MARCH 2000
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THE NEW!

73® Amateur Radio Today

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Demystifying Transmission Lines

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Today's NiCd Care

On the cover:
See page 29

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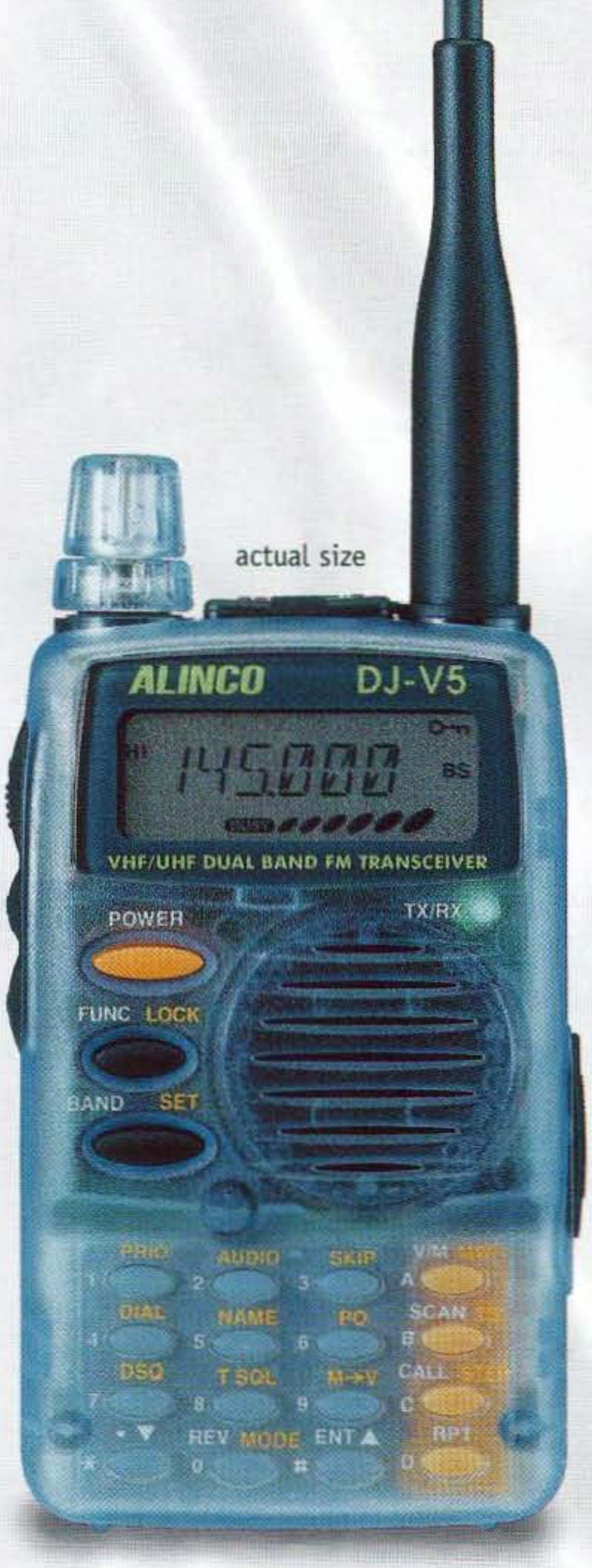

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THE NEW!

73 Amateur Radio Today

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DEPARTMENTS

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QRX . . .

Will the Digital Revolution Crush Amateur Radio?

Did the horseless carriage replace the horse and buggy? The pocket calculator made the slide rule obsolete. What did the audio tape cartridge do to the vinyl record pressing industry?

Will the audio compact disc (CD) ring the death knell for the audio cassette? Will the digital video disc (DVD) cause the demise of the video compact disc? The VHS video tape standard eliminated the use of the Beta format. Electronic desktop computers silenced the Frieden mechanical calculator with its obnoxious traveling carriage. Manual mechanical typewriters are dust collectors in closets. How many industries did the advent of the desktop computer of today decimate? How many industries did it annihilate? But not to overlook, how many new industries has it created?

Now read this: The mega-speed home computers, in conjunction with the new broadband technology of the Internet, World Wide Web (WWW), and all of the various associated forms of information exchange, will diminish amateur radio even more.

Has amateur radio already taken a hit below the water line, and is the world's greatest hobby quietly and subtly sinking silently out of sight? Are the *Hindenburg* and the *Titanic* still operational?

If one chooses to declare that commercial broadcast TV viewing has reduced amateur radio activity, how much will E-mail usage further reduce amateur radio operating and exchanges?

Doesn't E-mail have more privacy than a QSO?

Continued on page 6

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SS-12	10	12	1⅜ x 6 x 9	3.4
SS-18	15	18	1⅝ x 6 x 9	3.6
SS-25	20	25	2⅞ x 7 x 9⅝	4.2
SS-30	25	30	3¾ 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 9⅝	4.2
SS-30M*	25	30	3¾ x 7 x 9⅝	5.0

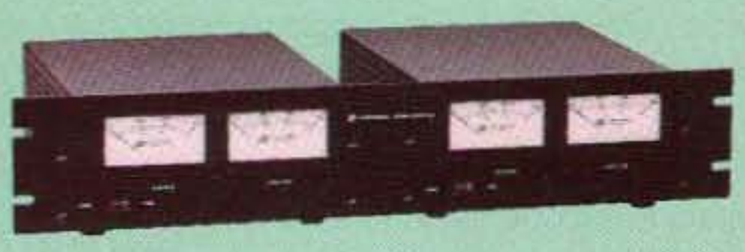
MODEL SRM-30

RACKMOUNT SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25	20	25	3½ x 19 x 9⅝	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 9⅝	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 9⅝	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 9⅝	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!!

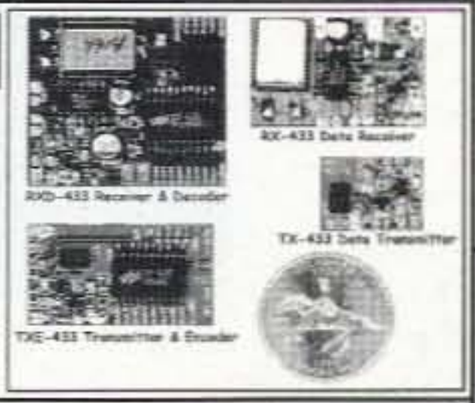
DDF-1, Doppler Direction Finder Kit $149.95

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

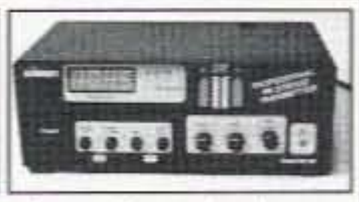
Wireless RF Data Link Modules



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 (80º) 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

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

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

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

Order Toll-free: 800-446-2295

Sorry, no tech info, or order status at 800 number

For Technical Info, Order Status
Call Factory direct: 716-924-4560

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ORDERING INFO: Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add $6.95 for shipping, handling and insurance. Orders under $20, add $3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

NEVER SAY DIE

Wayne Green W2NSD/1
w2nsd@aol.com

Okay, 2000 is really here, and Y2K wasn't even a bump in the road. It's a new year, a new century, and a new millennium, and the FCC gave us a huge present on December 30th, when they tore down the wall between license classes. Oh, I would have preferred for the Commission to have cut us down to one class, but eliminating the Novice, Tech-Plus, and Advanced was a most welcome step.

Now, all that stands between a Technician and an Extra is the memorization of some Q&As, so we have the opportunity to start rebuilding our hobby. We can make the year 2000 the start of a whole new era in amateur radio.

I'd love to see tens of thousands of Techs Generalizing themselves and taking advantage of the sunspot maximum, enjoying the excitement of working around the world on ten meters, and even six meters! Being able to make worldwide DX contacts all night on 20m, and sending out teams to activate every recognized rare country.

We have the opportunity to build our ham clubs as centers to promote emergency communications systems; to organize DXpedition teams; to promote special interests such as packet, slow scan, satellites, RTTY, Amtor, spread spectrum, foxhunting; to provide technical education; to actively promote our hobby in local schools; and to work cooperatively to help clean up our bands.

I'd like to see our ham club presidents take the initiative to rebuild the hobby, rather than shrugging off the responsibility to the ARRL. We don't need the FCC to help us clean up our bands. We don't need to cringe at competition from the Internet for the minds of kids. We have a hobby that can provide excitement and adventure. It sure has for me! All we have to do is start promoting it.

Let's promote the hobby on radio and TV shows. Let's use the Internet in every way we can think of to get kids interested. Art Bell and I talked ham radio to his millions of listeners on January 5th for most of three hours. The result was bushels of mail asking me how to get a ham license. There are thousands of radio talk shows, all around the country, so make it your business to get the shows in your area in touch with me so I can spread the word.

I'd love to see hams who are comfortable with public speaking going into schools and getting the kids excited over the hobby. We should start hitting 'em at least by the 8th grade. Take along a camcorder and show the club members at the next meeting how excited the kids get when they find out about amateur radio. Then edit the tape and make it available for other clubs to show so they can get their members to give talks at schools and tape 'em. I'd love to have a list of such tapes published in *73*. I've got excellent video tape duplicating facilities, so I could even help distribute tapes.

And while you've got your camcorder in action, how about doing a program on how to set up a ham satellite station? Or how to get involved with packet? How about some videos on the fiendish ways your club foxhunts have been set up. A video of your club Field Day effort? Or a mountaintop VHF DXpedition?

With the new iMacDV Special Edition computer and a digital video camcorder, you have a whole video production system. I got one for Christmas and I'm having a ball with it. I'm aiming at making some videos of me going into more detail on the history of the hobby, and elaborating on how you and your club can make the year 2000 the biggest and best in our history.

Let's get busy with club Web sites that will attract youngsters. Put programs on there that explain how much fun using your repeater can be. Let's have Internet/repeater interfaces. Let's have more repeater crossbanding. Let's make our ham club meetings so much fun that every ham within driving distance will come. Let's find exciting speakers. Get after any ham manufacturers or dealers in your area to come and talk. Video the talk and share it.

How about cleaning up our bands? We don't have to put that expense on the FCC — it's something we should be doing ourselves. The more trouble we are for the FCC, and the more expense we cause them, the sooner they'll get fed up with us, and that's something we sure don't need.

Amateur radio is a great hobby, but that isn't enough of an excuse for the government to spend money to support it. And yes, in times of emergency we're mighty handy to have around. But our real value to our country, to business and our government, is in our ability to attract youngsters to high-tech careers. As I've mentioned (endlessly), an ARRL survey just before they killed the American ham industry and most of our ham clubs — and almost killed the hobby 35 years ago with their incredibly stupid, greed-inspired, so-called Incentive Licensing petition to the FCC — showed that 80% of all newcomers were teens and 80% of those went on, as a result, to high-tech careers. This was one big reason why the 1970s and '80s were the heyday of the American electronics industry.

Here we are in the 21st century, in a world where high-tech products and services are what make or break countries. Our high-tech industries are having to either import foreign-trained workers or move R&D and production to countries with better-educated work forces. Our colleges are graduating more foreign engineers than Americans.

So let's get busy and do the promotion of amateur radio that the League should have been doing. Let's visit our schools and get the kids fired up about the excitement and adventure our hobby makes possible.

If you haven't been getting adventure from amateur radio, it's not for any lack of opportunities. You just have

Continued on page 8

Big Savings on Radio Scanners

COMMUNICATIONS ELECTRONICS INC.

Order on-line and get big savings

Take advantage of *73 Amateur Radio* special savings by entering your order directly on the internet at the Communications Electronics web site. Visit CEI at http://www.usascan.com, click on "CEI News" and get big E-Value savings. Resellers, get special pricing when you fax your sales tax license to CEI at +1-734-663-8888.

DISTRIBUTOR'S COUPON | Expires 03/31/2000 | #9912M7

SAVE $30 on one **Relm MPV32**

Save $30 when you purchase your RELM MPV32 transceiver directly from Communications Electronics Inc. For fast delivery, enter your order through our web site http://www.usascan.com or call Communications Electronics at 1-800-USA-SCAN. TERMS: Good only in USA & Canada. Only one coupon is redeemable per purchase. Void where prohibited.

RELM® MPV32-A Transceiver

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

Looking for a great hand-held two-way transceiver? Amateur radio operators depend on the RELM MPV32 transceiver for direct two-way communications with their ham radio repeater, fire, police department or civil defense agency. The MPV32 is our most popular programmable frequency agile five watt, 32 channel hand-held transceiver that has built-in CTCSS. This feature may be programmed for any 39 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 synthe-sized 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.

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*** – Lets you record channel activity from the scanner onto a tape recorder. ***CTCSS Tone Board*** (Continuous Tone Control Squelch System) 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 for temporary operation from your vehicle's cigarette lighter $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 & 10 feet of cable with plug attached $19.95. The BC895XLT comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO, EDACS, ESAS or LTR systems.

TrunkTracking Radio

DISTRIBUTOR'S COUPON | Expires 03/31/2000 | #991127

SAVE $70 on one **BC245XLT**

Save $70 when you purchase your Bearcat 245XLT scanner directly from Communications Electronics Inc. For fast delivery, enter your order through our web site http://www.usascan.com or call Communications Electronics at 1-800-USA-SCAN. TERMS: Good only in USA & Canada. Only one coupon is redeemable per purchase. Void where prohibited.

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. Order on-line at http://www.usascan.com for quick delivery.

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

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RELM RH256NB-A 25 watt VHF mobile transceiver	$284.95
RELM SMV4099W-A 40 watt VHF mobile transceiver	$349.95
RELM RMV60B-A 60 watt VHF mobile transceiver	$699.95
Uniden GRANTXL-A SSB CB Mobile	$124.95
Sangean ATS909-A shortwave receiver	$229.95
Sangean ATS818CS-A shortwave receiver	$199.95

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Monitor fire, police, weather, marine, medical, aircraft and other transmissions with your radio scanner from CEI.

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AOR5000+3-A desktop receiver with synch AM/AFC/NB	$2,399.95
AOR AR16BQ wideband handheld scan with quick charger	$209.95
Bearcat 9000XLT-A 500 channel base/mobile scanner	$344.95
Bearcat 895XLT-A1 300 ch.TrunkTracker base scanner	$194.95
Bearcat 278CLT-A 100 ch base AM/FM/SAME WX alert	$169.95
Bearcat 248CLT-A 50 ch.base AM/FM/weather alert scanner	$99.95
Bearcat 245XLT-A 300 channel TrunkTracker II scanner	$269.95
Bearcat Sportcat 200 alpha handheld sports scanner	$184.95
Bearcat Sportcat 180B handheld sports scanner	$149.95
Bearcat 80XLT-A2 50 channel handheld scanner	$109.95
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Bearcat BCT12-A2 Stormtracker info mobile scanner	$144.95
Bearcat BCT7-A information mobile scanner	$149.95
ICOM ICR8500-A1 wideband communications receiver	$1,499.95
ICOM PCR1000-A1 computer communications scanner	$399.95
ICOM R10-A1 handheld wideband communications rec.	$339.95

AOR® AR8200B Radio Scanner

Mfg. suggested list price $799.95/**Special $519.95**

1,000 Channels • 20 banks • 50 Select Scan Channels
PASS channels: 50 per search bank + 50 for VFO search
Frequency step programmable in multiples of 50 Hz.
Size: 2-1/2" Wide x 1-3/8" Deep x 6-1/8" High

Frequency Coverage:
500 KHz to 823.995 MHz, 849.0125–868.995 MHz, 894.0125-2,040.000 MHz (Full coverage receivers available for export and FCC approved users.)

The AOR AR8200B is the ideal handheld radio scanner for communications professionals. It features all mode receive: WFM, NFM, SFM (Super Narrow FM), WAM, AM, NAM (wide, standard, narrow AM), USB, LSB & CW. Super narrow FM plus Wide and Narrow AM in addition to the standard modes. The AR8200 also has a versatile multi-function band scope with save trace facility, twin frequency readout with bar signal meter, battery save feature with battery low legend, separate controls for volume and squelch, arrow four way side rocker with separate main tuning dial, configuarable keypad beep/illumination and LCD contrast, write protect and keypad lock, programmable scan and search including LINK, FREE, DELAY, AUDIO, LEVEL, MODE, computer socket fitted for control, clone and record, Flash-ROM no battery required memory, true carrier re-insertion in SSB modes, RF preselection of mid VHF bands, Detachable MW bar aerial. Tuning steps are programmable in multiples of 50 Hz in all modes, 8.33 KHz airband step correctly supported, Step-adjust, frequency offset, AFC, Noise limited & attenuator, Wide and Narrow AM in addition to the standard modes. For maximum scanning pleasure, you can add one of the following optional slot cards to this scanner: **CT8200** CTCSS squelch & search decoder $89.95; **EM8200** External 4,000 channel backup memory, 160 search banks. $69.95; **RU8200** about 20 seconds chip based recording and playback $69.95; **TE8200** 256 step tone eliminator $59.95. In addition, two leads are available for use with the option socket. **CC8200** PC control lead with CD Rom programming software $109.95; **CR8200** tape recording lead $59.95. The AR8200B comes with 4 AA ni-cad batteries, charger, cigar lead, whip aerial, MW bar antenna, belt hook, strap and one year limited AOR warranty. Enter your order now at http://www.usascan.com.

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QRX . . .

Number 6 on your Feedback card

continued from page 1

Doesn't E-mail essentially function QRM-less? Do propagational conditions deter the movement of E-mail during the vast majority of the time?

Has the home PC helped to sustain amateur radio? Yes, it has. Has the PC advanced amateur radio? Again, yes, it has.

Slow scan amateur television (SSTV) has been improved via the dedicated notebook PC. Packet radio is but another real winner due to the home computer. Amateur radio positioning system (ARPS), weather information processing, satellite orbit calculations, and many other communication processes have all been helped by the use of all types of personal computers.

Will computer networking, audio and video conferencing, site surfing, home pages, and other yet-to-be-defined innovations cause amateur radio communication to follow the slide rule and/or the 8-track cassette? Color TV essentially eliminated the desire for black-and-white television. Has not a new world order of communications spelled doom for ham radio?

Can amateur radio publications, as an example, survive the upheaval technology has caused in their industry? Can amateur radio support industries make the massive changes to their businesses within a few short years in order to survive?

Obviously, some services (publications) have closed their doors forever. Those currently remaining must have learned to cope with a hobby that continues to rapidly change to match a technology base that is changing even faster.

Will amateur radio be around to witness the end of the next century, 100 years from now? Is it a fading "wanna-be" and in failing health at the beginning of this new millennium?

Even suggesting that amateur radio is decaying is akin to shouting "Fire!" in a crowded theater. Is the digital revolution, which changed so many things, going to change ham radio so much that it can no longer compete or even exist?

Amateur radio must seek change — and welcome it when it comes. It is essential to seek change. When change does occur, it often comes with confusion. If amateur radio is to survive, it must not run from change, it must be prepared to run toward it. Change imposed by the digital revolution is an opportunity if amateur radio can solve the problems therein related.

In order for ham radio to grow and not diminish, we must focus, prioritize, commit, and use whatever resources and technology are available. We must broaden our efforts and apply them in the areas in which we have been successful.

The case must be made for amateur radio, at heart, that we are a national service resource!

Have you ever heard or read about a young high school student who was a licensed radio amateur shooting up his or her school? How many mass murderers can you name who were also active ham radio operators?

As a group we are not perfect or flawless, but we must be doing something right. There are many reasons for not allowing amateur radio to be overwhelmed by the huge tidal wave of digital technology. We owe it to ourselves and our hobby not to let it waste away, regardless what the case may be.

From providing emergency communication to comradeship, from electronic knowledge to the thrill of experimentation to giving our capabilities to our country in time of want, a need does exist for ham radio to stay viable and useful.

Thanks to Bill Parker W8DMR, 2738 Floribunda Dr., Columbus OH 43209-3120.

Cincy JOTA 1999

A joint effort on the part of two Cincinnati area clubs, the OH-KY-IN ARS and the Milford ARC, last October's Jamboree on the Air from Mitchell Memorial park on the west side of Cincinnati presented an excellent opportunity to demonstrate several aspects of ham radio, including both VHF and HF operation as well as 2-meter foxhunting techniques.

Following in the theme of the jamboree, Scouts were cycled among several operating locations and presented with the chance to exchange hellos with other hams across the United states, try their luck at transmitting CW, examine antenna designs and setup, and even try to sniff out several hidden 2-meter transmitters.

HF antennas consisted of a pneumatically powered 36-foot mast supporting a Mosley TA33 tribander, a 40-meter dipole, and a G5RV. Stations included a Yaesu FT-900 and a Kenwood TS-520.

***Photo A.** Jim WB8RRR controls the mike while Brian talks to a fellow Scout.*

666

Remember this number, because that is what the FCC is saying you will have to pay to take an Amateur Service exam this year — as if the bedeviled ARS doesn't have enough of a challenge in maintaining and raising its numbers without invoking the guy with the horns.

According to the Commission, the $6.66 figure is based on last year's 2.6% increase in the Consumer Price Index. The ARRL VEC has already said that it will be rounding the figure off to $6.65 when it begins collecting the new fee this year. Amen.

Thanks to the FCC and ARRL, via Newsline, *Bill Pasternak WA6ITF, editor.*

DARA Scholarships: $2,000 in 2000

The Dayton Amateur Radio Association says that it is now accepting applications for its year 2000 scholarship awards program. Applicants must be graduating high school seniors and hold any class of FCC-issued amateur radio license. Completed applications must be postmarked before June 1, 2000. Requests for applications must be accompanied by a self-addressed stamped envelope. Send for one from DARA Scholarships, 45 Cinnamon Ct., Springboro OH 45066.

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

Bomb Scare Aloft!

My CW "squeezer" keyer was built into a black plastic box. It functioned well, but you required several hours of patient practice to become proficient with it. Practice sessions included taking the new toy to bed with me and practicing "under cover," as it were.

On a commercial airliner, the "squeezer" rested in my lap and may have been the first laptop computer.

During our flight destined for Minneapolis, the stewardess was taking care of business and seeing that every

Continued on pg 61

MFJ *Switching* Power Supplies

Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these new 25 or 45 Amp MFJ MightyLite™ Switching Power Supplies!

No RF hash . . . Super lightweight . . . Super small . . . Volt/Amp Meters . . .

MFJ's new adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

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No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

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No RF hash!

These babies are clean . . . Your buddies won't hear *any* RF hash on your signal! *None* in your receiver either!

Some competing switching power supplies generate objectionable RF hash in your transmitted and received signal.

These super clean MFJ *MightyLites*™ meet all FCC Class B regulations.

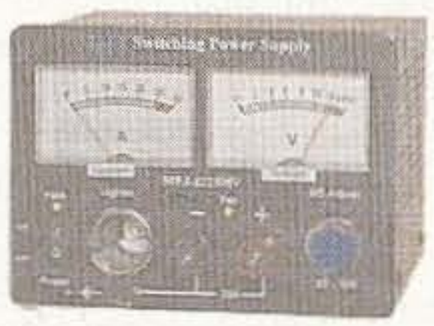
Low Ripple . . . Highly Regulated

Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load.

Fully Protected

You won't burn up our power supplies!

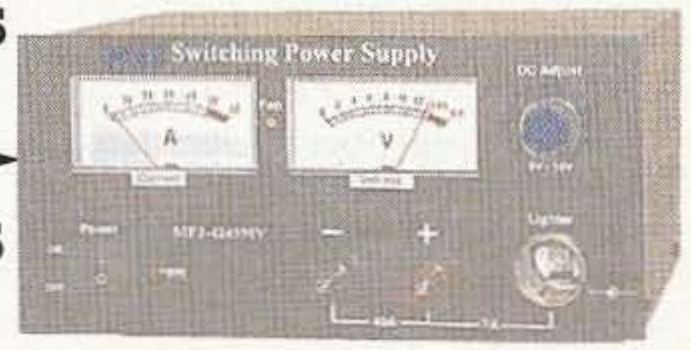
No RF Hash!



← MFJ-4225MV
25 Amp
$149.95
plus s&h

MFJ-4245MV →
45 Amp
$199.95
plus s&h

No RF Hash!



They are fully protected with Over Voltage and Over Current protection circuits.

Worldwide Versatility

MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

MightyLites™ . . . Mighty Features

Front-panel control lets you vary output from 9 to 15 Volts DC.

Front-panel has easy access five-way binding posts for heavy duty use and cigarette lighter socket for mobile accessories. MFJ-4245MV has two sets of quick-connects on the rear for accessories.

Brightly illuminated 3 inch meters let you monitor load voltage and current.

A whisper quiet internal fan efficiently cools your power supply for long life.

Two models to choose from . . .

MFJ-4225MV, $149.95. 25 Amps maximum or 22 Amps continuous. Weighs 3.7 pounds. Measures 5¾Wx4½Hx6D in.

MFJ-4245MV, $199.95. 45 Amps maximum or 40 Amps continuous. Weighs 5.5 pounds. Measures 7½Wx4¾Hx9D in.

NEW! 25 Amp MightyLite™

Super light, super compact switching power supply delivers 25 Amps maximum/22 Amps continuous at 13.8 Volts DC. Low ripple, highly regulated. ***No RF Hash!*** Five-way binding posts for high current. Quick connects for accessories. Over voltage/current protection. 110 or 220 VAC operation. Meets FCC Class B regs. 3.5 lbs. 5½Wx2½Hx10¼D in.

MFJ-4125
25 Amp
$109.95
plus s&h

MFJ 35/30 Amp Adjustable Regulated DC Power Supply

Massive 19.2 pound transformer . . . No RF hash . . . Adjustable 1 to 14 VDC . . .

MFJ-4035MV
$149.95
plus s&h

MFJ's heavy duty conventional power supply is excellent for powering HF or 2 Meter/440 MHz transceiver/accessories.

A massive 19.2 pound transformer makes this power supply super heavy duty! It delivers 35 amps maximum and 30 amps continuous without even flexing its muscles. Plugs into any 110 VAC wall outlet.

It's highly regulated with load regulation better than 1%. Ripple voltage is less than 30 mV. *No RF hash* -- it's super clean!

Fully protected -- has over voltage protection, fold back short circuit protection and over-temperature protection.

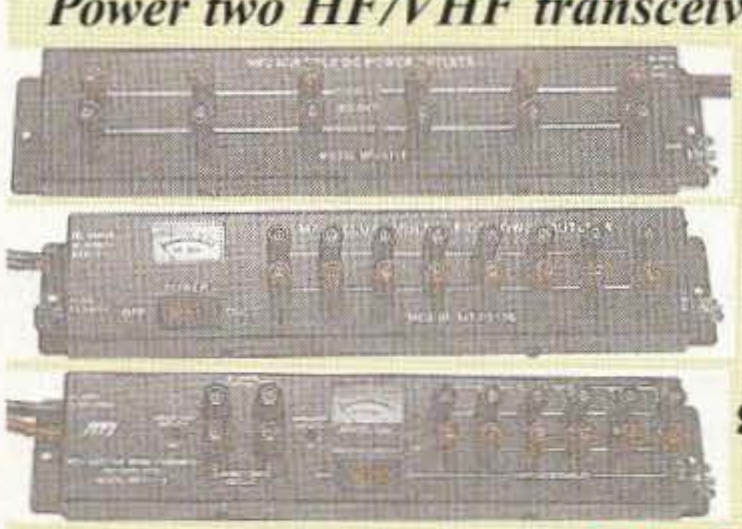
You get front panel adjustable voltage from 1 to 14 VDC with a convenient detent set at 13.8 VDC. A pair of front-panel meters let you monitor voltage and current.

Three sets of output terminals include a pair of heavy duty five-way binding posts for HF/VHF radios, two pairs of quick-connects for accessories and a covered cigarette lighter socket for mobile accessories.

A front-panel fuse holder makes fuse replacement easy. Whisper quiet fan speed increases as load current increases -- keeps components cool. 9½Wx6Hx9¾D inches.

MFJ *High Current* Multiple DC Power Outlets

Power two HF/VHF transceivers and six or more accessories from your 12 VDC power supply



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New!
MFJ-1117
$44.95
plus s&h

MFJ-1118, $74.95. This is MFJ's most versatile and highest current *Deluxe Multiple DC Power Outlet*. Lets you power two HF and/or VHF transceivers and six or more accessories from your transceiver's main 12 VDC supply.

Two pairs of super heavy duty 30 amp 5-way binding posts connect your transceivers. Each pair is fused and RF bypassed. Handles 35 Amps total.Six pairs of heavy duty, RF bypassed 5-way binding posts let you power your accessories. They handle 15 Amps total, are protected by a master fuse and have an ON/OFF switch with "ON" LED indicator.

Built-in 0-25 VDC voltmeter. Six feet super heavy duty eight gauge color-coded cable with ring tongue terminals. Binding posts are spaced for standard dual banana plugs. Heavy duty aluminum construction. 12½x2¾x2½ in.

MFJ-1116, $49.95. Similar to MFJ-1118. No 30 amp posts. Has "ON" LED and 0-25 VDC voltmeter. 15 amps total.

MFJ-1112, $34.95. Similar to MFJ-1116. No on/off switch, LED, meter, fuse.

NEW! MFJ-1117, $54.95. For powering four HF /VHF radios (two at 35 Amps each and two at 35 Amps combined) simultaneously. Tiny 8x2x3 inches.

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All are protected by MFJ's famous No Matter What™ one year limited warranty.

NEVER SAY DIE

continued from page 4

to watch for them and then actually *do* something. Get off the couch.

Heck, any two hams in the New England area could have put together a couple of 10 GHz tenth-watt transceivers and worked seven states. But it was Chuck WA1KPS and I who actually did it, and believe me that was one hell of an adventure! Wow, that was exciting!

When I got my ticket, over 60 years ago, I did it the same way as everyone else: I memorized the ARRL Q&A License Manual. Even though I'd been building radios, hi-fi equipment, and transmitters for several years, I didn't really understand squat about electronics. Nothing in my high school or even the first two years of college as an EE student helped me to understand the fundamentals. Nothing in *QST* helped, either.

Then, along came WWII, when I had just turned 19, so I was prime cannon fodder. I joined the Navy and went through their nine-month electronics training. It was superb! Within the first three months, I had a grounding in electronics that's made it possible for me to keep up with tubes, transistors, and even computer circuit designs.

It won't be long, I predict, before we'll have a similar education series available on video, complete with a virtual laboratory where we can build power supplies and radios.

Of course, I'd like to see a series of teaching videos available to any kid interested, starting with the basics, and covering all aspects of electronic equipment — such as telephones, television, radio, facsimile, satellite systems, and so on. We should be getting kids in the fifth grade or earlier started so they'll be able to cope with the technologies they'll be using, and so they will be able to help design, manufacture, sell, and service high-tech products.

But, everything depends on you. You can nod and agree, and do nothing. Or you can get started in getting your local ham club involved, triggering the startup of new school radio clubs, making your club meetings so exciting that you'll have to find a bigger place to meet, and so on. The ball's in your court. Will you help move our country toward a more prosperous future, or are you just going along for the ride during this incarnation?

Help!

There's only one of me and I have a serious conflict of interest. I want to do everything I can to keep *73* interesting and inspiring. I want to do all I can to help amateur radio grow so our country will be able to reclaim the high-tech industries we've lost to other countries. But, if you've been reading my editorials, you understand that I've discovered the secret to helping about 98.4% of Americans to be healthier (only 1.6% are in excellent health, according to a recent survey).

This hasn't left much time for me to do the job of editing *73* that I should have been doing, so I've been looking around for someone with the background and interest to grab the helm. I tried Dave K4TWJ in the last issue, but he was more interested in writing than editing, so that didn't work out and he's back with *CQ*.

The main job of an editor is to work with the advertising department to find hams who can review new equipment. Since buying a new piece of ham gear is one of the most fun aspects of the hobby, our product reviews are eagerly read. The editor should keep an eye out for hams who are experts in some special interest and get them to contribute articles.

We're interested in articles helping newcomers to get involved with ham satellites, packet, RTTY, slow scan, DXing, QRP, moonbounce, aurora and meteor scatter contacts, and so on. If you've been having fun with some special ham interest, how about your helping new hams get involved? What will they need in equipment? How do they get started?

Anyway, the editorial position is still open. And between E-mail and fax it's something that could be done from almost anywhere. The pay? Despite it being so much fun that payment should be completely irrelevant, we will provide a trickle of money. For any true-blue ham, editing a ham rag is nirvana. I'm not exaggerating, I've done it. Been-there, done-that.

Heck, when *CQ* offered me the editor's job in 1955 I left the hi-fi speaker company I'd built from scratch into a multi-million dollar empire to take the job. The editor's job didn't pay much, but it allowed me to travel all around the world and to go on expeditions to weird places like Navassa Island. Boy, did I have fun! And I kept on working, even though they owed me a year's pay. Then, when they fired me, I bet every dollar I had on starting *73*.

And More Help!

You'd like a fatter magazine, and so would I. There's just one way to guarantee that *73* will get fatter and that's if you'll help me to build the circulation. More readers will attract more advertisers. The economics of publishing dictate that we can publish one page of articles for each page of advertising.

You can help, too, by getting your friends and family to read my *Secret Guide to Health*. If we can get them to stop putting sugar, white bread, and other poisons into their bodies, their immune systems will be able to do incredible repair jobs for them. Maybe you've read about the recent studies showing a correlation between white bread and Lou Gehrig's disease. And the NutraSweet connection to multiple sclerosis. Well, I've been editorializing about stuff like this for almost 50 years now.

The Kook

A note from Frank Talmadge AA7IT says that he's lost friends by reading my editorials to them. "Wayne Green's a kook," they say. Well, of course they're right, from their viewpoint. It's much easier to call me a kook and thus not bother to examine the things they've been taught to believe in than to make the effort to think. Frank, any friends you've lost this way weren't worth keeping.

Almost everyone believes in doctors. I used to. They believe in college, as I used to. Some even believe in the Republican or Democratic parties. We all believe in the almighty dollar. We believe in NASA and space. We believe in fighting drugs. So I'm not picking the easy targets such as lawyers, judges, the police, or Clinton when I propose alternatives to doctors and college, and point out that we've been scammed just about every which way with our money, Social Security, the drug war, our public schools, the war on poverty, the Moon landings, our food supply, our drinking water, and so on.

If I were writing about things I hadn't carefully researched, I wouldn't expect to be taken seriously. This is why you see me citing the references I've found which back up the conclusions I've drawn.

I'd attract a bigger audience if I told people what they wanted to hear — if I repeated conventional stupidity. Oops, I should have said conventional wisdom, even though it's anything but that.

A New Record!

It's been taking me longer and longer to fast forward through the TV commercials (as I keep mentioning, I *always* tape any shows I might find interesting), so I wasn't surprised at an AP report that the average number of minutes of commercials during one hour of prime time is 11:12, up 14% from 1991. However, the current record holder is *Buffy, the Vampire Slayer*, with 23:46 minutes an hour! That's getting close to

Continued on page 44

HIGH QUALITY VHF & UHF EXCITER & RECEIVER MODULES

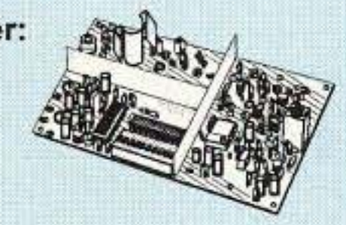
FM EXCITERS:

Rated for continuous duty, 2W continuous duty output.

T301 Synthesized VHF Exciter: for various bands 139-174MHz, 216-226 MHz. Dip switch freq. setting.

- Kit (ham bands only) ...**$109** (TCXO option $40)
- Wired/tested, incl TCXO...**$189**

T304 Synthesized UHF Exciter: various bands 400-470 MHz.



- Kit (440-450 ham band only) incl TCXO ...**$149**
- Wired/tested...**$189**

CRYSTAL CONTROLLED:

- **TA51:** for 6M, 2M, 220 MHz .....**kit $99, w/t $169**
- **TA451:** for 420-475 MHz. .....**kit $99, w/t $169**
- **TA901:** for 902-928 MHz, (0.5W out) .....**w/t $169**

VHF & UHF POWER AMPLIFIERS.

Output levels from 10W to 100W.....**Starting at $99**

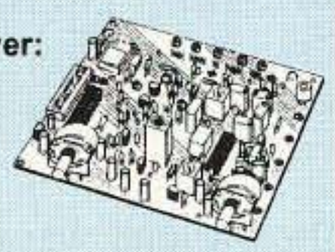
FM RECEIVERS:

***Very sensitive** – 0.2µV.*
***Superb selectivity,** >100 dB down at ±12 kHz, best available anywhere, flutter-proof squelch.*

R301 Synthesized VHF Receiver: various bands 139-174MHz, 216-226 MHz.

- **Kit** (ham bands only) ...**only $139** (TCXO option $40)
- **Wired/tested** ...**$209** (includes TCXO)

R304 Synthesized UHF Receiver: various bands 400-470MHz.



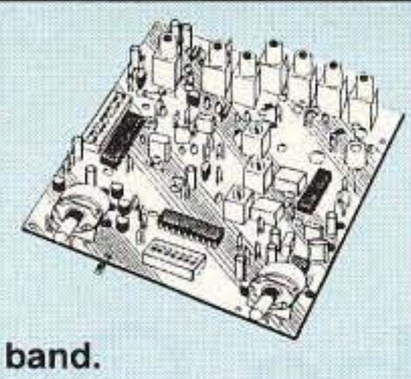
- Kit (440-450 ham band only) incl TCXO ...**$179**
- Wired/tested...**$209**

CRYSTAL CONTROLLED:

- **R100 RCVR.** For 46-54, 72-76, 140-175, or 216-225 MHz. .....**kit $129, w/t $189**
- **R144 RCVR.** Like R100, for 2M, with helical resonator in front end.....**kit $159, w/t $219**
- **R451 RCVR,** for 420-475 MHz. Similar to R100 above. .....**kit $129, w/t $189**
- **R901 RCVR,** 902-928MHz .....**kit $159, w/t $219**

R121 AVIATION RECEIVER

NEW



Exciting new AM receiver for the 118-137 MHz aircraft band.

- Ideal for monitoring at small airports.
- Allows pilot control of runway lighting.
- High-quality ELT monitor to detect and locate downed aircraft.
- Dip switch frequency selection.
- Superior sensitivity and selectivity.

R121 Receiver module wired/tested **$209**
R121 Receiver in A87 cabinet **$299**

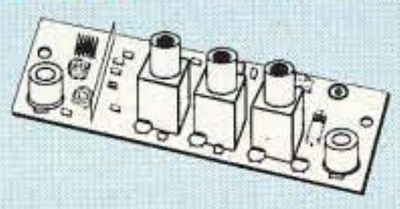
LOW NOISE RECEIVER PREAMPS

LNY-( ) ECONOMY PREAMP ONLY $29/w&t

- Miniature MOSFET Preamp.
- Low noise figure.
- *Available* for various bands from 28 to 450 MHz.

LNP-( ) PRESELECTOR ONLY $39/w&t

- Eliminate intermod!
- Low noise preamp
- Sharp 3-section filter
- Available for bands from 137 to 170 MHz.



LNG-( ) GaAs FET PREAMP

STILL ONLY $59, wired/tested

Available for 28-30, 46-56, 137-152, 152-172, 210-230, 400-470, and 800-960 MHz bands.

SUBAUDIBLE TONE ENCODER/DECODER

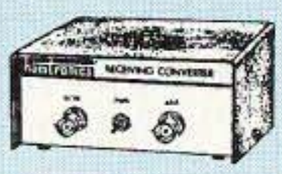
Access all your favorite closed repeaters!

- **Encodes** all standard CTCSS tones with crystal accuracy and convenient DIP switch selection.
- **Decoder** can be used to mute receive audio and is optimized for installation in repeaters to provide closed access. High pass filter gets rid of annoying rcvr buzz.

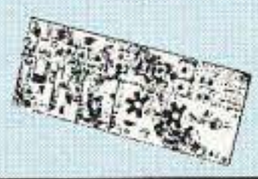
- **TD-5** CTCSS Encoder/Decoder Kit .....now only **$39**
- **TD-5** CTCSS Encoder/Decoder Wired/tested.....**$59**

TRANSMITTING & RECEIVING CONVERTERS

No need to spend thousands on new transceivers for each band!



- **Convert vhf and uhf signals to & from 10M.**
- Even if you don't have a 10M rig, you can pick up very good used xmtrs & rcvrs for next to nothing.
- Receiving converters (shown above) available for various segments of 6M, 2M, 220, and 432 MHz.
- Rcvg Conv Kits from $49, wired/tested units only $99.



- **Transmitting converters for 2M, 432 MHz.**
- Kits only $89 vhf or $99 uhf.
- Power amplifiers up to 50W.

WEATHER FAX RECEIVER

Join the fun. Get striking images directly from the weather satellites!

A very sensitive wideband fm receiver **optimized for NOAA** APT & Russian Meteor **weather fax** on the 137MHz band.

Covers all 5 satellite channels. Scanner circuit & recorder control allow you to automatically capture signals as satellites pass overhead, even while away from home.

See product review with actual satellite pictures in June 1999 QST, along with info on software and antennas.

- **R139 Receiver Kit** less case **$159**
- **R139 Receiver Kit** with case and AC power adapter **$189**
- **R139 Receiver w/t** in case with AC power adapter ...**$239**
- Internal PC Demodulator Board & Imaging Software **$289**
- Turnstile Antenna **$135**
- Weather Satellite Handbook **$20**

WWV RECEIVER

Get time & frequency checks without buying multiband hf rcvr. Hear solar activity reports affecting radio propagation.

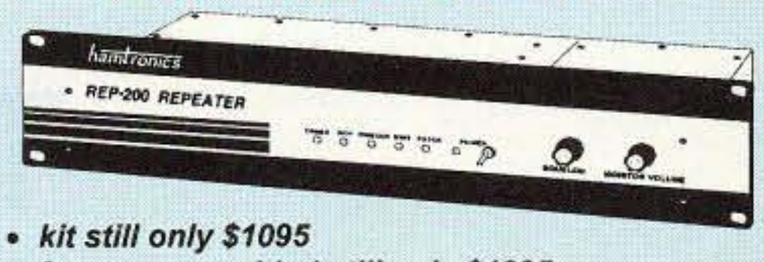
Very sensitive and selective crystal controlled superhet, dedicated to listening to WWV on 10 MHz. Performance rivals the most expensive rcvrs.

- **RWWV Rcvr** kit, PCB only **$59**
- **RWWV Rcvr** kit with cabt, spkr, & 12Vdc adapter **$89**
- **RWWV Rcvr** w/t in cabt with spkr & adapter **$129**

Get more features for your dollar with our

REP-200 REPEATER

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



- ***kit still only $1095***
- ***factory assembled still only $1295***

50-54, 143-174, 213-233, 420-475 MHz.
FCC type accepted for commercial service in 150 & 450 MHz bands.

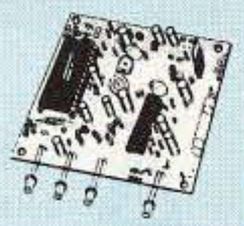
Digital Voice Recorder Option. Allows message up to 20 sec. to be remotely recorded off the air. Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!** .....**only $100**

REP-200C Economy Repeater. Real-voice ID, no dtmf or autopatch. .....**Kit only $795, w&t $1195**

REP-200N Repeater. Without controller so you can use your own. .....**Kit only $695, w&t $995**

You'll KICK Yourself If You Build a Repeater Without Checking Out Our Catalog First!

Hamtronics has the world's most complete line of modules for making repeaters. In addition to exciters, pa's, and receivers, we offer the following controllers.



COR-3. Inexpensive, flexible COR module with timers, courtesy beep, audio mixer. ..... **only $49/kit, $79 w/t**

CWID-2. Eprom-controlled ID'er..... **only $54/kit, $79 w/t**

DVR-1. Record your own voice up to 20 sec. For voice id or playing club announcements. .....**$59/kit, $99 w/t**

COR-4. Complete COR and CWID all on one board. ID in eprom. Low power CMOS. ..... **only $99/kit, $149 w/t**

COR-6. COR with real-voice id. Low power CMOS, non-volatile memory. .....**kit only $99, w/t only $149**

COR-5. µP controller with autopatch, reverse ap, phone remote control, lots of DTMF control functions, all on one board, as used in REP-200 Repeater. .....**$379 w/t**

AP-3. Repeater autopatch, reverse autopatch, phone line remote control. Use with TD-2. .....**kit $89**

TD-2. Four-digit DTMF decoder/controller. Five latching on-off functions, toll call restrictor. ..... **kit $79, w/t $129**

TD-4. DTMF controller as above except one on-off function and no toll call restrictor..... **w/t $89**

WEATHER ALERT RECEIVER

A sensitive and selective professional grade receiver to monitor critical NOAA weather broadcasts. Good reception even at distances of 70 miles or more with suitable antenna. No comparison with ordinary consumer radios!

Automatic mode provides storm watch, alerting you by unmuting receiver and providing an output to trip remote equipment when an alert tone is broadcast. Crystal controlled for accuracy; **all 7 channels** (162.40 to 162.55).

Buy just the receiver pcb module in kit form or buy the kit with an attractive metal cabinet, AC power adapter, and built-in speaker. Also available factory wired and tested.

RWX Rcvr kit, PCB only **$79**
RWX Rcvr kit with cabinet, speaker, & AC adapter **$99**
RWX Rcvr wired/tested in cabinet with speaker & adapter **$139**

Buy at low, factory-direct net prices and save!
For complete info, call or write for complete catalog.
Order by mail, email, or phone (9-12, 1-5 eastern time).
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Number 10 on your Feedback card

The Quest for Super Sounding Audio

How to improve your on-the-air image by 10 dB.

Whether your preferred mode of operation is SSB, FM, or AM, here is the inside info on radiating a big-time signal with million dollar–sounding audio.

An increasing number of amateurs are becoming seriously interested in full-bodied audio. This is apparent on all bands and modes of voice communications, and is also reflected in the transceivers and accessories operators select. Some of the resulting on-the-air signals sound so good that you just stop tuning and marvel at their richness — rather than focus on what the operator is saying. Why this dedication to super-terrific audio? Everyone has his own opinion, but I think it's because of our instinct to experiment as well as our desire to project a special on-the-air image.

"But my factory-supplied mike is a plug-in match for my transceiver, and my rig's ALC meter reads full range when using it. Surely that's good enough for general QSOs and mild-mannered DXing — right?"

"Good enough," sure. Outstanding? Questionable. Only when the audio response of your transmitted signal coincides with the audio range and response that brings out the best qualities in your own voice can you sound really superb. Accomplishing that goal calls for bringing together several variables in proper proportions.

***Photo A.** Heil Sound's new "GoldLine" microphone is the ideal way to have a terrific studio grade sound plus a pileup-busting signal for DXing with one economically priced mike. What's the secret? It has two elements you select as desired by a small toggle switch mounted above the PTT slide switch. Details in text.*

Paths to great sounding audio

Let's look at the various ways extraordinary audio can be pursued.

