Official Journal of
ARRL
The national association
for AMATEUR RADIO

QST

devoted entirely to

AMATEUR RADIO

July 2004

QST reviews

WiNRADiO G303i
Shortwave Receiver

Kenwood TH-K2AT 2 Meter
Handheld Transceiver

Cu loops for 222 and 440 MHz

Remote dc power through your coax

The technical side of FM

A touch sensor keyer paddle

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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

NEW IC-R20
ULTRA-WIDEBAND RECEIVER

Catch & Release!

And NO License Required!

Casting around for your next strike in a handheld receiver/scanner? Scale up your listening pleasure. On-the-fly, Icom's IC-R20 allows you to digitally record and play back up to 4 HOURS* of whatever you want to tune in on. *Zzzzzzzzzing!*

- **150kHz – 3.3GHz** (cellular blocked)
- **SSB/CW/AM/FM/WFM**
- **Dual Watch** – on the R20's easy-to-see, dot-matrix LCD. It, and the keypad, has backlighting
- **Internal Bar Antenna** – for improved low-band reception
- **1250 Memory Channels** – enter by front panel, or by optional PC software
- **Icom's Dynamic Memory Scan (DMS)** – store memories in up to 18 banks of 100, then mix and match your memories to scan as you like. Plus link the banks!
- **1650 mAh Li-Ion battery** – powerful, lightweight, and lasts for many hours of listening pleasure. Recharger included
- **Telescoping Antenna** – multi-angled, with popular BNC connection
- **CTCSS/DTCS/DTMF Decode** – listen in on the repeaters and "channelized" transmissions
- **Pre-Set Most Popular Memories** – fast access to all broadcast TV and FM radio frequencies
- **And Much More!** – Auto Squelch, Noise Blanker, Auto Noise Limiter, Attenuator and RF Gain controls, Multiple Scan functions (including Voice Scan Control), CI-V ready, and still more! Even a USB cloning cable is included!

Stop floundering and start listening, even if just for the halibut. With the R20, you'll be shouting WAHOO! Perch yourself at your favorite authorized dealer – they'll net you a reel good deal!

Dual Watch Between Bands!

download frequencies right from the web

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Coming Soon!

Download the FCC registered frequencies for any U.S. area–FREE.

Then download them straight into your R20 using Icom's optional cloning software.

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*1, 2 or 4 hours, depending on record compression level.

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 reliability. *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	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
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	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
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	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
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!*

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.

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	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
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	5000 in.-lbs.
Brake Power	**7500 in.-lbs.**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight	61 lbs.
Effective Moment (in tower)	**5000 ft.-lbs.**

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.

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SG7500NMO


SG7900A
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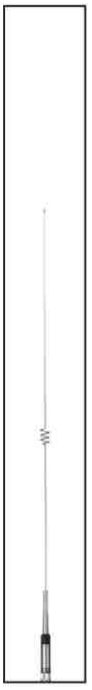
SGM911


NR72BNMO


NR73BNMO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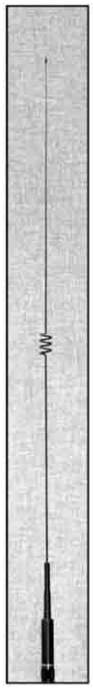
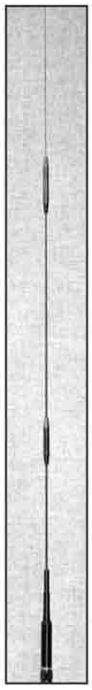

NR770HNMO
NR770HBNMO


CR627B
CR627BNMO

HV7A Mobile Antenna System

For New HF/VHF transceivers

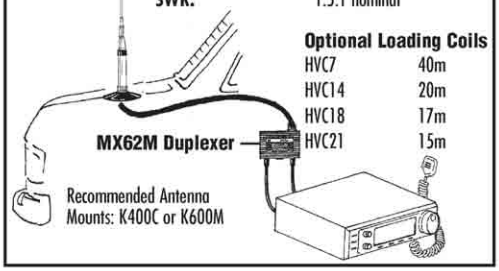
(Such as: IC706 series, FT100 & NEW FT8900R)

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

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Technical

News and Features

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QST Workbench

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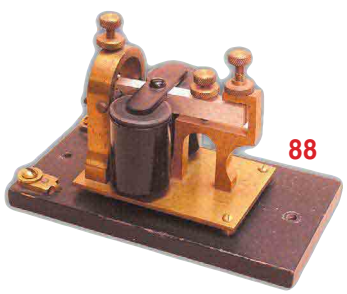

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Operating

Departments

Our Cover
Author W8NUE presents two versions of a rugged touch sensor keyer paddle. With no mechanics, it's ideal for home or the field. Photos courtesy Milt Cram, W8NUE.

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.

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*Payment arrangements available. Please write for details.

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The Ultimate in Dual Band Mobile Operating Ease!

The exciting YAESU FT-8800R Dual Band Mobile is the rig you've asked for, and it's available now! With a powerful 50 Watts of 2-meter power output (70 cm: 35 W), wide receive coverage, 800+ memory channels with 10 memory groups, independent two-channel operation (V/V, U/U, V/U), optional remote-head mounting kit, and cross-band repeater capability, the FT-8800R is packed with the features you demand, at a price you'll enjoy. And its superb ergonomics and creative firmware design make the FT-8800R the easiest Dual Bander to operate while driving!

144/430 MHz DUAL BAND

ACTUAL SIZE
*Simulated LCD display

FT-8800R
144/430 MHz FM DUAL BAND TRANSCEIVER

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.

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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)

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DSP
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ULTRA COMPACT
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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℠

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

Will Outperform Any Other Commercially Available Multi-band Antenna on 40m-10m!

4 Elements: 3 at 70 ft., 1 at 36 ft.
3 Active Elements: 6.9-13.5 MHz
4 Active Elements: 13.5-54.0 MHz
New: 100 MPH Wind Rating
Wind Load: 22.9 Square Feet
Weight: 169 Lbs.

Introductory Price:
only $3495.00

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.

SteppIR Antennas

23831 SE Tiger Mt. Rd.
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Toll Free: 866-STEPPIR (783-7747)

www.steppir.com

Protected by the following Patent: 66/7914

"IT SEEMS TO US..."

BPL—A Blind Alley

Speaking at the American Association of Community Colleges Annual Convention in Minneapolis on April 26, President George W. Bush said: "There needs to be technical standards to make possible new broadband technologies, such as the use of high-speed communication directly over power lines. Power lines were for electricity; power lines can be used for broadband technology. So the technical standards need to be changed to encourage that."

Mr Bush is wrong. Technical standards do *not* "need to be changed to encourage" Broadband over Power Lines (BPL). Even the self-proclaimed "cheerleaders" for BPL at the FCC realize that the rules already are too lenient when it comes to controlling the potential for BPL to interfere with over-the-air radiocommunication services.

Where did the idea for Mr Bush to promote BPL come from? Not from the experts that he asked for advice on "Building Out Broadband." On December 13, 2002 the President's Council of Advisors on Science and Technology (PCAST) delivered a report with that title. The PCAST report doesn't even *mention* BPL; its focus is on wireless broadband.

Everyone is in favor of increasing consumer access and lowering the cost of broadband services. During the past three years the United States has slipped behind other countries, notably those in Scandinavia, in its readiness to take advantage of Internet-based opportunities. In an election year, the administration's desire to be perceived as doing something about that is understandable. But there is growing evidence that BPL is a blind alley.

As radio amateurs, our concern about BPL is that it pollutes the radio spectrum. Were it not for this unfortunate side effect, BPL could be left to succeed or fail on its economic merits. We are not opposed to BPL; we are opposed to the interference it causes.

The problem facing BPL proponents is that radiation is unavoidable when you put a radio-frequency signal on an unshielded, unbalanced wire such as a power line. The power lines can't be shielded—a separate shielded cable is much cheaper—and they are inherently unbalanced because the load is changing all the time. So, power lines inherently are an inappropriate medium for broadband signals.

On the day after Mr Bush's speech the National Telecommunications and Information Administration (NTIA) released Phase 1 of its long-awaited study of BPL interference potential. The technical content of the report reflects the high quality we have come to expect from the NTIA. However, somewhere along the line the NTIA apparently received instructions to find a way to make elephants fly. As a result the report suffers from schizophrenia. Directly contradicting the FCC's claims in the BPL Notice of Proposed Rule Making that "the risk of harmful interference from Access BPL operations is low," the NTIA found that interference is "likely" to receivers trying to hear "low to moderate" signal levels extending to 75 meters (about 250 feet) for land vehicles and 460 meters (1/4 mile) for fixed stations. Land vehicles are nearly always within 250 feet of a power line—and needless to say, most fixed stations are within 1/4 mile of a power line. Even more remarkably, the NTIA report predicts interference to aircraft reception "within 40 km of the center of the BPL deployment area." For the metrically challenged, that's *25 miles*. Yet the NTIA does not take the logical next step of recommending a lower limit for BPL radiation. Instead the Phase 1 study suggests "several means by which BPL interference can be prevented should it occur." These include mandatory registration of certain parameters of planned and deployed BPL systems, frequency agility (notching and/or retuning), and "power reduction for elimination of interference." NTIA also recommends "avoidance of locally used radio frequencies," among other things, to BPL developers.

In a May 17 speech, NTIA Acting Assistant Secretary Michael D. Gallagher said the Phase 1 study "showed that interference risks are high under existing FCC Part 15 rules." However, he also claimed that "solutions exist to all identified BPL technical issues." This is true only if turning BPL systems off, and leaving them off, is counted as a "solution." We doubt that investors in BPL would regard that as a desirable outcome.

In May we said on this page that the important decisions about BPL deployment would be made in corporate boardrooms. On May 21 we were advised by a spokesman for PEPCO, the operator of a test BPL site in Potomac, Maryland, that a corporate decision has been taken *not* to invest in BPL. If someone were to approach them with a proposal to lease their lines to deliver BPL services, they would listen—but they're not committing any of their own money. We've heard of other power companies and cooperatives that have come to the same conclusion. Of course, such decisions are not heralded to the world by press release.

Manassas, Virginia is an example of a BPL deployment decision gone wrong. Last October the City Council voted unanimously to grant a franchise for BPL service to a company called Prospect Street Broadband LLC. At the time a Manassas official bragged that there was "very little financial risk" to the city. There was talk of as much as $4.5 million in revenue to the City over 10 years—even talk of tax reductions.

Less than six months later, on April 8, the City of Manassas "concluded its relationship with the initial Franchisee by mutual agreement and acquired the interests and equipment of the Franchisee." The franchise is out for rebid. The 77-page bid package makes for interesting reading. It doesn't take an MBA to figure out that operating the system is costing a lot more than it is producing in revenue from 100 paying customers as of the time the bid package was released. Curiously, there is no mention of any of this in the City's comments on the NPRM filed more than three weeks *after* the cancellation of the initial franchise.

Manassas has elected a new mayor who takes office July 1. We wish him luck finding his way out of the BPL blind alley. He'll need it.—*David Sumner, K1ZZ*

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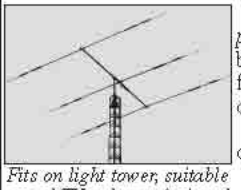

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TH-11DX	11	*For Gain and F/B ratio--See...*		4000	10,12,15,17,20	12.5	100	24	37	22	88	1.9-2.5	T2X	$1159.95
TH-7DX	**7**			**1500**	**10, 15, 20**	**9.4**	**100**	**24**	**31**	**20**	**75**	**1.5-2.5**	**HAM-IV**	**$869.95**
TH-5MK2	5	• www.hy-gain.com		1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	$759.95
TH-3MK4	**3**	• Hy-Gain catalog		**1500**	**10, 15, 20**	**4.6**	**95**	**14**	**27.42**	**15.33**	**35**	**1.9-2.5**	**CD-45II**	**$469.95**
TH-3JRS	3	• Call toll-free		600	10, 15, 20	3.35	80	12	27.25	14.75	21	1.25-2.0	CD-45II	$359.95
TH-2MK3	**2**	800-973-6572		**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 30 & 40 w/kit	7.5	100	14	31.5	17.25	45	1.9-2.5	HAM IV	$599.95

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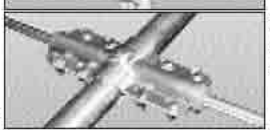
1. **Hy-Gain's** famous super strong *tooled* die cast *Boom-to-Mast Clamp*

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.

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ARRL in ACTION

***YOUR* membership at work**

By Steve Ford, WB8IMY, sford@arrl.org

ARRL Represents Amateur Radio at Broadcast Convention

The National Association of Broadcasters (NAB) produces the world's largest conference and exhibition for the electronic media. This year's convention had an official attendance of 97,544 (an increase of 11% over last year).

FRIED HEYN, WA6WZO

ARRL President Jim Haynie, W5JBP (right), discusses Broadband Over Power Lines with FCC Commissioner Kevin Martin at the 2004 NAB convention.

ARRL President Jim Haynie, W5JBP, Pacific Division Director Bob Vallio, W6RGG, and Honorary Vice President Fried Heyn, WA6WZO, covered programs that were of interest to Amateur Radio and spoke with key people in an effort to promote League goals. The ARRL team joined the Congressional Breakfast (Senator Burns and five US Congressmen), the FCC Chairman's Breakfast (Michael Powell with Sam Donaldson of ABC News) and the Regulatory Face-Off (four FCC Commissioners and the head of NTIA). Also, President Haynie was the main speaker at a local ham leadership get-together organized by Nevada Section Manager Dick Flanagan, K7VC.

The highlight for amateurs at the show was the Amateur Radio Operators' Reception sponsored by Bob Heil, K9EID, of Heil Sound. Nearly 1000 amateurs were in attendance.—*Fried Heyn, WA6WZO*

2004 Digital Communications Conference

The ARRL and Tucson Amateur Packet Radio (TAPR) join forces again this year to sponsor the Digital Communications Conference. DCC 2004 is being held in Des Moines, Iowa September 10-12. You'll be treated to forums on a variety of topics including APRS, software defined radio, high-speed multimedia and more. More information is available on the Web at **www.tapr.org/dcc**.

ARRL Volunteers Host ARES-NTS Seminar

ARRL members active in the Amateur Radio Emergency Service (ARES) and the National Traffic System (NTS) in Eastern Massachusetts met Saturday, April 24 in Bridgewater to foster greater cooperation between their respective programs. Section Manager Phil Temples, K9HI, called for the workshop in light of recent reports and recommendations by the League's Volunteer Resources Committee, and the ad hoc ARES Committee.

"It was a great day where much was accomplished," concluded Assistant Section Emergency Coordinator Rob Macedo, KD1CY. Macedo coordinated and chaired the workshop.

"I'm very pleased with the progress we made this past weekend," commented K9HI. "Folks from the NTS voice nets, digital nets and ARES leadership sat down and discussed their mutual needs and problems. There was no animosity between the different camps. I want to especially thank Carl, N1FY, and members of the Massasoit Amateur Radio Association for hosting the meeting at the Bridgewater EOC," Temples added.

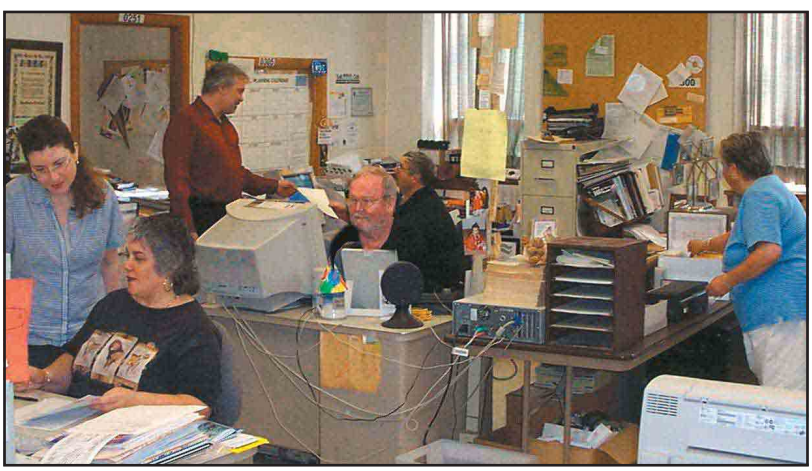
20 Years of the ARRL VEC

This year the ARRL Volunteer Examiner Coordinator program celebrates its 20th anniversary. According to Bart Jahnke, W9JJ, ARRL VEC manager, the program is still going strong. "We're churning through 30,000 applications annually, which is remarkable when you consider that only six people work in this department."

The ARRL VEC presently serves more than 25,000 currently accredited volunteer examiners throughout the world, processing applications for new licenses, upgraded licenses and more. "We're the top VEC program in the nation," Bart says, "with all credit due to the extraordinary contributions of our VEs. This program isn't about a few staff in Newington—it's all about the hard work of our volunteers giving something back to their communities."

In addition to processing a mountain of paperwork and serving the needs of its volunteer examiners, the ARRL VEC also reminds members when their licenses are about to expire. Every ARRL member receives a reminder in the mail when his or her license is within about 14 weeks of expiration.

To learn more about how the ARRL VEC has evolved over the last two decades, see the 20th Anniversary article in this issue.



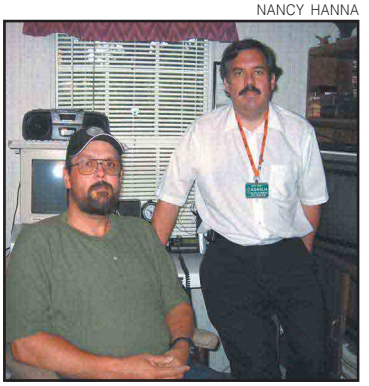
The ARRL VEC processes more than 30,000 applications annually.

A Dream Comes True in South Carolina

Nancy Hanna works at a hospital along with South Carolina Assistant Public Information Coordinator Mike Duff, KG4SLH. During a conversation, Nancy described how her husband Jerl had become extremely ill, losing both of his kidneys to disease. As they talked, she mentioned that her husband had always dreamed of getting his Amateur Radio license. Unfortunately, Jerl was frequently hospitalized and too weak to travel to take an exam.

Mike advised Nancy on which study guides to purchase for Jerl. In the meantime, he arranged for a special VE session for Jerl alone.

NANCY HANNA



Jerl, KI4CBL (seated) and Mike, KG4SLH.

On August 26, 2003, Jerl passed his Technician exam and became KI4CBL. Mike started a fundraiser for Jerl and collected enough money to buy a 2-meter rig and power supply. Others donated the antenna and coax. Mike, along with Bobby Collins, KG4BZK and Mac Cullom, K4AVR, drove to Jerl's home in Hemingway, South Carolina, and assembled the station. Not only is Jerl now an active ham, he is a member of the ARRL and the ARRL-affiliated Florence Amateur Radio Club in Florence, South Carolina (**www.w4ulh.org**).—*Dr James Boehner, N2ZZ, South Carolina Section Manager*

ARRL Technical Relations Staff Journeys to Geneva

Walt Ireland, WB7CSL, of the ARRL Technical Relations staff attended meetings of Working Party 6E and Study Group 6 of the ITU Radiocommunication Sector in Geneva, Switzerland, April 29-May 7. Study Group 6 handles technical matters for the broadcasting services and Working Party 6E specializes in terrestrial broadcasting. David Sumner, K1ZZ, and Ken Pulfer, VE3PU, attended the WP 6E meeting for the International Amateur Radio Union (IARU).

The IARU remains involved in WP 6E, as it was during preparations for WRC-03, because this is a key group in the technical preparations for WRC-07. The use of much of the spectrum between 4 and 10 MHz will be reviewed at that conference; HF broadcasters would like an additional 250 to 800 kHz to be allocated to them in this frequency range, which inevitably would impact the allocations to other services.

Broadcasters remain very concerned about interference from Broadband over Power Lines (BPL). The NTIA report was released just before the start of the meeting and many attendees had the opportunity to download and read it. The report added to their concerns because it documents BPL emissions at levels far above what would cause interference to HF broadcasting reception.

League Volunteers Assist Salvation Army Disaster Conference

The Salvation Army Disaster Conference was held May 2-4 near Tahlequah, Oklahoma. The Amateur Radio portion of the conference featured forums on assembling HF stations, antenna design, station testing and emergency operation. Discussions also included techniques for checking into the Oklahoma ARES net, as well as descriptions of the CERT program and the development of Memorandums of Understanding (MOUs).

Attendees also networked with State Department of Emergency Administrators and pastoral staff. Presenters included Oklahoma Section Affiliated Club Coordinator Jim Richardson, N5OHL; Assistant Section Manager Eddie Manley, K5EMS, and Bill Crossland, N9SQV. Conference facilitators included Mark Hamblin, AE5MH, and John Thomason, WB5SYT, the Oklahoma Section Manager.

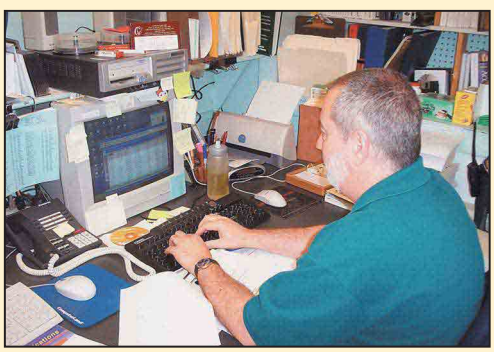
ARRL Hams at BirmingHAMfest

The ARRL was in high profile at the well-attended BirmingHAMfest 2004 in Birmingham, Alabama, May 1-2. Bill Moore, NC1L, DXCC Branch Manager, was checking QSL cards throughout the 2-day event. Bill also spoke at a DXCC forum, fielding questions on several topics, including Logbook of The World. "I had a good crowd at the forum," Bill said, "but little did they know that I had lost my entire *PowerPoint* presentation on the flight down to Alabama. I was awake in my hotel room until 3 AM recreating the whole thing!"

Also at BirmingHAMfest was ARRL Southeastern Division Director Frank Butler, W4RH, and International Amateur Radio Union President Larry Price, W4RA. Both spent much of their time speaking with members at the ARRL booth. They also chaired the ARRL forum at the event.

IT Keeps Headquarters Humming

The Information Technology department at ARRL Headquarters recently completed a network upgrade designed to boost efficiency. Moving bits and bytes with greater efficiency translates to improved communication between departments—and between Headquarters and members.



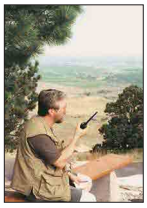
ARRL Programmer/Analyst John Proctor, KB1KJA, monitors activity on the Headquarters network.

"Headquarters still receives written requests for assistance from members, but the overwhelming favorite form of communication is e-mail," said IT department manager Don Durand. "Most League members have e-mail access and they aren't shy about using it! On any given day, we receive thousands of e-mails from members."

The IT staff spends much of its time maintaining the many computers scattered throughout the building. Blunting virus and hacker attacks also keeps them busy. "We're constantly monitoring for intrusions and applying various anti-viral patches," Durand said. "ARRL Headquarters has a very big pipeline to the Internet, so we always have to be on guard. It is a never-ending battle."

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.

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.

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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**.

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.

FCC License Renewal/Modifications Service

At just over 90 days before license expiration, ARRL sends FCC-license renewal notices to ARRL members reminding them to renew. ARRL will also handle duplicate license requests, as well as address or other license changes (upon receipt of a completed and signed Form 605) as a free members-only service.

Educational Materials

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

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**
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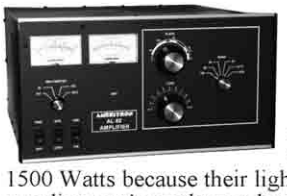

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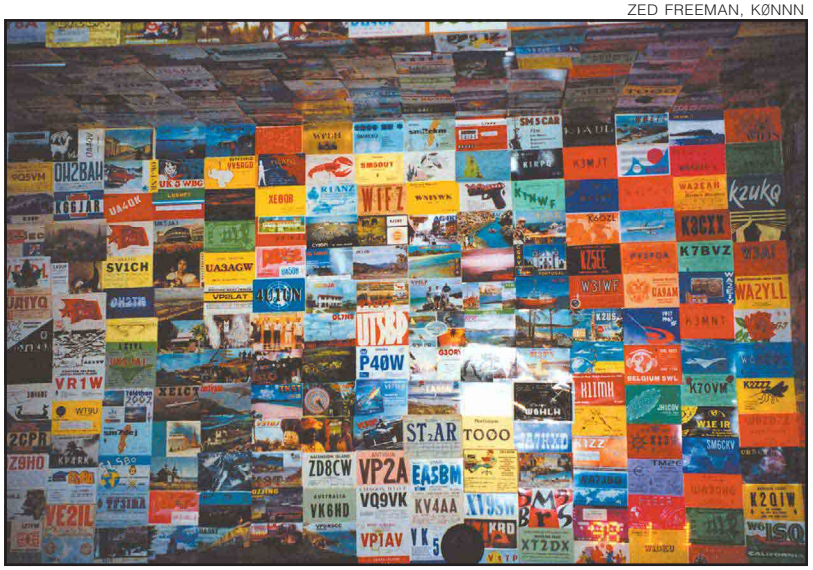


Gives a whole new meaning to the term wallpaper: **"I have quite an unusual shack," writes Zed Freeman, KØNNN, of Bemidji, Minnesota, with a dose of understatement. After collecting his wallpaper for 43 years, Zed used it to spruce up his shack, which was his daughter's room before she left for college.**

HENRYK KOTOWSKI, SMØJHF

70 years...and counting. **Ed Andress, of Poway, California, has held the same call sign, W6KUT, for seven decades. First licensed in Fresno at age 16, he is still quite active from his QTH north of San Diego, where he has impressive antennas for all bands, including 160. In his 70 years on the air, Ed has worked all DXCC entities. His son Kurt, K7NV, is an active contester.**

Every Kid Wins

"Thanks for the radio check and 73. This is KC9EKW, Every Kid Wins, Ryves Hall Amateur Radio Club, QRT."

Jim Edwards, KA9DIF, director of the Ryves Hall Youth Center and trustee of its Amateur Radio Club station, KC9EKW, in Terre Haute, Indiana, puts down the mic of the newly acquired Kenwood TS-2000 transceiver, made possible by a grant from the Rose Hulman Institute of Technology Homework Hotline, and breathed a sigh of satisfaction. Along with volunteers from Vigo County ARES, The Wabash Valley ARA and members of Illiana SKYWARN, Jim was putting the finishing touches on the antenna party.

How did the KC9EKW come to pass? When I was about 11, Jim recalls, I became interested in Amateur Radio. Unfortunately, there was no one out there offering to help me earn my ticket. It wasn't until long after I graduated high school that I finally found a ham class and was licensed. I have found much joy in the hobby and have made many friends.

I started Ryves Hall Youth Center 21 years ago. Although the building was nothing more than a "hole in the ground" at that time, we opened the doors and offered all of our services free of charge to any child walking through our doors. It has always been my hope that someday we could Elmer children and introduce them to a fantastic hobby.

Since 1982 we have served thousands of children, most of whom come from families living in poverty. We are constantly looking for ways to motivate our children to continue in school and hopefully end the cycle of poverty. In November 2002, we completed a building expansion project that tripled the size of our facility—the perfect time to introduce Amateur Radio. We now have a club call (KC9EKW), a decent station, and a code trainer and two paddles so our children can learn Morse code. Since our classes started we have had seven youths and three adults licensed.

—Keith Reedy, WA9DRO

COURTESY WA9DRO

Aaron Keller, KC9ECB, and Jim Edwards, KA9DIF, in the Ryves Hall ARC station.

COURTESY WA9DRO

Skyhook in the making: **Kevin Berlin, K9HX; Bob Anderson, WB9RRX; Jason Berlin, KC9BBK, and in the foreground Randall and Dustin Norton collaborate on putting together one of the antennas at KC9EKW, the station at Ryves Hall Youth Center in Terre Haute, Indiana.**

Royal celebration: W6RO, the wireless room aboard the *Queen Mary*, celebrated 25 years of continuous operation on April 29, 2004. Permanently berthed at the Port of Long Beach, "The Queen" provides one of the most popular tourist attractions in Southern California.

During 25 years of operation from the ship's wireless room, Amateur Radio Station W6RO (the club call sign of the Associated Radio Amateurs of Long Beach, an ARRL Special Service Club) has presented a positive image of Amateur Radio to more than 4 million visitors.

At the center of this impressive operation is Nate Brightman, K6OSC. Nate has spearheaded Amateur Radio aboard the *Queen Mary*, recruited hundreds of operators, garnered equipment donations from leading manufacturers and maintained excellent relations with "The Queen's" management. At the recent 25th Anniversary celebration held in the Queen's Salon aboard ship, ARRL Southwestern Division Director Art Goddard, W6XD, presented a Special Service Award to W6RO Radio Operators. Brightman accepted the award on behalf of the hundreds of volunteer Operators from across Southern California.

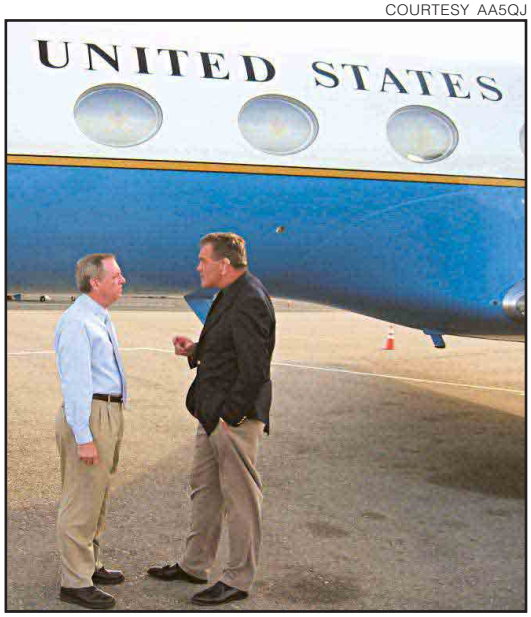
For more information on W6RO, see **www.mpicomputers.com/ham/queen/** and **www.queenmary.com/pdf/press_w6ro25th.pdf**.—*Art Goddard, W6XD*

Nate Brightman, K6OSC, seated at the controls of W6RO—The Wireless Room aboard the *Queen Mary*. Standing is Nate's son, Howard, K6OSD, beaming his approval of dad's 25 years of leadership that has brought Amateur Radio operation to the attention of more than 4 million visitors since April 1979.

FRIED HEYN, WA6WZO

At a reception commemorating 25 years of Amateur Radio operation aboard the ship, sponsored by the RMS *Queen Mary* Foundation, are, from the left, Joseph Prevratil, President and CEO of Queen's Seaport Development, Inc; Art Goddard, W6XD, and Nate Brightman, K6OSC, Manager of W6RO, the Wireless Room aboard the *Queen*

COURTESY AA5QJ



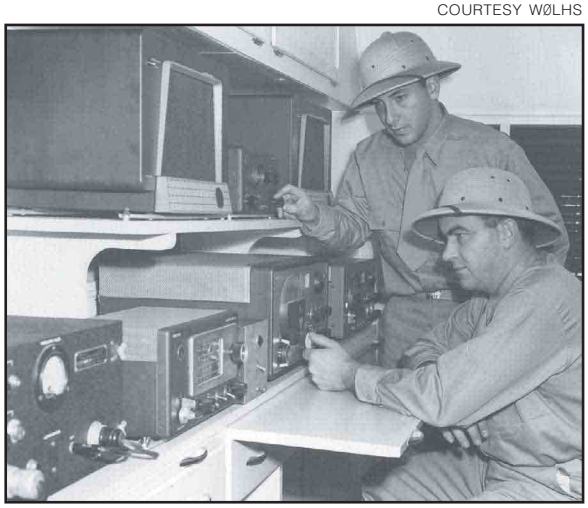
Congratulations!: **Charlie Kunz, AA5QJ, of Las Vegas, Nevada (left), met Secretary Tom Ridge of the US Department of Homeland Security on April 18 when Ridge visited Las Vegas. The brief meeting, covered by several local media, was part of the Citizens Corps Volunteer Greeter Program. According to the DHS Web site, the Program recognizes "the contribution citizens make in helping to keep our hometowns secure." While meeting Secretary Ridge, Charlie took the opportunity to hand him a copy of ARRL's comments to the FCC on the BPL threat. Kunz, who serves as ARES Emergency Coordinator and RACES Officer for Clark County, Nevada, said it was an honor to represent Citizens Corps for the city of Las Vegas and Clark County. There is more information at www.citizencorps.gov/news/vgp/index.shtm.**

"The Rest of the Story" of the Gatti-Hallicrafters African Expedition, 1947-48 Can Now be Told

By Bill Snyder, WØLHS; **billsnyde@msn.com**

Right after World War II, the Hallicrafters Company, a leading equipment manufacturer of ham radio gear at the time, sponsored a grand DXpedition to the three East African countries of Kenya, Tanganyika and Uganda. It was a deluxe expedition with custom house trailers, eight trucks and a super ham station complete with a rhombic antenna aimed at the United States. I was one of two hams selected from the 9000 applicants who answered a two page ad in *QST*. The other was Bob Leo, W6PBV (later W7LR). The organizer of the expedition was Italian explorer Atillio Gatti. This was to be his 11th trip to Africa. There is a very good article on the DXpedition by Mike O'Brien, NØNLQ, in the December 1993 issue of *QST*. "The rest of the story" can now be told, and you can find it, along with photos and links, at **www.qslnet/pa0abm/ghe/00ghe.htm**.

COURTESY WØLHS



In November 1947, in the "hamshack on wheels," Robert Leo, W6PBV (top) and the author get familiar with the state of the art Hallicrafters gear they were to use during their 6 month odyssey to East Africa. The Gatti-Hallicrafters African Expedition was the first to be underwritten by a major Amateur Radio equipment manufacturer. The photo was taken at a press party in New York City.

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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.

90 YEARS AND COUNTING

♦ On behalf of President Pedro Mucharraz, XE1PM, all of the Executive Committee at FMRE and Mexican Amateur Radio, please convey our warmest heartfelt congratulations to everyone at the American Radio Relay League on occasion of its 90th anniversary celebration!

The American Radio Relay League has come a long way in uniting US Amateur Radio and defending its rights. It has done a formidable job during its 90 years of existence, and the tasks, challenges and opportunities that it is facing nowadays are even more formidable. We are sure that it will continue to do such an excellent job!

Our very best wishes to you all on your 90 years young and we toast for many more years to come!—*73 de Carlos F. Narvaez, XE1FOX, Vice President and International Affairs Director, Federacion Mexicana de Radio Experimentadores (FMRE), Mexico City, Mexico*

♦ Friends, on behalf of PZK, the Polish Amateur Radio Union, let me congratulate the League, its members and officers, on the occasion of your 90th birthday!

To us, the ARRL is a stalwart guardian of Amateur Radio tradition, great in leadership, technical progress and support in international contacts with other IARU Administrations.

Keep up the good work, stay healthy as an organization—and thanks for being there!—*73, Wes Wysocki, SP2DX, PZK/IARU liaison officer, Gdansk, Poland*

PUBLIC SERVICE SCANNING

♦ As ham radio operators assume even more extensive communication responsibilities within the homeland security framework, manufacturers should consider designing VHF/UHF Amateur Radios capable of monitoring public service frequencies with the latest trunking scanning technologies including Motorola, Analog Trunking, EDACS/EDACS SCAT and LTR.

Coordinating communications during weather, civil and other emergencies is much easier when the left hand knows what the right hand is doing. Having the ability to hear public service frequencies as part of an amateur mobile or base transceiver can greatly assist an operator in myriad ways. As more and more metropolitan police and fire departments switch to trunking technologies, the earlier Amateur Radios with wide-band scanning capabilities are becoming useless in what used to be a tremendous asset.

The first VHF rigs that allowed wideband scanning were great. But technology is changing and I ask those who make the rigs we use to help us stay on top of the game when it comes to emergency communications. Please add trunking capabilities to new designs for both VHF and UHF mobile and base Amateur Radios.—*Joe March, K9JHM, Carmel, Indiana*

SOME OLD, SOMETHING NEW...

♦ I read the article entitled "A Picture of You" in the June 2004 edition of *QST* [pages 45-47].

I want you to know that I thoroughly enjoy Old Radio because of the content, photos and variety of topics. The column is consistently well researched. Although I came into the Amateur Radio pastime in 1979, about 10 years after the end of the era that Old Radio typically covers, I thoroughly enjoy reading about the older equipment and operators. I hope Old Radio will be a part of *QST* for many, many years to come. —*Brad Farrell, K4RT, Washington, DC*

♦ Many thanks for your great articles on RTTY in the May 2004 issue [Old Radio, pages 94-95]. As a young boy and a new Novice ham (KN1DMB) in the 1950s, I recall so vividly the constant clacking of the Model 12, later the 14, at the shack of my wonderful uncle (and Elmer) Ed Clammer, W2BDI (later K3GIF and W3UN). His daily QSOs with many other RTTY hams discussed in your article included Phil Catona, W2JAV; Ed (Brownie) Brown, W2PAU; Wayne Green, W2NSD, and Merrill Swan, W6AEE. Those gentlemen were surely the pioneers of RTTY in the 1950s. (Ed is one of those pioneers shown in the photo on page 94.) I also clearly remember many RTTY DX contacts from Ed's shack, including a daily QSO with a ham named Henry in Cape Town, South Africa. Ed was also a pioneer in QCWA as well as AMTOR. It was with great regret and sadness to lose Ed, the most important man in my life, when he became a SK in 1992. Due to the Vanity Call Sign Program, as well as the fact that I was also an Extra Class ham, I was able to obtain his latest call sign in 1995. Your article brought back great memories. Please accept my eternal gratitude for not only this particular article, but for the constant reminiscences available primarily due to your excellent Old Radio column. —*Alan Clammer, W3UN, Santa Barbara, California*

PROMULGATE THE WILDERNESS PROTOCOL

♦ David Haun, KB5UGN, brought up a valuable point [Correspondence, May 2004, page 24] when he related his backwoods 2 meter operation. The Wilderness Protocol can help you find a friend when you think none is around, and can possibly save your life in an emergency.

The Wilderness Protocol only works if we use it. And it's simply not emphasized enough in amateur circles. I fear too few hams even know such universal operating procedures exist.

When I teach the Radio Merit Badge class to Boy Scouts I always cover the procedures. In a true emergency, a Scout will know how to conserve battery power by only operating at certain intervals, and will know what frequencies to use. Being fully aware that the majority of Scouts aren't hams, I always mention the FRS procedure to be followed in the wilderness: FRS channel 1 with no subtone.

I'd like to see *QST* publicize these procedures more often.—*James Alderman, KF5WT, Carrollton, Texas*

EARTHQUAKE SCENARIO

♦ In late March 2004, Kentucky Amateur Radio operators participated in a history making venture. Banding together with federal, state and local emergency responders, amateurs provided communications for a four day simulation of a New Madrid Seismic Zone episode approximating those that occurred in 1811 and 1812. During the first day of the exercise, all communications from the local EOCs to the state EOC went via Amateur Radio. On the three days that followed, many more messages flowed over the amateur bands from western Kentucky EOCs, as well as from state emergency management, the Kentucky National Guard and US 1st Army.

State and federal officials were amazed at the usefulness of Amateur Radio, with one serious exception. On two separate occasions during the exercise the Kentucky Emergency Net, operating on 40 meters, was asked to move or cease operating by other amateurs

saying that we were on "their" frequency. One station even insisted that he be told who gave us the authority to use that frequency. A few denounced the use of Amateur Radio for an exercise, as it was "not a real emergency anyway" and we were interfering with their daily use of the frequency. Needless to say, state and federal officials within earshot were less than thrilled by that kind of attitude. I have heard similar tales from others concerning even emergency operations on Amateur Radio bands.

While we all know that no one "owns" a frequency, it seems to me that some allowance should be made for the exercise use of any frequency on occasion. Exercises like the four day event here can be every bit as important as an actual response. There are no designated "exercise frequencies" or "emergency frequencies" in any Amateur Radio band plan. While an exercise or even a working disaster showing up one day on your favorite HF frequency may be a little disconcerting, would it not be better overall to make an exception rather than make a scene?

The bad perceptions that these served agencies may get from those denouncing the use of Amateur Radio for drills and emergencies have great potential to leave some unfavorable lasting impressions with important officials. In our case, both a two and a three star Army General were in hearing range of some of the comments we received via 40 meters. These gentlemen as well as other officials may one day be asked for their input on the life or death of Amateur Radio or one of our bands. What effect might that experience have on their reply? Think about it.—*Ronald Dodson, KA4MAP, Kentucky Section Emergency Coordinator, Webster, Kentucky*

SCARING THEM UP

♦ Aha—with "Scaring Up Contacts" in June [page 61], at last something for the beginner. There was a lot more of that sort of thing in *QST* almost 60 years ago when I could only SWL.

I wish there was more "technical" writing, too, as in the beautifully illustrated April ESE story. Amateur Radio works so well in adventure tales that it's too bad we can't find more published ham fiction—or at least know where to look for it.—*Anne Grimm, KA7TON, Raymond, Washington*

[Starting with the January 2004 issue, we have added a short article suitable for beginners in each month's Workbench section. We welcome the chance to review potential articles for this section from newcomers (and others). This month's article is on page 56.—*Ed.*]

THE HAM DEFENSE CORPS

♦ One of the most important things that ARRL does is something that many Joe Hams are totally oblivious of. How many hams know that if not for ARRL's diligent efforts in representing us, fighting and lobbying on behalf of ham radio in Washington and at world conferences, there would be no ham radio as we know it? Joe Ham and thousands of his brethren are totally unaware of the painstaking, assiduous, scrupulous time-consuming preparations, the jawboning of legislators and communications ministries, and the voluminous preparations, draftings, redraftings and midnight oil that I believe must go into creating these weighty presentations and position papers.

May I chide the League for not telling of these efforts more effectively, not only to members but to hams in general?

Surely among our ranks there are some sharp PR persons who can create ideas for "telling what should be told" briefly and to the point.

I propose creating a "Marketing Corps" or "Defense Corps," for want of a better name, of informed hams who would carry the message to their local clubs that ARRL membership is not just subscribing to *QST*, but more importantly, it is about supporting the League's activities on our behalf.

Whether you read your *QST* from cover-to-cover or not at all or merely skim, the fact that *QST* is included with membership could be considered a bonus.

Each club would have a "defense committee" to keep the club aware of the many predators who lurk in dark corners of legislative halls waiting to pounce on any opportunity to ingest our frequencies. It would also promote ARRL membership to help in repulsing frequency grabs. Defense committees would report, along with other committees at each meeting, info from ARRL on who trying to do what and with which and to whom, and who is doing what in response.

