Official Journal of
ARRL
The national association
for AMATEUR RADIO

QST

devoted entirely to
AMATEUR RADIO

May 2004

QST reviews
Several automatic antenna tuners

New life for an old mouse

Shortened antenna for 80 meters

Deluxe HF Receiver Multicoupler

$4.99 US $6.99 can.
05
19260
0 843655 9

Visit the *ARRLWeb* at www.arrl.org

IC-7800
The Ultimate HF!

Multiple Meter Readouts See the latest in meter technology with the '7800's virtual meter system. These digital meters are visually superior to and of a higher performance than analog. Don't believe it? Log on to www.icomamerica.com/7800 and see for yourself!

Multiple Spectrum Displays You can select a standard spectrum display either centered on your operating frequency or a fixed range to view the band! Choose how you want to SEE the band, and then tune to what signals you see. (Photo shows the fixed range spectrum display.)

CF Card Slot The ultimate way to "take your rig with you". Just pull your CF card from your '7800, slide it into another '7800, and you now have your rig!

Triple Band Stack Registers Memorizes the last 3 used frequencies – quick recall for band hopping, provides the ultimate in multi-mode flexibility.

DUAL RECEIVER CONTROLS

Digital Voice Recorder Controls Simple record and play controls for the internal DVR. Great for quick recording and playback of a call, great for reducing the number of broken calls in your log.

Dual VFO Tuning Knobs Independent tuning knobs for each receiver. There's no mistake about which receiver you are adjusting, as the size difference allows for "no-look" operation!

DUAL RECEIVER CONTROLS

Gentlemen, start your engines. All four of them!

Power your way to front of the pack with Icom's new IC-7800. Cutting edge digital meets the best of world class analog, resulting in an amazing 110dB of receiver dynamic range and a *+40dBm IP3 in the HF bands!* But that's not all. The '7800 has two identical, independent receiver circuits. Receive two different bands simultaneously on different antennas, with no adverse effects from one receiver to the other – take your band hopping and contesting to the next level! There are four 32-bit floating point DSP units with 24-bit AD/DA converters, one each for the main RX, second RX, TX, and spectrum scope, to accelerate data processing to whiplash speeds! Newly designed power amplifiers provide a powerful 200W of output power at full duty cycle and low transmit IMD. So what are you waiting for? Make your move. See your authorized Icom dealer!

Dual Receive Controls Separate key receiver controls are available for each receiver. Controls for volume, RF gain, and DSP controls, the '7800 also has independent controls for the Digital Twin PassBand tuning as well as the 70 dB Manual Notch filters. Whether in a contest, or just hopping around the bands, easy access to receiver controls such as volume, RF gain, and AGC adjustments are at your fingertips.

Dual Digital Twin PassBand Tuning Only Icom brings you Digital Twin PassBand tuning. Adjustments can be made for each receiver without affecting the other receiver.

Independent Digi-Sel Controls Incorporated into the IC-7800 is a newly designed digital pre-selector, with separate controls for each receiver.

Independent Auto Tune Automatically zero beat your CW or AM carrier signals. The '7800 makes sure you're right on the proper frequency for these modes. Each receiver has a separate control.

Independent AGC Settings Multiple AGC settings for each receiver. On-the-fly adjustment for either preset AGC settings, or a completely variable AGC control.

www.icomamerica.com

ICOM

Tune in the world with Icom!

New IC-R5

Winning performance! Compact, and packed with features!

150 kHz – 1.3 GHz* • AM, FM, WFM • 1250 Alphanumeric Memories • CTCSS/DTCS Decode • Weather Alert • Dynamic Memory Scan (DMS) • Preprogrammed TV & Shortwave • Weather Resistant • 2 AA Ni-Cds • PC Programmable

IC-R3

See & Hear all the action!

• 500 kHz – 2.45 GHz* • AM, FM, WFM, AM-TV, FM-TV • 450 Alphanumeric Memories • CTCSS with Tone Scan • 4 Level Attenuator • Telescoping Antenna with BNC Connector • 2" Color TFT Display with Video/Audio Output • Lithium Ion Power • PC Programmable

IC-R10

Advanced performance!

500 kHz – 1.3 GHz* • AM, FM, WFM, USB, LSB, CW • 1000 Alphanumeric Memories • Attenuator • Backlit Display & Key Pad • VSC (Voice Scan Control) • 7 Different Scan Modes • Beginner Mode • Band Scope • Includes AA Ni-Cds & Charger • PC Programmable

New Software IC-PCR1000 BON

Turn your PC into a wide band receiver! Compatible with most PC's and laptops, the 'PCR1000 connects externally- in minutes! Now with Bonito™ software! Updated ICOM software compatible with later versions of Windows™ OS is also now available!

• 100 kHz – 1.3 GHz* • AM, FM, WFM, USB, LSB, CW • Unlimited Memory Channels • Real Time Band Scope • IF Shift • Noise Blanker • Digital AFC • Voice Scan Control • Attenuator • Tunable Bandpass Filters • AGC Function • S Meter Squelch • CTCSS Tone Squelch • Computer Controlled DSP w/optional UT-106

download frequencies right from the web
www.icomreceivers.com

IC-R75

Pull out the weak signals!

• 30 kHz - 60.0 MHz* • AM, FM, S-AM, USB, LSB, CW, RTTY • 101 Alphanumeric Memory Channels • Twin Passband Tuning (PBT) • Commercial Grade • Synchronous AM Detection (S-AM) • Optional DSP with Noise Reduction Auto Notch Filter • Triple Conversion • Up to Two Optional Filters • Front Mounted Speaker • Large Display • Well Spaced Keys and Dials • PC Remote Control with ICOM Software for Windows® (RSR75)

IC-R8500

The experts choice!

• 100 kHz - 2.0 GHz* • AM, FM, WFM, USB, LSB, CW • 1000 Aphanumeric Memories • Commercial Grade • IF Shift • Noise Blanker • Audio Peak Filter (APF) • Selectable AGC Time Constant • Digital Direct Synthesis (DDS) • RS-232C Port for PC Remote Control with ICOM Software for Windows® (RSR8500)

Find out more!
www.icomamerica.com

ICOM®

*Cellular frequencies blocked.

hy-gain ROTATORS

. . . the first choice of hams around the world!

HAM-IV

HAM-IV
$559.95

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum readability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of 2 1/16 inches.

HAM IV and HAM V Rotator Specifications	
WindLoad capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power (in lbs.)	800
Brake Power (in lbs.)	**5000**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight (lbs.)	26
Effective Moment (in tower)	**2800 ft/lbs.**

TAILTWISTER SERIES II

For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/ Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, 2 1/16 inch max. mast.

T-2X
$649.95

T-2XD
$1029.95
with DCU-1

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power (in lbs.)	1000
Brake Power (in lbs.)	**9000**
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight (lbs.)	31
Effective Moment (in tower)	**3400 ft/lbs.**

CD-45II

CD-45II
$389.95

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to 2 1/16 inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power (in lbs.)	600
Brake Power (in lbs.)	**800**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight (lbs.)	22
Effective Moment (in tower)	**1200 ft/lbs.**

HAM-V

HAM-V
$949.95
with DCU-1

For medium antenna arrays up to 15 square feet wind load area. Similar to the HAM IV, but includes *DCU-1 Pathfinder* digital control unit with gas plasma display. Provides automatic operation of brake and rotor, compatible with many logging/contest programs, 6 presets for beam headings, 1 degree accuracy, auto 8-second brake delay, 360 degree choice for center location, *more!*

AR-40

AR-40
$289.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. 2 1/16 inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power (in lbs.)	350
Brake Power (in lbs.)	**450**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight (lbs.)	14
Effective Moment (in tower)	**300 ft/lbs.**

HDR-300A

HDR-300A
$1379.95

For ***king-sized*** antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

HDR-300A Rotator Specifications	
Wind load capacity (inside tower)	25 square feet
Wind Load (w/ mast adapter)	**not applicable**
Turning Power (in lbs.)	5000
Brake Power (in lbs.)	**7500**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight (lbs.)	61
Effective Moment (in tower)	**5000 ft/lbs.**

ROTATOR OPTIONS

MSHD, $99.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $39.95. Light duty mast support for CD-45II and AR-40.
TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

Digital Automatic Controller

DCU-1
$649.95

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1 degree accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

AR-35 Rotator/Controller

AR-35
$69.95

For UHF, VHF, 6-Meter, TV/FM antennas. Includes automatic controller, rotator, mounting clamps, mounting hardware. 110 VAC. One Year Warranty.

RBD-5
$29.95

NEW! Automatic Rotator Brake Delay

Provides automatic 5-second brake delay -- insures your rotator is fully stopped before brake is engaged. Prevents accidentally engaging brake while rotator is moving. Use with HAM II, III, IV, V, T2Xs. Easy-to-install. Includes pre-assembled PCB, hardware.

http://www.hy-gain.com
Nearest Dealer, Free catalog, To Order . . .
800-973-6572
Voice: 662-323-9538 **Fax:** 662-323-6551

hy-gain

Antennas, Rotators & Towers
308 Industrial Park Road,Starkville, MS 39759, USA

IC-703
The QRP Rig!

(IC-703 shown actual size)

Looking for the best in a QRP rig?
Better check the fine print first.

- **DSP.** That's right, pull out the weak signals! Automatic Notch and Noise Reduction is included.
- **Low Current Consumption.** With current drain as low as 300mA on 9.6VDC, this QRP rig rivals some handheld radios. The '703 is designed for maximum efficiency!
- **Internal Antenna Tuner.** 160-10M or 160-6M*. Internal, automatic and designed with latching relays so no current draw when the match is achieved.
- **Big Ears.** Sensitivity of 0.16μVat 10dB S/N rivals some of the big rigs. This helps compensate for antenna compromises when you're in the field!
- **Cold Hands.** Don't worry, the '703 comes with the TXCO, so your frequency will not drift when you touch the knob with cold hands. Ready for outdoors!
- **CW Memory Keyer.** Contest QRP is sweet with the internal CW Memory Keyer. Three memories capable of holding 50 characters each. Variable pitch control (300-900Hz) with a bug, paddle, or straight key.
- **Easy to See, Large Display.** The '703's display is over 300% larger than the competition's .
- **Built-in Pop-up Stand.** The pop-up stand is great when operating from a table top.
- **Adjustable Power Output.** Power is adjustable from 10W down to 0.1W, for more flexibility.
- **Smart Power Mode.** The '703 knows when to throttle back the current to prolong battery life.
- **HF or HF & 6M.** Icom's engineers focused on the bands that really mean the most to QRP operators.
- **IC-706MKIIG Operations.** Anyone who has a '706 will know how to operate without the manual!
- **No Assembly Required.** The '703 is ready to go when you are!

AH-703 HF/50MHz 5 Band Antenna

Designed specifically for use with the '703 and LC-156 Backpack. Compact size - stows easily when not in use.

Going portable?

BP-228 Battery Pack

2800mAh/9.6V. Compact and lightweight. Up to 7 hour operating time depending on power level selected.

LC-156 Backpack

Designed by hams, for hams! Take your hobby with you into the great outdoors. The LC-156 offers plenty of room to store and protect your '703, batteries, antenna, and other gear!

IC-703. Best bang for your buck!

Contact your Icom dealer today!

Go QRP!

www.icomamerica.com

ICOM®

*Depending on version.

May 2004 ♦ Volume 88 Number 5

CONTENTS

In order to ensure prompt delivery, we ask that you periodically check the address information on your mailing label. If you find any inaccuracies, please contact the Circulation Department at **circulation@arrl.org** or 860-594-0200 immediately. Thank you for your assistance.

See page 15 for detailed contact information.

Telephone: 860-594-0200
Fax: 860-594-0259

Technical

75

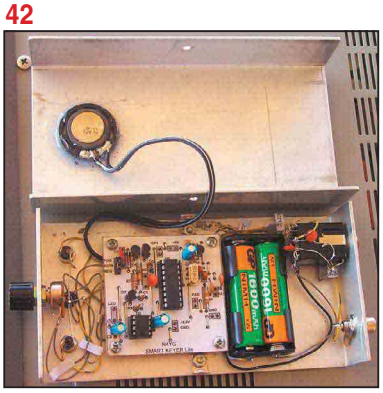
55

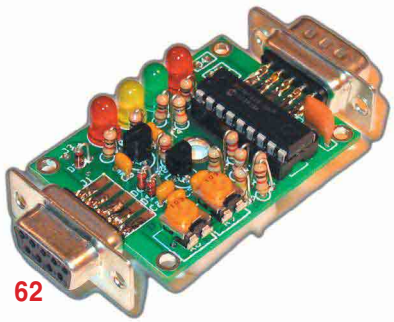
News and Features

QST (ISSN:0033-4812) is published monthly as its official journal by the American Radio Relay League, 225 Main Street, Newington, CT 06111-1494, USA. Periodicals postage paid at Hartford, CT, USA and at additional mailing offices. POSTMASTER: Send address changes to: *QST*, 225 Main St, Newington, CT 06111-1494, USA

QST Workbench

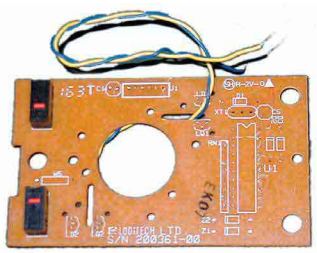
42





62

54



67

Operating

Departments

Our Cover
Have two or three receivers? The W8ZR receiver multicontroller will allow you to switch between as many as eight receivers, compare their performance on the air and mute them when transmitting. Features include switchable preamp, mute circuits, filters and built-in power supply. The article begins on page 31. Photos by Jim Garland, W8ZR.

US & Possessions: Membership in the ARRL, including a one year subscription to *QST*, is available to individuals at $39. Age 65 and over, with proof of age, $36. Licensed radio amateurs age 21 and under and the eldest licensee in the household may qualify for the rate of $20. Life Membership, including a subscription to *QST* is available at $975.* Age 65 and over, $900.* Membership and *QST* cannot be separated. Libraries and institutions, $39 per year. Single copies $5.

International
To compensate for additional postage for mailing outside the US, the following rates apply:
Canada: Membership in the ARRL, including a one year subscription to *QST*, $49, payable in US funds. Life Membership, including a subscription to *QST* is available at $1225.* Libraries and institutions, $49 per year.
All Other Countries: Membership in the ARRL, including a one year subscription to *QST*, $62, payable in US funds. Life Membership, including a subscription to *QST* is available at $1550.* Libraries and institutions, $62 per year.

*Payment arrangements available. Please write for details.

Membership without *QST* is available to the immediate family of a member living at the same address, and to anyone who is legally blind, for $8 per year.

Foreign remittances should be by international postal or express money order or bank draft negotiable in the US and for an equivalent amount in US funds.

QST is available to blind and physically handicapped individuals on audio cassette from the Library of Congress, National Library Service for the Blind and Physically Handicapped. Call 1-800-424-8567.

Indexed by Applied Science and Technology Index, Library of Congress Catalog Card No: 21-9421.

R&L Electronics

1315 Maple Ave HAMilton, Oh 45011
Local/Tech 513-868-6399
(800)221-7735
http://randl.com email sales@randl.com
Fax 513-868-6574

YAESU

Choice of the World's top DX'ers℠

FT897D ..... Call

ATAS120 *Active tuning antenna*.....289.95
CT62 *CAT Computer interface cable*.....26.95
FC30 *Bolt-on Antenna Tuner*.....229.95
MD100A8X *Desk Microphone*.....123.95
YF122S *2.3 kHz SSB Filter*.....156.95

FT857D.....Call

ATAS120 *Active tuning antenna*.....289.95
CT62 *CAT Computer interface cable*.....26.95
FC30 *Bolt-on Antenna Tuner*.....229.95
MD100A8X *Desk Microphone*.....123.95
MH59A8J *Remote control DTMF mic*.....61.95
YF122S *2.3 kHz SSB Filter*.....156.95
YSK857 *Separation Kit*.....51.95

FT8800R ..... Call

CT39 *Packet Interface Cable*.....9.95
MEK2 *Microphone Extension Kit*.....38.95
MMB60 *Quick Release Mobile Bracket*.....27.95
PS14K *Power Supply*.....43.95
YSK8900 *Separation Kit*.....49.95

FT7800R.....264.95

MEK2 *Microphone Extension Kit*.....38.95
MLS100 *External Speaker*.....43.95
MMB60 *Quick Release Mobile Bracket*.....27.95
PS14K *Power Supply*.....43.95
YSK7800 *Separation Kit*.....51.95

VX7R/B.....Call

SMABNC *BNC to SMA Adapter*.....3.50
CD15A *Desktop Rapid Charger*.....29.95
CMP460A *Waterproof Speaker/Mic*.....48.95
CSC88 *Soft Case*.....14.95
CT91 *Microphone Adapter*.....9.95
EDC5B *DC Cable w/Cigarette Plug*.....23.95
EDC6 *DC Cable*.....7.95
FBA23 *AA Cell Battery Case*.....27.95
FNB80LI *Lithium Ion Battery*.....59.95
MH57A4B *Speaker Mic*.....27.95
SU1 *Barometric*.....33.95
VC27 *Earpiece Microphone*.....27.95

VX2R ..... Call

CSC90 *Soft Case*.....19.95
FNB82LI *3.7v 1000mAh Li-Ion Batt*.....34.95
MH34B4B *Speaker Mic*.....27.95
MH37A4B *Earpiece Mic*.....27.95
VC25 *Vox Headset*.....59.95
YUEDC21 *DC Adapter Cable*.....34.95

Yaesu Closeout Items

CSC62 *Soft Case for 11/41 w/FNB31*.....4.95
CT30 *Mic "Y" Connector for 10/40/50*.....7.95
FBA17 *AA Holder 23/411/470*.....17.95
FM747 *FM Unit for 747/840*.....55.95
FNB31 *4.8v 600mah battery for 11/41/51*..24.95
FNB38 *9.6v 600mah battery for 11/41/51*..29.95
FRC6 *DTMF Pager Unit 2400/2500*.....39.95
MH36A6J *Replacement Mic FT3000M*.....39.95
RH1 *Rubber Protector for 10/50*.....4.95
XF110C *500hz CW filter 900/890*.....59.95
XF117CN *300hz CW filter for FT100*.....69.95
XF455C *CW Filter for FT102*.....59.00

IronHorse

Mini HF Sticks

Set of 5 mini HF sticks. 75, 40, 20, 15, and 10 meters. They will handle up to 250 watts PEP. Mounts on any 3/8 x 24 thread mount.

Special price good through 5/15/04 or until stock is depleted, Limit 2

$54.95

Model # IHF5MS

Length
75m = 76"
40m = 44"
20m = 41"
15m = 39"
10m = 36"

JETSTREAM

Model # CO201
2 Position Coax Switch

$19.95

Model # JT40R
Lightning Surge Protector
DC-500 Mhz 400 watts

$19.95

SIXTY METERS AND MORE!

New Upgrades to Our Most Popular Models

TCXO 0.5 ppm Included

ALL MODE
PORTABLE/BASE TRANSCEIVER

FT-897D

60 m Band

HF/50 MHz 100 W/144 MHz 50 W/430 MHz 20 W
20 W (Optional FNB-78 Battery Required)

TCXO DSP

DSP
DIGITAL SIGNAL PROCESSING
Included

ULTRA COMPACT
ALL MODE MOBILE TRANSCEIVER

FT-857D

60 m Band

HF/50 MHz 100 W/144 MHz 50 W/430 MHz 20 W

DSP

FNB-85 1400 mAh Long-Life Ni-MH Battery and NC-72B Charger Included

ULTRA COMPACT
ALL MODE PORTABLE TRANSCEIVER

FT-817ND

60 m Band

HF/50/144/430 MHz 5 W

ATAS-25 Manually-Tuned Portable Antenna

The ATAS-25 is a manually-adjusted portable antenna ideal for field use with the FT-817. Designed for mounting on a standard camera tripod (1/4" stud), the ATAS-25 is tuned by sliding the shorting ring of the loading coil up or down and selecting the appropriate number of top sections. Counterpoise wires are supplied.

The ATAS-25 is constructed of high-grade materials for maximum efficiency, and it's the perfect traveling companion for your FT-817!

Freq. Range:	Amateur Bands 7-450 MHz.
Max. Power:	HF/50 MHz: 100 W SSB/CW (50% Duty, 1 min. TX/RX)
	AM/FM: 50 W
	144/430 MHz: 50 W
Size:	Max. Length 7'3" (2.2 m)
	Min. Length for Carrying: 2' (0.6 m)
Weight:	2.1 lb. (930 g)

ATAS MICRO

YAESU
Choice of the World's top DX'ers℠

Vertex Standard
US Headquarters
10900 Walker Street
Cypress, CA 90630 (714)827-7600

For the latest Yaesu news, visit us on the Internet:
http://www.vxstdusa.com

The Ultimate Dream Beam....

SteppIR Antennas Proudly Introduces the MonstIR™ Yagi -

World Class Monoband Performance
40m - 6m... and EVERY Frequency in Between!

When other manufacturers talk about bandwidth they are referring only to SWR bandwidth - Front-to-back and gain will suffer greatly over a ham band.. Ours is nearly perfect over the ENTIRE band!

Always the correct length - each element length is automatically adjusted from the ham shack with an electronic controller

Continuous coverage - antenna is optimized at every point within specified frequency range, with nearly 1:1 SWR!

Will outperform any other commercially available multi-band antenna on 40m-10m

Fixed element spacing represents very little compromise because the elements are adjusted to optimize length at every frequency

Switch antenna direction in 2.5 seconds or less with 180° mode

Simultaneous gain in opposite directions with bi-directional mode

4 elements: 3 @ 70 ft, 1 @ 36 ft
3 Active Elements 6.9-13.5 MHz
4 Active Elements 13.5- 54.MHz
90 MPH Wind Rating
Handles 3 KW Easily
22.9 ft² Windload
120 lb Weight
34 ft Boom

Introductory Price: $3495.00

www.steppir.com

SteppIR Antennas
23831 Tiger Mt. Rd SE
Issaquah, WA 98027
Tel: 425.391.1999 Fax: 425.391.8377
Toll Free: 866-STEPPIR (783-7747)

"IT SEEMS TO US..."

BPL: What Now?

An important date is looming on the horizon: May 3, the deadline for comments on the FCC's Notice of Proposed Rule Making (NPRM) on Broadband over Power Line (BPL) systems, ET Docket No. 04-37.

The purpose of the NPRM is *not* to allow BPL to be deployed. BPL systems may now operate under the existing Part 15 rules. If the FCC did nothing, BPL systems could continue to be installed and operated. Licensed radio services, including the Amateur Radio Service, would continue to be protected by the rule that prohibits unlicensed devices from causing harmful interference. BPL systems would continue to have no protection against interference *to* their operation by licensed services.

The NPRM, which follows a Notice of Inquiry (NOI) in which the FCC sought information about BPL technology and the interference environment, does not propose to change any of that. Indeed, the NPRM reaffirms that the "no interference" principle must remain inviolate.

The NPRM *does* propose *new requirements* for BPL systems. The intent is to make it easier to track down who is responsible for interference and to make sure that the BPL system operator can immediately take whatever steps are necessary to mitigate interference. These include requirements that BPL systems "shall incorporate adaptive interference mitigation techniques" as well as "a shut-down feature to deactivate units found to cause harmful interference."

These proposed requirements need quite a bit of fleshing out to afford any real protection. They offer no practical relief from interference for mobile stations. We would have preferred a decision simply to ban BPL as a technology that stands to do more harm than good. The record in the NOI proceeding certainly would support such a decision.

Still, the FCC's proposals go a couple of steps in a positive direction. Certainly they should offer no comfort to the BPL industry, which is on clear notice from both the FCC and from us that interference will not be tolerated. Someone who makes an investment in BPL will have no grounds for whining when they lose their shirts.

So, why the hue and cry against BPL? There are several reasons.

There are BPL proponents who from the very beginning have denied that interference is a problem. They have continued to deny it even in the face of clear and mounting evidence to the contrary. Their comments filed in response to the NOI were laughable, as we pointed out on this page last October.

We have the FCC Chairman acting as a self-described "cheerleader" for BPL. Chairman Powell says he will "welcome the day when every electrical outlet will have the potential to offer high-speed broadband and a plethora of high-tech applications to all Americans." Especially galling was to hear him say on February 12 that BPL could be "the great broadband hope for a good part of rural America." Anyone who has taken a serious look at the economics knows that this is a false promise. BPL is not a low-cost option, especially in sparsely populated areas. Who needs wires anyway, when Broadband Wireless Access is just around the corner?

We have the power companies' spotty record of resolving power line interference caused by electrostatic discharge. How can we believe they will do any better fixing problems caused by a technology with which they have no experience? There is one sentence in the NPRM that is guaranteed to arouse the ire of any active amateur. In discussing why it believes the likelihood of BPL interference is low, the Commission says: "We…expect that, in practice, many amateurs already orient their antennas to minimize the reception of emissions from nearby electric power lines."

Finally, the NPRM does not deal at all with a problem that concerns many amateurs almost as much as interference from BPL: interference *to* BPL. Yes, Part 15 says that "interference must be accepted that may be caused by the operation of an authorized radio station." Try explaining that to your drunken neighbor when he can't download his dirty movie because you're on 20 meters.

Still and all, the best approach in responding to the NPRM is a positive approach. Yes, we would have preferred a ban on BPL—but the FCC hates to pick winners and losers. They prefer to "let the marketplace decide." The rules they have already proposed make it even less likely that the marketplace will decide in favor of BPL, but that is someone else's concern. Our concern is to support the FCC's proposals as far as they go (remember, they're better than the *status quo*), to document exactly how they fall short of providing the protection that over-the-air services—especially the Amateur Radio Service—need and deserve, and to provide specific proposals for improvement.

The improvements we have in mind include:

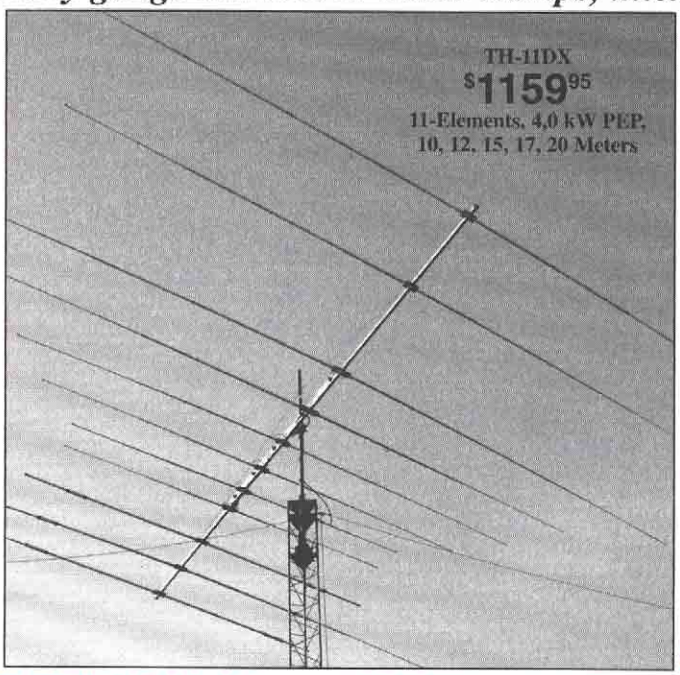
- Performance standards for interference mitigation. Mitigation must be available 24/7, and must be immediate upon receipt of a complaint.
- The BPL database must be readily accessible to the public and kept up to date.
- Because mitigation is impractical in the case of mobile stations, a radiated emission limit sufficient to protect mobiles must be established and enforced.
- BPL systems must be tested for rules compliance by an independent laboratory prior to initiation of service.
- To ensure an informed marketplace, marketers of BPL services must give clear notice to consumers that licensed radio services have priority and that the delivery of BPL services therefore cannot be guaranteed. Receipt of this notice must be acknowledged in writing prior to the signing of any contract for service.
- There must be severe penalties for noncompliance with these rules.

If you want to file comments—and we hope you will—*read the NPRM first!* Pay particular attention to paragraphs 39-43; the FCC asks for comments on several aspects of its proposals. The NPRM is available on the FCC Web site in Microsoft Word (**hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-29A1.doc**) and as an Adobe PDF file (**hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-29A1.pdf**).

How the FCC handles BPL is important, but the most important decisions about BPL deployment will not be made at the FCC. They will be made in corporate boardrooms—and the smart money will choose to go elsewhere, not to BPL.—*David Sumner, K1ZZ*

hy-gain HF BEAMS...

...are stronger, lighter, have less wind surface and last years longer. Why? Hy-Gain uses durable tooled components -- massive boom-to-mast bracket, heavy gauge element-to-boom clamps, thick-wall swaged tubing -- virtually no failures!



TH-11DX, $1159.95. 11-element, 4.0 kW PEP, 10,12,15,17,20M

The choice of top DXers.

With 11-elements, excellent gain and 5-bands, the super rugged TH-11DX is *the "Big Daddy" of all HF beams!*

Handles 2000 Watts continuous, 4000 Watts PEP.

Every part is selected for durability and ruggedness for years of trouble-free service.

Features a low loss log-periodic driven array on all bands with monoband reflectors, BN-4000 high power balun, corrosion resistant wire boom support, hot dipped galvanized and stainless steel parts.

Stainless steel hardware and clamps are used on all electrical connections.

TH-7DX, $869.95. 7-element, 1.5 kW PEP, 10,15,20 Meters

7-Elements gives you the *highest average gain* of any Hy-Gain tri-bander!

Dual driven for broadband operation without compromising gain. SWR less than 2:1 on *all* bands.

Uniquely combining monoband and trapped parasitic elements give you an excellent F/B ratio.

Includes *Hy-Gain's* diecast aluminum, rugged boom-to-mast clamp, heavy gauge element-to-boom brackets, BN-86 balun. For high power, upgrade to BN-4000.

TH-5MK2, $759.95. 5-element, 1.5 kW PEP, 10,15,20 Meters

The broadband *five element* TH5-MK2 gives you outstanding gain.

Separate air dielectric *Hy-Q* traps let you adjust for maximum F/B ratio on each band.

Also standard is *Hy-Gain's* exclusive *BetaMATCH*™, stainless steel hardware and compression clamps and BN-86 balun.

TH-3MK4, $469.95. 3-element, 1.5 kW PEP, 10,15,20 Meters

The super popular TH-3MK4 gives you the *most gain for your money* in a full-power, full-size durable Hy-Gain tri-bander!

You get an impressive average gain and a whopping average front-to-back ratio. Handles a full 1500 Watts PEP. 95 MPH wind survival.

Fits on average size lot with room to spare -- turning radius is just 15.3 feet. Four piece boom is ideal for DXpeditions. Rotates with CD-45II or HAM-IV rotator.

Features *Hy-Gain BetaMatch*™ for DC ground, full power *Hy-Q*™ traps, rugged boom-to-mast bracket and mounts on standard 2"O.D. mast. Stainless steel hardware. BN-86 balun recommended.

TH-2MK3, $369.95. 2-element, 1.5 kW PEP, 10,15,20 Meters

The 2-element TH-2MK3 is Hy-Gain's *most economical* full power (1.5kW PEP) full size tri-bander.

For just $339.95 you can greatly increase your effective radiated power and hear far better!

Ruggedly constructed, top-performing, compact 6 foot boom, tight 14.3 foot turning radius. Installs almost anywhere. Rotate with CD-45II or HAM-IV. BN-86 balun recommended.

EXP-14, $599.95. 4-element, 1.5 kW PEP, 10,15,20 Meters

Revolutionary 4-element compact tri-bander *lets you add 40 or 30 Meters!* Has 14 foot boom and tight 17.25 feet turning radius. Fits on roof tri-pod, mast or medium duty tower.

Hy-Gain's *patented* broadbanding *Para Sleeve* gives you less than 2:1 VSWR. 1.5kW PEP.

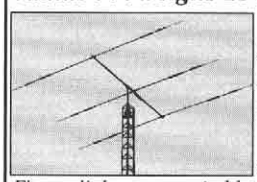
BetaMATCH™ provides DC ground to eliminate static. Includes BN-86 balun. Easily assembled.

Truly *competitive against giant tri-banders at half the cost!*

QK-710, $179.95. 30/40 Meter option kit for EXP-14.

Compact 3-element 10, 15, 20 Meter Tri-Bander

For limited space . . . Installs anywhere . . . 14.75 ft turning radius . . . weighs 21 lbs . . . Rotate with CD-45II, HAM-IV



Fits on light tower, suitable guyed TV pole, roof tri-pod

TH-3JRS, $359.95. Hy-Gain's *most popular* 3-element 10, 15, 20 Meter tri-bander fits on most lots! Same top performance as the full power TH3MK4 in a compact 600 watt PEP design.

Excellent gain and F/B ratio let *you* compete with the "big guns".

Tooled manufacturing gives you *Hy-Gain* durability with 80 MPH wind survival.

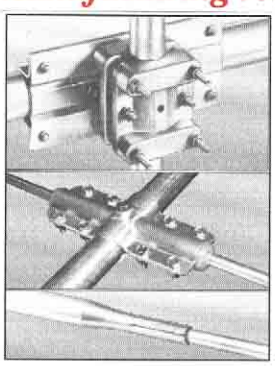
Model No.	No. of elements	avg Gain dBd	avg F/B dB	MaxPwr watts PEP	Bands Covered	Wind sq.ft. area	Wind (mph) Survival	Boom (feet)	Longest Elem. (ft)	Turning radius(ft)	Weight (lbs.)	Mast dia O.D.(in.)	Recom. Rotator	Retail Price
TH-11DX	11	*For Gain and F/B ratio--See...* • www.hy-gain.com • Hy-Gain catalog • Call toll-free 800-973-6572		4000	10,12,15,17,20	12.5	100	24	37	22	88	1.9-2.5	T2X	$1159.95
TH-7DX	**7**			**1500**	**10, 15, 20**	**9.4**	**100**	**24**	**31**	**20**	**75**	**1.5-2.5**	**HAM-IV**	**$869.95**
TH-5MK2	5			1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	$759.95
TH-3MK4	**3**			**1500**	**10, 15, 20**	**4.6**	**95**	**14**	**27.42**	**15.33**	**35**	**1.9-2.5**	**CD-45II**	**$469.95**
TH-3JRS	3			600	10, 15, 20	3.35	80	12	27.25	14.75	21	1.25-2.0	CD-45II	$359.95
TH-2MK3	**2**			**1500**	**10, 15, 20**	**3.25**	**80**	**6**	**27.3**	**14.25**	**20**	**1.9-2.5**	**CD-45II**	**$369.95**
EXP-14	4			1500	10,15,20 with 30/40	7.5	100	14	31.5	17.25	45	1.9-2.5	HAM IV	$599.95

Tooled Manufacturing . . . Highest Quality Materials

1. Hy-Gain's famous super strong *tooled* die cast *Boom-to-Mast Clamp*

2. *Tooled* *Boom-to-Element Clamp*

3. Thick-wall *swaged* aluminum tubing



Tooled *manufacturing* is the difference between Hy-Gain antennas and the others -- they just don't have it (it's expensive!).

Die-cast aluminum boom-to-mast bracket and element-to-boom compression clamps are made with specially *tooled* machinery.

Hy-Gain antennas feature *tooled* swaged tubing that is easily and securedly clamped in place. All tubing is deburred and cleaned for smooth and easy assembly.

Durable precision injection molded parts.

Hy-Gain *antennas are stronger, lighter, have less wind surface area, better wind survival, need no adjustments, look professional and last years longer.*

Free Hy-Gain Catalog

and Nearest Dealer . . . 800-973-6572

Call your dealer for your best price!

hy-gain

Antennas, Rotators & Towers

308 Industrial Park Road, Starkville, MS 39759 USA

Toll-free Customer Sales Hotline: 800-973-6572

• **TECH:** 662-323-9538 • **FAX:** 662-323-6551

http://www.hy-gain.com

Extreme Design Engineering Construction

Go ahead, take your Alinco transceiver to the limits! Face the heat of the action with confidence that your equipment was built to be dependable when it counts the most.

Whether you're a storm chaser, emergency responder, disaster relief volunteer, or the first person on the scene of an incident, your Alinco HT is ready to make things happen!

For Demanding Users Like You!

DJ-596T Mark II Dual-Band HT

VHF and UHF performance in a great looking package. Easy to operate with a large, backlit alphanumeric display, full-size control pad, powerful Ni-MH battery, 6 ~ 16 VDC auxiliary power input, up to 5 watts output. CTCSS encode+decode, DCS, wide and narrow FM modes and new super-accurate frequency stability that meets the toughest standards of demanding users! Want more? Check out the optional digital communications board and the many accessories tailored to your operating needs.

DJ-196T 2 Meter HT

This rugged VHF HT is built for heavy use and keeps coming back for more. Put the power of 5 watts and 40 memories to work for you. The large alphanumeric display makes it easy to manage and the full-size backlit keypad makes field operations easy, with direct frequency input and clearly marked secondary functions. Nothing's held back, with autodial memories, DCS, CTCSS encode+decode, and even a built-in theft alarm!

DJ-296T 222 MHz HT

Finally! A 222 MHz HT that's affordable and built Alinco-tough. If you're not on 222, you're missing a band that's open for action. An amazing 160 memories allows you to store frequencies over a broad service area. This full-power HT sports a Ni-MH battery, external power port, high performance antenna, CTCSS encode+decode, DCS, autodial and more. Are you only using part of your privileges? Alinco can help you get on 222 MHz today!

DJ-496T UHF HT

From 430 to 450 MHz, your DJ-496T opens the door to amazing possibilities, from basic voice communications to controlling repeaters, remote bases, working through cross-band transceivers and more. The 40 memories come up on a large, alphanumeric display and the high capacity Ni-MH battery provides long-lasting power. CTCSS encode+decode, DCS, cable cloning and a host of optional accessories to suit your particular operating needs.

Are you ready for extreme operations?
You are if you're carrying an Alinco

www.ALINCO.com

ARRL in ACTION

YOUR membership at work

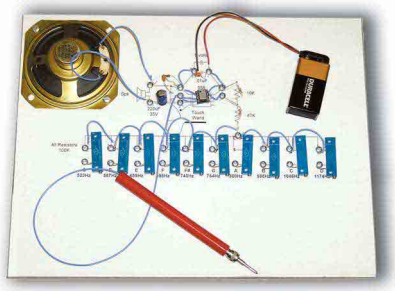
By Dave Hassler, K7CCC, dhassler@arrl.org

Almost-No-Solder Project Teaches Many Concepts

ARRL Education and Technology Program Coordinator Mark Spencer, WA8SME, has done it again, developing a nifty kid-oriented, almost-no-solder project that's fun to build and explore. It's a small, one-octave electronic organ, built with just a handful of discrete components and one simple integrated circuit. The IC socket requires a small amount of soldering that can be done by an adult prior to actual construction.

"This is a little more involved than the original no-solder code practice oscillator project, but it allows for a whole mess of things that can be studied during the construction and use of this little organ," Spencer said. Fundamental concepts such as frequency, pitch, period, wavelength, square versus sine wave, amplitude, duty cycle, RC time constants, stability and more can be explored with the organ project. Complete plans can be found on the ARRL Web site at **www.arrl.org/news/features/2004/02/28/1/**.

MARK SPENCER, WA8SME



The Almost-No-Solder Electronic Organ project can teach over two dozen concepts in electronics and physics...and it's fun, too!

League VP Aids ARECC Class

We learn by doing. This March, ARRL Vice President Kay Craigie, N3KN, helped a class taking Level I of ARRL's Amateur Radio Emergency Communications Course (ARECC) get the hang of moving messages along the National Traffic System by generating and receiving transcontinental messages. Kevin Rock, KD5ONS, and Patricia Rock, KD5PZO, teach a hybrid ARECC class in Northwest Oregon.

They met Kay and Carter Craigie, N3AO, at SeaPac 2003, in Seaside, Oregon, where Kay was a featured speaker to the ARRL Northwestern Division convention last summer. There, Kevin and Carter got to talking about emergency communications, a passion for both of them.

"Between the two of them, they hatched the plan for Kevin and Patricia's students to send me radiograms [in Pennsylvania] and for me to reply," Kay said. "Of course I was happy to help." Each student sent a radiogram and Kay responded to the messages with individualized replies, so the students could have the experience of receiving formal message traffic. "This had the good side effect of providing more messages for the operators on my home club's VHF traffic net to send and receive," she noted.

ARRL BPL Presentations Given in Washington, DC

The ARRL Technical Relations Office staff made presentations to several groups in Washington, DC this past winter on Broadband over Power Line (BPL). On February 24, Chief Technology Officer Paul Rinaldo, W4RI, briefed the Interdepartment Radio Advisory Committee (IRAC) on ARRL observations at BPL sites. General Counsel Chris Imlay, W3KD, and Rinaldo made a similar presentation to National Public Safety Telecommunications staff on March 10. "We carried the message that Amateur Radio is likened to the canary in the coal mine: short wave listeners and hams are closest to residential power lines that might be carrying BPL signals," Rinaldo said. On March 4, as a member of the Institute of Electrical and Electronics Engineers (IEEE), Rinaldo participated in Congressional Visits Day, an effort by 36 organizations to visit congressmen and women.

League to Highlight Grassroots Action at Hamvention

Want to make your voice stand out when it comes to Amateur Radio issues? If so, the ARRL has a must-attend forum at the Dayton Hamvention this month that's just for you. "How Grassroots Action Gets Lawmakers' Reaction," a forum on grassroots political action, will be held at noon Friday, May 14.

ARRL General Counsel Chris Imlay, W3KD, will give a talk on influencing Congressional representatives, New England Vice Director Mike Raisbeck, K1TWF, has a presentation on getting state legislators to work with hams, and ARRL President Jim Haynie, W5JBP, has titled his remarks "ARRL: Tighten that Cinch and Go Do It!" Great Lakes Division Vice Director Dick Mondro, W8FQT, will be the master of ceremonies and Great Lakes Division Director Jim Weaver, K8JE, will offer the opening remarks.

Mondro said that the forum was developed by the ARRL Board to bring attention to the importance of communicating with legislators on Amateur Radio issues. "[We] have gathered experts to answer your questions," Mondro said. "President Haynie and General Counsel Imlay have spent more time [representing Amateur Radio] in Washington than anyone in recent history and they have the knowledge to teach us how to get action."

Iowa Club Recognized as a "Point of Light"

The Points of Light Foundation and Volunteer Center National Network designated The Tri-State Amateur Radio Club (TSARC) as the Daily Point of Light for March 29. An ARRL-affiliated club, TSARC is headquartered in Cresco, Iowa. The Foundation recognized the club for voluntarily providing communication during emergencies and for supporting Red Cross and The Salvation Army relief efforts. President George W. Bush and former President George H. W. Bush, have endorsed the Daily Points of Light Award, and each will send a congratulatory letter to the club.

In 2002, TSARC also was the beneficiary of a $1500 ARRL Foundation grant to assist its emergency communication efforts. The money helped to supplement funds the club had been able to raise on its own toward the $6500 cost of a 16 foot equipment trailer.

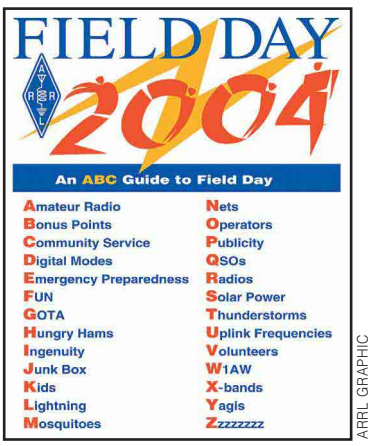
Ham Radio Highlights Indiana Science Teachers Conference

An Amateur Radio presentation went into overtime February 20 as excited teachers asked questions of speakers Neil Rapp, WB9VPG, and ARRL Field and Educational Services Manager Rosalie White, K1STO. Rapp, with White's assistance, put on an hour-long forum at the Hoosier Association of Science Teachers, Inc (HASTI) 34th Annual Conference in Indianapolis, Indiana.

"Neil had presented a PowerPoint presentation on how he uses Amateur Radio at Bloomington South High School [an ARRL Amateur Radio Education and Technology Program school] to help him teach physics and chemistry," White said. "I demonstrated a robot rover, a code practice oscillator and other circuit board projects for hands-on activities student use to learn wireless technology." White also spoke about the Education and Technology Program and ARISS, Amateur Radio on the International Space Station. Rapp brought HF and VHF radios to show the teachers.

ARRL PHOTO

ARRL Field and Educational Services Manager Rosalie White, K1STO, teamed with ARRL Amateur Radio Education and Technology Program teacher Neil Rapp, WB9VPG, to present a well-received forum at the 34th Annual Hoosier Association of Science Teachers, Inc.



ARRL GRAPHIC

New Field Day Shirt Spells It Out

They're new, and descriptive, too! The official ARRL Field Day T-shirts and pins are now available, with the front of the shirt detailing what Field Day 2004 is all about with an A-to-Z list. Jump over to the special Field Day Web site at **www.arrl.org/FieldDay** where you'll find links to download the 2004 Field Day packet and order shirts and pins.

For League Officials, Volunteers, Hamcation Is All About Serving Others

Why is it that vacations—intended for relaxation—always seem to have a bustle about them? At Hamcation 2004 in Orlando, Florida, ARRL directors and field volunteers were plenty busy February 12-14 as Hamcation hosted the ARRL Southeastern Division Convention. Southern Florida Section Manager Sherri Brower, W4STB, said ARRL forums were well attended. "The most covered topics were license restructuring, BPL and homeland defense," she said.

Brower, with three other Section Managers, answered direct questions from members and shared ideas about promoting Amateur Radio and the League in the Southeastern Division.

Simple Pitch Nets New Member

It shouldn't be so surprising, but there are many opportunities to sell the benefits of ARRL membership to prospective members—it just takes someone to go out and make the offer. San Joaquin Valley Section Manager Charles McConnell, W6DPD, did just that, attending a one-day Technician license class in Turlock, California in March to discuss the role of ARRL in the Amateur Radio community. "My talking points were the reasons they should join ARRL and what ARRL has to offer them," McConnell said. "I signed up one new member right there and left ARRL membership applications, which offer a free *Repeater Directory* with membership."

OK Section Courts Emergency Managers on BPL Issue

Looking to gain the support of emergency managers in their state, the Oklahoma Section submitted an article on BPL to the newsletter of the Oklahoma Emergency Management Association, which was published recently. Assistant SM for FCC and Legislative Issues Eddie Manley, KD5JGB, wrote the article.

"A friend of mine who is the editor of the Oklahoma Emergency Managers Association newsletter was visiting and I asked him to let those EMs who are not close to Amateur Radio know about the BPL issue. He then asked me to write up a note for him. I want all the support we can obtain to defeat BPL," Manley said.

The article pointed out that all HF communication—not just Amateur Radio—will be affected by BPL, including some emergency frequencies. "I follow the ARRL information [on BPL] very closely. The League is on top of BPL and we want to reinforce anything that we can here in Oklahoma," Manley said.

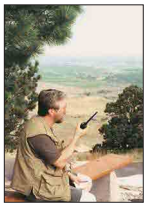
ICOM Initiative Noted

BOB INDERBITZEN, NQ1R

ICOM's national sales manager, Ray Novak, N9JA (left), accepted an award March 9 recognizing the company's participation in ARRL membership recruitment initiatives. ARRL Sales and Marketing Manager Dennis Motschebacher, K7BV, presented the award during Novak's visit to ARRL Headquarters. ICOM most recently supported a League membership campaign tied to purchases of new ICOM radios. Participating dealers distributed ARRL membership vouchers to customers, underwriting a portion of the first-year membership dues for brand new members.

Guide to ARRL Member Services

ARRL, 225 Main Street, Newington, CT 06111-1494



www.arrl.org/services.html/ **860-594-0200**

Technical and Regulatory Information Services

A wealth of problem-solving information is available to you on the ARRLWeb at **www.arrl.org/tis/**. Can't find the answer there? Call the Technical Information Service at 860-594-0214 from 9 AM to 4 PM Eastern Time, or e-mail **tis@arrl.org**.

Do you have a question about FCC Rules or local antenna restrictions? See the Regulatory Information Branch on the Web, call 860-594-0236 or e-mail **reginfo@arrl.org**.

ARRLWeb www.arrl.org

Log on for news, information and ARRL services. Members have access to special ARRL Web site features. Place free classified ads. Download and view *QST* product reviews and search the on-line periodicals index.

ARRL E-mail Forwarding

Life in cyberspace is easier when you have your own **arrl.net** e-mail address. When you switch Internet Service Providers, all you have to do is let us know and we'll change your e-mail forwarding automatically. You're spared the hassle of having to tell everyone that you've changed addresses! Sign up on the Web at **www.arrl.org/members-only/emailfwd.html**.

ARRL News

The ARRL News service is the most credible source of news for the amateur community. Breaking stories are available on the ARRLWeb. You can also listen to ARRL Audio News on the Web, or by telephone at 860-594-0384. Have a news tip? E-mail **n1rl@arrl.org**.

QSL Service

The most economical way to send and receive QSL cards throughout the world is through the ARRL QSL Service.

Educational Materials

A complete line of educational materials are available to schools, clubs and individuals.

Books, Software and Operating Resources

You can rely on ARRL for the very best publications and products: license manuals, circuit design and project resources, antenna construction ideas, and more. Shop online or locate a dealer near you at **www.arrl.org/shop**. What's the secret for making great publications even better?**—We listen to you!** E-mail your publications feedback, suggestions and product ideas to **pubsfdbk@arrl.org**.

Insurance

The ARRL "All Risk" Ham Radio Equipment Insurance Plan provides protection from loss or damage to your amateur station and mobile equipment by theft, accident, fire, flood, tornado, and other natural disasters. Antennas rotators and towers can be insured too. Call 860-594-0211.

DXCC/VUCC

The DX Century Club and VHF/UHF Century Club award programs are among the most popular Amateur Radio awards in the world.

Volunteer Examiner Coordinator (VEC)

Are you looking for a place to take your license exam? Do you have questions about the examination process? The ARRL VEC network is the largest in the nation.

Trust in Advertising

ARRL's advertising acceptance process is a unique and respected service provided to both members and advertisers. The ARRL Lab regularly evaluates products for acceptable construction quality, safety, compliance with FCC requirements and performance claims. Members rely on *QST* and other ARRL publications to locate reputable suppliers of Amateur Radio equipment and services.

ARRL Foundation

This is your source for scholarships and other financial grant programs to support Amateur Radio. See **www.arrl.org/arrlf/** on the Web or call 860-594-0397.

Write for *QST*

We're always looking for articles of interest to amateurs. See our Author's Guide at **www.arrl.org/qst/aguide/**. If you have questions, or wish to submit an article for consideration, send an e-mail to **qst@arrl.org** or simply mail your article to *QST* c/o ARRL Hq.

Interested in Becoming a Ham?

Phone toll free 1-800-326-3942, or e-mail **newham@arrl.org**. We'll provide helpful advice on obtaining an Amateur Radio license. See **www.arrl.org/hamradio.html**.

We're at *your* Service

ARRL Headquarters is open from 8 AM to 5 PM Eastern Time, Monday through Friday, except holidays. Call **toll free** to join the ARRL or order ARRL products: **1-888-277-5289** (US), Monday-Friday only, 8 AM to 8 PM Eastern Time. From outside the US, call 860-594-0355. The fax number is 860-594-0303 (24 hours a day, 7 days a week).

If you're in Connecticut, stop by ARRL Headquarters for a visit and tour. Located at 225 Main St, Newington, CT 06111, HQ offers tours at 9, 10 and 11 AM, and 1, 2 and 3 PM Monday through Friday, except holidays. Bring your license and operate W1AW anytime between 10 AM and noon, and 1 to 3:45 PM.

If you have a question, try one of these ARRL Headquarters departments . . .

	Contact	*Telephone*	*Electronic Mail*
Joining ARRL	Membership Desk	860-594-0338	**membership@arrl.org**
***QST* Delivery**	Circulation Desk	860-594-0338	**circulation@arrl.org**
Permission Requests	Maty Weinberg	860-594-0229	**permission@arrl.org**
Publication Orders	Sales Desk	860-594-0355	**pubsales@arrl.org**
Amateur Radio News	Rick Lindquist	860-594-0222	**n1rl@arrl.org**
Regulatory Info	John Hennessee	860-594-0236	**reginfo@arrl.org**
Exams	VEC	860-594-0300	**vec@arrl.org**
Educational Materials	Educational Services	860-594-0267	**ead@arrl.org**
CCE/EmComm Courses	Dan Miller	860-594-0340	**dmiller@arrl.org**
Contests	Dan Henderson	860-594-0232	**contests@arrl.org**
Technical Questions	ARRL Lab	860-594-0214	**tis@arrl.org**
DXCC	Bill Moore	860-594-0234	**dxcc@arrl.org**
Awards/VUCC	Eileen Sapko	860-594-0288	**awards@arrl.org**
Development Office	Mary Hobart	860-594-0397	**mhobart@arrl.org**
Advertising	Advertising Desk	860-594-0207	**ads@arrl.org**
Media Relations	Jennifer Hagy	860-594-0328	**newsmedia@arrl.org**
QSL Service	Martin Cook	860-594-0274	**buro@arrl.org**
Scholarships	Development Office	860-594-0397	**foundation@arrl.org**
Emergency Comm	Steve Ewald	860-594-0265	**emergency@arrl.org**
Clubs	Field Services	860-594-0267	**clubs@arrl.org**
Hamfests	Gail Iannone	860-594-0262	**hamfests@arrl.org**
Write for QST	Joel Kleinman	860-594-0273	**qst@arrl.org**

Can't find the department you're looking for? Call 860-594-0200 or e-mail **hq@arrl.org**. Sending e-mail to any ARRL Headquarters staff member is a snap. Just put his or her call sign (or first initial and last name) in front of **@arrl.org**. For example, to send mail to Martin Cook, QSL Service Manager, use **n1foc@arrl.org** or **mcook@arrl.org**. If all else fails, send a message to **hq@arrl.org** and it will get routed to the right person or department.

ARRL Division Directors

As an ARRL member, you elect the directors and vice directors who represent your division on ARRL policy matters. If you have a question or comment about ARRL policies, contact your representatives at the addresses shown.

Atlantic Division

BERNIE FULLER, N3EFN
17668 Price Rd, Saegertown, PA 16433
(814-763-1529); **n3efn@arrl.org**

Vice Director: Bill Edgar, N3LLR
22 Jackson Ave, Bradford, PA 16701
(814-362-1250); **n3llr@arrl.org**

Central Division

GEORGE R. ISELY, W9GIG*
736 Fellows St, St Charles, IL 60174
(630-584-3510); **w9gig@arrl.org**

Vice Director: Howard S. Huntington, K9KM
25350 N Marilyn Ln, Hawthorn Woods, IL 60047
(847-438-3452); **k9km@arrl.org**

Dakota Division

JAY BELLOWS, KØQB*
997 Portland Ave, St Paul, MN 55104
(651-238-4444); **k0qb@arrl.org**

Vice Director: Twila Greenheck, NØJPH
3333 Owasso Heights Rd, Shoreview, MN 55126
(651-483-1214); **n0jph@arrl.org**

Delta Division

RICK RODERICK, K5UR*
PO Box 1463, Little Rock, AR 72203
(501-988-2527); **k5ur@arrl.org**

Vice Director: Henry R. Leggette, WD4Q
7335 Ginger Snap Cove, Memphis, TN
38125-4732 (901-757-0444); **wd4q@arrl.org**

Great Lakes Division

JIM WEAVER, K8JE
5065 Bethany Rd, Mason, OH 45040-9660
(513-459-0142); **k8je@arrl.org**

Vice Director: Richard Mondro, W8FQT
800 Dover St, Dearborn Heights, MI 48127
(313-730-2111); **w8fqt@arrl.org**

Hudson Division

FRANK FALLON, N2FF*
30 E Williston Ave, East Williston, NY 11596
(516-746-7652); **n2ff@arrl.org**

Vice Director: Joyce Birmingham, KA2ANF
235 Van Emburgh Ave, Ridgewood, NJ 07450-2918 (201-445-5924); **ka2anf@arrl.org**

Midwest Division

WADE WALSTROM, WØEJ
7431 Macon Dr, Cedar Rapids, IA 52411
(319-393-8982); **w0ej@arrl.org**

Vice Director: Bruce Frahm, KØBJ
PO Box DX, Colby, KS 67701
(785-462-7388); **k0bj@arrl.org**

New England Division

TOM FRENAYE, K1KI
PO Box J, West Suffield, CT 06093
(860-668-5444); **k1ki@arrl.org**

Vice Director: Mike Raisbeck, K1TWF
85 High St, Chelmsford, MA 01824
(978-250-1235); **k1twf@arrl.org**

Northwestern Division

GREG MILNES, W7OZ
740 SE 24th Ave, Hillsboro, OR 97123-7286
(503-648-6990); **w7oz@arrl.org**

Vice Director: Jim Fenstermaker, K9JF
10312 NE 161st Ave, Vancouver, WA 98682
(360-256-1716); **k9jf@arrl.org**

Pacific Division

BOB VALLIO, W6RGG
18655 Sheffield Rd, Castro Valley, CA 94546
(510-537-6704); **w6rgg@arrl.org**

Vice Director: Andy Oppel, N6AJO,
1308 Burbank St, Alameda, CA 94501-3946
(510-864-2299); **n6ajo@arrl.org**

Roanoke Division

DENNIS BODSON, W4PWF
233 N Columbus St, Arlington, VA 22203
(703-243-3743); **w4pwf@arrl.org**

Vice Director: Rev Leslie Shattuck, K4NK
218 Marion Ave, Anderson, SC 29624
(864-296-0916); **k4nk@arrl.org**

Rocky Mountain Division

WALT STINSON, WØCP*
5295 E Evans Ave, Denver, CO 80222-5221
(303-770-3926); **w0cp@arrl.org**

Vice Director: Warren G. "Rev" Morton, WS7W
1341 Trojan Dr, Casper, WY 82609
(307-235-2799); **ws7w@arrl.org**

Southeastern Division

FRANK M. BUTLER JR, W4RH
323 Elliott Rd SE, Ft Walton Beach, FL 32548
(850-244-5425); **w4rh@arrl.org**

Vice Director: Sandy Donahue, W4RU
222 Briarhill Ln, Atlanta, GA 30324
(404-315-1443); **w4ru@arrl.org**

Southwestern Division

ART GODDARD, W6XD
2901 Palau Pl, Costa Mesa, CA 92626
(714-556-4396); **w6xd@arrl.org**

Vice Director: Tuck Miller, NZ6T
3122 E 2nd St, National City, CA 91950
(619-434-4211); **nz6t@arrl.org**

West Gulf Division

COY C. DAY, N5OK
RR 1, Box 254, Union City, OK 73090-9726
(405-483-5632); **n5ok@arrl.org**

Vice Director: Dr David Woolweaver, K5RAV
2210 S 77 Sunshine Strip, Harlingen, TX 78550
(956-425-3128); **k5rav@arrl.org**

*Executive Committee member

ARRL Section Managers

The 15 divisions of ARRL are arranged into 71 administrative *sections*, each headed by an elected *section manager* (SM). Your section manager is the person to contact when you have news about your activities, or those of your club. If you need assistance with a local problem, your section manager is your first point of contact. He or she can put you in touch with various ARRL volunteers who can help (such as technical specialists).Your section manager is also the person to see if you'd like to become a section volunteer. Whatever your license class, your SM has an appointment available. Visit your section page on the Web at **www.arrl.org/sections/**.

Atlantic Division (DE, EPA, MDC, NNY, SNJ, WNY, WPA)

Delaware: Randall K. Carlson, WB0JJX, 121 Scarborough Park Dr, No. 10, Wilmington, DE 19804 (302-655-6179); **wb0jjx@arrl.org**

Eastern Pennsylvania: Eric Olena, WB3FPL, 284 Blimline Rd, Mohnton, PA 19540 (610-775-0526); **wb3fpl@arrl.org**

Maryland-DC: Tom Abernethy, W3TOM, PO Box 73, Accokeek, MD 20607 (301-292-6263); **w3tom@arrl.org**

Northern New York: Thomas Dick, KF2GC, 4 Jenkins St, Saranac Lake, NY 12983 (518-891-0508); **kf2gc@arrl.org**

Southern New Jersey: Jean Priestley, KA2YKN, 7158 Chandler Ave, Pennsauken, NJ 08110 (856-662-3587); **ka2ykn@arrl.org**

Western New York: Scott Bauer, W2LC, 1964 Connors Rd, Baldwinsville, NY 13027 (315-638-7551); **w2lc@arrl.org**

Western Pennsylvania: Rich Beaver, N3SRJ, 4A Cardinal Dr, Jeannette, PA 15644 (724-523-5656); **n3srj@arrl.org**

Central Division (IL, IN, WI)

Illinois: Sharon Harlan, N9SH, 5931 Alma Dr, Rockford, IL 61108 (815-398-2683); **n9sh@arrl.org**

Indiana: James S. Sellers, K9ZBM, 54676 County Road 8, Middlebury, IN 46540-8710 (574-825-5425); **k9zbm@arrl.org**

Wisconsin: Donald Michalski, W9IXG, 4214 Mohawk Dr, Madison, WI 53711 (608-274-1886); **w9ixg@arrl.org**

Dakota Division (MN, ND, SD)

Minnesota: Randy "Max" Wendel, KM0D, 8539 Bryant Ave S, Bloomington, MN 55420-2147 (952-888-5953); **km0d@arrl.org**

North Dakota: Kent Olson, KA0LDG, 7702 Forest River Rd, Fargo, ND 58104-8004 (701-298-0956); **ka0ldg@arrl.org**

South Dakota: Richard L. Beebe, N0PV, 913 S Gordon Dr, Sioux Falls, SD 57110-3151 (605-332-1434); **n0pv@arrl.org**

Delta Division (AR, LA, MS, TN)

Arkansas: Dennis Schaefer, W5RZ, 181 Schaefer Dr, Dover, AR 72837-7923 (479-967-4372); **w5rz@arrl.org**

Louisiana: Mickey Cox, K5MC, 754 Cheniere-Drew Rd, West Monroe, LA 71291 (318-397-1980); **k5mc@arrl.org**

Mississippi: Malcolm Keown, W5XX, 14 Lake Circle Dr, Vicksburg, MS 39180 (601-636-0827); **w5xx@arrl.org**

Tennessee: Larry W. Marshall, WB4NCW, 11 Hovis Bend Rd, Fayetteville, TN 37334 (931-433-5088); **wb4ncw@arrl.org**

Great Lakes Division (KY, MI, OH)

Kentucky: John D. Meyers, NB4K, 218 Cory Ln, Butler, KY 41006-9740 (859-472-6690); **nb4k@arrl.org**

Michigan: Dale Williams, WA8EFK, 291 Outer Drive, Dundee, MI 48131 (734-529-3232); **wa8efk@arrl.org**

Ohio: Joe Phillips, K8QOE, 2800 Jupiter Dr, Fairfield, OH 45014-5022 (513-874-0006); **k8qoe@arrl.org**

Hudson Division (ENY, NLI, NNJ)

Eastern New York: Pete Cecere, N2YJZ, 378 Ohayo Mtn Rd, Woodstock, NY 12498 (845-679-9846); **n2yjz@arrl.org**

NYC-Long Island: George Tranos, N2GA, PO Box 296, Bellport, NY 11713 (631-286-7562); **n2ga@arrl.org**

Northern New Jersey: William Hudzik, W2UDT, 111 Preston Dr, Gillette, NJ 07933 (908-580-0493); **w2udt@arrl.org**

Midwest Division (IA, KS, MO, NE)

Iowa: Jim Lasley, N0JL, PO Box 5, Chillicothe, IA 52548 (641-935-4337); **n0jl@arrl.org**

Kansas: Ronald D. Cowan, KB0DTI, PO Box 36, LaCygne, KS 66040 (913-757-4455); **kb0dti@arrl.org**

Missouri: Dale C. Bagley, K0KY, PO Box 13, Macon, MO 63552-1822 (660-385-3629); **k0ky@arrl.org**

Nebraska: Bill McCollum, KE0XQ, 1314 Deer Park Blvd, Omaha, NE 68108 (402-734-3316); **ke0xq@arrl.org**

New England Division (CT, EMA, ME, NH, RI, VT, WMA)

Connecticut: Betsey Doane, K1EIC, 92 Mohegan Rd, Shelton, CT 06484-2448 (203-929-7759); **k1eic@arrl.org**

Eastern Massachusetts: Phil Temples, K9HI, Apt 803, 125 Coolidge Ave, Watertown, MA 02472-2875 (617-331-0183); **k9hi@arrl.org**

Maine: William Woodhead, N1KAT, 68 Madison St, Auburn, ME 04210 (207-782-4862); **n1kat@arrl.org**

New Hampshire: Al Shuman, N1FIK, PO Box 119, Goffstown, NH 03045-0119 (603-487-3333); **n1fik@nhradio.org**

Rhode Island: Bob Beaudet, W1YRC, 30 Rocky Crest Rd, Cumberland, RI 02864 (401-333-2129); **w1yrc@arrl.org**

Vermont: Paul N. Gayet, AA1SU, 124 Macrae Rd, Colchester, VT 05446 (802-860-1134); **aa1su@arrl.org**

Western Massachusetts: William Voedisch, W1UD, 240 Main St, Leominster, MA 01453 (978-537-2502); **w1ud@arrl.org**

Northwestern Division (AK, EWA, ID, MT, OR, WWA)

Alaska: David Stevens, KL7EB, PO Box 113242, Anchorage, AK 99511 (907-345-6506); **kl7eb@arrl.org**

Eastern Washington: Mark Tharp, KB7HDX, PO Box 2222, Yakima, WA 98907-2222 (509-965-3379); **kb7hdx@arrl.org**

Idaho: Doug Rich, W7DVR, 2025 Regal Dr, Boise, ID 83704-7153 (208-376-7651); **w7dvr@arrl.org**

Montana: Doug Dunn, K7YD, 216 Fiddle Creek Rd, Livingston, MT 59047-4116 (406-686-9100); **k7yd@arrl.org**

Oregon: Randy Stimson, KZ7T, PO Box 1302, Beaverton, OR 97075-1302 (503-641-3776); **kz7t@arrl.org**

Western Washington: Edward W. Bruette, N7NVP, 305 NW Paulson Rd, Poulsbo, WA 98370-8112 (360-698-0917); **n7nvp@arrl.org**

Pacific Division (EB, NV, PAC, SV, SF, SJV, SCV)

East Bay: Ti-Michelle Connelly, NJ6T, 14490 Hemlock St, San Leandro, CA 94579 (510-483-6079); **nj6t@arrl.org**

Nevada: Dick Flanagan, K7VC, 2851 Esaw St, Minden, NV 89423 (775-267-4900); **k7vc@arrl.org**

Pacific: Kevin C. Bogan, AH6QO, 6606 Kahena Pl, Honolulu, HI 96825-1016 (808-778-4697); **ah6qo@arrl.org**

Sacramento Valley: Jettie Hill, W6RFF, 306 Saint Charles Ct, Roseville, CA 95661-5008 (916-783-0383); **w6rff@arrl.org**

San Francisco: Bill Hillendahl, KH6GJV, PO Box 4151, Santa Rosa, CA 95402-4151 (707-544-4944); **kh6gjv@arrl.org**

San Joaquin Valley: Charles P. McConnell, W6DPD, 1658 W Mesa Ave, Fresno, CA 93711-1944 (559-431-2038); **w6dpd@arrl.org**

Santa Clara Valley: Glenn Thomas, WB6W, 502 Walnut Dr, Milpitas, CA 95035-4133 (408-263-9450); **wb6w@arrl.org**

Roanoke Division (NC, SC, VA, WVA)

North Carolina: John Covington, W4CC, PO Box 1604, Belmont, NC 28012 (704-577-9405); **w4cc@arrl.org**

South Carolina: James F. Boehner, N2ZZ, 525 Barnwell Ave NW, Aiken, SC 29801-3939 (803-641-9140); **n2zz@arrl.org**

Virginia: Carl Clements, W4CAC, 4405 Wake Forest Rd, Portsmouth, VA 23703 (757-484-0569); **w4cac@arrl.org**

West Virginia: Hal L. Turley, KC8FS, 6 Ives Dr, Huntington, WV 25705 (304-736-2790); **kc8fs@arrl.org**

Rocky Mountain Division (CO, NM, UT, WY)

Colorado: Jeff Ryan, K0RM, 6721 Northface Ln, Colorado Springs, CO 80919-1508 (719-260-6826); **k0rm@arrl.org**

New Mexico: Bill Weatherford, KM5FT, 540 Mesilla NE, Albuquerque, NM 87108 (505-254-2299); **km5ft@arrl.org**

Utah: Mel Parkes, AC7CP, 2166 E 2100 North, Layton, UT 84040 (801-547-1753); **ac7cp@arrl.org**

Wyoming: Jay Ostrem, W7CW, PO Box 1993, Gillette, WY 82717-1993 (307-682-7839); **w7cw@arrl.org**

Southeastern Division (AL, GA, NFL, PR, SFL, VI, WCF)

Alabama: Greg Sarratt, W4OZK, 912 Pine Grove Rd, Harvest, AL 35749 (256-337-3636); **w4ozk@arrl.org**

Georgia: Susan Swiderski, AF4FO, 772 Camelot Way, Norcross, GA 30071 (770-449-0369); **af4fo@arrl.org**

Northern Florida: Rudy Hubbard, WA4PUP, PO Box 843, Milton, FL 32572-0843 (850-626-0620); **wa4pup@arrl.org**

Puerto Rico: Victor Madera, KP4PQ, PO Box 191917, San Juan, PR 00919-1917 (787-789-4998); **kp4pq@arrl.org**

Southern Florida: Sharon T. "Sherri" Brower, W4STB, 736 34th Ter, Vero Beach, FL 32968-1226 (772-562-3240); **w4stb@arrl.org**

Virgin Islands: John Ellis, NP2B, PO Box 24492, Christiansted, St Croix, VI 00824 (340-773-9643); **np2b@arrl.org**

West Central Florida: Dave Armbrust, AE4MR, 3024 Salem Ave, Sarasota, FL 34232 (941-685-2081); **ae4mr@arrl.org**

Southwestern Division (AZ, LAX, ORG, SDG, SB)

Arizona: Clifford Hauser, KD6XH, 8741 N Hollybrook Ave, Tucson, AZ 85742 (520-744-9095); **kd6xh@arrl.org**

Los Angeles: Phineas J. Icenbice Jr, W6BF, 19323 Halsted St, Northridge, CA 91324 (818-349-3186); **w6bf@arrl.org**

Orange: Carl Gardenias, WU6D, 20902 Gardenias St, Perris, CA 92570 (909-443-4958); **wu6d@arrl.org**

San Diego: Patrick Bunsold, WA6MHZ, 1615 La Cresta Blvd, El Cajon, CA 92021-4072 (619-593-1111); **wa6mhz@arrl.org**

Santa Barbara: Robert Griffin, K6YR, 1436 Johnson Ave, San Luis Obispo, CA 93401-3734 (805-543-3346); **k6yr@arrl.org**

West Gulf Division (NTX, OK, STX, WTX)

North Texas: Roy Rabey, AD5KZ, 600 Morning Glory Ln, Bedford, TX 76021-2207 (214-507-4450); **ad5kz@arrl.org**

Oklahoma: John Thomason, WB5SYT, 1517 Oak Dr, Edmond, OK 73034-7408 (405-844-1800); **wb5syt@arrl.org**

South Texas: E. Ray Taylor, N5NAV, 688 Comal Ave, New Braunfels, TX 78130 (830-625-1683); **n5nav@arrl.org**

West Texas: John C. Dyer, AE5B, 9124 CR 301, Cisco, TX 76437-9525 (254-442-4936); **ae5b@arrl.org**

AMERITRON *True Legal Limit*™ Tuner

Easily handles 1500 Watts continuous carrier even on 160 Meters . . . High-current edge-wound silver plated Roller Inductor . . . Two 500 pf high capacitance tuning capacitors with 6:1 vernier reduction drives . . . 3 core choke balun . . . Six position antenna switch . . . True peak reading Cross-Needle SWR/Wattmeter . . .

Call your dealer for your best price!

AMERITRON ATR-30

$599

Suggested Retail

- ***Handles 1500 Watts carrier***
- ***Super High Current edge-wound silver plated Roller Inductor***
- ***500 pf tuning capacitors with 6:1 vernier reduction drives***
- ***3 core choke balun***
- ***6 position antenna switch***
- ***True peak reading meter***

AMERITRON's ATR-30 *True Legal Limit*™ roller inductor antenna tuner is ham radio's toughest! It'll handle 1500 Watts *continuous carrier output* on *all* modes and *all* HF bands into most antennas -- even on 160 Meters where most antenna tuners fail.

It's perfect for Ameritron's most powerful amplifiers where the ATR-30 just loafs.

All band coverage lets you operate 1.8-30 MHz including all MARS and WARC bands.

Super High Current Roller Inductor

You'll see Ameritron's new *super high current* air core roller inductor. It's *edge wound* from a thick solid copper strip and silver plated. This produces a large surface area and a massive conductor. It can carry huge circulating RF currents and withstand tremendous heat that'll melt or burn ordinary roller inductors.

A gear driven turns counter and crank knob gives you precise inductance control.

Two 500 pf Tuning Capacitors

Two 500 pf -- *the highest of any antenna tuner* -- variable transmitting capacitors give you no-arc wide range impedance matching for true high power performance.

6:1 vernier reduction drives makes capacitor tuning smooth and easy.

Super Balun, 6 position Antenna Switch

Super heavy duty three core choke balun lets you match virtually any balanced feedline antenna without core saturation.

A 6 position antenna switch lets you select your desired operating antenna.

Read *true* Peak Power

Ameritron's active electronic *true* peak reading meter accurately reads forward and reflected power and SWR *simultaneously* on a lighted Cross-Needle meter.

Roomy Cabinet maintains High-Q

Roomy extra-strong .080 inch thick aluminum cabinet gives highest efficiency and lowest loss. 13¼Wx5⅜Hx17½D inches.

AMERITRON ATR-20 Antenna Tuner

ATR-20, $459. Handles a full 1.2 kW SSB and 600 Watts CW. It's designed to safely handle the full SSB power of Ameritron's AL-811/811H/80B, ALS-500M/600 and other 1.2 kW SSB amplifiers.Has vernier reduction drives.

Ameritron has the best selection of *True Legal Limit*™ HF Amplifiers

AMERITRON's legal limit amplifiers use super heavy duty Peter Dahl Hypersil® power transformer capable of 2500 Watts!

Ameritron's *most powerful* Amp

with Eimac® 3CX1500/8877 ceramic tube

AL-1500

$3045

Suggested Retail

TrueLegalLimit™

Ameritron's *most powerful* amplifier uses the herculean *Eimac®* 3CX1500/8877 ceramic tube. It's so powerful that 65 Watts drive gives you the full output power -- and it's just loafing because the power supply is capable of 2500 Watts PEP. All HF bands, all modes. 77 lbs., 17Wx10Hx18½D inches.

Ameritron's *toughest* Amp

with Eimac® 3CX1200A7 tube

AL-1200

$2645

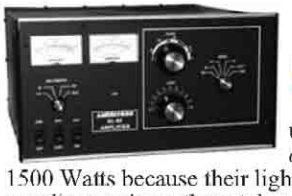
Suggested Retail

TrueLegalLimit™

Get ham radio's *toughest* tube with AL-1200. The *Eimac®* 3CX1200A7 has a 50 Watt control grid dissipation and the lowest history of field replacement of any modern transmitting tube that we use. 90 Watts in gives you full power out. All HF bands, all modes. 76 pounds, 17Wx18½Dx10H in.

Ameritron's *classic* Amp

with 2 graphite plate Amperex® 3-500G tubes



AL-82

$2545

Suggested Retail

TrueLegalLimit™

Most linears using 3-500Gs *can't* give you 1500 Watts because their lightweight power supplies *can't* use these tubes to their full potential. AL-82 is ham radio's *only* super 3-500G amp! 100 Watts in gives you full power out. All HF bands, all modes. Hefty 76 pounds, 17Wx10Hx18½D inches.

Desktop Kilowatt

with Amperex® 3-500G tube

AL-80B, $1349. Gives you full kilowatt SSB PEP output (85 Watts in) from a whisper quiet compact desk- top linear. 14Wx8½Hx 15½D". Plugs into 120 VAC outlet. Graphite plate *Amperex®* 3-500G tube. Nearly 70% efficiency. Weighs 48 lbs.

AMERITRON *no tune* Solid State Amplifiers

500 Watt Mobile Amp

ALS-500M, $799. 500 Watts PEP/400W CW output, 1.5-22 MHz, instant bandswitching, no tuning, no warm-up. SWR, load fault, thermal overload protected. On/off/bypass switch. Remote on/off control. DC current meter. Extremely quiet, fan off until needed. 13.8 VDC. 9Wx3½Hx15D in.

600 Watt FET Amp

ALS-600, $1299. *No tuning, no fuss, no worries -- just turn on and operate.* 600 Watts PEP/500W CW, 1.5-22 MHz, instant bandswitching, SWR protected, extremely quiet, lighted peak reading Cross-Needle SWR/Wattmeter, front panel ALC control, operate/standby switch. 120 or 220 VAC. Inrush current protected. 9½Wx6Hx12D in.

Flat Mobile SWR/Wattmeter

AWM-35, $159.95. 1⅝ inch thick, flat mounts on dashboard. Remote sensor, 25 ft. thin cable. True peak reading. Cross-needle, lighted. 1.5 kW, 1.8-30 MHz. *High-SWR* LED.

Call your dealer for your best price!

Free Catalog: 800-713-3550

AMERITRON®

. . . the world's high power leader!

116 Willow Road, Starkville, MS 39759
TECH (662) 323-8211 • **FAX** (662) 323-6551
8 a.m. - 4:30 p.m. CST Monday - Friday
For power amplifier components call (662) 323-8211
http://www.ameritron.com

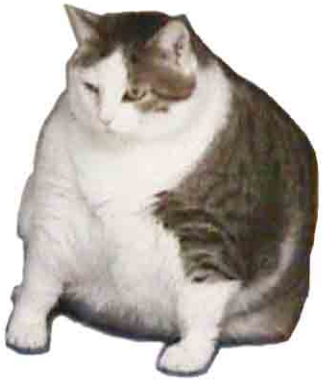
pounce on our great Icom deals!

Grayson

This is clearly the most advanced amateur radio ever developed. By sparing no expense, an incredible +40dBm intercept point has been achieved with ultra-wide dynamic range. And you'll enjoy this incredible performance in two fully independent receiver circuits. HF/6M

IC-7800 The Purrrfect Rig!

The PROII features a 32-bit floating point DSP digital IF filter with 51 selectable bandwidths. Soft and sharp filter shapes can be selected in both SSB and CW modes, independently. The selectivity lets you pull out weak signals like never before. Make the ProII the heart of your complete Icom station ! HF/6M



Howard

IC-756PROII Huge Savings!

Henry

100% full duty cycle operation. 32 bit floating point DSP and 24-bit AD/DA converter. Ultra wide dynamic range and good third order intercept point. Soft and sharp filter shapes can be selected in both SSB and CW modes independently. Change the settings on the fly and compare! HF/6M/2M

IC-746PRO Pick of the Litter!

Hanna

Visit **www.universal-radio.com** for great Icom values and more cool cats!

universal radio inc.

Universal Radio Inc.
6830 Americana Pkwy
Reynoldsburg, Ohio 43068-4113 USA
800-431-3939 Orders & Prices. **614-866-4267** Information.
614-866-2339 FAX. dx@universal-radio.com e-mail.

6725

Out Of This World Performance

ISS International Space Station
TM-D700A
2 meters & 440 MHz
(Currently On Board)

MIR Space Station
TM-V7A
2 meters & 440 MHz
(Mission Complete)

Kenwood is proud to be the only company chosen as a participant in both the INTERNATIONAL SPACE STATION (ISS) and MIR space programs. The TM-V7A received awards from the Russian Space Agency for its flawless performance aboard MIR. The KENWOOD TM-D700A 144/440MHz FM Dual Bander is now on board the International Space Station. But is it any wonder? This world class voice and data communicator has technologies which are perfect for any mission, whether on planet earth or in outer space. This all goes to show that operating a Kenwood Amateur Radio is out of this world.

KENWOOD
Amateur Radio Products Group

KENWOOD U.S.A. CORPORATION
Communications Division
Division Headquarters
3975 Johns Creek Court, Suwanee, GA 30024-1265
Customer Support/Distribution
P.O. Box 22745, 2201 East Dominguez St., Long Beach, CA 90801-5745
Customer Support: (310) 639-4200 Fax: (310) 537-8235

INTERNET
Kenwood News & Products
http://www.kenwood.net
#040304

JQA-1205 091-A
ISO9001 Registered
Communications Equipment Division
Kenwood Corporation
ISO9001 certification

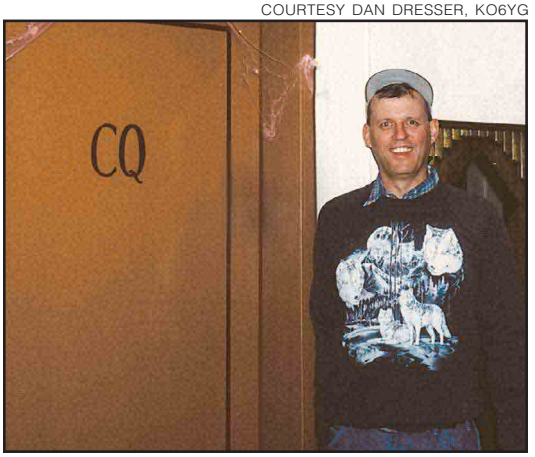
"We are gathered here..."

ARRL Northwestern Division Director Greg Milnes, W7OZ, writes: In December I was presented with an exciting and I think unique way to try to recruit members for the ARRL. I'm a retired Oregon trial court judge but still authorized for part time work and to perform wedding ceremonies. I was asked by a long time friend to tie the knot in a small ceremony. When the question arose, what did I charge to do weddings, I just happened to have a supply of ARRL membership forms handy. My charge? You guessed it—membership in the ARRL. As it turned out, the groom heard I was going to try to recruit him, and he beat me to it and rejoined the League before the wedding. Now the fee is a Family Membership for his wife. Oh yes, the bride notified me the Saturday before the wedding: She "aced" her test. Welcome KD7ZAE!

COURTESY GREG MILNES, W7OZ

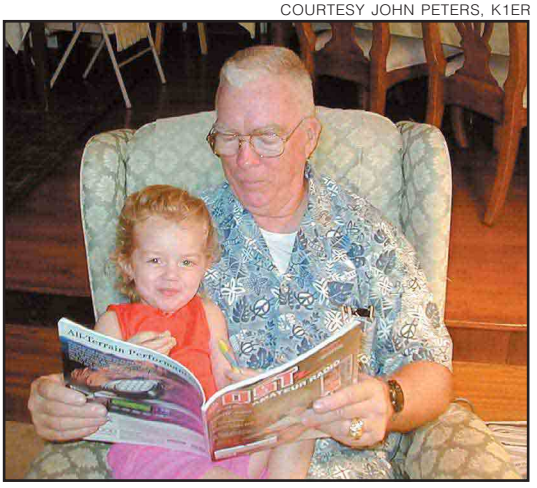
ARRL Northwestern Division Director Greg Milnes, W7OZ (left), officiated at the wedding of N7FNB and his newly licensed bride, KD7ZAE.

COURTESY DAN DRESSER, KO6YG



Going up? **Those in search of contacts need look no further than the elevator at the Copper Queen Hotel in Bisbee, Arizona.**

COURTESY JOHN PETERS, K1ER



John Peters, K1ER, an ARRL Charter Life Member from Aiea, Hawaii, shares his issues of *QST* with his 2-year-old granddaughter Anissa. Her mother Sarah, KA4DPW, who's been licensed 25 years, wonders when she'll be able to take Anissa to a VE session.

RICK FLEETER, K8VK

Impressive KL station: **Rick Fleeter, K8VK, of Reston, Virginia, who took these photos during a recent business trip to Kuala Lumpur, Malaysia, writes: This is my friend Sangat Singh, 9M2SS, operating the station he assembled at the Planetarium Negara, the National Planetarium of Malaysia. Located on a forest hilltop in Kuala Lumpur shared with the working Planetarium, the Headquarters of the Malaysian Space Agency, and a National collection of orchids growing on several acres, the shack is equipped for all the ham bands from 80 meters through Mode J, and is a critical link to the Malaysian microsatellite, Tiungsat. Elmer of many Malaysian hams, Sangat puts the shack at the disposal of visitors like me, who need a few minutes' respite from a hectic work schedule in KL.**

COURTESY WALT MAXWELL, W2DU

Ham's band: **Well known *QST* and book author Walt Maxwell, W2DU, of DeLand, Florida, writes: I read with sadness in *The ARRL Letter* that Alvino Rey, W6UK, became a silent key. I am very proud to say that I was one of the musicians in his Navy service band. This photo from November 1944 shows the band playing a gig for a group of military officers in Chicago, where we were stationed at the time. The four King Sisters also performed with us on that occasion. One of the sisters, Luise, was Al's wife. You can locate me in the picture as the second from the left in the trumpet section. Although I don't remember which ones were hams, in addition to Al and myself, quite a few others in the band were also licensed amateurs.**

COURTESY DARIN WICK, KG6GFQ, VIA ANDY OPPEL, N6AJO

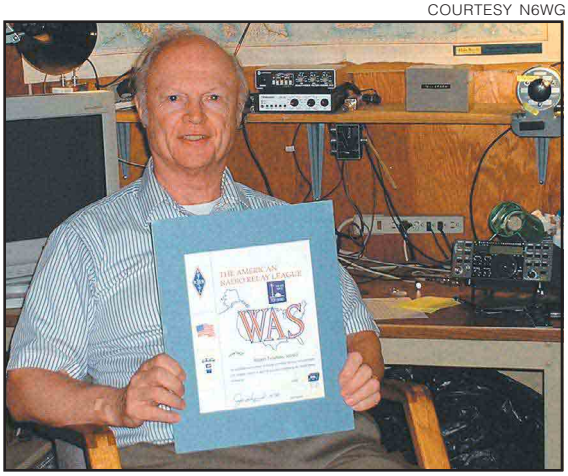
A winner!: **ARRL Pacific Division Vice Director Andy Oppel, N6AJO, met young Darin Wick, KG6GFQ, of Santa Rosa, California, at a recent meeting of the Santa Rosa ARC, where Andy spoke on BPL. His talk inspired Darin, a 13-year-old 8th grader at Sonoma Country Day School, to do this Science/English project on BPL. After winning second place, he wrote to Andy: "I got a good grade on my project. I got an A+ and won 2nd place in the school science fair! I made a simple square wave oscillator, which is in the black box on the right. The load is in the small box on the left, and I put an AM radio underneath the model power lines to demonstrate what BPL could sound like, and it worked well. It is not a true broadband signal and I am not sure if it is in the correct frequency range, but students and adults had fun trying it. My teachers were very impressed with my interviews. Thanks for helping make this an educational and fun science project!"**

COURTESY LYMAN MIX, K1PE

Back to the '60s

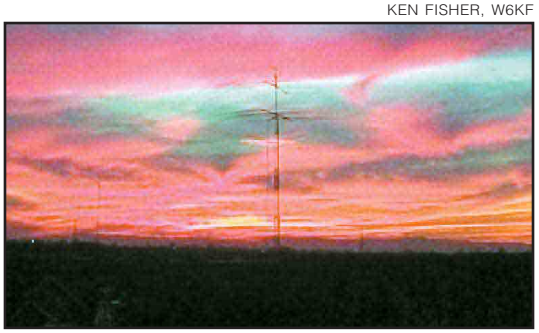
A photo showing some ARRL Headquarters staff and other guests at an ARRL Technical Department holiday party during the mid-1960s came to light recently, courtesy of Lyman Mix, K1PE. Front row, from the left: Miriam Knapp; Julius L. Galin, W1EA, and Roland Bourne, W1ANA. Back row: Ed Tilton, W1HDQ; Laird Campbell, W1CUT; Doug DeMaw, W1CER; Don Mix, W1TS (K1PE's uncle); Walt Lange, W1YDS; George Grammer, W1DF; Clark Rodimon, W1SZ; Lew McCoy, W1ICP, and Byron Goodman, W1DX. In commemoration of our 90th anniversary, there's a decade-by-decade look at some historical events in an article that begins on page 55.