The first place for possible improvement is the microphone used with your rig, as its audio response determines how much bass, midrange, and treble are initially available for processing. Next is the range and level of audio frequencies or tones passed, emphasized, and/or attenuated by your rig. Then, too, factory and/or in-field adjustment of injection oscillator frequencies (often called transmit DSP) determine the response of IF stages and crystal filters. This, in turn, influences whether a rig sounds predominantly bassy or tinny. Finally, multiband audio equalizers like those found in professional recording studios are being utilized in some "all out" amateur setups to tailor a preferred mike for a specific response and sound. Let's take a closer look at each of these variables, beginning with amateur radio's most familiar and most continuously popular accessory: the microphone.

The mike makes the difference

Over the years, amateurs have strived to obtain the most robust audio

Phantom-Powered Mikes

A large number of today's HF and VHF transceivers are supplied with and/or equipped for microphones utilizing condenser or "electret" elements. These mikes require DC power in the range of 1.5 to 8.0 volts to operate their element's associated preamp (which may be built into the element's case or contained on an adjacent/in-mike PC board). This "phantom mike voltage" (so nicknamed because it goes unnoticed or unrealized) is output from the transceiver's microphone socket and routed to the mike via its cable.

If a different type of microphone or mike element is directly substituted for a transceiver's matching electret microphone, phantom voltage may thus burn out the mike element. If the element can withstand phantom voltage without burnout, it can short-circuit phantom voltage and damage the transceiver.

How do you avoid this dilemma? Simple: Just be sure that you interrupt phantom voltage on the microphone's "hot" or positive wire before substituting another type of microphone or element. You may also need to increase mike gain to compensate for reduced gain from the disabled preamp — or you may be able to change only the mike element and leave the operating preamp intact.

Here's a simple way to identify and block phantom voltage. First, check your transceiver's manual and use your VOM to determine if and which mike socket pin carries phantom voltage. Then check inside the mike's case to determine if the voltage is applied directly to the element or only to an adjacent preamp (you may be able to continue using the preamp).

Next, insert a 1 to 5 µF 10 to 25 volt nonpolarized capacitor in series with one of the mike/element's leads to block DC and pass AC (audio). If a nonpolarized capacitor is not available, use two regular capacitors wired "back to back" as shown in **Fig. A**. Finally, check your new mike for proper gain and frequency response, and then enjoy projecting your new on-the-air image. — K4TWJ.

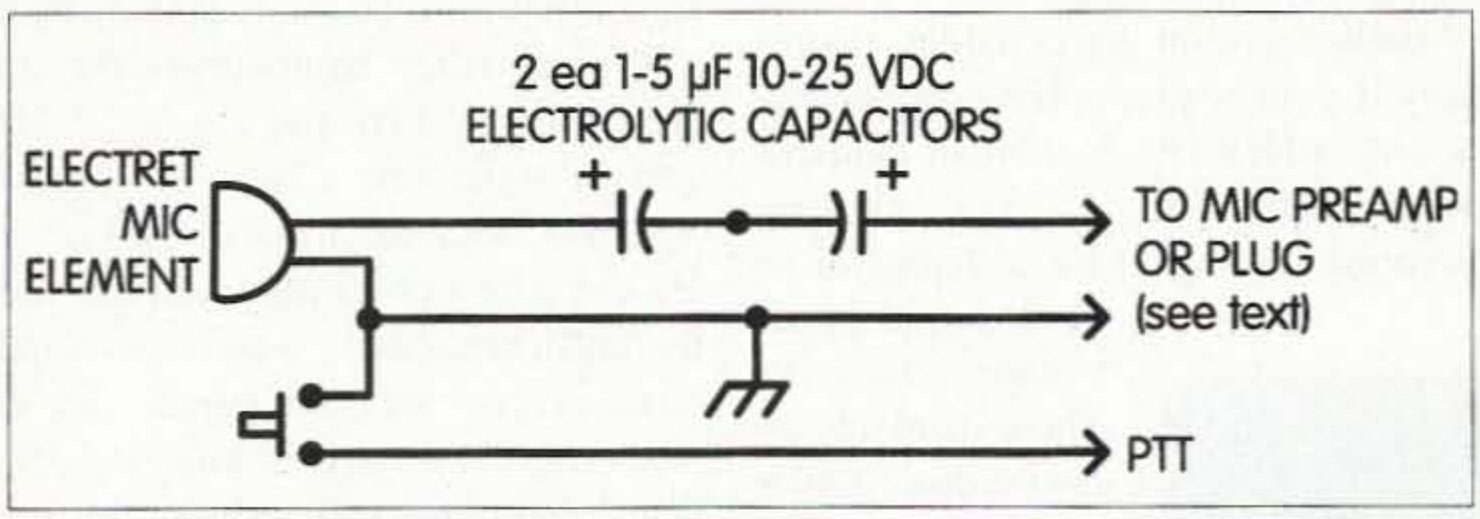

Fig. A. Using regular capacitors back-to-back.

possible on AM, FM, and SSB. Generally speaking, this was done by selecting a microphone or mike element that best fit your voice, or by adding an audio equalizer in the line between a favored mike and rig. Some all-time classic mikes making that list include Astatic's D104, Shure's 55SH and 444, Electro Voice's 664, and Collins' SM2.

One of the best sounding and most reasonably priced microphones I have used and heard in use is Bob Heil's new "GoldLine" Model GM-4 or GM-5 shown in **Photo A**. Rather than being tailored for maximum talk power like Heil's HM-10 mike or HC-4 "DX element" cartridge, this new GoldLine mike's main element is expressly designed to produce a full-range "million dollar sound" for super QSOs. A second and switch-selectable element you

Photo B. *Bob Heil's optional boom and preassembled mike-to-rig cables get you cooking with a new sound, a new image, and more desk room in short order. The boom and cable also add a professional "finishing touch" to a GoldLine mike's installation.*

choose at time of purchase is also included in the GoldLine: a medium range and mellow sounding HC-5 or a more concentrated range and pileup-cracking HC-4. You can thus project a "studio on the air" image one minute and (flip the mike's switch) a big-time DX signal the next minute. It's two mikes in one case!

Technically speaking, the GoldLine's main (studio grade) element has a frequency response of 50 Hz to 16 kHz, with a smooth rise of 4 dB centered on 2 kHz. This rise coincides with the upper range of most rigs' SSB filters, so, assuming sufficient mike gain, it adds a nice peak to the transmitted passband's upper end while retaining excellent low end bass. As a familiar comparison, Heil's HC-5 element has a response of 300 Hz to 4 kHz, with a sharper rise of 6 dB at 1800 Hz (less bass, fewer highs, and greater midrange peaking). The well-known HC-4 element's response is 600 Hz to 2800 Hz, with a 10 dB peak at 2 kHz: an even sharper response with more peaking and "punch" for DXing.

Thanks to an optional desk-type support boom and optional cable sets (**Photo B**), installing and setting up a Heil GoldLine mike is a snap. The boom clamps to a desk edge (side or rear), is adjustable in length and tilt angles, and frees up desk space for contest logs, etc. The cable sets are preassembled for plug-in-and-operate convenience. They include DC blocking capacitors to prevent mike or rig damage from phantom power, and are available for most popular transceivers (phantom power is typically used to power a rig's mating "factory mike").

Another option to consider (especially if your wallet is flat) is purchasing only a Heil HC-5 or HC-4 element and installing it in your existing microphone's case (use a capacitor to block DC/phantom voltage, however!). These elements do not produce "GoldLine-grade sound," but they outperform stock mikes by a mile. GoldLine mike elements are not sold separately. They are available only as complete microphones. If you have an older vacuum tube–type rig, Heil also has a low-to-high impedance audio transformer for matching a GoldLine, HM-10, HC-5, or HC-4 to the vacuum tube circuitry (**Photo C**). All of these mike goodies are available from Bob Heil K9EID and friends at Heil Sound Ltd., 5800 North Illinois, Fairview Heights IL 62208; telephone (618) 257-3000. Check them out!

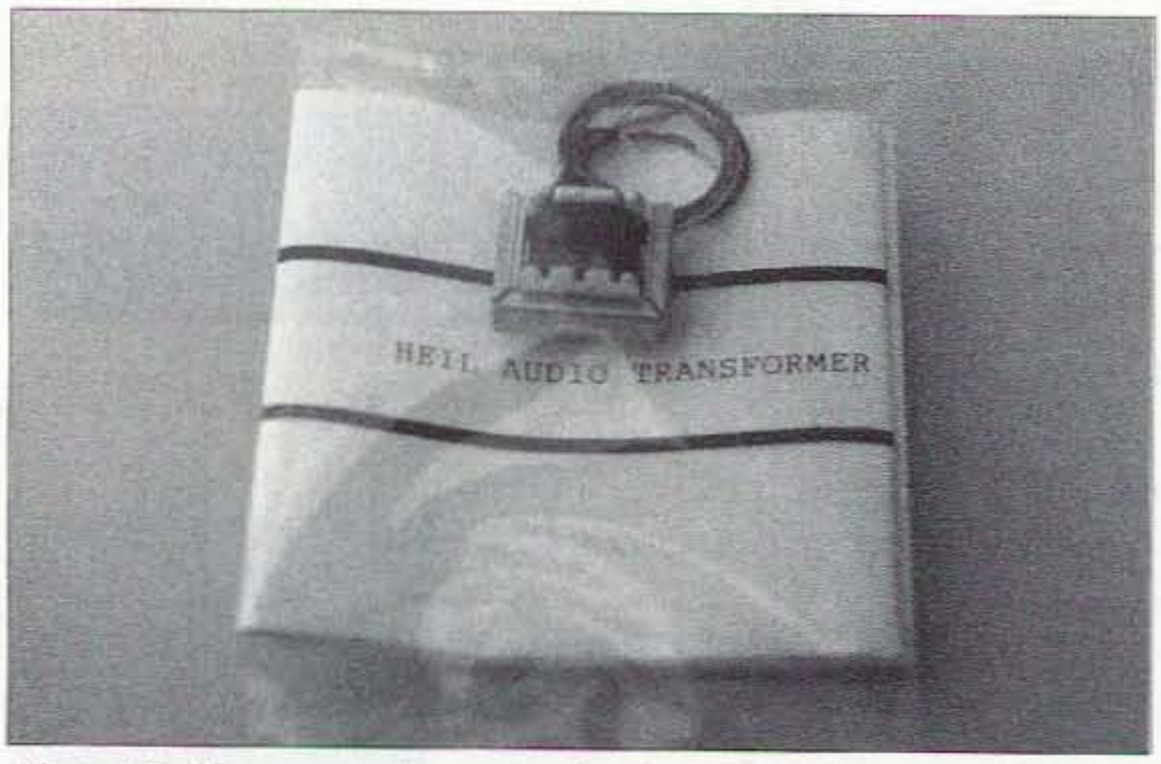

Photo C. *Want to make your classic DX-100, Johnson Ranger, HT-37, or KWM-2 sparkle with dazzling GoldLine audio? This little low-to-high impedance transformer available from Heil Sound does the job in high style.*

Rig notes

Like microphones, various makes and models of transceivers also exhibit their own distinctive on-the-air sound qualities — which can vary from "flat" to "fantastic." These variations are influenced by a rig's interstage coupling and bypass capacitors, IF bandwidth, and local oscillator or mixer injection oscillator's frequency.

How so? Coupling and bypass capacitors determine how much bass and treble pass through audio stages. Then, bandpass filters in IF stages shape and define the overall frequency response of the transmitted signal. Bear in mind that I am referring to *transmitted* bandwidth here, *received* bandwidth — which is usually the only measurement of selectivity listed or advertised in a transceiver's specs. *Usually, but not always, transmitted and received bandwidths are the same — but don't take that for granted.* Close study of your rig's circuitry tells the real story here.

Typical filter bandwidths for SSB are 2.1 or 2.2 kHz and 2.4 or 2.5 kHz, and in some rare cases, 2.7 or even 3.1 kHz. That addition of 300 or 400 Hz (bass or treble) may initially seem insignificant, but when associated transceivers are compared side-by-side, the difference is amazing. Narrow bandwidth rigs exhibit the most audio "punch" and "talk power," but wide bandwidth rigs just sound marvelous — assuming inclusion of a full range mike, naturally. Some lunchtime-type "napkin notes" should help clarify those statements.

Fig. 1 shows some approximate frequency response curves for Heil Sound's GoldLine, HC-5, and HC-4 mike elements (from top to bottom, respectively). The frequency response curve for an IF filter with a passband width of 2.2 kHz at its 6 dB points and 4.8 kHz at its 60 dB points is shown in

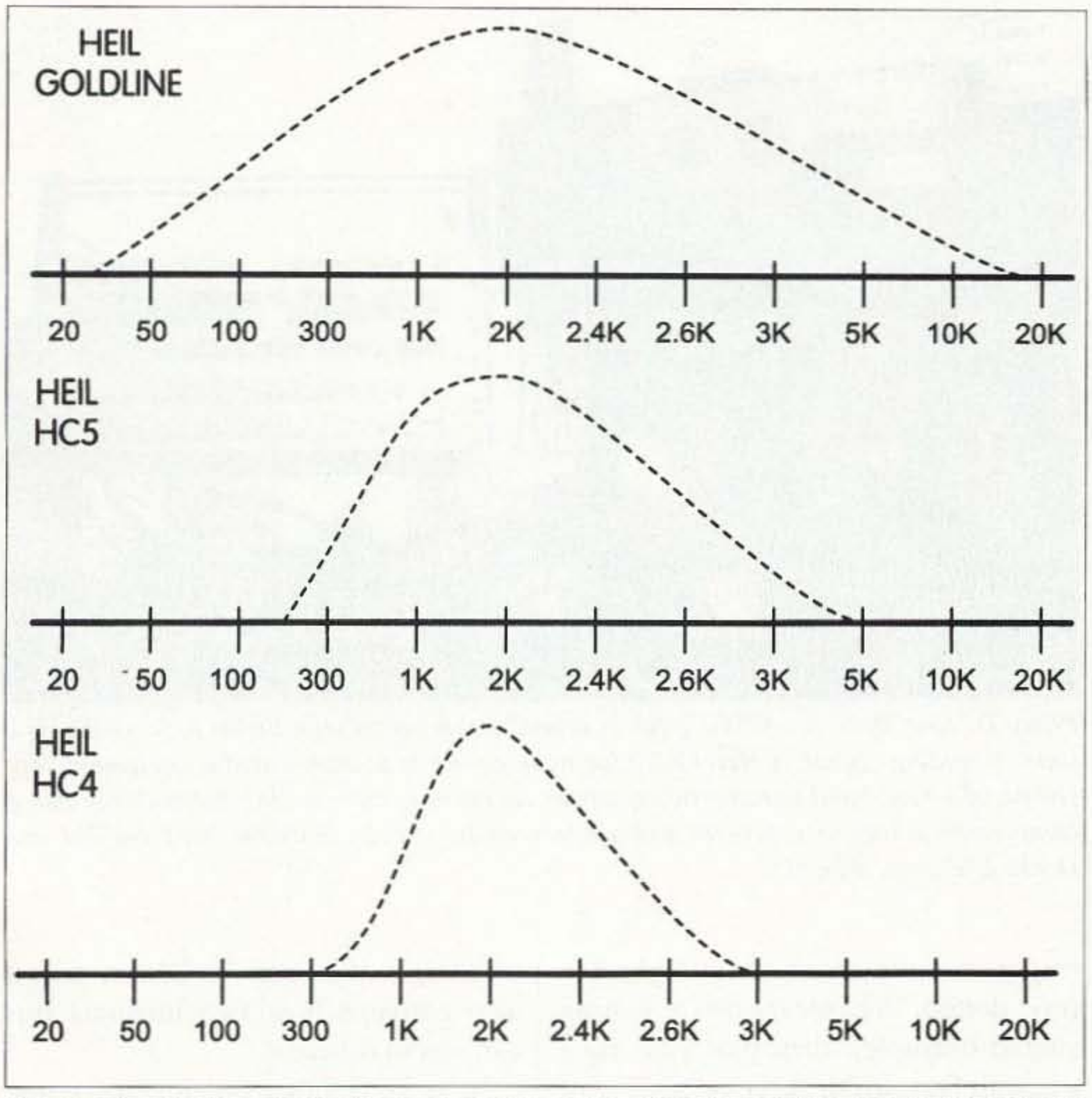

Fig. 1. *Graphical analysis of how response curves of various mikes and a transceiver's IF passband filter mate to produce an overall on-the-air sound favoring bass, treble, full range, and narrow range response. Explanation and discussion in text.*

Fig. 2. Above that response curve is a straight-line graph (no peaks or nulls) illustrating the full voice range of 20 Hz to 20 kHz. Plot your selected mike's

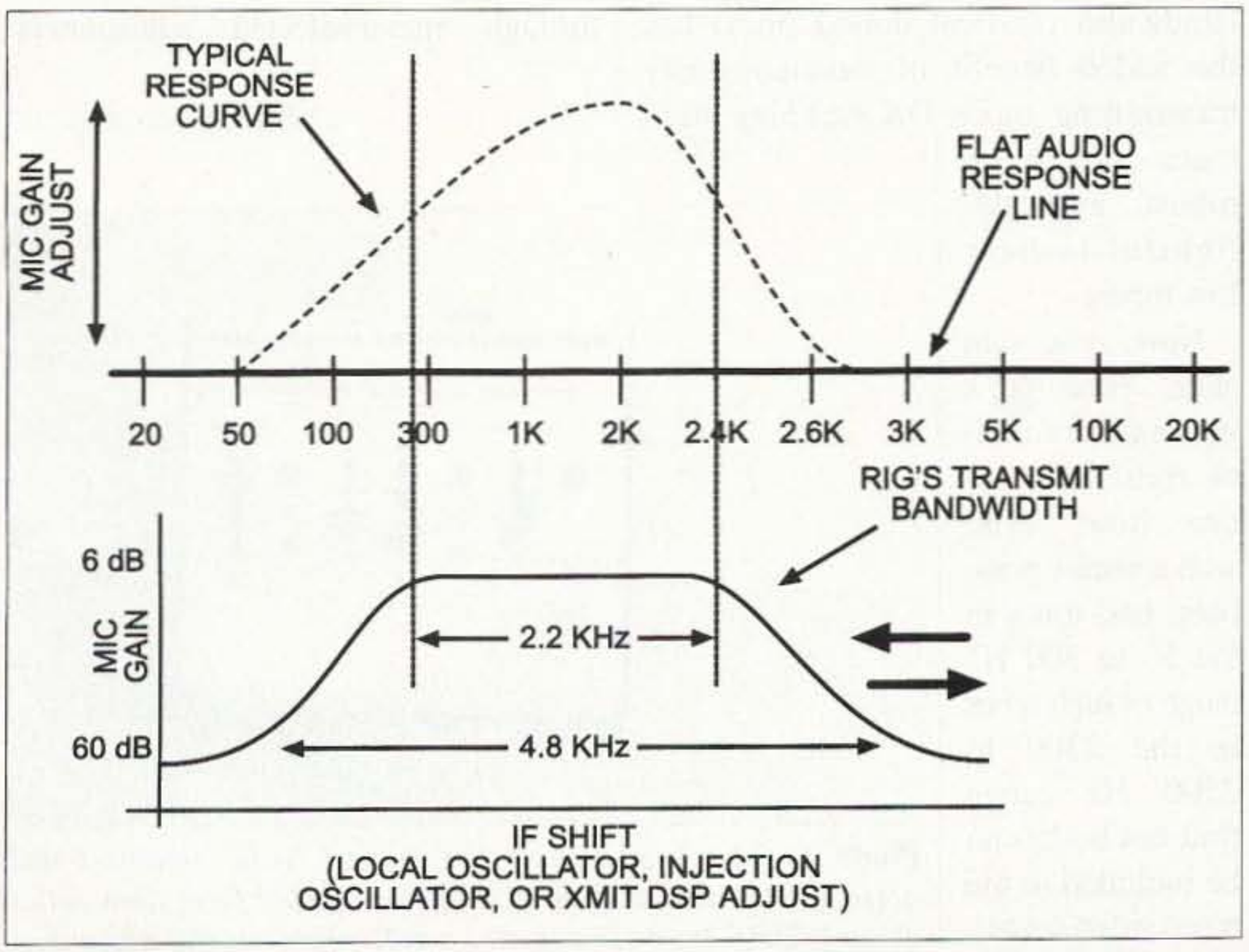

Fig. 2. *Observing how your mike's response curve and rig's transmit bandwidth work together.*

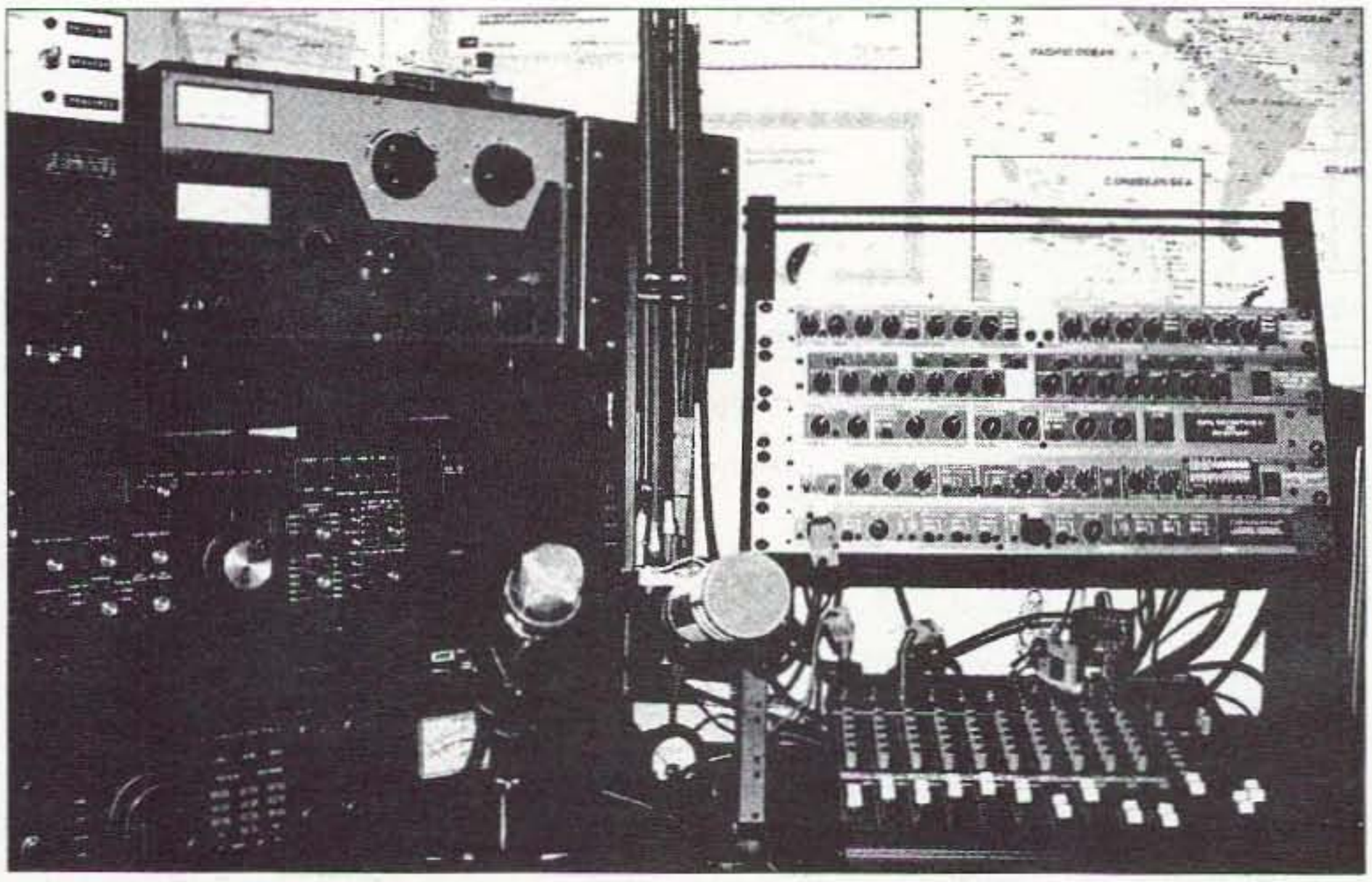

***Photo D.** John Basilotto W5GI gives us a peek at his secret ingredients for cooking up a super sounding signal. A Heil GoldLine mike connects to Aphex audio equipment consisting of a four-band parametric equalizer, an aural exciter, a "big bottom" booster, a compressor, a limiter, a reverb, and a mixer. Audio is then routed to his Icom 761 and Drake L4B amp. Whew!*

response curve above the straight line (my dotted line serves as a getting started example), then plot your rig's transmit bandwidth curve on a piece of clear plastic or wax paper to lay over it. By placing one curve (transmit) above or under the other (mike), you can see how the two work together, emphasizing some tones, dropping others, etc. You can also see that a 2.2 kHz bandwidth (vertical dotted lines) has the added benefit of simultaneously transmitting more DX-grabbing high tones and more robust and delightful-to-hear low tones.

Now, you can slide your rig's transmit curve left or right and notice how, even with a narrow passband, bass tones in the 50 to 300 Hz range or high tones in the 2200 to 2500 Hz range (but not both) can be included in the transmitted signal. That effect simulates adjustment of a rig's injection oscillator, and it also explains how two identical rigs can sound different.

Here is another interesting point. Newer transceivers have software/menu-adjustable injection oscillators. This feature is nominally called transmit equalization or transmit DSP, and gives you the ability to mate your rig's audio response with your mike and voice through menu-selected adjustments.

Continued on page 59

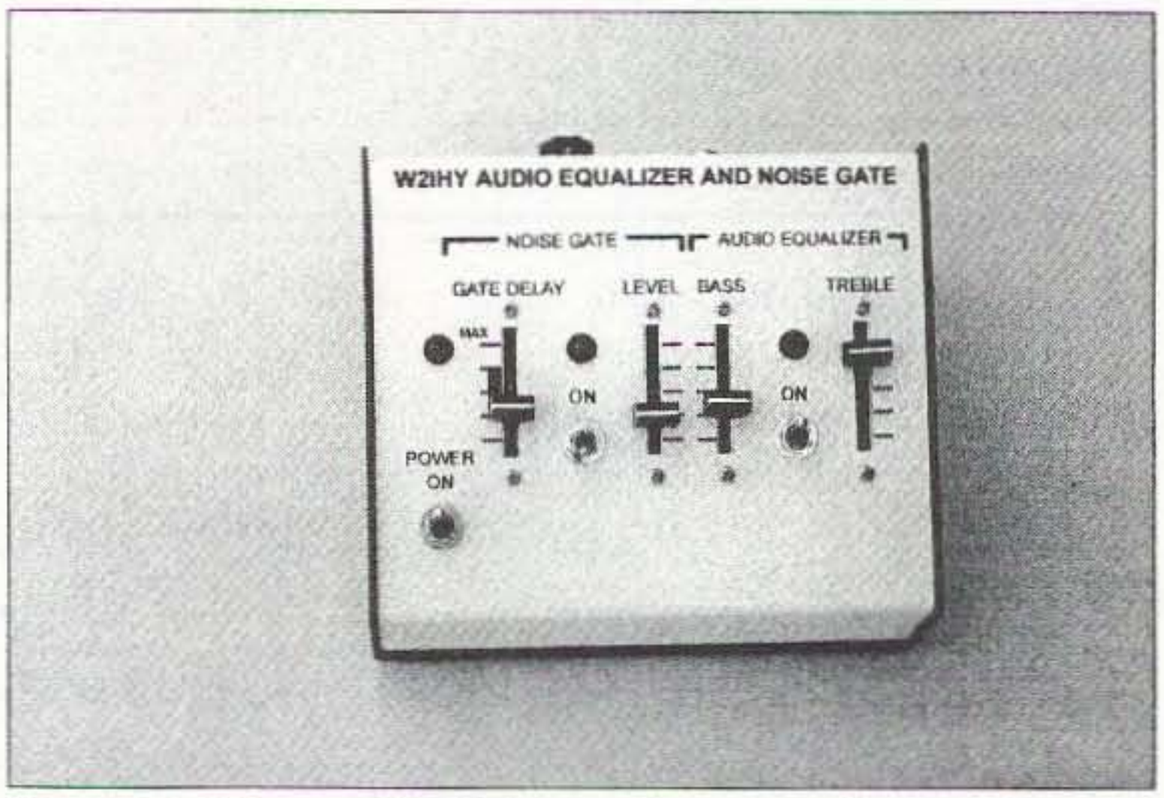

***Photo E.** This combination two-channel audio equalizer and noise gate is available in kit or preassembled form from Julius Jones W2IHY. It works with all 8-pin KenYaeCom rigs and mikes. Unit also works with Heil mikes and produces big-time sound at small-time cost.*

MFJ 24/12 Hour Clocks

Shown actual size

Dual 24/12 hour LCD Clock

MFJ-108B
$19.95 plus s&h

MFJ-108B dual clock has separate 24 hour and 12 hour displays. Lets you read both UTC and local time simultaneously. Features huge high-contrast 5/8 inch LCD numerals that makes it easy to read across the room. Mounted in solid brushed aluminum frame with sloped face for easy viewing. Synchronizable to WWV for split-second timing. Quartz controlled for excellent accuracy. Long life battery included. 4½Wx1D x2H in. MFJ's famous *No Matter What*™ one year limited warranty. *$6 s&h.*

DXer's Wall Clocks

MFJ-125, $29.95. 12 inch DXer's Quartz wall clock gives 24 hour time plus more. Has three smaller independently settable dials for 12 hour time, day of week and date. No more day/date confusion when logging DX! Highly visible, easy-to-read dials! Has Seconds hand.

MFJ-115, $24.95. Set this 24 hour clock to UTC/ GMT and you can determine the time in any time zone of the world at any time of the day. Premier world cities encircle its colorful world map face to indicate time zone. 12 inch face is easy to see across room. Has Seconds hand.

MFJ-105C, $19.95. *World's most popular ham radio wall clock!* True 24 hour Quartz movement. Huge 12 inch black face with large white numerals give excellent visibility across room. Attractive gold colored hour, minute and seconds hands.

MFJ-126, $24.95. 12 hour Quartz movement gives 12 hour time on inner dial (for XYL) and 1200 to 2400 hour time on its outer dial (for you). Attractive clean, white face is highly visible. Real glass cover! Handsome hunter green trim. Has seconds hand.

Hi-Contrast LCD Clocks

MFJ-119B, $49.95. Giant LCD Display 24/12 Hour Clock. Has *giant* see-across-the-shack 2¼ inch time digits. Digital calendar or clock modes. Displays inside temperature (F/C), relative humidity, month, date and day of week. Handsome hunter green and tan color. Wall mount. 8½x9 inches.

MFJ-118, $24.95. 24/12 hour clock has jumbo 1¼ inch LCD digits. Displays 24 or 12 hour time, year, month, date, and day of week. 100 year full calendar. Hang on wall or desk mount. 5¾Wx2½Hx½D in.

MFJ-107B, $9.95. 24 hour UTC Clock has large 5/8 inch LCD numerals. Synchronizable to WWV. Solid brushed aluminum frame lasts for years. Long life battery included. 2¼x1x2 in.

MFJ-112, $24.95. 24/12 Hour World Map LCD Clock displays time in *every time zone in the world*. Selected time zone flashes on LCD world map. Displays 24 or 12 hours, minutes, seconds, year, month, date, day, time zones, cities. Single button accesses pre-set second time zone. Alarms for two time zones. Adjusts for daylight savings time.

MFJ-152, $24.95. Read Indoor *and* Outdoor temperatures *and* 24/12 Hour time at-a-glance on huge 3/4 inch LCD digits! Choose F or C. Stores minimum and maximum temperature readings. Has backlight for in-the-dark viewing, outdoor temperature sensor with ten foot cable.

Bright LED Clocks

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Hugh Wells W6WTU
1411 18th St.
Manhattan Beach CA 90266-4025

Number 16 on your Feedback card

Salvage Special: TV/VCR Tuner Receiver

Watch the neighbor's curb for an old VCR!

Do you salvage old VCRs for parts? Ham experimenters are always looking for a challenging project, so let me describe one that I started which you may find interesting. This project appears to have a lot of promise, but will require some ingenuity to work out some details.

A ham friend mentioned that he was interested in building a receiver so that he could lie in bed at night and listen to TV audio. Of course, there are receivers available in addition to TV sets that do just that. Being a ham experimenter, my challenge was to construct a receiver from parts salvaged from an older VCR. The newer VCR tuners are digital, and that makes them difficult to use. The tuner and the video/sound IF system from a VCR were just what the doctor ordered to meet my friend's needs! Although I didn't use the power supply, it would have been a good choice because all of the necessary voltages would have been available. However, for this project, the size of the power supply was somewhat critical, so one was constructed from parts available from Radio Shack.

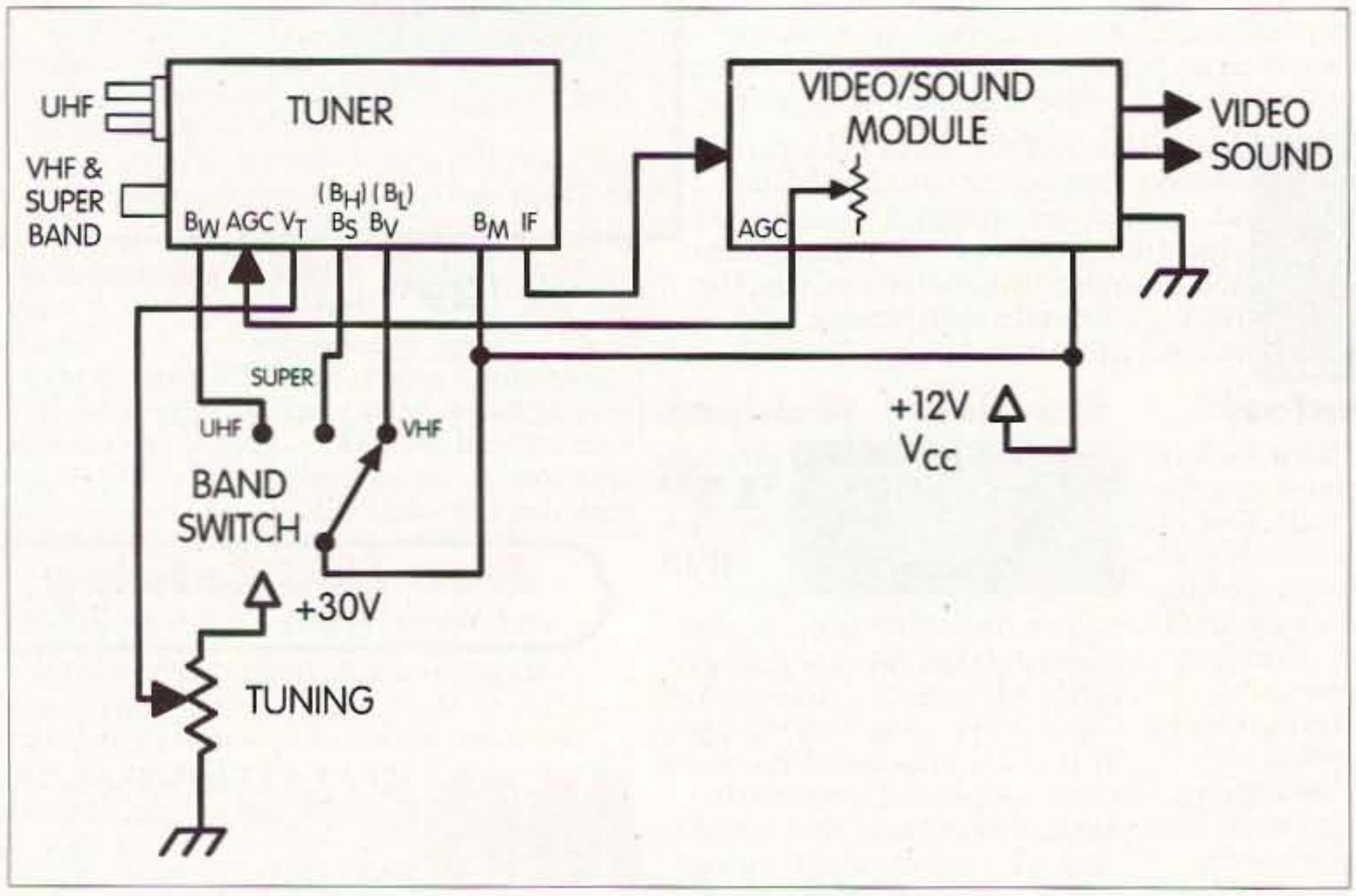


Fig. 1. *Simplified functional diagram of a typical VCR tuner and IF module system. The bandswitch and tuning pot were added for clarity.*

VCR receiver

Electronic TV/VCR tuners are capable of tuning a frequency band from about 50–900 MHz. A few frequency segments are skipped, but otherwise most tuners cover four ham bands, aircraft, part of the FM broadcast band, and some public service channels. The design of the tuner/IF system, as used in the VCR, monitors pretty much only the TV channels. Why? Modern TV and VCR receivers utilize a system called "intercarrier" to recover the audio signal from the received TV signal.

Taking a step backward for a moment, the sound and video signals are transmitted on their own carrier frequency, where they are separated by 4.5 MHz. In past years, two separate IF systems were used to accomplish the demodulation, and it was like having two independent receivers with the video operation at 45.75 MHz and the sound at 41.25 MHz. A single tuner was used, but the video and sound signals were kept apart and processed separately.

Later, an intercarrier system was

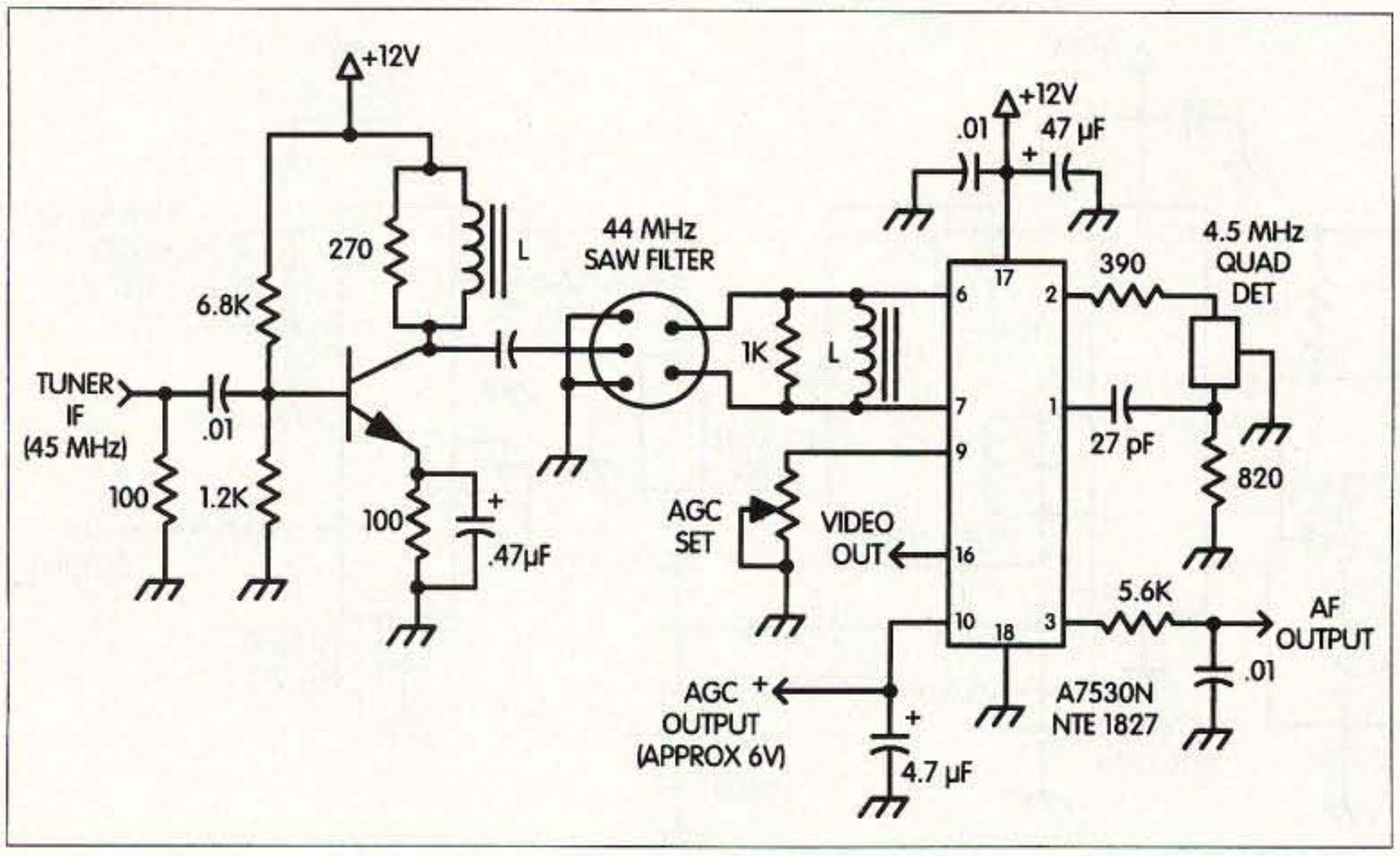


Fig. 2. Typical VCR single IC video and sound IF. The video output portion has been ignored.

developed to both simplify and reduce the parts count in the receiver. The sound IF at 41.25 MHz was dropped from the design; a simplified functional block diagram is shown in **Fig. 1**. Intercarrier refers to the use of a single IF at the output of the tuner that is then processed in support of the video, but has a bandwidth wide enough to pass the sound carrier. Toward the latter portion of the video IF, the sound at 4.5 MHz is split off and processed. The video carrier is AM (amplitude modulation) and is frequency stable, while the sound carrier is FM (frequency modulation).

Being stable, the video carrier is used as the "local oscillator" that is mixed with the FM sound carrier, creating an audio IF of precisely 4.5 MHz. Once separated from the video, the sound is processed and demodulated using a quadrature detector. **Figs. 2** and **3** show typical (but simplified) VCR IF systems.

The first, **Fig. 2**, shows how a single IC is used both for video and sound processing. **Table 1** lists a number of ICs that are also used in the type of circuit shown in **Fig. 2**, and is provided to help identify the correct module. **Fig. 3** shows a simplified, but typical, dual IC video and sound IF processor circuit. **Table 2** lists a number of ICs used in the dual IC configuration. NTE equivalent numbers are provided in the table listings where available, to aid in identifying IC pin functions. Whether one or two ICs are used, the IF system can be treated as one and the same when making up a receiver project. In most cases, the tuner and IF system can be salvaged as two modules. In some cases, the two modules are mounted on a common circuit board — and, they may, if desired, remain on the single board. Modifications will have to be made to the circuit traces on the board in order to apply the various required voltages.

As stated earlier, the original objective of the VCR circuit was to receive only TV video and sound. That means the audio can be recovered only as long as the video carrier is present to create the 4.5 MHz sound carrier. That makes the VCR receiver system a double conversion receiver. In order for the receiver project to support ham radio, it must be capable of monitoring signals in the ham bands that do not have a "video carrier" present to act as a local oscillator. For the receiver to "hear" the four (50, 146, 220, 450 MHz) ham bands and public service channels, a local oscillator must be added.

Local oscillator

In order to make the receiver function without the video carrier, a local oscillator must be provided and injected into the IF system as indicated in **Fig 4**. I've experimented with several methods for injecting the oscillator's

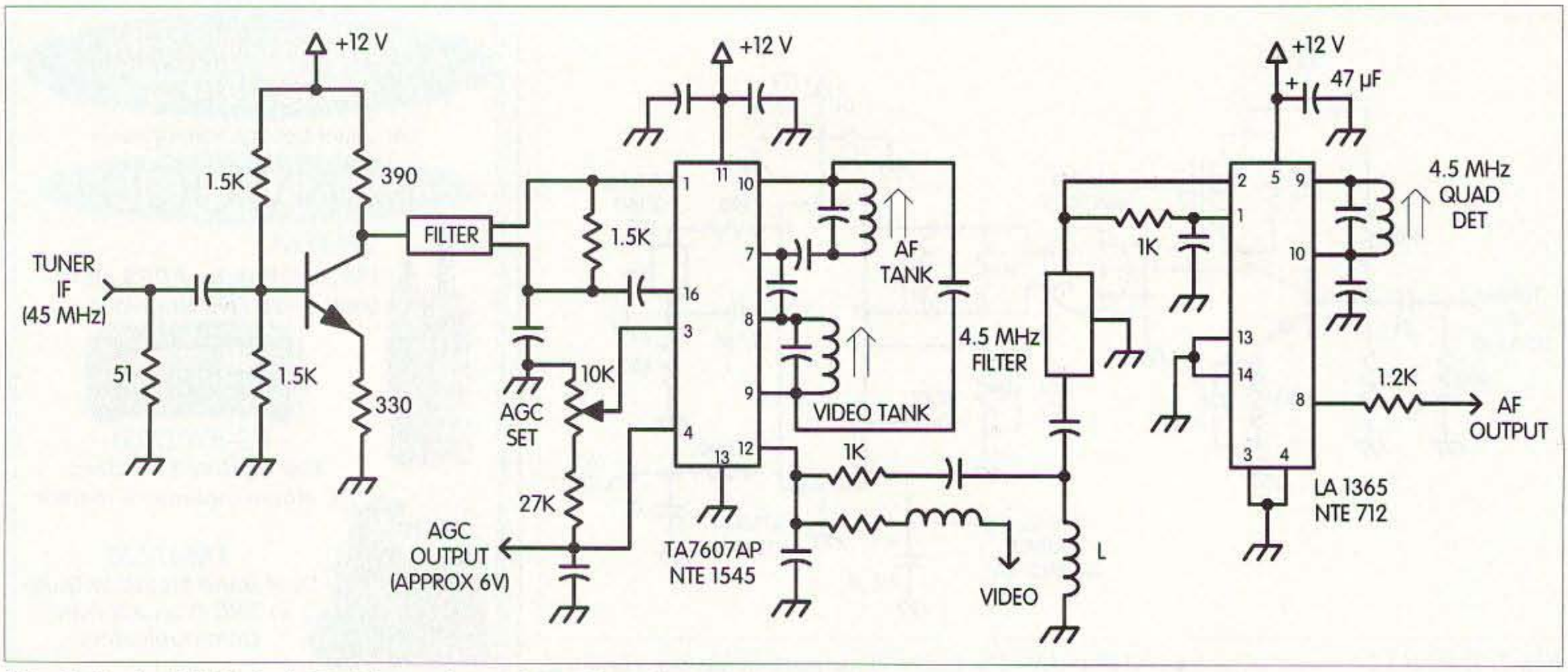


Fig. 3. *Typical VCR dual IC video and sound IF. The video output portion has been ignored.*

signal, but chose to perform the minimum amount of modification to the IF system. I suspect that there is a better way and place to inject the oscillator, but only further experimentation will provide the answers. Injecting the oscillator at the input of the SAW filter appears to work satisfactorily.

The new local oscillator must be offset from the tuner's IF by 4.5 MHz; the IF system was designed to accommodate a video signal at 45.75 MHz and a sound signal at 41.25 MHz. To accommodate that offset, I injected a 46 MHz signal during the experiment, but almost any signal frequency from about 44.5 to 47.5 MHz will work well, as the sound's quadrature detector will accommodate the shift without any degradation in performance.