The need for defending ourselves might even inspire hams to enlist their friends into becoming hams perhaps as potential "soldiers" in the "Ham Defense Corps."

This initiative could increase membership, increase legislative clout and increase available funding. Defense Corps? Marketing Corps? A combination of the two?

Virtually every country in the world has an army to defend itself against aggression. Shouldn't we have one too?—*Alexander "Al" Cohen, W1FXQ, Public Information Coordinator, CT Section, Newington, Connecticut*

[Thanks for the kind words, Al. Two ways we've been "spreading the word" about the good things the ARRL family (members, volunteers and HQ staff) are doing are the ARRL in Action column on pages 12 and 13 of each issue of *QST* and a monthly summary on our Web site —see **www.arrl.org/news/features/2004/04/30/2/**.—*Ed.*] QST

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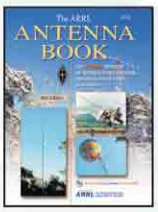

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By Milt Cram, W8NUE

The NUE Key—An Electronic Touch Sensor Paddle

Build a touch sensor (no moving parts) key—an all-electronic paddle to match your electronic key.

During the past few years I have had a heightened interest in low power operation—first with PSK31 and MFSK and, more recently, with SSB. Lately, however, I find myself operating quite a bit of QRP CW. With my revived interest in CW, I began thinking about electronic key paddles. I have an old Vibroplex single-paddle keyer, but it does not support iambic keying.[1] This led me to build a couple of mechanical units, but I decided that I would like to make a "no moving parts" paddle assembly. I wanted something that would be rugged enough for portable operation and one that would consume very little power.

As ideas rolled through my head, I came across a couple of *switched-capacitor* building block ICs in my junk box. During my working career (I'm now retired) I had designed and built a capacitive liquid-level sensor based on a switched-capacitor circuit. Now, it suddenly dawned on me that these ICs might be useful as a rugged and compact iambic keyer paddle circuit.

This project is a result of that idea and the following is a description of the design and construction of a touch-sensor keyer paddle. It uses two ICs and two FET transistors (for switching the output). The paddles are insulated and the circuit does not depend on skin resistance. Figure 1 shows the completed prototype paddle. A touch sensor, based on the capacitance change due to the presence of one's fingers, is employed for this "no moving parts" keyer paddle. Figure 2 shows a schematic of the entire circuit. This prototype uses a 9 V dc supply, although another design (Figure 9) operates from a 3 V supply.

[1]Iambic keying provides for the simultaneous closure of both dot and dash paddle levers to form Morse characters. Consequently, the paddle must have separate dot and dash levers. A good discussion of iambic keying and its modes can be found in "The Doctor is IN," *QST*, Dec 2003, p 51.—*Ed.*

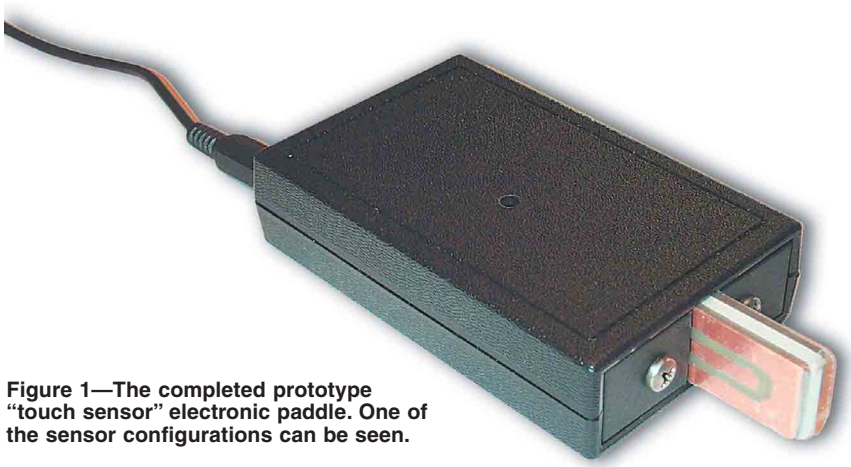


Figure 1—The completed prototype "touch sensor" electronic paddle. One of the sensor configurations can be seen.

Theory of Operation

A sensor capacitor is formed of conductors on a piece of printed circuit board (a piece of Mylar packing tape is placed across the surface of the printed circuit board to provide insulation). Figure 3 is a sketch of the sensor capacitor. Referring to Figure 4, the sensor capacitor is alternately switched between its charge and discharge state (into a resistor-capacitor network of 100 kΩ in parallel with 0.022 µF) at a rate of approximately 50 kHz. The charge stored in the sensor capacitor is given by the formula $Q_1=C_sV_1$. In this formula, Q is the charge (coulombs) on the sensor capacitor, C_s is the capacitance (farads) of the sensor capacitor and V_1 is the voltage to which the capacitor is charged (9 V dc, in our case).

If we assume that the voltage after switching C_s to the parallel RC circuit is V_2 volts, the charge on C_s will now be $Q_2=C_sV_2$. The difference between these two charge levels represents the amount of charge that is transferred to the RC circuit each time it is switched. Since switching occurs f_0 times per second, the amount of charge transfer that occurs is equivalent to a current flow of f_0 times the difference in charge $C_s \times (V_1-V_2)$. Also, Ohm's Law requires that current equals voltage (V) divided by resistance (R). Consequently, the switched capacitor may be considered to be equivalent to a resistor, R_{eq}, whose value is $(1/f_0C_s)$ Ω. The voltage that we can expect to get from the circuit is then equal to $[R/(R+R_{eq})] \times V$. (This is the voltage transfer formula for a simple resistive divider.)

If we further assume that C_s = 20 pF, V = 9 V dc and R = 100 kΩ, we will get an output voltage of about 0.8 V. If the capacitance increases to, let's say, 40 pF, then, when the sensor is touched, the voltage will increase to about 1.5 V. That magnitude of change is easily detected with a simple comparator if the reference input to the comparator is set for about 1 V.

Touching the sensor increases the capacitance of C_s. In the prototype, this sensor capacitance increase produced a voltage of about 1.8 V. Pressing harder on the sensor further increases the capacitance and increases the output voltage across the RC pair. The sensor output voltage is coupled into the positive input of a low power op amp— operating as a comparator. The negative input of the op

amp is connected to an adjustable voltage reference, derived from a resistive divider. This reference voltage is adjusted to be slightly greater than the voltage produced by the sensor when it is not being touched. When the sensor is touched, the voltage on the positive input becomes more positive than the negative input. This causes the output of the op amp to increase suddenly to near the supply voltage. The op amp output is fed to an N-channel enhancement mode FET (a 2N7000 or NTE490). The FET is nonconducting when the op amp output is very close to zero, and becomes highly conducting (a few ohms) when the op amp output is a couple of volts positive. The FET can then be used to "switch" the electronic keyer.

If the reference voltage is adjusted to be near the maximum voltage that can be obtained from the capacitive sensor, more pressure will be required to cause the output to switch. This means that the reference voltage adjustment is like the spring adjustment on mechanical paddles—the "feel" of the paddles is controllable.

The prototype unit uses an LTC1043 (Linear Technology) IC for the electronic switches. This device contains two DPDT switches and associated drivers, including an oscillator (see Figure 5 for a simplified diagram of the LTC1043). Consequently, one such device is sufficient for a dual-paddle keyer. The dual op amp selected is an LMC6462 (National Semiconductor). This op amp requires a supply current of less than 20 µA per amplifier. An OP281 (Analog Devices) or a MAX407 (Maxim) could also be used and would reduce the current demand even more (the OP281 is, in fact, used in the 3 V version described later). Since the gate currents of the FETs are negligible and the drains are connected to the output circuit (the electronic keyer), they add nothing to the total current draw of the paddle electronics. The measured total current drain is approximately 230 µA with a 9 V battery (keyed or not). Since the capacity rating of the 9 V battery is about 600 mAh, the battery should last for more than 2400 hours of continuous operation. Figure 6 shows an inner view of the electronics, less the paddles. Figure 7 gives a view of the paddles.

Note that, for small values of the sensor capacitance, the sensor output is proportional to the supply voltage. The reference voltage is also proportional to the supply voltage, via the resistive divider. Moreover, at a supply voltage of about 9 V, the oscillator frequency in the LTC1043 is relatively stable with supply voltage changes. The circuit is very tolerant, therefore, of supply voltage changes that might occur around the 9 V level.

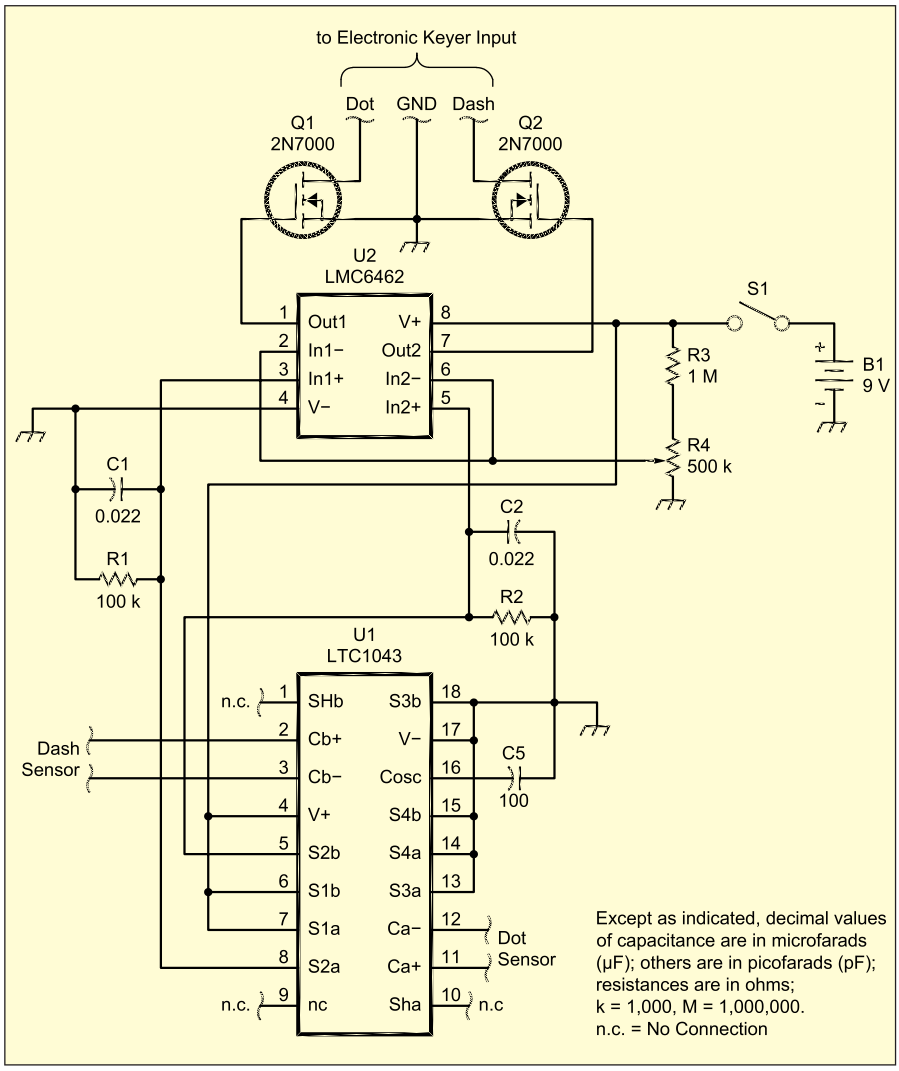


Figure 2—Schematic of the 9 V version of the paddle and the parts list for both it and the 3 V version (RS = RadioShack).

B1—Battery, 3 V (2-AAA cells or 3 V lithium cell); 9 V (Alkaline).
C1, C2—0.022 µF, 50 V capacitor (RS 272-1066).
C3, C4—1 µF, 35 V capacitor (3 V version only) (RS 272-1434).
C5—100 pF, 50 V capacitor (RS 272-123).
Q1, Q2—2N7000 FET (Mouser 512-2N7000BU).
R1, R2—100 kΩ, 1/4 W resistor.
R3—1 MΩ, 1/4 W resistor.
R4—500 kΩ trimmer potentiometer, CTS (Digi-Key U262R504B-ND).
S1—Toggle switch, SPST, miniature.
U1—LTC1043 switched-capacitor IC (Linear Technology) (Digi-Key LTC1043CN-ND).
U2—9 V version: LMC6462 operational amplifier IC (National) (Digi-Key LM6462BIN-ND); 3 V version: OP281 operational amplifier (Analog Devices) (Newark 91F2965).

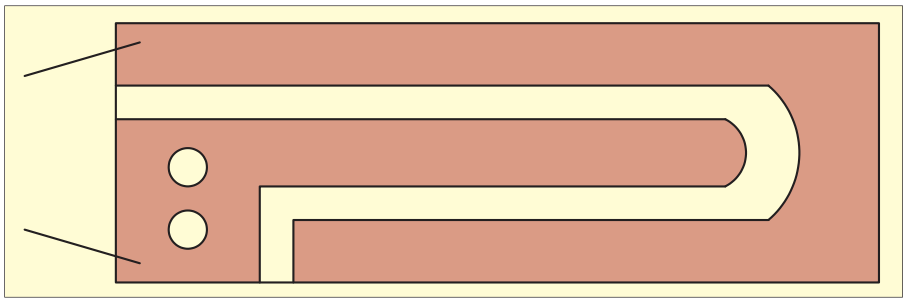


Figure 3—The sensor capacitor. The light areas represent the copper that is removed. The sensor is approx 5/8 × 1 1/2 inches in size.

Sensors

The sensor capacitors were made from a couple of small scraps of single-sided copper printed circuit board (Figure 7). For the first prototype, instead of etching the pattern, I used a Dremel tool with a small "burr" to cut the pattern I desired. Subsequent prototypes were etched after drawing the desired pattern with a "resist" pen.

The sensor capacitors should be relatively low capacitance—below 20 pF—when not touched. Touching them should increase the capacitance to 30 to 40 pF. This provides good dynamic range for the output voltage swing and gives good noise immunity at the input of the comparator. The sensor shown in Figure 3, with a single finger connected to the C_a and C_b inputs of the LTC1043, was empirically found to work the best. In this configuration, the + inputs are connected to the large copper area surrounding the single finger. The two sensors are separated by a 0.1 inch thick piece of plastic and are attached to the front panel of the housing by "L" brackets. The front panel was split into two halves, with enough material removed to allow mounting of the sensors—separated by the plastic.

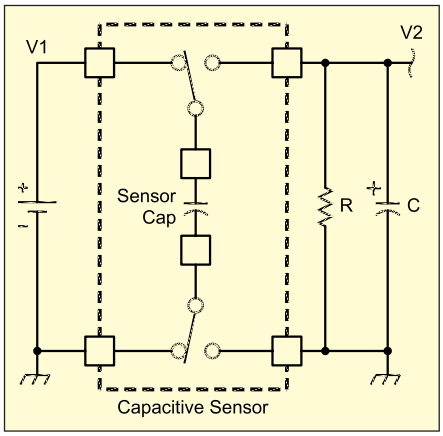


Figure 4—A simplified schematic of a "charge pump" capacitance sensor.

Adjustment

The only adjustment required is that for the reference voltage. I recommend initially setting the potentiometer to maximum voltage on the wiper. Then, without touching either sensor capacitor, reduce the voltage until both FETs conduct. Increase the voltage again, until both FETs just stop conducting. At this voltage, touching either sensor lightly should cause its corresponding FET to conduct and, if connected to an electronic keyer, that keyer should operate. If you desire more finger pressure before generating dots or dashes, simply increase the potentiometer setting.

If you should find that the dot and dash sensors have significantly different thresholds for triggering the output, there is a simple fix: Measure the voltage difference between the two + inputs of the op amp. If the voltage is more than several millivolts, add a small capacitor (5 pF) in parallel with either the dot sensor capacitor or the dash sensor capacitor. If the measured voltage increases in magnitude, put the small capacitor in parallel with the other sensor. This should cause the voltage to decrease or even

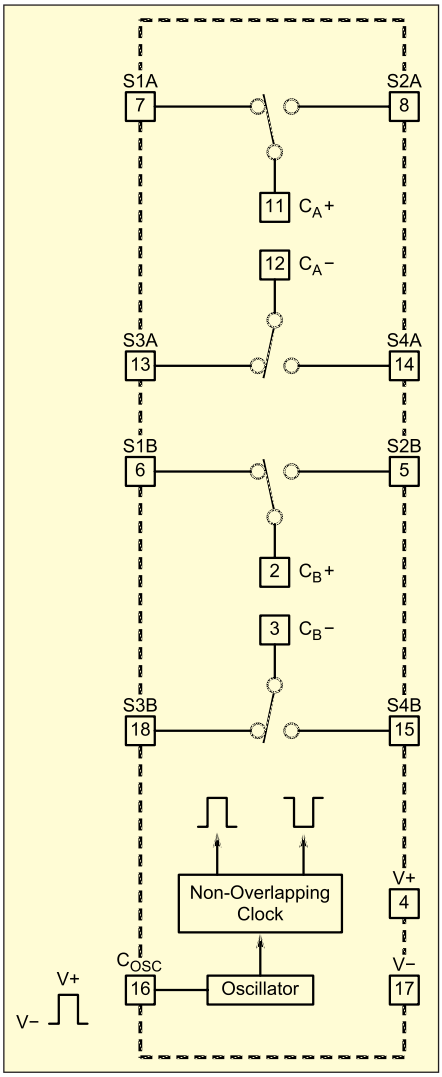


Figure 5—A simplified schematic of the LTC1043 switched-capacitor IC.

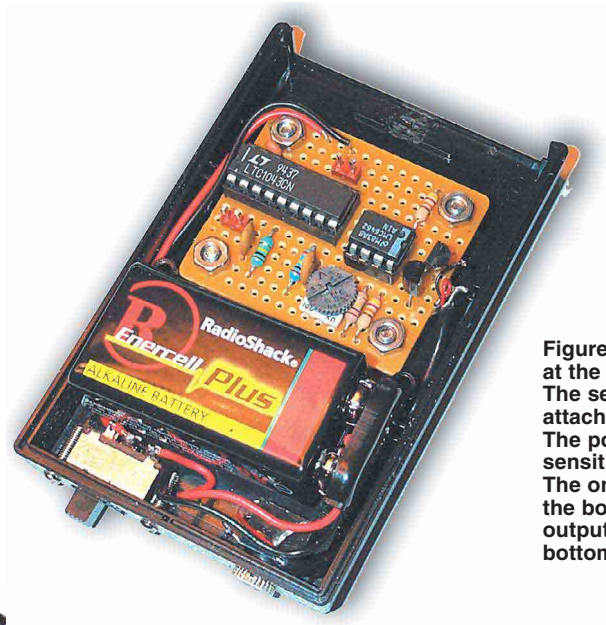


Figure 6—A look inside at the completed paddle. The sensors are not attached in this view. The potentiometer is a sensitivity adjustment. The on/off switch is at the bottom left and the output jack is at the bottom right.

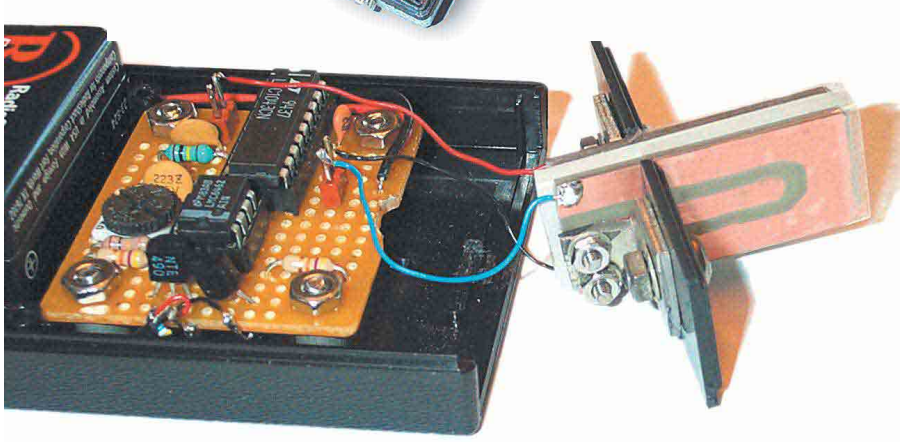


Figure 7—The completed sensor assembly. Both sensors are separated by a 0.1 inch thick piece of plastic and are attached to the front panel of the housing by two "L" brackets.

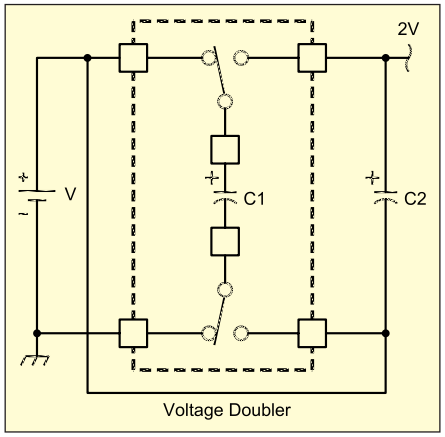


Figure 8—A simplified schematic of the voltage doubler circuit for the 3 V version. C1 is charged to V volts. After many switching cycles, the voltage on C2 will also approach V volts. The voltage on the positive side of C2 will then be the sum of the supply voltage V and the voltage on C2 (also V) or 2V.

change sign. If it does change sign, reduce the capacitance to 3 or 4 pF. On my prototype, I was able to adjust the voltage to a few millivolts with 4 pF in parallel with the dash sensor. (A small trimmer capacitor could also be added for nulling the voltage between the two + inputs of the op amp.) As the sensitivity pot is adjusted, both the dot and dash outputs should activate at almost the same point. If RF susceptibility is a problem, a 10 kΩ resistor should be added in series with each sensor lead.

Circuit Modifications for 3 V Operation

After successfully completing the 9 V dc version, I decided to look at the possibility of operating the circuit at lower voltage and lower total power consumption. Per the manufacturer's data sheet, the ICs used in this circuit should operate from a 3 V dc supply. The oscillator in the LTC1043, however, appears to be sluggish when starting from a positive supply voltage very close to 3 V dc. A design approach that came to mind was the use of another IC (two inverting gates) as an oscillator to drive the OSC pin of the LTC1043, overcoming the sluggishness of the internal oscillator. In addition, the op amp could be changed to an OP281 or a MAX407. With these changes, the total current draw is now less than 220 µA and the circuit can be powered from a 3 V lithium battery, or two AAA batteries.

As I studied the circuit I realized that the "low" side of each of the sensors was being switched unnecessarily. This led to the idea of using the "extra" switches as a switched-capacitor charge pump voltage-doubler (shown in Figure 8). I breadboarded this modification and found that it works with supply voltages below 2.5 V dc. With 2 AAA cells, the "doubled" voltage is in excess of 5 V, and the LTC1043 oscillator has no difficulty starting. A single 3 V lithium cell should also work fine. The schematic of the 3 V version of the electronic paddle is shown in Figure 9.

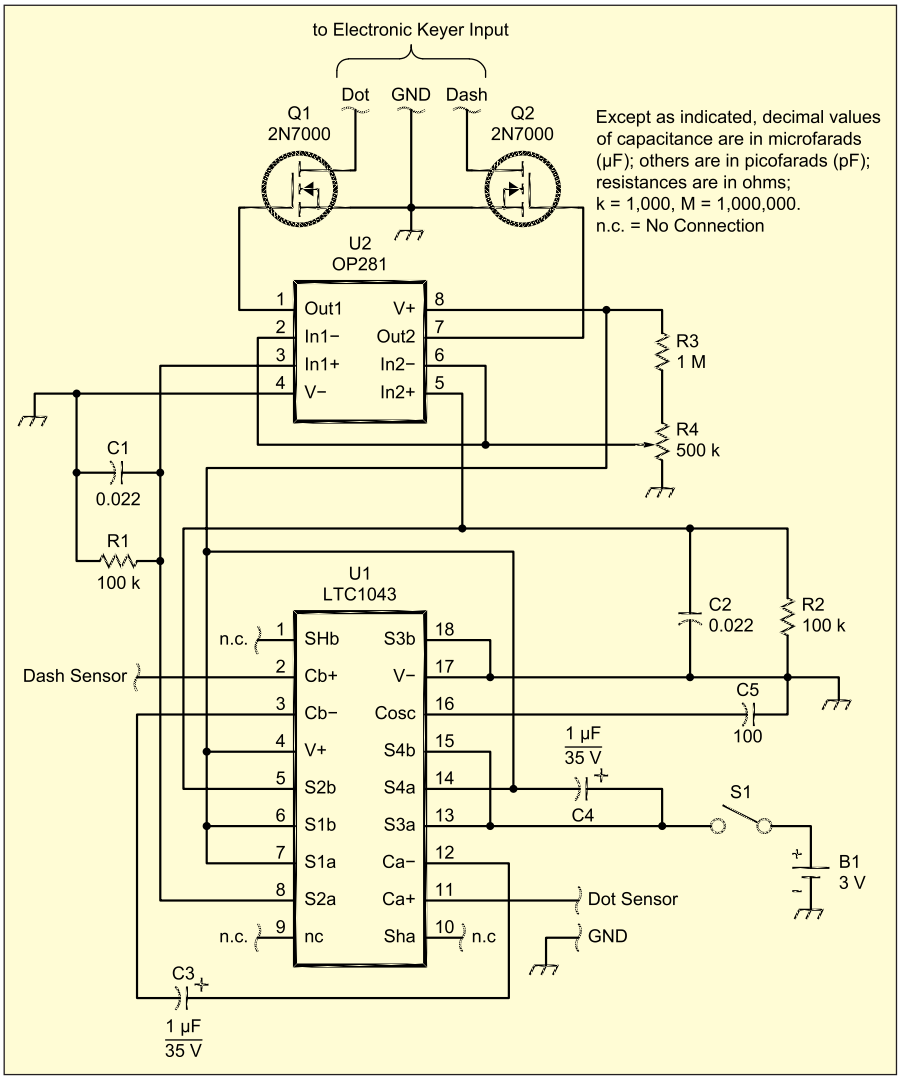


Figure 9—The schematic for the 3 V version of the paddle. Note the addition of capacitors C3 and C4 (the charge pump) and the change of U2 to a lower power operational amplifier. Use the parts list of Figure 2.

Final Notes

Most of the semiconductors for this project are available from Digikey (**www.digikey.com**). Other components are available from RadioShack (**www.radioshack.com**), Mouser (**www.mouser.com**) and Newark Electronics (**www.newarkinone.com**). The LTC1043 cost is just over $5. The LMC6462 cost is about $3. The FETs are less than 30 cents each. The total electronics cost should be about $10, not counting the switch, batteries, connectors, enclosure and sensor fabrication materials.

Most of the parts used are available in a surface mount (SMD) type package. Consequently, the unit can be miniaturized and packaged in a container not much larger than the battery itself. I used a RadioShack prototype board for my example and, as you can see, there's plenty of room on the board. So get out that soldering iron…build yourself an electronic paddle and operate with a truly "all electronic" electronic key.

Photos by the author.

First licensed in 1953 as WN8NUE, Milton ("Milt") Cram has held several calls, including his original (minus the "N") with an Amateur Extra class license. He is a longtime "homebrewer" and enjoys operating low power and the digital modes. Milt holds BEE, MS and PhD degrees in electrical engineering from Georgia Tech and comes from a family of hams (dad, Ernie, W8JXK (SK), great uncle, Oz, W1JUJ (SK), and son, Marc, KC5RWZ). You can reach him at 9807 Vista View Dr, Austin, TX 78750 or at **w8nue@arrl.net**.

By Gary S. Kath, N2OT

A CTCSS Tone Encoder with Morse Code Readout

Add a talking subaudible tone encoder to that old FM transceiver.

I'll never forget that morning in 1975 when my father gave me an ICOM IC-230 2 meter FM transceiver for Christmas. The radio had a digital frequency synthesizer and could transmit anywhere on the 2 meter FM repeater bands. My prior experience on 2 meters was with my Heathkit "Twoer": 5 W AM, regenerative receiver and rockbound. I was amazed that the IC-230 FM transceiver didn't need separate crystals for each repeater frequency.

After years of fun, the IC-230 was set aside when I purchased my Kenwood TH-79A 144/440 MHz dual band handheld. I recently came across the IC-230 and decided to resurrect the radio. I mounted it into my car but, unfortunately, the radio had no continuous tone coded squelch system (CTCSS)[1] tone encoder. That restricted the radio to simplex use only. A tone encoder would be an exciting project and it would extend the life and memories of my old transceiver.

I located a few commercial add-on tone encoders that used dip switches to set the CTCSS tone frequency. I also found a schematic for a low cost tone encoder using an NE567 tone chip. An unattractive feature of the NE567 is its timing via an RC network. This requires numerous networks to handle the 38 possible tone codes. These RC networks can vary with respect to temperature. I needed a stable circuit with multiple tone codes to allow me to surf the local repeaters. I designed a tone encoder circuit that permits easy frequency adjustment and is crystal controlled for stability.

Design Criteria

The IC-230 had an accessory jack on the side of the radio with 12 V dc output, transmit audio input, PTT and other accessory connections. Using the connections, I envisioned a modern CTCSS tone encoder that would plug into the accessory jack and would permit frequency setting via two push-button switches—one to step up and the other to step down through the 38 different tones.

I wanted the circuit to identify the set tone frequency using an audible Morse code message rather than a switch, dial or readout. My transceiver and tone encoder would be mounted under the car seat so I did not want to be distracted fumbling with BCD switches or trying to read a display while driving.

The IC-230 accessory jack had a PTT connection that operated in parallel with the microphone transmit push button. I included a feature to monitor the length of my transmission and provide an audible Morse code message for each minute of continuous transmitting. This acts as a time-out aid when making a long-winded transmission. In addition, the circuit sends an audible Morse code identification message every 10 minutes to remind me to identify my station. The completed encoder is shown in Figure 1.

Circuit Description

The heart of the encoder is a Microchip Technology (**www.microchip.com**) PIC16F84 microcontroller—U3 in Figure 2. The low cost microcontroller has 13 I/O ports, 64 bytes of data EEPROM, 68 bytes of data RAM and 1 k of FLASH program memory. The UP and DOWN push-button switches connect to ports RB7 and RB6 on the microcontroller.

I first attempted to use the PIC16F84 microcontroller to synthesize the CTCSS tone directly via a PWM sine wave algorithm—the FREQOUT PicBasic language command. This produced a raspy sounding tone with harmonic distortion. My attempts to clean up the sine wave using passive and active filtering were futile.

The Fairchild Semiconductor (**www.fairchildsemi.com**) ML2036 serial input programmable sine wave generator IC, U5, solved the problem. It generates a sine wave output from dc to 50 kHz with low harmonic distortion. The sine wave output is derived from an external crystal and no other external components are required.

The ML2036 produces a digital output whose frequency is determined by a 16-bit digital word. Its sine wave generator is composed of a sine lookup table, a digital-to-analog converter (DAC) and an output-smoothing filter. The DAC is driven by the output of the internal sine

GARY S. KATH, N2OT

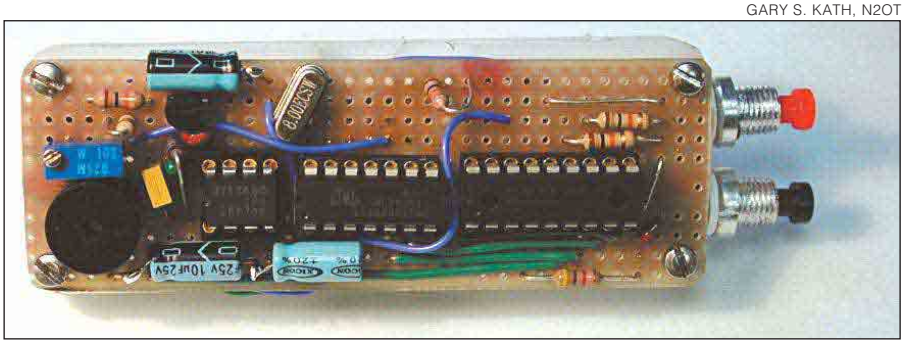


Figure 1—Component side of the Morse readout CTCSS tone encoder PC board. The push buttons select the tone frequency (up or down). Note the piezoelectric speaker in the lower left hand corner. The potentiometer immediately above it sets the audio drive level to the transceiver. The crystal can be seen in the upper middle section, above the ICs.

[1]Notes appear on page 34.

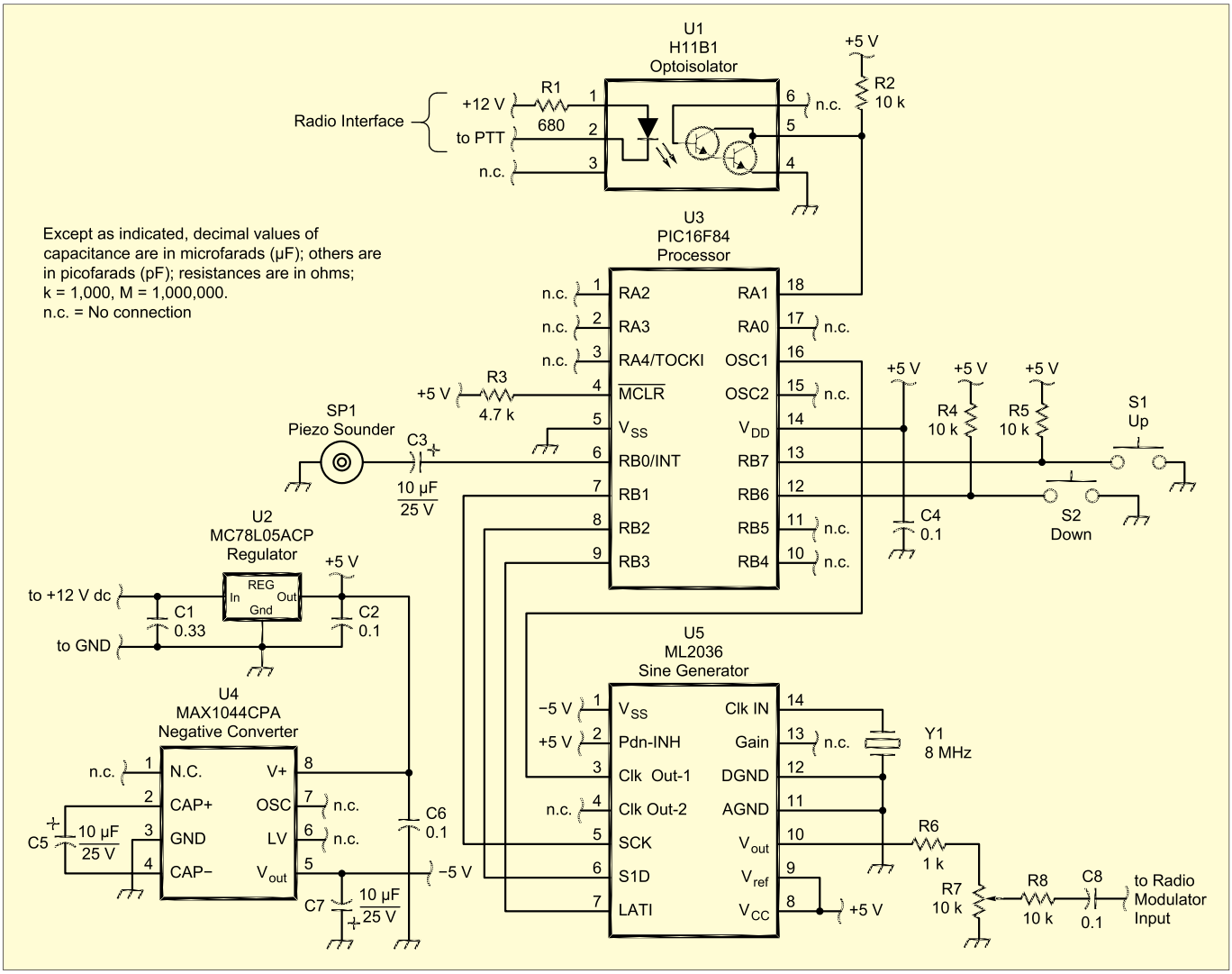


Figure 2—Schematic and parts list for the Morse readout CTCSS tone encoder. (Parts are available from the following sources: Digi-Key Corp, 701 Brooks Ave South, Thief River Falls, MN 56701-0677, 800-344-4539; www.digi-key.com. Newark InOne, 197 Hwy 18 South, Ste 205, E Brunswick, NJ 08816-1440, 732-937-6600; www.newark.com).

C1—0.33 µF, 35 V tantalum capacitor (Digi-Key P205056-ND).
C2, C4, C6, C8—0.1 µF, 35 V tantalum capacitor (Digi-Key P2053-ND).
C3, C5, C7—10 µF, 25 V electrolytic capacitor (Digi-Key 4211PHCT-ND).
R1—680 Ω, 5%, 1/4 W resistor.
R2, R4, R5, R8—10 kΩ, 5%, 1/4 W resistor.
R3—4.7 kΩ, 5%, 1/4 W resistor.
R6—1 kΩ, 5%, 1/4 W resistor.
R7—10 kΩ potentiometer (Digi-Key CT94Y103-ND).
S1, S2—Push-button switch, NO (Digi-Key EG205-ND).
SP1—Piezo ceramic audio transducer (Digi-Key 102-1133-ND).
U1—H11B1 optocoupler (Newark 81F9611).
U2—MC78L05ACP +5 V dc voltage regulator IC (Newark 38C7376).
U3—PIC16F84 microcontroller IC (Digi-Key PIC16F84A-20/P-ND).
U4—MAX1044CPA Maxim CMOS switched-capacitor voltage converter IC (Digi-Key MAX1044CPA-ND).
U5—ML2036CP Fairchild sine wave generator IC (Newark 34C1194).
Y1—8.000 MHz crystal (Digi-Key CTX406-ND).

lookup table and it generates a staircase representation of a sine wave. An internal filter smooths the analog output by removing the high frequency sampling components, resulting in a sinusoid with second and third harmonic distortion 45 dB below the fundamental.

The PIC16F84 microcontroller communicates with the ML2036 through a three-wire serial interface—clock, data and latch via ports RB1, RB2 and RB3. An 8 MHz crystal connects between the CLK IN and DGND—pins 14 and 12, respectively. No other external capacitors or components are required. The output from the ML2036, pin 10, is attenuated via R6, R7 and R8 and ac coupled to the audio input on the transceiver. Potentiometer R7 is used to adjust the modulation drive level.

The ML2036 also has a divide by 2 TTL clock output, pin 3. The clock output is directed to the PIC16F84 clock input, eliminating the need for a separate crystal for the microcontroller.

There is only one downside to the ML2036—it requires both positive and negative 5 V dc supplies. A Fairchild Semiconductor MC78L05ACP 3-terminal positive regulator IC, U2, provides +5 V dc from the +12 V dc output on the accessory jack. A Maxim (**www.maxim.com**) MAX1044 switched-capacitor voltage converter IC, U4, generates –5 V dc from the +5 V dc logic supply.

The Morse code audible messages are generated via the PIC16F84 and directed from port RB0 to a piezo audio transducer. The pitch of the audio is achieved using pulsewidth modulation. The sounder has plenty of audio drive to hear the audio messages over vehicle and road noise.

The optical coupler (optocoupler), U1, monitors the PTT signal from the transceiver and provides isolation from any

transients generated by the transceiver's transmit/receive antenna relay. The TTL output from the optocoupler is directed into port RA1 on the PIC16F84 microcontroller.

Software

Control software for the project was written in BASIC and compiled using a MicroEngineering Labs (**www.melbas.com**) *PicBasic Pro* compiler. A MicroEngineering Labs EPIC Plus Pocket PICmicro Programmer was used to program the code into the PIC16F84 flash memory. The source code and compiled 8-bit merged Intel HEX files for the tone encoder are available for download (**www.arrl.org/files/qst-binaries/ctcss_encoder.zip**).[2]

A subroutine was written to generate Morse code from ASCII character strings. Point to a string of ASCII characters and the routine automatically interprets the ASCII characters and generates the equivalent Morse code characters. The send speed is set using the DOTDURATION variable in the code. This subroutine can also be applied to other projects requiring Morse coded messages.

Since the ML2036 handles the task of sine wave synthesis, the PIC16F84 microcontroller can spend most of the time in a loop monitoring the UP and DOWN push-button switches. The 38 tone frequencies are stored in a lookup table in the nonvolatile data memory of the PIC16F84. If a switch closure is detected, the software increments or decrements to the next CTCSS tone in the lookup table. At each table value, the ASCII CTCSS tone numerals are sent to the user using the ASCII-to-Morse code subroutine. The operator hears 3 Morse code digits representing the selected tone. No decimal values are sent.

When the user releases the push button, the microcontroller software calculates and sends the appropriate 16-bit data value to the ML2036 via the 3-wire interface using the SEROUT command in *PicBASIC*. Upon receipt of the 16-bit data, the ML2036 immediately synthesizes the tone. The software then saves the last tone setting into the non-volatile memory of the PIC16F84, making the value available at next power-up.

The software checks the push-button switches every second and keeps a total of the number of seconds elapsed. When the time exceeds 10 minutes, the microcontroller sends a Morse message (station call sign) to remind the operator to identify. While looping, the software also checks the PTT line of the transceiver every second. If the microphone PTT button is pressed, an algorithm keeps count of the key-down seconds passed and sends an audible message every minute. The message is a number representing the number of minutes elapsed while transmitting.

Construction

Component layout is not critical. A 1×3.5 inch piece of perforated circuit board was used with point-to-point wiring. A DIP socket was used for the PIC16F84 to permit removal during software upgrades. The PCB was mounted to a block of plastic. Male pins were inserted into holes drilled in the plastic forming an integral male connector that mates with the transceiver's accessory jack. A PVC plastic enclosure box protects the circuitry, and the device is held in place by the accessory plug and a piece of double sided tape attached to the side of the radio.

Operation and Adjustment

Upon power-up, the circuit will send an audible Morse code ID followed by the letters PL and a 3-digit value representing the last set tone frequency. Press and hold the UP push button and a Morse code message will be sent for each CTCSS tone frequency value as the software steps up through the tone table. Press the DOWN push button to select a lower frequency tone. The last value in the table is 00, which will turn off the tone.

The only circuit adjustment is the audio drive output level to the transceiver via R7. If an FM deviation meter is unavailable, the easiest method is to have a local ham listen to the transmitter output and compare the drive sound level with a second radio generating the same CTCSS tone. For other types of transceivers, it may be necessary to change R8 and C8 to achieve the desired drive level. The final test is to key-up a local repeater.

Conclusion

This circuit adds an easily adjustable subaudible tone encoder, time-out timer and an ID reminder to older FM transceivers. My old IC-230 FM transceiver has been rejuvenated with the CTCSS encoder circuit and I'm now able to access local repeaters with ease. Don't discard your FM rig from the '70s—add a tone encoder and get that transceiver back on the air!