COURTESY N6WG



Congratulations! **Bob Tellefsen, N6WG, of Newark, California, earned his Worked All States award after working W1YRC, in Rhode Island, for his 50th state—all on 160 CW QRP. He started in 1999 by trying the ARRL 160 Meter CW Contest for the first time. Bob lives on a small residential lot, so antennas, he reports, were his biggest obstacle.**

KEN FISHER, W6KF



Red sky in the evening...: **Ken Fisher, W6KF, sees some great sunsets from Almond Ranch in Waterford, California. For those more interested in the antenna array, it consists (from the bottom) of a Force 12 C31XR, an EF-417 Force 12 17-meter monobander and a 13 element Cushcraft 2-meter beam at 85 feet.**

DON'T MESS WITH TEXAS TOWERS

★ Your PRO Headquarters ★

Save $200! AND receive a FREE PS-125!*

*This is a limited time offer! Call us for details!

ICOM IC-756PROII

ICOM IC-746PRO

IC-756PROII Features:

HF/6M • 100W • All Mode • Enhanced Rx • Dual Watch • 32 Bit IF-DSP • Independently Selectable IF Filter Shapes For SSB & CW • Variable Level Noise Blanker • Auto & Manual Notch Filter • Twin Passband Tuning • Improved 5" TFT Color Display • CW Memory Keyer • VOX • Auto Antenna Tuner • SSB/CW Synchronous Tuning • External Control For Voice Memory & Memory Keyer • Adjustable RIT Clear • 1/4 Tuning Steps In Digital Mode

- **32 BIT FLOATING POINT DSP & 24 BIT AD/DA CONVERTER.** At the heart of the '756PROII, the DSP is an incredible tool for handling the QRM found on the bands.
- **SELECTABLE DIGITAL IF FILTER SHAPES FOR SSB & CW.** Tailor the filter shape & bandwidth to your personal operating preferences or band conditions. Sharp for selectivity & signal fidelity, soft for readability, or somewhere inbetween - it's your choice! Change on the fly & compare the difference!
- **IMPROVED 3RD ORDER INTERCEPT POINT.** The newly designed 4 element system delivers a measurable improvement in the 3rd Order Intercept Point, resulting in less distortion from strong signals.
- **REAL-TIME BANDSCOPE.** The adjustable 5" TFT color display shows band activity with relative signal strengths around a center frequency. A peak hold feature gives a snapshot of band activity while using the Dual Watch & sub-band marker to search for new stations or open frequencies on a crowded band.

IC-746PRO Features:

HF/6M/2M • 100W • All Mode • Enhanced Rx • 9600 Baud Ready • 32 Bit IF-DSP & 24 Bit AD/DA Converter • Independently Selectable IF Filter Shapes For SSB & CW • SSB/CW Synchronous Tuning • Built-in RTTY • Variable Level Noise Blanker • Auto & Manual Notch Filter • Digital Twin Passband Tuning • Mic Equalizer • CW Memory Keyer • VOX • Auto Antenna Tuner

- **32 BIT FLOATING POINT DSP & 24 BIT AD/DA CONVERTER.** At the heart of the '746PRO, the DSP is an incredible tool for handling the QRM found on the bands.
- **SELECTABLE DIGITAL IF FILTER SHAPES FOR SSB & CW.** Tailor the filter shape & bandwidth to your personal operating preferences or band conditions. Sharp for selectivity and signal fidelity or soft for readability.
- **AGC LOOP MANAGEMENT.** Multiple AGC loops, controlled by the 32 bit DSP, filter out unwanted interfering signals, eliminating pumping of the AGC.
- **AUTOMATIC NOTCH FILTER.** Perfect for SSB operation to eliminate annoying heterodynes and "tune up", without effecting the receive audio.
- **MANUAL NOTCH FILTER.** Perfect for CW or digital operations, the 70db manual notch filter eliminates unwanted signal without effecting the actual passband of your filters.

FREE! PS-125*

PURCHASE AN IC-756PROII OR A 746PRO AND RECEIVE A FREE PS-125.

THAT'S A TOTAL VALUE OF $600!

($200 SAVINGS ON THE IC-756PROII, $400 VALUE ON THE PS-125)

AM-5924

TEXAS TOWERS

A Division of Texas RF Distributors, Inc.
1108 Summit Avenue, Suite #4 • Plano, TX 75074

(800) 272-3467

WEEKDAY HOURS:
9AM–5PM CST

LOCAL CALLS:
(972) 422-7306

SATURDAY HOURS:
9AM–NOON CST

EMAIL ADDRESS:
sales@texastowers.com

CREDIT CARDS:
M/C, VISA, DISCOVER

INTERNET ADDRESS:
www.texastowers.com

QUALITY begins with PEOPLE

Front (L-R): Lee Jones, WB4JTR, Chief Technical Officer; Gary Barbour, AC4DL, VP/Engineering Director; Jeff Parton, Enclosure Product Manager.
Rear (L-R): Staff engineers Boyd Lichlyter, KE4MCF; Eric Guinn, AC4LS; Bill Curb, WA4CDM; Mike Webber, KE4VSQ.

Quality products begin with quality people. Our equipment is designed for hams, by hams, because we're as devoted to the hobby as you are. Ten-Tec has 35 years of amateur radio manufacturing experience and hundreds of years of cumulative engineering design expertise among our employees. The Ten-Tec transceiver that is the center of your ham shack is a small piece of all of us that work here. We're proud of what we do, and proud that the best amateur radio equipment in the world is MADE IN AMERICA.

Nothing tops ORION for high-performance applications like weak signal DXing and contesting. Mode-appropriate roofing filters down to a minimum of 250 Hz, 100+ dB of dynamic range and superior sensitivity allow uncompromised receiver performance in any on-air situation.

$3300
$3599 with autotuner

- Dual 32 bit ADI SHARC DSP processors
- Very high RX intercept points, superior dynamic range and the industry's best RX phase noise performance.
- Mode-appropriate roofing filters. 7 total. 4 standard, 3 optional to a minimum of 250 Hz, assuring maximum rejection of undesirable signals from negative impact on overall receiver performance.
- Full dual receive capability including diversity control of both receivers with one tuning knob, if desired.
- 590 IF-DSP RX filters and fully programmable AGC available independently on both receivers.
- Real-time spectrum scope.
- Flash-ROM updatable. Always have the latest version of the transceiver.
- 30 day risk-free trial, 1 year factory warranty.
- Extended financing available

ORION VIDEO AVAILABLE!
DVD or VHS $10 refundable w/purchase

For complete information on the ORION, call our sales department at (800) 833-7373 or visit our website at www.tentec.com.

TEN-TEC

1185 Dolly Parton Parkway • Sevierville, TN 37862 • USA
Sales Dept: 800-833-7373 • Sales Dept: sales@tentec.com • Service Dept: service@tentec.com
Monday - Friday 8:00 - 5:30 EST • *We accept VISA, Mastercard, Discover, and American Express*
Office: (865) 453-7172 • FAX: (865) 428-4483 • Repair Dept.: (865) 428-0364 (8 - 5 EST)
Shipping is additional. TN residents add 9.5% TN sales tax.

CORRESPONDENCE

Your opinions count! Send your letters to "Correspondence," ARRL, 225 Main St, Newington, CT 06111.
You can also submit letters by fax at 860-594-0259, or via e-mail to: **qst@arrl.org.**
We read every letter received, but we can only publish a few each month. We reserve the right to edit your letter for clarity, and to fit the available page space. Of course, the publishers of *QST* assume no responsibility for statements made by correspondents.

NO MORE MR kW

♦ I want to thank you for the article "The Challenge of Being a Little Pistol" by Rod Vlach, NNØTT [Jan 2004, pages 48-49]. My experience is very similar to that described in the article. Looking at what's going on now on the amateur bands, the best way is the "No More Mr Kilowatt" way, followed by the example set by the Micro-Lite Penguins DXpedition Team. Years ago, to be a "Big Gun" meant a station with high power, good antennas and a *good operator*. Today, Big Guns are mostly bad operators with high power. We can hear the result on the bands—big QRM and a *zoo* on the DX frequencies.—*Robert Glowacki, SP6RGB, Boleslawiec, Poland*

THANKS!

♦ One evening last week, there was a pileup on 20 CW calling a DX station. I listened for a while to get the routine. Then I called him and on the third call, he came back with W5IQA? With my full break-in, I heard nothing so I responded with W5SQA. The DX came back with W5SQA? I responded with a report and the DX then confirmed the QSO with my call and 73 di-dit. Immediate after the di-dit, the pileup resumed with a lot of big signals.

What made me feel so good was that during the QSO nobody else jumped in, allowing my little 100 W to a dipole to get through. There really are courteous operators out there on CW these days. Thanks guys.—*Bob Linker, W5SQA, Holly Lake Ranch, Texas*

VERY PAINLESS

♦ I recently availed myself of your free service for members to renew their amateur license. This is a great way to do this—and very painless! Thanks a lot for this free service.—*Richard A. Hade, K9HSK, Princeton, Illinois*

Editor's note: The renewal service works this way: ARRL members automatically receive a form from ARRL with instructions on license renewal once they are *just outside* the 90 day window for renewal of their amateur license. This will be a letter with a form at the bottom of the letter to sign and return to the ARRL VEC. There is no cost to ARRL members.

ART GENTRY'S REPEATER

♦ Just wanted to tell you how much I enjoyed the article on Art Gentry and his repeaters ["Once Upon a Hilltop," Mar 2004, pages 52-54]. As a youngster growing up in LA I used his repeater while running around to school in my 53 Chevy with a Gonset Communicator 2 meter AM rig with a J pole antenna. I visited Art and Millie at their house on a few occasions and even went up to a repeater site on Mount Wilson with Art and Burt one night to do some emergency antenna work. Your article brought back some great memories.—*Jerry Boyd, KW7J (ex-WA6CUP/KG6LF/K6BZ), Baker City, Oregon*

NEW FRONTIER

♦ I want to thank Bruce Orand, N4ZXI, for his wonderful article, "ESE—A New Frontier" [Apr 2004, pages 53-55]. Last summer my wife and I were driving through the Arizona desert when we saw this incredible bright light shining down from the heavens. It was mid-day and this narrow beam of light had to be the brightest light I've ever seen. We pulled over and watched it for several minutes, but due to the surrounding hills it was impossible to tell what it was shining at.

When we got into town, we immediately called the FAA to report this sighting. I was told there had been many calls about the light and they had absolutely no idea what it was. They were warning all aircraft to stay away from it. After reading Bruce's article, I now know what caused that strange light. But next time he might tell the FAA ahead of time that he's going to turn the thing on!—*Doug Hockinson, AE6AY, Quincy, California*

♦ The article takes the annual April Fool's article to a totally new level. N4ZXI's article has it all—"technical" interest, humor and enough male bovine effluent to fertilize 40 acres!—*Allen T. Poland Jr, K8AXW, Keyser, West Virginia*

MONITORING PAYS OFF

♦ On February 29, 2004, a friend and I climbed Enchanted Rock in the Texas Hill Country. Enchanted Rock State Natural Area is dominated by two huge round rocks. The Texas Parks and Wildlife Department describes it as "...a huge, pink granite exfoliation dome that rises 425 feet above ground, 1825 feet above sea level, and covers 640 acres." It is pretty impressive. Upon reaching the summit, I tried to hit some distant repeaters with my handheld without success.

About an hour before sunset we descended to the Echo Canyon trail between Enchanted Rock and Little Rock (believe me, it's not). Due to poor planning and visibility, we lost the main trail and ended up on the side of Little Rock wondering if we would be spending the night.

We knew where we wanted to be and could see it in the distance, but actually getting there in the dark over treacherous crevices and a steep, slippery rock face was proving to be difficult. Before we got too low I decided to fire up 146.52 to let someone know our predicament. Immediately KD5IKX responded from about eight miles away. After telling him our situation and what our plan was, he assured me that he would be standing by. Thanks to a nearly full moon it took less than an hour to get back to the parking lot.

From the moment KD5IKX responded to my call I was confident that no matter what happened, we would get help if we needed it. I tip my hat to KD5IKX and the thousands of other hams who monitor 146.52. Those of us who frequent the wilderness owe a lot to the wilderness frequency.—*David D. Haun, KB5UGN, Austin, Texas*

MUSEUM STATION

♦ Back in November 2003, I was in Zurich on business and on a Sunday, I took a day trip (via train) to Lucerne. After going up Mt Pilatus, then walking around the old town area, I took a bus to the Swiss Museum of Transport and Communication. After visiting the train area (I'm also a railfan), I went to the communication area to see if by some chance there was a ham station.

I was warmly greeted by HB9RE and HB9DOZ, and we had a very nice visit.

So I was very pleased to see your article on the museum and its ham station [Apr 2004, pages 56-57]. The museum and finding a couple of fellow hams there was the high point of my day in Lucerne.

When I came back to Pittsburgh and shared my experience with our local Saturday breakfast group, one of my friends pointed out that as hams we are an international fraternity.—*Joe Birsa, N3TTE, Pittsburgh, Pennsylvania*

DISAPPOINTED

♦ For the 30 years I've been a ham, I've wanted to experiment with SSTV. With the advent of computers equipped with

sound cards and some very ingenious software it is now within my grasp. After cabling up the radio and building up an interface I tuned to 14.230 MHz to see first video come across my computer screen. Sure enough a clear, color picture of a lighthouse came across the screen.

The program I use will save the pictures as they are received so I just let program run while I did other chores. After a few hours I came back to the shack to review the pictures I had captured. Much to my surprise (and my wife's, as she happened to be looking over my shoulder), 8 out of the 10 pictures captured featured naked or semi-naked women.

Well I guess I won't be able to use this mode to impress potential hams or promote radio to youth groups or anyone else. How disappointing.—*Brian Cieslak, K9WIS, Waterford, Wisconsin*

RECONNECTING

♦ While on a four month furlough back in the USA, a ham friend gave me an old straight key. I resolved to brush up on my code and get back into CW, especially with the sunspot cycle waning. Upon my return home to Mozambique, I began catching up on the back issues of *QST* that had arrived in my absence, and read a letter in the Correspondence column about someone who was doing the same thing and gave some Web sites where I could get some programs to help with code practice. But as so often happens, before I finished the letter, I got interrupted and had to leave the house to attend to other matters.

Over the past few weeks, I kept thinking about that letter and issue of *QST*, but couldn't remember which issue had that letter, or where all those *QST*s had gone. Last night I found it—buried under papers on my second desk. I read that letter again and couldn't believe my eyes—it was written by ex-KBØSP, now W8LWB, Leonard Budd. It was Leonard who helped me get my ham ticket in 1982 when I became KAØNGP! Leonard, thanks for your continued help. Maybe one day we can QSO via CW at 20 wpm. And thanks to *QST* for providing this link.—*David W. Restrick, N1FHJ/C91W, Maputo, Mozambique*

WHICH IS BETTER, NINE OR SEVEN?

♦ It was the final inning of the World Series and the score was tied. The bases were loaded and Mickey Mantle was at bat. This was an era when you didn't have to be a Yankees fan to know Roger, Mickey and Whitey. Our teacher would allow several students to bring small transistor radios into the classroom to follow the game. There were two simple rules. We had to use an earplug and we had to keep the class informed of the score.

While listening to the game, I noticed the radio belonging to a classmate sitting next to me. In those days, the manufacture put the number of transistors (used in the radio) on the front panel. My classmate's radio had nine transistors and mine only seven. How could this be? Was this advertising? Was the other radio more powerful or louder? Did more transistors mean that more stations could be received?

That evening I was determined to find the answer. I assumed the transistors in question would be found by removing the back cover of the radio. I kept the power on as the back cover was removed. The radio was tuned to the high end of the AM band. By leaving the power on and listening to a station, I assumed there would be no harm as I poked around inside the radio. I also knew that 9 V was harmless as long as I kept my tongue off the battery terminals. At the age of 13 I thought I knew everything.

As luck would have it, a transistor was not one of them. I couldn't find seven of anything inside the radio. I came to the conclusion that the transistors must be inside one of the smaller parts on the circuit board. After all, they were known to be small. With the help of a small screwdriver (hairpin), I turned one of the screws on a small plastic box located behind the main tuning dial. As I turned the small screw on the plastic box, I heard a station calling from Mars.

Forget the World Series, forget Mickey and Roger and forget transistors. In 1963 I had become the first human being to pick up a station from another planet. My father was in the military and we were living at Fort Hood, Texas. I know now that I was adjusting the tuning capacitor and had picked up the local Army MARS (Military Affiliate Radio System).

Today, I still find it amazing that one can take a radio signal and force it to land at some considerable distance from the starting point. Night, day, winter, summer, equipment, power, luck, skill and the sun do make a difference with radio signals. My travels have taken me far. I have operated as TU2YV and 7Z1AB.

I am employed by the US Department of State and am currently stationed at the American Embassy in Conakry, Guinea, West Africa. I perform everything from LAN administration to communications. At work, it's high-speed data via satellite. At home I enjoy SSB on 18 and 14 MHz. RTTY and PACTOR are also favorites. I hope to work you soon.—*Johnnie O'Dell, 3XY8B/KA5BQM*

COMET™ & Maldol

specialists in "No Holes Mobile Mounts!"

CP Series Universal Lip Mounts

Four adjustment planes, four large setscrews holds them securely in place on virtually any lip 1/4" thick or less. Use on trunk lids, van doors, truck doors, hoods etc. 16' 6" of deluxe coax cable including 18" of mini RG-188A/U style for easy entry thru the weather seal without causing wind noise, water leaks and/or wind noise.
Max antenna size: 70"/16 ozs
Max Power: HF 130W VHF 75W UHF 45W

COMET *NEW* CP-5NMO
Universal lip mount with coax, NMO and PL-259 connectors.

COMET *NEW* CP-5 3/8-24
Universal lip mount with coax, 3/8x24 threaded stud and PL-259 connectors.

COMET CP-5M Universal lip mount with coax, SO-239 and PL-259 connectors.

Mount: CP5M Antenna: C757

Combine the coax style and length you need with a bracket from below. (assemblies also available with N-connectors)

COMET 3D5M/3D4M Standard low loss cable assembly. Gold plated SO-239/PL-259 connectors. 17' length/13.5' length.

COMET CK-3M5/CK-3M Deluxe cable assembly 17' length including 17" of RG-188A/U for easy entry from a lip mount without causing water leak, wind noise or coax damage. CK-3M 9'9" total length.

Choose the bracket that best fits your antenna and vehicle. All have multiple adjustments and fit virtually any lip 1/4" thick or less. Soft rubber protects the vehicle paint.

COMET RS-730 Heavy-duty, 4 adjustment planes, up to 70" antenna.

COMET RS-720/ RS-720NMO Med-duty, 3 adjustment planes, up to 60" antenna. NMO mount version.

COMET RS-520 Light-duty, 3 adjustment planes, up to 45" antenna.

Maldol PRM-T Heavy-duty, 3 adjustment planes, up to 80" antenna.

Maldol MK-30H 12VDC motorized mount. Mounts to vertical or horizontal door lip. Up to 70"/19 oz. antenna.

Maldol EM-B80 Light-duty, 2 adjustment planes, up to 40" antenna.

COMET GRB-5M **Trunk lip mount, low-profile, black anodized stainless steel.** Offset washers provide up to 17 deg vertical adjustment of antenna. 16'9" of deluxe cable included, 18" of mini RG-188A/U style coax for easy entry thru the weather seal. Gold-plated SO-239/PL-259 connectors.

The rear doors on newer trucks are the perfect place to mount antennas: • No holes to drill • Above roof line • Easy access

When mounting to a van, SUV, truck, etc., use the CP-5M or build your own system with components shown above. There are several mount sizes, coax diameters and coax lengths from which to choose.

NCG COMPANY

For a complete catalog, call or visit your local dealer. Or, contact NCG Company.
1275 N. Grove Street • Anaheim • California 92806
(714) 630-4541 • (800) 962-2611 • Fax: (714) 630-7024 • www.natcommgroup.com

Driven to Perform, In STYLE!

COMET™ and Maldol Mobile

COMET **BNC-24** • Dual-band 2M/70cm HT Antenna
RX range: 100-1200MHz • Length: 17" • Conn: BNC
Super flexible featherweight whip

COMET **SMA-24** • Dual-band 2M/70cm HT Antenna
RX range: 100-1200MHz • Length: 17" • Conn: SMA
Super flexible featherweight whip

COMET **SMA-503** • Dual-band 2M/70cm HT Antenna
RX range: 100-1200MHz • Length: 8.75" Conn: SMA

Maldol **MH-209** (BNC Conn) • 2M/70cm Dual-band HT Antenna
Maldol **MH-209SMA** (SMA Conn)
Wave: 1/4 wave • Length: 3" Soft flexible rubber

NEW *APEX Series*
MALDOL'S Newest Mobiles!
Bright Chrome and Brushed Aluminum Finish!

NEW *Challenger Series*
COMET'S Newest Mobiles!
Sleek, Super-Flexible, Dark Chrome Finish

NEW
Maldol NEW **AX-50** • Dual-band 2M/70cm
• Wave: 2M 1/4 wave • 70cm 9/8 wave • Length: 21" • Conn: PL-259 • Max Power: 60W

NEW
Maldol NEW **AX-75** • Dual-band 2M/70cm w/fold-over
• Wave: 2M 1/2 wave center load • 70cm 5/8 wave x 2 • Length: 30" • Conn: PL-259 • Max Power: 60W

NEW
Maldol NEW **AX-95** • Dual-band 2M/70cm w/fold-over
• Wave: 2M 1/2 wave center load • 70cm 5/8 wave x 2 • Length: 38" • Conn: PL-259 • Max Power: 60W

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

COMET **SBB-2/SBB-2NMO** • Dual-band 146/446MHz
• Wave: 146MHz 1/4 wave, 446MHz 5/8 wave center load • VSWR: 1.5:1 or less • Length: 18" • Conn: PL-259 or NMO Style • Max Pwr: 60W

Maldol NEW **EX-107B/EX-107BNMO** • Dual-band 146/446MHz
• Wave: 146MHz 1/2 wave, 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less • Length: 29" • Conn: PL-259 or NMO Style • Max Pwr: 100W

COMET **SBB-5/SBB-5NMO** • Dual-band 146/446MHz w/fold-over
• Wave: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • Length: 39" • Conn: SBB-5 PL-259/SBB-5NMO NMO • Max Pwr: 120W

COMET **SBB-7/SBB-7NMO** • Dual-band 146/446MHz w/fold-over
• Wave: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58" • Conn: SBB-7 PL-259/SBB-7NMO NMO • Max Pwr: 70W

NEW
COMET NEW **C757/C757NMO** Challenger Series • Dual-band 146/446MHz w/fold-over
• Wave: 146MHz 1/2 wave, 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less
• Length: 38" • Conn: PL-259 or NMO Style • Max Pwr: 80W

COMET NEW **CP-5M, CP-5NMO, CP-5 3/8-24** ***Universal mount and coax cable combos.*** (SO-239, NMO, 3/8-24/PL-259) Heavy-duty, adjustable RS-730 trunk/van/SUV/truck door mount and deluxe cable assembly. 16' 6" length w/18" mini RG-188A/U type coax. Max antenna 70".

NEW
COMET NEW **C767/C767NMO** Challenger Series • Dual-band 146/446MHz w/fold-over
• Wave: 146MHz 1/2 wave center load, 446MHz 5/8 wave x 2 center load • VSWR: 1.5:1 or less • Length: 40"
• Conn: PL-259 or NMO Style • Max Pwr: 80W

NCG COMPANY

For a complete catalog, call or visit your local dealer. Or, contact NCG Company.
1275 N. Grove Street • Anaheim • California 92806
(714) 630-4541 • (800) 962-2611 • Fax: (714) 630-7024 • www.natcommgroup.com

By Michael J. Polia, AB1AW

Shortened End-Fed Half-Wave Antenna for 80 Meters

Construct this easy-to-build shortened version of the classic end-fed half-wave radiator and enjoy one of our best "top bands."

Many of us would like to get on 80 meters, but have been discouraged due to antenna restrictions of one type of another. And, many of us do not have the room for a full size 80 meter half-wave dipole (130 feet). The classic vertical for 80 meters is also not practical due to its height and the extensive ground plane that is required. A shortened dipole may be possible, but even a half-size loaded dipole is about 65 feet and requires support of the feed line.

A random long wire is an alternative. Use of an antenna tuner with a random wire antenna, worked against a good ground or counterpoise, can be effective. To get reasonable efficiency, however, the "random wire" should be at least 1/4 wavelength (about 65 feet for 80 meters) long. Also, if that random wire is cut to a multiple of 1/4 wavelength, the wire impedance, as seen by the tuner, will be low. This necessitates the use of a good ground system to achieve reasonable efficiency.

A special category of wire antenna, used with an antenna tuner, is the end-fed half wave antenna, or EFHWA. This is essentially a half-wave dipole that is fed from one end, rather than from the center. The first advantage of this configuration is that a separate feed line is not required; one end of the wire is simply brought into the station and connected to the antenna tuner. The second advantage is that an EFHWA presents a relatively high impedance to the antenna tuner. This means that an extensive ground system is not required; a connection to a cold water pipe may be sufficient. Figure 1 illustrates the concept of the conventional end-fed antenna with tuner.

Shortening the EFHWA

An EFHWA for 80 meters is still a half-wave in size. We still have the problem of trying to fit it into a small suburban lot or other restricted space. We can, however, apply the theory and techniques of the classic (traditional) shortened dipole to the EFHWA to achieve a shorter antenna.

The theory and techniques for constructing a short dipole are well documented. Loading coils are the standard component added to a dipole in order to decrease its resonant frequency. The classic short dipole consists of a dipole that has two loading coils, one in each leg, as shown in Figure 2. The positions of the loading coils are typically symmetrical and dictate both the bandwidth and the resonant frequency of that antenna. For a given antenna length and coil reactance, the resonant frequency of the antenna decreases as the coils are moved toward the center of the antenna. The bandwidth also decreases as the coils are moved toward the center. If the coils are positioned at the feed point, they can be combined into one coil that has twice the inductance of one of the single coils. *The ARRL Antenna Book* contains detailed information, equations and charts for constructing a shortened dipole, including those needed for determining the values of the coil reactance and positions.[1] Once the coil reactance is determined for the desired antenna length, it is used to calculate the coil inductance for the desired operating frequency. More on this later when we calculate the coil inductance for our

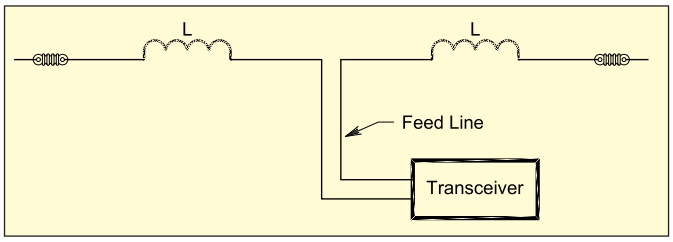


Figure 2—A half-wave dipole shortened with loading coils.

[1]*The ARRL Antenna Book*, 20th edition, pp 6-30 to 6-32. Available from your local dealer or the ARRL Bookstore. Order no. 9043. Telephone toll-free in the US 888-277-5289 or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

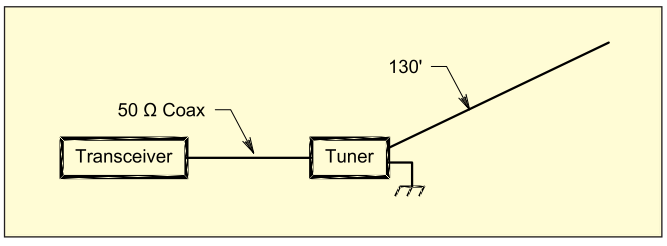


Figure 1—A traditional end-fed half-wave antenna for 80 meters fed with a transmatch or antenna tuner.

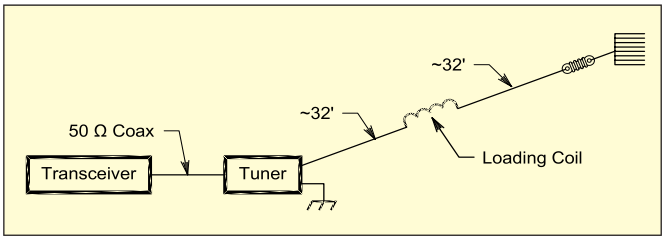


Figure 3—The end-fed half-wave antenna of Figure 1 is now shortened with a single center loading coil.

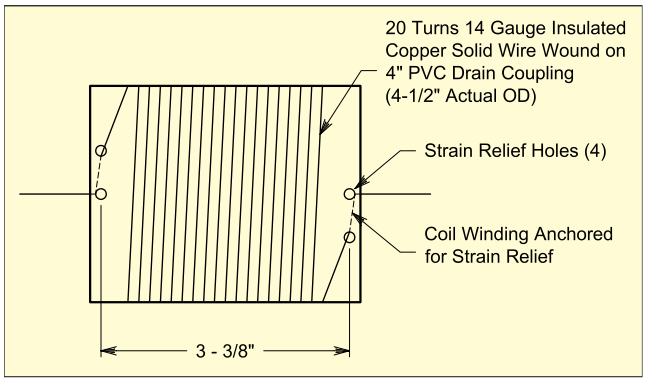


Figure 4—Coil construction for the center loaded antenna. Note the strain relief holes for wire anchor.

shortened EFHWA for 80 meters

The classic shortened dipole is still a dipole, and is traditionally fed like a standard size dipole, using coax or a balanced feed line. Just as a full size half-wave dipole can be end-fed, however, a shortened dipole can also be end-fed. This means that an equivalent end-fed, half-wave resonant 80 meter antenna can be constructed that is considerably shorter than a full size dipole. Such an antenna is constructed with a single loading coil, both for simplicity and to keep the antenna impedance at its ends equivalent to a full size end-fed half-wave dipole.

A dipole antenna, whether full-sized or shortened, can be center-fed, end-fed or fed anywhere in between. There is nothing "magic" about feeding the dipole in the center, except that it allows for an easy match to the standard low impedance (50 Ω) feed line and requires no special matching to your rig's output impedance. Any dipole can be fed off-center with the proper impedance matching between the antenna and feed line.

Off-center fed dipoles are popularly used as multiband antennas. As we move the feed point away from the center, the impedance increases until it reaches a maximum at the end of the wire. Moving the feed point to the end of a half-wave dipole results in a Zepp antenna, typically fed with a high impedance, open-wire, balanced feed line and a transmatch or antenna tuner. Finally, one end of a dipole can be fed directly by an antenna tuner (with no feed line required), resulting in an end-fed half-wave dipole.

Dipoles that are shortened using loading coils still exhibit the same feed point impedances at their centers, as well as at their ends. This means we can shorten an end-fed half-wave dipole using loading coils, in the same manner as a traditional shortened, loaded dipole, and feed it with an antenna tuner just as we would the standard end-fed antenna.

The electrical design of the shortened EFHWA is essentially the same as for a shortened dipole. Either a pair of off-center coils or a single center coil may be used. When a single center coil is used, its reactance is calculated to be twice that of one of the off-center coils. Figure 3 illustrates the concept of a single-coil shortened EFHWA with tuner. Here, the EFHWA is shortened by 50% using a single loading coil in the center, resulting in a 64 foot antenna for 80 meters.

Calculating the Antenna Size

In my implementation of this antenna, I decided to construct a half-size EFHWA for 80 meters. There was nothing magical about this length; it simply allowed the antenna to fit in my backyard. I predominantly operate CW and PSK31 on 80 meters, so I wanted an antenna with an approximate center frequency of 3600 kHz. I started by calculating the length of a standard dipole for 3600 kHz (468/3.6 MHz), or 130 feet for an 80 meter dipole. This was much too long to fit in my backyard. I needed an antenna about half of that length; that is, a total antenna length of 64 feet for operation centered at 3600 kHz. This is about 50% shorter than a full-size half-wave dipole.

The antenna would consist of two 32 foot sections with a single loading coil between the two sections. Using the chart provided in *The ARRL Antenna Book,* 20th edition (Figure 55, page 6-31), I determined that a half-size dipole with two coils located at the center (a *Dimension B, Position of Coil* of zero) required each coil to have a reactance of 500 Ω. This is equivalent to a single center coil that has a reactance (X_L) of 1000 Ω at frequency (f) of 3.6 MHz for an inductance (L) of 44 µH (where $X_L = 2\pi fL$).

To cover the phone portion of the band you will need to shorten the antenna a bit. For a center frequency of 3800 kHz, you'll need an antenna length of (468/3.8 MHz) /2 or about 61.5 feet. Two 31 foot legs will do the trick. The coil inductance drops to about 42 µH. However, this is only a difference of half a turn compared to the 44 µH coil. For practical purposes, the coil can be left at 44 µH.

Constructing the Loading Coil

I constructed the single loading coil using a 4 inch PVC drain pipe coupling and 14 gauge insulated solid copper wire. Both the 14 gauge wire and the PVC pipe coupling should be readily available at your local hardware or plumbing supply store. The outer diameter of the PVC coupling is about 4.5 inches. Twenty turns, close-wound, yield a calculated inductance of about 44 µH. I drilled a couple of holes at each end to act as a strain relief for the coil windings.

Figure 4 illustrates the coil construction. I used PVC pipe cement to cement the coil windings into place. The coil is placed between the two 32 foot legs of the antenna. Be sure to anchor it firmly. I made the legs of the antenna from an old short-wave antenna kit from RadioShack. I used the bare, stranded copper wire from that kit for the "far" leg, and the insulated lead-in for the "near" leg that entered the shack. Of course, any solid or stranded copper or copper-clad wire can be used.

Constructing the Tuner

Although nearly any tuner can be used to drive an end-fed antenna, a simple tuner consisting of a single coil and a variable capacitor is sufficient. Figure 5 shows the simple tuner I used. My tuner consists of a PVC pipe coil form for the inductor and a variable capacitor stolen from an old AM tube radio (this has a C

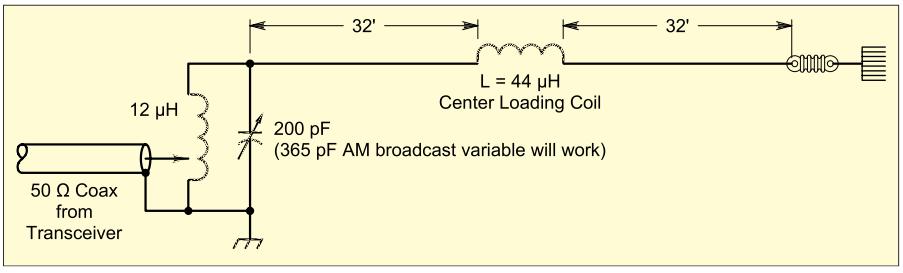


Figure 5—Although any single-wire tuner can be used, here is a simple tuner for the shortened end-fed wire antenna. The capacitor can be an AM broadcast band variable having a total C of about 365 pF.

of about 365 pF). If you don't have a suitable variable capacitor in your junk box, you can purchase one from a variety of electronic parts dealers. If you keep the transmit power under 10 W, you can even use the miniature tuning capacitor from an old portable AM radio. The coil is wound on a 5 inch length of 1 1/2 inch PVC pipe. The actual outer diameter of such a pipe is about 1.9 inches.

I used 18 gauge solid, bare copper wire to wind the coil. The wire should be readily available at your local hardware store. I found that Ace Hardware sells 25 foot rolls of 18 gauge solid, bare copper wire…perfect for winding coils. I wound 27 turns at 6 turns per inch, to cover 4 1/2 inches of the pipe. This results in a calculated coil inductance of about 12 µH. I chose this inductance because it resonates with a variable capacitor that adjusts within a range of 100 pF to 200 pF. This combination covers the entire 80 meter band.

I cemented the coil windings with hot glue to maintain even spacing between the windings (6 turns per inch). Using bare copper wire, I am able to place the coil tap at the proper point using a small alligator clip. I found that placing the tap at about 3 turns from the ground end yielded an SWR of less than 1.5:1 at 3600 kHz (with proper adjustment of the capacitor). This tap position will vary by a turn or so depending on your operating frequency and antenna installation position. Although I'm not sure of the power handling capability of this tuner, it is certainly sufficient for QRP operation. I find that I get about a 30 kHz bandwidth with a 2:1 SWR without the need to readjust the tuner setting.

Putting It Together

The antenna can be mounted in a variety of positions and does not have to be installed as a straight line radiator. As with conventional dipoles, you can install this shortened EFHWA as a sloper, an inverted V or an inverted L. The beauty of this is that you don't need to worry about the separate feed line to its center, as with a conventional dipole. I actually have the first 32 feet of the antenna running out my window, up the side of the house to the top of my brick chimney. At that point I have the coil tethered to the top of the chimney, and the second half of the antenna stretched horizontally across my yard to a tree. I brought the feed point into the shack through a window, simply closing the window down on the wire to keep it in place. Connect the feed point to the end of the tuner coil, adjust the coil tap and variable capacitor for best SWR and you are on the air! I've not tried using this antenna on other bands, but a conventional EFHWA can be made to operate on its even harmonics, so I suspect this shortened version can do the same, allowing operation on 40, 20 and 10 meters.

Michael Polia, AB1AW, was first licensed as WB1EET at age 14 in 1976. He received his Advanced class license while still in high school and earned the Amateur Extra class ticket in 2001. Mike has a BSEE from Northeastern University and an MS in Computer Science from Boston University. He has worked in various fields, including design and development of audio and radio/satellite equipment, medical and semiconductor instrumentation, and networking. Mike is currently a principal software engineer at Nortel Networks. Active on PSK31 and CW, he's interested in digital communications techniques and low power (QRP) operation. You can contact him at **ab1aw@yahoo.com**.

NEW PRODUCTS

GOOSENECK SPEAKER/ MICROPHONE HOLDER FROM MFJ

◊ MFJ offers the MFJ-390 flexible speaker/microphone stand to hold most small microphones or speaker microphones for desktop use. The stand has a heavy base designed to stay put on the operating desk. Price: $14.95.

To order, or for your nearest MFJ dealer, call MFJ Enterprises at 800-647-1800 or order at **www.mfjenterprises.com**, fax 662-323-6551; or write MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759.

NEC2GO—NEC2 ANTENNA MODELING SOFTWARE

◊ *Nec2Go* uses simple edit commands, including variable definitions, so that complex designs can be simplified. Some of the features included are true modeling by equation using algebraic statements, variable substitution in sweep or view mode, automatic segment generation, auto segment tapering option for long wires, average gain test and fast convergence test. Output functions include automatic plotting at angles of maximum gain or manual az/el plots and a network designer to build L networks, T networks and Pi networks. The program also supports user defined coax entries using transmission line equations (including loss). A context sensitive help function is available for all screens and controls. A free demo download limited to 20 segments and the full version are both available at **www.nec2go.com**. Price: $39.95.

N3FJP's MID-ATLANTIC QSO PARTY LOG

◊ A logging program is available to support the new Mid-Atlantic QSO Party contest scheduled for May 8 and 9, 2004. The *Mid-Atlantic QSO Party Log* logging software checks for duplicates (including partials), lists all contacts and sends computer generated CW via your serial or parallel port and wave files via your sound card. In addition it prepares log files for submission. Interfaces are provided for most Elecraft, ICOM, Kenwood and Yaesu radios.

You can download the software from N3FJP's Web site, **www.n3fjp.com**. The *Mid-Atlantic QSO Party Log* is limited to 30 contacts until registered. For permanent use of this program, a $6 registration fee is required. A package of software, including this program and 43 others is also available via download or CD. For more information, check the Web site or e-mail to **snkdavis@aol.com**.

WINDSHIELD MOUNT FOR SMALL DEVICES FROM PRO.FIT

◊ Pro.Fit International has announced the introduction of a new vehicle mount for small devices called the *Windowmate*. This mount can be used to secure items such as GPS receivers or small radio control heads for Amateur Radio and other equipment. The attachment uses a suction cup for the windshield and provides screw holes for device attachment. For more information, or to purchase see **www.pro-fit-intl.com** or call 800-388-0073.

By James C. Garland, W8ZR

A Deluxe HF Receiver Multicontroller

Need to feed several receivers from one antenna or supply a signal to multiple sites? This versatile distribution amplifier sports eight outputs (seven selective), a switchable preamp, mute circuits, filters and a self-contained power supply—all in one neat box.

If you're like many experienced amateurs, the number of HF receivers in your ham shack has been gradually climbing over the years. Perhaps you keep a receiver on your workbench to monitor a favorite net while you're wiring up a homebrew project. You may have a second receiver for surfing the international broadcast bands and yet another one (or in my case, three!) as part of your vintage AM station.

Or possibly you're one of the thousands of "boatanchor" collectors who just likes the solid heft and warm sound of the Collins, Hallicrafters, Hammarlund and National radios from Amateur Radio's "golden age." If you fall into any of these categories, this project may just be your cup of tea.

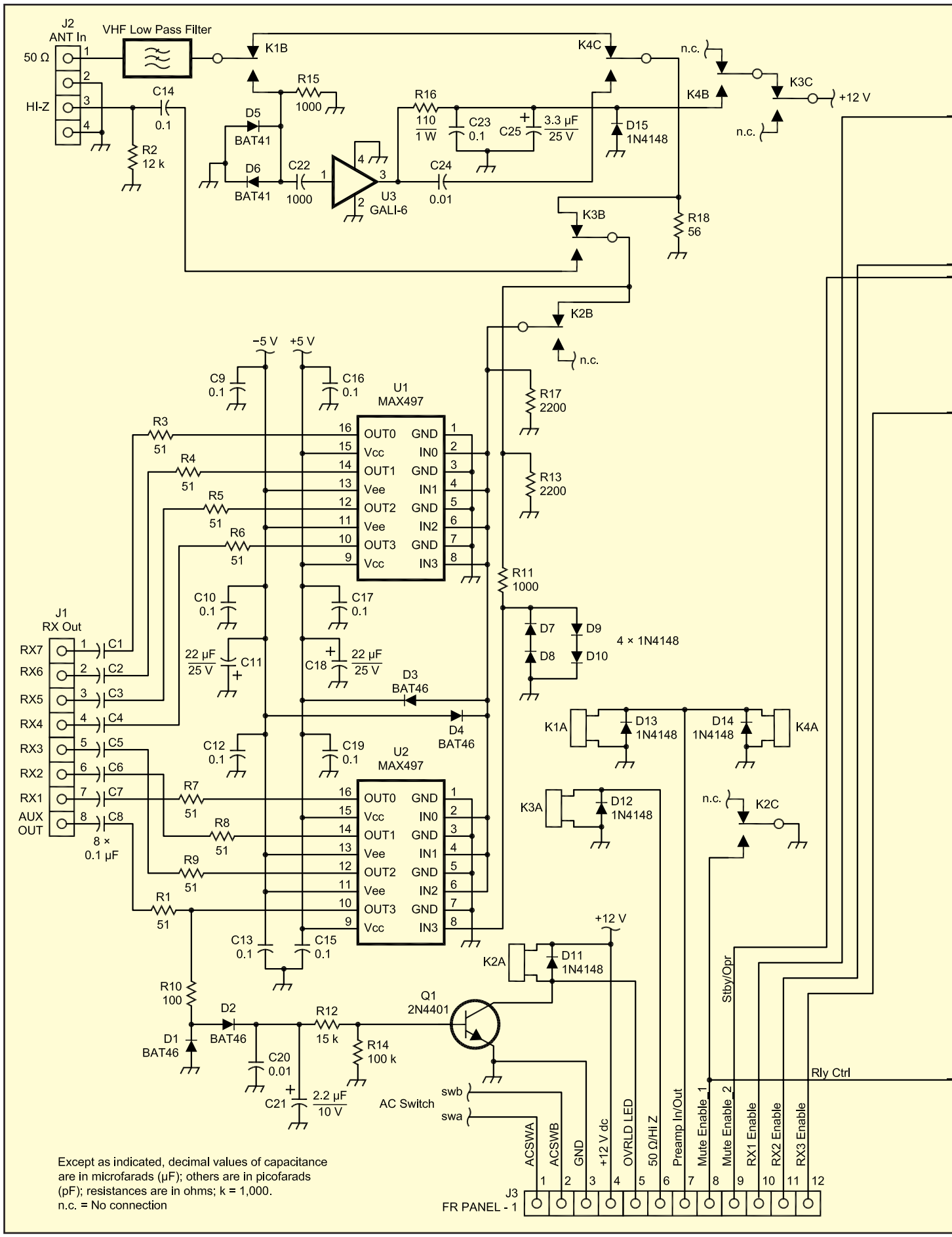
So what the heck is a receiver multicontroller? Basically, it is a variation on a "multicoupler," which is a broadband antenna distribution amplifier for HF receivers. A multicoupler has a receive-only antenna input, with isolated and buffered outputs that feed multiple receivers. Commercial multicouplers typically have eight outputs, while rack-mounted military versions used by intelligence agencies and government monitoring stations may accommodate as many as 32 receivers. Because the outputs are isolated, there is no signal loss or attenuation, as one might have with a simple passive signal splitter, and there is no interaction or "signal-sucking" among the connected receivers.

This HF receiver multicontroller, shown in Figure 1, is an active, eight-receiver coupler that covers 100 kHz to 55 MHz. What makes it special are its additional features especially suited to Amateur Radio operators and SWLs. First, it provides the ability to enable or unmute (selectively) any combination of up to seven receivers (an eighth output is always active). Thus, comparing receiver performance in on-the-air tests, or switching between receivers in a contest, is simply a matter of throwing a front-panel switch.

Figure 1—This receiver multicontroller can accommodate up to eight HF receivers using a single antenna with no loss of signal strength. It includes muting, overload protection and other features for hams and SWLs. The cabinet (should you wish to use it); a model ERC-7-08 from Buckeye Shapeform (www.buckeyeshapeform.com), measures 8.5×7.6×3.8 inches.

Secondly, the multicontroller has a control input jack that, when grounded, mutes all the enabled receivers. Hook up the control jack to your transceiver's external relay line and all the receivers in your station will mute whenever you transmit. An overload circuit automatically disconnects the receivers if too much RF voltage is induced onto your receiving antenna.

Among the other useful features is a switchable wideband +12 dB low noise preamplifier, especially helpful in perking up older vacuum tube receivers on the higher frequencies. The multicontroller also has provisions for an optional AM broadcast band filter to prevent overload or cross modulation from strong commercial AM stations. Finally, it has a separate high-impedance antenna input (in addition to a standard 50 Ω input). You can use this high-Z input to match simple wire antennas to receivers designed for 50 Ω anten-


J2
ANT In
50 Ω
HI-Z
VHF Low Pass Filter
K1B
K4C
n.c.
K3C
+12 V
K4B
R15
1000
R16
110
1 W
C23
0.1
C25
3.3 µF
25 V
D15
1N4148
C14
0.1
R2
12 k
D5
BAT41
D6
BAT41
C22
1000
U3
GALI-6
C24
0.01
K3B
R18
56
K2B
n.c.
−5 V
+5 V
C9
0.1
C16
0.1
U1
MAX497
OUT0 GND
Vcc IN0
OUT1 GND
Vee IN1
OUT2 GND
Vee IN2
OUT3 GND
Vcc IN3
R17
2200
R13
2200
R3
51
R4
51
R5
51
R6
51
R11
1000
C10
0.1
C17
0.1
D7
D8
D9
D10
4 × 1N4148
J1
RX Out
RX7
RX6
RX5
RX4
RX3
RX2
RX1
AUX
OUT
C1
C2
C3
C4
C5
C6
C7
C8
8 ×
0.1 µF
22 µF
25 V
C11
C18
22 µF
25 V
D3
BAT46
D4
BAT46
K1A
D13
1N4148
D14
1N4148
K4A
C12
0.1
C19
0.1
U2
MAX497
K3A
D12
1N4148
n.c.
K2C
R7
51
R8
51
R9
51
R1
51
C13
0.1
C15
0.1
+12 V
K2A
D11
1N4148
R10
100
D2
BAT46
R12
15 k
Q1
2N4401
D1
BAT46
C20
0.01
R14
100 k
C21
2.2 µF
10 V
AC Switch
swb
swa
Stby/Opr
Rly Ctrl
ACSWA
ACSWB
GND
+12 V dc
OVRLD LED
50 Ω/Hi Z
Preamp In/Out
Mute Enable 1
Mute Enable 2
RX1 Enable
RX2 Enable
RX3 Enable
J3
FR PANEL - 1
1 2 3 4 5 6 7 8 9 10 11 12
Except as indicated, decimal values of capacitance are in microfarads (µF); others are in picofarads (pF); resistances are in ohms; k = 1,000.
n.c. = No connection

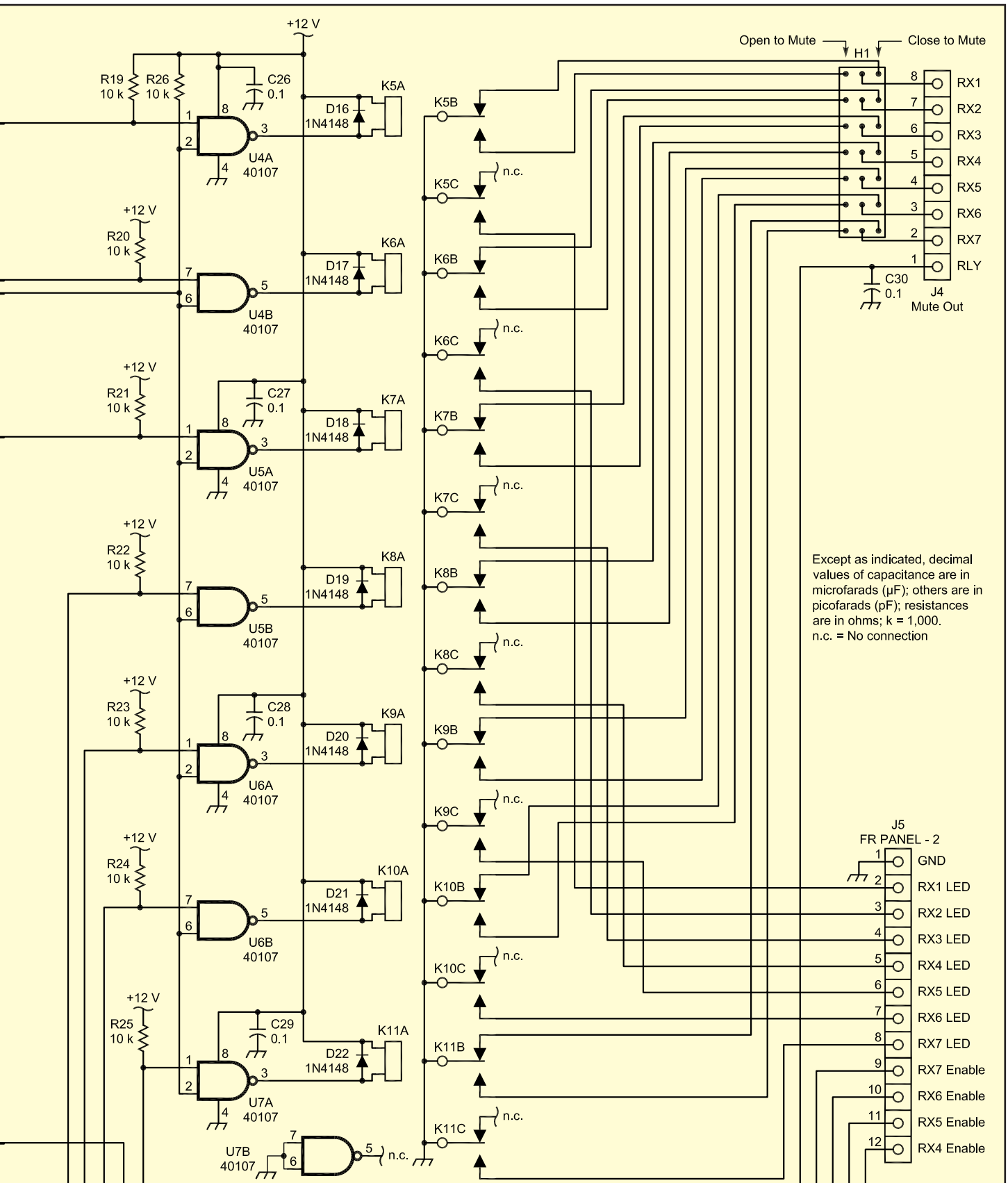


Figure 2
[see caption on next page]

Figure 2—Schematic diagram and parts list of the main circuit board. See www.w8zr.net/multicontroller/ for detailed part numbers and supplier information.

C1-C10, C12-C17, C19, C23, C26-C30, C39, C40—0.1 µF, 50 V ceramic disc capacitor.
C11, C18—22 µF, 25 V electrolytic capacitor.
C21—2.2 µF, 25 V tantalum or electrolytic capacitor.
C22—1000 pF, 50 V ceramic disc capacitor.
C25—3.3 µF, 25 V tantalum or electrolytic capacitor.
C20, C24—0.01 µF, 50 V ceramic disc capacitor.
C31, C32—0.01 µF, 250 V ac, ac line rated capacitor.
C33, C36—47 pF mica capacitor.
C34, C35—100 pF mica capacitor.
C37, C38—4700 µF, 35 V electrolytic, snap-in capacitor.
D1, D2—BAT46 Schottky diode.
D3, D4, D7-D22—1N4148 or 1N914A signal diode.
D5, D6—BAT41 Schottky diode.
DB1—Bridge rectifier, Rectron DB103 (1 A, 200 V PIV).
F1—Fuse 1/4 A, 3AG (115 V ac) or 1/8 A 3AG (230 V ac).
H1—Header, SIP 0.100 inch, 7 pins × 3 rows with shorting jumpers.
J1, J4—Connector, Molex, 8-pin, 0.156 inch, side-entry.
J2—Connector, Molex, 4-pin, 0.156 inch, side-entry.
J3, J5—Connector, Molex, 12-pin, 0.156 inch, side-entry.
J6—Header, Molex, 3-pin, 0.156 inch, top-entry.
K1-K11—Relay, Axicom V23105, DPDT, 12 V dc, 960 Ω coil.
L1, L3—8 turns, 22 gauge enameled wire, air-wound on 1/4-20 thread former.
L2—9 turns, 22 gauge enameled wire, air-wound on 1/4-20 thread former.
Q1—2N4401, 2N2222 or equivalent, NPN general purpose transistor.
R1, R3-R9—51 Ω, 1/2 W resistor.
R18—56 Ω, 1/2 W resistor.
R10—100 Ω, 1/4 W resistor.
R11, R15—1 kΩ, 1/4 W resistor.
R2—12 kΩ, 1/4 W resistor.
R12—15 kΩ, 1/4 W resistor.
R13, R17—2200 Ω, 1/4 W resistor.
R19- R26—10 kΩ, 1/4 W resistor.
R14—100 kΩ, 1/4 W resistor.
R16—110 Ω, 1 W resistor.
R27, R28—150 Ω, 3 W resistor.
T1—Transformer, Stancor SW-520 (115 V ac primary) or DSW-520 (115/230 V ac primary), 10 V CT, 0.6 A dual secondary.
U1, U2—Integrated circuit, Maxim MAX497CPE.
U3—Integrated circuit, Mini-Circuits GALI-6.
U4-U7—Integrated circuit, 40107.
U8—MC7805, +5 V dc voltage regulator.
U9—MC7905, –5 V dc voltage regulator.
Heatsinks (2)—Aavid Thermalloy, TO-220/126/127.

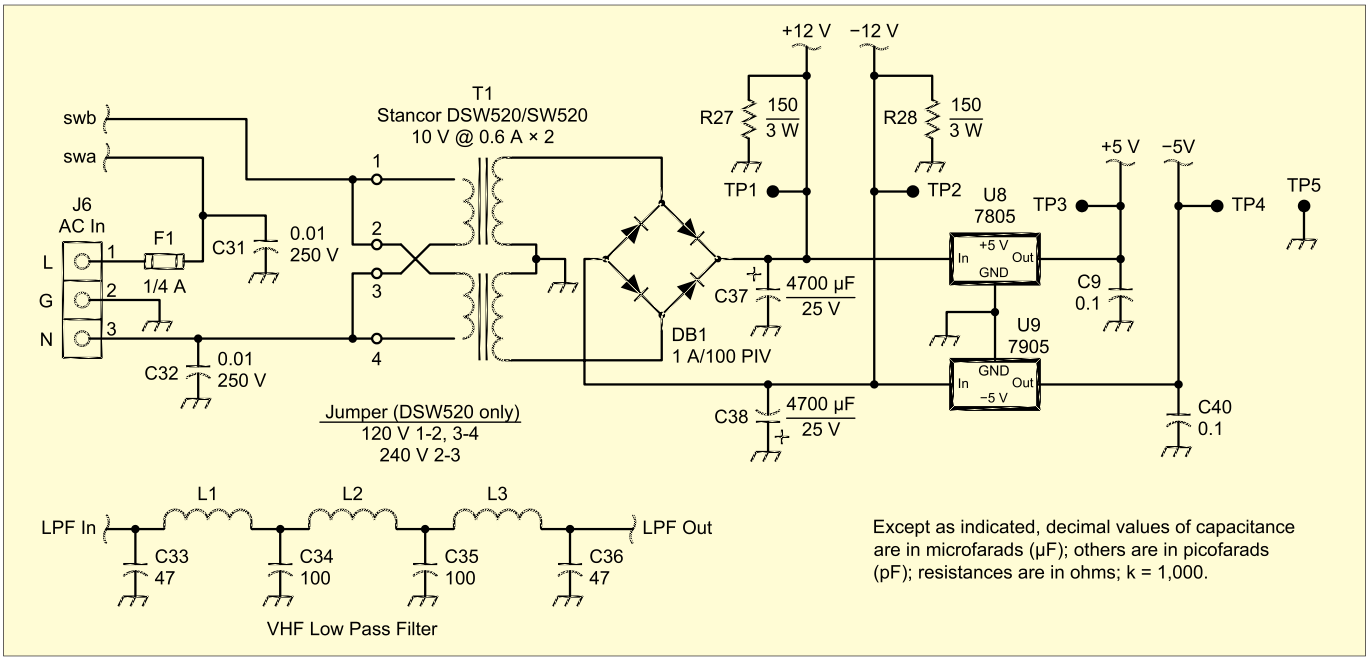


Figure 3—The power supply and VHF low-pass filter mount on the main circuit board. The power supply provides ±12 V dc (unregulated) and ±5 V dc (regulated). The VHF filter has a cutoff frequency of 75 MHz. Component values are given in the caption of Figure 2.

nas, without suffering any signal loss.

In short, if you've got more than one shortwave receiver, the multicontroller will greatly simplify your station's operation. No more hooking and unhooking a snarl of cables when you want to try out another receiver. Now, the multicontroller does all the work with the flip of a switch.

Best of all, this multicontroller project is easy to build. To simplify construction, all the parts mount on four printed circuit boards that plug together and slide as a unit into a matching metal enclosure, thus avoiding point-to-point wiring. If you can stuff a circuit board and are familiar with standard electronic components, then you shouldn't have any trouble completing this project over a weekend. Should you have any questions or need any more information, a supporting Web site (**www.w8zr.net/multicontroller/**) will provide all the extra help you'll need. The Web site includes parts and supplier lists, additional photographs and detailed assembly instructions. Time to start warming up your soldering iron!

Circuit Description

The schematic diagram of the multicontroller's four printed circuit boards is shown in Figures 2 through 6. The main circuit board houses the bulk of the components, while the front and rear panel circuit boards contain the switches, LED indicators and input and output connectors. A fourth board houses the optional AM/VLF high pass filter.

Distribution Amplifiers

The heart of the multicontroller is comprised of two Maxim MAX497 integrated circuits. Each MAX497 contains four 275 MHz low-noise amplifier/buffers, primarily intended for use as video amplifiers. In this application, these remarkable ICs are used as low noise RF amplifiers, with the bandwidth limited by low-pass and high-pass filters. Each of the MAX497's four channels has an open loop voltage gain A_V=2 (6 dB), an input resistance of 1.2 MΩ and an output resistance of 0.1 Ω.

As shown in Figure 2, the RF input to the main circuit board is through connector J2, which has separate inputs for

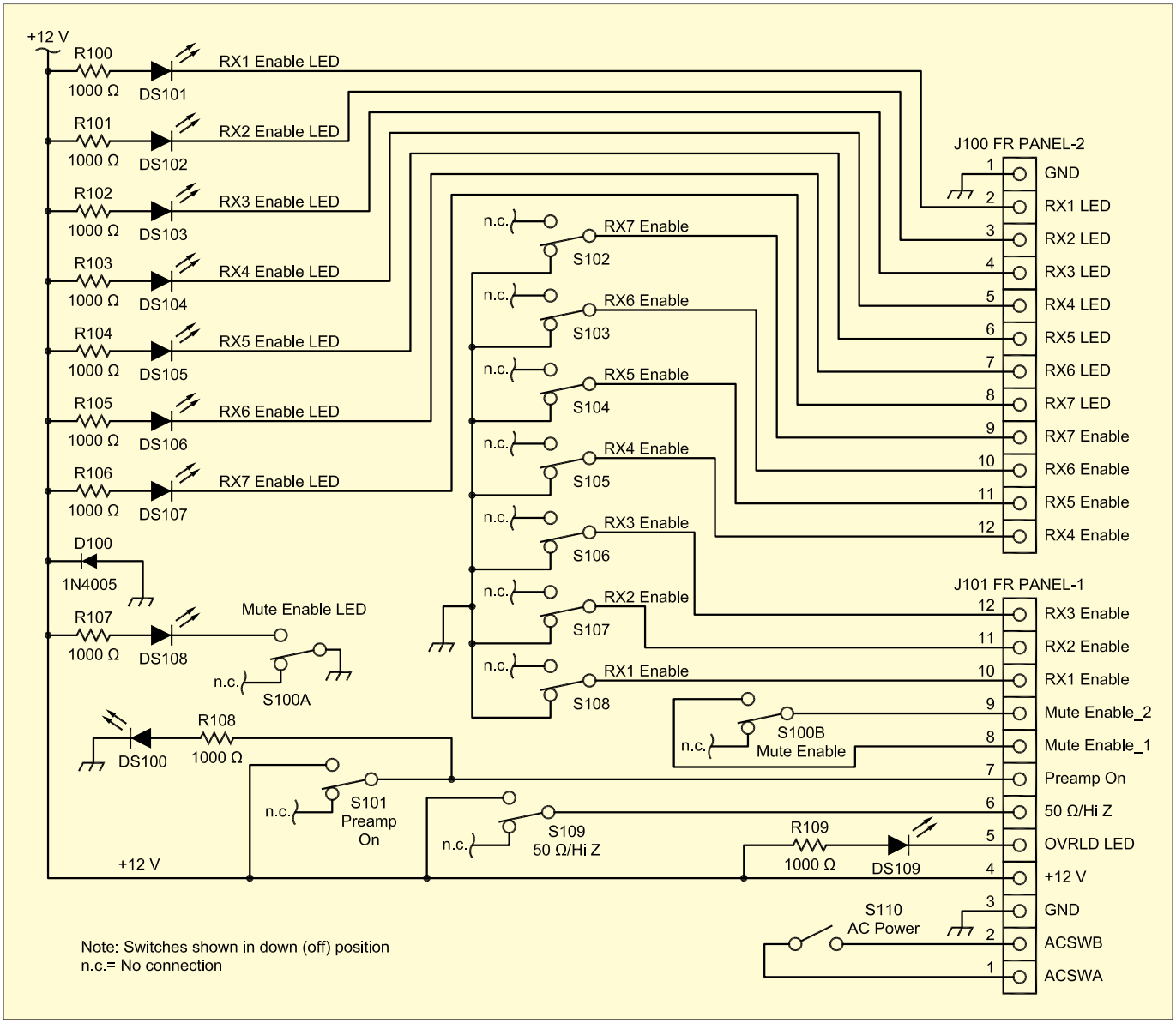


Figure 4—Schematic diagram of the front panel circuit board, which houses the switches and LED indicators.
D100—1N4005 diode or equivalent.
DS100, DS108—LED, yellow, size T1 3/4.
DS109—LED, red, size T1 3/4.
DS101-DS107—LED, green, size T1 3/4.
J100, J101—Header, Molex, 0.156 inch 12 pin, straight.
R100-R109—1000 Ω, 1/4 W resistor.
S100—SPDT ac switch (RadioShack 275-648).
S101-S109—SPDT toggle switch, miniature.
S110—DPDT toggle switch, miniature.

50 Ω and high-impedance antennas. Signals at the 50 Ω input pass through a 7-element low-pass filter consisting of L1-L3 and C33-C36, which has a cutoff frequency of approximately 75 MHz and is intended to attenuate strong local FM and TV stations. If overload from such stations is not a problem, the component values of the inductors and capacitors can be divided by two, raising the cutoff frequency to 150 MHz and extending the multicontroller's coverage to the 2 meter amateur band and the commercial FM broadcast band.

After filtering, the signal passes through relay contacts K1b, K4c, K3b and K2b and then to seven of the independent inputs of U1 and U2. Resistors R18, R17 and R13 set the input resistance of the amplifiers at approximately 50 Ω. The value of R18 can be changed if other input resistances are desired, such as 75 Ω or 92 Ω. Schottky diodes D3 and D4 protect the inputs of U1 and U2 by limiting peak-to-peak RF voltages to approximately 10.6 V.

The high-impedance input at J2 is routed around the low-pass filter through relay contacts K3b and K2b, and then to seven inputs of U1 and U2. R2 dissipates static charge on the high-impedance antenna and C14 provides DC isolation. With high impedance antennas, the input impedance of the amplifiers is set by the parallel combination of R2, R17 and R13 and is approximately 1000 Ω.

The eight amplified outputs of U1 and U2 are coupled through resistors R1 and R3 through R9 to the RX OUT connector, J1. When you are operating into a 50 Ω load, half of the amplifiers' outputs are dropped across resistors R1 and R3 through R9. The 6 dB gain of U1 and U2 compensates for this signal loss, resulting in an overall system gain of 0 dB.

Overload Protection

Both the 50 Ω (50 OHM) and high-impedance (HI-Z) inputs are also connected to an eighth input (IN3) on U2. Because this input is always active, it is protected against strong RF voltages by D7 through D10, with R11 providing isolation from the other inputs. The buffered output of this

amplifier is connected to the AUXILIARY OUTPUT terminal of J1 and also, via R10, to a voltage doubler consisting of Schottky diodes D1, D2. These diodes have a low "turn-on" threshold, which increases the sensitivity of the overload detector circuit. The rectified output of D1 and D2 is filtered by C20 and C21 and applied to the base of switching transistor Q1. The voltage divider comprised of R12 and R14 determines the threshold voltage at which Q1 conducts and actuates overload relay K2. The attack time of this circuit is a few milliseconds, while the decay time, determined by C21, R12 and R14, is about 0.25 second.

When Q1 conducts, K2b disconnects the antenna from the 7 inputs of U1 and U2, while K2c mutes all the connected receivers. An RF voltage in excess of about 1000 mV is required to trip the overload circuit

Preamplifier

An internal low-noise preamplifier can be used with 50 Ω antennas to provide a nominal +12 dB gain. The preamplifier is based on U3, a newly released Mini-Circuits GALI-6 low noise integrated amplifier with an intrinsic frequency response of dc to 4 GHz. This amplifier has an impressive third-order intercept point (IP3) of +35 dBm and can accommodate input signals as high as +20 dBm without damage. The preamplifier's low frequency response is set by C22 and C24, which reduce the effective preamplifier gain below 100 kHz. Schottky diodes D5 and D6 and resistor R15 protect U3 from excessive RF signals. Bias current for U3 is set by R16 and is approximately 70 mA. The +12 V dc power for U3 is routed through relay contacts K4b and K3c, which disconnect preamplifier power when the high-impedance antenna is selected or when the preamplifier is bypassed. Diode D15 protects U3 from reverse voltage transients or inductive spikes on the power supply line.

Mute and Control Circuits

The seven receiver outputs have identical mute circuits, which can be independently configured with internal jumpers, either as close-to-mute or open-to-mute. One such circuit consists of NAND gate/buffer U4a, in combination with relay K5. Input 1 of U4a is held high by R19, unless it is grounded by the front panel RECEIVER ENABLE switch.

Similarly, input 2 of U4a is held high by R26. Note that input 2 of all the NAND gates are connected together with a common control line, so that grounding this line switches all seven NAND gate outputs high. Input 2 can be grounded by the front panel MUTE ENABLE switch, by relay contacts K2c, or by grounding the rear panel CONTROL jack J213. Resistor R200 and capacitor C201 on the rear panel circuit board isolate the control line at J213 from stray RF voltages.

When both inputs of U4a go high, the output of U4a toggles low, thus energizing relay coil K5a and closing contacts K5b and K5c. When K5a is energized, its corresponding receiver is enabled (unmuted). The normally open or normally closed contacts of K5b are selected by jumpers on H1, and K5c lights an LED when its receiver is enabled.

Note that grounding the control line at J213 mutes the receivers but does not disable the antenna ports or disconnect the antenna from the receivers. There is no reason to disable these antenna ports, because the overload circuit automatically limits the RF antenna voltages on the ports to safe levels.

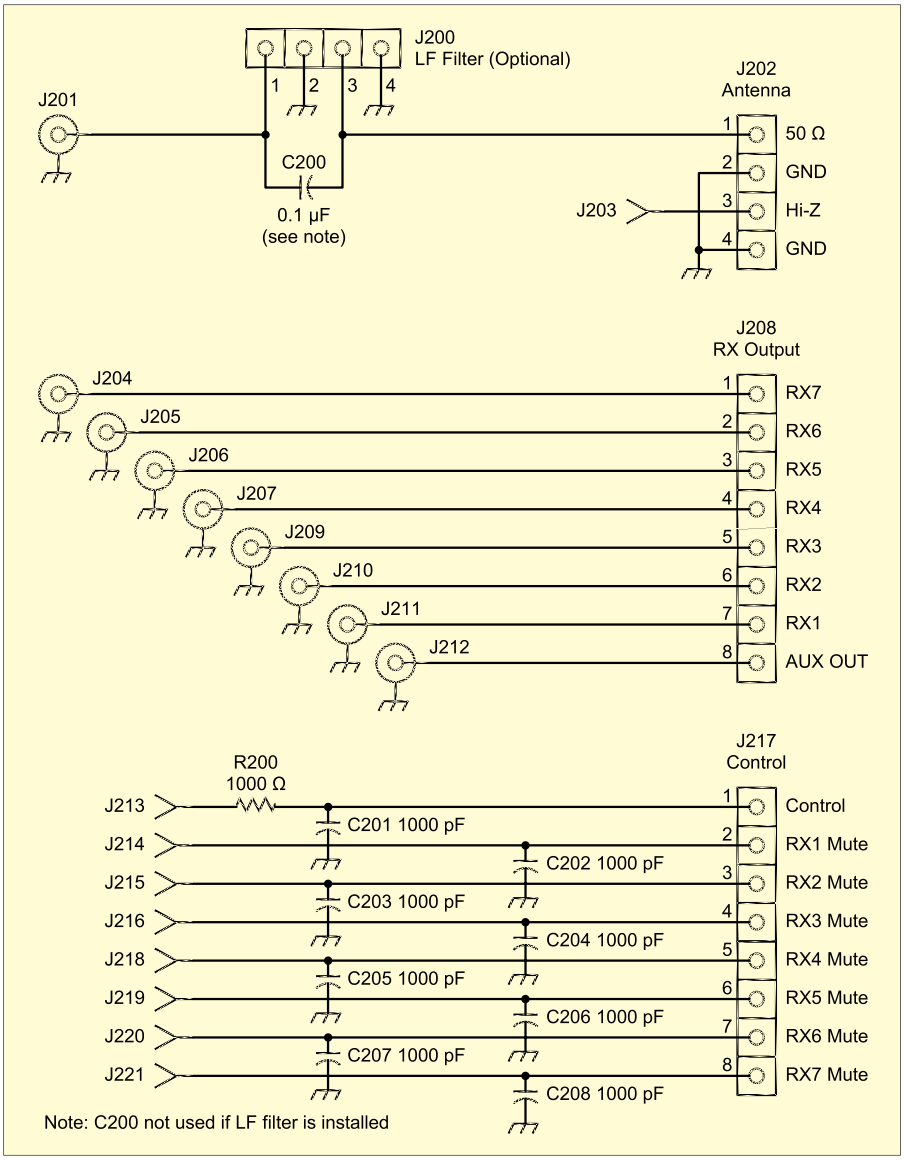


Figure 5—Schematic diagram of rear panel circuit board.

C200—0.1 µF, 50 V ceramic disc capacitor.
C201-C208—1000 pF, 1000 V ceramic disc capacitor.
J200—Header, Molex, 0.100 inch, 4 pin, straight.
J202—Header, Molex, 0.156 inch, 4 pin, straight.
J208, J217—Header, Molex, 0.156 inch, 8 pin, straight
J201, J204-J207, J209-J212—BNC PCB-type vertical mount jack.
J203, J213-J216, J218-J221—RCA–type phono jack, rear chassis mount type (front control nut).
R200—1 kΩ, 1/4 W resistor.

AM/VLF Filter

The optional low-frequency filter consists of C300 through C309 and inductors L300 through L302. This filter is based on a design from *The ARRL Handbook*, modified to use off-the-shelf components. The filter response has a slight attenuation of about 3 dB at the lower end of the 160 meter amateur band (1.8 MHz), which increases to about 30 dB at 1.5 MHz. Below

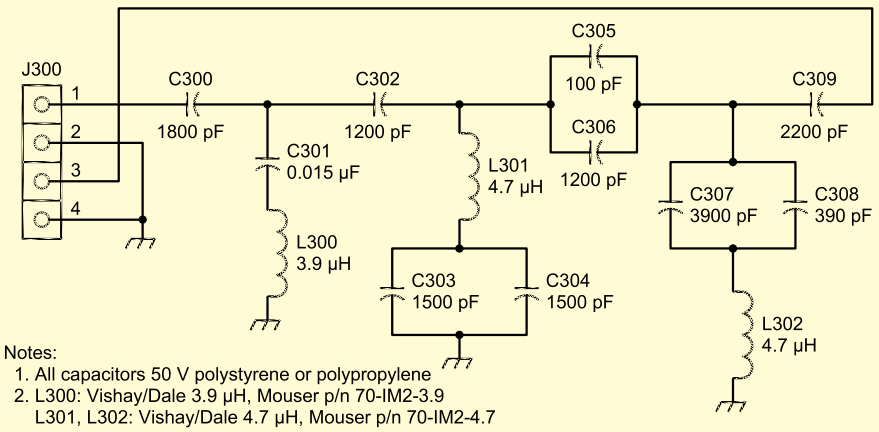


Figure 6—Schematic diagram of the AM/VLF high-pass filter, used to prevent overload from strong local AM broadcast stations.

C300—1800 pF, polystyrene capacitor.
C301—0.015 µF, polypropylene capacitor.
C302, C306—1200 pF, polystyrene capacitor.
C303, C304—1500 pF, polystyrene capacitor.
C305—100 pF, polystyrene capacitor.
C307—3900 pF, polystyrene capacitor.
C308—390 pF, polystyrene capacitor.
C309—2200 pF, polystyrene capacitor.
J300—Socket, 0.100 inch, pin strip, 4-pin.
L300—3.9 µH, molded inductor, Vishay/Dale 70-IM2-3.9.
L301, L302—4.7 µH, molded inductor, Vishay/Dale 70-IM2-4.7.

1.5 MHz, the attenuation rises rapidly to 60 dB or greater. The filter is useful in applications where overload from strong AM broadcast band stations is a problem. If it is not needed, the input and output terminals are jumpered on the rear panel circuit board by C200.

Power Supply

The dual 10 V windings of power transformer T1 are connected in series and the resulting 20 VCT voltage is rectified by diode bridge DB1 and filtered by C37 and C38 to produce unregulated voltages of approximately ±12 V dc. Bleeder resistors R27 and R28 help stabilize the voltage by drawing about 80 mA from each supply.

Regulators U8 and U9 produce ±5 V dc for powering U1 and U2. If the dual-primary version of T1 is used, the primaries can be jumpered on the circuit board for either for 115 V ac or 230 V ac operation. The single-primary version of the transformer can only be used on 115 V ac.

Construction Options

The multicontroller uses high quality commercial-grade components and is therefore not an inexpensive project. To duplicate it exactly will set you back about $250. Fortunately, builders can cut costs significantly by substituting a bit of elbow grease for convenience. However, because the multicontroller uses RF components that work well into the UHF region, I strongly recommend that you use the available printed circuit boards and not attempt to duplicate the circuit using wire wrap or other wiring methods. The double-sided circuit boards use ground plane construction, with special attention to RF component placement, bypassing and layout.

Detailed construction information is available on the Web site mentioned earlier; however, views of the circuit boards can be seen in the following figures. The completed main circuit board, before the addition of the front and rear panel assemblies, is shown in Figure 7. The AM/VLF high-pass filter can be seen mounted to the main board in Figure 8. A view of the completed multicontroller assembly, with both panels installed and ready for cabinet installation, is shown in Figure 9. There certainly is no reason other than convenience to use the specified commercial cabinet or, for that matter, the front and rear panel printed circuit boards. These boards are used merely to simplify the switch and connector wiring and eliminate most of the point-to-point wiring, but the layout for these circuit components is not critical. Builders should also not be reluctant to fabricate their own enclosure and use direct wiring for the switches, LEDs and connectors. There are five spare mounting holes on the main printed circuit board that were meant to facilitate different enclosure options.

If you do use your own cabinet, you should replace the side-entry Molex connectors J1-J5 on the main circuit board with ordinary 0.156 straight pin male head-

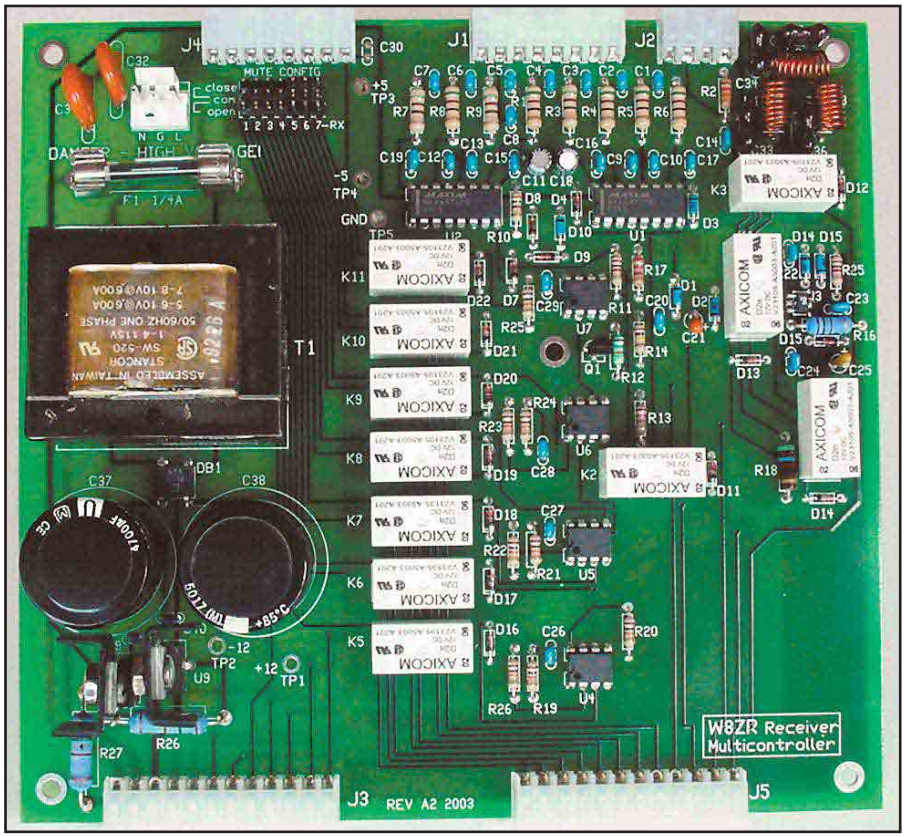


Figure 7—The main circuit board houses the bulk of the multicontroller's circuitry. The power supply is on the left side and the VHF low-pass filter is at the upper right. The heart of the multicontroller is comprised of two 16 pin Maxim MAX497 quad video amplifier integrated circuits, shown in the upper center. The board's five mounting holes are not needed for the specified cabinet, but they may be used with other cabinet options.

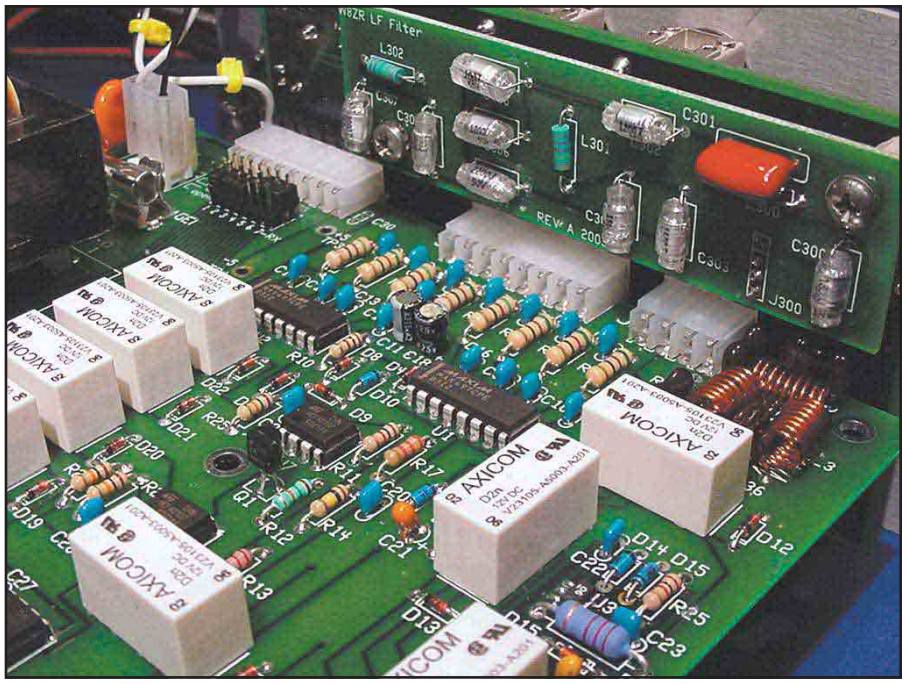


Figure 8—The AM/VLF high-pass filter attenuates signals below 1.8 MHz and mounts on the rear panel circuit board. It is only required if you are subject to strong local AM broadcast band interference. Eliminating it allows the multicontroller to pass the AM broadcast band and other LF signals. The 75 MHz low-pass filter is visible just below the right side of the AM/VLF filter circuit board, where inductors L1, L2 and L3 can be seen.

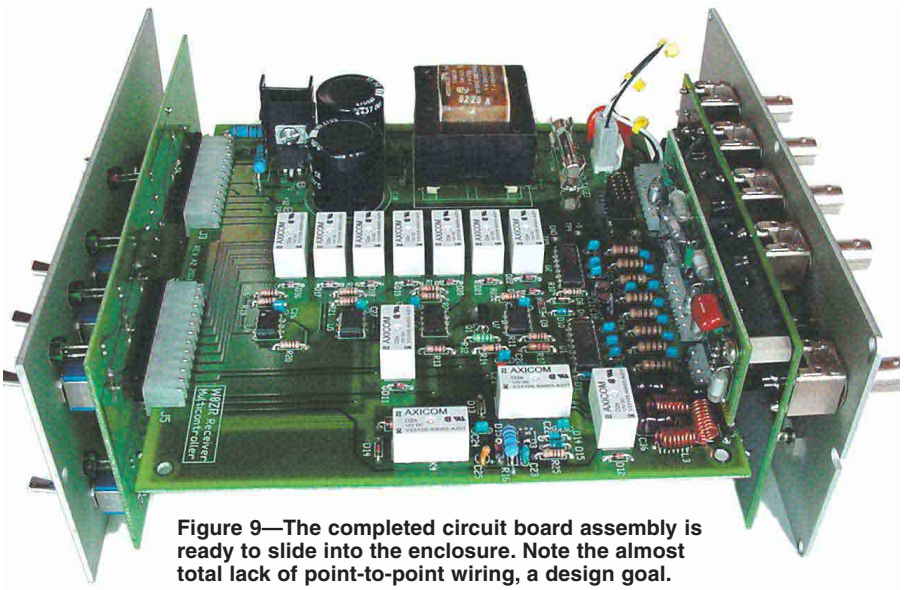


Figure 9—The completed circuit board assembly is ready to slide into the enclosure. Note the almost total lack of point-to-point wiring, a design goal.

ers. Then, you can conveniently make connection to the headers with mating female connectors having crimp-type terminals. Use ordinary hookup wire for the switches, LEDs, and mute jacks, but be sure to use miniature coaxial cable (such as RG-174/U) for the RF wiring.

Operation

Installation of the multicontroller takes but a few minutes. Connect your HF receiving antenna to either the 50 OHM or HI-Z antenna jack, and use BNC jumper cables to connect the output ports and any of seven receivers. If desired, you can connect an eighth receiver to the AUXILIARY OUTPUT port, but keep in mind that this port is always active, with no mute capability.

Next, connect ordinary shielded RCA phono patch cables between the mute jacks on the multicontroller and the corresponding mute terminals on your receivers. Take care to use normally open or normally closed jacks, as appropriate for your receivers' muting requirements. Also hook the relay control line of your transceiver or transmitter to the multicontroller's CONTROL jack, again using an ordinary shielded phono cable. (Hint: You can use an unused mute jack on the multicontroller to control a linear amplifier. Since the relay contacts in the multicontroller are rated at 1 A @ 100 V dc or 150 V ac, you should be able to control most commercial or homebrew amplifiers.)

Once the multicontroller is hooked into your station, select any desired receiver by toggling its corresponding switch on the multicontroller's front panel. If the MUTE ENABLE switch is on, then grounding the control line will simultaneously mute all of the enabled receivers.

The preamplifier can be used with any 50 Ω antenna and will provide about +12 dB of gain. I advise, however, that you use it only when you need to dig out weak signals. Because the preamplifier covers the entire HF spectrum, it will lessen the dynamic range of the multicontroller and it will also be prone to overload from the strongest stations in the spectrum.

Finally, keep in mind some other uses for the multicontroller. It is a great adjunct to your workbench. I frequently use mine with my signal generator, because it gives me multiple 50 Ω isolated and buffered generator outputs. I hook a frequency counter to one output, an oscilloscope to a second, and use the remaining outputs wherever I need to inject identical signals. I have a GPS-derived master 10 MHz oscillator in my workshop, and with the multicontroller, I can fan out the 10 MHz signal to every counter, transceiver, and oscilloscope in my station that has an external timebase input. I have also learned that the multicontroller makes a dandy impedance converter for using short wire antennas with radios that have only 50 Ω inputs. My Kenwood TH-F6A handheld transceiver sounded dead on the HF bands with a short whip antenna, but it came to life when I used the multicontroller to transform the whip impedance to 50 Ω. Be sure to let me know if you find other uses for this handy instrument.

Photos by the author.

Jim Garland, W8ZR, was first licensed in 1955 and has held the calls WØZKE, W8KFL and G5APG. Jim is a lifelong homebrewer and has published articles on his home-built receivers, linear amplifiers and the "EZ-Tuner." That tuner was described in April, May and June 2002 QST*, and referenced in the 2003 and 2004 editions of* The ARRL Handbook*. He is also interested in DX and collects vintage Amateur Radio equipment. Jim has an Amateur Extra class license and is a Life Member of the ARRL. Jim holds a PhD in experimental condensed matter physics and is president of Miami University, in Oxford, Ohio. You can reach him at* **w8zr@arrl.net**.

By Ray Abraczinskas, W8HVG

A Rugged Broadband Tri-Band VHF-UHF Base Antenna

W8HVG exploits the classic ground-plane with a simple design using materials available at your local hardware store. The result is a good performing and easy to build antenna.

Commercially available single feed line tri-band VHF-UHF base antennas on the market today consist of fairly expensive fiberglass shrouded radiators, which can create precipitation static noise on weak signal reception or fail due to damage from rain, ice loading and/or lightning. There are also several broadband, scanner, discone-type antennas available but they're not capable of handling much transmit power. Just thinking about the frailty of any of these antennas during a winter ice storm on a 300 foot tower gives pause for thought.

The Problem

The Independent Repeater Association[1] (of Michigan) operates a 2 meter linked repeater system, and has 11 repeaters tied together continuously via auxiliary links on the 222 MHz and 440 MHz bands. The system uses 47 antennas. This past spring, we had to replace four system antennas that were damaged by ice. That's what prompted this idea about making a rugged tri-band VHF-UHF base antenna using locally available materials. It had to have a single coax feed and be rugged enough to withstand several inches of ice loading such as we sometimes get during Michigan's cold winter season.