I've shown the use of a common-base Colpitts oscillator as a suitable choice for this application. The crystal, series-resonant (typically a 3rd overtone), is placed in the base circuit to ground.

Specific circuit values will have to be worked out to accommodate the parts available from your junk box. When the oscillator is in operation, the injection level of the signal appears to have a minimum threshold level of about 25 mV, with a maximum level at about 150 mV. I used 75 mV in my tests, so a means for controlling the injection amplitude may be required. I was successful in using a 1–30 pF compression padding capacitor for controlling the injection level. Adjustment of the injection is done with a known ham band signal being present, and the capacitor is adjusted for maximum recovered audio. At that point the padding capacitor may be fully compressed. No further adjustment is then required.

A switch is used in the 12 V supply line to the oscillator so that it may be disabled whenever TV audio is being received.

IC P/N	NTE Equiv.
A7530N	1827
AN5111	1440
AN5176K	--
KA2919	1728
KA2923	1827
LA7502	15001
LA7520	1728
LA7530	1827
LA7550N	--
LA7575	--
M52354	1656
M51356P	1656
M51362SP	--
M51365	7015
TA7678AP	--
TA7680	1572
TA7681	1570
TAB677N	--

Table 1. *Typical ICs used in a VCR's* single *IC video and sound IF. This listing is provided to help identify a video/sound module.*

Audio amplifier

Since the salvaged IF system may not have an audio amplifier included, I'm suggesting one that will work with this tuner receiver project. A single LM386 audio IC, as shown in **Fig. 5**, or an LM380, will work well in this application. The circuit shown will drive either a speaker or a set of headphones to an adequate level.

Because the audio obtained from the IF system has no de-emphasis, a de-emphasis circuit should be added. Although it's OK to operate without de-emphasis, the hiss level may be a little hard to handle over a long period of time. Rolling off the high frequency portion of the hiss with an RC network makes the noise more tolerable. There is no squelch circuit in the VCR IF system, but you can build one if you desire.

I chose the de-emphasis network values to roll off the hiss to meet my hearing needs and for listening to voice modulated signals. If the receive system is used for listening to TV or

VIF	NTE Equiv.
AM167013A	749
AN5111	1440
HA11215A	1469
TA7607AP	1545
TA7644BP/AP	--
UPC1366	1522
SIF	**NTE Equiv.**
AM167001A	712
AN5215	1234
AN5250	1404
GL3201	712
HA1124	712
HA11229	1575
KA2101	712
LA1365	712
LM3065N	712
LSC1008P	712
M51173P	--
TA7337P	--
TBA120AS	1292
UPC1391H	1668
UPC575C2	1140

Table 2. *Typical ICs used in a VCR* dual *IC video and sound IF. IC listing is provided to help identify a video/sound module.*

FM audio, then some experimentation with the de-emphasis circuit values may be desired to adjust the audio passband in support of music. Reducing the 0.01 µF capacitor values to 0.005 µF may satisfy your desire.

Power supply

Power requirements for the receiver system project are really minimal, but the voltages need to be stabilized. A suitable power supply for the tuner receiver project is shown in **Fig. 6**.

Specifically, the tuning voltage requires regulation to prevent it from wandering around. When setting the maximum tuning voltage, the target value is 30 volts, but that may not always be achieved, and a value of 28-29 volts is acceptable. The final voltage is determined by raising the regulator's output (using the VOLTAGE SET pot) to maximum and then backing it down slightly to bring the output under regulator control. Regulation is uncertain at the maximum value because of the loss in regulator headroom, but pulling it down slightly allows the regulator to function properly.

Because of the low current being drawn by the receiver system, no heat sinking of the regulators is required. If desired, the regulators may stand vertical on a PC board, or be laid flat against the board.

Circuit notes

Fig. 1 shows the requirements for enabling the tuner so that it will cover

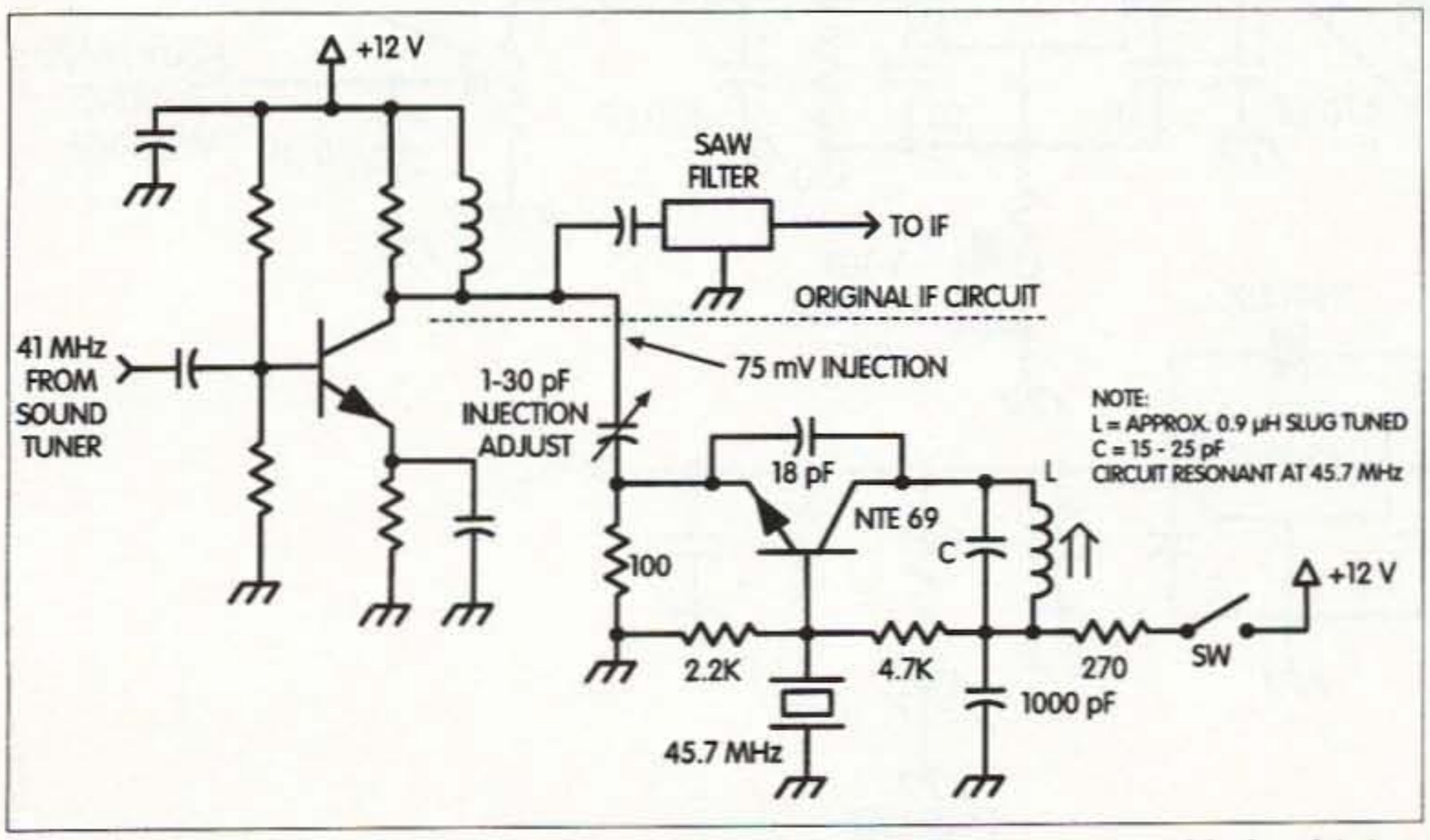


Fig. 4. *Suggested local oscillator to be added for signal injection. Variable level injection is used for best conversion. A switch is used to enable/disable the oscillator.*

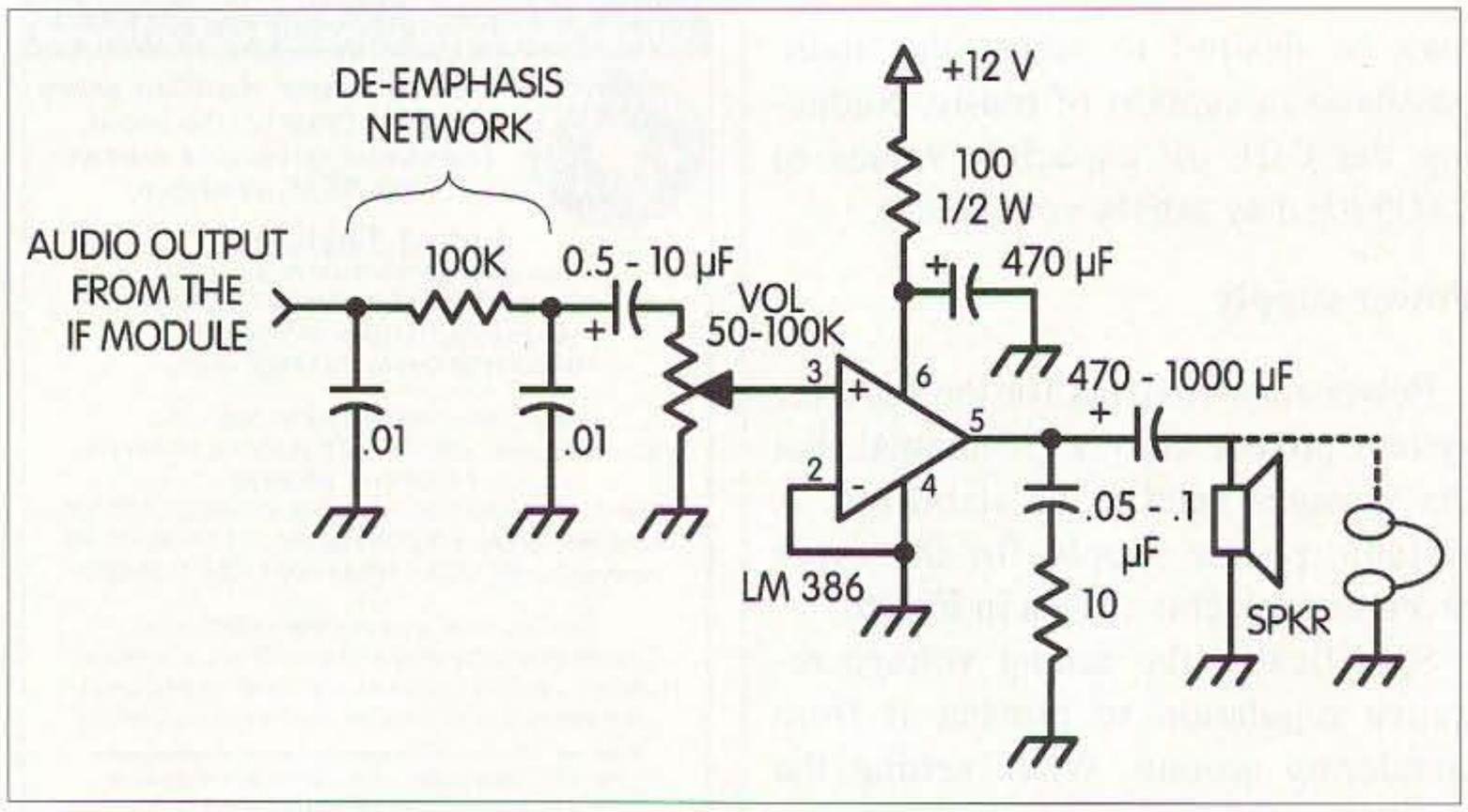


Fig. 5. A suitable audio amplifier to be used with the VCR sound IF, which can drive either headphones or a small speaker.

the available bands using a bandswitch that puts +12 V onto the band select pin of the tuner.

Fig. 6 shows how the tuning voltage line is to be controlled with a multiturn pot. A small value pot is connected in series with the tuning voltage pot that will function as a fine-tuning control. This pot is set normally to its center position and then rocked back and forth for a fine tuning adjustment. As an alternative method, a pot may be used to control a small voltage (typically 2 volts maximum) applied to the AFC terminal.

Tuning TV audio signals is very easy with the tuning pot, but hams and public service present a narrow tuning target and require the use of a fine tuning control.

All tuners require an AGC voltage in the range of +6 to +7 volts. The desired voltage may be obtained from the AGC pot located within the IF module, as is done in the VCR configuration, or the AGC voltage may be obtained from a pot dividing the +12 volts. If the latter is chosen, the pot value may be 10k and it will also function as an RF gain control.

The antenna input impedance for the tuner may at first appear confusing, but a 52 ohm transmission line works well with TV/VCR tuners. When connecting to the UHF input, tie one pin to ground and connect the other to the center of the coax connector. Each of the antenna inputs will require a suitable antenna for the frequency band to be covered. A suitable antenna may be connected to the respective input because the bandswitch will enable the antenna input as required by the tuner.

Performance

To gain an understanding of the tuner-receiver's sensitivity, I measured the input sensitivity while operating in the 450 MHz ham band and found it to be approximately 10 µV to achieve background noise quieting. Even at 10 µV, ham repeaters located many miles away provided quieting signals. When used as a TV audio receiver, the performance is as desired, but when monitoring the narrow deviation as used in the ham and public service bands, the recovered audio amplitude appears to be a little on the low side. More audio amplification may help resolve that issue.

Continued on page 59

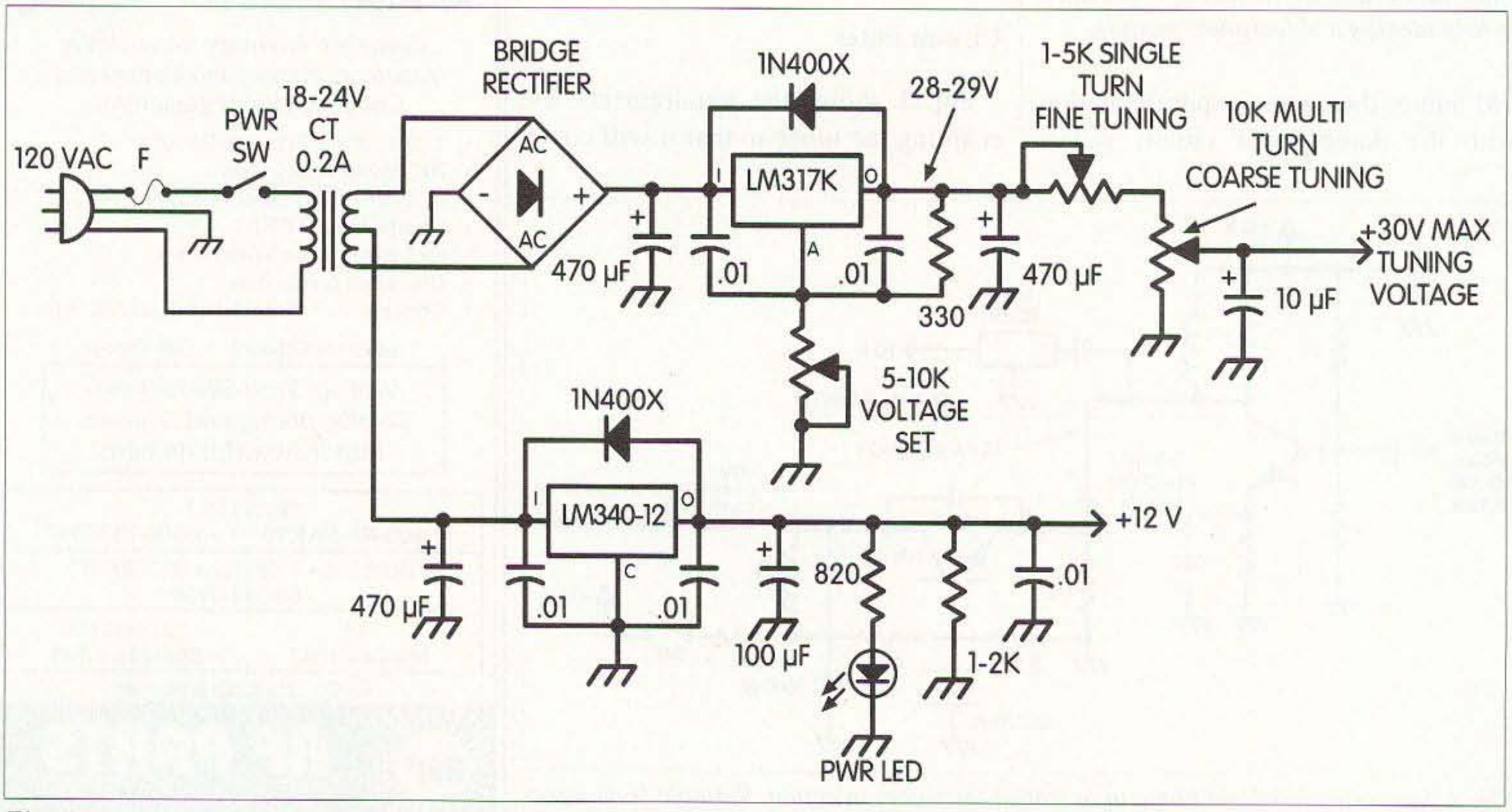


Fig. 6. A suggested power supply for powering a tuner and IF module.

Art Housholder K9TRG
700 Wellington
Elk Grove IL 60007

Number 21 on your Feedback card

The Care and Feeding of NiCds

Some clever tips for long life, plus a neat home-brew charger.

In today's world of rechargeable lithium-ion, nickel metal hydride, and renewable alkaline batteries, traditional nickel cadmiums may still be your most logical and cost-effective choice. Here, long-time battery wizard K9TRG explains some ground floor facts and offers up an easy-brew charger for these gems.

There has been *much* misleading information about NiCds. First of all, memory in most *modern NiCds* is almost nonexistent today. Much has been written about completely discharging NiCds before recharging them. If a NiCd cell is discharged much below the standard test voltage of 1 or 1.1 volts per cell, you stand a good chance of permanent cell reversal and loss of cells.

Some electronic devices have a low voltage cutoff circuit that is supposed to stop the complete depletion of the battery. It's possible that this is what was meant by completely discharging the battery before recharging. The statement is misleading, as it is wrong to allow a NiCd battery discharge to even near *zero volts* per cell.

The standard test for NiCd cells is capacity in mA, times one hour. Thus, a 450 mA cell or battery should deliver 450 mA for 60 minutes before it drops below 1.1 volts per cell.

It is difficult to have long battery life with quick or rapid charging. Heat is the enemy of any type of battery. Rapid charge batteries use several methods to prevent overheating and are only partially successful.

The charger circuit I would like to show here will solve several problems. First, it is inexpensive, simple, and has only a few parts. Secondly, you will have *some* fast charge capability, but more important, you will be able to leave the charger on forever, with no overcharging. This design has been used for 15 years on some batteries, and they are still going strong. A view of the charger's PC board assembled and ready for use is shown in **Photo A**. A view of the PC board (only) is in **Photo B**, and its circuit diagram is in **Fig. 1**.

We take advantage of some fixed assets in this design, for cost, simplicity, and safety. Select your power transformer keeping the following in mind: NiCds should be charged at 10 percent of their rated capacity. A 450 mA battery should be initially charged at *approximately* 45 mA, so a 50–75 mA transformer is acceptable. This is one of the fixed assets, to prevent battery overcharging.

As for the AC output voltage, select a transformer with a voltage rating about 1.4 times the desired DC voltage, plus .75 volts for each of the 2 diodes and regulator. If, for example, you want to charge a 12 volt battery pack, the AC RMS voltage should be about 19 volts. Any more, and you will

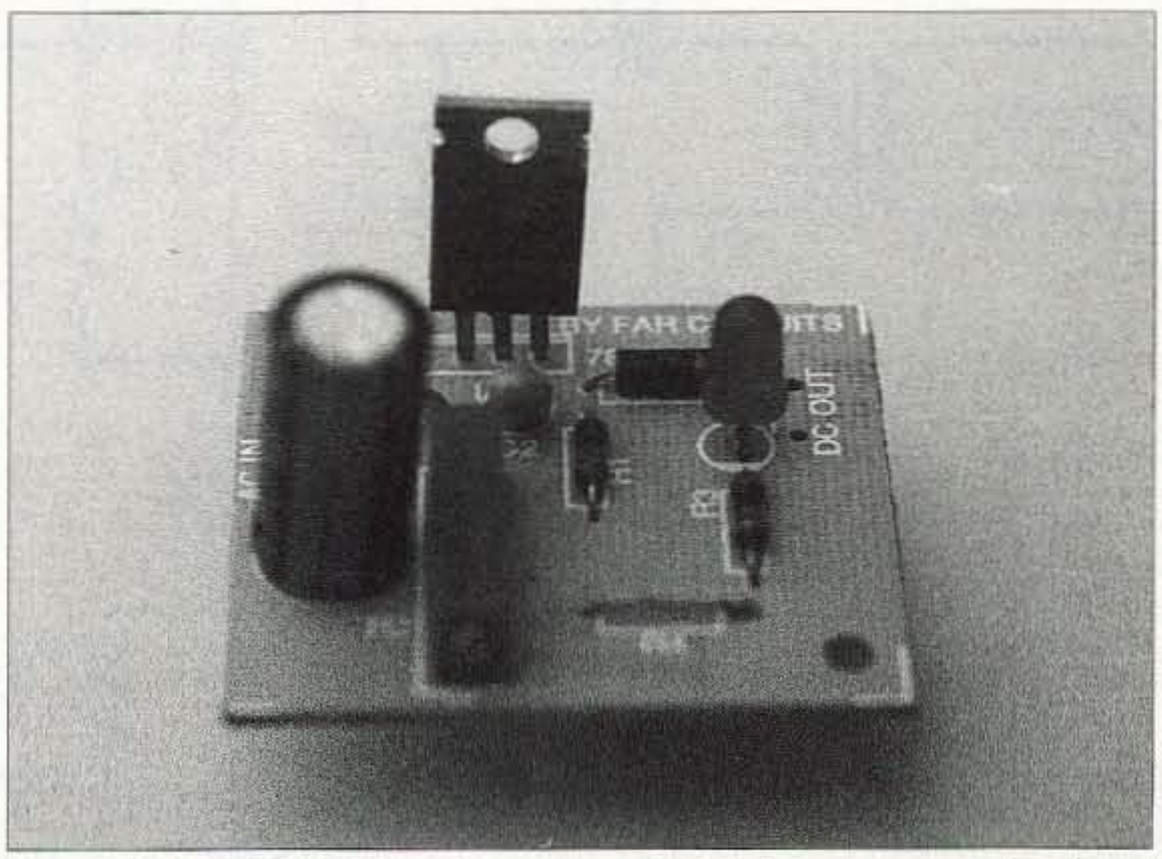


Photo A. *The K9TRG multipurpose NiCd charger assembled and ready for interconnection to an external transformer, as discussed in text. Board is only 1.5 inches square. Photo by K4TWJ.*

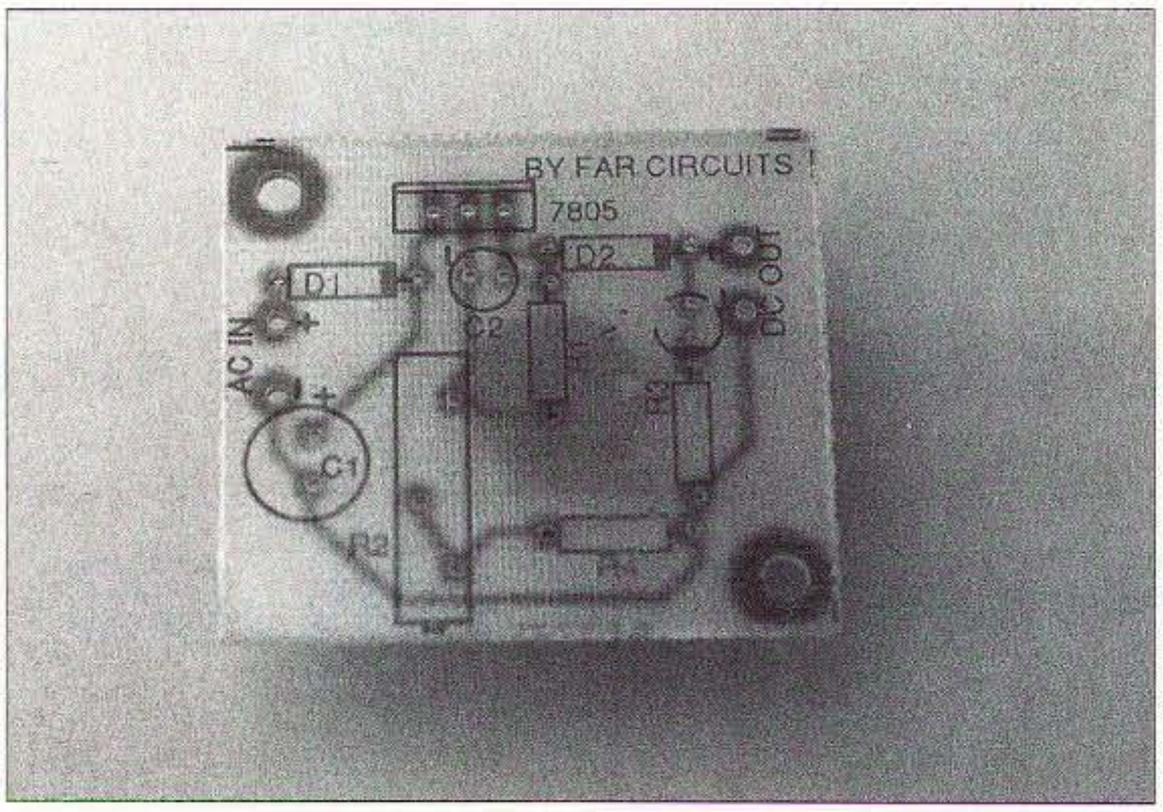


Photo B. *FAR Circuits' PC board of the K9TRG multipurpose NiCd charger is pre-drilled and silk-screened, with a parts placement guide for easy and foolproof home assembly. Photo by K4TWJ.*

have excessive heat to dissipate; any less, and you will not have enough voltage to reach the full rated charge current. The excess heat is not a problem for the regulator, provided you use the proper heat sink. Wall transformers are a good choice, as they are plentiful and inexpensive at hamfests.

The next fixed asset we take advantage of is the 7805 regulator. It is rated at 1 amp if properly heat sinked, but more importantly, it has thermal limiting. The 7805 regulator is normally fixed at 5 volts; however, with 2 extra resistors it can be configured for any output voltage from 5 to 30 volts.

To describe the circuit and the built-in safety features we mentioned earlier, we use the current limiting of the transformer as part of the method to avoid overcharging the battery. The fixed asset of the 7805 voltage regulator is its internal thermal overload protection. Unless you are charging high current batteries (that need over 200 mA), we recommend you delete the heat sink. The regulator will pass 100–200 mA with out it for some time and will shut down automatically if you accidentally draw more current for some period of time. This *also* protects the battery from overcharge.

D1–D2 can be almost any silicon diodes; 1N4001s should work well here, as they are rated at 1 amp and have a PIV of 50 volts. For the 10 cells used for this article, R1 is 1000 ohms and R2 is a 1000 ohm, 15-turn Radio Shack pot for easy vernier fine tuning. R2 ideally should be closer to 1500 ohms, but is not easily available; add 1-2-300 ohms for more R4 if a little more output voltage is required. Be sure to place a jumper in its place if you use the FAR Circuits PC board, and do not use the extra resistor. R3 is 1000 ohms and D3 is an LED to indicate power; both may be deleted if desired. C2 is a 2.2 µF. tantalum, C1 is 470 µF, and both can be rated at 25 to 50 volts. D2 prevents a back voltage of the battery from destroying the regulator. Charging *voltage* for *NiCds* should be about 1.4 to 1.45 volts per cell at full charge, or approximately 10 x 1.43 = 14.30 *volts* for a battery pack. NiCds like some AC component in their charging. In fact, some inexpensive chargers use 115 volts AC from the line with a current limiting resistor, or pilot light, and a diode, period.

Now we need a little patience to adjust *properly*. Set R2 to maximum voltage, and monitor the charge *current*. Adjust R2 for about 10 percent of the rated capacity of the battery or pack. Leave this setting for 24 hours. Then *slowly* adjust R2 so that the charge current is about 1 or 2 percent of the battery capacity; the charge voltage should be about 14.32 volts. Leave this set for another day or so, then reset R2,

Continued on page 60

Parts List		
Name	**RS No.**	**Cost**
D1, D2	276-1101 or 276-1102	2 for $.49
D3	276-026	2 for $1.29
C1	272-1030	$.99 ea.
C2	272-1435B	$.69 ea.
7805	276-1770	$1.19 ea.
R1, R3	271-1321	4 for $.49
R2	271-342	$1.49 ea.
PCB	Far Circuits, 18N640 Field Court, Dundee IL 60118; fax (847) 836-9148; $3.00 ea.	

Table 1. *Parts list.*

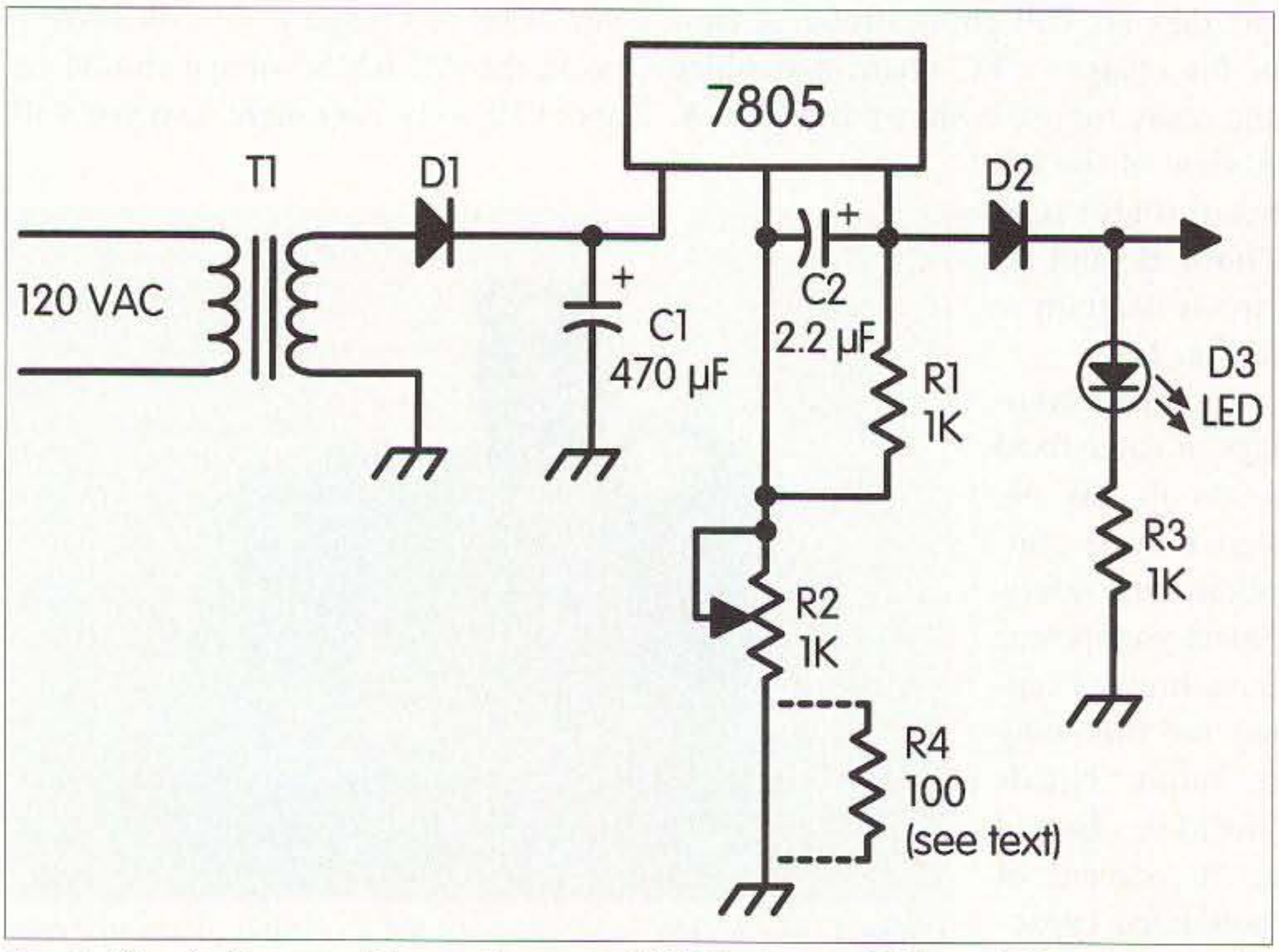


Fig. 1. *Circuit diagram of the multipurpose K9TRG charger. PC boards for easy assembly available from FAR Circuits.*

John A. Kuecken KE2QJ
2 Round Trail Drive
Pittsford NY 14534

Number 23 on your Feedback card

Secrets of Transmission Lines

Part 7: Impedance matching.

In the previous chapter, we saw that a mismatched line can be corrected by placing a stub at the appropriate point on a transmission line. In this, the last chapter of the series, we will be looking at some techniques for impedance matching.

The use of stubs for matching is generally confined to UHF and microwave frequencies. At 2 MHz, a quarter-wave stub is 123 feet long in air dielectric line, and 80 feet long in polyethylene insulated line. A lumped parameter circuit, coils and capacitors, would be more convenient and probably cheaper at these frequencies.

We also saw that it is frequently convenient to use admittance parameters, as well as the use of the Smith Chart, in transforming impedance to admittance and vice versa. The program in **Table 1**, written in BASIC, is a quick way to perform the inversion. Note that the two circuits may be equivalent, but they can have very different values. Let us assume a frequency of 4 MHz. Suppose that we measure an impedance of 40 + j60 ohms. This is a 40 ohm resistor in series with a 23.9 µH inductor. Transforming this to admittance, we obtain 7.69 - j11.5 mmho, which is a 130 ohm resistor in parallel with a 34.6 µH inductor. Note that both the resistor and inductor values have changed significantly. While the component values have changed significantly, both circuits have the same power factor and phase angle. If concealed inside a box with only the two terminals brought out, it would be impossible to distinguish the circuits if measurements were made only at 4 MHz. Of course, measurements at other frequencies would permit distinction.

The transmission line equations

With the wide availability of personal computers, the most common means of solving the transmission line equation is by computer rather than

```
10 '%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
20  '                    Y/Z INVERSION
30  '                 BY JACK KEUCKEN
40  '                       03/16/95
50 '%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
60  CLS
70  INPUT "IS INPUT DATA Z OR Y?";A$
80  IF A$ = "Y" GOTO 300
81  IF A$ = "y" GOTO 300
90  INPUT "ENTER R";R
100 INPUT "ENTER X";X
110 DEN = ((R*R)+(X*X))
120 G = R/DEN
130 B = -X/DEN
140 PRINT "ADMITTANCE IS";G;"+J";B;" "
150 INPUT "PRESS ANY KEY TO CONTINUE";B$
160 GOTO 60
290 '%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
291 '              Y TO Z TRANSFORMATION
300 INPUT "ENTER CONDUCTANCE IN MHOS";G
310 INPUT "ENTER SUSCEPTANCE IN MHOS";B
320 DENY = ((G*G)+(B*B))
330 R = G/DENY
340 X = -B/DENY
360 PRINT "IMPEDANCE IS";R;"+J";X;" "
370 INPUT "PRESS ANY KEY TO CONTINUE";B$
```

Table 1. *Y/Z inversion program in GWBASIC.*

graphically on the Smith Chart . The program in **Table 2**, also written in BASIC, is a means of solving the transmission line equations. Lines 200 and 210 are included to prevent division-by-zero errors. The program asks for the line Zo and defaults to 50 ohms if none is entered. The line electrical length is called for in wavelengths. This permits one to work in either feet or meters. Conventionally, wavelengths are given in meters; however, you may work wavelengths in feet if you choose. The length must be corrected for the velocity of propagation on the line.

$\lambda = 300/F$ meters
eqn (7-1)

where
λ = wavelength
F = frequency in MHz

For example, let us assume that we have a Teflon-insulated cable that is 2.5 meters (8.2 feet) long. (To convert meters to feet, multiply by 3.28.) At 10 MHz, λ = 300/10 =30 meters. The cable electrical length is 2.5/(30*.65) = 0.128 wavelengths. Teflon cable has a Vp of .65. You can look up the cable Vp in the manufacturer's data or a handbook.

For another example, let us consider in **Table 3** the results for a transmission line with an electrical length of 2.5 meters at a variety of frequencies terminated in a 10 ohm resistor.

The Smith Chart illustration in **Fig. 1** shows this data and tells us why the Smith Chart has hung on in popularity. I doubt that there are more than three people in the world who could look at these data columns and realize by inspection that they represent a 5:1 VSWR circle. On the other hand, it is pretty obvious from the Smith Chart figure that the data path is concentric about the center of the chart.

Notice that the electrical lengths listed are all positive and go toward the generator. If you enter any of the R and X values along with the negative of the electrical length, you will get back to the 10 + j0 with some small truncation errors.

The fact that the chart spirals clockwise with increasing frequency is not to be neglected either. If your data ever shows a counterclockwise spiral with increasing frequency over any significant span, there is something dreadfully wrong with your measurements. For this to happen, we would have to have inductors whose reactance decreases with increasing frequency, and capacitors whose reactance increases with increasing frequency .

Note that a terminating load that is purely resistive will have a constant VSWR with changing frequency; however, a termination with a reactive part will have a VSWR that varies with frequency. For example, a termination with a series inductor that measured 10 + j10 ohms at 10 MHz would look like 10 + j20 at 20 MHz and 10 + j30 at 30 MHz. Obviously, the VSWR is increasing with increasing frequency. By a similar token, a termination with a series capacitor would have a VSWR that decreased with decreasing frequency

You will frequently use negative line lengths with this program, since the more common case is that you have the impedance bridge and signal generator on the ground and the antenna

```
100 REM*****************************************************************
110  REM                    TRANSMISSION LINE EQUATIONS
120  REM                          BY JACK KEUCKEN
130  REM                              09/12/97
140 REM*****************************************************************
150  CLS
160  PI = 3.14159265#
170  INPUT "ENTER LINE Z0";Z0
171  IF Z0 = 0 THEN Z0 = 50
180  INPUT "ENTER  REAL PART OF LOAD";ZR
190  INPUT "ENTER IMAGINARY PART OF LOAD";ZI
200  IF ZR = 0 THEN ZR = .000001
210  IF ZI = 0 THEN ZI = .000001
220  INPUT "ENTER LINE LENGTH IN WAVELENGTHS";BL
230  PRINT "A LINE OF";Z0;"OHMS WITH AN ELECTRICAL LENGTH OF";BL;
"WAVELENGTHS"
240  IF ZI<0 THEN J$ = "-J" ELSE J$ = "+J"
250  PRINT "TERMINATED IN A LOAD OF";ZR;J$;ABS(ZI);"OHMS"
260  BL = 2*PI*BL: REM CONVERT TO RADIANS
270 REM*****************************************************************
280  REM                          THE CALCULATION
290  AN = TAN(BL)
300  ZI2 = Z0*AN
310  IMN = ZI+ZI2
320  NUM = SQR((ZR*ZR)+(IMN*IMN))
330  RED = Z0-(ZI*AN)
340  IMD = ZR*AN
350  DEN = SQR((RED*RED)+(IMD*IMD))
360  PHNUM = ATN(ZR/IMN)
370  PHDEN = ATN(RED/IMD)
380  MAG = NUM/DEN
390  ZS1 = Z0*MAG
400  PH = -(PHNUM-PHDEN)
410  RZS = ZS1*COS(PH)
420  IZS = ZS1*SIN(PH)
490  IF IZS<1 THEN J$ = "-J" ELSE J$ = "+J"
500  PRINT "THE INPUT IMPEDANCE IS";RZS;J$;ABS(IZS);"OHMS"
510  V1 = Z0-ZR
520  V2 = SQR((V1*V1)+(ZI*ZI))
530  V3 = Z0+ZR
540  V4 = SQR((V3*V3)+(ZI*ZI))
550  V5 = V2/V4
560  PRINT "THIS CORRESPONDS TO A VSWR OF";((1+V5)/(1-V5))
570  STOP

2200  RUN
```

Table 2. *Transmission line equations program in GWBASIC.*

f (MHz)	Len. el.	R	x
10	0.0833	13.2	+j 27.3
20	0.167	35.9	+j 74.5
30	0.25	250	+j 0
40	0.33	35.9	–j 74.5
50	0.417	13.1	–j 27.2
60	0.5	9.98	–j 0

Table 3. *Data for a transmission line with an electrical length of 2.5 meters.*

will be in the air at the other end of a transmission line. You insert a negative line length to rotate the impedance back to the antenna so that you can see what it takes to match the antenna.

Sometimes you have the situation where you have an impedance measurement and you would like to know the VSWR. This can be done graphically on the Smith Chart, or you can use the computer program with a very small line length — like 0.000001 wavelength.

The right place for matching

The very best place for impedance matching is always right at the discontinuity. There are three reasons for this:

1. The longer the transmission line, the more the data are smeared out by the transmission line effect. If the impedance is matched right at the discontinuity, it will nearly always have the maximum matched bandwidth.

2. High VSWRs de-rate the cable.

3. Line loss effects are multiplied on the mismatched line.

Let us address ourselves to the latter two effects. The actual solutions to the transmission line equations with real lossy transmission line is another order of magnitude more sophisticated and will not be tackled here. However, from some simpler considerations we can begin to make an estimate.

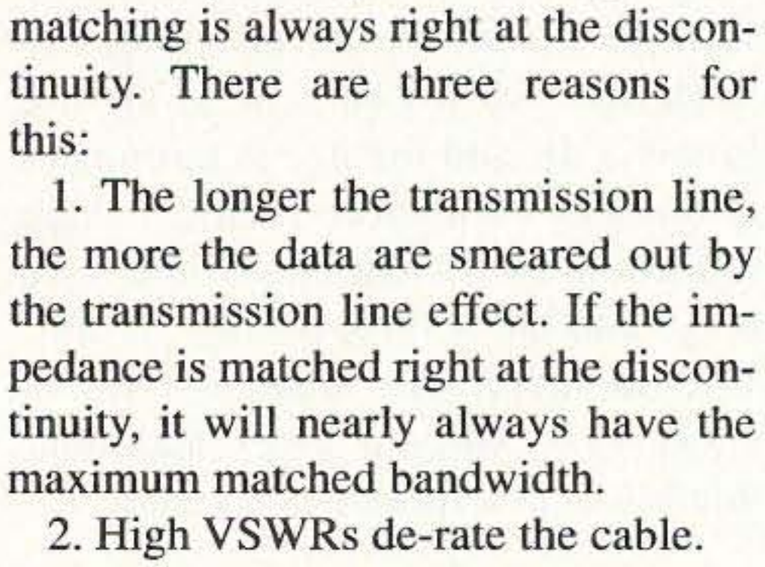


Fig. 1. *This Smith Chart shows a 5:1 VSWR circle.*

We can begin by considering point 2 above. Let us presume that we have 1,000 watts and that we have a lossless antenna coupler or transmitter tank circuit. On a matched 50 ohm termination, our hundred watts would require:

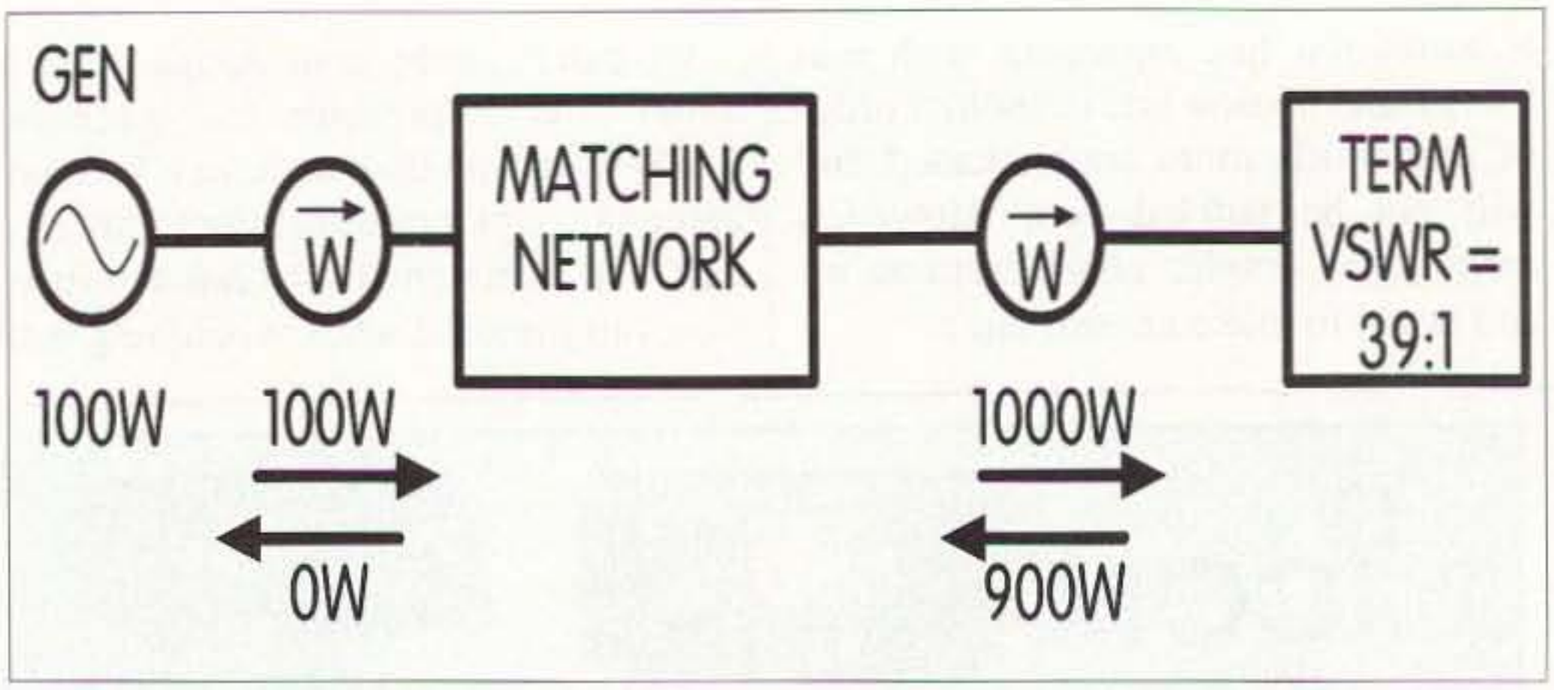


Fig. 2. Voltage multiplication by standing waves.

1,000 watts = (V*V)/50 = 223.61 VRMS = 316.23 V peak

We saw that a 5:1 VSWR will give a peak resistance of 250 ohms. Then:

1,000 watts = (V*V)/250 = 500 VRMS = 707 V peak

The voltage and current are both increased by the square root of the VSWR. At 1,000 watts input, the current is increased from 4.47 amperes to 10 amperes by the 5:1 VSWR.

The peak voltage is of interest since this is what causes arcing. Conversely, the current-induced breakdown is caused by thermal effects, so the RMS values are of interest.

