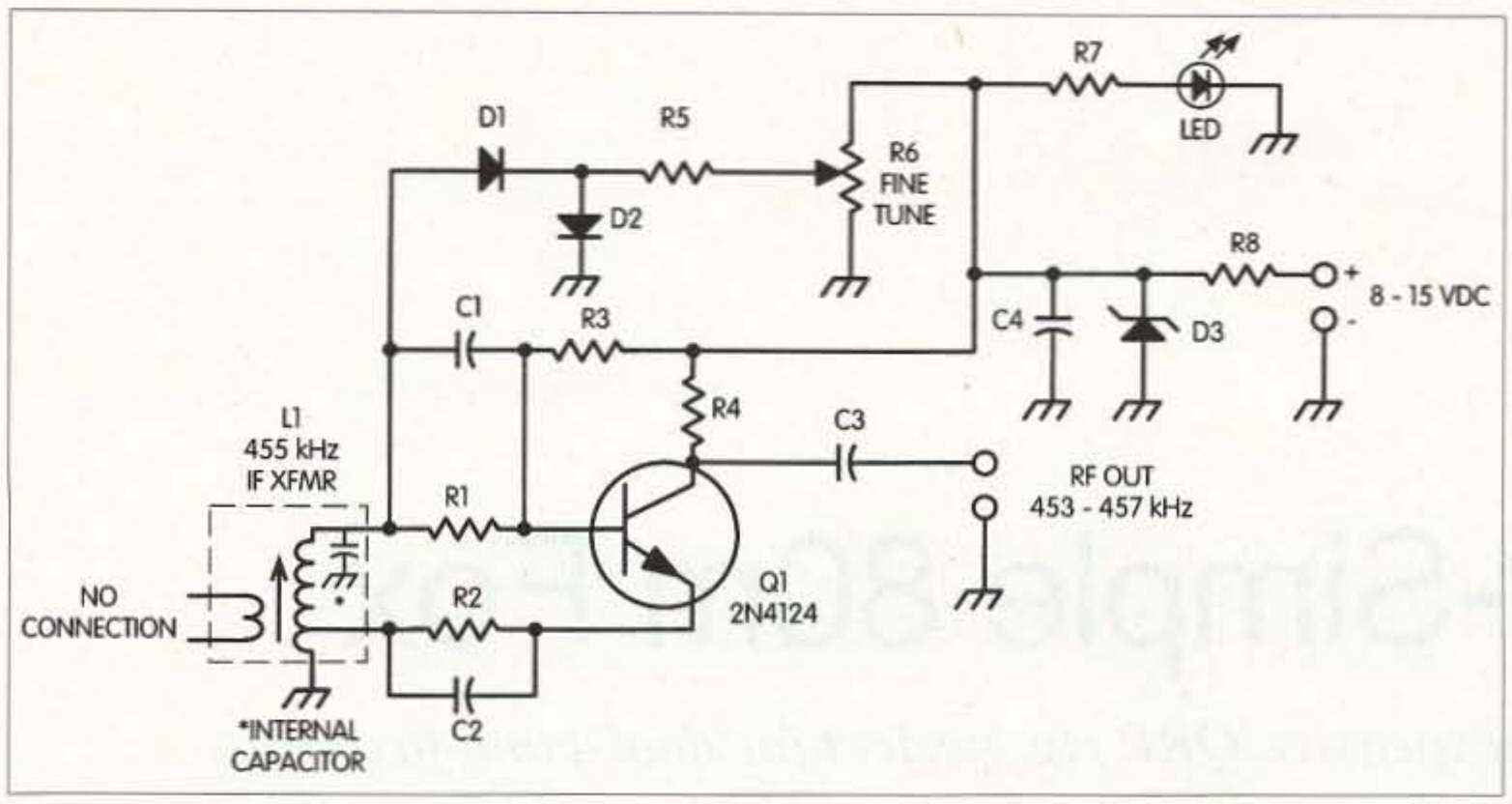

Fig. 1. BFO schematic.

by using the general coverage receiver in your transceiver, or actually using the shortwave radio that you have purchased.

1. Apply power to your BFO. For this test, you can use a standard 9 V battery.

2. Place the output wire from your BFO near the antenna connector of the receiver. If your receiver has a whip antenna, the wire may be clipped to the antenna.

3. Set the BFO fine tuning control to the middle position.

Part No.	Description
R1	15k 1/8 W
R2	470 ohm 1/8 W
R3	22k 1/8 W
R4	100 ohm 1/8 W
R5	330k 1/8 W
R6	10 pot
R7	1k 1/8 W
R8	220 ohm 1/8 W
C1	47 pF
C2, C3	100 pF
C4	0.1 µF
L1	455 kHz IF transformer
Q1	2N4124 NPN transistor
D1, D2	1N4002 silicon diode
D3	6.8 V zener diode
LED1	LED diode
Required but not listed: DC power source, well-filtered, 8–15 V; Hookup wire or minicoax to couple BFO to receiver; Solder, soldering iron, hand tools, and alignment tool for L1	

Table 1. Parts list.

4. Tune your receiver to 455 kHz, and, using the alignment tool, adjust the slug in L1 until you hear the BFO signal. Your BFO is now ready for use with any AM-only shortwave receiver.

5. If you are using the BFO with your AM-only shortwave radio, tune the radio to any frequency where there will obviously be CW, RTTY, or SSB signals, then adjust the slug in L1 (refer to step 4) until you hear the background hiss, and beeps and whistles characteristic of CW/RTTY reception.

We used the Ten-Tec kit, and installed the approximately 1.5-inch-square PC board inside a small minibox, adding an on/off switch and battery holder. Our connection to our Drake SW1 was made using the screw terminals marked as antenna connection, with our actual receiving antenna connected to the SO-239 coax connector. There is a remote possibility that you will not obtain satisfactory BFO operation by coupling the oscillator's output to the receiver's antenna. In this case, it may be necessary to try a direct connection to the receiver's 455 kHz IF section through a low value (10 pF or less) capacitor.

Considering the fact that many excellent AM-only shortwave receivers are available for less than $50 from *73* advertisers or locally at your mall, the addition of a $10 BFO makes them even more useful, especially for monitoring for band openings. The choice is yours: Either scrounge around, or waste gas going from here to there for the parts, or pay $9 plus shipping to Ten-Tec for the kit. Either way, it's one heck of a value-added addition to an AM-only shortwave radio.

By the way, if you do order the Ten-Tec kit, be sure to tell them you read about it in *73 Amateur Radio Today!*

A complete kit of materials, including the etched and drilled printed circuit board, is available as the T-Kit 1050 BFO from Ten-Tec Corporation, 1185 Dolly Parton Parkway, Sevierville TN 37862-3710; 1 (800) 833-7373; [www.tentec.com]. 73

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Super-Simple 80m Fox

Build this easy and inexpensive QRP rig, perfect for dual-band foxboxes.

Are you looking for simple and inexpensive transmitters to get 80-meter foxhunting started in your area? Do you want to add 80 meters to your existing 2-meter foxboxes? Here's your answer. This rig uses one IC and one transistor, yet it puts out almost three watts of clean keyed CW with a 12-volt battery pack. It's not fussy about antenna matching and the circuit board is only a little bigger than the new "Adopt a Child" stamp.

Credit for this circuit design goes to Rik Strobbe ON7YD of Baal, Belgium (**Photo A**). He calls it the ATX80. Rik has served as Interim Chair of the ARDF Working Group in IARU Region 1 (Europe and Africa), so he understands the requirements for radio foxes in international competitions. Over a dozen of these little rigs have already been built stateside and are in regular use with no problems.

Circuit description and construction notes

Fig. 1 is the complete transmitter schematic. One gate of U1, a quad NAND IC, is the active element of the oscillator. The series-resonant crystal is in the feedback path. Grounding pin 1 stops the oscillation, which should be done between transmissions to prevent oscillator radiation (backwave). Even with a well-shielded enclosure, the backwave can be heard about 15 feet from the transmitter, a potential giveaway to nearby foxhunters.

The remaining gates of U1, connected in parallel, form the buffer/driver stage. CW keying also takes place here. The final uses a fast-switching field-effect transistor (MOSFET) by International Rectifier Corporation that operates in Class C at about 50% duty. Components between Q1 and the antenna provide DC blocking and low-pass filtering.

Bare circuit boards are available from FAR Circuits for four dollars each, plus $1.50 shipping for up to four. Ask for the "ATX80 transmitter." If you wish to make your own boards, artwork is available via link from my "Homing In" Web site. See **Table 1** for the parts list. Eighth-watt resistors fit best on the circuit board, but you can squeeze quarter-watters in (**Photo B**).

L1 is a miniature RF choke suitable for 80-meter blocking. Values in the 5 to 10 microhenry range are OK. Make

Photo A. *Rik Strobbe ON7YD, designer of this transmitter, teaches the principles of 80-meter ARDF at the 1999 IARU Region 2 Championships in Portland, Oregon.*

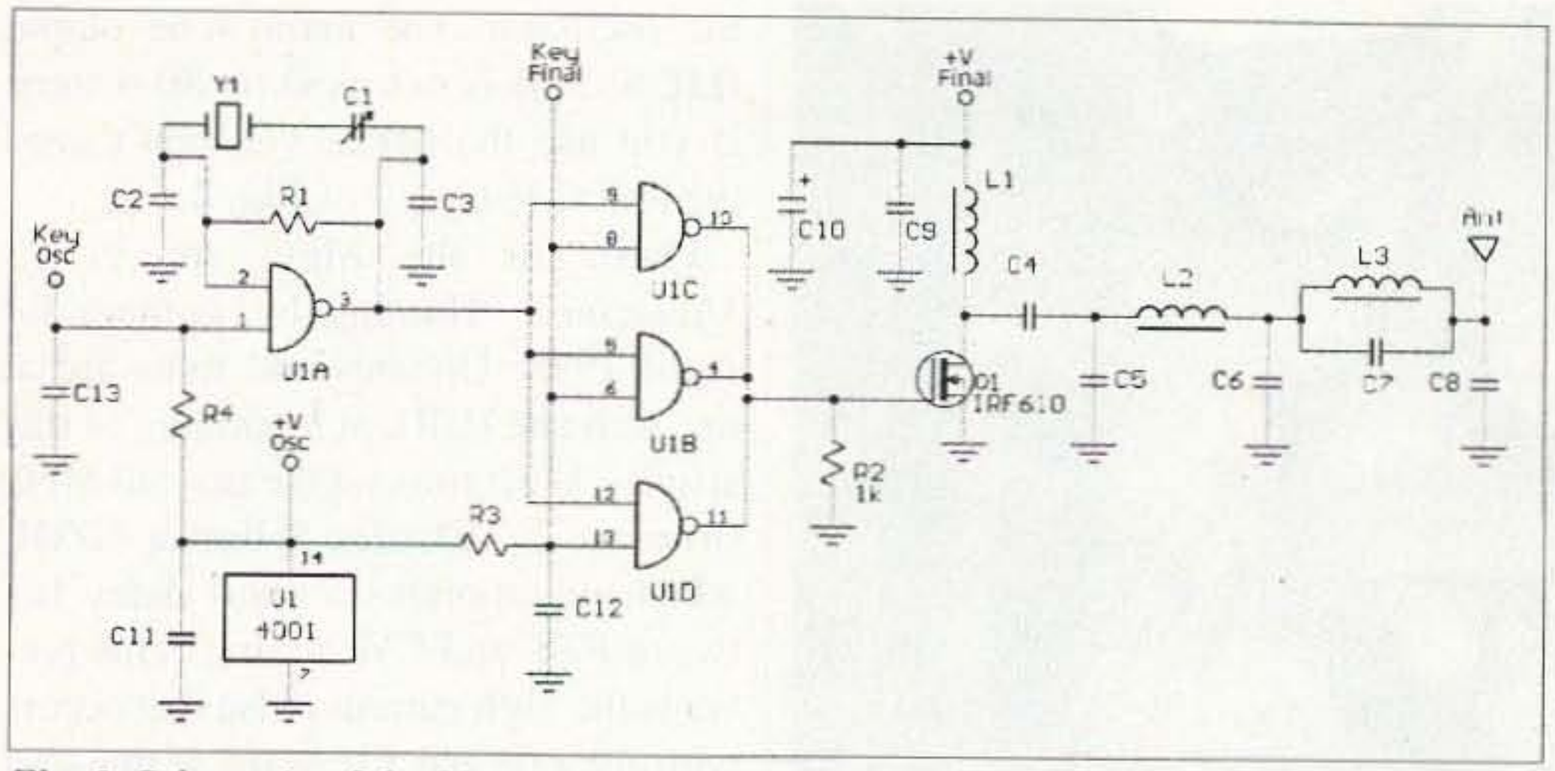

Fig. 1. Schematic of the 80-meter transmitter.

sure it can handle at least an ampere, because nearly that much will go through it if you inadvertently key the final without the oscillator running.

L2 and L3 in the output lowpass filter are wound with AWG #24 enameled wire on Amidon T50-6 (1/2-inch O.D. yellow) iron powder toroidal cores. Space the turns evenly around the circumference of the core. These coils stand vertically on the board and should be fastened down to prevent damage from shock and vibration. I used "hot glue."

The rest of the parts are available at Digi-Key and many local electronics parts houses. Parts for five transmitters should cost about fifty dollars. You'll spend less if you have a well-stocked junk box (**Photo C**).

Like most 80m ARDF promoters, I chose 3579.5 kHz for my course foxes. TV colorburst crystals for that frequency are plentiful and inexpensive. The board is laid out for crystals with 3/16-inch lead spacing. I used junk box crystals in much larger holders by bending the leads and drilling out the holes slightly so that they fit.

Rik says that you can use a ceramic resonator (such as 2TA-3.58MG by ECS International, available from Digi-Key) in place of the crystal. With the resonator, the frequency can be tuned from about 3579 to 3630 kHz with C1. The downside of using a resonator is that frequency stability is not as good. You may have to experiment with lower values of C3 and use NPO capacitors at C2 and C3 to prevent drifting as Q1 warms up the circuit.

With a crystal, I found the transmitter is "stable as a rock" and adjusting C1 has little effect. I replaced that trimmer with a 47 picofarad fixed capacitor.

For a finish line beacon, select a

Parts List

Name	Value
C1	10–60 pF trimmer
C2, C3	150 pF
C4, C11, C15	0.1 µF
C5	330 pF
C6	1500 pF
C7	120 pF
C8	0.001 µF
C9, C12, C13	0.01 µF
C10	10 µF tantalum
C14	680 pF
D1–5	1N4148 or equiv.
Fuse	See text
L1	Rf choke, see text
L2	26T, see text
L3	24T, see text
Q1	IRF610
R1	1.8M
R2	1k
R3, R4	15k
R5	680k
R6, R7	56k
R8	330k
U1	CD4001B
U2	CD4049B
Y1	Crystal, see text

Table 1. Parts list.

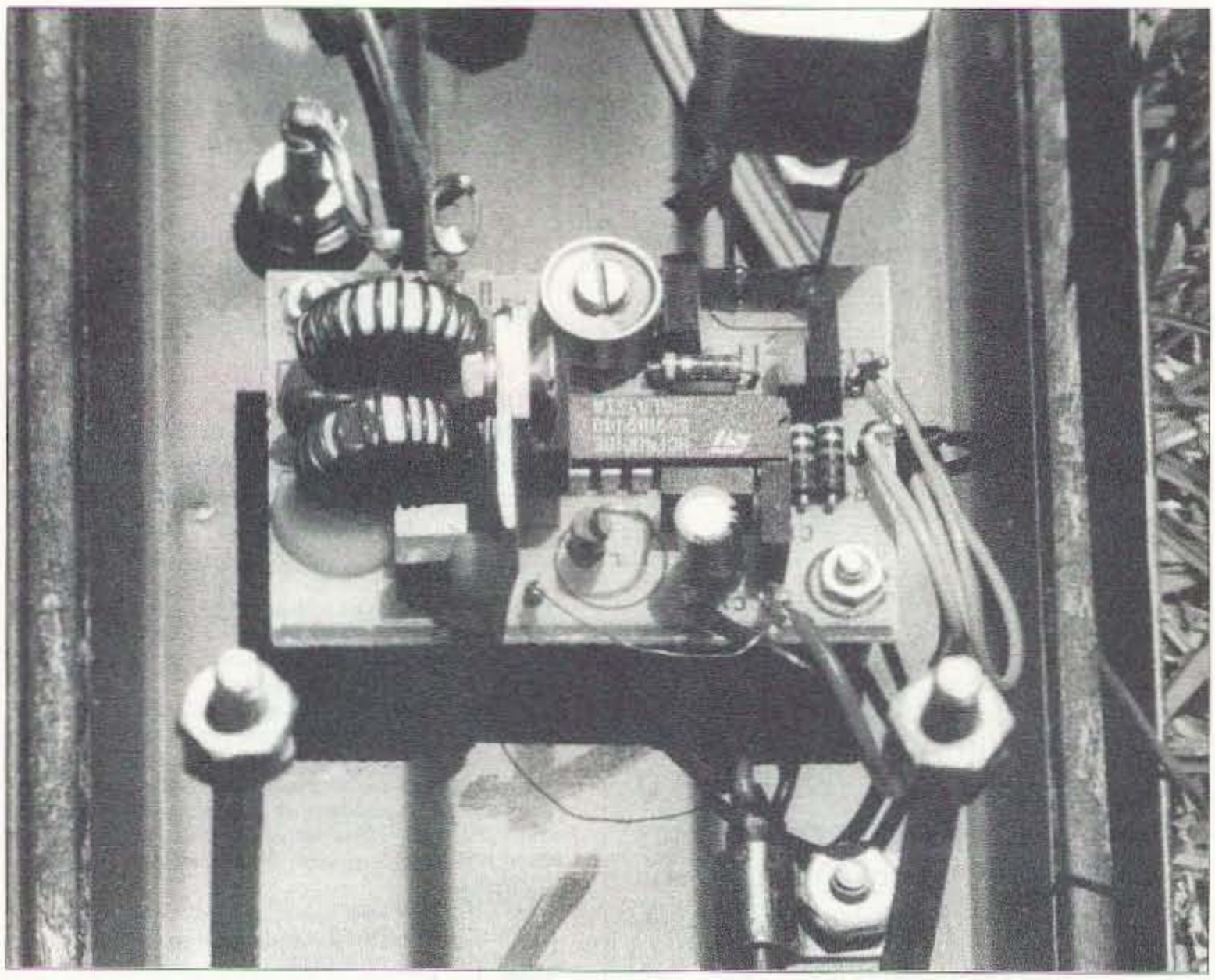

Photo B. *A 2 x 1-3/8 inch circuit board holds all components for the QRP transmitter.*

frequency at least 20 kHz away from the course foxes. A 3546.8 kHz crystal is 99 cents in the B.G. Micro catalog. That supplier also has 3-packs of colorburst crystals for a dollar per pack. North American 80m foxtailing events are in daylight, when there's no distant propagation and the band is quiet. Nevertheless, take care to avoid any local daytime net frequencies.

You'll need a heatsink at Q1, even though there isn't much room for it. I trimmed the sides from Aavid 593002B03400 sinks to get flat 1- x 1-1/8-inch anodized pieces with suitable bolt holes. Putting tape on one edge prevents shorts to leads of C4 and C5. Thermal grease under the transistor insures best heat transfer to the sink. Hot glue holds the sink in place on the board to keep transistor leads from getting bent.

Keying and timing

The Montreal Fox Controller (MFC) by François Tremblay VE2JX and Jacques Brodeur VE2EMM is ideal for keying and timing of this transmitter in a foxbox. Use the 80-meter (CW) MFC output to key the final and the two-meter PTT (TX ON) output to key the oscillator. The audio tone output (MCW/2M) is not used on 80 meters. If you use the MFC, you don't need the interface circuit of **Fig. 2**.

Plans for the MFC are in *73 Magazine's* "Homing In" column for April 1998. Updates and links are at my Web site (URL at beginning of this article). I recommend the revised MFC firmware by Charles Scharlau NZØI, which incorporates a short delay between PTT and CW keying. This prevents the high current pulse that occurs with the original firmware at the start of each transmission.

The PicCon by Byonics (Byon Garrabrant N6BG) is also a suitable controller for this transmitter. It has only one keying output, which is selected by DTMF command to be either CW or PTT. To have separate keying of oscillator and final, a simple hardware modification is necessary. I came up with this mod and the interface circuit of **Fig. 2** so I could use PicCons to control both 80m and 2m transmitters in five of my foxboxes (**Photo D**). Either or both bands will transmit at the programmed times, determined by the settings of S1 and S2.

The PicCon mod is simple: Isolate the extra grounded pad of the 6-wire connector on the board (the pad closest to the corner). I carefully used a Dremel tool with a #192 cutter bit. Now, connect a wire from the newly isolated pad to pin 6 of the 16F84 PIC socket. (Yes, it's pin 6 and not pin 7. There is an error on the schematic in the version 1.0 PicCon manual.)

This mod brings out the audio square wave on the blue cable wire (pin 6 of the RJ11 connector) at a level sufficient to drive logic gates. Use the black wire (connector pin 2) for both "radio ground" and "DC ground." Command the ID Tone for about 800 Hz (B375). Do not set the PicCon for CW Mode (B502).

In **Fig. 2**, U2 and associated components detect the envelope of the audio tone, which is buffered and becomes the CW keying line to the final stage of the transmitter. DC isolation with C14 is important because the resting state of the PicCon tone output can be either logic HIGH or LOW. D4 and its

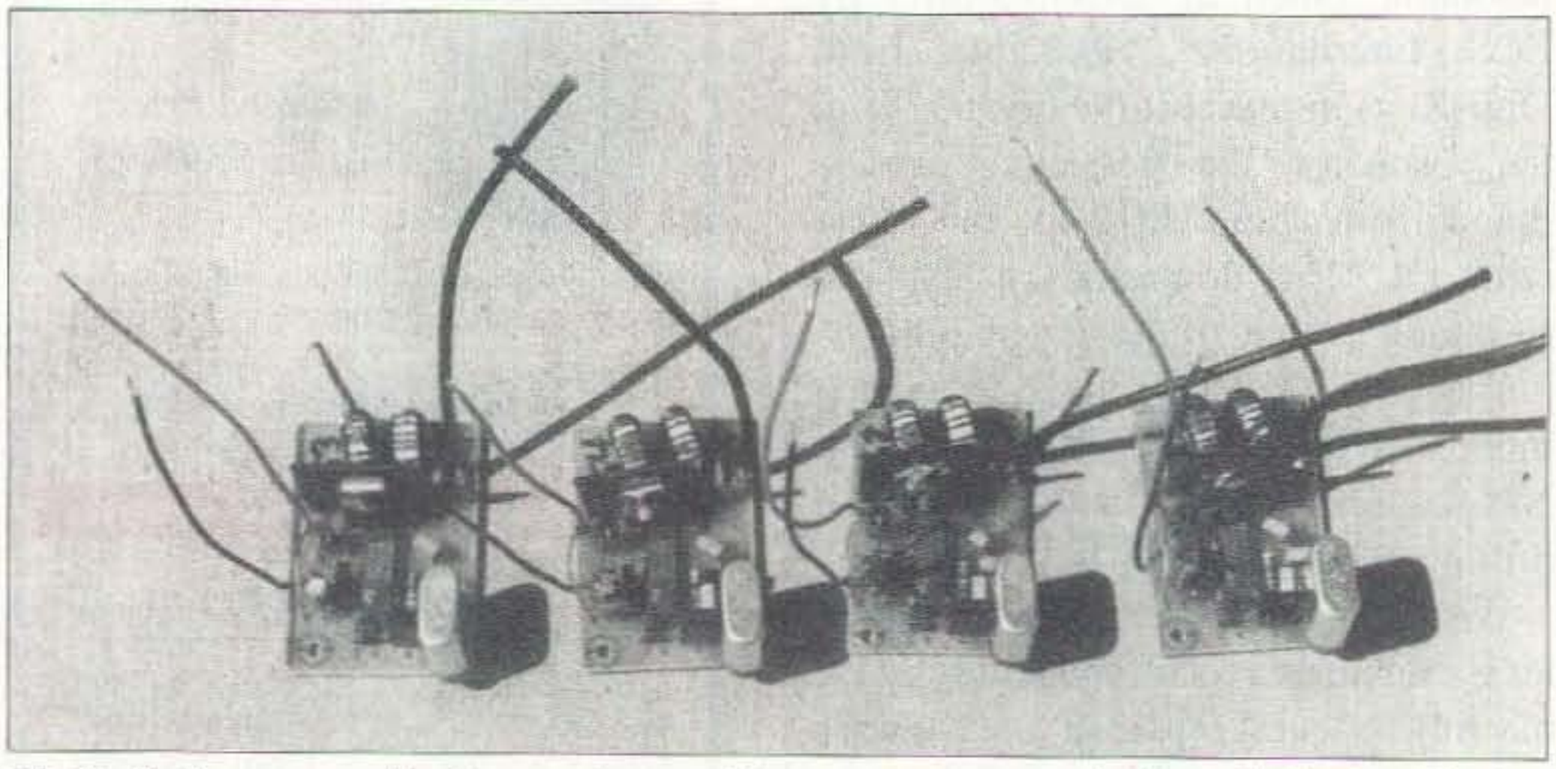

Photo C. *Four assembled transmitters with output coax attached, ready for installation in foxboxes.*

connection to U2-14 keep the final from being keyed if the oscillator is not on.

I built my interfaces on 1-3/8-inch-square pieces of perfboard. Components inside the dashed lines in **Fig. 2** are part of the keying circuit of my existing two-meter transmitters. The diode across the relay coil is important to prevent inductive "kick" from damaging D3 and U2 when the relay opens. If your transmitter uses relay keying and doesn't have this diode, add it.

U2A and U2B provide logic HIGH output that follows the CW keying. I use it to drive the LM317 voltage regulator control terminal in my two-meter transmitter through a resistor of about 47k ohms. This provides about 50% keyed amplitude modulation in addition to the MCW FM. It's very helpful to users of foreign-made two-meter AM RDF sets with audio strength indication, such as the Ron Graham (Australian) and Altai (Russian) units. See "Homing In" in the March and June 1998 issues of *73 Magazine* for more details of my 2m foxboxes. If you don't use those two gates, be sure to ground the inputs (pins 3 and 5). Leaving them open would cause high supply current.

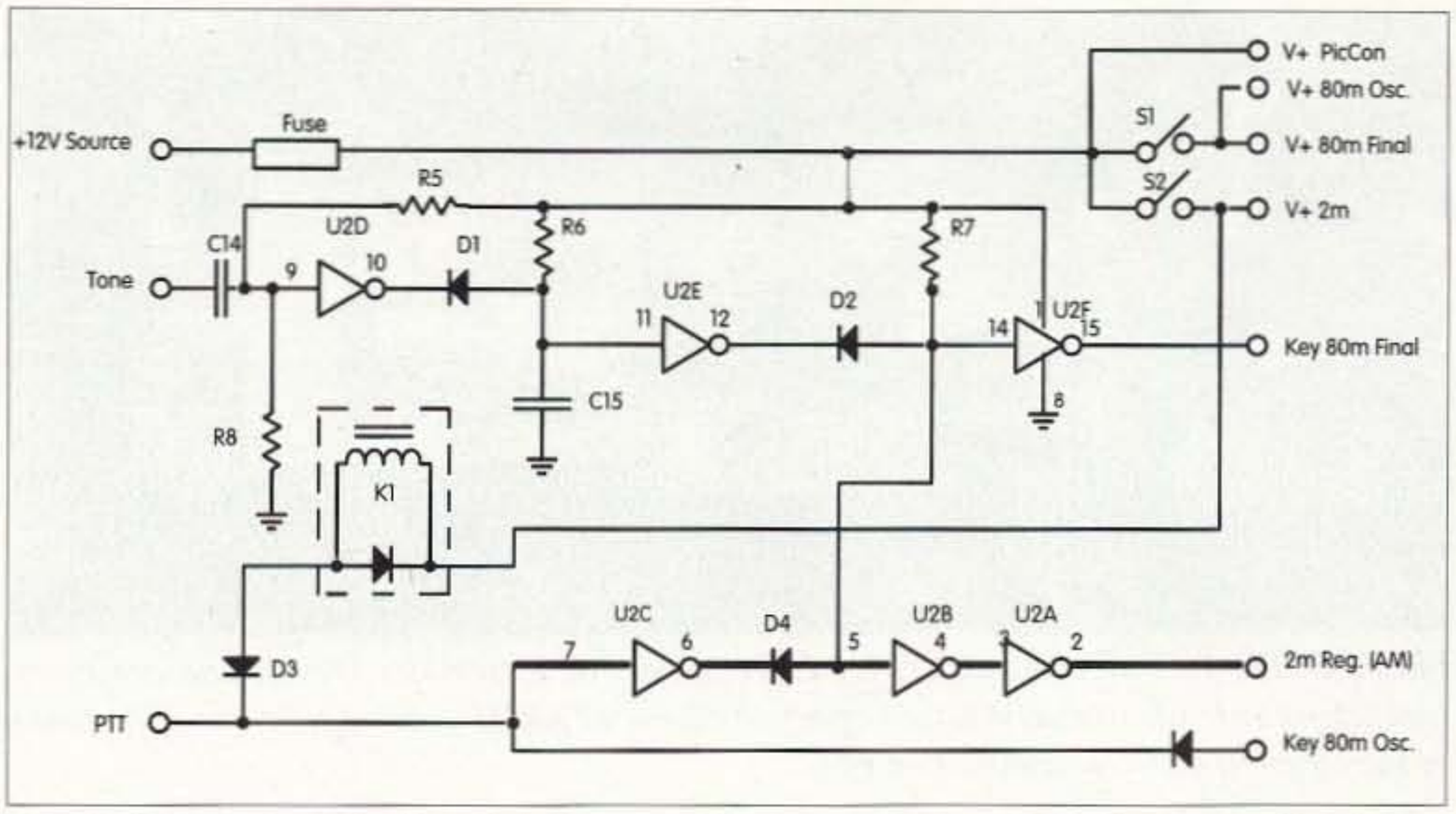

Fig. 2. *Schematic of the interface between 80m transmitter and PicCon controller. It also shows the 12-volt power distribution for the dual-band foxbox.*

Build it tough

Foxboxes take a lot of abuse, so make yours as rugged as possible. Like most ARDF course-setters, I prefer surplus ammunition boxes for enclosures because they are inexpensive and waterproof. By mounting all the electronics (except battery) on the lid and securing all cables, there is no worry about wires and coaxes flexing and breaking just before a hunt.

Photo E shows how I constructed my finish-line beacon. Note the clamp that holds battery wires to the lid. This prevents them from breaking at the connection to the transmitter board. RF output to the antenna wire goes through the lid on a Pomona #3760-2 insulated binding post. Radial wires connect to a grounding bolt and wing nut on the outside of the lid.