The typical amateur homebrew VHF-UHF antenna made for FM operation consists of flip-flopped coax sections in a fiberglass or PVC pole, 300 Ω ribbon cable J-poles in a PVC pipe, or the ever-popular J-pole design made out of soldered copper pipe. I decided to explore other designs, because I had at one time or another constructed all of them, and I wasn't particularly happy with the mechanical aspects of any.

[1]Notes appear on page 41.

I was always intrigued by the "do-it-yourself" aluminum stock available in most hardware stores. There are usually many choices available, in a rack of different sized aluminum tubes, angles, channels, flat stock and sheet stock. And, with the abundance of stainless steel hardware available in the same stores, there just had to be a simple design solution. It turns out that there was, and it has many excellent features. That completed design is shown in Figure 1.

The Solution

After looking at various types of ground plane antennas, I saw the value of that design approach. But I knew that it had to be rugged enough to withstand ice and winds, so making it out of coat hanger wire and an SO-239 coax connector was out of the question. Also, it had to be well insulated around the base area so that the ice and snow would not short it out, and it had to be easy to build. It also had to be multi-band capable, because we use the 144, 222 and 440 MHz bands on our repeater network.

Figure 1—The side-mounted broadband tri-band VHF-UHF ground-plane antenna is made of aluminum flat-stock.

The antenna literature describes how to parallel dipole antennas for multi-band operation and also how to parallel mobile whips of different lengths. The solution to multi-band operation became evident by using aluminum flat stock and a readily available base-mount insulator used for mobile antennas. The heavy-duty base insulator has a $^3/_8$-24 threaded collar on top and an SO-239 threaded receptacle on the bottom, and is shown in Figure 2. This mount is available at hamfests, antenna dealers or CB radio stores, or directly from the supplier.[2] The only additional hardware required for the base insulator is a $^3/_4$ inch long by $^3/_8$ inch diameter 24 thread stainless steel bolt and lock washer to mount the radiating elements.

The Design

The design is based on a classic quarter-wave ground plane vertically polarized antenna. The radiator element is a V with different side lengths; one side is for 144 and 440 MHz, and the other side is for 222 MHz (parallel radiators). The counterpoise is simply two identical inverted Vs, each with different side lengths. Again, one side of the V is for 144 MHz and 440 MHz and the other side is for 222 MHz. The 2 meter (144 MHz) sides of the counterpoise are aligned with the 2 meter radiator and the 222 MHz sides are aligned with its radiator.

Figure 2—The base used is a "deck-mount" antenna base for 3/8 × 24 threaded antennas.

BASED ON ORIGINAL ANTENNA DRAWING BY CAROL ABRACZINSKAS

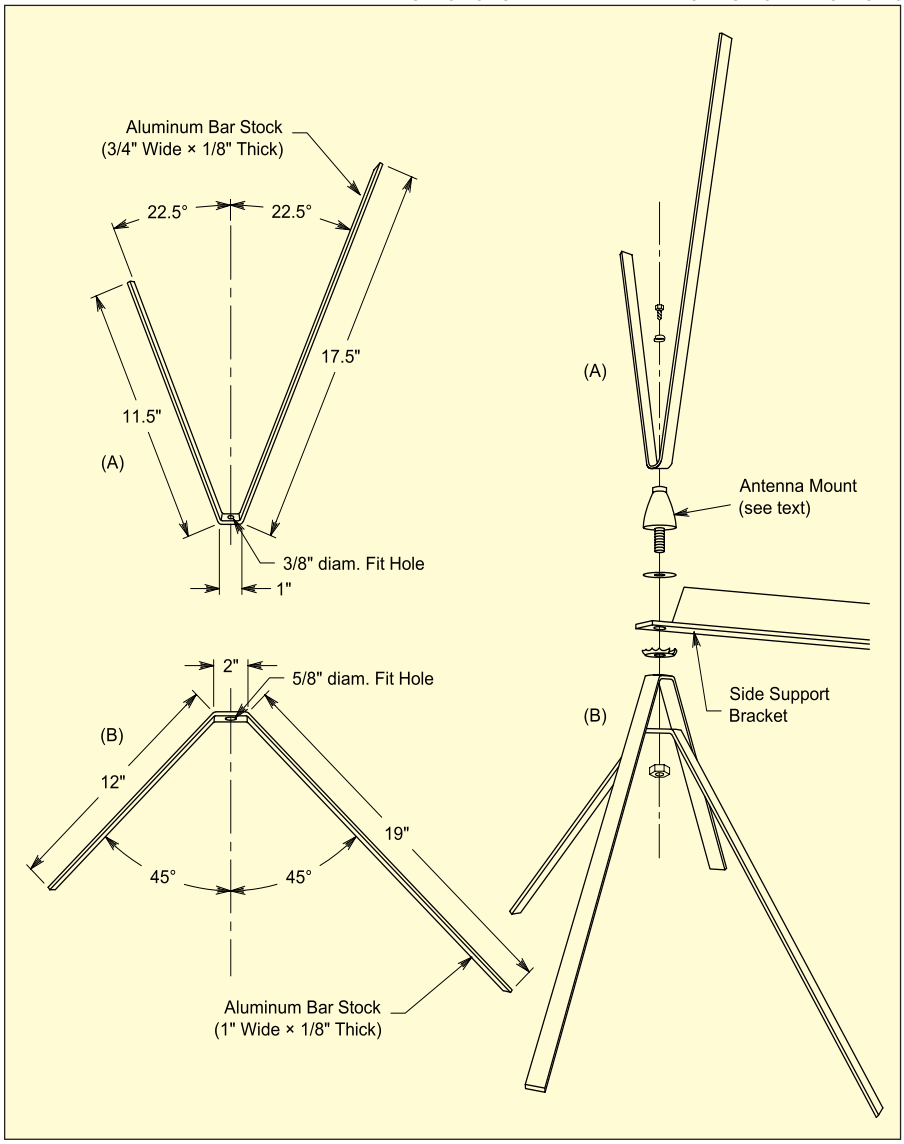


Figure 3—Dimensions for cutting, bending and drilling the radiator and counterpoise elements are shown, along with an assembly diagram.

Radiator—1 piece aluminum flat stock, 30 inches long, 3/4 inch (1 inch stock can be used; see text) wide × 1/8 inch thick.
Counterpoise—2 pieces aluminum flat stock, 33 inches long, 1 inch wide × 1/8 inch thick.
Base mount—Solacon (HWM) or RadioShack (21-1116) (see text).
Bolt—3/8-24 × 3/4 stainless steel with lockwasher.

My specific requirements were for an antenna that could receive 144 MHz and 222 MHz with one coaxial feed line. It turned out that the design also works well on 440 MHz, as the 2 meter part of the antenna works as a 3/2 wave antenna on 440. The SWR is less than 1.2:1 on all three bands. Antenna perfectionists may want to add another quarter-wave V radiating element, specifically for the 440 MHz band. The 144 MHz element does work on 440 MHz, but as a 3/2 wavelength radiator, it probably has non-optimum lobes.[3]

The antenna elements are made with wide aluminum flat stock and the SWR is low across all the bands. But, being a simple dipole antenna on each band, no gain over a dipole is claimed. My requirements were for a rugged side-mounted antenna; hence the 2 inch wide horizontal aluminum angle support shown in the photo is used for a side mount. The antenna can be mast mounted by making a small aluminum angle bracket to capture the antenna mount and clamp it to a mast with two stainless steel U-bolts. If the antenna is made with aluminum and stainless hardware, it will last indefinitely without rusting or corroding, contrary to that of many copper J-pole antennas. Corrosion will affect the antenna's appearance and, more importantly, its performance.

Construction

The V radiator element is made from 3/4 inch wide aluminum flat stock, 1/8 inch thick and 30 inches long, as shown in Figure 3. The 3/4 inch width was chosen considering the 3/8 inch bolt used to fasten it, but 1 inch wide flat stock could also be used, as well. (If you do use the 1 inch stock, you may need to do additional adjusting for the lowest SWR.) Mark to drill a 3/8 inch diameter fit hole, centered a distance of 18 inches from one end of the flat stock. Drill the hole after bending it.

Measure 1/2 inch each side of the hole center, and at each distance, mark a line. Using a metal brake or a vise, carefully bend the flat stock (at each line) into a V shape with each side making approximately a 22.5° angle from the vertical. One side should be 11.5 inches long and the other side should be 17.5 inches long, with a 1 inch center portion. If everything checks out, carefully drill the hole in the center portion.

The V counterpoise elements are similarly made from two, 1 inch wide, aluminum flat stock bars, 1/8 inch thick, and each one is cut 33 inches long. Mark to drill a 5/8 inch diameter fit hole, centered a distance of 13 inches from one end of the flat stock. Drill the hole after bending it.

Measure 1 inch each side of the hole center and at each distance, mark a line. Using a metal brake or a vise, carefully bend the flat stock (at each line) downward into a V shape, with each side making approximately a 45° angle from the vertical. One side should be 12 inches long and the

other side should be 19 inches long, with a 2 inch center portion. If everything checks out, carefully drill the hole in the center portion. Note that the counterpoise elements are formed into a 90° V angle (inclusive) and the radiator V element is formed into a 45° V angle (inclusive).

If you are going to side-mount the antenna on a tower, use 2 inch aluminum angle stock and drill it to mount the base as shown. Drill the necessary holes in the aluminum angle stock to side-mount it to your tower using stainless steel U-bolts. If you are going to mount the antenna on top of a mast, use a small piece of aluminum angle stock to mount the antenna base. Drill the holes accordingly, to mount it to your mast using stainless U-bolts.

If everything checks out measurement-wise, carefully file all the sharp edges and debur the holes. You are now ready to assemble the antenna and, once again, Figure 3 should be referenced for its construction. Remove all hardware from the base except for the rubber gasket. Place the base through the hole on your mounting scheme and install the giant star-washer. Place the two counterpoise elements on the coax connector pointing downward, then install the nut. While tightening the nut, hold the two counterpoise elements aligned 90° apart. Now, using the $^3/_8$ inch stainless bolt and lock washer, fasten the radiator element pointing upward. While tightening the bolt, hold the radiator element to align the longer side directly in between the two long counterpoise elements. The short elements should align correspondingly.

Now you are ready to check out the SWR. The dimensions shown should require no additional pruning or lengthening in order to achieve a low SWR. If you find that you would like to try to improve things, however, try bending the radiator and/or the counterpoise elements slightly before you resort to cutting. If you need to extend the radiator element a small amount, lay a small piece of flat stock on the element and temporarily clamp it with a small alligator clip. Adjust it to lengthen the radiator slightly. If an SWR improvement occurs, fasten it permanently with two small stainless sheet metal screws and recheck the SWR.

Performance

We installed this antenna with $^1/_2$ inch hardline at the 180 foot level on a tower used for one of our outlying remote receivers and nodal links, and its performance has been gratifying. Mobile coverage is beyond a 30 mile radius and handheld transceiver coverage is about 10 miles, depending on the terrain.

This tri-band antenna, using only one coaxial feed line and a diplexer, provides excellent fill-in coverage for 2 meter mobiles and handheld transceivers. It also serves a dual purpose—simultaneously receiving 222 MHz auxiliary link signals for transmitting to the main repeater. The antenna's rugged construction should ensure that it has a long life.

My sincere thanks to Tom Werkema, KA8YSM, at Werkema Machine, Inc, for helping to make the antenna, and to my daughter, Carol, for drawing it.

Notes

[1]**www.w8hvg.org**.

[2]The antenna mount is available from Solacon (Model HWM), 7134 Railroad St, Holland, OH 43528 or RadioShack **www.radioshack.com;** catalog no. 21-1116).

[3]A separate 440 MHz radiator should be an asset, because operating as a third-harmonic antenna, the antenna will have a higher high-angle radiation component on 440 MHz than on 144 MHz. That radiation angle, therefore, won't be optimum for 440 MHz mobile stations far from the repeater.—*Ed.*

Photos by the author

*Ray Abraczinskas, W8HVG, was first licensed as W3HJR in 1956, and as KA2MA, in Japan, in 1957. He holds a BSEE degree and retired in 2000 as a Special Projects Manager from Smiths Aerospace in Grand Rapids, Michigan. Ray enjoys ham radio, genealogy, fishing in Canada and writing. He also assists the Independent Repeater Association with building and maintaining the Michigan Link Repeater System (***www.w8hvg.org***). You can contact Ray at 4295 Kentridge SE, Grand Rapids, MI 49508;* **abra@i2k.com**.

NEW PRODUCTS

VERSION 3.01 *MULTIPSK*

◊ In the January 2004 issue of *QST*, Steve Ford, WB8IMY, reviewed *MultiPSK* freeware terminal software as provided by Patrick Lindecker, F6CTE. This versatile software allows operation in many digital modes through the use of a soundcard in a PC. Patrick has now announced an update, V 3.01, available on his Web site. This version includes the ability to translate and transmit in THROB 1 and 2, MFSK8, MFSK16 (with SSTV functions according to the MixW format), panoramic reception of PSKFEC31 and the addition of supervision functions. Although this software is freeware, a $35 license is required to use some of the special features. For more information or to download a copy, see Patrick's Web site, **www.members.aol.com/f6cte/**.

PHASE LOCKED OSCILLATOR FROM JWM ENGINEERING

◊ JWM Engineering Group has announced the model 1152 Phase Locked Oscillator, designed to improve frequency control of microwave receivers and transmitters using crystal based local oscillator chains. Models are available for amateur transceivers operating from the 1296 MHz to the 10,368 MHz bands. The Model 1152 requires a stable external 10 MHz frequency reference oscillator and 13.8 V dc at 200 mA. A minimum of +10 dBm RF output is provided with typical phase noise specified as –115 dBc/Hz at 100 kHz.

For complete model information, frequency options, specifications and ordering information, see **jwmeng.com/model1152.html** or contact JWM Engineering Group, 9 Westchester Ct, Trabuco Canyon, CA 92679-4955; tel 949-713-6367, **jmulchin@jwmeng.com**. Price: $229.95.

ACCESSORY CIGARETTE LIGHTER ADAPTER FROM MFJ

◊ MFJ offers a cigarette lighter adapter to allow powering devices such as keyers, test equipment and accessories with similar power requirements from an auto cigarette lighter socket. The MFJ-551 has a retractable cord that extends to 60 inches. Price: $6.95.

To order, or for your nearest MFJ dealer, call MFJ Enterprises at 800-647-1800 or order at **www.mfjenterprises.com**, fax 662-323-6551; or write MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759.

DXPEDITION MARK II FRONT END SAVER WITH PREAMP FROM RADIOWARE

◊ Gary Nichols, KD9SV, and Radioware announce a new version of the DXpedition Model of Front End Saver including built-in 80 and 160 meter preamps. The Mark II is designed to work with radios without a separate receive antenna input such as the ICOM IC-746 or IC-706 series. The Mark II allows you to select one of up to four separate receive antennas or the transmit antenna for receive. It automatically switches to the transmit antenna when the radio is keyed and is controlled using the radio's accessory connector for 13.8 V dc and send keying signal. The Mark II has adjustable receive gain from 0 dB to approximately 23 dB and includes filtering designed to reduce AM broadcast station overloading. Price: $259.95.

For more information, contact Craig at Radioware, PO Box 209, Rindge, NH 03461; tel 800-457-7373 or 603-899-6957, **www.radio-ware.com** or **radware@radio-ware.com**.

By Joseph Lunsford, N4YG

The Smart Keyer Lite

Want a battery-powered keyer with almost every feature you'll need including long battery life? Look no further!

Some readers are familiar with the Smart Keyer series, designed by the author and marketed during the 1980s and '90s in the pages of *QST* and other radio journals. Having discontinued that venture several years ago and being recently retired, I decided that all the design work should be made available to anyone wishing to construct the keyer for their own use. I was still getting calls from hams who wanted to acquire the Smart Keyer, so I started to assemble the design data for publication. As I gathered the information, it became clear to me that the average ham would find the project too challenging, if not impossible. Part of this was due to the cost of the Intel 8749 microcontroller (used in the original design). That part was now obsolete, and its price had increased dramatically.

A better idea, I concluded, would be to design a Smart Keyer that the average ham could construct in a weekend for $50 or less, so I decided to design a new Smart Keyer using current technology. The Microchip 16F84A controller was selected because of its outstanding performance, low cost, low power and powerful instruction set. I decided that the new design would be called the Smart Keyer Lite because of its small size, low power requirements and practical design approach. The overall goal was a comprehensive keyer design offering features that a major percentage of active CW operators would find useful.

The result of my design is shown in Figures 1 and 2. The unit measures 1×3×6.25 inches. A single knob serves not only as a SPEED control, but also as an adjustment control for many designed-in options that the operator can select. On the front top of the cabinet are two push buttons and an LED. The push buttons are used for playing back messages as well as controlling the keyer modes and options. A STATUS LED serves as a visible feedback signal to the operator. Two jacks, one for paddles and one for transmitter keying, are located on the rear panel.

Design Requirements

The following design goals were decided upon:

- Small size, minimum hardware count and minimal cost
- Easy construction (a weekend)
- Battery powered (battery life of 1 year, minimum)
- Two message memories, user loadable and nonvolatile
- One repeatable message with a variable delay
- Sidetone with variable tone and volume
- Positive or negative keying selection
- Keying mode control (iambic, dot memory, dash memory)
- Potentiometer speed control
- Weight control
- User control of character interval and message playback space

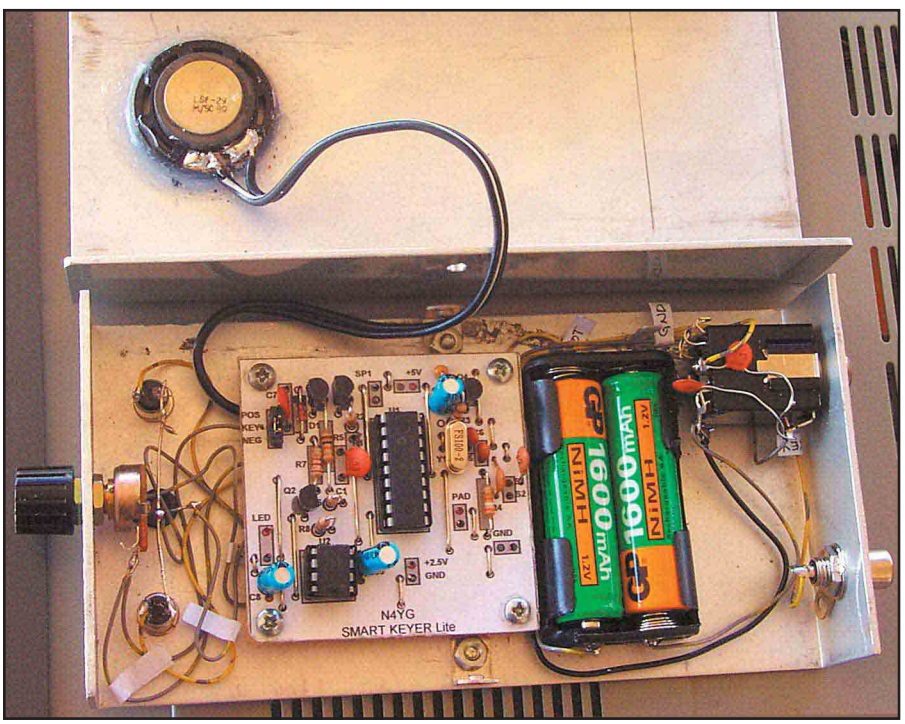


Figure 1—The completed Smart Keyer Lite—an interior view.

The first task was to develop a circuit and construct the keyer hardware that would support these objectives. The second, and most difficult, task was to write the code for the 16F84A. The construction was completed in a couple of days and then several weeks were spent writing code. The only requirement not met was that of variable sidetone frequency. The 16F84A has 1k of program memory, which was not sufficient to complete all the requirements. Since something had to go, the variable tone was it, as it had lowest priority. When all the code was completed, the 16F84A program memory was completely filled.

A description of the code, which makes the 16F84A function as a keyer, is beyond the scope of this article; that object code is readily available to anyone who wishes to load a 16F84A. The many features and the procedures for accessing the keyer features will be described later. Several files are also available that describe the operation of the keyer in detail and greatly simplify construction of the circuit board. These files are available at the ARRL Web site (**www.arrl.org/files/qst-binaries/smart keyer.zip**).

The Circuit

The schematic diagram for the circuit is shown in Figure 3. The circuit contains two integrated circuits—the 16F84A microcontroller, U1, and the MAX660 charge pump voltage doubler, U2. The purpose of U2 is to provide 5 V dc to power the 16F84A from a 2.5-3 V dc source (two AA cells). Note that U1 has two ports, A and B. Port B provides inputs from the two push-button switches and the paddles. It also provides outputs to drive the LED and the positive and negative keying circuits. The two keying circuits are independent and both can be brought out to separate rear panel jacks. If one has a rig with solid-state finals (positive keyed), as well as a rig with vacuum tube finals (negative keyed), separate jacks on the rear panel might be a good idea. The circuit shown in the schematic brings the two outputs to a 3-pin header where a jumper selects one or the other. Do not try to key an old cathode-keyed transmitter with this keyer. If you want to key one of these, contact the author.[1]

In the OPERATING mode, the two push buttons, S1 and S2, play back messages stored in flash memory. S1 and S2 have other functions as well, in other modes. Port A provides outputs to the drive circuit for the speaker, for the sidetone output, and an output and an input for the time constant sensing circuit consisting of R1 and C1. The time constant circuit provides a linear control, primarily for changing keying speed. This is a simple analog-to-digital converter used for setting up the many options available to the operator, as well as for controlling speed. The 10 MHz crystal provides an accurate timing clock. The drive circuit for the speaker is a push-pull arrangement; it was chosen because it provides symmetric drive and eliminates the "thump" sounds associated with simpler circuits. Any type of speaker can be used; I chose a 1 inch Mylar type because of its size.

Figure 2—A rear view of the keyer.

U2, the MAX660 charge pump, and its associated circuitry along with capacitors C8 and C9 can be eliminated if you elect to go with a 4 cell battery source. This would double the battery life, if space for the additional cells is available within your enclosure. AA or AAA type cells can be used for a battery supply. These can be normal alkaline batteries, rechargeable nickel cadmium (NiCd) or nickel metal hydride (NiMH) type cells. Two AA sized nickel metal hydride cells, with the MAX660, were used in my implementation in order to minimize size, but any of the battery options will provide an operating life of 1 year or more.

Construction

Figure 1 shows the internal layout of the unit I built. My enclosure was made from some sheet aluminum I had on hand, which was then cut and bent. I would caution against putting the two push-button switches on a vertical portion of the enclosure panel. This makes pressing the switches difficult. If they are placed on a horizontal top surface, the enclosure won't move when the buttons are pressed. All the parts are readily available, except for the MAX660, which must be ordered from Maxim.[2]

The main part of the circuit is constructed on a 2.2 inch square section of Vero board. You can get this from a number of parts suppliers, including Ocean State (See Figure 3) and the author. Vero board is very suitable for simple, one-off projects, such as this. The board has a rectangular grid of holes spaced 0.1 inch apart and conducting copper foil strips are centered on the holes, running in one direction. With the copper foil strips running east-west and most parts oriented in a north-south direction, wire jumpers are used to connect parts as desired. Before placing parts on the board, the copper foil strips are broken by removing foil to eliminate undesired conducting paths.[3] More details relative to construction and operation can be found on the ARRL Web page dedicated to this project (**www.arrl.org/files/qst-binaries/smart keyer.zip**).

Before placing the parts on the board, use the board and the other parts to mark the location and mounting holes on your enclosure. Mount the jacks, switches, LED, potentiometer and speaker. You can glue the speaker to the panel, as I did, with silicone sealant. I used the same technique to attach the battery holder to the enclosure. Assemble the circuit board. The following steps worked well for me. Place components on the board in the following groups and solder them in place before going to the next group—jumpers, resistors, diode, IC sockets, header, capacitors, the crystal and transistors.

Be careful when soldering the Vero board. I have found solder bridges to be much more likely with Vero board than with a standard printed circuit board. Check the board thoroughly in a good light before proceeding. Do not put the ICs into their sockets yet.

Attach connecting wires to the completed board. I like to connect these to the bottom of the board. Make sure these have plenty of length and that they are marked appropriately. There should be 13 wires attached—S1: 2 (1 plus ground); S2: 1 (share ground with S1); R1: 2; paddle jack, J1: 3 (dot, dash and ground); key jack, J2: 1 (get ground from paddle jack); LED, D2: 2 and speaker, SP1: 2.

Attach the leads from the battery holder to the appropriate point on the board. If you are supplying 5 V (4 cells), then connect them to the two junctions marked for this purpose—near the top of the board. If 2 cells and the MAX660 voltage doubler are used, connect to the 2.5 V connection—near the bottom of the board. You may want to include a switch in your design, as I did. My switch was part of the paddle jack, J1. With the paddles unplugged, my keyer has no power applied. This can prevent battery drain if the keyer is packed away where the switches could be accidentally closed.

Mount the circuit board to the enclosure using 4-40 hardware and threaded 1/4 inch standoffs. Attach wires from the circuit board to the appropriate compo-

[1]Notes appear on page 45.

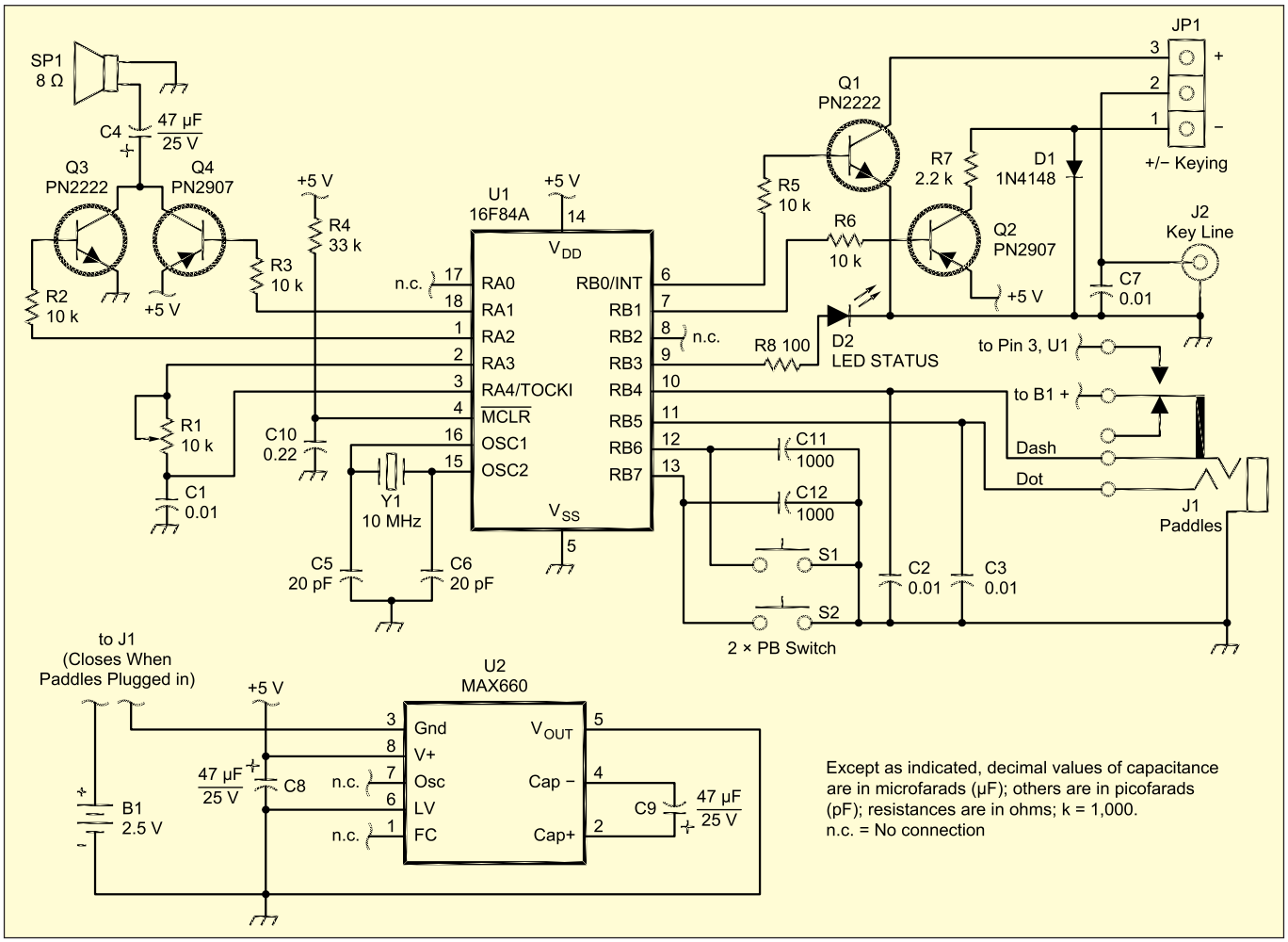


Figure 3—The Smart Keyer Lite schematic and parts list. U2, an active voltage doubler circuit, can be eliminated if a higher battery voltage is used. Battery lifetime in excess of one year is expected, regardless of the battery option selected.

C1, C2, C3, C7—0.01 µF, 50 V ceramic disk capacitor, 5% (Mouser 140-50P5-103K).
C4, C8, C9—47 µF, 25 V electrolytic capacitor, 10% (Mouser 140-XRL10V47).
C5, C6—20 pF, 50 V ceramic disk capacitor, 5% (Mouser 140-50N5-220J).
C10—0.22 µF, 50 V ceramic disk capacitor, 10% (Mouser 581-SA105E224M).
C11, C12—1000 pF, 50 V ceramic disk capacitor, 5% (Mouser 140-50P2-102K).
D1—1N4148 diode (Jameco 36038).
D2—T1 LED (Jameco 34622).
Q1, Q3—PN2222 transistor (Jameco 178511).
Q2, Q4—PN2907 transistor (Jameco 178520).
R1—10 kΩ potentiometer, 1/4 W (Mouser 31CN401).
R2, R3, R5, R6—10 kΩ, 1/4 W resistor, 5% (Jameco 29911).
R4—33 kΩ, 1/4 W resistor, 5% (Jameco 30841).
R7—2.2 kΩ, 1/4 W resistor, 5% (Jameco 30314).
R8—100 Ω, 1/4 W resistor, 5% (Jameco 29946).
S1, S2—Push-button switch (Jameco 164566).
SP1—Speaker, 8-16 Ω (Jameco 88410).
U1—16F84A microcontroller, 18 pin (Jameco 193332). (Unprogrammed. See Note 4.)
U2—MAX660 charge pump converter (Maxim/Dallas).
Y1—10 MHz miniature parallel cut crystal (Mouser 559-FOXS100-20).

Miscellaneous

J1—1/4 inch stereo phono jack with switch (Mouser 161-0087).
J2—RCA jack (Jameco 159484).
JP1—3-pin header (Jameco 109575).
Jumper for header (Jameco 22023).
Knob—(Mouser 450-2034).
18 pin IC socket (Jameco 112230).
8 pin IC socket (Jameco 112205).
Enclosure (Ocean State has a variety).
4-40 spacer (4), 1/4 inch threaded (Mouser 534-1891).
4-40, 3/16 inch machine screws (8).
B1—2 AA cells (or 4 cells, see text).
Battery holder (Ocean State BH321, 2 cell or BH341, 4 cell).
2.2 inch square Vero board (Vero-type board is available from Ocean State Electronics, PO Box 1458, 6 Industrial Dr, Westerly, RI 02891; tel 800-866-6626; www.oselectronics.com; part nos. 12-618, 12-619).

nents. Install the jumper on the 3 pin header to select positive or negative keying, as desired. Note that capacitors C2 and C3 are not mounted on the board. These should be installed at the paddle jack. Before installing batteries, insert the ICs into their sockets and verify pin 1 locations and proper orientation.

Operation

Install the batteries and plug in the paddles. When the paddles are tapped, you should hear the sidetone and dots or dashes. About five seconds after releasing the paddle, you will see the LED wink at you. This is normal and is an indication that the 16F84A is going into *sleep* mode. This will be explained later. Press push button S1. You should hear a message. Press S2 and you should hear another message. Rotate the speed knob to change speed.

The first task will be to calibrate the SPEED control. To do this, we will enter the *setup* mode briefly. Hold the DOT paddle closed and press S1. When the STATUS LED comes on, release both. Now press S1 and release. Rotate the SPEED control until you hear "S" followed by a number between 15 and 35. Rotate the control until you hear "S 25" repeatedly. Now, loosen the set screw on the control knob until it rotates freely on the potentiometer shaft. Rotate the knob until the pointer is vertical and tighten the setscrew. Now, when the pointer is in the vertical position, you will know that

your speed is the same as your center, preadjusted speed. The SPEED control allows you to select speeds within 10 words per minute of the center speed. For example, if the center speed in 20 wpm, then the speed range of the SPEED control is 10 to 30 wpm. Center speed is set in the *setup* routine described below.

The keyer has 5 operating modes: *operating*, *playback*, *load*, *tune* and *setup*. The *operating* mode is just that, the mode in which you use the paddles for keying. The *playback* mode allows you to play back messages by pressing S1 or S2. The *load* mode allows you to replace the message currently in one of the memory bins with one you can key in. The *tune* mode makes continuous keying possible. The *setup* mode activates a 10-step process for setting the options for the keyer. These modes will be described only briefly here; the files are available on the Web site, however, and include more detail.

Setup Mode

The *setup* mode is entered by pressing and holding the DOT paddle, while simultaneously pressing S1. The string of dots will cease and the STATUS LED will light. The 10 steps in the *setup* process are:

1) Sidetone volume, 0-10—hear "V 0-10"

2) Center speed, 15-35 wpm—hear "S 15-35"

3) Right-hand/left-hand paddles (switch paddles)—hear "R" or "L"

4) Message 1 loop delay, 0-40 seconds—hear "D 0-40"

5) Dot memory on/off —hear "E ON" or "E OFF" (meaning dot on/off)

6) Dash memory on/off —hear "T ON" or "T OFF" (meaning dash on/off)

7) Iambic on/off—hear "I ON" or "I OFF"

8) Weight, 30-70%—hear "W 30-70"

9) Character space (space between characters during message playback)—hear "CS 0-10"

10) Word space (space between words during message playback)—hear "WS 0-20"

You are now ready to change the volume of the sidetone. At this point you can choose either to change the sidetone volume or to leave it at its current level and proceed to the next step or to exit *setup*. To leave the volume unchanged and proceed to the next step, press S1. In this way, you can proceed to any step by repeatedly pressing S1, but this must be done before rotating the SPEED control. To exit *setup*, press S2. Rotation of the SPEED control will initiate a change of the current item.

If you wish to change sidetone volume, rotate the SPEED control until you begin to hear, in CW, "V," followed by a number from 0 to 10. The LED will also go off. The list above shows the prompts that will be heard from the sidetone when you elect to change a particular *setup* item. The volume heard in the *setup* mode is the true volume, except when the sidetone is turned off—that is, when a volume of "0" is selected. If set to zero (you hear "V 0"), the sidetone will be turned off, but the volume will remain at a low level during *setup* mode. As you turn the control, you will hear "V 0-10" repeatedly. When you hear the volume you want, press and hold S1 until the LED comes on to accept the setting and proceed to step 2. To accept the setting and also exit *setup*, press S2 or tap a paddle. After audible feedback begins, S1 and S2 have no effect unless they are depressed during the time when the feedback message ends.

Playback Mode

Pressing S1 or S2 while in the operating mode will activate the *playback* mode and will instantly start the corresponding message. The LED will light. Tapping one of the paddles will interrupt a message in progress and will exit the *playback* mode. Message 1 may be programmed to repeat after a delay. The amount of delay before repeating is selected in step 4 of *setup*. Delays between 0 and 20 seconds may be selected. A delay of 0 is interpreted as a nonrepeating message rather than an immediate repeat. If a message is set to repeat, the LED will be continuously lit and the message will continue repeating until a paddle is closed.

Load Mode

To enter the *load* mode, first play either of the two messages, then, as the message is playing, press and hold the button corresponding to the message to be loaded until the message completes. Note that since message 1 may be a repeating message, it may be necessary to play message 2. The LED will remain lit, indicating that the *load* mode has been entered. At this point you can key in the message. When finished, press either S1 or S2 to exit the *load* mode.

Tune Mode

To enter the *tune* mode, press the DASH paddle and hold it while pressing S2. The LED will light. At this point, pressing S2 will cause a key-down condition for tuning. To exit the *tune* mode, press S1 or tap either paddle.

Operating Mode

The *operating* mode requires little explanation. You will note that after operating the keyer and pausing for about 5 seconds, the STATUS LED will wink briefly. This is a signal that the 16F84A has gone into "sleep" mode. This is normal and will happen each time there is a pause. The LED will also blink for 5 ms. When an action resumes, the 16F84A awakes in less than a microsecond. The 16F84A draws less than 1 µA while it is asleep.

Finally...

The design effort turned out to be bigger than anticipated but I am pleased with the results. I hope that you will enjoy using the *Smart Keyer Lite* as much as I have enjoyed designing it. I found the current drain to be extremely low, about 70 µA while the processor is sleeping. Almost all of this was consumed by U2. A unit using a four cell supply, without U2, draws less than 1 µA when asleep. In the key-down condition, any of these options draw about 3 mA from a 5 V dc source. I expect about two years of battery life from mine. I have operated my own *Smart Keyer Lite* for about two months and have not discovered any bugs. If you find any bugs in the completed keyer, please report them to the author. A kit containing most of the parts to build the keyer is available from the author.[4]

Notes

[1]A simple keying relay can be used to key cathode-keyed transmitters. See S. Karty, KD4VRS, "The Dangers of Cathode Keying," *QST*, Nov 2003, pp 28-30.—*Ed.*

[2]Maxim Integrated Products, Inc, 120 San Gabriel Dr, Sunnyvale, CA 94086; 800-998-8800; **www.maxim-ic.com/samples**.

[3]A shallow pilot hole made with a drill bit slightly wider than the foil strip can be used in a Vero board hole to easily cut the copper foil at that point. This has worked for the editor for years.—*Ed.*

[4]The author will supply a basic kit of essential parts, less the MAX660 IC, enclosure, speaker and battery supply, but including a programmed 16F84A µcontroller for $35, including shipping. A programmed 16F84A alone is $13, also including shipping. Contact the author at 1304 Toney Dr, Huntsville, AL 35802 or at **n4yg@hiwaay.net**.

Joe Lunsford, N4YG, was first licensed as WN4RUF, in 1969. He is an avid CW operator, who enjoys a good ragchew, but in prior years he's also chased his share of DX. Joe has designed a dozen or more keyers, and is responsible for the Smart Keyer series, popular during the 1980s and '90s and advertised in QST *and* CQ *of that period. He also designed the Smart Filter, a switched-capacitor filter still in use by many hams (including this editor). Now retired, he spends more time operating the bands, but still manages to design. Other activities include playing golf and enjoying his two granddaughters, not necessarily in that order! Joe has held an Amateur Extra class license for 26 years and has a Master's degree in EE. You can reach him at 1304 Toney Dr, Huntsville, AL 35802;* **n4yg@hiwaay.net**.

By John Ceccherelli, N2XE

The Dipole Dilemma

A successful QSO from a wilderness location is, more often than not, dependent on the antenna.

Erecting a dipole in the wild presents some challenges. Assuming you arrived at your destination under human power, you've brought everything you need—except the tower. Most people rely on natural structures for obvious reasons. This presents a huge problem when the destination is a high summit with a great view. That great view usually means no trees—the dipole dilemma.

The dipole is about as close to the perfect antenna as one can imagine. It has a little gain on the broadside and some useful nulls on axis. Get it up to a reasonable height and it presents a good match for coax and rig. It's light, simple, compact and foolproof. The dipole works well in many compromise situations and can be used in multiple configurations including as a flattop, inverted V, sloper and L. You can let the ends droop with reckless abandon and not suffer much performance loss.

Figure 1—The quintessential "dipole dilemma" location. The peak in the foreground is a favorite operating location. Unfortunately, none of the trees on top are over 6 feet tall.

Great Location, No Trees

The example shown in Figure 1 is typical of the dipole dilemma. Its features are a gorgeous knob longing for a radio setup and not a usable tree over 6 feet high. I suppose you could erect the dipole anyway and rationalize that it's really 1000 feet above average terrain. This has some merit as the radiation pattern is enhanced. The feed-point, however, does notice the ground right underneath. The radiation resistance of a low dipole may deviate markedly from 50 Ω. Simulations show that a low dipole should work fairly well, but I've never had very good luck with one.

A 33 foot telescoping fiberglass pole as a center support actually works well, but the pole weighs about 3 pounds and it's difficult to erect solo. If you've resigned to hauling another 3 pounds, you might as well engineer something more manageable than a 33 foot noodle.

The $^1/_4$ wave vertical antenna can perform well if it has an adequate ground system. Although verticals have a reputation for radiating equally poorly in all directions, they work very well in certain applications—near salt water is a well-understood example. Ground loss usually prevents a vertical from outperforming a dipole—even a low one. But a vertical will provide respectable performance and it's a whole lot easier to erect on a rocky summit.

QRP—It's Not Just Wimpy, It's An Education

I get a lot of flack for operating QRP mobile. My rig of choice is the Small Wonder Labs DSW. With 2 W out and no automatic gain control, it's a fun rig. After several thousand miles driving up and down the hills in the northeast US, it became clear that signals improved at the top of a hill. A vertical antenna on a high summit seemed to be a reasonable idea.

Some backyard testing confirmed that a Hamstick with counterpoise worked better than it does on my truck. A few trips to some local summits also confirmed that a Hamstick could pump out a respectable signal. With the stinger removed, the pieces are 4 feet long, a tad awkward for backpacking. It could be improved.

What Does the Simulation Say?

Experience suggested that a vertical outperformed a low dipole on hilltops. Rather than rely on anecdotal evidence, I turned to *EZNEC* for some answers. Figure 2 compares a flattop 20 meter half wave horizontal dipole up 33 feet with an inverted V and a half wave dipole 8 feet above flat ground. I consider the half wave dipole up 33 feet to be the gold

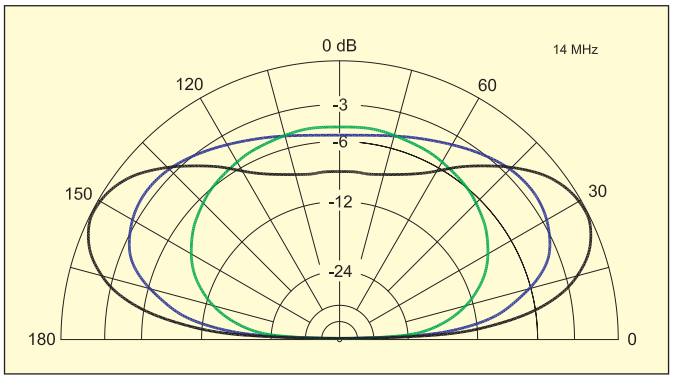


Figure 2—Comparison of 20 meter dipole antennas. A flattop horizontal half wave up 33 feet is shown in black. An inverted V up 33 feet is shown in blue. The flattop horizontal half wave up 8 feet is shown in green. All simulations are with poor conductivity soil.

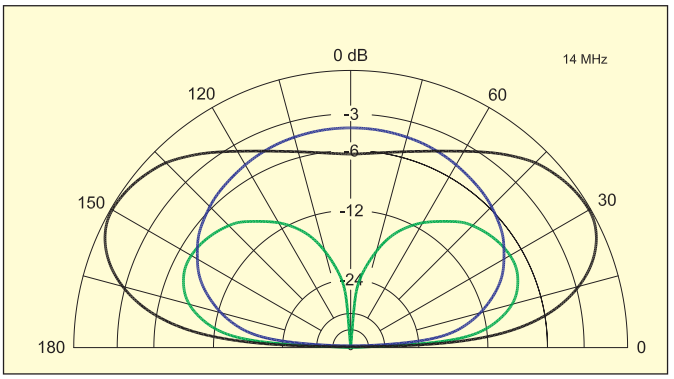


Figure 3—Comparison of the inverted V up 33 feet (black) with the low flattop horizontal dipole up 8 feet (blue) and the 1/4 wave vertical (green). All use the poor conductivity, flat ground model.

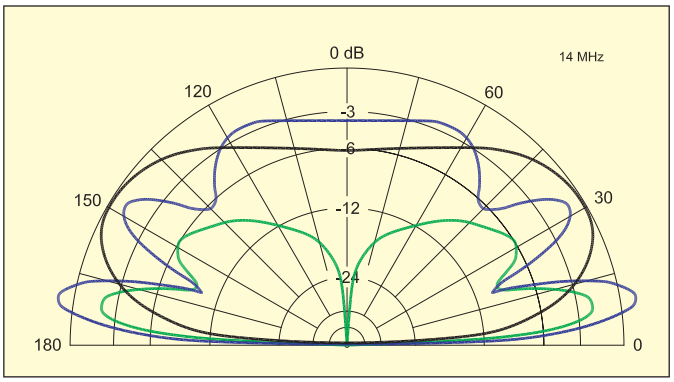


Figure 4—Comparison of the inverted V up 33 feet (black) with the low flattop horizontal dipole up 8 feet (blue) and the 1/4 wave vertical (green). The inverted V is over flat ground for reference, the low dipole and vertical are over poor conductivity using the hill summit ground model.

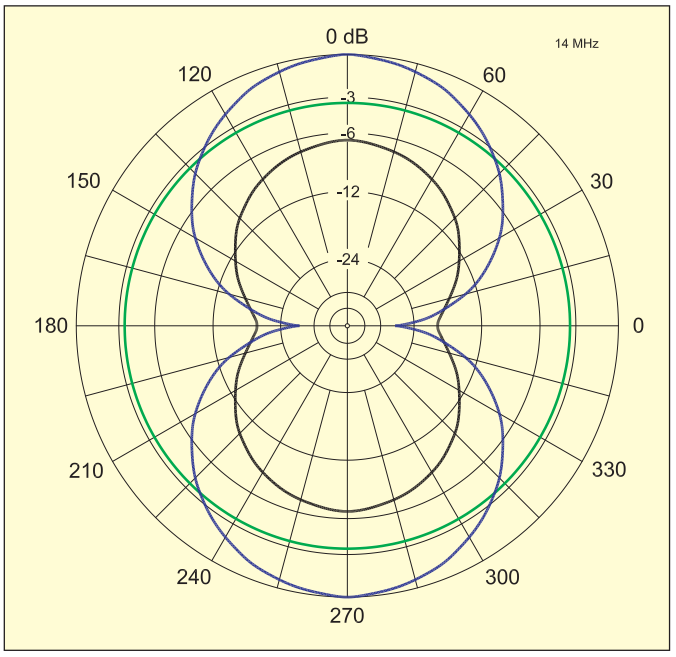


Figure 5—Azimuth pattern (10° elevation) of the inverted V over flat ground (black) and the low dipole (blue) and vertical (green)—both using the poor conductivity hill-summit ground model.

standard. It's hard to get any better than that on a backpacking excursion. The inverted vee, while not quite as good, is probably a more achievable configuration than the flattop, so that will be the 0 dB reference in the following figures. The dipole, even 8 feet up, is often difficult to install on a rocky barren summit. As Figure 2 shows, it doesn't radiate very well either.

Figure 3 shows a 20 meter 1/4 wave vertical compared to the inverted V and low dipole over poor mountain soil. The vertical is about 2 dB better than the low dipole for radiation angles below 30°. The 2 dB difference is hardly noticeable and experience shows the vertical can outperform the inverted V by an S-unit or more at times, so something is amiss.

Ground Model

Correlating real life to a simulation can be frustrating. The most obvious problem with the previous simulations is the ground definition. Lobe elevation is determined by ground reflections away from the antenna. Vertical antennas are more sensitive to ground interaction up to 100 wavelengths away for low angles.

Unfortunately, it's not easy to simulate a hill with *EZNEC,* but a wire grid ground model might give a clue as to why the vertical seems to perform better than the simulation indicates.

Figure 4 shows the same antennas as Figure 3 but with a "hill" (30° slope and only 83 feet high due to *EZNEC* segment limitations) underneath them. The vertical exhibits a tremendous increase in low angle radiation. The low dipole exhibits even greater low angle radiation and it shows a nice lobe at 32°. Is the simulation accurate? Almost certainly not, but it does suggest that low angle radiation improves markedly for antennas on top of hills. This correlates well with my mobile experience but fails to explain why the vertical seems to do so well.

Azimuth Pattern

While the vertical does not show better simulation performance broadside to the low dipole, it does radiate equally in all directions. If the received signal is on (or near) axis to the dipole, the vertical will be a much better performer. Figure 5 shows the difference in azimuth pattern of the three antennas. This

helps explain some of the positive field experience.

Polarization

The only other plausible explanation for the good field performance of the vertical is polarization. It's generally accepted that sky wave signals are randomly polarized.[1] In theory, a perfectly cross polarized signal would induce no energy into a linearly polarized antenna.

In side by side tests with a dipole and the vertical, the dipole usually wins on short skip (high angle sky wave) and it's a toss-up on DX (low angle sky wave). But when the vertical is better than the dipole, it's a lot better. Maybe sky wave signals are randomly polarized, but my guess is they're slanted toward vertical polarization more often than not.

I trust *EZNEC* more than my limited amount of testing. Maybe my judgment is a bit colored by the vertical's ease to erect. I also suspect that since my vertical was constructed by myself, psychologically, it just seems to work better than a low dipole. At least the simulation indicates that in some cases, it actually does.

The Fly Rod Vertical

Many hams I know are also fly fishermen, and some are not very good ones. As such, there's an ample supply of fly rod tubes available—the fly rods long since destroyed by car doors or other rod enemies. Some of these same folks have a similar track record with Hamstick antennas. This makes for a cornucopia of parts suitable for homebrew vertical antennas. Throw in some aluminum tubing, some leftover Hustler parts, and a really nifty, compact and portable vertical antenna is possible. The fly rod tube serves as both container and part of the radiating element.

I'm on version 3 of the fly rod vertical (FRV) as shown in Figures 6 and 7. Each version has gotten a progressively longer mast and a fatter, but shorter, carrying tube. Each version has tried to improve portability, ruggedness and performance and version 3 is close to optimum for my use. The mast is four sections, each 2.5 feet long of $^1/_2$ inch OD, 0.083 inch thick

[1]B. Sykes, G2HCG, "The Enhancement of HF Signals by Polarization Control," *Communications Quarterly*, Nov 1990 (Reprinted from *Practical Wireless*).

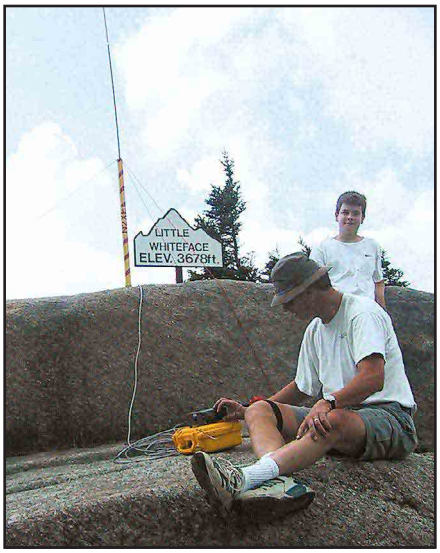


Figure 6—The Fly Rod Vertical in action on the summit of Little Whiteface Mountain near Lake Placid, New York. N2XE is operating an Elecraft K1 while son Greg keeps onlookers from tripping over guy lines.

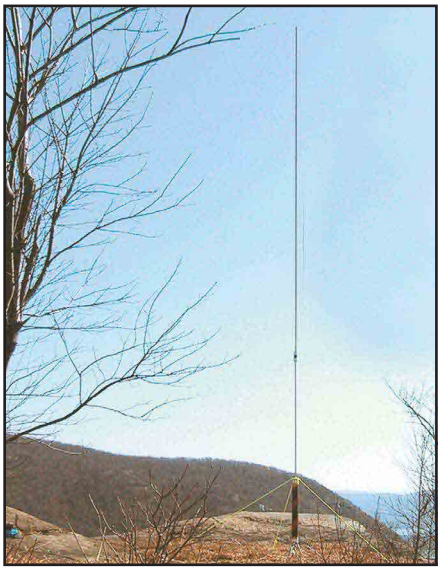


Figure 7—The FRV is setup on that gorgeous knob shown in Figure 1. The FRV is set up for 40 meter operation. The antenna stands 17 feet tall in this configuration.

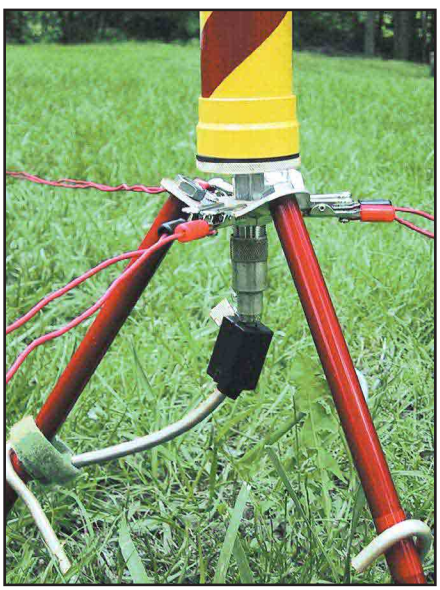


Figure 9—Bottom detail of the fly rod vertical. Note the nylon washer isolating the ground radial and tripod system from the active element. The triangular plate with the tripod legs is a Hustler VP1 tri-band adapter.

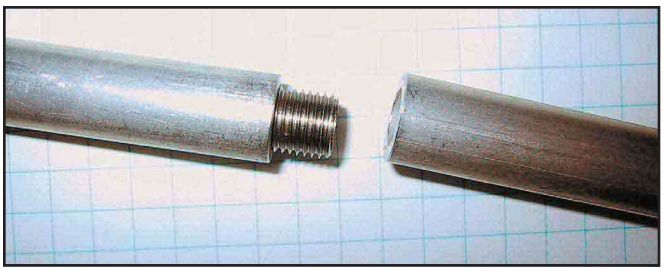


Figure 8—The FRV mast section connection. A 1 inch long, $^3/_8 \times 24$ TPI stud is on one end secured with Locktite (or strike with punch). The receiving end is tapped and the sections simply screw together.

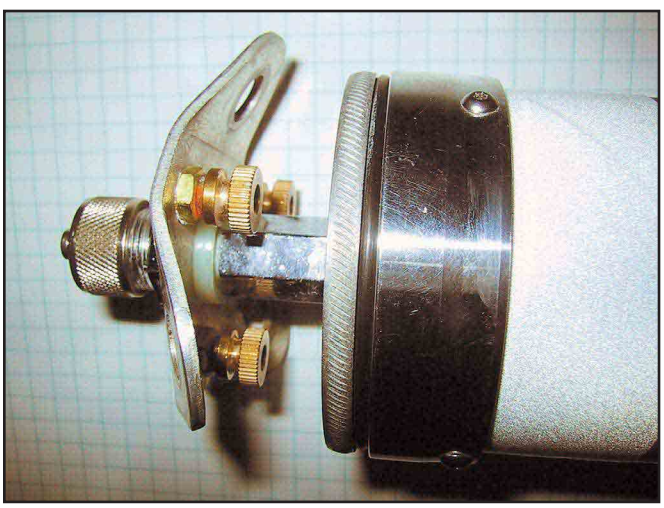


Figure 10—The FRV RF cap assembly and tube with collar. Note the screws on the collar that provide good electrical contact from the collar to the tube.

walled aluminum tubing. The same tubing is used for the 10 inch tripod legs. All tubing is attached with 3/8 inch, 24 TPI studs (Figure 8). This also makes it easy to use Hustler resonators for any band. I suppose there are many different ways to make a mast but I've found that the thick wall, 1/2 inch tubing is about the minimum that can survive the high winds often found on hilltops.

Aside from the mast, the only other tricky part of the FRV is the tripod stand and RF feed arrangement. The tripod base is a Hustler VP-1 multiband adapter, originally intended to attach many Hustler resonators to a single mast. The center hole needs to be drilled out to 1/2 inch diameter to accommodate the insulating nylon washer (see Figures 9 and 10). An SO-239 antenna stud attaches to the VP-1 so that the VP-1 is on the shield side of the coax (ground) and the threaded tube cap is the hot side.

The tripod legs are made in the same fashion as the mast with 3/8 inch studs tapped into the tubing. Use a nut, finger tight, to attach the legs to the VP-1.

The Tube

If you're not a bad fisherman and don't know any, you can procure a fly rod tube brand spanking new. The best fly rod tubes in existence, in my opinion, are those made by REC Components (**www.reccomponents.com**). My latest version of the FRV uses a custom tube from REC. I had them make a tube with a screw cap and collar on both ends for a couple of reasons: the cap and collar is stronger than the plain end cap and it's much easier to attach the 3/8 inch long nut on the mast side of the tube. The cost was about $50, easily making the tube the most expensive component.

Figure 13—The disassembled Fly Rod Vertical. If you use a fat 2 1/2 inch diameter fly rod tube, you can stuff it all in, including the feed line.

Since the collar is glued to the tube, you need to ensure good electrical contact. Three 4-40 screws, drilled and tapped into the collar will suffice (see Figure 10).

Since the mast (including the carrying tube) is 12.5 feet tall, a Hustler 17 meter resonator is needed to tune the vertical on 20 meters. In this configuration, and using low loss coax, my Elecraft K1 has no problem using its internal tuner to cover the 30, 20 and 15 meter bands. This may not be the most efficient way to operate but I've always been able to work what I can hear on those bands. In addition, you don't have to waste time switching resonators for band changes.

For 40 meters, the FRV needs either more metal in the air or some inductance to tune it to resonance. Figure 7 shows the FRV with a resonator made on a PVC tubing form.

Ground Radials

Probably the most confounding issue with vertical antennas is ground. The simulations show the ground scheme to be highly significant. In practice, I find it's not that big of a deal. As long as you're willing to accept that your antenna is only 60% to 75% efficient, you have a lot of latitude with the ground configuration. I've settled on six 20 foot wires. I've tried many different lengths and it just doesn't seem to make much difference. The ground wires are attached to the VP-1 with alligator clips and evenly fanned out as shown in Figures 9 and 11.

Figure 11—Close view of the FRV guy and ground wires. The ground consists of six 24 gauge, 20 foot wires attached to the VP-1 with alligator clips (two ground wires per clip).

Figure 12—N2XE working the Empire Slow Speed Net on 80 meters with the FRV in the rain-soaked Shenandoah Valley of Virginia. The signal report was 579 with 20 W from a Ten-Tec Argonaut 5. Not too shabby. The FRV blends in with the trees well and is difficult to avoid at night, even with a flashlight. The spiral reflective tape was added shortly after this trip.

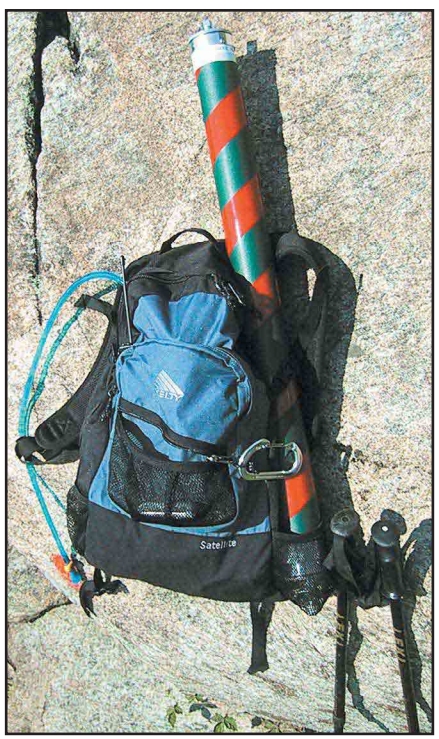


Figure 14—All packed up and ready to go home.

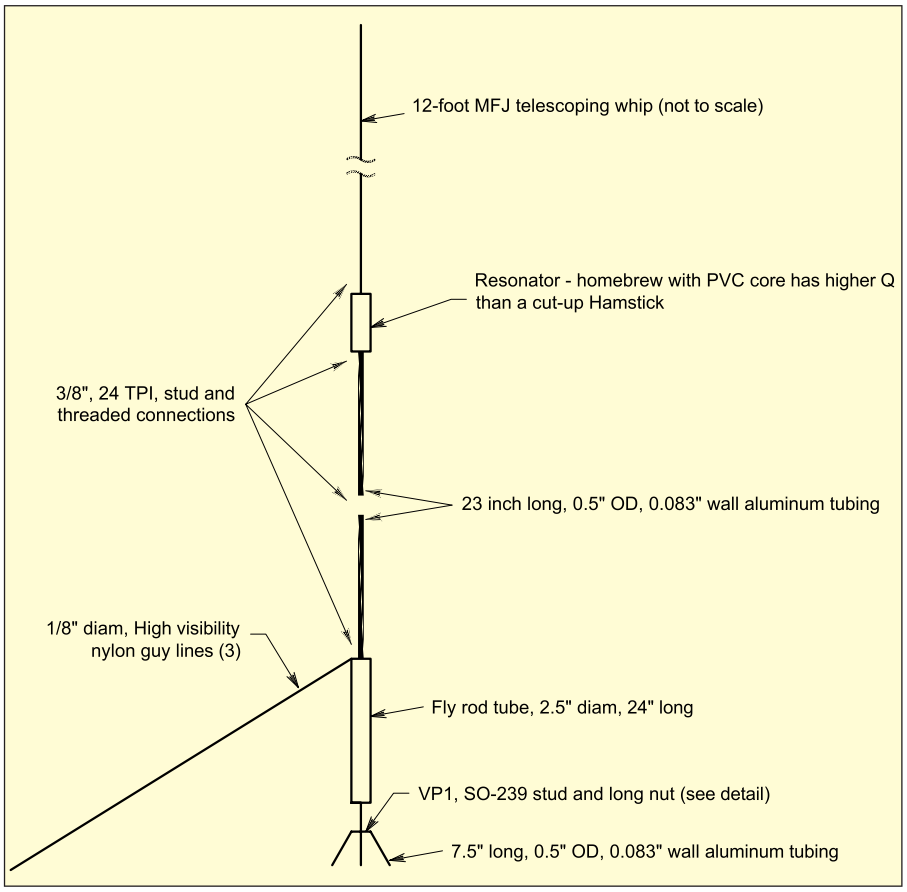


Figure 15—Detailed layout of fly rod vertical.

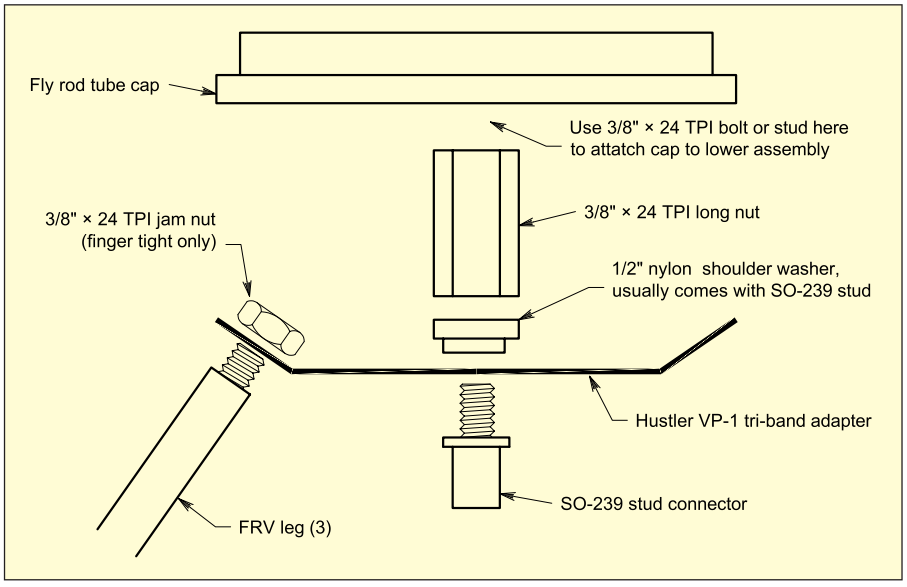


Figure 16—FRV base and tripod details.

A ground-mounted vertical should exhibit a feed-point impedance of about 36 Ω with a perfect ground. Mine always measure around 50 Ω so the difference must be 14 Ω—11 Ω of ground resistance and the rest, the loading coil loss. That's great for SWR but it means the efficiency is only about 70% and at the full QRP gallon, 1.4 W is keeping the coil and earthworms warm.

I'd much rather have a 36 Ω feed point impedance and a 1.5:1 SWR, but the excellent coax match allows me to use a 20 foot RG-178 feed line without much guilt. In addition, RG-178 stuffs into the tube nicely.

Finishing Touches

A good FRV would not be complete without a candy cane spiral of reflective tape. The spiral started out as a whimsical decoration. The last version I constructed had a beautiful green powder coated tube, and my wife convinced me not to spoil its crisp, clean appearance. On a recent camping trip (see Figure 12), however, everyone kept tripping over it in the dark. The reflective tape spiral has become an absolute necessity.

The Acid Test

Field experience with the FRV has been very good. The simulations indicate it should be a decent performing antenna, particularly on hilltops. Then again, stories of working rare DX with a light bulb are not uncommon. With that in mind, I had to put the FRV through a challenging test.

On July 12, 2003, I ventured back to the hill in Figure 1 with only a 40 meter Rock Mite and the FRV. Only 400 mW, no VFO, 72% antenna efficiency (worse on 40 meters) and RG-178 feed line seemed to be a pretty stiff test. Just to make it interesting, Mother Nature had the sun burp up a few flares, and the planetary K index was 7.

Undaunted, I trudged up the 1000 vertical feet and set up. Working less than half a watt, the best strategy is to listen so I listened. The band was not active. I did hear a few stations way off frequency. Two stations did call CQ on the Rock Mite frequency and I worked both Dennis, K1LGQ, with his Elecraft K1 and Brian, N1BQ, both in Maine and about 250 miles distant from me. I don't think a light bulb would have fared as well.

I've built several of these fly rod verticals and they perform quite well on all bands between 80 and 10 meters. Figures 13-16 provide the construction details. At 3 pounds, the FRV is heavier than any rig and battery I'm likely to put in a backpack but it has great potential to be optimized for weight.

The FRV sets up easily and is convenient to strap to a backpack. It doesn't exactly solve the dipole dilemma, but it does make it easy to get on the air.

All photos by the author.

John Ceccherelli, N2XE, loves QRP, CW and backpacking with both. When not on the air, John spends his time attempting to trisect angles, researching communication minutiae and collecting slide rules. He is a Senior Engineer for IBM in Hopewell Junction, NY and lives in nearby Wappingers Falls, NY. You may contact John at **n2xe@arrl.net**.

By William Baker, W1BKR

Amateur Radio is Part of New Media Task Force

While America profoundly felt the pain of September 11, 2001, we at Thirteen/WNET, the flagship PBS station in New York, suffered the added burden of knowing our transmitters were at the epicenter of the catastrophe. Our transmitter engineer, Rod Coppola, KA2KET, was lost at his post atop Tower One of the World Trade Center while attempting to keep us on the air in the face of insurmountable odds.

Before the smoke had even cleared, our staff at the studio location, about a mile away on West 33rd Street rallied into action, offering our facilities to the Red Cross, the Mayor's Office of Emergency Management, our colleagues in New York public radio and others who were providing aid or had been displaced.

In the days immediately following the disaster, our amazing technicians got our signal up on cable and through a makeshift backup transmitter in Alpine, New Jersey. Right away we got to work producing and airing special programming to provide insight, help, direction and hope to our community and to America at large.

Many saw those programs on cable, yet millions in the New York metropolitan area were unable to receive our broadcast signal from the shorter antenna tower and low-power backup transmitter. That left them cut off in a time of crisis, unable to receive important newscasts and programming—not only from Thirteen/WNET, but also from our commercial colleagues across the region. The World Trade Center was home to one of the world's largest consolidations of television transmitters, with a total ERP of 9.4 million watts. And, with five digital transmitters already on-line, it had become the key platform for launching our city into the new era of digital television. So the destruction of the Twin Towers was truly devastating to New York media and the millions who depend on it.

Almost a year later, the FCC called together the broadcasting and communications industries of the nation to create a unique task force to ensure the public will never again be without the critical benefit of radio and television in times of crisis.

The result was the formation of the Media Security and Reliability Council (MSRC), a Federal Advisory Committee comprised of broadcasters, cable, satellite and other communications entities working with the federal government. The goal of the MSRC is to prepare a comprehensive national strategy for securing and sustaining broadcast and multichannel video programming distribution (MVPD) facilities throughout the United States during terrorist attacks, natural disasters and all other threats or attacks nationwide.

I am a member of the MSRC, and in working with my colleagues to make recommendations for helping the public in times of emergency, my mind naturally turned to Amateur Radio. In contemplating the media needs America may face during a future crisis, I hear the ham operator's credo—"when all else fails—Amateur Radio"—resonating loud and clear.

Of course, public and commercial broadcasters have immense capability, backup and resources. But September 11 taught us that even those can fail. What can we do during times when even our most powerful media channels are incapacitated?

I have proposed that Amateur Radio can play a critical role, and I'm pleased to report that my colleagues happily embraced the suggestion, including the following statement in their preliminary recommendations:

"Radio and television stations should have the ability to access alternate telecommunications capabilities. These may include: satellite phones, Amateur Radio facilities in studios, and alternate 450 MHz communication repeater sites with portable handheld units."

In addition, the committee's recommendations contain numerous proposals for redundant facilities, and I believe there may be an important role for Amateur Radio to play in that area as well.

Moreover, committee members told me they welcome amateur operators and view them as a resource in times of crisis. I was delighted by the esteem so many held for ham radio operations. Bob Ross, who is senior vice president for East Coast Operations at CBS, told me he has offered his transmitter and antenna sites when possible or practical to amateur groups to keep them close at hand and that he respects the value the amateur community can offer.

Public broadcasters have said the same. Thirteen/WNET's sister station WLIW21 in Plainview, Long Island has offered its tower, located at the highest point on the huge island, to an amateur repeater for many years.

Thirteen/WNET also has an amateur station donated by the family of a Silent Key. At Thirteen/WNET's main studio on West 33rd Street in Manhattan (also home of the Associated Press and the *New York Daily News*), we operate a G5RV antenna located on the roof of the building next to the microwave and satellite dishes used for television transmission. Our super ham and chief operator is Eric Spiegel, KE2EJ. He also set up a repeater on the Empire State Building, home of Thirteen/WNET's main analog transmitters

This is the perfect time for organized, thoughtful amateur groups to come forward with ideas and reasonable requests to broadcasters. Keep in mind that these broadcasters are under no obligation to cooperate, and even the most enlightened of them will often be unable to participate due to security issues and other factors. But, in those situations where it is possible, we can envision a uniquely American union of citizens, corporations and government that will show the strength of Amateur Radio to all. Let's take advantage of this excellent opportunity to let America know that we in the ham radio community will always be there, even in the most trying of circumstances—no matter what.

After 9/11, the Thirteen/WNET antenna was moved to the top of the Empire State Building.

William Baker, W1BKR, is president of Thirteen/WNET New York, America's flagship PBS station. You can contact the author at 2 Highgate Rd, Riverside, CT 06878-2611; **w1bkr@arrl.net**.

By Joel P. Kleinman, N1BKE

Joe Walsh, WB6ACU — No Ordinary Average Ham

I'm just an ordinary average guy
My friends are all boring
And so am I
We're just ordinary average guys.

~From "Ordinary Average Guy," by Joe Walsh

Well, yes and no… Although his experiences through several decades as storied rock singer/songwriter might lead you to expect something entirely different, Joe Walsh, WB6ACU, does seem like a pretty ordinary guy. When the Eagles guitarist, solo artist, songwriter—and longtime ham—graciously took a few minutes to talk during his first visit to ARRL HQ and W1AW on March 6, he was soft-spoken, unpretentious and eager to put in a good word about his favorite hobby. There's more about the visit of Joe Walsh and Bob Heil to ARRL Headquarters on the ARRLWeb (**www.arrl.org**).

What was your biggest surprise when you first saw the ARRL HQ building and W1AW?

I didn't realize there was that many people involved. I thought it was a nice station in an old vintage building and some offices where they put together the magazine. [I had] never thought about overseeing the volunteer infrastructure and all the rest of what goes on here, like the QSL Bureau and awards certificates. The people here aren't here for the money. They're dedicated people, I can see that—it's a real team. I have to look at the League a little differently—I took a lot of it for granted. I wish every ham could come here and visit.

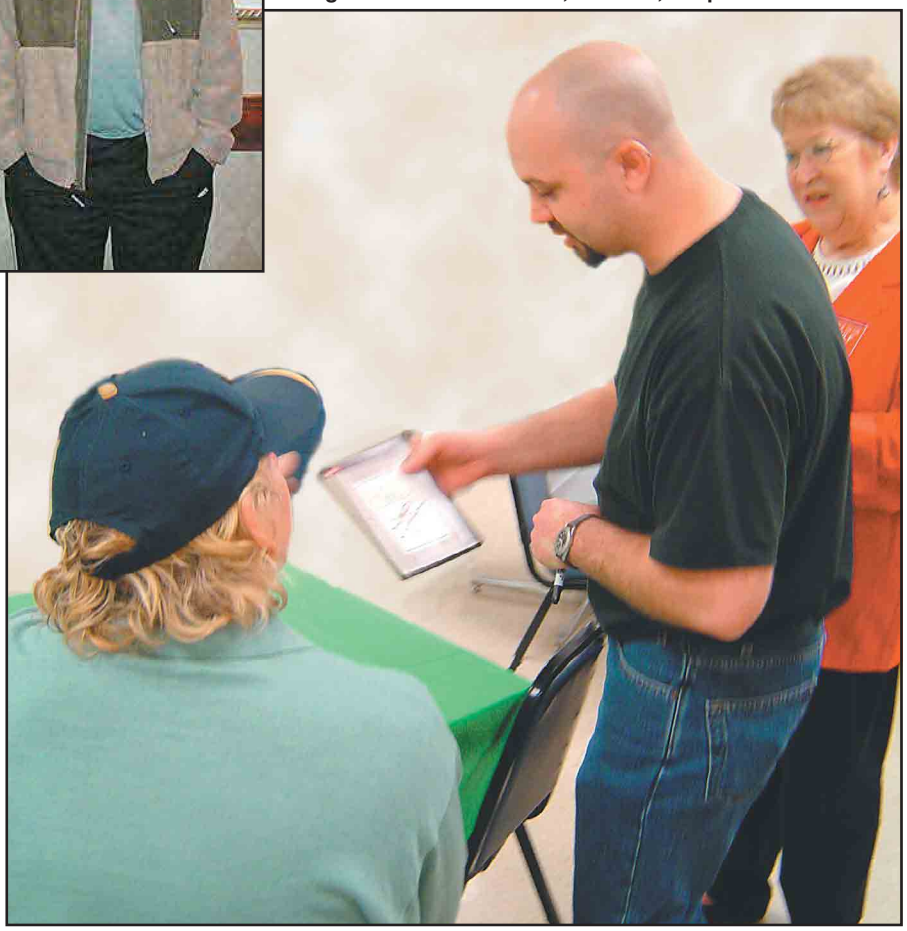
[Some hams say] the League doesn't care about this or that…I want to say to them, "Hey look—come here and meet the people that work here. You'll look at

During their tour of the ARRL HQ building, the noted microphone designer Bob Heil, K9EID, and Joe Walsh, WB6ACU, met ARRL staffers, including Senior News Editor Rick Lindquist, N1RL (right).

JOEL HARRISON, W5ZN

Joe and Bob, flanking ARRL Chief Executive Officer David Sumner, K1ZZ, were the guests of honor at a donor reception Friday evening.

ARRL staff also had a chance to meet Joe at an autograph session Friday afternoon. Dan Wolfgang brought along an Eagles DVD. Helen Dalton, KB1HLF, is up next.



it in a whole new way." There isn't a person in there who wouldn't jump right in to help me in some way—and not because I'm a celebrity in some circles.

What did you enjoy the most about your visit?

Meeting the people, one on one, shaking hands. When you get on the air and become buddies and meet at Dayton, you say, "How could that voice come out of *you*—you're not supposed to look like that!" It's the same thing with the League—you don't know what you'll find until you get here. [After touring ARRL Headquarters] you can really appreciate the League.

What was your first station like?

I was licensed as WV2KAC in 1961 in Queens, New York. I had one crystal on 7152, a Heath DX-20 and a BC-348 [a WW 2-era receiver]. I got my General later on, and have been on the air on and off ever since.

Joe enjoyed working the ARRL International DX Phone Contest from W1AW.

What effect has Amateur Radio had on your life?

Amateur Radio has done nothing but make my life more fun, more interesting. I have friends around the world. And they *stay* friends, you know?

What's your most memorable ham radio experience?

Ali, A61AJ, in Dubai invited us over a few years ago. John Brosnahan [WØUN] was there. We operated the CQWW Phone Contest. It was my first big contest. For the first time, I *got* it—I got to grasp the rush and excitement, being the object of a pileup. He's got quite a contest station.

What have you been up to recently, ham radio-wise?

I joined the Southern California DX Club—it's a really good club. I'm going to hang out with those guys. I've still got a lot to learn.

Photos by the author except as noted.

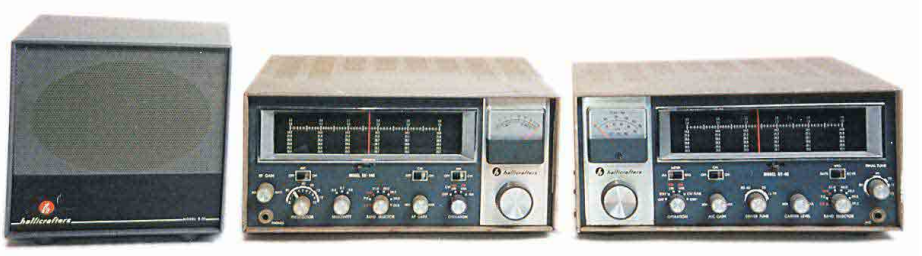
By Louis L. D'Antuono, WA2CBZ

The Halli-Twins

The Hallicrafters SX-146 receiver and HT-46 transmitter were quite a pair in their day.

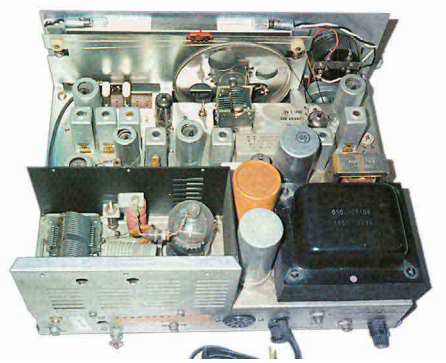
Even before I received my Novice license in 1975, I decided to select a communications receiver for my station. I went down to Harrison Radio in New York City to purchase a used model. After I reviewed a number of popular units, the salesman suggested I purchase a Hallicrafters SX-146 receiver. He explained its usefulness for code practice and sideband reception because it featured a product detector. After surveying a number of *QST* past issues, I learned that it had been manufactured by Hallicrafters in late 1965 and first advertised in said magazine in January 1966.

At the same time, Hallicrafters produced a companion transmitter, the HT-46, which I subsequently bought in 1976. These units formed the basis of my first amateur station and they always performed excellently whenever I used them. Higher priced models did perform better, but for compactness, versatility and simplicity, the SX-146 and HT-46 are exceptional.



The SX-146 and HT-46 can be coupled together to share a VFO for transceive operation.

The SX-146 covers all frequencies between 2 and 30 MHz with an external oscillator, with the exception of the rig's intermediate frequency of 9 MHz.



Rated at 175 W PEP on SSB and 150 W on CW, the HT-46 uses a 12HY7 driver followed by a 6HF5 power amplifier.

The Receiver

The SX-146 is a single conversion receiver that was designed primarily to cover the 80 through 10 meter ham bands. It utilizes nine vacuum tubes and a silicon diode power rectifier.

Aside from its ham band coverage, the radio can cover any frequency between 2 and 30 MHz with an external oscillator, with the exception of 9 MHz. The intermediate frequency is 9 MHz, which virtually eliminates images.

It uses a slide rule dial that is nearly linear on all bands. The only unusual feature of this dial is that while the 80 and 40 meter bands tune from left to right, the 20, 15 and 10 meter bands tune from right to left because of the heterodyning frequency conversion. The receiver also features a vernier tuned preselector.

The Transmitter

The HT-46 transmitter is a mirror image of the SX-146 receiver and serves a dual purpose. It can be used as a standalone transmitter or in conjunction with the receiver. It can also function as a transceiver with the SX-146 by using that radio's internal oscillator. There is a front panel slide switch that selects either of these choices. Before transceive operations are accomplished, a slight internal adjustment is required. Alongside this switch, there is a calibration slide switch that provides a low level signal for zero beating. In terms of power input, the transmitter is rated at 175 W PEP on SSB and 150 W on CW. The transmitter uses nine tubes and a silicon rectifier power supply.

Performance

Both of these units performed superbly the first time I fired them up. The initial thing I noticed was that the product detector made copying sideband and deciphering Morse code easier. The stability was good and the selectivity provided by the standard crystal filter was impressive. At certain times, though, I wished for greater sensitivity to copy DX. To solve the shortcoming of the main tuning knob's small size, I substituted a larger National brand knob and raised the height of the receiver.

The transmitter performed just as well as the receiver. All of the signal reports I received were satisfactory, although I often toyed with the idea of using a linear amplifier for DX. An Ultimate Transmatch solved the problem of the antenna impedance matching capability that was lacking because of its fixed loading output.

With today's increased practice of split frequency operation, these radios will not miss a beat, and it's easy enough to switch between running in transceive mode or separate units.

All photos by the author.

Louis D'Antuono, WA2CBZ, holds an Amateur Extra license and teaches social studies at James Madison High School in Brooklyn, New York.

By Joel P. Kleinman, N1BKE

The ARRL at 90

On May 18, 1914, Hiram Percy Maxim and Clarence Tuska founded the American Radio Relay League. This decade by decade look covers a few of the events that shaped the ARRL and the Amateur Radio Service.

When the League was founded on May 18, 1914, as Europe was about to move toward war, the world was shrinking rapidly as wireless experimenters progressed from dimly lit workshops to real world applications. An article in the April 1914 issue of *The Electrical Experimenter* entitled "Marconi Lights a Lamp Six Miles Away" read, in part:

> It is announced that Sig. Marconi has succeeded in lighting an electric lamp by electricity through the agency of wireless at a distance of six miles. A bulb was attached to a receiver connected with an aerial receiving wire. The transmitter was linked up with a 100-horsepower apparatus, and as soon as the power was applied the lamp lighted and remained lighted so long as the power was kept on.[1]

The article also included this note of controversy:

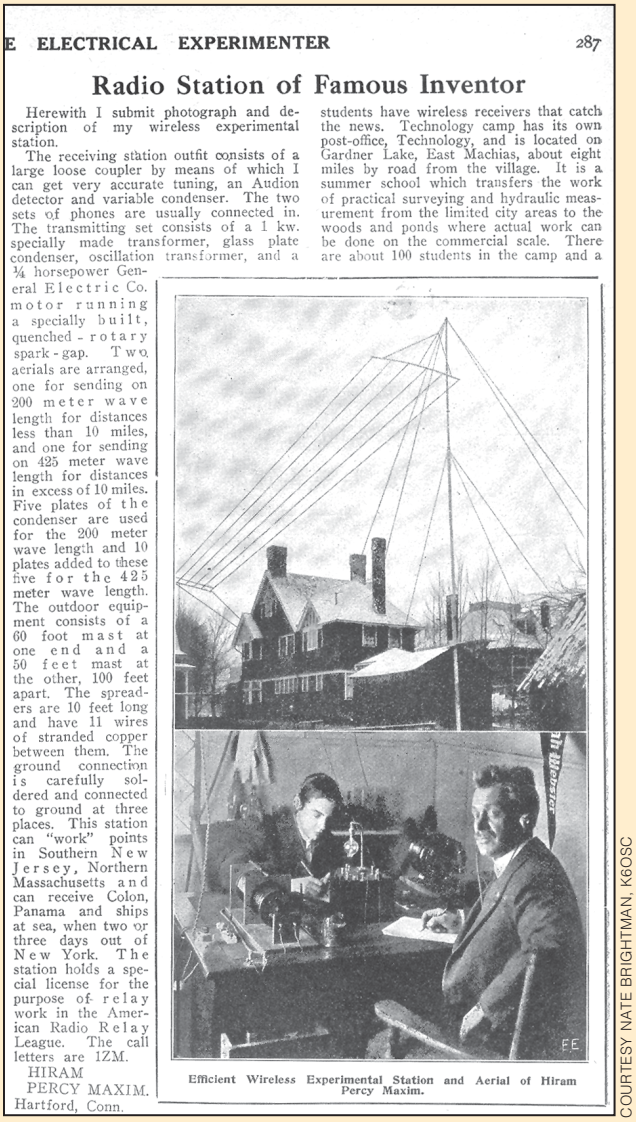
> Nikola Tesla, who, 10 years ago was called the father of wireless telegraphy, said recently that he did not believe Sig. Marconi had been able to light an electric lamp by wireless at a distance of six miles.
>
> "Not that it cannot be done," said Mr. Tesla. "I have done it myself. I did it about 14 years ago, when I lighted electric lights at some distance from my laboratories without the means of wires. But I think Sig. Marconi's plant is not sufficient enough to accomplish any such result."

At the same time, an article in *Electrical Review* reported that the Ondophone, a portable crystal receiver, was being sold in France to pick up time signals now being broadcast from the Eiffel Tower. It was one of the first commercial receivers to be offered to the public.[2]

[1]Notes appear on page 59.

THE TEENS—KING SPARK RULES AS A.R.R.L. IS BORN

Soon after he and Clarence Tuska founded the League, noted Hartford inventor Hiram Percy Maxim wrote a description of his impressive station, 1ZM, at his home in Hartford, Connecticut. "Herewith," the article in *The Electrical Experimenter* for October 1915 began, "I submit photograph and description of my wireless experimental station." An update was to grace the cover of the October 1920 issue of *QST*. By this time, HPM's station transmitter was a homebrew spark gap beauty, which he named Old Betsy. Today, Old Betsy resides in the Maxim Memorial Station, W1AW, in Newington.



E ELECTRICAL EXPERIMENTER 287

Radio Station of Famous Inventor

Herewith I submit photograph and description of my wireless experimental station.

The receiving station outfit consists of a large loose coupler by means of which I can get very accurate tuning, an Audion detector and variable condenser. The two sets of phones are usually connected in. The transmitting set consists of a 1 kw. specially made transformer, glass plate condenser, oscillation transformer, and a ¼ horsepower General Electric Co. motor running a specially built, quenched-rotary spark-gap. Two aerials are arranged, one for sending on 200 meter wave length for distances less than 10 miles, and one for sending on 425 meter wave length for distances in excess of 10 miles. Five plates of the condenser are used for the 200 meter wave length and 10 plates added to these five for the 425 meter wave length. The outdoor equipment consists of a 60 foot mast at one end and a 50 feet mast at the other, 100 feet apart. The spreaders are 10 feet long and have 11 wires of stranded copper between them. The ground connection is carefully soldered and connected to ground at three places. This station can "work" points in Southern New Jersey, Northern Massachusetts and can receive Colon, Panama and ships at sea, when two or three days out of New York. The station holds a special license for the purpose of relay work in the American Radio Relay League. The call letters are 1ZM.

HIRAM PERCY MAXIM.
Hartford, Conn.

students have wireless receivers that catch the news. Technology camp has its own post-office, Technology, and is located on Gardner Lake, East Machias, about eight miles by road from the village. It is a summer school which transfers the work of practical surveying and hydraulic measurement from the limited city areas to the woods and ponds where actual work can be done on the commercial scale. There are about 100 students in the camp and a

Efficient Wireless Experimental Station and Aerial of Hiram Percy Maxim.

COURTESY NATE BRIGHTMAN, K6OSC

ARRL cofounder Hiram Percy Maxim wrote this article for a popular wireless magazine, *The Electrical Experimenter*, in 1915.

THE '20s—WE SPAN THE ATLANTIC (AND THEN THE PACIFIC AND THEN...)

During the 1920s, as commercial radio was beginning to hit its stride, hams hit theirs as well, spanning the Pond in the ARRL-sponsored Transatlantic Tests. In December 1921, hams in the Northeast US and in Europe launched signals at each other on a predetermined schedule, and several stations managed to hear each other's Morse code transmissions. Hams had proved that the short waves, long thought useless for reliable long-distance communication, could carry radio signals thousands of miles.