In a case that can easily arise, a centerfed half-wave dipole cut for 80 meters becomes a centerfed full-wave dipole on 40 meters. This is actually a very effective antenna because it acts as two half-waves in phase, and has significantly higher gain than a half-wave. The impedance at the center of this antenna on 40 meters is typically about 2,000 ohms. This is a VSWR of 40:1; the peak voltage for a kilowatt is multiplied up to 2,000 V peak, and the current to 28.27 amperes RMS. The VSWR has multiplied the voltage and current from levels that are easily handled on RG-58U cable and BNC connectors to values that will almost certainly destroy them. An open wire or ladderline of 300 or 400 ohms impedance could be used here. The VSWR and the losses are both lower.

To drive this point home a bit more, let us examine a case similar to the 80/40 meter dipole. In **Fig. 2** we see a generator, a directional wattmeter, a lossless matching network and another directional wattmeter, and a termination with a 39:1 VSWR. For a 39:1 VSWR, the reflection coefficient is 95%, which says that the forward power to backward power is in a 10:9 ratio. In order for the load to dissipate 100 watts, the forward power must be 1,000 watts and the backward power 900 watts.

The lossless matching network must turn the backward power around and add it in phase to the incoming 100 watts from the generator. This is a technique that is frequently used to test components for power handling when one does not have a source of RF equal to the power rating for which the component must be tested.

Losses

Considering a similar setup, let us assume that the transmission line has a loss of 1 dB for the length and frequency in use. A 1 dB loss means that only 79% of the power leaving the matching network reaches the load. With a 39:1 VSWR, 90% of that is reflected, and only 79% of the reflected power gets back to the matching network. That would amount to 0.79*0.9*0.79 = 0.56. Instead of a VSWR of 39:1, the matching net would view a VSWR of 7:1. Without belaboring the point too much, it is easy to see that the VSWR also multiplies the losses in the line. For a realistic evaluation of the power loss, we would have to consider the losses in the matching network that will not be zero. If the line loss is 3 dB and the line is terminated in an open or a short circuit, voltage reflection coefficient at the line input is 0.5 and the VSWR is only 3:1. Fig. 19-5 in the *Radio Amateur's Handbook*, 1999 edition, gives additional line losses as a function of VSWR.

Lumped element matching

At HF frequencies, it is quite common to use lumped elements — that is, resistors, capacitors, and transformers — to match impedances.

Referring to **Fig. 3(a)**, we see a rudimentary Smith Chart in impedance coordinates. We can always add a Yo circle to a Smith Chart with a compass. The circle passes through the Zo point and the Z = 0 point. In the figure, the antenna is designated by a large surveyor's mark. It is situated in a point of lower than 50 ohms resistance and a rather large capacitive reactance. The situation is similar to the impedance

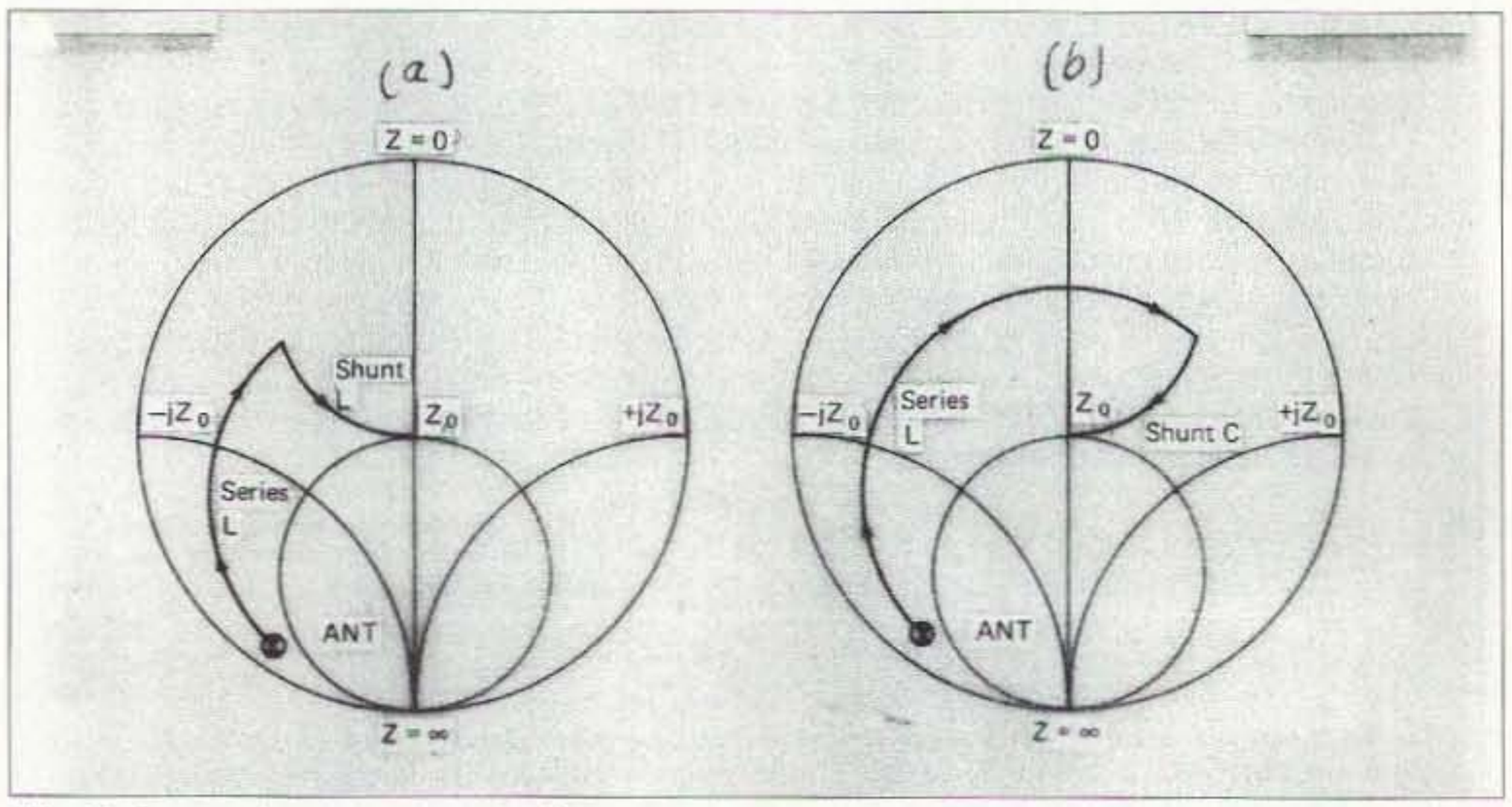


Fig. 3. Lumped parameter matching.

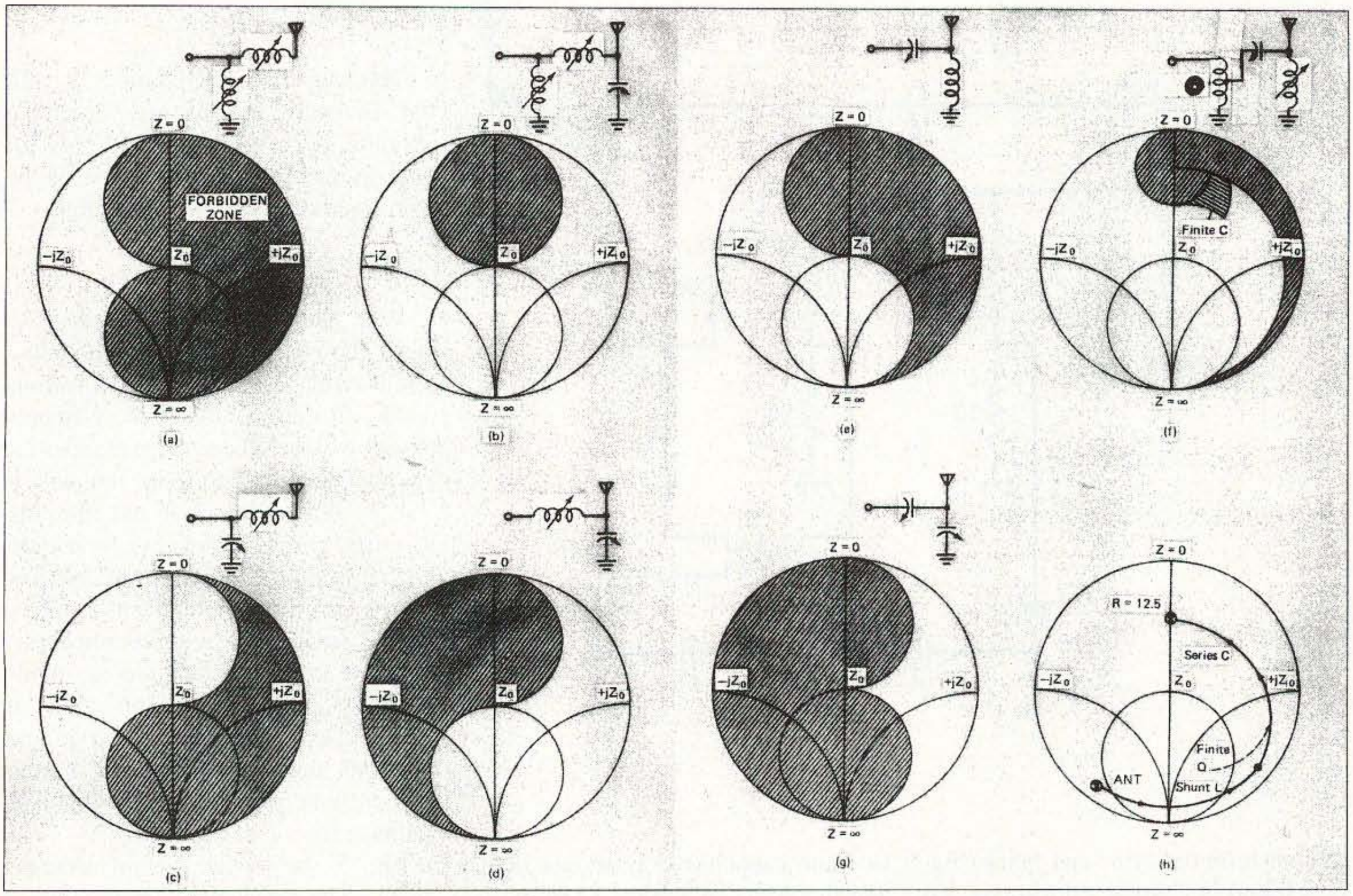


Fig. 4. Some matching circuits.

of an electrically small mobile whip — for example, a 12-foot whip at 7 MHz.

If we add a series inductance to the whip, the impedance point moves along a constant resistance line in the direction of less and less capacitive reactance. We keep adding inductive reactance in series until we reach the Yo line (probably 20 mmho, if the chart is Zo = 50 ohms). At this point, we add shunt inductance until the point impedance reaches the Yo (and Zo) point and the antenna is matched.

In **Fig. 3(b)**, we add more series inductance until the antenna crosses the zero reactance line and meets the Yo curve on the inductive side d. In this case, shunt capacitance will bring the point in to a match.

Fig. 4 shows some matching circuits, including the areas on the Smith Chart where they cannot be used. For example, the circuit at **Fig. 4(a)** cannot be used in any of the shaded areas because the antenna is already inductive or the resistance cannot be moved to a matching line. In **Fig. 4(b)**, the addition of a shunt capacitor permits the swing of inductive data at the right (inductive) side over to the left (capacitive) side, where the two-inductor circuit of **Fig. 3** could do the job.

Fig. 4(c) shows a forbidden region on the inductive side because the antenna is already too inductive. The inverse of this arrangement is in **Fig. 4(d)**. It is noteworthy that the forbidden

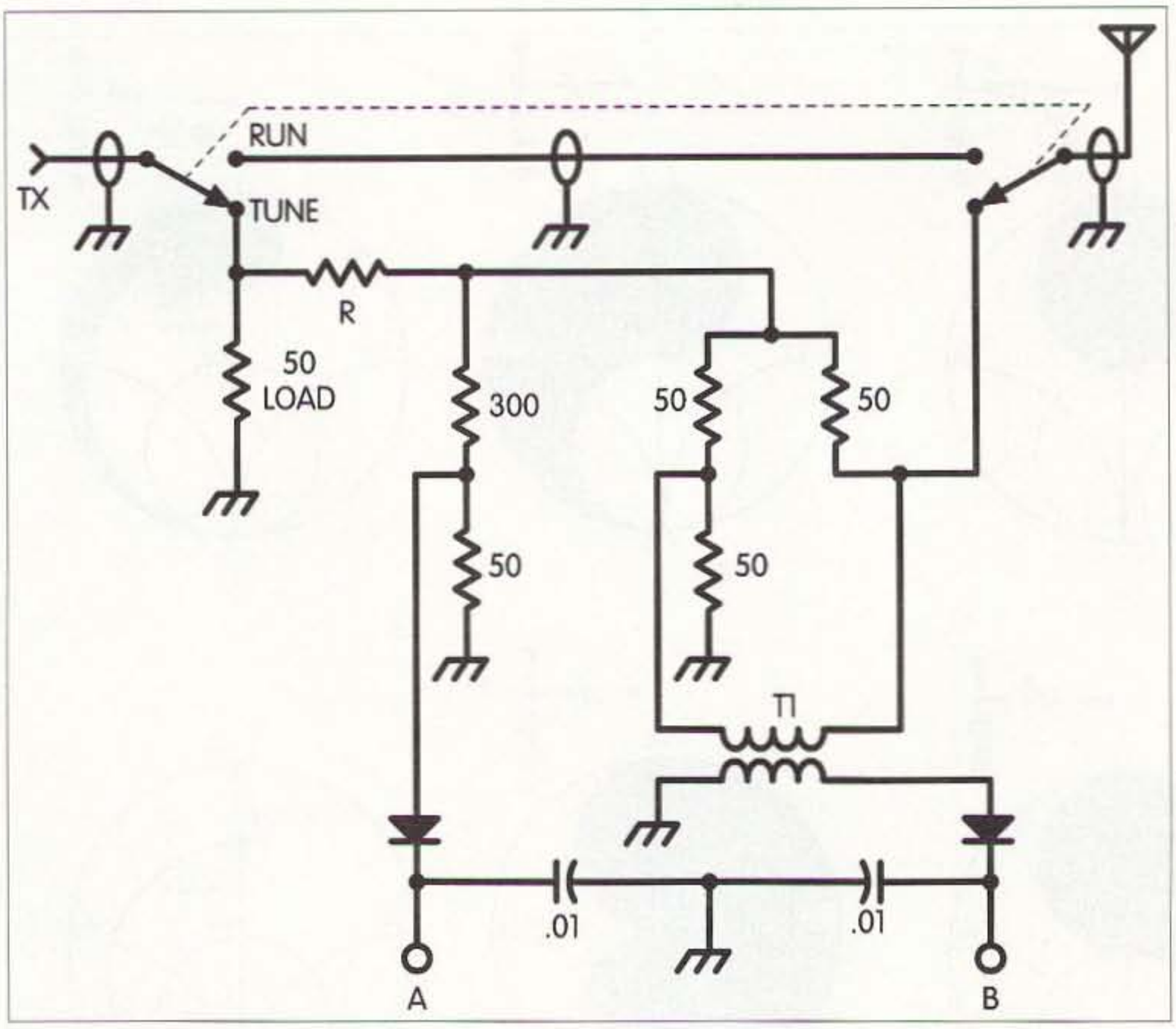


Fig. 5. Micro tuner.

regions form the "yin" and "yang" figures found in Chinese philosophy and literature.

Fig. 4(e) is useful for matching electrically small antennas; however, it may not handle an antenna that goes through the quarter-wave resonance at 37 + j0 ohms, which lies within the forbidden zone. This problem is corrected in **Fig. 4(f)** by the addition of a 4:1 impedance transformer. In this case, we match the antenna to 12.5 ohms and then step up to 50 ohms with an autotransformer.

The circuit of **Fig. 4(g)** is useful mainly for matching inductive antennas, such as loops.

Harking back to the circuit in **Fig. 4(f)**, this is a very useful circuit that I have employed many times for matching mobile, marine, and aeronautical antennas. With the proper range of components, it will handle these antennas from 1.8 to 30 MHz. **Fig. 4(h)** shows the path. The shunt inductor takes the antenna over to the 12.5 ohm line on the inductive side, whereupon the series capacitor carries it up to the 12.5 + j0 point to be transformed to 50 ohms by the 2:1 ratio transformer. The limitation in matching range due to finite capacitance is shown in (f), and the effect of a finite Q in the inductor is shown in (h). With electrically small antennas, the effect of the losses in the elements must be included in the design.

There are, of course, many other possible tuning networks, including "Tee" and "Pi" types, that can be solved using the Smith Chart techniques. In general, the lowest loss and broadest bandwidth networks will be those that move the load toward the match point most directly — that is, in the direction of decreasing VSWR.

Line transformers

One of the techniques used for impedance matching is the line transformer. We earlier observed that the resistance values on a mismatched line went from Zo/VSWR to Zo*VSWR. On the 50 ohm line, the 10 ohm resistor produced 10 ohms, and a quarter-wave away, 250 ohms. This can be used to transform impedances. If we have a 10 ohm load and wish to transform it to 50 ohms, a line 1/4 wave long with a Zo equal to the geometric mean between the two will do the trick:

$$Zo = \sqrt{(50*10)} = 22.36 \text{ ohms}$$

This technique is very frequently used for microwave stripline and waveguide circuits, but it is used at HF only for the rare occasion when a line of the correct Zo happens to be available.

The micro tuner

With the previous discussion, we have shown a number of networks using variable elements to match various loads. In general, all of the elements must be of the proper value in order for an impedance match to be obtained. It can be time consuming and irritating to others to emit a carrier while searching for a tuned condition. My answer to this is what I refer to as a micro tuner, which reduces the emitted carrier to a few milliwatts, thereby minimizing the interference to others. It also serves as a protective device that prevents the transmitter from seeing any extreme mismatches which might damage it.

Fig. 5 shows the general arrangement. The transmitter feeds into a double pole double throw switch. For the 160 through 10 meter range I have used a small relay for this function, something with a rating of 120 V and a few amperes. The relay functions as a tune/operate switch.

In the tune position, the relay goes to the 50 ohm dummy load constructed in the first chapter. This load absorbs most of the power during tune-up and presents a stable load to the transmitter, preventing any damage.

The resistor labeled R taps off a few milliwatts for the bridge and the power sample. It should be selected based upon the power your transmitter produces during tuning.

The bridge resistors are quarter-watt carbon film types such as Tech America 900-0187; the 300 ohm resistor is a half-watt T.E.900-0366 or equivalent. The diodes are preferably germanium RF or switching types such as 1N3666; however, silicon 1N914 or 1N4146 types will also work. The germanium types have a lower forward drop and are more sensitive.

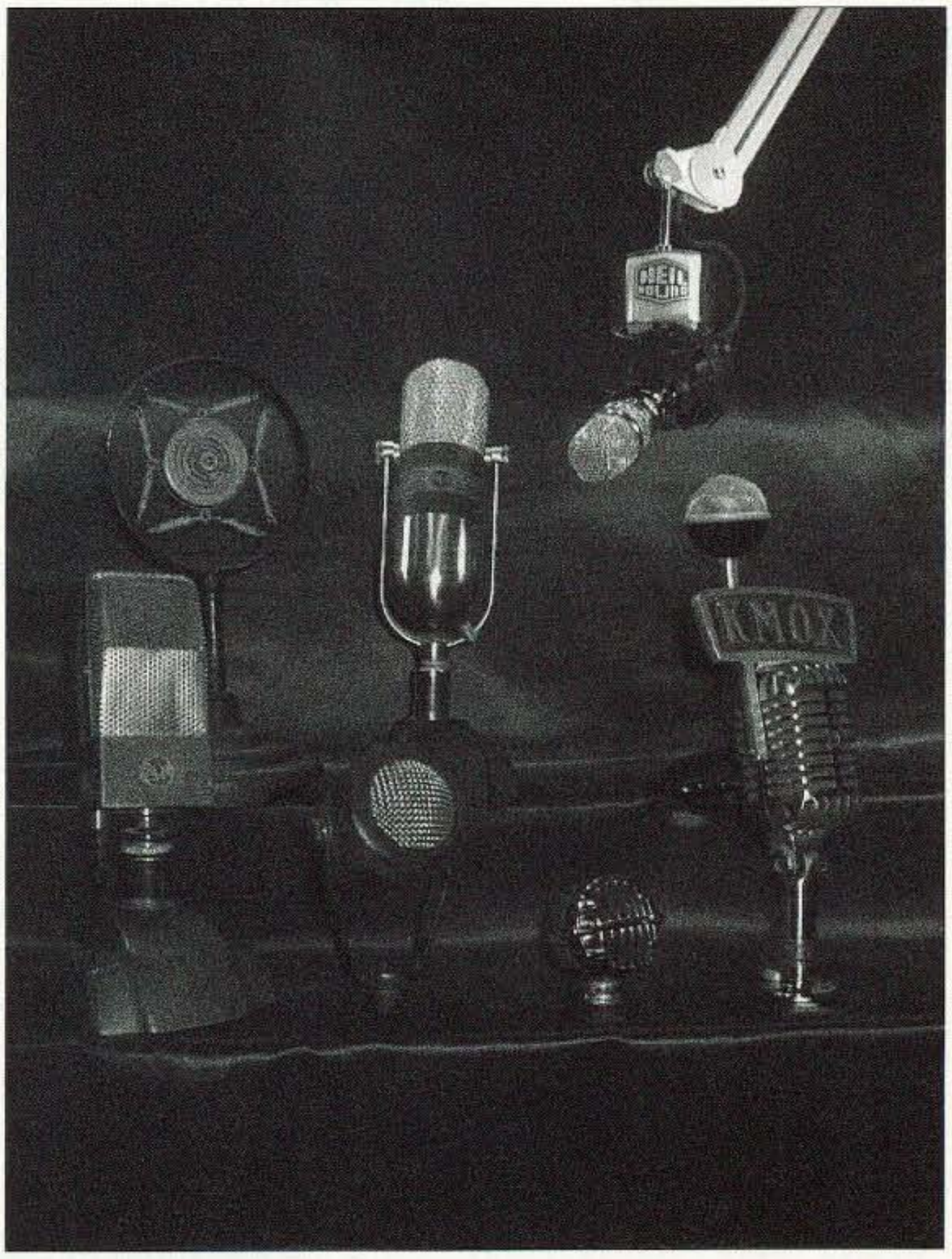
Continued on page 60

On the Cover

Number 29 on your Feedback card

by Dave Ingram K4TWJ

The fascinating array of microphones in our cover photo is compliments of well-known audio guru Bob Heil K9EID. Although only samplings from Bob's extensive and historically significant collection, they represent over seven decades of radio broadcasting and communications. Whip out your pocket magnifier, scrutinize their authentic "used by notable personalities" battle scars if you like, and let's take a whiplash tour of the little delights.



Starting at the left top, the flat round mike shock-mounted in a "four-edged star" spring arrangement is an ElectroVoice model 50. It was a hallmark mike at the beginning of the studio recording era, and it is affectionately called an "Al Jolson mike," as he was one of the first folks to use it in a talking movie or recording studio. Next on the right is a very notable RCA77 "Capsule mike." Below and to the left of the 77 (under the EV50) is the well-known RCA44 "Diamond mike." Both the 77 and the 44 are ribbon or condenser mikes: They require phantom-powered external preamps for operation and exhibit outstanding audio quality. These mikes were quite popular in recording studios and big-time radio stations during the 1940s and early 1950s. Magnificent little critters, aren't they! The 77 is also nicknamed a "Letterman mike" or a "Larry King mike," as both entertainers use them as stage props (their on-the-air mikes are wireless lapel items).

Continuing on along the bottom row, the round mobile speaker–looking mike on the 44's right side is a genuine Turner U9S. It was widely used by newscasters of the 1930s and is also called the "Winston Churchill mike," as he was often photographed behind one. Look back through old *QST* and *Radio News* magazines, and you will also spot this delight in many amateur radio setups. Can you imagine refurbishing and retrofitting one of these gems with a Heil mike element today? Wow! Romance recaptured for sure! Roll over Beethoven and dig these mikes to use. Whew!

The little chrome-grilled mike beside the U9S is special in many ways. The original version was an Astatic JT30 "bullet" crystal mike. Bob Heil introduced a number of big-time entertainers, harmonica players, and blues singers to this unique sounding mike — The Grateful Dead, Bob Dylan, Jay Giles, "Magic Nick," and more. After the mike became famous (thanks to K9EID), Shure came out with an identical model called the 520DX — the "Green Bullet." Modern versions of the 520DX sport a volume control in place of their stand mounting hole. Harmonica players hold them in their hand. When adapted to a modern ham transceiver they exhibit a sort of "Wolfman Jack" sound.

The adjacent mike (lower right) is a legendary Shure 55S. This particular one was retired from KMOX, the CBS affiliate station in St. Louis that carried Bob's *High Tech Heil* program for the past 22 years. He discussed everything from consumer electronics to ham radio on the program. The Shure 55S, incidentally, was recently nicknamed the "Elvis mike" in honor of the king — who used it often.

Positioned above the 55S is a classic Brush crystal microphone which was popular during the 60s. This treat was used in studios and amateur setups alike. Its mating "universal" stand supported desk and/or handheld use.

Finally, the top right mike is Bob Heil's new and available right now GoldLine mike. It sits in its optional shock mount assembly, and it is a killer! The GoldLine mike is especially designed to glamorize any modern transceiver with dynamite sounding audio. This gem is also two microphones in a single case. By flipping a small switch on the mike's side, you can change it from an image-enhancing full bodied sound to a DX pileup penetrating sound on-the-spot. More details on this amazing new microphone are included in my feature article, "The Quest for Super Sounding Audio," which starts on page 10.

Cover picture layout/design by Sandy Ingram WB4OEE; photo by Bob Heil K9EID. 73

Dr. Rick Olsen N6NR
23437 SE 17th Pl.
Sammamish WA 98029

Number 30 on your Feedback card

The DX Partyline Low Noise Wavecatcher

Here's a great noise reduction loop for SWLing.

The old maxim about necessity being the mother of invention is still true. While developing material for my monthly radio show entitled "Tech Talk with Dr. Rick" (which aired last year as a ten-minute segment on HCJB's "DX Partyline"), it became clear to me that not much has been published or devised to mitigate noise problems experienced by shortwave listeners. So I set about to design a very simple and inexpensive antenna that our listeners could build and experiment with. So enthusiastic was the response that we decided to have a "name that antenna contest," and publish a small construction booklet. Here are the details.

Once again a design based upon a square loop has come forth out of HCJB. Nearly everyone is familiar with the cubical quad antenna that was designed by HCJB's own Clarence Moore W9LZX in 1942. The uniform distribution of RF current around brother Moore's loop was the medicine needed to eliminate the problem of burning the ends off of the directional antennas used by HCJB. Many derivatives have come forth from that design, perhaps the most noteworthy within the past 25 years being the "Quagi" antenna[1] developed by Dr. Wayne Overbeck N6NB.

The uniform nature of current distribution of square loops also inspired Brian Beezley K6STI to develop a horizontal loop[2] that exploits this property to minimize, if not eliminate, sources of impulse noise that plague radio reception. For Brian, the need was to drastically reduce noise at 1.8 and 3.5 MHz for the benefit of radio amateurs who enjoy "top band" DXing. What I have done is to optimize this design for use from 3 to 26 MHz for the benefit of the thousands of shortwave DXers out there who suffer from the impact of noise. This noise reduction loop is for you! And hats off to Clarence and Brian for the inspiration!!

The basic design of this type of noise reduction antenna is that of a

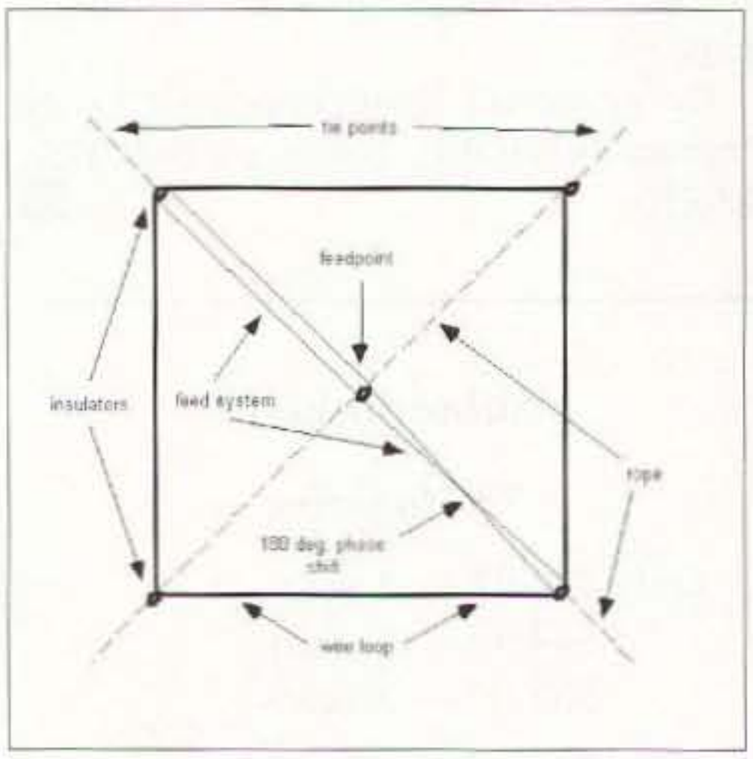


Fig. 1. *Basic diagram of the noise reduction loop (attic configuration).*

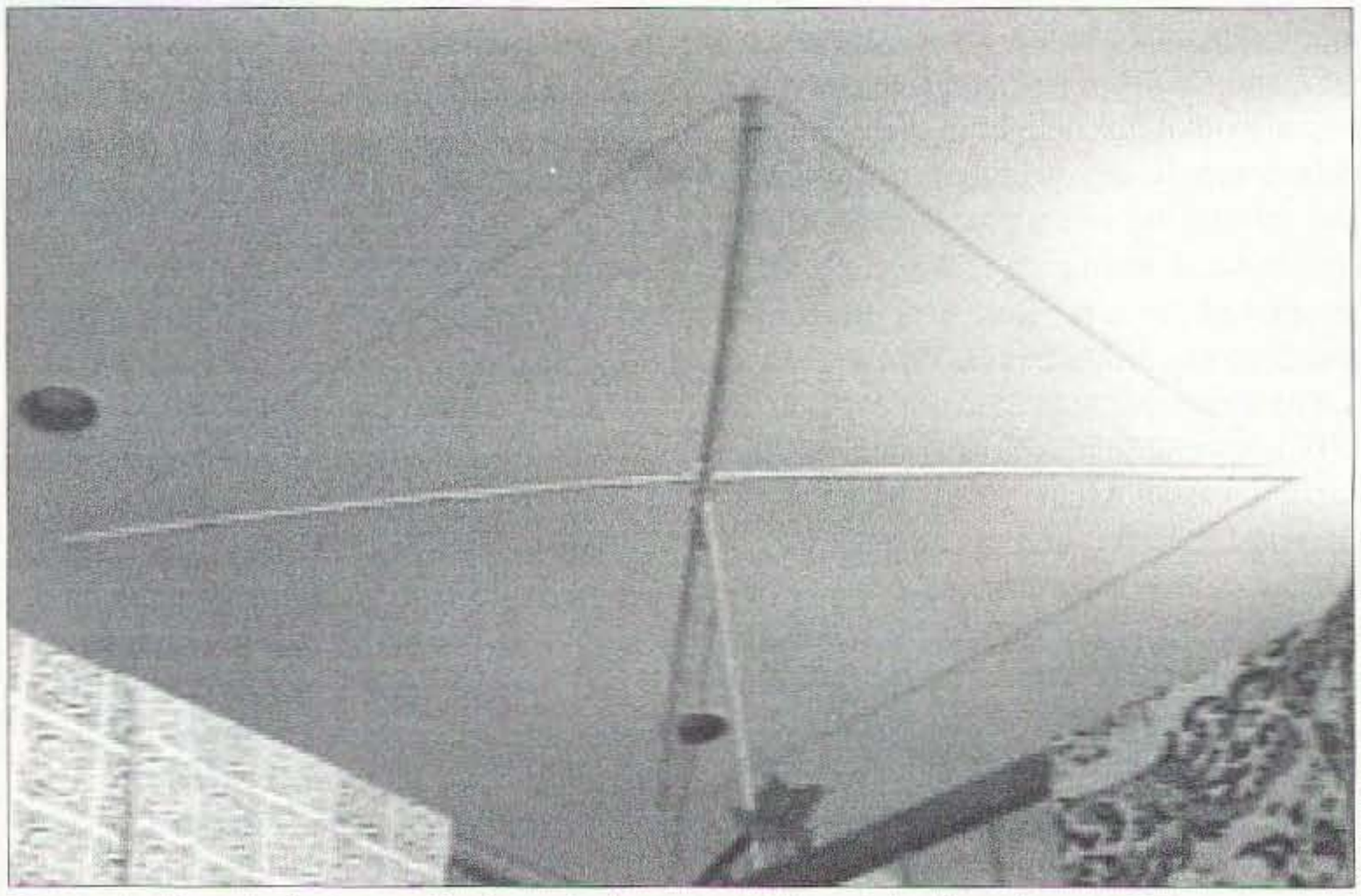


Photo A. *Here is the low noise loop in the second floor loft of my home QTH.*

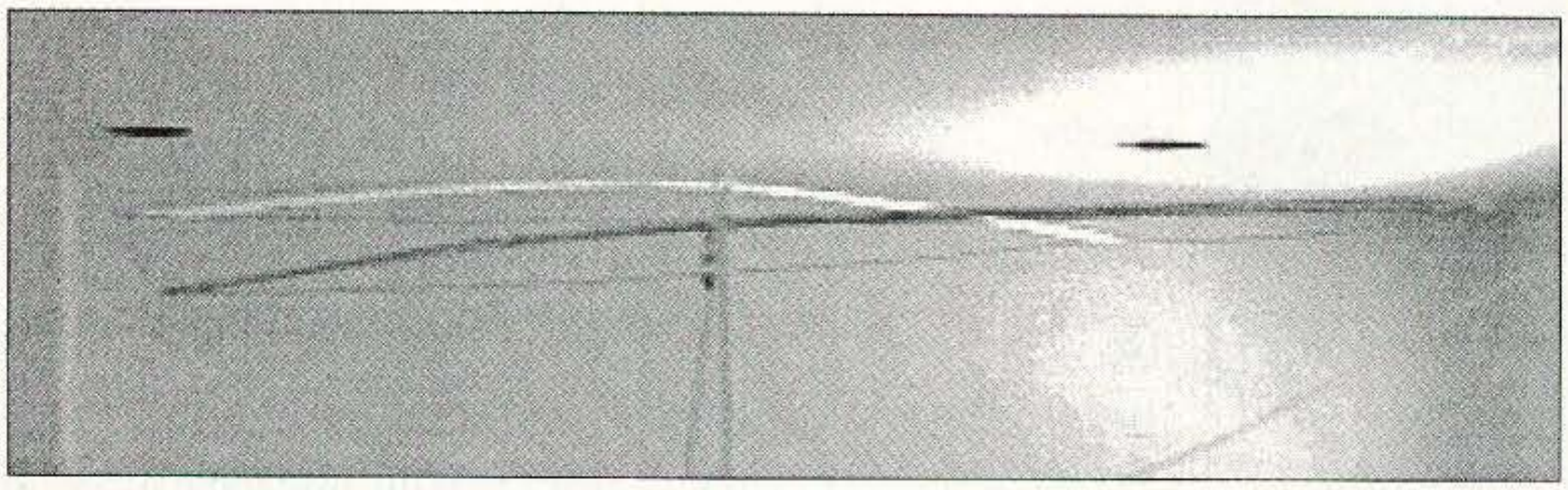


***Photo B.** Side view of the 5.7-foot loop.*

square wire loop configured in a horizontal manner. **Fig. 1** shows the basic layout of the antenna as it is viewed from the top. The loop is formed in two halves, with two of the corners fed through an open hole in a ceramic (or plastic) insulator. The other two corners are fastened at either ends of the same type of insulator, and connected at these points to the feedline, which forms the hypotenuse of the two right triangles that make up the loop.

This type of antenna is extremely lightweight, and may be used quite effectively in the attic of a wood-framed home. **Fig. 1** shows each of the four insulators being tied off to a suitable mechanical fastener such as a ceiling joist. The addition of a rope orthogonal (at a right angle) to the feedline is necessary to keep the loop square when hung properly at all four points.

A fifth insulator is used as the point where the antenna is joined to feedline going to the receiver. Note in the drawing that for the antenna to operate properly, the two ends are fed 180 degrees out of phase by twisting the feeder at one end. The attic antenna works very well when 450-ohm ladder line is used as the feeder.

In order to determine an optimum size for the broad range of frequencies employed by shortwave broadcasters, I built two versions of this antenna, which you can see in **Photos A** and **B**. The first was optimized for higher frequencies of around 12 to 26 MHz, and the second was a compromise that covers the entire range from 3 to 26 MHz. In this case, I used 4-foot- and 5-foot-long solid spreaders instead of just rope. This yielded loops that were approximately 5.7 feet and 7 feet square, respectively. It was my desire to make it possible for this antenna to be hung below a patio, or fastened to a mast outdoors, or even (against the esthetic objections of my wife) to be set it up in the loft of our house. I can't imagine why she would object. I think it is a true work of art.

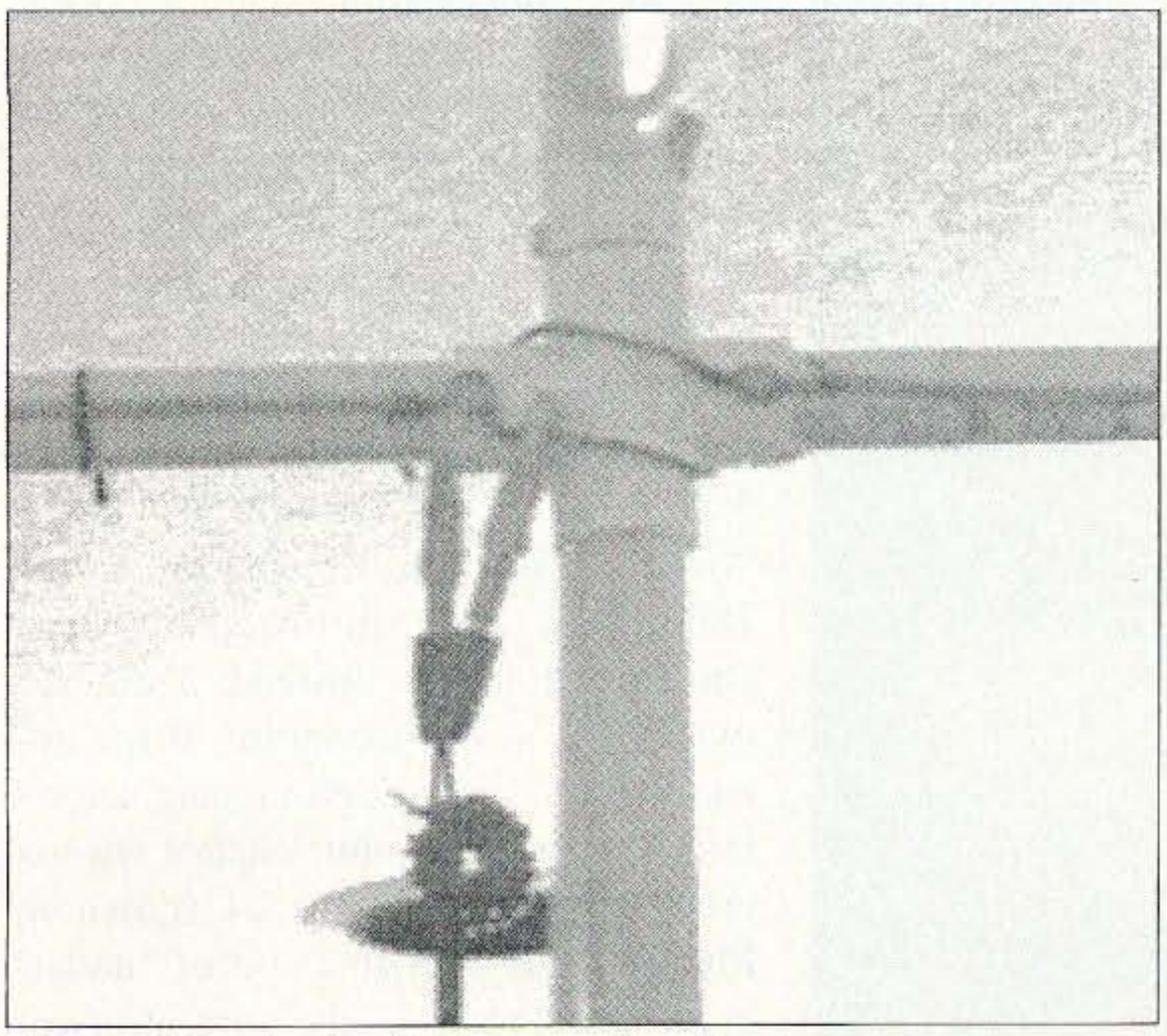


***Photo C.** Simple wire feed system tie points.*

The material I used is half-inch PVC irrigation pipe. It is one of the most inexpensive materials available. You might also want to use wooden dowel rod, bamboo, fiberglass tubing, or some other nonconductive material for your loop. PVC also has an additional advantage, as there are some ready-made fittings that can be purchased off-the-shelf that are handy for joining the spreaders together, and at right angles as well. Take a close look at the photos in **Photos C** and **D**. I used two four-way junctions with a 3-inch piece of 1/2-inch PVC (now invisible) to join them together. I then threaded a small self-tapping screw into each joint to keep them from slipping apart, or twisting away from their 90-degree orientation.

Since some of you might not have ready access to 450-ohm ladderline or

Photo D. *300-ohm feed system tie points.*

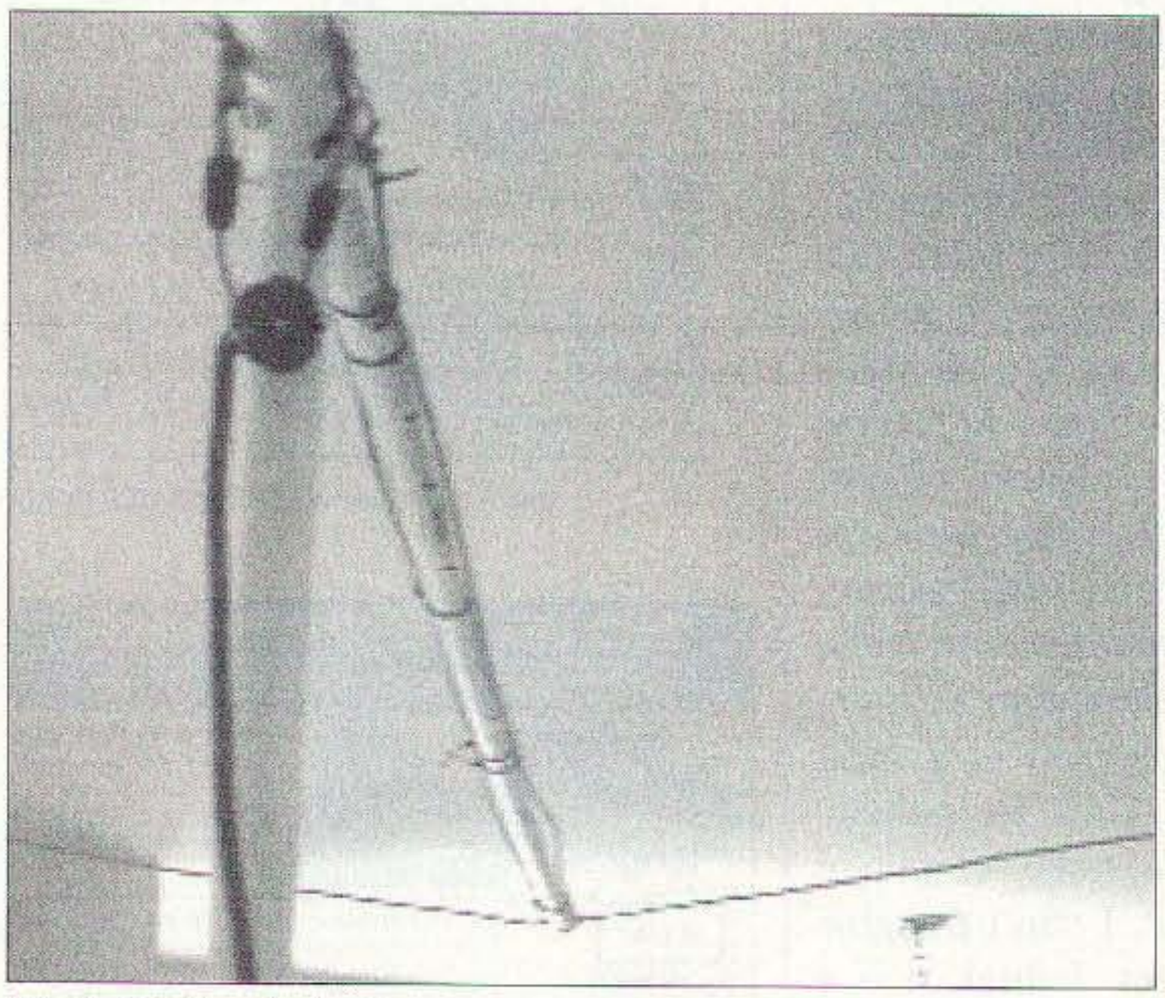


Photo E. *Simple feed system.*

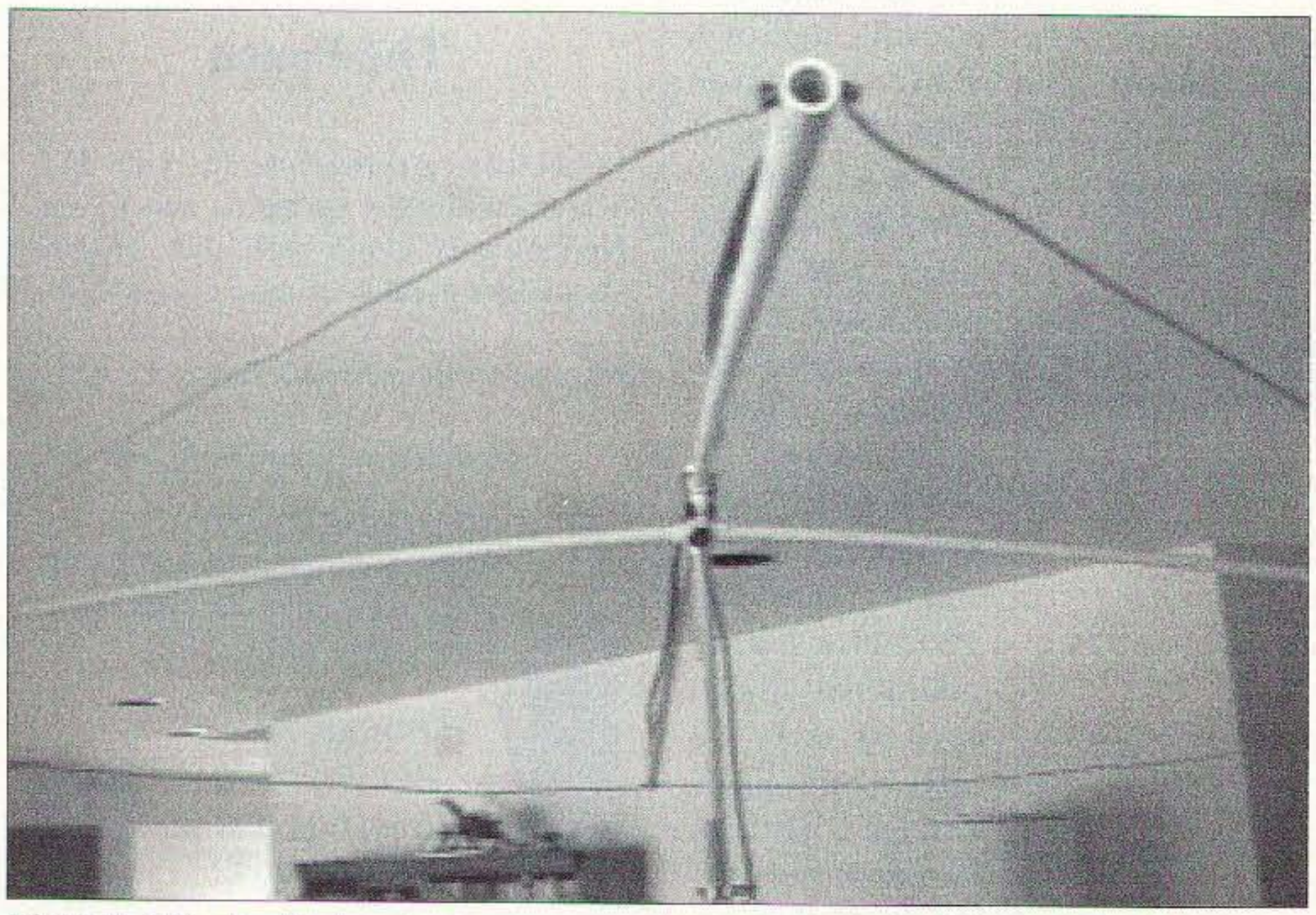


Photo F. *300-ohm feed system.*

300-ohm twinlead, I constructed the feeder of the smaller loop out of wire — hence its name: "simple wire" feeder. **Photos C** through **F** show the difference in appearance and construction of the two feeder systems. I used 300-ohm twinlead on the larger loop to see if there was any significant degradation in performance with the simple wire feeder. To my joy, there was not. As for the wire, just about anything will do, just so long as you can solder to it.