The BNC feedthrough in **Photo E** is left over from previous use of that ammo box on two meters. Someday I may use it for a remote control antenna. When fully assembled, a cover plate is held in place by the five long bolts. The heavy battery in the box bottom is cushioned by foam, but the cover over the transmitter and MFC provides physical protection to them in case the battery shifts in transit.

The fuse in **Fig. 2** prevents battery meltdown if an accidental short occurs. Value should be about double the maximum transmit current of all transmitters in the foxbox. Two amperes should be about right to start. Since fuseholders can become intermittent, I prefer to solder in about an inch of fine magnet wire (AWG 32) instead of using an ordinary 3AG fuse and holder.

Why the concern about intermittents? Both PicCon and MFC have delay-start timers so that you can put

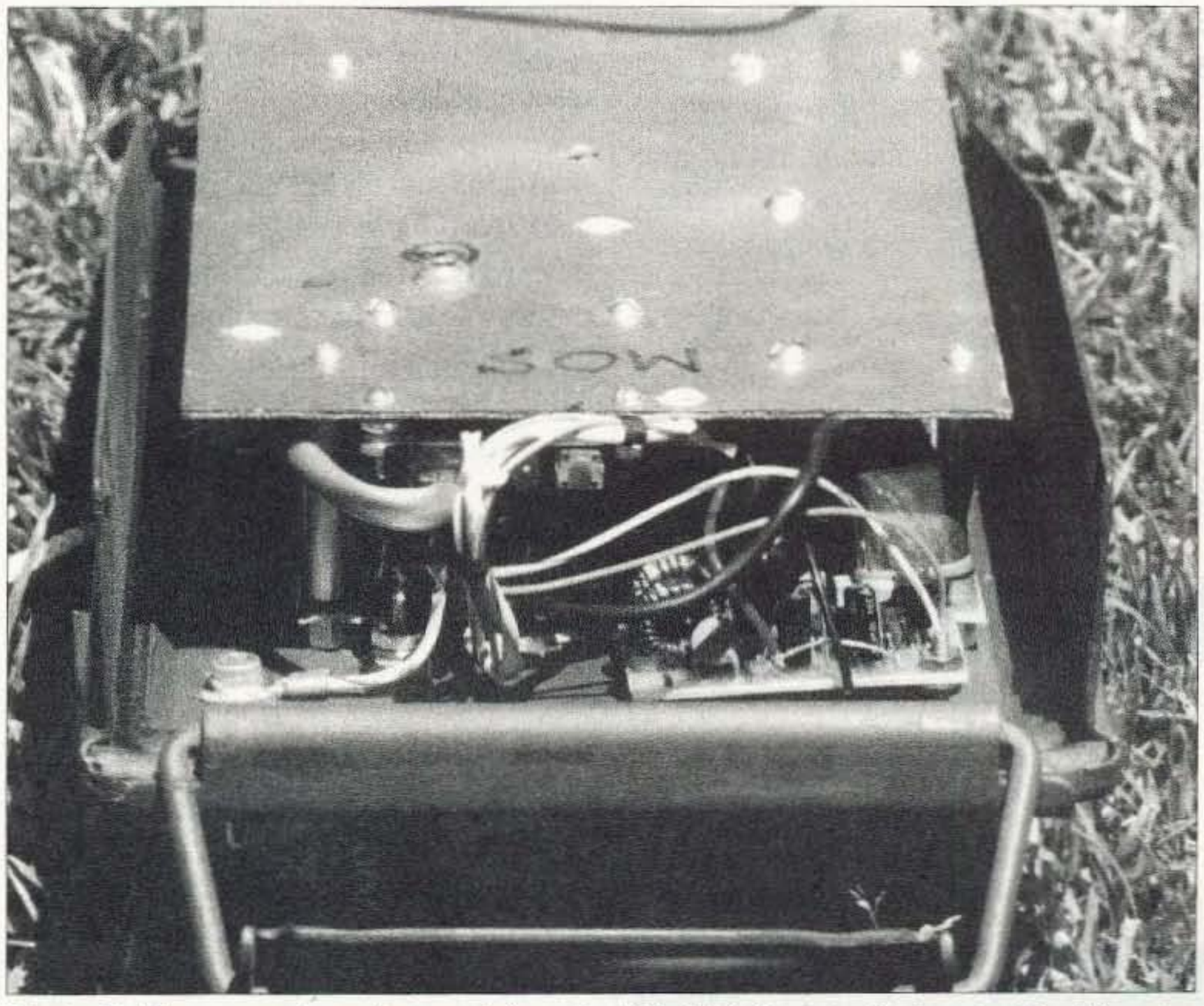

Photo D. *There wasn't much room left on the lid of this 2-meter foxbox, but the 80-meter board fit right in. The edge of the PicCon with reset button and LED indicator is visible on the underside of the protective plate.*

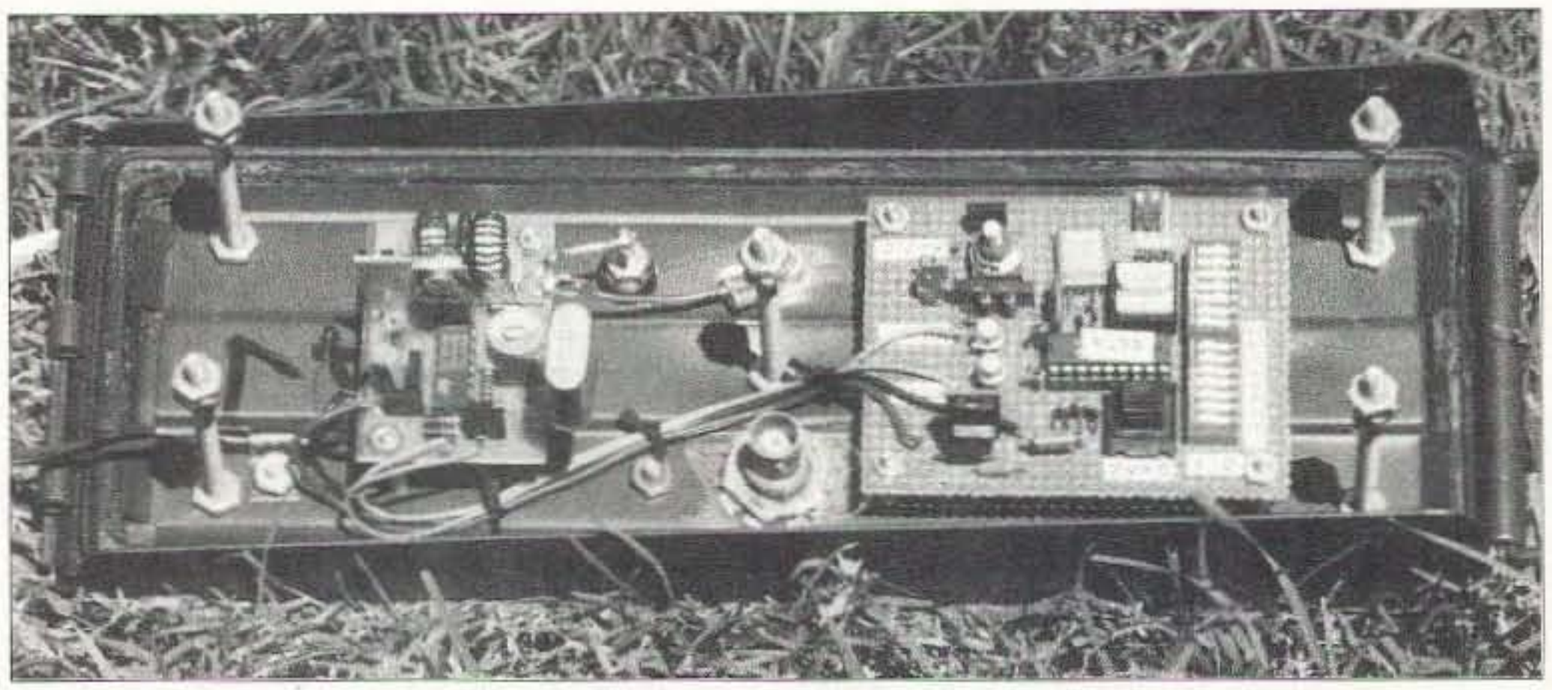

Photo E. *The ATX80 transmitter (left), Montreal Fox Controller (right) and a battery (not shown) are all you need for an effective 80-meter ARDF transmitter. They all mount in the cover of a small ammunition box.*

your foxboxes out on the course several hours ahead and have them start in proper sequence just as the hunt begins. If power to these controllers is interrupted for only a few milliseconds during the countdown, they will reset and there will be dreaded silence at start time.

Slide switches in my projects have developed intermittents in the past, so I use toggle switches or soldered wires instead. All switches should be mounted completely inside the foxbox to prevent accidental activation or deactivation in transit. Check battery connectors regularly and re-crimp as needed to prevent another cause of intermittents.

Components in **Fig. 2** were largely determined by the contents of my junk box, which includes lots of CMOS ICs. Bipolar logic with open-collector outputs would have made for a more elegant design, eliminating D1, D2, and D4 at the expense of higher supply current during countdown. Let your own parts sources be your guide.

Will it smoke?

My preferred method of initial checkout for projects like this is to apply power and verify critical IC and transistor node voltages before these devices are installed. (That's after doing a careful visual inspection of all other parts, of course. I found a solder bridge on one board that way.) I prefer sockets for ICs, but there wasn't room on this board.

For foxbox service, use a 12-volt lead-acid or nickel-cadmium battery pack. At typical 12.5 V pack voltage, I measured 3.1 watts RF into a 50-ohm dummy load. This is at the low end of the IARU requirements for championships (3 to 5 watts), but has been more than adequate for southern California foxhunts. Under these conditions, total current drain of all stages was about 400 milliamperes. Second harmonic was -36 dB relative to the fundamental, and third harmonic was -52 dB. All other harmonics and spurs were -64 dB or better. These values meet the FCC requirements in 97.307(c).

For more RF output, you can increase the final stage supply voltage. At the extreme, Rik got 19 watts out of his rig with a 30-volt supply, using a much larger heat sink on Q1. Do not exceed +15 volts to the oscillator and buffer stages. The circuit board has separate voltage source pads for oscillator and final.

There are no antenna tuning and matching adjustments, but this transmitter is very tolerant of nonmatched loads. You can get an idea of the closeness of match by measuring the final DC current. I sometimes get only 300 mA or so when using a random vertical antenna (see "Homing In" elsewhere in this issue), but so far the foxhunters have always heard the signal at the start point, which may be three or more kilometers away.

Many thanks to Rik Strobbe ON7YD for providing this design to radio-orienteers. Thanks also to Bob Frey WA6EZV, who arranged for the stateside circuit board source. I'm eager to hear of your experiences with this little transmitter. You can send E-mail or postal mail to the address at the head of this article.

Resources

Amidon Associates, Inc.
240 Briggs Avenue
Costa Mesa CA 92626
(714) 850-4660
[http://www.amidoncorp.com]

B.G. Micro
555 N. 5th Street, Suite 125
Garland TX 75040
(800) 276-2206
[http://www.bgmicro.com]

Byonics
Byon Garrabrant N6BG
8128 Kokoma Dr.
Las Vegas NV 89128
[byon@byonics.com]
[http://www.byonics.com]

Digi-Key Corporation
701 Brooks Ave. S.
Thief River Falls, MN 56701
(800) DIGI-KEY
[http://www.digikey.com]

FAR Circuits
Fred Reimers KF9GX
18N640 Field Court
Dundee IL 60118
(847) 836-9148
[farcir@ais.net]
[http://www.cl.ais.net/~farcir/] 73

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9128 Surrey NE
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YOU Can Build the FoxFinder 80!

Here's how to get started in the exciting world of 3.5 MHz ARDF.

The purpose of this article is to describe how to build a simple amateur radio direction finding (ARDF) receiver for 80 meter international-style transmitter hunting. The criteria for the receiver is that it must be easy to align without expensive lab equipment, and all the parts must be easy to locate. In the case of this receiver, the majority of the parts were purchased from Digi-Key, Newark, Radio Shack, and Radio Shack Unlimited. One component was purchased from Amidon Associates, and another part was located at a local surplus store (10-turn knob pot used for VFO control).

Unlike for VHF direction finding (DF) equipment, very little information about complete 80 meter DF sets can be found in the United States. Bits and pieces of information relating to DF antennas can be found in books such as the current edition of the *ARRL Antenna Handbook.* Another source of information is a book by Joe Moell KØOV titled *Transmitter Hunting: Radio Direction Simplified.* Also, a new book by Joe Carr is a good source of information about loop antennas; its title is *Joe Carr's Loop Antenna Handbook.*

Information on small CW receivers can be found in the *ARRL Handbook,* QRP handbooks and the Internet.

Back in May of 1999, I started developing my first portable receiver for use in the ARDF competition of the Tenth Anniversary Friendship Radiosports Games in Portland OR, in August 1999. The result was an operational receiver that was used there. I was the only US contestant with my own 80-meter equipment. All other US contestants used equipment provided by the Europeans.

The receiver described in this paper is my second-generation design. My first version receiver shown in **Photo A** was the one that was used in the Portland event. It was a superhet with an 8 MHz IF and a ferrite rod antenna with a vertical sense whip (more on why a sense antenna is required later). Several improvements were made based on my experience using the original

Photo A. *Receiver used in 1999 Portland games by Jerry Boyd WB8WFK.*

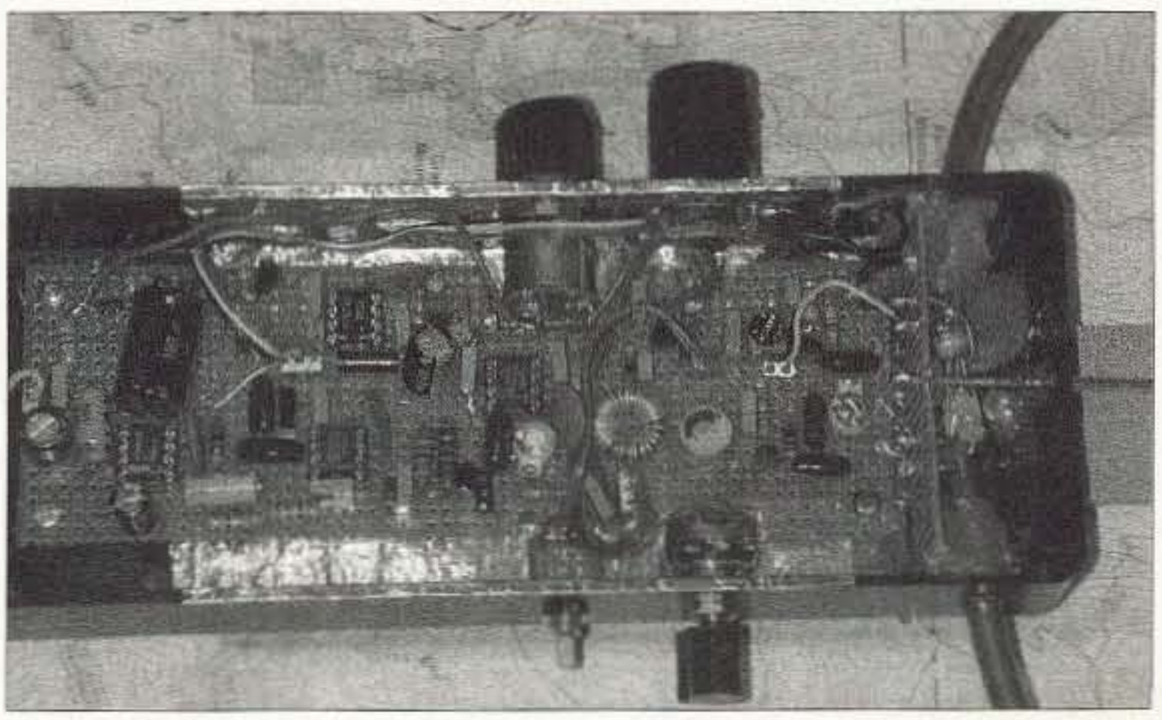


Photo B. *Inside view of the receiver. After gluing the loop in place, coils L1 and L2 are wound. First, coil L1 is wound using 6 turns of #28 wirewrap wire. The wire ends are connected to the bulkhead (see* ***Fig. 5****). Next, sense-coupling coil L2 is wound using 5 turns of wirewrap wire.*

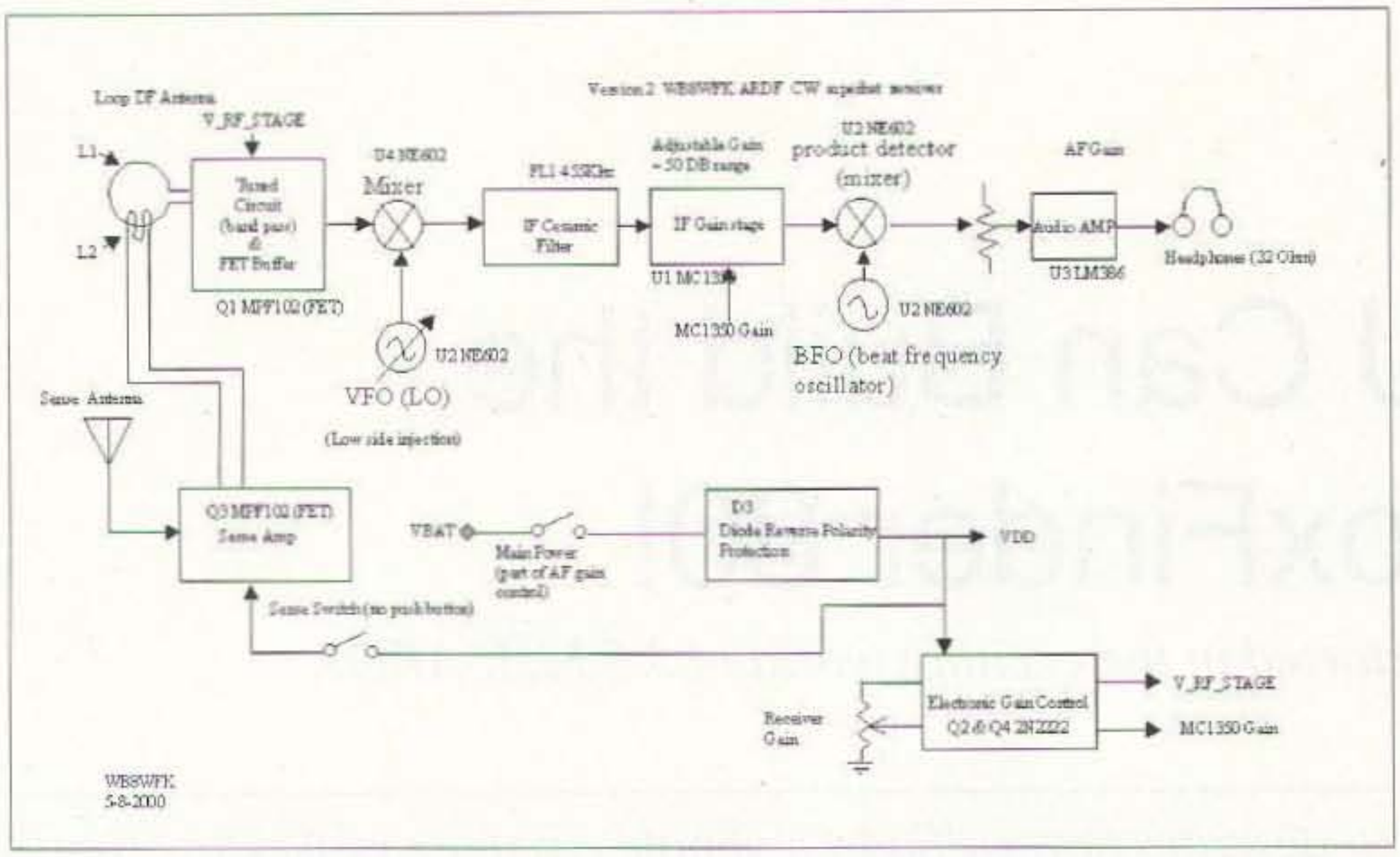


Fig. 1. *HF DF receiver block diagram.*

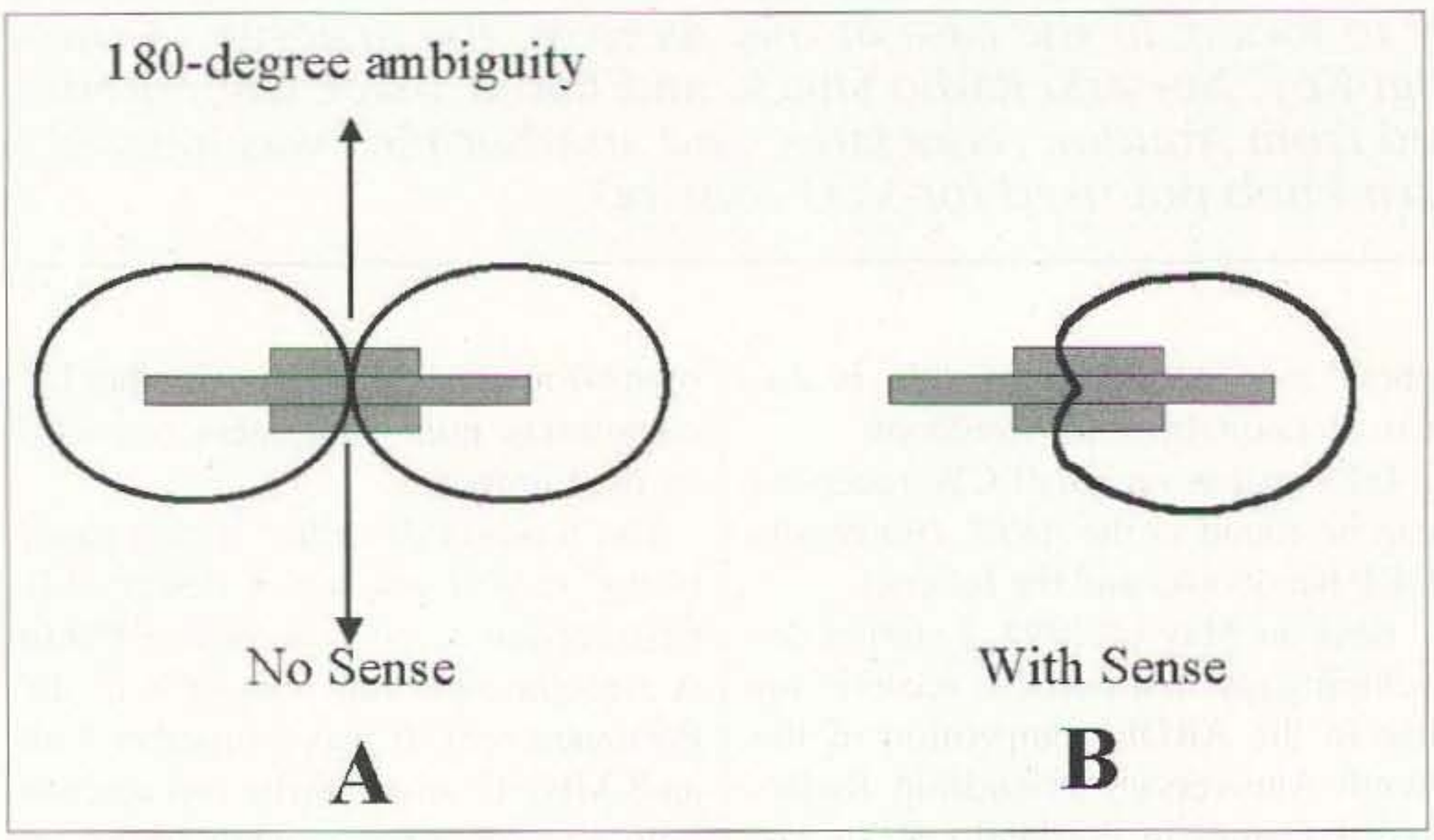


Fig. 2. *Loop antenna patterns, viewed from above looking down onto receiver. A. No sense. B. With sense.*

receiver during the 1999 hunt. It is my hope that this receiver will inspire the beginning of experimenting with home-built HF DF sets in the United States.

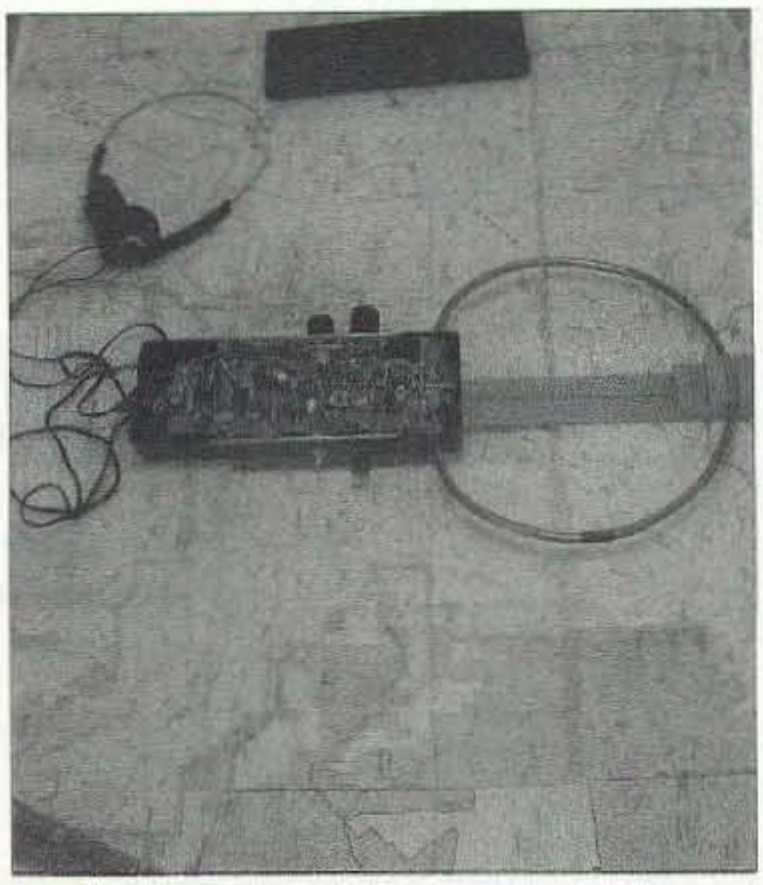


Photo C. *Another view showing how sense antenna and loop are attached.*

To improve the receiver, size and weight reduction efforts were undertaken. The first generation receiver was awkward to carry, and I decided that the next receiver must be as small and light as possible. After all, an ARDF course can be up to 8 km in length, and weight becomes important. A plastic case was used for both receivers. To provide shielding, the inside is lined with copper foil.

Next, cost reduction efforts were used for the second-generation receiver, including the design of the loop. This would make it more affordable to reproduce. The $15 ferrite rod used in the first receiver was replaced with a loop wound inside 1/4-inch copper tubing using wirewrap wire.