Now the bar was set a bit higher—who would make the first two-way contact between North America and Europe? *QST* Editor K. B. Warner spurred on ARRL members with this challenge: "And *QST* hereby offers one genuine Brown Derby to the first American amateur to establish two-way communication with Europe. Up and at 'em, lads!"[3] The Brown Derby was claimed November 27, 1923 when ARRL Traffic Manager Fred Schnell, 1MO, in West Hartford, Connecticut, worked Leon Deloy, 8AB, in Nice, France, on 100 meters. The *QST* editors were so excited that the article describing the momentous event gave the incorrect date of November 17![4]

FROM AUGUST 1973 *QST*

Less heralded than HPM, the other ARRL cofounder, Clarence Tuska, who was later to be 1WD and 1ZT, was a teenager when he and Maxim launched the ARRL. Tuska served as the editor of the first issues of *QST*—before *QST* was the official organ of the ARRL. This photo shows him (at the left) with K2WW and W3SW in 1973 with a receiver he had designed 50 years earlier.

FROM JANUARY 1924 *QST*

John Reinartz, 1XAM, who made one of the first two-way transatlantic contacts on November 27, 1923 with this transmitter, designed it himself—as well as the equipment used at 1MO and 8AB for the very first two-way radio contact across the Atlantic. Reinartz was a prolific *QST* author during the 1920s and '30s.

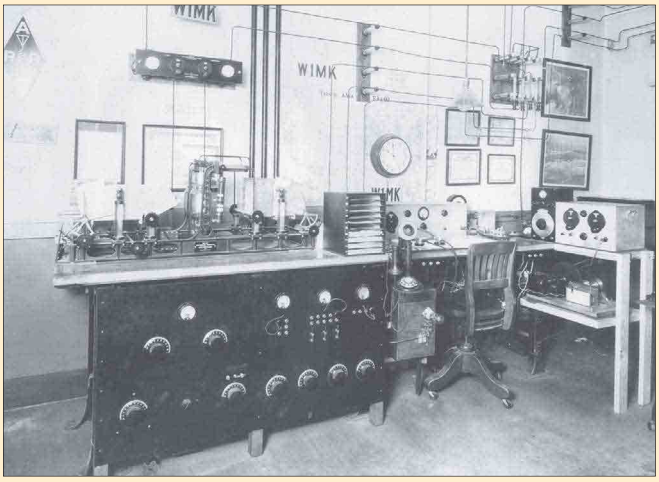
THE '30s—"STATION AND SKILL ALWAYS READY FOR SERVICE..."

The first instance of Amateur Radio public service dates to at least March 1913,[5] but it came into its own during the 1930s as more hams were able to communicate reliably over greater distances than ever before. Writing in 1936, ARRL Assistant Secretary Clinton B. DeSoto described what was to become the birth of the Maxim Memorial Station, W1AW:

> Beyond all doubt the greatest emergency public service performance in amateur history was that during the Great Flood of March, 1936. Throughout eastern United States in mid-March streams of rising waters, augmented by hard rains, rose almost overnight to flood tide. Lakes and rivers bulged with the input from steady downpours, melting snows, thawing river ice-cakes. As the crisis became apparent amateurs, warned by A.R.R.L. broadcasts of possible flood danger beginning on March 1st, were on the job... At the peak of activity, it was estimated that a thousand amateur stations were engaged in the emergency work. There was perhaps a billion dollars in property damage...[6]

Among the casualties was W1MK, the ARRL station at Brainard Field, Hartford's airport, on the banks of the rampaging Connecticut River. Just weeks before the catastrophe, Hiram Percy

FROM DECEMBER 1930 *QST*



Before it was swept away in the Great Flood of 1936, W1MK had served amateurs from Hartford's Brainard Field for eight years.

THE ’40s—HAM RADIO IN WARTIME

Service took on a whole new meaning in the 1940s. At the beginning of the decade, with war again raging in Europe, hams were restricted to making domestic contacts. After the US entered the war in December 1941, Amateur Radio was virtually shut down for the duration. The League supplied thousands of copies of *The ARRL Handbook Special Defense Edition* to the US Government, which put it to good use training thousands of service personnel in electronics fundamentals and the international Morse code.

FROM DECEMBER 1943 *QST*

The War Emergency Radio Service was created in June 1942 to provide communications related to the war effort in the US. Although not part of the Amateur Radio Service, WERS actively recruited hams (for obvious reasons). It was administered by local civil defense organizations. Like all service-eligible men, hams served overseas as well, of course, often with great distinction. *QST* kept its readers updated with regular reports. The photo shows the WERS control center in Erie, Pennsylvania, in 1943.

THE ’50s—TECHNICAL ACHIEVEMENT

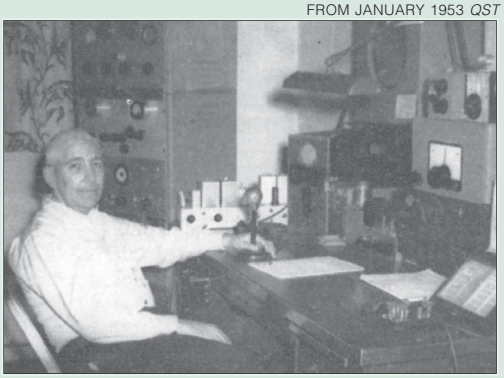
As humanity reached toward the stars, hams on Earth were stretching technological frontiers. The May 1957 issue of *QST* featured an editorial by John Huntoon, W1RW, that read, in part:

> Amateur radio is proud, and justly so, of its extensive record of technical contributions to the electronic art. However, in recent years we have occasionally heard the view expressed that, because of the billions of dollars now being poured into elaborate research programs by the industry, the day of the amateur contributing anything useful to the advancement of the art is past.
>
> Bosh![7]

The editorial went on to discuss the contribution of individual amateurs to projects associated with the upcoming International Geophysical Year, sporadic-E propagation studies (known as the ARRL Propagation Research Project), another propagation study in Belgium and plans for amateurs to track cosmic ray telemetry from high altitude balloons.

Elsewhere in that issue was an article entitled “Operation Smoke-Puff,” by O. G. Villard Jr, W6QYT, and R. S. Rich, W6OPX. Mike Villard, who became a Silent Key only recently, was an experimenter extraordinare whose pioneering work on single sideband, sporadic E and long delayed echoes earned him great distinction over the course of several decades.

FROM JANUARY 1953 *QST*



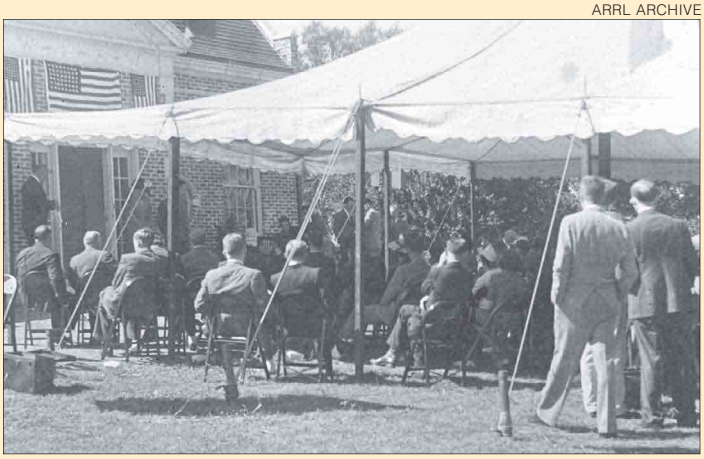
Single sideband came of age in the 1950s, and *QST*’s “On the Air with Single Sideband,” written by By Goodman, W1DX, featured the latest techniques and equipment designs. This photo, from the January 1953 installment of the column, shows *QST* author Earl Weaver, W2AZW, with his “well organized” SSB station.

Maxim had died suddenly while on a trip out West. After a site was found in the Hartford suburb of Newington (miles from the river), the new state-of-the-art station was dedicated in 1938 to the memory of the League’s cofounder and long-time President—the Maxim Memorial Station, W1AW.

F. E. HANDY, W1BDI

***Going up!* Long-time ARRL Communications Manager F. E. Handy, W1BDI, documented the construction of the League’s new station. The typewritten label in Handy’s scrapbook describes the subject: “First floor framework complete. Stone and brick work started. Feb 8.”**

ARRL ARCHIVE



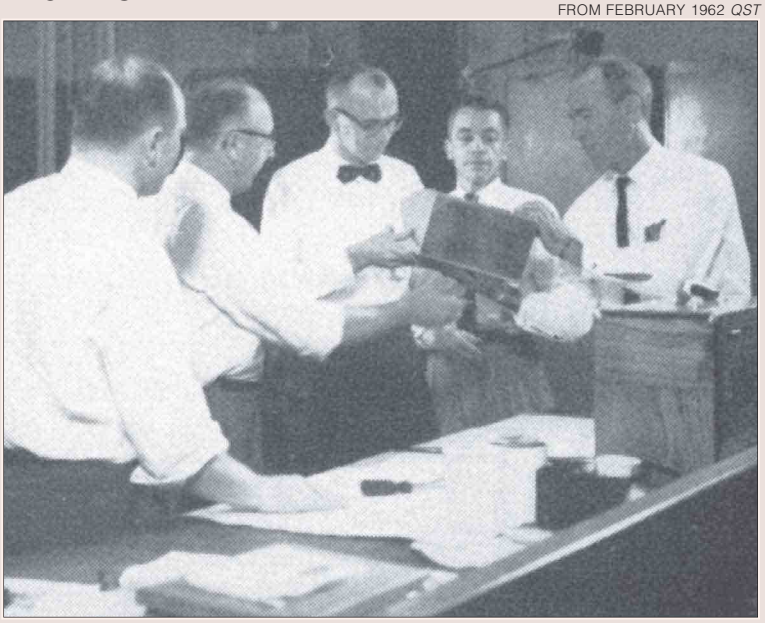
With dignitaries on hand in the then-sleepy outpost of Newington, the brand new ARRL station was dedicated in September 1938 in memory of Hiram Percy Maxim. Today’s ARRL Headquarters building was built on the site in 1963.

THE ’60s—HAMS DESIGN AND BUILD THEIR OWN SATELLITE

Not long after the Soviet Union shocked the Free World with its launch of the first artificial Earth satellite in October 1957, a group of San Francisco Bay-area hams got the idea to build one of, by and for hams. When Oscar I was launched December 12, 1961, it was the world’s first non-governmental satellite—an achievement that made headlines around the world. In fact, the Project Oscar Association was made up of a group of ham volunteers who designed and built Oscar I in their garages—for a minuscule cash outlay.[8]

Once it was built, the group had the seemingly daunting task of convincing a governmental entity with a rocket to put it into orbit. As it turned out, that part of it went very smoothly, and it hitched a ride aboard Discoverer XXXVI. The tiny satellite achieved orbit and beeped HI in Morse code as it circled the Earth 312 times before its battery ran down. The space age had begun for the world’s hams. The ARRL had provided support to the Project Oscar Association, and the February 1962 issue of *QST* trumpeted the success of the project with a front cover launch photo and an entire special section devoted to the Project Oscar Association and Oscar I.

FROM FEBRUARY 1962 *QST*



The caption to this February 1962 *QST* article read: Ready to go! Oscar completes its qualification tests with flying colors! At final check-out are: (left to right): Gail Gangwish; Nick Marshall, W6OLO; Don Stoner, W6TNS; Chuck Towns, K6LFH; and Fred Hicks, W6EJU.

THE ’70s—HAMS WORLDWIDE SHARE IN SUCCESS AT WARC 79

The crowning achievement of the decade was actually reported in detail in the February 1980 issue of *QST*.[9] The articles conveyed a sense of the long and hard-fought international effort, spearheaded by the ARRL and the IARU, with support from the ARRL Foundation, that resulted in three new HF bands for the Amateur Radio Service. Preparations for WARC 79 had begun in earnest back in 1975, and the new 10, 18 and 24 MHz bands provided tangible evidence that the years of hard work had paid off handsomely.

The Federal Republic of Germany issued this Amateur Radio-themed stamp in commemoration of WARC 79.

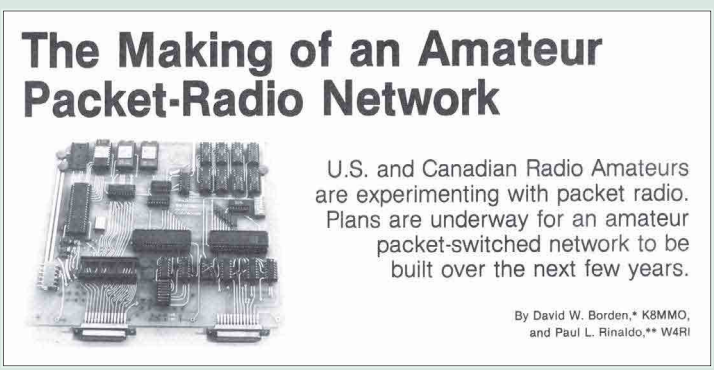
FROM FEBRUARY 1980 *QST*

The IARU Team of observers to WARC 79. Front row: JA1NET, WA6IDN, 9V1RH, HK3DEU, SP5FM, W1RU; rear: VE3CJ, K1ZZ, G5CO, WØBWJ, ZL2AZ, W4KFC. Absent from photo: G2BVN, YV5BPG.

THE ’80s—COMPUTERS INVADE THE HAM SHACK

The April 1981 issue of *QST* heralded the onset of digital ham radio with a short article, “First Packet Repeater Operational in U.S.”[10] “This repeater,” the authors wrote, “is one of the first steps in what is proposed to be a nationwide if not international network of interconnected computer systems.”

The first survey of the packet state of the art came in the October 1981 issue: “The Making of an Amateur Packet Radio Network,” by digital pioneers David Borden, K8MMO, and Paul Rinaldo, W4RI (now ARRL Chief Technology Officer). Harking back to the early days of Amateur Radio, a Stray in the April 1982 issue proclaimed the “First Transcontinental Packet-Radio QSO.” By this time, a core group of hams was experimenting with the power of the computer, and applying that power to all aspects of ham radio. The result: The evolution of ham radio from discrete components to the success of such Amateur Radio software as PSK31 and WSJT, as well as digital signal processing and software defined radio technology—and the myriad ways hams have exploited the power of the Internet.



The Making of an Amateur Packet-Radio Network

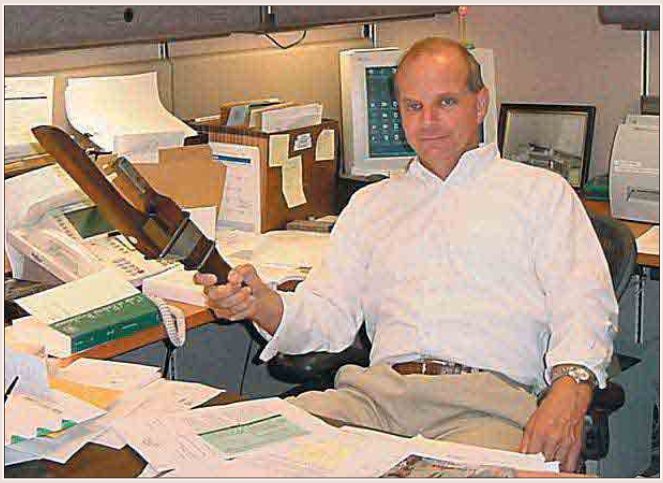
U.S. and Canadian Radio Amateurs are experimenting with packet radio. Plans are underway for an amateur packet-switched network to be built over the next few years.

By David W. Borden,* K8MMO, and Paul L. Rinaldo,** W4RI

Early experiments with packet radio led to the computer-based digital modes that we take for granted today. This article, from the October 1981 issue of *QST*, provided the first general introduction to packet radio.

THE ’90s—THE FCC PUTS TEETH INTO AMATEUR RADIO ENFORCEMENT

Responding to years of encouragement from the ARRL and individual hams, the FCC in November 1998 gave Riley Hollingsworth the authority to help make life uncomfortable for those, licensed or not, who intentionally disregard the rules and regulations of the Amateur Radio Service. It’s safe to say the amateur bands have not been the same since, and Riley has become one of the best known—and most lauded—US hams.



ROBIN HEWITT

Riley Hollingsworth serves the amateur community as the FCC’s Special Counsel for Enforcement. He credits firm ARRL pressure aimed at the FCC during the summer of 1998 with the subsequent action that created his position.

FROM AUGUST 2001 *QST*, COURTESY W5JBP

The Amateur Radio Education and Technology Program is ambitious, wide-ranging—and successful. ARRL President Jim Haynie, W5JBP, shown here with DeGolyer Elementary School teacher Sanlyn Kent, KD5LXO, and several newcomers to Amateur Radio, initiated the program soon after taking office in 2000.

THE ’00s—AMATEUR RADIO IN THE CLASSROOM

Although Amateur Radio has been in the nation’s classrooms for decades, the initiative called “The Big Project” (more formally known as “The Amateur Radio Education and Technology Program”) has brought it to a new level. The brainchild of current ARRL President Jim Haynie, W5JBP, the Program has lofty goals—to bring the wonders of Amateur Radio to hundreds or even thousands of classrooms across the country. “It’s time to do some bold things,” Haynie said in the first mention of the Program in the July 2000 issue of *QST*.[11] Under the Program, the expertise of local hams and amateur station equipment are enhancing the education of students in geography, math, electricity, electronics and physics. The ARRL Foundation and hundreds of individual hams have supported the Program with monetary contributions, and the Program is showing every indication of becoming the great success it was envisioned to be.

Join Us for our Centennial!

Elsewhere in this issue is a listing of long-term ARRL members, including some who have supported the League—and the Amateur Radio Service—for more than 70 years. But whether you’ve been a member for 70 years or 7 weeks, we hope you’ll join us 10 years hence as we commemorate our centennial year. As it was in May 1914, the ARRL is today “of, by and for the amateur”—a group of people with a sincere interest in communicating via Amateur Radio, experimenting and performing public service.

Thanks to John Huntoon, W1RW; George Hart, W1NJM; and Perry Williams, W1UED, for providing information for this article.

Notes

[1]White, Thomas, “United States Early Radio History,” Section 7, “Pioneering U.S. Radio Activities (1897-1917)” at **earlyradiohistory.us/sec007.htm**.

[2]“Vest Pocket Wireless Receiving Instrument,” *Electrical Review and Western Electrician*, April 11, 1914. Cited by White.

[3]K. B. Warner, “Two Way Tests with Europe,” *QST*, Mar 1923, p 15.

[4]K. B. Warner, “Transatlantic Amateur Communication Accomplished!” *QST*, Jan 1924, p 9.

[5]C. DeSoto, *Two Hundred Meters and Down* (West Hartford, CT: ARRL, 1936), p 37.

[6]DeSoto, pp 170-171.

[7]“Technical Contributions,” It Seems to Us, *QST*, May 1957, p 9.

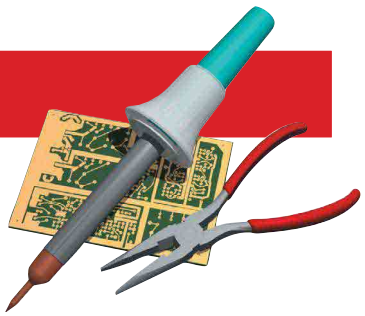
[8]The Project Oscar Association still maintains a Web site at **www.clarke-design.com/ProjectOscar/**.

[9]R. L. Baldwin and D. Sumner, “The Geneva Story,” *QST*, Feb 1980, pp 52-61.

[10]H. Magnuski and P. O’Dell, “First Packet Repeater Operational in US,” *QST*, Apr 1981, p 27.

[11]R. Lindquist, “Happenings,” *QST*, Jul 2000, p 71.

The author is Managing Editor of QST. *He can be reached at* **jkleinman@arrl.org**.



The Doctor is IN

Q Richard, K5RN, asks an interesting question: I have wondered for a long time why Amateur Radio operators use both upper and lower sidebands. Most commercial and military communications systems make use of only one sideband (usually USB). Hams seldom mix upper and lower SSB on a single band. Could the answer be that it has something to do with interference (QRM) reduction?

A Richard, the answer has much to do with history and it was a matter of economics. In the early days of SSB, the most cost effective way of generating and receiving an SSB signal was to use a 5 MHz (approximate) crystal filtered IF and a 9 MHz (also approximate) tunable VFO—you could then cover both the 75 and 20 meter bands relatively cheaply and easily. Back then, before phase locked oscillators and frequency synthesis, covering both sidebands meant you'd have to buy two crystals for carrier injection, a somewhat costly proposition. Staying with the convention of using USB for the upper bands and LSB for the lower bands saved SSB pioneers money.

For receiving, the incoming signal (3.8 MHz or 14 MHz) was *heterodyned* or mixed with the 9 MHz VFO to produce a 5 MHz IF (using the mixer-produced sum and difference products). For transmitting, a 5 MHz carrier oscillator was *summed* with the 9 MHz VFO to produce the 20 meter (14 MHz) signal. It was *differenced* with the VFO to produce a 4 MHz (3.6-3.9 MHz), 80 meter signal. The result, after passage through a shared (common) crystal filter, was a lower sideband signal on 80 meters and an upper sideband signal on 20 meters—a convention still used today. In actuality, there's no reason not to use USB on 75 meters or LSB on 20 meters, provided the receiving operator knows you are doing this. In fact, by mutual consent, two stations might resort to "unconventional" sideband operation to avoid interference in a crowded band.

Q Mike Perry, N7MP, writes: I have a Hustler 6 band vertical mounted on my travel trailer. I would like to adapt it to the 160 meter band if I could just figure out how. I may have a solution but need some verification. I think I can remove the existing 80/75 meter coil, mount a sloping aluminum plate on top of the tubing at that location, then remount the 80/75 meter coil on one side of the plate and a 160 meter coil on the other side. Will the new L/C/F and single-layer coil-winding calculator define the size coil I'd need for 160 meters?

A No, the LCF calculator merely calculates the inductance of a coil, or the resonant frequency of a coil/capacitor combination. You'll need to make use of a much more complex calculation—the size of a loading coil needed to resonate a shorter antenna. The equation to do that appears on page 6-31 of the 20th edition of *The ARRL Antenna Book*[1]—and it is pretty complicated to deal with. Fortunately, a graph, which makes the calculation easy, is provided in Figure 55 on that page. Using a *Dimension B* of zero and an antenna length of 6% (for an 8 foot whip at 160 meters) gives a coil reactance of about 4000 Ω. This translates to an inductance of about 350 µH for a base loaded coil at 1.8 MHz.

That value agrees well with that presented in Table 1 on page 16-5 of *The ARRL Antenna Book* (345 µH). The inductance will increase as the coil is moved higher and it will be about double that figure for a center-loaded antenna. The specifics for a coil of that inductance (700 µH) are 190 turns of 22 gauge wire, 3 inches in diameter, 10 inches long. That's a pretty large inductor, especially to mount at the antenna center. Considering the wind loading and motional dynamics of a mobile installation, you'd probably be better off with a base mounted coil of 345 µH (135 turns of 18 gauge wire on the same size form). I would urge you to read chapter 16 of the current (20th edition) of *The ARRL Antenna Book*. It pertains particularly to mobile antennas and loading coil design.

Your particular situation is complicated by the fact that there are multiple loading coils involved. While there are techniques to model that situation, the most practical solution may be to measure the antenna with an antenna analyzer and calculate the inductance required to resonate the antenna. Or, you could just add more inductance until the antenna resonates on 160 meters, while carefully observing the antenna analyzer. Remember though, that the coil Q will probably be pretty high (the reactance will be necessarily high in order to resonate a short whip on 160 meters) and this will result in a very narrow bandwidth (about 6 kHz with a coil Q of 300). Don't expect to cover all of 160 meters with low SWR with that combination! Operating 160 meters efficiently from a mobile station represents a challenge that few hams have tackled. Good luck!

Q From Ed, N5QVQ, comes this: I have a satellite XM portable radio receiver that I am trying to adapt for use in my airplane. The only inconvenience is that it needs the audio output amplified with a volume control. When used in an auto or a similar installation, it uses a cassette adapter that plugs into an existing stereo system for amplification and control of volume. I am currently using a portable cassette (9 V dc battery power) player for this purpose and then connecting its output into the audio panel of my plane.

Do you have any ideas for a homebrew adapter using an IC and voltage regulator I can build and power with the existing 12 V dc cigarette lighter source, thereby eliminating the cumbersome cassette player?

A You might consider the amplified speakers that come with computers. These are popular with homebrewers of QRP gear; they are effective as an inexpensive solution to the audio question. They are frequently powered at the 12 V dc level or have a built-in diode rectifier to convert ac from a "wall-wart" supply. As such, they'd be easy to power from a dc source. You might also consider an amplified extension speaker available from RadioShack (**www.radioshack.com**; catalog no. 21-541).

Pages 22.24-22.25 of *The ARRL Handbook* have a head-

[1]Available from your local dealer or the ARRL Bookstore. Order no. 9043. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

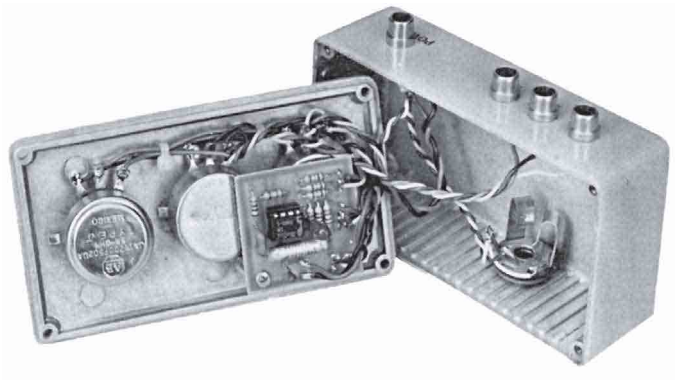


Figure 1—A simple audio mixer/amplifier using the LM386. It appears in the current edition of *The ARRL Handbook*, page 22.44.

phone mixer using an LM386—its approximately 400 mW output is probably similar to that of your cassette player and you'd be able to mix the input with other feeds to your headset. That completed mixer is shown in Figure 1. If you need more output, use an LM380 IC. The LM386-4 has a maximum voltage rating of 18 V dc and the LM380 has a maximum voltage rating of 22 V dc, so there's no need for a voltage regulator with either device. The data sheet for the LM386 device can be found at: **www.national.com/ds/LM/LM386.pdf**. The data sheet for the LM380 can be likewise found at **www.national.com/ds/LM/LM380.pdf**.

Q Robert, WA2AXZ, asks: The manual for my Jeep Wrangler Sahara warns against the installation of transmitting equipment. I know that all new cars today are almost 100% computer controlled and operated, from the engine spark to the dash gauges. I want to install a HF and 2 meter mobile in the beast but I fear the worst, a fried Jeep control computer! How can I install a rig and antenna safely (as I have done for over 30 years in other vehicles) without needing to key the mic for help when the car dies?

A I'm afraid there's no easy answer here, but there are solutions. I would try a moderate power level HF transceiver first and increase the power output incrementally and see if that has any effect on the control computer. If you increment the power in small steps from a low level and carefully observe the effects at each level, I don't believe you'll have to worry about permanently damaging the digital control equipment within the vehicle. As always, use the minimum power necessary to get the job done.

There may be a manufacturer's service note that the dealer is aware of (or not—you may have to do some research) that addresses that issue. Rely on the manufacturer for assistance. If the vehicle is sold for any law enforcement application, it will certainly be modifiable to accept VHF/UHF radio equipment and you should be able to get that data. Ferrite toroid and/or bead filters placed on input and output control lines of the computer could also be an answer. Look at the ARRL Web page dedicated to RFI suppression; it speaks to automotive RFI issues: **www.arrl.og/tis/info/rfigen.html**.

Make sure your mobile installation is based on sound engineering principles. Keep the input dc power leads large enough to handle the current (you may have to go to shielded dc input lines—easily done when RG-8/U type coax is used for the dc) and make sure that the SWR is low, keeping the feed line as short as possible. Also, keep the RF where it belongs—within the coax and not on the shield braid. A choke balun at the antenna may help ensure that. Another tip: Keep the antenna as far as possible from the engine compartment. For help with automotive RFI problems see *The ARRL RFI Book*.[2] Good luck—mobile operation is usually possible from any vehicle with the proper precautions.

Q Here's a question from Peter, W1EHY: It appears that at least some of us are going to have to contend with BPL. To the best of your knowledge, will a digital radio system (like the AOR ARD9800) eliminate the problem of noise?

A Digital radio can certainly enhance the system signal to noise (S/N) ratio by suppressing the noise at moderate S/N ratios (see Product Review, Feb 2004 *QST*, pp 80-81) but it can't recover a signal from below the noise floor. Unfortunately, BPL can raise the local noise floor dramatically (by tens of dBs) and effectively "bury" weak signals that are below that noise. There aren't too many communications systems that can recover signals from below the noise floor. Those that do rely on sophisticated signal summing algorithms and they use very narrow bandwidths with phase lock techniques. These systems are used principally for deep space communications. For more specific information on how BPL works and its effects, please see the ARRL Web pages on the topic at: **www.arrl.org/tis/info/HTML/plc/**.

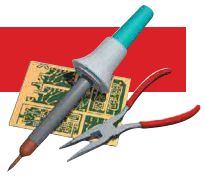
Q Dale, N8MI, writes: I built an older transmitter from the 1955 edition of *The ARRL Handbook*, page 158. The B+ voltage is 365 V dc. My problem is that I can't get the final (a 6L6) to draw more than 35 mA of plate current at resonance. This is into a 50 Ω resistive load. I noticed that the screen voltage was low, so I paralleled a 10 kΩ resistor with the 18 kΩ screen resistor. This brought the plate current up to 45 mA, but according to the article, the 6L6 should load to at least 75 mA. The power supply is capable of delivering 90 mA because it will draw that out of resonance. Does the Q of the PA tank circuit affect the plate current?

A No, the Q of the PA tank circuit does not affect the plate current, as long as the ratio of the unloaded to loaded Q is enough to effect the desired impedance transformation. However, I would carefully check the final plate coil and the output coupling coil (L1 and L2 in the original circuit). You may not be getting enough coupling between the coils, even though the number of turns is the same. You probably need to increase the number of turns on L2 until the final amplifier draws the desired plate current (75-100 mA) at resonance.

Also, I would advise that you bring the screen resistor up in value a bit. With the original screen resistor bypassed with 10 kΩ, you now have about 6.4 kΩ in the screen supply and you may be coming close to exceeding the maximum screen dissipation rating of the 6L6 (3.5 W). The maximum rated screen voltage for a 6L6 is 300 V—measure it and the screen current to be sure. Adding turns to the output coupling coil (L2) will probably affect the point of resonance of the final plate tuning capacitor, as well as increasing the coupling. A swinging output coupling link or a capacitor in series with L2 would afford an easy way to get variable output coupling without messing with turns (that's how they did it in the "old" days). Have fun with that vintage transmitter!

[2]Available from your local dealer or the ARRL Bookstore. Order no. 6834. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

Do you have a question or a problem? Ask the Doctor! Send your questions (no telephone calls, please) to: "The Doctor," ARRL, 225 Main St, Newington, CT 06111; doctor@arrl.org; www.arrl.org/tis/.



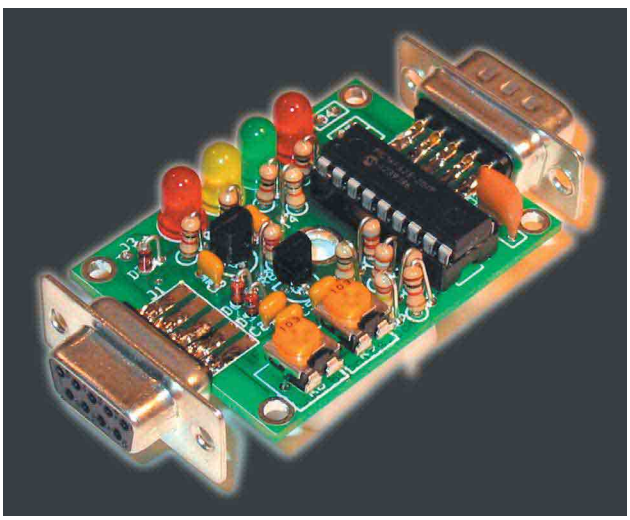
Byonics TinyTrak3 GPS Position Encoder

Reviewed by Stan Horzepa, WA1LOU
QST *Contributing Editor*
1 Glen Ave, Wolcott, CT 06716-1442
wa1lou@arrl.net

TinyTrak3 (TT3) packs many features in a tiny footprint ($2^1/_4 \times 1^5/_8 \times ^3/_4$ inches). Developed by Byon Garrabrant, N6BG, the TT3 allows you to interconnect a global positioning system receiver to a transceiver for transmitting your position as calculated by the GPS. TT3 massages the position data received from the GPS and puts it into a packet format. When transmitted and received, the data can be properly decoded to indicate your position, for instance on a map displayed by a computer running APRS (Automatic Position Reporting System) software in another ham shack.

The TT3, GPS and radio equipment combination makes up a "system" commonly referred to as a "tracker" in APRS parlance. Trackers are typically installed in vehicles that are critical in various operations like emergency and public service scenarios so that the current position of the vehicle is available to those in the operation who need to know.

The advantage of TT3 is that it eliminates a TNC (terminal node controller) that normally performs the massaging and packet building function. Unlike a TNC, TT3 does not decode received packets; it only transmits packets.



Building and Installation

I built the kit and it was a simple and quick task. With the assistance of the kit's excellent set of instructions, anyone who knows the business end of soldering iron should be able to build the kit in an hour or less. The builder needs to make only two decisions during kit construction: (1) whether to trim the PC board so that its connectors have a lower profile when installed in the optional case and (2) whether to install resistor R8, which is not needed if TT3 will be used with a transceiver that does not key its transmitter via current through the microphone line. By the way, if you decide to trim the PC board for a lower profile, you should trim before you begin populating the board with components.

After you build the board, you connect it to the serial port of your computer and configure it using *TinyTrak3Config.exe*, a *Windows* application you download from the manufacturer's Web site (**www.byonics.com**) in a ZIPed file that also contains a .pdf version of TT3's documentation. A Mac OS TT3 configuration application is downloadable from **mdco.net/irving/tinytrak.html**.

Configuring TT3 is straightforward if you are familiar with configuring an APRS station. If in doubt, just configure your call sign and use the default settings of the other parameters. By the way, you can configure TT3 with two different configurations ("Primary" and "Secondary") and (1) select the desired configuration with switch SW1 or (2) configure TT3 to alternate call sign and digi path from one transmission to the next (by enabling the Alternate Digi Paths parameter).

Time Slotting, Power Switch and SmartBeaconing are three features of the TT3 that merit full descriptions.

Time Slotting allows you to preset the transmission times of multiple trackers. Each tracker can be configured to transmit at a different specified time to avoid two trackers transmitting at the same time, which results in the receiving station being unable to receive one or both of the tracker's transmissions.

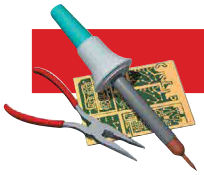
When enabled, the Power Switch feature turns on the GPS and transceiver at a user-specified time, sends a position packet, then turns off the GPS and transceiver. This option can be configured to wait until a second transmission is completed before powering off the equipment in case the first transmission does not contain a valid position packet due to the GPS not being locked on to the GPS satellites. The Power Switch feature requires the addition of a relay to toggle power on and off when commanded by TT3. The relay must be able to handle the power requirements of the transceiver and GPS.

SmartBeaconing is my favorite feature and as far as I'm concerned, worth the price of admission. When enabled, SmartBeaconing varies the rate of transmission depending on changes in the speed and heading of the tracker. For example, as the tracker increases speed, the TT3 increases the transmit rate. Without this option, the transmission rate would remain the same as the tracker goes faster, resulting in widening gaps and less accurate position information on the maps of APRS stations receiving the tracks of the tracker. For additional position accuracy, SmartBeaconing also uses CornerPegging, which forces a new position packet transmission each time the tracker turns a corner.

TT3 uses a female DB-9 for the connections to the transceiver (audio in and out, ground and PTT, if needed) and a male DB-9 connector for the connections to the GPS (data from the GPS and ground). You also use the male DB-9 to connect TT3 to your computer during configuration.

For this review, my APRS station at home monitored the TT3 using street-level maps. It was refreshing to see my tracker turn each corner on the map instead of occasionally cutting across the virtual lawns, which typically occurs with my normal APRS mobile station that is without the CornerPegging feature.

Manufacturer: Byonics, 8378 Granite Mountain Ln, Las Vegas, NV 89129; **www.byonics.com**. *TT3 kit $30; TT3 kit and case $36; TT3 board built and tested $54; TT3 built and tested with case $60.*



By J. D. Harper K6KSR

Use the Right Phonetics

How to cut confusion, add clarity and ensure accuracy.

THIS IS KICKER-SIX-KENYA-SISTER-ROBERT. NAME IS JOHN. HOW COPY, OLD MAN?

OKAY JAN, BUT MISSED YOUR CALL SIGN. PLEASE REPEAT.

ROGER. THAT'S KING-SIX-KILIMANJARO-SALEM-ROCHESTER. YOU ROGER THAT?

OKAY—I GOT YOU IN SALEM, NEAR ROCHESTER. GIMMIE THAT CALL ONCE MORE.

AWRIGHT, OLD MAN, IT'S KILO-SIX-KILO-SIERRA-ROMEO.

GOT IT THAT TIME—K-6-K-S-R. YOU'RE FIVE-BY-NINE HERE. YOUR NAME JOHN OR JAN?...

The irony here? The guy was 5-by-9, on a clear frequency, and still couldn't be understood!

Did she say *Tracy* or *Stacey*? Was he located in Kokomo or Pocono? Is she raising her power or her tower? Ever been confused by similar sounding words like these? Of course you have! The good news: The confusion can be eliminated and clarity enhanced through the use of *phonetic* spelling—but only if both parties use the same phonetic alphabet.

Can we Talk?

Of course. Whether we use FM, sideband or AM, we do it all the time—some of us do it incessantly, without even thinking. But can we be assured that we're understood? Well, that's another matter entirely—and it's the main reason we should get in the habit of using a generally accepted *phonetic alphabet* whenever we're using our voice to communicate.

What's a phonetic alphabet, anyway? It's a system of using word-sounds to define each letter, instead of just saying the letter itself. While the science of phonetics is fraught with complexities far beyond the scope of this article, here's the crux of it: When voice communications are hampered by poor band conditions, interference from other stations, weak signals or bad audio, sounding out the word that's been assigned to each letter can enhance clarity and accuracy for the receiving station.

Take a look at some of the letters and numbers that have similar sounds: B C D E G P T V...A K J...M N...Q U...F S...FIVE. NINE. Then there are the words like REPEATER and METER; MIC and SPIKE, and any number of other combinations of "like-sounding" words. It's easy to see how just saying the word could lead to misunderstanding.

Now stir into this complication adverse band conditions, and you have all the makings for a boatload of problems. Or, as chain-gang warden Strother Martin tells prisoner Paul Newman in the film "Cool Hand Luke": *What we've got here...is failure to communicate.*

Everybody Wants to Get into the Act...

There's a wide variety of phonetic alphabets, used by various nations, governments, bureaus and departments. And since there are no domestic laws governing the use of specific phonetics in radio communications, you're free to toss about any ridiculous word combos you'd like. Your communication may fail...but at least you won't get arrested for it.[1]

We're going to concern ourselves with the most recognized and widely used phonetic alphabet—that adopted by NATO and the International Telecommunication Union (ITU) back in 1956. It's been accepted as the world standard by the Federal Aviation Administration, the International Civil Aviation Organization, the US military—and the ARRL (see Table 1).

Why Everybody Should Be on the Same Page...

Why all the fuss about using standardized words, anyway? Isn't the word *Italy* or *Image* as good as *India*? Phonetics experts say that, even though those three words have the short "I" sound, research shows that the ITU alphabet is better understood by a wider variety of operators, foreign and domestic. Some would argue that parts of the standard phonetic alphabet, such as *Romeo, Sierra, Yankee* and *Juliet*, don't have

[1]Here's what Part 97 [97.119(b)(2)] has to say about the phonetic alphabet: "Use of a standard phonetic alphabet as an aid for correct station identification is encouraged;"

Table 1
ITU Standard Phonetic Alphabet

A—ALFA	(AL-fah)	J—JULIET	(JEW-lee-ETT)	S—SIERRA	(see-AIR-rah)
B—BRAVO	(BRAH-voh)	K—KILO	(KEY-loh)	T—TANGO	(TANG-GO)
C—CHARLIE	(CHAR-lee)	L—LIMA	(LEE-mah)	U—UNIFORM	(YOU-nee-form)
D—DELTA	(DELL-tah)	M—MIKE	(MIKE)	V—VICTOR	(VIK-tah)
E—ECHO	(ECK-oh)	N—NOVEMBER	(no-VEM-ber)	W—WHISKEY	(WISS-key)
F—FOXTROT	(FOKS-trot)	O—OSCAR	(OSS-cah)	X—XRAY	(ECKS-ray)
G—GOLF	(GOLF)	P—PAPA	(pah-PAH)	Y—YANKEE	(YANG-key)
H—HOTEL	(hoh-TELL)	Q—QUEBEC	(keh-BECK)	Z—ZULU	(ZOO-loo)
I—INDIA	(IN-dee-ah)	R—ROMEO	(ROW-me-oh)		

the punch to come across effectively, especially to those who speak languages other than English. Is there a better choice? Some believe *Radio, Sugar, Yokohama, Japan, Zanzibar* and *America*—part of what can be called the DXers' phonetic alphabet—are stronger than *Romeo, Sierra, Yankee, Juliet, Zebra* and *Alfa*. You'll get an argument no matter which side you choose. The only sure thing is that both ends of the QSO must use the same phonetic alphabet.

Imagine being neck deep in net operations and emergency communications during a catastrophe, and amid all the clamor and agony of that earthquake, tornado or hurricane you're trying to understand one op who insists on using his own brand of phonetics, and another who uses the ITU standard half the time and *whatever pops into my head* the other half. Clever and humorous word substitutions may have their place, but it's clear that they can lead to miscommunication, particularly in net or emergency situations.

Using Your Voice to Enhance Communication

A few tips are in order. Try to speak slowly and distinctly as you say the appropriate words. Check your transmitter's mic gain for any overmodulation. Experienced ops will tell you that pronunciation should carry a slight emphasis on a syllable but should be accent-free. A few examples of good pronunciation: *KEY-loh see-AIR-rah ROW-me-oh.* Table 1 includes a pronunciation guide.

The Dreaded "Phonetic Overkill"

Knowing when *not* to use phonetics is nearly as important as knowing when to apply them. You've likely heard the monotonous tones of the operator who feels the need to spell each and every word phonetically... NAME IS BILL—BRAVO INDIA LIMA LIMA... LOCATED OVER HERE IN DALLAS, THAT'S DELTA ALFA...

If you're given a 59 signal report by the receiving station, forget the phonetics—unless you're forwarding some unusual or potentially ambiguous words, or the receiving station asks for fills.

The whole idea of phonetics is to help us become better communicators, cut confusion and enhance understanding—whether we're operating a contest, chasing DX, running a net or handling emergency traffic. When you need to use a phonetic alphabet, memorize and use the ITU phonetic alphabet in Table 1. Oscar Kilo? OK!

First licensed in 1955 as Novice station KN6KSR, John Harper cut his ham teeth on homebrew rigs and military conversion sets. A dedicated boatanchor fan and QRP enthusiast, he still builds much of his own gear. John is a former commercial photographer and copywriter whose articles and photos continue to appear in a wide variety of national periodicals and trade books. You can contact the author at 8260 Christie Dr, Frisco, TX 75034, **k6ksr@earthlink.net**.

STRAYS

LIFE MEMBERS ELECTED MARCH 13, 2004

◊ Karyn W. Allan, KAØK; David W. Anderson, K4SV; Michael J. Arquilla, N8SD; Leif Asbrink, SM5BSZ; William L. Ashby, N6FFC; Robert L. Atkinson, K5UJ; Gary E. Balltrip, WA4FLH; James F. Berg, Jr, WØOSQ; Jeffrey W. Biggerstaff, KG4UOG; Ruth A. Bigio, KB4LIF; Dennis R. Boone, KB8ZQZ; Ronald L. Brooks, KC8QYF; Laird M. Brown, K3LMB; Philip L. Brown, WE7A; David R. Broyles, KH7SO; Michael L. Coomer, KA9LHE; Mark L. Du Moulin, WB2ERS; John G. Ellis, N8VJP; Robie L. Elms, AJ4F; Enrique J. Fernandez, KF4GBT; Toribio B. Flores, Jr, AA9ZI; Alfred A. Fronefield, KC5VCF; Karen L. Gerharter-Goodman, KG6USN; Michael J. Graham, N2ZU; Christiana K. Green-Toups, KB5PWJ; Terry G. Harris, KC5TFQ; Andrew W. Hohenner, KG6JFW; Richard W. Holst, K2RWH; Walter L. Jackson, AA3SG; David L. Jones, K4DLJ; Donald J. Kash, KZ9S; William J. Kenagy, KG6RLO; Mike D. Kowalsky, AC8Y; Ray A. Krohn, KD3RN; Charles W. Lassiter, AC5UZ; Mike A. Lomangino, KB2UUH; Hugh C. Maddocks, K3SS; Terry J. Maton, G4GHU; Anthony C. May, KG6SXY; David K. McCarty, K5GN; Ronald McCombs, WA7ONE; Morris E. McMillian, W8XF; L. Gary McQueeney, WG5M; Roger K. Merideth, KE6GVO; Scott A. Miller, NQ2F; James M. Nelson, KE4GWW; Daryl L. Noel, W4EC; Thomas Ostertag, DG8SAM; Keith W. Pageau, Jr, N8PDH; Harold W. Patchin, KBØBUQ; William P. Pavela, KG4VDS; Fred A. Podbielak, KC2EIM; Steven D. Portnoff, KD7LVX; Dale R. Reed, KB7VEJ; Rod E. Ruffin, N7ROD; Daniel T. Ruth, W3ZF; Jeffrey J. Ruth, N3THP; Max F. Sabo, K2MAX; Loris J. Simcik, KB1HTB; Eugene Skopal, AE2F; Alan S. Smith, Jr, KF4ZUX; D. I. Sparvell, AD6TP; Carl R. Stevenson, WK3C; Marvin W. Taylor, AEØEG; Reginald Thatcher, W6ZXI; Todd N. Tolhurst, WA1M; Stephen R. Veader, N4DXS; Howard A. Waxman, KO4GS; Burton S. Wolfe, W4SNT.

BEN KITTRIDGE, WA1PBR

Thrifty EME antenna: **Paul Kelley, N1BUG, of Milo, Maine, took a used Cushcraft Boomer and added several elements and 9 feet to its length, winding up with a 38 foot boom with 20 elements. Azimuth is via the Armstrong method, and elevation control is via two pieces of hinged 2×6s. As the back of the antenna is heavier than the front, the front is raised and lowered by either releasing or pulling on the blue rope attached to the front. Paul has even calibrated the rope length in degrees elevation. The receive preamp and the TX/RX relay are protected by an upside down plastic trash basket.**

G. NORTON BULLINGER, AF9Z

Nice URL, folks: **G. Norton Bullinger, AF9Z, of Warrenville, Illinois, came across a sign recently that caught his attention. The "call sign prefix," K3, is short for Kankakee, the sign's QTH.**

Experiment #16: Switchmode Regulators—*Part 2*

Last month, we looked at the switchmode power converter. We constructed a *buck regulator* that outputs a voltage *lower* than its input. This month, the inductor in that circuit is used to create a *higher* output voltage. Let's examine the *boost regulator*.

Terms to Learn

- *Continuous and Discontinuous Mode*—In continuous mode, current flows in the inductor at all times. In discontinuous mode, inductor current only flows for part of the time.
- *Converter*—A circuit that transfers energy while converting it from one form to another, such as from a low voltage source to a high voltage load.
- *Saturated*—The state of an inductor core that cannot store any additional magnetic energy.

Background

Strictly speaking, our circuits are *converters* and not really regulators; they transfer energy from the power supply to a load and in the process change the voltage. Unlike our two circuits, *regulators* control the output so that it matches a desired set point. However, our buck and boost circuits are typical of the fundamental circuitry used in a true switchmode regulator.

The ability of the boost regulator to increase the output voltage over that at the input is very handy. Boost regulators are used in many types of battery-powered equipment, allowing one or two 1.5 V cells to power equipment that requires 5 V or more.

Figure 1 shows the boost regulator schematic. Like the buck regulator, the inductor carries all of the load current, but instead of being "downstream" from the switch transistor, it's now "upstream," with the switch connected between the inductor and ground. The commutating diode is now connected from the output of the inductor to the load capacitor.

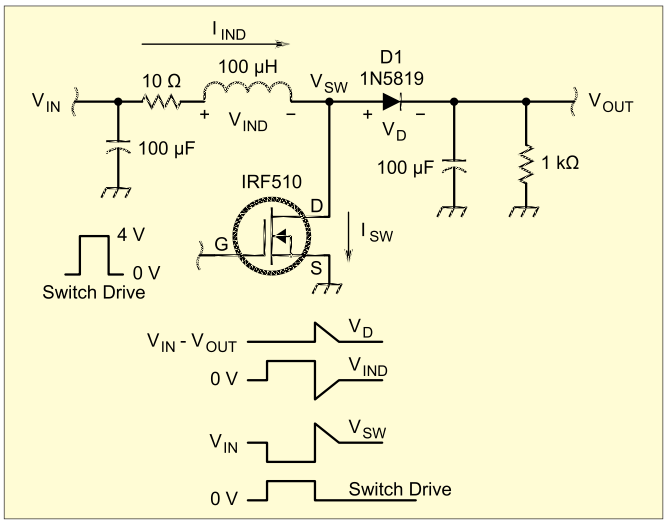


Figure 1—The basic boost regulator circuit using an FET as a switch.

At first, this looks funny—how can this possibly work? When the switch is ON, it's shorting the inductor to ground! The diode doesn't really look like it's doing anything at all, just passing current along to the output.

Let's start with the switch and the inductor. If the switch was never turned on at all, dc current would flow from the input source, through the inductor and diode, and on to the output capacitor. Output voltage would be less than the input voltage by the amount of forward voltage drop across the diode—about 0.7 V.

What does turning the switch ON and routing that current to ground accomplish? As with the buck configuration, the purpose of the switch is to "charge" the inductor with energy stored in a magnetic field by applying voltage to the inductor. When the switch is turned OFF, the inductor current is interrupted, causing the voltage across the inductor to rapidly change from positive to negative in the amount of $L\times(\Delta i/\Delta t)$. Since the input capacitor holds the inductor's input voltage constant during this period, the inductor's output voltage at the FET drain is forced to become greater than that of its input. This higher inductor output voltage forward biases D1 and allows the stored energy to be transferred to the output capacitor as current.

Inductor current gradually decreases until the inductor output voltage is insufficient to keep D1 forward biased. D1 then stops conducting with the output capacitor now charged to a higher voltage than at the power supply input. This is like pulling back a slingshot in order to release it and throw a weight to a higher level.

Figure 2 shows how inductor voltage changes when the switch is turned ON and OFF. Initially, the inductor voltage is at the full input voltage with the switch holding its output at ground potential. (The voltage "droop" observed is due to the relatively small input capacitor being discharged.) When the switch turns OFF, inductor voltage immediately reverses. With its input voltage constant, the output voltage rises to a higher voltage than the input. (Remember that it is the voltage across the inductor that becomes negative, not voltage with respect to ground.) The inductor output voltage gradually decays as the stored energy is

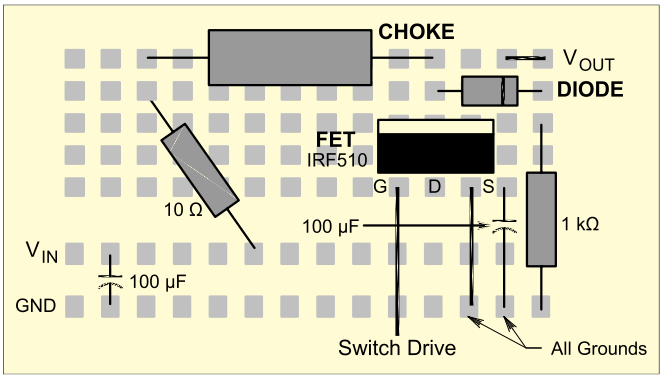


Figure 2—The recommended layout for the boost regulator of Figure 1. It is constructed on a common prototyping board.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

transferred through D1 to the output capacitor. This relationship is shown in a simplified way in Figure 1.

If all components were lossless and the switch frequency is held constant, the output voltage would be:

$V_{OUT} = V_{IN} / (1 - \text{Duty Cycle})$ [Eq 1]

This is because the inductor voltage is added to the input voltage only during the period during which it is discharging—a time directly proportional to charging time. The commutating diode, D1, contributes more loss in this circuit because it is in series with the supply current at all times, not just during one-half of the inductor charge/discharge cycle. The diode's forward voltage drop is subtracted from the available output voltage.

Understanding how the inductor energy is stored and released is key to the operation of switchmode regulators. Just as important is the realization that the input and output capacitors temporarily hold voltage constant while the voltage across the inductor can change quickly. This constant voltage enables the changing inductor voltage to be either *added* to the input voltage (as in the *boost* configuration) or *subtracted* from the input voltage (as in the *buck* configuration).

Another important distinction between different types of switchmode designs is whether inductor current flows all the time or just some of the time. The former is called *continuous mode*. If current flows only part of the time, as in our buck and boost regulators, that is a *discontinuous mode* design. Inductors in a continuous mode circuit must be selected so that the energy in the core that is always present does not cause the core to *saturate*, like a bucket being overfilled with water.

Building a Boost Regulator

Since the switch drain is connected to the inductor and the source to ground, instead of in series with the inductor, the gate drive voltage can be reduced to 4 V. In addition, to more clearly observe the boost function, the output load resistor is increased to 1 kΩ.

- Build the circuit shown in Figure 1, and lay it out according to the general guidelines of Figure 3. As with the buck converter, keep leads short and direct, and use a common ground for the signal and oscilloscope leads.
- Set the function generator to supply 10 kHz pulses, with a duty cycle of approximately 10%, a minimum voltage of 0 V and a maximum of 4 V. Apply 3 V dc to the input (two D cells in series will work). If your function generator can't add a dc offset, see experiment #14 for a method of generating the proper waveform. If limited to a 50% duty cycle, increase the frequency to approximately 50 kHz.
- The output voltage measured on a voltmeter should be somewhat above 4 V dc, depending on the type of inductors and capacitors you use. My circuit's output was 4.7 V dc.
- If your oscilloscope has the ability to add two channels of input together on the screen, this would be an excellent time to learn how to use that facility. Typically, channel 1 is connected to the inductor input, channel 2 to the inductor output, and the two channels are added together, with channel 2 set to invert the input signal. Both channels must be set to the same vertical input sensitivity (volts/division) in order to perform the operation correctly. The result should look something like Figure 2 and is a display of channel 1 plus an inverted channel 2.
- Vary the switch drive duty cycle and see how the output compares to Equation 1. In my case, increasing the duty cycle to 50% resulted in an output voltage of 8.3 V dc.
- Set the duty cycle to obtain an output of 6 V dc. Experiment with different values of load resistance to see how that affects output voltage. *Caution*—removing the load completely will result in a fairly large output voltage (possibly as high as 70 to 80 V dc) as the inductor discharges into the open circuit, pumping the capacitor full of charge. This can easily exceed the capacitor's working voltage rating and cause it to fail.
- As you change the load, readjust either duty cycle or frequency to return the output voltage to 6 V dc. This is just what a regulator circuit would do to control the output of a switching supply!

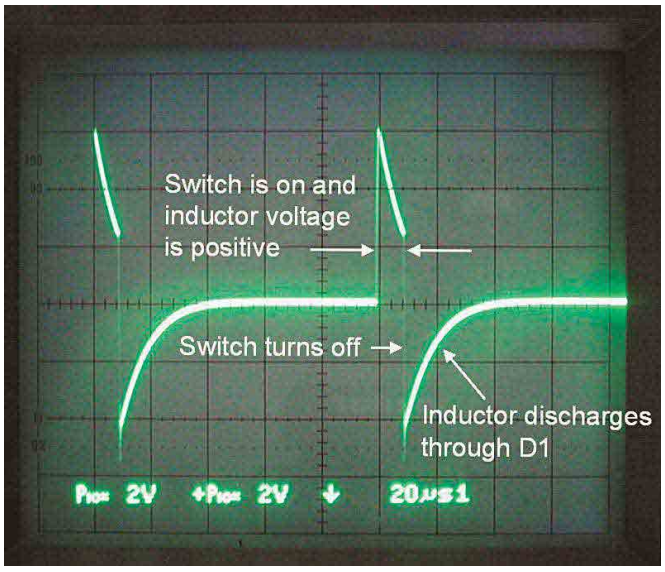


Figure 3—An oscilloscope photo of the inductor voltage. The droop on the top portion of the waveform is the input filter capacitor being partially discharged. Note how quickly the voltage reverses when the switch is turned OFF.

Suggested Reading

No additional reading material is suggested beyond that recommended last month.

Shopping List

There are no new parts from last month, but here is the list for those of you just starting:

- 100 µH choke capable of handling 1 A (RadioShack 273-102 or equivalent)
- IRF510 transistor (RadioShack 276-2072)
- 1N5819 fast-recovery rectifier (available from Jameco, Digi-Key and other vendors)
- Two 100 µF, 25 V dc tantalum capacitors
- 10 Ω and 100 Ω, 1/4 W resistors

Next Month

Back into the realm of op-amps we will go for a quick spin cycle through the world of the oscillator. We'll investigate the phase shift oscillator—a simple source for sine waves in the audio region.

Hands-On Radio Web site: **www.arrl.org/tis/info/html/hands-on-radio/**. QST

STRAYS

I would like to get in touch with...

◊ others who have had an cardioverter defibrillator (ICD) implant. *—Peter A. Brandenberg, K2MMT, 71 Burr Farms Rd, Mount Kisco, NY 10549;* **peter@brandenberg.tv**

By Gary Sargent, KE8WO

A Data to PC Interface (or... New Life for an Old Mouse)

Ensure clean signals for both your rig and your PC—build a useful data coupler out of a salvaged old mouse.

It was going to be a fun weekend. My wife and I were in Greenville, South Carolina where she was attending a business conference. I decided this was a good chance to test out my new Yaesu FT-817 low power rig. I packed it up with a tuner, some wire for an antenna, and my trusty laptop PC. I had just built a simple direct interface to couple the rig to the PC and my plan was to string some simple wire antennas in the hotel room to try out some digital modes on 20 meters.

The Problem

On a bright morning I strung up an antenna in the hotel room and settled back to tune to 14.070 MHz for some PSK31 signals. But PSK is not what I heard. What I heard was &%#@!&! noise and, wouldn't you know, it seemed to peak right in the digital portion of 20 meters!

It turned out that the noise was present for two reasons: 1) My interface to the computer was not isolated (the FT-817 and PC share a common ground) and 2) The antenna was just a few feet from the PC. No amount of fiddling with the antenna, the tuner or the distance between the antenna and PC solved the problem. I closed up shop for the weekend and went for a nice long walk in a nearby state park to contemplate the problem.

The Solution

I decided that I needed to come up with an electrically isolated interface to connect my FT-817 data port to the PC. Eliminate the common ground—that would greatly reduce noise from the PC getting into the FT-817. My existing "noisy" FT-817 interface included full CAT (computer aided transceiver) capability and it was quite effective when I operated with a normal coax-fed antenna located some distance from the operating position.

What I needed was an isolated interface to couple both the audio in and out and the push-to-talk (PTT) circuitry to my PC.[1] The FT-817 data port uses a 6 pin mini-DIN connector and I had read that a mouse connector would work just fine. I happened to have a bunch of old computer mice lying around and thought: Why not use the whole mouse—cable, connector and all—for the interface? The result is the computer mouse-based interface project described here.

Building It

The first task was to round up a suitable isolated interface circuit. This basic circuit will work with many modern transceivers—replace the 6 pin mini-DIN connector with a suitable connector to fit your radio. T1 and T2 are 1:1 600 Ω audio coupling transformers that provide isolation for the audio input and output signals, and U1 (an optocoupler) isolates the PTT control line generated from the computer serial port DTR line.

I checked out a couple of "mice" I had on hand and selected an old Compaq model. Looking at Figure 2, you'll note that there are a fair number of mouse components that will need to be removed to provide room for the interface circuitry. The components include some interesting optical shaft encoders and circuitry that would be fun to use on another project.

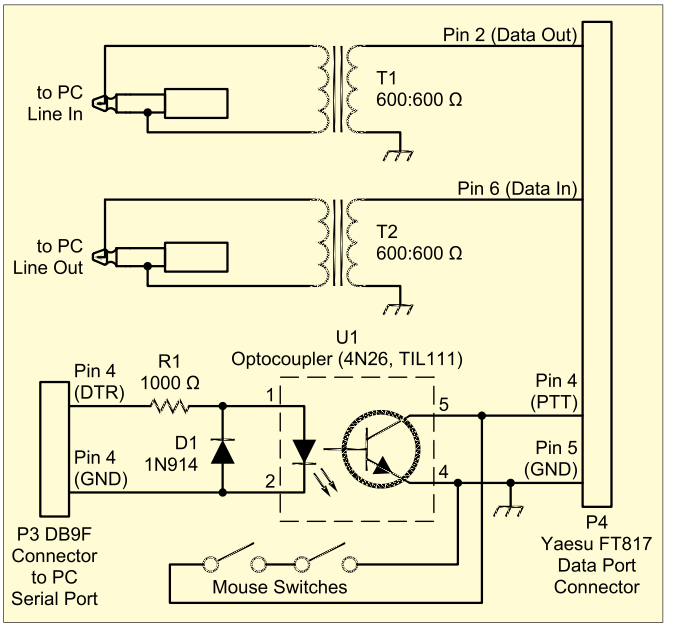


Figure 1—The schematic of the data/PC interface. It uses both an optocoupler and audio coupling transformers for isolation. Part numbers are RadioShack.

D1—Diode, 1N914, 1N916 or 1N4148 (276-1122).
R1—1000 Ω, 1/8 W resistor (271-1118).
T1, T2—1:1 600 Ω audio coupling transformer (273-1374).
U1—Optocoupler, 4N26, TIL111 or MOC3010 (276-134).
Miscellaneous
P1, P2—3.5 mm stereo plug (274-284).
P3—9 pin female D-sub connector (276-1538).
P4—Existing mouse 6 pin mini-DIN connector.
PCB—General purpose IC PCB (276-148).
Mouse—Salvaged computer mouse with 6 pin mini-DIN connector.

[1]Getting rid of any RF on the audio and control lines would help, as well. Ferrite beads and toroids are ideal for this purpose and could be built into the same interface enclosure. See *The ARRL Handbook*, 2004 Ed., pp 28-11 to 28-14.—*Ed.*

Figure 2—The mouse uncovered. Most of these components will be removed.

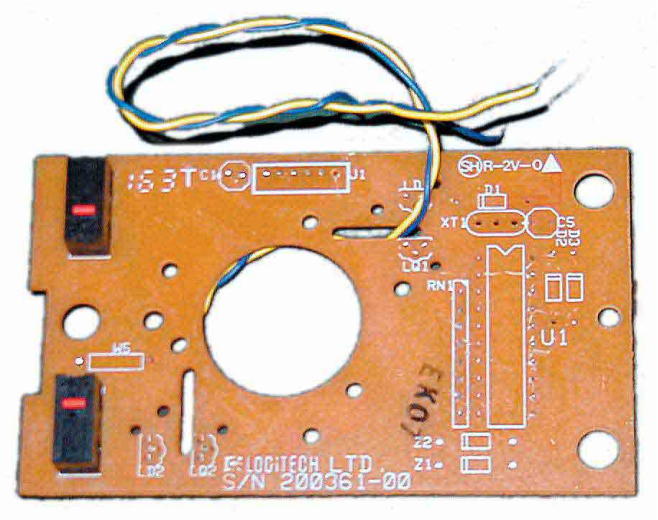


Figure 3—The "cleaned up" mouse circuit board. Note that the two mouse switches are all that remain.

PHOTOS BY THE AUTHOR

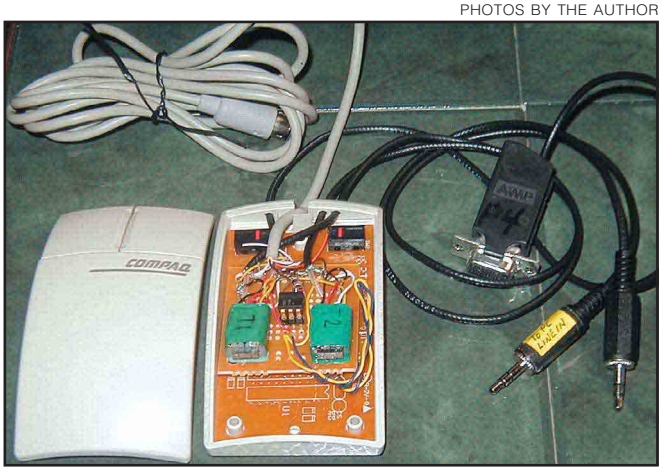


Figure 4—The completed mouse data/PC interface. The components mount to a sub-board that is then glued to the main board.

For this project, though, all I wanted to retain was the ability to use the two mouse buttons as manual activation for the FT-817's PTT line.

The first step was to verify that the mouse's mini-6 pin DIN connector would, in fact, "work." Interestingly, all of the data port signals are available, save for the squelch signal (data port pin 1). Also, even though a mouse cable has six wires, the sixth wire connects to the connector's shell.

Next, I took the diagonal cutters to the board and quickly removed all of the components except for the two switches. I also used a knife on the circuit side of the board to isolate the switch traces from the rest of the old PC board traces. While I was there, I used my multimeter to identify the switch's normally open contacts (it also included normally closed contacts). I wired the two switches in series and attached two wires to connect them to the new small circuit board. Figure 3 shows the cleaned up mouse circuit board. Notice that the two mouse switches are the only components that remain.

Finally, I drilled three small ($^3/_{16}$ inch) holes through the mouse base plastic enclosure to allow small cables to pass out to the PC's AUDIO IN, AUDIO OUT and SERIAL ports. Be careful to position the holes such that you will be able to route the cables properly to allow the mouse cover to be reattached.

The mouse now has enough room to accept a small circuit board containing the circuit components. The circuit board I used is a small RadioShack unit designed for a single DIP IC. It works well to hold the 6 pin optical coupler chip, it provides other pads for the rest of the components and it serves to terminate the cables. I used some RG-174/U coax cable for the three connectors that go to the PC. Make sure you pass the cable through the mouse enclosure holes you drilled *before* you install the connectors and solder to the circuit board. Also, make sure these three cables are long enough to connect to your PC ports. Cable lengths of about 18 inches would be an approximate minimum. Figure 4 shows the new PCB glued to the old mouse board and ready to have the mouse cover reinstalled.

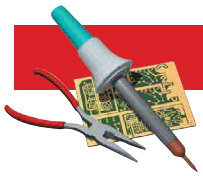
Checking It Out

Testing is fairly simple. Use your multimeter to verify the mouse cable DIN pin connections to the circuit board. Do the same for the audio connector signals back to the circuit board. Ensure that the audio lines are not shorted to each other.

Plug the mouse (P4) into the data port on the back of the FT-817 and the audio connectors to the appropriate PC audio AUDIO IN (P1) and AUDIO OUT (P2) ports. Finally, connect the DB9 (P3) connector to the PC serial port. You will use the *Windows* AUDIO IN and AUDIO OUT level controls to adjust the signal level to drive the transceiver properly from the PC and vice versa. You can use the mouse switches (since they are in series, both must be pressed) for keying the rig manually when tuning up.

The noise level at the FT-817 due to the PC is now much reduced. I'm now ready to venture forth with the little transceiver, some wire, tuner and laptop for some serious DXing on my next vacation trip. I need, however, a stealthy way to get an antenna wire out of a modern, steel enclosed, hermetically sealed and electrically noise-polluted hotel room! Hmm… time for another walk in the woods!

Gary Sargent, KE8WO, was first licensed in 1969, while pursuing an electrical engineering degree. He currently holds an Advanced class ticket. Gary enjoys the digital modes and tinkering with computers and radio, which has resulted in several published articles. He is currently an engineer at a computer services company. You can reach him at 4227 Willow Run Dr, Dayton, OH 45430; **garysargent@att.net**.



HINTS & KINKS

CW FREQUENCY MATCHING WITH MUSICAL INSTRUMENT TUNERS

◊ Many transceivers provide no means to help the operator match the transmitted frequency to that of the other station. Usually it's a case of matching the audio beat tone for the received CW signal by ear.

I've found that quick and accurate CW frequency matching—within a few hertz—is possible through use of a digital tuner meant for musical instruments. The better tuners are actually small audio frequency counters, complete with a crystal time base. They display frequency not in hertz, but as points on the musical scale: notes and hundredths of a note. Their circuitry allows them to "listen" only when a tone is present, ignoring background noise between CW dits and dahs, while displaying the average pitch continuously. I found these tuners to be effective and accurate with weak signals, almost to the point where the signals vanish in the noise. The input audio level is not critical.

The two tuners in Figure 1, a Seiko ST-747 and a Korg CA-30, work about equally well for this purpose. They cost about $20 to $30 from retailers or on-line suppliers. I didn't test other models, but I suspect some might not work for CW, particularly under noisy band conditions.

To use a tuner for CW frequency matching, you'll first need to determine exactly what pitch of a received CW signal corresponds to zero beat of your transmitter with that station. To determine this, find a reference signal and zero beat your transmitter to it by listening on a second, independent receiver. Then, switch to receive mode on your transceiver and note the pitch reading on the tuner for this reference signal. For any future station you wish to contact, adjust your receive frequency so the tuner shows this same pitch reading.

The tuners in Figure 1 have built-in microphones, but feeding an audio signal directly to the microphone-input jack of the tuner yields much better results. I found mine worked best with a series resistor of about 100 kΩ in the line between my transceiver headphone jack and the tuner input. I'd suggest experimenting with different resistances. Find a value low enough to yield a pitch display on the tuner with a weak CW signal, yet high enough that no pitch displays if only noise is present.—*Dick Lamb, KØKK, 44 Post Rd, Iowa City, IA 52245-3622;* **k0kk@arrl.net**

Figure 1—Musical instrument tuners like these can help the CW operator quickly and accurately tune a transmitter to the frequency of another station.

N CONNECTOR FAILURE

◊ My 6 meter quad (4) Yagi antenna system uses nine common N connectors. About two years ago one of the connectors came apart. This last winter two more of these connectors also failed. These connectors have been in use about 10 years. There are no markings on these connectors, so I do not know who made them.

Just this spring, my former employer in the two-way business-radio business was installing a new FM broadcast antenna system and tower (88 to 108 MHz). There were eight N connectors on a factory-made matching harness. Of these eight, four of the new connectors failed—even when hand-tightened. Again, the connector maker was unknown. The construction crew was forced to secure the connectors with plastic tape until a new harness arrived.

The Failure

There is a snap ring in a groove in the body of the connector (see Figure 2). This snap ring is compressed and the coupling sleeve slipped over the snap ring. This snap ring then enters a matching groove in the coupling sleeve. All of the many connectors I have seen with coupling sleeves use this method of assembly.

On my failed connector, I measured the metal thickness of the coupling sleeve at about 0.040 inch. The snap-ring groove depth is around 0.025 inch deep. If the manufacturer is a little sloppy in machining this coupling-ring groove, there is maybe only 0.010 inch holding the ring together.

On the connector I checked, the snap ring inserted in the coupling sleeve was loose in the grove, and I could see visible movement. When I shook the coupling sleeve, I could hear it rattle in its 0.025-inch-deep groove. The locking of the snap

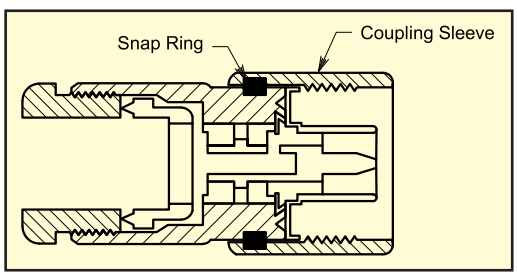


Figure 2—A cross-section of an N connector coupling sleeve and snap ring.

Bob Schetgen, KU7G ♦ Senior Assistant Technical Editor ♦ h&k@arrl.org

ring is controlled by the release of the snap ring in the coupling sleeve's groove.

Another possible problem area is temperature. Here in western Colorado, we often see a day-to-night temperature change of 50°F or more, plus solar heating. Just yesterday (May 27, 2003), the night-to-day swing was 48°F. Today, it is 46° so far and increasing.—*William J. LeBaron, WØMTK, 1155 W Paradise Way, Fruita, CO 81521-2049*; **w0mtk@gvii.net**

USING LINEAR POTENTIOMETERS FOR AUDIO APPLICATIONS

◊ Few things are more frustrating than trying to finish your latest project shortly after midnight and being unable to find that last necessary component in your parts bin or junk box. I was in such straits one night, when I needed a potentiometer with an audio-taper but had only linear pots on hand. This circuit converts a linear input to a logarithmic output.

Figure 3 shows a simple way to make a linear pot function like an audio pot. Select R1 with about one-tenth the value of R2 for best performance. For example, if you are using a 100 kΩ linear pot for R2, try a 10 kΩ fixed resistor for R1. Figure 4 shows the percentage output related to percentage of available shaft rotation for linear and audio pots as well as this circuit.

Be aware that the stage feeding this circuit will see a varying load resistance. For example, the values above produce an input load resistance that can vary between 9091 Ω and 100,000 Ω (ignoring any loading caused by the following stage). I haven't observed any noticeable effect from this in my applications.

This idea is widely known among audio experimenters, but it doesn't seem to be used much by hams. I hope it will make your next trip to the junk box for a volume control more rewarding.—*Jim McClanahan, W4JBM, 300 Relais Trace, Alpharetta, GA 30004;* **w4jbm@arrl.net**

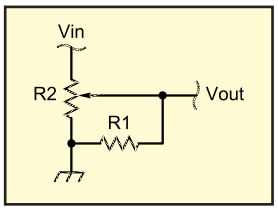


Figure 3—A simple circuit allows the use of linear pots in applications normally needing audio pots.

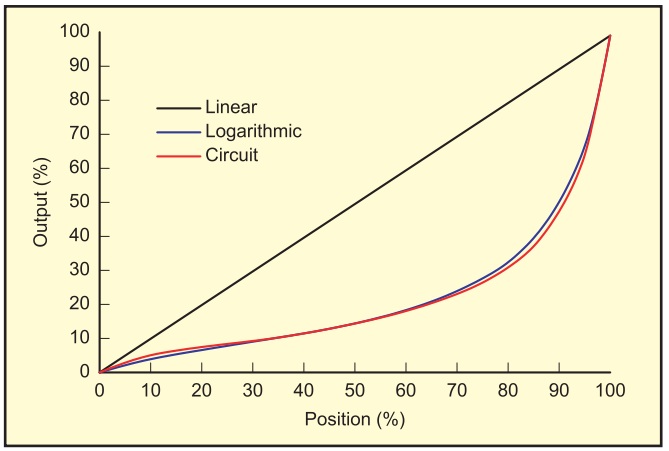


Figure 4—A comparison of the output of linear pots, audio pots and the circuit shown in Figure 3.

NEW KNOBS FOR YOUR YAESU FT-50 HANDHELD

◊ I have big hands and it's hard for me to get a grip on the small volume and channel knobs atop the Yaesu FT-50 radio, especially when I have the slip-on rubber grip on the radio. Yaesu builds the VXA-100 air-band transceiver on the same frame, and it uses much bigger knobs (although their functions are reversed from what they are on the FT-50). The part numbers are:

RA012580B VXA-100 Channel knob (the volume knob on a FT-50); cost: 61¢.

RA0125700 VXA-100 Knob (vol) (the channel knob on a FT-50); cost $1.01.

Carefully pull off the old knobs, and after lining up the two cutouts with the plastic bosses on the outer knob and the flat section on the shaft and the inner knob, press them onto the shafts.

You might want to order several sets of knobs with your local club; there is a $4 minimum shipping charge.—*Ron LaPedis, N6QGK, 2115 Sea Cliff Way, San Bruno, CA 94066-1040;* **n6qgk@arrl.net**

PSK-31 COM-PORT SOFTWARE PROBLEM

◊ I had been frustrated trying to run PSK-31 using my computer with the *Windows XP* operating system. I had installed a PSK-31 program that could use the RTS line of the COM1 port to key the PTT on my transceiver. My problem was that the RTS line was constantly held high. I feared that there was some exotic problem with *Windows XP*.

It turns out that the solution was very simple, but it eluded me (and maybe other hams) for several days.

I had simply unplugged the cradle for my Palm Pilot and plugged in my PSK-31 interface into the COM1 port, but I had not realized that the Palm Pilot *HotSync Manager* program in my computer was still controlling the COM port. Once I disabled *HotSync Manager* the PSK-31 program was able to key my transceiver properly. What a relief!—*David Powell, NM5U, 1732 Ponderosa St, Los Alamos, NM 87544-3034;* **nm5u@arrl.net**

DEET INSECT REPELLENT WARNING

◊ As summer approaches, hams will be getting out into natural environments for events such as Field Day. We will be applying liberal amounts of DEET. As the Consumer Specialty Products Association says, "DEET is the common name for N, N-diethyl-m-toluamide, which is the active ingredient in the most widely used insect repellents applied to the skin." (**www.deet.com/deet_fact_sheet.htm**).

I want to make all amateurs aware of one problem with DEET. In strong as well as diluted concentrations, DEET will soften or dissolve many plastics. The battery compartment of my Alinco DJ-G5 softened in my hand, just after I used the hand to apply DEET. Some spilled into a Stearlite clear plastic container that held a 250 W soldering gun, and two Garmin GPS units. All had substantial damage to their cases from the DEET. So, be careful how you apply and use DEET-containing bug repellents this summer.—*David Pearce, ABØNG, 4571 Huntridge Dr, Roswell, GA 30075-6367;* **ab0ng@arrl.net**

Hints and Kinks items have not been tested by *QST* or the ARRL unless otherwise stated. Although we can't guarantee that a given hint will work for your situation, we make every effort to screen out harmful information. Send technical questions directly to the hint's author.

QST invites you to share your hints with fellow hams. Send them to "Attn: Hints and Kinks" at ARRL Headquarters, 225 Main St, Newington, CT 06111, or via e-mail to **h&k@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether praising or criticizing an item, please send the author(s) a copy of your comments. QST

Automatic Antenna Tuners—A Sample of the Field

Joel R. Hallas, W1ZR
Assistant Technical Editor

A few years back, we surveyed the antenna tuner market in these pages. All those tuners were manual ones. A few automatic tuners were available at that time, but they were the exception rather than the rule. Since then, a number of manufacturers have focused their attention on automatic antenna tuners and it seems as if there's now one for every application.

For this review we selected representative tuners from a number of manufacturers. There are two general configurations: those providing remote tuning, with the tuner intended to be near the antenna, and those intended to be colocated with the station equipment. For those manufacturers having models in each camp, we selected one of each.

As noted in the specifications, each tuner is different and they don't exactly line up head-to-head, so a direct comparison is not always appropriate. Still, for each we will provide the basic data you would need to decide if one of these is a good fit for your needs. If you like the looks of a particular manufacturer, but the tuner reviewed doesn't exactly meet your requirements, check their Web page or your dealer for other models at different power levels or with different features. For this review we stuck to those at the 100 to 200 W level and tried for a representative self-contained and remote tuner from each manufacturer.

For these tests, we looked at units designed to work with any radio. In addition to these, most HF radio manufacturers offer external auto tuners designed to operate exclusively with their radios. One manufacturer, LDG, also offers tuners with the capabilities to operate with specific radios' commands. Many HF radio manufacturers also offer internal autotuners as a part of their transceivers. We generally review these as a part of the radios. We elected to stick to general purpose models for this review. Those selected for this test include the RT-11 and Z-100 from LDG, the MFJ-991 and from SGC the SG-237 and MAC-200.

Figure 1—Tuners from LDG, MFJ and SGC—ready for test.

Remote vs Colocated Autotuners

It's probably worth a paragraph or two to discuss the relative merits and appropriateness of the two configurations. If the antenna(s) to be matched terminate right at the station equipment, without a transmission line (or with a very short one), there is no particular advantage to having a remote tuner. On the other hand, that setup often results in problems with "RF in the shack," or EMI within the house. I have one antenna setup of that form and whenever I use it, the RF resets the kitchen FM radio, causing it to lose track of time and memory.

Most find it a better solution to have the antenna system stop somewhere outside the house and have a transmission line interconnect the radio and antenna. With a remote tuner, the matching can be at or near the antenna, resulting in a well matched transmission line coming back to the radio. With the tuner at the radio, the matching takes place near the radio, and the SWR on the line out to the antenna will often be high. Note that in both cases the radio will be provided a good match and will happily put full power into the system. With the remote tuner, often more of the power will be radiated by the antenna and less will be dissipated as heat by the transmission line. Some radios now come with automatic tuners as part of the radio. These can be functionally equivalent to the local tuner. The separate tuner does offer two advantages over the internal tuner—it can support multiple radios, and most can match a higher SWR than many of the internal tuners.

The key factor in deciding between a local and a remote tuner then becomes how much of the transmitter power actually reaches the antenna system and how much will heat up the transmission line. This is a function of operating frequency, SWR and line length. The place to start the analysis is with *The ARRL Antenna Book*.[1] Figure 23 in Chapter 24 provides the attenuation in 100 feet of *matched* transmission line for each of the common types. Table 14 in the same chapter provides the *additional* loss for the nonmatched case as a function of SWR and matched loss. Using the two tables, you can determine the total loss of your transmission line. If the loss is acceptable, you can tune at the transmitter end. If not, by tuning at the antenna end you can eliminate most of the additional loss due to mismatch.

An example might be helpful. A multiband antenna such as my G5RV might have a 5:1 SWR on parts of 10 meters. If we feed it with 150 feet of RG-58 cable we have a matched loss of about 3.5 dB and the 5:1 SWR adds about another 2 dB for a total of 5.5 dB loss or about 71% of our power heating up the line! By moving the tuner to the antenna end of the coax, we reduce that to 55%. Another option is to change the transmission line (my solution immediately after making that calculation!). If we go with lower loss RG-8 instead, we have a

Bottom Line

Automatic antenna tuners can provide a quick and easy method of matching multiband or nonresonant antennas quickly and effortlessly. Performance is on par with manual tuners and there is now a selection available providing a fit to most requirements.

Joel R. Hallas, W1ZR ♦ Assistant Technical Editor ♦ w1zr@arrl.org

matched loss of about 2 dB (1.3 dB per 100 ft) and the SWR adds about another 0.3 dB for a total of 2.3 dB, or a loss of about 41% of our power. With the tuner at the antenna, the total loss would be the 2 dB or 37%—not much of a difference. Note that I didn't consider the tuner losses here, under the assumption that they would be the same at either location. The numbers get much more grim as the SWR goes up, by the way.

Two notes of caution—first, if you measure the SWR at the shack end of the cable, it will appear better than it is, due to the cable loss; second, the matched loss from Figure 23 is the *best* matched loss for new and dry cable. The actual loss can only go up from there, especially if the cable came from some dark corner of your basement, or worse, from an unknown source at a flea market.

Note that all of these tuners are designed for unbalanced (coax) cable between the tuner and the radio and, with the exceptions noted, unbalanced operation on the antenna side (coax or single wire antennas) as well. In order to use these tuners with a balanced load, it is best to decouple the ground side of the tuner from the transmission line. A coax choke can be used, or a balun (balanced to unbalanced transformer) can be employed. If you are using a balun, it is best to keep the line impedance within a SWR of about 4:1 (with respect to the usual 200 Ω impedance of a 4:1 balun) to avoid heating, loss and possible balun damage. A subsequent planned review will look at the special class of unbalanced to balanced tuners that sidestep this issue in an elegant way and are once again appearing on the market.

A word or two about the data shown may be in order. Please note that we used the same precision resistive load set for each tuner. In most cases, this includes data outside the manufacturers' specification range. We measured at a single frequency in each band, and for 6 meters we just measured the case with a 1:1 load for all the tuners that claimed operation there.

THE TUNERS—ALPHABETICALLY

LDG RT-11 and Z-100

A look at LDG's Web page, **www.ldgelectronics.com**, will show you their selection of tuners and accessories. In addition to the RT-11 remote control tuner and the Z-100 local tuner, tested, they offer an autotuner rated at 1000 W. As this review was being prepared, they also announced a much more feature rich desktop unit to complement the very basic, but lower cost Z-100.

LDG RT-11

The RT-11 is a rugged, weatherproof tuner designed to be used inside or outdoors. It has coax connectors on input and

Figure 2—LDG RT-11 (left) with control box and Z-100. A 12 ounce beverage container is included for scale.

Table 1
LDG RT-11 Remote Automatic Antenna Tuner

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Input SWR range: to 10:1 (3:1 on 6 meters).	See below.
Output SWR range: not specified.	See below.
Frequency coverage: 1.8 to 54 MHz.	As specified.
Input power: 0.1 to 125 W, 50 W on 6 meters.	Tested at 50 W on HF, 20 W on 6 meters.
Power requirements: 11 to 14 V dc, 7 to 250 mA.	Idle 0 mA, max 140 mA at 13.8 V dc.

Measured power loss into resistive loads (%) / Input SWR at match:

SWR	*Load (Ω)*	*160 Meters*	*80 Meters*	*40 Meters*	*20 Meters*	*10 Meters*	*6 Meters*
16:1	3.125	No Match	No Match	27 <1.5:1	22 2.6:1	<10 <1.5:1	
8:1	6.25	No Match	17 <1.5:1	17 <1.5:1	19 <1.5:1	20 <1.5:1	
4:1	12.5	11 <1.5:1	11 <1.5:1	12 <1.5:1	13 <1.5:1	26 <2:1	
2:1	25	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	23 2.1:1	
1:1	50	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	21 2.1:1
2:1	100	<10 <2:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	17 <1.5:1	
4:1	200	<10 <2:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	15 <1.5:1	
8:1	400	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	28 <1.5:1	
16:1	800	<10 <1.5:1	12 <1.5:1	<10 <1.5:1	<10 <1.5:1	19 <1.5:1	

Table 2
LDG Z-100 Desktop Automatic Antenna Tuner

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Input SWR range: to 10:1 (3:1 on 6 meters).	See below.
Output SWR range: not specified.	See below.
Frequency coverage: 1.8 to 54 MHz.	See text.
Input power: 0.1 to 125 W, 50 W on 6 meters.	Tested at 50 W on HF, 20 W on 6 meters.
Power requirements: 7 to 18 V dc, 250 mA.	Idle 0 mA, max 160 mA at 13.8 V dc.

Measured power loss into resistive loads (%) / Input SWR at match:

SWR	*Load (Ω)*	*160 Meters*	*80 Meters*	*40 Meters*	*20 Meters*	*10 Meters*	*6 Meters*
16:1	3.125	No Match	No Match	15 <1.5:1	10 <1.5:1	<10 <1.5:1	
8:1	6.25	No Match	13 2.6:1	15 <2:1	15 <1.5:1	20 <2:1	
4:1	12.5	No Match	<10 <1.5:1	<10 <1.5:1	<10 <2:1	<10 <1.5:1	
2:1	25	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	17 <1.5:1	
1:1	50	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	20 <2:1
2:1	100	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	
4:1	200	<10 2.1:1	<10 2.2:1	<10 <1.5:1	11 <1.5:1	<10 <1.5:1	
8:1	400	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	11 <1.5:1	<10 <2:1	
16:1	800	11 2.2:1	14 2.3:1	15 <1.5:1	33 <1.5:1	43 <1.5:1	

output and is rated at 125 W from 1.8 to 30 and 50 W to 54 MHz. It is rated to match antennas with an SWR of 10:1 to 30 MHz and 3:1 from 50 to 54 MHz. This unit has an optional remote control designed to be used up to 100 feet from the tuner (15 foot cable supplied). The remote control provides the ability to force a new tune, set for semi or full auto operation, keep the unit from tuning and allows bypassing of the tuner (straight through operation for matched antennas or out of band receive). In addition, LED indicators let you know the status and whether the SWR is below 1.5:1. One caution with the remote, the mounting bracket screws are not captive so you may want to use double-sided tape to secure it to a surface. The RT-11 also has a jack to allow interfacing to radios designed to control proprietary tuners by emulating their commands. Special cables are offered to hook to various Alinco, ICOM, Kenwood and Yaesu radios for this purpose.