I mentioned on one of the *Tech Talk* segments that I built this antenna in less than an hour, so I expect you will have a similar experience, especially considering that I am all thumbs. Your construction time will vary, so here goes.

After joining the two spreader joints together, insert the four spreader elements into the joints. Make sure that the spreaders are mounted at right angles to one another. (A word to the wise: Check this *first,* before sinking the screws.) With the spreaders in place, the hypotenuses of the two loop-halves for each antenna are 8 and 10 feet, respectively.

You may now prepare for the addition of the wire by drilling a small hole just large enough for the wire in the non-fed spreader ends as shown in **Photo G**. Be careful to cut enough wire to allow for each of the two triangles as well as the simple wire feeder, plus a little extra for good measure. (It is much easier to cut off the excess than it is to add more to a short end!) In the case of the smaller loop, this works out to a little less than 20 feet of wire (5.7 + 5.7 + 4 + 4 = 19.4, plus some extra). You may then feed the wire through the hole at the end of the spreader, and keep passing it through until you arrive at the midpoint of the wire.

Next, drill small holes in the "fed end" of the two remaining spreaders, and use tie-wraps to secure the wire to the end on the horizontal sides of the tubing, as shown in **Photo H**. You may then use additional tie-wraps to secure the wire to opposite sides of the spreaders, thus forming a crude "open-wire" feeder for the antenna. You may also use fisherman's twine, string, or other materials to secure the wire to the spreader. However, I don't recommend using a conductive material such as wire, for obvious reasons.

Because I had elected to use the loop wire to also form the simple wire feeder, it is not possible to put a "twist" in one end to accomplish the 180-degree phase shift needed at each end of the feeder. Instead, I did the twist right at the feedpoint of the antenna. After sinking self-tapping screws into the spreader joint, copper wire is used to form the twist as shown in **Photos I** and **J**, with a sort of "under/over" attachment of the wire at opposites sides of the joint. The next step is

to cut and solder the loop wire to the pigtails that extend off the screws at opposite ends of the feedpoint you have just fashioned.

As for the larger loop, the decision to construct the feeder out of 300-ohm twinlead caused me to build the antenna slightly differently (you can use either method on either antenna). I used the same through-hole technique on the un-fed spreaders, but on the fed end of the other two spreaders, I sank self-tapping screws in the ends, as shown in **Photo K**. This allows you to use a lot less wire.

Fasten the wire to the screws along with the distant ends of the 300-ohm feeder, and solder them together. **Photos C** through **F** show you how to lay the twinlead along the upper spreader, and fasten it to self-tapping screws that are sunk into the midpoint at opposite sides of the upper center joint. Remember to take care that one feeder has the requisite "twist" in it to form the 180-degree phase shift. Here's a hint for you: If you want to use an ohmmeter to check to see if the phasing is correct, touch the leads of the meter to the opposite poles of the feedpoint. If you measure a short circuit, you did it right! If you measure an open circuit, it's back to work to get it right. I'll let you have some fun figuring that one out yourself.

Feeding the antenna

Hey, the antenna is built already. That was fast! Now comes the important part: hooking the antenna to the receiver. I measured the impedance of the antennas at the various shortwave bands and discovered that they were at or above 150 ohms in most cases. I had intended to use either 75- or 50-ohm coax to feed the antenna so as to maintain good noise isolation going into the shack. In order to get the antenna impedance a bit closer to 50 ohms on my favorite bands, I decided to put a 4:1 balun transformer at the feedpoint of the antenna. I did this to minimize mismatch losses in the coax that would degrade the performance of the antenna.

Fig. 2 and **Table 1** show how the feedpoint impedance of the antenna varies from 3 to 26 MHz. These measurements were taken with a 4:1 balun (terminated with a 50-ohm load on its primary side) across the feedpoint of the loop. I chose to use a 4:1 balun as I had intended to use 50-ohm coax to feed the antenna, and wanted to keep the end points of the impedance excursions down to a manageable level.

I had originally built the balun when I constructed the smaller loop. Its impedances are a little higher. The impedance of the smaller loop does not drop off at the higher frequencies as much as the larger loop. As it turns out, the larger loop resonates at around 33 MHz, while the smaller loop resonates at around 45 MHz. However, the larger loop has some directional characteristics at the higher frequencies that can come in handy, depending upon your setup. Its larger aperture has a beneficial effect at the lower frequencies as well. I also got a nice peak right

Continued on page 34

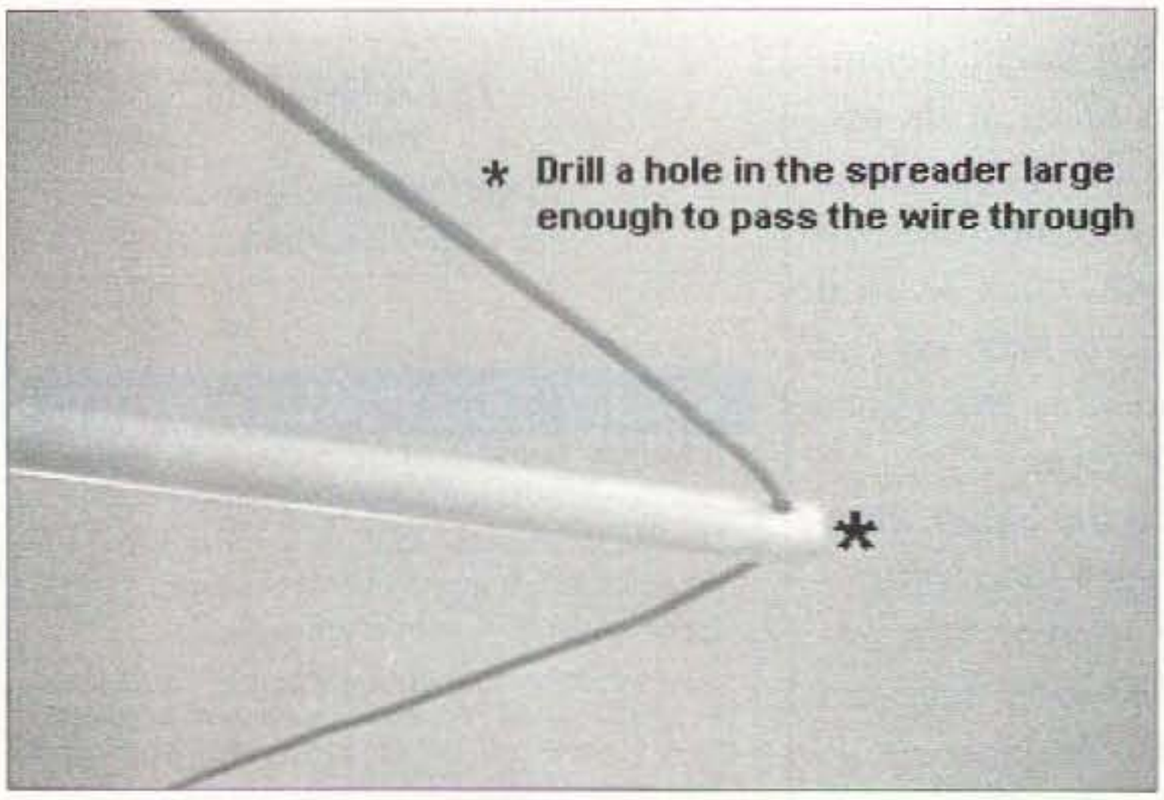


Photo G. Construction of the non-fed corner of the loop.

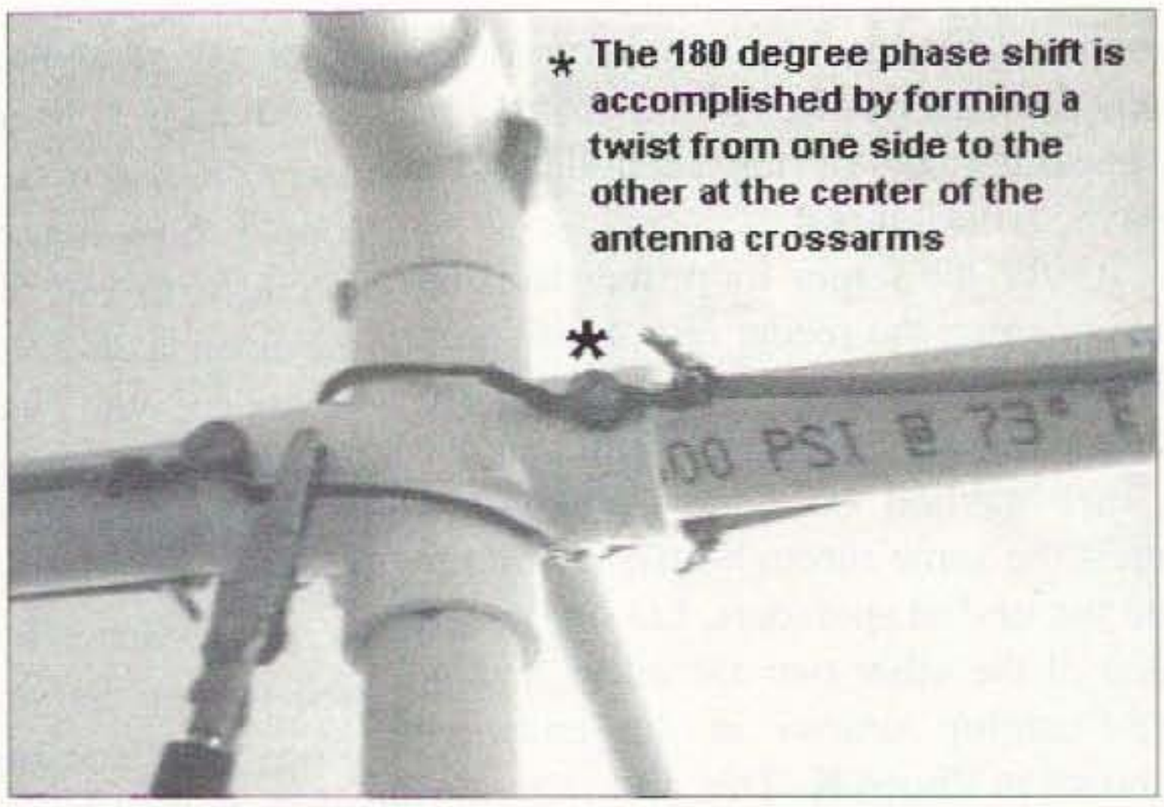


Photo I. Construction of 180° phase shift in the simple wire feed system.

around 9745 and 12015 kHz, which transforms down to about 60 and 50 ohms, respectively. This is an acceptable untuned mismatch on my two favorite DX frequencies!

Here's how to make a simple 4:1 balun that will help to minimize impedance mismatches from 3 to 26 MHz. There are various ways of constructing a 4:1 balun, but I chose to build one similar to what is described on page 25-16 of the 1991 edition of the *ARRL Antenna Book*. **Fig. 3** shows the drawings from that page. The construction of the balun is very simple. Start with an Amidon T-68 series powdered iron core with an inside diameter of 0.6 inches. Next, take some 24-gauge plastic-coated wire and wind 10 turns on the core as shown in **Photo L**, then solder the ends as shown, leaving a pigtail at each end that could be connected to the feedpoint on the loop as well as the coax (see **Photo M**).

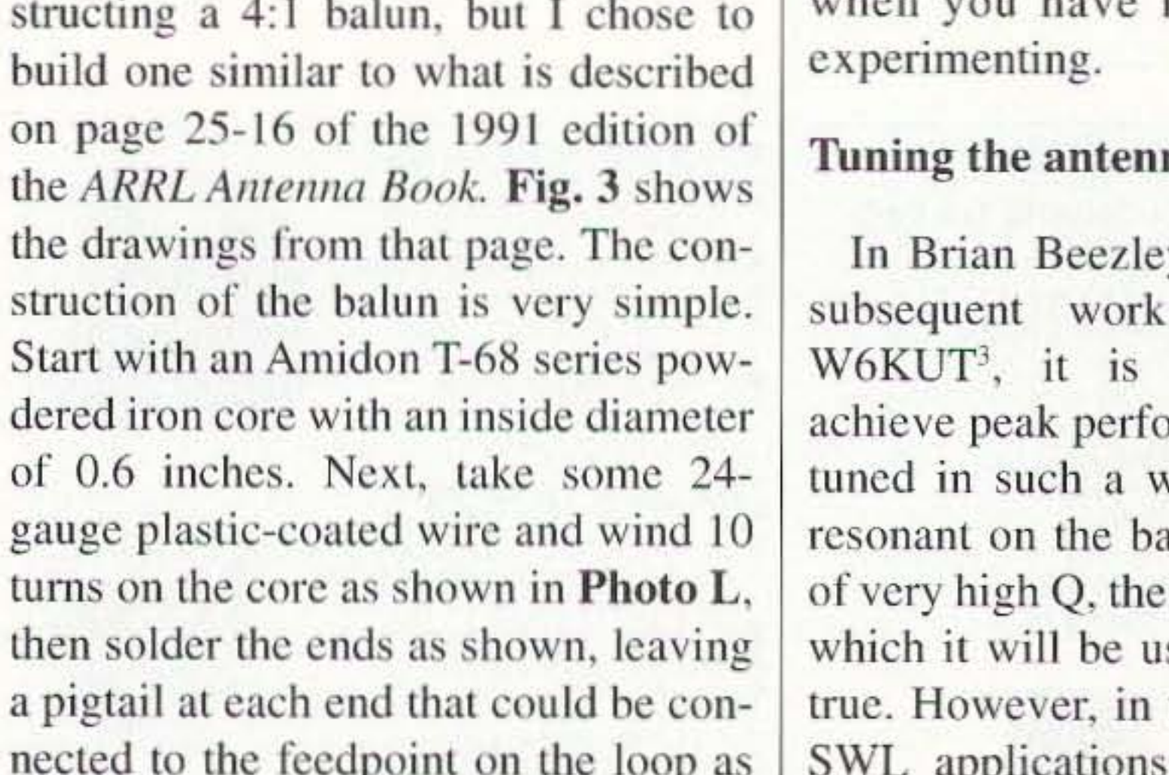


Photo H. End view of the transition from loop to simple wire feed system.

Since I was doing a lot of experimenting, I decided to put some clip leads on the ends of the high impedance side of the balun so that I could quickly connect and disconnect from the antenna in order to make measurements, and the like. I strongly recommend that you solder the pigtails directly to the feedpoint on the loop when you have finished your own experimenting.

Tuning the antenna

In Brian Beezley's article, and in a subsequent work by Ed Andress W6KUT[3], it is suggested that to achieve peak performance, the loop be tuned in such a way that it becomes resonant on the band (and in the case of very high Q, the exact frequency) on which it will be used. This is entirely true. However, in the vast majority of SWL applications, and especially in the case where cost and complexity are to be avoided, this is not practical. This would require a matching network for each of the shortwave bands all the way from 3 to 26 MHz. To those who are not constrained by cost and complexity I highly recommend this approach. Ed and Brian's articles provide excellent insight into how this can be accomplished.

Fortunately, acceptable performance may be obtained by tuning the antenna remotely. This can be accomplished in either of two ways. The first way is with a simple antenna tuner. I tested this method with a couple of small tuners I had lying around. In technical terms, this method provides a conjugate match for the antenna and receiver by tuning (matching) the impedance discontinuity present at the receiver's end of the coax coming from the loop. In simple terms, it makes the antenna and receiver happy because they both see a 1:1 match of their characteristic impedance when looking into the coax.

However, this approach has a couple of disadvantages (but not terribly bad ones in a receive-only system). First, the antenna is nonresonant, so its efficiency is not optimum compared to the resonant case. Also, one of the fundamental characteristics of transmission lines is that they not only function as a waveguide for received signals, but also are complex impedance transformers. Consequently, in a remotely tuned system, the untuned impedances can vary greatly from the antenna to the receiver. Thus a higher loss component can be expected. Ah, but we can fix that with a preamp. More on that later as well.

The other approach, one suggested by the MFJ Corporation[4], is to series-resonate the whole circuit at the receiver's end with a simple LC network. The MFJ-956 does a reasonable

***Photo J.** Bottom view of phase shift construction.*

job at this. It is a simple circuit that has a 350 pF variable capacitor in series with several switched inductor values with a toroidal inductor (the same size and material used on the balun) that has 30 or 40 turns of #30 enameled magnet wire on it. You can experimentally choose several "taps" on the inductor, and select them with a wafer switch to tune the desired band along with the variable capacitor (see **Fig. 4**).

This method also works quite well, but is rather sensitive to the impedance of the device it is feeding. It likes to

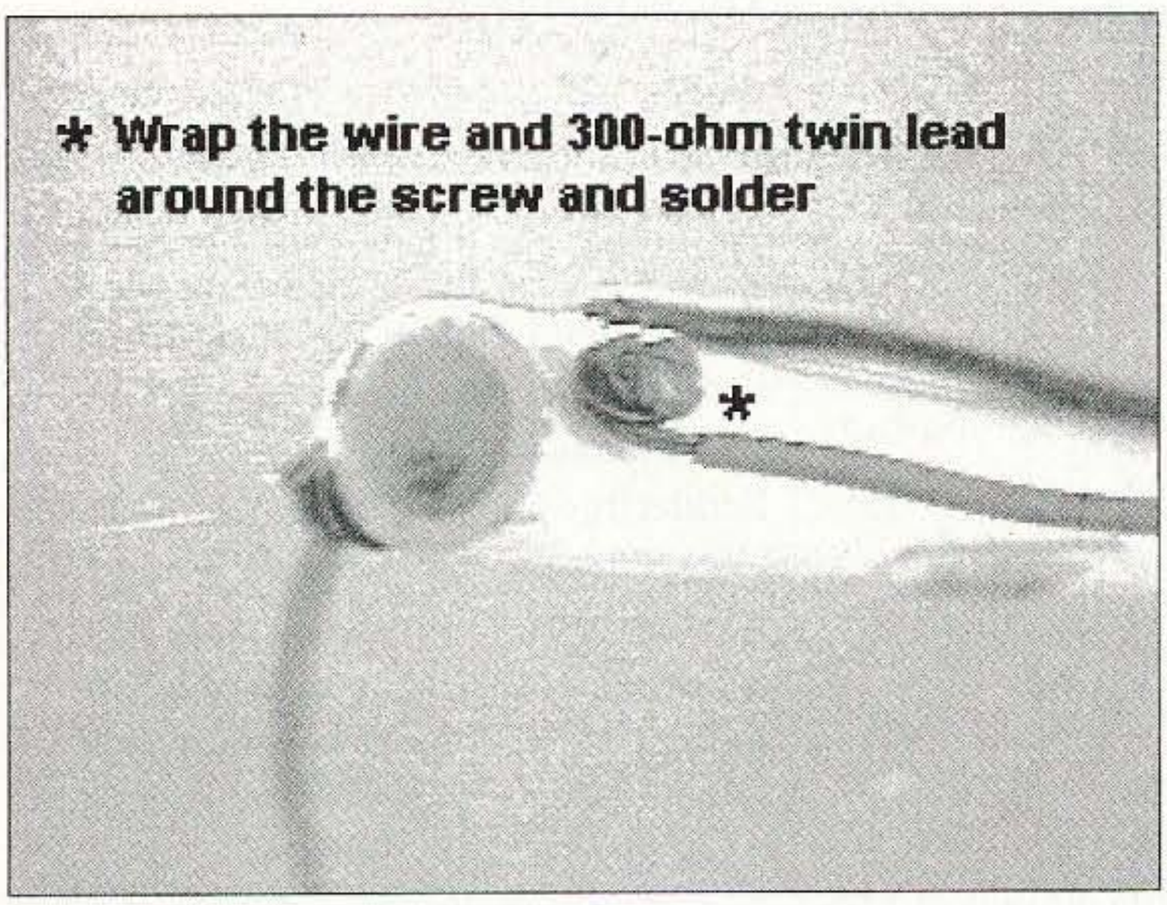


***Photo K.** Formation of the 300-ohm twinlead feeder.*

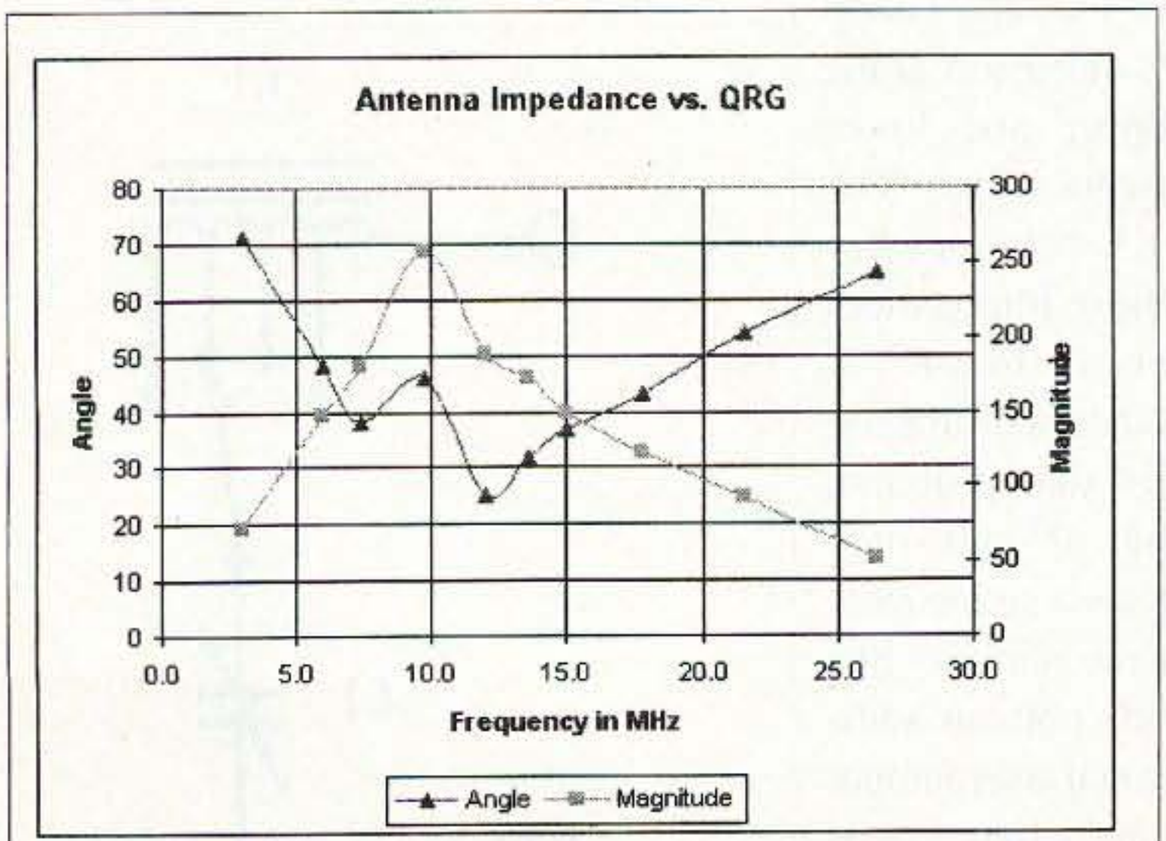


***Fig. 2.** Larger loop antenna impedance vs. frequency (see also **Table 1**).*

QRG	Antenna Z	
MHz	Magnitude	Angle
3.0	72.0	71.0
6.0	148.0	48.0
7.4	180.0	38.0
9.7	257.0	46.0
12.0	188.0	25.0
13.6	172.00	32.0
15.0	150.0	37.0
17.7	122.0	43.0
21.5	92.0	54.0
26.4	52.0	65.0

***Table 1.** Plotted points **on Fig. 2**.*

to select the band and tuning range that you desire. And it's inexpensive, too, costing less than $50 U.S., if my memory serves me correctly ($49.95, to be exact — ed.).

If you don't have one available to you, and can build one yourself, all you need to do is put a 350 pF variable capacitor in series

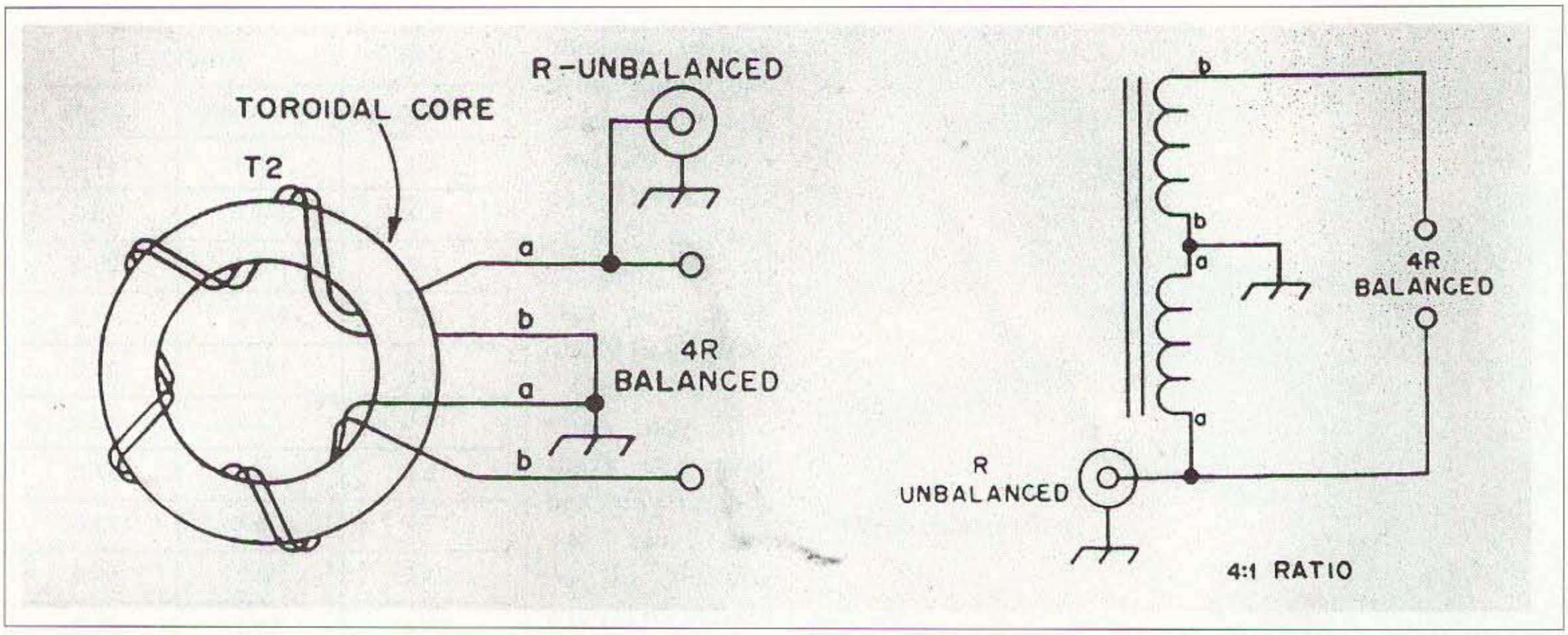


Fig. 3. *Schematic diagrams of the 4:1 balun (courtesy ARRL).*

see a high impedance of 50 ohms or greater, and that's where a small preamplifier comes in handy. This method also has the benefit of functioning as a rudimentary filter for reducing or eliminating interference and desensitization that comes from nearby AM and FM broadcast stations. If you find that you cannot find a "peak" on one of the desired SW bands, try using a slightly longer or shorter coax jumper to, or from, the filter. Recall that in **Fig. 2**, the impedance of the larger loop is rather low at the upper and lower frequencies. The 4:1 balun makes those impedances even lower. A tuner will usually fix that problem, but if you only have a series-resonant circuit like this one, an additional coax jumper can often transform that impedance to a much more manageable point on the Smith Chart.

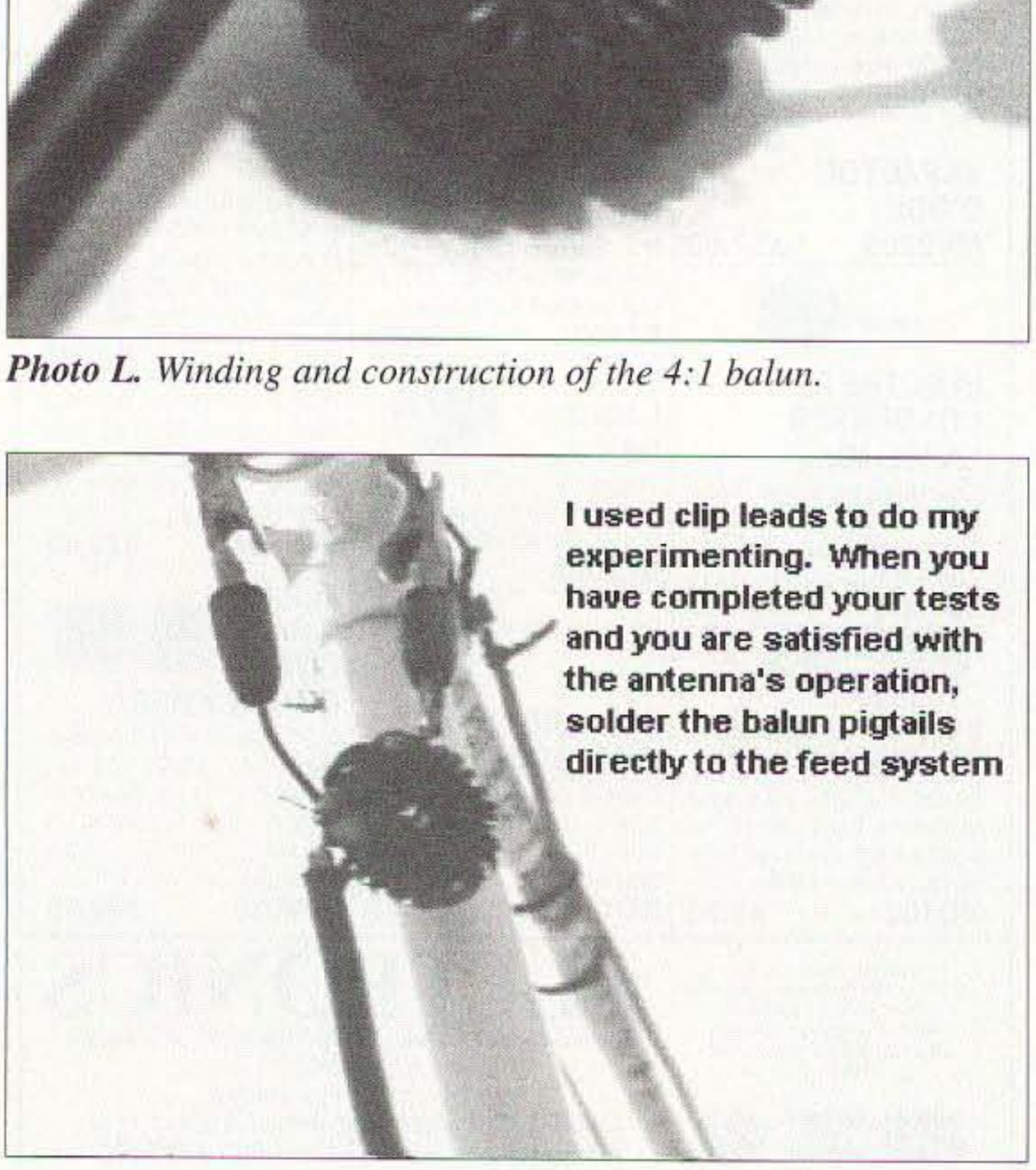


Photo L. *Winding and construction of the 4:1 balun.*

Photo M. *Placement of the balun on the simple wire feed system.*

The preamplifier

The advantage of using coaxial transmission line in this system is that it provides a reasonably good shield against noise that might be induced into the feed system. The disadvantage is that losses can be much greater in a nonresonant system like this one. Ladderline has much less loss, but you have to be much more careful to avoid induced interference.

Fortunately, a great deal of those losses can be compensated for with an effective preamplifier. There are many good designs that provide between 15 and 35 dB of gain. The amount of gain

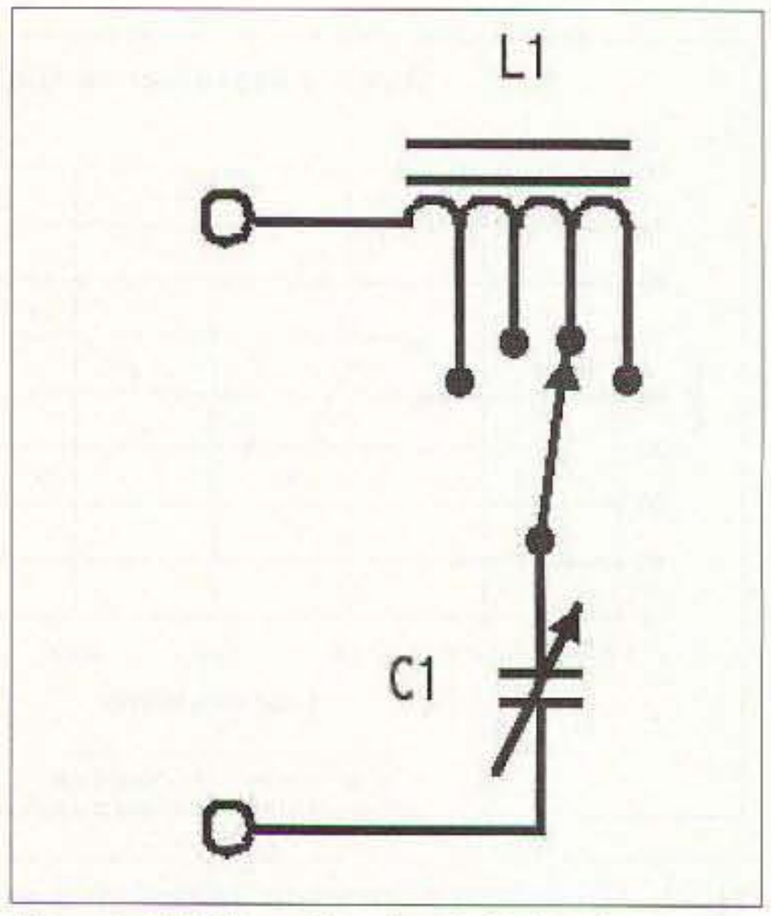


Fig. 4. *Multiband series LC circuit.*

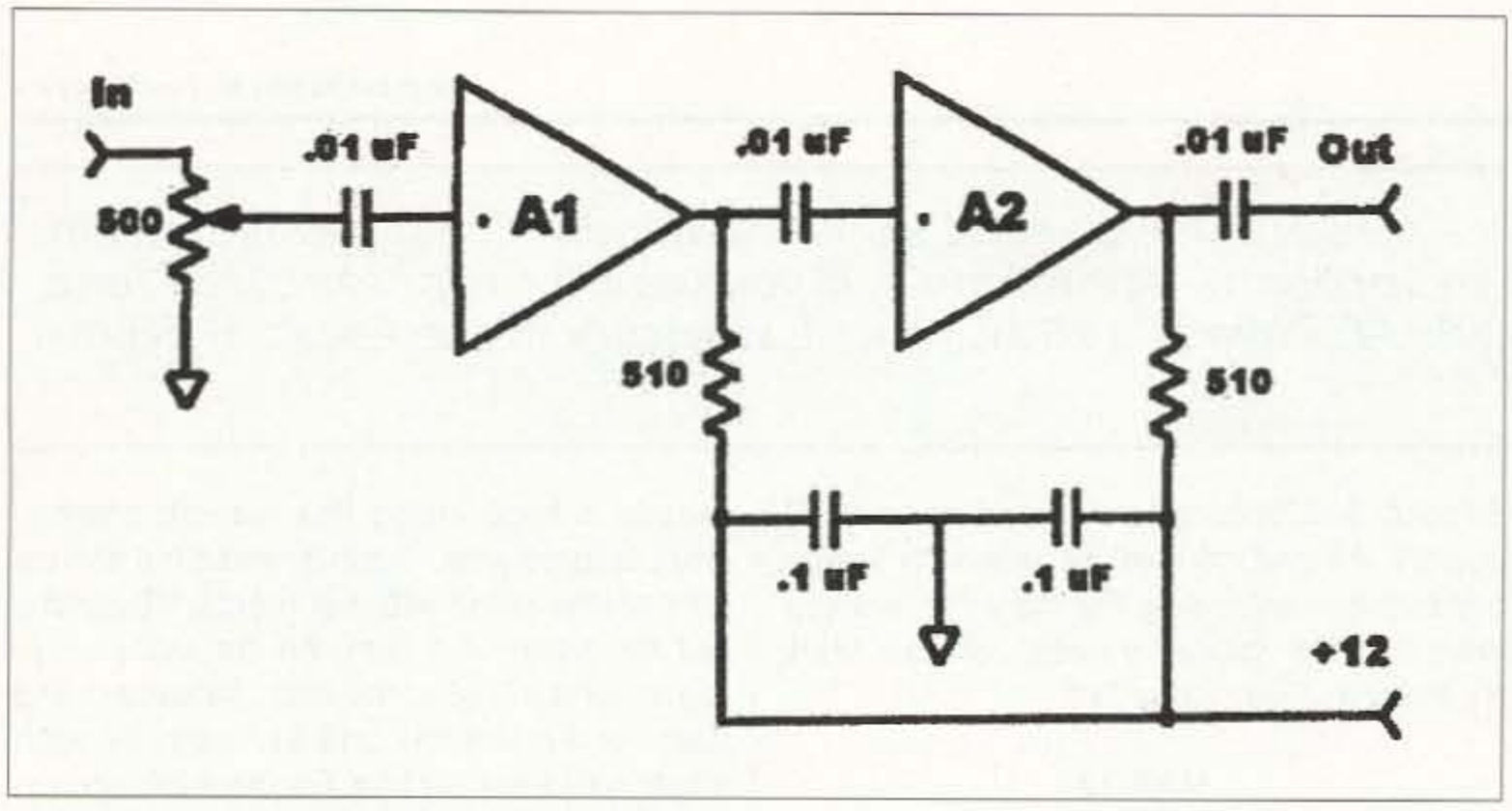


Fig. 5. Schematic of the 30 dB gain preamp.

required depends greatly on the configuration of your listening station. I had wonderful results with a little broadband U-310 amplifier (that's a field effect transistor, or FET) that I built. It gave me about 15 dB gain, which was all I needed as my receiver has a hot front end.

My friend, Dr. John Petrich W7HQJ, came up with an outstanding little preamplifier that is not only easy to build, but also provides upwards of 35 dB of gain — and that can come in handy with receivers that have a stingy front end. When I used it in conjunction with the series LC tuner and the loop indoors, I was logging stations from every corner of the globe. It didn't perform as well as my 86-foot-long centerfed wire at 110 feet, but I didn't expect it to, either.

The basic building block of this amplifier is the MAR6 MMIC made by Mini Circuit Labs[5]. It is designed to operate within a 50-ohm system, which makes building this preamp a breeze. It should be noted that if only modest gain of 15 dB is desired, only one amplifier is used. This will eliminate the need for one each of the 0.1, 0.01 capacitors, and the 510-ohm resistor.

Because the MMICs are 50 ohms in and out, there's no need for fancy impedance transformation networks and the like on the circuit board. You can simply cut squares on the foil side of a PC board, and solder the handful of components in place. I'll leave that piece up to your imagination.

This leads me to some final comments I'd like to make. As I said before, the job of reducing noise while covering such a broad range of frequencies, while providing a very simple, inexpensive solution, is a pretty tall order. The hours and hours I spent with this antenna have convinced me that it goes a long way to satisfy those goals. But I also hope that you will just have some fun building it and playing with it. It is my sincere desire that you, and others, will come up with numerous ways of improving on its design and construction. I hope, too, that there will be some perfectionists out there who will come up with a version of this antenna that is truly elegant.

Just use your imagination, and have some fun. It's cheap! Oh, and if you think of anything that I overlooked and should be included in future extrapolations of this little antenna, please let me know, will you?

Notes

1. Overbeck, W. "The VHF Quagi." *QST.* April 1977, pp. 11–14.

2. Beezley, B. "A Receiving Antenna That Rejects Local Noise." *QST.* September 1995, pp. 33–36.

3. Andress, E. "A K6STI Low-Noise Receiving Antenna for 80 and 160 Meters." *QST.* Sep. 1995, pp. 37–41.

4. P.O. Box 494, Mississippi State MS 39762, USA; [http://www.mfjenter- prises. com].

5. P.O. Box 7128, Branson MO 65615, USA; (800) 654-7949. 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."

Calendar events

Number 38 on your Feedback card

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 June issue, we should receive it by March 31. Provide a clear, concise summary of the essential details about your Calendar Event.

MAR 4

KNOXVILLE, TN The Shriners of Kerbela ARS will sponsor their annual Hamfest at Kerbela Temple, 315 Mimosa Ave., Knoxville TN, 8 a.m.–4 p.m. Admission is $5. Indoor vendor tables are $8 each plus admission of $5. Setup Friday 4 p.m.–8 p.m.; and Saturday 5 a.m.–8 a.m. Overnight security will be provided. Talk-In on 144.83/145.43 or 146.52 simplex. Smoking indoors is permitted in designated area only. Contact *Kerbela Amateur Radio Service, Kerbela Temple A.A.O.N.M.S., 315 Mimosa Ave. SE, Knoxville TN 37901.*

MAR 5

NEW WESTMINSTER BC, CANADA The Burnaby ARC 14th Annual Fleamarket will be held at New Westminster Armouries, 6th St. and Queens Ave., New Westminster, BC. Open to sellers at 9 a.m., buyers 10 a.m.–2 p.m. Talk-in on 145.35(-) or 442.85 VE7RBY. For information and table registration please *call between 7 p.m and 9 p.m. PT, Jim at (604) 946-9801; or Bob (604) 524-9177.*

MAR 11

LONDONDERRY, NH The Interstate Repeater Society Annual Spring Flea Market will be held March 11th at the Londonderry NH Lions Club. Talk-In on 146.850. Tables $10, buyers $2. E-mail *[Harold@neainc.com]; or call Paul at (603) 883-3308.*

SCOTTSDALE, AZ The Scottsdale ARC Hamfest will be held March 11th, starting at 6 a.m., at Scottsdale Community College, 101 North–Exit Chaparral Rd., 9000 E. Chaparral Road, Scottsdale AZ. Talk-in on 147.18. Admission $2; tables $5. VE exams. Contact *Roger Cahoon KB7ZWI, 8501 E. Edward, Scottsdale AZ 85250. Tel. (480) 948-1824; mobile (602) 725-7256; Fax (602) 943-7651. E-mail [wmgraceco@msn.com] c/o Roger Cahoon.*

WEST FARGO, ND The Red River Radio amateurs will host their annual Hamfest and Computer Fair on Saturday, March 11th. The event will start at 8 a.m. and run until 3 p.m. at the Red River Valley Fairgrounds in West Fargo. Talk-In on 146.76(-). Ham radio and computer gear will be sold at the flea market and some commercial vendors will be present. VE exams and seminars will also be featured. Admission $5 in advance, $6 at the door. Tables $8 each; $25 for commercial vendors (with AC power). All ground-level access with Friday night drive-in unloading. For more info, visit the Web at *[http://www.rrra.org];* or call *Mark Kerkvliet at (701) 282-4716.*

MAR 12

YORK, PA York County Area Vocational-Technical School will present "Springfest Y2K," Sunday, Mar. 12th, starting at 8 a.m. Tailgating and setup at 6 a.m. Directions: I-83 to Exit 6; south to 1st light; left into school. Talk-in on 146.97(-). Admission $5, under 12 years old free. Tables $20; contact *Richard Goodman WA3USG, Springfest Hotline (717) 697-2490; or E-mail [Yorkfest@aol.com].* VE exams. Pre-register. Contact *Virginia Moore N3LZS, (717) 252-1694.* Bring copies and certificates. Send payments and requests to *Keystone VHF Club, P.O. Box 7462, York PA 17404.* Visit the Voc-Tech Web site at *[http://members.aol.com/yorkfest].*

MAR 18

MARIETTA, GA The Kennehoochee ARC's 47th Hamfest will be held Saturday, March 18th, 8:30 a.m.–3 p.m., at Jim Miller Park. From I-75 at Windy Hill Rd., go west for approx. 5 miles to Austell Rd. Take a left, go 1/4 miles to Callaway Rd.; take a right on to Callaway Rd., go 3/4 mile. The hamfest is on the right. Talk-in on 146.88(-). Setup Friday 1 p.m.–6:30 p.m. and Saturday 6:30 a.m.–8:30 a.m. Admission $5 at the gate. Children under 12 years free with an adult. 8 ft. tables $20 inside A or B buildings. Outside space 10 ft. x 10 ft., $10. Outside covered 10 ft. x 10 ft. space $15. Electricity $10 per vendor. Free parking. VE exams will be conducted at the First United Methodist Church, Saturday, starting at 9 a.m. Please send SASE with orders to *Charles Golsen N4TZM, 5580 Lake Forrest Dr., Atlanta GA 30342, tel. (404) 252-3303, E-mail [cgolsen@atlanta.com]; or Rubens Fiuza Lima PT2RFL, 5064 Ravenwood Dr., Marietta GA 30066; tel. (770) 928-7038. E-mail [rubens@mindspring.com].* Please, no phone calls after 9 p.m. ET.