Also the IF frequency was changed from 8 MHz to 455 kHz so that low-cost

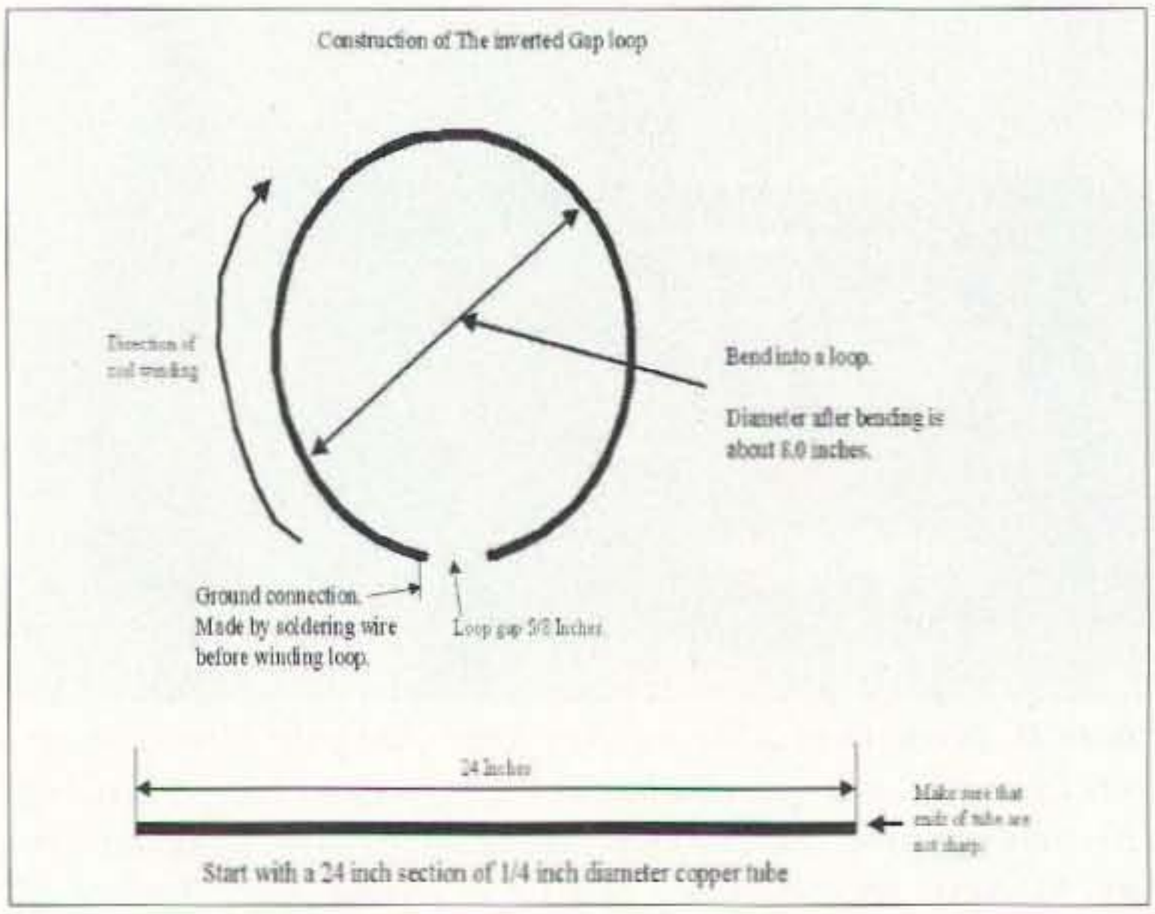


Fig. 3. *Faraday shield construction.*

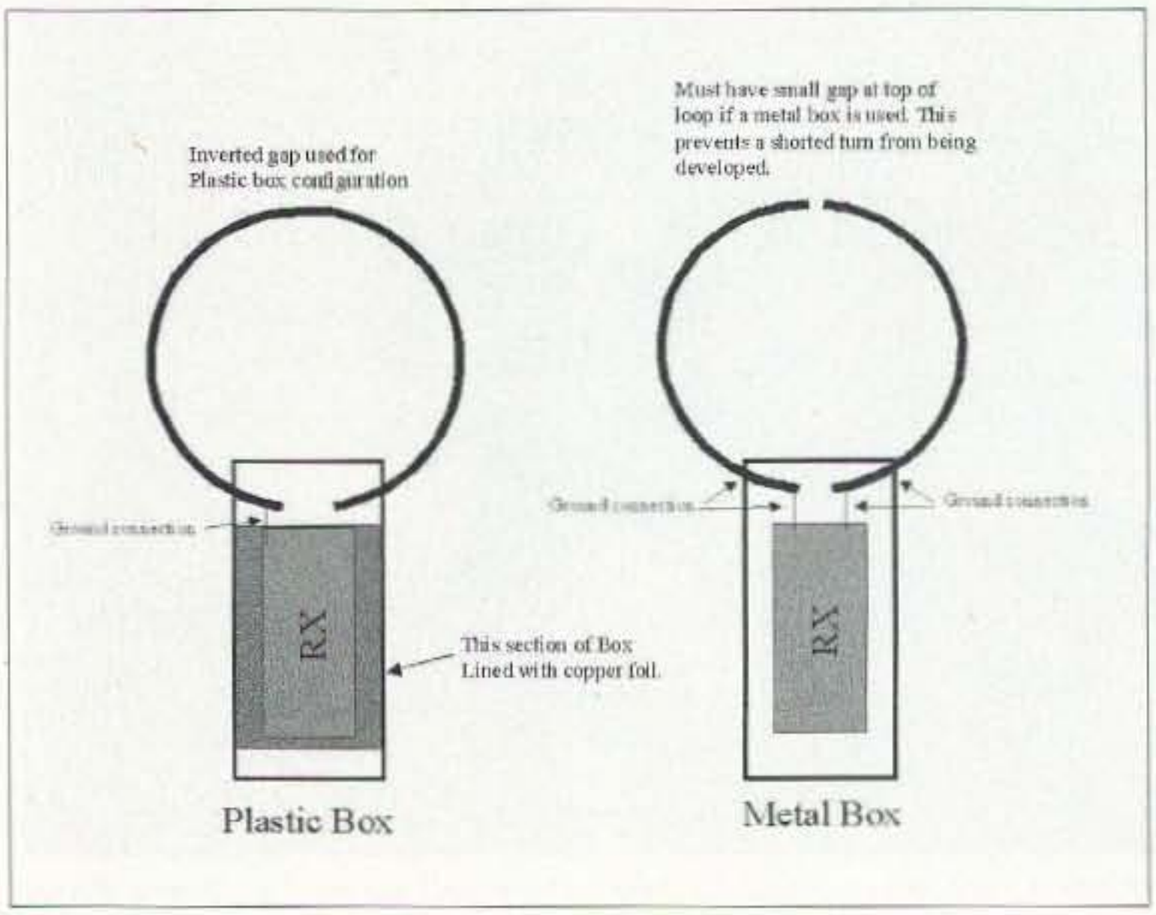


Fig. 4. *Diagrams showing the use of a plastic box or a metal box.*

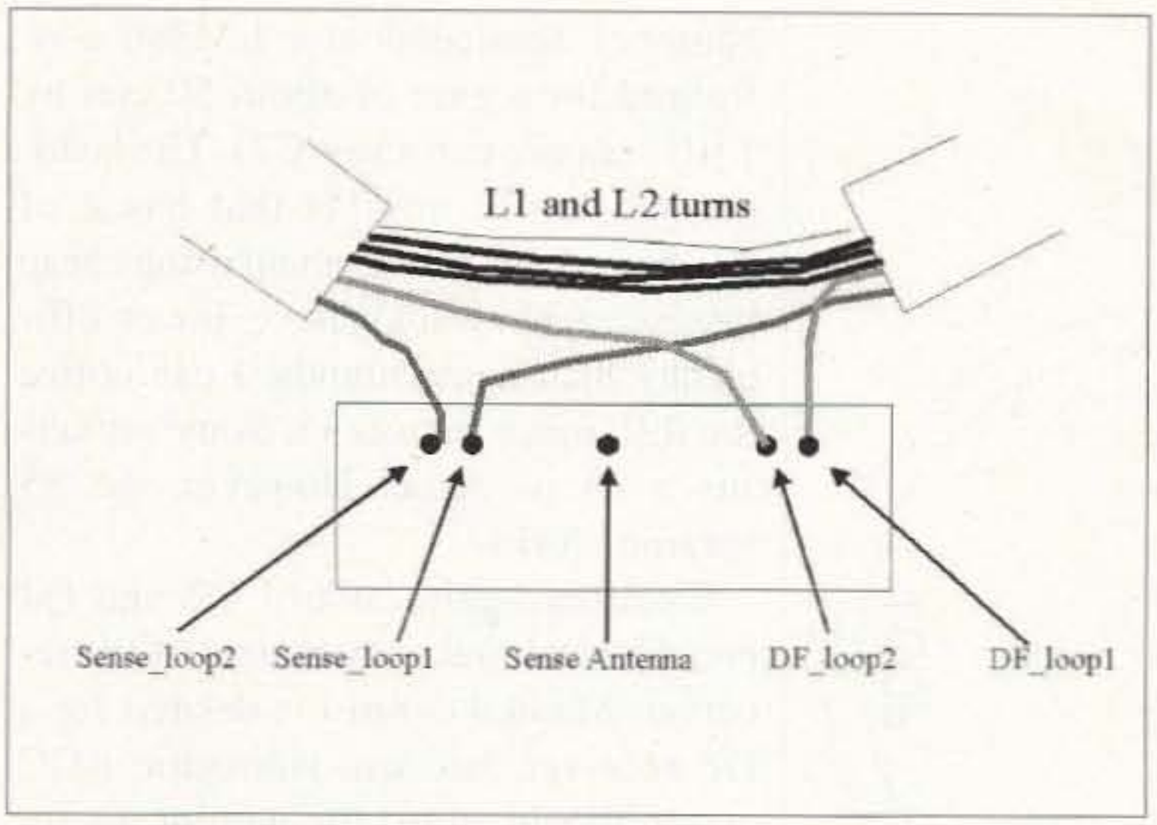


Fig. 5. *Bulkhead connections, as viewed from receiver PCB.*

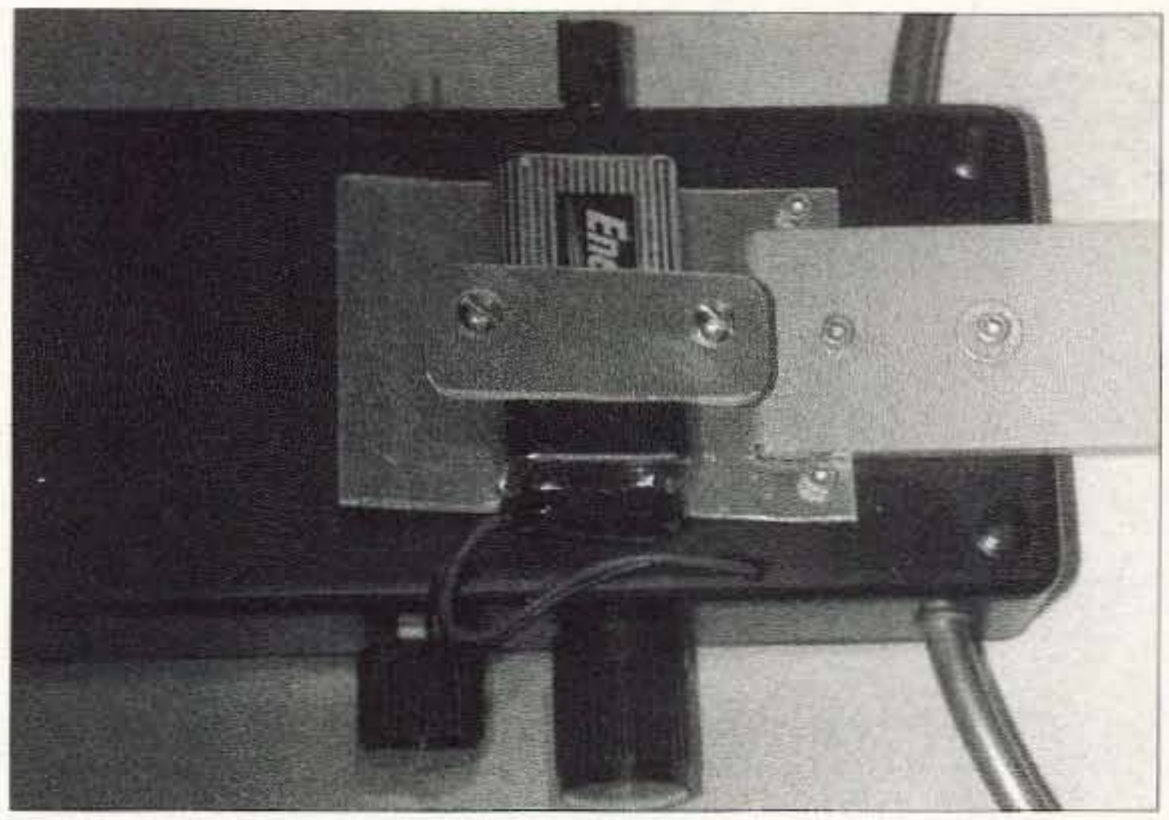


Photo D. *Home-made battery holder.*

AM radio IF filters from Digi-Key (or surplus sources) could be used. The 8 MHz version used a homemade crystal filter in the IF made from microprocessor crystals and required a crystal selection process. I thought that this would not be easy to reproduce without test equipment to verify its operation. The improved receiver has a "no-tune IF."

Another improvement was the addition of electronic switching for the sense antenna. This appears to be a common feature in European designs. This allows the sense enable switch to be located in a location that is easy to operate with one hand. A normally open push-button switch is used for the sense switch. The receiver is powered by a 9 volt battery.

Block diagram and receiver operation

Refer to **Fig. 1** for an overview of the receiver. The signal is first picked up by L1, the primary DF antenna (L2, the sense-coupling loop, will be discussed later). L1 and L2 are housed in a Faraday shield made from 1/4-inch copper tubing. L1 presents the typical figure-eight pattern (refer to **Fig. 2A**) The voltage induced into the DF loop is amplified by Q1 FET amplifier. Adjusting the drain voltage controls the gain of Q1. The electronic gain control circuit Q2 accomplishes this. The gain control operation is nonlinear.

Following amplification by Q1, the signal is passed on to U4 a Phillips NE602 (or SA602). U4 is configured as a Gilbert cell mixer and varactor diode–tuned VFO. The VFO is operating 455 kHz below the desired received signal (referred to as low side injection). The data sheet specifies a conversion gain of 14 dB at 45 MHz. No graph was provided to determine the value at HF.

After conversion to the IF frequency the signal is filtered by FL1 to remove undesired signals. FL1 has a 6 dB bandwidth of 4 kHz. U1 is an IF amplifier with adjustable gain control. The data sheet specifies a gain of 50 dB (at 45 MHz) and a gain control range of 60 dB (at 45 MHz). Adjusting the AGC voltage controls the gain of U1. The electronic gain control circuit Q2 & Q4 accomplish this. Following amplification by U1 the signal is converted to base band (audio) by product detector U2 and BFO U2. A low cost ceramic resonator determines the BFO frequency. U2 is also a Phillips NE602 (or SA602).

After conversion to base band, the signal is amplified to a level to drive a stereo headphone by U3. U3 is a

Photo E. *Author's daughter, Megan, finds null without sense.*

Photo F. *Megan activates sense and notes that the signal nulls.*

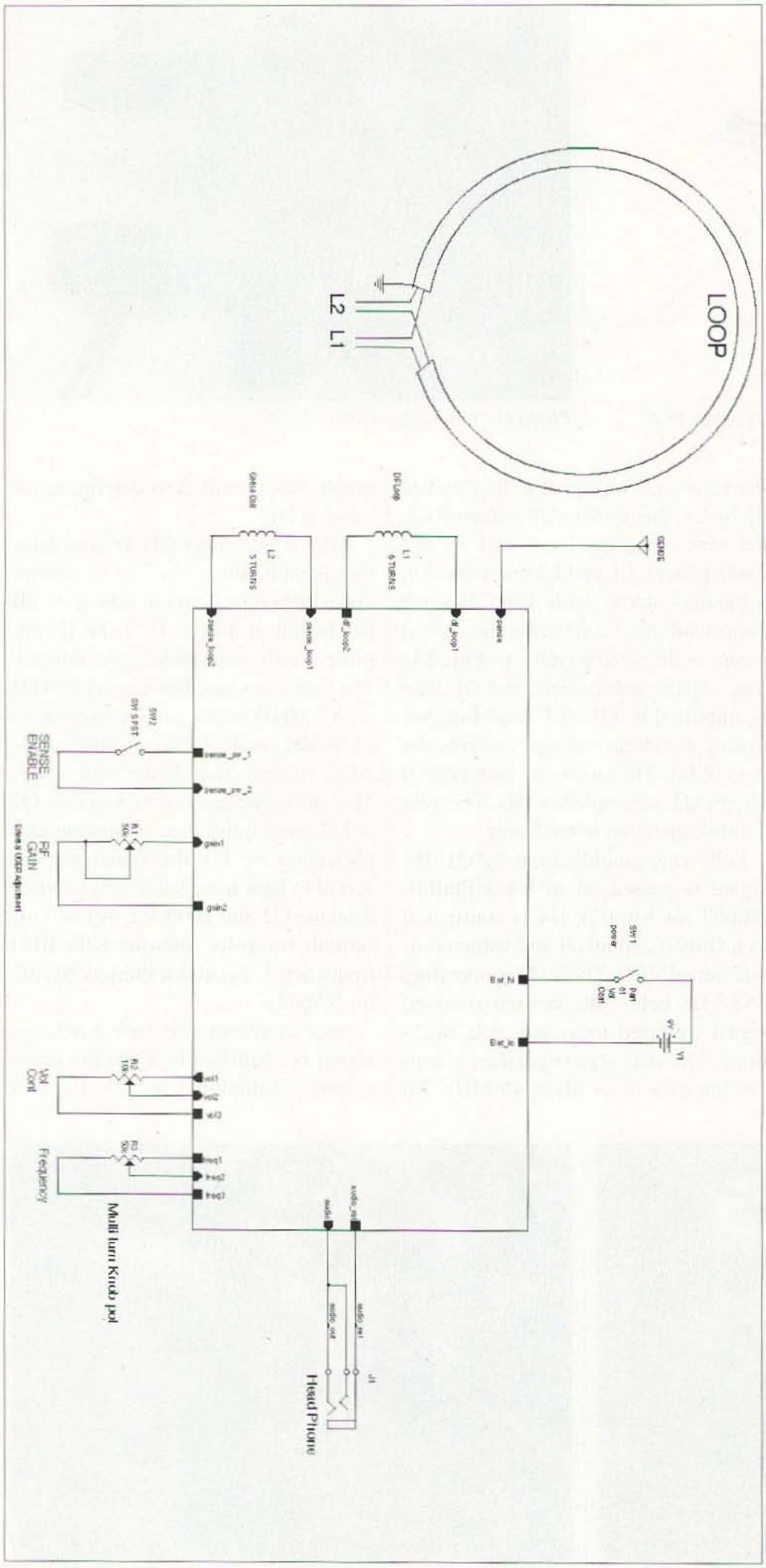


Fig. 6. Top level schematic.

National Semiconductor LM386 configured for a gain of about 50 (set by 1 µF ceramic capacitor C7). The headphones can be any set that has Z of 32 ohms. A quick note about using cheap headsets: They may have lower efficiency than name brands. I can notice the difference between a Sony set versus a $5 no-name. However, the $5 version works.

Electronic gain control Q2 and Q4 provides manual gain control of the receiver. Manual control is desired for a DF receiver, because automatic AGC action would adjust the gain of the receiver as the loop is turned. This could make finding the null difficult because of AGC trying to maintain a constant volume level.

Because the loop provides a figure-eight pattern, two nulls would occur. Thus a 180-degree ambiguity exists. The nulls are perpendicular to the loop axis (**Fig. 2A**). The sense antenna and sense amplifier is used to modify the pattern of the loop to allow solving the ambiguity. When the sense switch is closed, VCC is applied to the drain of Q3, amplifying any voltage induced into the sense antenna. The amplified signal is summed, with the signal being received by the DF loop through coupling loop L2. A cardioid pattern (**Fig. 2B**) results, thus producing one null and a peak.

Faraday shield construction

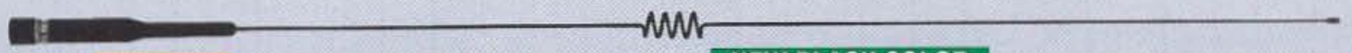
Refer to **Fig. 3**. To form the Faraday shield, start by cutting a 24-inch section of 1/4-inch copper tubing. After cutting the tubing, it is very important to remove any sharp edges on the ends. This will prevent damage to the coils during and after winding (sandpaper was used for this operation). Next, bend the loop as shown in **Fig. 3**.

Attaching Faraday shield to box

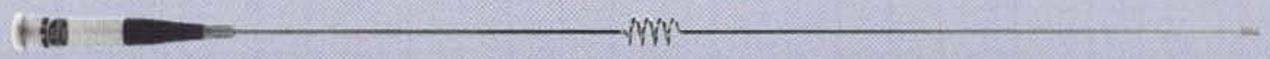
Next, we attach the loop to the box after bending the loop. My version used a plastic box, so I used the inverted gap configuration described in **Fig. 4** (left side). If a metal box is used, it's very important to use the configuration shown on the right-hand side of **Fig. 4**. The reason for doing this is to prevent the Faraday shield

SB-15 • Tri-band 52/146/446MHz w/fold-over
Gain & Wave: 52MHz 0dBi 1/4 wave • 146MHz 4.5 dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 • Length: 58" • Conn: PL-259 • Max Pwr: 120W

SBB-7 **SBB-7NMO** • Dual-band 146/446MHz w/fold-over **NEW BLACK COLOR**
Gain & Wave: 146MHz 4.5dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 • Length: 58" • Conn: SBB-7 PL-259/SBB-7NMO NMO • Max Pwr: 70W



SBB-5 **SBB-5NMO** • Dual-band 146/446MHz w/fold-over **NEW BLACK COLOR**
Gain & Wave: 146MHz 2.5dBi1/2 wave • 446MHz 5.5dBi 5/8 wave x 2 • Length: 39" • Conn: SBB-5 PL-259/SBB-5NMO NMO • Max Pwr: 120W



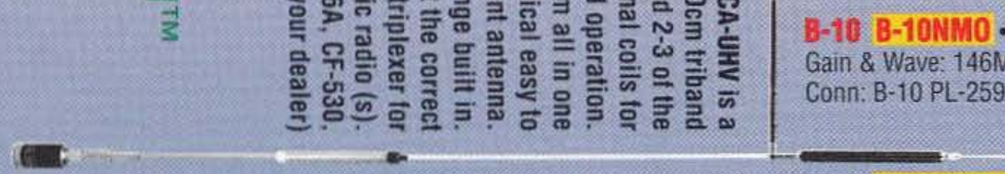
~~THEFT~~ **Z750** • Dual-band 146/446MHz w/fold-over • Includes COMET exclusive theft-resistant lock!
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 446MHz 5.5dBi 5/8 wave x 2 • Length: 39" • Conn: Gold-plated PL-259 • Max Pwr: 200W

~~THEFT~~ **Z780** • Dual-band 146/446MHz w/fold-over • Includes COMET exclusive theft-resistant lock!
146MHz 6/8 wave 4.5dBi • 446MHz 5/8 wave x 3 7.2dBi • Length: 62" • Conn: Gold-plated PL-259 • Max Pwr: 150W

B-20 **B-20NMO** • Dual-band 146/446MHz w/fold-over
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 446MHz 5.0dBi 5/8 wave x 2 • Length: 30" •
Conn: B-10 PL-259/B-20NMO NMO • Max Pwr: 50W

B-10 **B-10NMO** • Dual-band 146/446MHz cellular look-a-like •
Gain & Wave: 146MHz 0dBi 1/4 wave • 446MHz 2.15dBi 1/2 wave • Length: 12" •
Conn: B-10 PL-259/B-10NMO NMO • Max Pwr: 50W

- The **CA-UHV** is a 6M/2M/70cm triband antenna. Add 2-3 of the stock or optional coils for 5-6 band operation.
- HF-70cm all in one economical easy to mount antenna.
- Fold-over hinge built in.
- Select the correct duplexer or triplexer for your specific radio (s).
- CF-706A, CF-530, CFX-514N (Ask your dealer)



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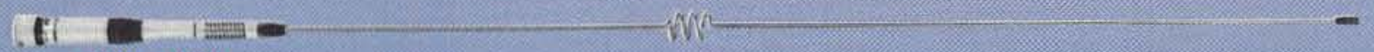
Gain & Wave: HF-6M 1/4 wave • 2M 3.4dBi 5/8 wave • 70cm 2.15dBi 1/2 wave • VSWR: HF 1.6:1 or less • 6M-70cm 1.5:1 or less • Length: 6'2" •
Max Pwr: HF 120W SSB • 6M 200W SSB/100W FM • 2M/70cm 100W FM • *L-14 Optional 20M coil • *L-18 Optional 17M coil



***NEW** **MSG-1000C** • Dual-band 146/446MHz w/spring whip and fold-over
Gain & Wave: 146MHz 2.15dBi1/2 wave • 446MHz 5.5dBi 5/8 wave x 2 • Length: 39" • Conn: PL-259 • Max Pwr: 120W

***NEW** **MSG-1100C** • Dual-band 146/446MHz w/spring whip and fold-over
Gain & Wave: 146MHz 3.5dBi1/2 wave • 446MHz 6.0dBi 5/8 wave x 2 • Length: 43" • Conn: PL-259 • Max Pwr: 150W

***NEW** **MH-209SMA** • Dual-band 146/446MHz HT Antenna w/SMA Conn
Gain & Wave: 0 1/4 wave • Length: 3" Flexible rubber • Conn: Male SMA • Max Pwr: 5W

***NEW** **SMA-503** • Dual-band 146/446MHz HT Antenna w/SMA Conn
Length: 8.75" • Conn: Male SMA • Max Pwr: 10W

***NEW** **MH-510** • Tri-band 52/146/446MHz HT Antenna w/SMA Conn
Gain: 0/0/ 3.2dBi • Length: 20.75" • Conn: Male SMA • Max Pwr: 10W

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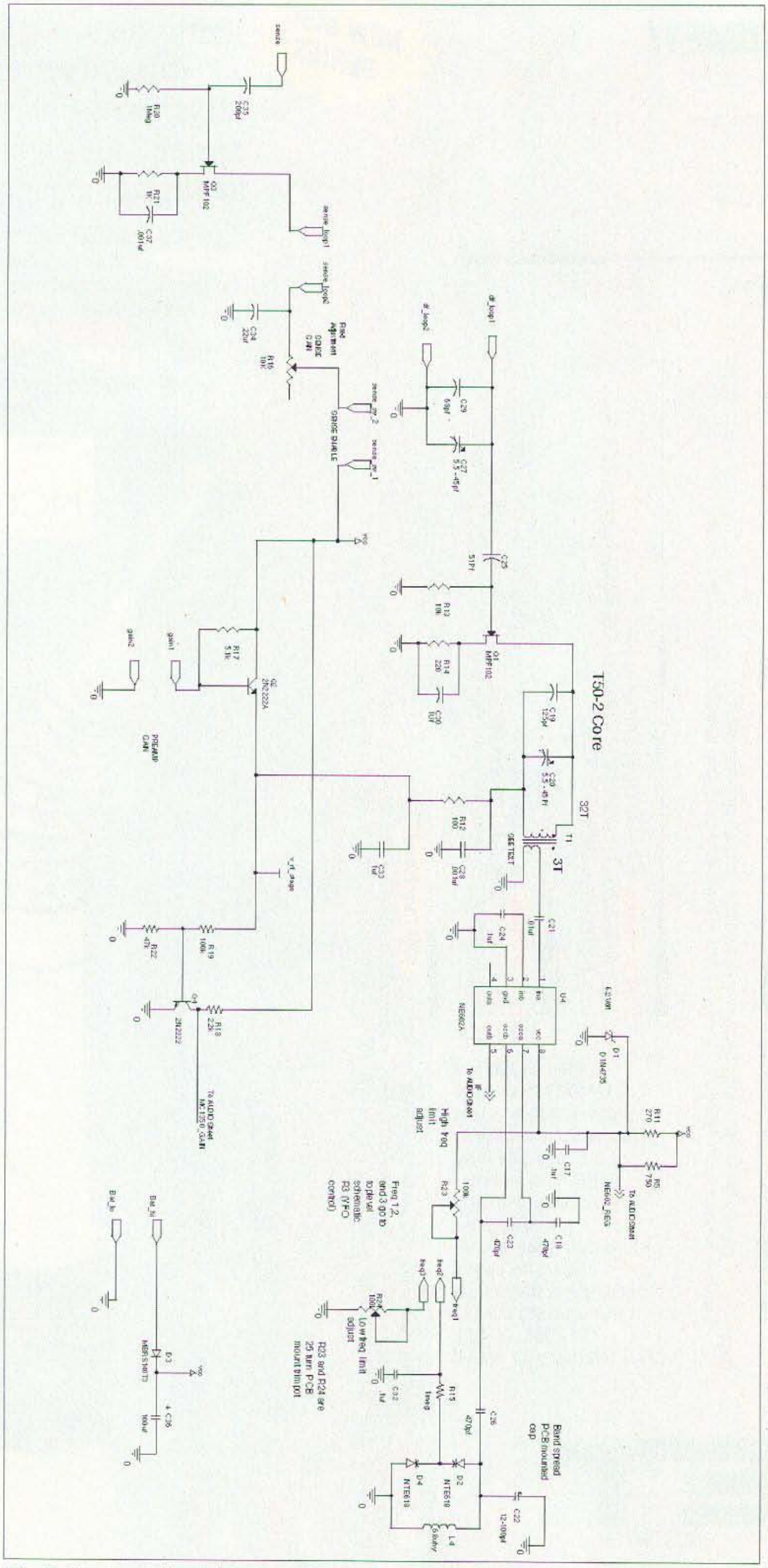

Fig. 7. Receiver schematic.

from forming a shorted turn. If the inverted gap configuration is used with a metal box, the receiver will not work. Also, if a plastic box is used, you need to provide some shielding for the receiver board. Do not extend the shielding above the position shown. This shielding is connected to the receiver circuit board ground.

After gluing the loop in place, coils L1 and L2 are wound. First, coil L1 is wound using 6 turns of #28 wirewrap

Parts List A

Qty.	Name	Value	Note
3	C1, C13, C36	100 µF	RS 270-1028
7	C2, C3, C4, C9, C17, C24, C32	0.1 µF	Ceramic from junk box (JB)
2	C5, C6	500 pF	Silver mica JB
4	C7, C10, C30, C33	1 µF	Ceramic JB
4	C8, C11, C15, C21	0.01 µF	RS
1	C12	10 µF	RS
1	C14	220 µF	RS 272-956
1	C16	0.1 µF	RS
3	C18, C23, C26	470 pF	Silver mica JB
1	C19	125 pF	Silver mica JB
2	C27, C20	5.5–45 pF	Newark 9304
1	C22	12–100 pF	Newark 9328
1	C25	51 pF	Silver mica JB
2	C28, C37	0.001 µF	RS
1	C29	68 pF	Silver mica JB
1	C31	100 pF	Silver mica JB
1	C34	0.22 µF	Ceramic JB
1	C35	200 pF	Silver mica JB
1	D1	1N4735	6.2 V RS 276-561A
1	D2	MV104	Newark MV104
1	D3	MBRS140T3	Newark MBRS140T3
1	FL1	TK2330	Digi-Key TK2330-ND
1	J1	Stereo phone jack	RS
1	L1	6T #28	See text
1	L2	5T #28	See text
1	L3	150 µH	Digi-Key DN41154-ND
1	L4	6.8 µH	Digi-Key M8023-ND

Table 1. Parts list.

wire. The wire ends are connected to the bulkhead (see **Photo B** and **Fig. 5**). Next, the sense-coupling coil L2 is wound using 5 turns of wirewrap wire.

The sense antenna is made from a 20-inch section of 3/32 bronze rod purchased from a local welding supply store. The sense antenna is attached to the bulkhead and hot-glued in place. Next, connections from the bulkhead to the main board are made for the sense antenna, L1 and L2. For safety

Parts List B

Qty.	Name	Value	Note
2	Q1, Q3	MPF102	RS 276-2062
2	Q2, Q4	2N2222A (MPS2222A)	RS 276-2009
1	R1	50k pot	Small JB
1	R3	50k (use 51k fixed R) 10-turn knob pot	Surplus
2	R8, R13	10k 1/4 W	RS
1	R16	10k PCB pot	RS 271-282
1	R4	22Ω 1/2 W	RS
1	R5	750Ω 1/4 W	JB
1	R6	470Ω 1/4 W	JB
2	R7, R10	10Ω 1/2 W	RS
1	R9	1.5k 1/4 W	RS
1	R11	270Ω 1/4 W	RS
1	R12	100Ω 1/4 W	RS
1	R14	220Ω 1/4 W	RS
2	R15, R20	1 meg 1/4 W	RS
1	R17	5.1k 1/4 W	JB
1	R18	2.2k 1/4 W	RS
1	R19	100k 1/4 W	RS
1	R21	1k 1/4 W	RS
1	R22	47k 1/4 W	RS
1	SW1 & R2 power	Volume control	RS 271-215B
1	SW2	SPST	JB or check RS
1	T1	T50-2 core	Amidon. Wind with #28 wirewrap wire, 32T PRI/3T SEC
1	U1	MC1350	NTE745 or ECG745, purchase at any TV parts store
1	U2, U4	NE602A	RS Unlimited RSU 11928173
1	U3	LM386	RS 276-1731
1	X1	455 kHz	Digi-Key, TK9942-ND
1	Box	8 x 3 x 1	RS 270-1808

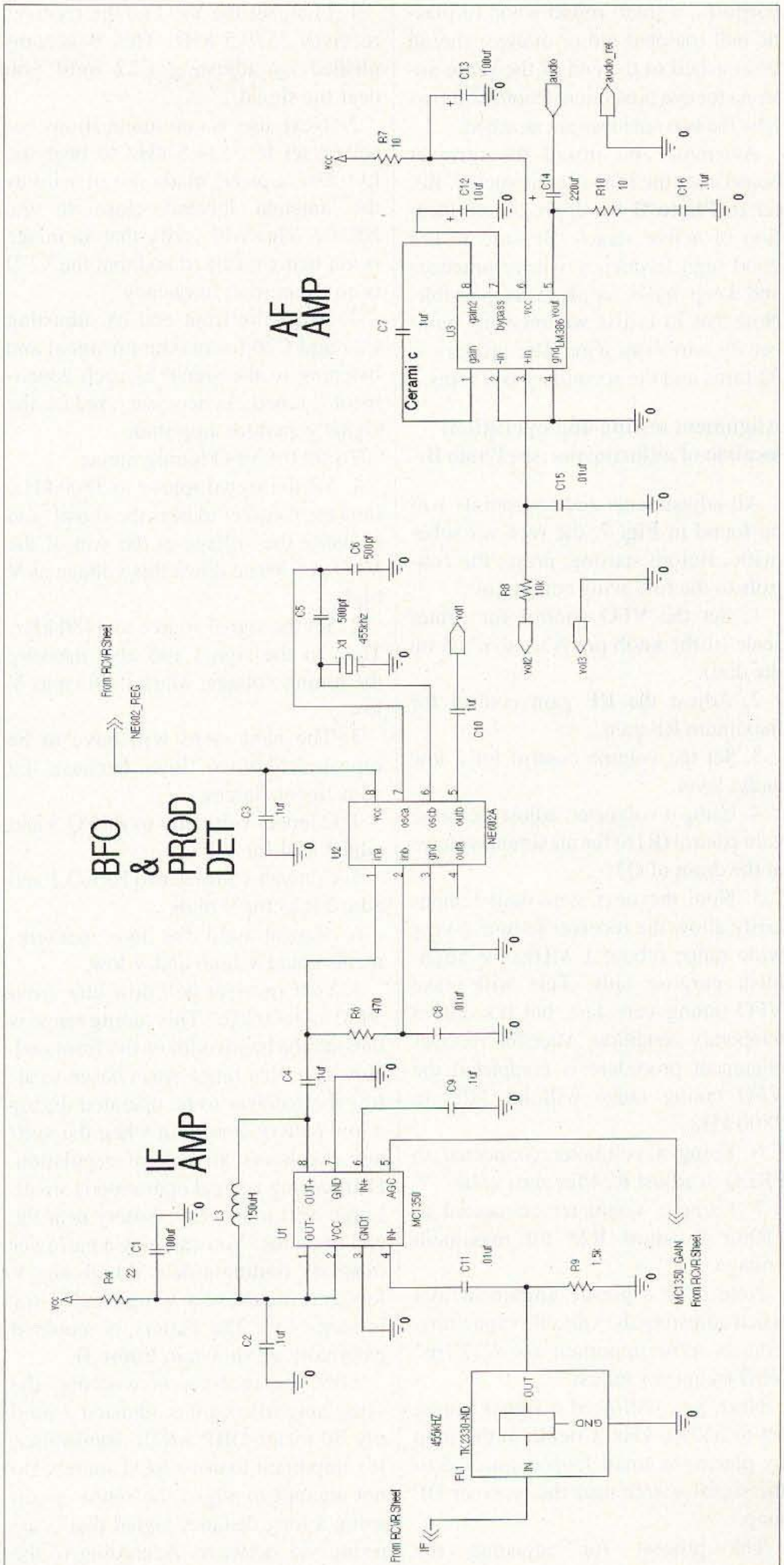

Fig. 8. *Audio schematic.*

purposes, a small round wood or plastic ball (painted red or orange) should be attached to the end of the sense antenna for eye protection. **Photo C** shows how the two antennas are attached.