In my trials at home, I found that the RT-11 effortlessly tuned every antenna I had on all bands with a very low SWR, always well below 1.5:1. The tuning seemed to take about 5 seconds and hit the result the first time. While automatic operation is possible without radio interface or remote control, I would have trouble imagining it and would suggest the remote for those without a compatible radio. For one thing, once tuned, it won't automatically restart the tuning process until the SWR reaches 3:1, a value that might cause many radios to "fold back" (reduce power) significantly.

The manual mentions that tuning should take place at the 25 W level, with full power applied only after tune is achieved, so that relay life will not be reduced. They also indicate that if a radio has the common power output fold back with high SWR it will automatically reduce power appropriately. I wouldn't count on that providing sufficient reduction, especially as the match is approached; I would instead manually reduce power while tuning.

LDG Z-100

The Z-100 is a self contained desktop unit with a 125 W rating (50 W on 6 meters). This unit is the first of a new series of tuners being released by LDG, with others providing additional features and controls. This is a basic unit corresponding to its low price, but none the less provides the needed tuning functions with straightforward "one button" operation. It includes memory of the settings for the last 200 matches made and tries those before it branches to its "unknown tune" algorithm. This is a clever idea that avoids the need to measure frequency. It is particularly useful for the case in which more than one antenna is used, since it really doesn't care—if it made the match before it will do it again, in a fraction of a second. A feature of this unit is that it only draws power when actually tuning. Upon completion, the relays remain latched without power required until the next tune is requested. This is particularly appealing for portable low power operations in which every milliamp-hour is carried in.

The operation of this tuner is fundamentally different than the others in that it will only tune when the TUNE button is pushed. This has an advantage in that it will not start tuning inadvertently on high SWR, potentially applying full power during tune. Upon changing frequency, the operator can decide whether or not to initiate the tune cycle. By pushing the button for less than 0.5 seconds, the tuner goes to bypass. Between 0.5 and 3 seconds the tuner will attempt to find a match from memory (typically less than half a second), and only initiate a full tune if needed. If the button is pushed for more than 3 seconds a full tune cycle is initiated, ignoring any memorized settings. This is easier to deal with than it sounds

since the LEDs provide a confirmation of tuning mode. A green LED also indicates if the match is less than 1.5:1 or between 1.5 and 2:1. An early production unit exhibited some inconsistent tuning results on 6 meters. The manufacturer has developed a method of improved internal decoupling that solved this problem and the results reflect that change. LDG states that this will be included in future production units and that anyone having problems with 6 meter tuning on early units should contact them directly.

Manufacturer: LDG Electronics Inc, 1445 Parran Rd, PO Box 48, St Leonard, MD 20685; tel 877-890-3003; fax 410-586-8475; **www.ldgelectronics.com**. Price: RT-11 Tuner, $209; Remote head, $39; Z-100, $149; 12 V power cube for either tuner, $10.

MFJ-991

MFJ has recently announced a series of autotuners. All are in the typical indoor/co-located configuration, but with the available remote kit (ordered, but not received in time for the review) can be used as a remote tuner if kept out of the weather. They offer the MFJ-991 (tested) 150 W rated tuner, a tuner with similar features rated at 600 W and a 300 W autotuner with digital display, balun and two port antenna switch. As with the LDG, the MFJ tuners require their tuning be accomplished at reduced power.

Figure 3—MFJ-991 Autotuner.

The MFJ-991 front panel provides full control capability and forward and reflected power metering with "crossed-needle" SWR measurement display. Two features of the '991 are not found on other tested units and are worth mentioning. First, the '991 has the capability to allow manually adjusting the C and L values of the tuner while in receive. This is helpful if you are using your radio for receive only and wish to attempt to match to increase signal strength. The second feature is the ability to select the SWR threshold at either 1.5 or 2:1. In our testing the tuner went to the best match it could find in either case. The difference was in how far you could change frequency before it would automatically retune when you transmitted. If your radio can tolerate a 2:1 SWR, this could provide a benefit. The '991 could tune my G5RV on all bands and remembered the last setting for each frequency (1000 memories), with a one-click reset. Tuning the first time on a frequency was typical of the cycle time of the other units. This unit sounded somewhat louder (it has 18 heavy duty relays) than the other test samples, although not an issue for the single click associated with a memorized tune.

The MFJ-991 can interoperate with ICOM and Alinco tuner control commands. Appropriate interface cables are available from MFJ.

In addition to the obvious controls and indicators, there are some subtle ones as well. There are a number of meter "sig-

Table 3
MFJ-991 Desktop/Remote Automatic Antenna Tuner

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Input impedance range: 6 to 3200 Ω.	See below.
Output SWR range: 1.5:1 or 2:1 selectable.	See below.
Frequency coverage: 1.8 to 30 MHz.	As specified.
Input power: 5 to 150 W.	Tested at 50 W.
Power requirements: 12 to 15 V dc, 1.0 A.	Idle 90-300 mA, max 500 mA at 13.8 V dc.

Measured power loss into resistive loads (%) / Input SWR at match:

SWR	*Load (Ω)*	*160 Meters*	*80 Meters*	*40 Meters*	*20 Meters*	*10 Meters*
16:1	3.125	No Match	27 <1.5:1	20 <1.5:1	15 <1.5:1	<10 <2:1
8:1	6.25	12 <1.5:1	14 <1.5:1	15 <1.5:1	24 <1.5:1	19 2.6:1
4:1	12.5	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	12 <1.5:1
2:1	25	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1
1:1	50	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1
2:1	100	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1
4:1	200	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1
8:1	400	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	11 <1.5:1	11 <1.5:1
16:1	800	<10 <1.5:1	16 <1.5:1	<10 <1.5:1	<10 <1.5:1	23 <1.5:1

nals" sent to the operator that will not be clear without a cruise through the manual. For example, if you forget to reduce power before tuning, the power meter swings to full scale and the tuner is bypassed. If you toggle between 1.5 and 2:1 SWR threshold, the meter briefly jumps up to indicate that SWR.

To order, or for your nearest MFJ dealer, call MFJ Enterprises at 800-647-1800 or order at **www.mfjenterprises.com**, fax 662-323-6551; or write MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759. Price: $220.

SGC SG-237 and MAC-200

SGC has been making automatic antenna tuners for many years, and offers a wide selection. Until recently, they concentrated on remote tuners, usually the weatherproof type, at power ratings of 100 to 500 W. More recently, they have introduced a number of variations of their SG-237, a board version to build into your own radio or antenna cabinet, an open enclosure model for remote but indoor use and one with controls and indicators intended for portable use. They have recently released a Multiple Antenna Controller, MAC-200. The units we tested were an SG-237 (one that has fed the backstay of my sailboat for some years) and a relatively new combination unit, the MAC-200.

SGC SG-237 Autotuner

The SG-237 was the first in a series of SGC tuners that were much more compact than their previous (and continuing) line, the SG-230 (200 W, 1.6-30 MHz), SG-231 (100 W, 1-60 MHz) and SG-235 (500 W, 1.8-30 MHz). The SG-237 is rated at 100 W PEP, both for operation and for tuning (40 W continuous carrier power). The transmitter connection is via a 9 foot combined RF, control and power cable (25 and 50 foot extensions available), while the antenna connection is via a single ceramic insulated terminal. While the tuner is designed to feed a single wire against ground, I have successfully employed mine into coax fed antennas as well as loops and single wires. This is a rugged unit in a compact waterproof aluminum enclosure that can slide in almost anywhere. It needs no remote control box to work, and I've used mine that way for years. An optional remote control is offered (and we tested with it) to provide a positive indication of match and to allow a lockout or a forced reset. The lockout can be handy in a portable or mobile environment to avoid the tuner attempting to retune due to the temporary proximity of outside objects while in motion, for example. The '237 provides a memory function that uses the measured transmitter frequency to result in the tuner settings last used to successfully tune to that frequency. This means that instead of taking 5 to 10 seconds to tune, the previously stored

Figure 4—SGC SG-237 (left) and MAC-200.

Table 4
SGC SG-237 Remote Automatic Antenna Tuner

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Input SWR range: corresponding to a minimum 7 foot antenna above 3.5 MHz, 23 feet above 1.8 MHz.	See below.
Output SWR range: 1.4:1 typical.	See below.
Frequency coverage: 1.8 to 60 MHz.	As specified.
Input power: 3 to 100 W.	Tested at 50 W.
Power requirements: 10.5 to 18 V dc, 300 mA.	Idle and tuning 270 to 480 mA at 13.8 V dc.

Measured power loss into resistive loads (%) / Input SWR at match:

SWR	*Load (Ω)*	*160 Meters*	*80 Meters*	*40 Meters*	*20 Meters*	*10 Meters*	*6 Meters*
16:1	3.125	21 <1.5:1	21 <1.5:1	19 <1.5:1	No match	<10 <1.5:1	
8:1	6.25	16 <1.5:1	18 2.1:1	20 <1.5:1	24 <1.5:1	23 <1.5:1	
4:1	12.5	11 <1.5:1	12 <1.5:1	15 <1.5:1	17 <1.5:1	23 <1.5:1	
2:1	25	<10 <1.5:1	11 <1.5:1	21 <2:1	18 <2:1	26 <1.5:1	
1:1	50	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	12 <1.5:1	29 <1.5:1
2:1	100	<10 <2:1	<10 <2:1	<10 <1.5:1	13 <1.5:1	14 <1.5:1	
4:1	200	No match	<10 2.1:1	<10 <1.5:1	16 <1.5:1	10 <1.5:1	
8:1	400	No match	<10 2.1:1	10 <1.5:1	16 <1.5:1	18 <1.5:1	
16:1	800	<10 <1.5:1	<10 <1.5:1	14 <1.5:1	30 <1.5:1	58 <2:1	

Table 5
SGC MAC-200 Desktop Automatic Antenna Tuner and Controller

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Input impedance range: 5-1000 Ω (feed line) 0.2-5000 Ω (long wire).	See below.
Output SWR range: 2:1 typical.	See below.
Frequency coverage: 1.8 to 60 MHz.	As specified.
Input power: 1.5 to 200 W.	Tested at 50 W.
Power requirements: 10 to 18.5 V dc, 230 mA.	Idle 280 mA, max 530 mA at 13.8 V dc (meter light on) Idle 240 mA, max 490 mA at 13.8 V dc (meter light off)

Measured power loss into resistive loads (%) / Input SWR at match:

SWR	*Load (Ω)*	*160 Meters*	*80 Meters*	*40 Meters*	*20 Meters*	*10 Meters*	*6 Meters*
16:1	3.125	No Match	39 <2:1	24 <2:1	<10 <1.5:1	<10 <1.5:1	
8:1	6.25	No Match	16 <1.5:1	18 <1.5:1	15 <1.5:1	30 <1.5:1	
4:1	12.5	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	18 <1.5:1	27 <1.5:1	
2:1	25	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	25 2:1	
1:1	50	<10 <2:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	12 <2:1	27 <2:1
2:1	100	<10 <1.5:1	<10 <2:1	<10 <2:1	<10 <2:1	14 <1.5:1	
4:1	200	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	14 <2:1	
8:1	400	<10 <1.5:1	<10 <1.5:1	13 <1.5:1	15 <1.5:1	17 <1.5:1	
16:1	800	No match	22 <1.5:1	14 <1.5:1	25 <1.5:1	31 <1.5:1	

settings for a frequency are applied in milliseconds and used if the resulting SWR is less than 2:1. In some cases they won't be right (and a new tune will be initiated), if a different antenna is used, for example, but their concept is that this tuner is out where the antenna is and thus should see the same impedance for a given frequency each time that frequency is employed.

SGC MAC-200 Multiple Antenna Controller

This device combines a 200 W autotuner, a five port automatic or manual antenna switch, power and SWR meters and a balun in one compact package. This is a nice unit and quickly grew on me in operation. It has enough controls and indicators to keep me entertained even when the bands aren't open.

For some time, most manual tuners have had provisions for switching antennas as well as tuning them. This is very handy, since even those with just one antenna should have a dummy load to switch to for tune up. I have no numbers, but I would guess more hams have more than one HF antenna than have only one. I don't have fancy HF antennas, but I have a G5RV I use on 80 through 10, a Lazy-H, perpendicular to the G5RV for 30 through 10 meters and a 70 foot wire vertical for use when it makes sense (not often in my part of New England). With the MAC-200, I can memorize which antenna to use on which band. It switches antennas on the first dot of a CW string (full power—no problem) and I'm there. As noted, at my station, on some bands the antenna is a function of the direction to the distant station, I can just touch the MANUAL button and I can select a different antenna by touching a button numbered 1 to 5.

As configured, antenna one is intended for balanced feed, antenna two has a terminal for a single wire feed, and three through five are terminated in UHF (SO-239) coax connectors.

The separate meters for power and SWR are handy. The SWR meter is especially convenient in that it computes and indicates SWR independent of power level without an adjustment. The manual warns that the meters are not of the precision type and I can attest to that. Their meter indicated 80 W while my Bird 43 showed 100. This is still very useful to let you know if all is well.

This is a handy unit, in a cabinet matching the cross section of the SGC-2020 transceiver (but somewhat longer), it can be made to fit in most shacks. In mine it can slide beneath the shelf that holds my equipment three inches above the desk, for example. The one limitation some may have is it provides a "typical" match of 2:1. Well 2:1 is fine for some transmitters, while others may start to "fold back" above 1.5:1 and this may be a problem if yours is in that group. On the other hand, looking at the data it is clear that most of the time it was below 1.5:1 with our loads.

Our original unit remembered which antenna to use on each band, but didn't memorize tuner settings. A warranty replacement unit had a flawless memory function.

Manufacturer: SGC Inc, 13737 SE 26th St, Bellevue, WA 98005; tel 425-746-6310; fax 425-746-6384; **www.sgcworld.com**. Price: SG-237, $360; Smartlock remote control, $59; MAC-200, $360.

Many thanks to ARRL Lab Engineer Mike Tracy, KC1SX, for taking all this data and to *QST* Technical Editor Stu Cohen, N1SC, for his comments and encouragement. After a few weeks of living with autotuners, neither Stu nor I are sure we can ever go back to cranking our rotary inductor tuners!

See the Product Review auction at **www.arrl.org/prauction** *for the latest equipment up for bid.* QST

ARRL Urges "Thoughtful, Considered Comments" on BPL Proposals

The ARRL will comment by the Monday, May 3, filing deadline on the Broadband over Power Line (BPL) *Notice of Proposed Rule Making* (*NPRM*) in ET Dockets 03-104 and 04-37. The *NPRM* proposes to amend its Part 15 rules to adopt new requirements and measurement guidelines for so-called "Access BPL" systems that provide broadband access via electric utility power lines. ARRL CEO David Sumner, K1ZZ, says the League recommends that members read the *NPRM* and develop their own thoughtful, considered comments that specifically address the FCC's BPL proposals, reflect positively on the amateur community and, if possible, offer alternative recommendations. He asked amateurs to keep four things in mind.

"First, this is not a proceeding to 'permit' or 'authorize' BPL," he said. "BPL is already permitted under the existing Part 15 rules."

Second, the *NPRM* reaffirms that licensed services must be protected from harmful interference and are not required to protect BPL systems. "This is good, but we can't take it for granted that the principle will be honored in practice," he said. "Third," Sumner went on, "the *NPRM* proposes additional, new constraints on BPL to protect licensed services. The FCC did not go far enough, but at least the proposals aim in the right direction."

Finally, while the League continues to believe firmly that BPL is "a very bad idea," arguing that the FCC should ban BPL "will not get us anywhere," he concluded. Instead, Sumner says, amateurs must document beyond any doubt the levels of protection that must be given to over-the-air services, then leave it for others to decide whether BPL is feasible within those limits. "We need to prove that the risk of interference is significantly greater than the BPL proponents say it is," Sumner said.

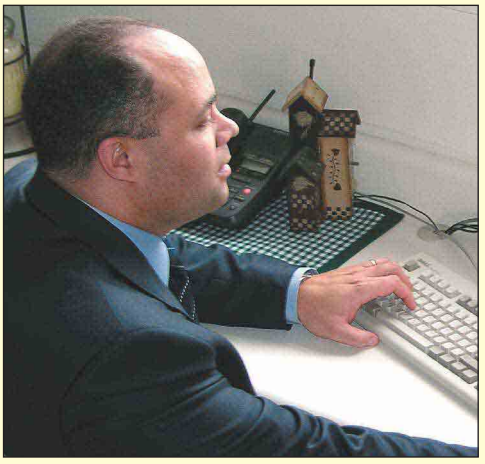
Additionally, the FCC's proposed "interference mitigation" requirements fall far short of providing real protection from harmful interference, Sumner asserted, and that the Commission is ignoring the practical problems that will arise when Amateur Radio transmissions disrupt BPL systems.

A Close Encounter of the BPL Kind with FCC Chairman

A BPL home demonstration in the Raleigh, North Carolina, area March 5 provided an opportunity for area amateurs to take their concerns about the technology to FCC Chairman Michael Powell face to face. While ARRL Public Information Officer Gary Pearce, KN4AQ, doesn't believe his brief encounter with the FCC head and amateurs' longer discussions with Commission and electric utility staffers will stop or slow the seeming BPL juggernaut, they were valuable anyway.

"We consider the day successful in the context that we were able to speak directly with several high-level FCC officials, key Progress Energy officials and the CEO of Amperion—a BPL provider," Pearce said. "Long-term success will be measured by how much of a problem BPL poses to Amateur Radio, or how much of a problem is avoided."

GARY PEARCE, KN4AQ



FCC Chairman Michael Powell takes a firsthand look at a BPL-provided Internet connection in a North Carolina residence.

While Pearce says he only spent about 30 seconds with Powell, that was long enough to tell the chairman that amateurs believe BPL's interference potential has been understated and will prove more difficult to resolve than the FCC suggested in its February BPL *Notice of Proposed Rule Making*.

Earlier that day, Powell responded to a question about BPL interference that amateurs had sent to the *Raleigh News & Observer*. Powell told the newspaper that the FCC would not let BPL interfere with critical services. "The question is whether it does, and to what extent, and what limits can be placed to make sure it doesn't," Powell said. "We've been fully committed to only allowing things within the range of what we're convinced won't create impermissible interference."

But Powell went on to say that if BPL can provide broadband access anywhere there's a power outlet, "We're not going to be easily dissuaded from doing something that has that much potential."

Progress Energy and BPL partner Amperion now are operating three field test sites in Wake County, south of Raleigh. Acting on a tip, Pearce and several other area amateurs—ARRL Technical Specialist Frank Lynch, W4FAL, among them—showed up at the prearranged BPL demonstration at a residence near Fuquay-Varina.

While Pearce witnessed the demo inside, others, including Wake County ARRL Emergency Coordinator Tom Brown, N4TAB—an engineer—stayed outside to chat with a Powell advisor. "Overall," Brown said, "I think we were successful in illuminating a few issues and opening more doors instead of closing them."

Pearce told ARRL that some hams—most a half-mile or so away from the field test sites—already have identified BPL interference on 10 and 12 meters. But he was unsuccessful in getting Powell or others in the FCC delegation to take a quick spin in his mobile radio-equipped vehicle to show him what BPL sounded like "from our perspective." The FCC officials suggested instead that the amateurs arrange a similar demonstration in Washington.

Pearce said he was happy to be able to put "a human face" on Amateur Radio's side of the issue. "We know they heard us and that we made a good impression," he said. "We hope it was a deep one as well."

Rick Lindquist, N1RL ♦ Senior News Editor ♦ n1rl@arrl.org

The FCC acknowledged that "amateur operations are likely to present a difficult challenge" to BPL deployment, especially in the case of hams—an estimated 150,000 of them—who use high-gain antennas sited near power lines. The proposed rules remain silent, however, on the issue of mitigating BPL interference to the estimated 70,000 Amateur Radio HF mobile stations.

Interference mitigation for mobile stations "is clearly impractical," Sumner asserted. "Since BPL systems operating at the present Part 15 limit cause harmful interference to mobiles, the only solution is an absolute limit on radiated emissions that is *lower* than the present limit." As of press time, the ARRL was in the process of determining scientifically such a limit.

Sumner further noted that the *NPRM* does not mandate a publicly accessible BPL database to facilitate interference mitigation for fixed stations. The League also wants the FCC to establish performance standards for BPL interference mitigation. "There must be severe enforcement penalties for failure to resolve a complaint in real time and for failure to maintain the database," he said.

The League encourages anyone, particularly radio amateurs, who has actually experienced BPL interference to file detailed comments documenting the interference. "BPL proponents claim they are not getting interference complaints," Sumner noted. "If we let them claim their systems are 'clean' when we know they aren't, shame on us."

The deadline for reply comments—comments on comments filed by others—is Tuesday, June 1. Interested parties may file comments and reply comments via the Internet using the FCC's Electronic Comment Filing System, **www.fcc.gov/cgb/ecfs/**. The FCC has advised that commenters should post their remarks in Docket No. 04-37.

HAWAII ANTENNA BILLS GET ARRL SUPPORT, MAINLAND'S ATTENTION

The ARRL has come out in support of two pieces of Amateur Radio antenna legislation under consideration in Hawaii. Both measures have attracted the attention of hams on the mainland as possible models for state or national legislation.

As of press time, the two bills had cleared the House on a 34-17 vote and had progressed to the Senate. Both bills have been assigned to the Senate Consumer Protection and Housing Committee.

House Bill 2773 would allow Hawaiian amateurs living in condominiums to install antennas on their units under certain guidelines. HB 2774 would permit antenna installations, with conditions, by Hawaiian amateurs living in subdivisions subject to homeowners' association covenants, conditions and restrictions (CC&Rs).

The ARRL submitted written testimony on the bills' behalf when they were heard February 25 by the Hawaii House Committee on Consumer Protection and Commerce, chaired by their sponsor, Rep Ken Hiraki.

"These bills would simply assure the ability of federally-licensed Amateur Radio operators to install unobtrusive, basically functional antenna systems without the often arbitrary, or arbitrarily administered, private regulations that routinely preclude Amateur Radio operation," the ARRL said in urging approval of both measures. Passage of the bills, the League asserted, would help to ensure stations would be available to provide emergency and disaster-related communications if normal communications were disrupted.

FCC News

FCC GIVES FORMER LICENSEE SECOND CHANCE TO RENEW

The FCC has given a former Indiana radio amateur another chance to renew his General ticket, which expired in 2000. In an *Order on Reconsideration* released February 3, the Commission granted a waiver to Frank R. Michalak, ex-KA9EMU, permitting him to submit a late-filed renewal application. Michalak had 60 days from the *Order*'s release to do so.

In its *Order*, the FCC dismissed Michalak's petition seeking reconsideration of a December 1999 FCC action that dismissed his license renewal application. Michalak initially ran afoul of the requirement to provide a taxpayer identification number—typically a Social Security number—with his application. Later, he encountered problems using the Universal Licensing System (ULS) and with illness.

The FCC said it had reviewed his request anew using all information it currently had before it in the proceeding. The Commission agreed with Michalak that his situation was sufficiently exceptional to permit him to refile for renewal if he's still interested in being a radio amateur. "Based on such review, we conclude that Michalak should be granted a waiver to permit the filing of a late-filed renewal application," the Commission said.

Amateur Enforcement

♦ **FCC keeps up pressure on alleged unlicensed 10 meter operations:** The FCC in February continued its efforts to stem alleged unlicensed operation—primarily by long-haul truckers—on the 10 meter amateur band. Enforcement Bureau Special Counsel Riley Hollingsworth wrote FedEx Corporation CEO Frederick W. Smith enclosing a complaint asserting that some FedEx drivers have used "Amateur Radio transmitters to communicate on the 10-meter Amateur Radio band without a license," Hollingsworth said. The complaint focused on alleged operations in Tennessee.

Hollingsworth told Smith that anyone using a radio transmitter on ham radio frequencies must have an amateur license. He pointed out that some truckers have been known to use uncertificated dual-purpose CB radios that also can transmit on 10 meters. CB gear must be FCC certificated—formerly known as type acceptance—but ham radio gear does not need to be. So-called dual-use ham/CB transceivers may not be sold or marketed under FCC rules.

Hollingsworth asked Smith to advise FedEx drivers that such operation of radio transmitting equipment without a license is a violation of federal law and could subject violators to stiff fines and even jail time as well as seizure of equipment.

Two other trucking firms also were the target of FCC warning notices involving complaints of unlicensed operation on 10 meters. Hollingsworth wrote Carl Leonard Ross of CLR Transport in Saluda, North Carolina, citing allegations that a CLR Transport vehicle traveling on I-85 in North Carolina "was the source of unlicensed radio transmissions on the 10-meter Amateur Radio band on July 14, 2003." Cassidy's Express of Bristol, Pennsylvania, heard from the FCC regarding reports that one of its vehicles was the source of unlicensed radio transmissions while under way in Pennsylvania last October 9.

In its written testimony, the League said the two measures contain sufficient protections against adverse effects to neighbors, and "reach a good balance between the legitimate interests of condominium and apartment owner's associations and homeowner's associations on the one hand, and the clear benefit to the public of available Amateur Radio communications."

The two Hawaii measures, the League said, would apply existing federal principles regarding "reasonable accommodation" of amateur communications to all residences, whether subject to municipal or private land-use regulations.

The bills have since moved to the Hawaii State Senate, where they passed first reading March 9 and appeared headed for referral to the Senate Consumer Protection and Housing Committee.

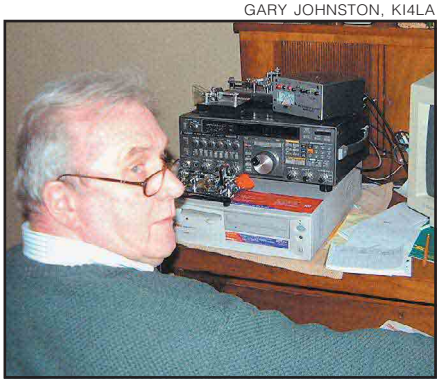
ARRL Pacific Section Manager Kevin Bogan, AH6QO, was calling on Hawaii amateurs to draft supportive e-mails or letters to their state senators or to even visit them, if convenient.

PAST ARRL PRESIDENT AMONG HAMVENTION 2004 AWARD WINNERS

Hamvention has named ARRL President Emeritus George S. Wilson III, W4OYI, of Owensboro, Kentucky, the recipient of its 2004 Special Achievement Award. The Hamvention Awards Committee selected Wilson based on his decades of service to Amateur Radio through the ARRL, his public service and emergency communications work and his determination to overcome the debilitating effects of a 1995 stroke that left him partially paralyzed.

A ham since age 16, Wilson—an attorney by profession—has remained active in Amateur Radio for more than 50 years. The ARRL's 11th president, Wilson suffered a stroke in February 1995, and he subsequently stepped down after serving just over three years in the League's top volunteer post. Wilson's legacy includes a near lifelong involvement in the League's emergency and public service communications programs. He remains active in public service and emergency communication, and he continues his League service as a Great Lakes Division Assistant Director.

GARY JOHNSTON, KI4LA



ARRL President Emeritus George Wilson, W4OYI, will receive the Hamvention 2004 Special Achievement Award.

Honored with Hamvention 2004's top award—Amateur of the Year—is Dave Kopacz, KY1V/VP5X, of Hopkinsville, Kentucky. An ARRL member, Kopacz created and funded a program that gives young hams an opportunity each year to win an expenses-paid DXpedition trip to North Caicos Island.

"The Awards Committee feels that it is this kind of support for young people that will assure the future of Amateur Radio," Hamvention's said in announcing the 2004 award winners.

Kopacz developed the "Young Ham Contest Program" last year, and 14-year-old Daniel Bradke, W2AU, was the first DXpedition trip winner, operating as part of the VP5X Contest Group during last November's CQ World Wide CW Contest. "I hope to get other hams involved in the program and eventually sponsor kids for every major contest," he said.

Barry Sanderson, KB9VAK, of Indianapolis has been named as recipient of the Hamvention 2004 Technical Excellence Award. The Awards Committee selected Sanderson for developing of a multi-channel, multiphase slow-scan television modulation scheme known as Redundant Digital File Transfer (RDFT). Sanderson has been a Hamvention forum presenter for the past three years.

Hamvention 2004 is Friday through Sunday, May 14-16, at Hara Arena near Dayton, Ohio. Awards will be presented at a recognition program Saturday, May 15.

JIM WHITE, K4OJ, SK

James A. "Jim" White, K4OJ (ex-K1ZX and ex-WA1NNC), of Seffner, Florida, died February 12. The well-known ham radio contesting enthusiast had undergone heart valve surgery a day earlier.

"Jim White, K4OJ, was a dear friend and a continual inspiration to contesting," said George Wagner, K5KG, a member of the Florida Contest Group that White founded a decade ago, serving as its first president. "OJ, as we affectionately called him, was always positive and ready to help, inspire, learn, tease, quip, pontificate and challenge all of us."

An ARRL Life Member and a Headquarters employee during the 1970s, White was the son of Ellen White, W1YL, and the late Bob White, W1CW, both well-known amateurs and former ARRL staff members. Not surprisingly, Jim White worked in the ARRL Contest Branch. Over the years, he also wrote articles for *National Contest Journal* as well as for *QST*.

ELLEN WHITE, W1YL

After Bob White died in 2002, Jim White established the R. L. White Memorial Operators' Club to keep his father's W1CW call sign active during various operating events. Always sporting a big signal out of South Florida, Jim White shared a multiop contest station with his mother. Ellen White said K4OJ was on the air during the First Class CW Operators' Club Marathon the weekend before he died.

"His operating abilities were manifest, and he almost always was the first one to volunteer his help, in spite of his declining physical abilities," she said.

White once said he was bitten by the contest bug after being enlisted as the Novice op for the Connecticut Wireless Association's Field Day effort. "I love contesting," he said in his call sign listing on QRZ.com. "There is something about the camaraderie, discipline and knowledge contesting demands that fits me; it doesn't fit everyone . . . but it sure fits me."

White's family invites memorial donations to the Florida Contest Group White Memorial Fund—now honoring both W1CW and K4OJ—care of Fred Perkins, K4LQ, 3437 Lake Josephine Dr, Lake Placid, FL 33852.

VHF Contests Redux

As most of you know, the number of logs submitted to ARRL contests that cover 50 MHz and above has been steadily declining for the better part of a decade. This fact has not escaped notice of the ARRL Board of Directors, who in January 2002 formed a subcommittee of the Membership Services Committee to review both these contests and the VHF+ awards programs. A survey was published in September 2002 to provide input to the committee, and its membership was expanded to include more active VHF contesters. Starting on February 20, 2004, the committee Chair, Tom Frenaye, K1KI, the New England Division Director, posted the committee's projected recommendations in several public forums to stimulate discussion and feedback from the VHF+ community. To see the recommendations go to **www.arrl.org/news/features/2004/02/26/2/**. I write this prior to the comment deadline, when neither the committee nor I have had a chance to study the responses. So this column will focus on some philosophical issues and provide a little more detail about the major recommendations. The speculations are mine and not the committee's, and some of the recommendations will no doubt be altered by discussions of the feedback by the time you read this.

Intentions

Tom stated the goals quite succinctly. First is to encourage the participation of more people. Where are these new participants going to come from? Those who operate day-to-day already enter the contests though they might spend more time in them if they had more people to work. Second is to encourage participants to work more stations. One would think this is an obvious reason to enter a contest, but some practices defeat this purpose. One is *grid circling* between rovers, where most of the contest is devoted to working only one or a very few other rovers, and the rest of the time is devoted to traveling to another grid corner—usually on roads that are not good VHF locations. Another is *captive roving* where a rover devotes the entire contest to working only one station, sometimes even ignoring other stations that call. Third is encouraging longer-distance contacts. This rewards better antennas and better hardware.

More Participants

The ICOM IC-706 series is believed to be the most popular radio ever built, and thousands more hams own the Yaesu FT-100/FT-8x7 series. Both Yaesu and ICOM offer multimode HF/VHF QRP radios. Several HF/VHF home-station radios (such as Kenwood's TS-2000) provide 6 and/or 2 meter multimode capabilities. All in all, there are probably more than 100,000 of these radios available for VHF(/UHF) use. All of this has happened in the last 10 years while the number of logs in the VHF contests has been dropping steadily. There is still not enough Cabrillo formatted data to see any trends, but from the 2001-2002 data we do know that number of total calls in the VHF contest logs ranges from 4500 to 9000 depending on the contest. Given a remarkably constant "unique" rate just under 40%, and knowing that analysis of other contests implies that many of the "uniques" are incorrectly copied call signs, that puts the total number of participants at not much more than 5000. The results for the UHF contest are much worse, with only 705 different calls listed in 2002.

There is some evidence that this is a self-perpetuating problem. HF operators find VHF contests "boring" unless there are enhanced conditions (E_s or tropo for instance) or think they will be "boring" so they either never participate or participate, find activity levels below what interests them and never return. Here the committee has recommended a low-power limited-band option using 50, 144 and 432 MHz to conform to what is commercially available and owned by many non-participants. Many of the responses note that 222 MHz should be included because reasonably priced transverters are readily available, and the committee will look very closely at this. They also recommended a *Hilltopper* category limited to a six-hour operating period to appeal to QRPers who also have lots of equipment that works VHF but haven't been entering VHF contests.

This Month

May 1	Microwave Sprint 6 AM to 1 PM local
May 1-2	2 GHz and Up Contest 6 AM May 1 to 12 midnight May 2, local time
May 8-9	50 MHz Spring Sprint 2300Z May 8 to 0300Z May 9
May 14	Dayton Weak Signal Banquet 6 PM
May 15	Dayton VHF Session 1 PM to 4:30 PM

There are no weekend days with good EME conditions in May*

*Moon Data from W5LUU

Expanded Microwave Contests

Microwave activity is at an all time high, but as we have seen, activity in the UHF contest is very low. Here the committee believes that the problem is the format of the UHF contest and proposes to replace it with a contest format better suited to this type of operation. The model is the 10 GHz and Up Cumulative, which is the only ARRL VHF+ contest growing in activity. The Cumulative has the following appealing features for a microwave contest:

- Six-digit grid reports.
- Pure-distance scoring.
- Changing location by 10 km counts a new location.
- Encouraging lower band scheduling and liaisons.

The recommendation is to have a three-weekend cumulative microwave contest incorporating all bands from 13 cm up in May, August and September. The tentative dates are the first week in May, the first week in August and the former 10 GHz Cumulative weekend in September. Based on the responses, each of the weekends may be scored individually as well. This contest will have several categories: 2.3-5.7 GHz, 10 GHz only and 10 GHz and up. Thus, those who are interested only in 10 GHz and the bands above can continue to operate as they did in the 10 GHz Cumulative. Each weekend would start anew. There would be a home-station section and portable section for each category and a multioperator category.

Scoring Metrics

Forty years ago, scoring graduated by frequency made sense not only as an incentive to learn to build equipment for these bands but also to populate bands where there was essentially no activity. Now equipment is readily available and there is real activity in many places though less in others. Long-distance mi-

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) ♦ w3zz@arrl.org

Taking Emergency Communication Training to the Next Level

By Daniel J. Sullivan, KO1D
207 West Cameron Rd
Falls Church, VA 22046
djs13@yahoo.com

Okay, you are psyched! You took the ARRL Amateur Radio Emergency Communications Courses Level I and Level II; you are half way through Level III and looking forward to a future Emergency Coordinator position. You check in dutifully on the local ARES, RACES, SKYWARN and NTS nets. You begin to wonder what else is there to learn!

There are many opportunities available to ham radio operators which would further our being seen as a "professional service." The courses and programs listed in this article are those you might have heard of, but might not have explored, because you really didn't see how applicable they were to what we do. By no means is this list exhaustive. If I contacted five communities and spoke to their emergency coordinators and emergency managers, I could probably add five more programs for each conversation. Instead, this article is designed to introduce you to some basic steps which will impress upon served agencies how serious we are at improving our capabilities and understanding their roles.

In this article we first examine some of the training opportunities we hams, in our role as emergency communications personnel, should consider taking. Then we explore the world of exercises and a long-term approach to developing a quality exercise program. I purposely left out classes on SKYWARN and MARS because they have become far more commonplace than the offerings listed in the article.

Further Training Opportunities

In the course of emergency communications, you come to work with a great many agencies and organizations. Each of these agencies and organizations has a great deal of effort put into various training regimens in order to properly execute their stated purpose or mission. For example, emergency managers do drills and exercises to review and learn emergency plans for the local jurisdiction. The question is how can you become part of this?

Once you are part of it, what do you do? How do you capitalize on this growing amount of knowledge? What can you as a member of a local emergency communications group do to prepare yourself for a possible activation, and actually rehearse whatever role you might have in the community?

FEMA

FEMA offers the Community Emergency Response Team, or CERT, program. This is a program that recognizes the need for training volunteers during large-scale disasters. At this time, there are seven courses designed for emergency management, public safety, fire and EMS operations. Consult with your local Emergency Management Agency (EMA) about your emergency communications group's role in a CERT program (**training.fema.gov/EMIWeb/CERT/overview.asp**).

Also on-line, you can learn about various aspects of emergency management through the FEMA Emergency Management Institute Independent Study Program. These courses are free and available on-line at their Web page: **training.fema.gov/EMIWeb/IS/**. Some of the more basic courses all emergency communicators should consider include:

IS-001 Emergency Manager, An Orientation to the Position. This course presents a basic understanding of what emergency management is and what the emergency manager does

IS-002 Emergency Preparedness, USA. A course which helps create an understanding of personal preparedness to natural and technological disasters

IS-195 Basic Incident Command. An interactive course to familiarize yourself to the basic structure and application of the Incident Command System.

IS-292 Disaster Basics. This is designed to give a basic understanding of FEMA and its role in a disaster.

For those who are in leadership and training positions you should further consider getting the Professional Development Series certification. These seven courses help give a greater amount of understanding to how emergency management works through more theory and planning instruction, how to communicate and manage others in stressful situations and how to develop proper exercises for your community. (See Professional Development Series Web site: **training.fema.gov/EMIWeb/PDS/**).

Fire Department

Did you realize that in many jurisdictions you cannot be involved with any aspect of a hazardous materials event without some level of training? That means if there is a communications emergency during a chlorine gas leak or a weapons of mass destruction (WMD) incident requiring RACES or ARES assistance, you may not be allowed by law to perform your function. Many local fire departments offer HazMat awareness courses that can be given to your local emergency communications group. If your jurisdiction requires a more in-depth understanding of Self Contained Breathing Apparatus (SCBA), Personal Protective Clothing (PPE) or other aspects of HazMat operations, you should work with the local fire department and your Emergency Manager to develop the appropriate curriculum. If they decide that this is not something they want volunteers involved with, do not press the issue. HazMat operations are not places for well-meaning, but untrained, ham radio operators!

The American Red Cross

The American Red Cross has been offering disaster courses for many years. They cover all aspects of disaster operations from basic introductory level courses to managing a large-scale disaster. As a member of the local emergency communications group, you should make it a point to take several of these courses in order to familiarize yourself with American Red Cross operations. At the absolute minimum, every single member of your emergency communications group should have a current certification in First Aid and CPR as well as the Introduction to Disasters course. These courses will help give emergency communications volunteers some basic information on how to help themselves personally and allow them to gain a greater understanding of what one of our primary served agencies does on scene.

Steve Ewald, WV1X ♦ Public Service Specialist ♦ sewald@arrl.org

Public Safety

It's been raining for several days, and suddenly the power goes out at the local public safety dispatch center. RACES volunteers are requested to help staff communications equipment at the Emergency Operations Center (EOC) and the Emergency Communications Center (ECC) until the problem is resolved. This is an occurrence that is more likely than many realize. Do you know how to operate all the commercial radios and any other specialized equipment at the EOC or at any other ECC? Spend some time and organize a meeting with local public safety communicators and have them introduce you to any communications equipment that you might be requested to staff during an emergency.

Print Media

I ride the Metro to work and home each day, which gives me about an hour each way to read. As you can imagine, I go through a couple books a month plus the newspaper. Some consideration should be given to simply reading a few books about topical issues for your group. A couple of books I have read and found helpful include:

Preparing for Terrorism: The Public Safety Communicator's Guide by George Buck, PhD, Lori Buck, and Barry Mogil (Stamford, CT: Delmar Publishers, 2003). This is a book that lays out considerations prior to and during, as well as, some basic aspects of a terrorist event and emergency management aspects thereof for communication specialists.

Preparing for Terrorism: An Emergency Services Guide, by George Buck, PhD. (Stamford, CT: Delmar Publishers, 2002). This book gives an outstanding description of how Emergency Management is structured and operated in the United States. It includes aspects of the Murragh Bombing After Action Report from Oklahoma City.

Mission Critical Communications magazine (Pandata Corporation, Centennial, Colorado): you can subscribe on-line at **www.mccmag.com**. This is a monthly magazine free to people in public safety and emergency management (if they qualify during the survey taken when you register). It includes information about commercial products, new technologies, commercial industry news and regulatory information.

This is just a small sampling of available information sources. I know there are more publications available. Just browse the ARRL, RSGB or other ham radio Web pages for their publications section and see what interests you most.

Office for Domestic Preparedness

Within the US Department of Homeland Security (USDHS), lies an agency whose purpose is to educate and train first responders for the unthinkable. The USDHS Office for Domestic Preparedness (USDHS/ODP) helps local jurisdictions conduct training exercises on a variety of WMD events. They also have courses on various aspects of terrorism and HazMat events that might be applicable to you. Work with your Emergency Manager and see which courses might be applicable to your group. You can find a course catalogue at this Web site: **www.ojp.usdoj.gov/odp/library/bulletins.htm**.

Also, work with your Emergency Manager or other served agencies and develop a relationship so that you can be included in any USDHS/ODP-sponsored WMD/Terrorism exercises the community may be having. As is often said, it is much better to develop a relationship prior to an event then during one. That is especially true in this day of terrorist threat levels and Chemical, Nuclear, Biological, Radiological and High Yield Improvised Explosive (CNBRE) awareness. Working with local public safety and helping elevate their awareness of your capabilities will help give you credibility and perhaps even include your group in their response plans.

You have all this great knowledge. Now what?

Exercises and Drills

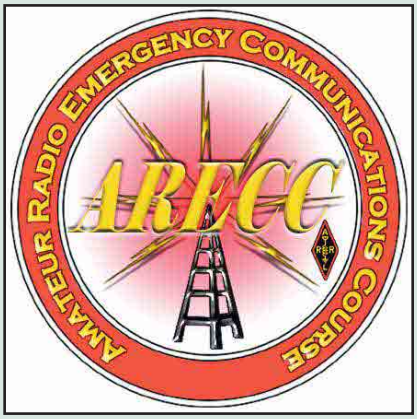
We all know about the annual Simulated Emergency Test (SET) and Field Day. How many of us see Field Day as a contest with the perk of being outdoors on a nice June day? How many have really gone so far as to develop a strategy and goals for an SET? How many have written an analysis of our emergency communications groups revealing strengths and weaknesses and then built upon those lessons learned? While it happens occasionally, perhaps it should happen more.

ARRL Section Emergency Communications plans describe how a section would respond to a request for assistance during a communications emergency. That plan needs to be tested. If you like to race cars, you do not take the jalopy onto the track at Daytona for a spin in early February and declare yourself ready for the NASCAR Daytona 500. You cannot expect the same of your plan either. You, as an emergency communicator, need to take that plan out for a spin one nice and quiet day and see if it will really work as it is designed. Then you need to address any misgivings you had about that plan while promoting the plan's strengths to anyone who will listen.

Each week, you may have an ARES or RACES net on your local repeater or HF frequency. These are considered drills. Most of us just sit at home or in the car as we drive to and from our errands and check in and say how nice a week it was and that you can hear everyone. It really doesn't accomplish much because when a real disaster hits home, your check-in list and your operator pool may not have the same content for whatever reason.

As that famous cook on TV says, kick it up a notch. Take it from a weekly drill to a year-long effort to improve your group's effectiveness. Break the year into quarters, and begin the first quarter with a small planning group for the year's SET. Within your group, decide which emergency communications groups and served agencies should be represented. Then meet and begin your planning sessions.

ARRL CEP Certification and Continuing Education Program



To learn more about the ARRL Amateur Radio Emergency Communications training program and the on-line ARRL Certification and Continuing Education program, log onto **www.arrl.org/cce/**. Level I, "Introduction to Amateur Radio Emergency Communications," is a basic course to raise awareness and provide additional knowledge and tools for any emergency communications volunteer. Level II, "Intermediate Amateur Radio Emergency Communications," has a more in-depth study into Amateur Radio emergency communications to enhance the skills and knowledge received from previous experience. Level III, "Advanced Amateur Radio Emergency Communications," is the third and final stage of the three-level courses. This course is designed to bridge the gap between basic participation and leadership.

Your first goal should be to develop some goals and objectives of what you want to learn, improve, demonstrate or otherwise test in a given scenario. Next, select that scenario with the understanding that it be realistic in nature for your jurisdiction. The best way to do this is to coordinate your efforts with the local emergency management agency's Training Officer. It is his/her job to help coordinate training dates, maintain a training calendar and help establish exercises for local first responders. He/she would be intimately aware of any hazard assessment done in the jurisdiction and which scenarios are most feasible. Most importantly, by coordinating with this individual and placing your SET on the training calendar for the jurisdiction you attain another level of credibility and support for your efforts.

Once you have established your goals/objectives and your scenario, develop some rules on how things will be done. What will be artificial? If the scenario calls for liaison to Smith County, and Smith County is not available for the exercise, then delegate someone to handle that role so participating groups and served agencies can execute their plans. If you notice during the planning that somehow no plans were made to include a certain participating group or agency, find a way to ensure a role for them in the exercise.

Tabletops, Drills and Full-Scales

At this juncture we need a bit of a side note about exercises. There are several different classifications of exercises. The three most applicable to ham emergency communicators would be Tabletops, Drills and Full-Scales. Going a bit out of order you already are well aware of drills and full-scales. RACES is required to hold drills on a regular basis. An ARES net on Sunday morning is essentially a drill. Field Day and the Simulated Emergency Test, although not necessarily true full-scale exercises since they only involve one function — in this case communications — has one crucial element of a true full-scale, multi-functional, multi-agency exercise: You deploy personnel and material into the field for the purpose of testing response capabilities. If you organize your SET to be at the same time as an American Red Cross exercise or a local emergency management exercise, you now have your full-scale exercise.

The Tabletop is probably the least known to most hams. Essentially as defined by FEMA in IS-139 Exercise Design:

> The tabletop is largely a discussion guided by a facilitator (or sometimes two facilitators who share responsibilities). Its purpose is to solve problems as a group. There are no simulators and no attempts to arrange elaborate facilities or communications. One or two evaluators may be selected to observe proceedings and progress toward the objectives.

For reference to FEMA, IS-139 Exercise Design, see **training.fema.gov/EMIWeb/downloads/is139Unit5.doc**

For a far more in-depth appreciation of exercises, exercise design and exercise execution consult the FEMA IS-120 Introduction to Community Exercises and IS-139 Exercise Design courses (**training.fema.gov/EMIWeb/IS/**).

Editor's note: This article will continue next month.

Field Organization Reports

Compiled by Linda Mullally, KB1HSV

Public Service Honor Roll
February 2004

This listing is to recognize radio amateurs whose public service performance during the month indicated qualifies for 70 or more total points in the following 6 categories (as reported to their Section Managers). Please note the maximum points for each category:
1) Participating in a public service net, using any mode. —1 point per net session; maximum 40.
2) Handling formal messages (radiograms) via any mode. —1 point for each message handled; maximum 40.
3) Serving in an ARRL-sponsored volunteer position: ARRL Field Organization appointee or Section Manager, NTS Net Manager, TCC Director, TCC member, NTS official or appointee above the Section level. —10 points for each position; maximum 30.
4) Participation in scheduled short-term public service events such as walk-a-thons, bike-a-thons, parades, simulated emergency tests and related practice events. This includes off-the-air meetings and coordination efforts with related emergency groups and served agencies. —5 points per hour (or any portion thereof) of time spent in either coordinating and/or operating in the public service event; no limit.
5) Participation in an unplanned emergency response when the Amateur Radio operator is on the scene. This also includes unplanned incident requests by public or served agencies for Amateur Radio participation. —5 points per hour (or any portion thereof) of time spent directly involved in the emergency operation; no limit.
6) Providing and maintaining a) an automated digital system that handles ARRL radiogram-formatted messages; b) a Web page or e-mail list server oriented toward Amateur Radio public service —10 points per item.

Amateur Radio stations that qualify for PSHR 12 consecutive months, or 18 out of a 24- month period, will be awarded a certificate from Headquarters upon written notification of qualifying months to the Public Service Branch of Field and Educational Services at ARRL HQ.

647 AD4BL
630 W7TVA
520 N2LTC
445 K2MPE
440 N9VE
435 W2MTA
368 AB2IZ
345 KB2DQ
340 KA2ZNZ
279 KC2DAA
270 W2FPG
255 KC2MBC
249 N2YJZ
236 KB2ETO
235 NN2H
230 KK3F
220 KB2SNP
210 KA2GJV
KB2CCD
198 N2IK
197 K2ABX
190 AG9G WA2ZCM KB2KOJ WI2G
181 WA1QAA
180 W7ARC KB3GFC
178 K7EAJ
170 WA9ZTY N5IKN K8AE
168 K9JPS KB5ILY
165 KB2VRO
160 W3YVQ
156 N2YBB
155 KC8QNE
150 N2JBA WB1CHU
144 KG9B
138 NN7H
135 KD5ONS
131 KB5JBV
130 KA5KLU AC5XK KW1U WX4H KA0DBK N2GJ W0UCE WB5ZED
128 W1PLW
125 KD1LE
120 N5WSW WB2UVB K2UL AB4XK N1LKJ W1GMF N2JWW WX4J W6IVV WB0TAQ N8IO K4IWW W4DAC W8YS K6YR K5DPG
119 AC5VN
118 W3CB
117 W4EAT
115 K9FHI KK7TN WB2KNS WA1URS
113 W8MMN
112 N1IST
110 W5GKH N5OUJ W4NTI W9BHL N7CM N7YSS AG4DL KC5OZT N3SW W3ZQN WA5OUV K4BEH AF4NS KE4JHJ N7EIE W7QM N7YSS N8NMA NF5B K5MC N2AKZ WA9JWL
109 WB2LEZ KD5YMW
107 W4ZJY N3RB
106 KB5PGY KB9KEG W2DWR
105 KD4CQJ
N3YTD W5CU AD5IS AB8NI
104 KC8VOA
103 W5IM N4JBP KB8NDS
102 KF4OCU
101 WA1JVV K3JL
100 N5SIG K4SCL W9CBE N1IQI W0HXB N7DRP NR2F W8IM N9MN KB5TCH WN0Y KK5GY WA8SSI W1ALE W9NXC WA2WMJ WA2YBM W7LG KG0GG KC2EOT WB2QIX AB0WR W1QU KC2GOW KB2KLH
99 W3NJ W7TC N8FXH
97 KB0DTI
95 KC8VIF
94 KA9RZL
93 N2RTF KJ7SI AF2K
92 KZ7T KA2BCE
91 W2CC W2DSX
90 W4CKS KB2RTZ WA2CUW N3KB WW3JC KC7SGM K1JPG KF4WIJ K2YYF W3TWV N1JX AB8SK KC8UTL N8DD WB4GGS W4WXA K4FUM K7UGT WD8DHC KA8WNO K2AN KG2D WB2IJH W4DLZ N5KWB KE3FL AA3GV N3WK N3OR WB8RCR KE2SX
89 K4RLD WD4LSS
87 KF7GC
86 KF6OIF WB6UZX K8VFS KD1SM
85 KL7OR W7RRC W6JPH
84 KK1A
83 W6QZ W5PY
82 W4DGH K8SH KG4OQA W8CPG
80 AG4AC N2HQL K8KV WD8Q K4WKT AA4YW N2LJD K7MQF W5NK K3IN WA0LYK
78 N7TOD N8JAT WD9FLJ KC6NBI
76 W2QOB N3ZOC
75 KC2IYC KC4ZHF
74 W7DPW K8CQF
73 KA0O W5XX
71 W4AUN W4FAL AB0UY
70 WB4BIK KC8BTE

The following stations qualified for PSHR in previous months, but were not recognized in this column: (January) WA1URS 120, K1HEJ 104, NM1K 100, N1VXP 100, W1QU 100, KA1GWE 90, KA1RMV 90. (December, 2003) N1IST 142, N1LKJ 120, W1GMF 120, KW1U 120, N1IQI 110, N2JWW 110, KD1LE 105, W1PLW 105, KB1JEC 100, N1TPU 87.

Section Traffic Manager Reports
February 2004

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, CO, DE, EB, EMA, ENY, EPA, GA, IL, IN, KY, KS, LA, MDC, ME, MI, MO, MS, NC, NFL, NLI, NNJ, NNY, NTX, NV, OH, OK, OR, ORG, SB, SD, SJV, SNJ, STX, TN, VT, WCF, WI, WMA, WNY, WPA, WV, WWA, WY.

Section Emergency Coordinator Reports
February 2004

The following ARRL Section Emergency Coordinators reported: AK, AR, AZ, CO, EWA, GA, IL, IN, KY, LA, MDC, MN, MO, NC, NFL, NLI, NNJ, NV, SD, SFL, SJV, SNJ, SV, TN, VT, WMA, WNY, WPA, WTX.

Brass Pounders League
February 2004

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 points or a sum of 100 or more origination and delivery points for any calendar month. All messages must be handled on amateur frequencies within 48 hours of receipt in standard ARRL radiogram format.

Call	*Orig*	*Rcvd*	*Sent*	*Dlvd*	*Total*
W4ZJY	0	1723	1839	7	3569
W1GMF	0	481	3031	51	3553
KK3F	33	1462	1422	40	2957
WB5ZED	37	1345	1225	31	2638
KA5KLU	0	948	1110	29	2087
N2LTC	0	798	779	55	1632
WB5NKC	20	99	1207	3	1382
K7BDU	4	656	653	2	1315
KW1U	0	1054	895	4	1953
N1IQI	0	500	1203	0	1703
AK6DV	0	617	498	8	1123
W4EAT	0	548	563	1	1112
W6IVV	0	505	521	0	1026
WX4H	0	351	541	5	897
W7QM	6	452	432	4	894
K9JPS	0	411	31	383	825
AB0WR	0	356	355	0	711
N5SIG	4	304	313	16	637
WB4GGS	0	277	323	5	605
KD8HB	-	-	-	-	605
W4DAC	15	272	255	28	570
N2JWW	20	296	176	71	563
N8IXF	-	-	-	-	552
W7TVA	48	213	172	89	522
W6DOB	2	138	320	47	507

BPL for 100 or more originations plus deliveries: N9VE 382, W9IHW 321, and K5MC 125. The following stations qualified for BPL in previous months, but were not recognized in this column: (January) NM1K 969. (December 2003) W1GMF 2894, KW1U 1488, N1IQI 1453, QST

VHF Contests Redux

As most of you know, the number of logs submitted to ARRL contests that cover 50 MHz and above has been steadily declining for the better part of a decade. This fact has not escaped notice of the ARRL Board of Directors, who in January 2002 formed a subcommittee of the Membership Services Committee to review both these contests and the VHF+ awards programs. A survey was published in September 2002 to provide input to the committee, and its membership was expanded to include more active VHF contesters. Starting on February 20, 2004, the committee Chair, Tom Frenaye, K1KI, the New England Division Director, posted the committee's projected recommendations in several public forums to stimulate discussion and feedback from the VHF+ community. To see the recommendations go to **www.arrl.org/news/features/2004/02/26/2/**. I write this prior to the comment deadline, when neither the committee nor I have had a chance to study the responses. So this column will focus on some philosophical issues and provide a little more detail about the major recommendations. The speculations are mine and not the committee's, and some of the recommendations will no doubt be altered by discussions of the feedback by the time you read this.

Intentions

Tom stated the goals quite succinctly. First is to encourage the participation of more people. Where are these new participants going to come from? Those who operate day-to-day already enter the contests though they might spend more time in them if they had more people to work. Second is to encourage participants to work more stations. One would think this is an obvious reason to enter a contest, but some practices defeat this purpose. One is *grid circling* between rovers, where most of the contest is devoted to working only one or a very few other rovers, and the rest of the time is devoted to traveling to another grid corner—usually on roads that are not good VHF locations. Another is *captive roving* where a rover devotes the entire contest to working only one station, sometimes even ignoring other stations that call. Third is encouraging longer-distance contacts. This rewards better antennas and better hardware.

More Participants

The ICOM IC-706 series is believed to be the most popular radio ever built, and thousands more hams own the Yaesu FT-100/FT-8x7 series. Both Yaesu and ICOM offer multimode HF/VHF QRP radios. Several HF/VHF home-station radios (such as Kenwood's TS-2000) provide 6 and/or 2 meter multimode capabilities. All in all, there are probably more than 100,000 of these radios available for VHF(/UHF) use. All of this has happened in the last 10 years while the number of logs in the VHF contests has been dropping steadily. There is still not enough Cabrillo formatted data to see any trends, but from the 2001-2002 data we do know that number of total calls in the VHF contest logs ranges from 4500 to 9000 depending on the contest. Given a remarkably constant "unique" rate just under 40%, and knowing that analysis of other contests implies that many of the "uniques" are incorrectly copied call signs, that puts the total number of participants at not much more than 5000. The results for the UHF contest are much worse, with only 705 different calls listed in 2002.

There is some evidence that this is a self-perpetuating problem. HF operators find VHF contests "boring" unless there are enhanced conditions (E_s or tropo for instance) or think they will be "boring" so they either never participate or participate, find activity levels below what interests them and never return. Here the committee has recommended a low-power limited-band option using 50, 144 and 432 MHz to conform to what is commercially available and owned by many non-participants. Many of the responses note that 222 MHz should be included because reasonably priced transverters are readily available, and the committee will look very closely at this. They also recommended a *Hilltopper* category limited to a six-hour operating period to appeal to QRPers who also have lots of equipment that works VHF but haven't been entering VHF contests.

This Month

May 1	Microwave Sprint 6 AM to 1 PM local
May 1-2	2 GHz and Up Contest 6 AM May 1 to 12 midnight May 2, local time
May 8-9	50 MHz Spring Sprint 2300Z May 8 to 0300Z May 9
May 14	Dayton Weak Signal Banquet 6 PM
May 15	Dayton VHF Session 1 PM to 4:30 PM

There are no weekend days with good EME conditions in May*

*Moon Data from W5LUU

Expanded Microwave Contests

Microwave activity is at an all time high, but as we have seen, activity in the UHF contest is very low. Here the committee believes that the problem is the format of the UHF contest and proposes to replace it with a contest format better suited to this type of operation. The model is the 10 GHz and Up Cumulative, which is the only ARRL VHF+ contest growing in activity. The Cumulative has the following appealing features for a microwave contest:

- Six-digit grid reports.
- Pure-distance scoring.
- Changing location by 10 km counts a new location.
- Encouraging lower band scheduling and liaisons.

The recommendation is to have a three-weekend cumulative microwave contest incorporating all bands from 13 cm up in May, August and September. The tentative dates are the first week in May, the first week in August and the former 10 GHz Cumulative weekend in September. Based on the responses, each of the weekends may be scored individually as well. This contest will have several categories: 2.3-5.7 GHz, 10 GHz only and 10 GHz and up. Thus, those who are interested only in 10 GHz and the bands above can continue to operate as they did in the 10 GHz Cumulative. Each weekend would start anew. There would be a home-station section and portable section for each category and a multioperator category.

Scoring Metrics

Forty years ago, scoring graduated by frequency made sense not only as an incentive to learn to build equipment for these bands but also to populate bands where there was essentially no activity. Now equipment is readily available and there is real activity in many places though less in others. Long-distance mi-

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) ♦ w3zz@arrl.org

crowave contacts are currently inhibited by the expense of amplifier devices. Even with good antennas, working any distance on tropo on any VHF+ band with one or two watts from an ordinary location is not easy. Yet technology is ever improving, and surplus amplifiers have appeared in recent years, so that problem will eventually disappear. Given even a few tens of watts, surprising distances are readily possible as we are finding on 3.4 GHz with the widespread availability of the 40 W Toshiba amplifiers.

The current graduated scoring by frequency makes all the VHF contests microwave contests. With a contact/multiplier ratio essentially never greater than four, it makes no sense to try to get an unsure multiplier on 6 or 2 meters when you can make a sure contact on one of the microwave bands. Therefore what you hear on 2 meters and to a lesser extent on 6 meters is stations constantly disappearing to work contacts on other bands manufactured by moving everyone they work. Only a massive E_s opening on 6 meters changes this reality and then only for a short time. Those upper-band contacts are just worth too many points. Likewise there is no reason to try for a distant contact on any band—they all count the same.

The committee has recommended that contacts within your own grid and those grids touching it count 2 points and with grids beyond that 3 points regardless of band. To the serious competitor, contacts on the higher bands are still absolutely necessary both for the multipliers and their contact points, but they would no longer dominate the VHF contests to the extent that they have. To limit some of the abuses outlined in the next section, the committee recommended that contacts with rovers be one point regardless of distance. The responses clearly indicate that this rule gives the impression of devaluing rover contacts, which was not the intent, so this part of the recommendation is likely to change. One possible solution is to count non-rover to rover contacts like any others, count rover to rover contacts in contiguous grids one point and beyond that 3 points.

Rover Rules

Several of the committee members, myself included, strongly supported a return to the original rover rules where all contacts and all grids count separately from each activated grid. In the past almost all rovers agreed with that; but from the responses I've read so far, that's no longer the case. It's an important distinction because the most effective strategy is different in each case. Under the old rules (as Brian, ND3F, has shown) the best strategy is to stop at about eight grids staying just until the rate begins to drop significantly and then move to a new grid. Under the present altered rules, the most effective strategy is to start at one end of a heavily populated area in a fixed location. Then drive at least 400 miles or more in a straight line stopping only rarely where there are unusually high concentrations of stations until you reach the other end, where you end the contest like you began. Under the original rules, rover scores are so large that they unduly distort the club competition, but under the current rules (with rover to rover contacts limited to 1 point in the same or adjacent grids and grid circling banned, see below) rover scores could be retained in the club competition.

Both the single and multioperator classes and the club competition are affected by grid circling at four-grid intersections and by captive roving where a rover works only one station. In both these cases, the only beneficiaries of these manufactured contacts are the partners in the grid circling dance or the single station that the captive rover works. The committee proposed to ban both practices. Tom's e-mail did not explain how the log checker would recognize these practices. A quantitative measure is always the best way, but they were unable to find any that would not cause other problems. Therefore, the answer will be to describe each practice and use software to detect its existence by checking logs. It's possible that someone in Wyoming or northern Maine might operate from grids where there is only one station to work on many bands. Yet someone who works one station 50 times in seven grids and passes through EM12 and EM13, for example, among others without working more than four other contacts would be suspect. Nor can he escape by not submitting a log—the software will catch the station he works.

Several responders have suggested quantitative measures for these practices. Preventing a rover from operating more than one time from a given grid only reduces the circling by half. The only effective rule is saying that once a rover has made a contact from a grid, he cannot make a contact from another grid for a fixed period of time, say one hour. There are disadvantages here as well, but they appear not to be as serious as some others. Again, this is something that the committee will need to discuss.

June VHF Party 50-1296 MHz

The committee believes that emphasizing the VHF nature of one of the contests is a good idea. The recommendation makes the June contest 50-1296 MHz to take advantage of E_s propagation, but some who like this idea have offered an alternative suggestion that January should be the more VHF-oriented contest because the opportunity for mountain-topping is much less at that time. I would have thought that under the mediocre propagation conditions that exist most of the time in January, the more bands the better. Likewise, stations in June may be too busy working E_s to devote the time needed to run from band to band, but perhaps that is not the case.

ON THE BANDS

In years of lower sunspot numbers like 2004, February is often a quiet month, propagation-wise. The winter E_s season has either ended or will end very early in the month. It is too early and too cold for much tropospheric enhancement and auroral activity is often not great. This year was much more active than expected on 6 meters, but otherwise, there was little enhancement to report.

6 Meters

What had already been a good winter E_s season roared into February unabated. The following reports are from the named individual plus some fills from the Internet propagation reflectors at **DXworld.com** and DX Summit. My local contact, Dave, N3DB (FM18), reports E_s for 9 of the first 12 days of February, including double hop E_s on the 7th to TI and XE. Bill, KØHA (EN10) and Jon, NØJK (EM17), had a big day into Mexico on the 2nd and to a lesser extent on the 3rd, with contacts to XE2SNG, XE2TEP and XE2TH (DM30), XE2YW (DL82) and XE2NBE (EL05). They both enjoyed a widespread four-hour opening to the east early on the 4th. Late on the 7th into the early GMT hours of the 8th featured a strong opening from Texas to Florida and thence into DL47 and EK09 in Mexico. Gary, KB3HJA, joined the crowd who worked both Mexico and TI5KD. Meanwhile, NØJK worked westward into DN36 and DN57, and NW7O worked eastward into Illinois, Missouri and Nebraska. On the 10th, NØJK notes a four-hour midday opening extending from 1500Z to 1900Z with multiple E_s clouds from western South Carolina to northern Alaska. He, N3DB and the propagation reflectors note a long-lived E_s opening on the 12th from 1300Z to 2300Z covering most of the eastern and Midwestern US. An opening this long this late in the season is very uncommon.

Midmonth, Russ, N1RAM (FN65), had an unusual E_s/TE opening late on February 14 starting with LU1DMA/B and then LW3EX. The following day Pat, W5OZI, worked XE3PNH (EL61) in Cancun and shortly thereafter OC3I (FI00) as did Graham, KE4WBO, in EL96. Both of them heard strong backscatter signals at that time typical of an F2 opening. Later that day, weak aurora appeared on 6 meters for one of the few times in February. Jack, N6XQ, the operator of OC3I located north of Lima, Peru, says that after working a few XEs on February 13 and 14 he had a much stronger opening working about 45 W4s and

W5s on the 15th and few Caribbean and South Americans later, early on the 16th. Jack also says the OA4B beacon is up and running with 13 W into a vertical antenna on 50.036 MHz. DX Summit shows that WP4NIX had numerous TE signals into CX and PY and the next afternoon (their time) both 5B4 and SV were into ZS on TE.

Microwaves

Brian, WA1ZMS, claims a new World and North American record of 79.6 km for the 241 GHz band for a contact from EM96wx with W2SZ/4 [Pete W4WWQ operator] in FM07fm on their fourth attempt over this path. This contact also represents the fifth grid for W2SZ/4 and the first claimed VUCC on this band. Atmospheric attenuation ranged from 0.273 dB/km at W2SZ/4 to 0.681 dB/km at WA1ZMS/4. The contact used QRSS, very slow-speed CW that allows very narrow bandwidths (1.3 Hz) to improve S/N and the Spectran (I2PHD/IK2CZL) waterfall display to detect the signal. The transmitter is a Gunn oscillator driving an anti-parallel Schottky GaAs diode as a tripler producing about –1 dBm output. High stability and low phase noise is achieved by using new homebrew direct synthesizers as reference oscillators. Contacts over any distance at these frequencies are a real technical and operational feat. It is difficult simply to generate a signal of this stability and receive it, not to mention the difficulty of aiming an antenna with less than 1° beamwidth (see Figure 1). They did all of this and endured the many months of operating when the temperatures are low to avoid as much attenuation by water vapor as possible. Congratulations, Brian and Pete!

EME

Lance, W7GJ, provides an excellent primer on 6 meter EME work at his Web site **www. bigskyspaces.com/w7gj/Welcome_to_6m_ EME.htm**. He points out that a station with 1 kW output to a modern well-designed Yagi over 1.5 λ long is now EME-capable on 6 meters using the K1JT JT65 mode and discusses many important features that define the possibility of EME contacts. With 6-meter DX conditions now limited pretty much to E_s propagation and an occasional E_s/TE link, modern technology has provided us with another way to work DX.

HERE AND THERE

Spring Sprints

The last two Spring Sprints (see the April WA50) occur this month, the Microwave Sprint on May 1 and the 50 MHz Sprint on May 8-9. Liaison frequencies are encouraged in the Microwave event. Look at **www.etdxa.org/** for further information.

W5VAS SK

Paul, N5HYV, called with the sad news that Hank Arsaga Jr, W5VAS, of Metairie, Louisiana, passed away on March 1. Hank was well-known for his booming VHF signal especially for many of us on 6 meters and for being a fine Elmer to many hams in the New Orleans area. His beacon W5VAS/B in Kenner, Louisiana on 50.060 MHz was one of the best known in the continental US. John, N5JM, tells me that he will lead a group of local hams to maintain Hank's call and beacon as a memorial.

BRIAN JUSTIN, WA1ZMS, FROM **WWW.MGEF.ORG**

Figure 1—Homebrew 30 cm parabolic reflector with Cassegrain feed system used for the new 241 GHz record. The feed is a W2IMU-style dual-mode horn and the gain is estimated to be about 53 dB.

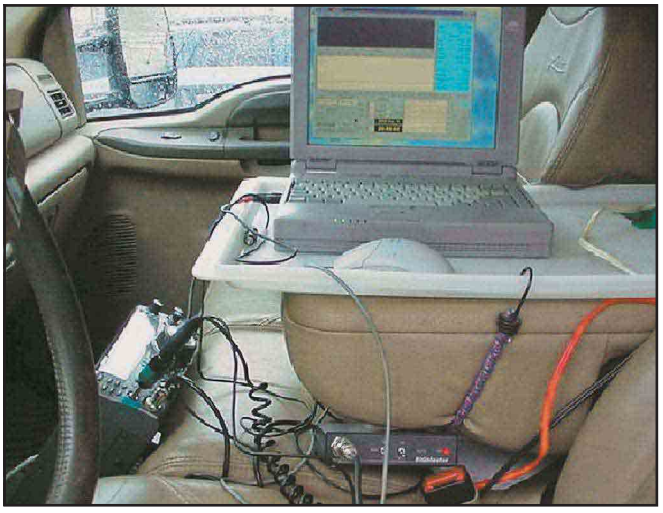


Figure 2—June is the time to hit the road. We have all worked John, WZ8D, on his travels. Here is a WSJT setup from the cab of John's camper. The radio is mounted at the lower left.

Dayton

The 12th annual Dayton Weak Signal Banquet sponsored by the Weak Signal Group will be held at the Holiday Inn North in Dayton Friday night May 14 beginning at 6 PM. This is an excellent way to meet your friends. Further information can be found at **www.wa8wzg.com/weak%20signal.htm**. The VHF Session organized by Red, W8ULC, will be on Saturday, May 15, from 2:15 to 5 PM in Room 2. This session always has lots of interesting information so plan to be there.

2 GHz and Up Worldwide Club Contest

Covering all microwave bands above 23 cm, this contest sponsored by the San Bernardino Microwave Society runs from 6 AM local time Saturday, May 1, to 12 midnight Sunday, May 2. *Note that is a revised date.* Operate a maximum of 24 hours. Entries are based on clubs or groups with three categories depending on numbers of members (2-10, 11-50, >50). The exchange is six-digit Maidenhead Locators. Send logs (due 30 days after the contest) to SBMS Contest Committee, Pat Coker, N6RMJ, 40916 179th St, Lancaster, CA 93535. For further information, see **www.ham-radio.com/sbms**.

European WW EME Contest

There were 112 entries in the 2003 *REF/DUBUS* EME Contest as reported at **www.marsport.demon.co.uk/2003results.pdf**. Leading scores were I2FAK on 2 meters, F6KHM on 70 cm, F2TU on 23 cm, OE9XXI on 13 cm, F2TU on 5 cm and F6KSX on 3 cm. HB9Q was the multiband winner followed closely by OZ4MM and F2TU.

Global Six Meter Marathon

From Seppo, OH1VR, comes word of the 2004 Six Meter Marathon. The objective of the Marathon is to work as many DXCC countries as possible on 6 meters between 0000Z May 8, 2004, and 2400Z August 8, 2004. The results of the contest will be published during the Tampere Six Meter Forum in Tampere, Finland, on August 14. There is a North American class. Further information is available at **www.50mc.tk/**. QST

4U1UN—United Nations Headquarters

On the afternoon of February 3, 1978, most DXers around the world had no idea that on the following day, just a few hours later, there would be a new DXCC country on the air for the first time. Appropriately, it was Dr Maximilian "Max" C. DeHenseler, HB9RS, who would make that first QSO as 4U1UN at approximately 0045Z on February 4, 1978 during the ARRL DX Contest. As you can imagine, there was a lot of confusion among the participants in the contest and DXers alike.

A New Country is Born

In early 1978 Max, who was the Chief Cartographer for the UN and President of the United Nations Radio Club, began his work to get 4U1UN on the DXCC list. Back in those days "distinctively separate administration" Entities were possible. Max worked through the UN Secretary General to obtain the needed approval to activate 4U1UN from the top floor of the UN Secretariat Building. The September 1978 issue of *QST* reported that the ARRL Board of Directors had approved the addition of the United Nations Headquarters to the DXCC list following the recommendation of the DX Advisory Committee (DXAC). QSOs made on or after February 4, 1978 would be approved for DXCC credit.

4U1UN Becomes a Rare Entity

From the inception of 4U1UN until the early to mid '90s the station was very active by both UN club members and guest operators. In the '90s there was a conflict between a guest operator and the UN. We won't go into the details here; however, the results were that 4U1UN activity was significantly less than it had been. Since then 4U1UN has started to appear on many most wanted lists and currently ranks no. 57 worldwide on *The DX Magazine's* 2003 Most Wanted List. In Europe it ranks no. 56. For the rest of the world (Africa, South America and Asia) it's no. 30. Here in the US it is not in the top 100.

New York City

New York City is just less than 300 kilometers (200 miles) from my home. It's about a four hour drive or around two and a half hours via train. Several years ago I started hinting to Steve, KU9C, that I would love to go and operate from the 4U1UN station, even if just for a few hours. In the fall of last year I started asking around again to see if my daughter Christa, KB3JIU, my dad Tony, N3ME, and I could go up for a day and operate from the club station. Our plan was to take the train, which was reasonably priced and could drop us just a few blocks from the United Nations in midtown Manhattan. We originally planned to go in December, possibly on a day that Christa was off from school. However, due to the schedule of our host we had to postpone until January 30. Christa had school so we ended up taking her out for "an educational field trip." Unfortunately, my dad was unable to join us. He really wanted to go but realized it was important for us to go on with the plans.

KU9C

Christa, KB3JIU, works down the pileup from 4U1UN, while Bernie, W3UR, listens in.

During daylight hours Steve, KU9C, helped keep 4U1UN on the air.

Visitors can listen in as a translator reports in six different languages.

Christa takes a look at a model of all of the UN buildings. But where are the antennas models?

On Friday morning Christa and I got up at 4 AM and headed to the Amtrak station near the Baltimore Washington International (BWI) Airport. This was her first time on a train. It took about half the time of driving and we would not have to worry about parking. There we met up with Steve, KU9C, who also took the train to New York City's Penn Station. The three of us took a taxi to our hotel, which was directly across the street from the UN. We dropped off our luggage and then walked across the street to the visitor's entrance. Since we had more lug-

Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org

A look at the United Nations Secretariat Building from our hotel. This is a 39 story building with a penthouse on top. If you look carefully you can see the multi-band vertical. The antennas are over 550 feet off the ground.

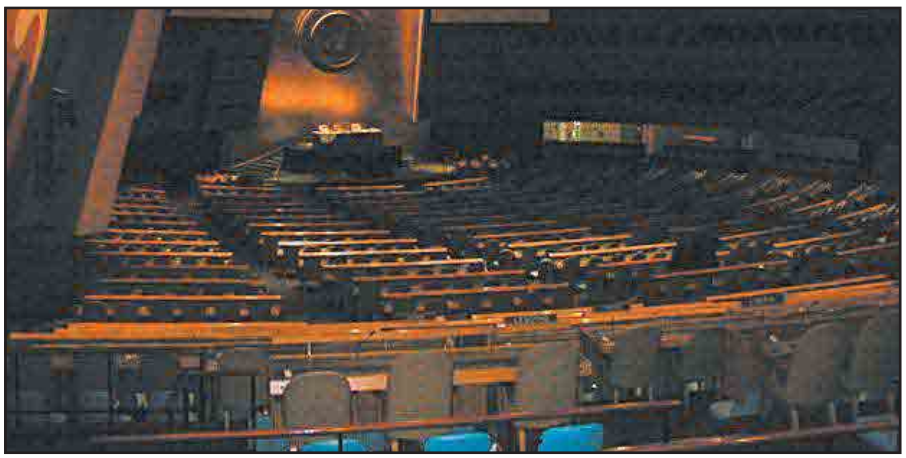
Press releases are available in dozens of languages.

gage (laptop, IC-706 and accessories) we went into the guard house, where they called up to Mohamed, KA2RTD, our host. After clearing the security check point, we then went up to the 4U1UN station, which is located in the penthouse atop the UN building.

We had originally planned to do RTTY, but the day before our operation another member of our team, Henry, KT1J, had to cancel due to some personal business. Henry had our RTTY cables. He assured us next time we could do RTTY. Once we got in the shack we turned off the NCDXF 4U1UN beacon and used that vertical antenna on one rig and the multiband dipole on another rig. We quickly discovered it would be impossible to operate both rigs at the same time due to interstation interference. Next time a band pass filter will be needed.

Realizing that Asia is the most difficult area to work, we tried to look for those stations on 20 meters at the beginning of our operation. Conditions were not very good. So with just one rig and lousy conditions we set up Christa on 40 meters SSB. This was her first DXpedition and she generated an instant pileup. About every hour or so we switched operators.

At one point Steve was operating so Christa and I were able to take a tour given by our host, who was able to take us into some areas the normal tour didn't travel through. It was a great opportunity and we were able to keep the 4U1UN (For You One United Nations) station on the air. After our initial operation on 40 meters, we bounced between the higher bands working down the pileup and then switching to the next higher or lower band. Although propagation was pretty bad we were able to work some Europeans. We only managed to work three Asian stations (4X, 5B and JA), and that was on 30 meters. Christa and I were able to stay and operate until 9 PM local.



The General Assembly is composed of representatives of all Member States, each of which has one vote. Decisions on important questions, such as those on peace and security, admission of new Members and budgetary matters, require a two-thirds majority.

Afterward we walked to our hotel just across the street and got some much needed R&R before heading home the following morning.

Future Activity from 4U1UN

Operating from the 4U1UN station has been limited for several reasons. The club has about 10 members, of which about three are interested in and able to operate HF. Our host is one of the most active members, but he does not enjoy the big pileups. Operations from the club station must include a UN club member, who is responsible for the station and security.

Currently the antennas are a multiband dipole and multiband vertical. There are plans to install another larger vertical. That work, however, must be done by a certified UN electrician or maintenance worker. Hopefully, they can also install a 6 meter loop antenna at the same time. A request was also made, three years ago, for the electricians to run a 220 V line to be used for the amplifier. At the moment, when the amp is working it runs on 110.

All future operations of 4U1UN will be pre-announced in the DX bulletins to alert everyone and to help prevent pirate operations. For those who need 4U1UN for a new country, keep an eye on the bulletins and be prepared to take a day off from work or have an open weekend. All QSL requests for 4U1UN should go to the club station address, Grand Central Station, PO Box 3873, New York, NY 10163.

Thanks

Christa and I would like to thank the 4U1UN United Nations Amateur Radio Club, KA2RTD, KU9C and KT1J for making our operation possible. We hope to have the opportunity in the future to once again say QRZ Four You One United Nations? Until next month, see you in the pileups!—*Bernie, W3UR*

Photos by W3UR except as noted. QST

Noise in Microwave Receivers

In the first installment of Microwave Low Noise Amplifiers (January 2004 *QST*), we explored circuits and construction. In the second installment (March 2004 *QST*), we continued with an understanding of noise, and ran through some examples and formulas. Now it is time to look at an entire receive system to determine our ability to dig signals out of the noise.

Review

In review, let's recall the units and measures that we employ for gain and noise. These can be logarithmic or linear, and because formulas and our understanding can work easier with a particular choice, it is helpful to be able to convert between them.

Linear measures express the relationship between units as direct multiples. For instance, if we have 200 mW going into an amplifier, and a linear gain factor of 4, then the output is expected to be 800 mW. If we have a linear signal to noise ratio of 20, we expect the signal to have twenty times the power of the noise (in the bandwidth). If we have a noise temperature of 1000 kelvins (K) and add a noise power

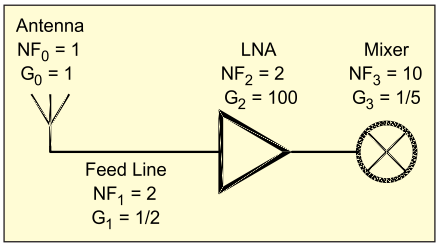


Figure 1—A simple example of a receiver front end.

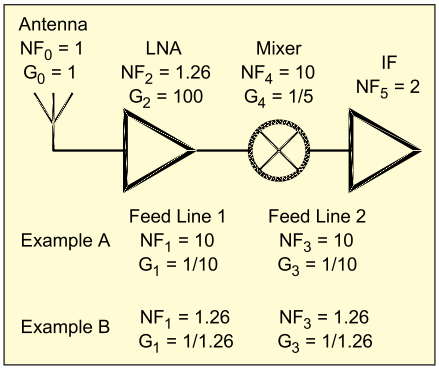


Figure 2—LNA placement (A) in shack and (B) at top of tower.

Noise Factor

We use *noise factor* (NF) rather than *noise figure* (nf) in this calculation, and can convert to any units when done. If noise is expressed in temperature or noise figure, it must be converted to noise factor for each component. The formula for cascaded noise factor is:

$$CNF_1 \quad NF_0 + \frac{NF_1 - 1}{G_0} \quad CNF_2 \quad CNF_1 + \frac{NF_2 - 1}{G_0 G_1} \quad CNF_3 \quad CNF_2 + \frac{NF_3 - 1}{G_0 G_1 G_2}$$

and so forth—or for an entire system:

$$CNFsystem \quad NF_0 + \frac{NF_1 - 1}{G_0} + \frac{NF2_1 - 1}{G_0 G_1} + \ldots$$

Where CNFx is the cascaded noise factor at the output of element x, NFx is the noise factor of the individual element at stage x, and Gx is the linear gain of element x. Losses are expressed as fractional values for linear gain and the noise factor for an attenuator is equal to the inverse of the fractional gain, for example a 3 dB attenuator has a gain of ½ and a noise factor of

$$\frac{1}{1/2} \text{ or } 2.$$

Refer to Figure 1 for our first example. Our first element (subscript of zero) is the antenna. Assuming it has no significant resistive losses, it has a linear noise factor of 1 (no noise) so NF_0 is therefore 1, and no loss or gain, so its linear gain is 1. The next element is the feed line. Its loss is a linear gain fraction, for example ½ for 3 dB of loss, and the noise factor of an attenuator is the inverse of the gain, or in this case 2. Applying the equation, we get a CNF_1 of 2. We can put our LNA next. Let's assume 20 dB of gain (linear gain factor of 100) and a noise factor of 2 (same as a noise figure of 3 dB or temperature of 290 K). Applying these numbers we get a CNF_2 of 4. To convert to noise figure, we take 10 log(4) = 6 dB noise figure at the output of the LNA. Just as derived above, the 3 dB of feed-line loss directly added to the 3 dB of LNA noise figure to make a 6 dB system. When you take the next step, where typically a feed line and/or a mixer follows the LNA, you will see that quite a bit of loss can be tolerated without sacrificing much system noise figure. It is the gain of the LNA that overcomes the effects of the subsequent loss.

If you do some rough calculations you can see that a typical hilltop system with feed-line loss below 1 dB, an LNA with about 20 dB of gain and a noise figure of better than 1dB, driving a mixer with a (conversion) loss of 7 dB and a noise figure below 10 dB, can result in a complete receiver that has a noise figure below 2.5 dB.

Let's examine two home station examples. As shown in Figure 2, example A, we have an antenna mounted at some distance from the receiver. It is not uncommon to have 10 dB of tower-to-shack cable loss at microwave frequencies, and we use that figure for this example. Adding an excellent LNA with a 1 dB noise figure and 20 dB of gain at the end of such a lossy feed line, followed a 1 dB loss in front of the example mixer and first IF stage, results in a total system noise figure of about 11.5 dB. You are invited to do the calculation yourself. On bands below 47 GHz, an 11 dB system noise figure is considered very poor performance.

Now, as shown in example B of Figure 2, let's move the LNA near the antenna, and assume that cabling and TR relay introduce 1 dB of loss between the antenna and LNA. Using the same cable with 10 dB of loss from the tower to the receiver, the equations show that the resulting system noise figure is about 5 dB. This is a much better result than the previous example, but has the added complexity of a mast mounted LNA and remote TR switching and sequencing. Most microwavers with home stations remotely mount LNAs and TR relays near the antenna in order to overcome the effect of feed-line loss. Even high performance portable hilltopping stations are designed with the lowest possible loss in the TR switching and feed lines in order to get the best performance from the receiver.

My thanks go to Dick Knadle, K2RIW, for his help in reviewing this column. Dick has been a significant technical contributor to the VHF and above amateur community for a number of years.

Tom Williams, WA1MBA ♦ wa1mba@arrl.org

equivalent to 2000 K, then the result is a noise power equivalent of 3000 K. If we have a noise factor of 2, and double it, we will end up with a noise factor of 4. All of these are linear measures.

Logarithmic measures are expressed in decibels, where a decibel is 10 times the logarithm of the linear measure. In our case of an amplifier with a gain factor of 4, we would say that it has 10 log(4) or about 6 dB of gain. In our case of a linear signal-to-noise ratio of 20, we would have a 13 dB signal-to-noise ratio. Going from 1000 K to 3000 K is the equivalent of going from a noise figure (referenced to the standard 290 K) of 6.48 dB to a noise figure of 10.54 dB, or a 4.06 dB worsening of noise figure. A noise factor of 2 is a noise figure of 10 log(2) or about 3 dB, and a noise factor of 4 is about a 6 dB noise figure. If any of these are puzzling, please review the formulas in the March 2004 column.

What do we Want our Receivers to do for Us?

Receivers are meant to receive the signal of interest and minimize the reception of signals and noise that are not the signal of interest. Interference rejection, selectivity, and distortion are important parts of this process, but are not considered in this column. We are, however, interested in minimizing noise while providing sufficient gain to hear the weakest of signals. And so, we focus on gain and noise. Recall that the opposite of gain is loss, and is often expressed as a negative logarithm (for example, –3 dB) or a fractional linear measure (for example, ½).

The noise performance of a receiver can be treated as a cascade of its gain (and loss) elements, each with its own noise contribution. Recall that the formulations for the noise figure, noise factor, and noise temperature of an amplifier all are devised so as to make the amplifier appear to have perfect gain with the electronic noise contribution of the amplifier injected at its input terminals. Although this model is not usually correct, it does not matter because the amplifier or other element of a system is treated as a "black-box"—meaning that we do not have to understand its inner workings to fully comprehend its effects in the system. Its external behavior is completely sufficient for this type of analysis. We can also apply the same reasoning to other elements of the receiver that are not amplifiers, such as a mixer or attenuator.

Loss Between the Antenna and Low Noise Amplifier

Any loss between the feed and the LNA adds to the noise figure of the system. Unfortunately, the amount of this loss is often simplified. As you will see, in cases where the background noise power entering the antenna is 290 K, the degraded noise figure is exactly equal to the loss, but for other cases it can be quite a bit more. In the following example, let's consider a signal that is 3 dB above the thermal noise at the antenna terminals (in the given bandwidth). Noise temperature is a measure of power, so we can say that the *equivalent temperature* of the signal is twice the thermal background, or in this case 2 × 290 = 580 K.

Just what affect does loss in front of our LNA have on performance? We know that the loss elements (such as the antenna feed, any coax or waveguide, and the TR relay) provide some measurable attenuation of the signal. This attenuation applies equally to the background noise and the signal. The attenuator also provides noise of its own, and is in proportion to the amount of attenuation and the physical temperature of the loss elements. Because amateurs do not have the means to cryogenically cool their feed lines, let's assume that the loss elements are at standard temperature.

The amount of noise added by the lossy components is one minus the gain factor times the physical temperature (in kelvins). Remember that a loss is a fractional gain. So, if we have 3 dB of loss, we would have a gain of –3 dB or a linear factor of ½. Because 1–½ is ½, the added noise is ½ of 290 K or 145 K.