MAR 18–19

MIDLAND, TX The Midland ARC will hold their annual St. Patrick's Day Hamfest 8 a.m.–5 p.m. Saturday, March 18th, and 8 a.m.–2 p.m. Sunday, March 19th, at the Midland County Exhibit Building. Some of the many features include a huge inside flea market, dealers, large tailgate area, T-hunts, and a full service concession stand with hot meals. VE exams will be given at 1 p.m. on Saturday. Pre-registration $7, $8 at the door. Tables are $12 each for the first four and $17 each for each additional table over four. For more info contact the *Midland ARC, P.O. Box 4401, Midland TX 79704; or Larry Nix N5TQU by E-mail at [oilman@lx.net].* You can view a hamfest flyer on-line and download a registration form at *[http://www.w5qgg.org].*

MAR 19

JEFFERSON, WI The Tri-County ARC will present "Hamfest Y2K" Sunday, Mar. 19th, at Jefferson County Fairgrounds Activity Center, Hwy. 18 West, in Jefferson WI. Talk-in on the 145.49 rptr. The event will run 8 a.m.–2 p.m. Vendors will be admitted at 7 a.m. Vendors-only parking will be provided for unloading. Admission $4. 8 ft. table space at $6 each. Plate lunches and beverages will be provided by Jefferson County 4-H. VE exams will be available. For additional info contact *TCARC, 413 S. Main St., Fort Atkinson WI 53538. Tel. (920) 563-8740 evenings; Fax (920) 563-9551; E-mail [tricountyarc@globaldialog.com].*

MAUMEE, OH The Toledo Mobile Radio Assn. (TMRA) will hold their 45th Annual Hamfest/ Computer Fair, 8 a.m.–2 p.m. at the Lucas County Recreation Center, 2901 Key St., Maumee OH. For details, send SASE to *Paul Hanslik N8XDB, P.O. Box 273, Toledo OH 43697-0273. Tel. (419) 243-3836.*

STERLING, IL The Sterling-Rock Falls ARS 40th Annual Hamfest will be held at the Sterling High School Fieldhouse, 1608 4th Ave. Talk-in on 146.25/.85. Electronic, radio, computer, and hobby items will be featured at the large indoor flea market. Free parking, including areas to accommodate self-contained campers and mobile homes. Tickets $3 in advance, $4 at the door. Tables $5 each without electricity. Tables with electricity are $6 each. Bring your own cord. Setup Saturday 6 p.m.–9 p.m., and Sunday beginning at 6 a.m. Doors open to the public at 7:30 a.m. Sunday. Use only the North doors on Miller St. Vendors use West Entrance. Public use East Entrance. For advance tickets or tables, contact *Lloyd Sherman KB9APW, Sterling-Rock Falls ARS, P.O. Box 521, Sterling IL 61081-0521;* or call *(815) 336-2434. E-mail [lsherman@essexl.com].* Advance ticket

Continued on page 60

VHF and Above Operation

Number 39 on your Feedback card

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

Noise Figure Meters: Getting the System to Work

Last month, I described the new test bench noise figure meter that I had purchased at a local swap meet. While it is a very special and quality piece of test equipment for the work bench, it did not come "ready-to-work out of the box," as a new device would be. Here, let's look at my efforts to put this noise figure meter back into service.

Scrounged from the leftovers of commercial operations, many pieces of test equipment that become orphans are auctioned off, or, no longer being required, are frequently separated from accessories that make a test set a complete functioning unit. Cords, probes, and even AC cords, along with special external devices normally part of these devices, become tossed into other boxes and sold when unintentionally separated from their main unit.

Such was the problem with my Ailtech 7514 noise figure meter. Its external parts missing included the manual, an external noise head, and a 30 MHz preamplifier with a very special connector to mate with the front of the NF meter to provide power to the external noise head. I will never figure out this connector! Ordering one to retain the unit in unmodified condition was a shock, as the remote preamp connector plug cost over $30, not to mention shipping costs. All this connector does is to feed ground and +40 and +20 volts DC to external regulators in the remote 30 MHz preamp used with the system. Wow, what a price shock! Needless to say, I did not order one, but rather went to Radio Shack, where for just less than $3 (tax included) I purchased a 4-pin standard mike connector plug and panel jack.

I mounted the new jack on the rear panel, drilled a hole, and used an old 7-pin miniature tube-type socket chassis punch to knock out a large hole so that I did not have to file the hole and produce metal chaff inside the NF meter. Normally, the preamp would use a positive DC voltage, but the one I selected for my use from 1 to 12 GHz was a positive ground preamp for 70 MHz. Junk box innovation always saves hard-earned money.

This special negative supply preamp just happened to be in the junk box and functioned well. A more conventional preamp with positive DC power requirements could have been used just as well here. I tried other preamps from my junk box, but this positive ground 70 MHz unit performed best, so it was converted to 30 MHz by adding a few capacitors and retuning existing inductors on the preamp.

I was about to construct a positive ground DC source inside the chassis when I got a stroke of luck. I obtained a copy of the manual and found a negative 20 volt supply already inside the NF meter, in addition to the 40 and 20 volt positive supplies. Looking over the manual showed an option #09 that provided internal circuitry for multiband mixing at additional frequencies vs. the simpler one frequency IF 30 MHz that I had. I determined from the schematic that the load on the -20 volt supply without the circuitry that I did not have was beefy enough to support my external negative DC power requirements for my modified 70 MHz to now 30 MHz preamp.

With this modification in hand, I was ready to attempt operation with the noise head that I located in New York through Bruce N2LIV. Got to thank Bruce for making the noise head available, as without the AIL-7616 noise head that I obtained from him, I would have had to construct a home-built one. That would have worked, but would have had many calibration problems. Given more time to experiment, I will describe construction of home-built noise heads in a later column to help others put a unit of their own construction together.

The system, now nearing completion with this new noise head and modified preamp, started to get my emotions going. It was quite exciting anticipating the first system test of the noise figure meter, as I had wanted a quality test set for a very long time. Yes, I had had an earlier noise figure meter

Photo A. *The Ailtech 7514 noise figure meter and HP-8620C sweep oscillator are used with mixer as local oscillator for making noise figure measurements at microwave frequencies from 5–10 GHz.*

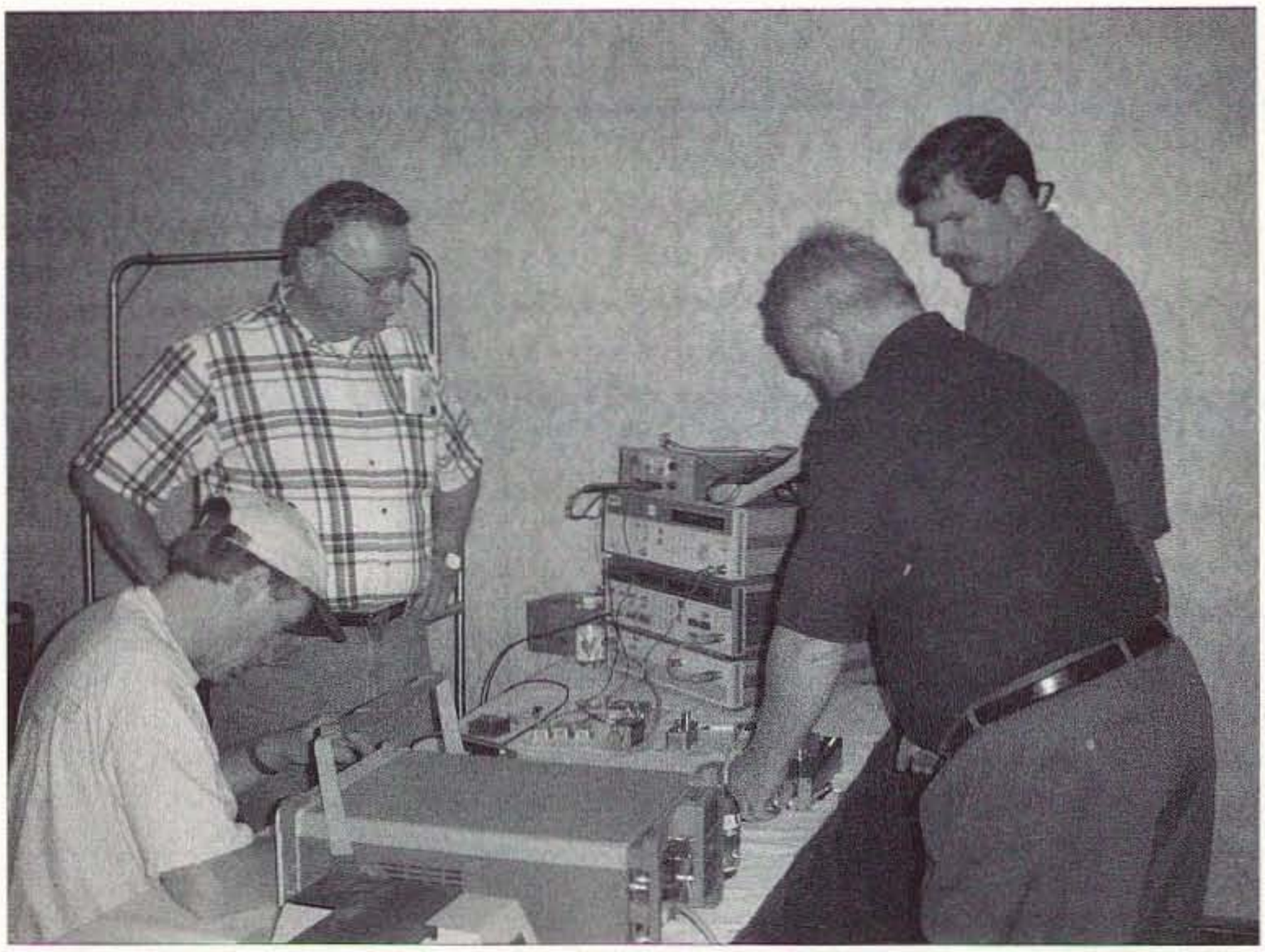


Photo B. *Here's the noise figure measurement table that was part of the Microwave Update '99 conference in Plano TX.*

in operation, but it was designed for less sensitive systems and would not function well below the 2 to 3 dB noise figure ranges. This unit was the Saunders NF meter — the Ailtech 7514 NF meter would be quite an improvement should it perform as expected.

Let's take a look at just what the Ailtech 7514 system constitutes with my new 7616 noise head. The frequency range of the noise head normally sets the range of coverage within which the noise source is calibrated. To test over the frequency range of the AIL 7616 noise head, all that is required is the noise head, a 30 MHz preamp with about 20 dB of gain and a microwave broadband mixer, and a local oscillator. The local oscillator can be anything that will produce a CW signal in the microwave frequency range required and produce enough power output for injection to a mixer allowing good mixer conversion. LO generator output power should be in the neighborhood of +7 to +10 dB. Usually this is maximum output of most signal generators. Be careful of some sweep oscillators, as they can be capable of greater output and need to be checked prior to use lest you might overpower a mixer and turn it into a doorstop by letting the smoke out. Either a CW signal generator or sweep oscillator in CW mode can be used — just be certain of its output capability and don't overpower your mixer. Usually, for most low level mixers +7 to 8 dB is all that is needed.

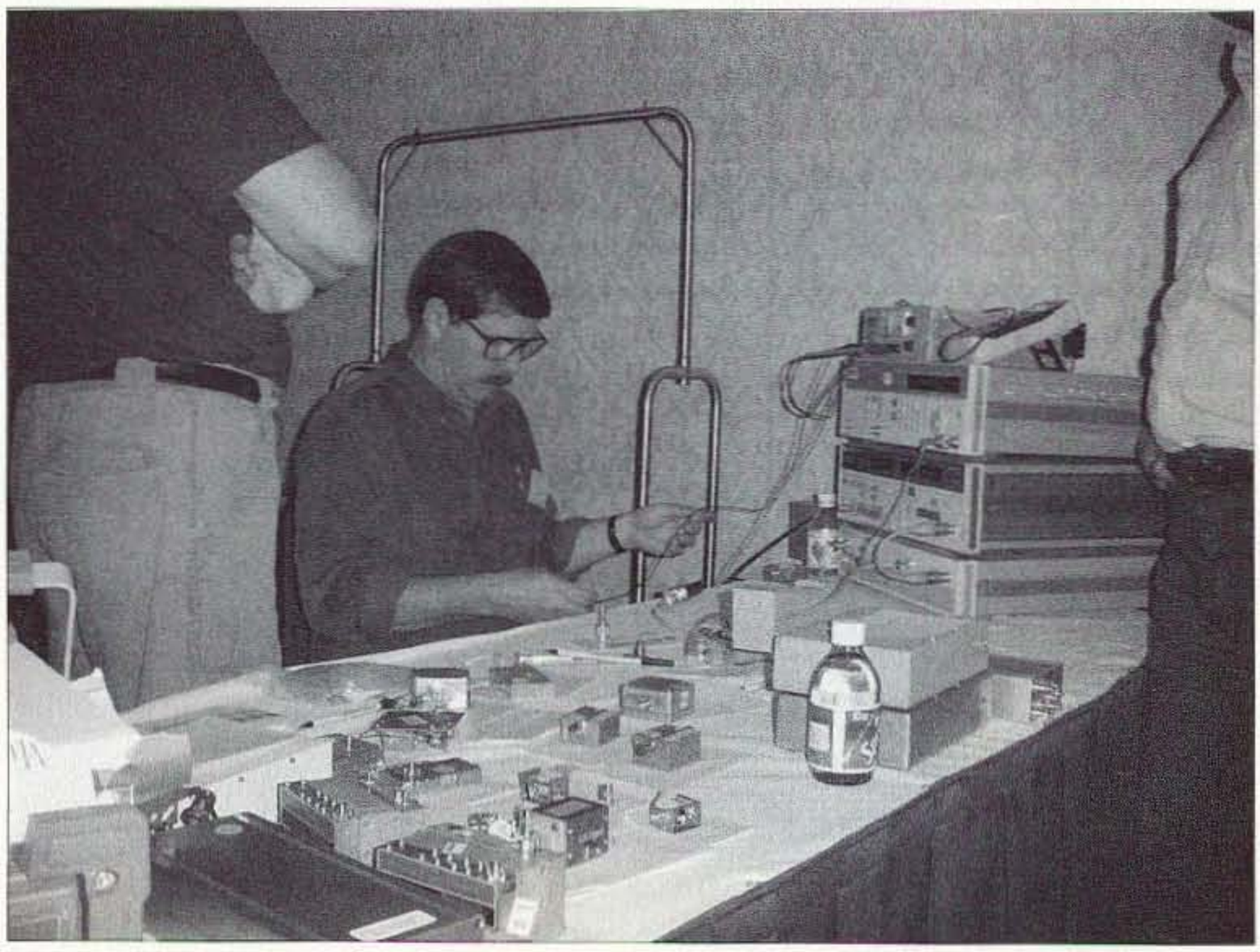


Photo C. *Closer shot of preamps and other devices waiting to be tested at Plano on Oct. 23, 1999.*

Here is the setup that I used. The parts that I used are not specific, as other devices will function well. The parts I used reflect what I had in my junk box. I had an MD-80 mixer with SMA coaxial connectors that covered 1 GHz to 18 GHz and on the bench an HP-8620 sweeper with a 86290C plug-in that provided RF signals over 2 to 18 GHz. The sweeper in CW mode became my LO injection at the desired test frequency.

The preamp at 30 MHz was connected to the IF port on the mixer, and the noise head connected to the RF port of the mixer. Calibrating the system is quite easy with the Ailtech 7514 NF meter. All that needs to be known is the noise power of the noise head. The power is stamped on the side of the 7616 noise head as 15 dB ENR (±1 dB over 1 to 12.4 GHz). With the above calibration (ENR power) and coaxial connections made and power applied, turn on the sweeper sig gen LO and hit cal on the NF meter.

Set the noise power stamped on the noise head (15 dB ENR) to the 15 dB ENR mark on the meter and then hit auto. Now you read the noise figure directly on the meter. In my configuration as shown above with the noise head, mixer, and LO power from the sweeper connections, I read on the NF meter 6 dB. What this 6 dB represents from the noise figure meter is actually, in this setup, very near actual conversion loss of the mixer.

The system is now ready for an unknown component, be it a microwave preamp at the frequency of test, or whatever. The NF meter is ready to test devices, allowing retuning to improve performance sensitivity by setting for lowest noise figure. Here, gain does not reflect maximum sensitivity but, rather, what noise figure your preamp has does. The lowest or least number such as 0.45 dB indicates a much more sensitive device than 1.2 dB. The entire game here is having a meter that allows you to adjust your device at frequency for best (lowest) noise figure.

In the above test, I was using a frequency of 10,368 MHz. I repeated the measurement over the range of the sweeper from 2 to 12 GHz, using the sweeper in a CW mode point

frequency at several spot frequencies, and the results were very close to the 6 dB reading over frequency. I suspect wobbles in the reading were due to noise calibrations in the noise head, with some being due to the mixer and connections. All in all, the setup calibration was quite good and, to say the least, I was quite pleased.

To put the NF meter in operation testing preamps for each of our microwave bands from 1 to 12 GHz, all that is needed is to place the preamp under test between the noise head output and the mixer RF port and repeat the above test calibration. Set the dB ENR in Cal and press auto to read the new noise figure readings. On a test 10 GHz preamp that was tested at Microwave Update '99 in Plano TX, it measured with a 2.17 dB noise figure. On my setup, it measured 2.2 dB NF. I was clicking my heels, as now I could work on amps from 1296 to 10 GHz easily with this setup. Now, could it work at 450 MHz and 2 meters? 450 MHz would be interesting, but 2 meters would be even more so. Remember that the noise head used is only calibrated over 1 GHz to 12 GHz, and operation at 450 MHz or even 144 MHz is quite out of calibration ranges.

By being able to use 2 meters, a converter could be constructed for conversion of microwave converters to translate the 144 MHz IF to 28/30 MHz IF frequency that the noise figure meter requires. This converter means that complete RF transverters can be tested from RF input to IF output, which is 144 to 145 MHz normally in equipment we construct here in the San Diego Microwave Group. 450 MHz IF converters could be used as well: however, most of our equipment uses 144 MHz as the system IF because 2 meter multimode radios were more easily obtained than those for 450 MHz.

Back to the converter issue for 450 MHz. I had a Lunar Electronics RF converter for 432 MHz mode J Oscar converter to 28 MHz and gave it a try. Connecting the noise head to RF input and the IF output to the IF input on the NF meter, an external oscillator was not required, as the converter had an internal crystal oscillator providing the mixing LO for 432 minus crystal LO = 28 MHz IF. Turning the system on, calibrating the same for 15 dB ENR, and hitting auto showed 4 dB NF. Placing an FET preamp between the noise head and the converter and repeating the above test reduced the noise figure to 0.7 dB NF, a great improvement, and showed the system to function well even below its normal calibration of the noise head.

Now to construct a working 144 MHz converter to make my requirement complete. I had a working 116 MHz LO already constructed and used a 144 MHz bandpass filter, but wanted to use a positive supply to power the LO and IF preamp for this application rather than mix power supplies inside and outside of the NF meter. I went through the design stage and used a wideband HP bench 20 or 40 dB amp and gave it a try. Well, this failed right off the bat. The amp, while it did give gain as marked, produced so much internal noise that the noise meter could not tell when the noise head was connected. Further attempts at using MMIC amps — even band-limited to below 100 MHz — showed the same results: The noise meter locked up on internal noise being generated in the MMIC or because of other contributing factors not explored. In short, it did not function.

I thought I was trying to put too much gain in the system to overcome differences in the noise power, as the noise head is only rated to 1 GHz, and here we are trying to use it at 144 MHz. Well, that might be part of the problem, but all I was concerned with was trying to make a converter for 144 to 28 MHz function. Finally, I put a low noise 10 meter U-310 JFET preamp in the mixer system and tried it. No lockup on the NF meter. Still needed a little more system gain in the converter. I then used a 15 dB gain 144 MHz FET preamp and this functioned well.

The noise figure measured 7 dB. I am sure it's better than this, but the system worked. Remember, the noise head being used was only rated to 1 GHz, and we were trying to use it at 144 MHz — way out of calibration range. I call the 7 dB reading greatly suspect. It did not matter what the converter noise figure was, as it was to be a part of a much larger scheme using microwave converters and using the 144 MHz converter on the IF output to connect to the NF meter 30 MHz IF input. Whew, what an exercise in operations and system test!

Was the exercise worth all the aggravation in making the barebones AIL-7514 NF meter function by constructing all the needed external equipment? Oh, you can bet on it for sure. After going through all this effort, I would be a real unhappy camper if I should misstep and drop or damage the noise head. It is called in this hobby "unobtanium." When you are lucky enough to have one, protect it. Do not key your transmitter into it, as it will give up its smoke, and that material, once released from its container, can never be put back. Just use caution and be careful. Remember, you can measure a dozen times, but can only cut once.

Why did I describe this effort in detail? Well, to describe all the steps we go through to put something together hopefully will assist you in a methodical manner to put a similar setup together. Be it an Ailtech meter or some other one, the principles are all the same. The chase to put together an orphaned test set can involve quite a quest in looking for components cables and manuals. The most important asset to mention is all the assistance you can obtain from others. It's this sharing of information that is so necessary to our repair effort, which could not have been pulled off without this assistance. The Internet was the vehicle that played the major role in searching for information and material. It provided for locating a manual, and the search for the manual turned up a noise head. That's because there are sharing amateurs who take the time to read questions on amateur-related reflectors, great sharing of information forums.

In my case, the questions in looking for information and manuals netted both a noise head and a manual, which I was quite happy to pay for. Additionally, while the manual did splendid on the noise meter, it left out much on the external preamp (probably a separate manual), and that left me with further questions, as you can see from my experiments in this article. There were many other E-mail replies concerning how others interfaced their meters. These replies all helped to formulate my system into what it is today. I am not a purist and thus will not worry about the absolute calibration of my system. While it is nice to know exactly what the real number is, it is good enough for me to have eyes that allow improvement with a small uncertainty and to know how to make noticeable improvements with this test set.

In review

Noise figure test equipment can give you a handle on performing a meaningful test, and allow you to tweak the circuit and gain improvements to any system under test by using a meter such as the one I have. It allows you to adjust your system or preamps to a lower number, which equates to better sensitivity. A higher noise figure number means poorer sensitivity; lower numbers mean better sensitivity. Hopefully, you will be able to locate a meter for your own use. In another column I will, when tests are complete, describe a simple noise head you can use on your systems to make improvements to your equipment. It will be a simple unit to construct, but one that if all design plans go well will give you an effective test device for the work bench.

I hope you found this example covering my involvement with noise figure meters to be of interest, and I also hope that you can put it to use in testing your own microwave or UHF/VHF systems. 73

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083-5640

Contacting AO-27

Last time, we investigated information about AMRAD-OSCAR-27. This month, we'll get down to the basics of making contacts via this crossband repeater in the sky. With a typical dual-band handie-talkie and the details in this column, you can get on the air and make contacts NOW. If you haven't yet listened to and made contacts through an amateur radio satellite, it's time to start.

Your Earth station: AMRAD-OSCAR-27 (AO-27) is a single-channel crossband FM repeater. The input is on 145.850 MHz. The downlink is on 436.797 MHz. Thus, to work the satellite, you will need to transmit on two meters and receive on 70 cm. A dual-band 2m/70cm HT that can transmit on one band while simultaneously receiving on the other is all you need. I use an older Alinco DJ-580T and the larger 12-V battery pack to get the most possible output on two meters, five watts. While my radio required some simple hardware modifications to operate in the 430-440 range, most new HTs are ready to go over the whole U.S. 70cm band, right out of the box.

Your satellite antenna

I have four dual-band antennas for my HT. All use BNC-type antenna connectors. The short stock "rubber duck" that came with the Alinco DJ-580T is good for local communications and repeaters, but it just doesn't have enough capture area to receive AO-27 or transmit to the satellite. Several companies make longer antennas that can be used for hamsat communications. My first was the Diamond RH77B. It's 15 inches long, and has been used for dozens of AO-27 contacts while I have been out on camping trips and cruising the Caribbean. A similar but less expensive antenna is the MFJ-1717. It measures 16 inches long and looks like it came from the same manufacturer. You will like it.

Photo B. *The Alinco EMS-8 speaker/mike and earbud headphones ready for AO-27.*

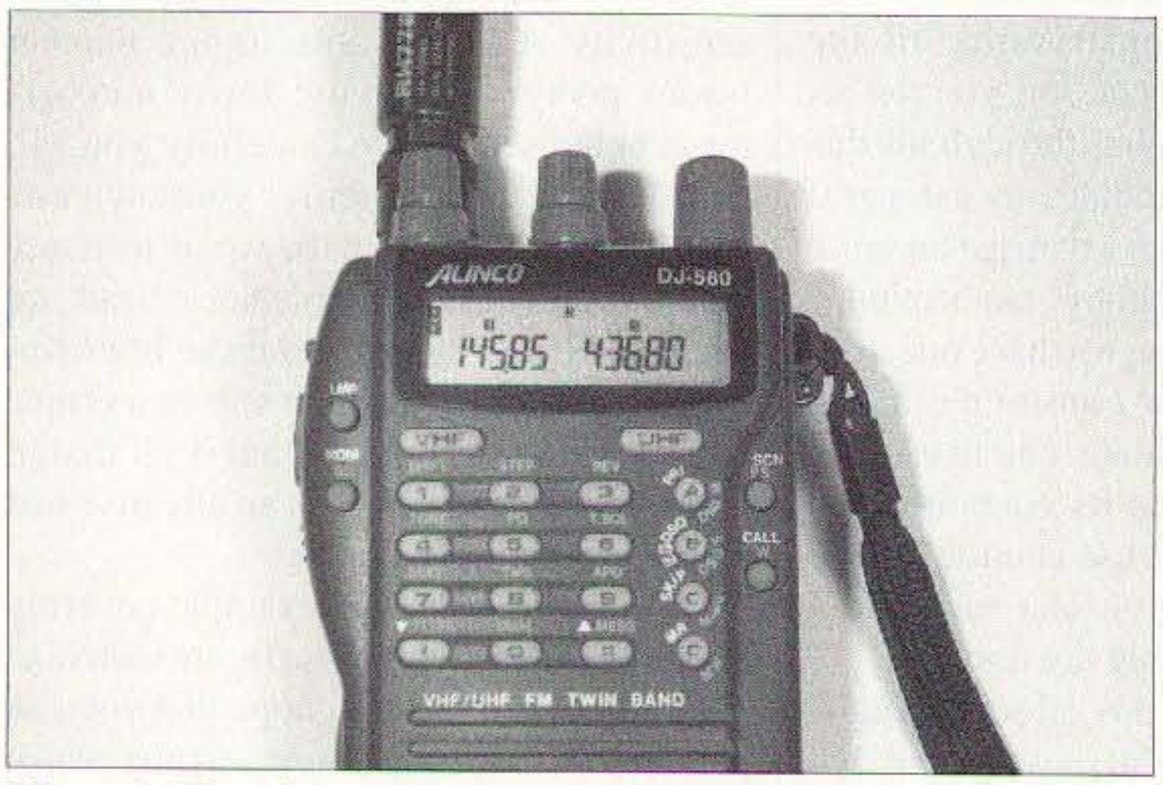


Photo A. *The Alinco DJ-580 set to go for AO-27 operation.*

Photo C. *The Mirage dual-band power amplifier can make a difference for mobile or home operation.*

My newest favorite for satellite work is the MFJ-1712. It is a telescopic dual-bander, providing a 1/4 wave whip on two meters and a 5/8 wave whip on 70cm. When collapsed, it measures 7.25 inches. When fully extended, it is 19.25 inches. Unlike the other antennas, it is rigid and a bit longer when fully extended. When collapsed, the length is identical to that of the HT with the larger battery pack. It fits well in the same inexpensive camera case that I use to transport the HT, spare batteries, and other accessories.

Your accessories

Yes, you can use a stock dual-bander to make satellite contacts, but due to the full duplex nature of the crossband operation, it's not convenient or easy. Two items make a big difference: a speaker/mike, and an earphone or earbud headphones.

The speaker/mike allows you to move the HT around for best reception without making your head go through the same gyrations. The antennas on the satellite are changing their apparent polarization with respect to you during a pass. To get the best reception, and uplink, it is necessary to orient your HT antenna for the clearest signal. It becomes second nature after you have done it once.

The earphone or earbud headphones prevent feedback and help when signals fade. On most HTs, the built-in mike is very close to the built-in speaker. For crossband repeater work, feedback is the result. You won't like it, and the other satellite operators won't either.

For a campout or trip where extra gear is a problem, the mike and phones are all you will need. If you are working from a car, a small dual-band amplifier can help, but antenna orientation is a problem. Most mobile whips are mag-mounts and hard to move around for best satellite reception, but it can be done and provides another option. Maha and Mirage have some nice amplifiers that can provide some extra power to help during crowded conditions on the satellite.

Your tracking data

Several satellite tracking programs had problems after the first of the year. The data provided in **Table 1** was derived from a Y2K-compliant version of Silicon Solutions GrafTrack Rev. 4.01. The data from the program has been trimmed down to provide information about the best single pass per day for AO-27 as seen from Boston MA, Houston TX, and Los Angeles CA.

Pick a location that has a longitude similar to yours. For example, if you live in San Francisco, use the Los Angeles data. On March 1st, orbit 33514 will be at the Time of Closest Approach (TCA) at 17:23 UTC or 09:23 PST for Los Angeles. AO-27 will be at 50 degrees elevation to the east. For an observer in San Francisco, this TCA will occur a few minutes earlier.

You can hear the satellite about seven minutes before and after TCA. All orbits are descending. That means that the satellite is traveling from the north to the south.

Continued on page 60

	Boston MA			Houston TX			Los Angeles CA		
March	TCA	El+Az	Orbit	TCA	El+Az	Orbit	TCA	El+Az	Orbit
01	1538	32W	33513	1543	43E	33513	1723	50E	33514
02	1511	55W	33527	1655	32W	33528	1835	30W	33529
03	1444	85E	33541	1628	62W	33542	1808	56W	33543
04	1417	48E	33555	1601	68E	33556	1741	78E	33557
05	1529	37W	33570	1534	34E	33570	1714	40E	33571
06	1502	65W	33584	1646	39W	33585	1826	36W	33586
07	1435	72E	33598	1619	76W	33599	1759	69W	33600
08	1408	40E	33612	1552	55E	33613	1732	63E	33614
09	1520	45W	33627	1525	28E	33627	1705	33E	33628
10	1453	78W	33641	1638	48W	33642	1817	44W	33643
11	1426	59E	33655	1610	86E	33656	1750	84W	33657
12	1538	31W	33670	1543	44E	33670	1723	51E	33671
13	1511	53W	33684	1656	31W	33685	1835	29W	33686
14	1444	87E	33698	1629	60W	33699	1808	54W	33700
15	1417	49E	33712	1601	70E	33713	1741	79E	33714
16	1530	37W	33727	1534	35E	33727	1714	41E	33728
17	1503	64W	33741	1647	38W	33742	1826	36W	33743
18	1435	73E	33755	1620	75W	33756	1759	67W	33757
19	1408	41E	33769	1552	56E	33770	1732	65E	33771
20	1521	44W	33784	1525	28E	33784	1705	34E	33785
21	1454	77W	33798	1638	47W	33799	1817	43W	33800
22	1426	61E	33812	1611	88E	33813	1750	82W	33814
23	1359	34E	33826	1543	45E	33827	1723	52E	33828
24	1512	52W	33841	1656	30W	33842	1835	29W	33843
25	1445	88E	33855	1629	59W	33856	1808	53W	33857
26	1417	50E	33869	1602	72E	33870	1741	81E	33871
27	1530	36W	33884	1534	36E	33884	1714	42E	33885
28	1503	63W	33898	1647	37W	33899	1826	35W	33900
29	1435	74E	33912	1620	73W	33913	1759	66W	33914
30	1408	41E	33926	1553	57E	33927	1732	66E	33928
31	1521	43W	33941	1525	29E	33942	1705	34E	33942

Table 1. *March 2000 tracking data for AO-27.*

NEVER SAY DIE

continued from page 44

50:50. No, I've deprived myself of this commercial extravaganza, one which would exhaust even my fast forward patience. Hmm, I'll have to start timing some of the commercial breaks. Some go on and on (and on) with ads for food products no one should ever buy, and endless car ads, with an occasional program break.

Schools

A recent *Newsweek* article cited the statistics confirming "that what you earn depends on what you learn." Yet, here we are with our public schools providing less and less learning compared to other countries, as proven through international tests, and even as compared with previous generations.

But what can parents do? Home schooling often does a wonderful job of educating children, but that means that one parent has to be dedicated to it, and in today's world it takes the incomes from two wage earners to make ends meet. Sure, there are some private schools bucking the trend, but they're expensive, and often difficult for the kids to get into.

What about improving the public schools? Over the dead bodies of the National Education Association union leaders, who seem dedicated to making sure that as many teachers as possible have as high wages as possible, with no regard whatever to their ability to teach. I wish I could get you to read some of the books I've found which explain in detail how bad our schools have gotten, and why. They're reviewed in my past editorials and in my *Secret Guide to Wisdom*. Oh, well, I can lead you to the water, but I can't get most people to actually drink.

One holdover from the 19th century is the firmly implanted idea in most teacher's minds that forcing their students to memorize facts in order to pass a test is "teaching." Getting kids to understand new concepts is teaching, not quickly forgotten stuff memorized to pass a test.

I went through K–12 and college, but I sure didn't emerge educated. I didn't understand squat. Oh, I did get a superb electronic education, courtesy of the U.S. Navy, with no thanks whatever to my college EE course. WWII came along and the draft board insisted that I would be of much more value as cannon fodder than wasting my time in college passing tests of my short-term memory. I opted for depth charge fodder and spent the war aboard the *USS Drum* SS-228, which you'll find on display in Mobile AL, complete with the flags painted on the conning tower for the Japanese ships we sunk. It was a bunch.

I'm now well educated, with no thanks to the K–12 schools I attended or to my four years in college. I'm self-educated. And this is essentially what the Sudbury Valley School in Framingham MA is permitting its students to do. I do think they should bring in people like me to open the doors of curiosity for their kids so they'd get even more excited about educating themselves.

I've talked with a lot of college professors as I've gone around giving lectures on entrepreneurialism at schools such as Yale, Babson College, Boston University, Rensselaer, Case-Western, and so on. Few (almost none) have been well educated, from my viewpoint. "Well, I don't know anything about that," is the answer the minute I get out of their dedicated field.

More money is not going to improve our public schools. Higher paid teachers won't help either. Nor will having more teachers. All of these "fixes" have been tried, over and over, and none have improved kids' test scores. More and higher paid administrators hasn't helped either, though this approach has been tried endlessly.

As teaching via DVDs becomes available, parents will finally have an alternative to the public school dumbing down brain grinder. Worse, as has been chronicled in many books, the concentrated efforts of the public schools to counter parental teaching and brainwash the kids with socialist ideologies needs to be stopped.

Can kids learn through self-education, even in their early years? Of course they can! Kids love to learn. They eat it up. That's what they've been doing ever since they were born. They've been exploring and learning. As soon as they can talk, they're an incredible nuisance, forever asking "why?" That's a major nuisance, because many parents don't know why. Kids need to be stimulated, not bored.

Some entrepreneur or school is going to start making grammar school subjects available on DVD, and we'll soon see the rise of a business that will eclipse Microsoft — and will change the world.

Fuzzy Laws

Maybe you've wondered why our courts (read: judges) more and more are making the laws. The reason is simple, the obfuscating career politicians you have been electing and then re-electing have been passing fuzzy laws which then are invitations to litigation. By avoiding specifics, they avoid making people angry.

Gee, what a surprise, considering that most of our career politicians got their hands into the public till after being lawyers. So they're busy passing laws which say all kinds of feel-good things that are so vague they don't upset the people who re-elect them. Then it's up to judges to decide what the new laws mean in practice.

Take that seemingly well-meaning Americans With Disabilities Act of 1990, which set a modern record for vagueness. Barriers to the disabled must be removed "where removal is readily achievable" and the cost "not unduly burdensome." Civil rights protection is extended to all Americans with impairments that "substantially limit" one or more of "major life activities."

Well, I'm going to sue the next company that refuses to hire me. You see, I'm disabled because I'm 77 years old, and for no other reason. That's age discrimination. That "impairment" is limiting my major life activity of making a living.

So we have expensive spectacles such as the recently deceased Judge Garrity's forced bussing of kids. Surveys have proven this a huge failure, with us taxpayers picking up the multibillion dollar tab.

If legislators would enact clear and definitive laws, they might be able to save us a lot of misery and expense. It'll never happen.

Crystal Ball

Jim Guinta W3WA asked what I thought amateur radio might be like if the present trend continues. Golly, that's difficult to imagine! What do *you* think?

Of course, if the League got busy promoting the hobby, we might stand a chance. There certainly is a lot of pioneering still left to be done. Packet at 9,600 baud is pathetic. Let's get busy adapting digital compression technologies to amateur radio. We should be able to send most of the stuff they're doing on the Internet.

But, if things continue as they have, we'll have almost no incoming hams, ditto Techs upgrading.

The pioneering today is in the Internet. By 2010, we should be able to join chat groups on just about any subject of interest, with participants anywhere in the world, and automatic language translation. We'll have access to any movie ever made, and tens of thousands of old TV shows. Between the Internet and the 2010 version of DVDs (probably the size of a penny), we'll be able to learn about any subject we can imagine via an interactive video course.

Will anyone even care if some one or a group goes to some rare spot and sets up a satellite-linked Web site? Will I go yet again to Navassa Island (KC4AF in 1958 and

KC4DX in 1973), down between Haiti and Jamaica, to put digital video pictures of the island and a travelogue on a Navassa Web site? But then there's no League to offer a certificate for people contacting 100 countries on the web, so there may not be much interest in Web DXing.

So, if the present trends continue, what's *your* guess for what amateur radio will be like in 2010?

Schools 2020

I probably should make my prediction for 2050, but I'm always over optimistic about how long it will take for changes to be made. At any rate, I have a vision of the future for our schools and you can do like 99.99% of the people and either scoff or ignore it. Or you can say, hey, there's one hell of an opportunity for me to help move the world along, and make some money doing it. That's always a good combo.

With virtually all of the stuff that's included in today's curriculums for K–16 eventually being available on either DVD or whatever better medium replaces DVDs, amazingly interactive ways of learning will be open to our kids. Note, I did not say anything about teaching or learning today, which seem to be virtually lost concepts in our present public school system.

Most of the classrooms by 2020 will be in laptop DVD/Internet units, not in school buildings. Courses will be taught by performers and kids will learn because it's fun and they want to learn, not because they will be punished if they don't, as it is today. The Sudbury Valley School in Framingham (Mass.) has shown that this heretofore unthinkable concept actually works.

Many animal trainers have learned that they can do much more using love instead of punishment, but this concept still seems alien to many parents and most certainly is to the public school system.

But with DVDs easy to carry and Internet connections everywhere, kids will be free to travel and see the world, taking their classrooms along with them. The teachers' unions are going to fight this to their death, but the need for teachers will inevitably fade away as they are replaced by professional actors teaching via DVDs. This will mean a need for fewer administrators, too. Plus the need for very few classrooms and their maintenance. Fewer books, too. In all, the cost of educating kids may be able to be cut by around 75% or more, with the resulting education vastly superior to anything available today at any price.

Okay, let's take some of those savings and invest them in a different kind of education.

If our schools go to a 50-week per year schedule, as I have proposed, with students having the option to take "vacations" whenever they want, we could put the savings into group tours of other countries. If kids, starting, say, at around ten years old are able to go in groups to visit other countries, laptop classrooms in hand, by the time they are 18 they'll have been able to visit over 25 countries, spending a week or so in each one. With over 200 countries out there to visit, our kids wouldn't seriously bog down the visiting facilities in other countries. But then, our program would, I believe, quickly be adopted by more and more countries for their kids.

It doesn't cost very much per passenger for dedicated flights, but to get the program started, I'd suggest making a deal with the airlines to fill any unsold seats with student travelers, each with a box lunch provided by the school travel program. This would keep the added cost to the airlines of filling the unsold seats to almost nothing, making things like a $100 fare to Kenya feasible.

The visiting students would be met and shown around by local students, anxious to take advantage of the opportunity to improve their English. I suspect that special hotels would soon appear in one major city after another, catering to these student tour groups. This would also help to keep costs to a minimum.

Hmm, let's see. If a million American kids are in the travel program, and they're visiting 200 countries, that would net out to about 5,000 per country, divided by one week per visit for 50 weeks of the year, would give us about 100 students visiting a country at any time per one million kids in the program. That wouldn't overload even the smaller countries, and the larger cities would easily handle ten times that many visitors, and love it.

So, with most of the stuff kids need to learn, and that's vastly more than they're learning today, being taught via laptop classrooms, why would we need schools at all? That's easy. With both parents working we'll still need the baby-sitting function of schools. Plus I envision our schools helping kids to learn far more skills than at present, and most skills require equipment. But, rather than have every school have to have a chemistry lab, an electronics lab, and so on, my idea is for every school to build some sort of a lab into a tractor trailer so it can be used to service a dozen schools — being moved from one school to another every couple of weeks or so. In this way, we can have one for video production, another for audio recording, one for computer repair, one for cooking, another for woodworking, one for metalworking, another for optics, glass blowing, car servicing, and so on.

The students would know what labs would be available and when, and could sign up for those that interest them. Yes, of course there would be promotions on the Internet explaining what skills each lab would help them acquire and the benefits involved. Whoops, I almost forget one with driving simulators, another for flying, etc. Simulators

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On the Go

Mobile, Portable and Emergency Operation

Number 46 on your Feedback card

Steve Nowak KE8YN/4
1011 Peacock Ave. NE
Palm Bay FL 32907-1371
[ke8yn@netzero.net]

Promoting Mobile and Portable Operations

This month, Steve looks at the many benefits of mobile and portable operations. He also points out how they can be used to expose nonhams to our wide world of radio, plus shows us how an HF station can pack into a briefcase for any remaining Y2K preparedness we might need.

Why do so many of us enjoy operating mobile or portable? Like most aspects of ham radio, there are almost as many reasons as there are amateur radio operators. For some people, it is just a practical decision. People who live in homes that have deed restrictions or covenants prohibiting antennas may find that mobile operations are the only opportunity that they have to get on the air. In other cases, it may be a matter of time; the time spent in the car may be long due to an extended commute, so the best time to get in some ham radio time is while driving to and from work. With some occupations such as truck driving, the entire day might be spent driving, so the radio may be a way to enhance the hours as well as to provide a good backup communications system. Believe it or not, there are still some places where ham radio signals go and cellular signals don't! For others, it may be in support of another interest; if you have the pleasant opportunity to spend significant time sailing your boat or touring the country in a motor home, a small ham rig can add 10 dB to the overall enjoyment of the experience.

In each of these cases, there are certain benefits that appeal to each operator differently. For some, it may be the joy and appreciation of a technologically oriented gadget. There is a certain intrinsic appeal to the look of a well-designed rig with many features mounted in a prized vehicle, especially now that rigs have gotten so small. No cell phone or other gadget can compare to a nice multiband rig neatly installed in an automobile.

Some people just enjoy the chance to communicate. Operating mobile allows you to chat with the usual gang on the local repeater or with someone in a location you may have never even heard of before. And, there is the "rehumanization" aspect: After a hard day of work, the chance to get on the air may help you to mellow out considerably before getting home.

Why operate portable?

Portable operations provide a whole new set of opportunities. If your job involves a lot of traveling, a portable rig may allow you to get in some radio time from the hotel room. With the band open now, ten meters is ideal, and a small 10 meter FM transceiver, power supply, and dipole can be easily packed into a corner of the suitcase. A gel cell and trickle charger take up even less space than a small power supply, and the rig and antenna may then fit into your briefcase.

Going camping? What a great opportunity to operate campfireside. Your wife wants to take the family to her brother's for the weekend? Here's the chance for you to sneak off and get in some DXing while everyone else is forced to listen to your brother-in-law's same old stories.

Photo A. *Kids of all ages are drawn to ham radio. It's up to us to encourage their interest and enthusiasm.*

Sharing the hobby

There is another great reason for mobile and portable operations. Mobile and portable ops provide a wonderful chance to share the hobby with others. Unfortunately, ham radio is one of the best kept secrets around. It's odd that a hobby which features communicating with the whole world manages to be kept under wraps by its practitioners. Think of it — in some cases, we may be in contact with hams on the opposite side of the world more regularly than we are with the neighbors across the street. We share the hobby with those who are already involved but rarely with those who might become interested if favorably exposed to amateur radio.

A shortage of young hams

How many young hams do you know? By young, I mean truly young as in less than 30, and not relatively young as in anyone born after I was. Now deduct those who have a parent or other close relative who is a ham and who brought them into the hobby. How many can you count now? I'll bet the small number you had before now approaches or has reached zero. Now, compare that to people in the same age bracket who are computer literate. Quite a difference, isn't there? No, it's not because

today's youth is undisciplined, disrespectful, disinterested, or intellectually compromised. The reason is that almost everybody is exposed to computers, while very few are exposed to amateur radio. You can't become interested in something about which you know nothing.

Why did we get into ham radio in the first place? Because it is fun, that's why! Note that I did not say that it *was* fun — it *is* fun. Kids will still be drawn to ham radio the same way they always have been, but most of them are never exposed to it in a way that creates interest. It is almost the opposite, in fact. Each of us is rightfully proud of the fact that we passed the appropriate tests to get licensed. Unfortunately, we sometimes focus so much on the rigors that we scare people. C'mon — this is a hobby, not navy SEAL training we're talking about! Getting a ham license is a landmark, not an ordeal. We need to show others what a fun hobby it is and stop scaring them off.

There are many people out there who may have a potential interest in ham radio but don't know how to break into the hobby. There are others who could be interested if they were exposed to it. In the old days, it was not uncommon for a potential ham to notice an antenna array on someone's house and to go knock on the door to ask about it. In this way, many a youngster found a willing Elmer who would guide and coach them and get them started in the hobby. Today, our society no longer encourages such straightforward contact. A young man or lady who mentioned trying such a tactic to parents would probably be advised that such activity was not appropriate or safe for a number of very good reasons. Therefore, we as hams need to expose people to the hobby in a positive and interesting manner in a safe environment.