Notes

[1]Continuous tone coded squelch system (CTCSS) is a subaudible tone system used on many repeater systems. The CTCSS signal is added to the audio modulation of the transmitted signal and is decoded by the repeater receiver, allowing the signal to pass. It is also referred to as *PL*, or *Private Line*, a Motorola trade name.

[2]The author will consider doing a limited amount of programming of the PIC processor and will offer a helping hand to those readers who might have difficulty handling the processor programming. Contact the author directly.

Gary S. Kath, N2OT, was first licensed in 1968 as WN2EPP. An instrumentation and automation engineer for 25 years, he has a BSEE from Widener University and an MSEE from Carnegie Mellon University. Gary enjoys DXing, contesting, low power operation, designing circuits, software development and HF wire antenna experimentation. He can be reached at **njklepper@worldnet.att.net**.

NEW PRODUCTS

THE LIGHTNING GUARD MODEL 100

◊ The Lightning Guard Model 100 is designed to protect your transceiver from lightning when it is not in use, or when you're not in the shack. Power and a single antenna connect through the Lightning Guard to a single transceiver. Relays in the unit pass power and the antenna through to the transceiver when energized.

In MANUAL mode, when the Lightning Guard is switched OFF, the relays de-energize, disconnecting power (10 A maximum) and antenna (200 W maximum, SO-239 connectors), and connect both wires of the transceiver side of the power cord and the transceiver antenna input to the power ground wire. An external ground can also be connected.

In AUTO mode, the main power switch is left in the ON position. If there is a momentary interruption in ac power, as there sometimes is with lightning storms, the relays de-energize, shunting the connections to ground. The relays remain de-energized, and the equipment remains grounded, until manually reset. Note that this unit augments and cannot replace a properly installed lightning arrestor and surge protector system. Introductory price: $88 including shipping. For more information, contact Electronic Specialty Products LLC, PO Box 711, Geneva, FL 32732; tel 407-349-9150; **www.electronicspecialtyproducts.com**.

By Phil Salas, AD5X

Remote DC Power Through Your Coax

Tired of running separate dc cables out to your tuner or antenna relay? AD5X shows how to pump dc down that feed line.

I operate portable every time I go on vacation and I'm always experimenting with different types of antennas. The recent price drop for the SGC SG-239 auto-tuner[1] encouraged me to use this in combination with a random-length wire dipole. This combination works well for me, so I'll probably continue to use this setup in the foreseeable future. One thing that troubled me, however, was the new requirement to carry several different lengths of dc cabling in order to power the SG-239. I carry both 15 foot and 25 foot sections of RG-174/U coax for portable use, so I can use either one section or both, depending on my proximity to the antenna location. Now I needed additional 15 and 25 foot sections of dc cabling to go along with the coax.

My setup really looked like a rat's nest when both the coax and dc power wires were connected. Additionally, at my home location, I realized that I sometimes needed to get dc from my shack out to my antenna (for remote relay switching or other functions). I decided that the time had come to build up a couple of dc input/output boxes that would let me inject 12 V dc power into the rig end of the coax, and recover the 12 V dc at the remote end of the coax cable. A design goal included making sure that all parts were easy to find and locally available.

[1]Notes appear on page 37.

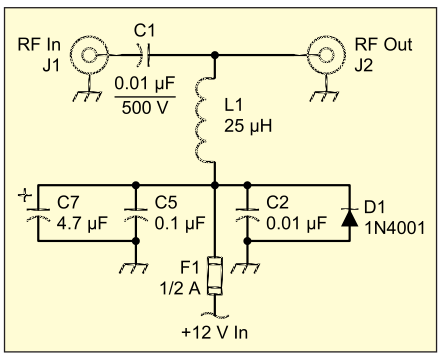


Figure 1—The dc injection (send) module used to send dc power down the coaxial transmission line. See Figure 2.

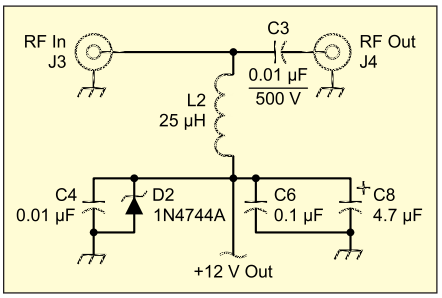


Figure 2—The dc recovery (output) module used to extract dc power from the coax. Part numbers are RadioShack (www.radioshack.com).

C1-C4—0.01 µF, 500 V disc ceramic capacitor (272-131).
C5, C6—0.1 µF, 50 V capacitor (272-135)
C7, C8—4.7 µF, 35 V electrolytic capacitor (272-1024).
D1—1N4001 diode (276-1101).
D2—1N4744A, 15 V Zener diode (276-564).
F1—5×20mm, 1/2 A fuse (270-1047) and 5×20mm fuse holder (270-362).
J1-J4—SO-239 coaxial socket (278-201).
L1, L2—100 µH RF choke (273-102).

Miscellaneous

Aluminum box (270-235).
Terminal strip (274-688).
Grommets (2) (64-3025).
Powerpole connectors (www.powerwerx.com).
For weatherproof enclosure (hardware or builder's supply):
Outlet box—(Red Dot RIH31LM) with blank cover (Red Dot RCCB) and 1/2 inch plugs (Red Dot S603E).
For IC-706 tune interface controller:
R1—10 kΩ, 1/4 W resistor (271-1335).
S1—Switch, push button, SPST (275-1547).
Molex connector, 4 pin (274-224).

The Design

Injecting dc onto a coax cable requires that there be good RF isolation between the signal and the dc source, since the dc source will effectively look like a ground, or short, to the RF signal riding on the coax. So, you need a couple of dc blocking capacitors that have *low* impedance at RF and a good inductor that has a *high* impedance at RF. The inductor must also be capable of handling the dc current required. The design is shown in the L schematics of Figures 1 and 2.

For the inductors (L1, L2), I chose a readily available RadioShack RS273-102 RF choke.[2] This inductor has an inductance of 100 µH and is capable of handling 2 A. The big question, of course, is how well the inductor performs across the HF bands. To determine this, I connected my RF analyzer (an MFJ-259B) across the inductor and swept it across the 1.8-30 MHz range. Unfortunately, I found that it became series resonant at about 11.5 MHz. However, 100 µH is significantly more inductance than is necessary

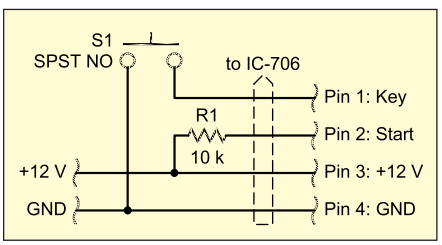


Figure 3—The ICOM IC-706 tune/12 V interface constructed by the author.

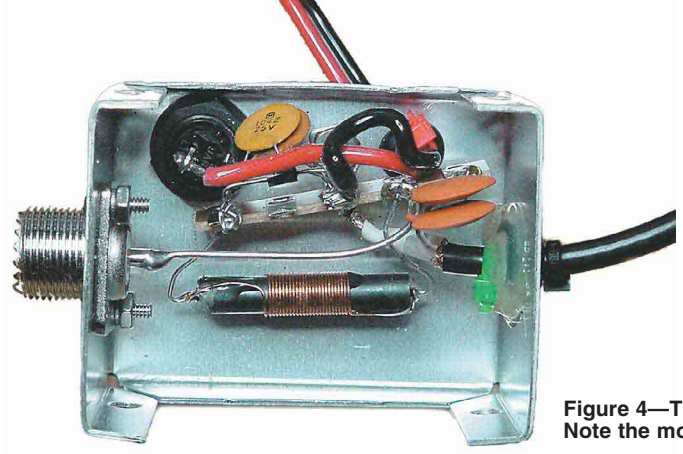


Figure 4—The dc injection module. Note the modified RF choke.

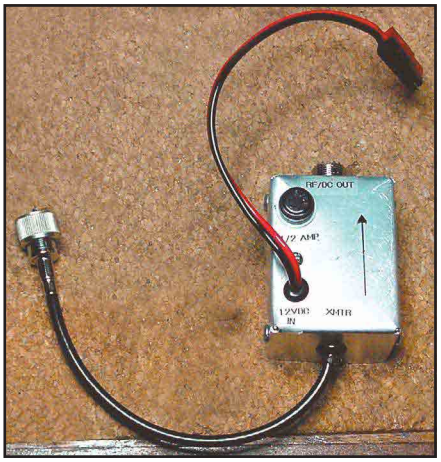


Figure 5—The completed dc injection module showing the RF and dc input lines.

to provide good RF isolation at HF. A value of 25 µH gives excellent isolation from 3.5 MHz on up, and is even fairly good at 1.8 MHz (X_L = 283 Ω at 1.8 MHz).

The RadioShack RF choke is made up of 50 turns of enameled wire, wound in two layers, on a ferrite form. Each layer consists of 25 turns of wire. To modify the inductor to 25 µH, clip the enameled wire lead associated with the top winding and unwind the top row of turns. You should be removing 25 turns. Now cut off the excess length, tin the wire end and wrap and resolder the enameled wire to the tinned lead it was originally connected to. This will give you almost exactly 25 µH of inductance. Rechecking the modified inductor with my MFJ-259B, I found that the series resonance point had moved to above 70 MHz.

The rest of the design is straightforward. I fused the input at 1/2 A, since my remote current requirements would be below this. And I used a 1N4001 diode (D1), oriented as shown in Figure 1, to protect against reverse voltage at the input. Both high-and low-frequency bypass capacitors were used on the dc side of the inductor as shown in the schematics (0.01 µF, 0.1 µF and 4.7 µF capacitors—C2, C4; C5, C6 and C7, C8, respectively). DC blocking capacitors (C1 and C3) were used on the RF side of the inductor. On the output box (Figure 2), I put in a 15 V Zener diode (D2) to clamp any voltage spikes, should they occur. Also, if you plan to operate on 160 meters, you may want to parallel two 0.01 µF capacitors instead of using the single 0.01 µF blocking capacitor (C1, C3) shown in Figures 1 and 2. Try to keep your signal-carrying lead lengths as short and direct as possible, as we're dealing with RF in addition to dc.

Refer to the Figures 4, 5 and 6 to help with your assembly. In Figure 5, you'll note that I used a pigtail coax cable for the connection to my transceiver. This is obviously an alternative to the SO-239 interface shown on the schematic and in the parts list. The labeling on the two boxes was made using a Casio labeler with "black on clear" tape. I also used a permanent marker pen to draw an RF/signal flow direction arrow on both boxes. Figure 7 shows the completed "antenna end" dc recovery module.

For a remote box permanently located outside near your antenna, you should build the dc output circuitry into an electrical weatherproof outlet box rather than the RadioShack aluminum box.[3] I bought my outlet box and blank panel from a local builder's supply store, but they're carried by most hardware stores. The electrical outlet box used here is a 3 hole, 1/2 inch, outlet box. The blank panel comes with a weather resistant seal. The 3 hole outlet box comes with two 1/2 inch plugs. Unfortunately, you need a third plug, so that's the reason I show an additional package of plugs on the optional parts list. I built all the circuitry onto the blank cover as can be seen in Figure 9. Note that I also connected a ground wire between the panel and the outlet box ground. The panel screws are probably fine for providing ground between the two assemblies, but I figured that the extra wire wouldn't hurt.

The two screws that come with the blank panel are *not* stainless steel, so they will rust over time. I therefore replaced these screws with #6 stainless steel flathead screws, and I also used #6 stainless steel hardware to mount the terminal strip to the blank panel. To weatherproof the dc output cable, I punched a 1/4 inch hole in the blank panel and passed the dc cable through it. I next applied some hot glue to the inside of the blank panel (component side) letting a little hot glue seep through the hole. Then I applied some

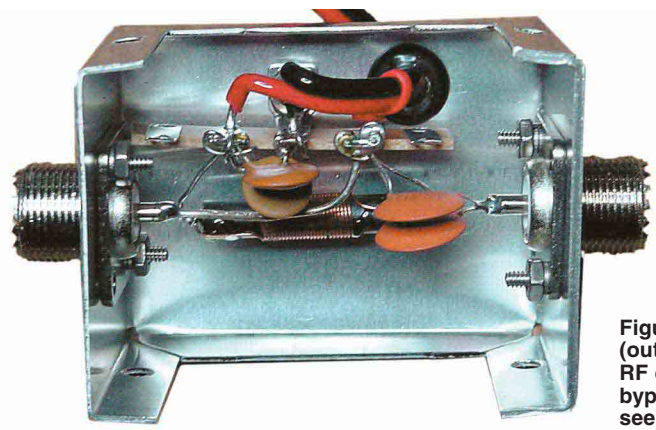


Figure 6—The dc recovery (output) module. The output RF choke, blocking and bypass capacitors can be seen clearly.

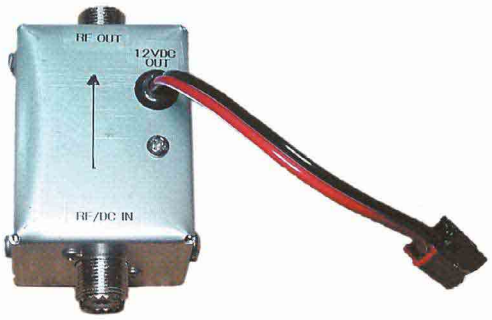


Figure 7—The completed dc output module.

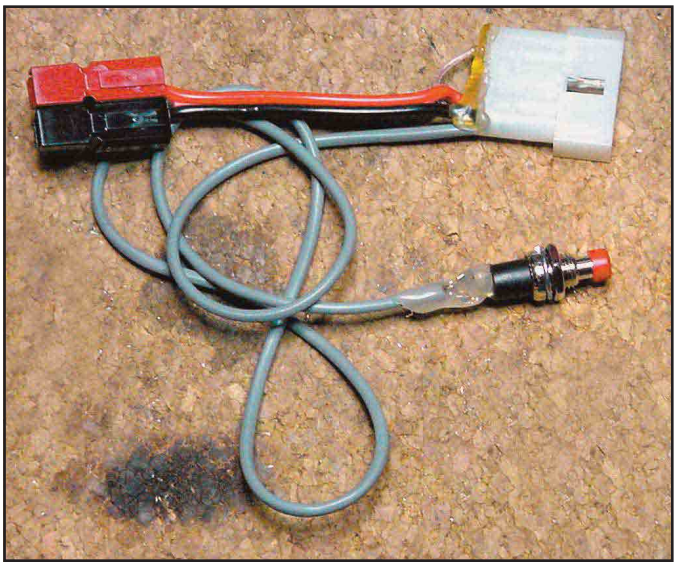


Figure 8—The IC-706 tuner adapter, which is discussed in the text. Its schematic is shown in Figure 3.

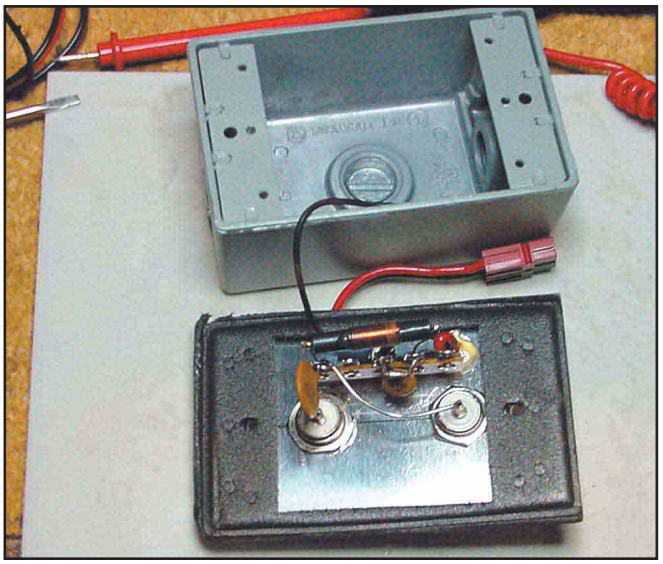


Figure 9—The weatherproof version of the dc output module is built into an outdoor electrical box.

clear epoxy to the outside of the blank panel around the exiting dc cable. The last thing you'll need to do is to install the three 1/2 inch plugs into the outlet box. The finished weather resistant box can be seen in Figure 10.

I missed my goal of making all parts locally available due to my use of Anderson Powerpole connectors. Other than these connectors, everything is available from RadioShack and your local hardware store. You can also use the Molex-style dc connectors available from RadioShack or any suitable connector pair that can handle the current.

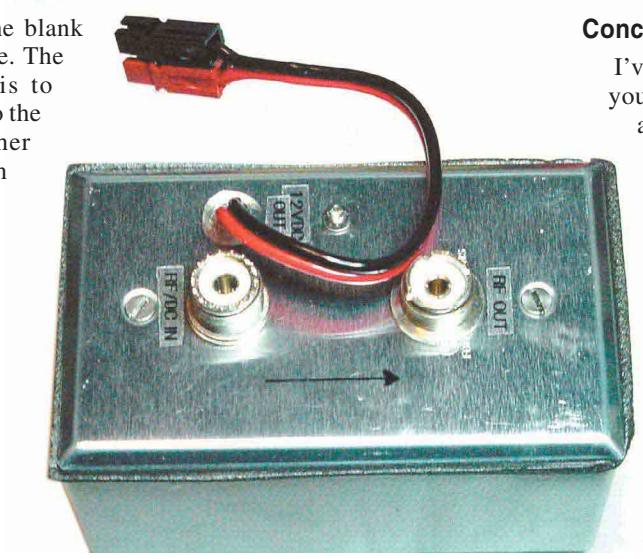


Figure 10—The completed "outdoor" dc output box suitable for permanent installations. Be sure to seal those coax connections!

Testing

When the boxes were completed, I first ran VSWR tests with the MFJ-259B across the HF through 6 meter frequency range. The output of the remote box was terminated in a good 50 Ω load. I used 25 feet of RG-58/U between the boxes. I measured a VSWR of less than 1.3:1 from 1.8 MHz through 54 MHz.

Next I connected up my ICOM IC-706MKIIG to the input and fed the RF to the SG-239 through the two boxes and 25 feet of RG-58/U. I remotely powered the SG-239 with a separate power supply directly at the SG-239 so that I was not running dc down the coax. I verified proper operation of the SG-239 from 40 through 10 meters. The antenna used was a 17 foot wire on the SG-239 RF OUT lead, and a 20 foot wire on the SG-239 GND lead.

Finally, I connected the input box dc connector to the 12 V dc output from the IC-706MKIIG. I'd built a 4-pin IC706/AH-4 connector-to-Powerpole pigtail, along with a TUNE switch as shown in Figures 3 and 8. Pressing this momentary normally open push-button switch causes the IC-706MKIIG to output a 10 W CW signal for tuning purposes. The output box dc connector was then connected to theSG-239. I ran my IC-706MKIIG at 100 W and verified that all bands (40-10 meters) worked as before—only now the SG-239 was being directly powered through the coax cable!

Conclusion

I've described some simple circuitry you can build in order to inject dc voltages into your coaxial transmission line, and recover these voltages remotely. With the design described here, performance is excellent from 1.8 MHz through 54 MHz. In my case, I use this method to remotely power an antenna tuner, principally for portable operation, but it's suitable for a permanent installation, as well. This setup can be used for any remote power requirement if you have coax running to your remote location. Tuner manufacturers—here's a suggestion: Since the parts needed to do this are few and inexpensive, perhaps those of you who make remote auto-tuners might consider including this capability in your future auto-tuner designs.

Notes

[1]SGC, Inc, 13737 SE 26th St, Bellevue, WA 98005; **www.sgcworld.com**.

[2]**www.radioshack.com**.

[3]The SO-239 and PL-259 connectors are not waterproof. These should be carefully sealed with a coax sealant if the dc output module will be used in a permanent outdoor installation.—*Ed.*

Photos by the author.

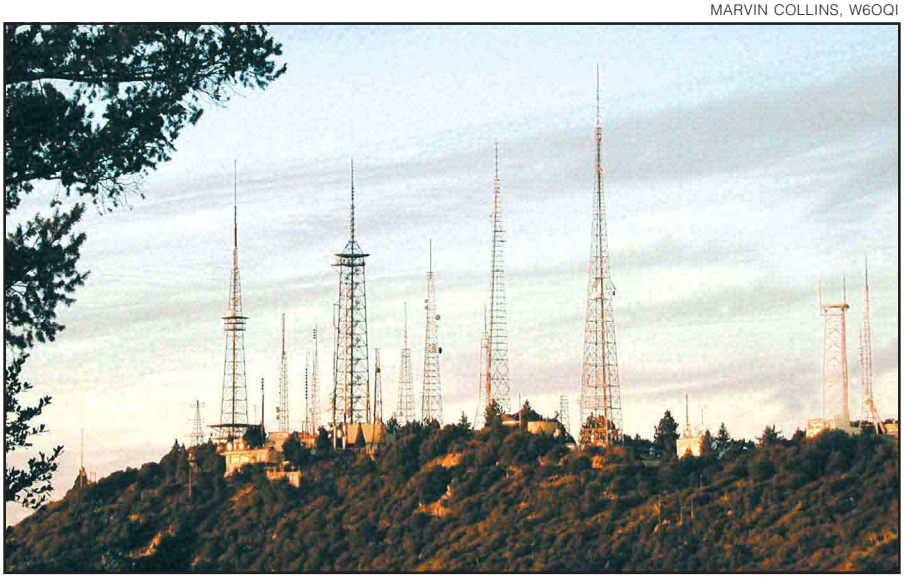
Phil Salas, AD5X, is an ARRL life member and has been a ham for 40 years. He has BS and MS degrees in electrical engineering and is currently Vice President of Engineering at Celion Networks in Richardson, Texas. Phil can be reached at **ad5x@arrl.net**.

By H. Ward Silver, NØAX

About FM

If you learn its fundamentals, you can demystify FM's seemingly complex behavior.

MARVIN COLLINS, W6OQI



The first practical frequency modulation (FM) systems were developed by Major Edwin Howard Armstrong, the prolific radio inventor, in the early 1930s. They offered immediate advantages over competing AM systems—higher fidelity and lower noise—advantages that are still true today.[1] As a result, FM systems are in wide use by people around the world, not only radio amateurs, as versatile communications and broadcast transmission mediums. It is the rare ham that has not used a portable or handheld transceiver on a repeater or a simplex frequency—many amateurs use it as their exclusive communications mode.

Even though FM is widely used, it is often poorly understood. The basic idea is straightforward—make the RF signal's frequency, rather than its amplitude, rise and fall with the modulating signal. One can quite easily imagine the result—as the amplitude of the message changes, the RF signal's frequency changes—tracking each peak and valley as shown in Figure 1. The creation of this signal requires an interesting and surprising bag of tricks, as we shall see.

Some Useful Concepts

Instantaneous Frequency and Deviation

Let's start by learning the appropriate terminology so that we can be precise in our discussion. The frequency of the FM signal at any instant in time is called the *instantaneous frequency*. The variations back and forth around the carrier frequency are known as *deviation*.

FM is one of two types of *angle modulation*. The other type is known as *phase modulation* (or PM). Both modulation types are in use by amateurs—they create similar on-the-air signals, and they can be received by the same equipment. The difference between FM and PM is that while the deviation of an FM signal depends *only* on the amplitude of the message signal, the deviation of a PM signal depends on *both* the amplitude and frequency of the message.[2]

Modulation Index

Just as amplitude modulation (AM) has a *modulation index* that measures the degree to which the message is modulating the RF signal, so does angle modulation. For AM, the index measures the amplitude relationship between the single pair of sidebands and the carrier. Angle-modulated signals have more than one set of sidebands—two, three, five or more, depending on how the phase of the carrier is altered by the message signal.

But doesn't the modulation cause a frequency shift in an FM or PM signal? Yes, because changing a signal's phase is effectively the same as changing its frequency during that same period. And, vice versa, changing a signal's frequency can be thought of as shifting its phase. There is an excellent description of the relationship between frequency and phase in the reference cited in Note 2.

The modulation index, m, for angle modulation, is a measure of the maximum amount of phase change the message signal can cause—more phase change (a larger value of m) results in more side-

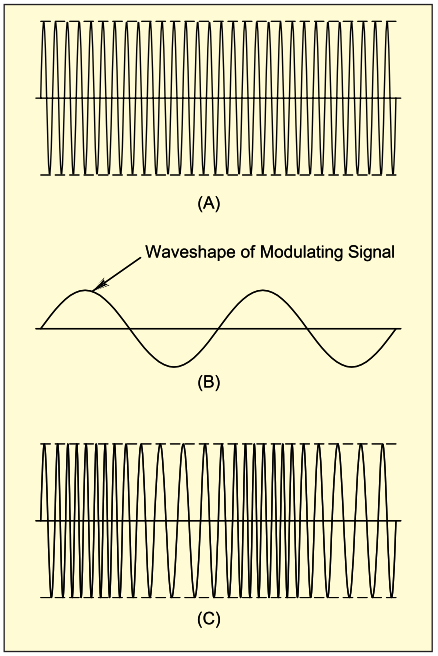


Figure 1—Graphical representation of frequency modulation. In the unmodulated carrier (A) each RF cycle occupies the same amount of time. When the modulating signal (B) is applied, the radio frequency is increased and decreased according to the amplitude and polarity of the modulating signal (C).

[1]Notes appear on page 42.

bands. For our single-tone message:

$m = A \times f_d / f_M$ (for FM)

$m = (\phi_{MAX}) = k_p \times A$ (for PM)

where:

m is calculated in radians and there are $180/\pi$ radians in the 360° of one complete cycle of a sine wave. (1 radian ≈ 57.3°)

A is the amplitude of the message signal in volts.

f_M is the frequency of the message signal in herts.

f_d is the *frequency deviation constant* that represents the sensitivity of the modulator in hertz of deviation per volt of the message signal.

$A \times f_d$ is called the *peak deviation*.

ϕ_{MAX} is the maximum value of phase change caused by the message signal.

k_p is the *phase deviation constant* and is similar to f_d in that it specifies the sensitivity of the phase modulator in radians of phase change per volt of the message signal.

For PM, m doesn't depend on message frequency at all. For an FM signal, m will be larger if the peak deviation gets larger or if f_M gets smaller. For example, loud low-frequency signals can cause m to become quite large unless the transmitter limits deviation and microphone gain or frequency response.

Bandwidth

FM signals are classified as narrowband (m≤1) or wideband (m>1). Amateur and commercial mobile services use narrowband FM to preserve power and spectrum space, sacrificing fidelity and message signal bandwidth. Commercial broadcast FM is wideband, delivering high-fidelity entertainment-quality signals with high power transmitters in 150-kHz-wide channels.

Note that nothing changes the power of the signal: *Angle-modulated signals are constant power signals*—regardless of the amplitude or frequency of the message signal. That's why your power meter doesn't change whether you're speaking softly, loudly or not at all! Power amplifiers for FM don't have to be linear, either, since there are no amplitude variations to preserve. The frequency of the signal is all that matters. The amplifier can be designed for optimum efficiency instead of linearity. That's what the SSB/FM switch on a VHF amplifier does—it changes the amplifier's operating point from one that optimizes linearity to another that optimizes efficiency.

Bessel Functions

The modulation index, m, is the key to determining the overall shape of an FM or PM signal. This shape—which specifies the amplitude of each sideband—is described mathematically by *Bessel* functions. Technically, there are an infinite number of sidebands in an angle-modulated signal, but the amplitudes of sidebands far from the carrier are insignificant and can be ignored. Narrowband angle-modulated signals are usually considered to have up to three sets of sidebands with useful power.

As m increases, so does the number of sidebands, but their relative amplitudes do not always increase. In fact, at certain values of m, some of the sidebands or the carrier disappear completely. For example, the carrier disappears when m equals 2.405, 5.52 and 8.654 (and other values). The first sideband will disappear when m equals 3.85, and so on.

For the simple case of a message consisting of a single tone, all of the sidebands are separated from the carrier by integral multiples of the message signal frequency. Figure 2 shows what the sidebands on *one* side of the carrier look like for different values of m and a 1 kHz message signal. (There is a symmetric set on the other side.) The component at 0 kHz offset represents the carrier. It's important to remember that all four examples have the same amount of *total* power—it's just distributed differently as m changes.[3]

Obviously, one can't be looking at tables of Bessel functions to determine signal bandwidth on the air. Certain conventions and calculation shortcuts are used

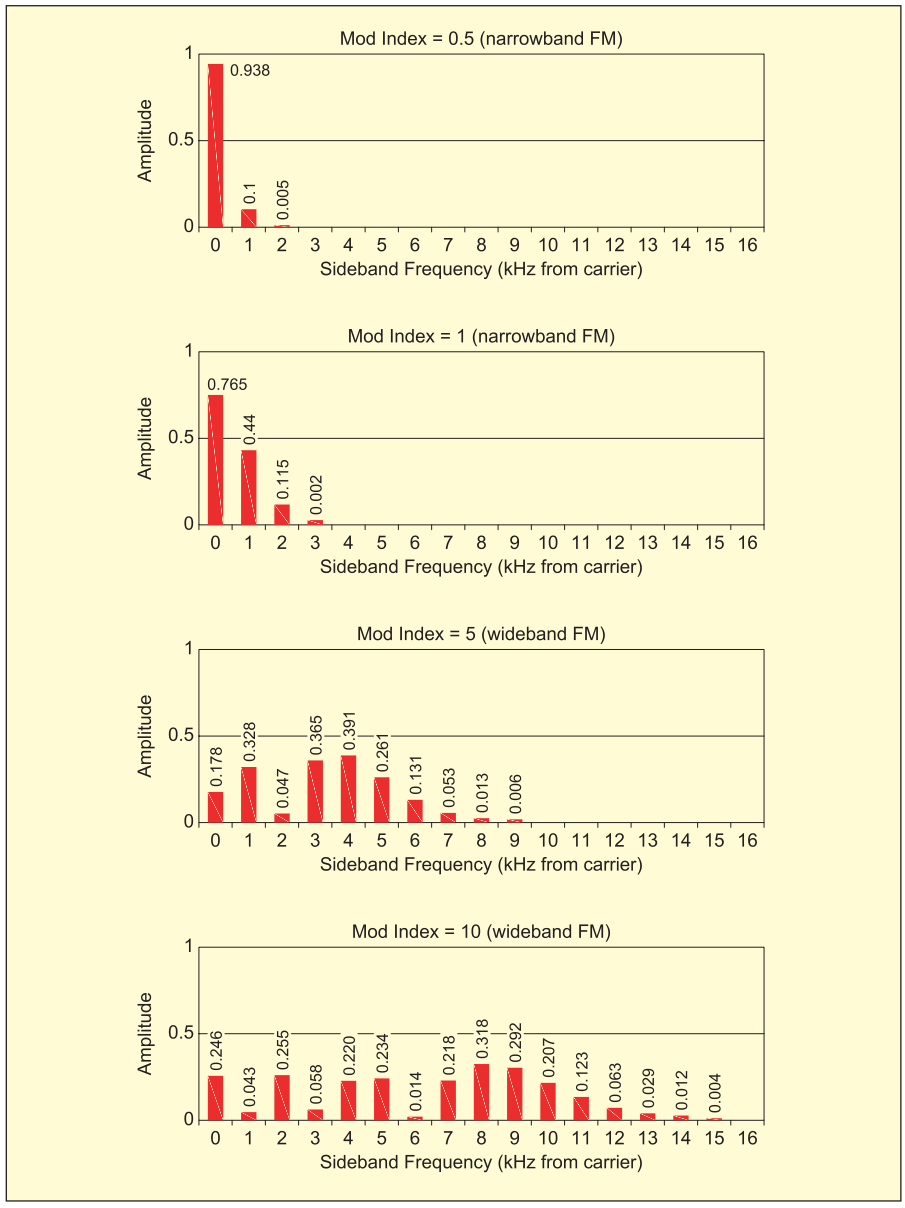


Figure 2—These graphs show the carrier and one side of an FM signal with a 1 kHz message signal at different modulation indexes. Note how the sidebands increase *and* decrease as modulation index changes. All of these spectrums have the *same total power*.

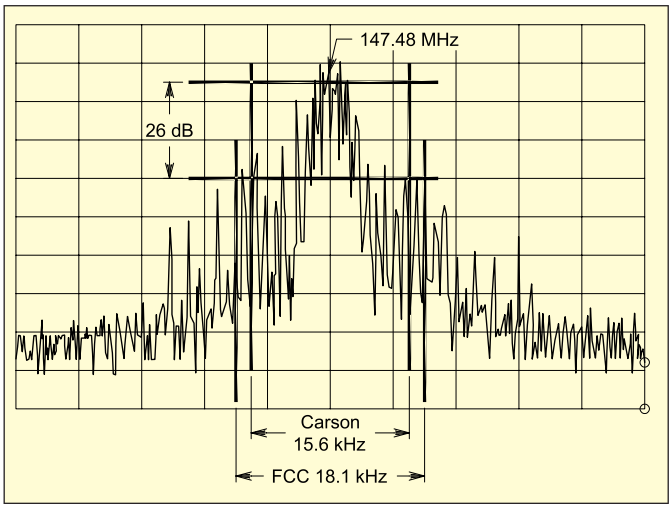


Figure 3—This is a spectrum analyzer display of a typical 2 meter VHF FM repeater. The bandwidths and amplitudes for Carson's Rule and the FCC Part 97.307 bandwidth definition are overlaid on the spectrum.

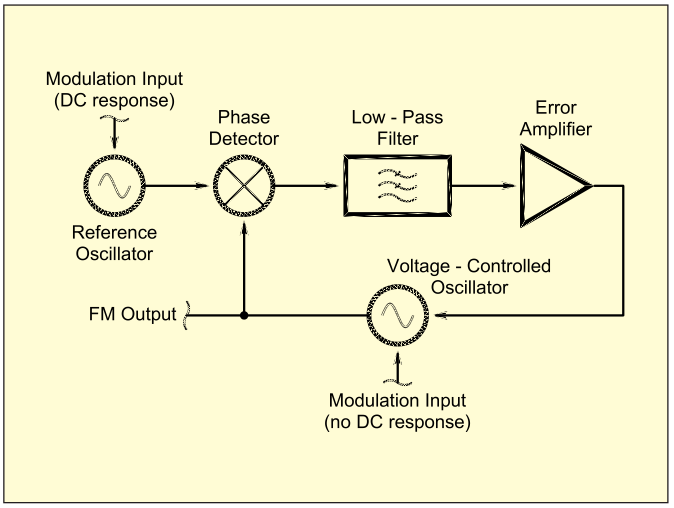


Figure 4—A phase-locked loop (PLL) can be used to generate FM by modulating either the reference oscillator or the voltage-controlled oscillator (VCO). To preserve a dc level in the message signal, the reference must be modulated.

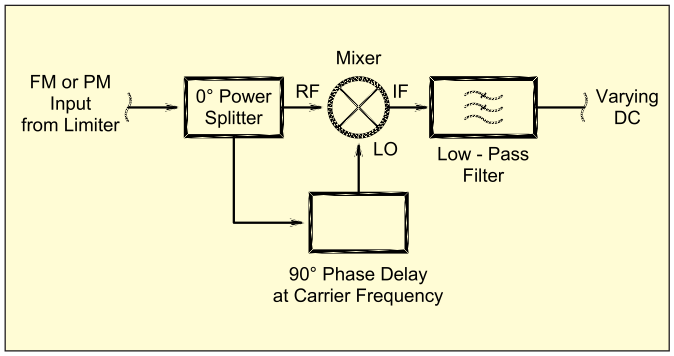


Figure 5—The quadrature detector produces a dc voltage output that varies with amplitude and polarity of phase differences from those at the carrier frequency.

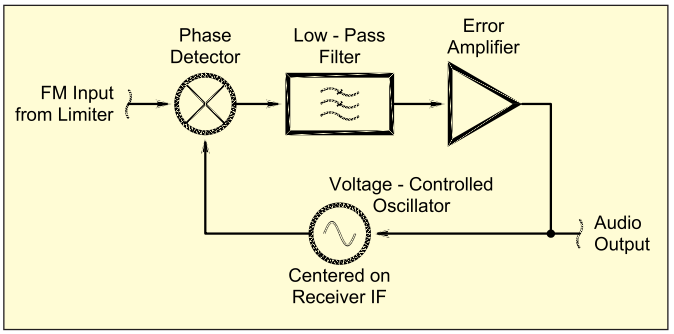


Figure 6—A PLL can be used to demodulate FM by letting the loop track the incoming signal. The error signal that causes the VCO to track is a replica of the message signal used for modulation.

instead. The Amateur and Land Mobile services have settled on 5 kHz of deviation as providing a good compromise between bandwidth, fidelity, noise and power requirements.

Carson's Rule

The bandwidth, B, of an angle-modulated signal is often estimated by an approximation known as *Carson's Rule*. If one adds up the power in all the sidebands, it can be shown that to include 98% of the signal power the following formula applies:

$$B \approx 2\ (m + 1)\ f_M$$

So far, we've only discussed the cases when the message signal is a simple tone. For complex signals, such as voice or data, m changes constantly as the amplitude and frequencies of the message signal change. Luckily, convenient substitutes for m and f_M are available.[4] Taking the place of m in the approximation is the ratio of the peak deviation to the bandwidth of the message signal, called the *deviation ratio,* D. This is a constant for any given FM transmitter.

$$D = f_d \times A / W$$

For f_M, we can substitute W, the bandwidth of the message signal, and the approximation becomes:

$$B \approx 2\ (D + 1)\ W \qquad \text{(Carson's Rule)}$$

If we use typical values for deviation (5 kHz) and message bandwidth (3 kHz for voice), D is 1.6 and B is 15.6 kHz. This combination appears to fit comfortably in a 20 kHz channel, the most common amateur FM channel spacing, with some spare room (called a *guard band*) to accommodate extra sideband energy and off-frequency stations.

Be careful! Carson's Rule is just a method of estimating the bandwidth in which a certain amount (98%) of the signal power is contained. As an example of another method, the FCC defines signal bandwidth (for any type of signal) in Part 97.3(a)(8) as "The width of a frequency band outside of which the mean power of the transmitted signal is attenuated at least 26 dB below the mean transmitted power within the band." In addition, the modulation index of angle-modulated signals is limited by Part 97.305(f)(1) to a maximum value of 1.[5] These two rules define a single "channel" and how much energy is allowed to be present outside that channel.

As an example, an FM signal carrying 3 kHz bandwidth speech from a 100 W transmitter, with an average output of 50 W across the channel, just meeting the FCC's output level and modulation index rules, could contain sidebands with a power of 0.125 W, 9 kHz from the carrier.[6] Including these low-power sidebands increases the bandwidth to 18 kHz. Figure 3 shows the spectrum of a typical 2 meter repeater output showing the limits for both Carson's Rule and the FCC bandwidth definition.

Given the sensitivity of modern receivers and the power of modern transmitters, using either Carson's Rule or the FCC definitions will likely be insufficient to guarantee that there is no interference to

adjacent channels close to the minimum spacing.

Transmitting FM

Direct and Indirect FM

Generating an angle-modulated signal requires some method of varying either the frequency or phase of an RF signal. The first method that might come to mind is varying the reactance of the frequency-determining elements of an oscillator. This method, called *direct FM*, causes the frequency of oscillation to change.

An unmodulated carrier can also be passed through a tuned circuit whose reactances are modulated by a message signal, altering the signal's phase. The result is a PM signal whose deviation is directly proportional to both the amplitude and frequency of the message signal. If the message signal is filtered, so that its amplitude is reduced in half as its frequency doubles, the amplitude and frequency effects on the deviation are balanced, and an FM signal known as *indirect FM* results. Examples of both direct and indirect FM modulators can be found in the references.[7,8]

A phase-locked loop (or PLL) can be used to generate FM by modulating the voltage-controlled oscillator (VCO) or reference oscillator as shown in Figure 4. The resulting frequency error between the VCO and reference causes the phase detector to generate a signal that attempts to force the VCO back to the reference frequency. If the message signal needs to include dc, such as for transmitting a pulse train or a video signal, then the reference oscillator must be modulated or else the loop's frequency-correcting mechanics will "correct" the dc level out.

Modulation Quality

If high speed data at 9600 baud or greater is to be transmitted using FM, then the method used to generate FM and the quality of the modulator are significant. Minor distortion that makes no difference for voice transmission can slow or prevent high-speed data transmission. Most older radios were designed for voice, and while suitable for low-speed 1200 and 2400 baud data, they may not be usable at data rates of 9600 baud and higher.

Modems used to encode and recover data from transmitted signals are particularly sensitive to the linearity of the modulator and to the transitions between the different data symbols. Nonlinearity results in a blurring of the message signals—just as if noise had been added. Transitions that are too abrupt or not smooth also make it more difficult for the modem to distinguish the new symbol properly. When you purchase a radio for data applications, make sure it is rated for that service.

When one adjusts an FM transmitter—either for repair or during construction—it is important to set the deviation properly to avoid interference to adjacent channels and distortion in the received signals. This can be done without sophisticated test equipment if one has access to a receiver with a CW filter that can tune to a carrier frequency of the equipment being adjusted. A single audio tone is used to modulate the transmitter while the test receiver listens on the carrier frequency. The audio tone's frequency is set to:

f = maximum desired deviation / 2.405

where the constant 2.405 represents the modulation index at which the carrier goes to zero. The deviation is slowly increased from zero (an unmodulated carrier) until the carrier received on the test receiver reaches a minimum value. This and other methods are more fully described in the reference material.[9]

Receiving FM

Once the FM or PM signal has been generated and transmitted, it is then necessary to demodulate it and recover the message signal—voice or data. Both FM and PM signals are received and demodulated using the same methods.

AM signals are demodulated by circuits that react to the amplitude of the signal. For FM, the message is encoded in the frequencies of the received signal, so any amplitude variations, such as noise or static, can be discarded. This is why FM reception can be largely free of atmospheric and man-made noise. These effects cause amplitude variations in the signal—very few external processes make unwanted changes in a signal's frequency.

Limiting, Quieting and Capture Ratio

Amplitude variations are removed from the received signal by amplifying it until it essentially becomes a square wave of constant voltage. An AM signal subjected to this treatment would be horribly distorted, but for FM, the information is still there in the form of frequency variations. This process is called *limiting*. When a signal is strong enough to drive an FM receiver's amplifiers all the way into saturation or *hard limiting*, so that no further increase in output is possible, then all AM noise is eliminated. This is the origin of the term *full quieting*—the signal is strong enough for the receiver to have completely eliminated all AM noise. As the signal strength drops, the limiters can't remove all of the noise so it starts to reappear in the output audio.