Assemble and install the receiver board after the loop is constructed. Refer to **Photo B** for approximate location of active stages. Be sure to use good high frequency wiring practices and keep leads as short as possible. Note that T1 is also wound using number 28 wirewrap wire. The primary is 32 turns and the secondary is 3 turns.

Alignment testing and operation; location of adjustments (see Photo B)

All adjustments and test points will be found in **Fig. 7**, the receiver schematic. Before starting, preset the controls to the following conditions:

1. Set the VFO control for center scale (if the knob pot is used, it's 5 on the dial).

2. Adjust the RF gain control for maximum RF gain.

3. Set the volume control for a low audio level.

4. Using a voltmeter, adjust the sense gain control (R16) for maximum voltage at the drain of Q3.

5. Note the next steps will temporarily allow the receiver to tune a very wide range (about 1 MHz) for alignment purpose only. This will make VFO tuning very fast, but it's only a temporary condition. After the receiver alignment procedure is completed the VFO tuning range will be 3480 to 3800 kHz.

6. Using a voltmeter connected to FREQ 3, adjust R24 for zero volts.

7. Using a voltmeter connected to FREQ 1, adjust R23 for maximum voltage.

Note: Use a plastic alignment tool when adjusting the variable capacitors. This is most important for C22, the VFO frequency adjust.

Next, you will need a signal source set to 3579.5 kHz. Couple to the loop by placing a small loop connected to the signal source near the receiver DF loop.

The process for adjusting the bandspread capacitor and peaking the front end is as follows:

1. First, set the VFO so the receiver receives 3579.5 kHz. This is accomplished by adjusting C22 until you hear the signal.

2. Next use a communications receiver set to 3124.5 kHz to hear the LO. Use a probe made out of wire as the antenna located close to the NE602. This will verify that an image is not being received and that the VFO is on the correct frequency.

3. Align the front end by adjusting C27 and C20 for maximum signal and listening to the signal as each adjustment is tuned. As necessary, reduce the signal generator amplitude.

To set the VFO tuning range:

1. Set the signal source to 3800 kHz, tune the receiver to hear the signal, and measure the voltage at the arm of the VFO pot. Write down this voltage as V high.

2. Set the signal source to 3480 kHz. Tune in the signal and also measure the tuning voltage. Mark it down as V low.

3. The next steps will have to be repeated about 6 times because the adjustments interact.

4. Connect voltmeter to FREQ 3 and adjust R24 for V low.

5. Connect voltmeter to FREQ 1 and adjust R23 for V high.

6. Repeat until the two measurements equal V high and V low.

7. Your receiver will now tune from 3480 to 3800 kHz. This tuning range is outside the bandwidth of the front end. However, this range was chosen to allow the receiver to be operated during a low battery condition when the voltage regulators are out of regulation. Drift during normal operation is small. Large drift indicates a battery near the end of its life. You can pick a narrower range by finding a new V high and V low. Just use the new V high and V low in steps 4–5. The battery is mounted externally, as shown in **Photo D**.

After the receiver is working, the sense amplifier gain is adjusted. I used my 80 meter QRP ARDF transmitter. It's important to use a local source. Do not attempt to adjust the sense circuit using a long distance signal that is arriving via skywave. According to the *ARRL Handbook*, it is possible to get poor (or no) nulls on a signal that is via skywave (page 14-5, *ARRL Antenna Handbook,* 18th edition). I aligned the sense antenna system at a distance of about 500 feet from the transmitter. So far, testing indicates that the sense antenna works over the useful range of the receiver. The only thing I noticed is that the sense antenna does not produce a null or peak at a distance less than about 15 feet from the transmitter. However, the loop still produced nulls. In a real ARDF event you can see the markers at a distance where the sense is still working.

To adjust the sense antenna, perform the following sequence:

1. At a distance of about 500 feet (minimum) from the transmitter, rotate the receiver and find the null. Now rotate the receiver 90 degrees from the null (for now, any direction). Push the sense switch and rotate R16 through its range. If you are in the right quadrant, you will find a place in the adjustment range of R16 where the signal will dip. If you continue adjusting R16, the signal will pass the dip and increase in strength. If you don't find the dip, rotate 90 degrees in the opposite direction from the null. You should find it. Adjust R16 for a dip in signal strength. Mark the side of the loop pointing toward the transmitter (where the dip occurred) with tape.

2. Test the operation of the sense by finding the null. Knowing the direction of the transmitter, rotate the loop 90 degrees (use the end that is not marked with the tape). Push the sense switch. The signal should increase.

3. Go back to the null (without the sense switch pushed), and rotate the loop (end marked with tape) 90 degrees toward the transmitter. Push the sense switch. The signal should dip.

4. Another simple test is to hold in the sense switch while rotating the receiver. The signal should dip when the end marked with tape is pointing toward the transmitter (the dip is 90 degrees offset from the null obtained with no sense). The signal should peak when the end of the loop with no tape is pointed at the transmitter.

Operation (refer to Photo E)

Safety first! Always watch out for

power lines and where the sense antenna is pointed.

First, find the null without the sense antenna active. After the null is found, rotate the receiver 90 degrees from the null and activate the sense (**Photo F**). Note the strength of the signal before and after activating the sense. If the signal dips or slightly decreases, the taped end of the loop is pointing toward the transmitter. If the signal increases, the nontaped end of the loop is pointing toward the signal. After the 180 degree ambiguity is solved, deactivate the sense and use the null without sense. That null is usually deeper.

Closing comments

Dale Hunt WB6BYU suggested that it may be possible to replace T1 with a modified 10.7 MHz IF transformer. If anyone tries that, please let me know. I am currently working on having a professional board layout done. I plan to use a footprint for T1 that would allow a standard 10.7 IF transformer to be substituted. Dale also suggested that the VFO coil could be replaced by an adjustable inductor, and that could eliminate the need for a variable capacitor for C22. For field-testing, I am currently using a 0.15 watt CW transmitter that was designed for ARDF use. The plans for it, as well as information concerning the availablility of PCBs, can be found on my Web site.

Acknowledgments

I would like to thank the following people for assisting with this project: my wife Gail, for putting up with the long hours that can occur when undertaking something like this; my sister-in-law, Toni, for reviewing the text; Dale Hunt WB6BYU, for reviewing schematics and making suggestions (Dale also provided information about European receivers); and Mike Pendley K5ATM, for digital image processing.

Additional references

My Web site (Albuquerque transmitter hunters) is at [http://home.att.net/~wb8wfk]. The Homing In Web site is at [http://members.aol.com/homingin/index.html]. 73

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80m ARDF Comes to America

If your club holds only 2m ARDF events, you're missing half the fun. There's another international foxhunting band, too.

Before 2m FM took off in the late 1960s, clubs held their mobile hidden transmitter hunts (T-hunts) on the 80m and 10m bands. Look through ham radio magazines of the 1950s, and you'll see a variety of radio direction finding (RDF) antennas sticking out of car windows, including big box-shaped loops and little ferrite rods.

Transmitters and receivers used tubes back then, so "portable" really meant "big and heavy with a handle." Low-voltage dry cells were necessary to light tube filaments, and high-voltage batteries powered the tube plates. That didn't stop the ham hiders of that era, who sometimes put their emitters in baby carriages and built them into fake fire hydrants, just like today.

Skywave propagation makes eighty meters a crowded place after dark, so foxhunts on that band were daytime events. (At night, ten meters was preferred.) The winner was usually first vehicle to be spotted by the hider, so hand-held "sniffers" were unnecessary.

Almost a half century later, hams on this continent are rediscovering the joys of shortwave-band RDF. That's because it's an important part of the international on-foot foxhunting scene. Today's solid-state technology makes it easier and much more fun.

Europe leads the way

As regular "Homing In" readers know, competitive on-foot foxhunting (also called foxtailing, radio-orienteering, FoxOring and ARDF) follows rules that are promulgated by the International Amateur Radio Union (IARU). They originated in eastern Europe, where the sport began on 80 meters in the 1970s (**Photo A**). Two meters was added later. Nowadays, IARU's national, regional, and world ARDF Championships have an 80m event on one day and a 2m event on another.

Photo A. *In the early days of ARDF in Europe, fox transmitters were just like the ones used in USA T-hunts of the 1950s — big, bulky, and keyed by hand.*

In a few countries such as Sweden, 80 meters is still the primary band for ham radio transmitter hunts. A few years ago, I interviewed Per-Axel Nordwaeger SMØBGU, who put out courses for the 1994 ARDF World Championships near Stockholm. P-A dislikes the signal reflections that plague VHF hunts. "I don't find 2 meters as interesting because it's so unpredictable," he says. "You end up in many places other than where the transmitter really is."

Stockholm foxhunts are Wednesday evening at 7 p.m. in large wooded forests. In most months, that's well after sunset. Snow-covered courses are frequent. The hider puts out seven transmitters, timed to come on automatically and to transmit one after another in sequence.

"Our old-fashioned receivers interfered with each other," says P-A. "So we had to spread the hunters out. They scatter into the forest two minutes before the first fox starts. They are allowed to continue to search for two minutes after the last transmitter shuts off, then return to the start. About an hour after the hunt ends, the foxes automatically start transmitting again to help the organizer find them to pick them up."

According to SMØBGU, most Swedish radio-orienteers use the same receiver design, which is about the size of a cigarette pack (**Photo B**). "Two Swedes started building them around 1965," he says. "The circuit has been improved over the years. We can buy them either complete or in parts. The ferrite loop is quite OK. My friend Lars Nordgren SMØOY uses a larger air-core

loop instead. It is heavier to carry, but gets a sharper bearing null."

Stateside foxhunters know that 2-meter RDF is made more difficult by multipath. VHF signals reflect from buildings, hills, and mountains. Bearings are most accurate when transmitters and receivers are line-of-sight and there are no large terrain features nearby. When you're in a canyon on the back side of a hill, 2-meter signals are weak, and bearings aren't trustworthy.

Eighty meters is a different story. Groundwave is the primary propagation mode for fox signals on that band in daytime. Long metal structures such as power lines and fences can affect bearings if they are close to the receiver. But in general, bearings are sharper and more consistent than on VHF. Eighty-meter RDF equipment is smaller and lighter, too. That explains why winning times on 80m were two to 16 minutes better than for the same age/gender divisions on two meters in the 1998 ARDF World Championships.

Ewald Stadler DJ2UE of Herrenberg, Germany, is a foxhunt organizer and trainer for the Deutscher Amateur Radio Club. He says, "On 80 meters, you have to know your equipment, the null and front-to-back ratio. But mostly it's running, a sport competition. However, on two meters, it's a brain competition. You have to be very careful what you do because of the signal reflections. On 80 meters, you can stand still and navigate and take your bearing and then go, but on two meters, no way! If you stand still and take a bearing, you may be off by 30 degrees."

ARDF promoters around the USA are adding 80 meters to their events. Starting in March, all of our southern California multifox practice/demonstration sessions have had at least one 80m transmitter. Usually the hunters find the 2m foxes first, then start over again on eighty using borrowed gear. Most of them express amazement at the sharp, bounce-free bearings on the new band.

Sharp bearings and small lightweight RDF gear make 80m an ideal band for introducing youngsters, particularly pre-teens, to amateur radio and ARDF. Would this be a great activity for your next Scout campout or Jamboree-on-the-Air?

Getting bearings on 80m

Several manufacturers make "longwave-to-microwave" multimode hand-held receivers and scanners covering the 80m band. Available models include the Icom IC-R10, Yaesu VR-500, Alinco DJ-X10T, and AOR AR8200IIB. With such a set and an RDF antenna, you're ready for an 80-meter hunt (**Photo C**). Be sure that the receiver has CW or SSB modes in addition to FM, because 80m foxes send keyed CW.

On two meters, you can get a rough bearing by simply holding your handie-talkie or scanner close to your chest and turning around, listening for the signal null that indicates that the source is behind you. This "body shield" technique won't work with an 80m handheld, because these long-wavelength signals pass right through our bodies with almost no attenuation.

Reflectors or shields of metal won't make your 80m set reliably directional either. Attempts to shrink 80m yagis, quads and other high-gain antennas to portable size have proven futile. So loop and rod antennas are the best way to get good 80m bearings, just as they were almost a half-century ago.

Large, multiturn box-frame loops are accurate and sensitive for mobile use (see "Homing In" for August 1991). However, they're too big and clumsy to carry on foot. Winding about the same amount of wire on a small ferrite rod makes for a light easy-to-carry antenna that has the same sharp nulls and almost the same sensitivity. Small air-core loops can also be effective if care is taken to achieve good electrical balance.

Adding a vertical "sense" whip or wire with proper signal phase resolves the rod or loop's inherent 180-degree ambiguity. More about the theory and practice of HF loops, rods, and sense circuits is in the *ARRL Handbook* and my RDF book. *(Transmitter Hunting — Radio Direction Finding Simplified* by Moell and Curlee is published by TAB/McGraw-Hill, ISBN number 007-1560068.)

Champion 80m ARDFers of Europe and Asia prefer integrated receiver/antenna sets. Each country seems to have its only favorite design. A set by Siegfried Pomplun DL3BBX is popular in Germany and the Netherlands (**Photo D**). You can buy a kit version for about US$95, if you're willing to arrange for currency exchange. There is a Web link at the "Homing In" site with more information.

Altai ARDF sets from the Barnaul Radio Factory in southwestern Siberia are used throughout the former Soviet Union. That factory makes the "Altai-3.5" for eighty meters, which has a tunable receiver and loop/spike directional antenna system (**Photo E**). The loop is about one foot in diameter.

The USA doesn't have a favorite 80m receiver/antenna set yet, but Jerry Boyd WB8WFK of Albuquerque (**Photo F**) is working hard to create one. See his article, "YOU Can Build the FoxFinder 80!", elsewhere in this issue of *73*.

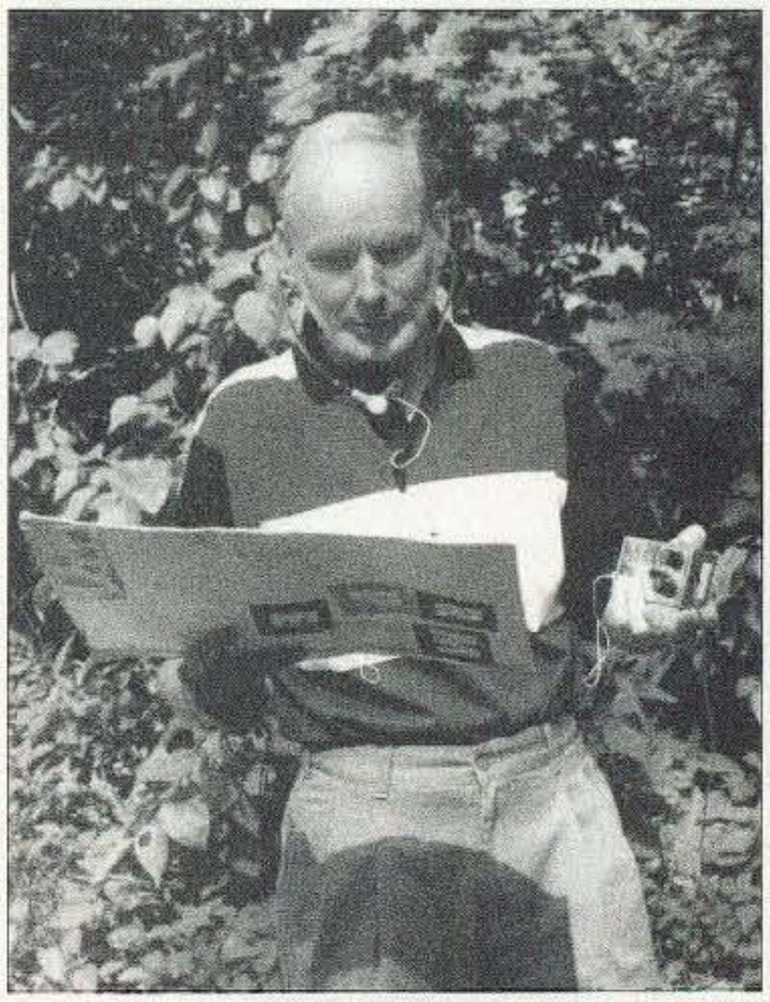

Photo B. *Per-Axel Nordwaeger SMØBGU is ready for the next Stockholm hunt in the forest. Note his cigarette-pack-size receiver with rod and sense antennas.*

International rules for 80m ARDF call for transmitters to have 3 to 5 watts output, keyed CW. Frequency range is 3500 to 3600 kHz. A General class or higher license is required for the hider above 3525 kHz and Extra below 3525 kHz. There's no license requirement for the foxhunters, of course.

The most popular 80m fox frequency is 3579.5 kHz, because inexpensive TV

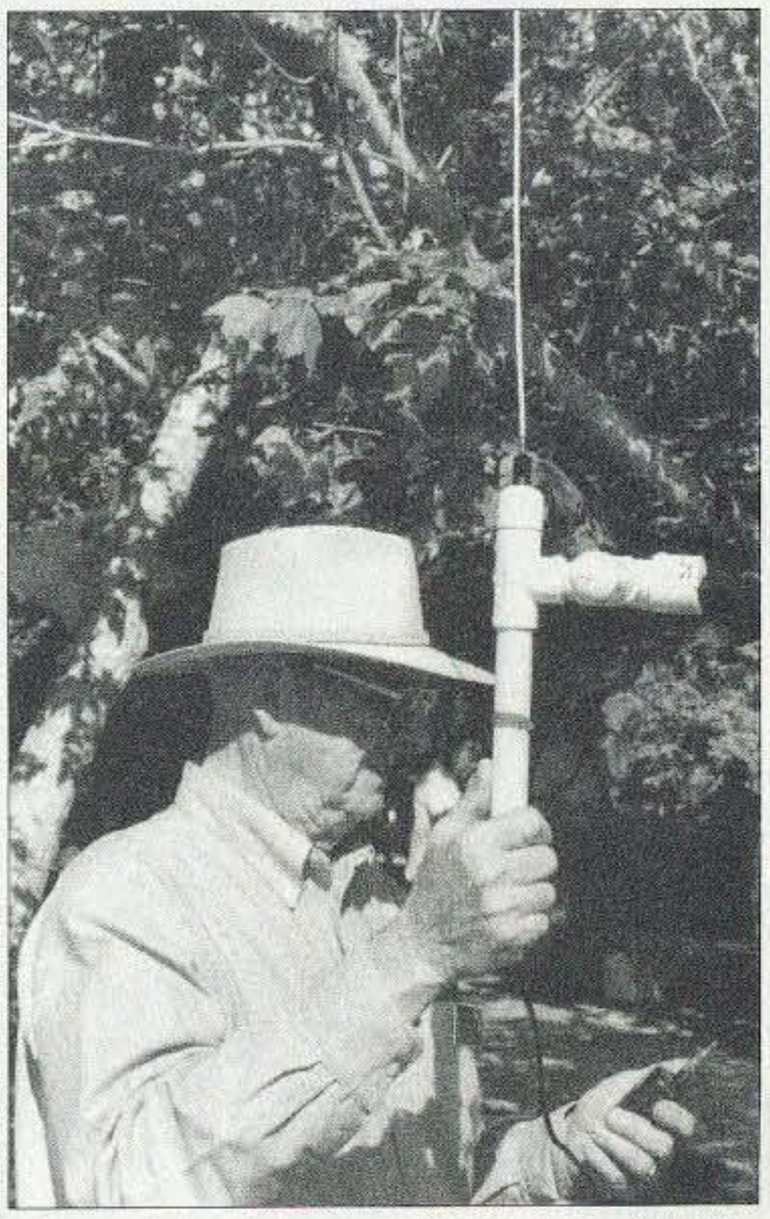

Photo C. *Bob Legg W6QYY built this 80-meter RDF antenna to use on foot with his MF/HF/VHF multimode hand-held scanner at a recent southern California hunt.*

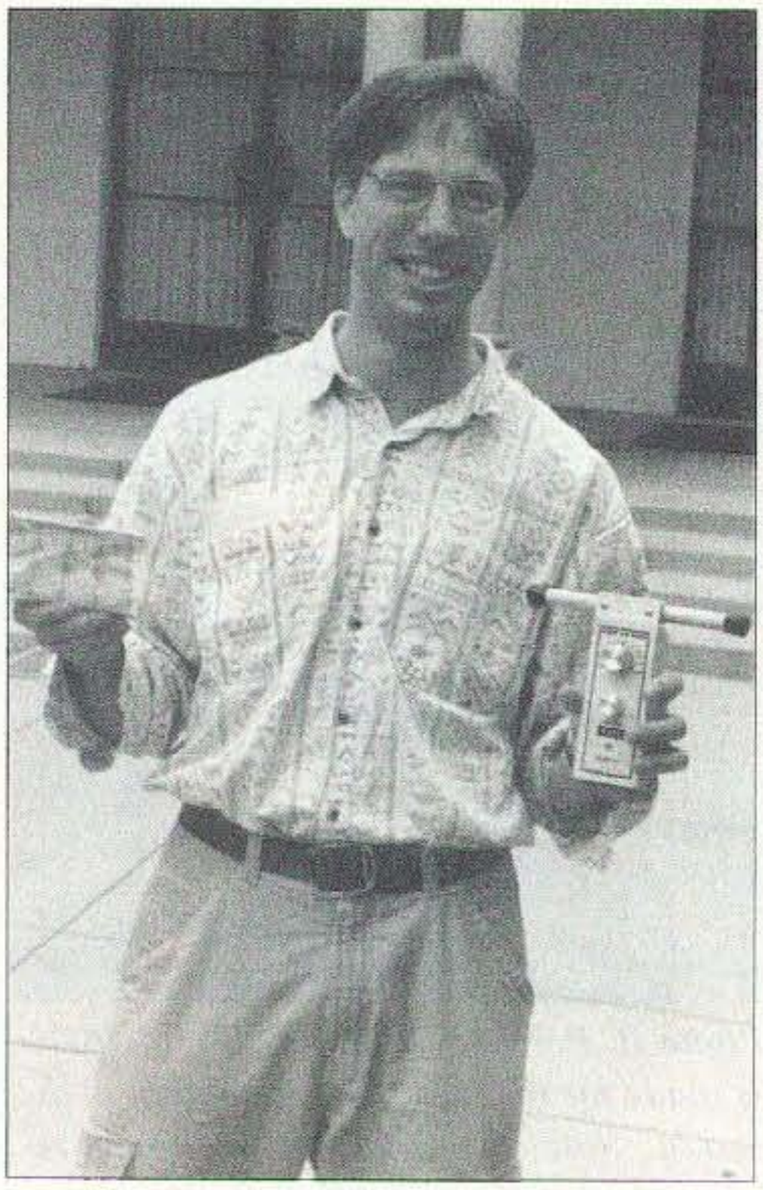

Photo D. *Try it, you'll like it! Matthew Cook gave high marks to 80m ARDF after experiencing it for the first time at Caltech in Pasadena this spring. In his left hand is an 80m receiver/antenna set by Siegfried Pomplun DL3BBX.*

colorburst crystals on that frequency are easy to find all over the world. The finish line beacon frequency should be at least 20 kHz away from the five fox transmitters to prevent QRM on simple receivers.

Most QRP crystal-controlled CW transmitters can be pressed into service as 80m foxes. See my article, "Super-Simple 80m Fox", in this issue of *73* for an excellent design by Rik Strobbe ON7YD. Antenna polarization must be vertical, to provide best results with loops and rods.

Shoot up your antenna

Fox transmitting antennas for 80m are easy if there are trees at the hunt site. I found that a more-or-less vertical wire 20 to 30 feet up into a tree and a single radial wire of the same length provides plenty of signal to the starting point, even on an IARU championship-size course, when used with the ON7YD transmitter.

How do you get the antenna up into the tree? And more important to a harried foxhunt organizer, how do you put five antennas into five trees in a short time? My answer: A slingshot. There are some new commercial slingshot/spinning-reel contraptions for sale to hams, but I have had excellent results with a simple twelve-dollar slingshot from the local sporting goods store. Rather than loft a leader line and then haul up the wire with it, I launch the radiating wire directly.

For me, AWG #24 stranded wire with the multicolored Teflon jacket is just right. I found white wire with brown, black, and green stripes that camouflages well in leafy trees and on the grass. After one 80m hunt, I asked a hunter what he thought of my antennas. He said, "What antennas?"

Here are some antenna-launching tricks that I learned the hard way:

1) Tie a "3/8"-size lead sinker (10 grams) to the far end of the wire, launch the sinker over a high branch, and the wire will follow. Be sure to secure the transmitter end of the wire so you don't loft the whole wire out of reach.

2) The pile of wire on the ground must offer absolutely no resistance to being pulled up. Allow no tangles, and definitely no tree branches or other debris under the wire to snag it.

3) Hold the slingshot upside-down, so that as the wire falls away after launch, it doesn't tangle in the yoke of the slingshot.

4) Put tape over the eye of the sinker where it connects to the antenna wire. Before I did, I got a nasty cut on my fingertip from the sharp point of the eye on one launch.

NOTE: Use extreme caution with your slingshot. Wear safety glasses and watch out for others nearby. Check and obey local laws. The possession and use of slingshots may be regulated by ordinances and park rules.

The radial wire(s) can just be stretched out on the ground. I usually stick short skewers into the soil to hold the far ends of the radials in place and keep the wire from coiling up. In two locations at the June ARDF Team USA Qualifying Runs, the foxes were next to a creek, so I dropped the radials into it.

Having only one radial results in a more covert hidden transmitter, but it reduces system efficiency and makes the radiation pattern somewhat directional. If possible, run the radial in the direction of the start point, to put maximum signal in that direction. Use care to minimize the hazard of tripping over it.

Better transmitter antennas may be needed if power is lower, receiver sensitivity is less, or there is a high noise level at the site. For the ARDF Championships in Portland last year, Dale Hunt WB6BYU made antenna sets consisting of a 26-foot vertical wire, three 16-foot radials, and an RF matching transformer. His transformers were wound on Amidon T-130-2 cores, 5 turns on the primary (connecting via 50-ohm coax to the transmitter) and 55-turn secondary (to antenna and radials). I could

Photo E. *For many years, 80m ARDF has been part of physical education in Russian schools, including both licensed and unlicensed youngsters. The "Altai-3.5" is one of very few commercially manufactured ham equipment items there.*

***Photo F.** Jerry Boyd WB8WFK was the only competitor at the 1999 ARDF Championships in Portland who built his own 80m receiver/antenna set from scratch. He's crossing the finish line in this photo.*

tell that these antennas worked very well, as I copied the foxes several miles away on my mobile rig.

The need for tall trees for wire antennas limits the number of suitable 80-meter foxhunting sites in southern California. I'm experimenting with standalone 80-meter vertical antennas made from PVC irrigation pipe wound with magnet wire. Any suggestions from your experiences would be welcome.

Unfinished business

I incorrectly identified the hand holding the RDF set in Photo C of August's "Homing In." It actually belongs to Tony Boegeman WA6ZMZ of San Diego, California. Tony is active in both mobile and on-foot foxhunting with the Amateur Radio Club of El Cajon. He mounted the Comet KC1 RF Bug on his time-difference-of-arrival RDF unit to tell when he's within a few feet of the transmitter.

Response to my call to host the 2001 USA ARDF Championships has been good. WB6BYU, who has more ARDF hosting experience than just about anyone else in the country, reminded me to mention that corporate sponsorship and in-kind donations can help balance the budget for an event of this kind. For example, a division of Motorola provided medals for the 1999 Championships on Portland.

"Generally it is easiest to find someone to sponsor the medals," Dale says. "It's harder to get the buses paid for. Donations require a lot of advance work, because many companies plan them over a year ahead." Don't forget T-shirts for the competitors, with a unique logo for your event.

I'm still interested in hearing from clubs and club councils interested in putting on the next multination ARDF event in this country. Details were in last month's column and are on my Web site. For that and for any RDF-related matters, use the postal and E-mail addresses at the beginning of this article. 73

CALENDAR EVENTS

Listings are free of charge as space permits. Please send us your Calendar 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 2001 issue, we should receive it by November 30. Provide a clear, concise summary of the essential details about your Calendar Event.