While it is true that there is information out there on becoming a ham, people have to really be determined to find it. There are many new giant bookstores out there with millions of books. Some of these stores include restaurants or coffee shops to make the book buying experience more pleasant. They have books on everything — well, almost everything. I haven't seen a book about ham radio at the bookstores in my neck of the woods. Ham radio books may be special-ordered, but that presumes that you know which book you want; the whole appeal of a bookstore is that you can flip through different books to see which ones you like. So how about the local library? If the aspiring ham is lucky, there may be a four- or five-year-old copy of a dry license preparation manual. In most cases, that's enough to sour him or her on ham radio and send the individual back to the Internet.

A different approach

I propose a different approach. Let's take ham radio out into the community and expose everyday people to the fun of the hobby. There are all kinds of groups who might be interested. Among the young people there are Scouts, the Boys' and Girls' Clubs, and don't forget schools. Give a busy teacher a break, and offer to do a presentation during science class. If you work with ARES or RACES, how about a presentation at the Red Cross meeting for disaster services volunteers? And then there are the senior centers, where many folks who never had the time before now meet.

Of course, you want to present something interesting to these folks. People react to what they can see or hear or touch better than things they merely hear about or read about. This is exciting stuff, so let's show them some things that they haven't seen. Make it something different, yet keep it easy to understand. Two meters is easy to transport and show off, but in most cases it's kind of predictable. Everybody has seen cell phones, Citizens Band, and Family Radio Service radios, so unless you have a schedule lined up with the space shuttle, I wouldn't rely on two meters or 440 MHz to get people excited. Of course, the other extreme is equally unsatisfactory. This is the

***Photo B.** Many modern HF rigs such as the Alinco DR-M03 10-meter FM transceiver readily lend themselves to portable operation and can be taken almost anywhere.*

Field Day demonstration where sixteen hams set up a circus tent with a 2,000 watt high frequency station requiring tons of equipment and 3 miles of antenna wire.

Have radio, will travel

Why not use a portable rig? A modern six-meter or ten-meter rig may require only two connections — one to a power source and one to an antenna — and it's ready to operate. A dipole or other wire antenna can be strung up quickly in a minimum amount of space with very little effort. If you've operated on the band regularly in the past, you should know which repeaters are able to be accessed, so try to orient the antenna appropriately. In a matter of minutes, you could be on the air talking to a station a hundred or a thousand miles away. Pass the microphone around and let others try a little DX — we sometimes forget how addicting it can be. If you brought along a handful of

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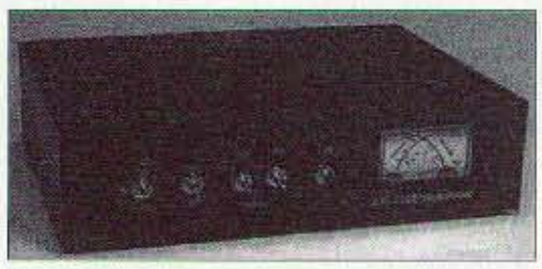
New Products

Number 48 on your Feedback card



NEW AUTOTUNER

LDG Electronics has announced the AT-11P, a new model in their autotuner line of products. The MP features a dual cross needle meter, providing forward/reflected power and SWR indications. Additionally, an optional remote head is available to allow the tuner to be remotely mounted and still have control over the functions and visual indications of its status.

The MP also features an interface for the Icom IC-706 radio. While it will operate with any HF radio, the AT-11MP will use the built-in tune button on the IC-706 faceplate and tune when this is pressed.

The AT-11MP operates 1.8 to 30 MHz at 5 to 150 watts continuous. The tuning circuit features a switched "L network" and is microprocessor-controlled via a Motorola 68HC11. Power requirements are 11 to 14 VDC with a current consumption of 15 to 500 mA (250 mA average). The AT-11MP will tune practically any coax feed antenna.

This unit is available fully assembled and tested for $239; as kit with enclosure, $199; and as kit without enclosure, $169. For the optional remote head, the prices are $39 assembled, $29 kit. A balun impedance matching transformer is available to allow the tuner to tune endfed, longwire, and random length antennas: $30 assembled, $25 kit.

For further information, contact LDG Electronics, 1445 Parran Road, St. Leonard MD 20685; tel. (410) 586-2177; fax (410) 586-8475; E-mail [ldg@ldgelectronics.com]. Their Web site can be found at [www.ldgelectronics.com].

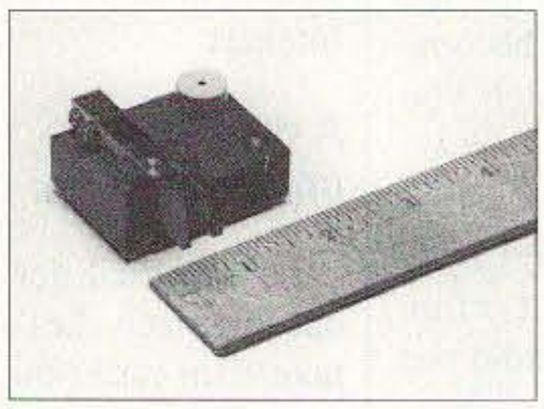
NEW HAMTRONICS CATALOG ... PLUS

Hamtronics has recently released their new Year 2000 catalog, which contains 40 pages of kits and wired units for amateur radio, two-way shops, scientific and industrial users, and OEMs. Several new products have been added to the usual lineup of high quality VHF and UHF.

The T304 and R304 are new UHF versions of their popular exciter and receiver modules using new low-noise frequency synthesizer technology. The LNY is a new series of low-cost VHF and UHF receiver preamps. The LNP is a new line of VHF receiver preselectors with a low-noise preamp built in, helping to eliminate intermod interference from paging transmitters and other out-of-band sources.

These new products are added to the already popular selection of VHF and UHF FM transmitters, receivers, power amplifiers, transmit and receive converters, preamps, repeaters, DTMF controllers, autopatches, and digital radio modems that Hamtronics has manufactured for 38 years.

For a free copy or further information about any Hamtronics product, contact them at 65-D Moul Rd., Hilton NY 14468-9535; tel. (716) 392-9430; E-mail [jv@hamtronics.com]. Their Web site is at [www.hamtronics.com]. Remember to say you saw it in *73!*



NEW FROM PADDLETTE: MINIATURE PADDLE KEY-KEYER COMBINATION

Paddlette Co. is pleased to announce two new products, their models KP-1 and KP-3 iambic paddle key/electronic keyer combinations. Both models combine a Paddlette key with an Embedded Research TiCK keyer IC in a tiny 1-1/2" x 2" enclosure — total weight: 1.7 ounces.

Both units generate strings of dits and dahs in response to paddle strokes, and in addition provide a menu of keying options to the user. These are accessed by holding the push-button down until the desired Morse character is heard, then releasing the button and following the simple instructions in the manual. The basic KP-1 menu items and Morse symbols are: speed — "S"; tune — "T"; paddle select — "P"; piezo on-off — "A"; straight key mode — "SK"; and iambic mode A/B — "M". The model KP-3 adds two 50-character message memories and recalls plus a beacon mode that will repeat either message ad infinitum (or until user hits either paddle).

Both are very high quality, professional-grade units — rugged, reliable, and easy to use. They are completely self-contained, including the 200 mAh, 3 volt lithium coin cell. Key-up current drain is 1 microamp; key-down drain is 0.6 milliamp. Battery life under average operating conditions (two hours per day, 365 days a year — 50% sending, 50% receiving) should exceed one year. Output is to a 1/8-inch mono jack and will drive any normal solid state transceiver. Both models feature a very strong magnetic hold-down and an optional knee mount.

Prices: Model KP-1, $72; with knee mount, $79.75. Model KP-3 $82; with knee mount, $89.75. Shipping and handling: $3.75, first class U.S. mail.

To order or further information, contact Bob Hammond KI7VY, Paddlette Co., P.O. Box 6036; Edmonds WA 98026; tel. (425) 743-1429; E-mail [bham379627@aol.com].

LOGWINDOWS 3.06.50

Creative Services Software has now released its latest update to LogWindows, version 3.06.50. Created in 1994 by Ira Chavis WA1W, LogWindows interfaces with all of the CSS TNC host mode programs, including PacTerm '98, PKTerm '99, and MultiComm Host.

LW 3.06.50 is now on the Web at [www.cssincorp.com/logwindows]. This version is a combination activation key, and use the full capabilities of the program. Installing the demo version will overwrite any older version already installed.

Prices are $49.95 retail (16-bit); $25 current upgrade; and $35 competitive upgrade for users of other log programs. New purchasers of or upgraders to 3.06.50 will receive all future 3.x upgrades for free, as well as a free upgrade to the 32-bit version when it becomes available.

For further information, contact Creative Services Software, 503 West State Street, Ste. 4, Muscle Shoals AL 35661; tel. (256) 381-6121; E-mail [sales@cssincorp.com].

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Michael Bryce WB8VGE
SunLight Energy Systems
955 Manchester Ave. SW
North Lawrence OH 44666
[prosolar@sssnet.com]

Tending the (Antenna) Farm

This month, WB8VGE takes us a couple of steps further in QRP fun with some good pointers on building and using QRP gear. Truly, QRP is the route to low cost and go anywhere hamming!

It's almost springtime, and what better time of the year to fix up the antenna system after all those winter storms. And, according to the people who are supposed to know these things, the solar index is getting higher and higher. It's really going to be easy to work the world with a watt or two during the coming spring and summer season.

But before the snow starts melting, it's time to check out the antenna farm. Since we moved from the old homestead, our new QTH is lacking a single tree for holding up antennas. I managed to tie off a nylon rope in a neighborhood tree. The other end is attached to the eve of my house. The distance is about 700 feet.

Between the two, I have an all-band folded dipole that covers 80 to 10 meters, including the WARC bands. The dipole has an SWR of less than 1:2 on all bands. On some bands, such as 30 meters, the SWR is flat across the band. Since I had installed this antenna in the late fall, it had to go up and stay operational all winter long.

Since all I operate is QRP, I had to get the most out of this antenna. So, if you're going to work on your antennas before winter, you may find these tips helpful in increasing the efficiency of your antenna system.

Since I had such a long run between the transceiver and the antenna, I used a very good quality of coax. The coax is made by Belden and is RG-213U. Since the majority of the cable is run on top of the lawn, I choose the type that has an UV proof jacket.

Coax does not last forever. If your coax says "Allied" or "Olson," it's time to replace it! Coax does wear out due to UV breakdown. Water can easily get into the jacket and the braid, making the entire length of coax nothing more than expensive garden hose.

The dipole is really heavy. I used 3/16" dycron rope. Had I known how heavy the dipole is, I would have used 1/4" rope instead. As it is now, the rope is straining as tight as I can pull it. Even at this tension, the dipole sags in the middle. To keep the weight off of the rope as much as I can, the coax between the balun on the dipole and the ground is Belden mini 8.

A "barrel" connector was used to tie the two together. To keep water from entering the coax at the connection, wrap the two connectors and the barrel with two layers of electrical tape. Keep the tape as tight as you can while you wrap the connection. Be sure to extend the tape well past the connectors. After the layer of tape, put on a layer of coax seal. This stuff will keep the water out of the coax. The tape is there so that you can remove the coax seal and still unscrew the connections. Without the tape, it's almost impossible to remove the coax seal!

Oh, yes, lest I forget: Don't try to save a buck by using cheap SO-239 connectors. It's false economy! I use only silver-plated connectors. I really don't see the need for gold-plated connectors for my use. And, please, don't use "used" coax connectors. It's not worth the hassle to get all the solder out of a connector, so use a new one!

If you have more than one radio, then use a good quality coax switch. I still use my old Heathkit switches that I assembled

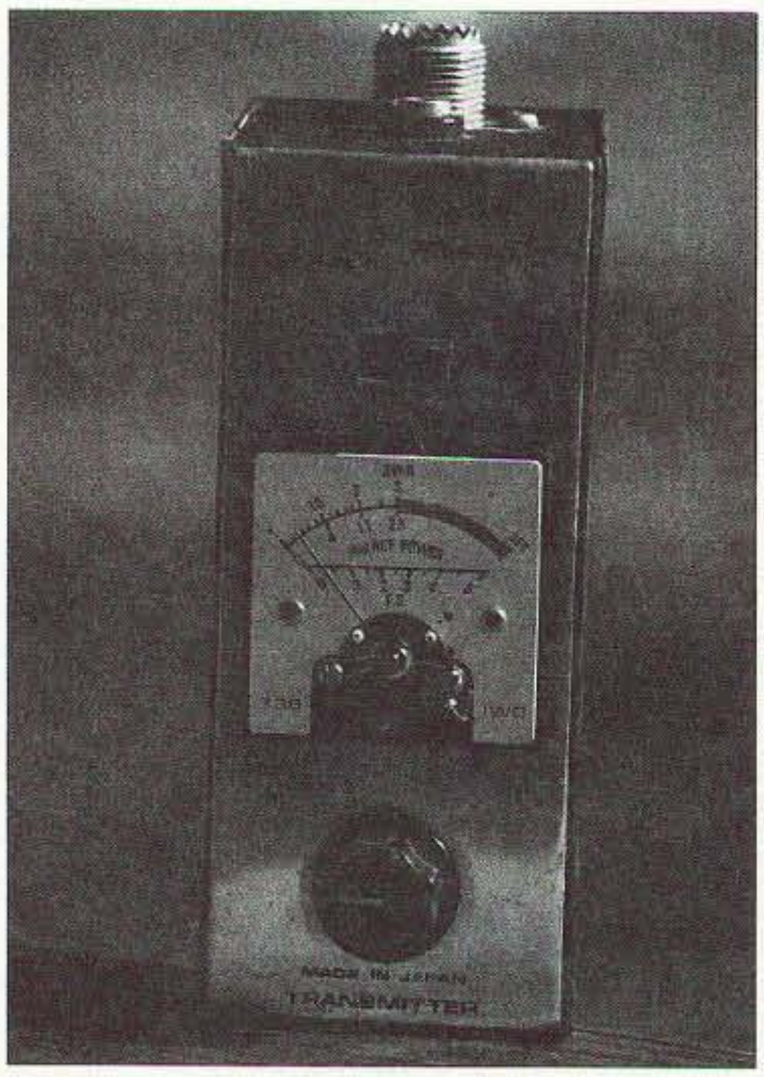

Photo A. *Here is an old CB-type SWR meter. It's easy to use and works great in the HF bands.*

Photo B. *The Ten-Tec Argonaut 509 has a built-in SWR meter. As a matter of fact, all the Argonaut series have SWR meters. Don't use an external SWR meter if your rig already has one inside. It's a waste of watts.*

Photo C. *Here's a Heathkit IM-4190. It's great for QRP, but does require a 9 volt battery to be installed inside.*

Photo D. *Ten-Tec makes this small tuner that's perfect for mobile use or QRPing in the field.*

decades ago. They still work like new. I know of one ham that uses a patchboard with all connections via BNC connectors. This eliminates all the loss via the coax switches, but it's not what you need if you plan on contesting.

New antenna at my house

Right after I put up the all-band folded dipole, I started to assemble a Gap antenna. I won't get into the "how it works," but I can say that it does what it is supposed to do.

That thing is big. It's somewhere close to over 25 feet high. It's not an easy antenna for one person to get up in the air. Gap has a foldable mount that allows one to walk the antenna up into a vertical position. I am too cheap to spend that much money, so I came up with a tilt mount all my own.

This version is very easy to make. In fact, it's a no brainer! All you need is a six-foot piece of 4 x 4 treated lumber, a 30" piece of 1/14" schedule 40 water pipe, and some 3/8" by 7" bolts, nuts, and washers.

The first step is to dig a hole 18" in diameter and about 3 to 4 feet deep. Before the 4 x 4 is placed into the hole with some cement, you need to drill two holes into the 4 x 4. You will need a large drill press to handle the 4 x 4 and the pipe. Secure the pipe to the 4 x 4 with some wood blocks and clamps.

You want to locate the 30" pipe up onto the top two feet of the 4 x 4. Here, you'll drill two holes. One is placed near the bottom two inches of the pipe; the other is located up 20" from the bottom hole. We're not launching missiles here. Just eyeball the measurements. The idea is to have one hole at the bottom of the pipe, and the other hole up about 20" or so.

If you take a smooth bastard file and file down the pipe so that it is flat, you'll provide a better spot for the drill bit to bite into. Before you start the drill spinning, be sure you have the pipe well clamped to the 4 x 4. The idea is to drill through the pipe and then into the 4 x 4. When the first hole is done, drill the second hole. If you do this correctly, then you'll have two holes in the pipe and two holes in the 4 x 4. And if things did not slip, all the holes will line up correctly.

With the holes drilled in the pipe and 4 x 4, it's time to cement the 4 x 4 into the hole. I use the stuff in a bag, but don't mix it with water. Instead, I just pour the cement into the hole dry. The moisture from the ground is all the water you need. I know it sounds goofy, but it really does work.

With the mount secured into the ground, the small pipe is attached by the two bolts. The longer pipe is then screwed into the smaller one with a pipe coupler. With the two pipes now one piece, the Gap antenna is mounted with the mounting hardware supplied with the antenna. When the Gap is secured, the entire apparatus is walked up into a vertical position. The antenna is held upright with the last bolt.

This mount works just great on the Gap antenna. It will work with just about any vertical antenna. Since the Gap antenna does

Continued on page 61

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Jack Heller KB7NO
P.O. Box 1792
712 Highland Street
Carson City NV 89702-1792
[jheller@sierra.net]

From Feld-Hell to MT63 to More PSK

Ham radio is fun. Even more so is the exhilaration experienced when your computer speaks through your radio to another similar setup thousands of miles away, and that is what this column is about. It gets easier and more dependable all the time, as you'll learn when you read on.

A while back, I mentioned Hellschreiber, a very old digital concept that has been resurrected and is being used by hams partly because it is different and mostly due to the fun and feeling of accomplishment that comes from not following the crowd. It is an interesting mode, and it deserves a look by you and me.

The quick bird's-eye view I gave earlier was that it resembled a system of facsimile. It does, but the part that piques my interest is that it was invented in the 1920s and used by the German army, apparently successfully.

There is an alternate name for Hellschreiber: Feld-Hell. With a name like mine, you would think all this would make sense. I still had to look it up. The first name I mention translates to "bright writer." Feld, meaning square, changes the meaning to "bright square." I am not sure what is so bright and shiny about this mode but, in looking at a picture of the output, the large square "pixels" forming the letters seem to make for a fitting name.

Some exciting news that Pete KE4PPI sent in an E-mail is that there is at least one other digital mode out there to add to our list of toys. If you go to the URL in **Table 1**, you can learn all about the MT63 mode. It is a more modern development, and those who have used it claim excellent results under poor conditions, much as with PSK31.

There is one drawback. The width of the signal is minimally 500 Hz, and it can be run at 2,000 Hz. Nevertheless, it is interesting to read about the evolution of it, as some of the same people who worked with this had a hand in the development of PSK31. Just a little aside here: "History" in digital territory has been written mostly during the last 20 years, and my opinion is that the advent of PSK31 by the ham community is soon to have a positive influence on commercial/military communications. It will either be borrowed or adapted and put to good use to replace some of the older, slower modes.

Use your soundcard

You will be interested to note that both of the modes mentioned above can be operated with the use of your soundcard, just as you would for PSK31. Some devoted hams have gone the extra mile and written the necessary software. Also, there are instructions to get you past the setup hurdles, and you will find all the information you ever want on the Web site concerning frequencies and times used by the devotees.

The rest of the PSK hookup

I have put off building a keying circuit for some time because you can, for the most part, switch between transmit and receive manually on PSK31. I am not alone here. I have communicated with others while still manually switching between transmit and receive. It is just so easy to get this running, and difficult to stop having fun and return to the finishing touches.

A lot of hams have downloaded the free PSK31 software. All that I have tried works well. A few hams have expressed the opinion that one version works and another doesn't. Possibly there are conflicts with certain hardware. The biggest stumbling block is the hookup. That shouldn't be difficult, because there are lots of instructions out there.

My way

My preference is to use the accessory jack on the back of the Icom 735. It works well, with no need for a special attenuation circuit as is necessary when using the mike jack. My first hookup was two shielded audio cables from a 5-pin DIN (yes, into the 8-pin DIN) to the Line-in and Line-out jacks on the SB-16 soundcard. That was instant success, but I had to toggle the transmit button on the radio plus click the appropriate button on the screen to switch between transmit and receive. But it worked, and I had other busy projects.

I might add that there is a problem with this straightforward hookup. You do have to set the volume on the soundcard software control to avoid overdriving the radio. And you will need to reset it from time to time. The instructions with the software explain the procedure. It will work for you. The problem is that this is not quite as convenient as setting a pot on an external attenuator, which is what you use if you connect to the mike jack of your radio.

Whatever hookup you use, you will want to include a circuit to key the PTT from the PSK software. Finally, I bit the bullet, studied various recommended circuits, and put together the one in **Fig. 1**. The cost was minimal. You can purchase anything you need to do this at Radio Shack. The computer connection is the serial port.

This was chosen because it was the most direct approach and, with a little effort, I was able to fit it into a 9-pin connector. In the end, I have the PSK31 interface having three cables terminating in a 5-pin DIN plug that fits into the accessory socket (#1) on the back of the Icom 735. The two stereo plugs fit into the soundcard jacks, and the new third leg simply plugs into the serial port of the computer. I considered taking a photo of the finished product, but it wouldn't show much. The fine details of fitting everything together get lost unless the picture

is blown up to a half page. Refer to the description with the schematic.

It took a little fiddling with the PSK program to determine which laptop Comm port Windows95 was directing the PTT signal to from the software. There is only one visible port, but there is the mouse and the modem to contend with and Windows95 makes its own choices there. Comm 2 works in this case. Yours may be different. After that, life is good. The PSK31 software now tells the computer when to transmit and when to receive.

So, the next assignment was to adapt (simply plug in?) the cable to the 25-pin desktop. After securing the correct-gender 25- to 9-pin adapter, getting the cables into the soundcard of the computer, and setting the configuration to PTT in the Logger software, it didn't work.

When all else fails

Well, there were some choices. There is a great manual all printed for this program. But first. …To prove who's in control, I have to give everything a once-over and use up the time the manual would have saved. In this case, I did stumble on the answer before looking in the printed material.

There is a configuration window that gives a PTT port choice with three options. I had chosen the dedicated option. That apparently conflicted with some other choices I had made previously. The problem cleared up when I clicked on the "shared with radio" option. Then … I went to the manual that I have with numbered pages but no index. On page 107 the procedure is described.

It was there all the time, and I am not smarter than those who wrote the book (though there are bits of advice that conflict somewhat with what I had done). I think the conflicts refer back to what I said about looking at all the various circuits before I started this project. Everyone has a different opinion. I hesitate sometimes to state mine because there is the distinct possibility that my best shot is just waiting to be shot down, but you will find what works for me in the attached information.

Pegasus

There is a relatively new radio on the market from Ten-Tec. The Pegasus is a low-cost radio with a smart computer software front end that seems to be tickling the tastes of digital users I talk to on the air. While I was experimenting with the PTT on my old-fashioned Icom 735, I ran across two Pegasus users in a row who just couldn't say enough good about their new rigs. And they weren't fresh out of the box, because they both told me about the several software updates they had already installed.

Source for:	Web address (URL):
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — orig. PSK31 — also Logger	http://aintel.bi.ehu.es/psk31.html
Site with links to PSK31 and Logger 6.12	www.mysite.com/k5fq
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
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
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SV2AGW free Win95 programs	www.forthnet.gr/sv2agw/
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 or Feld-Hell	www.qsl.net/zl1bpu/
MT63	www.qsl.net/zl1bpu/MT63/MT63.html

Table 1. *List of on-line sources.*

My only experience so far concerning

Continued on page 61

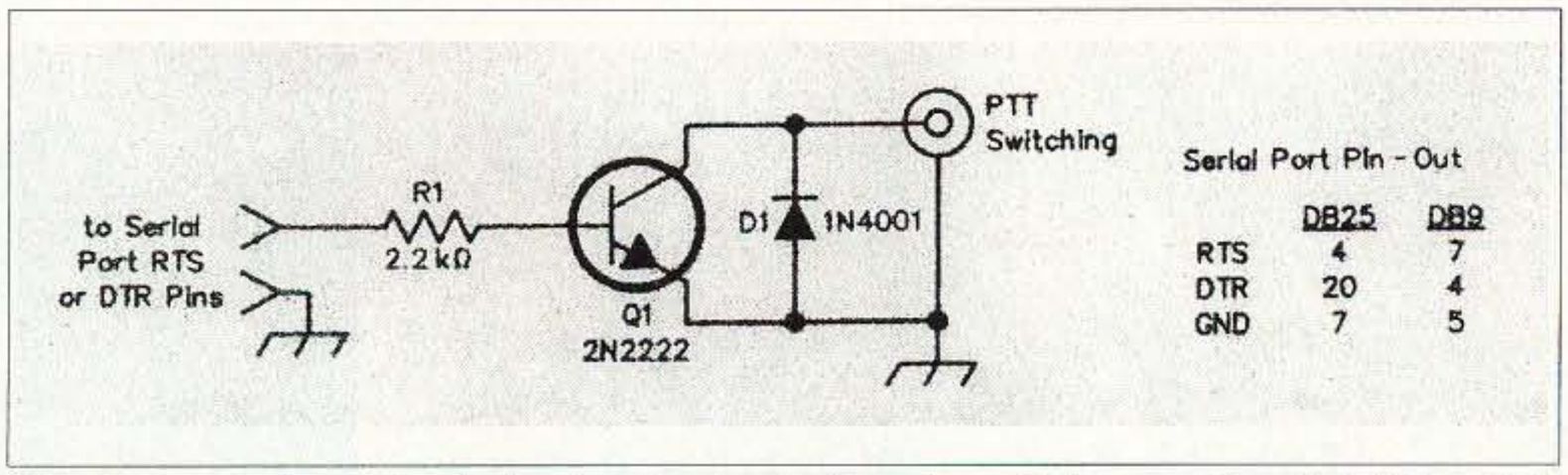

Fig. 1. *Two choices exist for keying the circuit from the serial port, either the RTS or DTR pin. I chose the DTR. Pinouts for 25- and 9-pin jacks are provided. There are only three small parts, and they fit handily inside the 9-pin Radio Shack connector hood. The shielded cable to the radio port is, in the case of the IC-735, connected to the 5-pin DIN for the Accessory 1 socket. That socket has 8 pins, but only four are used, and the 5-pin plug fits those that are needed. The finished product is the DIN plug with three shielded cables — one to the serial port, and two to the soundcard. See text.*

Number 54 on your Feedback card

Dr. Rick Olsen N6NR
P.O. Box 538
Issaquah WA 98027-0538
[n6nr@arrl.net]

B'reshith — Beginnings

Way back 35 years ago, I never would have believed that I would be writing the DX column for 73 Magazine. No way, Jose! But Evelyn Garrison can be a rather persuasive individual, as some of you already know. Then again, I said something similar nearly two years ago when I started doing features and a monthly show for HCJB World Radio. The fact is that I have since developed a passion for journalism. Not bad for the guy who flunked freshman English at Arizona State University, eh?

Well, 35+ years of hamming and four college degrees later, here I am. There were two things that finally flung me over the fence — three, actually. First of all, it has been way too long since there was a DX column in *73 Magazine*. The second is that if you read Dave Ingram's "wish list" in last month's issue, you may have noticed that DXing didn't make the list. I just *had* to do something about that. Finally, I came to the realization that over the years, the one thing that has kept me interested and active as a radio amateur is my love of DX. Now I not only get to chase it, but I can write about it, too. Way cool!!!

Before I overwhelm you with my enthusiasm, there's something else you should know. In the process of giving his approval for this column, and for my authorship as well, Wayne Green challenged me with the statement, "We don't need just another DX column." I have to give it to the old cuss, he's right on the mark. There are numerous excellent columns in print today, and you are all aware of most of them. In addition, the Internet provides almost real-time information on what is going on around the globe. So why add *73* to the mix? What in the world can this magazine do to add value to what is already being read by hundreds of thousands of DXers worldwide? My proposal is to focus on people who chase DX — their likes, dislikes, adventures, and opinions. In addition, I intend to join with organizations like the Ontario DX Association to provide a focus and a forum for the often-overlooked individuals who also love to chase DX, namely shortwave listeners. I recall that for six years prior to getting my ham license, I was a shortwave listener. And guess what? I still am!

To be sure, this column will also provide newsworthy items, QSL information, contest info, and reports on DXpeditions. There will be interviews with both the plain and fancy among us, as well as some nostalgia. It will be fun to explore some trivia, and to see what has happened to some of us old-timers over the years. Speaking of which, check out this QSL card (**Photo A**) I found in an old shoebox. I had a QSO with this guy way back in the early '60's. I recall that working this guy was one of the events that played a role in getting a young high school kid who looked an awful lot like me interested in DX. Does anybody know what ever happened to him? Does he even get on the air anymore? I hear that Art Bell might know his whereabouts.

Oh, and how about this QSL (**Photo B**)? I had the great pleasure of operating for a few months in 1994 and 1995 from BY1QH in Beijing, China. These young gentlemen were my hosts. I also had the great honor of attending one of their graduation parties, and treated them all to dinner on the Tsinghua University campus. A little over four years has passed, and I am sure that most of them have completed, or are about to complete their graduate degrees. Anybody out there know what they are doing now? If you have any info, please drop me

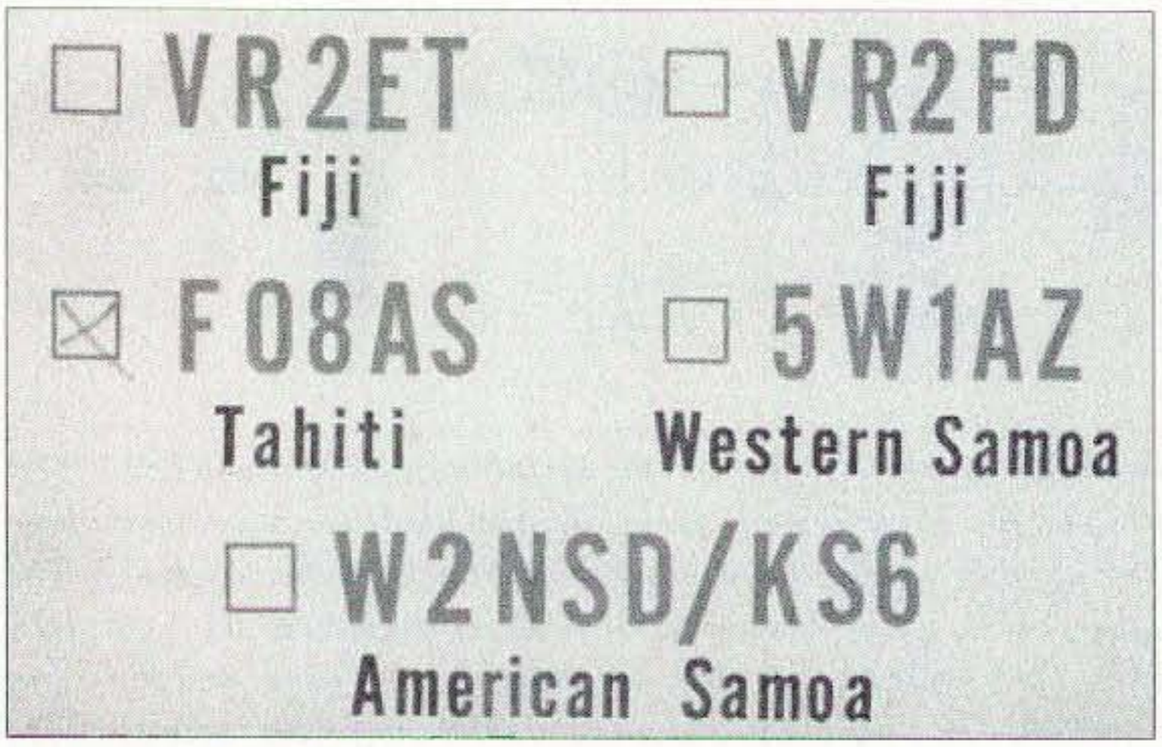

Photo A. *QSL card.*

Photo B. *A memory from the time I operated from BY1QH in Beijing, China.*

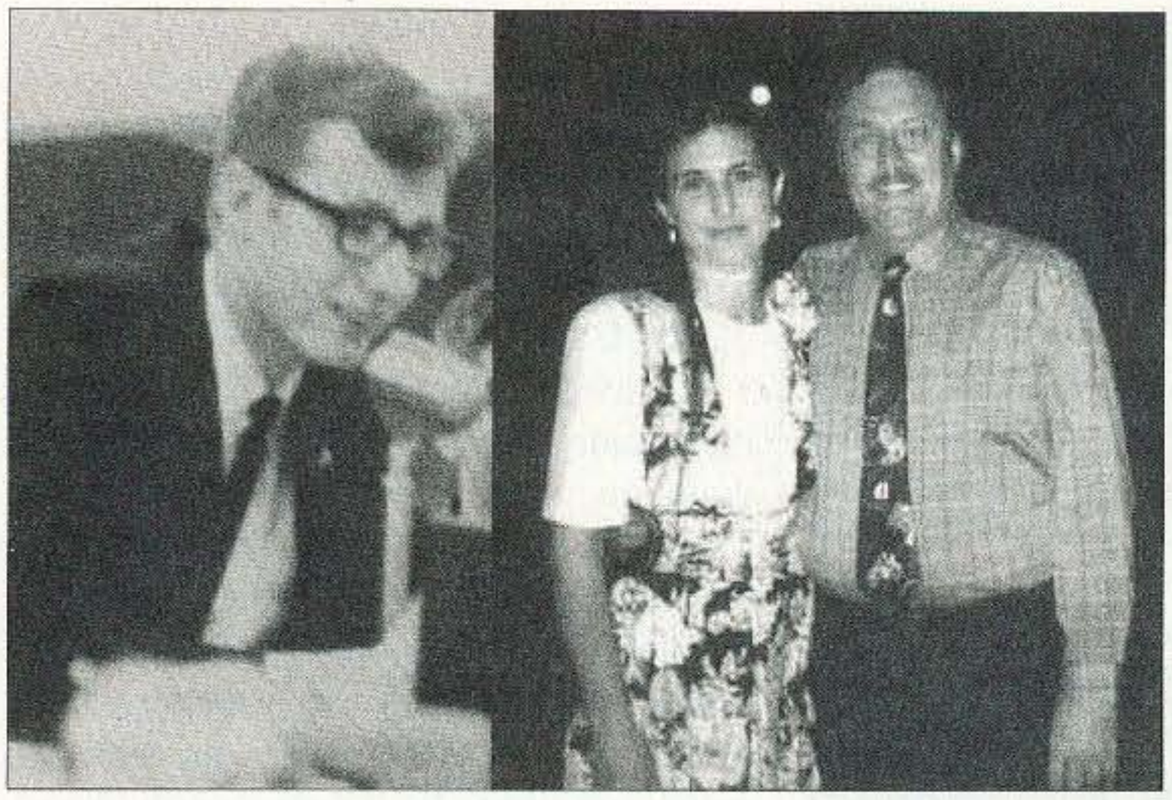

***Photo C.** Before and after.*

a line, and I'll do a short "before-and-after" feature on them. Don't forget photos.

Speaking of before and after, some of you are probably wondering what I look like (and even more couldn't care less, I'm sure). So here is a glimpse of the DX hound himself (**Photo C**). The guy on the left is me at the ripe old age of 16. Back then I was the president of Saguaro High School's amateur radio club in Scottsdale AZ.

My call back then was WA7CNP. To the right stands the same guy with bigger pants, and less hair. Now my call is N6NR, and that gorgeous gal next to me is XYL Connie W7CDO. Nobody has yet come up with a rational explanation as to why such a good-looking lady settled for a guy like me. She says it was because she likes my singing. Man! I hope I don't lose my voice.

The DX Dynasty Award

I'm not too excited about engaging in auto-revelation, but they say that confession is good for the soul, so here goes. Back about 1975, my DX passions were heating up to afterburner proportions. I was becoming a real card-carrying QSL hound, so much so that the horns on the top of my head were becoming quite visible. My on-the-air behavior was in rapid decline, inversely proportional to my snagging the next rung on the DXCC ladder. I was determined to make the Honor Roll before I hit 30. It was about that time that a dear friend several years my senior (and whose callsign is awfully close to mine) took me aside and explained to me that I was embarrassing myself, as well as my fellow members in the Central Arizona DX Association. By the grace of God, I saw the wisdom in what he was saying, and made the decision that there were other priorities which transcended the ravenous acquisition of QSLs and endorsements on my DXCC certificate. Before long, people would actually say HI to me once in a while at DX club meetings, and getting on the air was becoming fun again.

To this day I don't chase after QSLs, and my DXCC certificate still only has a 160-country endorsement, despite the fact that my logbook has over 320 worked in it. DXing is still a blast, and the guys at the Western Washington DX Club don't run the other way when I show up. The way I figure it, OH2BH and I both have a few years left in us, so I can still look forward to working some new ones.

Now, if that sounds a bit like you, don't worry — I'm not going to ask you to come to my confessional. Rather, I'd like to offer an alternative to the great expense of QSL hoarding, and immense frustration when one of the big guns works one over the top of you. It's called the DX Dynasty Award,

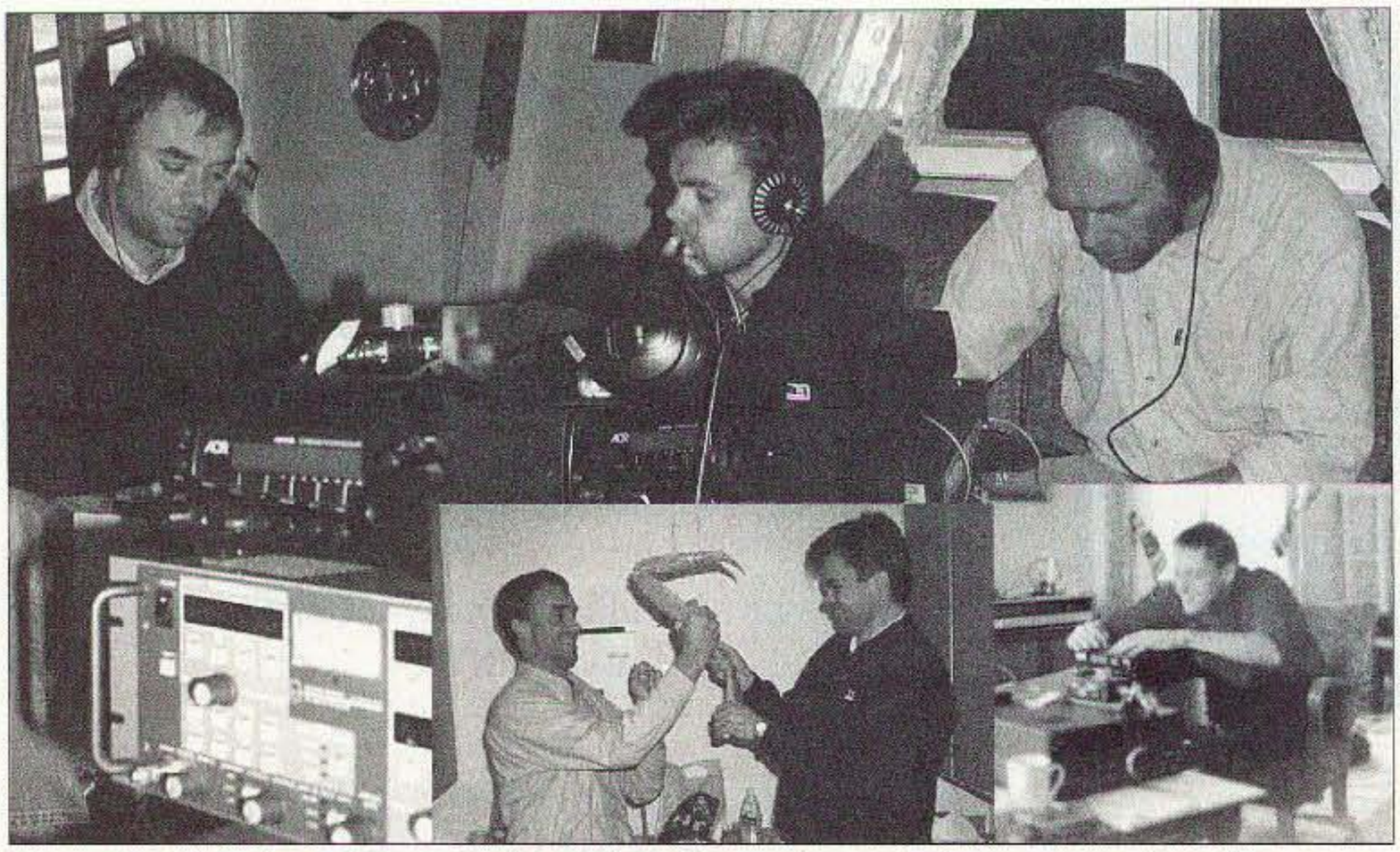

***Photo D.** This photo shows the four DXpeditionaries at their respective listening posts.*

and it's available to those like us who have a high degree of integrity, and are satisfied with just "havin' 'em in the log." Here are the rules:

The basic award is issued for 100 countries worked. If you pull funny stuff with your log, YOU are the one who has to look yourself in the mirror EVERY DAY knowing that you were not entirely honest with us. Endorsements come in 50 country increments up to 350, and then by 25 after that (i.e., 250, 300, 350, 375 ...). The basic award is mixed-mode, and there are special endorsements for you name it: CW (my favorite), SSB, baudot, ASCII, Amtor, Pactor, QRP, spread spectrum, EME, FM, AM, FAX, SSTV, and yes, indeed, SWLing. Logs submitted must clearly show the band and modes used for the specific endorsement desired. I almost forgot: There are single band endorsements for all amateur bands, if you are that resourceful.

There are some specific limitations (hey, don't blame me, I didn't create this thing). Only contacts made on or after Jan 1, 1987, are eligible. All bands and modes are acceptable, including crossmode contacts (with the exception of mode-specific or single band endorsements). Signal reports are noncritical: If you can hear 'em, and they can hear you, that's a contact in our book! The countries list is an amalgam of those listed in the countries lists of award programs from any IARU nation (and I need to ask Wayne a couple more questions on how this one works, so stay tuned for further details). The addition of a country does not require that you wade through a mass of bureaucracy. Simply send a copy of the award rules from an IARU member country to *73*, Attn: DX Forum, for evaluation. New countries will be announced when necessary right here in the DX Forum. If you want a copy of the DXD countries list, or an application for the award, just send an SASE to 70 Hancock Rd., Peterborough NH 03458, USA, Attn: DXDA.

The award is not free, but it is orders of magnitude cheaper when you consider all that money you saved on QSLs. The basic fee is $6 US, and IRC are not accepted. Each endorsement is $2 US, with the exception that endorsements given upon initial application (that's when you get the first basic award) are free. You also get your name and callsign published in *73* at no extra charge. Got it? So get it!!

Just listening

Now it's time to focus on SWL DXing. As I mentioned, I have been an SWL DXer since around 1958. My first DX was a station in Quito, Ecuador, with the callsign HCJB. I was hooked. I rapidly branched out into medium wave DXing, commonly known as the AM broadcast band. I remember listening to KOMA late at night. What a treat it was to turn out the lights in my bedroom and listen to far away Oklahoma City from my little listening post in Scottsdale AZ.

As DXing goes, that's flyweight stuff compared to what I recently discovered on the DX Listeners Club Web site from Norway [www.dxlc.com]. Their club was founded in 1955, and their mailing address is a relatively short distance from the town where my family came from, Arendal. Quite often their members will go on DXpeditions, but not in the same sense as radio amateurs are accustomed to. In this

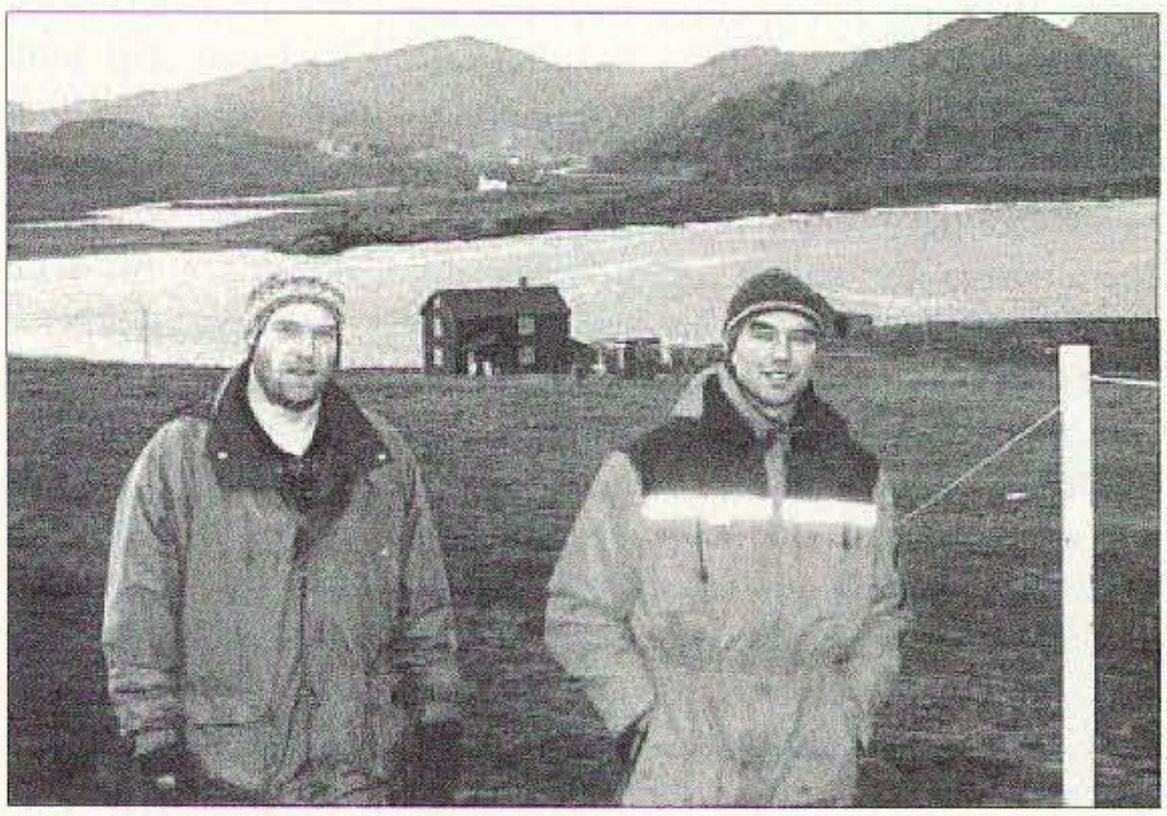

***Photo E.** Here are Bjarne (left) and Rolf at one of the antenna supports for the Pacific wire. The house is below, middle, while Kongsfjord is in the background. For all you guys who don't go below 40m, that's what the end of a beverage looks like.*

case, SWL DXers, especially MW DXers, will trek to a place that has ideal listening properties, set up long beverages, and start listening and logging stations that are remarkably long distances away.