The ability of an FM receiver to amplify small signals and suppress noise is a measure of its sensitivity. A receiver spec sheet will state how much noise is suppressed for a certain input signal level. An example might be "0.2 µV for 20 dB of quieting." This means that, compared to the receiver output with no signal present (imagine the receiver output noise with the squelch opened), the audio level will be 20 dB quieter if a 0.2 µV unmodulated signal is present. The more sensitive the receiver, the lower the input level requirement will be for an equivalent amount of quieting.

A similar effect occurs when two FM signals are present at the receiver input. Because of the high gain of the limiters, the stronger of the two signals will dominate as if the weaker is noise. The weaker signal effectively disappears. This property of FM receivers is called the *capture effect* and the measurement of that effect results in a specification called *capture ratio*. The capture ratio represents the difference in dB required between two signals such that the stronger signal will suppress the weaker one. Lower numbers are better and a capture ratio of 1.5 dB is considered good.

It doesn't take much for the stronger signal to suppress the weaker one completely—as little as a 1 dB difference in signal strength could achieve that. Capture effect can be observed when two stations try to access a repeater receiver at the same time. The weaker signal will be suppressed until the stronger signal stops transmitting. If you've ever taken an out of town drive while listening to your favorite FM station and notice another station on the same frequency suddenly "popping" into the channel, you've experienced capture effect.

Detectors

How do FM receivers change the frequency variations back into a message signal whose amplitude varies? There are several methods that can turn the frequency variations into voltage variations of received audio.

Slope detection is the simplest (and oldest) method. Imagine trying to tune past a carrier with an SSB or CW receiver. When the carrier is centered in the receiver passband, it will be at its loudest. As the receiver is tuned past the carrier, the filter's rolloff will cause the carrier amplitude to diminish. If the receiver was tuned back and forth rapidly with the carrier on the slope of the filter's response, the result would be an ac signal that varies with the tuning. Slope detection works similarly except that the tuning is fixed and the signal frequency varies, sliding up and down

the slope of the detector's response curve.

The *discriminator* and *ratio detector* rely on the phase relationships of voltage and current in the primary and secondary windings of a transformer tuned to the IF of the receiver. Because the balance of the signals in the transformer changes above and below the center frequency of the transformer, the rectified signals from each side of the secondary winding can be combined in an external circuit to create a voltage that varies with the frequency of the signal at the transformer's primary winding. This varying voltage is amplified to create the receiver's output audio. A more detailed discussion of these detectors is available in the references.[7,10]

A *quadrature detector* utilizes an interesting property of angle-modulated signals that allows the message signal to be recovered when the RF signal is multiplied by a time-delayed version of itself, as shown in Figure 5. Quadrature detectors are currently the most popular FM detector, as they are a simple circuit to implement on ICs. The time delay function is usually provided by a tuned circuit external to the IC.[7]

FM can also be detected by a PLL. As shown in Figure 6, the PLL's natural function of tracking a changing input frequency can be employed to generate a voltage that varies as the input frequency changes. The PLL phase detector compares the output from the receiver's limiter to the VCO frequency. Any errors are fed back to the VCO so that it follows the input signal. The error signal shifts up and down as the input signal frequency varies, creating a replica of the original message signal.

Conclusions

After reading this article, I hope that perhaps some of FM's fundamentals will have been made clearer and that the jargon commonly tossed around on the repeater will have a little more meaning. Modulation techniques and theory are fascinating areas of radio theory for the interested amateur and are a key to cutting-edge wireless technology.

The author would like to thank John Davidson, KC6TFS, ARRL Orange Section Official Observer Coordinator for his communications regarding FM signal bandwidth and repeater channel spacing.

Notes

[1]M. Eisenberg, K3DG, "The Father of Modern Radio," *QST*, May 1991, pp 49-51.

[2]H. Hyder, W7IV, "Phase Versus Frequency Modulation," *QST*, Jul 1981, pp 33-34.

[3]If your Web browser can display Java applets, an excellent graphic demonstration is available at **www.algomusic.com/jmsl/tutorial/FMSpectrumApplet.html**. Using this program, you can adjust both the amplitude and frequency of a single-tone message signal and watch the sideband amplitudes change while the value of m is displayed.

[4]Ziemer and Tranter, *Principles of Communications: Systems, Modulation and Noise*, Boston: Houghton-Mifflin Company, 1976, section 3.2.

[5]CFR Title 47, Volume 5, Part 97.

[6]If sideband power is calculated as 20 log $[J_n(1)/0.5]$, then the 3rd sideband of a 3 kHz signal would be 27.9 dB below the average power in the channel, represented by a sideband amplitude of 0.5.

[7]*The ARRL Handbook for Radio Communications*, Newington: ARRL, 2003, Chapter 15, "Mixers, Modulators and Demodulators."

[8]D. DeMaw, W1FB, "First Steps in Radio, Part 17—Understanding FM Transmitters," *QST*, May 1985, pp 23-25, **www.arrl.org/tis/info/pdf/8505023.pdf**.

[9]*The ARRL Handbook for Radio Communications*, Newington: ARRL, 2003, Chapter 12, "Modulation Sources."

[10]D. DeMaw, W1FB, "First Steps in Radio, Part 18—Understanding FM Receivers," *QST*, Jun 1985, pp 25-27, **www.arrl.org/tis/info/pdf/8506025.pdf**.

First licensed as WNØGQP in 1972, H. Ward Silver, NØAX, is a frequent contributor to QST. *The author of the current* QST *column, "Hands-On Radio," he is an engineer, an author and a teacher. Ward enjoys contesting and DXing; he has helped new and prospective hams of all ages and is the author of the newly published book* Ham Radio for Dummies. *He can be contacted at 22916 107th Ave SW, Vashon, WA 98070 or at* **n0ax@arrl.org**.

NEW PRODUCTS

PROGRAMMABLE BATTERY ANALYZER FROM CADEX

◊ Cadex has added the C7400ER to its C7000 battery analyzer line. This unit is the most powerful battery analyzer in their series and provides four charging stations. Each station can be programmed to charge and discharge up to 6 A, adjustable in 25 mA increments. The analyzer is said to accommodate nickel, lead and lithium based batteries with voltages from 1.2 to 36 V (28.8 V for nickel-based batteries). Batteries interface with custom *SnapLock* adapters that automatically configure the analyzer to the correct settings. The optional *BatteryShop* software is designed to transfer control to a PC.

For more information, see their Web site **www.cadex.com** or contact Cadex Electronics Inc, 22000 Fraserwood Way, Richmond, BC, Canada, V6W 1J6; tel 604-231-7777; Fax: 604 231-7755.

W4RT ANNOUNCES CONTROLLER FOR MOTORIZED ANTENNAS

◊ W4RT Electronics has introduced The Antenna BOSS, a motorized antenna controller that provides the interface between an antenna and an ATAS compatible Yaesu radio such as the FT-100D, FT-847, FT-857 or FT-897. Tuning of the antenna is accomplished by using the TUNE button on the radio just as if an ATAS-100 or ATAS-120 were connected. The Antenna BOSS features dynamic motor braking, motor stall detection and braking, control of 6 to 12 V dc motors without programming or special sensors in the antenna. Operation with legal-limit amplifiers and manual control for 60 to 160 meter operation is said to be provided to overcome the ATAS control limitation. Power for the antenna motor and The Antenna BOSS is provided by the radio.

Price: $179 plus shipping. Contact W4RT Electronics, 3077-K Leeman Ferry Rd, Huntsville, AL 35801, fax: 256-880-3866, **boss@w4rt.com**, **www.w4rt.com**.

By Dave Hassler, K7CCC, and Bart Jahnke, W9JJ

The ARRL/VEC: Two Decades of Servic

The ARRL Volunteer Examiner Coordinator program is 20 years old this month. Celebrate the accomplishments of the ARRL/VEC and peer into the future of peer-provided license testing.

1984. Just thinking about the year brings up all kinds of images. George Orwell's book and the Apple Computer Super Bowl commercial it inspired. Reaganomics. Duran Duran. That brand new ICOM IC-751. Another thing in Amateur Radio that was brand new was ARRL's agreement with the Federal Communications Commission to become a Volunteer Examiner Coordinator. The League signed the agreement with the FCC on July 21, 1984.

After two decades of use, the VEC system of Amateur Radio license testing is so ingrained in the amateur culture that most hams today never had to drive an hour to Downtown Somewhere and sit in a sparse room while an FCC Field Office official presided over a testing session. The seed of the VEC program originated in 1954, when General or higher licensees were permitted to administer Novice and Technician tests. But two things that occurred in the late 1970s led to the development of the VEC concept: the exams had not changed much in many years, which led to the appearance of "answer books," and FCC Field Offices began to hold fewer and fewer testing sessions in the wake of government downsizing.

In 1982, the League saw it was time to act and set about defining a program that would train the volunteer examiner, develop a large, updated and often-rotated pool of questions, and provide more frequent and convenient exam sessions. ARRL volunteers and staff worked with key FCC staff to lay the foundation of the program. Their efforts resulted in Public Law 97-259, which gave the FCC the authority to establish a volunteer testing system.

That was just the first step; a program had to be fleshed out that would have integrity and provide top-flight service. ARRL's first VEC manager, Curt Holsopple, K9CH, said in a July 1994 *QST* article that his office was committed to a tight, honest system that would work right the first time and do so on a national level. "There would be no half-way efforts," he wrote. "...We had to anticipate problems and...we intentionally over-designed the program...."

Holsopple's team spent most of 1983 and early 1984 writing and rewriting exam questions and creating Morse code tapes. New rules were drafted, and hams with Extra and Advanced tickets were recruited, trained and certified. Sophisticated data processing systems that would maintain detailed records for the FCC were built from the ground up. And authorization for test expense reimbursement, so essential for the long-term survival of the program, was obtained through Congress. When everything was ready, the League and the FCC signed the formal agreement that made ARRL a national Volunteer Examiner Coordinator. The first ARRL/VEC-given exams were taken by candidates at the 1984 ARRL Pacific Division Convention on September 1 in Santa Clara, California.

PAUL TOTH, NA4AR

Candidates anxiously watch as a VE team in the West Central Florida section processes their upgrades.

COURTESY BOB REED, W2CE

Announcement of the FCC/ARRL signing of the VEC agreement, Hotel Penta, New York City, 1984.

1954: As of June 1, candidates for Novice and Technician licenses no longer need to travel to an FCC office for an exam.

1984: On July 21, ARRL becomes a VEC at the ARRL National Convention in New York City. The ARRL/VEC conducts its first testing session in California on September 1 at the ARRL Pacific Division Convention.

1993: In July, the FCC began requiring three examiners for a Novice exam—bringing all testing under the VEC system, adding additional credibility. It also provides a more uniform means of information dissemination to Novice license examiners.

1982: ARRL works with the FCC, outlining plans for what would become the Volunteer Examiner Program. Public Law 97-259 allows FCC to establish a VE system.

1987: On March 21, the FCC requires that two General or higher class examiners be present at a Novice testing session; Novices gain additional privileges. The FCC splits the 50-question Element 3 Technician/General written exam into two separate tests.

Late 1970s: FCC Amateur Radio licensing opportunities begin to dwindle in the face of federal government cutbacks.

1983: ARRL organizes a Volunteer Examiner Coordinator's office to develop the League's program. Volunteer examiners, under the supervision of the FCC, administer tests to more than 600 applicants at the Dayton Hamvention.

1986: The FCC turns question pool maintenance over to VECs. The VECs establish a question pool committee, with their first effort—revision of the Extra class pool—released 24 months later.

1991: On Valentine's Day, the FCC drops the 5 WPM Morse code requirement to earn the Technician license, clarifies accommodative testing procedures that may be used for persons with physical disabilities, introduces a 13 or 20 WPM Morse exam waiver for persons who had already passed a 5 WPM test.

ARRL/VEC Today

There are 14 Volunteer Examiner Coordinators recognized by the FCC, of which the ARRL/VEC is one. Coordinating more than two-thirds of all exams administered today, ARRL/VEC currently has 25,000 accredited examiners in its ranks and over the past two decades has accredited nearly twice that number. "When 2004 is over, we expect to have administered over 1.25 million exam elements, to nearly 820,000 applicants at over 90,000 test sessions," said ARRL's VEC Manager (since 1989) Bart Jahnke, W9JJ. "Plus, we have approximately 1000 VE teams that are stocked up with materials to provide on-demand testing capacity." He said that after 20 years, the VE process is down to a meticulously managed science. Setting up the exams is cut-and-dried work and support from ARRL Headquarters is provided in a highly coordinated fashion.

Jahnke said that three main challenges face today's Volunteer Examiner teams. Finding available time to organize and run testing sessions in the face of many other commitments is difficult for many VEs. There are also issues of securing testing locations and the challenges associated with lining up publicly accessible testing locations. Volunteer Examiner teams also need to think about themselves and where new recruits for the team are going to come from.

Current HQ VEC Department Staff

Bart Jahnke, W9JJ
VEC Manager

Maria Somma, KB1KJC
VE Services Supervisor

Perry Green, WY1O
Assistant to the VEC Manager

Pete Warner, KB1KJB
VE Services Assistant

Nonie Madone
VE Services Assistant

Ann Brinius
VE Services Assistant

Teams have to identify qualified individuals, determine if they have the time to be involved and then effectively fold them into the program.

Another thing that VE teams are doing is getting out the message that they are active and ready to serve, promoting both the VEC system and Amateur Radio in general. Jahnke notes that this is needed precisely because today there are so many distractions available. "A lot of it has to do with how much technology has evolved in the last 20 years," he said. Indeed, VCRs, cell phones and computers, all but ubiquitous today, were afforded to few people in 1984.

"There is no doubt that we have to go out and proactively promote Amateur Radio," Jahnke said. "In the past, especially initially, things worked pretty well on the 'if you build it, they will come' philosophy. We just wanted to present a secure and convenient system for those who wanted to take exams. But now, we need to get the message out."

A 1994 Larkfield ARC VE session was held at the Harborfields Public Library, Greenlawn, New York.

COURTESY LARC

During 1997 Fall National Exam Day, Don, KB2ZPJ, accepts his newly earned CSCE from the VEC team consisting of AA2KZ, WK2R and AB2BB.

1994: The FCC upgrades its computer system. The "Technician Plus" license is created. License renewals are now only permitted within 90 days of expiration, or up to two years after expiration.

1995: With the introduction of electronic license application processing at the FCC, the test-to-ticket time plummets from 14 weeks to three days.

1999: The FCC implements the Universal Licensing System, consolidating multiple databases and forms for improved access and efficiency.

2000: April 15 brings license restructuring. Only three license classes can now be earned—Technician, General and Amateur Extra—with a single 5 WPM code speed required for General and Amateur Extra. Novice and Advanced licenses are still renewable and can be modified.

2001: Ringing in the new year, the FCC implements faster processing of license data submitted by VECs. The FCC queues up all applications received each hour and completes processing for most applications within 90 minutes.

2003: The 2003 World Radiocommunication Conference (WRC-03) removes the Morse code examination requirement from the Radio Regulations. Each country decides whether to retain the code requirement. Amateurs file various petitions with the FCC regarding code.

2004: The ARRL and others petition the FCC to create a new entry-level license that would include additional HF phone privileges without requiring a code test. ARRL also proposes consolidating all current licensees into three classes, retaining a code exam only for the highest class.

JODI MORIN, KA1JPA

Future: ARRL/VEC seeks to further increase efficiencies in the program, engage in further promotion of Amateur Radio in local communities through VE efforts and continue the highest standards of exam integrity.

VECs in the Amateur Service

Anchorage Amateur Radio Club
907-338-0662
jwiley@alaska.net

American Radio Relay League
860-594-0300
vec@arrl.org

Central America CAVEC, Inc
256-536-3904
dontunstill@comcast.net

Golden Empire Amateur Radio Society
530-345-3515
wa6zrt@aol.com

Greater LA Amateur Radio Group
818-892-2068 (home)
gla.arg@gte.net

Jefferson Amateur Radio Club
Doug@bellsouth.net

Laurel Amateur Radio Club, Inc
301-937-0394 (1800-2100 hrs)
301-572-5124 (1800-2100 hrs)
aa3of@arrl.net

The Milwaukee Radio Amateurs' Club, Inc
262-797-6722
kf9pu@aero.net

MO-KAN VEC Coordinator
785-867-2011
WO0E@earthlink.net

Sandarc-VEC
619-465-3926
n6nyx@arrl.net

Sunnyvale VEC Amateur Radio Club, Inc
408-255-9000 (24 hours)
vec@amateur-radio.org

W4VEC
336-841-7576
w4vec@aol.com

W5YI-VEC
817-860-3800
800-669-9594
NB5X@w5yi.org

Western Carolina Amateur Radio Society VEC, Inc
865-687-5410
wcars@korrnet.org

BUTCH SMITH, N4TK

The ARRL Nashville VE Team shows its colors.

What's Next?

Whether it's the ARRL license restructuring proposal or another that's adopted by the FCC in the coming months, ARRL/VEC staff feel the coming changes will mean more activity for VE teams and VECs. "Right now, we're in a state of uncertainty," said Maria Somma, KB1KJC, who has served as VE Services Supervisor since 1986. "Will there be code testing or not? No one knows. Will there be a new entry license class? If so, we (the Amateur Community, our VEs and the National Conference of VECs Question Pool Committee) will have to prepare the new pools and exams. Then, when the changes go into effect, we can expect to see an increase in the number of applicants who will want to test." Assistant to the ARRL VEC Manager Perry Green, WY1O, adds that "the procedure for testing will not change—nor do we suspect will the test contents for General or Amateur Extra—but there will definitely be a need for proactive VE teams to handle the increase we'll see."

Elsewhere in this article you'll find contact information for the 14 currently authorized VEC groups. If you'd like to be an active participant in giving back something to Amateur Radio, consider contacting ARRL (or any of the 14 VECs) and finding out how you can be a part of the next chapter in the VEC story. QST

By Darrel Wyatt, KG4LWQ

MARS "Invades" Belize

As this story of an operation in Belize demonstrates, the Military Affiliate Radio System remains ready to patch military personnel through to family and friends back home, much as it did during the Vietnam conflict.

MARS is the acronym for Military Affiliate Radio System, made up of amateur and military stations that provide Department of Defense-sponsored emergency communications and handle morale and welfare traffic. Although they are primarily HF stations operating on military frequencies, MARS stations also operate on VHF outside the amateur bands.

Most Amateur Radio operators or military personnel have heard little from MARS since Vietnam, except for a brief burst of activity during the first Gulf War. However, MARS operators don't go away; they are just quiet and are not likely to engage in self-promoting activities. On my first outing as Recruitment Coordinator for Florida Army MARS, I found amateurs had for the most part heard of MARS, but only in the past and were generally misinformed. Some thought the organization had disappeared, while others believed it was a rather private organization and difficult to join. I even had one amateur tell me that he thought you had to "know someone" to get you in! All were surprised to learn that *all* Amateur Radio operators are eligible for HF phone privileges on the MARS frequencies.

SGT TIM LAWN

Drawing of Black Hawk during routine maintenance. The Army Aviation Assets support the medical team for Casualty Evacuation Missions and support the Task Force in other general missions. The aviation assets routinely deploy with their HF radios. It was a special treat for them to be able to access the MARS phone patch network with their own tactical HF radios.

Ten Days to a MARS Call Sign

MARS stations use military frequencies and make no distinction as to the class of amateur license. A military operator does not even need to have an amateur license—just his commander's okay and a call sign issued by MARS headquarters. With all the Technician class licensees out there, this proved to be a great recruitment tool because I could offer them almost instant HF phone privileges on our frequencies. The application is a simple form, and it generally takes only about 10 days to get a new MARS call sign issued. This is fertile ground for a MARS recruiter!

It didn't take me long to learn that it was much easier to recruit new members than to retain them. Some simply did not care for the more disciplined radio procedure required on a military net, but others found that there wasn't as much traffic as they imagined. When we failed to keep them busy, they got bored and lost interest. The diminishing military traffic is often blamed on the widespread availability of e-mail, cell phones, better availability of landlines, prepaid phone cards and even on satellite telephones. Troops often have access to these modes of communications in locations that would have previously been too remote for landline access.

What eventually became apparent was that the biggest challenge I faced was recruiting more *customers*, not recruiting more operators! One would think that would be the easy part, since we are in essence offering a free service. How could that be difficult to sell?

As any good salesman or recruiter knows, it's best to start at home with the people you know. That is exactly what I did. My Army Reserve unit was scheduled for a deployment on a humanitarian mission to Belize. I approached my commander. He fortunately was also an amateur operator. With his approval we applied for and were granted a military unit station license for the 73rd Field Hospital. The frequencies were requested through the MARS chain of command. The operation also required the approval of the host nation, and US Southern Command. This all required a great deal of coordination but it came together nicely.

I also wanted to be able to operate in the amateur bands while in Belize, so I applied directly to the Belize government for a reciprocal amateur call sign. US amateurs wishing to operate on the

amateur bands from Belize must obtain a reciprocal license. This can be obtained for $20 US from Public Utilities Commission, PO Box 300, Belize City, Belize. In my case, the Public Utilities Commission processed my request as a "renewal," and did not issue me an amateur call sign. Since I had no prior Belize license, this turned out to be rather frustrating. The original license was eventually issued, but not before my trip was over.

It is such a beautiful country and the people are so nice, I intend to go back on my own sailboat when I can stay longer. When I do, I definitely want to be able to operate on the amateur frequencies. For those amateurs planning a trip to Belize, I recommend that you apply for your reciprocal license at least six months in advance of your trip. For this mission, the MARS system worked out much better.

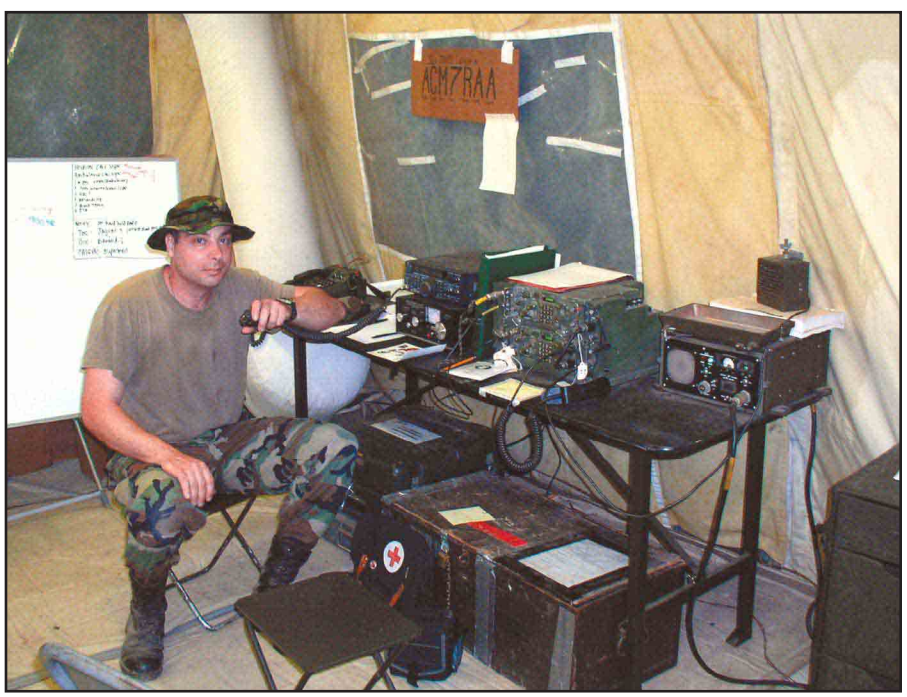
Looking for Gear

Surplus government radio equipment is not as readily available as it once was, so part of my job was to accumulate the radio gear necessary for any DXpedition. I chose a Kenwood TS-450SAT, which I bought used on eBay and had modified to operate on the MARS frequencies. A MARS friend also lent me a spare Kenwood TS-950 transceiver. The choice of equipment was influenced by the fact that our unit would be there for over 12 weeks, and we would have experienced amateur operators there only for four of those weeks. I wanted equipment that was simple to operate and that was more or less "expendable" if lost or damaged in transit or operation. I also purchased the large military packing crates designed for such delicate equipment. All of the equipment had to be packed up and ready to ship, two months prior to our expected deployment.

My other task in this project was to arrange the training for our military operators. This was an interesting challenge, for these operators are neither amateurs nor military communication specialists. This particular mission allowed for none of our administrative or support personnel. Every soldier I had to work with was either a medic or a nurse. These people by virtue of their military basic training have training in military Radio Telephone Procedure, but by the very nature of their specialties, they were not experts in radio communications, and none were amateurs. They all trained-up quite expeditiously; in fact, our MARS phone patch coordinator later commented that he had never seen a group of operators train up and become proficient quite so quickly.

The equipment was packed in containers along with the rest of our unit's equipment and was shipped out of the port of Corpus Christi. We followed by air two months later. Upon my arrival in-country, we faced a four hour bus ride from Belize City to our base camp near the town of Dangriga.

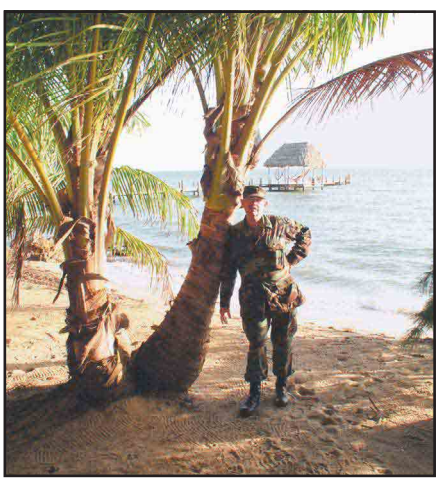
Soldiers erecting the antenna mast that supported the tactical SINGARS antenna and the inverted-V dipole for the MARS station.



A MARS operator in the hospital at base camp in Belize. The station consisted of off-the-shelf commercial amateur equipment modified for MARS operations, which function on military frequencies.

Dangriga at Last

Upon my arrival at base camp, I found that all of my equipment had arrived without any apparent damage, except that the relay circuit for the amplifier was in-



The author takes a little time to enjoy the beautiful country. Unfortunately, the base camp was not located in such an attractive setting.

During their training back home, military operators learn basic military radiotelephone procedure. Most were not amateurs but required only minimal familiarization training to teach them MARS procedures and phone patch techniques.

operable. When we packed up the equipment, we did not have the frequencies authorized, so I delayed packing the antennas pending frequency authorization and carried wire for a dipole in my duffle bag.

Our base camp was located in an empty cleared field, not far from the town of Dangriga. We had no commercial phone service, and our hospital had no commercial power. We operated off of two 100 kW field generators.

We were there in support of Joint Task Force Jaguar. This operation was a joint effort by the Army, Navy, Marines and Air Force to provide engineering and medical support to both the deployed US forces and the local communities.

Our station was licensed as an Army MARS station, but we found great interoperability with our Air Force partners. Most of the phone patches were handled by our Army MARS phone patch station in Silver Springs, Florida. The Air Force phone patch station at Patrick Air Force Base was of considerable assistance when the Army station was not available. We also had great support from several individual MARS stations in Kentucky, Missouri, Tennessee, New York and Pennsylvania. We were able to support members from each of the armed services and heighten the awareness of MARS and our capabilities. One of our patients, a heat casualty, was able to make a call home and tell his family he was okay. Our Deputy Task Force Commander (who was Marine Corps) was able to call home to stay in contact with a personal emergency that almost called him away from the Task Force. Others were able to call home, from the "middle of nowhere" and just say, "I'm okay, and I love you!"

The deployed unit's tactical satellite communication equipment failed early in the deployment, but MARS was able to pass traffic related to critical resupply issues. In several cases our MARS operators were able to complete a phone patch to a key individual back home to arrange for important pieces of resupply equipment to be hand-carried by individuals due to rotate in.

In the early days of the deployment, we completed 20 to 30 phone patches each day. This created an enthusiasm at our MARS stations back home that will be difficult to duplicate until there is another mission. During the third week of the deployment, the landlines arrived in base camp and MARS traffic dropped precipitously.

Still a Need

At the MWR (Morale, Welfare and Recreation) tent, we left the inscription, "Florida Army MARS, First to Communicate." The lesson we learned during this exercise was that there is indeed still a place for MARS. That place is primarily to support a rapidly mobile force, which may be deployed well in advance of landlines. Once the landlines arrive, we may very well be perceived as obsolete. Our role, should we choose to accept it, is to be prepared to support the rapidly mobile troops who do not yet have access to landlines. There we will still be very much appreciated. If we are prepared for that role, we will have a long future.

MARS members who are also members of the National Guard or Reserves may be eligible to receive reserve retirement points for their MARS activity. MARS is alive and well. It stands ready to support our troops wherever they go. Amateur Radio operators should consider contacting their local MARS organization to explore the exciting opportunities available only to MARS members. Those in the National Guard or Reserve (or eligible to join) should give this even more consideration, given the unusual opportunity to combine Amateur Radio and service to our country.

Photos by the author.

Darrel Wyatt, KG4LWQ, is an Amateur Extra class amateur and a member of ARRL. A medical doctor with 34 years of service with the National Guard and Army Reserves, he is currently a Lieutenant Colonel with the 73rd Field Hospital in St Petersburg, Florida, and was recently deployed to Belize with his reserve unit. He is also a member of Florida Army MARS. You can reach the author at PO Box 202, Crystal River, FL 34423; **recruitment@flmars.org**.

Army MARS Wants You!

The following is from the Army MARS Web site (**www.asc.army.mil/mars/join.htm**). Navy/Marines (**www.navymars.org**) and Air Force (**www.afmars.tripod.com/mars1.htm**) MARS have Web sites as well.

Eligibility

The applicant must:

Be 17 years of age or older. (Signature of parent or legal guardian is required when an applicant is under 18 years of age.)

Be a United States Citizen or resident alien. (Possess a valid amateur radio license issued by the Federal Communications Commission (FCC) or other competent U.S. Authority.)

Possess a station capable of operating on MARS VHF and/or HF frequencies.

Agree to operate a minimum of 12 hours per calendar quarter with 6 hours being on VHF and/or HF networks.

Types of Membership

There are four types of membership:

Individual Membership: A privately owned VHF and/or HF radio station, licensed by the FCC and/or host authority, operated by an individual who is a member of and licensed by Army MARS.

Club Membership: A radio station licensed in MARS that is established, operated, and maintained by volunteers under the auspices of a properly constituted military and/or civilian amateur radio club.

Auxiliary Membership: Auxiliary membership is designated for non-operators who perform a support function.

Military Unit Membership: Military unit MARS stations are operated and maintained under the auspices of a military command, and are authorized on the table of distribution and allowances/table of organization and equipment (TDA/TOE). Military station categories include active Army, Reserves, National Guard and Corps of Engineers.

Applying for Membership

To request an application for membership, either e-mail our administrative staff or write to: Attn NETC OPE MA, US Army Netcom/9th ASC, 2133 Cushing St, Ste 3102, Fort Huachuca, AZ 85613-7070.

By John J. Pise, Jr, KX1X

Ham Radio at MassJam 03

Would we want to demo ham radio for upwards of 8000 eager scouts? You betcha!

Back in January 2003, I was asked if Venture Crew 510 would be interested in providing a ham radio demonstration for the 8-10,000 scouts who were to attend the Massachusetts Boy Scout Jamboree (MassJam 03). It was to be held October 11-13 at the Barnstable Fairgrounds in Falmouth. Who could pass up such an offer? It has always been my belief that youth *are* interested in ham radio—it just needs to be shown to them.

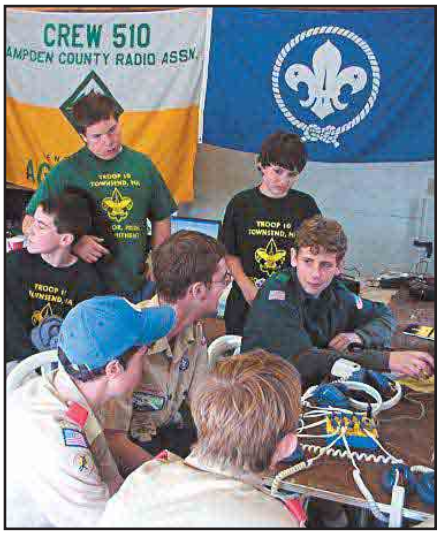
Venture Crew "DX"

Just over three years ago, after my second year of teaching the Radio Merit Badge at the Horace A. Moses Scout Reservation in Russell, Massachusetts, a couple of my prior year "students" returned to the ham shack to let me know that they had in fact followed my direction, and were just about to take their Technician test. After some discussion, someone came up with the idea of having an "electronic" camporee in the fall instead of the usual scout skills, first aid and woods tools type of event. I brought the idea to the Pioneer Valley Council, and it was received with a very positive response.

I was sure to have the camporee over Jamboree on the Air weekend, and invited these new Technicians to be part of my staff, helping with and operating the three or four planned JOTA stations. We also ran a JOTI (Jamboree over the Internet) station using a cell phone and PC projector. There was one more youth ready to take his Technician test, so we invited the local VE team to the camp. Happily, he passed.

The camporee was an overwhelming success. The youth who had been on staff got along so well together and had fun communicating on their 2 meter handhelds as part of the staff. It was decided at that time that we should band together to do ham radio more often, as a group …and Venture Crew 510 was on its way (510 in Roman numerals is "DX").

Venture Crew DX has just celebrated its second anniversary, and is 11 youth strong…4 Extras, 3 Generals, and 4 Technicians. The Crew's club call sign is NE1C (New England's #1 Crew), and Venture Crew 510 is an ARRL affiliated club.



World Brotherhood: **Luke, KB1ISP, tunes the world as scouts look on. In the background, a flag representing World Brotherhood of Scouting is certainly appropriate for the occasion.**

On the Way to MassJam

We are very lucky to have a supporting chartered organization behind our Venture Crew. The Hampden County Radio Association (HCRA) has been instrumental in our receiving donations of equipment and funds. We are also allowed to use their assets, which include a military surplus tower and TA33 Jr triband beam that we brought to MassJam. Using proceeds from donated equipment and funds donated by the membership of the HCRA, Crew 510 was able to purchase an ICOM IC-746 transceiver.

With the tower, beam, and a number of radios and computers, along with tents and luggage, Crew 510 made its way down the Mass Pike, and then south along I-495 to Falmouth, on Cape Cod.

We Arrive at Barnstable Fairgrounds

It wasn't long after we arrived at the fairgrounds that Murphy did likewise. As we pulled up to the building that had been confirmed as being ours to use for our demonstration, we noted tents had been put up in the area in which we had planned to put our 50 foot military tower (with associated guy wires).

When I met with the Physical Arrangements manager, he gave us unfortunate news. The building that we were to use was full of fairground equipment, and was now unavailable, but he had reserved us a place in the "Exhibitor's Hall," and brought us over to that building. There were already people setting up uniform displays, playing loud radio, which echoed through the hall. An ominous sign had been posted—patch trading was also to be in this hall. The outlook was dim. The echo and noise that would be generated by a hundred people at a time would make our job very difficult, and the noise that we generated from SSB and CW operations, I'm sure, would not endear us to our fellow "exhibitors."

I explained to the PA manager that the "exhibitor's hall" solution would be unworkable, and that we would have to pull out if a truly workable solution could not be found. We set up our tents for the evening, and thought we would surely be leaving in the morning.

Around 10 PM that night, the PA manager brought us another alternative. They had not confirmed that the broadcast radio station was going to be there, and, actually no one seemed to think they would show. He brought us over to a building—actually it was a two car garage—and asked if this was acceptable. Sure was!

The Crew quickly brought the equipment to the building (before they changed their minds) and started the setup. There were five 8 foot tables in the building set in a "U" shape. Three HF radios were set up, two for SSB and/or CW, and a digital station. Pictures and maps were pinned to the hemosote walls. Standby radios, other equipment, Radio Merit Badge books and other attractive items were placed in a glass display case that was also in the building.

The next morning, Alan, KB1HUM;

Wired up: **Venture Crew 510 President, Luke, KB1ISP, works a contact on 40 meters as visiting scouts listen in on headphones. Luke is an Extra Class license holder.**

Attentive audience**: Brian, KB1IGM, teaches visiting scouts about ham radio as Mike, KB1FWN, looks on.**

Brian, KB1IGM; John, KB1FTX, and adult advisor Dave, AA1YW, raised the tower and G5RV. The tower was put up at only 30 feet, rather than the full height of 50 feet, because of nearby power cables. The G5RV antenna was attached to it and strung across to another building. The VHF receive antenna for our repeater was put on top, at about 35 feet.

MassJam Demo

Demo time came at about 12 noon Saturday. As scouts began to descend on the Midway, the full magnitude of 8-10,000 scouts began to become apparent. Almost immediately, and for the rest of the afternoon until 5 PM, patrols, in sizes ranging from 6 to 10 scouts, stopped in to get a taste of ham radio.

Mike, KB1FWN, was already at the 20 meter SSB station calling CQ. A patrol of scouts came and sat around, anxious to "get on the air." While Mike was working toward getting a contact queued up, Brian, KB1IGM, and Luke, KB1ISP (Crew President), discussed what ham radio is and how easy it is for anyone to get their ham license.

Steve, KB1GHC, was at his Kenwood TS-520 transceiver, making digital contacts. Steve had constructed a homebrew interface for computer-to-TS520 communication.

Andy, KB1FVL, and his brother Erik, KB1FSU, showed scouts their handhelds, and prompted them to use the NE1C temporary repeater. Luke, KB1ISP; Justin, KB1ISQ, and Steve, KB1GHC, worked together to keep the low power (10 W) EchoStation (by K1RFD) repeater going.

As one of the conditions for earning the "Baden Powell" pin, patrols needed to get signatures from four different midway events. This kept the flow of scouts coming into the ham radio demo consistent throughout both Saturday and Sunday afternoons. At the ham radio demo, patrols were required to listen in for at least 10 minutes to get a sign-off on their award sheet.

The beam was fixed toward the west so we could work as many domestic contacts as possible. We were able to make a sprinkling of contacts with Italy, Germany and France, however. The patrols in the station just before closing at 5 PM were treated to a contact with Japan as the 20 meter band went long.

After five hours of steady demos, the program called for scouts to return to their campsites for dinner, and an evening program that did not include the midway. Physically and mentally drained from the long day, crew members settled down to a fine chicken dinner prepared by Andy and John. After some discussion about the day, the end of a disappointing Boston Red Sox playoff game, and cleanup after dinner, it was time for me to hit the sack, in preparation for a 7 hour shift and then teardown the following day.

Already Buzzing at 8 AM

When I returned to the demo station at 8 AM, things were already buzzing as some crew members were preparing the radios for another day of demos, some were preparing breakfast, and some were still sleeping on the floor of the demo station. Biff, AA1DI, another assistant advisor for our crew, was ready and waiting to get on the 20 meter SSB station.

A cold and wet soaking rain had settled into the area, and we knew we were in for a busy day, as we were sure that scouts would be anxious to hear our demo (in a *dry* building). From 10 AM straight through until 5 PM we were again visited by patrol after patrol seeking sign-offs, and others returning for more information on ham radio. The Pennsylvania QSO Party made 40 meters interesting throughout most of the day.

On 20 meters, Biff settled into a pileup, trying to work each one with a short QSO with a scout waiting to squeeze the microphone. During the afternoon, an adult scouter who saw our demo called his dad in Florida and asked him to get on the air on the frequency we were on to make a contact. It worked—the scouts around the demo area were very impressed at how simple that contact was to make.

Many scouts just came by our demo area to enjoy a dry location, but soon became interested in what was going on. Many returned a second time after getting interested in what they had heard and learned. Most of the questions concerned how to get a license and where to get information.

After 7 hours of a constant stream of scouts and scouters, the time finally came to close up shop and tear down. What took 6 to 7 hours to set up only took about one and a half hours with the cooperation of the entire crew. A great spaghetti dinner followed, and our participation in MassJam was complete.

We're Ready for MassJam 07

Kids *are* interested in ham radio. I expect there will be a MassJam again in 2007, and I'll be there with my Crew, if I can be! Until then I'll be doing Radio Merit Badge classes, JOTA demos, Field Day and other requested ham radio demos—just to prove that fact…we just need to show it to them.

Photos by the author.

A "hobby" crew dedicated to ham radio and Emergency Communication, Venture Crew 510 was the recipient of a grant from the ARRL's Victor C. Clark Youth Incentive Program in October 2003. John Pise, KX1X, is the adult Advisor for BSA Venture Crew 510 (DX). He has been a ham since 1997 when he was introduced to ham radio at a scouting demonstration. He can be reached at 195 Willimansett St, South Hadley, MA 01075; **kx1x@arrl.net**.

By Joel R. Hallas, W1ZR

Dayton Hamvention 2004: The Place to be in Mid May!

Hams from around the world converged on Dayton for "the year of the contact" at Hamvention 2004.

In my experience, if you put two hams in a room, before long they'll be arguing whether they are really there or not—it's pretty hard to get hams to agree on much! There does seem to be something tens of thousands of hams can agree on—Dayton, Ohio, is the place to be on Hamvention weekend. This year, it was May 14-16. I'm not sure if you can get an "eyeball DXCC" award, but I received a hand delivered QSL from Klaus, DL2QB, chatted with Gulli, TF8GX, who had stopped by at HQ on his way to Dayton, and met hams from many countries throughout the weekend. We were also pleased to see our friend and now former ARRL News Editor Dave Hassler, K7CCC, who stopped at Dayton en route to his new position as publisher of an Oregon newspaper.

This was my first experience at the Dayton Hamvention. I was impressed with the scope of the operation—for the first day and a half, I had to leave trails of bread-crumbs just to find my way around.

For those competent enough to find their way around, there was a lot to see and do, more than could actually be done by a single person. Throughout each day, there were generally four forums (fora?) going on simultaneously. If you just picked one for every time slot, and sometimes it was hard to choose, you would miss looking over the displays at vendor booths or at the neat stuff in the flea market.

The ARRL booth turned out to be a very popular meeting place. Over 6000 ARRL Dayton 2004 buttons were given out, according to Marketing Manager Bob Inderbitzen, NQ1R. Circulation Manager Kathy Capodicasa, N1GZO, on booth duty with Bob throughout the event, reported that both memberships and book sales exceeded those of recent years.

A Funny Thing Happened on the Way to—

The forums—what a great variety to choose from! I counted a total of 45 on the schedule and they covered most ham interests. On the technical side, there were forums on digital communications (3), lightning protection, satellite communications, antennas (2, one 3 hours long!), ATV (2), ARRL (3), FCC and regulatory issues (2), operating (5), emergency communications (3), antique radio (3), YLRL and even one for bicycle hams. If you couldn't find a few of interest, you must have been looking for the annual Dayton Trapshooting event instead—it's the other time of year when Dayton residents leave their cars in the garage!