NOV 4

LAWRENCEVILLE, NJ The Delaware Valley Radio Assn. Hamfest will be held Nov. 4th, 0800–1300 at Lawrence High School, 2525 Princeton Pike, Lawrenceville NJ. General admission is $5; outdoor spaces $10 (includes one admission). Additional spaces $10/ Admission $5. Indoor spaces $15, includes one admission. Second indoor table $10/ Admission $5. Limited electrical supply. Vendor setup at 0630. For information about VE exams, check the Web at [www.slac.com/w2zq]. Talk-in on 146.670 PL 131.8. For more info, call *(609) 882-2240, or E-mail [w2zq@arrl.net].*

LONDONDERRY, NH The Interstate Repeater Society ARC Annual Fall Flea Market will be held Nov. 4th at the Londonderry Lions Club on Mammoth Rd. Space is limited, so reserve it now. E-mail reservations to *[Harold@neainc.com];* or call *Paul at (603) 883-3308.* This event will be held rain or shine. There will be over 35 tables inside, and room for more undercover outside. Electricity is available to 13 of the 35 tables. $2 discount to the first 10 people to provide their own table. After that it is $10 per supplied table. Vendor setup is at 6 a.m. Early bird shoppers will be admitted 6 a.m. to 8 a.m. for $10. Admission 8 a.m.–1 p.m. is $3 each. Directions: Route 93 North to Exit 4 in NH. Top off the ramp left turn. Straight west on Route 102 until you pass Dunkin' Donuts on the left, next light is Route 128, turn right. The Londonderry Lions Club is about a mile on the right. Talk-in on 146.850.

NOV 5

LINGLESTOWN, PA A hamfest will be sponsored by the Central Pennsylvania Repeater Assn. at Linglestown Firehall and grounds, 5901 Linglestown Rd., Linglestown PA. Exit 26 off I-81, Exit N. Mountain Rd. off Rt. 22. Talk-in on 145.47 (WA3KXG) - offset. VE exams at 9 a.m. Admission $5, tailgating $5, indoor tables $10. For indoor table reservations and/or info, call *Harold R. Baer at (717) 566-8895;* or write to *619 W. Second St., Hummelstown PA 17036.*

MT. JOY, IA The 29th Annual Davenport Radio Club Hamfest/Computer Show will be held Nov. 5th at the Iowa National Guard Hangar, at the Mt. Joy Airport. Space is being planned for over 250 tables. Commercial vendors. Everything from parts to complete stations. Computer hardware and software. FSTV demo. No tailgating. No food or drinks may be sold. All tables must be rented through the club; bring your own chairs. Talk-in on 146.88/.28 alt 146.64/.04, no PL. Tickets are $5 in advance, with double prize stubs, and $6 at the door with one prize stub. Free parking. Under 14 admitted free. Lots of prizes. You need not be present to win. Hours are Sunday from 8 a.m. to 2 p.m. Main prize drawing at 1 p.m. Setup on Saturday from 12 p.m.–5 p.m. Sunday setup 6 a.m.–8 a.m. Advance tickets via mail only: *Bill Bolton WBØBBM, 28755 Utica Ridge Rd., Long Grove IA 52756; E-mail [gemobile1@aol.com].* For tables and tickets, contact *Dave Mayfield W9WRL, 1819 7th St., Moline IL 61265; or E-mail [hamfest@gw1td.com]. Tel. Saturdays, 9 a.m.–1 p.m. (309) 762-6010 and ask for Dave. Fax (309) 757-1880.* When sending mail, include a business size SASE and make checks payable to Davenport Radio Amateur Club, or DRAC. Tables are $12 each. If you need electricity, add $1; first come first served.

NOV 11

GOLDEN, CO The 2000 Rocky Mountain Radio League, Inc. Hamfest will be held 8 a.m.–2 p.m. at Jefferson County Fairgrounds, 15200 W. 6th Ave., in Golden. Take the Indiana exit from 6th Ave. Talk-in on 144.62/145.22 MHz. Admission $4 per person; tables $10 in advance or at the door. VE exams, ARRL forum, refreshments, door prizes. Contact *Ron Rose NØMQJ, (303) 985-8692, or E-mail [nØmqj@arrl.net].*

MONTGOMERY, AL The Montgomery ARC will host the 23rd annual Montgomery Hamfest and Computer Show in Garrett Coliseum at the South Alabama State Fair grounds, located on Federal Drive in the northeastern section of historic Montgomery. Talk-in on 146.24/.84, W4AP. Ragchew on 146.32/.92 (with phone patch *up/#down), 147.78/.18, 449.50/444.50. Flea market reservations required to assure table. Tailgaters welcome, $5 per vehicle space. For more info, write to *Hamfest Committee, c/o 2141 Edinburgh Dr., Montgomery AL 36116-1313;* or phone *Phil at (334) 272-7980 after 5 p.m. CST. E-mail [k4ozn@arrl.net].* Visit the Web site for late breaking news and events, *[http://jschool.troyst.edu/~w4ap/].* Admission $5; free parking. Inside flea market setup 3–8 p.m. Friday evening, Nov. 10th, and 6–8 a.m. Nov. 11th. Doors open to the public 9 a.m.–3 p.m. CST. VE exams on-site, beginning at 8 a.m., by CAVEC. Bring original and a copy of your current license, picture ID, and $3 fee.

NOV 12

CHICAGO, IL The DeVry Institute of Technology, 3300 N. Campbell Ave., Chicago IL, is the location for the Chicago ARC Ham Auction, Sunday Nov. 12th. Items in auction will be transmitters, receivers, transceivers, amplifiers, tuners, accessories, signal generators, oscilloscopes, 2-way radios, TVs, VCRs, antique radios, tubes, parts, books, computers, audio, stereo, etc. Your electronic goods will be auctioned if you bring them in before noon. All sold goods are subject to a 10% donation. If purchased back by the seller, then a 5% donation will be due. All items sold on an as-is as-shown basis. All sales final. For more info, call *Dean, (708) 331-7764, morning or evening; call George, (773) 545-3622, 10 a.m.–1:30 p.m. or after 3 p.m.* Remember, one man's junk is another man's gold!

NOV 18–19

FT. WAYNE, IN The 28th Annual Fort Wayne Hamfest & Computer Expo, sponsored by the Allen County Amateur Radio Technical Society (AC-ARTS), will be held at the Allen County War Memorial Coliseum at the corner of Indiana 930 (Coliseum Blvd.) and Parnell Ave. Open to the public 9 a.m.–4 p.m. EST on Saturday, and 9 a.m.–3 p.m. EST on Sunday. Vendor setup is Friday evening and Saturday morning. Admission $5, good for both days, at the door only. Parking is $2. There are over 1100 commercial and flea market tables all under one roof, containing both new and used radio, computer, and general electronics items. Activities will include many forums and meetings, with VE exams on Saturday. Shuttle bus service provided to and from Smith Field Airport, and shopping centers. Talk-in on 146.88(-). For more info, leave a message on the answering machine at *(219) 483-8163 (tables), or (219) 484-1314 (general info),* and you will be contacted. You can also send an SASE to *AC-ARTS / Fort Wayne Hamfest, P.O. Box 10342, Fort Wayne IN 46851;* or visit the WWW site at *[http://www.acarts.com].*

NOV 19

BENSON, NC The 12th Annual JARSFEST

will be held Sun. Nov. 19th at the American Legion Complex in Benson NC. Talk-in on 147.27 (+600). Dealers, tailgate section, VE exams. For further info, call *(919) 894-3352 or (919) 894-3100, 7 p.m.–10 p.m.* The Club Web site is at *[www.jars.net]. E-mail [blambert@interpath.com].*

NOV 25

EVANSVILLE, IN The 8th Annual Evansville Winter Hamfest will be sponsored by E.A.R.S. and The Ham Station, Nov. 25th, 8 a.m.–2 p.m. at Vanderburgh Co. 4-H Center Fairgrounds Auditorium. Talk-in on EARS Wide Area Repeater Network 145.150(-) Evansville/146.925(-) and 443.925(+) Vincennes. Alternate: EARS repeater 145.110(-). Use 107.2 CTCSS on all frequencies listed! Vendor setup 5 p.m.–9 p.m. Friday; 6 a.m.-8 a.m. Saturday, Central time. Admission $5. Free parking. Free tailgating. Indoor flea market. Table space available. Commercial dealers. 8-ft. flea market tables $8 each; wall spaces $10 each if money received by Nov. 15th. Add $2 each after Nov. 15th. For table reservations or info, contact *Neil WB9VPG at (812) 479-5741; or write EARS, 1506 S. Parker Dr., Evansville IN 47714. E-mail [ears@w9ear.org].* Hamfest Web site at *[http://w9ear.org/hamfest.htm].*

SPECIAL EVENTS, ETC.

NOV 4–5

HUNTINGTON, WV The Tri-State ARA and the world-renowned Museum of Radio & Technology, of Huntington, will team up to operate a special event from the Museum's station WV8MRT, 1700 UTC Nov. 4th–1700 UTC Nov. 5th. This event highlights the museum's celebration of 100 Years of Radio, making a full century since Marconi invented the wireless. Main frequencies of operation will be 7.240, 14.240, 21.340, and 28.340. For a certificate, send QSL and 9 x 12 SASE to *Tri-State ARA, P.O. Box 4120, Huntington WV 25729 USA.*

NOV 25–26

MOROCCO The Bavarian Contest Club will be operating again as CN8WW from Morocco in the CQ WW Contests. They will be a Multi/Multi team, so there is a very good chance to work CN on all bands from 160–10m. A new picture QSL card is being offered for the upcoming activities. Work CN8WW on 5 or 6 bands and receive a special QSL card to honor your high performance. QRG's ±QRM: 1.833, 3.503, 7.003, 14.033, 21.033, 28.033 kHz. Before and after the contest, they will operate as 5C8M in CW, SSB, RTTY, 6m, and also on the WARC bands. For more info check the Web at [http://www.dl6fbl.de/cn8ww/]. QSL cards for CN8WW and 5C8M go via DL6FBL (buro or direct): *Bernd Och, Christian-Wirth-Str. 18, D-36043 Fulda, Germany.*

DEC 8–9

BETHLEHEM, IN The Clark County ARC will operate W9WWI, 1500Z Dec. 8th–2200Z Dec. 9th, in celebration of the Christmas season. Operation will be on General 75, 40, and 20 meters. QSL with an SASE for a certificate to *CCARC, 1805 E. 8th St., Jeffersonville IN 47130 USA.* 73

The Digital Port

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Work Wonders with WinWarbler 1.6.5

A fine new piece of PSK31 software found me lately. It was working when I first downloaded it some time ago, but it was still early in the developing stages. And developments came rapidly, as I followed and used this unique approach to software for our increasingly popular mode.

At this writing, I have just downloaded version WinWarbler 1.6.5, which must be at least 15 updates on the original 1.3 series I first used. That first version worked pretty well, but was plagued with crashes. The author, Dave AA6YQ, found the cause of the crashes, which seemed to be caused by something in Windows as I recall, and it has been smooth sailing ever since.

The display has three receive panes and a broad spectrum display, which makes it a real contender during any competitive operating exercise. Plus, it allows you to watch one ragchew while you check to see who is calling CQ. You can select any of the three panes simply by clicking on it and then, when you move the cursor to the spectrum display, wherever you click is where that pane will start tracking and displaying copy.

The package is easy to set up and get operating. After that, you will find the program to be extremely intuitive — it's designed by a ham who understands how I like to operate a program. Some have expressed the opinion that it could soon rival DigiPan for popularity due to its ease of setup and excellent documentation.

I have been having fun with this program, and you can, too. It is as easy to download and get up and running as any program available today. The more I work with it, the better the experience becomes. In just a short time, the program has taken on all the creature comforts I have begun to take for granted, plus a few more.

Dave has included an easy to use mini-log that writes a log file in ADIF format and is ideal to import into Logger. It works well with that program, which is also free for the download. I know, because I gave it a try as soon as the log was put in the program, and the import was flawless. And if anybody can screw up something that works for everybody else, I am the hands-down champ.

There is an adequate set of macros for your editing pleasure. I wrote macros for the areas I feel are normal and had all the available buttons used, even after some judicious combining and selecting. I suggested to Dave there was a need for a few more, and within a few days he made an Alt+Function set available along with a simple selection process.

I like to use defined keyboard keys for macros so that I can keep my hands in one place. You can either click the function keys on the monitor screen or use the keyboard, whichever works for you. The buttons on the screen are identified by function key number and, as you define the macros, the title is displayed on the key. All the info you need is on the screen. You won't need a list taped to the side of the monitor.

Another built-in piece of intuitive coordination is that the color of the pane is reflected in the color of the vertical line in the spectrum display that corresponds to the frequency you are tuned to. It is easy to quickly identify where on the spectrum each pane is tuned and determine what is or is not working.

You can control the colors of the three receive panes so they can reflect your choice of favorite colors. I changed mine, but only for a short time. Pretty colors are nice, except that it is too easy to arrive at a color scheme that becomes difficult to read. It didn't take long to return to original selections. They might be termed "default," but there is not a default selection for colors, so a word of wisdom (from experience): Keep track of where you start.

If you are already using one of the popular soundcard programs for PSK, your cables and PTT setup should work just fine. This is an area that has become nearly standard with most programs. I have two Icom rigs and in that case both rigs connect the same, but more importantly, I can use most of the current software without changing any settings or using any different cables between the radio and the computer. And that is with the use of the accessory connector on the back of the Icom and the commonly recommended serial port–activated PTT circuit.

I mention this as there are often discussions about using other methods to interface the computer and the radio. In some cases, hams are able to successfully use the mic connector for audio input and output with home-brew attenuator circuits. This sounds like a good way to go, until you talk to those who have had trouble building adequate attenuator circuits.

Along with that is the problem of controlling PTT via VOX when employing the mic connector interface. Now, there is something else out there and I have not had my hands on the unit as yet, but I talk to a lot of happy users. A little box is being sold under the name of RIGblaster. Check the URL in the chart.

I can only endorse this unit as far as hearsay will stretch at this time. However, I have not heard anyone say they couldn't make the interface work, and every user I have talked to over the air has had a very clean transmitted signal. So, if it is as good as it sounds, it is a very good deal. An assembled unit that is virtually plug and play. I see already-made-up cables listed, which makes for a neat installation without the assembly hassle.

And the package is apparently a lot more successful than the "plug 'n' pray" that became common in the computer industry a few years back. Now that I have said those nice things, I hope I do not receive a deluge of negative reader response. That can be a problem when you only hear the good from others and then pass it on.

You will also be pleased with the documentation for WinWarbler. With the versions I have been using, the program is not as yet displaying the help files on its own, but nearly so. I downloaded all the help files from the Web site and found that when I clicked on the "Help" button, my Netscape browser would come up and display the help files. It did it so well and so quickly the first time, I had to do a double-take to see what happened.

The point is, you will find everything you need to get going, write macros, and configure the program. If you are not already using a soundcard program, you will find a link from the Web site to the WM2U Web site with all the information you need to answer your questions. (See the chart.)

Plus, you will find, if you decide to make your own PSK31 interface, that the info available is about as simple as it gets. You will make up two audio cables from your soundcard to your rig, and you will find that is a barebones hookup that will allow you to copy PSK31. You can transmit as well, by manually toggling the transmit on your transceiver. A lot of us did this in the beginning (many still do) and it works.

You will, if not at first, at some point want to build a PTT circuit, and that is described for you through the link. With those three connections made, the operation of your radio will seem automatic.

There is another facet to all this. I did not dwell on the fact you need not carefully move your tuning knob on your receiver to get the PSK31 signal "dead-on" for proper reception. Most PSK31 programs allow you simply to click on the received signal and have the magic begin.

However, Dave carried it another step. He uses a "xcvr freq" box, where you can enter the frequency from your transceiver. Then the spectrum display is automatically calibrated for the frequency of the station you are working. This resultant frequency reading is then entered into the log so you know what your operating frequency was rather than just "20 meters." Take a look at the screen shot and the numbers above the waterfall.

This means that your log will include the frequency worked along with the other pertinent information you like to enter into the record. Speaking of logging, Dave has made the mini-log very responsive, in that it not only makes the log info available in ADIF format, but also you can clear the log using a mouse/keyboard combo once you have imported the current info into your regular log program.

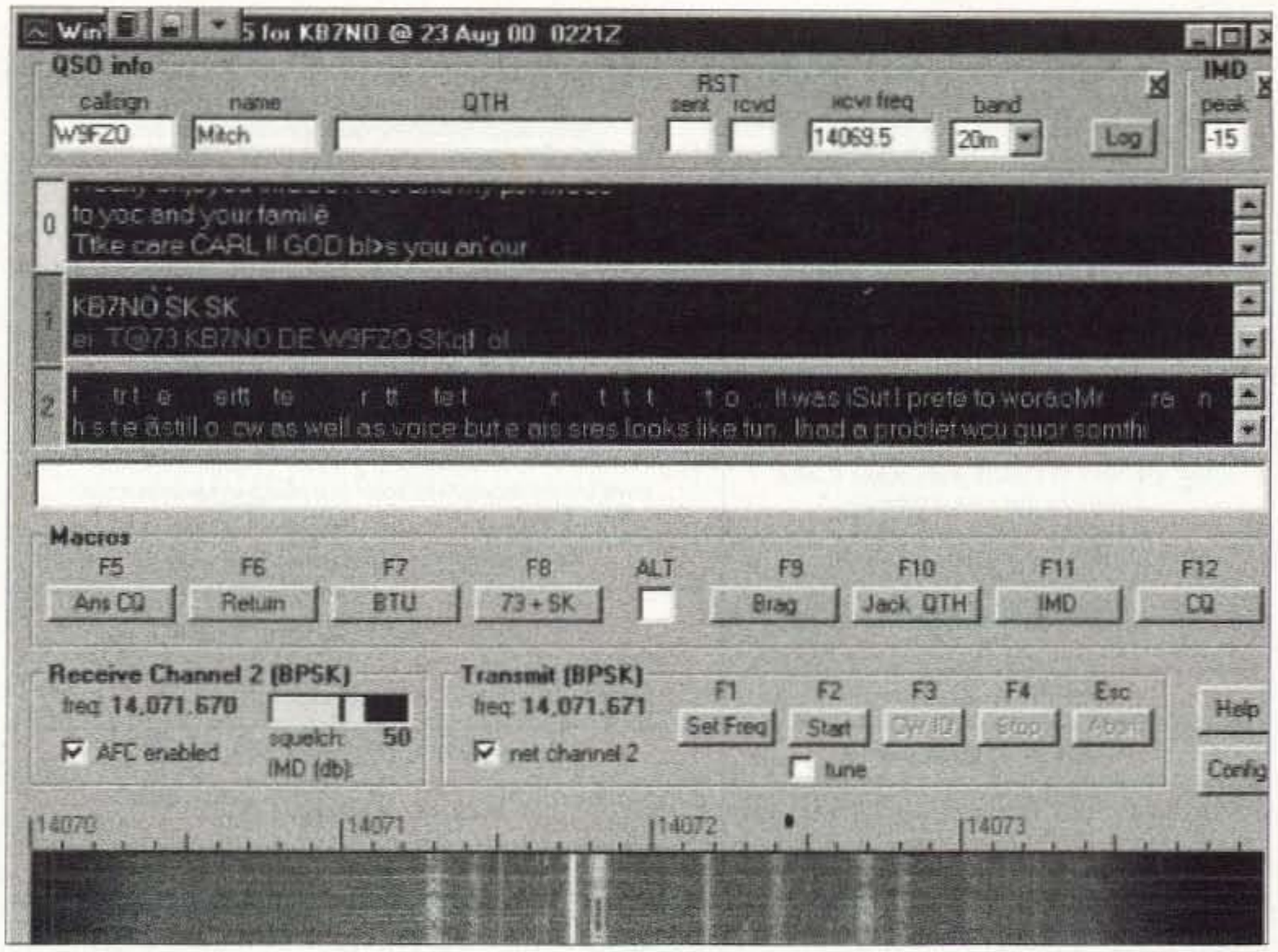

Fig. 1. *Screen shot of WinWarbler 1.6.5. This shows each receive pane containing text that is being copied simultaneously. The only one not tuned to a signal is the middle pane, where I had just signed with a ham. All that was necessary to log the QSO was to click the "log" button, and the next station could be worked. Each pane has its unique color, which matches the vertical tuning bar in the waterfall at the bottom. The white space is the transmit window that supports type-ahead. Your macros will display there also. The eight definable function keys, F5 through F12, carry the ID on the screen that you give them during programming. They will do double duty with the help of the Alt key, and that can be toggled by clicking on the box in the center of the row. This gives a total of 16 macros you can define that are easy to spot in the screen, no list needed. An idea of the popularity of this mode can be gained from the waterfall, with at least 10 signals showing. Note the frequency indicators above the waterfall. These are as accurate as you allow them to be, according to your entry at the top of the screen.*

This is a convenience when compared with other programs' mini-logs, where it is necessary to manually locate and delete the information from the file to avoid double imports into your log program. Still, you must remember to clear the entries — otherwise, it becomes necessary to remove the duplicates after they are imported a second time. So many things to remember — a person can get a terrible headache while having all this fun.

I almost forgot to mention the trick spectral display that was recently added to the program as an option to the waterfall. These displays work better for the eyes for some folks who do not like to watch the waterfall for tuning. Additionally, there is a provision to change the colors on the waterfall for another variation of the display.

All in all, this is one whale of a program. You will find all the bells and whistles you could ask for, a complete set of instructions for hardware wiring, and full documentation on the use of the program — and it is free for the download. (See the chart.)

Other modes are still waiting in the background. I watch for more activity with the multi-tone modes and only see limited contacts being made. It seems that the PSK31 mode really took off, and it deserves all the attention it is getting. It works with low power and is easy to set up, and new software such as WinWarbler is being introduced regularly.

When I work the folks on RTTY, it seems there are few who haven't wondered what this soundcard craze is all about. Many RTTY hams who have not yet tried PSK31 are continuing to use the hardware-driven systems and do not realize how easily they can get into the new mode.

Interestingly, many who change become "converted" and seldom return to the RTTY ... except at contest time. If there is something that will retain the RTTY proponent it is the contest.

I talk to some who are only vaguely aware of programs such as MixW and TrueTTY, which make RTTY available on the soundcard, as well as PSK31 and other

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nais.com/~jaffejim/mixwpage.htm
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
Site with links to PSK31 and Logger 7. Also Zakanaka and scope program	www.chroniclenetworks.com/~dwm/logger-zakanaka.htm
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use — new version 1.2	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Timewave DSP & AEA products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://home.t-online.de/home/dl4rck/ [use lowercase DL4RCK]
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
BayCom — German site	www.baycom.de/
BayCom 1.5 and Manual.zip in English	www.cs.wvu.edu/~acm/gopher/Software/baycom/
N1RCT site — excellent RTTY ref.	http://www.megalink.net/~n1rct/
Int'l Visual Communication Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Creative Services Software	www.cssincorp.com
Hellschreiber & MT63	www.freeweb.org/varie/ninopo/iz8bly/index.htm

Table 1. *The goodies list.*

fascinating modes. I know my PK-232MBX has been gathering dust for the last few years. The only thing not available for a soundcard is PACTOR, and that is because of licensing fees. How our world changes.

Tracking your movements?

When I was mentioning deleting files, I was reminded of something. I have gotten a little miffed (more like exceedingly displeased) with the demand to allow the installation of "cookies" in my computer when I am accessing the Internet. I get a lot of stories on this, and it is passed off all the way from a subversive activity by the federal government to a helping hand from Internet commercial gurus so I will more easily find what I want on the Internet.

That last statement is a crock of you-know-what. For whatever it is worth, if you are not aware, commercial list makers are placing the cookies and gathering information about your interests (not mine anymore), so they can compile demographic files and sell them to marketing companies who, in turn, can offer you all those once-in-a-lifetime, too-good-to-be-true deals through the mail (shredder fodder) and over the Internet.

A cookie is simply a short text file that uniquely identifies your computer for anyone who has the capability of tracking these cookies. By tracking, your every visit to any Web site is recorded and compiled at some great compiling station at an undisclosed location.

I object to the whole idea of someone messing with my computer while I am not watching them. So, I came up with a solution. I let these used car-lot style salesfolk put their cookies in a file in my computer so I can be allowed access to their Web site. Then I remove them.

At least once a day, I go to the [cookies.txt] file and delete the contents. You can do the same if you do not wish strangers tracking your every move on the Internet. The operation can be performed either from DOS or by simply checking the directory where your Internet browser resides in Windows. I find the fastest is to do a "Find" for [cookies.*] and then double-click on the file when it comes up. This prints the file on the screen in an editor and the rest is up to you. (Select and delete.)

I learned very early that these intruders into my sanctum feel they are far more important than I am and are quick to tell me to buzz off if I complain about their activities. So the simplest way to keep them out of my hair and still be allowed access to "their" territory is to use the above approach.

As I mentioned, it has been claimed that the government has the capability of checking on their citizens' interests for other means. I haven't seen a cookie I could identify to a government source, so that last claim may be simply rubbish or else the ones who need tracking have cookies fashioned for their needs. All is possible.

If you have questions or comments about this column, E-mail me [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO. 73

If you're a No-Code Tech, and you're having fun operating, tell us about it! Other No-Code Techs will enjoy reading about your adventures in ham radio—and we'll pay you for your articles. Yes, lots of nice clear photos, please. Call Joyce Sawtelle at 800-274-7373 to get a copy of "How to Write for *73* Magazine."

On the Go

Mobile, Portable and Emergency Operation

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Mobile HF Lessons From the Hamfest

This weekend we had our local hamfest here in Melbourne, Florida. Besides all the obvious equipment treasures, hamfests tend to provide a wealth of opportunities for writers. There's the chance to see old friends and catch up on what you've missed. There's the chance to have a face-to-face QSO and finally put a face with that voice and call you've spoken with but never met. And, unfortunately, there is the chance that one may find out that the reason a particular station hasn't been on the air lately is because he or she has become a silent key.

I am pleased to report that the Amateur Radio Emergency Service (ARES) table was quite busy even though it was located a bit out of the way. People were lined up to get their picture taken for ARES identification cards or just to chat with other hams involved in disaster communications. It is always gratifying to see how hams are not only willing to help out in an emergency, but how they're also willing to meet the requirements to ensure that they will be ready if called upon to serve.

Naturally, there is also the chance to make meaningful technical evaluations and comparisons. Therefore, when I arrived at the hamfest site I immediately checked out the vehicles in the parking lot. While some people (normal people?) might be inclined to compare the makes and models and years of the automobiles themselves, we hams check out the important features — what kind and how many antennas are present and how they are mounted. I must admit I was surprised by the number of cars with HF antennas. I catch a fair amount of good-natured razzing from nonham friends because of the antennas on my car, but I must admit that even I was quite jealous of some of the vehicles I saw in the parking area. Screwdriver antennas, bug-catchers, and multiband systems with multiple resonators were as common as ants at a picnic. From the view in the parking lot, it would seem that the current band conditions have made quite a mark on the interest in talking with the world from our cars and trucks. On the other hand, it may not be just the conditions but may reflect the availability of high quality, easy-to-use equipment that lends itself so easily to mobile use. This got me to thinking about this phenomenon.

Recently, when the hobby of amateur radio underwent its restructuring, a lot of the discussion concerned the change in the requirements to demonstrate the ability to communicate by the use of Morse Code. At the time, many of us reflected on the changes in our hobby so that we are no longer dependent, as we once were, on Morse Code as the single mode we could use to communicate. Instead, of course we can choose from among a whole range of modes, which has made the dits and dahs of CW, while still enjoyable, less critical to our hobby.

The capabilities we take for granted today totally outstrip any of the expectations that many of us had even a few years ago. Who would have thought we'd be marrying global positioning satellite (GPS) systems with packet radio for Automatic Packet Reporting Systems (APRS)? Digital Signal Processing was quite an exotic (and expensive) accessory only a few years ago. Today, it is a common feature on many reasonably priced transceivers. For that matter, what isn't included in most mid- to upper-end transceivers? It wasn't that many years ago that I obtained a used transceiver which, when paired up with its accessory cabinets, covered the best portion of a desk. A few years later, I purchased a transceiver from the same manufacturer that was only two models newer and included all the same features in a single unit about the size of the proverbial breadbox.

This technology growth has not only made the ability to operate HF from the average automobile or van possible, but also made it downright common. It was not too many years ago that a transceiver required 110 volts AC to operate, occupied a lot of space, was quite heavy, and produced a significant amount of heat. Now, a rig with all-band capability can fit into a very small package and put out 100 watts of power. Today, most rigs are designed for 12-volt DC operation. I saw a lot of interest at the hamfest in both new and veteran rigs to be used in mobile applications. But is it just the technology that has led to the growth in interest in mobile operations?

It seems like we are all facing the crunch of time, and for many of us the only opportunity to get in some DX hunting is while on the road. After a ten- or twelve-hour workday, many families expect to have a little time spent on them, rather than huddled over the rig in the ham shack. On the other hand, the commute to and from work or the trip from one work location to the next provides excellent opportunities to work a few exotic stations.

Currently we're at a good point in the sunspot cycle, which has made operating conditions much better for HF operations. The higher frequency bands such as ten meters provide excellent operating characteristics. A ten-meter antenna is reasonably sized for mobile use and provides relatively good coverage throughout a fairly spacious band. Besides the ability to operate sideband, one can also choose FM and use one of the many repeaters available throughout the world.

It could be the challenge, of course. After all, when the big guns are putting a kilowatt into stacked monobanders at 120 feet, cutting through the pileup with a hundred watts into a short vertical does provide a sense of satisfaction. Anyone can operate

Continued on page 58

New Products

Mini-News from MFJ

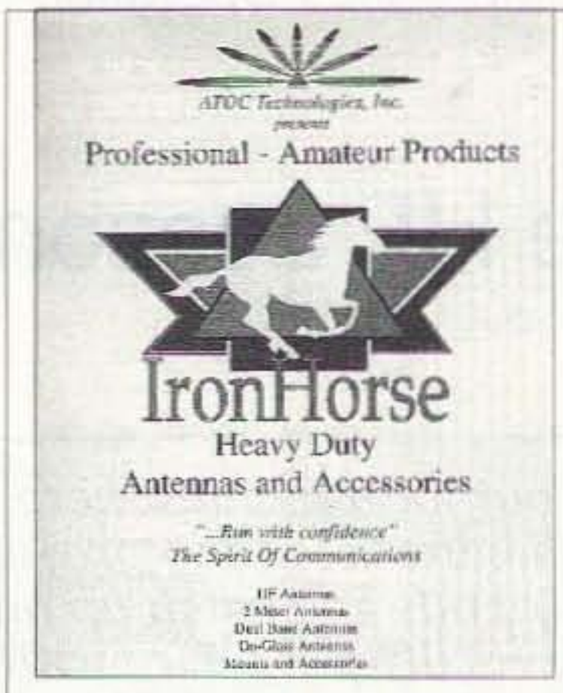
• QRP-Cubs are complete single-band transceivers that fit in the palm of your hand. Using SMT, these rigs achieve big-time performance with mini-sized package. The kits provide all SMT parts mounted and soldered; you just insert and solder the through-hole parts such as connectors, inductors, and trimmers. Designed by QRP-ARCI Hall-of-Famer K1BQT. Available for 80, 40, 30, 20, 17, and 15 meters. MSRP: MFJ-93XXK (kit), $99.95; MFJ-93XXW (wired and tested), $149.95.