Let's try an example. If we have a background noise of 290 K and a signal equivalent to 580 K, then the signal-to-noise ratio entering our antenna (over the given bandwidth) is a linear factor of 580/290 = 2 (or 3 dB). We know that the feed line loses 3 dB, or a linear gain of ½, so the background power drops form 290 to 145 K and the signal drops from 580 to 290 K at the output of the feed line. The feed line adds 145 K of noise, so now the signal is at 290 K and the noise is at 145+145 = 290 K. The signal-to-noise ratio has become a linear factor of 290/290 = 1, or 0 dB (signal power equal to noise power) or a degradation of 3 dB from its original. In this case the signal-to-noise ratio has dropped by exactly the same amount as the loss. So, in terrestrial examples it is convenient to calculate degradation of front-end noise by exactly the loss between the feed line and the LNA.

Now let's try the same thing, but with a space-pointed antenna. Here the background thermal noise into the antenna might be as low as 15 K. Let's assume that the signal from the satellite (in the given bandwidth) 3 dB stronger than the noise, or 30 K equivalent. Our 3 dB cable loss will drop the antenna noise to 7.5 K and our signal to 15 K, and then add 145 K of its own thermal noise, resulting in a noise level of 152.5 K with a signal level of 15 K. The signal-to-noise power ratio converted to dB are10 × log(15/152.5) = –10.07 dB signal-to-noise. Our cable with only 3 dB of loss has buried our signal 10 dB below the noise! From these examples, you can see that although a little loss in front of the LNA might be tolerated in terrestrial communications, it can be disastrous for space communications.

Receiver (Total System) Noise Figure Equation

The noise figure of a receiver requires a combined analysis of noise and gains of the cascaded components between the antenna and the speaker. Usually, one can ignore everything after the first or second IF. However, if gain levels are available, it can be instructive to analyze your entire system. QST

STRAYS

GILDA KRIEGER

Roanoke Division Director Dennis Bodson, W4PWF, presents Sari Krieger with the 2003 Bill Leonard, W2SKE, Professional Media Award. Krieger, a staff writer with Virginia's *Potomac News* and the *Manassas Journal Messenger*, was honored for her story about the negative effects of Broadband over Powerline (BPL) on ham radio. Sari's father David Krieger, AK2A, attended the presentation as he traveled through the area, heading south from his home on Long Island.

Bandwidth vs Mode—A Multimedia View

By Mark Miller, N5RFX

Imagine a public demonstration of multimedia communication using Amateur Radio on the HF bands. While talking to a DX station he passes back a picture of himself in his shack, then passes a binary file with a new configuration for the latest ham multimedia program. Today's wireless communications trend is to combine the communication media of voice, text and graphics.

This exciting form of communications can really grab an audience, but Amateur Radio operators are faced with Part 97 regulatory challenges when experimenting with these new communications trends in the HF bands. The Amateur Radio operator must be careful to read and understand Part 97.305 titled "Authorized emission types." The FCC defines nine types of emissions: CW, MCW, Phone, Image, RTTY, Data, Pulse, Spread Spectrum and Test. These emission types are authorized on certain subbands of the HF bands and not on other subbands.

Historically, mode emissions have been segregated. In 1977 the FCC issued Docket 20777 with the goal to streamline Part 97 and to eliminate emission segregation. The docket created four categories of permissible bandwidth: less than 350 Hz, less than 3.5 kHz, less than 35 kHz and greater than 35 kHz. This would make technical restrictions far looser, allowing greater experimentation as new modes were created. The problem with Docket 20777 was with the way the bandwidths were assigned. Certain emission types could not operate where they had traditionally operated. AM enthusiasts, for example, could only operate above 28 MHz. The Amateur Radio community filed comments with the FCC opposing the bandwidth segregation of Docket 20777 and the FCC did not adopt those changes.

The next real action by the FCC occurred in 1988 when PR Docket No 88-139 was released. From this docket we have the foundation of our current Part 97 rules. In this docket, the FCC states: "We wish to recognize and encourage the experimental nature of the amateur service." Under advancing the radio art, the FCC states: "It is our intent that amateur operators in the United States be allowed to experiment with the full range of modulation types."

They go on to state: "The principal use of emission designators in regulations for the amateur service is to relegate the transmission of certain inharmonious emission types to different segments of the frequency bands." It clearly was the intention of the FCC to allow amateurs latitude to experiment with differing modulation schemes, but it is also clear that the FCC intended to segregate emission types. The FCC stated: "This approach should eliminate the inadvertently imposed restrictions while continuing necessary emission type segregation."

Multimedia radio emissions are the current trend in communications. Multimedia radio communications mix voice, data and images in a single radio event (QSO). While Part 97 gives us latitude to experiment with different modulation types, it limits the way that we can combine the content of those modulation types on a particular frequency. An example is the software program *MixW* that Steve Ford, WB8IMY, wrote about in the August 2003 issue of *QST*. *MixW* has a feature that combines a data emission with an image emission.

Part 97 allows both types of emissions but not on the same frequency when operating in the 80 through 10 meter bands. To operate this way without a frequency change, you would have to use 160 meters or 6 meters and above. SSTV mixes phone and image emissions as a normal part of operating. Digital voice is a reality today and Part 97 does not limit us from using this mode. If you wanted to use digital voice, and then send a file, you cannot do that on the same frequency in 80 through 10 meters. Future Amateur Radio digital experimentation marries different communication content types into a multimedia event, but Part 97 burdens us with making a frequency change when the content changes. To correct this problem we need to move away from content-based emission segregation and move toward the more generic bandwidth segregation.

The challenge is to implement changes that allow innovation and advancement of the radio art without inadvertently excluding modes that have historically operated in certain band segments. Sweeping changes to Part 97 are difficult to achieve, but the ARRL Digital Ad Hoc Committee in their report to the ARRL Board on March 24, 2003 suggest sweeping changes. See **www.arrl.org/announce/reports-0307/hf-digital.html**. This report lays out a blueprint for adopting bandwidth segregation for the digital bands. Many hams complain about "wide" digital signals on 80, 40, and 20 meters but have no recourse because Part 97 does not use bandwidth as a factor in determining if a signal is allowed on a particular frequency. Today the factors that determine if a mode belongs in a CW/RTTY/digital subband or a phone/image subband are its content and baud rate. The lines that define content used to be clear, but now given the multimedia environment that we live in today those lines are blurred.

As Vic Poor stated in the introductory letter to the ARRL Board, "Digital operation is one of the fastest growing areas in Amateur Radio today. It embraces all that the younger generation considers important, to include the computer, digital messaging of all kinds, and the Internet." Part of the future of Amateur Radio is looking at the world around us and using the airwaves as they have never been used before; to do this we must have regulations that truly foster advancement of the art.

The author can be reached at **markm@kramrellim.com**. *His Web site is at* **home.comcast.net/~mdmiller7/**.

QST Op-Ed Policy

The purpose of Op-Ed is to air member viewpoints that may or may not be consistent with current ARRL policy.

1) Contributions may be up to two-thirds of a *QST* page in length (approximately 900 words).

2) No payment will be made to contributors.

3) Any factual assertions must be supported by references, which do not necessarily have to be included in the body of the article to be published.

4) Articles containing statements that could be construed as libel or slander will not be accepted.

5) The subject matter chosen must be of general interest to radio amateurs, and must be discussed in a way that will be understandable to a significant portion of the membership.

6) With the exception that the article need not be consistent with League policy, the article will be subject to the usual editorial review prior to acceptance.

7) No guarantee can be made that an accepted article will be published by a certain date, or indeed, that it will be published at all; however, only articles that we intend to publish will be accepted, and any article we have decided against publishing will be returned promptly.

8) Send your contributions to ARRL Op-Ed, 225 Main St, Newington, CT 06111.

Passing the Baton

The ARRL Foundation is headed in an exciting new direction! In March of this year, Foundation functions joined forces with ARRL's Development Office—to strengthen both entities fundraising clout. With so many important issues facing Amateur Radio, it was natural to marshal our philanthropic talents under one leadership focal point. The ARRL Foundation, with an outstanding scholarship program and specialized mini-grant programs, will now reap the benefit of enhanced Web and print publicity, not to mention greater opportunities for ARRL members to better compare all the choices available for their charitable dollars.

Former Secretary Mary E. Lau, N1VH, said, "Our growth over the past 30 years has been rewarding for all concerned—our generous contributors, scholarship and grant recipients, and especially to enhance ARRL's mission to fund specialized projects in the US and abroad. I'm pleased that ARRL is now positioned to finally integrate its endowment partner fully into the HQ family of professional development functions."

Current Foundation Secretary Mary M. Hobart, K1MMH, is also ARRL's Chief Development Officer. With Development Associate Debra Johnson, this dynamic duo has made wonderful strides in building the resources necessary for ARRL to continue its BPL efforts, support the ARRL Educational and Technology Program, keep W1AW a beacon for hams and provide for historic preservation. Adding Foundation programs that serve college students, science museums, IARU societies and disabled hams widens the good that ARRL can do in the community.

ZACHARY LAU, W1VT

Mary Lau, N1VH, seen enjoying microwave fun atop Mount Wachusett in central Massachusetts. Mary runs a peer counseling service in Newington, Connecticut, but expects to be operating in next month's June VHF QSO Party and the August UHF and 10 GHz and Up Contest events.

Contributor's Corner

We wish to thank the following for their generous contributions to:

The Al Hix, W8AH Memorial Scholarship Fund
Olie and Louise Rinehart, WD8V and KA8ZGY
Constance B. Hix
Kanawha ARC, Inc
David C. Hoaglin, K1HT

The Edmond A. Metzger Scholarship Fund
M. E. Breeze, W5DVP

The Jesse Bieberman Meritorious Membership Program Fund
Martin J. Green Sr Memorial Scholarship
Martin J. Green Jr, K2PLF

Victor C. Clark Youth Incentive Fund
Gary Ferdinand, W2CS
Linda Ferdinand, N2YL
Frank Horn, W7NSN

The General Fund
Southeastern Connecticut Radio Amateur Mobile Systems
Hamfesters Radio Club, Inc
Ms Christine Bradley in memory of Forrest W. Balliet Jr, W6LWD
Harold Burt, W9HB and Ireese Albrighton in memory of Frank Burt, WB9EJE
James R. Prine, W5NUI in memory of Joe Knight, W5PDY
James E. Swafford, W7FF, in memory of William H. Faulkner, W4DO
Art Goddard, W6XD
Benjamin H. Ballard Jr, W6VJ
John L. Brittan in memory of Dr Karel R. Slatmyer Jr, W8LAO
David Axe, W7AGJ, in memory of Raymond Ubis, KG7UB

As received and acknowledged during the months of **January** and **February 2004.** QST

Mary E. Lau, N1VH ♦ Former Secretary, ARRL Foundation, Inc ♦ n1vh@arrl.org

Amateur Radio's Web "Top 20"

Since I am not a rocket scientist, I recently completed an *un*scientific study to determine the most popular Amateur Radio sites on the Internet. Using a variety of search engines, I came up with the list that follows these introductory paragraphs.

Please note that I excluded the Web sites of the various Amateur Radio hardware and software manufacturers and dealers. These sites are certainly popular, but you and I already know who they are and how to find them when we need them so there is no need repeating them here.

I also excluded the Web sites of foreign Amateur Radio organizations because the primary audience of *QST* lives in the US and I excluded local Amateur Radio organization Web sites because the primary audience of *QST* lives *throughout* the US. Finally, I discarded any sites that I could not access, despite the fact that the search engines said that I could.

If your favorite Amateur Radio Web site is missing from the list don't blame me; I used the data provided by the search engines and did not manipulate that data in any way to the benefit or detriment of any Web site. So, let's begin; here is the Number One Web site with a bullet:

1. ARRLWeb: ARRL Home Page

www.arrl.org is the home of the American Radio Relay League, the US national organization of Amateur Radio operators. It needs no introduction and it is no surprise that it heads the list.

2. Ham Radio On-line

www.hamradio-online.com has original stories about wireless communications and Amateur Radio, on-line forums and chat rooms, real-time radio propagation reports and links to other sites.

3. QRZ.COM Home Page

www.qrz.com is world famous for its searchable call sign database, but it also contains news, license renewal information, DX spotting reports, and much more.

4. AMSAT-NA

www.amsat.org is the site of The Radio Amateur Satellite Corporation of North America, the folks responsible for ham radio birds in outer space.

5. Amateur Radio and DX Reference Guide

www.ac6v.com is the mother of links to other Amateur Radio Web sites. Compiled by Rod Dinkins, AC6V, it features over 80 pages containing more than 3000 links that cover over 400 radio-related topics.

6. The Amateur Radio Web Ring

www.digdez.com/amateur is the home of a Web ring of 587 Amateur Radio Web sites. (A "Web ring" or "Webring" links similarly minded Web sites together to facilitate finding and navigating the sites.)

7. eHam.net Home—Amateur Radio (Ham Radio) Community Site

www.eham.net is a Web site for Amateur Radio operators around the world featuring call sign lookup, product reviews, classified advertisements, news, articles and more.

8. IARUWeb

www.iaru.org is the Web site of the International Amateur Radio Union, which is the worldwide voice and source of information for radio amateurs.

9. Amateur Radio Newsline Home Page

www.arnewsline.org is the home page of the service that provides Amateur Radio news worldwide.

10. mods.dk

www.mods.dk is the top Web site on the Internet for finding modifications and improvement of Amateur Radio equipment. The site contains over 1700 modifications.

11. Beginners Guide to Ham Radio

www.irony.com/ham-howto.html is a Web site that provides a great resource for learning how to become an Amateur Radio operator.

12. CQ Home Page

www.cq-amateur-radio.com is the home of *CQ* magazine and its sister publications. It has news and articles pertaining to ham radio and includes links to related sites and forums.

13. The DXZone.com—Ham Radio Guide

www.dxzone.com provides a guide to ham radio, scanning and short-wave listening via links to other Web sites.

14. HamRad—Amateur Radio Resource

www.hamrad.com provides a resource for finding Amateur Radio manufacturers, dealers, organizations and modifications. It is also the home of HamRad Trader pages.

15. K1DWU Dot Net

www.k1dwu.net is another Web site of ham radio links. It has a collection of over 4500 links to Amateur Radio sites worldwide that are verified each week.

Figure 1—NASA's International Space Station Reference Web site (spaceflight1.nasa.gov/station/reference/radio/) is one of the most popular Amateur Radio Web sites according to the Internet search engines.

16. University of Arkansas at Little Rock's Amateur Radio Club Home Page

www.ualr.edu/~hamradio is the home of UALR's ham club and its award-winning call sign database server.

17. International Space Station Reference

spaceflight1.nasa.gov/station/reference/radio/ is the National Aeronautics and Space Administration (NASA) Web page dedicated to Amateur Radio with reference to the International Space Station.

18. NB6Z—Digital HF Ham Radio

home.teleport.com/~nb6z is dedicated to the HF Amateur Radio digital modes and contains information on what they are and how to use them.

19. *Linux* Hamradio Application and Utilities Homepage

radio.linux.org.au provides an overview of Amateur Radio software for the *Linux* operating system (see the March installment of Digital Dimension for more information about *Linux*).

20. Amateur Radio Reference

www.panix.com/clay/ham is another comprehensive Web site providing links to other Amateur Radio Web sites.

There were a few surprises in this list, including a couple I was completely unaware of, but I now have bookmarked them for future reference.

Stan Horzepa, WA1LOU ♦ One Glen Ave, Wolcott CT 06716-1442 ♦ wa1lou@arrl.net, www.tapr.org/~wa1lou

Greenkeys—A Roundup of RTTY

During World War II, Radioteletype became a reliable form of communication. Every branch of the military used it to provide written communication. After the war, returning hams and radio operators who became hams wanted to use Teletype on the ham bands. It took a while.

At first they were limited to VHF, but on February 20, 1953 the FCC authorized HF RTTY using "F-1" Frequency Shift Keying. They were permitted on the following bands: 80 meters (3500-3800), 40 meters (7000-7200), 20 meters (14,000-14,200) kHz.

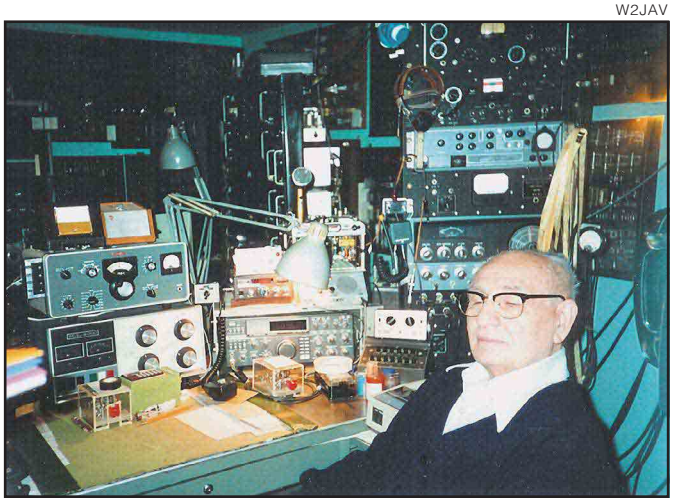
Hams everywhere were delighted; the FCC had adopted most of the suggestions they had made. The very minute F-1 was allowed, hams started to make contacts with each other. In no time at all, they were in contact worldwide.

Phil Catona, W2JAV

One of the true RTTY pioneers lived near me in southern New Jersey: Phil Catona, W2JAV. Phil was one of the movers and shakers who brought about ham RTTY. Phil was very active—so much so that he earned WAS RTTY certificate number 2.

An engineer for RCA in Camden New Jersey, he contributed and designed many circuits for RTTY use. Many are still in use today. One of his most famous was a 1957 Radioteletype Converter, called the W2JAV Converter. Built with miniature tubes, it was published in *CQ* magazine and later in *The New RTTY Handbook*, by Byron Kretzman, W2JTP.

W2JAV



Phil's last ham station from the late 1990s. His Model 32 Teletype machine is behind him, just out of view.

W2JAV

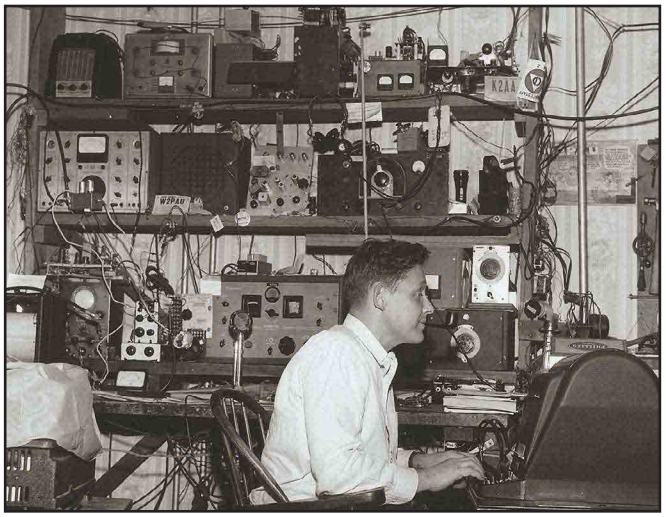
Phil Catona, W2JAV's, 1952 RTTY station in Hammonton, New Jersey. The large TTY in the center is a Teletype Model 12, and on the right with the cover removed is a Model 14. The relay rack with his call on top, contains all of the circuits needed for radio teletype. The other relay rack, left, is his homebrew transmitter. His Hammarlund Super-Pro receiver is on top of the desk.

W2JAV

These are some of the men who helped develop and promote RTTY for ham radio. This meeting was in the 1950s, in New York City, I believe. They gathered for a couple of days to share their knowledge and promote RTTY. There were seminars, equipment demonstrations and an evening banquet. I'm told a couple of them even brought their TTY machines and had them working in the hotel rooms—no small feat. They finally all got together and posed for a photo. From the left: Seated are Stew Davis, W4ZC/2; Ed Kephart, W2SPV; Wayne Green, W2NSD, and Merrill Swan, W6AEE. Second row, standing are Tom Howard, W1AFN; Al Hughes, W1FGL; Frank Gibson, W3MHD; Bob Weibrecht, W9TCJ; Frank White, W3PYW; Dick Urian, W3CRO; Ed Clammer, W2BDI; Phil Catona, W2JAV; Ken Payne, W1RBF; Bob Straub, W2PBG, and Boyd Phelps "Beep," W9BP. Third row, standing on stairs are Tom Stewart, W2TBD; Clay Cool, W2EBZ; Tom, W1WRP(?); Roy Weise, W2TKO; Cecil Gregson, W9CNN, and Ed Brown "Brownie," W2PAU. Not shown are Keith Harris, W3UWM, and Jim McCurley, W8KYL.

John Dilks, K2TQN ♦ 125 Wharf Road, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

W2JAV

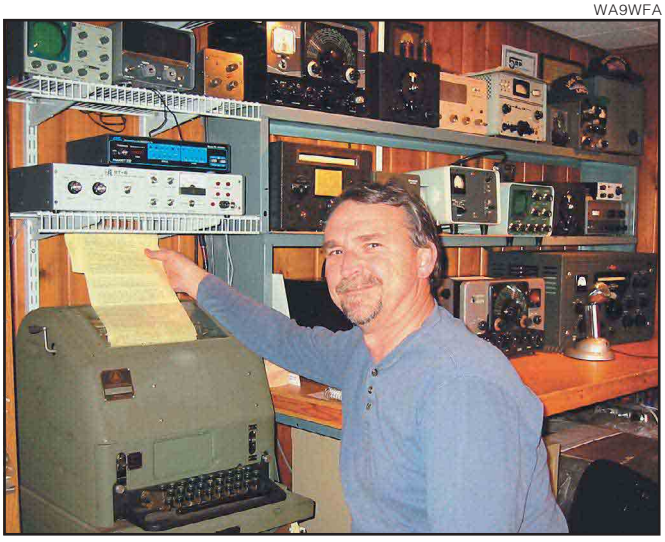


This is the 1958 station of Phil's lifelong friend Brownie, Miles Brown, W2PAU. Brownie is using his Model 26 Teletype. Behind him is just part of his station. In spite of the cluttered look, everything worked. Brownie was Technical Editor for *CQ* magnitude for a number of years.

W1EVZ

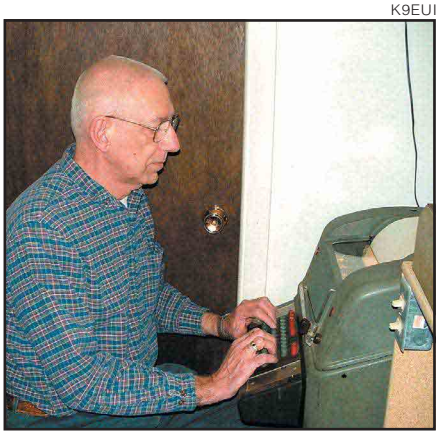
Jim King, W1EVZ, from Holyoke, Massachusetts sent this photo to confirm a QSO on August 27, 1952 with W2JAV. Jim was using a Model 12 Teletype and a Hammarlund HQ-129X receiver. Behind him is his homebrew transmitter. This contact was on VHF, as HF RTTY was not permitted at that time.

WA9WFA



Here is a vintage RTTY station still being used today. It belongs to Scott Freeberg, WA9WFA. Just above the Model 15 Teletype is his vintage solid-state HAL ST-6 Demodulator. He also uses the Heath Monitor Scope for tuning in the RTTY signal. Scott's first experience with Teletype was back in the early 1970s aboard the USS *Okinawa*, sitting off the coast of Vietnam. Later, in college, he learned about ham radio RTTY and has been active since.

K9EUI



Bob Roehrig, K9EUI, owns a Model 28 Teletype. This model was much improved over the Model 15. It ran much more quietly and looked more modern.

Phil's design was not original and he did not claim that it was; instead, it gave credit to each of the earlier designs he adapted it from. The big thing he did, though, was to create an ultrareliable converter that would give good copy through some rough conditions. It was easy to build and easy to set up.

Phil was famous for filter design and finding better ways to copy stations. Later he designed a solid-state converter that fit inside the Polar Relay cover. I built both of his converters during the 1970s, when I was on RTTY. (A Polar Relay is a device that moves a center contact in two directions, between two other contacts, depending on the direction of current flow through its coil. These were adapted from landline Teletype circuits and usually worked reliably. Polar Relays were used in almost every ham's RTTY setup.)

Phil also developed one of the earliest solid-state QRP transmitters for RTTY, and used it regularly on 40 meters with 45 mW. The circuit was published in the RTTY column of the August 1957 *CQ* magazine. One of his first DX contacts with it was VE2ATC.

After retirement, Phil remained active and continued to help new RTTY enthusiasts get on the air. He became an SK a few years ago. I'll have more about Phil in future columns.

The Price is Right

I'm going to keep this short so you can see a lot of photographs this month. These are from some nice shacks of the past and a couple still in use today. I do have a message to share, though:

Today you can have a lot of fun with your computer on RTTY and other digital communication modes. It sure is easy to hook up and participate that way. But for a real thrill, you should try an old Teletype machine and an RTTY converter hooked to your receiver.

It seems that a lot of Teletype machines are available now, most of them for free. Many old-timers are reducing their shacks and moving into smaller homes. Think about saving one of them. It will be an effort to get it home and then past your significant other. You will need to clean it and oil it and find a spot to set it up in the shack, but it will be worth it. Believe me, you'll never forget the look in your SO's eyes the first time you fire it up and get it working.

A good place for more information on RTTY is **www.rtty.com/index.htm**.

I'll see you at the hamfests. Look for my hat and say hello.—*K2TQN* QST

COMING CONVENTIONS

EMCOMMWEST CONVENTION

May 22-23, Reno, NV

The EMCOMMWEST Convention, sponsored by the ARRL Nevada Section, will be held at the Fred W. Traner Middle School, 1700 Carville Dr; NW of the intersection of I-80 and Hwy 395; go N on Hwy 395 to Oddie Blvd, turn W on Oddie Blvd, proceed to Montello St, turn S, watch for event signs and proceed to Carville Dr, turn left to school. Doors are open Saturday 9 AM to 5 PM, Sunday 9 AM to noon. Features include Reno Spring Ham Swap, ARRL forum, ARECC Symposium (by Dan Miller, K3UFG), vendors, American Red Cross Emergency Communication Response Vehicles on display, speakers and presentations, VE sessions (all classes), self-contained RV parking (Reno Salvation Army Headquarters, located on NW corner of Oddie Blvd and Sutro St), Friday evening barbeque (May 21, 5 PM; Salvation Army Headquarters parking lot). Talk-in on 147.21 (123 Hz), 147.15. Admission is $10 in advance, $15 at the door. Contact Don Carlson, KQ6FM, 5591 Barcelona Ct, Sparks, NV 89436; 775-354-2788; **kq6fm@arrl.net**; **www.emcommwest.org**.

WYOMING STATE CONVENTION

May 29-30, Casper

The Wyoming State Convention, sponsored by the Casper ARC, will be held at the Parkway Plaza Convention Center, 123 W "E" St, located off Center St, slightly S of the Interstate; take Exit 188A off I-25. Features include swap tables, commercial vendors, forums, foxhunt, VE sessions (to register contact Tim Bachmeier, AB7BJ, 307-265-0830; **ab7bj@bresnan.net**), DXCC card checking, meetings, QCWA lunch, banquet (Saturday eve, western style barbeque, $15; guest speaker ARRL Rocky Mountain Division Director Walt Stinson, WØCP). Talk-in on 146.94. Admission is $10 in advance, $12 at the door. Tables are $5. Contact Rev Morton, WS7W, 1341 Trojan Dr, Casper, WY 82609; 307-235-2799; **ws7w@arrl.org**; **www.wyohamfest.com**.

April 23-24
Southeastern VHF Conference, Atlanta, GA*

April 23-25
International DX, Visalia, CA*

April 30-May 1
Louisiana State, Baker*
Midwest Division, Lebanon, MO*

April 30-May 2
San Joaquin Valley Section, Fresno, CA*

May 1
South Carolina Section, Greenville*

May 1-2
Alabama Section, Birmingham*

June 4-6
Atlantic Division, Rochester (Henrietta), NY

June 11-12
Iowa State, Sioux City
Tennessee Section, Knoxville

June 18-19
West Gulf Division, Arlington, TX

June 19-20
Northwestern Division, Seaside, OR

July 1-4
Arizona State, Williams

July 9-11
San Francisco Section, Ferndale, CA

***See April *QST* for details.**

GEORGIA SECTION CONVENTION

June 5, Marietta

The Georgia Section Convention (76th Annual Hamfest), sponsored by the Atlanta Radio Club, will be held at Jim Miller Park, Cobb County, 2245 Callaway Rd; just N of downtown Atlanta, located minutes from Interstates 75 and 285; from Atlanta go N on I-75, take Exit 260 (Windy Hill Rd), go W 6 miles, turn left on Austell Rd, then right on Callaway Rd. Doors are open 8:30 AM to 3:30 PM. Features include flea market, dealers, demonstrations, forums, VE sessions. Talk-in on 146.82 (146.2 Hz). Admission is $5. Tables are $15. Contact John Talipsky, N3ACK, 385 Madison Chase Dr, Lawrenceville, GA 30045; 770-995-6446; **johnka4vqh@aol.com**; **www.atlantahamfest.com**.

Attention Hamfest and Convention Sponsors:

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

Note: Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance. QST

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

HAMFEST CALENDAR

Attention: The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **May 1** to be listed in the **July** issue. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

(Abbreviations: *Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission.)

†Arizona (Pinetop/Lakeside)—Jun 4-5; Friday noon to 5 PM; Saturday 7 AM to 3 PM. *Spr:* Amateur Radio Council of Arizona (ARCA). Blue Ridge High School, 1200 W White Mountain Blvd; from Show Low go S on Hwy 260 to Lakeside, turn left into school grounds at traffic light on Yellow Jacket Blvd (Mile Post 351). 2nd Annual White Mountains Hamfest, commercial vendors, paved tailgating ($5 per two-car space), VE sessions (Main Building, 1 PM; $12 fee), Transmitter Hunt, RV parking. *TI:* 145.31 (110.9 Hz). *Adm:* $1, under 13 free. Tables: first table $15 ($3 for each additional; free electricity, bring your own cords). Cris McBride, KB7QXQ, Box 3396, Pinetop, AZ 85935; 928-367-6607; **kb7qxq@arrl.net**; **www.whitemtnhamfest.com**.

†ARRL Hamfest

†California (Fair Oaks)—May 16, 6 AM to noon. *Spr:* North Hills RC. Bella Vista High School, 8301 Madison Ave; from I-80 go E on Madison Ave for 5.8 miles to school on left; from Hwy 50, take Hazel Ave for 2.6 miles to Madison Ave, go W on Madison Ave for 1.4 miles to school on right. Ham Swap, refreshments. *TI:* 145.19 (162.2 Hz). *Adm:* Free. Tables: $10. Kim Scheidel, KE6RKX, 731 N Market Blvd, Unit M, Sacramento, CA 95834; 916-417-4864; **ke6rkx@arrl.net**; **www.k6is.org**.

†Connecticut (Goshen)—May 15; set up 6 AM; public 8 AM to 1 PM. *Spr:* Southern Berkshire ARC. Goshen Fairgrounds, 150 Old Middle St (Rte 63), ½ mile S of Rte 4 traffic circle. Vendors, tailgating, VE sessions (9:30 AM), refreshments. *TI:* 147.285 (77.1 Hz). *Adm:* $3. Tables: $10. Lee Collins, K1LEE, 5 White Hollow Rd, Lakeville, CT 06039; 860-435-0051; **k1lee@arrl.net**.

†Connecticut (Vernon)—May 29, 9 AM to 1 PM. *Spr:* Natchaug ARC. Tolland County Agricultural Center, 24 Hyde Ave (Rte 30); I-84 to Exit 67, follow signs for approximately ½ mile to event. Refreshments. *TI:* 145.11. *Adm:* $4. Tables: $15. Wayne Rychling, N1GUS, 59 Clint Eldredge Rd, Willington, CT 06279; 860-487-1921; **n1gus@arrl.net**.

†Florida (Titusville)—Jun 5; set up 6 AM; public 7 AM to 1 PM. *Spr:* North Brevard ARC. Disabled American Veterans Chapter 109, 435 Singleton Ave; I-95, Exit 220 (Garden St), go E to first traffic signal (Singleton Ave), turn N, proceed 3 blocks to event. Tailgating ($10 per space), VE sessions (8 AM to 1 PM; walk-ins accepted). *TI:* 145.49. *Adm:* Free. Tables: $10. Bob Jones, N6USP, Box 1033, Mims, FL 32754; 321-264-2622; **n6usp@gnc.net**; **www.northbrevardradioclub.org**.

Georgia (Marietta)—Jun 5, Georgia Section Convention. See "Coming Conventions."

†Illinois (Decatur)—May 2, 7 AM to noon. *Spr:* Cenois ARC. Richland Community College, One College Park; corner of Rea's Bridge and Brush College Rds. Free outdoor flea market (with ticket purchase), VE sessions (10 AM; walk-ins only). *TI:* 147.1, 442.25 (103.5 Hz). *Adm:* $5, under 16 free. Tables: Free. Spencer Carter, N9LVW, Box 245, Blue Mound, IL 62513; 217-692-2460; **n9lvw@msn.com**; **www.cenois.com**.

†Illinois (Princeton)—Jun 6; set up Saturday noon, Sunday 5 AM; public 8 AM. *Spr:* Starved Rock RC. Bureau County Fairgrounds, 811 W Peru St, ½ mile W of IL Rte 26; Exit 56 off I-80, S to

Rte 6 (Peru St), W 2 blocks to Fairgrounds. Hamfest/Computer Show, flea market, dealer displays, vendors, excellent parking, refreshments. *TI:* 146.955 (103.5 Hz). *Adm:* advance $5 (2 stubs), door $7 (1 stub). Tables: $10 (before May 15), $15 (after May 15); electricity available, bring your own drop cords. Nick Sotiriou, KB9PUT, Box 302, Varna, IL 61378; 815-228-8070 or 815-856-2408; **kb9put2002@yahoo.com** or **srrchamfest @yahoo.com**; **www.qsl.net/w9mks/hamfest. htm**.

†Illinois (Springfield)—Jun 5; set up Friday eve; public Saturday 6 AM (flea market pavilion); 8 AM (building opens) to noon. *Spr:* Sangamon Valley RC. Illinois State Fairgrounds, Cooperative Extension Building; from I-55 take Exit 100B, go W on Sangamon Ave for 3 miles to Fairgrounds, enter Gate 11 (2nd Gate, ¼ mile W of Main Gate), proceed to Building 30. Giant covered flea market ($5 per car load; you must provide your own tables), commercial exhibits, vendors, dealers, VE sessions (9 AM, walk-ins accepted, no registrations accepted after 10 AM; $12 fee). *TI:* 146.685. *Adm:* $5. Tables: indoor $5 per 5-ft (reservations highly recommended, limited electricity). Ed Gaffney, KA9ETP, 13997 Frazee Rd, Box 14A, Divernon, IL 62530; 217-628-3697; **egaffney@ family-net.net**; **w9dua.com**.

†Kentucky (Independence)—Jun 5, 7 AM to 2 PM. *Spr:* Northern Kentucky ARC. Summit View Middle School, 5002 Madison Pike; I-275 to Exit 80 (KY Rte 17), go S 5¼ miles to traffic light, turn right, go ¼ mile on right, look for signs. Flea market, vendors, VE sessions (8:30 AM), ARRL forum (10 AM), foxhunt (11 AM), refreshments. *TI:* 147.255. *Adm:* $5, under 13 free. Tables: $15 (each table includes 1 admission ticket); outside flea market $2 per space plus admission ticket. Robert Blocher, N8JMV, 2061 St Rte 125, No 10, Amelia, OH 45102; 513-797-7252; **n8jmv@arrl.net**; **home.fuse.net/dom/**.

†Kentucky (Louisa)—May 1, 8 AM to 2 PM. *Spr:* Big Sandy ARC. Louisa Community Center, corner of Pike and Jefferson Sts; take US 23 to Louisa, turn off onto Rte 2566, go 1 mile to first traffic light in front of Food Land Plaza, turn left, follow marked highway ½ mile to Pike St, turn right in front of Fire Station, go ¼ mile across railroad tracks, Community Center on right. ARES Special District 9 Meeting, ARES forum (with KY SM John Meyers, NB4K), VE sessions. *TI:* 147.39. *Adm:* $4. Tables: $4. Fred Jones, WA4SWF, 511 N Lackey Ave, Louisa, KY 41230; 606-638-9049; **wa4swf@foothills.net**; **www.bsarc.org**.

†Maine (Hermon)—Jun 5; set up 6:30 AM; public 8 AM to 1 PM. *Spr:* Pine State ARC. Hermon High School, Rte 2; I-95 to Exit 180 (old Exit 44), go N on Cold Brook Rd to Rte 2, go W on Rte 2 for 1½ miles to High School. Dealers, tailgating, programs (pros and cons for code requirements, discussion of new proposal for Novice ham license, building antennas, Echo-Link, PSK-31, setting up a ham station on VHF and HF fixed and mobile), VE sessions (all classes). *TI:* 146.94, 146.52. *Adm:* $5. Roger Dole, KA1TKS, 852 Bog Rd, Hermon, ME 04401; 207-848-3846; **rdole@ hermon.net**; **www.n1me.com**.

†Maryland (West Friendship)—May 30, 8 AM to 2 PM. *Spr:* Maryland FM Assn. Howard County Fairgrounds, 2210 Fairgrounds Rd; take Exit 80 off I-70 to Rte 32, S to Rte 144, turn right, go W on Rte 144 approximately 1 mile to Fairgrounds. Commercial vendors, tailgating ($5 per space; indoor spaces $10 per space), refreshments. *TI:* 146.76, 224.76, 444.0 (107.2 Hz). *Adm:* $5. Tables: advance by May 14 $25, door $30 (includes electricity). John Elgin, WA3MNN, c/o MFMA, Box 351, Hanover, MD 21076; 301-641-5313 (6-10 PM); **wa3mnn@arrl.net**; **www. marylandfm.org**.

Massachusetts (Cambridge)—May 16. Nick Altenbernd, KA1MQX, 617-253-3776 (9 AM to 5 PM).

†Michigan (Chelsea)—Jun 6, 8 AM to 1 PM. *Spr:* Chelsea ARC. Chelsea Fairgrounds, M52 and Old US 12; from I-94, take Exit 159 (this is M52), go N into Chelsea, turn W on Old US 12 at first traffic light to Fairgrounds. Good Old-Fashioned Swap. *TI:* 145.45 (100 Hz). *Adm:* advance $4, door $5. Tables: $10. Derek Sheehan, W7REX, Box 43, Chelsea, MI 48118; 734-622-2813; **w7rex@arrl. net**; **www.qsl.net/wd8iel**.

†Michigan (Grand Rapids)—Jun 5; set up Friday 7 PM, Saturday 6 AM; public 8 AM. *Spr:* Independent Repeater Assn. Hudsonville Fairgrounds, 2 miles N of I-196 at Exit 62. Hamfest/ Computer Fair, famous "Roadkill-Chili" potluck supper (Friday, 7 PM), dealers, displays (vintage ham and military radio equipment), alternative energy exhibits, trunk sales (10-ft space $6 each), Michigan Repeater Council Quarterly Meeting (1 PM), VE sessions (10:30 AM, walkins), camping ($10), handicapped accessible, free parking, refreshments. *TI:* 147.16 (94.8 Hz). *Adm:* $5, under 12 free with accompanying adult. Tables: 8-ft $8. Kathy Werkema, KB8KZH, 562 92nd St SE, Byron Center, MI 49315; 616-698-6627; **kwerkema@juno.com**; **www.w8hvg.org**.

†Mississippi (Pascagoula)—May 21-22; set up Friday noon; public Friday 5-9 PM, Saturday 8 AM to 2 PM. *Spr:* Jackson County ARA. Jackson County Fairgrounds Civic Center, 2309 Shortcut Rd; Exit 69 off I-10, Hwy 63 S to Hwy 90, W to Singing River Hospital, turn right on Hospital Rd to Fairgrounds behind hospital. Hamfest/Computer Show, numerous dealers and vendors, VE sessions (Saturday, 9 AM; $12 fee, bring picture ID, latest license and/or all applicable CSCEs and 1 copy of each; copies must be legible), forums (ARRL/MS Section, ARES/RACES, others), refreshments. *TI:* 145.11. *Adm:* $4, under 12 free ($10 max per family). Tables: $8 (8-ft; tables must be paid in advance to assure reserved space). Ira Groff, NN5AF, 17200 Spring Lake Dr W, Vancleave, MS 39565; 228-826-5095; **nn5af@ arrl.net**; **www.angelfire.com/ms3/jcarc**.

†Missouri (Nevada)—May 15, 8 AM to 2 PM. *Spr:* Nevada ARC. Nevada Vernon County Community Center, 200 N Ash St; from the N or S on Hwy 71 take the Hwy 54 Exit, proceed W on Hwy 54 to 4th traffic signal, turn right on Ash St, go 2½ blocks N. *TI:* 147.135. *Adm:* Free. Tables: $10. Carl Pokorny, KØCB, Box 567, Nevada, MO 64772; 417-667-2112; **k0cb@arrl.net**.

Nevada (Reno)—May 22-23, EMCOMMWEST Convention. See "Coming Conventions."

†New Jersey (Washington Township)—May 29; set up 6 AM; public 8 AM to 2 PM. *Spr:* Bergen ARA. Westwood Regional High School, 701 Ridgewood Rd; from Rte 17 N or S to Linwood Ave, go E to Pascack Rd, N on Pascack, go ¼ mile to Ridgewood Rd, E on Ridgewood to High School. Vendors ($15 per space, includes 1 admission, no reservations required; reservations required for limited number of indoor spaces with electrical power), tailgating, VE sessions (8-10 AM only, Novice through Extra, $12 fee), DXCC card checking, lots of parking, refreshments. *TI:* 146.79 (141.3 Hz), 146.52. *Adm:* $5, nonham family members free. Jim Joyce, K2ZO, 286 Ridgewood Blvd N, Washington Township, NJ 07676; 201-664-6725; **k2zo@arrl.net**; **www. bara.org**.

†New York (Massapequa)—May 23, 8 AM to noon. *Spr:* Great South Bay ARC. Sunrise Mall, One Sunrise Mall; from Brooklyn, Queens, and Nassau take the LIE, Northern or Southern State Parkway to Rte 135 (Seaford-Oyster Bay Expressway) S to Rte 27 (Sunrise Hwy) E for 3 miles, entrances to Sunrise Mall will be on left. Flea market, vendors, VE sessions. *TI:* 146.685 (110.9 Hz). *Adm:* $6. Tables: $10. Walter Wenzel, KA2RGI, 373 15th St, W Babylon, NY 11704; 631-669-3714 (days) or 631-957-0218 (eves until 10 PM); **ka2rgi@arrl.net**; **www.gsbarc.org**.

†New York (Queens)—Jun 6; set up 7:30 AM; public 9 AM to 2 PM. *Spr:* Hall of Science ARC. New York Hall of Science Museum Parking Lot, 47-01 111th St (Flushing Meadow Corona Park). Electronics and computer equipment, tailgating ($10 per space), Museum Exhibit Station WB2JSM, VE sessions (10 AM; Lenny Menna, W2LJM, 718-835-1548), tune-up clinic, free parking, refreshments. *TI:* 444.2 (136.5 Hz), 146.52. *Adm:* $5. Stephen Greenbaum, WB2KDG, 85-10 34th Ave, Apt 323, Jackson Heights, NY 11372; 718-898-5599; **wb2kdg@arrl.net**; **www.qsl.net/hosarc**.

†North Carolina (Durham)—May 29, 8 AM to 2 PM. *Spr:* Durham FM Assn. National Guard Armory, intersection of Duke St and Stadium Dr; I-85, Exit 176B, go 0.8 mile N on Duke St, take right onto Stadium Dr. VE sessions (on site), refreshments. *TI:* 147.225. *Adm:* $5. Tables: $12. Linda Jackson, KF4LJZ, 122 Infinity Rd, Durham, NC 27712; 919-477-8368; **kf4ljz@aol.com**; **www.dfma.org**.

†North Carolina (Greenville)—May 15; set up 7 AM; public 8 AM to 3 PM. *Spr:* East Carolina Antique RC. Kiwanis Club, 177 Forelines Rd (Winterville); off Hwy 11, S of Greenville. Swapfest, antique radios and parts. *TI:* None. *Adm:* Free. Tables: inside space $15, outside tailgate space $10 (bring your own tables and chairs). Herman Schnur, K4CTG, 3205 Brick Kiln Rd, Greenville, NC 27858; 252-752-2264; **hschnur@ cox.net**.

†North Carolina (Winston-Salem)—Jun 5, 6 AM to 1 PM. *Spr:* Forsyth ARC. Dixie Classic Fairgrounds, Home and Garden Building, 27th St; I-40 to US 52 to Akron Dr; follow signs to Fairgrounds. Flea market, tailgating ($5 per space), VE sessions (9 AM, at nearby Red Cross Building), camping, refreshments. *TI:* 146.64 (100 Hz). *Adm:* $5. Tables: $15 (8 ft; electricity $10 per outlet). Raymond Taber, WX1NCC, 165 Gloria Dr, Mt Airy, NC 27030; 336-202-4592 or 336-723-7388; **wx1ncc@yahoo.com**; **www.wshamfest. netfirms.com**.

†Ohio (Dayton)—May 14-16; Friday 8 AM to 6 PM, Saturday 8 AM to 5 PM, Sunday 8 AM to 1 PM. *Spr:* Dayton ARA. Hara Arena Complex, 1001 Shiloh Springs Rd. Hamvention's 2004 theme is "Year of the Contact," exhibitors and vendors showing their latest products and equipment, huge outside vending area, forums on all facets of Amateur Radio (all 3 days), VE sessions (held within Hara Arena all 3 days, Technician through Extra class; reservations highly recommended, walk-ins accepted), Special Events Station. *TI:* 146.94, 146.91. *Adm:* advance $20, door $25, (good all 3 days); under 13 free. Henry Ruminski, WD8JOI, 937-775-2950; **henry.ruminski@ wright.edu**; or Gary Des Combes, N8EMO, c/o Dayton Hamvention, Box 964, Dayton, OH 45401-0964; 937-276-6930 or 937-276-6934; **info@ hamvention.org**; **www.hamvention.org**.

†Ohio (Hilliard/Columbus)—May 30; set up 7:30 AM; public 9 AM. *Spr:* Franklin County Hamfest Committee. Franklin County Fairgrounds, Columbia St; take the I-270 outerbelt to W side of Columbus, exit at Cemetery Rd (Hilliard), go 1.5 miles W on Cemetery Rd to Norwitch St, turn right (just before R/R overpass), go 0.5 mile N on Norwitch (look for Fairgrounds signs), turn right onto Columbia St, straight ahead to Fairgrounds entrance. Electronics flea market (buy, sell, trade), equipment, computers, antique radios, free parking. *TI:* 146.76 (123 Hz). *Adm:* $5. Tables: $5 (8-ft). Chris Lind, KC8BUO, Box 14281, Columbus, OH 43214; 614-267-7779; fax 614-263-7934; **clind2@juno.com**.

†Pennsylvania (Butler/Pittsburgh)—Jun 6, 8 AM to 3 PM. *Spr:* BreezeShooters ARC. Butler Farm Showgrounds, PA Rte 68, W of Butler. 50th Annual Hamfest/Computer Show, large indoor and outdoor flea market, computers, electronics, vendors, tailgating ($5 per space), VE sessions (noon, CB Ranger Bldg), plenty of free parking, handicapped parking, overnight camping (hookups $10), refreshments. *TI:* 147.36. *Adm:* $5, under 12 free. Tables: $20. Robert Benna, N3LWP, 1010 Willow Dr, Pittsburgh, PA 15237; 412-366-0488; **n3lwp@verizon.net**; **www.breezeshooters.net**.

†Tennessee (Mountain City)—May 8, 8 AM to 1 PM. *Spr:* Johnson County ARC. National Guard Armory, 1923 S Shady St (Hwy 421), E of downtown, next door to hospital; from Boone, NC take Hwy 421, from Johnson City, TN take Hwy 67 to Hwy 421, from Abington, VA take Hwy 58 to Hwy 91 to Hwy 421 to Mountain City. Swapfest, tailgating ($2 per space), VE sessions (1 PM, walk-ins accepted), eyeball QSOs, tour new W4MCT EOC. *TI:* 146.61 (103.5 Hz), 443.925 (103.5 Hz), 145.47, 146.52. *Adm:* $2. Tables: $5. Danny Herman, K4DHT, Box 55, Mountain City, TN

37683; 423-727-0723; **k4dht@preferred.com**.

†Texas (Amarillo)—May 22, 9 AM to 4 PM. *Spr:* Panhandle ARC. Thompson Park, 24th St and Dumas Hwy; from N 287 take 24th St Exit, turn W to park entrance, proceed N past Zoo and Wonderland Park. Swapfest/Picnic, catered barbeque ($6 purchase in advance). *TI:* 146.94 (88.5 Hz). *Adm:* Free. Tables: Free. Gene Bitner, WA5ETK, 3202 Clema St, Amarillo, TX 79107-7415; 806-383-0115; **wa5etk@cox.net**; **home.earthlink.net/~picnic-swapfest/**.

†Texas (Belton/Temple)—May 22, 7 AM to 3 PM. *Spr:* Temple ARC. Bell County Expo Center, 301 W Loop 121; from I-35 take Exit 292, go W on Loop 121 for approximately ¼ mile to the Expo Center on left. Swapfest, commercial vendors, dealers, new equipment, used gear, electronics, computers, accessories, huge tailgate area, VE sessions (1 PM, on site, all classes; $12 fee), group meetings, RV camping, handicapped accessible. *TI:* 146.82 (123 Hz), 444.7 (123 Hz). *Adm:* $1. Tables: $10-$25. Mike LeFan, WA5EQQ, Box 4511, Temple, TX 76505; 254-773-3590; fax 775-264-1978; **hamexpo@tarc.org**; **www.tarc.org**.

†Virginia (Manassas)—Jun 6; set up Saturday 2-10 PM; public Sunday 8 AM to 3 PM. *Spr:* Ole Virginia Hams ARC. Prince William County Fairgrounds, 10624 Dumfries Rd (Rte 234). 30th Amateur Radio, Computer, and Electronics Show; tailgating ($6 per space plus admission; gates open 6 AM); 4th Call Area QSL Bureau Reps; DXCC QSL card checking; "Virginia QSO Party" Awards Ceremony; VE sessions (Bill, K9ZD, 703-754-7913; **k9zd@arrl.net**); free parking; refreshments. *TI:* 146.97, 224.66, 442.2. *Adm:* $6. Tables: $20 (with electricity and chairs). David Lane, KG4GIY, 9327 Camphor Ct, Manassas, VA 20110-6669; 703-361-3042; **kg4giy@arrl.net**; **www.w4ovh.net**.

†Washington (Stanwood)—May 8, 9 AM to 3 PM. *Spr:* Stanwood-Camano ARC. Stanwood Middle School, 9405 271st St NW; N or S on I-5 to Exit 212, go W on SR 532 to 3rd stoplight, turn N on 88th Ave NW, go 1 block and turn left, school is on left about 3 blocks. Flea market, antiques, electronics, computers, VE sessions, free parking, refreshments. *TI:* 145.19. *Adm:* $5. Tables: $15. Dave Huppert, KA7FDC, 1864 S Edgewood Dr, Camano Island, WA 98282; 360-387-6123; **huppert@whidbey.net**.

†Washington (Wenatchee)—Jun 4-6. *Spr:* Apple City RC. Dryden Gun Club, Hwys 2 and 97; follow signs. VE sessions. *TI:* 146.68 (156.7 Hz). *Adm:* $7. Tables: Free. John Lathrop, N7RHY, 804 Ferry, Wenatchee, WA 98801; 509-662-6007; **n7rhy@gte.net**.

†Wisconsin (Cedarburg)—May 1, 8 AM to 1 PM. *Spr:* Ozaukee Radio Club. Circle B Recreation Center, 6261 Hwy 60; 3.5 miles W of I-43 or 10 miles E of Hwy 45, at the intersection of Hwy 60 and County I. 26th Annual Amateur Radio and Computer Swapfest, VE sessions. *TI:* 146.97 (127.3 Hz). *Adm:* advance $4, door $5. Tables: $10. Gene Szudrowitz, KB9VJP, W55 N865 Cedar Ridge Dr, Cedarburg, WI 53012; 262-377-6792; **szuds39@msn.com**; **www.qsl.net/orc**.

Wyoming (Casper)—May 29-30, Wyoming State Convention. See "Coming Conventions."

CONTEST CORRAL

W1AW Qualifying Runs are 7 PM EDT Monday, May 3 (2300Z May 3) (10-40 WPM QRL), and 9 AM EDT Friday, May 21 (1300Z May 21). The K6YR West Coast Qualifying Run will be at 9 PM PDT Wednesday, May 12 (0400Z May 13). Check the W1AW Schedule elsewhere in this issue for details.

SO—Single-Op, M2—Multiop-2 Transmitters, MO—Multiop, MS—Multiop, Single Transmitter, MM—Multiop, Multiple Transmitters, AB—All Band, SB—Single Band, S/P/C—State/Province/DXCC Entity, HP—High Power, LP—Low Power, Entity—DXCC Entity, HP—High Power >150 W, LP—Low Power >5 W and <150 W, QRP is <5 W

No contest activity on 30, 17 and 12 meters. Refer to the contest Web sites for information about awards. Unless stated otherwise, regional contests only count QSOs with stations in the region. Publication deadline for Contest Corral listings is the first of the second month prior to publication. In order to publicize the maximum number of contests, readers will be referred to an earlier issue of *QST* if the rules have been published within the past year.

May 1-2

2 GHz and Up World-Wide Club Contest—sponsored by the San Bernardino Microwave Society, 6 AM local time May 1 to 12 midnight May 2, operate 24 hrs max. Frequencies: All bands 2.4 GHz and higher. Categories: Small (2-10 members), Medium (11-50), Large (> 50). Exchange: 6-digit Maidenhead Locator. For scoring and other information: **www.ham-radio.com/sbms**. Logs due 30 days after the contest to SBMS Contest Committee, Pat Coker, N6RMJ, 40916 179th St, Lancaster, CA 93535.

European Union Contest 2004—CW/Phone/PSK31/RTTY/SSTV—sponsored by the Royal Union of Belgian Amateur Radio (UBA) from 0000Z to 2400Z May 1. This is a one-time contest to welcome new countries to the European Union. Frequencies: 160-10 meters according to IARU band plan. Categories: SO, MS (6, 12 and 24 hour; QRP (<5 W), LP (<100 W) and HP) and SWL. Exchange: RS(T) and serial number. QSO points: New EU stations—25 pts, EU stations—10 pts, non-EU stations—3 pts, own country—1 pt, OR5EU—100 pts. Score: QSO points × EU WPX prefixes counted once per band. For more information: **www.uba.be**. Logs due May 30 to **weu.contest@uba.be** or to Carine Ramon, ON7LX, UBA HF Manager, Bruggesteenweg 77, B-8755 Ruiselede, Belgium.

IPA Contest—CW/SSB—sponsored by the International Police Association from 0000Z-2359Z May 1 (CW), 0000Z-2359Z May 2 (SSB), each mode considered a separate contest. Frequencies: 80-10 meters. Categories: SOAB, MS, SWL. Exchange: RS(T) and serial number, IPA stations add "IPA." QSO points: Non-IPA—1 pt, Non-US IPA—2 pts, US IPA—5 pts, IPA club—10 pts, US stations with 1×1 call—20 pts. Score is QSO points × US states + IPA stations + 1×1 calls counted only once. For more information: **www.iparc.org**. Logs to **n2pig@arrl.net** or to Alex Dutkewych, N2PIG, PO Box 211, Pulteney, NY 14874-0211.

MARAC County Hunters Contest—CW—sponsored by the Mobile Amateur Radio Awards Club from 0000Z May 1-2400Z May 2. Frequencies (MHz): 3.575, 7.050, 14.050, 21.050, 28.050, work fixed stations once/band and mobiles once for each county and band. Categories: Mobile, Portable, Fixed. Exchange: RST and county or SPC. County line QSOs count as one QSO but separate multipliers. QSO points: Fixed stations in NA—1 point, Mobile/Portable—15 points, DX—5 pts, one station must be in a US county. Score is QSO points × US counties (count only once). Mobile/Portables sum score from each state. For more information: **www.countyhunter.com**. Logs due June 10 to **w3dya@juno.com** or Norm Beavers, W3DYA, 3320 McMillan Dr, Tyler, TX 75701-8239.

10-10 International Spring Contest—CW/Digital—from 0001Z May 1-2359Z May 2, logs due May 17 (see Feb *QST*, p 103, or **www.ten-ten.org**).

Microwave Spring Sprint, 0600-1300 local, May 1 (see **www.etdxa.org/vhf.htm**).

Indiana QSO Party—CW/SSB—sponsored by the Hoosier DX and Contest Club from 1500Z May 1-0300Z May 2. Frequencies (MHz): CW—1.805 and 40 kHz above the band edge on 80-10 meters, SSB—1.845, 3.850, 7.230, 14.250, 21.300, 28.450, try 160 at 0200Z, no crossband QSOs. Categories: SOAB (HP, LP < 100 W, QRP < 5 W), MS (incl use of spotting assistance), Mobile, Portable. Exchange: RS(T) + S/P or IN county (DX stations send RS(T) only). QSO points: SSB—1 pt, CW—2 pts, contact stations once per band/mode and once per county. Score is QSO points × IN counties or S/P/C counted once per mode. Bonus for working W9UUU (call sign may change—check Web site). For more information: **www.hdxcc.org/inqp**. Logs due June 15 to **inqp@hdxcc.org** (Cabrillo format preferred) or HDXCC, c/o Mike Goode, N9NS, 10340 Broadway, Indianapolis, IN 46280-1344.

ARI International DX Contest—CW/SSB/Digital—sponsored by ARI from 2000Z May 1-1959Z May 2. Frequencies: CW/SSB—160-10 meters; Digital—80-10 meters, change bands or mode no more than once per 10 min. Categories: SO-CW, SO-SSB, SO-Digital, SO-Mixed, MS-Mixed, SO-SWL-Mixed. Exchange: RST and Italian Province or serial number. QSO points: own country—0 pts (mult only), own continent—1 pt, different cont—3 pts, Italian stations—10 pts. Score: QSO points × Italian Provinces + DXCC entity (except I, ISØ, IT9, IG9/IH9) counted once per band. For more information: **www.ari.it/contari04.html**. Logs due June 2 (Cabrillo format is encouraged) to **aricontest@ari.it** (Cabrillo format is encouraged) or to ARI Contest Manager, I4UFH Fabio Schettino, PO Box 1677, 40100 Bologna, Italy.

New England QSO Party—CW/Phone—2000Z May 1-0500Z May 2 and 1300Z-2400Z May 2. New England is ME, NH, VT, MA, CT and RI. Frequencies (MHz): CW—40 kHz above band edge; Novice/Tech—3.705, 7.130, 21.130, 28.130; SSB—3.880, 7.280, 14.280, 21.380, 28.380; no crossmode or crossband QSOs, all CW QSOs in CW band segments. Categories: SOAB (HP, LP and QRP), MS (includes stations using any kind of spotting assistance), mobiles use same categories. Exchange: RS(T) and S/P (non-US/VE sends "DX") or NE county/state. Work stations once per band/mode and mobiles in each county. County lines logged as two QSOs. QSO points: phone—1 pt, CW and Digital—2 pts. Score: Non-NE stations—QSO points × NE counties; NE stations—QSO points × S/P/C; mobiles total QSO points from all counties and count multipliers only once. For more information: **www.neqp.org**. Logs due 30 days after the contest to **logs@neqp.org** (Cabrillo format preferred) or NEQP, PO Box 3005, Framingham, MA 01705-3005.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

May 1-10

North American Spring Meteor Scatter Rally-sponsored by the WSJT Group from 0000Z May 1 and ends 0000Z May 10 during the annual Eta Aquarids meteor shower. Please note that the annual Eta Aquarids is a morning shower, the radiant being in a good position from about 0500 to 1200 local time. For more information: **www.qsl.net/wa5ufh/Rally/NAHSMS.htm**.

May 8-9

Mid-Atlantic QSO Party—SSB/FM/CW—sponsored by the Independent Mid-Atlantic QSO Party Committee from 1600Z May 8-2400Z May 9. Mid-Atlantic states include Delaware, Maryland-DC, New Jersey, New York, Pennsylvania, Virginia and West Virginia. Frequencies: 160-10 meters 50 kHz from bottom of band segment for operating mode, 50, 144, 222, and 432 MHz. Categories: SO (LP and QRP (<5 W), MS/Club, Mobile, all classes except QRP max 200 W output. Exchange: serial number and QTH (Mid-Atl stations send 3-letter county and 2-letter state, US/VE send state or province, DX sends "DX"). QSO points: Phone—1 pt, CW—2 pts, Mobile—3 pts. Score: QSO points × Mid-Atl counties (Mid-Atl stations count S/P + 1 DX), all multipliers counted only once. For more information: **www.qsl.net/maqso**. Logs due June 10 to **maqplogs@yahoo.com** or Mid-Atlantic QSO Party, Attn: Chuck Reville, K3FT, 6400 Baltimore National Pike 131, Baltimore, MD 21228.

Nevada QSO Party—CW/SSB/RTTY—sponsored by the Area 51 Contest Club from 0000Z May 8-0600Z May 9. Frequencies: 160-6 meters, CW 15 kHz and SSB 25 kHz above General class band edge. Categories: SO (QRP <5 W, LP, HP >100 W), MS, MM, and County DXpedition (all LP, HP), Rover. Exchange: RST and S/P/C or Nevada county. QSO points: SSB—1 pt, CW/RTTY—2 pts. Score is QSO points × Nevada counties or S/P/C counted only once. Logs due June 15 to **nk7c@cox.net** or Pat Hess, NK7C, 759 Fairway Dr, Boulder City, NV 89005. For more information, see **members.cox.net/nvqso2004**.

Oregon QSO Party—CW/SSB—sponsored by the Central Oregon DX Club from 1400Z May 8-0200Z May 9. Frequencies (MHz): 80-10 meters, CW—40 kHz above band edge, SSB—3.850, 7.250, 14.250, 21.350 and 28.450, no repeater QSOs. Exchange: RS(T) and OR county or SPC. QSO points: SSB—1 pt, CW—2 pts. Score: QSO points × OR counties (OR stations add S/P/C) counted once on each mode. One extra multiplier for every 8 QSOs with the same county. 100 bonus points for working K7O. For more information: **www.codxc.com**. Logs due June 10 to **k4xu@arrl.net** or to Oregon QSO Party, c/o CODXC, 61255 Ferguson Rd, Bend, OR 97702.

FISTS Spring Sprint—CW—sponsored by the FISTS International CW Club from 1700Z-2100Z May 9 (see Feb *QST*, p 103, or **www.fists.org/sprints.html**).

Alessandro Volta RTTY DX Contest—sponsored by COMO and ARI from 1200Z May 8-1200Z May 9. Frequencies: 80-10 meters. Categories: SOAB, SOSB, MS, SWL. Exchange: RST, serial number, CQ Zone. QSO points: see table on Web site. Score: QSO points × DXCC entities + W/VK/VE/JA/ZL call areas × total QSOs. For more information: **www.contestvolta.com**. Logs due July 31 to **log@contestvolta.com** or to Francesco Di Michele, I2DMI, PO Box 55, I-22063 Cantu, Italy.

50 MHz Spring Sprint, sponsored by the Eastern Tennessee DX Association from 2300Z May 8-0300Z May 9 (see **www.etdxa.org/vhf.htm**).

Portuguese Navy Day—CW/SSB/PSK31—sponsored by the Portuguese Navy Radio Amateurs from 0800Z May 8-2300Z May 9. Frequencies: 80-10 meters according to the IARU band plan. Exchange: RS(T) and serial number. QSO points: see Web site for table. Score: QSO points × multipliers. For more information: **www.qsl.net/cq5mgp/regulamentos_ing.html**. Logs due May 24 to Comissao Cultural da Marinha-Concurso Radio 2004, Attn: CT4DZ, Praça do Imperio, 1400-206 Lisbon, Portugal.

May 15-16

Newcomers Run—CW—sponsored by the QRP ARC International from 1800-2000Z May 15. Exchange: "New" if a newcomer and "Elmer" for holders of certificates from previous QRP ARCI contests. For more information: **2hams.net/ARCI/index.htm**.

Baltic Contest—CW/SSB—sponsored by the Lithuanian Radio Sports Federation from 2100Z May 15-0200Z May 16. Frequencies (MHz): CW 3.510-3.600, SSB 3.600-3.650 and 3.700-3.750. Categories: SO-CW/SSB/Mixed, MS, SWL. Exchange: RS(T) and serial number. QSO points: Baltic (YL/ES/LY) stations count EU—1 pt and non-EU—2 pts, EU stations count Baltic—10 pts, non-Baltic—1 pt; non-EU stations count Baltic—20 pts, non-Baltic—1 pt. Score: total QSO points. For more information: **www.lrsf.lt/bcontest**. Logs due July 1 to **lrsf@lrsf.lt** or PO Box 210, LT-3000 Kaunas, Lithuania.

His Majesty King of Spain Contest—CW—sponsored by the Union de Radioaficionados Españoles (URE) from 1800Z May 15-1800Z May 16 (SSB is June 26-27). Frequencies: 160-10 meters using IARU Region 1 band plan. Categories: SOAB, SOSB, and MS. Exchange: RST and serial number or EA province. QSO points: 1 pt/QSO. Score: QSO points × EA provinces counted once per band. For more information, send e-mail to **ure@ure.es.** Logs due June 25 (SSB by July 30) to **concursoshf@ure.es** or URE HF Contests, PO Box 220, 28080 Madrid, Spain.

US Counties QSO Party—SSB—sponsored by The Mobile Amateur Radio Awards Club from 0000Z May 15-2400Z May 16. Frequencies (MHz): 3.880, 7.240, 14.275, 21.340, 28.340. Work fixed stations once/band and mobiles once for each county and band. Categories: Mobile, Fixed. Exchange: RST and county or S/P/C. County line QSOs count as one QSO but separate multipliers. QSO points: US fixed stations—1 point, US mobile—15 pts, all others—5 pts, one station must be in a US county. Score is QSO points × US counties (counted only once). Mobiles sum score from each state. For more information: **www.stpaulisland.net/countycontest.html**. Logs due June 18 to (US logs) **wv2b@juno.com** or Duane Traver, WV2B, 99 Oregon Hill Rd, Lisle, NY 13797-1002, non-US logs to **snichols@mvosprey.com** or Scott Nichols, VE1OP, 387 Rudderham Rd, Point Edward, NS B2A 4V6, Canada.

May 29-31

CQ WW WPX Contest—CW—sponsored by *CQ* Magazine from 0000Z May 29-2400Z May 30 (see Mar *QST*, p 100, or **home.woh.rr.com/wpx**).

Great Lakes QSO Party—Phone/CW/RTTY/PSK31—sponsored by the Michigan DX Association from 0000Z May 29—2359 May 30, SO stations work 36 hours max. Frequencies (MHz): 160-2 meters, no repeater or satellite, CW—3.560, 3.720, 7.090, 7.135, 14.075, Phone—3.870, 7.260, 14.270, 21.370, 28.450. Categories: A (>100 W), B (5-100 W), C (<5 W), D (Club and MO), E (CW only), F (Mobile), G (Digital, one of RTTY or PSK31). Great Lakes are MI, IL, IN, WI, MN, OH, PA, NY, VE2, VE3. Exchange: Name, S/P/C, Great Lakes stations also send county. QSO points: Phone—1 pt, CW/Digital—2 pts, QRP or mobile—3 pts. Score: QSO points × Great Lakes counties (counted only once). Bonus points: 500 pts for QSO with W8DXI (once only), mobiles add 100 pts for each county with at least 10 QSOs. For more information: **www.mdxa1.org/1aglqp.html**. Logs to **bripaw@yahoo.com** (Cabrillo format) or Brian Pawloski, W8BRI, PO Box 140012, Grand Rapids, MI 49514-0012.

QRP ARCI Hootowl Sprint—CW—sponsored by the QRP ARC International from 2000-2400 local May 30. For rules, see December 2003 *QST*, page 84, or **2hams.net/ARCI/index.htm**.

MI QRP Memorial Day CW Sprint—sponsored by the MI QRP Club from 2300Z May 30-0300Z May 31 (see Jan *QST*, p 97, or **www.qsl.net/miqrpclub**).

FEEDBACK

◊ Experiment #12 of "Hands-On Radio" [Jan 2004, Figure 2, page 62], should show V_o with its "+" sign at the bottom of R1 and referenced to ground. This will then be consistent with Equation 2.—*tnx Jason Dugas, KB5URQ*

◊ In Experiment #15 of "Hands-On Radio" [Apr 2004, page 71], Equation 3 should read $E=1/2\ LI^2$ and *not* $E=1/2(LI)^2$.

◊ In "The Skinny on Antennas" [Apr 2004, page 30], the formula for antenna length got transposed (second column, mid-page). The parenthetical factor should be (468/7.15), *not* (486/7.15).

STRAYS

FRITZ HUTTELMAYER, WB2QWH

The old Morse shuttle: **All who shuttle between 5 and 20 WPM are apparently being asked to queue up, and there are so many in this group that they need to go to two different places! Fritz Huttelmayer, WB2QWH, of Cheektowaga, New York, found this sign at Colonial Williamsburg, Virginia.**

FREE AD SPREADS THE WORD

◊ Each year, the Nashoba Valley (Massachusetts) ARC provides communications support for the Annual Fall Classic soccer tournament. This past year there were 230 teams competing, and 16 hams donated about 160 hours of their time to support the event. The Tournament Committee offered the Club a complimentary ad in their 12 page program. The ad gave the NVARC the opportunity to promote Amateur Radio and the Club.—*information provided by John Griswold, KB1HDO*

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

KB1EOI, William J. Edmonds, New Ipswich, NH
K1LAV, John F. Lewis Sr, Windsor Locks, CT
KA1LII, Ernest I. Kilkenny, East Falmouth, MA
K1MAX, Maxim J. Jacques, Dresden, ME
W1TEI, Henry L. Stagg, Ellsworth, ME
W2BMA, William B. McMillan, Baltimore, MD
KA2DWV, Jay Van Orman, Niagara Falls, NY
W2ISE, William R. Wise Jr, Fishkill, NY
N2KWF, Mervyn E. MacLeod, Bloomfield, NJ
KB2PIY, Gerson Finkelstein, Maspeth, NY
N2UKG, Sarkis Doudian, Briarwood, NY
*W2UNJ, William M. Rust, Cortland, NY
WA2VSO, Robert W. Weaver, Johnson City, NY
*W3ATJ, George E. Bartges, Carlisle, PA
N3BSI, Gerald J. Hilwig, Accokeek, MD
W3CAV, William J. Henzly, Uniontown, PA
*K3IC, John W. Frank, Millersville, MD
KT3J, Frank W. Heemstra, Yankton, SD
W3LAP, Jim F. Thompson, Cochran, GA
N3NOT, Allan Dale, Manchester, MD
W3PID, John M. Griffing, Orlando, FL
K3SGV, David R. Derr, Frackville, PA
*W4ANM, Wilbur L. Younts, Randleman, NC
KE4ATK, James E. Grant Jr, Sarasota, FL
KD4BQ, James W. Walters Jr, Huntsville, AL
W4BUG, Charles D. Ritchie, Boca Raton, FL
WD4BUL, Leon C. Nodine, Anderson, SC
KI4CB, I. F. Wood Jr, Surfside Beach, SC
KR4C, Grady L. O'Kain Jr, Oak Ridge, TN
K4CRX, Lloyd L. Matthews, Conyers, GA
N4CSF, Louis J. Raymond, Tucson, AZ
N4DBR, Lawrence Fiebig, Euclid, OH
*W4DO, W. Harrison Faulkner Jr, Charlottesville, VA
WB4GSG, William E. Alcorn, Whitley City, KY
N4HLB, John G. Evans, Reidsville, NC
KG4NAS, Calvin C. Bagley, Godwin, NC
N4NCK, Wiley W. Ayscue Jr, Butner, NC
K4NHY, Winston Adkins, Pikesville, KY
*K4OJ, James A. White, Seffner, FL
N4PJE, Cecil H. Yates, Fayetteville, TN
N4PUP, Leo E. Treece, Vale, NC
N4RWH, William E. Hayes, Warner Robins, GA
*K4SOI, John G. Werner, Pensacola, FL
WA4TJW, William E. Parrott, Knoxville, TN
KG4VEY, Robert W. Slater, New Ellenton, SC
WA4WGZ, Edward C. Solley, Knoxville, TN
W4XD, Joseph F. Moomaw Jr, Gloucester, VA
KC4ZEB, Hulen F. Girdler, London, KY
WB5BHD, William J. Rector, Grove, OK
KT5G, Bill Anderson, Midland, TX
KM5GR, Jim Bardwell, Edgewood, NM
*W5KL, Leland W. Smith, Harrison, AR
*W5LSU, Herb L. Ramey, Greenwell Springs, LA
K5QOE, Robert R. Spinks Sr, Monahans, TX
N5TCL, Victor G. Hill Jr, Nichols Hills, OK
KD5TQF, John M. Anderson, Carlsbad, NM
W5UIP, Heinz G. Broweleit, Tulsa, OK
WA5USU, Arthur R. Bergeron, Carlsbad, NM
KK6AJ, F. Bob Chow, Oakland, CA
KD6AWF, William Lowe, Berkeley, CA
WA6CYF, Jerry Zakrzewski, Harper Woods, MI
N6FZO, Thomas G. Summers, Laguna Woods, CA
W6HLY, David O. Mann, Fullerton, CA
K6IME, Leroy T. Williams, Pinole, CA
N6KNO, Merrill M. Stone, Rolling Hills Estates, CA
WA6ODB, Phillip G. Wong, Oakland, CA
W6OO, Don Osborne, Sebastopol, CA
WA6PIE, Galen E. Mc Cormick, Chino Hills, CA
W6PLH, Peter L. Heckenlaible, Carmel Valley, CA
WB6PQJ, John E. Zaferis, Quartz Hill, CA
*W6RXD, Edward B. Thornley, Torrance, CA
KC6ULT, George S. Berry, San Mateo, CA
K6VI, Walter J. Manning, Anza, CA
AB6WW, Gustavo T. Unguez Sr, Torrance, CA
KC7BOF, Roger A. Clampitt, Carson City, NV
W7FCM, Fred C. Miller, Mesa, AZ
W7HOT, Wilson Martin, Tucson, AZ
KA7MGM, Marvin W. Gustafson, Santa Maria, CA
KB7OMN, Barbra Dahl, Klamath Falls, OR
W7PN, Harold W. Johnston, Coupeville, WA
KI7UA, Pierre B. Goral, Kirkland, WA
KB7UZ, Jack L. Butler, Great Falls, MT
*WA7WM, Willie B. Mayes, Spokane, WA
WB8EYM, Donald A. Holloway, Kalkaska, MI
KE8FQ, Marion B. Fryer, Washington Court House, OH
AB8HR, Richard E. Cragg, Grosse Pointe Park, MI
*W8LAO, Karel R. Slatmyer Jr, Mattawan, MI
KB8PUM, Johnny N. Mills, Teays, WV
WE8SIX, Lincoln E. Engwall, Ludington, MI
KA8UVU, Kenneth D. Rea, Amsterdam, OH
W8ZNV, Bruce D. Cummons, Massillon, OH
KA9EFS, Alice A. Fowler, Friendship, WI
KC9EIQ, Ned A. Wood, Chandler, IN
*W9FXK, George F. Mcintosh, Normal, IL
KG9MQ, David B. Brinkley, Decatur, IL
N9UOY, Orval J. Lokker, Baldwin, WI
W9VTZ, Herschel O. Haunfelder, Milwaukee, WI
*KB9WRQ, Scott D. Eskew, Chicago, IL
WB9WXW, Joan M. Tarlini, Kankakee, IL
W9WYG, Joseph A. Miller, Hartford, WI
KØCNS, Richard Brandenberg, O'Fallon, MO
WØCVS, Ross O. Coleman, Grand Junction, IA
NSØD, Charles T. Blubaugh, Greeley, CO
WØELS, Stacie O'Dowd, Lake Tapawingo, MO
KCØEOJ, Jack L. Drenik, Pittsburg, KS
*KCØGF, Dennis D. Wing, Grand Island, NE
KCØQK, Chester J. Swanson, Roseville, MN
ABØTC, Thomas J. Currier, Duluth, MN
WØTHG, Charles N. Mc Candless, Pueblo, CO
I4GFN, Govoni Franco, Bologna, Italy
SM7AGF, Bengt Svenson, Lund, Sweden
VP9LF, Eric Blackwell, Niagara Falls, ON, Canada
VP9LR, Anthony E. Davis, Devonshire, Bermuda

*Life Member, ARRL
**Charter Life Member, ARRL
‡Call sign has been re-issued through the vanity call sign program.

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Kathy Capodicasa, N1GZO ♦ Silent Key Administrator ♦ n1gzo@arrl.org

STRAYS

QST congratulates...

70 year member
John Power, W2AXU, Trenton, NJ

60 year members
William Murphy, W1ODZ, Salem, VA
Thomas Bright, W2OHI, Citrus Springs, FL
Frank Cooper, W3NV, Canfield, OH
Louis Dimasi, W3SMX, Oakmont, PA
Robert McCuistion, W5HY, Lubbock, TX
Edward Gessert Jr, K6CQR, Grass Valley, CA
Albert Martin, AH6N, Colorado Springs, CO
Frederick Holsclaw, N7BB, Peoria, AZ
Roland Plotts, W7JYR, Phoenix, AZ
Egon Loeckel, N8EL, Cape Coral, FL
Raymond Kaas, W9CBS, Sturgeon Bay, WI
Howard Pramann, WØRXL, Duluth, MN

50 year members
Norman Gertz, K1AA, Orlando, FL
Al Brogdon, W1AB, Fitzwilliam, NH
George Jones, N1GJ, Bourne, MA
Gilbert Slater Sr, W1WAC, Pawtucket, RI
Warner Smith, W1YBT, Williamstown, MA
Kenneth Newman, N2CQ, Woodbury, NJ
George Cook, WW2D, Newark, NY
Robert Buus, W2OD, Holmdel, NJ
Frank Kiefer, K2PWG, Port Jefferson Station, NY
Royce Simmons, W2RBN, Stormville, NY
Bernard Swedloff, K2SWZ, Blackwood, NJ
Clinton Spencer Jr, W3BBB, Lansdale, PA
Stephen Buchanan, W3DDC, Brandon, FL
Otto Claus Jr, W3LZZ, Parkton, MD
Richard Moll, W3RM, Abington, PA
John Kanode, N4MM, Boyce, VA
David Langley, W4YDY, Greenville, NC
Don Jackson, AE5K, Saint Joe, AR
Robert Kellow, W5LT, Richardson, TX
Victor Poor, W5SMM, Melbourne, FL
Glenn Clamp, W5VIO, San Antonio, TX
Brad Sage, K6JPR, Pleasant Hill, CA
Richard Darling, AH7G, Hilo, HI
A. R. True, W7SAE, Murray, UT
Richard Fisher, W8AM, Hamilton, OH
James McEwuen, W8GUL, Morgantown, WV
Ernest Hutko, W8IUX, Cuyahoga Falls, OH
Gordon Lauder, W9PVD, Webster, WI
John Anderson, W9TRC, Springfield, IL
William Williams, W9VQC, Fort Walton Beach, FL
Jacob Ritzen, WØJHY, Sebring, FL
Norman Yeutter, WØKCJ, Alexandria, MN
Lester Entringer, WØYLS, Dubuque, IA

QST congratulates...

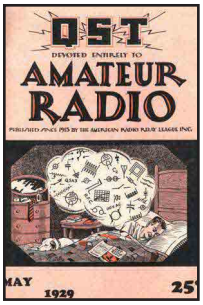
◊ 12 year old Benjamin Kier, KC2MNC, of Jamesville, New York, who recently became the third generation Kier amateur. He follows his uncle Howard Kier, WA2JDC, Schaumburg, Illinois, and grandfather Allen Kier, W2PEA, Syracuse, New York. Benjamin is a member of the Jamesville-DeWitt Middle School Amateur Radio Club, whose club Elmer is teacher R. Mark Erickson, K2RME.—*Allen Kier, W2PEA*

ENSOR MUSEUM ON REGISTER OF HISTORIC PLACES

◊ The Ensor Farmsite & Museum in Olathe, Kansas, former home of Marshall (W9BSP—later WØBSP) and Loretta (WØUA) Ensor, has now been placed on the National Register of Historic Places. There's more about the Farmsite in Mar 2004 *QST*, p 21, and at **www.cr.nps.gov/nr/feature/wom/2004/ensor.htm**.—*Larry Woodworth, WØHXS*

75, 50 AND 25 YEARS AGO

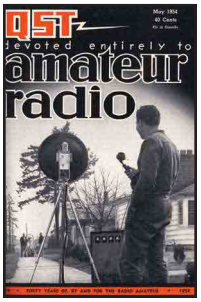
May 1929



♦ The cover illustration, by H. R. Hick, shows a ham who has fallen asleep while reading *QST*, and is now dreaming in electronic symbols. The editorial discusses the end of the League's Technical Development Program, which had been financed from A.R.R.L. funds, and its success in bringing Amateur Radio technology up to the current state of the art.

The lead article salutes "W8ARO—A Successful '1929 Type' Station" for his modern equipment. "The President's Corner," by Hiram Percy Maxim, talks about hams who have been "Rocking the Boat" lately because of the government's new radio regulations. "Another '1929' Receiver" is presented by P. S. Hendriks. J. M. Grigg tells about "Single Control for the High-Beat Super-Heterodyne." K. B. Warner pens a sad farewell to Ross Hull, the director of the League's Technical Development Program, as Ross ends his service to the League and returns to his native Australia. "The Governors–President Relay," by William Smith, reports on hams relaying messages from the governor of each state to the President; Gil, W1CJD, provides accompanying cartoons to the article. The Burgess Battery Company, in their back-cover ad, tells about Burgess batteries having been used to set "The World's Record! Direct two way communication between *The New York Times* Radio Station and Commander Byrd's airplane flying over the Antarctic...."

May 1954



♦ The cover photo shows W7JIP, W7OKV, and W7OAY testing the 10,000 Mc. gear they used to set a new DX record on that band. The editorial is a four-page retrospective look at the first 40 years of the League and its considerable accomplishments.

Willard Bridges, W1NWO, describes his compact bandswitching kilowatt rig, in "High-Power Pi-Network Amplifier with Parallel Tetrodes." Ed Tilton, W1HDQ, discusses his latest project, "A 40-Watt Amplifier for 220 Mc." Howard Morrison, W7ESM, tells about using "Cascaded Half-Lattice Crystal Filters for 'Phone and C.W. Reception." Two articles describe the use of loaded elements to build compact beam antennas: "A Compact Two-Element Beam for Twenty," by Carl Getter, W1MIJ; and "The VP (Vest Pocket) Beam," by Jerry Hemmen, WØVZC, and Wyman Pigg, WØQFG. George Mouridian, W1GAC, updates his Mighty Mo rig (*QST*, December 1951), in "'Mighty Mo' Gets Mightier." By Goodman, W1DX, presents Part I of "Some Principles of Radiotelephony." The article "Novice & Technician Exams by Mail" reports that, effective June 10, 1954, "examinations for Novice and Technician Class licenses will be available only by mail." An ad in this issue offers military surplus J-38 keys for 79¢ from Radio Shack, a two-store chain in Boston.

May 1979

♦ The cover photo shows W1HFA's "Versakeyer" electronic keyer. The editorial notes the ARRL's 65th anniversary, and introduces us to Hiram Hamilton Maxim, son of League founder Hiram Percy Maxim, who recently visited HQ.

Paul Horowitz, W1HFA, describes his "Versakeyer—A Multimode Paddle Keyer." HQ's Doug DeMaw, W1FB, discusses "An Experimental VMOS Transmitter," a four-FET CW rig for 10 or 15 meters. Ed Oxner, ex-W9PRZ, tells how to "Build a Broadband Ultralinear VMOS Amplifier." The VMOS theme continues, with Wes Hayward, W7ZOI, outlining "A VMOS FET Transmitter for 10-Meter CW." Charles Ellis, WØYBV, describes "A Novel Way to Mount a Rotary-Beam Antenna," with his mast coming through the roof to bear on the attic floor. The "Product Review" column takes a good look at the new Drake TR-7 HF transceiver. "Extra Special Extras," by Bobbie Chamalian, WB1ADL, tells about the ham activities in Ridley Park South Junior High School, led by teacher Arthur Smith, N3DR. Kevin Wollschlager and Carl Bixby, W1TKG, describe "The RV Service Net System" that campers have established. QST

Al Brogdon, W1AB ♦ Contributing Editor

W1AW Schedule

PACIFIC	MTN	CENT	EAST	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	TELEPRINTER BULLETIN				
4 PM	5 PM	6 PM	7 PM	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	TELEPRINTER BULLETIN				
6:45 PM	7:45 PM	8:45 PM	9:45 PM	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	CODE BULLETIN				

W1AW's schedule is at the same local time throughout the year. The schedule according to your local time will change if your local time does not have seasonal adjustments that are made at the same time as North American time changes between standard time and daylight time. From the first Sunday in April to the last Sunday in October, UTC = Eastern Time + 4 hours. For the rest of the year, UTC = Eastern Time + 5 hours.

♦ **Morse code transmissions:**
Frequencies are 1.8175, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13 and 15 wpm.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 wpm.

Code practice text is from the pages of *QST*. The source is given at the beginning of each practice session and alternate speeds within each session. For example, "Text is from July 2001 *QST*, pages 9 and 81," indicates that the plain text is from the article on page 9 and mixed number/letter groups are from page 81.

Code bulletins are sent at 18 wpm.

W1AW qualifying runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted on approximately 3.590 MHz by K6YR. See "Contest Corral" in this issue. At the beginning of each code practice session, the schedule for the next qualifying run is presented. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. The fee structure is $10 for a certificate, and $7.50 for endorsements.

♦ **Teleprinter transmissions:**
Frequencies are 3.625, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz. Bulletins are sent at 45.45-baud Baudot and 100-baud AMTOR, FEC Mode B. 110-baud ASCII will be sent only as time allows.
On Tuesdays and Fridays at 6:30 PM Eastern Time, Keplerian elements for many amateur satellites are sent on the regular teleprinter frequencies.

♦ **Voice transmissions:**
Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ **Miscellanea:**
On Fridays, UTC, a DX bulletin replaces the regular bulletins.
W1AW is open to visitors 10 AM to noon and 1 PM to 3:45 PM on Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

Headquarters and W1AW are closed on New Year's Day, Presidents' Day (Feb 16), Good Friday (Apr 9), Memorial Day (May 31), Independence Day (Jul 5), Labor Day (Sep 6), Thanksgiving and the following Friday (Nov 25-26), and Christmas Day (Dec 24). QST

SPECIAL EVENTS

Senigallia/Ancona, Italy: Anacona and Senigallia Amateur Radio Clubs, II6CC. 0600Z **Apr 15**-2200Z **Apr 18**. XV Annual Meeting of the National Association of Carabinieri. HF/VHF/UHF SSB/CW/RTTY. QSL, IZ6FUG via bureau; or for QSL with special postmark: ARI Associazione Radioamatori Italiani, PO Box 122, 60100 Ancona, Italy. For QSL with special postmark send 1 Euro or $1 US to cover postage, by May 14, 2004. **iz6fuq@tiscali.it**.

Ashland, OH: Ashland Area Amateur Radio Club, W8O. 1200Z-1900Z **Apr 17**. Ashland County Earth Day 2004. 7.300 7.025 4.000 3.525. Certificate. AAARC/W8RPS, 834 CR 30A, Ashland, OH 44805.

Cleburne, TX: TAEC and Johnson County Amateur Radio Clubs, K5AEC. 1500Z **Apr 24**-2400Z **Apr 25**. Johnson county 150 centenninal celebration. 14.250. QSL. Gerald Mohr, 1000 CR 414, Cleburne, TX 76031.

Millville, NJ: Millville Army Airfield Museum, N2M. 0800Z **Apr 30**-1900Z **May 2**. 2004 AmExpo and Wheels & Wings Air Show. 448.525 146.655 14.275 3.925. QSL. MAAFM/AmExpo, 1 Leddon St, Millville Airport, Millville, NJ 08332. **www.p47millville.org**.

Conway, AR: Faulkner County Amateur Radio Club, W5AUU. 1800Z-2400Z **May 1**. Toad Suck Daze Festival. 21.350 14.250. Certificate. W5AUU, PO Box 324, Conway, AR 72032.