Since I had other duties, I checked in on just a few:

ARRL Forum

Our host—Great Lakes Director Jim Weaver, K8JE, introduced ARRL President Jim Haynie, W5JBP, who spoke eloquently on his ideas of what it was we needed to do to keep Amateur Radio intact and moving forward to the next generation. On top of his list was the need to pull together on license restructuring—it's going to happen and the current ARRL proposal is the most fair to all. Jim rejects the claims of some that the new exams will result in "dumbing down" our hobby. Rather, the new exams cover different material—those of us who can still draw schematics of Colpitts, Pierce and Hartley vacuum tube oscillators may not be able to answer current questions on RF safety, digital processing or optical communications. It's different, not necessarily easier, in Jim's view.

The biggest threat to Amateur Radio Jim sees is not what the FCC will do next, but how we treat the new hams who join our ranks. Our recent survey showed that 25% of new licensees leave the hobby after just a year, likely, in Jim's view, because they are ignored on the air. We need to be more welcoming, not just to new hams, but to anyone who shows up on a repeater we are listening to. Let's take new hams under our wings, welcome them on the air, find out if

ARRL President Jim Haynie, W5JBP, gratefully accepts a member renewal at the ARRL booth. Pacific Division Director Bob Vallio, W6RGG, looks on.

Nine year old member Emily (Chick) Bishop, KI4CHK, from Cleveland, Tennessee checks in at the ARRL booth with her dad, Mike, KI4AME.

What's New for '04—Lots!

Many manufacturers unveiled new items this year at Dayton, some available for sale now and some that will show up on dealer shelves during the coming year. On the top of the list in the latter category is the first showing of Yaesu's new high-end HF and 6 meter transceiver, the FT DX 9000, filling the spot at the top of Yaesu's line. This radio, scheduled for release late this year, features a highly developed front end with a specified third order intercept typically greater than +40 dBm. There will be a choice of three roofing filters to allow top dynamic range for close-in signals in each of two identical receivers. There will be two models available: a 200 W output radio with built-in supply and a 400 W model with external supply. We are looking forward to getting our hands on one of these!

Also newly released from Yaesu are a ruggedized dual-band handheld, the FT-60R, and a waterproof automatic antenna tuner, the FC-40, with memories, designed to work with their FT-897 and FT-857 radios.

Although ICOM didn't have any new radios to announce this year, their high-end transceiver, the IC-7800, announced at last year's Hamvention is now available and generated considerable interest.

Martin Jue, K5FLU, president of MFJ, showed me a few new items in their extensive product line. The first answered a need I've had for a while in the form of an aluminum-sided rugged carry case for portable gear. The MFJ-6404 is designed to hold a portable transceiver and accessories with items held in place by a customizable form insert arrangement.

Also from MFJ was a new approach to small high efficiency loop antennas. They have added to their current offering of a fixed loop, a pair of tuners designed to tune larger wire loops efficiently. The larger, but still smaller than a quarter wavelength, loops should allow higher efficiency due to their higher radiation resistance and are easier to carry for portable operation (MFJ-935). Another unit is available for home station use carrying the model number MFJ-936.

Bob and Sarah Heil of Heil Sound announced a new Proset Quiet Phone headset with the headphone portion based on their new active noise canceling earphones. Heil also has a new headset carrying case in sizes to fit both larger and smaller sized headsets. This is designed to reduce travel damage to headsets that have often been improperly packed for shipment.

Gordon Hardman, WØRUN, of Alpha Power showed me his new laboratory grade computing power/SWR meter. The 4510 provides both analog and digital outputs, as well as software provided to allow computer display and data acquisition.

West Mountain Radio, the Rigblaster folk, announced a few new dc power related offerings. The first is the PG-40 Powergate uninterruptable power system (see my Dec 2003 *QST* article to get the idea) based on N1ZZ's charger design. The other is a CBA—computerized battery analyzer.

Palstar showed a new model in their line of truly balanced legal limit tuners. The AT1KBAL has a slightly reduced tuning range than their larger model, but is easier to operate and has a lower cost.

Cushcraft announced a new 22 foot high vertical antenna for 80 and 40 meters, the MA8040V, suitable for portable or backyard operation.

Although Kenwood didn't have any new radios to announce, they did announce the availability of the "portable bracket" that allows operation of the TS-480 radio unit in one piece. This was previously available just in Europe and will now be available as an accessory in the US, perhaps as a result of our suggestion in the June 2004 Product Review?

Two companies offered new Software Defined Radio (SDR) products. Flexradio Systems has added power amplifier, enclosure and integration options to their high performance SDR transceiver, formerly available only as a 1 W PC board set. Winradio has added the G313i to their line of SDR receivers. Features beyond the G303i, reviewed in this issue, include DSP processing and continuously variable bandwidth.

SGC showed the first units of their new self contained (built-in battery supply) SG-211 60 W auto tuner for balanced or unbalanced antennas.

DX Engineering showed a new capacitance-hat loaded $^2/_3$ size rotatable dipole, adjustable from 10 to 30 MHz.

New to the US amateur market is Australian maker of high quality HF amplifiers, Emtron. On display was the new DX-1d compact kW amp joining its larger sibling the DX-2 legal limit amp. We expect to see more of these amps in the coming months.

The ARRL booth had some new items as well. The designers and developers of the *TravelPlus for Repeaters* CD-ROM repeater mapping software were on hand to show off their new upgrade to large crowds of appreciative onlookers. Many took advantage of the special upgrade offer. A handful of ARRL's newest titles also made their debut, including *VoIP: Internet Linking for Radio Amateurs*, *APRS—Moving Hams on Radio and the Internet*, and the second edition of *ARRL's Low Power Communication*.

All in all, a good mix of new products for one ham convention!

Yaesu's new top of the line HF/6 meter transceiver, the FT DX 9000.

they need help getting started, even help them learn to solder on their first coax connector, as someone once did for us, so they feel like they're part of our group.

Having new hams participate with us will help us find the 100 cosponsors we will need to pass the Spectrum Protection bill, now in congress. We all need to be behind such legislative action in order to make sure Amateur Radio, as we know it, will continue for future generations.

FCC Forum

The FCC Forum was moderated by Bill Cross, W3TN, the Amateur Radio coordinator of the FCC's Wireless Telecommunications Bureau. Bill gave a thorough briefing of the 18 petitions currently under consideration based on actions arising from the 2003 World Radiocommunication Conference. Of particular interest were those related to license restructuring and changes to 7 MHz subband allocations based on European shortwave broadcast stations gradually moving away from the 7.1 to 7.2 MHz segments. Bill introduced FCC Special Counsel for Amateur Radio Enforcement Riley Hollingsworth, who provided an update on enforcement action. See this month's Happenings column for more on Riley's comments.

Antenna Technology Forum

Noted superstation contester Tim Duffy, K3LR, moderated this forum, which included many interesting speakers. Of particular interest to this observer was the presentation by Dean Straw, N6BV, *The ARRL Antenna Book* editor, on how to use available terrain data to readily determine antenna take-off angle as a function of tower height. Dean showed that it isn't always true that a 200 foot tower performs better than a 120 foot one (I was quite relieved!). Most of the presentations are available on Tim's Web site, **www.k3lr.net**.

ARRL Public Relations Forum

The annual Public Relations Forum was held Sunday morning at Hara Arena. With plenty of humor mixed in, several members of the League's Public Relations Committee offered PR tips to help club Public Information Officers and others promote

Andy Oppel, N6AJO, receives the EmComm Mentor of the Year Award from ARRL Emergency Communications Course Manager Dan Miller, K3UFG.

West Mountain Radio's Del Schier, K1UHF, proudly exhibits their new computerized battery analyzer.

ARRL Donors Celebrate at the Air Force Museum

On Thursday evening, May 13, more than 80 ARRL donors gathered for the third annual Donor Reception held at the Air Force Museum in Dayton. Hosted by the ARRL Development Office, donors arrived by car and by bus to enjoy refreshments and camaraderie in the WWII exhibit of the Museum. Guests were welcomed by Chief Development Officer Mary Hobart, K1MMH, and ARRL President Jim Haynie,W5JBP. Standing in the shadow of vintage aircraft, President Haynie thanked the donors for their generous support of key ARRL programs—Education & Technology, Spectrum Defense, W1AW Endowment and the ARRL Diamond Club.

In preparation for a special presentation, President Haynie invited attending members of the ARRL Maxim Society to join him at the podium—Judy and Jim Dicso, K2SZ; David Brandenburg, K5RQ; Carter Craigie, N3AO, and Kay Craigie, N3KN. The group and President Haynie welcomed Ken Fath, N4KF, as the newest member of the Maxim Society and present him with a framed portrait of Hiram Percy Maxim. The ARRL Maxim Society honors donors whose lifetime giving exceeds $10,000.

Haynie next introduced the evening's honored guest, baseball great and Amateur Radio contester Joe Rudi, NK7U. In his informal remarks, Rudi shared with guests his experiences on the road in baseball and how he was able to operate from his hotel on road trips. Rudi told the group about his station in Oregon and his efforts to build antennas in the challenging topography around his home.

In an important part of the evening, President Haynie brought the guests up to date on one of the hottest topics in Amateur Radio—BPL. He told them of the work ARRL is doing currently to present the ARRL position and scientific findings to the FCC, and of a key meeting taking place in Washington later in May.

The 2004 Donor Reception was the largest to date and a successful evening that gave ARRL Development and ARRL Directors in attendance an opportunity to thank donors for their generosity and loyalty.—*Mary Hobart, K1MMH*

The Maxim Society welcomes Ken Fath, N4KF.

ARRL President Jim Haynie, W5JBP, greets honored guest Joe Rudi, NK7U.

A full conference room greets Bill Cross, W3TN, at the FCC Forum. Most forums were well attended.

Amateur Radio in their communities. From creating and promoting special events to using popular Web search engines to deliver Amateur Radio related news items, all attendees walked away with ideas they could incorporate into their new or ongoing PR programs back home.

Jim McDonald, KB9LEI, moderated the forum and was joined by fellow PR Committee Members Sherri Brower, W4STB (Chairman); Tim Lewallen, KD5ING; Jeff Reinhardt, AA6JR; Rich Moseson, W2VU, and Bill Morine, N2COP.—*tnx ARRL Media Relations Manager Jennifer Hagy, N1TDY*

And That's Not All!

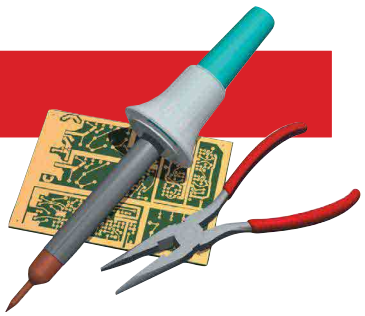
Outside of the Hamvention itself there were a number of special interest gatherings. The ARRL Donor Banquet is described in a sidebar by Chief Development Officer Mary Hobart, K1MMH, its host. In addition there were dinners especially for DXers, QRPers, QCWA members, VHFers, SSTVers, AMSAT members, Contesters and the one I attended on Friday night, the 2004 Emergency Communication banquet. Most require advanced ticket sales, so if you want to participate next year check in with the organizer well ahead of Hamvention time.

The ARRL EmComm Banquet was hosted by ARRL Emergency Communications Course Manager Dan Miller, K3UFG, and was held at Ryan's Restaurant in nearby Kettering, Ohio. This event was open to all who had completed at least one of the EmComm courses, and the 75 attendees represented organized emergency communications from all regions of the US.

Following an enjoyable dinner, a presentation was made to honor the members of the Tri-State (serving parts of Iowa, Minnesota and Wisconsin) Amateur Radio Club's Emergency Response Team on their receipt of the Presidential Points of Light Award. A large copy of the award certificate was displayed and all in attendance were invited to sign it before it went back to Hara Arena to be available for signing by all at the Hamvention.

Another presentation was made to Andy Oppel, N6AJO, to recognize his achievement as EmComm Co-Mentor of the Year. The other winner was Judy Taylor, WD8EOP, who was unable to be with us. In EmComm on-line courses, a mentor is an individual who interacts with all the students in a course to help them learn all that is needed to complete the course successfully.

Joel Hallas, W1ZR, is QST *Product Review editor. He can be reached at* **jhallas@arrl.org**.



The Doctor is IN

Q Gary, N7GK, writes that he needs help with the prevention of RFI to a cable modem that he uses for Internet access.

A I would try a common mode choke on the cable feeding the modem. While the *ARRL RFI Book*[1] contains a detailed explanation of the common-mode choke, you'll find making one is a pretty simple matter. Wrap 10 to 15 turns of the cable through an Amidon (**www.amidoncorp.com**) FT-140-77 ferrite core. (Use an FT-240-77 core if the connectors or cable are large. For interference from 80 or 160 meter signals, use type J (75) material. Use type 43 ferrite material for VHF signals.) The common-mode chokes should be installed right at the affected device. In your case, that would be directly at the modem. The ARRL RFI Web site (**www.arrl.org/tis/info/rfigen.html**) contains a list of EMI/RFI materials suppliers for ferrite chokes. You can also refer to the advertisements in *QST*—there are usually several advertisers offering ferrite materials and chokes.

Q From Myles, K3VTT: I am a new ham and am about to set up a station. I have been reading a lot about transmission lines and antennas. I keep reading that for 2 meter work and above, ladder line would be the best feed line for my antenna. I have not been able to find any articles about how to install the line, however. Some articles caution about running ladder line too near to metal. I would want to run it perpendicularly across a steel support beam in my house and across an aluminum grid in my drop ceiling. Do you think that path would be a problem and are there any good articles about the installation and care of ladder line?

A Ladder line (it is also referred to as *window* or *open-wire* line) is generally not recommended for 144 MHz and above ("above" meaning higher in frequency but shorter in wavelength) due to the difficulty of obtaining good quality line for VHF/UHF use, its ineffectiveness at these frequencies and the difficulty in installing it properly. It's worthwhile to reprint a paragraph written by Dean Straw, N6BV, in *Simple and Fun Antennas for Hams*:[2] "For a fixed distance between the (ladder line) wires (say, 1 inch for 450 Ω window line) the spacing in terms of wavelengths goes up as the frequency is raised. Thus the phase difference between the currents flowing in each wire will be different from the 180° needed for complete cancellation for higher frequencies. For this reason open-wire line loses its effectiveness as the frequency goes into the low UHF range. You will rarely find open-wire line used above the 450 MHz band, while coax is still going strong at 1.2 GHz and beyond."

That said, ladder line *is* recommended for HF use and has such low loss at these lower frequencies that SWR almost ceases to be a problem. A "flat-top" or dipole as long as you can make it, fed in the center with ladder line and matched through an antenna tuner, makes an excellent multiband HF antenna. Ladder line is far superior to coax here because of its loss characteristics. Ladder line run perpendicular to a metal structure should be spaced several inches from it. Common TV standoff insulators will suffice, and one can be used on each conductor of the line, if you're careful to not change the line spacing. An excellent reference for the installation of ladder line at HF can also be found in the earlier mentioned reference, *Simple and Fun Antennas for Hams*, Chapter 11, where it is pointed out that the line should be spaced away from nearby conductors by a factor of three times the wire spacing. For 450 Ω ladder line, this works out to be about 3 inches.

The ceiling grid should not pose a problem if the line is not coupled closely to it for any appreciable distance. Try to cross the grid perpendicularly; run the line equally between the grid supports and try to avoid close parallel coupling. The same arguments apply to outdoor use when the feed line comes close to any support structures. It's also a good idea to give the line a few twists while installing outdoors. This will keep

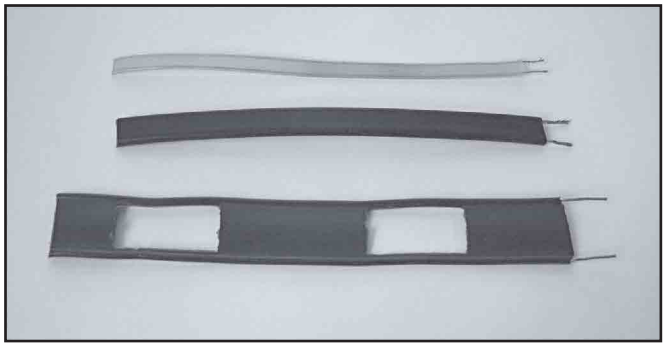


Figure 1—Three types of open-wire line. TV receiving line is at the top, heavy duty transmitting line is at the center, and 450 Ω window-type ladder line is at the bottom. Window line has characteristics that come closest to traditional open-wire bare conductor line.

Table 1
Common Types of Open-Wire Transmission Line

Type	Z_0 Ω	*Velocity Factor, %*	*Wire Gauge*	*Power Handling*	*Matched-Line Loss, 100 MHz*
TV Twin Lead	300	80	#22	Low	1.4 dB/100'
Twin Lead	300	80	#20	Med	1.1 dB/100'
Generic Window	405	91	#18	High	0.3 dB/100'
High-Power Window	450	91	#16	High	0.3 dB/100'
Open-Wire	600	92	#12	High	0.2 dB/100'

[1]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 860-594-0203; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2]Available from your local dealer or the ARRL Bookstore (see footnote 1). Order no. 8624.

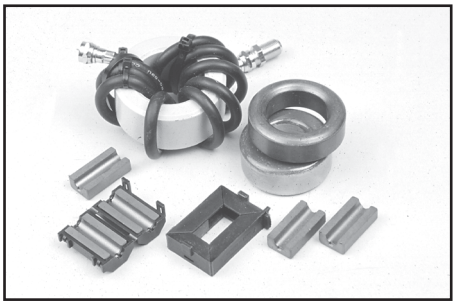


Figure 2—A selection of common-mode chokes. The rear toroid cable section with F-type connectors would be suitable for a satellite downlink cable. Make sure the connectors are waterproofed.

the wind from grabbing the flat line and blowing it around—the objective being to minimize line motion with respect to surrounding structures. Examples of open-wire lines can be seen in Figure 1. Table 1 lists some of their characteristics.

Additionally, a good reference on installing open-wire line at VHF/UHF can be found in an old edition of *The Radio Amateur's VHF Manual*, Third Edition, 1972, pages 162 and 165. (This is no longer available but it may be obtainable at your local library or a used book dealer.) The author claims that with a 100 foot run of 12 gauge conductors spaced 5/8 inch apart with Teflon spreaders every 6 feet, losses of 1.1, 1.35 and 1.56 dB were obtained on 144, 220 and 432 MHz. That represents the best that can be expected in a practical installation. By comparison, 1 5/8 inch *Heliax* (**www.andrew.com**) coaxial cable has under 0.5 dB of loss on all of the bands 70 cm and below (here, "below" means lower in frequency; longer in wavelength). It is probably cheaper too—surplus large diameter coax is often free for the asking from commercial users—if you hunt around for someone who needs to get rid of it. Even 1/2 inch *Heliax* will beat ladder line at these frequencies. The difficulty is finding it inexpensively and finding suitable connectors for it. The connectors are apt to set you back as much as the cable itself! This smaller coax is much easier to handle than the heavier variety.

Q From Will, KC6NCF, comes this: I have recently signed up for DirectTV satellite TV service. It occurred to me that the coax cable run from my VHF/UHF amateur antenna might interfere with the coax from the satellite dish while I am transmitting. The most suitable location for the dish would place both coax runs together for about 50 feet. Other dish locations may have some tree shadows to deal with but would allow coax separation. Is this a critical consideration? Would the proximity cause interference to the TV? What would be the optimum separation of the coax?

A In an ideal situation, the coax cable should not radiate but, if you were using an HF antenna, I'd be more concerned. If the load is balanced (like an HF dipole) and you feed it directly with coax, there will be some current on the outside of the coax shield braid. That could result in some radiation from the feed line. One way to reduce or eliminate that unwanted radiation would be to use a 1:1 balun transformer or a choke balun on the coax, near the antenna. 1:1 baluns are available commercially or you can make your own (see the current *ARRL Handbook* or *The ARRL Antenna Book*).

You mentioned, however, that your antenna is a VHF/UHF antenna and that your transmitter power is moderate. Normally, the directionality of both antennas will work to your advantage, as will the moderate power. The satellite dish has fairly high gain at its design frequency and its acceptance cone will probably not see the VHF/UHF radiation. Likewise, the VHF/UHF antenna will generally be well matched to its feed line and there will be minimal or no feed line radiation.

Whether or not these effects will mitigate an overload or interference problem is difficult to say. My guess is that it will be okay, but it could still be problematic. The first thing to try if there is a problem is a common-mode RFI choke on the dish coax feed line. Some of these are illustrated in Figure 2. Particularly note the coaxial choke with F-type fittings, to the rear. Chokes can consist of several ferrite beads or a toroid on the feed line, as shown. A good information reference for common-mode ferrite chokes is *The ARRL RFI Book*.[3]

The next approach would be a high or low-pass filter on the satellite feed line. The filter characteristics would depend on the downlink IF frequency and the frequency of your amateur operation. This would probably have to pass dc, as there is likely a dc signal on the satellite feed line to supply power to the dish preamp/converter. The satellite service people could probably recommend a suitable filter. Coax separation would also help, but only to the extent that there is coax leakage or radiation. The only way to tell is by trying to separate the two cables. There's no optimum distance…if there's leakage—the farther apart, the better—subject to diminishing returns, of course. Good luck!

Q From Mike, W7KOL, comes the following: I constructed a loop skywire antenna from the pages of *ARRL's Wire Antenna Classics*.[4] The loop is 43 feet high on four poles with 272 feet of copper wire fed at the corner with RG-8/U coax into a 1:1 balun. The coax from the shack to the feed point is 145 feet in length. I have a tuner, but I cannot get the antenna tuned to an SWR of 1:1. Do I need to recalculate the copper wire length? The article said to let the tuner do the work and not to worry too much about wire length, but the author is obviously not at my site.

A If you model the antenna (*EZNEC*[5]) given those parameters, you'll find that the SWR is significantly better with a feed line impedance of about 300 Ω. With a coax feed line of 50 Ω your existing tuner may not be able to transform the line impedance to 50 Ω resistive when the SWR is high. My first suggestion would be to feed the loop with either 300 Ω or 450 Ω ladder line. Either bring the ladder line directly into the shack and go into the balanced input of your tuner or mount a 4:1 balun outside and use 50 or 75 Ω coax into the shack. The 4:1 balun should replace your 1:1 balun.

If you don't want to go this route you can try adding about 15 to 25 feet of coax to your existing feed line and see if your tuner has an easier time coping with that "new" impedance. I would advise going the ladder line route, however, as the significantly lower loss of the ladder line under high SWR conditions will result in more power getting to the antenna. You'll find that loop to be an excellent and highly effective antenna if you can maximize the power getting to it. You can do that by reducing the SWR that the transmitter sees and reducing the transmission line loss by using ladder line. And, incidentally, one of the newer crop of auto tuners would be ideal for this sort of installation. That configuration with a ladder line fed loop is what I use very successfully on all of the HF bands. I hope this helps and good luck!

[3]See footnote 1.
[4]Available from your local dealer or the ARRL Bookstore (see footnote 1). Order no. 7075.
[5]**www.eznec.com**.

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/.

By J. D. Harper, K6KSR

Recruiting with T-Hunts

With no previous experience—and no license—required, chasing the fox is the perfect way to let prospective amateurs get a taste of ham radio.

For the uninitiated, witnessing a T-hunt must resemble a fire drill at the funny farm. Here's a bunch of fellas and gals in what appears to be a state of confused concentration, trudging around trees and bushes, earphones screwed to their heads, each carrying a handheld radio in one hand and what resembles a weird mess of coat hangers on a stick in the other. Occasionally they'll wave their coat hangers around as if trying to discourage the mosquitoes.

No, they're not crazy. They're just participants in the highly popular ham sport known as "fox hunting." It's a kind of life-size video game, played outdoors and combining a bit of radio electronics with plenty of ham socializing.

Using radio direction finding equipment and techniques, the "hunters" are in a race to locate a small, tone-emitting hidden transmitter—the wily "fox." This high-tech version of a British tradition can be undertaken on foot, on bicycles, on motorcycles or in automobiles stacked with sophisticated direction-finding antenna arrays.

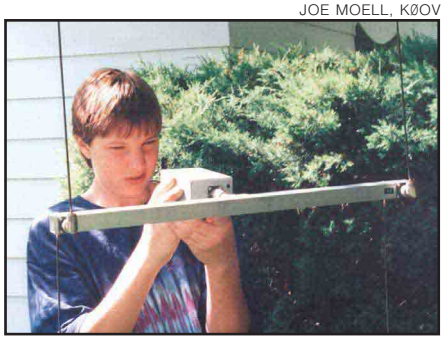
But fox hunting can provide the amateur community with a lot more than fun. It's probably the most direct route for the newcomer who wants to learn about radio and antenna systems through hands-on participation. There's no license required and no experience necessary.

De-tech for Recruiting Success

For the sake of our service, and in the name of our Elmering tradition, each of us should take on the challenge of demystifying the technical side of things—to have the patience and perseverance to be the teachers we are supposed to be—to help that prospective ham begin his or her *learning* journey. What's in it for you? How about amateurs who really care about Amateur Radio and are driven to perpetuate the highest standards of the hobby. The radio club setting is the ideal starting point.

- Make your fox hunts fun for the entire membership—and beyond. Try positioning it as a *club sport* instead of a high-tech exercise. Add some amenities such as food and refreshment time-outs, or an awards function after the hunt. And, since the hunt is done almost entirely in the listening mode, get radios in the hands of those as yet unlicensed and pair them with a guide who can show-as-they-go. There'll be a need for drivers if your hunt goes mobile. Here's an opportunity for unlicensed spouses to get involved.
- De-tech some of those impressive, confusing T-hunt terms and techniques. Some clubs indoctrinate their members, either as a part of the regular club meeting as a tutorial in the club publication or on its Web page.
- Veteran fox hunters know the power and flexibility of small and simple beam type antennas. What better way to teach the newer hams and prospects about antennas than to conduct an antenna workshop. VHF and UHF beams can literally be made from coat hangers if you want to really get down to basics. A number of clubs hold regular "Antennas in the Park" events. These picnic-style outings at the local park provide fun for everyone and an opportunity for participants to build and test their mini-wonders.

JOE MOELL, KØOV



Eric Jensen, of Nebraska City, Nebraska, prefers to hunt on foot.

We all learn faster and more effectively *by doing*. That same principle can be applied to ham recruitment through fox hunting. And, it's a great foundation for continuing the ham educational process.

If you'd like to learn more about fox hunting, here are just a few resources that in turn can lead you to many more:

- A list of ARDF resources can be found on the ARRLWeb at **www.arrl.org/tis/info/direction-finding.html**.
- *Transmitter Hunting: Radio Direction Finding Simplified*, by Joe Moell, KØOV, and Tom Curlee,WB6UZZ. Considered by many to be the ARDF (Amateur Radio Direction Finding) bible, it's available at book stores and through the ARRL (order no. 2701).
- *Homing In*, an outstanding Web site for beginner and old pro alike, it's owned and operated by Joe Moell, KØOV, at **members.aol.com/homingin**.
- The Hudson Valley Direction Finding Association is an informative site with links to related Web sites. **www.hvdfa.webhop.net/**.
- A Direction Finding Web site for IARU Region 2 (North and South America) is at **www.ardf-r2.org/en/**.

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**.

Sounds Sweet Speaker

My daughter watched as I struggled to extract the Sounds Sweet speaker from its shipping box. She grabbed one end of the box and held on tightly as I slid the speaker free of its packing material.

"What in the world is that?" she asked.

Before I could reply, she said, "Oh, I've seen one of those before. That's a bass woofer for our gaming computer. This is going to be cool!"

"Not quite," I said as I lifted the dense black cube from the floor and gently lowered it to my station desk. "This is a speaker for Dad's radios."

Her interest level plunged about 90 dB, but mine was piqued. The Sounds Sweet speaker does indeed look like a bass woofer—the kind you find in so-called "satellite" home-theater speaker systems, and gaming computers. It is a 13-pound, 12×12×10-inch satin-black cube. In terms of design, the Sounds Sweet is a tuned-port, bass-reflex speaker, but it doesn't produce the type of low bass you would normally associate with speakers designed for music. Instead, the Sounds Sweet is specifically designed for communications audio. According to specifications, the Sounds Sweet frequency response is ±5 dB from 100 to 9000 Hz. The 8 Ω speaker is rated at 10 W RMS.

One of the first things you notice about the Sounds Sweet is the large speaker grill. That grill protects an 8-inch dual-cone speaker with a sizable ceramic magnet. You also notice the "hole" for the tuned port in the upper right corner. Speaker wires attach to spring clips on the back.

But Does it Really Sound Sweet?

The ARRL Lab doesn't have access to a large anechoic chamber, which is what we would need to measure the true output frequency response. So, subjective listening tests would have to do.

A view of the Sounds Sweet with the speaker partially removed. The dual-cone construction is clearly visible. The interior of the fiberboard cabinet is filled with acoustic foam.

Using it with several HF transceivers, I found that the Sounds Sweet lived up to its name. Some believe that "high fidelity" in voice communication should include throbbing bass frequencies. That isn't the case with the Sounds Sweet. The Sounds Sweet is designed for a crisp response in the mid-range with some, but not too much, bass response. As a result, SSB sounded remarkably clear, and AM signals had more than enough fidelity for a smooth, "warm" sound. The response held up well for CW, too. Copying code was a pleasure, even with extremely narrow filtering. With the high-end roll-off, hiss was nonexistent. FM was as intelligible as you'd expect. With the Sounds Sweet, I filled the house with the dulcet sounds of local repeaters, public service, etc.

Speaking of filling houses, I couldn't resist trying the Sounds Sweet with a tiny handheld transceiver. The test rig in question had a 1-inch diameter built-in speaker. Anything would sound better, but could the tiny radio even hope to drive the Sounds Sweet?

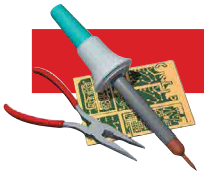
Drive it, it did—all the way to deafening volume. At full output, the audio began to distort, but that was the fault of the audio amplifier stages in the handheld, not the Sounds Sweet. Larger transceivers drove the Sounds Sweet to the pain threshold and the audio remained clear.

A Deluxe Station Speaker

The Sounds Sweet is a high-performance communications speaker for home stations. The only possible downside is its size. If you purchase a Sounds Sweet, you'll need a 12×12-inch area to place it. In some crowded stations, such space may be difficult to find. I wouldn't recommend placing objects on top of it, especially if you plan to crank up the volume. Small items have a tendency to vibrate and "walk off" the Sounds Sweet!

Manufacturer: Sounds Sweet, 99 W Shore Dr, Carmel, NY 10512; **www.soundssweet.com/**. *$99*

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org



By Richard W. Stroud, W9SR

Copper Loops for 222 and 440 MHz

These small copper pipe antennas feature rugged construction, wide bandwidth and good performance.

These antennas can be built using standard copper water pipe and fittings available from your local hardware or home building supplier. The 222 MHz version is made from 3/4 inch tubing, while the 440 MHz version is made of 1/2 inch tubing. Figure 1 shows the completed antennas. Both use copper fittings that adapt the antenna to 1/2 inch standard pipe threads for mounting. Copper is a good choice for VHF/UHF antennas because it is readily available, low in cost and easily worked, plus it has low losses at these frequencies.

Soldering is required during the assembly. The dimensions and tube cutting lengths are shown in Figures 2 (222 MHz) and 3 (440 MHz). All of the copper, brass and stainless hardware is available from hardware, plumbing or home building suppliers. The 8 gauge Teflon sleeving and wire is available from many surplus houses or from the author. Copper fittings from different manufacturers seat to slightly different depths so check the overall centerline dimensions carefully when laying out the antennas before soldering. The elbows that were used on the prototypes are metal stamped "EPC."

Fabrication

Soldering the components is not difficult. The ends of the tubing are first cleaned with steel wool and a thin layer of flux is added before assembly. It is an advantage to make a simple soldering fixture and it is advisable to wire the elements to this fixture (a piece of plywood) to keep the sides straight and square. Heavy aluminum foil between the plywood and the copper will prevent an accidental bonfire… be careful! When you use a propane torch, the tubing should be heated and bought up to temperature before solder is applied.

Use a standard rosin core solder. When properly heated, the solder will be "sucked" into the joint. Very little solder is needed and you will probably tend to use too much. If so, it will pool on the low side of the work and will need to be removed later if you are at all interested in appearance. Excess solder can be filed away after cooling. Any remaining flux should be removed and the copper can be polished for a nice appearance by using steel wool. (Use gloves when handling steel wool!) The finished antenna can be sprayed with Krylon 1301, a clear coat plastic, to preserve the finish. The antenna can be painted, if you desire, using an acrylic spray. Be sure to mask the front and back of the connector and exposed gamma tube end before painting.

The shape of the antenna is chosen so that the 50 Ω point on the tubing wall is roughly in line with the UG-58/U type N connector. The 1/4 inch gamma tube is placed through a hole drilled through the inside wall of the main tubing and soldered per the assembly drawings (Figures 2 and 3). The length of the wire inside the gamma tube is critical. The 14 gauge wire used is stranded and vinyl insulated. The insertion length for each band is 2 1/8 inches. Different sizes and wire types may require slightly different lengths projecting into the tube. The tube, Teflon sleeving and wire form the capacitance required to tune out the inductive reactance of the matching system. This is about 4.8 pF at 222 MHz and 6.4 pF at 440 MHz. The 5/32 inch OD 8 gauge sleeving fits snugly inside the gamma tube and the wire is a good fit inside the sleeving.

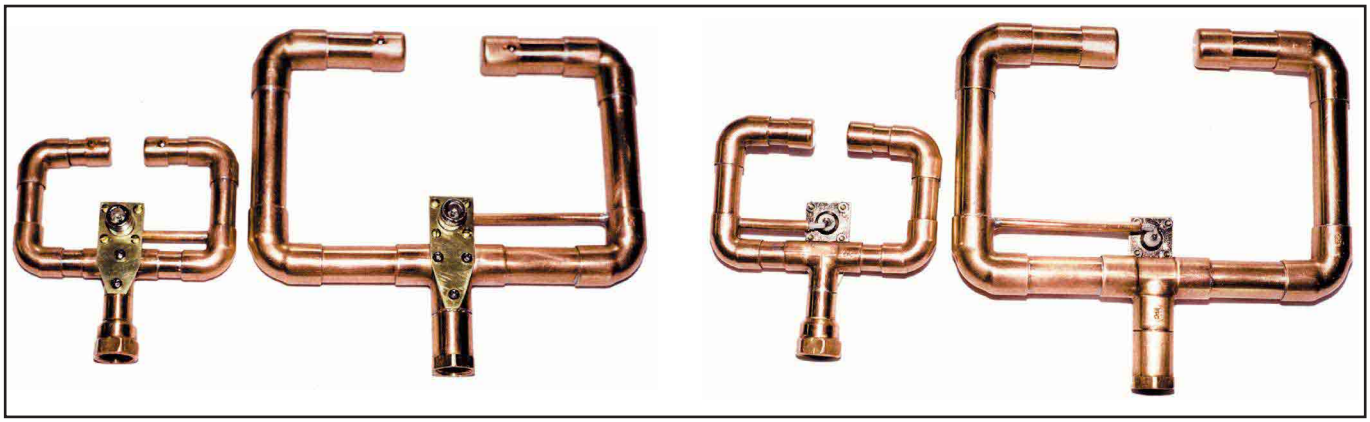


Figure 1—Front (left) and rear (right) views of the completed copper loops. The gamma tube penetrates the inner wall of the main element and is soldered parallel to the main lower tube. The connector mounting plate is anchored with self-tapping screws on the main and support tube centerline. The larger antenna is the 222 MHz version.

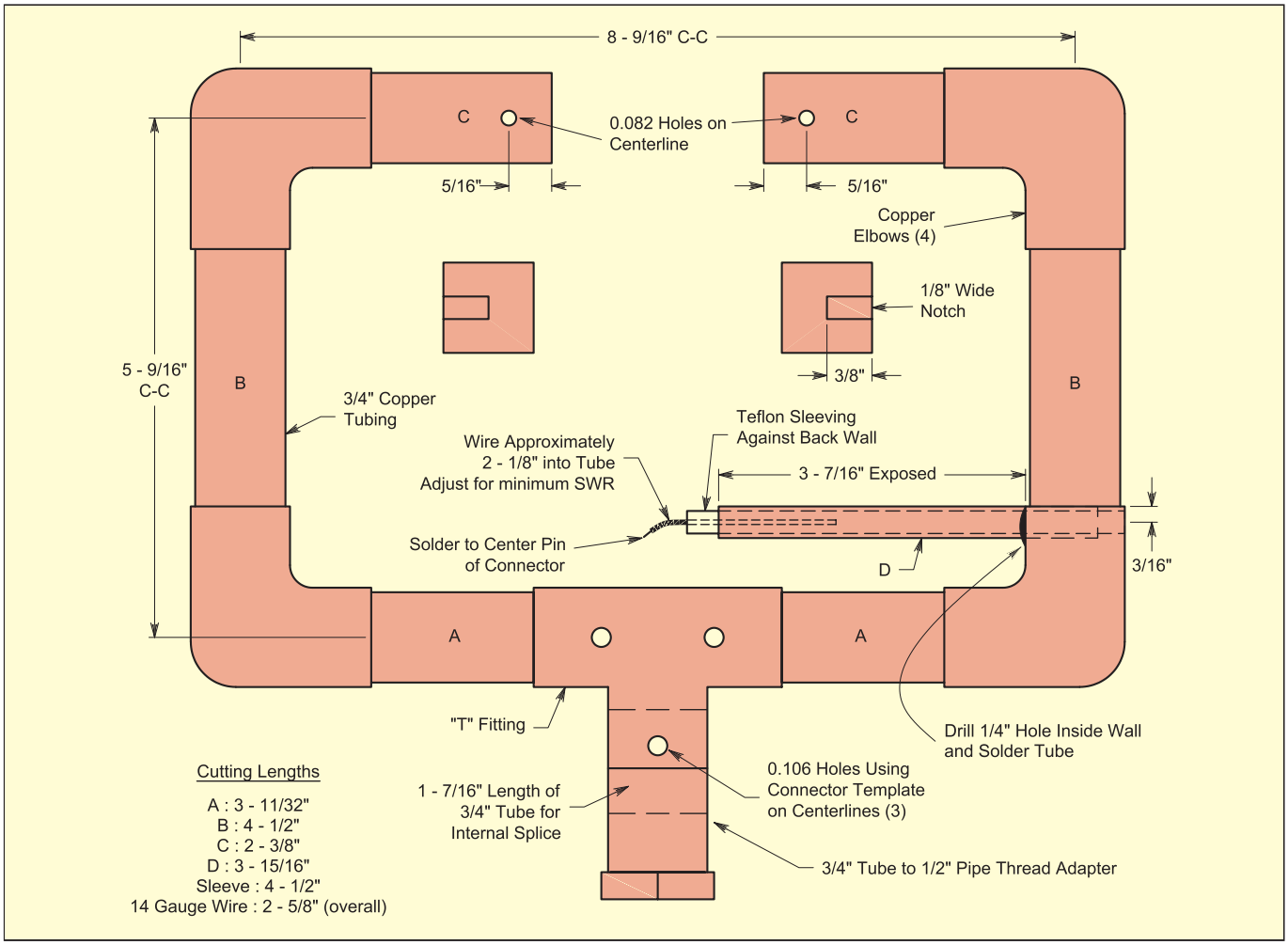


Figure 2—Assembly information for the 222 MHz loop antenna.

Connector Mounting Plates

The connector mounting plate outlines are shown in Figure 4. The plates are made of 0.062 inch brass stock and are attached to the copper antenna using #6 × 1/2 inch stainless self tapping screws at the point where it is internally reinforced. Three screws are used on the 222 MHz version and two are used on the 440 MHz version. Drill pilot holes into the adapter and the "T" (use a #36 drill) on the centerlines, using the completed mounting plate as a template. The connectors are type N, panel mount (UG-58/U), available from many surplus dealers or Digi-Key Corporation.[1] The connectors are attached using #4 screws, lock washers and nuts. All hardware should be brass or stainless steel to prevent corrosion and the connectors' rear terminations should be sealed against moisture penetration. The weight of the 222 MHz antenna is 1.6 pounds and the 440 MHz antenna weighs 1 pound.

Testing, Adjusting and Fine Tuning

All testing should be done with the antenna at least six feet above ground and away from any metal objects. Typical SWR at resonance is less than 1.2:1. This can be checked by using a VHF/UHF RF analyzer, a power meter such as a Bird model 43 or by measuring the return loss by use of a directional coupler, signal generator and RF voltmeter. In this case, the return loss at resonance should be at least 20 dB. The power-handling capability of the antenna is limited by the connector. This amounts to a few hundred watts at these frequencies.

The center frequency of the 222 MHz version can be set from about 216 to 230 MHz by adjustment of the end caps. The 440 MHz version can similarly be adjusted from 428 to 452.5 MHz. All adjustment should be with the two caps equidistant from the copper elbows. After you adjust the end caps to frequency, hold them in place using #4 by 1/2 inch stainless sheet metal screws. If you intend changing the antenna frequency often you might want to place slots in the caps, as shown, to make this adjustment easier.

The 2:1 SWR bandwidth on 222 MHz is 14 MHz and on 440 MHz is about 11 MHz. The wide bandwidth makes the antenna attractive for wideband applications such as amateur TV. The rugged construction also makes it ideal for remote beacon use.

Polarization and Pattern

Polarization can be chosen by arrangement of the elbows and pipe fittings. For horizontal polarization the antenna can be supported on a 1/2 inch threaded mast. For vertical polarization the antenna should be mounted with the open side in the vertical plane. In this case the support mast should be nonmetallic to avoid detuning the antenna. The cable should be routed back and away from the active part of the antenna.

As the patterns of the two are nearly identical, only those

[1]Notes appear on page 61.