• The MFJ-134 (24-hr.) and MFJ-132 (12-hr.) transparent clocks are cool! Their see-through display makes the numbers seem to float in midair, so don't run into these giant 1-3/4-inch-high digits as you walk across the shack. Alarm, snooze, operates on two AA batteries. MSRP: $34.95.

• At long last, some good coax patch cables. Here are 3-, 6-, 18-, and 50-foot lengths of RG-8X terminated in a molded, weather-resistant PL-259 connector on one end, open on the other. The MFJ-5850 50-footer has an MSRP of $17.95; shorter lengths, less — please inquire.

• The MFJ-1709 foot switch can greatly improve your efficiency by reducing fatigue — a great bonus regardless of whether you're a contester. Cushioned foot pedal on nonskid pad, 1/4-inch phone plug, 10-ft. cord. MSRP: $21.95.

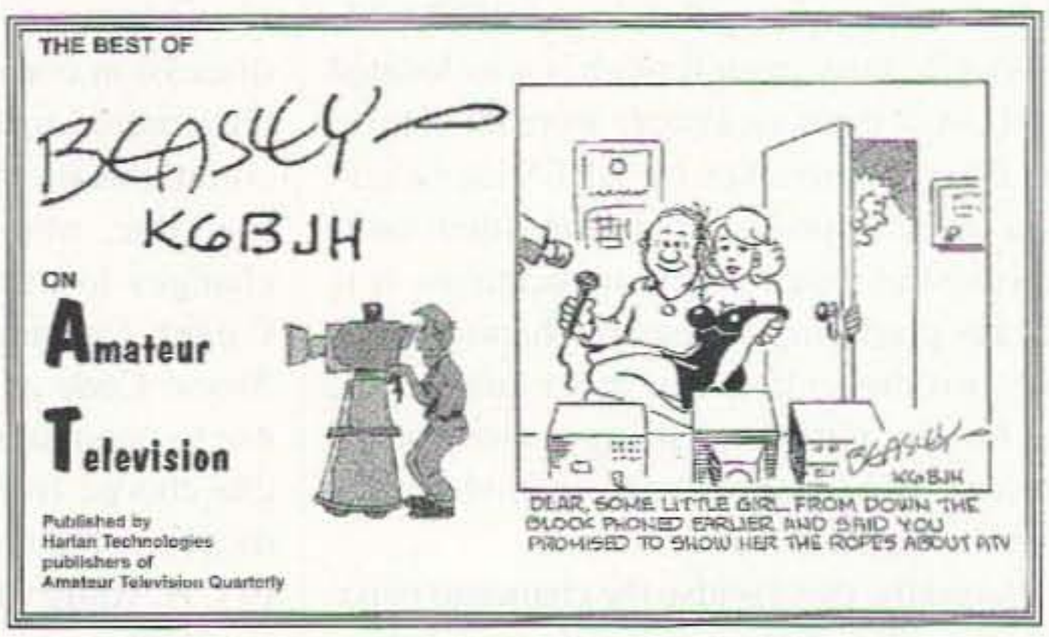
For further information about these or other MFJ products, please contact MFJ Enterprises, Inc., PO Box 494, Mississippi State, MS 39762; tel. (800) 647-1800; fax (662) 323-6551; E-mail [mfj@mfjenterprises.com]; Web [www.mfjenterprises.com].



New ATOC Catalog

ATOC Technologies, Inc., home of IronHorse heavy-duty antennas and accessories has issued a new catalog featuring their complete line of mobile HF antennas and systems; dual-band and VHF antennas; mag mount antennas and kits; and mounts and accessories.

For further information about this 6-pager, contact ATOC Technologies, Inc., PO Box 36, 23 South High St., Covington OH 45318; tel. (937) 473-2840; fax (937) 473-2862; site [www.atoctechnologies.com].



The Best of Beasley

If you're thinking about getting this 60-page booklet (115 cartoons) as a stocking stuffer for yourself or someone else, make sure the insurance premiums are paid first — someone is bound to bust a gut. This is a collection of the best of K6BJH's work over the years, as it appeared in *ATV Quarterly* (although these are not all ATV-oriented, by any means!). At $8.95 plus $3 s/h ($6 overseas), the price is also laughingly low.

For further info or to purchase, contact Harlan Technologies, 5931 Alma Dr., Rockford IL 61108; tel. (815) 398-2683; fax (815) 398-2688; orders (800) 557-9469.

Icom's IC-718 HF Xcvr

Although officially designated an "entry-level" rig, the IC-718 is still packed with features: simplified band stack register; direct frequency input; VOX; FSK; optional DSP; 1-Hz tuning; and of course more. Front-facing speaker and LARGE LCD readout are just two reasons this design is very op-friendly, too. Coverage includes 0.03–30 MHz; 101 memory channels available. Suggested MSRP: under $900.

For further information about this or other Icom products, please contact Icom America, Inc., 2380 116th Ave. N.E., Bellevue WA 98004; tel. (425) 454-7619; fax (425) 454-1509; Web [www.icomamerica.com/amateur/hf].

Be sure to let our advertisers know that you saw it in *73!*

Millennium Key

Morse Express has announced the availability of a limited edition Millennium Key, made by Llaves Telegraphicas Artisanes in the Balearic Islands of Spain. This limited edition (100) has the same mechanism as the LTA Model GMO, but also the following special features: hand-selected parts, highly polished and gold-plated; ebony knob and base; official certificate with serial number; and wood presentation box with red felt lining. $89.95

For further information, contact Morse Express, 2460 South Moline Way, Aurora CO 80014-1833; tel. (303) 752-3382; fax (303) 745-6792; orders (800) 238-8205; E-mail [hq@MorseX.com]; Web: [www.MorseX.com].

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R.S.#		page
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•	Alinco	CV2
•	All Electronics Corp.	11
•	Am-Com, Inc.	59
16	Astron Corporation	2
42	Bilal Company	17
56	Buckmaster Publishing	12
168	Buckmaster Publishing	56
99	Communication Concepts	37
•	Communications Electronics, Inc.	5
10	Communications Specialists, Inc.	37
•	D & L Antenna Supply Co.	15
13	Doppler Systems	52
•	East Coast Amateur Radio	13
•	E-Z Hang	37
193	GGTE	25
•	Ham Ambassadors	51
•	Ham Mall	23
•	Hamtronics, Inc.	9
42	Isotron	43
•	Kenwood Communications Corp.	CV4
86	MFJ Enterprises	7
•	Michigan Radio	49
160	Micro Computer Concepts	17
193	Morse Tutor Gold	25
•	NCG	33
•	Omega Sales	19
•	Omega Sales	61
•	Peet Bros. Company	15
•	Radio Book Shop	25
•	Radio Book Shop	28
•	Radio Book Shop	43
•	Radio Book Shop	46
•	Radio Book Shop	48
•	Radio Book Shop	52
•	Radio Book Shop	57
•	Radio Book Shop	63
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•	RF Parts	17
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If Your Xcvr Goes Brain-Dead

With the launch of Phase 3-D imminent last month, I decided to check out some of my microwave gear that had been getting dusty since AMSAT-OSCAR-13 became a shooting star a few years ago. The results were unexpected. My 2.4 GHz (13cm) tower-mounted receive converter was dead, and my all-mode Icom IC-1271A 1.2 GHz (23cm) transceiver was acting as if it were brain-dead.

Of the two problems I discovered, the 13cm receive converter was not a serious concern. Since I purchased the unit from Germany several years ago, I had collected a number of other 2.4 GHz units that, with some modifications, could easily and inexpensively, take its place. My receive converter is mounted within two feet of the semi–dish antenna that is an integral part of my hamsat antenna array. It has been out in the weather, and may have developed a leak or, if I'm lucky, the power cable has simply shorted or opened. It will be investigated during the cooler winter months. The most disturbing discovery, however, was the situation with the Icom IC-1271A. The display showed bizarre frequencies, when it worked. I had heard rumors that the rig's software was stored in battery-backed-up memory. This sounded rather foolish, so I had discounted it as some kind of ham-radio urban legend. Surprise! They were right.

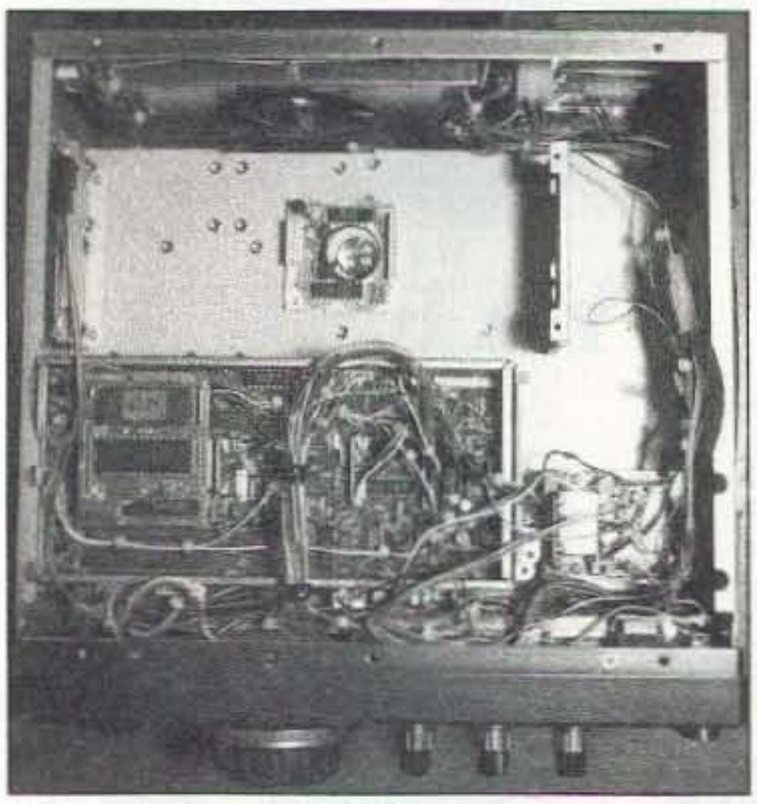

***Photo A.** An Icom 1271A transceiver with a new memory board from Italy to replace the original Icom unit shown above.*

Dismay

I purchased my IC-1271A almost 15 years ago. In the early 1980s, I had been using a European transverter to make terrestrial 1296 MHz contacts, but needed something that would tune down to the 23cm satellite band around 1269 MHz, in order to use the Mode "L" (23cm up and 70cm down) transponder on AMSAT-OSCAR-10. At the time, the only commercial rig that could do the job was the IC-1271A. I bought it. I made my first Mode "L" contact with Rip WA2LQQ on April 5, 1986. Seven L-mode QSOs later, the computer on AO-10 was dead. I now had a 23cm radio with no 23cm satellites in the sky. AO-10 still worked, but it could not be commanded for predictable Mode "L" operation. Fortunately, 14 years later, AO-10 is still working as an exceptional Mode "B" (70cm up and two meters down) hamsat, but Mode "L" is history.

Four and a half years later, in 1988, I was again using Mode "L" with my 1271A, but this time via AMSAT-OSCAR-13. This hamsat transponder was more sensitive than that on AO-10, and contacts were easier and more plentiful. Using a tube-type 23cm amplifier and a 45-element loop yagi, I made many contacts.

But before AO-13 was in orbit, I found that the IC-1271A could be a lot of fun for terrestrial long-distance (DX) work, and with the optional TV-1200 module, provided excellent 1.2 GHz AM amateur television (ATV) operation. After AO-13 reentered the atmosphere, the rig was used for a while for local AM ATV, but then became a dust collector. There were so many other exciting satellites to chase, so the loss of 1.2 GHz hamsat work was not a problem. But while my radio sat dark and silent on the shelf for years, I had no idea that its operating system and memorized channel frequencies were stored in volatile memory, tentatively held in place by a single lithium "coin cell" battery from the mid-1980s.

A typical coin-cell battery lasts about 10 years. In an air-conditioned environment like my radio room, it may last up to 15 years if the current consumption is low. Mine lasted about 14 years.

In 1992, I had purchased a service manual from Icom for $35. It contains numerous schematics and complete, well- written, information about the radio, complete with parts lists and tune-up procedures. There is, however, a significant gap concerning the RAM unit. The description of this daughterboard, which is attached to the logic unit on the bottom side of the radio, is lacking. Its purpose, significance, and service requirements are not mentioned. When my 1271A began losing its mind, I had no information on what to do about the dead battery.

The obvious fix was to replace the battery. Unfortunately, it was soldered into place. I found a suitable battery holder on an old PC communications board. I removed the old solder-tab CR2325 battery and replaced it with the holder. I got a new non–solder-tab CR2325 from Radio Shack and inserted it into the holder. Power up! The radio was still dead. Nothing seemed to make a difference. When the original battery died, so did the software that ran the radio. I was not pleased.

The search

My first reaction was to contact Icom, but I did not want to repeat my previous mistake of trusting a radio that was dependent on battery-backed-up programming. So I put out a cry for help to the AMSAT-BB remailer on the Internet [amsat-bb@

amsat.org]. Replies were numerous. The urban legend was true. There was no way that I could fix my radio without outside help. It was brain dead. I had three options: trash or sell the rig, buy a new RAM unit from Icom, or get a better replacement daughterboard from another source with operating code burned into nonvolatile memory.

The first option of trashing the rig was not acceptable. I have radios that are over 50 years old that still work great. I had spent nearly $1,000 for the Icom 1271A and had no intention of selling it as junk or throwing it away. It is a mere youngster compared to some of the rigs I have in active service.

The second choice of contacting Icom was obvious, since they designed and built the rig. I hoped that they could help. Icom maintains an Internet presence at [http://www.icomamerica.com]. I went there and discovered that I could visit their technical support site at [aol.com] or call them on the phone during California business hours. Since I don't have an AOL account, I called their Technical Support-by-Phone number at (425) 454-7619. The operator on the other end was a bit clueless about the RAM unit in the 1271A and promised to call back later.

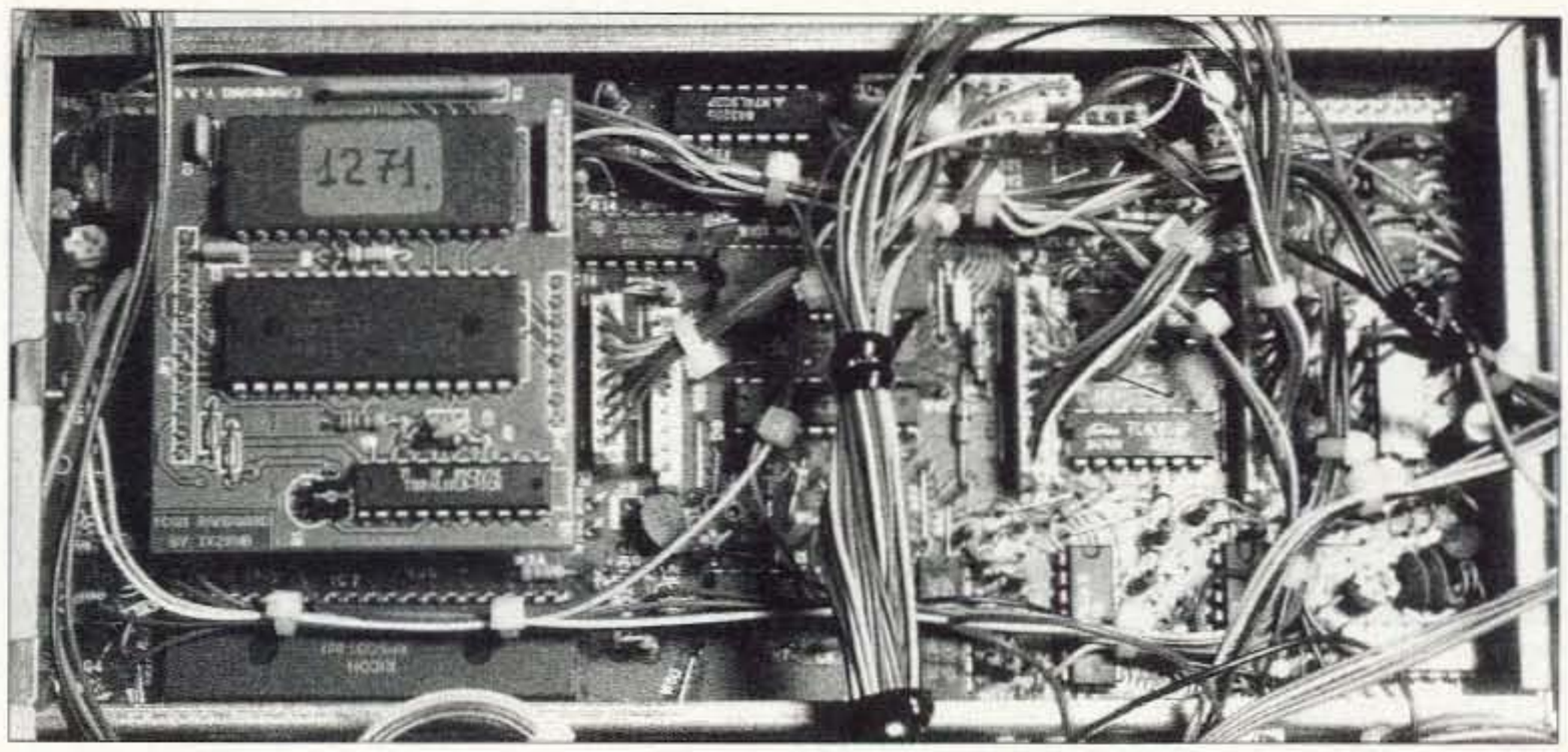

Photo B. *Close-up of the IK2RND EPROM/ RAMBOARD memory unit as installed in an Icom 1271A 23cm transceiver.*

I'm still waiting. Other independent Icom representatives or repair centers like Malcom Technical Support [mts@plix.com] might be better than the home office.

My preferred choice was to find a third-party, non-Icom source for a replacement for the RAM unit, which would not have the same design flaw (operation software in battery-backed RAM). E-mail from Mark KØMDJ mentioned a review in the July 1994 issue of *QST* (page 79) addressing the third-party nonvolatile option. Mike K4HN provided the Internet URL (Universal Resource Locator) for the company that had it, Wilco Electronics [http://www.ameritech.net/users/wilco788/my1.htm]. A second likely solution came from Woody KJ4SO. Woody owned an IC-271 and had purchased a direct, plug-in replacement daughterboard from Roberto Nardo IK2RND [Roberto.Nardo@pv.infn.it]. Woody highly recommended Roberto's

Continued on page 52

Photo C. The Icom 1271A transceiver back in service after a nearly disastrous memory failure.

HAMSATS

continued from page 51

solution and encouraged me to send E-mail at my earliest opportunity.

Surprises and solutions

I now had two possible sources for a correctly designed RAM unit replacement, one domestic and the other in Italy. I checked out the Wilco Electronics Internet site and was surprised to discover that there were several Icom radios with the same problem. Six models listed on the Wilco page included the IC- 271, IC-471, IC-1271, IC-745, IC-751, and the R71A. All of them apparently use the same replaceable plug-in memory module with operation code loaded into battery-backed RAM — time bombs ready to make the radios brain-dead. The base price for the Wilco ICM-1024B is $134.95 plus shipping. In addition to holding the rig's operating software in nonvolatile memory, there are frequency-expansion enhancements and more memories (from the base 32 to 1024) available for some of the six radios. E-mail to Jack Albert WA9FVP [wilco788@ameritech.net] yielded a fast response with additional information, and the caveat that the ICM-1024B had never been tested in a 1271 or 471, but works fine in all of the IC-271 transceivers, in addition to the HF rigs and R71A receiver.

I also sent E-mail to Roberto IK2RND. The next morning, I had a reply. Roberto's replacement board did not provide extra memories beyond the standard 32, but did include extended frequency coverage for the IC-751, IC-751A, IC-745, R71A, R71E, and the IC-271. The IC-471 and IC-1271 are simply provided, with the advantage of being back on-line and not subject to losing their minds to dead batteries. The cost for Roberto's EPROM/RAMBOARD is $60 cash — airmail shipping included. After considering the options afforded by the two choices, I carefully folded three new $20 bills in half, taped them between two of my QSL cards with a note, and sent it all in a securely sealed envelope to: Roberto Nardo, via Marchesi 27, 27100 Pavia, Italy, Europe. Eight days later, I received a padded envelope from Italy.

Success

The envelope from Italy contained a very professional circuit board, a QSL from Roberto, a curious two-conductor wire assembly with a diode, an annotated logic unit circuitboard pictorial, and a two-sided instruction sheet. The instructions were well written and very easy to follow. I skipped the part about how to get into the radio. Mine had been gutted on the workbench for a number of weeks. The remainder of the instructions required that I unplug the old RAM unit and replace it with the new EPROM/RAMBOARD. That's it! I powered up my IC-1271A and was back on the air in only a few minutes.

But there's more. The back side of the instruction sheet had details on what to do when the new battery died in about seven years. The RAM memory contains the 32 programmable channels and the last settings of the VFO A/B frequencies. The operating software is safely in the nonvolatile EPROM, but there is a sequence of things that must be done when replacing the lithium coin cell. The wire and diode assembly that came with the new board is used according to the simple sequence of instructions, in conjunction with the annotated pictorial sheet, to reset the memory. I have carefully placed these items inside my user's manual for possible use sometime around the year 2007. Until then, I have 10 watts, on any mode, ready for Phase 3-D or any other hamsat that has a 23cm uplink. I also have a radio that won't lose its mind the next time a battery dies. Do you have an IC-1271A or one of the other radios mentioned? The clock is ticking. 73

James W. Elkins Jr. KA8PHO
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Rootstown OH 44272

Add-On Digital Voltmeter

Strictly for those who love to build it themselves.

While building a power supply for use in the shack lately, I thought that it would be nice to have a way to know what the voltage on the output was. Since the supply that I was constructing was going to have a variable output, this would add a nice feature to it. I could use a standard-type meter, commonly found at parts stores or mail order catalogs, but I thought that I would "dress" it up a little and opt for a digital-type display. This would be a more accurate way to measure, if I ever needed to do so.

I started to search for a way to accomplish this. I could purchase a digital display ready to go from a box, but being of the building type, I feel guilty when I do this sometimes. I decided that I could build this feature also, if I could find some information on the subject. While looking at an older IC data book, I ran across an analog-to-digital converter that would do the job nicely. And the best part was that it did not use any very expensive parts. A quick check in some parts catalogs and on the Internet told me that the parts I was looking for were still around.

The IC of choice is an analog-to-digital converter, the CA3162E, that does the nice job of providing an output to drive a display driver, the CA3161E, and displays the information on a 3-digit digital display. Just the thing to keep an eye on our output voltage, while it is being varied.

The range of the finished "Add-On Digital Voltmeter," as built, will display any voltage in the range of 0–99.9 volts. It will also show an over-range condition with EE.E on the display. But this feature would probably not be a concern, as our variable power supply could not reach this amount on its output.

Refer to the schematic diagram, **Fig. 1.** The power to supply the "Add-On Digital Voltmeter" can be supplied from a separate DC voltage source or, as in our case, directly from the source that it is measuring. About 10–15 volts is good to work with. This will keep our "on board" voltage regulator, U3, happy. The input voltage to the regulator is polarity-protected by the diodes D1 and D2. The 5 volt regulated output is supplied to the A/D converter U2 and display driver U1, respectively. It is also used in the voltage divider circuit of R1, R2, VR3 for use as a 0.9 volt calibration source. (More on this later.) Resistors R3, R4, VR4 form a voltage divider circuit to "scale" our input voltage that we wish to measure down to a level that can be safely used at the input of our A/D converter.

One critical component is C3. A

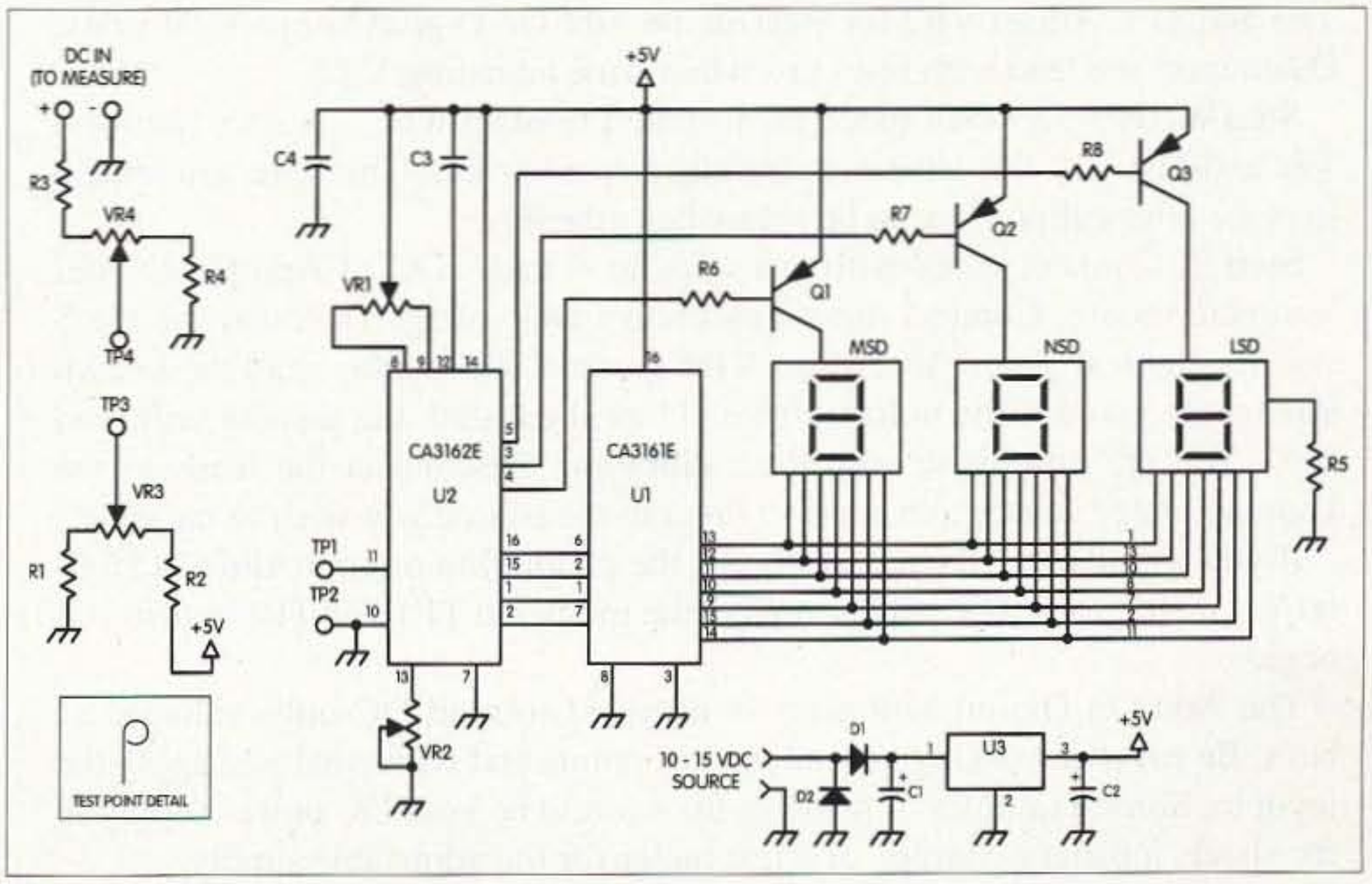

Fig. 1. Add-on digital voltmeter schematic.

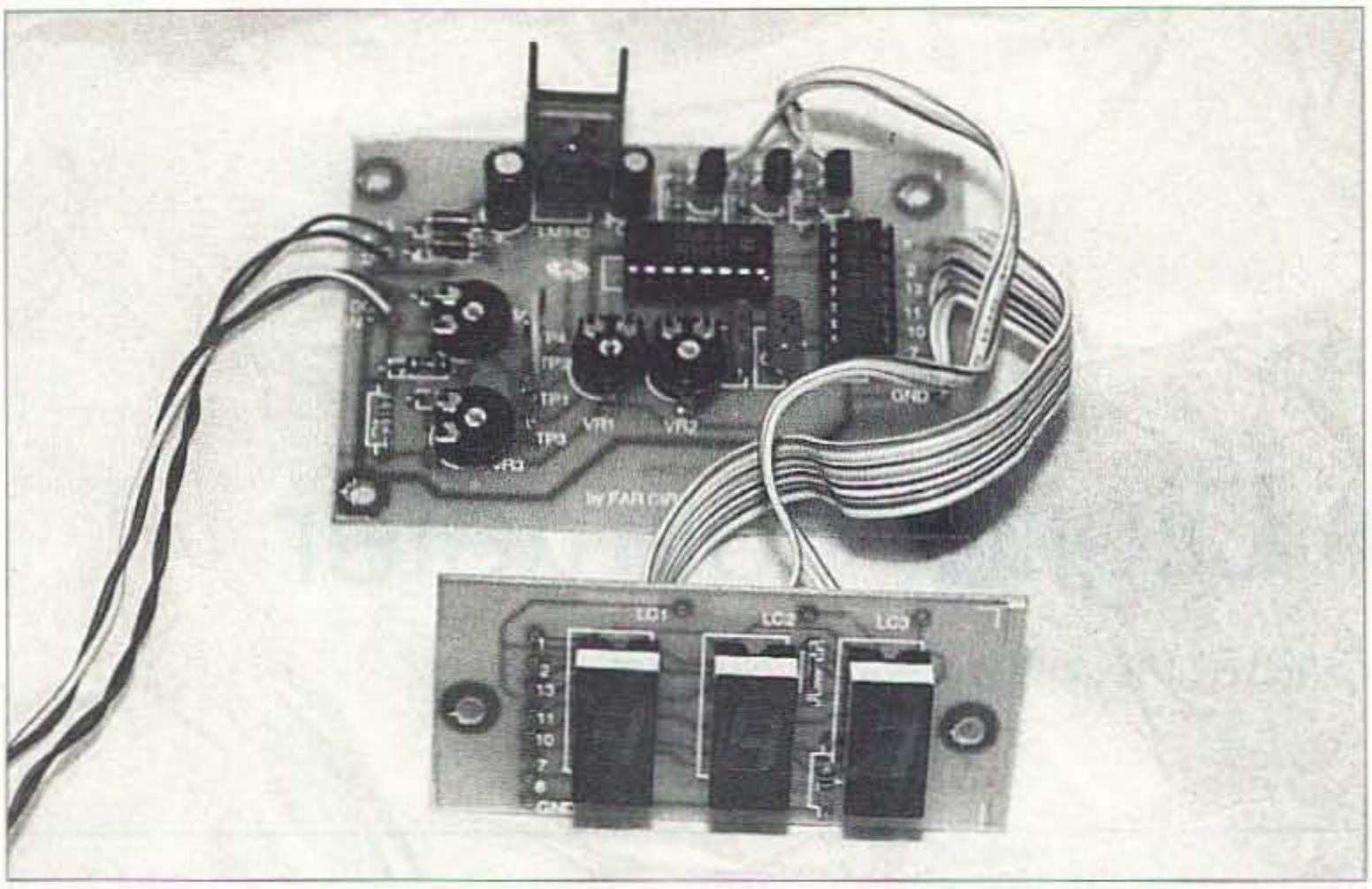

Photo A. Finished voltmeter showing digital display.

high-quality polyester type should be used here, as this component is used for timing by the A/D converter. Q1, Q2, Q3, are used as digit drivers, while the outputs of the display driver, pins 9-15, are wired to the common anode displays in multiplex fashion. Test points, shown on the schematic, will be used during calibration — this makes finishing up your "Add-On Digital Voltmeter" easier. The test points are simply resistor leads with loops formed in one end, soldered into the PC board.