The current DXLC Web page has a report from a group of gents who went up to the northern crest of Norway in October of last year, far above the Arctic Circle, to tune broadcast stations from literally all over the world. The location of this expedition was Kongsfjord (Kings Bay). They did not, however, go there with modest equipment. Here is a partial list of what they brought:

Receivers: JRC NRD-525G, Wellbrook 1:4 splitter/preamp, Sony MZ-R50 Minidisc recorder; JRC NRD-535D, RF Systems 1:4 splitter, Sony MZ-R30 Minidisc recorder; Watkins-Johnson HF-1000, AOR AR7030+, Wellbrook 1:4 splitter/preamp, two Sony MZ-R50 Minidisc recorders; AOR AR7030+, Kneisner+Doering KWZ 30, Wellbrook 1:4 splitter/preamp, Wikander 1:2 splitter/preamp, Sony MZ-R50 and JE-510 Minidisc recorders.

Antennas: 120 meter beverage at 310 degrees, bearing to the US/Canadian East Coast, bidirectional; 400 meter beverage at 340 degrees, bearing to the US/Canadian West Coast, bidirectional; 450 meter beverage at 005 degrees, bearing to Hawaii, unidirectional; 580 meter beverage at 035 degrees, bearing to western Pacific Ocean (targets New Zealand, Tonga, Fiji, etc.) on the main lobe, Africa and southern South America on the back lobe, bidirectional, but later terminated; 500 meter beverage at 085 degrees, bearing to Japan, Philippines, Australia on the main lobe, United Kingdom, Spain, and Latin America on the back lobe, bidirectional, but later terminated. All antennas were grounded separately and fed with RG-58 coax cables via home-brew 450:50 ohm transformers.

The Team: This photo (**Photo D**) shows the four DXpeditionaries at their respective listening posts. In clockwise order, we first have Rolf Torvik, who is one of Norske Statoil's research and development scientists. He is a veteran of these types of DXpeditions, having started DXing in 1975. Next we have Arnstein Bue, also a veteran, who has logged such stations as KHEY El Paso TX, and WRBD in Fort Lauderdale FL from his home in Trondheim. Then we have the somewhat pensive Bjarne Mjelde, who is perhaps the most senior member of the team. Bjarne is no stranger to these climes, as he lives north of the 70th parallel in Berlevag. Finally, we see Odd-Jorgen Sagdahl, who is seen after snagging a station in Hawaii. Not bad, Odd-Jorgen, but I wonder how many yanks realize how hard it is to hear the Pacific on 20m, let alone the MW bands? By the way, what is that thing they are fighting over? Is that what they use to terminate the beverages?

In their own words

As for the experience itself, what better reports than those from the participants themselves? Here is an excerpt from their diary:

Thursday, October 21st. Sunrise at 0545 and sunset at 1350. The Sun was up 8h5m, with a maximum elevation above the horizon of 8.7 degrees. Pre-expedition logs from Bjarne around 0600 on Thursday revealed some interesting signals from North America, including WRDZ Radio Disney 1300 (Chicago) w/local announcements, KADZ-1620 plus 2–3 other X-band stations. Arrived at the farm at 1500. All antennas were already erected, so the participants could start DXing right away. Conditions weren't too bad with DZAR Angel Radyo 1026 and DYWB Super Radyo 1269 already in the box. KBRW-680 very strong. Arnstein had talked to Roland Sandberg at Lemmenjoki, Finland, earlier on; he reported NA's from sunrise and many hours on. However, the Sun weather was not at all good, with predictions of unsettled to active levels. We knew little of what was to come!!! Weather: 5–7°C, windy, occasional rain. Solar weather: Daily A-index 15, low at 6, high at 32.

Friday, October 22nd. Sunrise at 0550 and sunset at 1345. The Sun was up 7h55m, with a maximum elevation of 8.3 degrees. We soon found out that the 400m NA wire didn't perform optimally. We removed the 120m NA wire and connected the former to the other coax lead-in. Much better signal. The "Pacific" wire at 035 degrees seemed to perform better than the "Asia" wire at 085 with regard to Far Eastern signals such as Japan. Less interference from Asian stations located farther west. Not much DX during the night, but in the morning we had some midwest Canada, Alaska, and western US stations. KKBJ Bemidji MN 1360 was probably the best log. Even a Hawaiian was logged, KAOI-1110, with a fair signal. At 0900 UTC we had an extremely early Japan opening when JOWF STV Sapporo came in with a potent QSA 5 signal. The hours ahead gave us a lot of stations from Japan, with an average of 10 reports each. Indeed, this looked promising! Then we received news from Boulder, Colorado regarding the solar weather... Weather: Around 4°C, gale force wind and rain.

Solar weather: Daily A-index 87, low at 19, high at 235!!! Planetary K-indices as high as 8! Severe storm conditions ...

Saturday, October 23rd. Sunrise at 0555 and sunset at 1340. The Sun was up 7h45m, with a max. elevation of 8.0 degrees. How is it possible to hear anything at all with A-indices close to 240??? Actually, we do, but not much. After a DXless night and not much more than KBRW to be heard in the morning, and a short Japan opening at around 1300 in the afternoon brought typical aurora conditions with tremendous signals from Thailand, India, and Pakistan. One example was Radio Kashmir 792 with Urdu stock market talk and a Castrol Motor Oil advert thrown in! It is a pity that local programming is so scarce. A few NWT stations were audible around 2130. The combined full Moon and aurora borealis transformed the evening dark into a greenish glow. A most spectacular view, but one we could do without. Weather: Cooling off with 2–3°C but only light wind. Solar weather: Daily A-index 26, low at 11, high at 50.

Sunday, October 24th. Sunrise at 0559 and sunset at 1335. The Sun was up 7h36m, with a max. elevation of 7.6 degrees. Around 0100 good signals from Canada's midwest followed by half-hour-long wipeouts when the band is completely empty. During the peaks, one can enjoy some of the stronger Canadians such as CFRN-1260, CFCW-790 with 8 kHz bandwidth and AM-sync. — a bit of a contrast to having to fight co-channel splatter during "normal" conditions. From 0600, a few continental US stations as well. Odd-Jorgen joins the relatively exclusive league of Norwegians having heard Hawaii on MW as he logs KAOI Kihei 1110. At around 0900 we headed for Berlevag for a most deserved shower and to purchase a king crab for our Sunday dinner. It seemed only appropriate to have king crab for dinner in our DX-ped at King's Bay. The meal was accompanied by Hungarian Tokayer white wine and Sapporo Draft beer, one that we heard several adverts for on JOWF Sapporo 1440. Truly an international meal, since the king crab itself was originally "imported" to this area from the Kamchatka Peninsula in the Russian Far East. Another tremendous afternoon for the Indian stations; even low-power frequencies like 1602 had S-9 signals from All-India Radio. Weather: 1°C, mostly dry but some sleet towards the evening. Calm. Solar weather: Daily A-index 23, low at 11, high at 41.

Monday, October 25th. Sunrise at 0604 and sunset at 1330. The Sun was up 7h26m, with a max. elevation of 7.3 degrees. Departure day for Odd-Jorgen. Unfortunately, the conditions stay more or less the same. Bjarne drives Odd-Jorgen to the airport at

	Freq	Date	Time	Station Comments
Africa	1377	22.1	2200	**VOFA**, Tanzania, with VOA News, at 2210 a "Radio Tanzania, Dar-es-Salaam" ID followed by a looong speech by Mrs. Madeleine Albright.
Asia	729	25.1	2151	**Jiangxi PBS** with very clear IDs.
	792	22.1	1521	**Azad Kashmir Radio**, Muzaffarabad AD "Castrol Motoroil"
		25.1	1425	**DZEM Manila**
	1008	22.1	1327	**JONR ABC Asahi Hoso**, Osaka
		25.1	1256	**CBS** Taipai w/EE ID "CBS Taipei"
		22.1	1511	**AIR Srinagar** – "Radio Kashmir", 4
	1260	22.1	1000	**JOIR TBC Tohoku Hoso**, Sendai
	1557	25.1	1522	**R. Pakistan/R. Kashmir**, Skardu, very strong with Urdu stockmarket reports, spot for Castrol Motor Oil, a spot heard so often it makes us wonder if Castrol is Radio Pakistan's main beneficiary…
	1602	22.1	1320	**JOFD NHK-2 Fukushima** very clear with local ID.
		25.1	1529	**All India Radio**, location unknown, very strong these 1kW stations this evening.
Pacific	1110	22.1	806	**KAOI Kihei HI**– only Hawaiian during
North America	540	24.1	604	**CBK Watrous SK** with local weather fore cast and "You are listening to CBC Radio in Saskatchewan"
	550	22.1	545	**KFYR Bismarck ND**
	850	24.1	515	**KOA Denver CO**
		22.1	1428	**KICY Nome AK**
	1090	24.1	530	**KRPM Seattle WA** "… Classic Country 10-90 KRPM"
	1400	26.1	551	**KART Jerome ID**
	1470	26.1	530	**KBSN Moses Lake WA** QRM CC CJVB
	1490	26.1	604	**KOWL South Lake Tahoe CA**
		26.1	524	**KYCY San Francisco CA** usually ID-ing "Yaddi yaddi Radio 15-50", only once did we notice a KYCY ID. KCCF and KVAN never surfaced long enough to be ID'ed.
	1560	22.1	813	**KKAA Aberdeen SD**, 3
	1580	22.1	632	**KGAL Lebanon OR** "Talk of the Valley", 2-3
	1600	22.1	638	**KWOM Watertown MN**, 2
	1630	22.1	544	**KCJJ Iowa City IA** for once a US rock music station on AM, "AM Stereo 1630 KCJJ".

Table 1. *Log and some highlights.*

1000 but misses little. Early afternoon brought a number of Philippines, DYDW Tacloban 1413, and DWCD Dagupan 1161.

Weather: 2–3°C, increasing wind to gale, rain, rain, rain, and some rain. At least the clouds hid the aurora borealis. Solar weather: Daily A-index 18, low at 4, high at 31.

Photo F. *For those who envisioned small tents and Coleman stoves, here are Arnstein, Bjarne, and Rolf getting ready for dinner. (We Norwegians know how to go in style!)*

Tuesday, October 26th. Sunrise at 0609 and sunset at 1325. The Sun was up 7h14m, with a max. elevation of 6.9 degrees. During the short week of the KONG4 DX-ped, the day shortened by more than 50 minutes! Typical catches during this period were CKSW-570, CHAK-860, CFYK-1340, and many Alberta and Saskatchewan stations, especially those located north in the provinces such as Lloydminster, Saskatoon, Edmonton, Wetaskiwin, St. Paul, Westlock, etc.

This was departure day, and ironically enough this last day produced quite a number of Northwest US stations, mainly in Washington but some from Oregon, too. Three WA/CA stations on 1550 were heard with around equal strength, but only "Yaddi yaddi Radio," KYCY, bothered to ID. Also equal were KARR and KMWX in WA on 1460. By the time we had to roll in the wires, most of the signals were gone, though.

And from the log

The results were astounding, and speak well for themselves. Here is a cut-and-paste of their log with some of the highlights **(Table 1)**. I was quite surprised to find a few stations from my home state of Washington included.

All in all I would say that they had a most successful outing. Wow, what an understatement! If you have access to the Internet, I suggest that you check out the DXLC Web page and get the full story. There are a number of striking color photos of that beautiful portion of Norway. You will also find more comprehensive details on the logs and the events, as well as some general information about MW DXing in Scandinavia. The URL is [http://www.dxlc.com/kong4/]. I hope you will check it out.

And now the news …

Here is a note from Bernie W3UR, that he received from Juan Carlos, CX7CC: Radio Grupo Sur (RGS) offers an award to celebrate the year 2000. Two special callsigns — CX2000 on phone and CW2000 on CW and digital modes (packet, PSK31) — will be in the air from January 1st.

Rules: Hams from Argentina, Brazil, and Uruguay must work the special stations on three bands and/or modes. The rest of the world must work the special calls on two bands and/or modes. The award is also open for SWL. All QSLs will be confirmed. To claim the award, send a list and 5 IRC or 5 $US to the RGS Award Manager, P.O. Box 2 - CP 11000, Montevideo, Uruguay, South America. Official RGS station CVC2000

will be active in CB. Three contacts with it must be done on three different days. To claim the award, send a list with the contacts and 5 IRC or 5 $US to the BC2000 Award Manager, c/o the RGS address above. RGS members need send only an SASE 22 x 30 cm for either of these awards.

Just in case you didn't hear about the following one, I'll pass along the press release that I received from John N7CQQ back in January:

N7CQQ Amateur Radio Club, Inc. sponsor of the Clipperton2000 expedition is very happy to announce that Icom America is sponsoring the DXpedition to Clipperton Island. Icom America will provide the new IC-756PRO for the Clipperton team members to use while on the expedition. Our thanks goes out to Mr. Ray Novak, National Sales Manager for Icom America.

Clipperton2000 is scheduled to depart San Diego, California USA on 23 February 2000. The team will be ready to operate on 1 March 2000 from Clipperton Island. We plan to have four (4) HF stations, one (1) 6 meter station and one (1) satellite station. We also plan to operate RTTY and the WARC bands from Clipperton. The DXpedition will shut down late on 8 March 2000 and depart Clipperton 9 March. Additional information on the expedition can be found at [www.qsl.net/clipperton2000]. Additional information about the Icom IC-756PRO can be found at [www.IcomAmerica.com].

And this just in from one of our UK friends, Phil G3SWH, concerning an IOTA run to Wasini Island in Kenya (IOTA AF-67). (We expect lots of pictures, Phil!)

We have a team of six experienced DX operators: Jim G3RTE, David G3UNA, Phil G3SWH, Rob 5Z4RL, Ian 5Z4IC, and Graham 5Z4GS. We plan to be active between 8th and 16th March 2000 with two stations, one on CW and the other on SSB on a 24-hours-a-day basis, using the special callsign of 5Z4WI. Propagation permitting, we expect to operate on all bands from 160 to 10 meters, with the exception of 30 meters, which is not presently permitted in Kenya. We have an expedition target of 15,000 QSOs. Wasini has been activated only once before, for a 24-hour period in the 1993 IOTA Contest.

Pulling the switch

So much for this month's introductory installment of the DX Forum. Next month, it's time to get down to business. Oh, and before I forget, don't miss the DXpedition to Clipperton. In coming installments we will have an interview with one of the folks at Icom concerning their sponsorship of this event. I will also be talking with Len Westbo W7MCU, who will provide insight as to how he approaches his duties as a QSL checker for DXCC.

In the meantime, if you would like to contribute material or news items, or would like to sound off in the "Vox Populi" segment of this column that will be inaugurated perhaps as soon as next month, you can E-mail or snail-mail me at the addresses above. *73 and good DX!!* 73

The Quest for Super Sounding Audio

continued from page 14

Modern transceivers with this capability include Kenwood's TS-570, 870, and 950; Yaesu's FT-1000; Icom's IC-706 and 746; and Kachina's 505. Details are in their operating manuals. Just remember to monitor your actual transmitted signal with a wideband receiver when making changes.

Earlier, I mentioned that some transceivers have different transmit and receive bandwidths (and a couple even have 3.1 kHz bandwidth). When combined with a wide range mike like Heil's GoldLine, the resultant audio can really knock your socks off. Collins' famous KWM-1 transceiver utilizes a 3.1 kHz mechanical filter, and its on-the-air sound is marvelous. Icom's IC-761 uses different transmit/receive bandwidths. On receive, several filters give selectable bandwidths of 2.2 and 2.7 kHz. On transmit, fewer and wider-width filters give a bandwidth of 3.1 kHz. Newer style and more fancy-looking transceivers are quite appealing, but I personally cannot find another rig comparable to my dear IC-761.

Audio equalizers

Taking a lesson from recording studios and large church audio systems, some big-time audio enthusiasts are integrating professional-grade audio equalizers into their stations (**Photo D**). These equalizers have fully adjustable low, mid-, and high ranges that can be set to accentuate your personal voice characteristics while minimizing sizzled S's and popped P's. Further, switch selection of various channels gives one or two connected microphones the ability to produce many different sounds such as "double level bass," reverb, etc.

An alternate and less expensive approach to the recording studio–type setup, and a unit especially designed to work interchangeably with KenYaeCom rigs and mikes (plus Heil mikes with KenYaeCom cables), is the W2IHY dual channel audio equalizer and noise gate shown in **Photo E**. This little tyke has separate bass and treble controls so that you can have a big bass sound when signal paths are good, or emphasize high tones for weak signal work or DXing. The W2IHY equalizer is available in kit or preassembled form from Julius Jones W2IHY, 19 Vanessa Lane, Staatsburg NY 12580; telephone (914) 889-4933.

One final thing to ponder: Remember those classic SSB phasing-type transmitters? They shifted an unwanted sideband 180 degrees in phase instead of removing it with a narrow crystal filter. Super sounding audio galore! Now, *that* should set fleamarket traders and rig restoring enthusiasts reeling and rocking! 73

Salvage Special: TV/VCR Tuner Receiver

continued from page 20

Of course, the reason for the low audio amplitude recovery is that the audio signal deviation for TV audio is 25 kHz, while hams and most public service operations use 5 kHz deviation. Making the deviation recovery slope steeper would increase the amplitude of the recovered audio level. The desire to change the detector's slope leaves room for further experimentation.

A down side to the project is that the new local oscillator signal will create harmonics that are tunable all the way up the tuning range. Although the harmonic signal is present, I've not found it to be very objectionable in my applications.

The potential for adjacent channel signal interference is present when two

or more channels occur simultaneously. The reason for interference is that the 4.5 MHz IF passband is about 130 kHz in support of TV audio, and the wide channel allows adjacent channels to pass through to the detector.

Conclusion

I found the TV/VCR receiver project to be interesting and very challenging. Only those challenges have been discussed that specifically enable you to get started on an educational journey of discovery. There are an abundance of challenges waiting ahead. Get on the experimenter's bandwagon, salvage a VCR, and get moving! 73

The Care and Feeding of NiCds

continued from page 22

so that the current is still about 1–2 percent of the rated battery current. What we are doing is setting the trickle charge current to the internal resistance of a fully charged battery or pack.

To test the circuit, attach any kind of small load to the battery for just a *few seconds.* Now turn on the charger again and watch the current. You should see the current go up, to something less than the maximum of the power transformer and the regulator. It will *slowly taper back down* to the *safe* 1 to 2 percent of the rated battery capacity. The transformer, regulator, and proper setting of R2 will result in an *automatic* charger that will give you some fast charge in the beginning *and a safe* trickle charge that you can maintain connected forever. 73

Secrets of Transmission Lines

continued from page 28

The transformer T1 is a bifilar-wound toroid. It is not critical. It only needs to present an open circuit reactance of about +j500 ohms at the lowest frequency you intend to use. I have used a Ferronics 11-220-K core ($\mu = 125$) about 3/8-inch in diameter and 3/32-inch thick with 40 bifilar turns of #30 enameled wire. It measured about 74 µH per side at 1 to 4 MHz.

The bridge is a fixed Wheatstone type that has the antenna as one leg. When the antenna looks like 50 + j0 ohms, the bridge output voltage as measured at B falls to zero. For all VSWRs below about 2:1, the voltage at B is lower than the forward voltage sample at A. The meter for reading voltages A and B should have an impedance no higher than 10k. A voltage comparator and an LED can compare the voltages A and B and light whenever the VSWR is less than 2:1.

In operation, the relay is flipped into the "tune" position and the transmitter keyed. With only a few milliwatts radiating, the tuner is tuned until the voltage at B is nulled. The transmitter is unkeyed and the relay switched to "run." Your fellow hams will thank you for the micro power tune-up.

Please feel free to use the two GWBASIC programs provided in this article. Due to their short length they are easy to key in if you are interested. 73

Calendar Events

continued from page 38

orders must be received by March 1st. Please send an SASE.

MAR 26

MADISON, OH The Lake County ARA will hold its 22nd annual Hamfest/Computerfest, 8 a.m.–2 p.m. at Madison High School on North Ridge Rd. in Madison OH. New and used amateur radio, computer and various other types of electronic equipment will be featured. The hamfest will also feature craft demonstrations and VE exams. Admission $5 at the door. 6 ft. tables $8, 8 ft. tables $10. To make table reservations call *Roxanne at (440) 257-0024.*

APR 1

WATERFORD, CT The Radio Amateur Society of Norwich will hold their Ham Radio Auction at the Waterford Senior Center on Rt. 85. From Hartford, take Rt. 2 South to Rt 11 to Rt 85 South. From the Shoreline, take Rt. 95 to Rt. 85 North. Talk-in on 146.730(-). Bring your gear to sell (10% commission to RASON). Free admission, free parking. *Contact Tony AA1JN at (860) 859-0162,* or see the RASON Web page at *[www.rason.org].* 73

Hamsats

continued from page 43

Tuning during the pass

Another concern is Doppler shift. Satellites in Low Earth Orbit (like AO-27) travel fast enough to cause apparent frequency shift for an observer on the ground at VHF, and especially UHF frequencies. At the beginning of the pass, the satellite downlink will "appear" to be as much as 10 kHz above 436.797 MHz. Set the HT to 436.810 MHz. When the satellite is at TCA, the frequency should be set to 436.800 MHz. As the satellite progresses to the south, tune down to keep received signals clear.

For the uplink, little or no frequency adjustment is required. Doppler shift on two meters is one third that on 70cm. While the downlink will seem to move as much as 20 kHz during the course of the pass, the uplink "drift" is only about 6 kHz. The FM receiver in the satellite will keep up with this much frequency shift.

Get on the air!

With the tracking chart in this issue of *73,* your HT, long whip antenna, speaker/mike, and earphone or earbud headphones, you're ready to make AO-27 contacts. Listen for the satellite. When it sounds good, try transmitting. Don't transmit unless you have good reception. Try weekdays first. The satellite is very crowded on weekends. While the satellite "regulars" try to give the portable and mobile stations priority, weekends are a problem. Imagine a repeater with a coverage area of North America! It's quite an experience just to hear the activity on AO-27. Try it!

I will be trying out the new MFJ whips during March on my 5 W HT. Listen for me on the listed passes. Next time, we'll look at other antenna options and another great FM satellite, SO-35. 73

On the Go

continued from page 47

interesting QSL cards with your local club newsletter (indicating when and where the next ham classes are scheduled, of course), you're in business.

Think of your portable rig as a powerful "show and tell" tool. It should be as important as a sample case is to a salesman or a Bible is to a missionary. Now, go fire up your own mobile or portable rig out there and get somebody excited about ham radio! 73

QRP

continued from page 51

not need radials, I did not have to worry about connecting them to the two pipes. However, if you need to use radials, it should be an easy job with some heavy copper braid.

Getting the most out of your QRP signal requires lots of work with the small things that most hams over look. Take care to make your antenna farm the best you can. The results will just amaze you! 73

The Digital Port

continued from page 53

these rigs had come when Les WA7HAM had written wondering if the Pegasus he had on order was going to work PSK31. It seemed, as I looked at the ads, that it should, so I E-mailed Ten-Tec and they claimed to be doing it just fine at the factory, but no details.

Then I found a ham who was just going through the initial setup with one, and he assured me he had gotten PSK31 working. My concern was having the tuning indicator visible while operating the radio from the same computer monitor. It seems the PSK31 tuning window manages to stay on top of whatever other window is on the screen and all is well.

It sounds as though Ten-Tec has excellent acceptance of this new product. One ham tells me that the waiting list is at least three months. Another comment I received was that the radio seemed to be made for the digital modes. At the advertised $895 price, it certainly is worth a look.

More toys found

As I search ham-related subjects, I come across ideas that are new to me more often than I remember. I will have to start a list so that I can run through it a bit at a time and tell you what I have found. That sounds like the goal of a procrastinator's club, but I just ran across a couple of links on the Internet while I was verifying URLs for this article that I had completely forgotten.

There are many good, ham-related ideas out there, and they are valuable to some of us. If there was no value, they wouldn't have been developed. We simply need to sort them out.

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

QRX

continued from page 6

passenger's seat belt was buckled. She noticed that one passenger wore one earplug while fiddling with a black box having wires running out the back. Strange!

She QSP'd her findings to the rest of the crew as we sensed that the aircraft began to fly in a big generous arc. We experienced an unscheduled landing in Dallas and were herded into a basement room while a ground crew took the airplane apart.

The fate of my keyer was in question. Hey, I could be getting in some practice! But having once worked for American Airlines and also the FAA, I knew they were just following regulations.

Eventually the flight continued and my keyer was returned unscathed, amid others muttering about "missing my connection," et cetera.

One lasting lesson was learned: Never inject any even *slightly* black box into the mix, for you will surely pay dearly in lost time.

Thanks to Gene Brizendine W4ATE, 600 Hummingbird Lane SE, Huntsville AL 35803-1610. 73

Never say die

continued from page 45

today can be amazingly realistic. I had the opportunity to sit in the cockpit of a C5B (like a 747) to do takeoffs and landings at airports all around the world and under all kinds of weather conditions, including 100-foot visibility fog when I was coming in to land at Honolulu. The simulator even let me feel every rough spot along the runway.

But imagine being able to learn algebra from a teacher who actually makes it fun to learn, complete with any kind of graphics that would help get the concepts across, and being able to do this in the afternoon after having visited the Taj Mahal or climbed a part of the Great Wall of China, or visited the terra cotta army recently uncovered at Xian in China! No one can understand how fantastic the Taj Mahal is until they've seen it up close.

How will the world react to millions of American goodwill ambassadors visiting their countries? And, in return, having their children able to see Disneyland, Epcot Center, Times Square, Coney Island, Branson, Las Vegas, the Grand Ol' Opry, the Grand Canyon, and so on? I'll bet we'd get a bunch to see New Hampshire's sights such as the Old Man of the Mountains, the Cannon Mountain tramway, the Mount Washington Cog Railway, and so on.

And all of this needn't cost as much as our present horribly inefficient public school system, with its antiquated curriculum, out-of-date textbooks, poorly trained teachers, run-down buildings, and large classes.

When kids are able to learn about what interests them instead of what is jammed down their throats, with the memorizing of facts in order to pass exams as the goal instead of understanding and dealing with new concepts, we're going to see a new America gradually develop. And then a whole new world as our pioneering approach is emulated. Well, America has always been a pioneering country, so what's new about that?

Kids should have the experience of visiting Rome, Paris, London, Berlin, Vienna, Budapest, Moscow, Nairobi, Johannesburg, Agra, Xian, Baghdad, Damascus, Stockholm, Madrid, and even Kuching and Bandar Seri Begawan. Let's not forget the lost city of Petra in Jordan, the pyramids in Egypt, a trip up the Amazon, the ruins of Athens, and scuba diving the Caribbean island reefs.

Can we do this by 2020? Why the hell not? But I can't make all this happen

Continued on page 64

PROPAGATION

Number 62 on your Feedback card

Jim Gray W1XU/7
210 E Chateau
Payson AZ 85541
[jimpeg@netzone.com]

March may represent "... the best of times and the worst of times ..." as Dickens began *The Tale of Two Cities*. HF propagation is anticipated to be good, even exceptional, during the first two weeks and the last week of this month, but it's the third and fourth week we have to watch out for, and here's why.

March — the month of the Spring equinox in the northern hemisphere — usually features better-than-average propagation on the HF bands and may be expected to do so this year, when Sunspot Cycle 23 is likely to peak.

However, during the peak of any sunspot cycle, huge sunspots, solar flares, and other phenomena become very pronounced, greatly disturbing the Earth's magnetic field, causing excessive ionization of the ionosphere and occasionally disrupting HF-band communications for days at a time. On such occasions, Earth's electric power distribution systems, and satellites with their vulnerable semiconductors, can be disrupted.

The days of March 14th–16th, but more likely the 20th–25th, may exhibit this kind of exceptional solar activity, accompanied by large geomagnetic-field disturbances, and possibly intense atmospheric and other geological upsets. Be prepared.

General band-by-band forecast

10 and 12 meters

Fairly regular DX may be expected on Good (G) days to Europe and the east before noon, and to Africa shortly after noon. Also, you may find good band openings to South America, the Pacific, and the southern hemisphere during the afternoon. Short skip between 1,000 and 2,000 miles during the day is anticipated for most days.

15 and 17 meters

You can look for excellent daytime DX to the southern hemisphere and to most areas of the world, peaking to Europe before noon and to most other areas of the world during the afternoon; daytime short skip beyond 1,000 miles will be frequent.

20 meters

Excellent DX openings to most areas of the world are expected on Good (G) days from local sunrise until long after sunset. Peak conditions should occur an hour or two after sunrise and again in the late afternoon. On Good (G) days, DX into the southern hemisphere can be worked during the hours of darkness as well. Short skip from 500 to over 2,000 miles is anticipated on most days.

30 and 40 meters

These may be your best DX bands from local sunset until sunrise, when you can expect frequent openings and often strong signals into the southern hemisphere. Daytime short skip to about 1,000 miles is expected, and beyond 750 miles after dark.

80 and 160 meters

Worldwide DX can be expected from local sunset through the darkness hours on Good (G) nights, limited of course by thunderstorm static on some paths. Short skip at night will extend between 1,000 and 2,000 miles. 73

March 2000

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F	2 F-G	3 G	4 G
5 G	6 G	7 G	8 G	9 G	10 G	11 G
12 G-F	13 F-P	14 P-VP	15 VP	16 P	17 P-F	18 F
19 F-P	20 P	21 P-VP	22 VP-P	23 P-VP	24 VP	25 VP-P
26 P-F	27 F	28 F-G	29 G	30 G	31 G	

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/12		20				17/20	20			15/17	10/12
ARGENTINA	15/17	15/17	20	30/40	30/40			10/12			12/15	12/15
AUSTRALIA	10/12	17/20	20	20	20	30/40	30/40	17/20				10/12
CENTRAL AM.	15/17	17/20	17/20	17/20	17/20	15/17	15/17	10/12	10/12	10/12	17/20	10/12
ENGLAND	17/20	30/40	40/80	40/80	30/40			15/17	10/12	15/17	15/17	17/20
HAWAII	10/12	12/15	17/20	17/20	20/30	20/30	17/20	17/20				10/12
INDIA	17/20	17/20						15/17				
JAPAN	10/12		17/20				17/20	17/20			15/17	10/12
MEXICO	12/15	20/40	20/40	20/40	20/40	15/17	15/17	10/12	10/12	10/12	17/20	10/12
PHILIPPINES	15/17		17/20	17/20			17/20	15/17	10/12			15/17
PUERTO RICO	15/17	17/20	17/20	17/20	17/20	15/17	15/17	10/12	10/12	10/12	17/20	10/12
RUSSIA (C.I.S.)	30/40	30/40	17/20	17/20				10/12	10/12	12/15	17/20	17/20
SOUTH AFRICA	20/30	40	20/30	20/30					10/12	10/12	12/15	12/15
WEST COAST	20/30	20/30	20/30	30/40	30/40			10/12	10/12	10/12	15/17	17/20

CENTRAL UNITED STATES TO:

ALASKA	10/12	12/15	17/20	17/20	20		17/20	17/20				10/12
ARGENTINA	15/17	15/17	20/30	20/30	17/20			10/12			10/12	12/15
AUSTRALIA	10/12	15/17	15/17		17/20	20/30	30/40	17/20			12/15	10/12
CENTRAL AM.	15/17	15/17	17/20	17/20	20/30			10/12	15/17	10/12	10/12	10/12
ENGLAND	30/40	30/40	30/40						12/15	12/15	17/20	17/20
HAWAII	12/15	15/17	15/17	17/20	17/20	20/30	30/40	17/20		10/12	12/15	12/15
INDIA	15/17	17/20						12/15	12/15			
JAPAN	10/12	12/15	17/20	17/20	17/20		17/20	17/20				10/12
MEXICO	10/12	15/17	17/20	17/20	17/20			10/12	10/12	10/12	12/15	12/15
PHILIPPINES	10/12		15/20	17/20					10/12	10/12		
PUERTO RICO	15/17	15/17	20/30	20/30	20/30			10/12	10/12	10/12	10/12	10/12
RUSSIA (C.I.S.)								12/15	12/15	12/15	17/20	17/20
SOUTH AFRICA			17/20	17/20					12/15	12/15	15/17	17/20

WESTERN UNITED STATES TO:

ALASKA	10/12	10/12	15/17	17/20	17/20	17/20		17/20	17/20			15/17
ARGENTINA	10/12	12/15	15/17	17/20	17/20						10/12	10/12
AUSTRALIA	10/12	12/15	15/17	15/17	17/20	17/20	17/20		17/20			
CENTRAL AM.	10/12	12/15	15/17	17/20	30/40				10/12	10/12	10/12	12/15
ENGLAND	17/20	17/20							15/17	15/17	17/20	17/20
HAWAII	10/12	10/12	12/15	15/17	20/30	20/30	30/40		12/15	10/12		
INDIA		15/17	17/20						12/15	15/17		
JAPAN	10/12	10/12	12/15	17/20	17/20	17/20			17/20			15/17
MEXICO	10/12	12/15	15/30	17/30	20/30				10/12	10/12	10/12	12/15
PHILIPPINES	10/12	10/12						17/20	15/17	17/20		
PUERTO RICO	10/12	12/15	15/30	15/30	17/30				10/12	10/12	10/12	12/15
RUSSIA (C.I.S.)	17/20				17/20			17/20	17/20	20	20	20
SOUTH AFRICA	17/20	20		20						10/12	12/15	12/15
EAST COAST	20/30	20/30	30/40	30/40	30/40			10/12	12/15	12/15	15/17	17/20

Table 1. *March Band-Time-Country chart. The higher band will be useful on Good days. Otherwise, use the lower band shown.*

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 its 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 us all out are right, we're in trouble. In this book I explain about the various disaster scenarios, from Nostradamus, who says the poles will soon shift, wiping out 97% of mankind, to Sai Baba, who has recently warned his followers to get out of Japan and Australia before December 6th this year. 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, or even Y2K? 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 method even *you* can learn the Morse Code in one hour and pass that dumb 5wpm Tech-Plus ham 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 code (using my system). This should only take two or three days. $5 (42)

Code Tape (T20): Start right out at 20 wpm and master it in a weekend for your Extra Class license. $5 (43)

Wayne Talks Not at Dayton: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. $5 (50)

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

$1 Million Sales Video: The secret of how you can generate an extra million in sales using PR. This will be one of the best investments you or your business will ever make. $43 (52)

Reprints of My Editorials from *73*.

Grist I: 50 of my best non-ham oriented editorials from before 1997. $5 (71)

Grist II: 50 more choice non-ham editorials from before 1997. $5 (72)

1997 Editorials: 148 pages. 216 editorials discussing health, ideas for new businesses, exciting new books I've discovered, ways to cure our country's more serious problems, Flight 800, the Oklahoma City bombing, more Moon madness, and so on. $10 (74)

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

1999 Editorials: 160 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" 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 outstanding and lower cost schools, no state taxes at all, far better health care, a more responsive state government, etc. $1 (85)

<u>Stuff I didn't write, but you need:</u>

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. This is a capping blow for René's skeptics. $35 (92)

Wayne Green

Box 416, Hancock NH 03449

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_ Yes! Put me down for a year of *73* for only $25 (a steal). Canada US$32. Foreign US$44 by sea.

_ I'd like to get more romance into my dreary life so send me your How-To-Dance Videos catalog.

_ I need some industrial strength stress reduction so send me your Adventures In Music CD catalog

Allow 4 weeks for delivery except foreign, though we try to get most orders shipped in a day or two.

Barter 'n' Buy

Number 64 on your Feedback card

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 June 2000 classified ad section is April 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

RF TRANSISTORS TUBES 2SC2879, 2SC1971, 2SC1972, MRF247, MRF455, MB8719, 2SC1307, 2SC2029, MRF454, 2SC3133, 4CX250B, 12DQ6, 6KG6A, etc. **WESTGATE**, 1-800- 213-4563. BNB6000

QSL CARDS. Basic Styles; Black and White and Color Picture Cards; Custom Printed. Send 2 stamps for samples and literature. RAUM'S, 8617 Orchard Rd., Coopersburg PA 18036. Phone or FAX (215) 679-7238. BNB519

Cash for Collins: Buy any Collins Equipment. **Leo KJ6HI.** Tel./FAX (310) 670-6969. [radioleo@earthlink. net]. BNB425

WANTED: High capacity 12 volt solar panels for repeater. [**kk4ww@ fairs.org**] or (540) 763-2321. BNB2630

MAHLON LOOMIS, INVENTOR OF RADIO, by Thomas Appleby (copyright 1967). Second printing available from **JOHAN K.V. SVANHOLM N3RF**, SVANHOLM RESEARCH LABORATORIES, P.O. Box 81, Washington DC 20044. Please send $25.00 donation with $5.00 for S&H. BNB420

Ham Radio Repair, Quality workmanship. All Brands, Fast Service. **Affordable Electronics**, 7110 E. Thomas Rd., Scottsdale, AZ 85251. **Call 480-970-0963**, or E-mail **HAM SERVICE@AOL.COM.** BNB 427

METHOD TO LEARN MORSE CODE FAST AND WITHOUT HANGUPS Johan N3RF. Send $1.00 & SASE. SVANHOLM RESEARCH LABORATORIES, P.O. Box 81, Washington DC 20044 USA. BNB421

ASTRON power supply, brand-new w/warranty, RS20M $99, RS35M $145, RS50M $209, RS70M $249. **Web:** [www.aventrade.com]. Call for other models. **(626) 286-0118**. BNB411

HEATHKIT COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. **Phone:** (616) 925- 5899, 8–4 ET. BNB964

"MORSE CODE DECIPHERED" Simple, elegant, inexpensive, comprehensive, logical, easy! E-mail [judlind@earthlink.net]. BNB428

Electricity, Magnetism, Gravity, The Big Bang. New explanation of basic forces of nature in this 91-page book covering early scientific theories and exploring latest controversial conclusions on their relationship to a unified field theory. To order, send check or money order for $16.95 to: American Science Innovations, PO Box 155, Clarington OH 43915. Web site for other products [http://www.asi_2000. com]. BNB100

COLLOIDAL SILVER GENERATOR! Why buy a "box of batteries" for hundreds of dollars? Current regulated, AC powered, fully assembled with #12 AWG silver electrodes, $74.50. Same, but DC powered, $54.50. Add $2.50 shipping. **Thomas Miller**, 962 Myers Parkway, Ashland OH 44805. BNB342

COLD FUSION! - FUEL CELL! - ELECTRIC BICYCLE! Each educational kit: (Basic - $99.95, Deluxe - $199.95, Information - $9.95.) CATALOG - $5.00. ELECTRIC AUTOMOBILE BOOK - $19.95. **KAYLOR-KIT**, POB 1550ST, Boulder Creek CA 95006-1550. (831) 338-2300. BNB128

Wanted Drake L4B or Heathkit SB-221 or SB-220, Hallicrafters HT-37 and SX101A. 1-888-917-9077(home), toll free, wnbryant@aol.com N5GXL Noel Bryant. BNB500

ROHN TOWERS HUGE DISCOUNTS CHECK PRICES AT HILLRADIO.NET BNB600

Wanted COLLINS S-LINE Pristine (RE) 32S3-A, 75S3-C, 516F2, 312B4, 30L1, or 30S1 and SM-3. Willing to pay top dollar for the station I have wanted since age 13. 1-512-925-3907 (cell), 1-888-917-9077(home), toll free residential, willbryant@aol.com WA5JUL Bill Bryant. **THIS STATION IS FOR PERSONAL USE, NOT FOR RESALE!** BNB700

NEVER SAY DIE

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alone. The monkey is on your back to break the present system and get us into the 21st century and out of the 19th, schoolwise.

Let's get rid of the regimented schools of today and let kids learn what they want, without any tests, grades, and so on. If they choose not to learn, that's their prerogative and they'll pay the price. No more K–12 or high school, since kids won't be segregated by grades and age. If a ten-year-old wants to learn calculus, why not?

Colleges are going to have to reinvent themselves, too. They're going to have to come down out of their ivory towers and provide practical, useful education, with a heavy emphasis on entrepreneurialism if they want to stay in business.

So, let's set our sights on American education in 2020, where our technological revolution will make it possible to totally revamp our whole school system. There are opportunities for thousands of new companies to get involved. We need a thousand or so interactive and fun teaching programs. We need to build mobile laboratories. We need to organize student tours all around the world.

Hey, wake up! 73

The New Approach to HF Radio!

PC not included

The Kachina 505DSP Computer Controlled Transceiver

Features:

- Works with any Computer Running Windows 3.1, 95 or NT
- Covers all Amateur HF Bands plus General Coverage Receiver
- IF Stage 16/24 Bit Digital Signal Processing (DSP)
- II DSP Bandpass Filter Widths from 100 Hz to 3.5 kHz (6 kHz in AM Mode)
- Band Activity Display with "Point and Click" Frequency Tuning
- On-screen Antenna "Smith" Chart, Logging Software and Help Menus
- Automatic Frequency Calibration from WWV or Other External Standard
- "Snapshot" Keys for Instant Recall of Frequencies and Settings
- Optional Internal Antenna Tuner

The Kachina 505DSP Computer Controlled HF Transceiver After twenty years of building commercial transceivers in Arizona, Kachina has decided the time is right for a new approach to amateur radio. The Kachina 505DSP is nothing short of a revolution in HF transceivers.

Why Use Knobs if You Have Windows? The old-fashioned front panel has become too cluttered to be useful. Too many knobs, too many buttons. Kachina's 505DSP transceiver connects to your computer's serial port and is completely controlled under Windows™. With optional cables, the radio may be remotely located up to 75 feet away from your computer. Imagine combining a state-of-the-art DSP transceiver with the processing power and graphics capabilities of your PC and you'll soon wonder why all radios aren't designed this way. Why settle for a tiny LCD display when your computer monitor can simultaneously show band activity, antenna impedance, heat sink temperature, SWR, forward and/or reflected power and a host of other information?

16/24 Bit DSP/DDS Performance In addition to 100% computer control, the Kachina 505DSP offers exceptional 16/24 bit DSP/DDS performance. IF stage DSP, "brick-wall" digital filtering, adaptive notch filters and digital noise reduction, combined with low in-band IMD and high signal-to-noise ratio, produce an excellent sounding receiver. Sophisticated DSP technology achieves performance levels unimaginable in the analog world. The transmitter also benefits from precise 16/24 bit processing. Excellent carrier and opposite-sideband suppression is obtained using superior phasing-method algorithms. The RF compressor will add *lots* of punch to your transmitted signal without adding lots of bandwidth, and the TX equalizer will allow you to tailor your transmitted audio for more highs or lows.

Seeing is Believing
American-made and designed, and able to stand on its own against the world's best, the 505DSP is bound to set the standard for all that follow. But don't take our word for it. Visit our website at http://www.kachina-az.com for detailed specifications, to download a demo version of our control software, or to see a current list of Kachina dealers displaying demonstration models in their showrooms.

Windows is a trademark of Microsoft Corp.
Specifications and features subject to change without notice.

KACHINA COMMUNICATIONS, INC.
P.O. Box 1949, Cottonwood, Arizona 86326, U.S.A.
Fax: (520) 634-8053, Tel: (520) 634-7828
E-Mail: sales@kachina-az.com

An APRS® transceiver built for tomorrow's communication needs with advanced features available today.

NEW!

TM-D700A DATA COMMUNICATOR 144/440MHz FM Dual Bander

Conspicuous with its extra-large amber & black display, Kenwood's new TM-D700A is fully equipped to make the most of the exciting opportunities offered by the Kenwood Skycommand System, SSTV, GPS and APRS® –the Automatic Packet/ Position Reporting System that is rapidly gaining popularity worldwide. This mobile transceiver with built-in TNC offers a wide range of data communications options, including simple packet operation using the AX.25 protocol. You can also send and receive SSTV images using Kenwood's VC-H1. Ham radio is truly entering a new era.

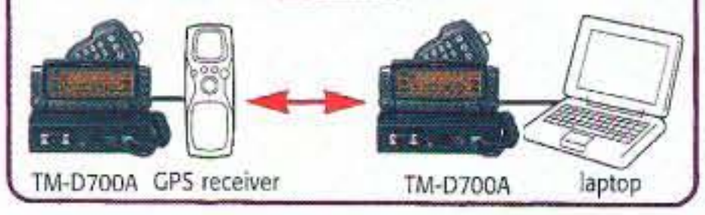
APRS® (Automatic Packet/Position Reporting System)

- **Position/directional data**
  With an NMEA-0183 compatible GPS receiver you can transmit position data for automatic calculation of distance, current speed and heading. Last 4 digits can be masked for position ambiguity. Manual input of latitude/longitude is also possible.
- **Versatile messaging**
  Transmission of position data can be accompanied by a choice of programmable status text (up to 28 characters), position comments (15 settings), icons and bulletins. For added messaging flexibility, individual alpha messages (up to 64 characters) can also be sent.
- **Station list**
  Store received APRS® data in up to 40 station reports.
- **Grid square locator**
  Position data is displayed on the grid square locator for visible reference.
- **BCON TX interval (0.2/0.5/1/2/3/5/10/20/30 min.)**
- **Packet path selection for Digipeat**
- **Weather station & PHG data reception**
- **Digipeat station and DIGI function capability**
- **Auto Message Reply**
- **Audible APRS® message receive (call sign) notification (requires VS-3)**
- **Waypoint position data output**

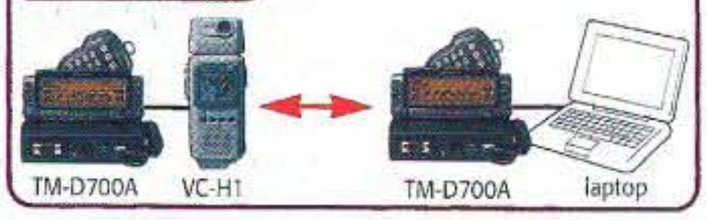
FEATURES

◗ Full Dual-band operation: VHF x VHF/ VHF x UHF/UHF x UHF ◗ Wide-band receive: 118~524, 800~1300 MHz (excluding cellular blocked + frequencies) ◗ Detached panel (extension cable and panel holder supplied) with extra-large (188 x 54 dots) backlit LCD and multifunction key display (reversible) ◗ Improved key operation announcement with optional VS-3 voice synthesizer ◗ Built-in 1200/9600bps TNC compliant with AX.25 protocol and KISS mode ◗ Simplified packet monitoring ◗ SSTV functions with Fast FM for transmission of images in just 14 secs (approx.) and dual receive for voice and image transmissions (two frequencies simultaneously) ◗ 200 memory channels with 8-character memory name input ◗ Up to 10 programmable memory scan banks ◗ Easy-to-use menu system similar to the TH-D7A ◗ Built-in DCS (Digital Code Squelch) and CTCSS encode and decode ◗ CTCSS tone frequency scan ◗ DCS code scan ◗ 9600bps PC-based packet communications for chat, BBS ◗ Kenwood Skycommand System (KSS) II for remote control of fixed HF transceiver (TS-570S/D(G) or TS-870S) ◗ DX packet cluster monitoring ◗ Cross-band repeater ◗ Wireless remote controller ◗ 1750Hz tone burst ◗ D-sub 9 pin terminal (for PCs) ◗ GPS input terminal (NMEA-0183) ◗ Visual band scope ◗ Mute function ◗ Memory control program available via Internet access ◗ New backlit microphone with alphanumeric message input.

Example A: with GPS receiver & laptop



Example B: with VC-H1



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