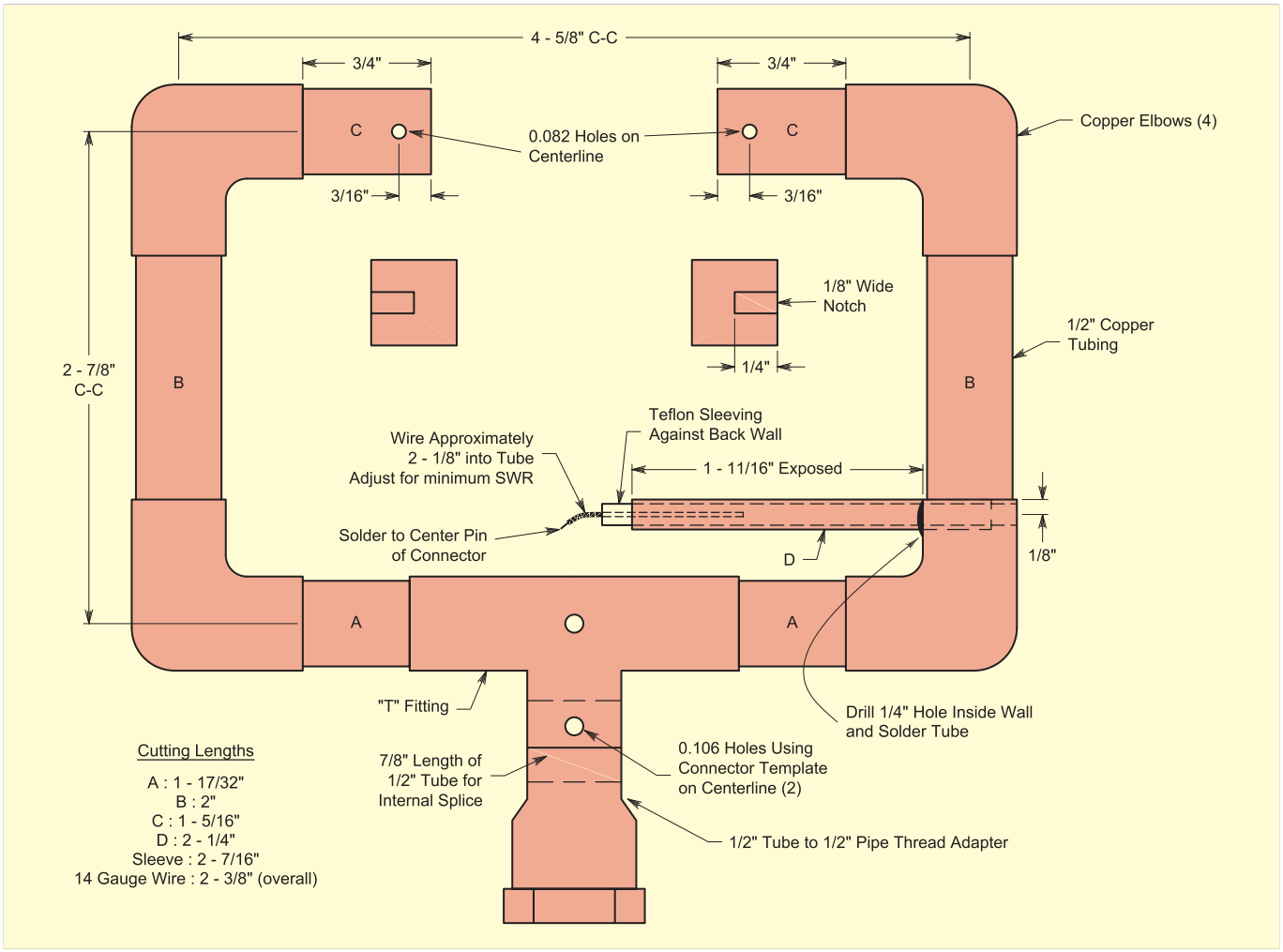


Figure 3—Constructional details for the 440 MHz antenna.

of the 440 MHz antenna are shown. The azimuth and elevation patterns for both horizontal and vertical polarization are shown in Figure 5.

How Do They Stack Up?

Once the loops are built you might want to consider stacking two or more for additional gain. Adding the second unit will increase the gain by about 2.7 dB. Recommended stacking methods are shown in Figure 6. Phasing of two antennas can easily be accomplished by using equal $^{3}/_{4}$ wavelength sections of 75 Ω coaxial cable (RG-59/U or RG-11/U). These are placed between each antenna and the feed point. The lengths are shown in Figure 6 and they include compensation for the velocity factor of the cables listed. The phasing network acts as a transformer, converting the individual branches to 100 Ω and, when fed in parallel, to 50 Ω to match the system feed line. A pair of stacked loops, vertically polarized, is shown in Figure 7.

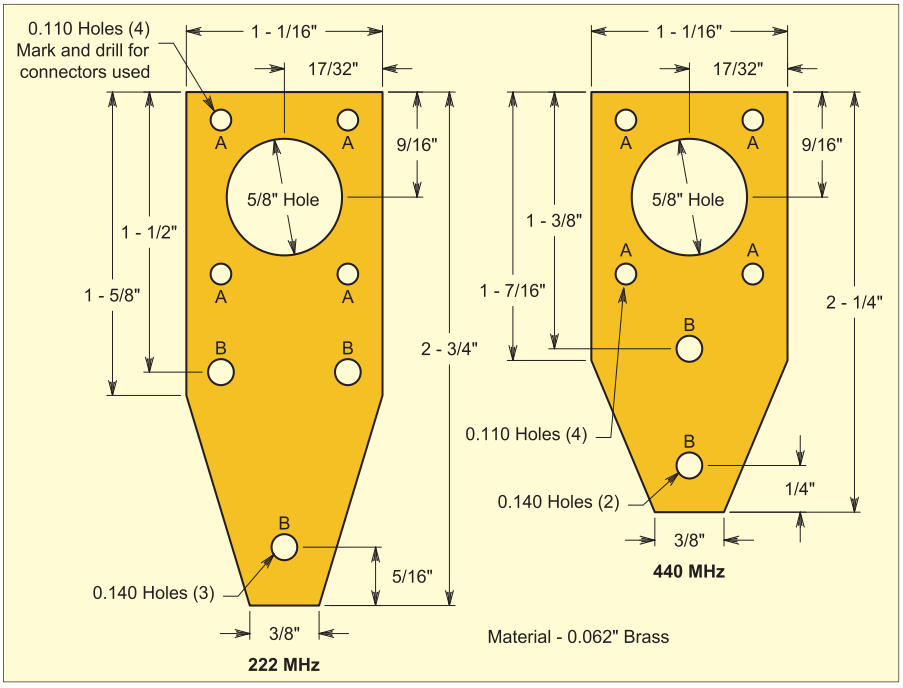


Figure 4—Constructional details for the feed connector mounting bracket.

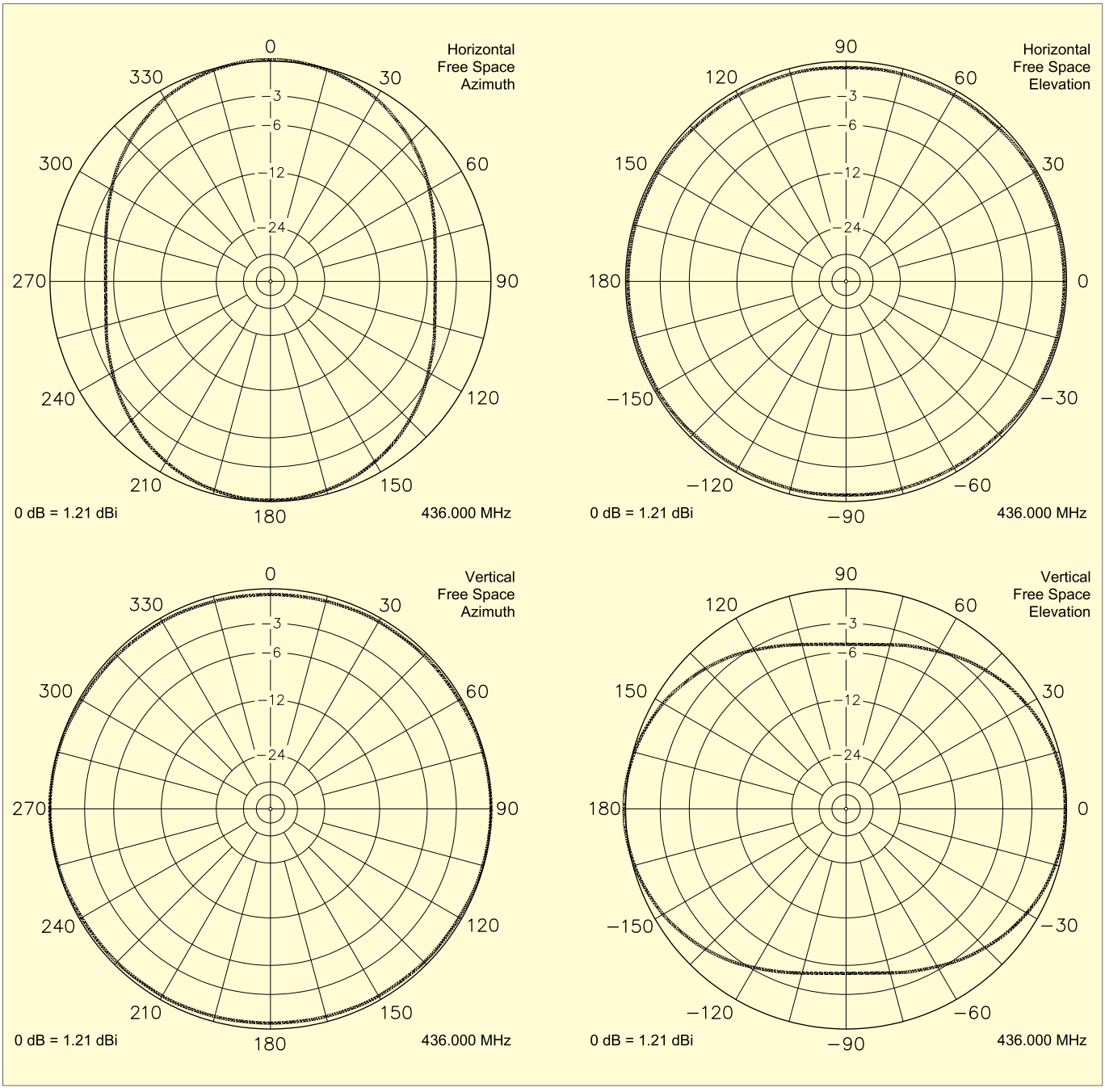


Figure 5—Azimuth and elevation patterns for both vertical and horizontal polarization modes for the 440 MHz antenna.

When two vertical units are stacked side by side, as in Figure 6C, the cable routing and metal support are not a factor. Further information on stacking, matching and phasing is available in *The ARRL Handbook*[2] and *The ARRL Antenna Book.*[3] Note that the gamma tubes are in the same direction on both antennas. If you are planning on stacking two antennas it is an advantage to build one of them with a feed point connector on the opposite side to that of its mate. This is so that phasing will be proper with the feed connectors both facing the midpoint of the array. Be sure to seal the back of the connectors, the mating cable connectors and the exposed end of the gamma tube against moisture entry. The type N cable connectors are waterproof if properly installed.

The Bottom Line

For an antenna that's not much larger than the palm of your hand, the 440 MHz antenna does a terrific job. With the antenna on a short test stand, I can work a 443 MHz repeater over 60 miles away and my experience with local (about 30 miles away) repeaters is very good. I can also hear the AO-27 satellite repeater. The 222 MHz antenna has also been tested locally and performs as expected. I want to thank Carl Luetzelschwab, K9LA, for running the antenna plots and Joe Stroud, K9MRI, for help with field testing.

Notes

[1]Digi-Key Corporation 701 Brooks Ave South, Thief River Falls, MN 56701-0677; **www.digi-key.com**.

[2]*The ARRL Handbook* is available from your local dealer or the ARRL Bookstore. Order no. 1964. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[3]*The ARRL Antenna Book* is 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**.

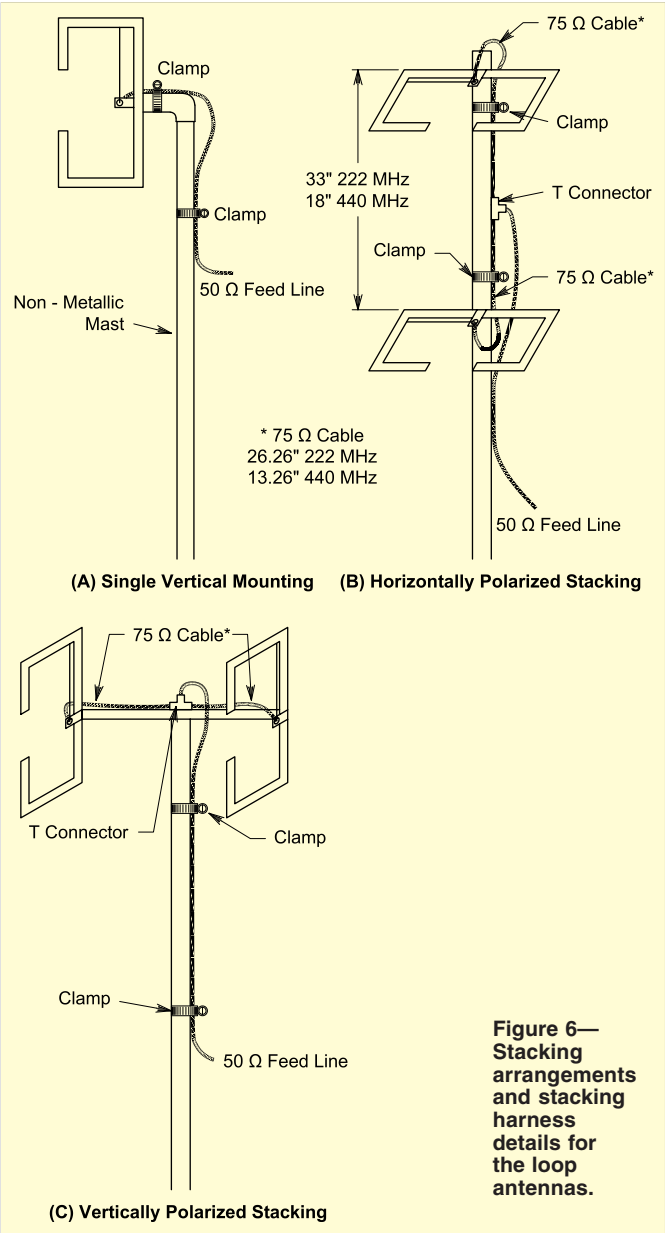


Figure 6—Stacking arrangements and stacking harness details for the loop antennas.

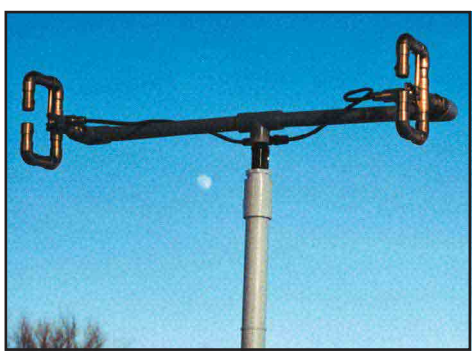


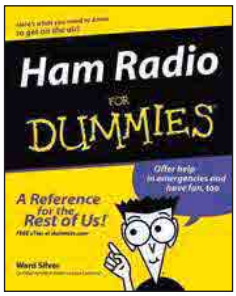
Figure 7—The complete loop antenna assembly shown in a stacked configuration for vertical-mode polarization.

Photos by the author.

Dick Stroud, W9SR, was first licensed in 1939 and received his Amateur Extra class license in 1952. Dick is an electrical engineer (retired) who spent over 30 years designing military electronics equipment. He obviously enjoys the art of homebrewing. You can contact him at PO Box 73, Liberty Center, IN 46766 or at **dikw9sr@citznet.com**.

NEW BOOKS

HAM RADIO FOR DUMMIES



By Ward Silver, NØAX

Published by Wiley Publishing, Inc, April 2004. 384 pages with index. ISBN 0764559877. Available from ARRL, order no. 9392, $21.99 plus shipping. Order toll-free 1-888-277-5289 or order on-line at **www.arrl.org/shop/**.

Reviewed by Rick Tavan, N6XI

◊ Well, it's about time! For years I have been wondering when the popular "for Dummies" series of books for beginners in just about everything would embrace Amateur Radio. The wait is over and *Ham Radio for Dummies* by *QST* Contributing Editor Ward Silver, NØAX, is now available…and it was worth the wait. Although best known perhaps as Dr Beldar of contest forum fame or as the editor of the biweekly *Contest Rate Sheet*, Ward has shown that he also understands the bewilderment of the neophyte and how to cure it. The book is true to the series, a highly readable introduction to the what, how and why of Amateur Radio. Eschewing technical jargon and excessive detail but reserving ample space to touch on every major aspect, *Ham Radio for Dummies* is an effective introduction for anyone who is curious about us.

Ham Radio for Dummies is not a license manual. Although it overlaps some of the content of classics like *Now You're Talking!* and the *General Class License Manual*, it does not replace them. It contains thorough overviews of the licensing process, types of on-the-air activities, station construction and the like, but it does not attempt to include "all you need to know" in order to do anything. Instead, this book refers extensively to other publications and on-line resources that will take the interested reader from curiosity to accomplishment.

I particularly liked Ward's layered approach to instruction, introducing topics in overview chapters before going into more detail later on. He provides the reader with descriptions of a broad spectrum of activities, all equally worthy of the reader's time, attention and further investigation. If there is any license class bias at all it is the assumption that the reader will advance to whatever level is necessary to pursue his or her particular interests. The book is well organized and written, although the illustrations could have been of a higher quality and more complete.

We should all own a copy or two of this book, if not for our own "expert" selves then for the next friend who comes along with questions about Amateur Radio. Let's give away a lot of copies to prospective hams—I predict a high success rate! And keep a copy on the shelf for yourself. It includes excellent introductions to special topics such as digital modes, QRP, contesting, DXing, satellite and TV. The chapter on Specialties certainly got my juices flowing to add a few more of those skills to my repertoire. Also, the admonitions on station maintenance and record keeping remind us of overdue improvements to our own amateur practice.

We were all Dummies once with respect to ham radio and some of us have enjoyed the progression from Dummy to Expert to Elmer. *Ham Radio for Dummies* is poised to launch a new generation onto that exciting trajectory. Congratulations to NØAX and the Dummies crew for another winner.

Experiment #18: Frequency Response

When the behavior of a circuit is dependent on frequency—and that's the case with just about any ac circuit—it's important to understand just how that circuit changes with frequency. That behavior description is called the circuit's *frequency response*. In mathematical terms it can be quite complex, but luckily there are some easy-to-understand methods of measuring and displaying frequency response. That's the topic this month and, along the way, we'll review what makes a dB a dB.

Terms to Learn

- *Cutoff or Half-Power Frequency*—the frequency at which a circuit's output is one-half of some specified reference value (usually a maximum value of gain or response).
- *Magnitude Response*—a graph of a circuit's effect on the amplitude of a signal passing from that circuit's input to its output.
- *Phase Response*—a graph of a circuit's effect on the phase shift of a signal passing from that circuit's input to its output.

Background

Technically, frequency response is an equation that describes how a circuit modifies a sine wave signal at any frequency. To most hams and experimenters, frequency response is usually represented as a pair of graphs. One graph, the magnitude response, shows how the circuit affects the signal's amplitude. The other, the phase response, describes the circuit's effect on the signal's phase.

Let's start with the most commonly seen response—magnitude. Figure 1 shows an example: the magnitude response of a band-pass filter. The ratio of output to input amplitude in dB is shown on the Y axis with frequency on the X axis. (If you're not familiar with the decibel, take a detour to the sidebar, Decibels and Ratios.) The curve shows that the input signal is passed to the output with no loss (or 0 dB) between the frequency range of 200 Hz to 5 kHz. Above and below those frequencies the filter removes more and more of the signal until, at 1 Hz, only 1/200th (–23 dB) and, at 500 kHz, only 1/1000th (–30 dB) of the signal remains. At 20 Hz and 20 kHz, we see that the filter passes half of the input signal because the output is 3 dB lower than it is in the *passband*.

Many different types of magnitude measurements can be plotted compared to frequency—voltage, power, brightness, loudness and so on. The object is to show how a quantity or a ratio of quantities varies with frequency.

The phase response (more accurately, phase shift) graph shows how the phase of the circuit's output relates to that of the input for a sine wave signal. Phase is always measured from the input to the output. A negative value, such as –45°, means that the output is lagging the input. Leading phase does not mean that the output signal somehow appears before the input signal. It means only that once the input has been applied for a while, the phase of the output signal is a little ahead of the input.

Figure 2 shows the phase response of a simple low-pass filter. At low frequencies, there is little effect on the phase. As the signal frequency rises, however, there is more and more phase shift until, at the cutoff frequency, there is 45° of lagging phase shift, plotted as a negative number. The phase shift then gradually approaches 90°.

Obtaining a Frequency Response

With computer tools such as spreadsheets, it's easy to do the calculations and make a graph. If you don't have a spreadsheet, then graph paper (use semi-log paper if you can get it,

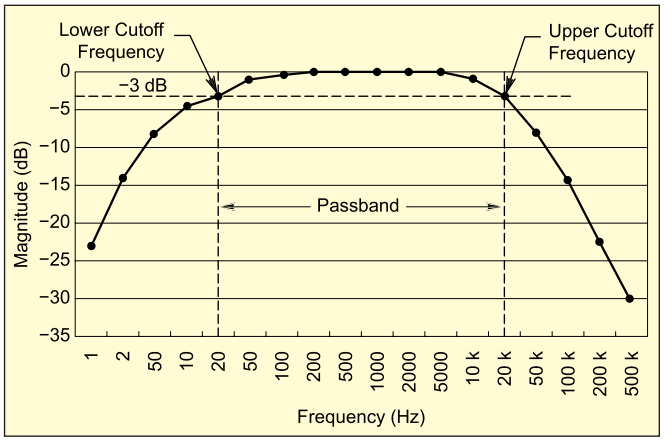


Figure 1—This magnitude response shows the effect of a band-pass circuit on a signal's amplitude as the frequency is varied. The upper and lower cutoff frequencies occur where only 1/2 of the input power is delivered to the output.

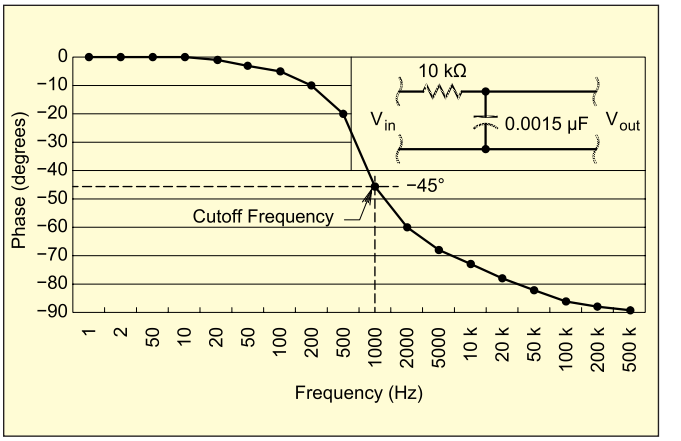


Figure 2—This is the phase response of simple RC low-pass filter. Note that the phase shift at the cutoff frequency is 45°, a trademark of single-pole filters.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

Decibels and Ratios

Why use dB? The decibel, or dB, is a mathematically convenient way of "compressing" wide variations in ratio by using logarithms. Since so many electrical phenomena are best viewed as ratios, using dB makes ratio relationships appear as straight lines on graphs.

A ratio between two power levels, P_1 and P_2, is calculated in dB as:

$$dB = 10 \log (P_1/P_2) \quad \text{[Eq 1]}$$

A power ratio of 10:1 is 10 dB, while 1000:1 is 30 dB and 10000 is 40 dB.

To compute dB using voltage (or current) ratios, the constant 10 in equation 1 must be changed to 20. This leads to the mistaken notion that there is "power dB" and "voltage dB"—not true! Where does the "20" come from? Recall that power is equal to V^2/R. Substituting that formula into equation 1 gives:

$$dB = 10 \log [(V_1^2/R) / (V_2^2/R)] = 10 \log [(V_1 / V_2)^2] = 10 \times 2 \log (V_1 / V_2) \quad \text{[Eq 2]}$$

This assumes that the measurement of voltages occurs across the same value of resistance, which is usually the case. You can see that there is only one type of dB. The confusion usually occurs when we are measuring a change in power by a factor of 2, which is always 3 dB. If voltage changes by a factor of 2, that translates to 6 dB and a power ratio of 4. To change power by a factor of 2 requires a voltage change of $\sqrt{2}$ or 1.414. Don't be confused!

Another common ratio rule-of-thumb is the "1-2-5 rule." Have you've ever wondered why meter scales and frequency ranges seem to be calibrated in this sequence? It's because dividing a range this way, for example 1-2-5-10-20-50-100-200-500 Hz, makes the steps in approximately equal ratios which appear equally spaced on a logarithmic axis. This is another way to help ratio relationships appear as easy to grasp straight lines on graphs.

with a linear axis for dB or phase and a logarithmic axis for frequency)[1] and a pencil will do just fine! A Microsoft *Excel* spreadsheet that you can use to make graphs is available on the Hands-On Radio Web site (**www.arrl.org/tis/info/HTML/Hands-On-Radio**).

There are some simple rules to follow whether using a spreadsheet or graph paper:

- Measure input and output in the same units, such as volts, and use the same measurement convention, such as RMS or peak-to-peak.
- Measure phase from the input to the output.
- Use 10 × log [ratio] for power and 20 × log [ratio] for voltage or current.

Measure the frequency response of the RC circuit shown in Figure 2. Set your function generator to output a sine wave of several volts. Connect it to V_{in} and monitor it with one oscilloscope channel. Connect the other 'scope channel to V_{out}.

- You can measure the magnitude response with a voltmeter on its ac voltage setting if it will read RMS voltage accurately to frequencies higher than 10 kHz (check your meter's manual). You won't be able to measure phase, however.
- If you have a single channel 'scope, switch the probe back and forth between input and output for each measurement to be sure that the input voltage remains constant.

Follow the 1-2-5 rule for frequency, starting at 1 Hz, measuring input and output voltage and phase. Enter the values into the spreadsheet or make a table.

To measure phase, adjust the trace position so that the zero voltage value of each channel falls directly on the center calibration line of the oscilloscope graticule. Measure the time between the input and output signal zero-crossings. Convert the time to degrees of phase by multiplying by 360f (f is the frequency of the signal). As the output signal voltage becomes smaller, you will have to increase the sensitivity (fewer volts/division) of the display to measure voltage and phase, so use the proper scale for the voltage reading.

[1]Free software for printing graph paper directly to your printer is available at **www.farm.kuleuven.ac.be/pharbio/gpaper.htm**. This will handle many graphing requirements, including log and semi-log plots at up to 6 cycles per axis.—*Ed.*

You will have a magnitude response graph that begins with approximately 0 dB at 1 Hz, reaches the cutoff frequency somewhere near 1 kHz, and steadily declines as frequency increases. The phase response should look a lot like Figure 2.

Swap the resistor and capacitor, with the resistor across the output, forming a high-pass filter. Measure the frequency response of this circuit. The magnitude response will increase with frequency to the very same cutoff frequency, gradually approaching 0 dB. Phase response will start at approximately 90° at 1 Hz, reach 45° at the cutoff frequency, and then gradually drop to 0°. You may find it easier to start at high frequencies and work your way down to 1 Hz.

Advanced Techniques

For actual measurements, you'll want to measure response at more frequencies than are covered by the 1-2-5 rule. For example, to plot a tuned circuit's response, you'll want to measure at several points close to resonance including the cutoff frequencies (where the magnitude is –3 dB exactly), whether or not they are on a 1-2-5 frequency. To use *Excel* for these graphs, use an "X-Y Scatter Plot" chart type and set the X-axis scale to be logarithmic. Enter all frequencies in exact numeric form (not as "200 k," for instance).

Suggested Reading

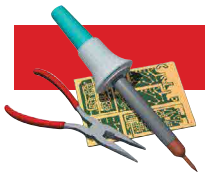
The 2004 *ARRL Handbook* devotes several pages in Chapter 4 to logarithms and decibel relationships. As an example of how ratio relationships can be plotted as straight lines using logarithmic axes, check out the inductive and capacitive reactance versus frequency graph in Chapter 6.

Shopping List

- 10 kΩ, 1/4 W resistor
- 0.0015 µF capacitor, any type

Next Month

Let's get back to the bench next month and learn about a neat circuit—the current source. We'll cover a couple of ways to generate constant current, including one of my favorites, the current mirror. QST



HINTS & KINKS

CO DETECTOR RFI

◊ Some amateurs are plagued with carbon monoxide (CO) and smoke detectors that are affected by RFI. In my case, if I pushed the memory button on my Kidde CO detector after transmitting at high power, it would display 800-1000 ppm of CO, after alarming.

My unit is a Kidde Nighthawk detector that plugs directly into an ac outlet. I opened the unit up, which is easy to do, and soldered a 0.01 µF, 1000 V disc ceramic capacitor across the ac line at the back of the plug. This was my first attempt at RF suppression. That did not completely cure the problem, but it reduced the displayed CO reading to 85 ppm. Next, I located the filter capacitor, in my case a 330 µF unit, positioned next to the 12 V transformer and rectifier diodes. Leaving the capacitor in place, I soldered an additional 0.01 µF, 100 V capacitor across the bottom of the existing 330 µF capacitor. That completely cured the problem. Pushing the memory button, the detector now displays 0 ppm and doesn't alarm. The problem could possibly have been solved with ferrite beads on the dc supply leads, but bypassing the dc for RF seemed like a good idea and no circuitry cuts or modifications were required. Since the changes are confined to the power supply, it seems unlikely that any normal performance parameters are affected.—*T. Tammaru, WB2TT, 58 Fish Hawk Dr, Middletown, NJ 07748;* **wb2tt@arrl.net**

KEY PADDLE HOLD-DOWN

◊ I've struggled for years trying to keep my keyer paddle from moving around on the desk, especially under my heavy-handed usage. I've tried double-back tape, small dabs of rubber cement and other glues. The list goes on and on. All those methods had one disadvantage or another.

I've now discovered the perfect method of eliminating that problem. Con-Tact brand (**www.contactbrand.com**) shelf paper makes a material they call "Grip Liner." It's relatively inexpensive and is easily cut with ordinary scissors. One roll could probably last a lifetime and find many uses in the ham shack.

I cut out a rectangular piece and laid it on the desk where I wanted the paddle located. This simple stuff keeps the paddle right where I want it to be; no matter how hard I bang on it. When I want to move it, I can quickly do so without having to go through the difficulties I had with things I tried before. The material can be located in any kitchen supply store and the cost is about $4. What a difference!—*Larry Winslow, WØNFU, 4500 Whitman Ave N, Seattle, WA 98103;* **larry_w@comcast.net**

TAMING COMPUTER POWER SUPPLY NOISE

◊ Recently, I purchased a new computer. Soon after plugging it in, I observed with dismay that, when the computer was in operation, every HF band filled up with very strong spurious signals. The computer completely spoiled HF operation—it even created objectionable interference on 144 MHz.

I intended to use the computer for the digital modes, using its sound card, so I clearly needed to find the cause and cure the problem.

Grounding the computer case didn't work; neither did shielding the exiting cables, or placing ferrite chokes on them. I tried everything short of exorcism! Just as I was ready to toss the computer, I realized that the kind of interference I experienced was far too strong to be originating from its main board logic circuits. Also, the noise had a raspy quality that changed when the floppy drive or the CD drive started spinning. I reasoned that the interference was coming from the computer's switching power supply.

But how? My older computer was extremely "quiet"—what was different in the new machine? I proceeded to open the case of the computer's power supply to do some troubleshooting.

I observed that the supply was without many of the ancillary circuits found in most older computer power supplies. This "new" supply had very small capacitors, small heat sinks, messy construction and, most importantly, *no input ac line filtering at all*! The ac leads went directly from the plastic power connector to the printed circuit board and connected to the bridge rectifier. The PCB had space for the filter components, but they had been omitted and jumpered! That's why it "transmitted" its switching noise and power oscillator harmonics so well—the power cable was serving as an antenna.

There were two solutions: Either dump the low-quality supply in the junk box and get a better one, or correct the shortcomings of the design. Being a ham, you can guess the route I took.

I constructed an ac mains line filter, following the schematic shown in "A 13.8 V, 40 A Switching Power Supply" in *The ARRL Handbook* (1999-2004 editions). It's a very simple but effective filter, used in all good quality supplies. The parts can be easily found in a junked, older computer power supply—those seem to be much better built. The part values are not very critical. Also, I replaced the cheap, plastic power input receptacle with a CEE-22 ac connector that has a built-in ac line EMI filter and fuse. After completing and checking the wiring (I used the empty area on the PCB to mount the new parts), I replaced the supply in the computer and screwed the covers in place. I then turned on my HF radio to 40 meters (the most troublesome band) and powered up the computer.

No noise at all! The problem had vanished. I checked all bands and confirmed that everything was okay. Now, I enjoy using my computer on the air…on every band. Furthermore, the power supply circuits have more protection now—the filter eliminates harmful line voltage spikes.

This information could also be applied to the switching power supplies used in some low-cost video monitors. *A word of caution*: When working on a computer power supply, apply all safety measures. These are dangerous, high-voltage circuits—the primary side of the supply is usually *not isolated* from the ac mains! Make sure the filter capacitors are completely discharged before working on the circuit and unplug the supply before working on it. If you feel you're not up to the task, have someone who is more experienced help you out.—*Anastasios Thomaidis, SV8YM, 9-11 Therianou Str, Zakynthos GR 291 00, Greece;* **sv8ym@hotmail.com**

EASY POWER SWITCH GUARD

◊ I have owned a number of MFJ antenna analyzers such as the model 249, 259 and now a model 269B. These are very

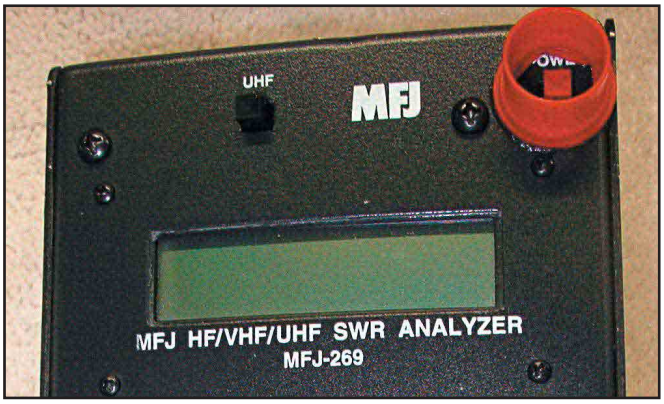


Figure 1—The power switch guards shown here are red plastic "caplugs" that are commonly used to cover RF connectors. Others can be made from plastic bottle caps.

useful instruments, but they use a large number of batteries. So, when the batteries need replacement, cost can be a factor. That's not so bad if you've used the unit and have run the batteries down, but it's no fun grabbing your analyzer and finding it completely dead without having been used.

With their exposed push-on/push-off power switches, the analyzers are very prone to accidental power on. I remember a visit I made to a power plant control room some years back. I noticed that critical switches there often had a guard around them to prevent accidental switch or button closure.

Thinking about this and looking around the shack, I found a simple solution. I had several plastic protector caps (**www.caplugs.com**) from some N connectors I had. To create a similar switch protector, I simply cut the bottom of the cap out with a hole large enough to pass the existing switch shaft. I then used a hot glue gun (a silicone adhesive can also be used for a no-mar attachment) to affix the cap switch protector in place over the power button. Now, simply pushing something against the analyzer (like the carrying case) will not cause an accidental power up. You have to insert a finger into the cap intentionally to access and turn on the switch. Figure 1 shows a completed installation. Switch guards can also be made from plastic bottle caps or even large nuts and washers. *—E. Kirk Ellis, KI4RK, 203 Edgebrook Dr, Pikeville, NC 27863;* **e.kirkellis@netzero.com**

ALKALINE VERSUS HEAVY DUTY BATTERIES IN HAM AND TEST EQUIPMENT

◊ I use only so-called "heavy duty" batteries in most of my portable test equipment and ham gear, since that equipment may sit on the shelf for weeks or months between uses. Alkaline battery chemistry can produce corrosive liquids as the batteries age and discharge. That can damage the battery compartment and sometimes the circuitry of the gear.

Heavy duty battery chemistry works the opposite way. Those chemicals tend to dry up as the batteries age and discharge. Hence, the likelihood of chemical leakage is significantly less than in the alkaline cells. In my 15 years as a ham, I've seen lots of radio gear ruined from leaking alkaline batteries, but I've yet to see any leakage from heavy duty batteries. Although alkaline batteries may give longer run times, it's a cheaper (heavy duty batteries are often half the price of alkaline cells) and safer solution to use heavy duty batteries in any equipment that has infrequent use. I now use alkaline batteries only if they are to be used in equipment that is very power hungry (a digital camera or a handheld transceiver that will see short-term use) or in equipment that sees frequent use and will be operated short-term until the batteries are exhausted. Keep this in mind the next time you plan to install batteries in that expensive piece of gear.*—E. Kirk Ellis, KI4RK, 203 Edgebrook Dr, Pikeville, NC 27863;* **e.kirkellis@netzero.com**

Figure 2—A low-cost but effective way to waterproof cable connectors in the field. A short length of pipe insulation does the job.

SAVING "FOGGED" PLASTIC

◊ In attempting to clean equipment, volatile and potentially harmful substances are often used—not only to your health—but also to the equipment. While cleaning some nearby gear on my bench I was not aware that a plastic cross-needle SWR meter in an MFJ Versa Tuner accidentally became "fogged." Thinking the meter worthless, I further exacerbated the problem by spraying cleaner on the plastic cover, as I tried to "buff" out the plastic, but it only made matters worse. But before tossing it in the junk box I came upon a procedure that refurbished the plastic cover, making it as clear as new and essentially rendering it "crystal clear."

I have an erasing pencil (a long soft white eraser, a Pentel "Clic" eraser). With 5 minutes of very easy labor, I was able to erase the fogged plastic cover and make it as bright and clear as it was when new. I believe the eraser material is available in other form factors as well; the pencil style is not a requirement.*—Robert Cowan, WB6DAC, 2740 Canary Dr, Costa Mesa, CA 92626;* **wb6dac@attbi.com**

WATERPROOFING FIELD DAY COAX CONNECTIONS

◊ After connecting two coax cables with a UHF barrel adapter during a Field Day exercise, you should waterproof it against the inevitable overnight rain (and morning dew). To accomplish this in less than 10 seconds, cut an 8 inch length of $^{7}/_{8}$ inch ID foam hot water pipe insulation (the non-split type), slide it over one coax connector, join the coaxes with a barrel, slide the insulation over the joint and strap it *tightly* one inch from each end with nylon cable ties. Done. The result is shown in Figure 2.

A 5 foot length of pipe insulation costs $1.50 and it will provide up to eight pieces of section. Nylon ties are 5 cents each. That's 30 cents per connection…a small price to pay for an essential requirement. It's cheaper than electrical tape and coaxial sealing tape and much faster, both in application and removal. To disassemble, cut the ties with diagonal pliers. *—Jim Yuen, WH6GS, 91-1517 Halahua St, Kapolei, HI 96707;* **wh6gs@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

WiNRADiO G303i Shortwave

Reviewed by Larry Wolfgang, WR1B
Senior Assistant Technical Editor

"Honey, I think I'll go listen to the computer for a while." Well, I could be planning to pop a music CD into the CD drive for some listening pleasure. Maybe even watch a DVD or tune in a favorite radio station over the Internet. With a good set of stereo speakers attached to my computer sound card, there are many possibilities. In this case, though, I have a WiNRADiO G303i receiver card installed in a PCI slot of the computer. That opens a whole new world of listening possibilities—literally. This radio tunes from 9 kHz to 30 MHz! Where do you want to go today?

It seems that many of us "old timers" cut our teeth on radio by listening to shortwave broadcast stations. It was quite a thrill to tune in programs from the British Broadcasting Company or the Canadian Broadcasting Company, take German lessons from Deutsche Welle, hear a different slant on the news from Radio Moscow or Radio Netherlands or listen to HCJB in Quito, Ecuador. Voice of America broadcasts were always informative and interesting.

It has been quite a while since I've spent much time SWLing, so when I was asked if I would like to review the G303i, I thought it would be fun to relive some of that old excitement. Besides, it is hard to turn down a chance to play with a new radio!

This radio, it turns out, is a software-defined radio. That means most of the hardware is already in your computer. You will need at least a 500 MHz Pentium III computer, although a 1 GHz or faster Pentium IV or Athlon processor is recommended. You will also need a 16 bit full duplex SoundBlaster compatible sound card. Again, a real Creative Labs SoundBlaster 16 or 32 bit sound card is recommended. You will also need *Windows 98* or a newer operating system. WiNRADiO offers several PC-based receivers. See the January 2002 issue of *QST* for a review of the WR-1550i receiver. Visit **www.winradio.com** for the latest information about all their offerings.

Installation and Set Up

The G303i package includes a PCI circuit card, which is the actual receiver unit, a program CD, an indoor "test" antenna, an SMA to BNC connector adapter and a 56 page User's Guide. Installation was easy—I let Mike Tracy, KC1SX, do that for me in the ARRL Lab. After all, Mike did all of the performance testing for the data in Table 1, and since I don't own a computer fast enough to run the G303i, I just planned to bring the test computer home for the review. Mike said the installation was uneventful. How exciting can it be to plug a card into an empty PCI slot? That's all there is to the hardware installation. Figures 1 and 2 provide a view to the high quality construction. Turn on your computer and let the operating system find the new hardware. Then just pop the enclosed CD into the drive and follow the on-screen instructions.

Figure 1—The top of the PCI card WINRADIO G303i hardware.

Double click the new WiNRADiO G303i icon on your desktop and click the ON/OFF button to turn on the radio. The WiNRADiO G303i virtual front panel display will magically appear on your computer screen. See Figure 3. At this point you will have to connect the supplied audio cable from the receiver output to your soundcard line input. (If you have a laptop or other computer that only has a mic input, you can use that.) Start the soundcard software control program and set the line input and speaker output levels to about midrange to start. Finally, go to the G303i virtual front panel and click the SETUP button (just under the USB button on the left half of the display). A small window opens, showing the G303i Demodulator Setup panel. See Figure 4. Now, let the fun begin!

You can use the antenna supplied with the G303i to test the receiver, but I recommend that you connect a better antenna for the most fun. The supplied antenna consists of about 20 feet of RG-174 coax with the outer braid stripped off half of that length. There is a BNC connector on the end of the coax. (I wonder why they chose an SMA connector for the receiver card. Few people will have an antenna that uses that connector. The package comes with the SMA to BNC adapter, though, and most hams will have whatever other adapters they may need to connect an existing antenna to the receiver.) For my testing, I used a mix of ham dipoles and beams appropriate for the band and got good results.

Bottom Line

The WINRADIO G303i provides considerable flexibility and reasonable performance for a receiver that takes up one card slot in a computer.