Constructing the "Add-On Digital Voltmeter" is very easy. The circuit

Continued on page 59

Quantity	Name	Description
3		Common anode displays, 0.3", left-hand decimal points, HP #5082-7610 or MAN3620A or equivalent
1	U1	CA3161E BCD-to-7-segment decoder
1	U2	CA3162E A/D converter
2		16-pin IC sockets
1	U3	LM340T5 +5 V regulator
3	Q1, Q2, Q3	2N3906 PNP transistors
2	D1, D2	1N4001 diodes
1	VR1	50k 10mm-style trimpot, Piher #PT10, horizontal (same for all trimmers)
1	VR2	10k 10mm-style trimpot
2	VR3, VR4	1k 10mm-style trimpot
1	R1	270 ohm 1/4 W resistor (all resistors carbon film 5%)
1	R2	2200 ohm 1/4 W resistor
1	R3	100k 1/4 W resistor
1	R4	680 ohm 1/4 W resistor
1	R5	100 ohm 1/4 W resistor
3	R6, R7, R8	4.7k 1/4 W resistor
1	C1	100 µF 25 V electrolytic capacitor
1	C2	10 µF 25 V electrolytic capacitor
1	C3	0.27 µF 50 V polyester PC-mount capacitor
1	C4	0.1 µF 50 V polyester PC-mount capacitor
4		1/2"-long wires, formed as shown in Fig. 2 (use clipped resistor leads)
1		PCB or perfboard. PCB available from Far Circuits, 18N640 Field Court, Dundee IL 60118-9269, $2 per set of 2.
3		14-pin IC sockets for displays
1		Heatsink for regulator, Aavid #5971B used in model
Optional parts: Connector for input voltages to PCB; enclosure; hookup wires; short length of ribbon-type cable. Parts can be obtained from a number of sources, including Jameco, Mouser, and Digi-Key.		

Table 1. Parts list.

Calibration Instructions

You will need to use a digital voltmeter to make some of the adjustments. Set the trimmer potentiometers VR1–VR4 to their center positions as a starting point.

Step 1. Provide 10–15 volts to the PC board at + and - VDC.

Step 2. Check output at U3, pin 3 for 5 volts.

Step 3. The display should read EE.E

Step 4. Attach a test lead with clips between TP1 and TP2. Adjust VR1 for a display of 00.0, then disconnect the test leads from TP1 and TP2.

Step 5. Attach a digital voltmeter (DVM) from TP3(+) and TP2(-). Adjust VR3 for 900 millivolts (.900 on the meter you attached). Disconnect the test leads to this meter when done adjusting. Attach test lead with clips between TP3 and TP1. Adjust VR2 for 90.0 on the Add-On Digital Voltmeter display. Disconnect the lead with test clips when done adjusting VR2.

Step 6. Using a small piece of insulated hookup wire, connect (jumper) TP1 and TP4 with this wire and carefully solder in place. This wire will remain in place after calibration, so be neat when attaching.

Step 7. Connect wires with test clips to + and - DC of Add-On Digital Voltmeter board. Connect these to a known DC voltage. You can use the 5 volt regulator if you wish. Adjust VR4 to make the display read the known voltage. If you use the voltage from U3 as suggested, the display will read 05.0. You are now done with the calibration. Disconnect the leads to the known voltage source and connect them to the source you wish to measure.

If you would ever like to "touch up" the calibration of your Add-On Digital Voltmeter, remember to disconnect the jumper at TP1 and TP4 before you begin.

The Add-On Digital Voltmeter is intended to read DC-only voltages as built. **Be careful** working around the test points and with what you apply the input to. Some examples of possible uses would be your DC power supply in the shack, a battery charger, or a test meter for the adjustable supply.

Paul L. Specht
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Port St. Lucie FL 34983
[pathdab@bellsouth.net]

Simple P.S. Add-Ons

Enhance your next power supply project with an overvoltage protector and a smart LED output level indicator.

Whether you're a novice or seasoned veteran, one of the first home-brew projects you'll ever build is a power supply. It certainly is one of the most popular, and will find many uses in your DX shack. Perhaps you're building a supply from scratch, or refitting an existing supply with new updated electronics, but whatever the case, there are some important decisions to be made, such as output voltage and current handling capability. Just as important are other things that deserve attention, like overvoltage protection and output level indication, just to name two.

The first and most important circuit here deals with overvoltage protection, sometimes called OVP for short. This circuit protects the output of the supply from soaring dangerously high in the event that something goes wrong with the regulator. Should the circuit fail, you could wind up with the regulator input voltage at the output, and in most cases this is about 25 volts or more! With that much voltage going into any rig, I don't have to tell you what would happen — KAABOOM!

The next circuit is what I call a smart LED. This gives you an output level indicator when a voltage meter is not used. Having a single LED across the output is common on some power supplies, but all it tells you is that the supply is on. What it doesn't tell you is how much or at what level, and if you don't have enough voltage at the output you won't transmit at full power. Knowing what's going on under the hood of your power supply is always a good idea. Whatever your reason for using the smart LED, it will give you an accurate level indication, with a red/green status from a single dual-color LED.

About the circuits

My original OVP circuit consisted of a zener diode, a couple of resistors, and an SCR. The idea was that if the output voltage would rise to 15.5 volts or more, the zener would gate on the SCR, crowbarring the output, and blowing the fuse. Now, this was simple and worked OK, but sometimes it would kill my output pass transistor when it crowbarred. Deciding that this was no fun, I came up with a more circuit-friendly design, illustrated by **Fig. 1.**

This circuit centers on an SN7404N hex inverter IC chip made of 6 inverters that, when put together, can form a latch-type circuit. The same circuit can be made with 3 or 4 transistors and at least a dozen or so resistors, but by using the IC chip, all these parts can be eliminated and a much simpler circuit can be built. Starting with **Fig. 1**, a sample of the output voltage is applied to point "A" at the cathode end of zener D1. When the voltage reaches 15.5 volts or more, D1 fires and places a high at

Continued on page 56

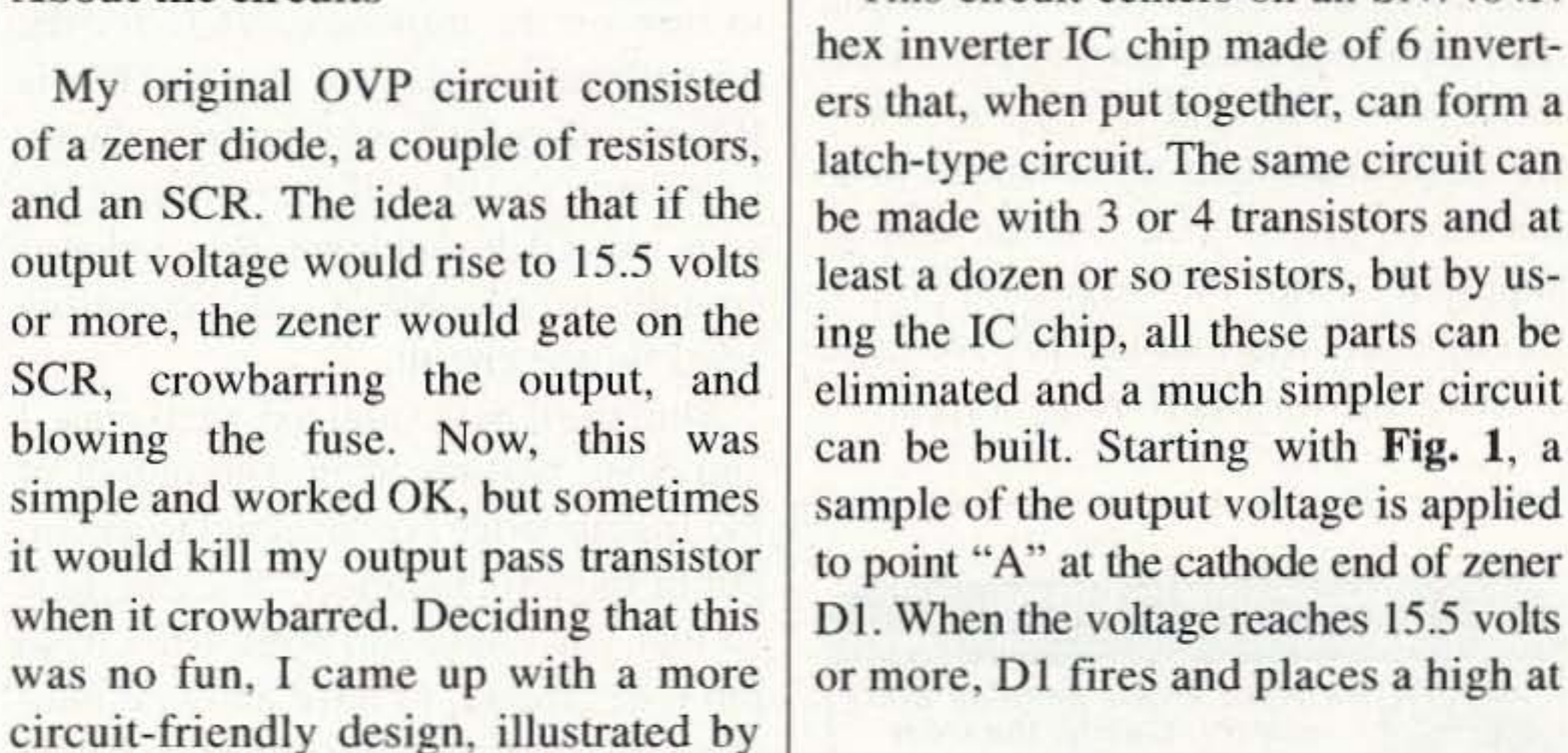

Fig. 1. *Schematic for the OVP circuit and pinout for IC1.*

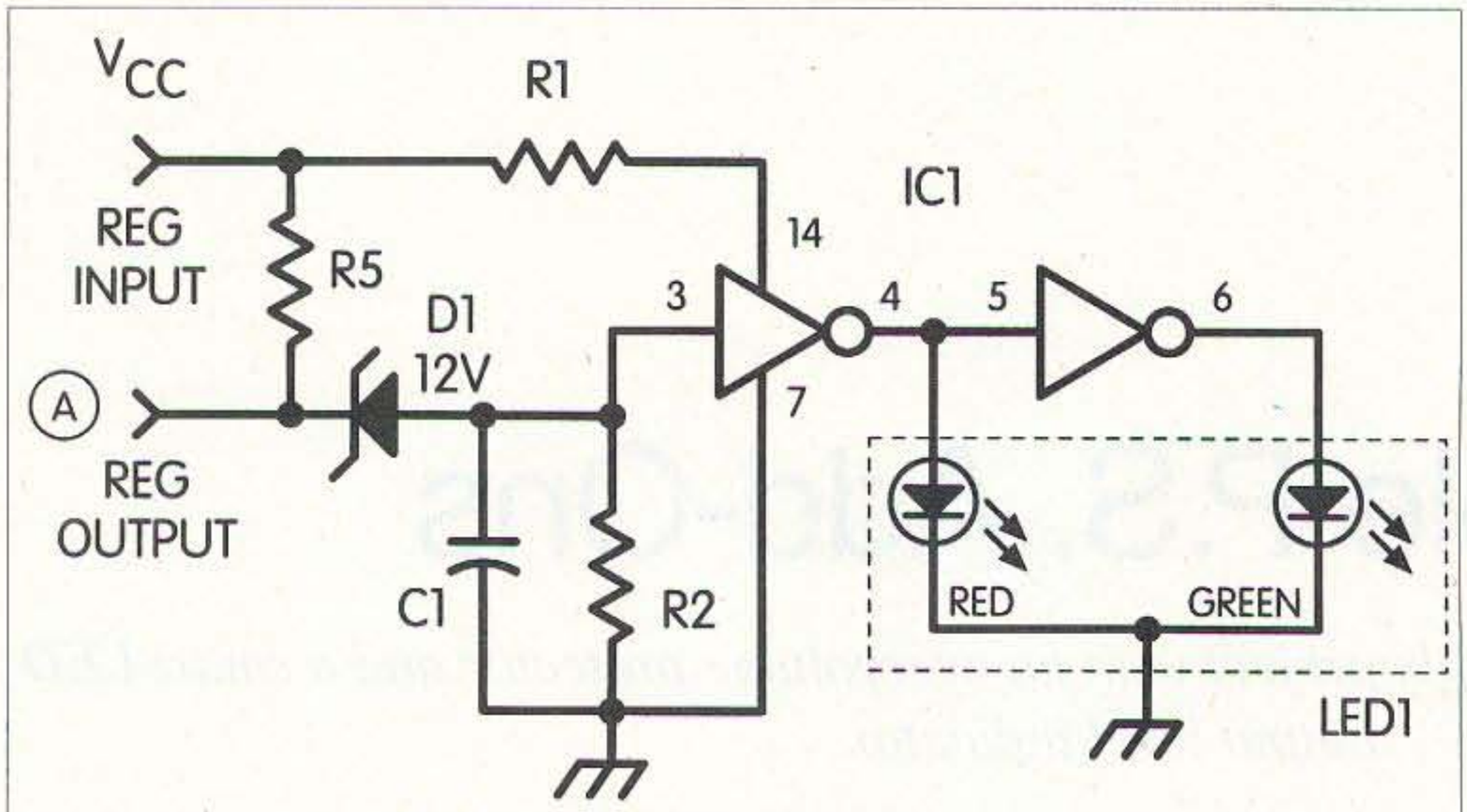

Fig. 2. Schematic for the smart LED circuit and pinout for IC1.

Part Name	Description	Value	RS Part No.
D1	Zener diode	12 V 1 W	276-563
D1	Zener diode	15 V 1 W	276-564
D2	Diode	WEP-170	276-1114
Q1	Transistor	2N2222 NPN	276-1617
IC1	IC	SN7404N	276-1802
R1	Resistor	680 ohm 2 W	--
R2, R3	Resistor	1k 1/2 W	271-1118
R4	Resistor	100 ohm 1/2 W	271-1108
R5	Resistor	1.5k 1/2 W	271-1120
C1	Capacitor	0.1 µF 50 V	272-135
LED1	LED red/green	Dual color	276-025
RY1	Relay	12 V 10 A	--
PCB1	PC board	Dual IC	276-159A
PCB2	PC board	Pre-etched	276-170

Table 1. Parts list.

Simple P.S. Add-Ons

continued from page 55

pin 3, which is the input of the first inverter.

At this point, pin 4, the output of the same inverter, goes low, and the base drive for Q1, via R3, is cut off, shutting down the relay and disconnecting the output. R2 is the current limiter for the zener diode, and C1 bypasses any RF hash that might try to sneak in at the input, pin 3. VCC for the chip is supplied from the regulator input through R1. Beyond the IC, we have a basic off-the-shelf relay circuit. I selected R3 for the base circuit because the output on pin 4 goes to 3.8 volts when all is normal and the supply is not in OVP shutdown.

I didn't want a lot of voltage at the base of Q1, but if you're curious, what we do have is 0.75 volts at the base when the zener fires, and this is perfect to turn on the transistor. VCC for the relay circuit is picked off at point "B" via R4, providing 10.8 volts to power the relay circuit, and even if the power supply goes into OVP shutdown, R4's value is enough to provide a safe operating level for the circuit.

You may have noticed that pins 4 and 5 are tied together. The output of the first inverter is connected to the input of the next inverter. This was done so that you could add a red LED from pin 6 to ground, to have an OVP indicator on the front panel of your power supply. The second inverter acts as a driver for the LED, and R1 drops enough voltage for the whole circuit so that no LED current limiter resistor is needed.

Fig. 2 illustrates the schematic for the smart LED — it too centers on an SN7404N chip. A sample of the output voltage is applied to point A at the junction of R5 and D1. When the voltage reaches 13 volts or more, D1 will fire, placing a high at pin 3 of the IC. Pins 4 and 5 will go low, turning off the red LED, and pin 6 will go high, turning on the green LED. Once again, R2 is the current limiter for D1, and C1 bypasses any RF hash at the input pin 3. Also, VCC for the IC is supplied via R1 from the regulator input.

Somewhat of a voltage divider is formed by R5 in that it allows D1, a 12 volt zener, to fire a little above its rating (approximately 13 volts). The value of R5 was chosen to allow the circuit to operate at the output voltage of communication power supplies, but you can change its value and the value of D1 to monitor a wide variety for voltages and applications.

Construction

Construction of these circuits is relatively simple. If you're installing them into an existing power supply, they can be constructed on their own PC board, and then wired in. Or if there is enough room on an existing board, the circuits can be installed that way, eliminating the need to etch your own board. However, a lot of power supplies are built from scratch, and for the benefit of those who like to "roll their own," I have listed two pre-etched boards in **Table 1**, the parts list.

The first board listed can hold two

Continued on page 59

On the Cover

The South Will Rise Again (in Your Back Yard)

Hy-Gain® has continued to develop the product line purchased from Telex in Nebraska in May of 1999. Randy Nash KC5NIS, Hy-Gain's antenna production specialist, says that now that the building has been expanded and its heavy-duty presses put in place, Hy-Gain of Mississippi can really get rolling.

Hy-Gain has already been producing the famous Hy-Gain antenna rotators, the entire VHF/UHF line, and many of the big beam antennas. "Now that the TH-7DX has been built, we will start on the TH-11DX, the Long Johns, and eventually the log periodic antennas," says Nash.

The new MFJ-269 covers 1.8 to 170 MHz plus 415-470 MHz! It can read SWR, complex RF impedance, resistance and reactance or magnitude and phase, coax cable loss (dB), coax cable length, distance to fault, return loss, reflection coefficient, inductance, capacitance, battery voltage, etc.

It has several new features above and beyond the usual popular MFJ ones. A built-in CoaxCalculator calculates coax line length in feet given coax length in electrical degrees, and vice versa, for any frequency and velocity factor (great for building matching sections and phasing lines). And a new 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters.

The MFJ-269 reads complex impedance as series-equivalent resistance and reactance (Rs + jXs) or as magnitude (Z) and phase (degrees). It also reads parallel equivalent resistance and reactance (Rp + jXp).

With this SWR analyzer you can also measure SWR and loss of coax with any characteristic impedance from 10 to over 600 ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 ohms, and more.

Be sure to look for more MFJ, Ameritron, Hy-Gain, Mirage, and Vectronics news, special features, and advertising in future issues of *73* Magazine. 73

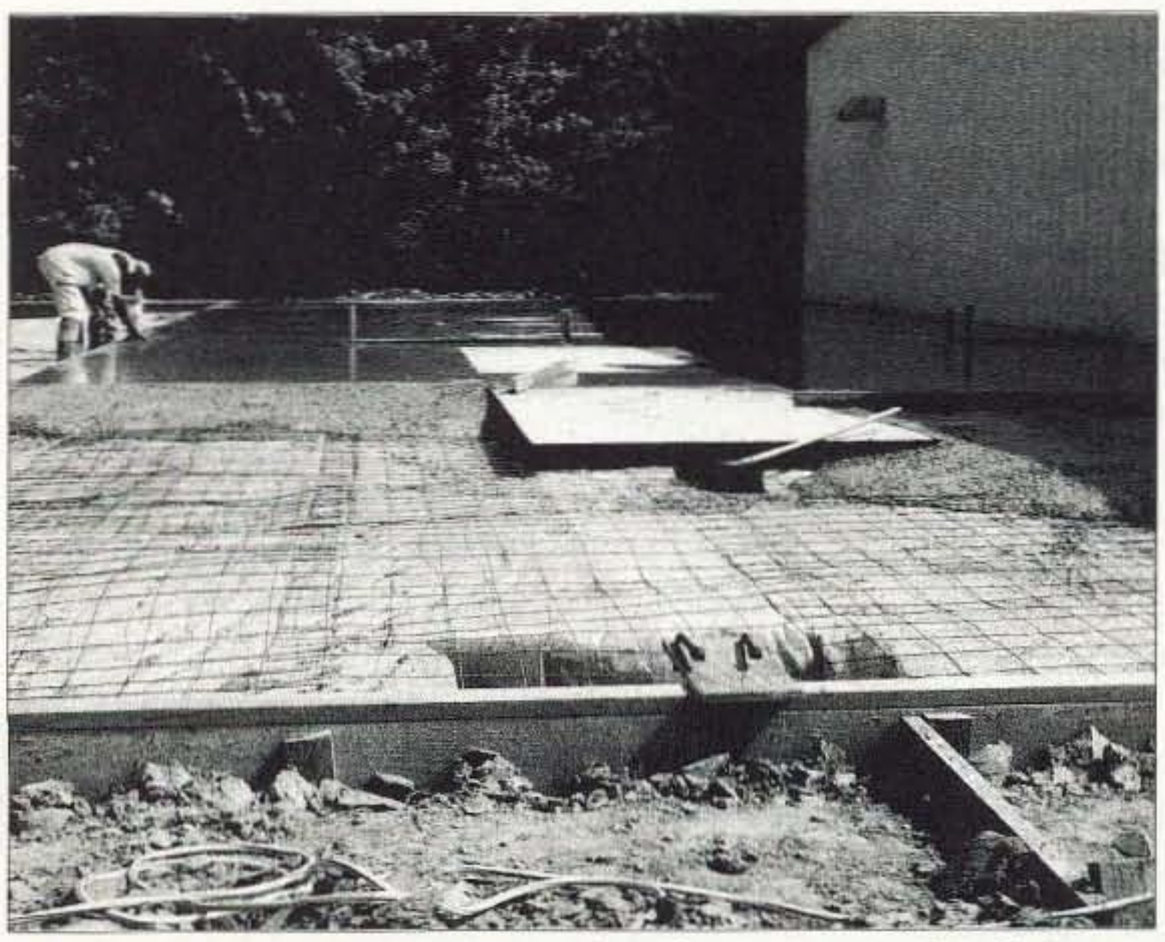

Photo A. *Hy-Gain's expansion takes shape — or is this their new Rebar Ground Plane Grid?*

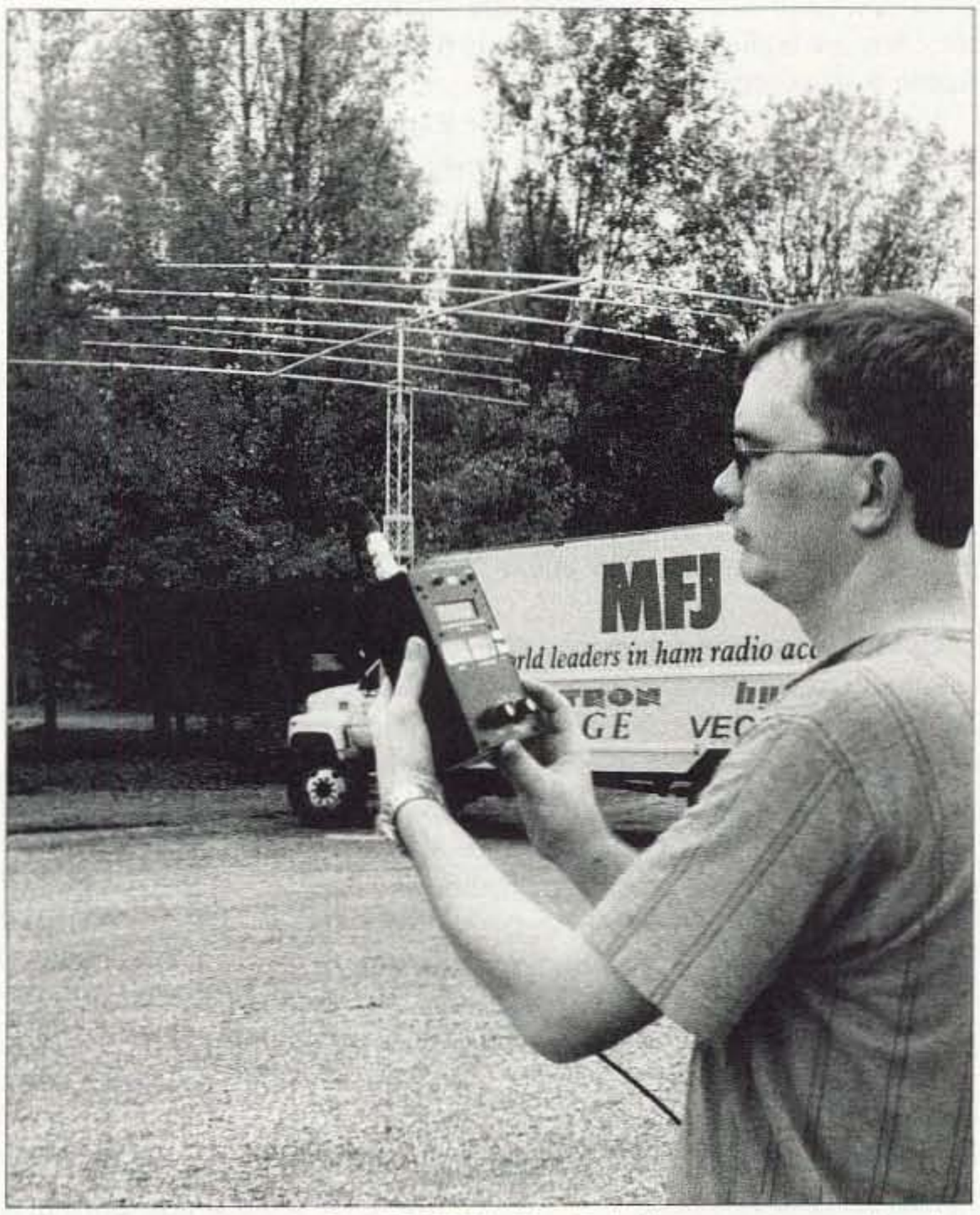

Photo B. *Randy Nash KC5NIS, Hy-Gain's antenna production specialist, tunes and tests a new Mississippi-made TH-7DX Hy-Gain antenna with an MFJ-269 SWR Analyzer.*

QRX

continued from page 6

When Motorola first announced that it would abandon the system, some hams suggested asking that the company simply give the entire constellation to ham radio for educational and experimental purposes. Unfortunately, the idea never gathered much momentum, and whether a formal offer was made is not known.

Thanks to VHF Reflector, *other news reports, via* Newsline, *Bill Pasternak WA6ITF, editor.*

The Antimatter Matter

Scientists at Europe's premier high-energy physics laboratory announced that they might be about to crack one of the great puzzles of physics: Where has all the antimatter gone?

That's right, we said antimatter — as in the fuel used aboard the mythical starship *Enterprise* to seek out new worlds and new civilizations, and to boldly go where no one has gone before. At least on TV and in the movies.

But real-life scientists studying the origins of the universe believe that the Big Bang that created the cosmos 15 billion years ago should have produced equal amounts of matter and antimatter. They are baffled as to why there is more of matter than antimatter.

Now, the European Laboratory for Particle Physics just outside Geneva says it may have the answer soon. It announced that it would be able to study antimatter in depth for the first time with the help of the world's first antimatter trap that became operational a few weeks ago.

The machine, which cost $11.5 million to build, is unique because it has the technology to slow down and trap antiprotons. These are the antimatter equivalent of the proton. It not only slows them down, but can actually hold them motionless, according to research spokesman Neil Calder.

Once they trap the antiprotons, the scientists will then throw in positrons, or the antimatter equivalent of electrons, in an effort to produce antihydrogen — the antimatter version of hydrogen, which is the simplest atom that exists.

Research scientists at the lab were able to create the first-ever atoms of antihydrogen — nine of them — in 1996, only to watch them disappear instantly after they came into contact with matter. And, unlike in the "Star Trek" story line, no gigantic explosion took place when the matter and antimatter joined. The anti-matter simply went away. *(Or something like that. — ed.)*

Thanks to Science Today, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

ARRL Collecting Restrictive CC&R Tales

Attention, all ye antenna-challenged and otherwise persecuted: The League has begun compiling a dossier of the often difficult experiences of hams with homeowner covenants, conditions, and restrictions. These are restrictions imposed by private homeowners' associations or by developers and are more often simply called CC&Rs.

The decision to investigate the effect of CC&Rs comes after the FCC turned down a request by the ARRL to reconsider the agency's denial of the League's request to extend the limited federal preemption known as PRB-1 to restrictive covenants. The League has said that it would like hams to be free to negotiate reasonable accommodation provisions with local homeowners' associations just as they do now with governmental land-use regulators. In declining last fall to act on the ARRL's initial request to expand PRB-1, the FCC drew the line at proposing specific rule changes to bring private restrictive covenants under the PRB-1 umbrella.

Since the FCC is standing by its decision to deny, the ARRL is inviting hams to send it accounts of how they have been denied the opportunity to install a tower or antenna on a home they own because of CC&Rs. The ARRL says that such narratives should relate directly to situations involving restrictive covenants and should be no longer than one page in length.

All submissions must include your name, callsign, the address at which you were denied the opportunity to put up an antenna, and the basis upon which you were denied. Also, include a copy of the contract language that would exclude your antenna or support structure and copies of any denial letters from a homeowners' association. Send this material to Antennas, c/o Steve Mansfield N1MZA at American Radio Relay League headquarters. Steve's address is 225 Main St, Newington CT 06111. E-mail submittals are welcome to smansfield@arrl.org with the subject line "antennas".

Thanks to David Black KB4KCH, via Newsline, *Bill Pasternak WA6ITF, editor.* 73

Letters

continued from page 8

I.M. Gottlieb W6HDM, Redwood City CA. An answer to a critic of my Aug. *73* article, "Cold Fusion and Hot Speculations":

I find myself impressed with Mr. Ken Stone's analytical skills and his obvious proficiency with physics and with thermodynamics. However, without deliberately being obstinate, I continue to feel the presence of a mystery in the athletic performances of horses and migratory birds.

I am not refuting Mr. Stone's logic of energy conversion, but it seems to me that it applies to mechanical horses, not to biological horses.

The overlooked difference between these horses is that one of them, the animal variety, can be expected to be limited by muscular fatigue. The mechanical critter, on the other hand, is not hampered by this process of physical exhaustion.