Toms River, NJ: Holiday City Amateur Radio Club, W2H. **May 1**-**May 15**. Commemorating the crash of the *Hindenburg* Airship at Lakehurst, NJ. Lower General HF bands, 145.170. QSL. Holiday City Amateur Radio Club W2HC, 9 Tahoe Ct, Toms River, NJ 08757.

Homewood, IL: Tri-Town Radio Amateur Club, W9H. 1600Z-2300Z **May 2**. Homewood Railroad Heritage Day. 28.340 14.270 14.040 7.270 146.49. Certificate. Gene Backlin, 26811 Greenbriar Dr, Monee, IL 60449.

Franconia, NH: Old Man Radio Club, N1H. 1500Z **May 2**-0100Z **May 3**. First anniversary of the collapse of New Hampshire's Old Man of the Mountain rock formation. 14.247 7.247. Certificate. Jim Cluett, W1PID, 1241 New Hampton Rd, Sanbornton, NH 03269. **www.qsl.net/oldman**.

Caldwell, NJ: West Essex Amateur Radio Club, W2EF. 1400Z-1900Z **May 8**. Operating from President Grover Cleveland's Birthplace. 28.350 21.330 14.250 7.250. Certificate. West Essex ARC, PO Box 54, Essex Fells, NJ 07021. **www.wearc.org**.

Wedowee, AL: Calhoun County Amateur Radio Association, WB4GNA. 1300Z-1800Z **May 8**. The Lake Wedowee Property Owners Association Kids Fishing Day. 444.750 146.555 14.260. Certificate. Randall Landers, 1316 Meadowood Ln, Oxford, AL 36203.

Fairmont, WV: The Mountaineer Amateur Radio Club, W8SP. 0000Z **May 8**-2400Z **May 9**. From the International Mother's Day Shrine in Grafton, WV, commemorating the first official observance of Mother's Day. Bottom portion of General 80 40 20 15 m SSB and CW; Novice 10 m SSB. Certificate and QSL. Charles T. McClain, K8UQY, Rte 4 Box 161, Grafton, WV 26354.

Springfield, OH: Westcott Wireless Preservation Association, W8AGA. 1700Z **May 13**-2200Z **May 16**. Frank Lloyd Wright's Westcott House Special Tour. 14.280 14.050 7.280 7.120. QSL. Matt Cline, KB8WFH, 825 S Tecumseh Rd, Springfield, OH 45506. **www.westcotthouse.org/w8aga**.

New Braunfels, TX: Highland Lakes Amateur Radio Club, W5A. 1400-2100Z **May 14**-1400-2100Z **May 15**. Experimental Aircraft Association SW Regional Fly-In. 21.360 14.260 7.260. QSL. c/o M. Warner, PO Box 784, Burnet, TX 78611. **www.hlarc.org/**.

Hartford, IL: Lewis and Clark Radio Club, K9L. 1400-2200Z daily **May 14, 15 and 16**. Bicentennial of Lewis & Clark departure from Camp DuBois, IL. 28.360 21.360 14.260 7.260. Certificate. LCRC, PO Box 553, Godfrey, IL 62035. **www.k9ham.net/k9l.htm**.

Altus, OK: Altus Area Amateur Radio Association, AJ5Q. 1600Z-2200Z **May 15**. 30th Anniversary of AAARA/ARRL Affillated Club. 21.360 14.260 7.260 3.960. QSL. AAARA, PO Box 8863, Altus, OK 73522-8863.

Clackamas, OR: North West Military Radio Enthusiasts, KD7VPH. 1600Z-2300Z **May 15**. Operating with vintage military gear for Armed Forces Day. 14.088 10.137 7.296 7.087. QSL. NWMRE, PO Box 334, Corvallis, OR 97330-0334. **www.exchangenet.net/nwmre/**.

Karnes County, TX: Radio Operators of South Texas, W5ROS. 0001Z-2359Z **May 15**. 150th birthday of Karnes County, TX. 24.960 21.360 14.260 7.260. QSL. Andy Meyer, KD5TNI, PO Box 175, Hobson, TX 78117. **www.thecountywide.com**.

Washington, DC: FBI Amateur Radio Association, K3FBI. 1200Z-2200Z **May 15**. 23rd Annual National Peace Officers Memorial Day. 21.280 14.280 7.280. Certificate. Jay Chamberlain, AE4MK, 27 Fox Run Ln, Fredericksburg, VA 22405. No SASE required.

Waterville, ME: Waterville Area Wireless Association, WA1WA. 1400Z-2100Z **May 15**. Boy Scouts Spring Camporee. 28.350 21.300 14.265 7.250. QSL. Waterville Area Wireless Association, R4 Box 8043 Matheson Ave, Winslow, ME 04901.

Wheaton, IL: DuPage Amateur Radio Club, W9DUP. 1600Z-2300Z **May 15**. Armed Forces Day. 145.25/144.65 28.400 14.290 7.250. Certificate. Robert B. Beatty, WB9HNS, DuPage ARC, PO Box 71, Clarendon Hills, IL 60514.

Lebanon, OR: Santiam Amateur Radio Club, W7Z. 1500Z **May 15**-0100Z **May 16**. Grand reopening of Lebanon, OR, Railroad Depot. 28.400 21.330 14.255 7.230. QSL. SARC c/o Wm Barfknecht, 521 Williams St, Lebanon, OR 97355.

Hammondsport, NY: Keuka Lake Amateur Radio Association, KV2W. 1300Z-2200Z **May 22**. Celebrate Birthdate of Aviation Pioneer Glenn H. Curtiss. 28.340 7.250 3.870. Certificate. Roy Koehler, PO Box 451, Avoca, NY 14809.

Lancaster, NY: Town of Lancaster Office of Emergency Management, KC2LAS. 0000Z **May 22**-2000Z **May 23**. Annual "How Ham Radio Can Save the Day" public demonstration. 21.350 14.250 7.250 3.950. Certificate. Town of Lancaster, Emergency Management Office, 525 Pavement Rd, Lancaster, NY 14086.

Asheville, NC: Western Carolina Amateur Radio Society, W4MOE. 1200Z-2000Z **May 28**. Thomas Wolfe Memorial Grand Reopening. 28.450 21.300 14.265 145.19. Certificate. Robert Dockery, WD4CNZ, 72 Ormond Ave, Asheville, NC 28806. **www.WCARS.org**.

Jefferson City, MO: Great Rivers Council BSA/Cupbord Creek Encampment-Discovery Corps, WØM. 0000-1800Z daily **May 28** and **30**. Reenactment of Lewis and Clark Exploration of Louisiana Purchase on the Missouri River. 28.360 14.260 7.260. QSL. Doug Mallory, ABØOA, 608 Sherwood Rd, Paris, MO 65275. **www.bsa-grc.org/cupbord**.

Chestertown, MD: Kent Amateur Radio Society, K3ARS. 1400Z-2000Z **May 29**. The 230th Anniversary of the Chestertown Tea Party. 14.240 14.040 7.240 7.040. Certificate. Kent Amateur Radio Society, PO Box 921, Chestertown, MD 21620. **www.qsl.net/k3ars/**.

Baton Rouge, LA: USS *Kidd* ARC/Baton Rouge ARC, W5KID. 1400Z-2200Z **May 30**. Memorial Day. General class bands, 14.250 to 14.320; CW QRP subbands. QSL. W5KID, c/o USS *Kidd* Museum, 305 S River Rd, Baton Rouge, LA 70802.

Belleville, MI: Yankee Air Force Museum, W8YAF. 1200Z-2000Z **May 31**. Observing Memorial Day at the Yankee Air Museum at Willow Run Airport. 7.270. Certificate. Frank A. Nagy, N8BIB, 24315 Waltz Rd, New Boston, MI 48164-9167.

Fall River, MA: Radio Operators for Missing Children, KB1HGK. 1300Z-1900Z **May 31**. From the USS *Massachusetts*, the 4th annual special event for missing children. 14.250 14.075 7.125 3.700. Certificate. Sheree Greenwood, K1SQ, PO Box 649, Warren, MA 01083. **www.lyceumpress.com/ham_radio.htm**.

Fort Monmouth, NJ: Robert D. Grant United Labor Amateur Radio Association, N2UL. 1200Z-2200Z **May 31**. Remembering those who made the supreme sacrifice for our freedom. 449.975 28.460 14.260. Certificate. RDGULARA, c/o WA2VJA, 112 Prospect St, Nutley, NJ 07110-0716.

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information.

Special Events Announcements: For items to be listed in this column, you must be an Amateur Radio club, and use the ARRL Special Events Listing Form. Copies of this form are available via Internet (**info@arrl.org**), or for an SASE (send to Special Requests, ARRL, 225 Main St, Newington, CT 06111, and write "Special Events Form" in the lower left-hand corner). You can also submit your special event information on-line at **www.arrl.org/contests/spevform.html**. Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; that is, a special event listing for **Jul** *QST* would have to be received by **May 1**. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (**events@ arrl.org**) to ARRL HQ. QST

STRAYS

I would like to get in touch with...

◊ anyone with a copy of the manual for the Lafayette Radio KT-173 20-in-1 electronics kit. *—Louis L. D'Antuono, WA2CBZ, 8802 Ridge Blvd, Brooklyn, NY 11209*

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

By **Michael J. Gibson, KH6ND**
PO Box 31193
Honolulu, HI 96820
kh6nd@lava.net

Results, 2003 November CW Sweepstakes

How did you fare with the flares?

Welcome to the results of the 70th ARRL November CW Sweepstakes. The first weekend of November 2003 brought us many close battles, two major solar flares accompanied by severe HF radio blackouts, and nine new division records. It was indeed a weekend that participants will remember for some time to come.

2003 saw a total of 1239 log entries, down from 1319 in 2002. This constitutes a 6% decline, and the first time in many years that we have not seen an increase in the number of logs submitted. This is the fewest number of entries since the year 2000, when there were 1236 official entries. As illustrated in Figure 2, only the Unlimited category has continued to grow steadily since its inception in 1999, as more and more entrants continue to opt for packet use in the CW Sweepstakes.

Clean Sweeps

There were only 39 clean sweeps realized in 2003. This was in stark contrast to the 159 sweeps seen in 2002. There were just 2 sweeps in the low power category versus 58 in 2002. 12 sweeps in the high power category versus 51 in 2002. 9 sweeps in the multi-operator category versus 14 the previous year, and 16 in the unlimited category, just less than half of the 33 from the year before. No QRP sweeps were achieved in 2003 versus 2 sweeps attained in the same category the previous year.

Low Power Category

Vaulting up from a 6th place category finish in 2002 at the Illinois station of K9RS, Mark, AG9A convincingly won the low power category this time around from NØNI in Iowa. Mark had 1225 QSOs and 79 sections for 193,550 points en route to shattering the Midwest division record set just last year by KØDI. Mark now owns 3 CW SS Division records, all set during the last three years; Low Power Midwest Division set from NØNI in 2003, Low Power Central Division from K9RS in 2002, and High Power Midwest Division from NØNI in 2001. You've been a busy fellow, OM—keep up the good work!

With only 7000 points separating 2nd through 7th places, the battle to gain one

NOAA/SEC

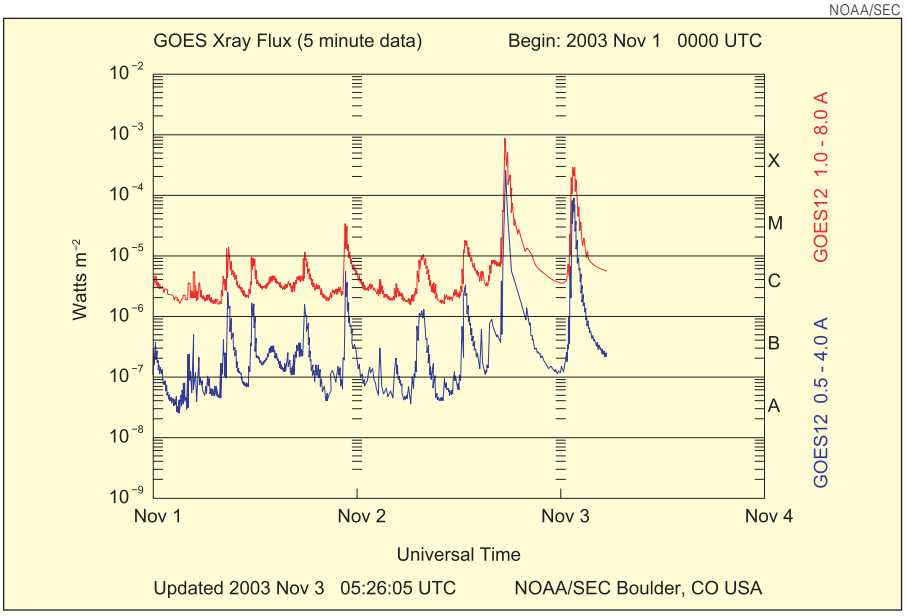


Figure 1—Two major solar flares impacted the 2003 CW Sweepstakes.

Log Entries By Year

Category	2003	2002	2001	2000	1999
A	650	701	652	656	638
B	219	227	240	213	205
Q	137	200	195	215	192
U	177	140	110	89	61
M	53	47	64	54	70
S	3	4	7	9	6
Total logs	1239	1319	1268	1236	1172

2003 Sponsored Plaque Winners—CW

Overall Single Operator High Power	WP3R (KE3Q, op)	Trey Garlough, N5KO
Overall Single Operator Low Power	NØNI (AG9A, op)	Kirk Pengelly, NØKK
Overall Single Operator QRP	N5DX	Ron Dohmen, NØAT
Overall School Club College Division	W2CXM	Mark Smith KD4JLC Memorial
Atlantic Single Operator High Power	K3MM	North Coast Contesters
Atlantic Single Operator Low Power	K3WU	Potomac Valley Radio Club
Atlantic Multioperator	N3OC	North Coast Contesters
Central Multioperator	WE9V	Don Haney, W9WW
Great Lakes Single Operator High Power	K9NW	North Coast Contesters
Great Lakes Single Operator Low Power	W8MJ	Mad River Radio Club
Hudson Multioperator	NJ2OM	Stuart Silverstein, K3UEI, Memorial
Midwest Multioperator	KØWA	Lincoln Amateur Radio Club
New England Single Operator QRP	W1QK	QRP Club of New England
Pacific Single Operator Low Power	K6OY	Robert A. Wilson, N6TV
Roanoke Single Operator High Power	N4AF	Potomac Valley Radio Club
Roanoke Single Operator Low Power	W4OC	Raleigh Amateur Radio Society - W4DW
Roanoke Single Operator QRP	K4ORD	Bill Harding, K4AHK
Southwestern Single Operator Low Power	AA6PW	Larry Serra, N6NC
Southwestern Single Operator QRP	N7IR	Ray and Donna Day, N6HE and N6HTH
West Gulf Single Operator High Power	WXØB (K5GA, op)	Ken Adams, K5KA
Canada Single Operator Low Power	VE3DZ	Don Haney, W9WW

Overall and Division Winners may purchase plaques that are not sponsored. The cost is $61.95 plus shipping and handling. Contact Kathy Allison, KA1RWY, at 860-594-0295 for more information.

of these positions was fierce. Making a giant leap from 11th place in 2002 into 2nd place we have Steve "the animal" KØSR (@ WØZT) from the northern reaches of the Midwest Division, the Minnesota section. Steve had 1177 QSOs × 79 sections for 185,966 points. During his rampage, the animal ravenously devoured the Dakota Division category record. As we all know how tough it is to score big from this area of the country, this obviously represents a superlative effort. It would appear that we need to turn him loose more often.

In 3rd place, just 2 QSOs behind KØSR, we find K4WX with 1175 Qs and 79 sections for 185,650 points from TN. Don fell 13,550 points shy of breaking his own Delta Division record set in 2002, when he won the low power category. 4th place went to Matt, K7BG, from MT, with 1180 Qs × 78 sections for 184,080 points, just 1570 points behind K4WX. Matt, like Don, fell just shy of breaking his own Division record. Rounding out the top 5 we have Bob, N4BP, operating from NP2B in the Virgin Islands section. Since Bob was the only entrant from the VI, 1177 of us are likely in his debt for our only VI contact. Combining this Q total with 78 mults resulted in a score of 183,612, only 468 points back of K7BG.

Sixth place finds KØEU from Colorado with 1140 Qs × 79 sections for a score of 180,120 points. Randy may have dropped back a few notches in the standings from last year, but he continues to own the Rocky Mountain Division record that he set in 1998. In 7th, K5WA combined 1133 QSOs with 79 sections for a score of 179,014 points from STX, and one place higher in the standings than his 8th place finish in 2002.

Our 2003 8th place finisher was N4OGW from the Mississippi section, with 1102 QSOs and 79 mults for a score of 174,116 points. In 9th place, KØDI logged 1060 QSOs × 77 sections for a score of 163,240 points from the Nebraska section. Our last member of the top 10 is VE3DZ, who crossed 1029 Qs with 79 mults for a score of 162,582. Since none of the top 10 were able to accomplish the feat in 2003, honorable mention is certainly in order for W4OC in 16th place, and K4XU in 21st place. These two standouts were the only stations out of 650 low power entrants that pulled off the clean sweep.

High Power Category

Once again, 2003 saw WP3R (KE3Q op.) at the top of the High Power heap. Rich took full advantage of a great set of antennas, and a desirable location in cruising to another high power victory. Even with only 78 sections worked, his 1457 QSOs were enough to outdistance the next score in the field by 5532 points.

In 2nd place, we have Steve, N2IC, putting everyone on notice that his move from Colorado to New Mexico has certainly not hampered his results. Steve had 1386 QSOs and a sweep for a total of 221,760 points, and a notch up from his 3rd place finish in 2002. One can only imagine what will happen to his scores as he continues to build his new station.

Just 2 QSOs behind for a 3rd place finish is Bill, K5GA, operating the well equipped station of WXØB. With 1384 QSOs and a sweep for 221,440 points, Bill made a big move up in the standings from his 8th place finish in 2002. With 2nd and 3rd place coming out of the Rocky Mountain and West Gulf Divisions, it looks as if we may see more big finishes from this part of the country in the near future.

In 4th place, down 2 notches from a 2nd place finish in 2002 is Mike, KH6ND, operating as KH7X at the station of KH7R. When asked about the drop, Mike muttered something about not having any off times left when the flares amputated 55 minutes of his operating time.

Leaping into 5th place after a 10th place finish in 2002, and the only member of the high power top 10 to set a new Division record we have Pat, N9RV, with 1359 Qs and 79 sections for 214,722 points. The Division record that Pat broke was set in 2002 by, you guessed it, N9RV. The important thing to keep in mind here is that this guy continues to find ways to improve each year (he was 12th in 2001). From the black hole of the Central Division, this is truly no small feat. Excellent work, OM!

Also in 5th place we have Todd, WDØT, operating WØSD to a tie with N9RV and the same 1359 Qs × 79 mults for 214,722 points. Todd has been a member of the top ten for more years than I can remember, and sole owner of 5th place in 2002. Well, this year he has to share that honor. His obvious long term commitment to SS CW is to be commended and should be an example to all of us what we can accomplish when we put our minds to it, and keep at it. Do we see some mid-USA rivalries heating up here as the sunspots decline?

Seventh place found Tree, N6TR, operating K7RAT to 1335 QSOs and a sweep

Top Ten

Single Operator, QRP

N5DX	129,668
K4XS	119,922
KG5U	117,868
K4RO	116,270
N7IR	106,334
NØUR	103,816
N2CU	103,332
K7MM4	99,256
WD7Z	98,750
W6JTI	96,854

Single Operator, High Power

WP3R (KE3Q, op)	227,292
N2IC	221,760
WXØB (K5GA, op)	221,440
KH7X (KH6ND, op)	215,360
N9RV	214,722
WØSD (WDØT, op)	214,722
K7RAT (N6TR, op)	213,600
K5TR (N5RZ, op)	212,510
K5GN	210,930
AK1W (K5ZD, op)	203,188

Multioperator

KØRF	227,204
N6VR	216,160
K6AM	214,400
K5TA	210,140
W6UE	196,640
WE9V	195,680
K4OJ	179,172
W6YX	171,040
W7RN	170,720
W7CT	162,424

Single Operator, Low Power

NØNI (AG9A, op)	193,550
KØSR	185,966
K4WX	185,650
K7BG	184,080
NP2B (N4BP, op)	183,612
KØEU	180,120
K5WA	179,014
N4OGW	174,116
KØDI	163,240
VE3DZ	162,582

Single Operator, Unlimited

K6LL	208,000
N6RO	194,400
K3PA	185,492
W7UT	180,320
K6YT (WØYK, op)	171,680
N5NA	162,898
N9FH	160,844
KI1G	159,588
K6RIM	154,560
K7OX	150,416

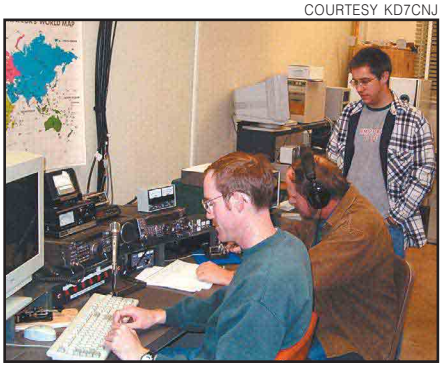
School Club

W2CXM	94,692
W2SZ (K2TJ, op)	41,890
K7UAZ	25,312

COURTESY KØSR

Steve, KØSR, operated from WØZT for an impressive 2nd place Single Op Low Power category finish.

COURTESY KD7CNJ



W4ES, KB7XL and KK7GP at the K7UAZ school club station. KD7CNJ must be behind the camera.

COURTESY K3PA

Drew, K3PA, set a new Midwest Division record with a 3rd place Single Op Unlimited category finish.

COURTESY N6TR

Tree, N6TR, operated as K7RAT for a 7th place Single Op High Power category finish.

COURTESY N4KM

K4OJ—enjoying the battle... 73 OM.

for a score of 213,600 points. After his remarkable record-setting performance in the QRP category in 2002 from W5WMU, Tree decided to stay home for a change and move back into the high power category. Tree fell just 5232 points short of breaking the Northwestern Division record that he set from W7RM way back in 1993. Of the 16 high power Division records, this is the second oldest on the books. Unless I miss my guess, there may be some in the Delta Division who would certainly wish him the best of luck if he were to stay home and try to break it again next year. I know all of us wish him the best of luck in any case, and are grateful for his tireless efforts in checking our logs, thereby dramatically improving the accuracy of the results. N6TR, an example for us all, both on and off the playing field.

Eighth place went to Gator, N5RZ, operating the growing station of K5TR. Gator left his West Texas QTH behind to give South Texas a try for a 1345 QSO × 79 mult, 212,510 point total. Ninth place was taken by Dave, K5GN, using his own call sign from the station of W5KU. Dave had 1335 QSOs × 79 sections for 210,930 points. Rounding out the top 10, and its only representative from the Northeast region is Randy, K5ZD, operating as AK1W. Randy had 1286 QSOs and 79 sections for 203,188 points. Randy set the current New England Division record in 2002.

Unlimited Category

For the second year in a row, the Single Operator Unlimited category was won by Dave, K6LL, in Arizona. Dave garnered 1300 Qs and a sweep for 208,000 points, and a comfortable victory in this steadily growing arena. Good job, Dave.

Second place belongs to Ken, N6RO, operating from his fine station in the East Bay section. Ken had 1215 Qs and a sweep for a score of 194,400 points in only his second foray into the assisted category, and his 51st CW Sweepstakes overall! In 3rd place, Drew, K3PA, from the Kansas section tallied 1179 QSOs and 79 mults for a score of 185,492 points, and in the process demolished the Midwest Division record. Not too shabby for a guy just back from 15 years of inactivity!

In 4th place is Bob, W7UT, in Utah. Bob racked up 1127 QSOs and a clean sweep for 180,320 points, and a new Rocky Mountain Division record. Another record bites the dust. Good job, Bob. Fifth place goes to K6YT operated by Ed, WØYK. Ed had 1073 QSOs and a sweep for 171,680 points from the Santa Clara Valley section.

Sixth place belongs to N5NA out of WTX. Alan had 1031 Qs × 79 sections for 162,898 points. In 7th place Fred, N9FH in Wisconsin combined 1018 QSOs with 79 sections for 160,844 points. In 8th place we find KI1G with 1023 QSOs and 78 sections for 159,588 points, and yet another new Division record, this time for the New England Division. 9th place—K6RIM—966 QSOs and a sweep for 154,560 points, and in 10th, K7OX, with 952 QSOs × 79 sections for 150,416 points.

QRP Category

Kevin, N5DX, set himself apart from the rest of the 5 W pack with an 842 QSO × 77 section 129,668 point effort. The 292 40-meter QSOs that he amassed were a big factor in his sizable margin of victory. It's pretty tough to beat 3 over 3 stacked on 40, especially at such low power levels! Kevin, the son of longtime contester K5GO, seems to be a chip off the old block. We look forward to many more strong performances in the future, Kevin.

In 2nd place, with 759 QSOs and 79 sections for a 119,922 point total is K4XS. Bill decided to give QRP a try, apparently with a considerable amount of success. With all of that aluminum working for him from the great station that he has put together, perhaps he'll decide to return to this tough category again someday.

Third place goes to longtime QRP stalwart Dale, KG5U, who had 746 QSOs × 79 sections for 117,868 points. Dale moved up 2 notches from his 5th place finish in 2002, and yet another appearance in the QRP top 10.

Fourth place gets pulled down by Kirk, K4RO. Kirk had 755 QSOs × 77 multipliers for 116,270 points, and climbed well up the ladder from his 8th place finish in the same category the previous year. In 5th place, Gary, N7IR logged 673 QSOs and 79 sections for a total of 106,334 points, and a couple of notches higher in the standings than his seventh place finish in 2002. Sixth place finds Jim, NØUR, also moving up two clicks from the previous year with a 683 QSO × 76 multiplier 103,816 point effort. Jim still owns the Dakota Division record he set with that eighth place finish in 2002.

In 7th place, and the only top 10 entrant from the Northeast Region, Tom, N2CU, collected 654 QSOs and 79 sections for 103,332 points, and a nice move up from 10th place QRP in the previous year. In 8th place, Dan, K7MM, had 653 QSOs × 76 mults for 99,256 points. Dan still holds the Northwestern Division record he set in 2001. Ninth place saw Dave, WD7Z, put together 625 QSOs × 79 multipliers for 98,750 points. Dave's effort is a great example of what can be accomplished in the CW Sweepstakes with a little ingenuity, and without a lot of steel and aluminum up in the air. His operation was portable, using only tree-supported wire antennas. In 10th place, W6JTI had 613 QSOs and 79 sections for a total of 98,750 points. No QRP Division records were set in 2003, and total entries in this category were down a whopping 31% from 2002. Is it possible that this decline had something to do with the intense solar disturbances that put

Top Five

Tables list call sign, score and class (Q = QRP, A = Low Power, B = High Power, U= Single Unlimited, M = Multioperator)

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)			Southeast Region (Delta, Roanoke and Southeastern Divisions)			Central Region (Central and Great Lakes Divisions; Ontario Section)			Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)			West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)		
AK1W (K5ZD, op, @K5ZD)	203,188	B	WP3R (KE3Q, op)	227,292	B	N9RV	214,722	B	N2IC	221,760	B	KH7X (KH6ND, op)	215,360	B
K1RX	188,968	B	N4AF	191,970	B	K9DX	182,016	B	WX0B (K5GA, op)	221,440	B	K7RAT (N6TR, op)	213,600	B
N2NT	188,336	B	W5WMU	171,132	B	KE9I	180,436	B	W0SD (WD0T, op)	214,722	B	N6TV	197,760	B
K3MM	181,116	B	N4ZR	170,478	B	K9NW	176,328	B	K5TR (N5RZ, op)	212,510	B	K6TA (N6BV, op)	190,232	B
AA3B	177,750	B	K4BAI	157,052	B	N0IJ	160,212	B	K5GN	210,930	B	VA7RR	190,074	B
W1RM	147,108	A	K4WX	185,650	A	VE3DZ	162,582	A	N0NI (AG9A, op)	193,550	A	K7BG	184,080	A
K3WU	144,096	A	NP2B (N4BP, op)	183,612	A	W8MJ	161,634	A	K0SR	185,966	A	AA6PW	149,380	A
N2MM	139,356	A	N4OGW	174,116	A	N9CK	158,340	A	K0EU	180,120	A	K4XU	147,200	A
NY3A	136,344	A	W4OC	155,040	A	K8BL	136,986	A	K5WA	179,014	A	N7CW	144,254	A
K1HTV	129,876	A	K9OM	148,678	A	N9JF	129,244	A	K0DI	163,240	A	K6OY	137,934	A
N2CU	103,332	Q	N5DX	129,668	Q	WI9WI	90,744	Q	KG5U	117,868	Q	N7IR	106,334	Q
VE9DX	81,158	Q	K4XS	119,922	Q	K9ZO	90,090	Q	N0UR	103,816	Q	K7MM	99,256	Q
W1QK	63,364	Q	K4RO	116,270	Q	N9CIQ	83,448	Q	WD7Z	98,750	Q	W6JTI	96,854	Q
W2EB	39,220	Q	W9WI	87,472	Q	N9NE	76,760	Q	N0SXX	85,200	Q	N7OU	91,884	Q
K2EK	35,088	Q	KC5R	57,152	Q	W8TM	68,700	Q	W5ROK (WA8ZBT, op)	74,936	Q	W7RAB (KH7YD, op)	85,008	Q
KI1G	159,588	U	N6ZO	106,334	U	N9FH	160,844	U	K3PA	185,492	U	K6LL	208,000	U
W2MU (WA2GO,op)	124,346	U	W4NF	102,024	U	W4FMS	129,948	U	W7UT	180,320	U	N6RO	194,400	U
K3WW	118,500	U	K3KO	83,616	U	W9IU	121,992	U	N5NA	162,898	U	K6YT (W0YK, op)	171,680	U
W1ZT	98,750	U	N4GG	78,624	U	KI9A	121,836	U	N0YY	133,068	U	K6RIM	154,560	U
W3HVQ	91,416	U	W4ZW	63,674	U	KG9X	120,274	U	KT0R	129,244	U	K7OX	150,416	U
K3NA	158,496	M	K4OJ	179,172	M	WE9V	195,680	M	K0RF	227,204	M	N6VR	216,160	M
N3OC	157,368	M	N4DD	156,468	M	K8CC	151,522	M	K5TA	210,140	M	K6AM	214,400	M
K2NNY	115,192	M	W4RM	152,312	M	K8JM	140,712	M	W7CT	162,424	M	W6UE	196,640	M
NZ1U	80,028	M	W4ZYT	61,620	M	KB9AX	119,448	M	K0WA	159,588	M	W6YX	171,040	M
K2CDJ	29,944	M				W8EDU	114,076	M	KB0VVT	150,696	M	W7RN	170,720	M

even the higher power participants out of business at times during the second half of the contest?

Multioperator Category

For the third year in a row, KØRF (+WØUA) took down 1st place in the multioperator category from Colorado with 227,204 points. After 25 years of operating as a team, Chuck and George seem to have figured out what it takes to win in this category.

Second place belongs to N6VR (+AC6T and KR6X) with 216,160 points from Santa Barbara. Congratulations to Ray, Steve and Lee on a new Pacific Division multioperator category record.

In 3rd place, K6AM (+N6MJ and N6KI) teamed up for 214,400 points from the Orange section, and in the process broke the Southwestern Division multioperator record set by K6AM in 2002. More congratulations, for John, Dan, and Dennis. In 4th place we have K5TA (+AA5B) collaborating on a 210,140 point effort from New Mexico. Fifth place goes to W6UE (+KA6SAR, N6AN, and W4EF) from the LAX section, with a 196,640 point total. Just 6 QSOs behind in 6th place, WE9V (+KO9A) teamed up for 195,680 points from the Wisconsin section.

Seventh place goes to K4OJ (+N4KM and W1YL) from the WCF section. Jim, Kevin, and Ellen teamed up for 179,172 points. Sadly, as this article was being written, Jim, K4OJ, became a Silent Key. Our condolences go out to his family and friends. I will miss his consistent presence on the air, and on the contest reflectors. We shall all certainly miss having him in the log. We have lost another longtime dedicated competitor, one who loved this sport as much as or more than any of us. God bless, OJ, many thanks for all the QSOs.

In 8th place, the W6YX Stanford University club station manned by N7MH, N6UK and AA6XV amassed 171,040 points. Only 2 QSOs behind, 9th place went to W7RN (@K5RC) operators K7AO and N6PN with a total of 170,720 points. The final member of the top 10 in this category is W7CT (+W7FB) with a 162,424 point effort.

Expanded Results, Line Score Printouts Available

For complete contest results online, please visit **www.arrl.org/contest.results/**. ARRL members without Internet access may obtain a printout of the complete line scores by sending a self-addressed, stamped envelope to ARRL Contest Results, 225 Main St, Newington, CT 06111. Please be sure to include the contest name and year.

School Club Category

2003 saw only three entrants in this category. In 1st place for the second year in a row is W2CXM, the Cornell University Amateur Radio Club. Eight operators (KB9YER, N2YYZ, KB2ZWZ, KC2IAW, WO9S, N2TQ, KC2KCF and N2VR) parlayed 607 QSOs and 78 sections for 94,692 points.

In 2nd place, with a brand new Hudson Division record is the Rensselaer Polytechnic Institute Amateur Radio Club, W2SZ, with K2TJ at the key. This is the first Hudson Division record in this category at 41,890 points.

Third place goes to K7UAZ, the University of Arizona Amateur Radio Club, manned by W4ES, KB7XL, KK7GP and KD7CNJ. With 25,312 points, Chris, KD7CNJ, comments: "Be sure to look for us full throttle in future contests; this was a warm-up! Look forward to competing against other college and school stations in future contests!" We all look forward to working K7UAZ again in 2004, Chris —especially on the weekend of November 6-8, the 71st running of the annual ARRL November CW Sweepstakes. Aloha! QST

ARRL June VHF QSO Party Contest Announcement

1800 UTC June 12-
0300 UTC June 14, 2004

How to participate: Any amateur station on any band above 50 MHz may be worked. The entry classes for Single Operator are high power, low power or portable. A Limited Multioperator station may either use four bands or less. A Multioperator Unlimited uses more than four bands. A Rover is a 1 or 2 person station that moves and operates from two or more grid squares. Any station may be worked once per band, regardless of the mode. You may re-work a rover station each time they move to a new grid square. Use of a spotting network makes your station a Multioperator entry. DX stations may only work W/VE stations for credit.

What to say: All stations give their call sign and 4 digit grid square locator (such as W1AW FN31). Information on how to determine your grid square is found on page 86 of the April 1994 issue of *QST* or online at **www.arrl.org/locate/gridinfo.html**.

Special interest: If the solar flux index is high, be sure to check out activity on 50 MHz. The June VHF QSO Party frequently has great coastal tropospheric propagation, so if you live near a coastal region stay alert. You can get some great conditions for operating.

Quirks: Summer conditions always present a challenge. The higher the concentration of amateurs in a region the larger pool of potential QSOs. A Single Operator Portable station operates from a single location away from home and must use a portable power supply, portable station and a maximum of 10 W PEP output. You are not required to send signal reports as part of your exchange.

Rule changes this year: The total transmitter output power for a high power entry in any category is either 1500 W PEP or the maximum allowable power level established by the national licensing authority of your country, whichever is lower. This event is now an Affiliated Club Competition event.

Best reason to participate: This contest is a good way to build up totals for the ARRL VHF/UHF operating awards such as VUCC. A band opening on 50 MHz could also present the opportunities to find new states for an ARRL Worked All States award or add entities to a DXCC total.

Relative challenge: VHF/UHF/Microwave operation presents unique challenges that test the best equipped operators, but it is also possible for someone to participate in this event with modest stations. You will get better results utilizing SSB or CW instead of FM. The more bands you are able to utilize the better your results.

Scoring: QSOs count one point each on 50 and 144 MHz, two points on 222 and 432 MHz, three points on 902 and 1296 MHz and four points each on 2.3 GHz and higher. On each band, every time you work a different grid square, you receive a multiplier. Your multiplier total is the sum of grids you worked per band. The final score is your QSO point total times your multiplier total.

How to report your score: You must send in your entry by July 14, 2004. E-mail Cabrillo format log to **JuneVHF@arrl.org** or send paper logs and complete summary sheet to June VHF QSO Party, ARRL, 225 Main St, Newington, CT 06111. You may also submit the entry by completing the Web Submission form at **www.b4h.net/cabforms**.

Complete rules: The complete rules may be found at **www.arrl.org/contests/forms**. You will also find links to the General Rules for all ARRL Contests, General Rules for ARRL Contests on bands above 50 MHz (VHF) and other forms and operating aids, log sheets for submitting your entry. If you don't have Web access, you can obtain the complete rules and forms by sending an SASE with postage for 2 oz to June VHF QSO Party Rules, ARRL, 225 Main St, Newington, CT 06111.

For more information: e-mail **contests@arrl.org** or phone 860-594-0232. QST

ARRL Field Day Announcement

1800 UTC June 26-
2100 UTC June 27, 2004

How to obtain full information: The full Field Day rules and information packet may be downloaded at **www.arrl.org/contests/forms**. You may also request the full packet by sending a large self-addressed envelope with 4 units of postage to Field Day Packet Request, ARRL, 225 Main St, Newington, CT 06111.

What is Field Day? Field Day is an operating event designed to test emergency preparedness in less than optimal conditions. It is the largest on-the-air operating event sponsored by the ARRL. Field Day gives both experienced operators and neophytes a chance to share ideas and new experiences in the Amateur Radio. Each year tens of thousands of amateurs and guests join in the excitement and camaraderie.

How to participate: There are six operating categories for Field Day. Class A is made up of any group (or club) with at least three persons which participates "in the field" away from a normal station location. Class B is for one or two person operations also operating away from a traditional station location. Class C is for Mobile stations. Class D is for home stations operating on commercial power. Class E is for home stations operating on emergency power. Class F is for stations operating from an established Emergency Operations Center.

What to say: All stations will exchange the number of transmitters they have in simultaneous operation, their entry category, and their ARRL/RAC Section. For example, a station in West Texas operating as Class A with 3 transmitters would send the exchange 3A WEST TEXAS. DX stations will use the term DX in place of an ARRL/RAC section designator. The complete list of sections is at **www.arrl.org/contests**.

Quirks: Stations that begin setting up their Field Day operation before 1800 UTC Saturday may operate only 24 consecutive hours. Stations that do not begin setup until 1800 UTC Saturday may operate the full Field Day time period.

Rules changes this year: A new Web-based applet will be available to allow clubs to submit their summary information directly to the ARRL. If you use the Web-submission option (found at **www.b4h.net/cabforms/**), you must still submit your supporting documentation (dupes sheets, proofs of bonus points, etc), either by regular mail or via e-mail to **fieldday@arrl.org**.

Best reason to participate: Field Day is *fun*! Whether you are a hard-core contester, someone who likes to build antennas, a casual operator, or someone just curious about the hobby, there are enough things happening at most group Field Day sites to capture your interest and get you involved. If you have never operated, make sure you visit your group's GOTA station (if it chooses to operate one) and *participate*! After a few contacts with a control operator, we bet you get hooked!

Relative challenge: The most challenging part of Field Day rests in the planning, preparation and setup of the event. By the time you actually start operating, you will find stations on pretty well every HF band and mode to keep you busy. VHF/UHF activity and satellite operation also present unique challenges that will keep your group testing its limits of creativity.

Scoring: Each CW and Digital QSO counts two points each, Phone QSOs count one point. You may work each station once per band and mode, CW, Phone and Digital. Your multiplier is determined by the maximum amount of power used by any transmitter at your site. Make all QSOs running 5 W or less, with a power source other than commercial mains or a motor driven generator and your multiplier is 5. Make all of your QSOs using 150 W or less and your multiplier will be 2. If you use more than 150 W your multiplier is 1. Voice modes (SSB, AM, FM, etc) are considered Phone.

Bonus points: Because Field Day is really about Amateur Radio demonstrating its emergency communications capability, there is a wide range of bonus points available. You can earn additional points by setting up in a public place, having an information table available, trying to secure media publicity, passing formal National Traffic System style messages, and more. The complete list of available bonus points is found in Field Day Rule 7.3.

How to report your score: Your entry must be postmarked by July 27, 2004. A complete entry includes an official Field Day summary sheet (completely and accurately filled out), documentation or proof of any bonus points that your group claims, and a list of stations worked broken down by band and mode. Full logs are not required for reporting Field Day. The Cabrillo file format is not designed to handle the various bonus points and extra information necessary to report Field Day entries. Regardless of your logging method, paper or electronic, you must still submit a summary sheet in the official format. Web submissions may be made at **www.b4h.net/cabforms/**. E-mail submissions should go to **fieldday@arrl.org**. Paper submissions should go to Field Day Entries, ARRL, 225 Main St, Newington, CT 06111

For more information: Contact the ARRL Contest Branch at **contests@arrl.org** or by phone at 860-594-0295. QST

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
2416 W. Victory Bl., 91506
(818) 842-1786
(800) 854-6046
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(800) 854-6046
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(800) 854-6046
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(800) 854-6046
Howard, KE6PWH, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
newcastle@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 854-6046
Leon, W7AD, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
Joe, KDØGA, Mgr.
John, N5EHP, Mgr.
denver@hamradio.com

PHOENIX, AZ
1939 W. Dunlap Ave., 85021
(602) 242-3515
(800) 444-9476
Gary, N7GJ, Mgr.
1 mi. east of I-17
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Chuck, N1UC, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

See us at Dayton Hamvention - Booths 20, 21, 22 & 23

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

CALL FOR YAESU SUPER SPRING SPECIALS!

YAESU

FT-897D VHF/UHF/HF Transceiver

- HF/6M/2M/70CM • DSP Built-in
- HF 100W (20W battery)
- Optional P.S. + Tuner • TCXO Built-in

Call Now For Our Low Pricing!

FT-1000MP MKV HF Transceiver

- Enhanced Digital Signal Processing * Not including 60M band
- Dual RX
- Collins SSB filter built-in
- 200W, External power supply

NEW Low Price!

FT1000MP MKV field unit 100w w/built-in power supply in stock

FT-8800R 2M/440 Mobile

NEW!

- V+U/V+V/U+U operation
- V+U full duplex • Cross Band repeater function
- 50W 2M 35W UHF
- 1000+ Memory channels
- WIRES ready

Call Now For Low Pricing!

FT-817ND HF/VHF/UHF TCVR

- 5W @13.8V ext DC • USB, LSB, CW, AM, FM
- Packet (1200/9600 Baud FM) • 200 mems
- built in CTCSS/DCS • TX 160-10M, 6M, 2M, 440
- Compact 5.3" x 1.5" x 6.5", 2.6 lbs
- FNB-85 NiMH battery + NC-72B included

Call Now For Low Pricing!

FT-2800M 2M Mobile

NEW!

- 65w • Ruggedly Built
- Alpha Numeric Memory System
- Direct Keypad Frequency Entry
- Bullet-proof Front End

Call Now For Low Intro Pricing!

VX-7R/VX-7R Black

50/2M/220/440 HT

- Wideband RX - 900 Memories
- 5W TX (300mw 220Mhz)
- Li-Ion Battery
- Fully Submersible to 3 ft.
- Built-in CTCSS/DCS
- Internet WIRES compatible

Now available in Black!

NEW Low Price!

VX-5R/VX-5RS

50/2M/440HT

- Wideband RX • 6M-2M-440TX
- 5W output • Li-Ion Battery
- 220 mems, opt. barometer unit
- Alpha Numeric Display
- CTCSS/DCS built-in

NEW Low Price!

VX-150

2M Handheld

- Direct Keypad Entry
- 5w output
- 209 memories
- Ultra Rugged

Call Now For Special Pricing!

FT-857D

NEW!

Ultra compact HF, VHF, UHF

- 100w HF/6M, 50w 2M, 20w UHF
- DSP included • 32 color display
- 200 mems • Detachable front panel (YSK-857 required)

Call for Low Intro Price!

FT-7800R 2M/440 Mobile

NEW!

- 50w 2m, 40w on 440mHz
- Weather Alert
- 1000+ Mems
- WIRES Capability
- Wideband Receiver (Cell Blocked)

Call Now For Your Low Price!

FT-920 HF+6M Transceiver

- 100w 160-6M, 12VDC * Not including 60M band
- Built-in DVR, CW Memory Keyer
- DSP, Auto-Notch • 99 Memories
- Computer controllable, CAT System

Limited Availability!

FT-8900R Quadband Transceiver

NEW!

- 10M/6M/2M/70CM • Wires capable
- 800+ memories • Built-in CTCSS/DCS
- Remotable w/optional YSK-8900

Call Now For Special Pricing

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

COAST TO COAST FREE SHIPPING
UPS - Most Items Over $100
Rapid Deliveries From The Store Nearest To You!

See us at Dayton Hamvention - Booths 20, 21, 22, & 23

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

DISCOVER THE POWER OF DSP WITH ICOM!

IC-706MKIIG

- Proven Performance
- 160-10M*/6M/2M/70CM
- All mode w/DSP
- HF/6M @ 100W, 2M @ 50W
  440 MHz @ 20W
- CTCSS encode/decode w/tone scan
- Auto repeater • 107 alphanumeric memories

IC-718 HF Transceiver

- 160-10M* @ 100W
- 12V Operation
- Simple to Use
- CW Keyer Built-in
- One Touch Band Switching
- Direct frequency input
- VOX Built-in
- 101 memories

IC-T7H Dual Band Transceiver

- 2M/70CM
- 70 alphanumeric memories
- 6W output
- CTCSS encode/decode w/tone scan
- Auto repeater
- Easy operation!
- Mil spec 810, C/D/E*1

IC-V8000 2M Mobile Transceiver

- 75 watts
- ICOM DMS scanning
- CTCSS/DCS encode/ decode w/tone scan
- Weather alert
- Weather channel scan
- 200 alphanumeric memories
- Backlit remote control mic

IC-7800 All Mode Transceiver

- 160-6M @ 200W
- Four 32 bit IF-DSPs+ 24 bit AD/DA converters
- Two completely independent receivers
- +40dBm 3rd order intercept point

IC-756PROII All Mode Transceiver

- 160-6M* @ 100W
- 32 bit IF DSP
- Enhanced 5 inch color TFT w/spectrum scope
- Selectable IF filter shapes for SSB & CW
- Enhanced Rx performance
- SSB/CW Syncronous tuning
- Multiple DSP controlled AGC loops
- Advanced CW functions
- 101 alphanumeric memories

IC-T90A Triple Band Transceiver

- 6M/2M/70CM @ 5W
- Wide band receiver 495kHz - 999.999MHz**
- 500 alphanumeric memories
- Dynamic memory scan
- Backlit keypad & display
- CTCSS/DTCS encode/decode w/tone scan
- Weather Alert

IC-2720H Dual Band Mobile

- 2M/70CM
- VV/UU/VU
- Wide band RX inc. air & weather bands
- Dynamic Memory Scan (DMS)
- CTCSS/DTCS encode/decode w/tone scan
- Independent controls for each band
- DTMF Encode
- 212 memory channels
- Remote Mounting Kit Included

IC-746PRO All Mode 160M-2M

- 160-2M* @ 100W
- 32 bit IF-DSP+ 24 bit AD/DA converter
- Selectable IF filter shapes for SSB & CW
- 102 alphanumeric memories
- Enhanced Rx performance

IC-V8 2M Transceiver

- 5.5W output
- 107 alphanumeric memories
- Customizable keys
- Auto repeater
- PC Programmable
- CTCSS encode/decode w/tone scan
- Drop-in trickle charger included

IC-2100H 25N 2M Mobile Transceiver

- Cool dual display
- 50 watts
- CTCSS encode/decode w/tone scan
- Backlit remote control mic
- Mil spec 810, C/D/E*1
- Auto repeater
- 113 alphanumeric memories

IC-208H Dual Band Mobile

- 55 watts VHF (2M), 50 watts UHF (70CM)
- Wide Band RX**
- 500 alphanumeric memories
- CTCSS/DTCS encode/ decode w/tone scan
- Detachable remote head
- DMS w/linked banks

ICOM®

*Except 60M Band. **Cellular blocked, unblocked OK to FCC approved users. ✦Limited time only. Check with HRO for details or restrictions on any offers or promotions.*1For shock & vibration.

CALL TOLL FREE

Phone Hours: 9:30 AM – 5:30 PM
Store Hours: 10:00 AM – 5:30 PM Closed Sun.

Toll free, incl. Hawaii, Alaska, Canada; call routed to nearest store; all HRO 800-lines can assist you, if the first line you call is busy, you may call another.

West.....800-854-6046
Mountain.....800-444-9476
Southeast.....800-444-7927
Mid-Atlantic...800-444-4799
Northeast.....800-644-4476
New England..800-444-0047

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
2416 W. Victory Bl., 91506
(818) 842-1786
(800) 854-6046
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(800) 854-6046
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(800) 854-6046
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(800) 854-6046
Howard, KE6PWH, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
delaware@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 854-6046
Leon, W7AD, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
Joe, KDØGA, Mgr.
John N5EHP, Mgr.
denver@hamradio.com

PHOENIX, AZ
1939 W. Dunlap Ave., 85021
(602) 242-3515
(800) 444-9476
Gary, N7GJ, Mgr.
1 mi. east of I-17
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr.
22191
(703) 643-1063
(800) 444-4799
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
virginia@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Chuck, N1UC, Mgr.
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
2416 W. Victory Bl., 91506
(818) 842-1786
(800) 854-6046
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(800) 854-6046
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(800) 854-6046
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(800) 854-6046
Howard, KE6PWH, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
newcastle@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 854-6046
Leon, W7AD, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
Joe, KDØGA, Mgr.
John, N5EHP, Mgr.
denver@hamradio.com

PHOENIX, AZ
1939 W. Dunlap Ave., 85021
(602) 242-3515
(800) 444-9476
Gary, N7GJ, Mgr.
1 mi. east of I-17
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Chuck, N1UC, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

See us at Dayton Hamvention - Booths 20, 21, 22 & 23

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

CALL FOR KENWOOD SPRING SPECIALS

KENWOOD

APRS, TNC Features Built In!

TH-D7A(G) 2M/440

- 2M/440 Dual Band
- Built-in 1200/9600 Baud TNC
- APRS Compatible
- DX Packet Cluster Monitor
- 200 Mems., CTCSS
- VC-H1 Messaging Control

Call Now For Low Pricing!

TH-F6A

2M/220/440
Dual Chanel Receive •
.1 - 1300 mHz (cell blocked) Rx •
FM, AM, SSB •
5w 2M/220/440 TX, FM •
435 Memories •
Li-Ion Battery •

Call For Low Price!

TH-G71A 2m/440

- 2m/440 Dual Band HT
- 200 Mems
- PC Programmable
- 6w 2m, 5.5w UHF @13.8 VDC
- Alphanumeric Display
- CTCSS Built It
- Backlit Keypad

Call For Low Price!

NEW!

TH-K2AT

2M Handheld
2m 5W •
VOX •
CTCSS/DCS/1750 Burst built in •
Weather Alert •

Call For Special Low Price!

TM-V7A 2M/440Mhz

- 50W/35W • 280 Mems • Visual Scan
- Alphanumeric • Enc/Dec & Duplexer Built-in
- Computer Programmable • 9600 Baud Ready
- Cool-blue Reversible LCD • Backlit Mic

Call Now For Low Price!

TS-2000 HF/VHF/UHF TCVR

- 100W HF, 6M, 2M • 50W 70CM
- 10W 1.2 GHz w/optional UT-20 module
- IF Stage DSP • Built-in TNC, DX packet cluster
- Backlit Front Key Panel

Call Now For Special Price!

TM-271A 2Mtr Mobile

NEW!

- 60 Watt, 200 Mems, CTCSS/DCS
- Mil-Std specs, Hi-Quality Audio

Call Now For Special Low Price!

TS-570DG/TS-570SG DSP Enhanced

- 100w HF, (100w on 6M TS-570SG only)
- QSK, CW Auto Tune • Autotuner incl 6M
- DSP • Large LCD Display • Elect. Keyer
- RCP2 Radio Control Program Compatible

Call Now For Your Low Price!

TM-D700A 2M//440 Dualband

- 50w VHF 35w UHF • Opt. Voice Synthesizer
- Receives 118-1300 mHz (cell blocked)
- Remote Head Inst. only (kit included)
- 200 Memories • Built In 1200/9600 baud TNC
- Advanced APRS Features
- Dx Packet Cluster
- Tone Scan • GPS/VC-H1/PC Ports

TS-480SAT/HX HF+6M Transceiver

- 480SAT 100w HF & 6M w/AT
- 480HX 200w HF & 100w 6M (no Tuner)
- DSP built in
- Remotable w/front panel/speaker

NEW!

Call Now For Your Low Price!

TM-742AD 2M/440Mhz

- Optional 3rd band available • Back-lit mic
- Up to 303 memories • 101 per band
- PL Encode Built in • Detachable front panel

Call Now For Your Low Price!

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

COAST TO COAST FREE SHIPPING
UPS - Most Items Over $100
Rapid Deliveries From The Store Nearest To You!

See us at Dayton Hamvention - Booths 20, 21, 22 & 23

HAM RADIO OUTLET

WORLDWIDE DISTRIBUTION

KANTRONICS

KAM '98

- Single port VHF or HF
- RTTY, CW, Packet, GTOR, AMTOR, WEFAX
- GPS, NMEA-0183 compatible
- 6-16 VDC, DB-9 connector port

Call Now For Your Low Price!

KAM XL

- DSP modem offers great performance on Packet 300/1200,G-tor,Pactor, Amtor,PSK-31
- RTTY, Navtex, ASCII, Wefax, CW, GPS NMEA-0183 and more!

Call Now For Special Pricing!

KPC-3 Plus/KPC-9612 Plus

High-performance, low power TNC. Great for packet, and APRS compatible.

Call For Special Low Price!

Detailed illuminated map shows time, time zone, sun position and day of the week at a glance for any place in the world.Continuously moving – areas of day and night change as you watch.

- Mounts easily on wall. Size: 34 1/2" x 22 1/2".

Reg $1295. SALE $999.95

ICOM

IC-R8500 Wide Band Receiver

- 100 kHz - 2.0 GHz*
- Commercial Grade • All Mode
- IF Shift • Noise Blanker
- Audio Peak Filter (APF)
- Selectable AGC Time Constant
- Digital Direct Synthesis (DDS)
- 1000 Alphanumeric Memories
- PC Controllable w/Optional Equipment

Call For ICOM Receiver Specials

IC-R75 Wide Band Receiver

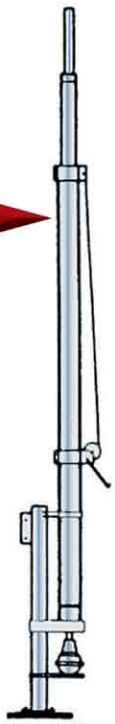
- 100 kHz - 60 MHz*
- Commercial Grade • All Mode
- Synchronous AM Detection (S-AM)
- Optional DSP w/Auto Notch Filter
- Triple Conversion
- Twin Passband Tuning (PBT)
- 1000 Alphanumeric Memories
- Up to Two Optional Filters
- PC Controllable w/Opt. Equipment

IC-R3 Wide Band Receiver

- 500 kHz - 2.45 GHz*
- 450 Alphanumeric Memories
- CTCSS w/Tone Scan
- 4 Level Attenuator
- Telescoping Antenna w/BNC Connector
- Lithium Ion Battery
- 2" Color TFT Display
- Audio/Video Output
- Four Way Action Joystick
- PC Programmable w/Optional Cable & Software

*816-901.995 MHz blocked; unblocked versions available to FCC approved users. FM video range for the IC-R3 is 900-1300 MHz & 2250-2450 MHz

US TOWER



Shown with Optional Rotor Base

MA-40

40' Tubular Tower

SALE $1099.95

MA-550

55' Tubular Tower

Handles 10 sq.ft. at 50mph
Pleases neighbors with tubular streamlined look

SALE $1669.95

TX-455

55' Freestanding Crank-Up
Handles 18 sq. ft. @ 50 mph
No guying required
Extra-strength const.
Can add raising and motor drive acces.

Towers Rated to EIA Specifications
Other Models at Great Prices!

SALE $1899.95

Buy From HRO, World's Largest U.S. Tower Dealer

All US Towers shipped by truck; freight charges additional

CALL TOLL FREE

Phone Hours: 9:30 AM – 5:30 PM
Store Hours: 10:00 AM – 5:30 PM Closed Sun.

Toll free, incl Hawaii, Alaska, Canada; call routed to nearest store; all HRO 800-lines can assist you, if the first line you call is busy, you may call another.

West	800-854-6046
Mountain	800-444-9476
Southeast	800-444-7927
Mid-Atlantic	800-444-4799
Northeast	800-644-4476
New England	800-444-0047

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
2416 W. Victory Bl., 91506
(818) 842-1786
(800) 854-6046
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(800) 854-6046
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(800) 854-6046
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(800) 854-6046
Howard, KE6PWH, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
newcastle@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 854-6046
Leon, W7AD, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
Joe, KDØGA, Mgr.
John, N5EHP, Mgr.
denver@hamradio.com

PHOENIX, AZ
1939 W. Dunlap Ave., 85021
(602) 242-3515
(800) 444-9476
Gary, N7GJ, Mgr.
1 mi. east of I-17
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Chuck, N1UC, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

MFJ *Pocket size* Morse Code Reader™

Hold near your receiver -- it instantly displays CW in English!

Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . .

Is your CW rusty? MFJ-461 **$79.95**

Relax and place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker . . .

Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you mis-copy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

Automatic Speed Tracking

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW.

Four Display Modes

1. Bottom line scrolls and fills with text, then that entire line is displayed on top line until bottom line refills -- makes reading text extra easy! Automatically displays speed in WPM.

2. Same as **1**, without speed display -- gives you maximum text display.

3. Top line scrolls, bottom line displays speed in Words-Per-Minute.

4. Both top and bottom lines scroll.

Two-line LCD display has 32 large 1/4 inch high-contrast characters.

MFJ Instant Replay

The last 140 characters can be instantly replayed. This lets you re-read or check your copy if you're copying along side the MFJ-461.

High Performance Modem

Consistently get solid copy from MFJ's high performance *PLL* (*phase-lock loop*) modem. Digs out weak signals. Even tracks slightly drifting signals.

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

Computer Interface

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

More Features

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable.

Battery saving feature puts MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery (not included).

True Pocket Size

Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny 2¼x3¼x1 in. 5½ ounces.

No Instruction Manual needed!

Super easy-to-use! Just turn it on -- it starts copying instantly!

Accessories

MFJ-26B, $4.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, $14.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, $5.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ *Pocket* Morse Tutor

MFJ-418 **$79.95**

Learn Morse code anywhere with this tiny *MFJ Pocket-sized Morse Code Tutor*™! Practice copying letters, numbers, prosigns, punctuations or any combination or words or QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed *CW Pro!* LCD, built-in speaker.

MFJ Code Oscillator

MFJ-557 **$29.95**

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312, $14.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. 8½x2¼x3¾ in.

MFJ *Pocket* CW Keyer

MFJ-403P **$69.95**

Built-in Iambic Paddle. Thumbwheel speed control. Adjustable weight. Adjustable sidetone with speaker. Iambic modes A or B. Fully automatic or semi-auto "bug" mode. Reversable paddle. Tune mode. RF-proof. Battery Saver. Tiny 2¼x3¼x1 in.

MFJ *miniature* Travel Iambic Paddle

MFJ-561, $19.95. 1¾Wx1¾Dx¾H in. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

Free MFJ Catalog
and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ . . . the world leader in ham radio accessories!

▪ Ham PROs ▪ Ham PROs ▪ Ham PROs ▪ Ham PROs ▪

Visit Your Local
Ham PROs!

Visit our new Web site www.hampros.com for group specials and links to your local dealer!
Whether it's over the counter or over the phone, we're your home town dealer!

YAESU
Choice of the World's top DX'ers℠

VX-7R/7RB
2M, 6M, 440 and
300mW on 222
Dual RX, Water Resistant

New Updated Version!

FT-857D
HF, 6M, 2M, 440
100W HF and 6M
50W on 2M, 20W on 440
Compact Mobile

New Updated Version!

FT-817ND
HF, 6M, 2M, 440
5W (w/13.8V ext. DC)
Wide RX

FT-7800R
2M, 440
50W on 2M, 40W on 440
NOAA WX w/Alert

Mark-V FT-1000MP/Mark-V Field
200W HF (100W Field)
Class A PA

New Updated Version!

FT-897D
HF, 6M, 2M, 440
100W HF and 6M
50W on 2M, 20W on 440

ICOM

IC-V8000
2M, 65W
Large Display
NOAA WX RX

IC-T90A
6M, 2M, 440
Wideband RX
WX Alert

IC-208H
2M, 440 FM Mobile
55W on 2M, 50W on 440

Free PS-125*

IC-756PROII
HF, 6M
100W All Modes
32 Bit DSP

Free PS-125*

IC-746PRO
HF, 6M, 2M
100W All Modes
32 Bit DSP

Free RMK-706*

IC-706MKIIG
HF, 6M, 2M, 440
100W on HF & 6M
50W on 2M, 20W on 440

* ICOM free accessories are for a limited time only. Call for details.

KENWOOD

TS-2000
HF, 6M, 2M, 440
Optional 1.2 GHz
Built-In Tuner (HF & 6M)

NEW!

TS-480SAT/HX
200W HF + 100W on 6M (HX)
100W HF & 6M w/Ant Tuner (SAT)
Standalone Control Panel

TH-K2AT
2M, 5W
NOAA WX w/Alert

NEW!

NEW!

TM-271A
2M, 60W
NOAA WX w/Alert
Front-Firing Speaker

BR-200 Kuranishi Instruments Japan
Laboratory Quality Antenna Analyzer
Test SWR and Impedance with
CONFIDENCE! Range: 1.8 - 170 MHz

MAHA®
Batteries and Chargers
Great for Digital Cameras, too!

2200 mAh AA Cells Now Available!

MasterCard VISA DISCOVER

Prices, products and policies may vary between dealer locations. Not all dealers have all product lines. All prices and products subject to change. Not responsible for typographical errors.

ComDaC Radio
800-382-2562
Local (269) 982-0404
FAX (269) 982-0433
1051 Main Street
St. Joseph, MI 49085
www.comdac.com

Universal Radio, Inc.
800-431-3939
Local (614) 866-4267
FAX (614) 866-2339
6830 Americana Pkwy.,
Reynoldsburg, Ohio 43068
www.universal-radio.com

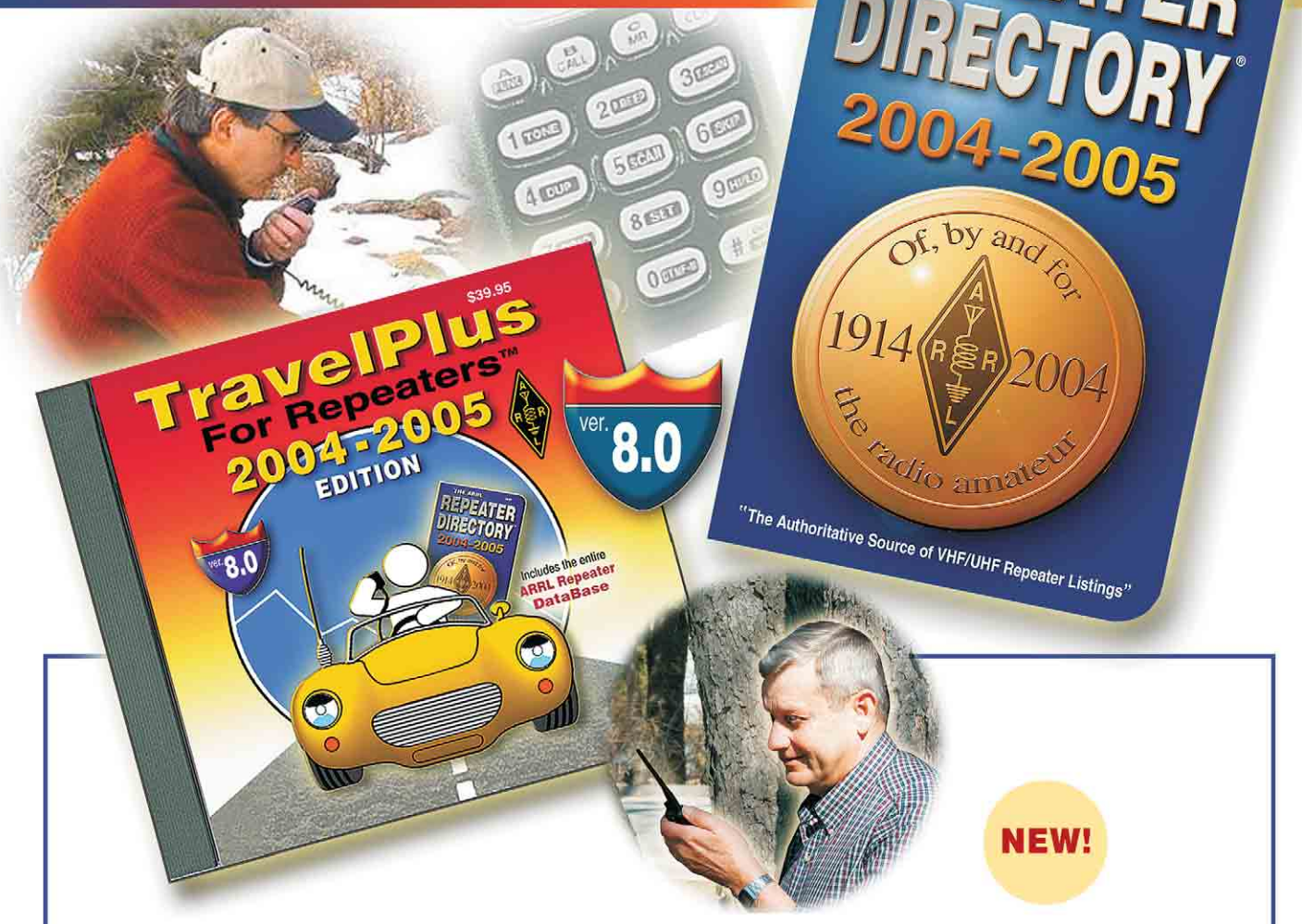
Radio City, Inc.
800-426-2891
Local (763) 786-4475
FAX (763) 786-6513
2663 County Road I
Mounds View, MN 55112
www.radioinc.com

Lentini Communications, Inc.
800-666-0908
Local (860) 666-6227
FAX (860) 667-3561
21 Garfield Street
Newington, CT 06111
www.lentinicomm.com

Austin Amateur Radio Supply
800-423-2604
Local (512) 454-2994
FAX (512) 454-3069
5325 North I-35
Austin, Texas 78723
www.aaradio.com

Associated Radio
800-497-1457
Local (913) 381-5900
FAX (913) 648-3020
8012 Conser
Overland Park, KS 66204
www.associatedradio.com

Keep in Touch



TravelPlus for Repeaters™ — version 8.0

Access repeaters in ways you've never imagined. ***TravelPlus*** on CD-ROM is like having *The ARRL Repeater Directory* on your COMPUTER!

- Map your travel route and tune in. Supports GPS.
- Print maps and repeater lists.
- **MORE DATA!** Includes *The ARRL Repeater DataBase*, IRLP nodes, AM/FM radio, broadcast television, and NOAA weather stations.
- Export data. Transfer to *Palm*™ or *Pocket PC*, radio programming software, and more.

TravelPlus for Repeaters CD-ROM
2004-2005 Edition, version 8.0
ARRL Order No. 9256 — **$39.95***
*shipping: $6 US (ground) / $14 International
Requires Microsoft *Windows*. Upgrade available for previous customers. Contact ARRL for details.

NEW!

The ARRL Repeater Directory® 2004-2005

This popular pocket-sized book is updated every year to include the latest frequency listings for repeaters across the US and Canada. Also includes:

- **IRLP (Internet linked) nodes**
- **Repeater Operating Practices** and hints for newly licensed hams
- **Frequency Coordinator** contact information
- Tips for **handling interference**
- **Using CTCSS tones** and Digital Coded Squelch (DCS)
- **VHF/UHF Band Plans** and a 2-meter channel-spacing map

The ARRL Repeater Directory
2004-2005 Edition.
ARRL Order No. 9191 — **$9.95***
*shipping: $6 US (ground) / $11 International

UPGRADE AT DAYTON
Bring your previous version of *TravelPlus* proof-of-purchase!

ARRL 1914-2004 DAYTON 2004 Of, by and for the Radio Amateur

ARRL *The national association for AMATEUR RADIO*

SHOP DIRECT *or call for a dealer near you.*
ONLINE **WWW.ARRL.ORG/SHOP**
ORDER TOLL-FREE **888/277-5289 (US)**

Sales Tax is required for orders shipped to CA, CT, VA, and Canada. Call for details

QST 5/2004

ICOM

IC-V8 Quality, simplicity, anywhere. (middle) This 144MHz FM transceiver's front panel and chassis are constructed of tough polycarbonate and die-cast aluminum for durability. The 5.5W V8 offers a 16-button keypad and 100 alphanumeric memories. CTCSS, DTCS and DTMF encoder are standard. 2.13"w x 5.19"h x 1.38"d, 12.3 oz..... **$124.99**

IC-T7H Powerful output and ample receive audio. (left) A 6W amp circuit provides superior transmit on VHF/UHF when 13.5 V DC is supplied. In addition, 500mW of AF is output from the speaker – easy to copy when noisy. Separate CTCSS tone encoder and enc/decoder standard. This 2M/440 MHz meets MIL SPEC. 2.25"w x 4.34"h x 1.06"d, 10 oz..... **$179.99**

IC-W32A User-friendly dualbander with independent band controls. (right) The high performance, full-function W32A meets demands of both novice and experienced operators: simple operation and advanced features. This 5W, 2M/440 HT has separate tuning and volume controls for each band. It also offers simultaneous receive, 200 memories, cloning capability, tone encode/decode, and skip scan. 2.25"w x 5.41"h x 1.31"d, 1 lb **$259.99**

IC-2100H-25N Durable 2M rig with superior RX IMD, performance. The 2100H25N offers 50W on transmit, extending its range. It also features CTCSS tone enc/decode, tone scan and 100 alphanumeric memories. It can be remote controlled using the new backlit mic. 5.5"w x 1.56"h x 7.09"d, 2 lbs, 10 oz... **$169.99**

IC-V8000 75W of "base station" power. The 75W V8000 also offers selection of 25, 10 and 5W as needed. With the operator-facing speaker, audio is clear even during mobile use. The 144-148MHz V8000 also features CTCSS and DTCS, standard DTMF encoder (optional decoder), 207 memories, FM narrow mode, and remote control mic. 5.9"w x 1.97"h x 5.9"d, 2.22 lbs..... **$189.99**

IC-208H High power dualbander, wideband receive. This 2M/70cm mobile provides 55/50W for long distance contacts, plus reduced power for local. The 208H covers 118-173, 230-549 and 810-999MHz (cell blocked) rx as standard. With improved DMS, detachable front, and 500 memories, mobile communications just got better. 5.56"w x 1.56"h x 7.31"d, 2.65 lbs..... **$299.99**

IC-706MKIIG Base station features, mobile size. The 160-10M + 6M, 2M, 70cm Mark II G is constructed for stable, quality output with low IMD and spurious emissions. It features tone squelch, DSP, auto repeater, and 107 alphanumeric memories. 6.56"w x 2.28"h x 7.88"d, 5 lbs, 6 oz..... NOW! FREE RMK706 included **$769.99**

IC-718 Origin of the HF transceiver. With performance found in the HF all-band 718, such as wide dynamic range, high S/N ratio, and full duty operation, making distant contacts is easy. Experi-ence its combo of the latest RF and digital technology. 9.44"w x 3.75"h x 9.41"d, 8 lbs, 6 oz..... NOW! FREE UT106 included **$569.99**

IC-746PRO 32-bit DSP takes you even higher. All-mode operation, 100W, 102 alphanumeric memories, and a multi-function LCD are impressive in the HF/50/144MHz 746PRO. Its floating point DSP and 24-bit AD/DA converter make it a must-have. Also has memory keyer, built-in antenna tuner and digital noise reduction. 11.3"w x 4.7"h x 12.5"d, 19 lbs, 13 oz ..... NOW! FREE PS-125 included © **$1379.99**

IC-756PROII A leap forward for the digital revolution. An all-mode, HF, 50MHz transceiver designed to include customer-suggestions. The PROII not only offers a 32-bit Floating DSP, but also has built-in 24-bit AD/DA converter, enhanced backlighting, selectable IF shape, adjustable noise blanker, and improved audio fidelity. 13.38"w x 4.38"h x 11.19"d, 21 lbs, 1 oz..... NOW! FREE PS-125 included © **$2299.99**

AES

AMATEUR ELECTRONIC SUPPLY

5710 W. Good Hope Rd.
Milwaukee, WI 53223
414-358-0333
1-800-558-0411
Fax 414-358-3337
Service 414-358-4087
milwaukee@aesham.com

621 Commonwealth Ave.
Orlando, FL 32803
407-894-3238
1-800-327-1917
Fax 407-894-7553
orlando@aesham.com

28940 Euclid Ave.
Cleveland, OH 44092
440-585-7388
1-800-321-3594
Fax 440-585-1024
cleveland@aesham.com

4640 South Polaris Ave.
Las Vegas, NV 89103
702-647-3114
1-800-634-6227
Fax 702-647-3412
lasvegas@aesham.com

Store Hours
Mon–Fri • 9am to 5:30pm
Saturday • 9am to 3pm

1-800-558-0411
www.aesham.com

Prices subject to change without notice.
© w/Instant Coupon, coupons expire 6/30/04

KENWOOD

TH-K2AT A triumph of advanced engineering and design. (middle) This 2M 5W HT is equipped with internal VOX, weather alert/RX, auto simplex checker, auto repeater offset and multiple scans. The K2AT also offers built-in CTCSS, DCS and 1750Hz tone burst. The K2AT charges up to 3X faster than others and meets MIL-STD-810 for resistance to rain, vibration, shock and humidity. 2.44"w x 4.38"h x 1.13"d, 12.5 oz..... **$159.99**

TH-G71A The brighter side of handy communications. (right) This FM, 144/440MHz boasts an illuminated keypad and LCD, high-performance antenna, and a stylish yet ergonomic design. The 5W G71A also offers convenience with menu mode, PC compatible and 200 memories. 2.31"w x 4.44"h x 1.44"d, 11.6 oz..... **$229.99**

TH-F6A Head-scratching, unique features. The FM 144/220/440MHz F6A offers dual-channel RX capability, 16-key pad, multi-scroll key, 5W, and 435 memories. Other attractive features include built-in ferrite bar antenna for AM, backlit LCD, lithium-ion battery, and a MIL-STD design. 2.3"w x 3.44"h x 1.18"d, 8.8 oz..... **$329.99**

TM-271A All-terrain performance. On or off road, the 144MHz, 60W 271A delivers powerful mobile performance and other features such as multiple scan functions, 200 memories, NOAA weather rx, and CTCSS/DCS. Yet, this MIL-STD transceiver goes easy on you, providing high quality audio, illuminated keys and large LCD **$189.99**

TM-G707A The essence of ease. From the extra-large panel to Kenwood's Easy Operation mode, the G707A is extraordinarily user-friendly. In addition to its regular profile, it can store four others for instant recall. This 50W/35W, FM dualband (144/440MHz) offers 180 multi-function memories with name function to identify each. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs..... **$269.99**

TM-V7A Cool Blue: The look of mobile communication. The V7A 144/440MHz FM transceiver marks a departure in ergonomic design with its easy-to-operate control panel and reversible LCD. The "5-in-1" programmable memory, 50/35W, DTSS and pager functions, and dual receive on one band make it a pace-setter. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs..... **$399.99**

TM-D700A Harnessing APRS®, GPS and SSTV. This FM 144/440MHz mobile features a built-in TNC offering options including simple packet. However, the brightest spot of the 50/35W D700A is its ability to enable APRS® without a computer. It also has 200 memories, dual receive, built-in CTCSS/DCS, and DX cluster monitoring. 5.5"w x 1.58"h x 7.68"d, 3 lbs..... **$519.99**

TS-570D(G) Affordable DSP without compromise. High-end technology doesn't mean a high-end budget. With 16-bit DSP, untouchable digital filtering, heavy-duty transmitter design, and central frequency control system, the 570D(G) provides powerful 160-10M operation. 10.63"w x 3.75"h x 11"d, 15 lbs..... **$989.99**

TS-480SAT New compact all-mode. This 100W HF/50MHz can operate on DC 13.8V and offers two power terminals. The 480SAT also features AF DSP, RX dynamic range, separate LCD control panel with speaker, auto tuner and 100 alphanumeric memories. Can be controlled from a PC and is PSK31 compatible **$1269.99**

TS-480HX 200W, without tuner **$1379.99**

TS-2000 Distinctive, packed for performance. The all-mode, HF, 2M, 6M, 70cm 2000 is serious about DSP. Its advanced digital technology converts analog waveforms into digital data, enabling digital processing like IF filtering, slope tune, and auto notch. 10.63"w x 3.75"h x 12.5"d..... **$1699.99**

AES
AMATEUR ELECTRONIC SUPPLY

5710 W. Good Hope Rd.
Milwaukee, WI 53223
414-358-0333
1-800-558-0411
Fax 414-358-3337
Service 414-358-4087
milwaukee@aesham.com

621 Commonwealth Ave.
Orlando, FL 32803
407-894-3238
1-800-327-1917
Fax 407-894-7553
orlando@aesham.com

28940 Euclid Ave.
Cleveland, OH 44092
440-585-7388
1-800-321-3594
Fax 440-585-1024
cleveland@aesham.com

4640 South Polaris Ave.
Las Vegas, NV 89103
702-647-3114
1-800-634-6227
Fax 702-647-3412
lasvegas@aesham.com

Store Hours
Mon–Fri • 9am to 5:30pm
Saturday • 9am to 3pm

1-800-558-0411
www.aesham.com

Prices subject to change without notice.

YAESU

AES
AMATEUR ELECTRONIC SUPPLY

VX-150 Designed to perform under the most difficult conditions. (left) This 2M 5W HT provides exceptional receiver performance with clean, clear transmit. Built to withstand outdoor use, the 150 is constructed to MIL-STD, with commercial-grade speaker and Omni-Glow™ keypad. 4.3"h x 2.3"w x 1"d, 11.5 oz..... **$119.99**

VX-2R Smallest HT dualband! (mid-left) This 1.5/1W dualband (144/440MHz) handheld offers VHF, UHF, shortwave, marine and aircraft bands, or WIRES™ linking. The 2R's wide band receive includes the AM broadcast band, continuous HF shortwave, VHF/UHF up to 729MHz, plus 800-960MHz (cell blocked). It also includes over one thousand memories (20 groups), CTCSS/DCS encode/decode and auto repeater shift. 1.9"w x 3.2"h x 0.9"d..... **$179.99**

VX-5R/VX-5RS Setting water resistance standards. (mid-right) Offering 5W (4.5W on 430MHz), the 5R/5RS cover 50/144/430MHz while providing short to microwave reception. Great for outdoors with optional barometric pressure unit. Black or silver. 2.3"w x 3.4"h x 1.1"d, 8.9 oz..... **$219.99**

VX-7R/VX-7RB The first submersible amateur HTs. (right) Water protected, the 50/144/430MHz, 5W 7R/7RB are rated for 3', 30-minute submersions. Magnesium bodies make them ideal for outdoors. Include dual/wideband rx, status strobe, and WIRES™ key. Silver or black. 2.4"w x 3.5"h x 1.1"d, 9.2 oz..... **$309.99**

FT-2800M Cool and quiet 65W operation. The most rugged 2M transceiver ever provides 65/25/10/5W with an extensive 221 memories, alphanumerics and CTCSS/DCS. The 2800M also features NOAA with weather alert, WIRES™ access, SmartSearch™, and excellent receive performance. With a bullet-proof front end and direct keypad entry, it's a dream come true. 6.3"w x 2"h x 7.3"d, 4 lbs... **$159.99**

FT-7800R Get "back to basics." This FM, 144/430MHz mobile boasts 50/40W output and 1000 memories. It also offers one-touch hyper memories, full-featured CTCSS/DCS, WIRES™ internet linking and wide receiver coverage. The 7800R has a large LCD and NOAA weather alert. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs..... **$279.99**

FT-8800R Easy operation, ultimate dualband. This 144/430MHz 50/35W mobile offers simultaneous monitoring of one band while operating the other. Besides extended receive, the 8800R provides 1000 memories, cross band repeat, versatile scan and CTCSS/ DCS. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs..... **$369.99**

FT-857D The world's smallest HF/VHF/UHF multimode. The 100W (HF/6M), 50W (2M), 20W (70cm) 857D provides wide frequency coverage, outstanding receive, and convenient remote-head use (optional). Includes 200 memories, ease of access to feature, advanced DX features, CW operating flexibility and now a built-in DSP. 6.1"w x 2"h x 9.2"d, 4.6 lbs **$779.99**

MK V FIELD Reach the HF Summit! The Mark V Field brings the technology of the 1000D and Mark V to you in a 100W, self-contained design. This HF all-mode features Class-A (25W) PA operation, interlocked digital bandwidth tracking, a variable RF front-end filter and the ergonomics of the Mark V along with an auto antenna tuner and internal switching-regulator power supply. 16"w x 5.3"h x 13.7"d, 33 lbs **$1739.99**

FT-897D All-in-one portable base. The all-mode, multi-band 897D features high output 100W (HF/6M), 50W (2M), 20W (70cm), rugged construction, 200 memories, TCXO and optional internal power supply and external antenna tuner. 7.87"w x 3.15"h x 10.3"d, 8.6 lbs **$889.99**

5710 W. Good Hope Rd.
Milwaukee, WI 53223
414-358-0333
1-800-558-0411
Fax 414-358-3337
Service 414-358-4087
milwaukee@aesham.com

621 Commonwealth Ave.
Orlando, FL 32803
407-894-3238
1-800-327-1917
Fax 407-894-7553
orlando@aesham.com

28940 Euclid Ave.
Cleveland, OH 44092
440-585-7388
1-800-321-3594
Fax 440-585-1024
cleveland@aesham.com

4640 South Polaris Ave.
Las Vegas, NV 89103
702-647-3114
1-800-634-6227
Fax 702-647-3412
lasvegas@aesham.com

Store Hours
Mon–Fri • 9am to 5:30pm
Saturday • 9am to 3pm

1-800-558-0411
www.aesham.com

Prices subject to change without notice.

ARRL PUBLICATIONS

SHOP DIRECT or call for a dealer near you.

ONLINE WWW.ARRL.ORG ORDER TOLL-FREE 888/277-5289 (US)

License Study Materials

Technician Class

Exam: • 35-question Technician test (Element 2)
• No Morse Code Exam

Now You're Talking! 5th edition. Amateur Radio's most popular FIRST license manual.
Order No. 8810 ..... $19.95

ARRL's Tech Q&A. 3rd edition. Review from the entire Technician question pool. Brief explanations follow each question. Quick & Easy!
Order No. 8829 ..... $12.95

ARRL Technician Class Video Course. 4th edition. Ace your first license exam—the fast, easy, fun way! Complete course includes 2 DVDs or 4 videotapes, coursebook, and practice exam software (CD-ROM, requires Microsoft *Windows*).
DVD Course, Order No. 9116 ..... $149 plus $12 s&h
VHS Course, Order No. 8837 ..... $149 plus $12 s&h

Ham University—Technician Edition. Get ready for your first license with this test-yourself quiz system.
CD-ROM for Win95-XP. Order No. 8956 ..... $24.95

General Class (upgrade from Technician)

Exams: • 35-question General test (Element 3)
• 5 WPM Morse code test (Element 1)

ARRL General Class License Manual
4th edition, valid through June 30, 2004. Order No. 8004 ..... $15
NEW! 5th edition, for exams beginning July 1, 2004. Order No. 9205 .... $16.95

ARRL's General Q & A. Make upgrading to General class Quick & Easy! Review from the entire question pool. Brief explanations follow each question.
1st edition, valid through June 30, 2004. Order No. 8586 ..... $12.95
2nd edition, for exams beginning July 1, 2004. Order No. 9213 ... $12.95 NEW!

ARRL General Class Video Course.
Passing your General written exam has never been easier! Complete course includes 3 videotapes, coursebook, and practice exam software (CD-ROM, requires Microsoft *Windows*).
Valid through June 30, 2004.
Order No. 8349 ..... $149 plus $12 s&h

Your Introduction to Morse Code. Pass the 5 WPM code test. Set includes two cassette tapes or two audio CDs with nearly 2-1/2 hours of practice.
cassettes #8322 ..... $14.95
audio CDs #8314 ..... $14.95

Ham University—Complete Edition. Learn Morse code with this feature packed easy-to-use software. Includes a written exam quiz generator with all three question pools. CD-ROM for Win95-XP.
Order No. 8735 ..... $39.95

Extra Class (upgrade from General)

Exam: • 50-question Extra test (Element 4)

ARRL Extra Class License Manual—8th edition
Order No. 8659 ..... $24.95

ARRL's Extra Q & A.
Order No. 8888 ..... $17.95

Operating and Reference

NEW! **ARRL Repeater Directory®—2004/2005 edition**. The authoritative source of VHF/UHF repeater listings. Order No. 9191 ..... $9.95

NEW! **TravelPlus for Repeaters™—2004-2005 edition**. Includes the entire *ARRL Repeater DataBase*. Map your travel route and tune in! CD-ROM, version 8.0. Order No. 9256 **Available late-May** 39.95

NEW! **APRS—Moving Hams on Radio and the Internet**. A guide to the Automatic Position Reporting System: station setup, operating, technical support, APRS software commands and more.
Order No. 9167 ..... $17.95

MAPS

The Radio Amateur's World Atlas. Full-color maps showing country boundaries, CQ zones, and more. Order No. 5226 ..... $12.95

ARRL Map of North America. 27 x 39 inches. Includes grids!
Order No. 8977 ..... $15

ARRL Map of the World (Azimuthal). 27 x 39 inches.
Order No. 7717 ..... $15

ARRL Map of the World (Robinson). 26 x 34.5 inches.
Order No. 8804 ..... $15

The ARRL Operating Manual. The most complete book about Amateur Radio operating. Information on hundreds of activities and modes. 8th edition. Order No. 9132 ..... $25

The ARRL DXCC List (May 2003 ed.) Order No. 8942 ..... $4

The ARRL FCC Rule Book—13th Edition. Order No. 9000 .... $12.95

ARES Field Resources Manual. Order No. 5439 ..... $8.95

The ARRL Emergency Coordinator's Manual. Order No. FSD9 .. $5

Best of the New Ham Companion. Order No. 6001 ..... $12

Stealth Amateur Radio. Order No. 7571 ..... $14.95

DXing on the Edge—The Thrill of 160 Meters. Operating tips and fascinating history. Book with audio CD! Order No. 6354 ... $29.95

The ARRL RFI Book. Order No. 6834 ..... $24.95

RF Exposure and You. Order No. 6621 ..... $22.95

QRP Power shows just how much fun it is to operate with 5 W or less. Order No. 5617 ..... $12

Hints & Kinks. 16th Edition. Order No. 8926 ..... $15.95

Ham Radio FAQ. Order No. 8268 ..... $14.95

YASME—The Danny Weil and Colvin Radio Expeditions.
Order No. 8934 ..... $24.95

Your Mobile Companion. Order No. 5129 ..... $12

ARRL's Vintage Radio. *QST* articles about the lure of vintage Amateur Radio gear: equipment, restoration, classic ads and more. NEW!
Order No. 9183 ..... $19.95

CD-ROM Collections

QST on CD-ROM!

QST View CD-ROM includes back issues of *QST* in convenient, space-saving CD-ROM format. ..... $39.95 per set.

$39.95 per set!

Years				
1995-99*	Order No. 8497	1965-69	Order No. 6451
1990-94	Order No. 5749	1960-64	Order No. 6443
1985-89	Order No. 5757	1950-59	Order No. 6435
1980-84	Order No. 5765	1940-49	Order No. 6648
1975-79	Order No. 5773	1930-39	Order No. 6710
1970-74	Order No. 5781	1915-29	Order No. 7008

*1995-99 set includes latest viewer (supports all sets).

QST View Collection. SAVE $80.40 when you order all 12 CD-ROM sets! Order No. QSTV ~~$479.40~~ ..... Only $399

ARRL Periodicals CD-ROM is a compilation of all *QST*, *QEX* and *NCJ* issues on one CD. ..... $19.95 per set.