The Front Panel

As Figure 3 shows, the computer display looks like the front panel of a radio. There are quite a few buttons and controls, but most of them are pretty well self-explanatory. The main TUNING knob in the middle of the panel even has a dimple for your finger. Well, it isn't quite a touch-screen control, but it looks realistic. Just below and to the left of the TUNING knob are a VOLUME control and a MUTE button. Mute comes in handy when you want to quickly quiet the radio. (It's not the best idea to tune a suddenly loud signal late at night with your son sleeping in the room above your shack!) To the far left is an AUDIO AGC button that will turn that feature on or off when you click it.

The demodulator spectrum display on the left makes it look like one of the new-

Joel R. Hallas, W1ZR ♦ Assistant Technical Editor ♦ w1zr@arrl.org

Table 1
WinRadio G303i, serial number 101240

Manufacturer's Specifications	Measured in ARRL Lab		
Frequency coverage: Receive, 0.009-30 MHz.	Receive, as specified.		
Modes of operation: AM, FM, SSB, CW.	As specified.		
Noise floor: –135 dBm.	Noise floor (MDS): 1.0 MHz, –123 dBm; 3.5 MHz, –133 dBm; 14 MHz, –131 dBm.		
AM sensitivity (10 dB S/N): 0.009-0.1 MHz, 9.0 µV; 0.1-2 MHz, 2.2 µV; 2-30 MHz, 0.9 µV.	AM, modulated 30% with a 1 kHz tone, 10 dB (S+N)/N: 1.0 MHz, 1.8 µV; 3.8 MHz, 0.67 µV.		
FM sensitivity (12 dB SINAD): 0.009-0.1 MHz, 2.2 µV; 0.1-2 MHz, 0.4 µV; 2-30 MHz, 0.2 µV.	For 12 dB SINAD: 29 MHz, 0.35 µV.		
Blocking dynamic range: Not specified.	Spacing 3.5 MHz 14 MHz	20 kHz 115 dB 113 dB	5 kHz 40 dB 38 dB
Two-tone, third-order IMD dynamic range: 93 dB.	Spacing 3.5 MHz 14 MHz	20 kHz 93 dB* 90 dB*	5 kHz 44 dB 44 dB
Third-order intercept: +5 dBm (20 kHz spacing). Not specified.	Spacing 3.5 MHz 14 MHz	20 kHz +6.6 dBm +6.6 dBm	5 kHz –74 dBm –73 dBm
Second-order intercept point: Not specified.	+27 dBm.		
FM adjacent channel rejection: Not specified.	20 kHz offset from 29 MHz, 66 dB.		
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz spacing, 29 MHz: 66 dB.*		
IF/audio response: Not specified.	Dependent on soundcard response.		
Spurious and image rejection: 60 dB.	IF rejection: 42 dB. Image: 53 dB.		

Third-order intercept points were determined using S5 reference.

*Measurement was noise limited at the value specified.

est top-of-the-line radios. You can watch the signals move across the demodulator passband as you tune up or down the band. Move that signal into the gray area (barely visible as a slightly lighter shade across the center of the display in Figure 3) to receive that signal.

Above the spectrum display there are nine MODE buttons and the SETUP button. While there is little information about what all these buttons represent, most of them are quite obvious. The AM button selects a 6 kHz bandwidth demodulator while the AMN button selects a 4 kHz demodulator. I couldn't find any information about AMS, but presume it means AM Synchronous detection. The CW mode uses a 500 Hz IF filter. Judging by the spectrum display, FM3 selects an FM demodulator with a 3 kHz bandwidth and FM6 selects one with a 6 kHz bandwidth. FMN (normal?) looks like a bandwidth of about 12 kHz.

The main frequency display is at the top left. You might also notice some buttons with up and down arrows under the frequency display. They represent one of the many ways to tune this radio. In the center at the top there is a box to select a tuning step size, with buttons below that go up or down one step at a time or 10 steps at a time. Just above the TUNING knob are the scanning controls. Select either an immediate (Search) scan, scan a set frequency range or scan the memory channels. (You can also lock out those memory channels that you don't want to scan.)

Next up across the top is the memory store and recall section. More about memories later. On the top right side is the S meter. This is a smooth operating single-needle movement that can be set to show S units, signal strength in dBm or signal strength in microvolts. If you select the µV display you can also select a peak-to-peak reading.

Down the right side of the display you will notice buttons to control the AGC speed, or to turn the AGC off. Below that is a box to set the squelch level, calibrated in dBm. This setting is helpful to quiet the background noise for scanning, to prevent the radio from stopping at every scan step whether or not there is really a signal present. If you set the AGC off (this is an IF AGC) then the IF Gain window lights up. Here you can set a gain value between 0 and 100, depending on band conditions and signal strength. This might prove useful for receiving very weak signals, where the signal is not strong enough to activate the AGC. There is also an 18 dB attenuator on this row, which you activate by clicking on the ATTEN ON button.

Just below the ATTEN, IF GAIN and SQUELCH buttons there is an interesting

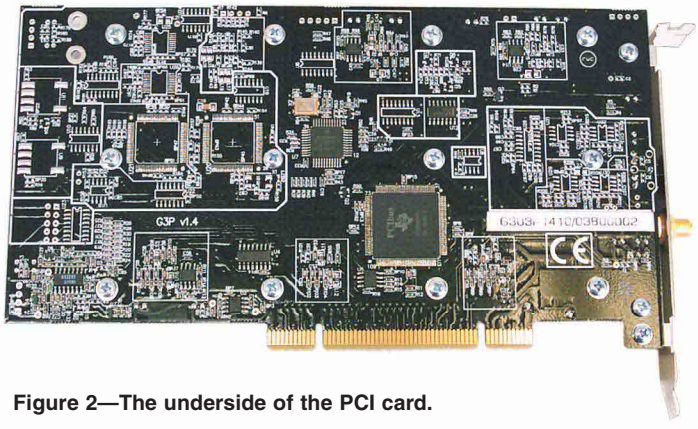


Figure 2—The underside of the PCI card.

Figure 3—Screen shot of virtual front panel.

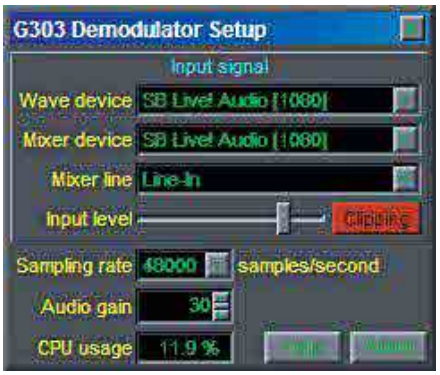


Figure 4—Screen shot of demodulator setup window.

row of yellow squares. This is the tuning pad. How many different ways are there to tune this radio? They are legion! As you move your mouse over these yellow blocks they will turn green, and a tuning step size will appear above the block. See Figure 3. These steps go from 10 kHz, 6.25 kHz, 5 kHz, 1000 Hz, 100 Hz, 10 Hz and 1 Hz through the same negative values. Make a quick frequency jump up or down the band simply by clicking one of these blocks!

The UTC/Local Time clocks near the bottom of the display are a neat feature. Rounding out the front-panel controls is the ON/OFF button and a small yellow triangle.

That yellow triangle must do something, right? Yes—it opens the Spectrum Scope display window at the bottom of the panel. Unlike the demodulator spectrum display, this Spectrum Scope shows signals across a defined spectrum sweep. For most of the review period, this display was not active, and no amount of clicking grayed out buttons or displays would change that. Just when I gave up and decided to report it as a non-functioning feature, it came alive! I'm glad it did, because it is a neat feature of the radio. I have no idea what I did that activated it—in fact, it actually came on after I had walked away from the radio for about an hour one day!

To use this feature, set the scan start and stop frequencies as well as the step size, and click the small right-pointing triangle/arrow point to start the scan. The radio will go silent while scanning your band range, and signal strengths will display on the graph. You can either set it to scan once or for continuous scan. Now for the neat part—stop the scan (click the square button) and click your mouse at any point along that graph. See Figure 3. You will have to scroll the graph left and right to see the entire range. See a blip that looks interesting? Click it and the radio goes there instantly. Assuming that signal is still present, you will be able to hear it! Tune the radio anywhere in the scanned range this way.

Tuning the WiNRADiO G303i

There are so many ways to tune this radio that it is hard to number them all. Forgive me if I miss a few. For example, just type a number on your computer keyboard and hit Enter. If the frequency is in the range of the radio, it will jump there. You can use the Up and Down arrow keys on your keyboard to change frequency one tuning step, according to the step size you have selected. If one tuning step at a time isn't quite enough, then use the Page Up and Page Down keys to jump 10 steps at a time.

By the way, if you select the AUTO button under the Step size window, the radio will decide the best tuning step for the mode/frequency you are using. This is a software-defined radio, so under the Options menu you can select the Autostepping command to specify your own choices for step size, even defining a new range for specific step.

If you prefer to use your mouse, you can click the up or down arrows under any digit on the display to change that digit. You can also click on the right or left arrows under STEP to change frequency one step at a time. The double arrows allow you to move ten steps at a time. Earlier I mentioned the tuning pad. Clicking one of those yellow (now turned green) blocks is another convenient way to jump to a new frequency by one of the steps shown there.

Of course we all like to tune radios using the tuning knob. Move your mouse over the knob and watch a curved line with arrow points on both sides appear. Click the right mouse button to tune up and the left to tune down—unless you happened to put the mouse over the bottom of the knob, in which case the tuning direction is reversed. While using the tuning knob, the default is to tune in 0.5 kHz steps. Through the use of the ALT, SHIFT and CONTROL keys you can temporarily change the step size to 50 Hz for fine tuning or to 5 or 50 kHz for large excursions. If you don't like the virtual tuning knob, you can also tune using the wheel on a mouse.

There is one tuning method you can't use with this radio. You can't simply click on a signal peak on the demodulator spectrum display and go there. This function is available in the "non-real time" swept spectrum scope, however.

The Professional Demodulator

The review radio was the model without the professional demodulator. For $100 more, the model with professional demodulator provides continuously variable IF bandwidth, from 1 Hz to 15 kHz. The professional demodulator also adds double sideband and independent sideband demodulators. In retrospect, we should have probably tested the professional model since the variable bandwidth feature would seem worth the extra cost. It compares favorably to the cost of a single filter in an analog radio and provides a level of flexibility not found in many radios.

Another option worth considering is the software add-on available to allow reception of the new digital shortwave format Digital Radio Mondiale (DRM). This additional plug-in is available for a $70 license fee and opens the receiver to this new mode. Serious shortwave listeners will want to take advantage of this capability as more and more stations move in that direction.

Software-Defined Radio

A couple of notes about the concept of a software-defined radio may be in order for those not familiar with the concept. When WiNRADiO releases new versions of the control software you can simply download the updates from the Internet (**www.winradio.com**) and you will have the latest and greatest radio! The radio uses a special interfacing standard called XRS (Extensible Radio Specification). WiNRADiO makes this standard available to software developers, who may provide applications for controlling the radio or develop other features. There is some interesting information about this at **xrs.winradio.com**. During the review period I did not download and try any of the applications available here, but it is nice to know that with a simple file download you can enhance your radio.

Thanks for the Memories

How many different frequencies or frequency/mode/squelch setting combinations do you want the radio to remember? A thousand? No problem! I would not be able to remember where to look for 1000 memories in the drop-down list when I went to retrieve them. But you might want to define the memories as part of up to 16 different groups of frequencies. One set for short wave broadcasters and another for aeronautical mobile stations? One set for your favorite Amateur Radio frequencies? What? You don't think 1000 frequencies will be enough, now that you think about the possibilities? Still no problem. Close that file and open another! How many files can your hard drive hold?

Storing a frequency is easy. Tune in the signal you want, select the mode and squelch setting you want to save, and then click on the S under the Memory box. Click the appropriate boxes to store the mode, squelch setting and memory scan lockout as desired. See Figure 5. When it comes time to go back to one of those memories you can click on the R button and a window will pop up showing the data you have stored. See Figure 6. You can also select a memory frequency simply by clicking one of the arrow buttons

Figure 5—Memory assignment, channel quantity limited only by hard drive!

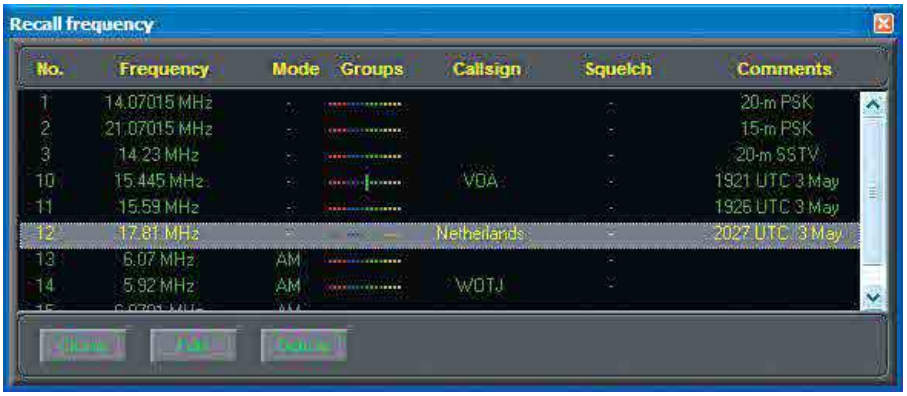


Figure 6—Memory listing allows quick return to any stored channel.

under the Memory box. Again, single arrows go one memory at a time and double arrows go 10 memories at a time.

Hardware and Circuit Operation

No radio review is complete without at least a few words about the circuit operation. In this case, a few are probably all we need.

The incoming signal is filtered and amplified, and then fed to a mixer. The first LO is a direct digital synthesizer and PLL operating over the range of 45.009 MHz to 75 MHz. This mixes the incoming signal to a 45 MHz IF where the signal is run through a crystal filter with 15 kHz bandwidth, and then amplified.

The second mixer stage uses another DDS/PLL oscillator at 45.012 MHz to mix the IF signal down to 12 kHz. This 12 kHz IF signal is fed to the soundcard input, and the rest of the signal processing is handled by the DSP in the soundcard. That's all there is to it!

On-The-Air Performance

What is the bottom line here? How does the radio stack up where it counts? Well Table 1 gives the receiver performance characteristics as measured in the ARRL Lab. Those numbers will tell you a lot about the receiver.

As I began to learn the various controls and features of this radio, I had fun scanning a couple of short-wave broadcast bands as well as a few of the other radio services out there. There are some interesting signals, and it was neat to hear VOA, BBC, Radio Netherlands and even Deutsche Welle again. I didn't hear as many stations as I had expected. Part of that is probably that a number of countries have cut back on their shortwave broadcasting efforts.

I used the radio to listen to a variety of signals on the ham bands. A look at Table 1 indicates that the receiver has competitive dynamic range at a 20 kHz spacing, typical of what's needed for shortwave broadcast listening, but the 5 kHz IMD results are not up to the specs of better HF transceivers. This receiver would thus not measure up in heavy contest operation, but that isn't what it's intended for, and it's unlikely that any contest operator would use it that way. For listening in the crowded amateur bands, the continuously variable bandwidth of the professional demodulator would provide a real benefit.

Another point worth mentioning is any SDR is dependent on the capabilities and limitations of the surrounding computer. It is possible that the receiver will operate with a lower performance computer than the 500 MHz Pentium III that is recommended, but any such operation is at your own risk. Similarly, we elected to purchase the specified sound card rather than hope that another manufacturers idea of "SoundBlaster Compatible" would turn out to be the case. In any event, the overall performance and sound quality will be limited by what the sound card can provide and how well the level settings are adjusted by the operator.

Manufacturer: WiNRADiO Communications Division of Rosetta Laboratories, 15 Stamford Rd, Oakleigh 3166, Australia; tel 61-39568-2568; **www.winradio.com**. Price: WR G303i with standard demodulator $499.99, with professional demodulator $599.99.

Kenwood TH-K2AT 2 Meter Handheld Transceiver

Reviewed by Dan Henderson, N1ND
ARRL Contest Branch Manager

It's the time of year when many of us begin checking out radio equipment for use outside. It is often useful to bring along a reliable 2 meter handheld when hiking in the woods, camping with the family, or just biking along enjoying the joys of the outdoors. We eventually decide it's time to consider purchasing a new rig, one with perhaps a bit more punch or one that's easier to program and use. With more and more repeaters requiring tone-encoding systems in order to allow access, we find that the handhelds that once served us well may come up short when matched up against newer offerings incorporating the latest technology.

Into this ever-competitive scramble to capture a market share, Kenwood brings a solid offering in the TH-K2AT. Sleek and trim, its relative ease of use will make it an attractive option to an old-timer seeking a replacement for the old handheld on its last legs, or as a first radio for a newly licensed amateur anxious to try 2 meter FM.

The TH-K2AT is designed with Kenwood's aim of "user friendliness" in mind. If you are like me, after the initial setup of the radio, you greatly prefer to be able to utilize the radio to its fullest without constantly having to refer to the instruction manual. In my testing of the radio under normal operating conditions, I found the TH-K2AT able to pass that test. With this concept in mind, I thought it a noteworthy approach that the manual very early on addressed "your first QSO." These are a simple, straightforward set of instructions that allow a beginner to use the TH-K2AT within a matter of minutes. Attach the antenna and battery pack, and you are in the driver's seat. The ease with which you can make that first QSO is important—the "bells and whistles" can come later.

Figure 7—The TH-K2AT 2 meter transceiver is compact yet big enough not to get lost in your hand!

Table 2
Kenwood TH-K2AT, serial number 50700013

Manufacturer's Specifications	Measured in ARRL Lab
Frequency coverage: Receive, 136-174 MHz; transmit, 144-148 MHz.	Receive and transmit, as specified.
Power requirements: 6-9 V dc battery; 12-16 V dc external supply. Receive (no signal), 0.10 A; transmit, 2.0 A, battery;1.8 A, external supply.	Receive (max volume, no signal), 0.25 A* battery; 0.36 A ext dc; transmit, 1.6 A battery, 1.5 A ext (tested at 13.8 V).
Size (height, width, depth): 4.4×2.4×1.5 inches; weight, 11.3 ounces.	
Receiver	**Receiver Dynamic Testing**
Sensitivity: 12 dB SINAD, 0.18 µV.	For 12 dB SINAD: 0.17 µV.
Adjacent-channel rejection: Not specified.	20 kHz offset from 146 MHz, 71 dB.
Two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset from 146 MHz, 67 dB, 10 MHz offset from 146 MHz, 78 dB.
Two-tone, second-order IMD dynamic range: Not specified.	95 dB.
Spurious and image rejection: Not specified.	IF rejection, 94 dB; image rejection, 70 dB.
Squelch sensitivity: 0.13 µV.	0.14 µV at threshold.
Audio out: 400 mW at 10% THD into 8 Ω (battery).	450 mW at 10% THD into 8 Ω (battery).
Transmitter	**Transmitter Dynamic Testing**
Power output: 5 W high, 1.5 W med, 0.5 W low.	5.2 W high, 1.7 W med, 0.6 W low (battery); 5.5 W high, 1.8 W med, 0.6 W low (ext dc).
Spurious and harmonic suppression: 60 dB.	73 dB.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal, 136 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	74 ms.

*see text

The results of the ARRL Lab testing are shown in Table 2. As noted, the radio met or exceeded all manufacturer's specifications. One note is worth passing along—Kenwood made a modification starting at serial number 51,000,000 to eliminate a problem with premature battery discharge. Radios with lower serial numbers should have been retrofitted prior to sale. If you happen to have a lower serial number unit a simple test can confirm if it has been upgraded. First, fully charge the battery. Put the battery on the radio with the radio turned off and leave it turned off over night. If the radio operates in the morning, the unit has been retrofitted, if the battery is dead in the morning contact Kenwood.

In addition to the evident drain while turned off, our early radio had a higher current drain during normal operation than the newer unit we checked.

The basic controls that an operator would need are easy to find on the TH-K2. One press of the ON/OFF switch on the front panel and you are ready for action. The digital readout on the front panel lights in a standard display, but is easily backlit by pressing the button just below the PTT switch on the side. This switch also illuminates the touchpad buttons on the front panel.

A dual control knob on the top of the radio serves as the basic input control. The smaller, lower knob controls the VOLUME, while the taller knob handles the VFO for TUNING. The squelch level is set by a menu item (discussed later). The second button on the side beneath the PTT opens the squelch when needed, however.

The TH-K2AT has several preset features that make its use easy for the beginner. When using the VFO to select the frequency, the radio automatically selects the standard repeater offset and shift ±. Non-standard offset and shifts can easily be accommodated from the MENU functions.

As with any radio now on the market, the TH-K2AT comes complete with all the necessary features for use in today's 2 meter FM world. Its selective call features include both easily programmable CTCSS (Continuous Tone Coded Squelch System) as well as a DCS (Digital Coded Squelch). Both allow the monitoring of a frequency but only open the receiver when the signal contains the selected subaudible tone or digital signal. Many repeaters use this feature to help reduce interference, and TH-K2AT users will be ready to use these features. Simply press the MENU button on the front panel, select Menu No. 2 (using the TUNING knob), re-press MENU, select CTCSS, press menu one more time and dial in the correct CTCSS code. Sound confusing? Not really, as the LED display provides easy to understand details as to which Menu is active.

One feature I particularly like is the ability of the TH-K2AT to be used with optional PC software for management of the memory channels. For those of us who may be a bit more comfortable with using the PC, this is certainly a plus. (What that really means is that for those of us whose eyes may not be quite as sharp as they once were, it's easier to manage the memory frequencies.) Kenwood provides a Web site where the necessary software can be downloaded (**www.kenwood.net/index Kenwood.cfm?do=SupportFileCategory &FileCatID=3**). The URL found in the manual is incorrect—one of the few problems I found with the documentation. An optional PG-4Y PC interface cable is

Bottom Line

The Kenwood TH-K2AT packs a lot of features in a small, light and easy to program and use handheld.

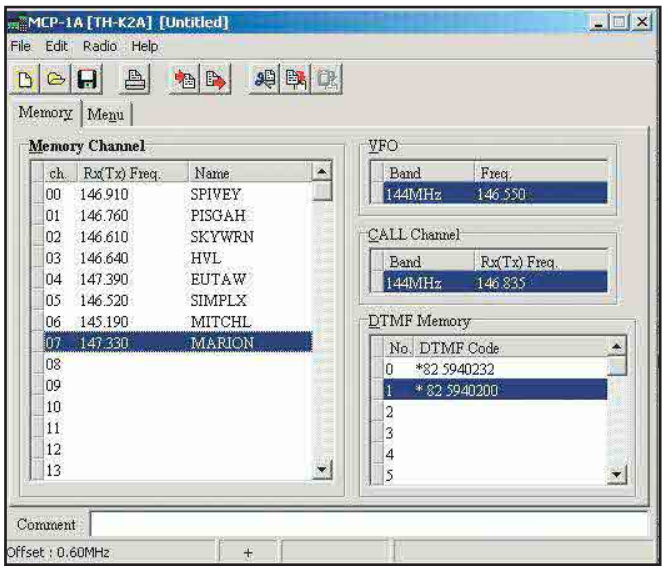


Figure 8—Screen shot showing memory channels from a connected PC.

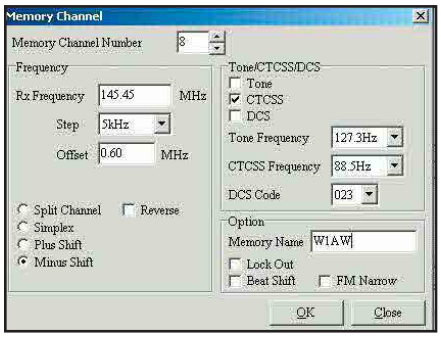


Figure 9—Screen shot indicating memory channel programming from a connected PC.

needed to connect the radio to your PC's COM port.

The PC programming feature holds true to the Kenwood focus of keeping it user friendly. As can be seen from the screen shots, programming from the keyboard is very straightforward. Figure 8 shows what is programmed into current memory channels, as well as the beginning frequency for the VFO, the CALL channel and the various DTMF numbers stored for speed dialing. For a recent trip to Western North Carolina, I programmed in several local repeaters. A simple press of the correct memory button and I was easily in communication with the hams "back home" during the visit.

Setting up individual channels in the TH-K2AT is shown in Figure 9. All I had to do to program any channel was select which channel to store the information in and type in the pertinent channel information. The information required is receive frequency, offset, shift, CTCSS/DCS code, select which to use and the memory name (for this, I tend to use the name of the mountain on which the repeater is located or the town that it generally serves). After verifying my data entry, a simple click on the OK button and the information is transferred to Figure 8.

Once the interface cable connects the TH-K2AT to the PC, the final step—the transfer of the information from the PC to the transceiver—is as simple as a click of the button on the software menu. While information can be edited directly in the handheld, I found it easiest to make additions or changes using the PC software and then uploading the new data to the radio.

One hundred memory channels are available on the TH-K2AT (or 50 if you choose to name specific channels). A total of 16 different pieces of information can be stored for each memory—from the CTCSS/DCS code to channel lockout to non-standard pair operation. Once programmed, the TH-K2AT is easily used in scanning and recall mode. After consulting the ARRL *TravelPlus for Repeaters,*[1] and a few minutes with the PC, I was ready to use the TH-K2AT while away from home. While traveling from Hartford to Baltimore on Amtrak, I scanned repeaters along the way and made several brief QSOs at stops. Without a more substantial antenna, however, I didn't attempt QSOs from the train while in motion.

The DTMF functions of the TH-K2AT include the ability to store up to 10 numbers in dedicated DTMF channels for use for speed dialing while using an autopatch. If your autopatch has required delays for dialing, they can be programmed in with varying lengths. The access codes for the repeater autopatch can also be programmed and stored into the DTMF channels.

Are you like me, turning on the handheld then wandering away or being distracted and forgetting about it? When you come back, you are faced with dead batteries. Not to worry—the TH-K2AT has a programmable auto-off function, with a 30 minute default. The feature includes an audible warning beep that will remind you of the impending auto-off action a few seconds before executing the command.

The receive frequency range of the handheld is from 136-174 MHz, which allows you to monitor frequencies adjacent to the US amateur bands. The TH-K2AT can be programmed to store one of the NOAA weather radio frequencies in the special AL (Alert) channel and monitor it for a weather alert. When the radio detects the NOAA alert, it will recall the programmed channel. Those involved with SKYWARN and emergency preparedness will find this a useful tool—whether at Field Day watching for severe weather or when providing communications at a public service event.

As a final test, the TH-K2AT was loaned to another amateur at ARRL headquarters for use during his public communications work in the 2004 Boston Marathon—a fit test for any operator or equipment! After a quick review of the manual and some simple setup, Bob Inderbitzen, NQ1R, reported the radio stood up to the full day of use. Bob summarized his use of the radio this way: "The thumbwheel access to the menus becomes so intuitive that you can reprogram the radio without looking at it. By the end of the marathon, I found I was simply counting clicks to change parameters like tones or the VOX. I like the radio because it is substantive—it's definitely not your microcredit card type transceiver."

After several weeks of testing and trials, the TH-K2AT definitely proved to be a rugged, easy-to-use introductory radio. It was very user friendly, with excellent documentation. In the very competitive field of low-cost handhelds, it is prepared to meet the needs of the active amateur. If you are looking for an easy-to-use 2 meter handheld, you would be well served to consider the Kenwood TH-K2AT when you make your next purchase. I know that I will.

Manufacturer: Kenwood USA Corporation, 3975 Johns Creek Ct, Suwanee, GA; tel 310-639-4200; fax 310-537-8235; **www.kenwood.net**. Price: TH-K2AT, $149.99; PG4Y programming cable, $32.99.

See the Product Review auction site at **www.arrl.org/prauction** *for the latest product review equipment up for auction. Included this month are the Ten-Tec Orion HF Transceiver, the Kenwood TS-480HX 200 W Transceiver, four auto antenna tuners and the Sounds Sweet speaker.* QST

[1] *TravelPlus for Repeaters* CD-ROM. 2004-2005 Edition, Version 8.0. ARRL, Inc. Available from ARRL dealers, or from the ARRL Bookstore for $39.95 plus shipping. Order no. 9256. Telephone toll-free in the US 888-277-5289 or 860-594-0355, fax 860-594-0303; **pubsales@arrl.org**; **www.arrl.org/shop/**.

Put BPL Proceeding on Ice for Further Interference Evaluation, ARRL Says

The ARRL asked the FCC May 3 to put its BPL proceeding on hold to allow more thorough research of BPL's interference potential to licensed radio services. Among other things, the League wants to more closely review the lengthy National Telecommunications and Information Administration (NTIA) Part 1 BPL study released April 27 (see below). Responding to the FCC's February 23 BPL *Notice of Proposed Rule Making* (*NPRM*) in ET Docket 03-47, the League also called on the FCC to apply "considerably more conservative radiated emission limits" to BPL than those applying to "normal" Part 15 devices. Five technical exhibits accompanied the League's comments.

"The Commission cannot be in such a hurry to deploy BPL . . . that it must sweep under the rug the mounting evidence that BPL is a significant source of interference to licensed radio services and is not in the public interest," the ARRL declared.

The League also took the FCC to task for its willingness to balance BPL's presumed benefits against the potential of harmful interference. "*The principal obligation of the Commission in permitting unlicensed devices or systems is to establish a radiated emission level that is sufficiently low that by their operation they will predictably not interfere with licensed radio services*," the ARRL emphasized.

The ARRL told the FCC that applying existing radiated emission limits to so-called "Access BPL" systems is inappropriate. "Those levels are far too high and were designed to address the interference of point-source radiators," the League said. "It is obvious that access BPL systems are distributive, line-source radiators." The ARRL recommended that the FCC apply a limit low enough to prevent interference to mobile stations that might operate in BPL-served neighborhoods.

The League further proposed amending Part 15 rules (§15.109) to require BPL systems to incorporate adaptive interference resolution techniques adequate to cause them to cease operation within an hour of a harmful interference report from an FCC-licensed station. The BPL system then wouldn't be permitted to resume operation within one kilometer (approximately 0.62 mile) of the complainant's station "unless and until the harmful interference is resolved." The ARRL also wants the FCC to require a detailed public Web-based BPL system database.

The FCC's *NPRM* offers no support for its conclusion that interference to licensed services would be minimal, the ARRL said, noting that amateur licensees have filed more than two dozen BPL interference complaints with the FCC. As far as it could tell, the League said, none of the complaints has been resolved, despite some good-faith efforts by power company and BPL providers. Amateurs' BPL complaints to the FCC "remain under wraps" in the Office of Engineering and Technology, the League said, instead of being handled by the Enforcement Bureau, which typically deals with power line noise complaints from radio amateurs.

"Mere mitigation" of interference is not sufficient, the ARRL said. "It is the absolute obligation of the operator of a Part 15 device or system to prevent interference." The League pointed out that the FCC's *NPRM* does not require interference resolution. "The interference to fixed amateur stations located in residences in normal geographic proximity to overhead power lines will be devastating and will preclude Amateur Radio communications," the ARRL predicted, calling the proposed mitigation techniques "too little, too late to avoid widespread interference."

"This proceeding should be placed on hold for a year in order to work out appropriate interference avoidance and resolution standards," the League concluded.

The League was among more than 1000 individuals and entities commenting in the proceeding. On the eve of the comment deadline, the FCC denied several requests—including one from the ARRL—to extend the comment period.

GARY PEARCE, KN4AQ

A BPL "extractor" on a Progress Energy pole near Raleigh, North Carolina.

NTIA Study Documents BPL Interference

The first phase of a long-awaited NTIA broadband over power line (BPL) study has suggested it's possible to accommodate BPL while managing the interference risk. The NTIA acknowledged that BPL signals "unintentionally radiate" from power lines but said there's "substantial disagreement as to the strength of the emissions and their potential for causing interference to licensed radio systems." The NTIA also said current FCC Part 15 measurement techniques may "significantly underestimate" peak BPL field strength. ARRL CEO David Sumner, K1ZZ, said the NTIA study clearly demonstrates that BPL systems pollute the radio spectrum.

"How can any responsible public official encourage the deployment of such systems," and how can any investor seriously consider pouring money into such an obviously flawed technology?" Sumner asked.

The extensive NTIA Phase 1 study looks at BPL systems using the HF and low-VHF spectrum from 1.7 to 80 MHz and defines interference risks from BPL to local radio reception while assuming the systems comply with existing Part 15 rules. The study proposes protecting 41 frequencies of the "most sensitive and likely most severely affected federal systems."

Among interference mitigation techniques, the NTIA study recommends reducing BPL device output power—which it called "the single most effective method" of reducing interference potential—and "shifting or notching" BPL frequencies.

NTIA interference calculations indicated

Rick Lindquist, N1RL ♦ Senior News Editor ♦ n1rl@arrl.org

"This proceeding should be placed on hold for a year in order to work out appropriate interference avoidance and resolution standards."—ARRL

that a BPL transmitter operating within Part 15 limits would significantly increase the noise floor for land-mobile receivers on frequencies below 30 MHz. The agency said it could be inferred from its calculations that "a vehicle-mounted HF receiver" operating in a residential neighborhood next to a BPL-energized line "may experience harmful interference" depending on a variety of factors, including frequency and distance from a BPL transmitter.

The NTIA study calculated that interference is likely to mobile stations in areas extending to 30 meters (98.4 feet) and to fixed stations in areas extending to 55 meters (180.4 feet) from a single BPL device and the power lines to which it's connected. With "low to moderate desired signal levels," the NTIA study continued, interference is likely at receivers within areas extending to 75 meters (246 feet) for mobiles and to 460 meters (1509 feet) for fixed stations.

ARRL Calls On White House to Withdraw Support for BPL

ARRL President Jim Haynie, W5JBP, has appealed to President and fellow Texan George W. Bush to withdraw his support for broadband over power line (BPL) technology and focus on "more suitable technologies" such as wireless broadband. At the same time, the League issued a call for members to support Haynie's request. In an April 26 speech in Minneapolis, Bush advocated changing technical standards to encourage BPL deployment in the US. Haynie told Bush that while the League supports universal and affordable broadband access, BPL is the wrong direction to take.

"Power lines were designed to transmit energy," not broadband signals, Haynie said in a fax. "The broadband signals radiate from power lines and cause severe interference to radio reception."

Haynie said test sites throughout the US and elsewhere have amply demonstrated BPL's potential to interfere. "You may have been told otherwise; if so, you were misinformed," he said, directing the president's attention to the BPL page on the ARRL Web site, **www.arrl.org/bpl**.

Bush told the Minneapolis gathering that there need to be technical standards to enable new broadband technologies such as high-speed communication over power lines. "Power lines can be used for broadband technology," Bush said. "So the technical standards need to be changed to encourage that."

"Once deployed," the president declared, "BPL has the potential to turn every electrical outlet into a broadband pipeline." Bush also suggested that BPL could supply broadband services to rural dwellers, a prospect that the League and others contend is not economically feasible.

The FCC's BPL *Notice of Proposed Rule Making* in ET Docket 04-37 proposes amending its Part 15 rules to adopt new requirements and measurement guidelines for "Access BPL" systems.

An information package on the ARRL Web site, **www.arrl.org/tis/info/HTML/plc/cta/**, explains how members can contact the White House and members of Congress to express their views on BPL deployment.

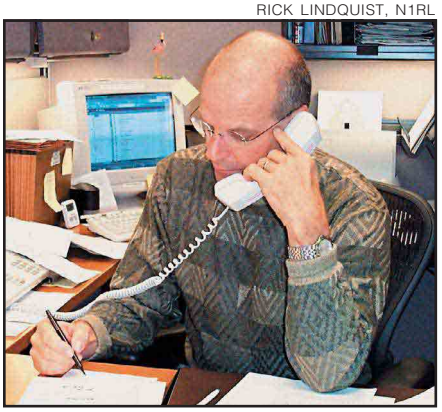
AMATEUR ENFORCEMENT CASES DECLINING

The number of Amateur Radio enforcement cases has continued to drop since a five-year peak of 350 in 2001. FCC Special Counsel for Enforcement Riley Hollingsworth told the Dayton Hamvention 2004 FCC Forum May 15 that 240 ham radio enforcement cases crossed his desk last year. As his tenure in amateur enforcement enters its sixth year, he's estimating only 175 cases in 2004.

"Two years ago at Dayton, I said that I hoped the day would come soon when enforcement would not be an issue in the Amateur Service," Hollingsworth said. While he doesn't believe amateur enforcement is in "maintenance mode" yet, he thinks it's well on the way to that goal. But he urged his audience not to become complacent just because there's active FCC Amateur Service enforcement. Although the percentage of "hard-core" cases is very small and rapidly declining, the remaining cases include "some real nasty ones," he said.

Hollingsworth said his main worry remains inappropriate or illegal on-the-air behavior and the sometimes-negative image it can present to decision makers at a time when Amateur Radio faces broadband over power line (BPL) and other threats to its spectrum. He proposed that amateurs concentrate on improving how they conduct themselves on the air while letting him deal with the remaining bad apples.

RICK LINDQUIST, N1RL



Riley Hollingsworth in his Gettysburg FCC office. The FCC resurrected Amateur Service enforcement under Hollingsworth in late 1998. His five-year report to the Enforcement Bureau earlier this year stressed Amateur Radio's importance to both FCC goals and national security—and that ham radio is "the only fail-safe communication system on the planet."

"No enforcement program in the world can save certain people from themselves or from being an embarrassment to the entire service," he said—reiterating a refrain that's now almost become his mantra. "If anything is the downfall of Amateur Radio, it will probably be the microphone. You have to focus on your image—what you *sound* like—all the time."

Hollingsworth also told the forum he's convinced that further Amateur Service restructuring is a necessity. "I don't know what the answer is, but it is clear you have to do something," he said, citing the rising average age of amateur licensees. "You have to bring in new blood, and you have to make them fine operators, as are probably 99 percent of you in the audience."

He also suggested that amateurs should be less concerned about any perceived "dumbing down" of the licensing requirements, because ham radio will continue to thrive in any event.

"It's not really what you do to get *into* Amateur Radio that counts. It's what you do once you get on the air," he said. "*Operate as if you were demonstrating Amateur Radio.*"

FCC MAKES MINOR AMATEUR RULE CHANGES

Minor amendments to various Amateur Radio (Part 97) rules became effective June 1. The regulatory changes, which the FCC made on its own motion rather than in reaction to any petitions, appeared May 5 in the *Federal Register*. The most extensive and substantive rule change involved §97.307(d), which defines spurious emissions. Updated language imposes a higher standard on newer transmitters or amplifiers of any power level. The revised rule provides that:

- the mean power of any spurious emission from HF transmitters or external RF power amplifiers installed after January 1, 2003, must be at least 43 dB below the mean power of the fundamental emission.
- the mean power of any spurious emission from HF transmitters or external RF power amplifiers installed on or before January 1, 2003, must not exceed 50 mW and must be at least 40 dB below the mean power of the fundamental emission. If the mean power output of such a transmitter is less than 5 W, the attenuation must be at least 30 dB.

The FCC's choice of the word "installed" reflects the language of the international *Radio Regulations*. Still exempt from the provisions of §97.307(d) are transmitters built before April 15, 1977, or those first marketed before January 1, 1978.

The FCC also redefined what constitutes an Amateur Radio operator to reflect the advent of the Universal Licensing System (ULS) electronic licensee database. Under the amended §97.3(a)(1), an amateur operator is "a person named in an amateur operator/primary license station grant on the ULS consolidated licensee database to be the control operator of an amateur station." The old rule defined an amateur operator as "a person holding a written authorization to be the control operator of an amateur station."

Among other changes, Technician or Technician with Element 1 credit licensees no longer may prepare Element 1 (5 WPM Morse) and Element 2 (Technician written) examinations.

The Commission ordered the rule changes and amendments within the context of a larger, wide-ranging *Notice of Proposed Rule Making* (*NPRM*) in WT Docket 04-140. That *NPRM* addressed several Amateur Radio-related petitions and proposes revisions to operating privileges. It also denied a dozen proposals outright.

The FCC deadline to comment on the various proposals put forth in WT Docket 04-140 was June 15. Reply comments are due by Wednesday, June 30. Among other changes, the FCC recommended adopting the ARRL's "Novice refarming" plan.

FCC OKAYS RFID TAGS AT 433.5 TO 434.5 MHz

The FCC has adopted a somewhat limited version of its earlier proposal to permit deployment of RF Identification (RFID) tags in a segment of the 70 cm band at much greater duty cycles than current Part 15 rules permit for such devices and at higher field strengths. Among other applications, RFID tags are used to track shipments and packing containers. A *Third Report and Order* (*R&O*) in ET Docket 01-278 released in April follows a 2000 petition by SAVI Technology to revise FCC Part 15 rules to accommodate such devices in the vicinity of 433 MHz. The ARRL has consistently opposed the proposal, but FCC just as unfailingly has tried to accommodate it. FCC Office of Engineering and Technology (OET) Chief Ed Thomas said RFIDs provide important public benefits.

"This item is designed to increase homeland security at ports, rail yards and warehouses," Thomas told an FCC open meeting. "It will foster the development of more powerful and advanced RFID systems that can identify the contents of shipping containers and determine whether tampering has occurred during shipment." Thomas said the devices also would increase efficiency in shipping operations and inventory control.

ARRL General Counsel Chris Imlay, W3KD, said SAVI has been raising the issue of homeland security in association with this proceeding for several months now. "This is the first time the FCC has acknowledged the argument," Imlay said, "but it helps the Commission justify the complete abandonment of its periodic radiator rules, and helps justify its abandonment of its custodial role of a natural resource."

OET's Hugh van Tuyl said the amended Part 15 rules would apply specifically to commercial shipping containers "in commercial and industrial areas." In certain cases, he asserted, current Part 15 requirements aimed at preventing interference to licensed services "may unnecessarily constrain the operational range of RFID systems as well as the speed and quantity of data that can be transmitted."

Despite the increased radiated field strength and maximum permissible duty cycle permitted for such devices, van Tuyl said the FCC believes "there will be no significant increase in the potential for interference to authorized services."

The *Third R&O* reflects certain accommodations that SAVI offered in response to a 2002 National Telecommunications and Information Administration study. It limits the operating band for such RFID tags to 433.5 to 434.5 MHz, instead of the 425 to 435 MHz SAVI originally wanted. It further would prohibit operation of RFID tag systems within 40 km (about 25 miles) of five government radar sites. Manufacturers of 433 MHz RFID systems would have to register system base station locations to assist in resolving interference complaints.

Most of the 130 amateurs commenting in opposition to SAVI Technology's RFID tags proposal supported the ARRL's position that the proposed rules were flawed and should not be adopted.

Amateur Enforcement

♦ **FCC revokes convicted killer's amateur license:** Roger Thomas Scaggs, W5EBC, will not get to keep his Amateur Radio license while he serves out a prison term that could keep him behind bars at least for the next decade. The FCC has adopted an *Order of Revocation* in the case of the Texas amateur licensee, now in prison for killing his wife in 1996.