In similar vein, the continual beating of the wings by the migratory bird bucking headwinds across the ocean should induce debilitating fatigue. I find it mysterious that some or most of such a flock makes the arduous journey. Even if insects are gobbled up in midflight, there must be something about animal metabolism that is not quite the way the texts have outlined it. (It is as if there were frictionless bearings connecting the wings to the bird's body.) Even if fueled by stored fat, why doesn't the bird tire?

Not withstanding this rebuttal to a rebuttal, I pledge my sincere effort to try to deal impartially with all viewpoints pertaining to the matter. 73

73 Tests the Drake SW1 Receiver

continued from page 21

there's a pretty good chance the current (when I bought mine) price of less than $200 might drop even lower. So, don't just sit there — it's time to add a whole new dimension to your shack. Get with it, and start tuning around the shortwave broadcast frequencies. Remember, shortwave listening was the Internet before there was an Internet, a way for people to get to know people in strange, exotic, faraway places. 73

On the Go

continued from page 47

from a fixed location, but real hams do it while in motion. Then, of course, there's the interesting effect that overpasses, underpasses, passing trucks and general velocity have on both the transmitted and received signal. If there were ever the need for a new buzzword, it would be a special designation for mobile QSB.

The difference between an obstacle and a challenge is that a challenge has a reward that makes overcoming the obstacle worthwhile. Mobile operation provides a number of very tangible rewards. Getting the unit installed just right into the car is often a challenge, and once completed it is a beautiful sight to behold. Then, getting the antenna mounted so it's structurally sound AND resonant can be another distinct challenge. While all of these are achievable and the results can be satisfying to the technician or craftsman in each of us, I don't believe that is the whole answer.

Let's face it. The real satisfaction comes

from talking to a ham in Japan while on the road. It comes from having the DXpedition station return with "the mobile four only." It comes from talking to another stateside station that happens to be mobile over a thousand miles away. The real satisfaction comes from the fact that mobile HF operation is just plain fun. 73

Add-On Digital Voltmeter

continued from page 54

can be laid out using perforated PC board, as was our first version, with copper on one side to solder our components. Or, a PC board set can be purchased — etched, ready to mount the components to, with a component silk-screen showing the layout of the parts. The purchased set includes two boards. One is for the separate display, which is nice because you will want to place this part in a window, to view it from. A clear plastic window or colored plastic display filter can be used to give the display a finished look. Either way is nice and, depending on your desires, you may decide to place everything on one board. Refer to the parts list for information on how to obtain the purchased set.

An interconnecting wire harness, or ribbon cable, can be used to connect the display portion of your project to the main PC board. Depending on your application, the desired length can be determined.

After assembly of the "Add-On Digital Voltmeter" is completed, you should double check your soldering, component layouts, and common construction faults. Be sure to use caution, when inserting the ICs in their sockets, to observe the correct locations of the number 1 pins. Refer to the Calibration Instructions to complete your project.

After calibration and installation of your "Add-On Digital Voltmeter," you can easily check the voltage you are measuring. The places you will find to use the "Add-On Digital Voltmeter" are limitless around the shack or workbench. I'm sure that you will find a nice use for this project, and enjoy building it as I have. 73

Simple P.S. Add-Ons

continued from page 56

DIP ICs or be broken in two, allowing two separate circuits to be constructed if one is all you want to build into your supply. The second board listed is more for constructing an entire power supply plus one or both circuits described here. This board has an upper and lower bus line and the foil pattern is laid out just like an experimenter's board, making it a lot easier to go from prototype to finished piece quickly. It's positively a nice way to go.

Once you've made your circuit board, wiring it in can be made much easier by using plug/jack wire assemblies. Basically, you have a plug made up of two or more wires and a jack that can be soldered onto your PC board. When the wires from the plug are soldered onto the corresponding areas of the power supply, just plug in your board and you're ready to go. The best source for these plug/jack assemblies is old discarded TV sets. Most TV shops throw a lot of sets away, and you can find some that have a wide range of wire count and size. The best ones to get are the ones that have their pins IC-spaced, making it easier to mount on your PC board.

Some of you may be thinking about the relay in the OVP circuit, considering the fact that the contacts are always closed during operation, bearing the burden of full load. The one I chose has a 12 volt coil and contacts rated at 10 amps, so this should be more than enough to handle most applications. The resistor R1 is a 2 watt and should not be substituted for wattage or value. You can use a higher wattage, never lower; the value was selected for best operation and is a common one, so no changes are needed.

I mention these two parts because they are the only ones you won't find at the local parts emporium. Most of the parts listed in **Table 1** can be found at your Radio Shack store or in a well-stocked junk box. The parts you can't find easily may be found at a TV repair shop. Stop in and get to know the owners. You may find you'll now have access to one of the biggest junk boxes in the world.

Final thoughts

Building and installing these circuits can be a lot of fun, and they are very useful. I know some people don't like to work with ICs that much, but these circuits are simple and can be put together in no time. The smart LED

Continued on page 61

PROPAGATION

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Steady As She Goes

High sunspot numbers will continue to cause erratic conditions throughout November. My calculations indicate generally (F)air conditions for the month, with some (P)oor and (G)ood days sprinkled about.

I don't foresee any spectacularly good or bad days during the period. Patient operators using good equipment will, of course, obtain the best worldwide results.

The first several days of November will be rather poor if the magnetic storm I predicted for late October develops. Other periods ripe for disturbance are the 6th–8th, 11th–13th, 17th–19th, and 27th–29th. The 17th and 18th have the most potential for severe solar activity, with detrimental effects possibly lasting several days. Happily, a strong ionosphere should recover quickly from most upsets and no total blackouts are expected.

Daytime signal degradation/absorption will increase as winter approaches, with the worst conditions occurring at midpath local noon, but nighttime propagation should continue to improve as the month progresses. As always, auroral echo and fading will be problematic on paths across the higher latitudes, as will atmospheric noise on the upper bands for paths across the hurricane belt and thunderstorm-rich tropics.

Band-by-Band summary

Daytime signal degradation/absorption typically *increases* during the winter months in the northern hemisphere primarily because the atmosphere gets colder and denser, allowing for a higher amount of ionization. The atmosphere also becomes shallower, which lowers the altitude of the ionized layers (especially F1 and F2), generally causing daytime skip distances to be shortened.

10–12 meters

Look for morning paths to Europe and Africa, midday paths to

November 2000						
SUN	MON	TUE	WED	THU	FRI	SAT
			1 F-P	2 F	3 F	4 F
5 F-G	6 F-P	7 F-P	8 F	9 F-G	10 G	11 P
12 F-P	13 F	14 F-G	15 G	16 G	17 P	18 F-P
19 F-P	20 F-P	21 F	22 F	23 F-G	24 F-G	25 F-G
26 G	27 F	28 F	29 F	30 F-G		

Table 1. *November 2000 calendar.*

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
Central America	15 (40)	20 (40)	20 (40)	(40)	(40)	(20-40)	(15) 20	10-20	10 (20)	10-17	10 (20)	(10) 20
South America	(15) 20	20 (40)	20 (40)	20 (40)	x	x	(15-20)	x	(10)	10 (15)	10 (20)	(10) 20
Western Europe	40	40	40	40	(40)	x	(10-20)	10 (20)	(10) 20	(15-20)	(20)	(20-40)
Southern Africa	(20-40)	(40)	x	x	x	x	x	(10-12)	10 (17)	(12) 17	(15-20)	20
Eastern Europe	(40)	(40)	x	x	(20)	x	(10-20)	(10) 20	(20)	x	x	x
Middle East	(40)	(40)	x	x	x	x	(10)	(10-15)	15 (20)	20	(20)	(20)
India/ Pakistan	x	x	x	x	x	x	x	(15-20)	x	x	x	(20)
Far East/ Japan	(15) 20	20	(20)	(20)	x	x	(20)	x	x	x	x	(10-20)
Southeast Asia	(15-20)	x	x	x	x	x	x	(10-20)	(10-15)	x	x	x
Australia	(10-17)	(15-20)	x	x	(20)	(30-40)	(20-40)	(10) 20	(10-20)	x	(20)	(10-15)
Alaska	15-17	20-30	x	x	x	20-30	20-30	15-17	15-17	x	x	15-17
Hawaii	(10) 15	(20)	20	(20)	20 (40)	40	(20-40)	(20)	(15-20)	x	(10)	10 (15)
Western USA	(10) 40	(15) 40	20-40	(20) 40	40	40	40	(20-40)	(10-20)	10-20	10-20	10-20

CENTRAL UNITED STATES TO:

Central America	(15) 20	20 (40)	(20) 40	(20) 40	(20) 40	40	(40)	(10) 20	10-20	10-15	10 (20)	15-20
South America	(15) 20	20	20 (40)	20 (40)	(20)	x	x	x	(10)	10	10 (20)	(10) 20
Western Europe	(40)	40	40	(40)	x	x	(20)	(15) 20	(10) 15	(15) 20	(20)	x
Southern Africa	20	(20)	x	x	x	x	x	x	(10-15)	(10) 15	15 (20)	20
Eastern Europe	x	(40)	x	x	x	x	x	(10) 20	(10-20)	x	x	x
Middle East	x	(40)	(20)	(20)	x	x	x	(10-15)	(10-15)	(20)	20	(20)
India/ Pakistan	x	(15)	x	x	x	x	(20)	x	(15)	x	x	x
Far East/ Japan	x	x	(20)	20	(20-40)	(40)	(20)	20	(15-20)	x	15	(15)
Southeast Asia	x	x	x	x	(20)	(20)	20	(15-20)	(15)	x	(15)	x
Australia	(10) 15	15	(15-20)	20	20 (40)	20-40	20 (40)	(20)	x	x	x	(10-15)
Alaska	15-17	15-17	x	x	x	(40)	(40)	20	20	x	x	x(
Hawaii	(10) 15	(15-20)	20	20	(40)	(20-40)	20 (40)	x	(15)	(15)	(15)	(10) 15

WESTERN UNITED STATES TO:

Central America	(20-40)	40	40	40	(40)	x	(20)	(10) 20	10 (20)	10 (20)	(10) 20	(15) 20
South America	17 (40)	(20)	x	x	x	x	x	(15)	12 (20)	10-20	10-20	12 (40)
Western Europe	x	x	(40)	(20)	(20)	x	(20)	(10-20)	(10) 20	(20)	x	x
Southern Africa	(20)	x	x	x	x	x	x	x	(10)	(15)	15 (20)	(15) 20
Eastern Europe	x	x	x	x	x	x	x	x	x	x	x	x
Middle East	(20)	(40)	(20)	20	20	(20)	x	(15)	(10) 15	(10-15)	(20)	(20)
India/ Pakistan	(15-20)	x	x	x	x	x	x	(20)	x	x	x	x
Far East/ Japan	(10) 20	(15-20)	x	x	(40)	40	(40)	x	x	x	(10-20)	10-20
Southeast Asia	(15)	(20)	x	x	x	x	x	(20)	(15) 20	(20)	(10-15)	10-15
Australia	(10-15)	(15-20)	x	x	x	(20-40)	(20-40)	20	(15-20)	15	(10-15)	10
Alaska	10-15	x	x	20-30	20-30	20-30	20-40	x	20	15	x	15-17
Hawaii	(15) 20	(15) 20	20	(20)	(40)	40	(20-40)	(15) 20	15 (20)	(10-15)	10 (15)	(10) 15
Eastern USA	(10) 40	(15) 40	20-40	(20) 40	40	40	(20-40)	(10-20)	10-20	10-20	10-20	10-20

Table 2. *November 2000 band, time, country chart.* ***NOTES: 1.*** *Plain numerals indicate bands that should be workable on Fair to Good (F-G) and Good (G) days.* ***2.*** *Numbers in parentheses indicate bands usually workable on Good (G) days only.* ***3.*** *Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.* ***4.*** *Be sure to check adjacent bands and times (±2 hours) for additional openings.*

Central and South America, and afternoon paths to Japan, Australia, Asia, and the Pacific. Openings move west as the day progresses. A short-skip of 1,000 to 2,000 miles will be typical.

15–17 meters

Expect openings to many areas of the world, with good opportunities to Africa, South America, and the Pacific. Conditions often peak during local afternoon. Short-skip distances will be beyond 750 miles in the daytime and early evening.

20 meters

Good DX to most areas of the world opens from just after sunrise until mid-evening. Peaks are an hour or so after sunrise, again in the late afternoon, and before midnight. Expect a 500- to 1,000-mile short-skip during the day and 1,000 to 2,000 miles at night.

34/40 meters

Good worldwide openings can exist on (G)ood days. Daytime short-skip is limited to less than 1,000 miles, but nighttime skip will be in the 500- to 2,000-mile range. Noise levels can be quite high due to thunderstorms or hurricane activity.

80/160 meters

DX to Europe and the southern hemisphere can be observed after dark through local sunrise on (G)ood days, but will be limited by noise. As always, good activity on 40 meters indicates that the higher bands may be open, too. The gray-line path can be worked 30 minutes before until 30 minutes after local sunset. Daytime short-skip range is up to 500 miles. 500 to 2,000 miles can be expected at night.

Happy Thanksgiving! 73

Simple P.S. Add-Ons

continued from page 59

circuit is an old design of mine that I have used for several applications over the past 10 years, and the circuit has performed flawlessly. The OVP circuit is a more recent design, but it too has worked perfectly and will be installed in every power supply I build.

I can't stress enough the importance of installing an OVP circuit in any power supply you build. Also, if you buy one, check to see that it has an OVP circuit. If not, install one, and you'll be glad you did. 73

NEVER SAY DIE

continued from page 4

briefly introduced me and asked why I thought NASA faked the Moon landings, which he said he was totally convinced had really happened. This topic wasn't on the outline. Stan had read the list of the books I've written, which included *Moondoggle*, a book which explains how I became convinced that NASA had faked *all* of the Apollo Moon landings.

Stan's game was clear. He thought he'd be able to discredit me as a conspiracy nut to get even with me for complaining about him. So I explained some of the reasons that the Moon landings could never have happened. Then we went to commercials. At the end of the commercials they had a caller who insisted on being heard, saying that he wanted to rebut me. Stan was, of course, delighted to put him on.

It was a caller from Louisiana who said he had worked on the LEM for General Dynamics and that not one person at General Dynamics believed for a minute that we'd ever really been to the Moon. They knew that the LEM was a fake, and that their engineers had never been able to get it to fly.

Stan was dumbstruck. By then the hour was over. So much for my hosting the show. Phooey.

These two turkeys seem to think they are Click and Clack, the Tappet Brothers. They're not.

Numbers

The recent move by the FCC to force us to give them our social security numbers, which, as far as I know (which is fairly far), has no legal basis, is another move to replace our individual names with numbers.

If you stop to think about it, which few people have, our whole school system, which kids are forced by law to endure, is aimed at robbing us of our individuality and forcing us to be as much alike as possible. There is no room for individuality. We all have to take the same courses at the same time, and those who ask too many questions are humiliated and embarrassed into shutting up. The whole class moves along at the speed of the slowest children, no matter how boring this is for the brighter kids. I used to bring tiny colored beads in and make bead rings and bracelets during classes. Or sketch rocket ships.

Everyone is taught to the tests, not to increase their understanding of the world and their possible roles in it.

The textbooks are dreadful, further ensuring that the children will be bored stiff. Homework consists almost entirely of short-term memorizing irrelevant stuff for a coming test.

The whole system has been intentionally designed to produce workers who will do what they are told and not ask questions. Our larger business organizations, the military, and government all reward those who make no waves and blackball those who are creative.

Be born, go to day care, and watch Sesame Street, go to public school and learn, sort of, to read. Then pass tests of your short-term memory for a few years. This goes on through college and advanced degrees. Then you get a job, do as little as you can and stay employed, ask no questions, volunteer no ideas, and get your yearly wage increases, mainly through seniority.

This system used to result in your getting a gold watch and a modest retirement pension, which almost was enough to pay your nursing home and funeral costs. Now companies have wised up and lay you off before the pension costs escalate for them. And that leaves you making do with a Social Security check. Good luck.

My friends, we are the golden goose. We are paying Congress and the government to make sure this system stays intact. It's a gravy train for Congress — maybe you've noticed that politicians will spend millions to get or keep their Congressional seats. And hundreds of

millions to be in the White House. That's *your* money they're spending, goosey.

What can you do? You can help break the gravy train tracks by encouraging Sudbury Valley type schools to be opened in your area and sending your kids to a school where they will be treated as individuals — where there are no tests, no homework, no grades, and not even any fixed curriculum. And yes, their system works — beautifully. Read any of the eight books about this school. Some are reviewed in my *Secret Guide to Wisdom.*

My *Secret Guide to Wealth* will help wise you up so you can kick the "job" habit and get started with your own company. That's where freedom lies.

Meanwhile, we are kept entertained by ball games, a hundred TV channels, and RVs — just as the Romans were entertained by the games while their civilization was crumbling through corruption.

When the FCC demands your Social Security number, tell 'em I said they have no legal right to it.

42 Countries!

Is it really necessary for us to keep troops in 42 countries? At a cost of billions? Talk about featherbedding! Who are our troops in Japan, Germany, France, and so on protecting?

Considering the incredibly wasteful way the military spends their budgets, how wise are the calls by Bore and Gush to increase military spending? How big an army do we need to be able to deal with any conceivable coming military needs? Where's the threat?

It didn't take a million men to deal with Saddam. Perhaps, if we had more intelligent military leaders and fewer politicians butting in (yes, I mean you, Bubba), we could stop filling warehouses with unused, outmoded military supplies.

Let's see, since the collapse of the Rusty Curtain, we've sent troops to Somalia, Haiti, Panama, Grenada, and Kosovo. And we bombed an innocent Sudan pharmaceutical factory, plus a Chinese embassy. Oops! So solly.

Yes, there are some rogue countries we need to be wary of, but not from their attacking us directly. The threats today are from smuggled nukes or biological terrorism attacks — and those have to do with the FBI, CIA, NSA, DIA, and so on through the many covert agencies, few of which seem to be able to cooperate with each other, or with the military.

Butts and Guts

If you've walked around a shopping mall or watched shoppers in supermarkets, you've seen the same sights I have: women with great big fat butts and men with great big fat guts. It is, of course, insulting to point out to them what grotesque shapes they've eaten their bodies into. Or that fat is ugly.

I'd like to tell these poor unfortunate people how easy it is to lose weight. A change to raw food will do it. They have to stop eating refined sugar and drinking diet drinks. The bioelectrifier helps, too. I've gotten excited calls almost daily from people using it who tell me about how much weight they've lost. That little gadget is working miracles for hundreds of people who've built or bought 'em.

Fat shortens your life, and it helps make you sick.

If you've lost the back issues of *73* with the bioelectrifier construction articles, you can order my *Bioelectrifier Handbook* from Radio Bookshop.

Stupidity

Yes, I understand how addictive cigarettes are. Almost every older person who still smokes wishes to hell they could stop. But how can we get the message to the Joe Camel– or Marlboro hemen–influenced kids who think smoking is cool?

When I see kids smoking, I don't think they're cool — I know they've got to be really big-time stupid. How dumb to take on an expensive lifetime addiction that is guaranteed to shorten their lives.

I thought about this as I read a recent UC-Berkeley Wellness Letter which said that 90% of all lung cancer cases are caused by cigarette smoking — and that there is no way to detect lung cancer early enough to cure it. The five-year survival rate at diagnosis is less than 13%. Further, chest x-rays have been proven not to save lives.

And that doesn't count the lives lost to emphysema, heart attacks, pneumonia, and the ills a nicotine-depressed immune system helps exacerbate — like cancer.

We made a great big fuss over 58,000 Americans getting killed in Vietnam over the several years of that war, but we ignore the 400,000 smoking-related deaths every year.

How can you help? By making a nuisance of yourself and telling every teenager you see smoking that it isn't cool — it's just clear proof of incredible stupidity.

The Fourth

When I was a kid, my dad and I would go down to the local grocery and buy fireworks. I had a great time setting off cherry bombs, firecrackers, and 4-inch salutes. At night, we'd shoot off a few small rockets. Later, there were memorable fireworks displays at the 1940 World's Fair, and in the '50s every Wednesday night at Coney Island — where I'd take some friends out on my Chris Craft cruiser and we'd anchor near the fireworks barge so we could see 'em up close.

But, the most remarkable displays I've ever seen were those put on at the Jaffrey NH airport by Jaffrey's Atlas Fireworks Company to show their new products to potential big buyers. They are the most awe inspiring displays I've ever seen.

But, you know, there are only three Fourth of Julys that really stand out in my memory. The first was in 1944, when my submarine pulled into the harbor at Fais Island and we destroyed a Japanese phosphate plant with our 5-inch deck gun. We blew it to smithereens. I was in the conning tower, watching the shells on my radar screen, and telling the gun crew exactly how many yards they were off the target, long or short, right or left.

The next memorable Fourth was in 1976, when Sherry and I were visiting Madrid's zoo, where Sherry got bitten by a baby tiger. I missed the photo op, so I had her do it again on camera.

Then there was the 2000 Fourth, where I did my first sky dive. They take you up to 14,000 feet, where you roll out of the plane. You free fall for a minute, which seems more like five seconds, and then parachute the rest of the way down to a gentle landing. Hey, that's addictive!

Self-CPR

According to Dr. Day, the first warning 60% of heart attack victims have of any problem is death. My cousin, who was quite a bit younger than me, keeled over last year at the dining room table. His wife had refused to take a CPR course, so she had no clue as to what to do to save him.

If you are alone, or have a spouse who is revulsed by the idea of giving someone mouth-to-mouth respiration, here's what you can do to keep from becoming an instant statistic. Of course, a better bet would have been for you to have read my *Secret Guide to Health* and followed my instructions, in which case you wouldn't be in that fix. But, you saved the $5, probably figuring, What the hell does Wayne know?

Okay, here's the pitch. When you begin to feel faint, you'll have about ten seconds left before you lose consciousness — and probably five more seconds before an IRS agent is dispatched to assess your estate taxes. You can stave off the tax man by coughing vigorously and repeatedly, taking a really deep breath before each long cough. Cough from deep in your chest. Repeat this every

Continued on page 64

Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

.....Wayne

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under $20 from the instructions in the book. $10 (#01)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. $5 (#02)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some difficult lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products. $5 (#04)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story?If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaut's biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

One Hour CW: Using this sneaky booklet even *you* can learn the Morse Code in one hour and pass that dumb 5wpm HF entry test. $5 (#40)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 or 20 wpm. $5 (#41)

Code Tape (T13): Once you know the code for the letters (#41) you can go immediately to copying 13 wpm (using my system). This should only take a couple of days. $5 (#42)

Code Tape (T20): Or, you can start right out at 20 wpm and master it in a weekend. $5 (#43)

Wayne Un-Dayton Talk: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. $5 (#50)

Wayne Tampa Talk: This is the talk I gave at the Tampa Global Sciences conference—where I cover amateur radio, cold fusion, health, books you should read, and so on. $5 (#51)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system,. our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: In the works.

Silver Wire: With two 3-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars' worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink, Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower-cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $25 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $25 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

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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, rather 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: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the February 2001 classified ad section is December 10, 2000.

President Clinton probably doesn't have a copy of *Tormet's Electronics Bench Reference* but you should. Check it out at **[www.ohio.net/~rtormet/index.htm]**—over 100 pages of circuits, tables, RF design information, sources, etc. BNB530

TELEGRAPH COLLECTOR'S PRICE GUIDE: 250 pictures/prices. $12 postpaid. **ARTIFAX BOOKS**, Box 88, Maynard MA 01754. Telegraph Museum: [http://wltp.com]. BNB113

Great New Reference Manual with over 100 pgs of P/S, transistor, radio, op-amp, antenna designs, coil winding tables, etc. See details at [www.ohio. net/~rtormet/index.htm] or send check or M.O. for $19.95 + $2.00 P&H to RMT Engineering, 6863 Buffham Rd., Seville OH 44273. BNB202

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NEVER SAY DIE

conintued from page 62

two seconds until help arrives in the form of someone with CPR experience, or your heart resumes normal beating.

The deep breathing will bring oxygen into your lungs and the coughing squeezes the heart, keeping the blood circulating, and encouraging the heart to regain its normal rhythm. This should give you enough time to get to a phone to call for help.

Maybe after you survive that notice from your body that you've been mistreating it, you'll finally read my book. Heart attacks are totally caused by what you've been doing to your body. If you continue to punish it, your number is going to come up.

Surprise! 73

"Brick-Wall" Selectivity

Today's elite-class operators demand the best RF weaponry available. Yaesu's exciting new MARK-V FT-1000MP answers the call, with an expanded array of receiver filtering, 200 Watts of power output, and Class-A SSB operation capability for the cleanest signal on the band. Enhanced front-panel ergonomics save you seconds in a pile-up or a contest "run," and Yaesu's HF design and manufacturing know-how ensures that no short-cuts have been taken in our effort to bring you the best HF transceiver money can buy. For more QSOs in your log, and more awards on your wall, there is only one choice: the MARK-V FT-1000MP from Yaesu!

I. IDBT: Interlocked Digital Bandwidth Tracking System

The IDBT feature greatly simplifies operation by matching the bandwidth of the DSP (Digital Signal Processing) system to the net bandwidth of the 8.2 MHz and 455 kHz IF stages. The IDBT system accounts for the settings of the IF WIDTH and SHIFT controls, and automatically sets a DSP bandwidth which matches the analog IF bandwidth.

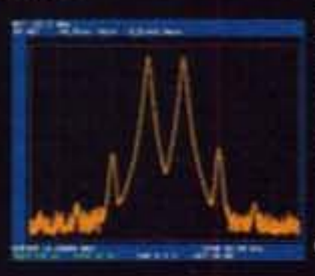
IDBT: A Breakthrough in Selectivity!

II. VRF: Variable RF Front-End Filter

Protecting the MARK-V's receiver components from strong out-of-band signals, the VRF system acts as a high-Q "Preselector," located between the antenna and the main bandpass filter networks, providing additional RF selectivity on the 160-20 meter Amateur bands for multi-operator contest teams, DX-peditions, or for operation near MW/SW broadcast stations.

III. 200 Watts of Transmitter Power Output

Utilizing two Philips® BLF147 Power MOSFETs in a 30-Volt, push-pull configuration, the MARK-V's transmitter puts out up to 200 Watts of clean output power, thanks to the conservative design of the PA section.



Class A 75 W PEP IMD

IV. Class-A SSB Operation

Exclusively available on the MARK-V FT-1000MP , a press of a front-panel button engages Class-A SSB operation of the transmitter, at a power output level of 75 Watts. Class-A operation produces incredibly clean signal quality, with 3rd- order IMD suppressed 50 dB or more, and 5th- and higher-order products typically down 80 dB or more!

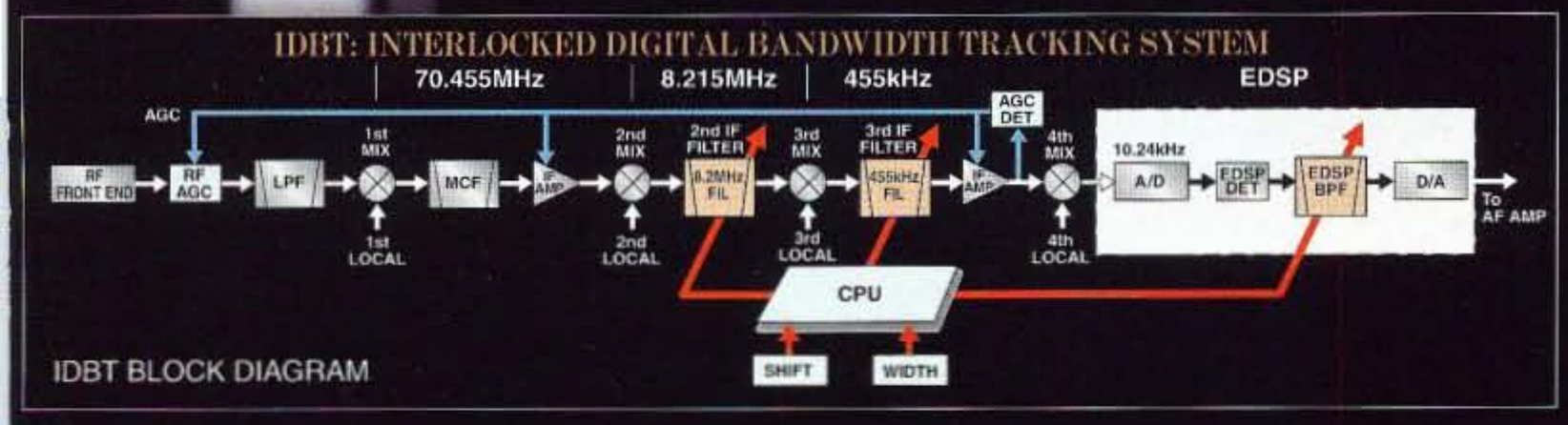
V. Multi-Function Shuttle Jog Tuning/ Control Ring

The immensely-popular Shuttle Jog tuning ring, which is concentric with the Main Tuning Knob, has a new look in the MARK-V: it now includes the activation switches for the VRF (left side) and IDBT (right side) features, so you don't have to move your hand position to activate these important circuits during contest or pile-up situations!

Photo shows optional MD-100A8X Deluxe Desk Microphone

HF 200 W All-Mode Transceiver

MARK-V FT-1000MP



IDBT BLOCK DIAGRAM

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...The All New Kenwood All Band/All Mode Transceiver Coming Soon!

Never before has an Amateur radio product provided such high performance and versatility. The new Kenwood transceiver is in a class by itself and will no doubt become the most desired All band/All mode Amateur transceiver ever produced. With Amsat's Phase 3D soon on the horizon, Amateurs everywhere will be looking to the sky to experiment with this exciting breakthrough in our hobby. Kenwood's new transceiver offers full functions on all HF bands as well as 6 meters. This is just the right equipment you'll need for making quick contacts. You'll discover it's dependable performance combined with easy operation will provide Ham operators a level of enjoyment impossible until now. VHF/UHF 144/440/1200 MHz operation is also available on the main band. Additionally, the sub-band offers 144/440 MHz operations for satellite TX/RX.

The All band/All mode transceiver also offers the following features that you could be missing on your current All-band/All mode transceiver: True IF-Stage DPS with 100% digital filtering; built-in auto antenna tuner; the world's first HF backlit front key panel; 5 antenna ports; transverter ready; 9-pin db connector for easy PC interface; built-in TNC; DX packet cluster monitoring with direct go-to function for HF and 6 meter openings; CW auto-tune...to name just a few.

Not only does the new Kenwood transceiver provide the most features and performance of any All band/All mode transceiver but it delivers exciting versatility by offering a traditional station radio or mobile head/no controls (black box) unit. It also can be operated by the ARCP computer control program to take control of most functions direct from your PC.

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Y2ARD-2029 #091900

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INTERNET
Kenwood Website
http://www.kenwood.net
Kenwood Information
ftp//ftp.kenwood.net