2003 Edition, Order No. 9124
2002 Edition, Order No. 8802
2001 Edition, Order No. 8632
2000 Edition, Order No. 8209
1999 Edition, Order No. 7881
1998 Edition, Order No. 7377
1997 Edition, Order No. 6729
1996 Edition, Order No. 6109
1995 Edition, Order No. 5579

QEX Collection CD-ROM. For Communications Experimenters! Includes all issues from ARRL's technical journal, *QEX*, from its beginning in 1981 through 1998. Order No. 7660 ..... **$39.95**

NCJ Collection CD-ROM. Contesters! Enjoy all the back issues of ARRL's popular contesting journal, *NCJ* from 1973 through 1998. Order No. 7733 ..... **$39.95**

Communications Quarterly CD-ROM. Access advanced technical topics in articles which cover transmitter, receiver and transceiver projects, theory, antennas, troubleshooting and more. Includes all issues published from 1990-1999. Order No. 8780 ..... **$39.95**

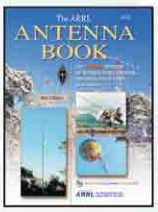
Ham Radio CD-ROM. Quick access to back issues of ham radio magazine, published from March 1968 to June 1990. ..... **$59.95 per set.**

Years 1968-1976 Order No. 8381 — **SAVE $30 when you order**
1977-1983 Order No. 8403 — **all 3 sets (1968-1990)**
1984-1990 Order No. 8411 — **Order No. HRCD $149.85**

HamCall™ CD-ROM. Thousands of worldwide call sign listings. Requires Microsoft *Windows* or MS-DOS. Updated regularly. Order No. 8991 ..... **$49.95**

Radio Amateur Callbook CD-ROM. Thousands of worldwide call sign listings. Requires Microsoft *Windows* or MS-DOS. Updated bi-annually. Order No. 9194 ..... **$49.95**

Antennas and Transmission Lines



The ARRL Antenna Book—20th Edition
Current antenna theory and a wealth of practical, how-to construction projects. Fully-searchable CD-ROM included (for *Windows* and Macintosh). Softcover, Order No. 9043 ..... **$39.95**

International Antenna Collection. Fixed and mobile antenna designs from 136 kHz to 1.3 GHz. Order No. 9156 ..... **$19.95**

Antenna Zoning for the Radio Amateur. Order No. 8217 ..... **$49.95**

ON4UN's Low-Band DXing. Antennas, Equipment and Techniques for *DXcitement* on 160, 80 and 40 Meters. Order No. 7040 ..... **$28**

ARRL's Yagi Antenna Classics. Yagis, Quads, Loops and other Beam Antennas. Order No. 8187 ..... **$17.95**

Simple and Fun Antennas for Hams. Order No. 8624 ..... **$22.95**

ARRL's Wire Antenna Classics. Order No. 7075 ..... **$14**

More Wire Antenna Classics—Volume 2. More dipoles, more loops, more collinears, and more wire beams and verticals! Order No. 7709 ..... **$14**

Vertical Antenna Classics. Order No. 5218 ..... **$12**

ARRL's VHF/UHF Antenna Classics. Build your own portable, mobile and fixed antenna designs. Order No. 9078 ..... **$14.95**

ARRL Antenna Compendium series—Practical antenna designs, and other articles covering a wide range of antenna-related topics.

Volume 7. Order No. 8608 **$24.95** — **Volume 3**. Order No. 4017 **$14**
Volume 6. Order No. 7431 **$22.95** — **Volume 2**. Order No. 2545 **$14**
Volume 5. Order No. 5625 **$20** — **Volume 1**. Order No. 0194 **$10**

Practical Circuits and Design

The ARRL Handbook—2004
The Standard in applied electronics and communications! Filled with projects, antennas, and indispensable references. Always revised!
Softcover, Order No. 1964 ..... **$34.95**

ARRL Handbook CD 8.0
View, search and print from the entire 2004 edition! CD-ROM for *Windows* and Macintosh. Order No. 1980 ..... **$39.95**

Digital Signal Processing Technology—Essentials of the Communications Revolution. Order No. 8195 ..... **$44.95**

Understanding Basic Electronics. Order No. 3983 ..... **$20**

Experimental Methods in RF Design. Design, build and measure equipment at both the circuit and the system level. Explore wide dynamic range, low distortion radio equipment, the use of direct conversion and phasing methods, and digital signal processing. CD-ROM included. Order No. 8799 ..... **$49.95**

L/C/F and Single-Layer Coil Winding Calculator. A slide rule for the experimenter working with filters, oscillators, impedance matching circuits or antenna coils and traps.Order No. 9123 ..... **$12.95**

Introduction to Radio Frequency Design. CD-ROM Included. Order No. 4920 ..... **$39.95**

W1FB's QRP Notebook Order No. 3657 ..... **$10**

NEW! **ARRL's Low Power Communication**. 2nd edition. Build, experiment, operate and enjoy ham radio on a shoestring budget. Order No. 9175 ..... **$19.95**

Digital and Image Communications

NEW! **ARRL's HF Digital Handbook**. 3rd Edition. Use your computer to talk to the world! Order No. 9159 ..... **$19.95**

NEW! **VoIP: Internet Linking for Radio Amateurs**. Order No. 9264 ..... **$17.95**

The ARRL Image Communications Handbook. See and talk with other hams! CD-ROM included with software utilities. Order No. 8616 ..... **$25.95**

Space and VHF/UHF/Microwave Communications

The Radio Amateur's Satellite Handbook. Order No. 6583 ..... **$24.95**

Tune in the Universe! Amateur Radio and the Search for Extraterrestrial Intelligence (SETI). Interactive book on CD-ROM. Order No. 8543 ..... **$24.95**

The ARRL Satellite Anthology—5th Edition. Includes specific satellite operating details. Order No. 7369 ..... **$15**

Weather Satellite Handbook. Order No. 4483 ..... **$20**

The ARRL UHF/Microwave Experimenter's Manual Order No. 3126 ..... **$20**

The ARRL UHF/Microwave Projects CD. CD-ROM includes Volumes 1 and 2 of *The ARRL UHF/Microwave Projects Manuals*. Order No. 8853 ..... **$24.95**

International Microwave Handbook. Reference information and designs for the microwave experimenter. Order No. 8739 ..... **$39.95**

If you'd like a complete publications listing or would like to place an order, please contact us:

1. To order or obtain the address of an ARRL Dealer near you, call toll-free (US): 1-888-277-5289 (non-US call 860-594-0355) 8 AM-8 PM Eastern time, Monday-Friday.
2. Fax 1-860-594-0303 24 hours a day, 7 days a week.
3. By mail to: ARRL, 225 Main St, Newington CT 06111-1494
4. Visit our World Wide Web site: http://www.arrl.org/shop

Shipping and Handling Information

In the US, add the following amounts to your order to cover shipping and handling (S/H). Add an additional $5.00 to the US rate for shipment outside the US. US orders will be handled via UPS or comparable ground service. International Air and other specialty forwarding methods are available. Please call or write for information. Sales Tax is required for shipments to CT 6% (including S/H),VA 4.5% (excluding S/H), CA (add applicable tax, excluding S/H). Canadian Provinces NS, NB and NF add 15% HST, all other Provinces add 7% GST (excluding shipping/handling).

Amount of Order	Add	Amount of Order	Add
$10.00 or less	$6.00	40.01 - 50.00	10.00
10.01 - 20.00	7.00	50.01 - 75.00	11.00
20.01 - 30.00	8.00	Over $75.00	12.00
30.01 - 40.00	9.00	CD-ROM only	6.00

We accept the following major credit cards: American Express, MasterCard, Visa and Discover. Prices and product availability are subject to change without notice.

Pull out and bring to Dayton!

Dayton 2004

May 14-16

Get a FREE Dayton 2004 button at the ARRL exhibit!

Advertisers:

- AOR U.S.A., Inc. – Booth #451-454
- ARRL – Booth #208-210, 220-222, 260-262
- Bencher, Inc. – Booth #11
- Diamond Antenna – Booth #365
- High Sierra Antennas – Booth #302
- ICOM – Booth #33-37, 562, 589
- Idiom Press – Booth #12
- LDG Electronics – Booth #114 (W4RT Electronics)
- Radio Amateur Callbook – Booth #44
- Timewave Technology, Inc. – Booth #111
- Zapchecker/Alan Broadband – Booth #112

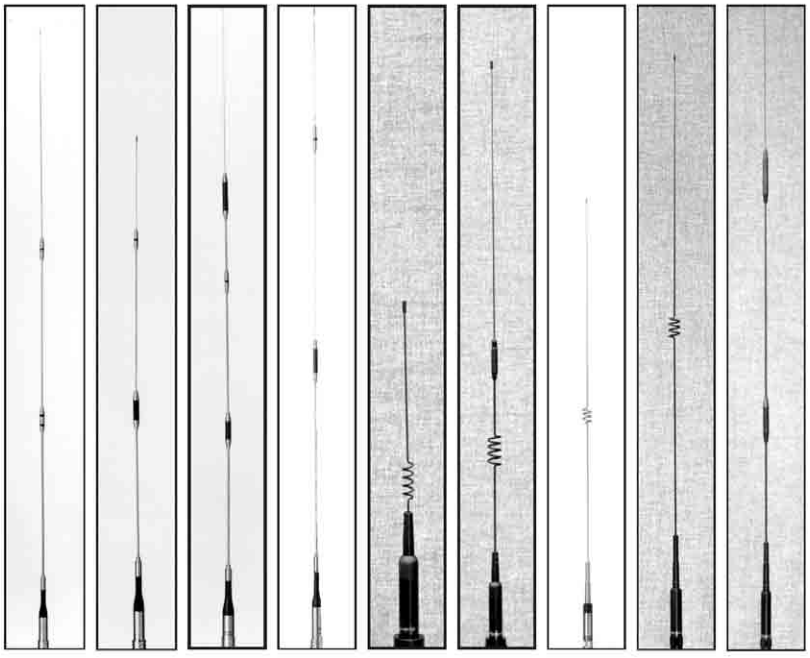
ARRLWeb: www.arrl.org

DIAMOND'S STATE-OF-THE-ART

VHF/UHF And HF/VHF Mobile Antennas– Maximum Performance Without Compromise

You've seen the rest...now own the BEST!

See us at Dayton Booth #365



SG2000HD | SG7500A SG7500NMO | SG7900A SG7900ANMO | SGM911 | NR72BNMO | NR73BNMO | NR770HA NR770HB | NR770HNMO NR770HBNMO | CR627B CR627BNMO

HV7A Mobile Antenna System

For New HF/VHF transceivers

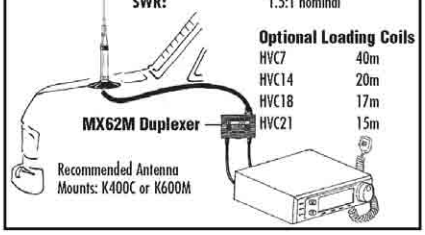
(Such as: IC706 series, FT100 & NEW FT8900R)

The NEW HV7A has 5 band capability: 70cm, 2m, 6m, and 2 HF bands through use of loading coils. Foldover feature allows for easy access into low overhead buildings. Ideal for users of IC706 series, FT100 and New FT8900R radios.

Bands Supplied:	10m/6m/2m/70cm
Opt. Loading Coils:	40m/20m/17m/15m
Power, P.E.P.:	HF 120w/VHF 200w
Mount Connection:	UHF
Length:	54"
SWR:	1.5:1 nominal

Optional Loading Coils

HVC7	40m
HVC14	20m
HVC18	17m
HVC21	15m



MODEL	BAND (MHz)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
MR77	2m/70cm	70	MAG	20	1/4λ, 1/2λ
MR77SMA	2m/70cm	70	MAG	20	1/4λ, 1/2λ
NR72BNMO*6	2m/70cm	100	NMO	13.8	1/4λ, 1/2λ
NR73BNMO	2m/70cm	100	NMO	33.5	1/2λ, 1-5/8λ
NR770HA7	2m/70cm	200	UHF	40.2	1/2λ, 2-5/8λ
NR770HNMO8	2m/70cm	200	NMO	38.2	1/2λ, 2-5/8λ
NR770RA	2m/70cm	200	UHF	38.6	1/2λ, 2-5/8λ
NR7900A*	2m/70cm	300/250	UHF	57	1/4+1/2λ, 3-5/8λ
SG7000A*6	2m/70cm	100	UHF	18.5	1/4λ, 6/8λ
SG7500A	2m/70cm	150	UHF	40.6	1/2λ, 2-5/8λ
SG7500NMO	2m/70cm	150	NMO	41.0	1/2λ, 2-5/8λ
SG7900A*	2m/70cm	150	UHF	62.2	7/8λ, 3-5/8λ
SG7900ANMO*	2m/70cm	150	NMO	62	7/8λ, 3-5/8λ
SGM510	2m/70cm	100	UHF	37	1/2λ, 2-5/8λ

MODEL	BAND (MHz)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
CR8900A*6, 11	10m/6m/2m 70cm	60	UHF	50	1/4λ, 1/4λ 1/2λ, 2-5/8λ
SG2000HD*	2m	250	UHF	62.6	1/2λ+3/8λ
CR320A*6	2m/1-1/4m 70cm	200/100 200	UHF	37.4	1/4λ, 1/2λ 2-5/8λ
CR627B*6,9 CR627BNMO*6,9	6m/2m 70cm	120	UHF/NMO	60	1/4λ, 1/2+1/4λ 2-5/8λ
HF6FX*6	6m	250	UHF	40	1/4λ
HF50CX*6	6m	200	UHF	75	3/8λ
NR22L*	2m	100	UHF	96.8	2-5/8λ
NR2000NA	2m/70cm 23cm	100	N	39	1/2λ, 2-5/8λ 5-5/8λ
M285*10	2m	200	UHF	52.4	5/8λ
M685*6	6m	200	UHF	52.4	1/4λ
MG200	2.4GHz	-	N	23.6	3-1/2λ
SGM911*6,9	6m/2m/70cm	60	UHF	41	1/4λ, 1/2λ,2-5/8λ
NR124	23cm	100	N	25	4-5/8λ

FOLD-OVER

Patented One-Touch Fold-Over Feature.
(Not available on M285, M685, MG200, MR77, MR77SMA, NR72BNMO & NR73BNMO)

* Not recommended for Magnet Mount
6 Grounding required
7 NR770HB same specs but in black finish.
8 NR770HBNMO same specs but in black finish.
9 52-54MHz only
10 Tunable from 140-174MHz
11 FM only

www.rfparts.com/diamond

Diamond Antenna Division of RF Parts Co. Tel: (760) 744-0900 • FAX: (760) 744-1943 • diamondantenna@rfparts.com

DIAMOND ANTENNAS

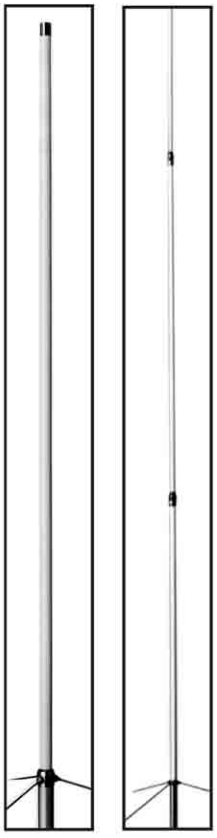
The Standard By Which All Others Are Judged.

Acclaimed as the technological leader in single & multiband antennas

• Wide-band Performance • Factory Adjusted–No Tuning Required • Highest Gain
• UPS Shippable • High Wind Rating • Fiberglass Radome • DC Grounded • Stainless Hardware

See us at Dayton Booth #365

X500HA (UHF-Conn.)
X500HNA (Type-N Conn.)
Ruggedized Base/Repeater Antenna



X50NA X500HNA

X50NA

The X50NA is an excellent choice where ruggedness is required in a medium–gain, dual-band, base/repeater application.

Features

- Wide frequency bandwidth
- Heavy duty fiberglass radome
- Stainless steel mounting hardware and radials
- Type–N Cable connection
- Compact size for easy mounting/installation

Specifications:

Freq.: 2m: 144–148MHz
70cm: 440-450MHz
Power: 200 watts
Wind Rating: 135 MPH (no ice)
Height: 5.6 feet

X500HNA

Diamond Antenna's best base station repeater antenna. Designed for strength and performance, the X500HNA is pretuned to achieve maximum gain in both the 2m and 70cm amateur bands.

Features

- Heavy duty fiberglass radome
- Overlapping outer shells for added strength
- Stainless steel mounting hardware and radials
- Strong, waterproof joint couplings
- Type–N Cable connection
- Wide band performance

Specifications:

Freq.: 2m: 144–148MHz 70cm: 440-450MHz
Power: 200 watts
Wind Rating: 90 MPH (no ice)
Height: 17.8 feet

COAX CONNECTION AT BASE END

HEAVY DUTY BASE/ RADIAL ASSEMBLY

STRONG JOINT COUPLINGS

DIAMOND Mono-Band Base/Repeater Antennas

MODEL	BAND (MHz)	WATTS	CONN.	HT. FT.	RATED WIND MPH (No. Ice)
CP22E [1]	144	200	UHF	9.0	70
DPGH62 [1]	50	200	UHF	21.0	78
F22A	144	200	UHF	10.5	112
F23A	144	200	UHF	15.0	90
F718A [2]	440	250	N	15.0	90
G200	2.4GHz	–	N	4.8	135

DIAMOND Dual-Band Base/Repeater Antennas

MODEL	BAND (MHz)	WATTS	CONN.	HT. FT.	RATED WIND MPH (No. Ice)
X50A	144/440	200	UHF	5.6	135
X50NA	144/440	200	N	5.6	135
X200A	144/440	200	UHF	8.3	112
X510NA [3]	144/440	200	N	17.2	90
X510MA	144/440	200	UHF	17.2	90
X500HNA	144/440	200	N	17.8	90+
X700HNA	144/440	200	N	24.0	90
U200	440/1240	100	N	5.9	135

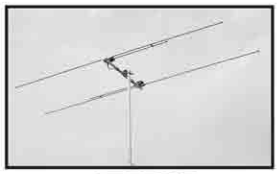
DIAMOND Tri-Band Base/Repeater Antennas

MODEL	BAND (MHz)	WATTS	CONN.	HT. FT.	RATED WIND MPH (No. Ice)
V2000A [5]	52/144/440	150	UHF	8.3	110
X3200A [4]	146/222/440	100/200	UHF	10.5	112
X6000A	144/440/1240	100/60	N	10.5	112

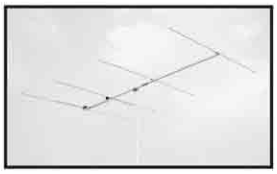
Most requirement: 1.4"-2.4"

DIAMOND Yagi Antennas

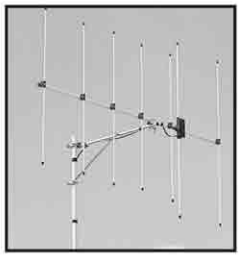
MODEL	BAND (MHz)	WATTS (PEP)	CONN.	BOOM LNTH.	ELEMENT PHASING
A502HB	50	400	UHF	2.6'	2 element
A504HB	50	400	UHF	10.7'	4 element
A144S5	144	100	UHF	37.5"	5 element
A430S10	432	100	UHF	43"	10 element
A430S15	432	100	UHF	89"	15 element



A502HB



A504HB



A144S5

NOTES:

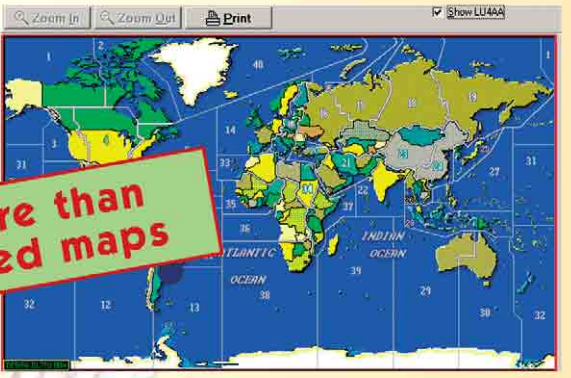
1. Heavy duty aluminum construction.
2. F-718A: 440-450MHz., F718L: 420-430MHz.
3. X510NJ: 144-147/430-440MHz.
4. 2m: 146-148; 100 watts
5. 52-54MHz. only

BAND: 144=144-148MHz., 222=222-225MHz., 420=420-430MHz.,430=430-440MHz., 440=440 450MHz., 1240=1240-1300MHz.

www.rfparts.com/diamond

Diamond Antenna Division of RF Parts Co. Tel: (760) 744-0900 • FAX: (760) 744-1943 • diamondantenna@rfparts.com

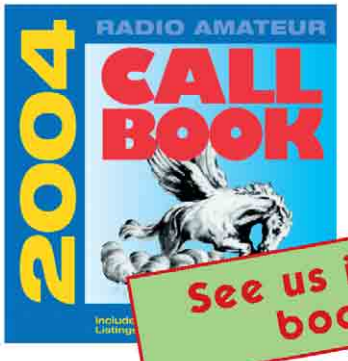
RADIO AMATEUR CALLBOOK
2004 Summer Edition



▲ Beacon Scheduler

◀ Map display

- Since 1920, the most complete and most accurate Amateur Radio callsign database
- Unreached quality of data. Quality ranking display
- The most comprehensive interface
- Multi-lingual: English, Spanish, German, French selectable
- Runs directly from CD-ROM, no installation needed
- Tested with Linux/Wine
- Beacon Scheduler displays the active beacon of the NCDXF/IARU HF beacon system on the index or on the world map
- Displays the location of your qso partner on one of the 250 detailed Amateur Radio prefix maps
- 60.000 QSL manager entries
- Summer Edition available May 15th, Dayton Hamvention
- Available also from your local radio store, ARRL bookstore or on our website www.callbook.com



See us in Dayton
booth 44

Summer 2004:
US $49,95 / Euro 49,95

Subscription Summer 2004 / Winter 2005:
US $74,95 / Euro 74,95

Radio Amateur Callbook
P.O. Box 161155, Miami, FL 33116

In Europe: P.O. Box 1170,
34216 Baunatal, Germany

AOR ARD9800 Fast Modem – Digital Voice and Image Interface

Convert Your Analog Transceiver to Digital Voice & Image

In One Easy Step!

No transceiver modifications are necessary.

See Our Product Review in February 2004 QST

See us at Dayton Booth 451-454

Use any conventional voice transceiver for digital voice communications and images* while you maintain analog capabilities.

The ARD9800 is a breakthrough in communications technology. By simply connecting the ARD9800 to a pair of transceivers, clear, reliable digital communications are a reality.

- **Digital voice communications using existing analog 2way radios.**
The ARD9800 uses the same audio frequencies (300 Hz ~ 2500 Hz) as microphone audio to modulate the voice signal. This allows you to use an analog radio as a digital voice radio.

- **Works on Single Side Band (SSB) mode.**
The Automatic frequency clarifier function adjusts frequency drift automatically in the SSB mode. (Approximately up to +/- 125 Hz). Utilizes the OFDM (Multi Carrier Modulation) circuit that is effective against Multi-path or Selective Fading, a powerful tool against adverse band conditions.

- **Automatic digital receive**
Automatic voice signal detector recognizes the received signal as analog or digital, automatically switching to the appropriate mode.

- **Digital Slow Scan TV***
Built-in video capture function (NTSC). Compresses the signal into AOR's original adaptive JPEG. Send and receive images (similar to analog slow scan TV, but better) in the digital mode. Built-in video output connector (NTSC) allows viewing the picture on an external monitor.

- **Built-in high grade Vocoder (AMBE)**
Utilizing high-grade digital voice compression delivers quality digital voice communications.

- **Built-in FEC error correction**
A powerful error correction circuit delivers stable and reliable communications also allowing "round table" conversations.

- **Small and compact unit. Easy to operate.**
Simply connect the ARD9800 between the microphone jack and microphone. No complicated modifications necessary.

- **Utilizes a uniquely designed high performance DSP engine**

- **Uses the established G4GUO open protocol**

Digital Amateur Radio could be the biggest development on the ham bands since SSB! Be sure to see the FAQ at www.aorusa.com!

AOR™
Authority On Radio

AOR U.S.A., Inc.
20655 S. Western Ave., Suite 112, Torrance, CA 90501, USA
Tel: 310-787-8615 Fax: 310-787-8619
info@aorusa.com http://www.aorusa.com

**image feature requires optional memory module.*
Specifications subject to change without notice or obligation.

PICTURE YOURSELF IN THE WINNER'S CIRCLE!

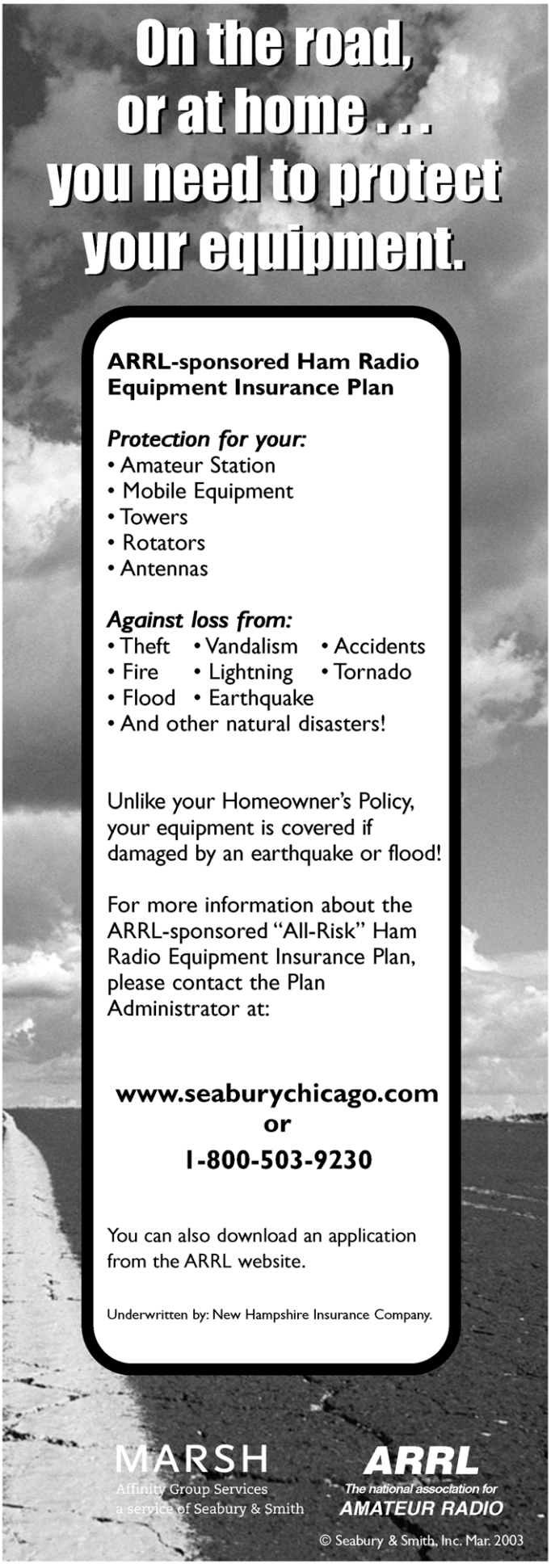
at Daytonx!

IC-7800

THE ULTIMATE HF!

Check under the hood at the main Icom booth!

ICOM



Don't Let a Lightning Strike Keep You Off The Air!

ARRL offers its Members Ham Radio Equipment Insurance.

How much time and money have you spent on your ham radio equipment? What if a natural disaster strikes, forcing you off the air? You'd want to be up and running again as soon as possible with the least amount of financial worry.

With the ARRL-sponsored "All-Risk" Ham Radio Equipment Insurance Plan, you can enjoy peace of mind knowing that your valuable equipment will be covered if it's damaged or stolen. Plus, your equipment and accessories are covered while in your car, as well as at home.

With this program, you pay the low annual rate of just $1.50 per $100 of replacement cost value! You'll find this to be significantly lower than comparable plans. If you rely solely on your homeowner's coverage, be prepared to pay a high deductible. With the ARRL-sponsored plan, you pay the low deductible of just $50 per claim. How much longer can you afford to go without coverage?

Marsh Affinity Group Services administers the ARRL-sponsored Ham Radio Equipment Insurance Plan. They have been providing insurance programs for professional organizations for over 50 years, and their strength and expertise make them a leader in the industry.

Don't wait for lightning to strike and leave you with damaged equipment and high replacement costs. Get protection now so you can avoid the financial burden of rebuilding your station. For more information, contact Marsh Affinity Group Services toll-free at 1-800-503-9230. Or, visit them on the web at www.seaburychicago.com.

MIRAGE. . .160 Watts on 2 Meters!

Turn your mobile, base or handheld into 160 Watt powerhouses and talk further, longer, clearer. . . All modes: FM, SSB, CW . . . Superb GaAsFET preamp . . . Overdrive, high SWR, Over-temperature protection . . . Remote controllable . . .

The MIRAGE B-5018-G gives you 160 Watts output for 50 Watts input on all modes – FM, SSB, or CW!

Ideal for 25-50 Watt 2 Meter mobile or base. Weak signals pop out with its low noise *GaAsFET* preamp and its excellent 0.6 dB noise figure. Selectable 5, 8 or 14 dB preamp gain.

Exclusive MIRAGE *ActiveBias*™ circuit gives *crystal clear SSB* without splatter or distortion.

B-5018-G is legendary for its ruggedness and is fully protected -- high SWR or excessive input power automatically bypasses the B-5018-G to prevent damage.

Heavy-duty heatsink spans entire length of cabinet. Power transistors protected by MIRAGE's *Therm-O-Guard*™.

Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ inches.

B-5018-G **$329**

B-1018-G, $409. MIRAGE's most popular *dual purpose* HT or mobile/base amplifier. 160 Watts out for 10 Watts in. For 0.25-10 Watt rigs.

B-2518-G, $329. Same as B-5018-G but for 10 to 25 Watt mobile or base. 160 Watts out for 25 Watts in.

RC-2, $45. Remote Control. On/Off, preamp On/Off, selects SSB/FM. With 25 foot cable.

Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

35 Watts for 2 Meter HT

For handhelds up to 8 Watts. 35 Watts out for 3-8 Watts in (18 W out/1W in)! 18 dB *GaAsFET* preamp. All modes: FM, SSB, CW. RF sense T/R switch. Reverse polarity protection. Includes mobile bracket, 1 year warranty. 5¼Wx1¾Hx4¾D in.

B-34-G **$99.95**

35 Watts, $79.95, FM only

B-34, $79.95. 35 Watts out for 2 Watts in. Like B-34-G, FM only, less preamp, mobile bracket. 3⅛Wx1¾Hx4¼D in

MIRAGE Dual Band 144/440 MHz Amp

Boost your *dual band* 144/440 MHz handheld to a powerful mobile/base -- 45 Watts on 2 Meters/ 35 Watts on 440 MHz! Works with all FM handhelds to 7 Watts. In-cludes *full duplex* operation -- lets you talk on one band, listen on other at same time. Auto band selection, RF sense T/R switch, single connector, reverse polarity protection, 5Wx1¾Hx5D in. Mobile bracket. One year warranty.

BD 35 **$159.95**

100 Watts for 2M HT

100 Watts out for 2-8 Watts in! Great for HTs up to 8W. FM, SSB, CW. 15 dB *GaAsFET* preamp, RF sense T/R, high-SWR protected. B-310-G **$199.95**

http://www.mirageamp.com

Nearest Dealer, Free catalog, To Order . . .

800-647-1800

Tech: 662-323-8287 **Fax:** 662-323-6551

MIRAGE *300 Industrial Park Rd Starkville, MS 39759*

Prices/specs subject to change without notice/obligation ©2004.

MIRAGE . . . the world's most rugged VHF/UHF amplifiers!

the *finest* antenna tuner made!

. . . the VECTRONICS HFT-1500

- ***High Current Roller Inductor***
- ***SSB*Analyzer Bargraph™***
- **Cross-Needle Meter**
- ***6 Position Antenna Switch***
- ***Built-in 4:1 Balun***
- ***Gear driven Turns Counter***

The VECTRONICS HFT-1500 is not just an antenna tuner . . . it's a beautifully crafted work of art, using the finest components available and the highest quality construction.

Every HFT-1500 aluminum cabinet is carefully crafted with a super durable paint that won't scratch or chip.

Attractive two-color Lexan front panel is scratch-proof. Take a quarter. Scratch the front panel. You won't leave a mark!

Arc-Free Operation

Two 4.5 kV transmitting capacitors and a massive roller inductor give you arc-free operation up to 2 kW PEP SSB.

Precision Resetability

A sturdy hand cranked roller inductor lets you quickly fly from band to band. A precision 5-digit gear driven turns counter lets you accurately retune.

HFT-1500 **$459.95**

Large comfortable knobs and smooth vernier drives make tuning precise and easy. Bright red pointers on logging scales make accurate resetability a breeze.

Absolute Minimum SWR

You can tune your SWR down to the absolute minimum! **Why?** Because all network components -- roller inductor and variable capacitors are *fully* adjustable.

Tune any Antenna

You can tune any *real* antenna from 1.8 to 30 MHz, including all MARS and WARC bands. You can tune verticals, dipoles, inverted vees, Yagis, quads, long-wires, whips, G5RVs, and more!

*SSB*Analyzer Bargraph™*

Exclusive 21 segment bargraph lets you visually follow your instantaneous voice peaks. Has level and delay controls.

Accurate SWR/Power Meter

A shielded directional coupler and backlit Cross-Needle meter displays accurate SWR, forward and reflected power simultaneously. Reads both peak and average power on 300/3000 Watt scales.

6 Pos. Ceramic Antenna Switch

Select two coax fed antennas (tuned or bypassed), balanced line/wire or bypass.

Built-in Balun

A heavy duty two ferrite core 4:1 balun feeds dual high voltage Delrin terminal posts for balanced lines. 5.5x12.5x12 inches. One year limited warranty.

Call toll-free, 1-800-363-2922

Order the HFT-1500 from Vectronics. Try it for 30 days. If you are not completely satisfied, return it for a full refund, less shipping and handling -- no hassles.

http://www.vectronics.com

Nearest Dealer, Free catalog, To Order . . .

800-363-2922

Voice: 662-323-5800 **Fax:** 662-323-6551

VECTRONICS®

300 Industrial Park Road,Starkville, MS 39759, USA

Prices/specs subject to change without notice/obligation ©2004 Vectronics

VECTRONICS . . . the finest amateur radio products made!

MFJ *IntelliTuner*™ Automatic Tuner

Automatically tunes any antenna balanced or unbalanced . . . Ultra fast . . . 2000 memories . . . Antenna Switch . . . Efficient L-network . . . Matches 6-1600 Ohms at 300 Watts . . . 1.8-30 MHz . . . 4:1 current balun . . . Cross-Needle and Digital SWR/Wattmeter . . . Aural SWR meter . . . Backlit LCD . . . Remote control port . . . Radio interface . . .

MFJ-993
$259.95 **New!**

The MFJ-993 *IntelliTuner*™ lets you tune any antenna *automatically* balanced or unbalanced -- *ultra fast*.

It's an automatic antenna tuning *console* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJs exclusive *IntelliTuner*™, *Adaptive Search*™ and *InstantRecall*™ algorithms give you *ultra fast* automatic tuning with over 2000 *non-volatile* revolving memories.

You get a highly efficient L-network, wide 6-1600 ohm matching at *full* 300 Watts SSB/150 Watts CW, 1.8-30 MHz coverage, Cross-Needle and *digital* meters, aural SWR meter, *backlit* LCD display, remote control port, radio interface, heavy-duty 16 amp/1000 volt relays and more.

It learns while you're having fun

As you're ragchewing, contesting or DXing, *your MFJ-993 is learning!*

When you transmit, the MFJ-993 automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!*

Each of two antennas can learn and remember over a thousand frequencies and tuner settings. They are safely stored in *non-volatile* revolving memory.

Highly Intelligent ultra fast tuning

MFJ *InstantRecall*™ first checks its memory to see if you have operated this frequency before. If so, tuning is instantaneous and you're ready to operate.

If not, MFJ's *IntelliTuner*™ algorithm -- based on MFJ's famous SWR Analyzer technology -- kicks in. It *measures* the complex impedance of your antenna. Next, it *calculates* the components it needs and instantly *snaps* them in. Then, it fine tunes to minimize SWR -- you're ready to operate. It's all done in a *fraction* of a second.

When the impedance is within its measurement range, the MFJ-993 is the *fastest automatic antenna tuner in the world.*

If it can't accurately determine impedance, MFJ's *AdaptiveSearch*™ algorithm goes into action. Frequency is measured and relevant components values are determined. Only those values are searched for ultra-fast tuning.

For even faster searches, you can set the target SWR to 2 (settable 1.0 to 2.0).

You can manually tune when you can't transmit (for listening out of ham bands).

Cross Needle and Digital Meters

Lighted Cross-Needle and *digital* SWR/Wattmeters lets you accurately read SWR, forward and reflected power at a glance.

An *aural* SWR meter lets you *hear* the tuned SWR when you can't see or read the meters.

Turn on a highly visible, instant response SWR LCD bargraph when you need it.

Backlit LCD Display

An easy-to-read *backlit* LCD displays SWR, forward/reflected power, frequency, antenna 1 or 2, L and C tuner values, on/off indicators and other information.

Remote Control Port

Plug in the **MFJ-990RC, $39.95**, remote control and put your tuner at your antenna or elsewhere and control it remotely.

The MFJ-993 supports radio tuner interfaces such as the ICOM 706 series. *Interface cables are available.*

The MFJ-993 is a compact 10Wx2¾ Hx9D inches. Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $19.95**.

Tune any Antenna

You can tune any antenna -- dipoles, verticals, beams, phased arrays, inverted vees, quads, random wires, mobile antennas, limited space antennas -- any antenna.

A 4:1 true current balun lets you tune any *balanced* antenna -- horizontal loops, vertical loops, multi-band doublets, quads, folded dipoles, Zepps.

150 Watt Automatic Tuner

New!
MFJ-991,
$219.95

MFJ-991, *150 Watt IntelliTuner*™ automatic antenna tuner. Similar to MFJ-993 but handles 150 Watts SSB/100 Watts CW, matches 6-3200 Ohms. Does not have digital SWR/Wattmeter/LCD display, aural SWR meter/audio feedback, antenna switch or 4:1 current balun for balanced lines.

600 Watt MFJ Automatic Tuner

MFJ-994,
$359.95
New!

MFJ-994, *600 Watt IntelliTuner*™ automatic antenna tuner. Similar to MFJ-993 but handles 600 Watts SSB/300 Watts CW, matches 12-800 Ohms. Does not have digital SWR/Wattmeter/LCD display, aural SWR meter/audio feedback, antenna switch or 4:1 current balun for balanced lines. Tuning must be done at low transceiver power with the amplifier bypassed.

Free MFJ Catalog
and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ . . . the World Leader in Ham Radio Accessories!

Ham Ads

Please contact the **Advertising Department** at **860-594-0231** or **hamads@arrl.org** for further information or to submit your ad.

1. Advertising must pertain to products and services which are related to Amateur Radio.

2. The Ham-Ad rate for commercial firms offering products or services for sale is $1.25 per word. Individuals selling or buying personal equipment: ARRL member 65¢ per word. Non-ARRL member $1 per word. **Bolding** is available for $1.75 a word. You may pay by check payable to the ARRL and sent to: Ham-Ads, ARRL, 225 Main St., Newington, CT 06111. Or, you may pay by credit card sending the information by fax to 860-594-4285 or via e-mail to hamads@arrl.org. The credit card information we need is: the type of credit card, the exact name that appears on the credit card, the credit card number, the expiration date and the credit card billing address.

3. Remittance in full must accompany copy since Ham-Ads are not carried on our books. Each word, abbreviation, model number and group of numbers counts as one word. Entire telephone numbers count as one word. No charge for postal Zip code. No cash or contract discounts or agency commission will be allowed. Tear sheets or proofs of Ham-Ads cannot be supplied. Ads submitted in writing should be typed or printed clearly on an 8 1/2" X 11" sheet of paper.

4. Closing date for Ham-Ads is the 15th of the second month preceding publication date. No cancellations or changes will be accepted after this closing date. Example: Ads received March 15th through April 15th will appear in June *QST*. If the 15th falls on a weekend or holiday, the Ham-Ad deadline is the previous working day. Please contact the Advertising Department at 860-594-0231 or hamads@arrl.org for further information or to submit your ad.

5. No Ham-Ad may use more than 100 words. No advertiser may use more than two ads in one issue. A last name or call must appear in each ad. Mention of lotteries, prize drawings, games of chance etc is not permitted in *QST* advertising.

6. New firms or individuals offering products or services for sale must check with us to determine if a production sample (which will be returned) should be submitted for examination. Dealers are exempted, unless the product is unknown to us. Check with us if you are in doubt. You must stand by and support all claims and specifications mentioned in your advertising.

The publisher of *QST* will vouch for the integrity of advertisers who are obviously commercial in character and for the grade or character of their products and services. Individual advertisers are not subject to scrutiny.

The American Radio Relay League does not discriminate in its advertising on the basis of race, color, religion, age, sex, sexual orientation, marital status or national origin.

The League reserves the right to decline or discontinue advertising for any other reason.

QST Ham Ads on the Web – Updated Monthly!
www.arrl.org/ads/ham-ads.html

Sell Your Radio TODAY!
Check out **RADIOS On-Line** on the ARRL web site:
www.arrl.org/ads/RadiosOnline/

Club/Hamfests/Nets

FRIEND OF BILL W.?? - Join HAAM net Saturdays at 12:30 Eastern on 14.290; Sundays at 09:30 Pacific on 14.340/2. K6LX

MARCO The Medical Amateur Radio Council Ltd. is a charitable non-profit group of health care professionals who meet weekly at 10:00am Eastern on Sunday for "Grand Rounds" 14.308 MHz. All are welcome. Membership inquiries to WE1MD@arrl.net or CBA. SASE for newsletter to: MARCO, 144 Head of the Tide Road, Belfast, ME 04915. http://www.marco-ltd.org

MFJ tiny Travel Tuner

Tiny 4½x2¼x3 inch tuner handles full 150 Watts! Covers 80-10 Meters, has tuner bypass switch, tunes nearly anything!

MFJ brings you the *world's smallest* full power 150 Watt 80-10 Meter Antenna Tuner. Extra wide matching range lets you tune nearly any antenna.

It's no toy, its got guts! Built with real *air* variable capacitors (600 Volt, 322 pF) and *three* stacked powder iron toroids to handle real power -- not just QRP. Bypass switch lets you bypass tuner when you don't need it.

You can use nearly any transceiver at full power with nearly any coax fed or random wire antenna for portable, home or mobile operation.

It's perfect for compact rigs like Icom IC-706MKIIG, Yaesu FT-100D, Kenwood TS-50, QRP rigs and others with a built-in SWR meter.

Operate anywhere, anytime with a quick easy set-up! Tune out SWR on your mobile whip from inside your car. Operate in your apartment with a wall-to-wall antenna or from a motel room with a wire dropped from a window or from a mountain top with a wire over a tree limb. Great for DXpeditions or field day. Be prepared for emergencies.

MFJ-902 is so small and handy, you'll rely on it wherever you go! It's easy to pack away in your briefcase, suitcase, backpack, glove compartment or desk drawer. It's tiny enough to slide in your back hip pocket! 4½Wx2¼Hx3D in.

MFJ-902
$79.95 **New!**

Tiny Travel Tuner with 4:1 Balun

MFJ-902H
$99.95

MFJ-902H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun* for balanced lines and 5-way binding posts for balanced lines and random wire. 5¾Wx2¼Hx 2¾D inches.

Tiny Travel Tuner with Cross-Needle SWR/Wattmeter

MFJ-904
$109.95

MFJ-904, same as MFJ-902 *Tiny Travel Tuner* but has *Cross-Needle SWR/Wattmeter.* Read SWR, forward and re-flected power all at a glance in 300/60 and 30/6 Watt ranges. 7¼Hx2¼Hx2¾D in.

ALL-in-one *Tiny Travel Tuner* with 4:1 Balun *and* SWR/Wattmeter

MFJ-904H
$129.95

ALL-in-one! MFJ-904H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun for balanced lines* and Cross-Needle SWR Wattmeter. Read SWR, forward and reflected power all at a glance in 300/60 and 30/6 Watt ranges. Has 5-way binding posts for balanced lines and random wire. 7¼Hx2¼Hx2¾D inches.

Long 10/12 foot Telescoping Whips

MFJ-1954
$19.95
10 Feet

MFJ-1956
$29.95
12 Feet

10 foot extended, 19 inches collapsed, MFJ-1954, $19.95. 12 foot extended, 22.5 inches collapsed. MFJ-1956, $29.95. Standard 3/8 inch by 24 threaded stud for use with all standard mounts. Durable 1/2 inch diameter plated brass. Telescopes for full 1/4 wave operation 2 to 12/15 Meters. Cover 17, 20, 30, 40, 60, 80, 160 Meters with loading coil. Use two for multi-band dipoles. Replace screwdriver antenna whip for highly efficient *fixed* mobile operation.

MFJ RF Isolator

MFJ-915 *RF Isolator*

MFJ-915
$29.95

prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. *Don't operate without one!* 5x1½ inches. For 1.8 to 30 MHz.

Portable Collapsible Antenna Tri-Pod

MFJ-1918
$39.95

Holds 66 pounds of antenna steady. Black *steel* base forms strong braced equilateral triangle 40 inches on a side. Non-skid feet. One inch diameter steel mast extends height to six feet. Strong base and mast locks. Easily add antenna mount or mast extension for greater heights. Collapses to 38 inches by 4 inch diameter. 6¾ pounds.

1500 Watt Lightning Surge Protector

MFJ-272
$39.95

Protect your expensive transceiver from static electricity and lightning induced surges with an ultra-fast gas discharge tube. Plug between rig and antenna, attach ground. DC to 1000 MHz. SO-239s.

All-Band G5RV Antenna

MFJ-1778
$39.95

Cover all bands, 160-10M with tuner. 102 ft. long, 1.5kW. Custom fiberglass insulator stress relieves 450 Ohm ladder line. Use horizontally, as inverted vee or sloper. Marconi on 160M.

40-10M G5RV Junior
MFJ-1778M, $34.95.
Half-size 52 foot *G5RV Jr* 40-10 Meters, 1500 Watts.

Glazed Ceramic Antenna Insulator

MFJ-16C06
$3.95
Package of six. (69 cents each)

Authentic *glazed ceramic* antenna insulator. Extra-strong -- will not break with long antennas and will not arc over or melt even under full legal power. Molded ridges give extra-long high voltage path to prevent high-voltage breakdown. Smooth wire holes prevent wire damage. Use as center or end insulator for dipoles, doublets, G5RVs, guy wires and others.

Current Balun/Center Insulator

MFJ-918
$24.95

True *1:1 Current Balun/Center Insulator* forces equal currents into dipole halves to reduce coax feedline radiation and field pattern distortion. Reduces TVI, RFI and RF hot spots in your shack. 50 ferrite beads on *Teflon*® coax. 1.5kW, 1.8-30 MHz. Stainless steel hardware. *Direct* antenna connection. 5x1½ in.

Free MFJ Catalog

and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

Prices and specifications subject to change.

MFJ . . . the world leader in ham radio accessories!

METRO-COMM. INC MID-ATLANTIC Echo-Link Node #119660 W3CH-R Wide Area repeater network NY, PA, NJ and Delaware. Come join us 24 hours a day. Weekly nets: Sunday 20:00 (Local 00:00 UTC) KB3FPM hosts a rag chew net. Monday 20:00 (Local 00:00 UTC). The Over The Hill Gang net. For a list of all the repeaters in the system e-mail w3publicservice@aol.com. Everyone is always welcome to join in on the fun - 24 hours a day! 73 Metro-Comm, Inc W3PS

RAINBOW AMATEUR RADIO ASSOCIATION Serving the gay/lesbian community since 1995. ARRL affiliated. Privacy respected. Three active weekly HF nets, monthly newsletter, e-mail server, chat room, VE teams, DXpeditions. Web site: www.rara.org. Information: PO Box 18541, Rochester, NY 14618-0541.

THE ARRL LETTER — The League's news digest for active amateurs, professionally produced and edited and available in a weekly electronic edition via the World Wide Web at www.arrl.org/arrlletter. Members may sign up for free email delivery of The ARRL Letter while registering on the Members Only Web Site, or by visiting their "Member Data page" after registering.

WILLIAMS, AZ. Amateur Radio Council of Arizona. (Formally Ft. Tuthill) Arizona's largest hamfest, JULY 2nd through 4th. I-40 exit 163. ARRL, Manufacturers, Dealers, Exhibits, Nationally Renouned Speakers, Seminars, HUGH SWAP AREA, Camping. SPONSORS: ARCA & City of Williams, AZ. ARCA, 16845 N 29th Ave #312, Phoenix, AZ 85053-3041. VM 602-881-2722, www.arca-az.org/arca.

WORK GEORGIA'S 159 COUNTIES: New award, with progress certificates for 50 and 100 counties. Atlanta Radio Club, http://www.w4doc.org

Property/Vacation/Rentals

A BERMUDA HAM QTH awaits you. YL/XYL friendly. Email edkelly@logic.bm or phone VP9GE at 1-441-293-2525.

ADVENTURE, RADIO, TRAVEL for HAMS and families - Arctic - Antarctica - Falklands - S. Georgia - Azores & other remote Atlantic locations. Join K9PET on "M/S Endeavour" **www.CASUALDX.com**

ALASKA DX VACATION RENTAL - plus fishing and hunting in Homer, Alaska. 2br/2 bath deluxe accommodations + ham shack. Rigs, KW amps, antennas. AL7DB@ARRL.NET, DiamondRidgeCottage@webtv.net, 1-907-235-7526

ANTENNAS WELCOME in Sun City Arizona! Let me send you free info about this remarkable "active retirement" community. It's safe, quiet and surprisingly affordable. N7RH@azqth.com. Don Steele, Ken Meade Realty, 800-877-1776

ANTIGUA West Indies QTH with radio and 7 towers with antennas. Constant electricity. Contact Roy, V21N, 954-962-4723 or 954-801-6061 or Sam at wt3q@frontier.net

BORNEO/9M6AAC - http://www.qsl.net/9m6aac

COLORADO CHALET with ham gear, www.lostcreekcabin.com. WØLSD, Buena Vista, CO.

CURACAO - PJ2T Oceanfront 2BR house, 11 Yagis, all watersports. ghoward@kent.edu http://www.pj2t.org

MFJ TUNERS

MFJ-989C *Legal Limit* Antenna Tuner

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

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

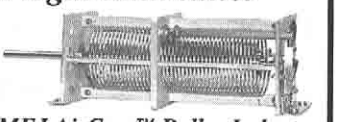
The rugged world famous MFJ-989C handles 3 KW PEP SSB amplifier input power (1500 Watts PEP SSB output power). Covers 1.8 to 30 MHz, including MARS and WARC bands.

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

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

MFJ-989C **$359.95**

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



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

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

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

MFJ *No Matter What*™ Warranty

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

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

MFJ-986 Two knob *Differential-T*™

MFJ-986 **$329.95**

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

MFJ-962D *compact* Tuner for Amps

MFJ-962D **$269.95**

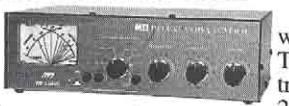
A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. 10¾x4½x10⅞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

MFJ-969 300W *Roller Inductor* Tuner

MFJ-969 **$199.95**

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

MFJ-949E *deluxe* 300 Watt Tuner



MFJ-949E **$149.95**

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

MFJ-941E *super value* Tuner

MFJ-941E **$119.95**

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

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

MFJ-945E **$109.95**

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

MFJ-971 *portable/QRP* Tuner

MFJ-971 **$99.95**

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

MFJ-901B *smallest* Versa Tuner

MFJ-901B **$79.95**

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

MFJ-16010 *random* wire Tuner

MFJ-16010 **$49.95**

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

MFJ-906/903 *6 Meter* Tuners

MFJ-906 **$79.95**

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

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921 or MFJ-924 **$69.95**

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

MFJ-922 *144/440 MHz* Tuner

MFJ-922 **$79.95**

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

MFJ-931 *artificial* RF Ground

MFJ-931 **$89.95**

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

Free MFJ Catalog
and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

1 Year *No Matter What*™ warranty 30 day money back guarantee (less s/h) on orders from MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(662) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (662) 323-6551; **Add s/h**
Tech Help: (662) 323-0549

C&S Sales

We stock hundreds of electronic products. Visit our web site to view our complete lines, and to place orders.

www.cs-sales.com

CALL TOLL FREE (Orders Only)
800-292-7711
SE HABLA ESPANOL

CALL, E-MAIL OR WRITE FOR OUR
FREE CATALOG
800-445-3201

Basic Tools, and a Means to Develop the Skills to Use Them!

Elenco M1750 $24.95

11 Functions:
- Freq. to 20 MHz
- Cap. to 20µF
- AC/DC Voltage
- AC/DC Current
- Beeper
- Diode Test
- Transistor Test
- Free Holster
- Meets UL-1244 safety specs.

Elenco LCM1950 $59.95

- Large 1" X 3¾" LCD
- Freq. to 4 MHz
- Inductance to 40H
- Cap. to 400µF
- Logic Test
- Resistance to 4,000MΩ
- Diode & Transistor Test
- Audible Continuity Test

Elenco Soldering Stations

Electronically controlled, ideal for professionals, students, and hobbyists. Available in kit form or assembled, with or without an iron.

Features:
- Cushion Grip Handle Soldering Iron (optional) with Grounded Tip for Soldering Static-Sensitive Devices. Easily Replaceable. Uses Long-Life, Plated Conical Tip.
- Heavy Steel, Non-Slip Base.
- Sponge Pad.
- Iron Holder Funnel - Reversible, left or right side.
- Steel Tray for Sponge Pad.

Four versions are available (assembled or kit):

SL540/540K	With 40W UL Iron	$29.95
SL5/5K	Without Iron	$24.95

These work with any iron! Turn any soldering iron into a variable iron.

Electronic Snap Circuits

As Featured in a July 2003 *QST* "Short Takes" Review!

Assembling simple, and even fairly advanced, experimental circuits is as easy as snapping together toy building blocks. Follow the colorful pictures in the manual to build exciting projects such as AM and FM radios, digital voice recorders, burglar alarms, doorbells, and more! (Depending on the specific model) No tools required!

Snap Circuits, Jr, (SC-100)
$29.95
Contains over 30 parts. Build over 100 different circuits!

Snap Circuits, Standard (SC-300) $59.95
Contains over 60 parts. Build over 300 different circuits!

Snap Circuits, Standard (SC-300S) Includes Computer Interface $74.95
Contains over 60 parts. Build over 300 different circuits and **20 computer interfaced projects!**

Snap Circuits, Pro (SC-500) NEW! $89.95
Contains over 75 parts. Build over 500 circuits!

Advanced Test Equipment for the Serious Experimenter!

Elenco GF8046

3MHz Sweep Function Generator with built-in 60MHz frequency counter
$199.95

This sweep (linear/log) function generator with counter is an instrument capable of generating sine square, triangle ramp, plus pulse, minus pulse, TTL, and CMOS pulse over a frequency range from 0.5Hz to 3MHz.

GF8025 - without counter Special! $99.95

Elenco F2800 $99

Handheld Universal Counter 1MHz - 2.8GHz

Features 10 digit display, 16 segment and RF signal strength bargraph.

Includes antenna, NiCad battery, and AC adapter.

Resolution to 10Hz.

C2800 Case with Belt Clip $14.95

Elenco RF Generator Model SG9500 $239

100kHz-150MHz (to 450MHz on harmonics) with counter (1Hz - 150MHz in 2 ranges)

Features internal AM mod. of 1kHz, RF output 100mV to 35MHz. Audio output 1kHz @ 1V RMS.

SG9000 (analog, without counter) $135

Elenco Oscilloscope Model S1325 30MHz Special $325

Free Dust Cover and x1, x2 Probes – 2 Year Warranty

S1330	30MHz	Delayed Sweep	$439
S1340	40MHz	Dual Trace	$475
S1345	40MHz	Delayed Sweep	$569
S1360	60MHz	Delayed Sweep	$725
S1390	100MHz	Delayed Sweep	$895

Digital Scope Super Specials

DS203	20MHz/10Ms/s Analog/Digital	$695
DS303	40MHz/20Ms/s Analog/Digital	$850
DS603	60MHz/20Ms/s Analog/Digital	$950

Elenco Quad Power Supply Model XP581 $75

- Fully Regulated and Short Protected
- Voltage and Current Meters
- All Metal Case

4 DC Voltages:
3 fixed: +5V @ 3A, +12V @ 1A, -12V @ 1A
1 variable: 2.5-20V @ 2A

C&S Sales, Inc.

150 W. CARPENTER AVENUE
WHEELING, IL 60090
FAX: 847-541-9904
TEL: 847-541-0710

www.cs-sales.com
e-mail: sales@cs-sales.com

Guaranteed Lowest Prices
UPS SHIPPING: 48 STATES 6% ($6 min.) – OTHERS CALL FOR DETAILS
15 DAY MONEY BACK GUARANTEE – 2 YEAR FACTORY WARRANTY
IL Residents add 8.5% Sales Tax
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

DXshack FG, J6, 3W, XU, XW TRX+kW AMP+Beam ANT & Bed. URL: //qth.com/dxshack email: xu2a@fsinet.or.jp

FOR SALE RANCH Home $139,900. Huntington Township, Luzerne County, PA. Three bedrooms, family room and hamshack on lower level entrance at grade. Fireplace and Alaska stoker stove. Forty-foot guyed tower, tri-band beam, Ringo Ranger, 160M dipole. Contact Prudential Poggi & Jones 888-263-1586 http//poggi-jones.com Charles Hooker, AD3L.

MAUI HAWAII - Vacation with a Ham. Since 1990. www.seaqmaui.com 1-808-572-7914 or kh6sq@arrl.net

Mountaintop retreat on 11 acres near Summerville, WV, ready for antenna and ham gear. WD8MZR 919-461-0107

MUST SELL, Silent Key: DX Paradise in Pompano Beach, Florida! 2 bedroom/2 bath furnished mobile home in adult park. A/C, carport, Florida room, Ham Shack, shed, tools and lots more! Monthly property rental fees paid through the end of 2004. 40-foot crank-over tower with 2-element 20-10 meter Lightning Bolt quad. Contact Doris Halpin, W2KXC, 954-655-5962

TO BUY A HOME for that antenna tower or any type of home in Palm Beach county, Florida, call me, **Mort Penn, K1MP, Realtor with Coldwell Banker**, 561-642-1900 or 561-308-6676 mortpenn@bellsouth.net

TURKS AND CAICOS: 3br/2 bath; pristine beach; XYL approved deluxe accommodations; rigs; amps; antennas. www.qth.com/vp5 270-259-4530; k4isv@k105.com **For rent or sale**

VY2TT www.peidxlodge.com

Antique/Vintage/Classic

ANTIQUE RADIO CLASSIFIED. Free sample copy! Antique radio's largest-circulation monthly magazine. Old radios, TVs, ham equip., 40s & 50s radios, telegraph, books & more. Ads & articles. Free 20-word ad monthly. Subscribe today. Six-month trial: $19.95. Yearly rates: $39.49 ($57.95 by 1st Class). Foreign: write. ARC, PO Box 802-B22A, Carlisle, MA 01741. Phone: 978-371-0512, Fax: 978-371-7129, Web: www.antiqueradio.com

ANTIQUE WIRELESS ASSOCIATION. The organization for all enthusiasts of antique and historical radio! Publishes OLD TIMER'S BULLETIN, covering vintage ham gear, keys, telegraphy, contests, broadcast receivers, vacuum tubes, historical, technical articles, restoration, and much more. AWA produces the famous annual Rochester, NY meet. Maintains world-famous historical radio-electronics communications museum. Membership only $20/year USA, $25 elsewhere. Antique Wireless Association, Box E, Dept. 1, Breesport, NY 14816. Check our Website: http://www.antiquewireless.org

APPLE 1 microcomputer for sale. Very rare. PO Box 179, Floyd, VA 24091. KK4WW, 1-540-763-2534 or Land@swva.net

BROADCAST MICROPHONES and accessories (call letter plates, stands) wanted: early carbon, condenser, ribbon, dynamic models. Cash or trade. James Steele, Box 610, Kingsland, GA 31548. 912-729-6106. jsteele@k-bay106.com; http://www.k-bay106.com/mics.htm

CLASSIC RADIOS — www.radiofinder.com finder@radiofinder.com

MFJ 1.8-170 MHz SWR Analyzer™

Reads complex impedance . . . Super easy-to-use

***New** MFJ-259B reads antenna SWR . . . Complex RF Impedance: Resistance(R) and Reactance(X) or Magnitude(Z) and Phase(degrees) . . . Coax cable loss(dB) . . . Coax cable length and Distance to fault . . . Return Loss . . . Reflection Coefficient . . . Inductance . . . Capacitance . . . Battery Voltage. LCD digital readout . . . covers 1.8-170 MHz . . . built-in frequency counter . . . side-by-side meters . . . Ni-Cad charger circuit . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . . and much more!*

***The** world's most popular SWR analyzer just got incredibly better and gives you more value than ever!*

MFJ-259B gives you a complete picture of your antenna's performance. You can read antenna SWR and Complex Impedance from 1.8 to 170 MHz.

You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

You can determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open in feet.

You can read SWR, return loss and reflection coefficient at any frequency simultaneously at a single glance.

You can also read inductance in uH and capacitance in pF at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

It has built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

Here's what you can do

Find your antenna's true resonant frequency. Trim dipoles and verticals.

Adjust your Yagi, quad, loop and other antennas, change antenna spacing and height and watch SWR, resistance and reactance change instantly. You'll know exactly what to do by simply watching the display.

Perfectly tune critical HF mobile antennas in seconds for super DX -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on one band, or analyze multiband performance over the entire spectrum 1.8-170 MHz!

Check SWR outside the ham bands without violating FCC rules.

Take the guesswork out of building and adjusting matching networks and baluns.

Accurately measure distance to a short or open in a failed coax. Measure length of a roll of coax, coax loss, velocity factor and impedance.

Measure inductance and capacitance. Troubleshoot and measure resonant frequency and approximate Q of traps, stubs, transmission lines, RF chokes, tuned circuits and baluns.

Adjust your antenna tuner for a perfect 1:1 match without creating QRM.

And this is only the beginning! The MFJ-259B is a complete ham radio test station including -- frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance and Reactance Analyzer, Coax Analyzer, Capacitance and Inductance Meter and much more!

Call your favorite dealer for your best price!

MFJ-259B **$259.95**

Call or write for *Free* Manual

MFJ's comprehensive instruction manual is packed with useful applications -- all explained in simple language you can understand.

Take it anywhere

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. It uses 10 AA or Ni-Cad batteries (not included) or 110 VAC with MFJ-1312D, $14.95. Its rugged all metal cabinet is a compact 4x2x6¾ inches.

How good is the MFJ-259B?

MFJ *SWR Analyzers*™ work so good, many antenna manufacturers use them in their lab and on the production line -- saving thousands of dollars in instrumentation costs! Used worldwide by professionals everywhere.

More MFJ *SWR Analyzers*™

MFJ-249B, $229.95. Like MFJ-259B, but reads SWR, true impedance magnitude and frequency only on LCD. No meters.

MFJ-209, $139.95. Like MFJ-249B but reads SWR only on meter and has no LCD or frequency counter.

MFJ-219B, $99.95. UHF *SWR Analyzer*™ covers 420-450 MHz. Jack for external frequency counter. 7½x2½x2¼ inches. Use two 9 volt batteries or 110 VAC with MFJ-1312D, $14.95. *Free* "N" to SO-239 adapter.

SWR Analyzer Accessories

Dip Meter Adapter

MFJ-66, $19.95. Plug a dip meter coupling coil into your MFJ *SWR Analyzer*™ and turn it into a sensitive and accurate bandswitched dip meter. Save time and take the guesswork out of winding coils and determining resonant frequency of tuned circuits and Q of coils. Set of two coils cover 1.8-170 MHz depending on your *SWR Analyzer*™.

Genuine MFJ Carrying Case

MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories.

Made of special foam-filled fabric, the MFJ-29C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends.

Has clear protective window for frequency display and cutouts for knobs and connectors so you can use your MFJ *SWR Analyzer*™ without taking it out of your case. *Look for the MFJ logo for genuine authenticity!*

MFJ-99, $54.85. Accessory Package for MFJ-259/B/249/B/209. Includes *genuine* MFJ-29C carrying case, MFJ-66 dip meter adapter, MFJ-1312D 110Vac adapter. ***Save $5!***

New! ***Tunable Measurement Filter***™

MFJ-731, $89.95. *Exclusive* MFJ tunable RF filter allows accurate SWR and impedance measurements 1.8 to 30 MHz in presence of strong RF fields. Has virtually no effect on measurements. Works with all SWR Analyzers.

MFJ *No Matter What*™ warranty

MFJ will repair or replace (at our option) your MFJ *SWR Analyzer*™ for one full year.

Free MFJ Catalog
Nearest Dealer . . . 800-647-1800
http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders from MFJ

MFJ-224 **$159.95**

MFJ 2 Meter *FM SignalAnalyzer*™

Measure signal strength over 60 dB range, check and set FM deviation, measure antenna gain, beamwidth, front-to-back ratio, sidelobes, feedline loss in dB. Plot field strength patterns, position antennas, measure preamp gain, detect feedline faults, track down hidden transmitters, tune transmitters and filters. Plug in scope to analyze modulation wave forms, measure audio distortion, noise and instantaneous peak deviation. Covers 143.5 to 148.5 MHz. Headphone jack, battery check function. Uses 9V battery. 4x2½x6¾ in.

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(662) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (662) 323-6551; **Add s/h**
Tech Help: (662) 323-0549

More hams use MFJ SWR Analyzers™ than any others in the world!

CODE PRACTICE OSCILLATOR MUSEUM: http://www.n4mw.com

COLLINS REPAIR - Specializing in S-Line and KWM2. Precision Collins Services, N6HK 661-822-6850. n6hk@csurfers.net

FOR SALE: 2-WE212D Make offer, local pick-up only. 425-746-9949, W7KKS

OUR Asheville, NC **Southern Appalachian Radio Museum** keeps history alive! - www.saradiomuseum.org

TELEGRAPH KEYS wanted by collector. Bugs and unusual or unique straight keys or sounders, and tube electronic keyers. Also pre-1950 callbooks. Vince Thompson, K5VT, 3410 N. 4th Ave., Phoenix, AZ 85013. 602-840-2653.

W4QCF MANUALS - buy/sell, www.w4qcfmanuals.com

Wanted GRC 109 receiver and accessories to complete outfit. Please contact Charles Wilson, MØCCD, 143 Cradge Bank, Spalding, Lincolnshire, England PE11 3AF. Tel. 0044 1775 766398

WANTED: pre-1925 battery radios, crystal sets, and vacuum tubes. Also early telegraph keys and pre-1900 electrical apparatus. Jim Kreuzer, N2GHD, 1541 Bronson Road, Grand Island, NY 14072. 716-773-4999. wireless@pce.net

QSL Cards/Call Sign Novelties

250 QSL CARDS $20.00 postpaid. We also print color QSL cards, eyeball cards etc. Send stamp for sample. Vaso Nagl, KD4WVK, 832 Woodcraft Drive, Nashville, TN 37214

AFFORDABLE QSL CARDS, available in small quantities with lots of options. Parma Graphics, K2BKA, 5 Rondout Harbor, Port Ewen, NY 12466. 845-339-1996.

CALL SIGN NAME BADGES. Club logos our specialty. Certified ARRL engraver. Capital Engraving, 3109 Marigold St, Longview, Washington 98632-3415. Al, WA7UQE. capengrave@kalama.com. http://www.kalama.com/~capengrave/

ENGRAVING: Callsign/name badges by WØLQV. Send for price list. Box 4133, Overland Park, KS 66204-0133. E-mail: LQ225147@juno.com

FREE SAMPLES. The QSLMAN®, Box 73, Monetta, SC 29105. Phone/FAX (803) 685-7117 anytime. Email: w4mpy@qslman.com. Always 100% satisfaction guarantee on anything we do. Check the web site at: http://www.qslman.com

NAME TAGS BY GENE: In full color, our artwork or yours. See our web page for samples and prices. **www.hampubs.com** Harlan Technologies 815-398-2683

NEW 2004 CATALOG READY! Call, write, email, or FAX for yours! SKYWARN, RACES, ARES supplies plus more. CAPS Unlimited/ SKYWARN Supply.com 972-496-6036; k5hgl@attbi.com, POB 460118 — Garland, TX 75046-0118.

OVERSEAS AIRMAIL POSTAGE plus complete line of airmail envelopes. Order directly from our web site — James E. Mackey, proprietor. www.net1plus.com/users/ryoung/index.htm

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.

MFJ's *MightyLites*™ are so light and small you can carry them in the palm of your hand! Take them with you anywhere.

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

MFJ's 25 Amp *MightyLite*™ weighs just 3.7 lbs. -- that's *5 times lighter* than an equivalent conventional power supply. MFJ's 45 Amp is even more dramatic -- *8 times lighter* and weighs just 5.5 pounds!

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. 5½Wx2½Hx10¾D 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

MFJ-1118
$74.95
plus s&h

MFJ-1116
$49.95
plus s&h

MFJ-1112
$34.95
plus s&h

New!
MFJ-1117
$54.95

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.

Free MFJ Catalog

Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(662) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (662) 323-6551; **Add s/h**
Tech Help: (662) 323-0549

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

General

Fax 605-886-3444

Burghardt INC. AMATEUR CENTER

Technical & Info 605-886-7314

1-800-927-4261

710 10th Street SW, Watertown, SD 57201

Call for Repack Special Pricing!

Call for your best price!

HEARD IT. WORKED IT. LOGGED IT!

Icom IC-756PROII *Plus Free PS-125**

SUPERCHARGED PERFORMANCE!

Icom IC-746PRO *Plus Free PS-125**

FREE PS-125 POWER SUPPLY

*When you buy a new 'PROII or '746PRO**

*This is a limited time offer. Call for details.

GO QRP!

Icom IC-703

Shown with Optional LC-156 Backpack

WE WANT TO BE "YOUR" RADIO DEALER

Check us out on the web (updated daily!)

www.burghardt-amateur.com

or e-mail us at
hamsales@burghardt-amateur.com

PROVEN PERFORMANCE!

Icom IC-706MKIIG

*Plus Free RMK-706 Remote Mount Kit**

GET INTO HF!

Icom IC-718

*Plus Free UT-106 DSP**

Serving Amateur Radio Operators Since 1937

6606

Jobs

Index of Advertisers

Advertising Department Staff:
Debra Jahnke, Sales Manager
Joe Bottiglieri, AA1GW, Accounts Manager
Diane Szlachetka, Advertising Graphic Designer

Toll Free: 800-243-7768
Direct Line: 860-594-0207 Fax: 860-594-4285
E-mail: ads@arrl.org Web: www.arrl.org/ads

For links to the Web sites of ARRL advertisers, visit **www.arrl.org/ads/adlinks.html**

Please patronize ARRL advertisers. Support those who support ARRL!

QST Advertising Deadlines:

Issue	Reservation Date	Materials Due Date
June 2004	Wednesday, April 14, 2004	Monday, April 19, 2004
July 2004	Tuesday, May 18, 2004	Thursday, May 20, 2004

Your Customers are Reading...QST!

If your company provides products or services of interest to our Members, please contact the ARRL Advertising Department today for information on building your business.

SAVE BIG ON ANTENNAS, TOWERS & CABLE

TELESCOPING ALUMINUM TUBING

DRAWN 6063-T832

.375	$.70/ft	1.375"	$1.75/ft
.500"	$.80/ft	1.500"	$1.95/ft
.625"	$.90/ft	1.625"	$2.25/ft
.750"	$1.00/ft	1.750"	$2.50/ft
.875"	$1.10/ft	1.875"	$2.75/ft
1.000"	$1.20/ft	2.000"	$3.00/ft
1.125"	$1.35/ft	2.125"	$3.50 /ft

In 6' or 12' lengths, 6' lengths ship UPS. Call for 3/16" & 1/4" rod, bar stock, and extruded tubing.

CUSHCRAFT ANTENNAS

13B2/A148-10S	$159/89
A270-6S/A270-10S	$79/99
A3S/A4S	$459/549
A50-3S/5S/6S	$99/169/269
A6270-13S	$199
AR2/ARX2B	$55/69
AR270/AR270B	$89/99
R6000/R8	$309/459
X7/X740	$649/269
XM240	$679

Please call for more Cushcraft items.

FORCE 12–MULTIBAND

C3	10/12/15/17/20m, 7 el	$599
C3E	10/12/15/17/20m, 8 el	$649
C3S	10/12/15/17/20m, 6 el	$539
C3SS	10/12/15/17/20m, 6 el	$559
C4	10/12/15/17/20/40m, 8 el	$759
C4S	10/12/15/17/20/40m, 7 el	$679
C4SXL	10/12/15/17/20/40m, 8 el	$979
C4XL	10/12/15/17/20/40m, 9 el	$1119
C19XR	10/15/20m, 11 el	$959
C31XR	10/15/20m, 14 el	$1299

Please call for more Force 12 items.

TRYLON "TITAN" TOWERS

SELF-SUPPORTING STEEL TOWERS

T200-64	64', 15 square feet	$1209
T200-72	72', 15 square feet	$1429
T200-80	80', 15 square feet	$1649
T200-88	88', 15 square feet	$1949
T200-96	96', 15 square feet	$2249
T300-88	88', 22 square feet	$2189
T400-80	80', 34 square feet	$2089
T500-72	72', 45 square feet	$1979
T600-64	64', 60 square feet	$1869

Many more Trylon towers in stock!

BENCHER / BUTTERNUT

Skyhawk, Triband Beam	$1129
HF2V, 2 Band Vertical	$249
HF5B, 5 Band Minibeam	$359
HF6VX, 6 Band Vertical	$339
HF9VX, 9 Band Vertical	$369
A1712, 12/17m Kit	$54
CPK, Counterpoise Kit	$129
RMKII, Roof Mount Kit	$159
STRII, Roof Radial Kit	$125
TBR160S, 160m Kit	$139

More Bencher/Butternut–call

M2 VHF/UHF ANTENNAS

144–148 MHz

2M4/2M7/2M9	$95/109/129
2M12/2M5WL	$165/209
2M5-440XP, 2m/70cm	$179

420–450 MHz

440-470-5W/420-450-11	$139/95
432-9WL/432-13WLA	$179/239
440-18/440-21ATV	$129/149

Satellite Antennas

2MCP14/2MCP22	$169/239
436CP30/436CP42UG	$239/279

ROHN TOWER

25G/45G/55G	$89/189/239
25AG2/3/4	$109/109/119
45AG2/4	$209/225
AS25G/AS455G	$39/89
BPC25G/45G/55G	$75/99/110
BPL25G/45G/55G	$85/109/125
GA25GD/45/55	$68/89/115
GAR30/GAS604	$35/24
SB25G/45/55	$39/89/109
TB3/TB4	$85/99

Please call for more Rohn prices.

US TOWER

MA40/MA550	$999/1549
MA770/MA850	$2599/3999
TMM433SS/HD	$1349/1649
TMM541SS	$1789
TX438/TX455	$1279/1749
TX472/TX489MDPL	$2899/7299
HDX538/HDX555	$1499/2549
HDX572MDPL	$6669

Please call for help selecting a US Tower for your needs. Shipped factory direct to save you money!

COMET ANTENNAS

GP15, 6m/2m/70cm Vertical	$149
GP6, 2m/70cm Vertical	$139
GP9, 2m/70cm Vertical	$169
B10NMO, 2m/70cm Mobile	$36
SB14, 6m/2m/70cm Mobile	$59
SBB224NMO,2m/220/70cm	$69
SBB2NMO, 2m/70cm Mobile	$39
SBB5NMO, 2m/70cm Mobile	$49
SBB7NMO, 2m/70cm Mobile	$69
UHV4/UHV6	$109/135

Much more Comet in stock–call.

M2 ANTENNAS

50–54 MHz

6M5X/6M7JHV	$209/269
6M2WLC/6M9KHW	$459/499

10/12/15/17/20m HF

10M4DX, 4 Element 10m	$399
12M4DX, 4 Element 12m	$399
15M4DX, 4 Element 15m	$449
17M3DX, 3 Element 17m	$399
20M4DX, 4 Element 20m	$529

More M2 models in stock–please call.

GLEN MARTIN ENGINEERING

Hazer Elevators for 25G

H2, Aluminum Hazer, 12 sq ft.	$359
H3, Aluminum Hazer, 8 sq ft	$269
H4, HD Steel Hazer, 16 sq ft	$339

Aluminum Roof Towers

RT424, 4 Foot, 6 sq ft	$159
RT832, 8 Foot, 8 sq ft	$239
RT936, 9 Foot, 18 sq ft	$389
RT1832, 17 Foot, 12 sq ft	$519
RT2632, 26 Foot, 9 sq ft	$869

UNIVERSAL ALUMINUM TOWERS

4-40'/50'/60'	$539/769/1089
7-50'/60'/70'	$979/1429/1869
9-40'/50'/60'	$759/1089/1529
12-30'/40'	$579/899
15-40'/50'	$1019/1449
23-30'/40'	$899/1339
35-30'/40'	$1019/1569

Bold in part number shows wind-load capacity. Please call for more Universal models. All are shipped factory direct to save you money!

DIAMOND ANTENNAS

D130J/DPGH62	$79/139
F22A/F23A	$89/119
NR72BNMO/NR73BNMO	$39/54
NR770HBNMO/NR770RA	$55/49
X200A, 2m/70cm Vertical	$129
X500HNA/X700HNA	$229/369
X510MA/510NA	$189/189
X50A/V2000A	$99/149
CR627B/SG2000HD	$99/79
SG7500NMO/SG7900A	$75/112

More Diamond antennas in stock.

MFJ

259B	$219
269	$299
941E	$109
945E	$99
949E	$139
969	$169
986	$289
989C	$309
1798, 80–2m Vertical	$249
1796, 40/20/15/10/6/2m Vert.	$189

Big MFJ inventory–please call

COAX CABLE

RG-213/U, (#8267 Equiv.)	$.36/ft
RG-8X, Mini RG-8 Foam	$.19/ft
RG-213/U Jumpers	Please Call
RG-8X Jumpers	Ple ase Call

Please call for more coax/connectors.

TOWER HARDWARE

3/8"EE / EJ Turnbuckle	$11/12
1/2"x9"EE / EJ Turnbuckle	$16/17
1/2"x12"EE / EJ Turnbuckle	$18/19
3/16" / 1/4" Big Grips	$5/6

Please call for more hardware items.

TIMES MICROWAVE LMR® COAX

LMR-400	$.59/ft
LMR-400 Ultraflex	$.89/ft
LMR-600	$1.19/ft
LMR600 Ultraflex	$1.95/ft

HIGH CARBON STEEL MASTS

5 FT x .12" / 5 FT x .18"	$35/59
10 FT x .18" / 11 FT x .12"	$129/80
16 FT x .18" / 17 FT x .12"	$179/129
20 FT x .25" / 21 FT x .18"	$315/235
22 FT x .12" / 24 FT x .25"	$149/379

GAP ANTENNAS

Challenger DX	$289
Challenger Counterpoise	$29
Challenger Guy Kit	$19
Eagle DX	$299
Eagle Guy Kit	$29
Titan DX	$329
Titan Guy Kit	$29
Voyager DX	$409
Voyager Counterpoise	$49
Voyager Guy Kit	$45

Please Call for Delivery Information.

LAKEVIEW HAMSTICKS

9106	6m	9115	15m 9130 30m
9110	10m	9117	17m 9140 40m
9112	12m	9120	20m 9175 75m

All handle 600W, 7' approximate length, 2:1 typical VSWR...$24.95

HUSTLER ANTENNAS

4BTV/5BTV/6BTV	$129/169/199
G6-270R, 2m/70cm Vertical	$169
G6-144B/G7-144B	$109/179

Hustler Resonators in stock–call.

ANTENNA ROTATORS

M2 OR-2800P	$1249
Yaesu G-450A	$249
Yaesu G-800SA/DXA	$329/409
Yaesu G-1000DXA	$499
Yaesu G-2800SDX	$1089
Yaesu G-550/G-5500	$299/599

ROTATOR CABLE

R62 (#18)	$.32/ft.
R81/82	$.25/ft./.39/ft.
R84	$.85/ft

PHILLYSTRAN GUY CABLE

HPTG1200I	$.45/ft
HPTG2100I	$.59/ft
PLP2738 Big Grip (2100)	$6.00
HPTG4000I	$.89/ft
PLP2739 Big Grip (4000)	$8.50
HPTG6700I	$1.29/ft
PLP2755 Big Grip (6700)	$12.00
HPTG11200	$1.89/ft
PLP2758 Big Grip (11200)	$18.00

Please call for help selecting the Phillystran size for your application.

WEEKDAY HOURS:
9 AM–5 PM CST

SATURDAY HOURS:
9 AM–12 NOON CST

CREDIT CARDS:
M/C, VISA, DISCOVER

TEXAS TOWERS

A Division of Texas RF Distributors, Inc. • 1108 Summit Avenue, Suite #4 • Plano, TX 75074

(800) 272-3467

LOCAL CALLS:
(972) 422-7306

EMAIL ADDRESS:
sales@texastowers.com

INTERNET ADDRESS:
www.texastowers.com

HUGE ICOM DEALS ★ HUGE YAESU DEALS

IC-756PROII..... Icom Special!
The Icom IC-756PROII is an all mode HF and 6m transceiver featuring 32-bit digital signal processing, auto antenna tuner, 100 watts RF output, digital twin PBT, 5" multifunction color TFT LCD display with band scope function, built-in CW and SSB memory keyers, and more. Supplied with hand mic and DC power cord.

PW-1..... In Stock!
The Icom PW-1 is a 1000 watt solid state linear amplifier for HF and 6m operation, featuring a high power automatic antenna tuner, built-in power supply, and a removable front control panel, and more.

IC-746PRO..... In Stock!
The Icom IC-746PRO is an all mode HF/6m/2m XCVR with 32-bit IF level DSP. The radio features a built-in auto tuner, built-in RTTY demodulator and decoder (reads out on the radio's LCD display), auto notch, digital twin PBT, and more. Supplied hand mic and DC power cord.

IC-910H ..... In Stock!
All-mode 2m/70cm dual band transceiver, featuring dual data inputs, CTCSS encode/decode, CW keyer, satellite mode, scan, sweep display function, optional 23cm module, optional DSP, and more. Supplied with hand mic and DC power cord.

FT-1000MP-V..... Yaesu Special!
Competition class HF DSP transceiver with auto tuner, 200 Watts RF output, and more!

FT-1000MP-V Field .....Special!
Low power (100W) version of the FT-1000MP-V, with built-in power supply.

FT-920 ..... Yaesu Special!
All mode HF/6m XCVR featuring DSP, auto tuner, and more. With up/down hand microphone and DC power cord.

Quadra System ..... In Stock!

FT-897..... In Stock!
"Backpack" all-mode HF/6m/2m/70cm XCVR offering 100 watts of output power! The radio can be run from optional internal batteries with reduced output of 20 watts, or an optional internal power supply can be installed instead. An optional bolt-on external auto tuner is also available. The FT-897 is a truly self-contained portable!

FT-847..... Yaesu Special!
Great all-mode XCVR covering HF/6m/2m/70cm! The radio is perfect for satellite operation, and features DSP, CTCSS tone encode/decode, and more. Supplied with microphone and DC power cord.

IC-703 ..... New, In Stock!
IC-703PLUS..... New, In Stock!
The Icom IC-703 is a compact HF XCVR, with built-in auto tuner, DSP, and more! The IC-703PLUS adds 6m coverage.

IC-706MK2G..... Icom Special!
The Icom IC-706MK2G is a compact HF/6m/2m/70cm all mode XCVR with DSP, CW keyer, built-in CTCSS encode/decode/scan, 107 memoriess and more. A detachable front panel offers convenient mounting, even in compact vehicles.

IC-718 ..... New Lower Price!

IC-2720H..... New!
Dual band 2m/70cm FM XCVR. Features remote control panel, CTCSS tone encode/decode/scan, cross band repeat, data jack, dual RX, extended RX, 212 memories, and more. Supplied with a DTMF hand mic, separation cable, mounting brackets, and a fused DC power cord.

IC-V8000..... In Stock!
Great 75W 2m mobile XCVR. Features CTCSS tone encode/decode/scan, 207 memories, front panel mounted speaker, and more. Supplied with a DTMF hand mic, mounting bracket, and DC cord.

FT-8900R..... In Stock!
Quad band mobile XCVR covers 10m/6m/2m/70cm, with cross-band repeat.

FT-8800R ..... New, In Stock!
Great 2m/70cm dual band mobile, 45/35 Watts, removable front panel, and more!

FT-7800R..... New, Please Call!
New, 2m/70cm dual band mobile XCVR.

FT-2800M ..... In Stock!
Rugged, 50W 2m mobile transceiver.

FT-857..... Now In Stock!
Ultra-compact all mode XCVR for HF/6m/2m/70cm. Features CW memory keyer, CTCSS encode/decode, 200 memories, optional DSP, and more. Supplied with a hand microphone, a fused DC power cord and mounting bracket.

FT-817..... In Stock!
A truly tiny self-contained all mod e HF/6m/2m/70cm QRP XCVR featuring tone encode/decode, 200 memory channels, VOX, and more! With hand microphone.

IC-T2H Sport.... Great Low Price!
IC-Q7A..... Great Low Price!
IC-T7H..... Icom Special!
IC-V8..... Great Low Price!
IC-W32A..... Now In Stock!
IC-T90A..... New, In Stock!

IC-208H..... Great Low Price!
A great 2m/70cm dual band mobile XCVR, featuring CTCSS tone encode/decode, 500 memories, removable control panel, and more. With a back-lit DTMF hand mic, mounting bracket, and a DC power cord.

IC-2100H..... Great Low Price!
Rugged 2m mobile XCVR with CTCSS tone encode/decode/scan, DTMF paging/squelch, 113 memories, and more.

IC-PCR1000..... In Stock!
IC-R8500/R75..... In Stock!
IC-R3/R5/R10..... In Stock!

G-2800DXA..... $1089
Heavy duty antenna rotator handles 34 sq. ft. of antenna load, and features 450° rotation, preset and variable speed.

G-1000DXA..... $499
G-800SA/DXA.....$329/409
G-450A.....$249
G-5500 ..... $599
G-550 ..... $299

FT-50RD..... New Lower Price!
VR-120D ..... In Stock!
VR-500 ..... In Stock!
VX-2R..... New, In Stock!
VX-5R..... New Lower Price!
VX-7R ..... New Lower Price!
VX-150..... New Lower Price!

WEEKDAY HOURS:
9AM–5PM CST

SATURDAY HOURS:
9AM–NOON CST

CREDIT CARDS:
M/C, VISA, DISCOVER

TEXAS TOWERS

A Division of Texas RF Distributors, Inc. • 1108 Summit Avenue, Suite #4 • Plano, TX 75074

(800) 272-3467

LOCAL CALLS:
(972) 422-7306

EMAIL ADDRESS:
sales@texastowers.com

INTERNET ADDRESS:
www.texastowers.com

DX DNA

In the fifteen years since it was born,
the FT-1000D has been recognized as the apex of performance
among elite-class HF base stations.

Now experience the rebirth of the renowned FT DX series,
bearing the electronic DNA from the FT-1000D
but advanced far more than just one generation. Or even two. . .

FT DX 9000

The radio... YAESU
Choice of the World's top DX'ers

YAESU
Choice of the World's top DX'ers℠
Vertex Standard
US Headquarters
10900 Walker Street
Cypress, CA 90630 (714)827-7600

For the latest Yaesu news, visit us on the Internet:
http://www.vxstdusa.com

Specifications subject to change without notice. Some accessories and/or options may be standard in certain areas. Frequency coverage may differ in some countries. Check with your local Yaesu Dealer for specific details.

Taking HF By Storm

The TS-480 Series

KENWOOD
Amateur Radio Products Group

KENWOOD U.S.A. CORPORATION
Communications Division
Division Headquarters
3975 Johns Creek Court, Suwanee, GA 30024-1265
Customer Support/Distribution
P.O. Box 22745, 2201 East Dominguez St., Long Beach, CA 90801-5745
Customer Support: (310) 639-4200 Fax: (310) 537-8235

INTERNET
Kenwood News & Products
http://www.kenwood.net

#040204

JQA-1205 091-A
ISO9001 Registered
Communications Equipment Division
Kenwood Corporation
ISO9001 certification