"We conclude, based on the evidence of his conviction for murder, that Mr. Scaggs lacks the basic requisite character qualifications to be and remain a Commission licensee," the FCC said in the *Order*, released April 23.

Last November, the FCC issued an *Order to Show Cause*, giving Scaggs 30 days to provide notice of appearance to present evidence at a hearing on the effect of his felony conviction on his qualifications to remain an FCC licensee and to determine if his license should be revoked.

Scaggs wrote FCC's Enforcement Bureau Chief David H. Solomon to argue that his record as a licensee did not warrant license revocation. The presiding judge determined, however, that Scaggs' letter did not constitute a notice of appearance and certified the case to the Commission for disposition. The FCC subsequently decided to revoke Scaggs' amateur license.

An Advanced class ticket holder, Scaggs had been a radio amateur since 1954, and the FCC says he's got a clean Amateur Service record. Following his murder conviction in 1998, the court sentenced him to 32 years in prison and levied a $10,000 fine. Scaggs, who turns 65 in June, won't have an opportunity for parole until he's about 75.

The FCC said it found that Scaggs' conviction "mandates the conclusion" that he does not possess the necessary qualifications to be or remain an FCC licensee.

EIGHT SECTION MANAGERS RETURNED TO OFFICE

Oregon Section Manager Randy Stimson, KZ7T, overcame a challenge from Kevin Hunt, WA7VTD, 549 to 461 votes, to remain in office for the next two years. ARRL Field and Educational Services staffers counted the ballots and verified the results May 18 at League Headquarters. A veteran ARRL Field Organization leader who previously served as Oregon SM from 1987 until 1998, Stimson, of Beaverton, accepted appointment as SM last July after Oregon Section ARRL members voted to recall then-SM Marshall Johnson, KK7CW.

Seven other sitting ARRL SMs faced no opposition and were declared re-elected. They are Sharon Harlan, N9SH, Illinois; Jim Sellers, K9ZBM, Indiana; Bill Woodhead, N1KAT, Maine; Rudy Hubbard, WA4PUP, Northern Florida; Glenn Thomas, WB6W, Santa Clara Valley; Paul Gayet, AA1SU, Vermont, and Don Michalski, W9IXG, Wisconsin.

New two-year terms of office began July1, 2004.

ARISS MULLS HAM RADIO'S ROLE IN DISTANT SPACE TRAVEL

The Elser-Mathes Cup, sitting idle for more than 75 years, is intended to mark the occasion of the first two-way Amateur Radio contact between Earth and Mars. That day may be moving closer. The Amateur Radio on the International Space Station (ARISS) International Team is contemplating ham radio's role as NASA—in response to a recent presidential initiative—seeks to expand the horizons of human spaceflight to the moon, Mars and beyond. During an International Team meeting March 25-26 in the Netherlands, ARISS International Chairman Frank Bauer, KA3HDO, said NASA's Education Office has asked ARISS to consider endorsing the initiative and start laying some groundwork for an Amateur Radio presence. That makes perfect sense to ARISS Secretary-Treasurer Rosalie White, K1STO, of ARRL.

"If our space agencies are going to Mars, it's natural we should think about it and do initial planning now," said White, who was among the more than two dozen ARISS delegates on hand at the European Space Research and Technology Center in Noordwijk. "We could start by targeting our educational materials on exploration beyond the International Space Station." The ISS—the home of the first permanent Amateur Radio station in space—is scheduled for completion in 2010.

Some ideas Bauer floated during the gathering included an Amateur Radio payload on the Red Planet as well as a Mars telecommunications satellite, remotely controlled Amateur TV and a repeater on the moon. The long-range planning will get further discussion when the ARISS International Team meets again in October.

In other matters, the ARISS team learned that a planned slow-scan television (SSTV) system will not launch to the ISS this year. With just two crew members aboard the space station and a need to make the most use of space aboard Russian Progress supply rockets, NASA has suggested that ARISS hold up the SSTV payload for a Progress rocket flight closer to the space shuttle's return to flight, when the ISS again will have a crew of three. The SSTV gear also needs additional preflight testing as well as work on the associated software.

Delegates learned that modifications were under way to a Yaesu FT-100 HF/VHF/UHF transceiver, which could go up to the ISS on a Progress rocket flight this fall. Other projects still in the discussion stage include an external digital ATV transponder and beacon.

ROSALIE WHITE, K1STO

A model of the ESA's *Columbus* module behind them, ARISS delegates focus eyes and cameras on a ceiling-mounted model of the ISS at the European Space Research and Technology Center. The ISS could gain a third ham station once the *Columbus* module goes into space. Through-hull fittings, or "feedthroughs," could accommodate UHF, L and S band operations possibly using patch-type antennas.

Media Hits

■ Ric Creager, KK4GV, scored a "hit" when *The Washington Post* published his letter to the editor. Creager was responding to an April 15 *Post* article that likened C-Band TV dish users to the "ham radio underground." His letter focused on ham radio as a highly visible communications resource during disasters, and he offered examples.

■ Jordan Webb, KI4AVG, received a lot of press attention in April after using his handheld transceiver to summon help in an attempt to save a drowning classmate during a school outing. Television stations WBIR, WATE and WVLT in Knoxville, Tennessee, covered Webb's use of ham radio during the emergency, as did *The Daily Times* in Maryville. Several days later, WBIR-TV ran another story, featuring Webb and Bob Wilson, KK4XA, as they taught an Amateur Radio class at a local middle school.

■ "Internet Access Over Power Lines Creates Radio Interference" was the headline on a recent Voice of America (VOA) Web story. The article went into great detail on the BPL issue, including the concerns of Amateur Radio operators throughout the United States. ARRL President Jim Haynie, W5JBP, was interviewed for a VOA radio story, and the VOA posted the Web piece soon afterward.

LONGTIME ARRL STAFFER, SSB PIONEER BYRON H. GOODMAN, W1DX, SK

Byron H. "By" Goodman, W1DX (ex-W6CAL, W1JPE), of East Hartford, Connecticut, died May 11 after a period of declining health. He was 93. A San Francisco native, Goodman belonged to the ARRL Headquarters staff for more than three decades, most of that time serving as a technical editor. Goodman authored and edited hundreds of *QST* articles and columns as well as other League publications, including *The Handbook for Radio Amateurs*. Former ARRL colleague and retired ARRL General Manager Richard L. Baldwin, W1RU (ex-W1IKE), best remembers Goodman for his pioneering efforts in SSB and for his technical expertise.

"He was a man of many talents," Baldwin said. "He was in the forefront technically—antennas, receivers, single sideband." Another former colleague and friend George Hart, W1NJM, said Goodman "probably introduced single sideband to hams."

Goodman initiated a series of columns on SSB in *QST* in 1948—a decade or more before the mode eclipsed full-carrier AM in popularity. His first article on the topic, "What is Single-Sideband Telephony?" appeared in that year's June issue. Longtime friend and golfing partner—and former ARRL Secretary and General Manager—John Huntoon, W1RW (ex-W1LVQ), says Goodman, through his articles, "helped to make SSB what it is."

First licensed in 1930, Goodman graduated from the University of California-Berkeley with a degree in electrical engineering. Upon arriving at ARRL Headquarters in the mid-1930s, his first position was as an assistant secretary to ARRL Secretary K. B. Warner, W1EH. But, Huntoon recalls, Goodman was never entirely comfortable in the front office, and when he subsequently joined the Technical Department, he never looked back.

Over the years, Goodman reviewed numerous pieces of new equipment, including the then-revolutionary Collins KWM-1, one of the first amateur SSB transceivers. Among his many antenna articles was the classic "My Feedline Tunes My Antenna." He also served as the first "How's DX?" editor from 1936 until 1947.

While his identity as their author was not widely known outside the ARRL Headquarters family, Goodman wrote a series of *QST* April Fool parodies under the pseudonym Larson (sometimes "Larsen") E. Rapp, WIOU.

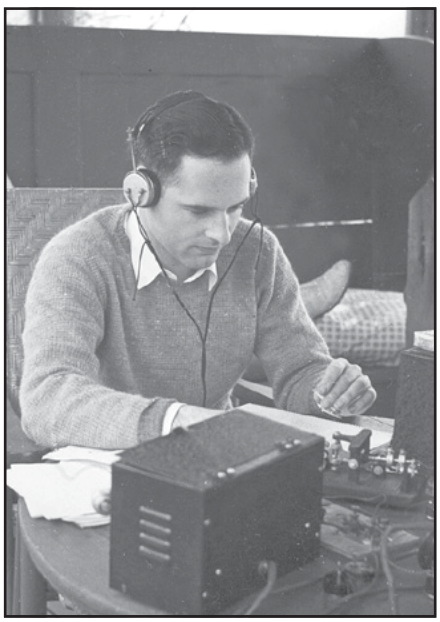
"By had a very great sense of humor, a very dry sense of humor," Hart said, describing Goodman as "quite a character."

A phony ad in the April 1960 issue announced the formation of "Larsen E. Enterprises, Inc," with Larsen E. Rapp as president. Bearing a "Not a Advertisement" disclaimer, the ad offered customers free access to the company's air-conditioned "Wonder Workshop" with each kit purchase. "If you don't have the time to assemble the entire kit yourself, one of our engineers will be glad to do it for you, just for the pleasure it gives him," the ad promised. "No tipping please."

In the "Print Shoppe," customers could purchase "authentic reproductions of the rarest QSL cards in the world." The price included having the company's "patient penman" fill in the card with your call sign and a signal report, duplicating the original ink and handwriting. Baldwin recalled that Goodman's spoofs sometimes elicited irate calls from members. "They didn't like to be fooled," he said.

In 1989, Goodman received the Dayton Hamvention's Technical Excellence Award. A member of the ARRL, the Quarter Century Wireless Association and the A1 Operator Club, he was not active on the air in recent years.

Survivors include Goodman's wife, Barbara (Huntoon introduced the couple), a daughter and a sister. The family has invited memorial donations to the American Heart Association, 2550 US Rte 1, North Brunswick, NJ 08902-4301.



By Goodman, then W1JPE, operates Field Day during the 1930s.

ARRL WELCOMES W3IZ TO HEADQUARTERS STAFF

Norm Fusaro, W3IZ, is the newest member of the ARRL Headquarters family. As ARRL Affiliated Club/Mentor Program Manager, Fusaro—who joined the ARRL Field and Educational Services (F&ES) staff May 17—is responsible for ARRL Affiliated Club support as well as for inaugurating a volunteer mentor program and an enhanced volunteer instructor program. The position is a new one at Headquarters, and Fusaro said he plans to make the most of his past informal experience as an "Elmer"—or mentor—helping new licensees to get up and running in Amateur Radio.

Norm Fusaro, W3IZ.

"Something I did on the local level was to be the guy to go out there and extend a helping hand, offer some guidance, open the station up for visitors," said Fusaro, who notes that he would have liked similar support when he first got his ticket some 20 years ago. F&ES Manager Rosalie White, K1STO, says the League created Fusaro's position after recent survey results indicated that far too many new licensees either never get on the air at all or don't remain active.

"We want people to enjoy Amateur Radio or to *keep* enjoying Amateur Radio," White said. She believes Fusaro's background in retail sales and customer service will stand him in good stead in his new post. In addition to Elmering many new hams in the past, Fusaro has also taught ham radio licensing classes. In his new position, he'll work with both clubs and individuals to establish a network of mentors. "The goal is to get the newly licensed ham some practical guidance and maybe some hands-on training," he said. He hopes to offer eventually a Web mentoring database new licensees can use to find assistance in their localities.

In addition to contesting, Fusaro enjoys ragchewing and RTTY. His favorite on-the-air events include the Pennsylvania QSO Party, the ARRL November Sweepstakes and the ARRL International DX Contest. He's an active HF mobile and portable operator too. His wife, Debbie, is N3ZXF.

In Brief

• **ARRL says "interference temperature" concept premature:** The ARRL says the FCC's proposed "interference temperature" concept is "highly premature and should not go forward" at this time. In a *Notice of Inquiry and Notice of Proposed Rule Making* in ET Docket 03-237, the FCC sought comment on the interference temperature metric—or model—for quantifying and managing interference, which it initially wants to implement in two microwave bands. The FCC asserts the new metric "could represent a fundamental paradigm shift" in its spectrum management approach by using a standard that takes into account "the cumulative effects of all undesired RF energy" at a given instant. The FCC suggests the interference temperature limit for a band "would serve as an upper bound or 'cap' on the potential RF energy that could be introduced into the band." The ARRL contends, however, that the FCC doesn't have enough information to put such a model into place, and it should not try to take a shortcut. The ARRL said the FCC should preserve the interference temperature concept as a "holistic method" of dynamic RF spectrum management—the determination of compatibility in sharing of allocations. But, the League said, localized noise studies in various bands are a prerequisite to putting an interference temperature metric into place, along with a "comprehensive evaluation of the differences in receiver sensitivities and emission modes" across various services and bands. The ARRL has been conducting noise studies in different geographic environments, and it proposed objective, formal studies to provide a basis for an interference temperature metric in the future. The FCC also needs to create a new management paradigm for unlicensed services, accompanied by "substantial change" in their regulation, the League said.

• **New Amateur Radio LF world record claimed:** Amateur stations in New Zealand and Asiatic Russia have laid claim to a new low-frequency world QSO distance record. Bob Vernall, ZL2CA, reports that the Wellington Amateur Radio Club's ZM2E Quartz Hill LF station and UAØLE, near Vladivostok, Russia, completed a two-way contact on March 20 on 137.70 kHz. The estimated path was 10,311 km (6392 miles). Operators on both ends used digital signal processing software to copy the signals. At one point, however, Vernall said that the very slow-speed (QRSS) CW signals at ZM2E were loud enough to decode "by ear," despite high noise peaks. A DXpedition station, UAØLE obtained permission to support its LF antennas from a 90 meter (295.3 foot) broadcast mast. On the big day, ZM2E started calling UAØLE at 0930 UTC—sunset in Vladivostok. The first good UAØLE signals showed up on the computer screen at 1030 UTC, Vernall said. The defining moment came when UAØLE confirmed reception of the report from ZM2E, and the New Zealand station acknowledged the report. Vernall and Andrew Corney, ZL2BBJ, were the operators at ZM2E. The operators in Vladivostok were Ed Lesnichy, RU6LA; Vlad Burakov, UAØLE; Vic Bondarev, UA9OC, and Andy Rodichev, RAØLGH.

• **Allen Baker, KG4JJH, wins *QST* Cover Plaque Award:** The winner of the *QST* Cover Plaque Award for April was Allen Baker, KG4JJH, for his article "A 6 Meter Moxon Antenna." Congratulations, Allen! The winner of the *QST* Cover Plaque award, given to the author—or authors—of the best article in each issue, is determined by a vote of ARRL members. Voting takes place each month on the *QST* Cover Plaque Poll Web page, **www.arrl.org/members-only/qstvote.html**. Cast a ballot for your favorite article!

• **Microwave Update 2004 issues call for papers:** Microwave Update 2004 has issued a first call for papers. The October 15-16 event in Dallas, Texas, will provide an opportunity for microwave enthusiasts to share technical achievements in the field of communications and experimentation. The conference is soliciting technical papers or information for publication in the Microwave Update *Proceedings*. Those interested in presenting papers at the conference should contact Al Ward, W5LUA, **w5lua@arrl.net**. *PowerPoint* presentations are preferred for forums. An LCD projector and overhead projector will be available. ARRL will publish the Microwave Update 2004 *Proceedings*, and authors don't need to be conference speakers to have their material included. Submit papers and presentations no later than August 16. Send electronic format or photo-ready hard copy via e-mail or USPS mail to Kent Britain, WA5VJB, 1626 Vineyard, Grand Prairie, TX 75052; **wa5vjb@flash.net**. The North Texas Microwave Society is sponsoring Microwave Update 2004, which also will include noise-figure testing, antenna gain testing and spectrum analysis. More information is on the conference Web site, **www.ntms.org/**.

SECTION MANAGER ELECTION NOTICE

To all ARRL members in the Eastern Massachusetts, Missouri, Nebraska, New York City-Long Island, Northern New York, South Carolina, Southern New Jersey, West Central Florida and Western Pennsylvania sections: You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the section concerned. Photocopied signatures are *not* acceptable. No petition is valid without at least five signatures, and it is advisable to have a few more than five signatures on each petition. Petition forms (FSD-129) are available on request from ARRL Headquarters but are not required. We suggest the following format:

(Place and Date)

Field & Educational Services Manager,
ARRL
225 Main St
Newington, CT 06111

We, the undersigned full members of the ARRL Section of the Division, hereby nominate as candidate for Section Manager for this section for the next two-year term of office.

(Signature____ Call Sign___ City__ ZIP__)

Any candidate for the office of Section Manager must be a resident of the section, a licensed amateur of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a petition for nomination. Petitions must be received at Headquarters by 4 PM Eastern Time on September 10, 2004. Whenever more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before October 1, 2004, to full members of record as of September 10, 2004, which is the closing date for nominations. Returns will be counted November 23, 2004. Section Managers elected as a result of the above procedure will take office January 1, 2005. If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning January 1, 2005. If *no* petitions are received from a section by the specified closing date, such section will be resolicited in the January 2005 *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Field & Educational Services Manager. You are urged to take the initiative and file a nomination petition immediately.—*Rosalie White, K1STO, Field & Educational Services Manager*

REPEAT NOMINATING SOLICITATION

Since no petitions were received for the Michigan Section Manager election by the repeat nomination deadline of March 5, 2004, nominations are herewith resolicited. See the above for details on how to nominate.

Nominees Sought for ARRL Board of Directors

If you're a full ARRL member in one of the following five divisions and are interested in playing a part in the League's democratic organization, here's the opportunity. Nominations are open for the offices of director and vice director for the 2005-2007 term in the Pacific, Rocky Mountain, Southeastern, Southwestern and West Gulf divisions.

ARRL Divisions

The policies of the League are established by 15 directors who are elected to the Board on a geographical basis to represent their divisions and constituents (see page 15 of any recent *QST* for a list of the divisions, directors and vice directors). These 15 directors serve for three-year terms, with five standing for election in each.

Just as in national or state politics, ARRL voters/members have the privilege and responsibility to decide that they like the actions of their incumbent representatives and support them actively for reelection or to decide that other representatives could do a better job, and to work for the election of those persons. Vice directors, who succeed to director in the event of a midterm vacancy and serve as director at any Board meeting the director is unable to attend, are elected at the same time.

Call for Nominations

Nominations are open for director and vice director in the five divisions mentioned above for the three-year term beginning January 1, 2005.

How to Nominate

1. *Obtain official nominating petition forms.* This package consists of a cover letter; a reprint of this election announcement; blank Official Nominating Petition forms and Candidate's Questionnaires for the offices of director and vice director; a copy of the ARRL Articles of Association and Bylaws; and an informational pamphlet for candidates.

Any full member residing in a division where there is an election may request an official nominating petition package. You don't need to be a candidate to request the forms. Your request for forms must be received by the Secretary *no later than noon Eastern Time on Friday, August 13, 2004.* There are separate forms for director and vice director nominations.

2. *Submit petition with statement of eligibility and willingness to serve.* Official forms bearing the *signatures of 10 full members of the division* and naming a full member of the division as a candidate for director or vice director, must be submitted, with a statement *signed by the candidate* attesting to his or her eligibility, willingness to run and willingness to assume the office if elected. These documents must be filed with the secretary *no later than noon Eastern Time on Friday, August 20, 2004*. Only original documents can be accepted; *no facsimiles of any kind are acceptable.* On Monday, August 23, 2004, the secretary will notify each candidate of the names and call signs of each other candidate for the same office. Candidates will then have until Friday, September 3, 2004, to submit 300-word statements and photographs, if they desire these to accompany the ballot, in accordance with instructions that will be supplied.

3. *Election Committee to certify eligibility.* In accordance with the Bylaws, an Election Committee, composed of three directors not subject to election this year, is responsible for the conduct of the election. This year, the Election Committee consists of Frank Fallon, N2FF (chair), George Isely, W9GIG, and Wade Walstrom, WØEJ.

The nominee must hold at least a Technician amateur license, be at least 21 years of age and have been licensed and a full member of the League for a continuous term of at least four years immediately preceding nomination. No person is eligible whose business connections are of such nature that he or she could gain financially through the shaping of the affairs of the League by the Board, or by the improper exploitation of his or her office for the furtherance of his or her own aims or those of his or her employer. The primary test of eligibility is the candidate's freedom from commercial or governmental connections of such nature that his or her influence in the affairs of the League could be used for his or her private benefit. The idea behind these rules is to ensure that candidates: (1) possess a lasting interest in Amateur Radio and the League, (2) have the legal capacity to make decisions for the ARRL and (3) are free from conflicts of interest.

Balloting Will Follow

If there is only one eligible candidate for an office, he or she will be declared elected by the Election Committee. Otherwise, ballots will be sent to all full members of the League in that division who are in good standing as of September 10, 2004. (You must be a licensed radio amateur to be a full member.) The ballots will be mailed not later than October 1, 2004 and, to be valid, must be received at HQ by noon Eastern Time on Friday, November 19, 2004. A group of nominators can name a candidate for director or vice director, or both, but there are no "slates," as such. Each candidate appears on the ballot in alphabetical order. If a person is nominated for both director and vice director, the nomination for director will stand and that for vice director will be void. A person nominated for both offices does have the option, however, of declining the higher nomination and running for vice director if he or she wishes. Because all the powers of the director are transferred to the vice director in the event of the director's death, resignation, recall, removal outside the division or inability to serve, careful selection of candidates for vice director is just as important as for director.

Absentee Ballots

All ARRL members licensed by the FCC, but temporarily residing outside the US, are eligible for full membership. Members overseas who arrange to be listed as full members in an appropriate division prior to September 10, 2004, will be able to vote this year where elections are being held. Members with overseas military addresses should take special note of this provision; in the absence of information received to the contrary, ballots will be sent to them based on their postal addresses. Even within the US, full members temporarily living outside the ARRL division they consider home may have voting privileges by notifying the Secretary prior to September 10, 2004, giving their current *QST* address and the reason that another division is considered home. If your home is in the Pacific, Rocky Mountain, Southeastern, Southwestern or West Gulf divisions but your *QST* goes elsewhere, let the ARRL Secretary know as soon as possible, but no later than September 10, 2004, so you can receive a ballot from your home division.

The Incumbents

These people presently hold the offices of director and vice director, respectively, in the divisions conducting elections this year:

Pacific—Bob Vallio, W6RGG and Andy Oppel, N6AJO

Rocky Mountain—Walt Stinson, WØCP and Warren G. "Rev" Morton, WS7W

Southeastern—Frank M. Butler Jr, W4RH and Sandy Donahue, W4RU

Southwestern—Art Goddard, W6XD and Tuck Miller, NZ6T

West Gulf—Coy C. Day, N5OK and Dr David Woolweaver, K5RAV

For the Board of Directors:

May 21, 2004

David Sumner, K1ZZ
Secretary

Taking Emergency Communications Training to the Next Level—*Part 3*

By Daniel J. Sullivan, KO1D
207 West Cameron Rd
Falls Church, VA 22046
djs13@yahoo.com

Note: Parts 1 and 2 of this article appeared in May and June 2004 issues of QST.

Don't Forget to Train Them, Too

After all this work you go out on a real activation because a served agency asks for help. During your activation you hardly do much other than answer a telephone, even though the person in charge has been frantically dialing and redialing their cell phone and not getting through. What's wrong with this picture? What have we left out?

Train the served agencies on what you can do. You learned all about their roles and took some of their specialized training to help you fill their needs. Now you have to do the same and educate them on just what it is we do. In one case, I happen to know that hams were originally included in the Emergency Support Function (ESF) 14: Public Information section of the emergency plan for a jurisdiction. It took some explanation to help the planners understand we do communications, but not in the sense of public information or media relations.

Don't be afraid to offer a training and orientation course for the served agency heads demonstrating what it is you do. Bring a handheld radio and take a roll call on a repeater (even be a bit sneaky and do it on IRLP). Write the extra letter and follow it up with a phone call for Field Day. Sit down and have some literature to put in their hands; place it there yourself explaining what ham radio emergency communicators do. Create a *Power Point* presentation outlining what ham radio is and how we have helped served agencies in the past. Most importantly, explain how you propose to help their agency in the future.

In the example given above, the person was utterly shocked when, at last defeated by modern technology, he allowed the ham to send a message to the emergency operations center with a request for some important information. Even better was the look on his face when 10 minutes later his phone rang and he got all the information he had requested. To top that, a local emergency manager needed some logistical information. His public safety people just were not coming through. Finally, he asked the ham operator at the EOC to see what he could learn. Immediately, reports started coming in where desperately needed supplies of water, ice and food could still be found within the jurisdiction. This information went immediately to a bank of telephone operators who in turn gave the information to the public. The ham who saw this reported a big smile on the emergency manager's face each time he got more information on these locations. This is the type of positive publicity you just cannot buy. (From Hurricane Isabel activation.)

The End or a New Beginning

In conclusion, there are a lot of ways to go after you take those first rudimentary steps into the world of emergency communications. I have hardly scratched the surface. Each jurisdiction has training programs waiting to be utilized by its volunteers. Many will openly welcome a group of technically adept individuals who have a willingness to cross-train in a number of areas. There are free on-line courses, relatively inexpensive books, courses with local public safety and service groups, and probably agencies and organizations I have failed to think of in the span of this short article.

There are enough natural events going on each month to keep hams quite busy, which is why we need to train and learn more overall. Think about the ops in 6 and 7 lands with the wildfires during the fall of 2003. How about those on the coasts and in the Caribbean who deal with hurricanes and tropical storms? Anyone wonder just what it would be like for a solar flare to hit Earth with such a magnitude that communications might be affected with devastating effects? Scientists found out in late October 2003 when at least one Japanese telecommunications satellite went down. That big ice storm along the Canadian border had people hopping a few years back in VE1, VE2, VE3, W1 and W2 when it decimated much of the electrical and telephone above-ground infrastructure. The annual tornado outbreaks up and down the center of the United States usually result in some ARES/RACES or SKYWARN activation.

The communications emergency possibilities are endless, which means the potential for our activation as a resource is as well. Our limits are based on how *professional* we *amateurs* are. You don't have to go to the excess shown in the introduction where your family abandons you, or vice versa for that matter, but with a little effort, an open mind and some easily available training, your effectiveness as a community resource increases tenfold.

I wish to thank the following people for reviewing this article and giving me some feedback. Without their input, I could not have done this: Charlie Dunlap, K1II, Emergency Manager Southwick, Massachusetts Emergency Management Agency; Lloyd Colston, KC5FM, Emergency Manager, Mayes County Emergency Management Pryor, Oklahoma; Steve Rodowicz, N1SR, Massachusetts Emergency Management Agency Region III RACES Officer, and Charlie Crizer, KF4MNE, of the American Red Cross, National Capital Region Chapter. I also wish to thank my team members at Community Research Associates, Inc, especially John Wisner and Shannon LaVine, for mentoring me in exercise design, execution and evaluation.

Daniel Sullivan was first licensed in 1992 as N1LYJ. Since then he has held the licenses MØCDR in the UK and AA1TE in the US, and has been active with ARES, SKYWARN and RACES. Dan is active and registered with Fairfax County (Virginia) ARES and RACES. He is also a member of the Hampden County (Massachusetts) Radio Association, Agawam; the Vienna (Virginia) Wireless Society, and the Northern Virginia FM Association, McLean. He now works as a member of a WMD Exercise Support Team for Community Research Associates, Inc, in Alexandria, Virginia, and resides in Falls Church.

LIMERICK GENERATING STATION EXERCISE

By Andy Shecktor, N3OMA

November 18, 2003, was a landmark day in Montgomery County, Pennsylvania. This was the day that FEMA, PEMA (PA Emergency Management), Montgomery County EOC, Montgomery County RACES/ARES and all MARS services participated in a joint simulated emergency at the Limerick nuclear generating station. For ARES this was also the Simulated Emergency Test event for the year. The event was scheduled to start at 2 PM EST and end at 9 PM EST. These times were approximate. The exercise acts as a timed event to determine activation and response times of all organizations involved, so the start and end times are determined on the day of the event.

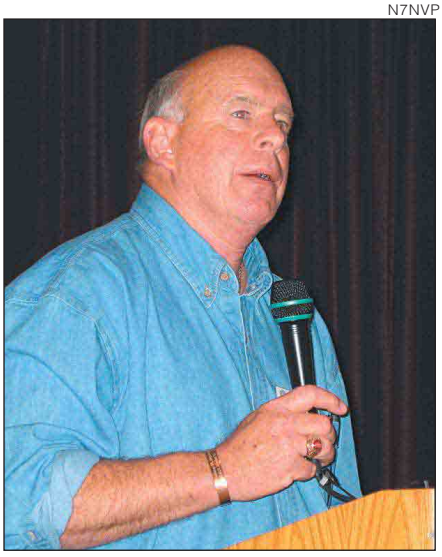
Andy Shecktor, N3OMA/AAT3JF, an assistant deputy radio officer for Montgomery County RACES and also the county SKYWARN coordinator, coordinated the MARS participation. This was the first year that MARS participated. MARS had participated in other simulated emergencies at nuclear facilities within the state, but this was the first time that Army, NAVMARCOR and Air Force MARS all participated in the same simulation, and also the first time that the military communications units have worked side by side with RACES/ARES.

The initial planning began a year in advance by discussing the possibilities of MARS participation in the event with Bob Lees, W3ZQN, the RACES/ARES coordinator and with the PA Army MARS state director. Also during this time, contact was made with the other state MARS directors, and the feasibility of a joint activity was evaluated. The actual planning began several months before the event. This turned out to be a much larger task than anticipated. Obtaining approval to operate with MARS is somewhat more complicated than working with amateur services. Unlike RACES/ARES, MARS is a federal entity. Things tend to take more time at this level, and approvals at several levels need to be obtained. Also, operating frequencies needed coordination and approval from the regional MARS directors. (Unlike the Amateur Service, MARS can operate only on assigned/approved frequencies for the specific purpose designated.)

Numerous "canned" messages are used during this event, and are represented by an alphanumeric designation instead of complete text. A determination was made to disseminate this in advance in its ARRL format so that the MARS operators would be aware of what was being transmitted. One of the major problems was that the exercise had an indeterminate starting time. This turned out to be one of the most difficult obstacles to overcome, as no one quite knew when to check into the net, which would begin once a request for MARS service was made. RACES/ARES members get activated by pager, and a request is put out over the local repeater, but MARS operations would be on HF only, with no pager notification.

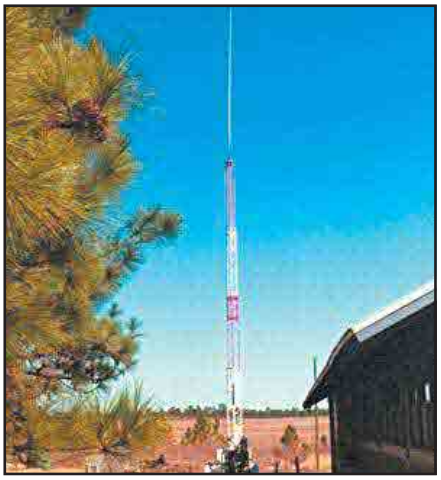
On the night of the event everyone waited patiently for the activation of RACES/ARES by the EOC, which did not occur until about 6 PM. Once activated, MARS assistance was requested and Andy and an assigned MARS operator went to the Upper Frederick emergency center and set up an HF MARS station. (During the exercise there are a number of emergency operation centers set up around the county and staffed by the local municipality, fire department, communications staff and others. RACES/ARES becomes the primary communications team once they are fully activated.)

N7NVP



The Sixth Annual Communications Academy was held March 20-21, 2004 in Shoreline, Washington. Over 200 Amateur Radio operators, emergency managers and others gathered to learn about emergency communications and disaster response. Keynote speaker Jerry Boyd, KW7J, gave a well received presentation on several topics including Developing Effective Working Relationships, Recruiting EmComm Workers, Working Insurance and Liability Issues, Hiring and Firing of Volunteers, Training, Establishing Objectives, Determining Staffing Needs, Documentation, Establishing Mutual Aid Agreements and Post-Event Critiques.

KEVIN ALLEN



The Chesterfield County Amateur Radio Society (South Carolina) moved their club repeater to the H. Cooper Black Field Trial and Recreation Center near Cheraw. They used this portable crank-up tower loaned to them for the rally by the local Rescue Squad. The Chesterfield County Amateur Radio Society provided communications support to the Sandblast 2004 Sports Car Rally, held this past winter, the Sandhill State Forest located in between Cheraw and McBee, along US 1. A total of 27 hams from several states and all over the state participated in the event. There were 40 sports cars entered with drivers from all over the US and several international drivers as well. There will be another Sandblast Rally next spring. Thanks to Mac Cullom, K4AVR.

The operation went well until Mother Nature took over. Several HF frequency changes were made successfully in the early stages of the exercise. Unfortunately, a solar flare had occurred earlier in the day, and toward the end of our operation the HF bands shut down rather abruptly, not permitting sufficient time to relocate to a usable frequency.

All in all the operation was a success, and FEMA, PEMA and the county representatives welcomed the MARS presence. Hopefully this will be repeated in two years (the next scheduled exercise) and will demonstrate resolutions to some of the problems encountered.

It is worth going over some of the problems encountered, as others may benefit from our work.

HF propagation can change so quickly that a transition to a functional band may not be possible. One possible solution is to have at least one frequency on each band predetermined (one for day, one for night). If propagation is lost, you could look for the net on the other frequencies in a predetermined order.

A backup plan is needed. Once communication via HF was lost MARS was "dead in the water." Next time several backup communications means will be planned. Note: Cellular or any similar service or trunking radio systems are not an acceptable backup, as these services tend to bog down during emergencies.

Two MARS operators and two RACES/ARES operators were planned for the one municipality that was to have MARS operators. Fortunately, the RACES/ARES coordinator added a third RACES person to the roster. As it turned out, Andy's sole duty was managing the MARS operation. This turned out to be a full-time job by itself.

While the participation of MARS was known for some time prior to the exercise, there was still a degree of surprise when the MARS operators arrived. Next time some public relations prior to the event on the purpose and capabilities of MARS should be done in advance.

RACES/ARES members are given photo ID cards for identification. Some MARS operators who participated in the exercise did not have adequate ID. It was suggested that a business card with the name and call sign of the member, or department name and contact information, may suffice. This has been tested in the past and went over well. It is extremely important when working disaster and public service agencies to have some form of ID that says who you are, even if it is not an official ID card.

Backup, backup and more backup. Backup is needed for every piece of required equipment, from radios and batteries to pens and pencils. If you need it for an operation, have at least two. This helped during this exercise by having additional radio equipment for the extra operator assigned.

In summary, the Limerick generation station exercise turned out to be an excellent learning experience for all who participated, both MARS and RACES/ARES. This is what radio is all about—learning to communicate efficiently and properly and helping the public when needed. Exercises during non-emergencies offer a chance to spot weaknesses

and correct them before there is an actual need for ham radio services.

Andrew Shecktor, N3OMA/AAT3JF, is an 11 year veteran of the Amateur Radio Service and has been a member of PA Army MARS for two years. He holds ARRL level III ECOM certification and is an assistant EC.

A LINK FOR EMERGENCIES

By Joe Schmidt, W4NKJ

"Voice over Internet" (VOI) is rapidly becoming a popular form of communication between radio amateurs. One software package, EchoLink, has more than 120,000 "ham" participants in 144 countries. New registrations are running over 1200 per week. Fifty percent of the users are located in the United States.

The free, easy to use program (**www.echolink.org**) allows high quality amateur-to-amateur voice communication over Internet 24 hours a day. Connections may be made between computers alone or with RF links on either or both ends of the circuit. EchoLink has already demonstrated its ability to serve during emergency conditions.

A valuable feature of the software is the ability, during a conference, to send text messages at the same time the connection is being used for voice communication. Stations operating on Internet can "check in" and transmit information without disrupting operation of a net. Simple copy and paste can be used to save the data to a program like Notepad or a word processor.

According to Julio Ripoll, WD4R, Assistant Volunteer Coordinator at the National Hurricane Center, "During Hurricane Isabel, an EchoLink net was used to obtain storm data for forecasters at the Center. Several weeks later, as Hurricane Juan swept over Nova Scotia, EchoLink enabled us to collect live reports through the Sydney, Nova Scotia repeater. EchoLink will be a part of our communication plan for the 2004 Hurricane Season."

John T. Fleming, WD4FFX, Warning Officer for the Florida Division of Emergency Management, said, "The software is particularly suited for conference use, a valuable feature during emergency conditions."

After the Columbia shuttle disaster, conference server WX_Talk in Texas was used to help coordinate debris location and recovery operations. Kevin Anderson, KD5CCH, RACES officer Nacogdoches, Texas, reported, "The server operated twenty-four hours a day for nearly two weeks."

Scheduled nets, using EchoLink, are starting to appear. One of the first was organized by Glenn Hale, KB7REO, Nevada Southern District Emergency Coordinator. The Skywarn Net meets on Wednesday at 1900 local time using node 152566.

About 1400 US repeaters are currently EchoLink enabled. Jonathan Taylor, K1RFD, author of the EchoLink program commented, " Repeater links can be set up quickly and inexpensively, using standard equipment. Not only is the system growing rapidly in size, the number of repeater links is increasing as a percentage of total users." During periods of light activity, many repeaters allow their members to enjoy contacts with amateurs from all parts of the globe.

With many lines buried, and switching centers supported by emergency power, telephone communication is frequently available even during severe conditions. Despite 150 mile per hour winds of Hurricane Andrew howling outside his home, the author never lost his telephone connection.

When power fails, provisions should be made to keep computers and DSL modems running with automobile or motorcycle batteries and small, inexpensive inverters. Operating without a monitor will conserve power.

Robust servers, such as Wx_Talk with emergency power and large-bandwidth access to the Internet can host hundreds of conference participants. EchoLink-enabled repeaters allow amateurs to connect seamlessly to nets operating on these servers.

Like any emergency communication technique, realizing the benefit of EchoLink will require practice through regular net operation and in simulated emergency drills.

Field Organization Reports

Compiled by Linda Mullally, KB1HSV

Public Service Honor Roll
April 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.

625 W7TVA
525 N2LTC
465 KC2HUV
455 N9VE
425 AB2IZ
390 N2YJZ
365 KA2ZNZ
348 W2MTA
338 KZ7T
330 KC2MBC
300 W7ARC
280 W2FPG W2LC
258 KB2RTZ
250 NN2H
247 KA2GJV
230 KB2CCD KB2SNP
228 K2ABX
225 KB2DQ
224 KK3F
217 AB5WF
215 K2MPE
KB2KOJ
207 WA1QAA
206 KB2ETO
205 WA2ZCM K2AN
200 K7EAJ
190 W2DWR WI2G
180 N2YBB
176 K4BMH
175 WA9ZTY W8JEB
174 K9JPS
172 KD5TXD
170 KB5JBV W1GMF
167 K2GW
165 AG9G
163 N2LJD N2JBA
160 KØIBS
158 N2HQL
155 N1IST N1LKJ
151 KB5ILY
150 WB1CHU
149 KD6YJB
148 KA2BCE
145 WB7WOW
141 KB1HDO
140 W7ADZ K7BFL K2GW KA2YKN WB2UVB NF5B
138 WB2LEZ KB5PGY
135 K9LGU KA9RZL W3YVQ KB3GFC
134 N2ECR
131 N2JRS AC5SU
130 W3ZQN N8IO W4EAT K5DPG WB5ZED VE3EUI KA5KLU AC5XK
127 W6JPH
126 KAØDBK KBØDTI NØZIZ
125 WB2KNS KC2IYC
122 W8MMN K4BEH
120 N2RTF WX4J KW1U K9FHI W9BHL
AB4XK K4RLD K4IWW AD4XV K2UL K5ER K6YR WB8RCR WBØTAQ W5IM N5OUJ
118 N3RB W3CB ABØUY
116 WA2YBM
115 KK1A WX4H
114 NN7H
113 W5PY
110 N2QZ N7CM N7YSS KC5OZT AG4DL W8IM N1IQI W6QZ N3SW WA5OUV N5IKN N7EIE W7QM N7YSS K3JL WD8Q W7GB W4DAC KE4JHJ AF4NS K5MC AC5VN N2AKZ AD5IS AI4DV W5GKH ABØWR
107 N3YTD
106 KB8NDS
105 K1YCQ N2YIR
102 KB9KEG
100 WA2WMJ KB5TCH KD5OYH NR2F N9MN KD4CQJ W9CBE N8FXH K4SCL WNØY KK5GY W7LG K3SS WA8SSI WØUCE W2QOB AF2K KC2EOT WB2QIX N1VXP W9NXC KB2KLH KC2GOW KC8QNE W1QU N5SIG KA4UIV
99 W3NJ W7TC
98 W4CAC
97 W1PLW W4ZJY WD4LSS K8ZJU
96 AL7N KO4OL
95 W7RRC W4NTI K3CN WG8Z K7UGT AA3SB W2DSX KO4SY
94 KJ7SI
93 KD5ONS WB6UZX
92 W2CC
90 N7DRP KC7SGM K6JT N3KB K2BCL K1JPG KF4WIJ W4CKS WD8DHC KA8WNO W3TWV W7ZIW K2VX N8DD KC8UTL W4LN N1JX WA2CUW KG2D N2VDK WA2GUP KA1GWE KA1RMV WB4GGS K4FUM N3WK AA3GV N3OR K3IN
89 N1TPU W8CPG
88 KF6OIF
87 WA1JVV W4AUN K4DND N3WKE
86 K2YYF KC8VOA
85 WW3JC KF7GC
84 WØHXB K8CQF K8VFZ
83 KV4AN
N2VQA
82 K8SH W5CU W4DLZ
81 K1FP
80 KL7OR KK7TN W7VSE NV5D K8KV N8IY KC4ZHF AB7AN K7MQF KG4VER K7GXZ AA4YW W2GUT WA2IAX W4WXA N3ZOC AA8SN WA0LYK KA4LRM
79 W1ALE WD9FLJ WB4BIK
78 KB3JGU W7DPW K4WKT
76 AE5V
75 W5XX KC6NBI
74 WA0KAQ
73 KC6SKK KG4OQA KF4OCU
71 KD7ZLF
70 AD5KE N1LAH W4DGH AB2LF KC2LGL W5NK KC8BTE N7TOD

The following stations qualified for PSHR in previous months, but were not recognized in this column: (January) K3IN 90. (March) W7TVA 560, N7EIE 110, W7QM 110, N7YSS 110, W7ARC 180, N1VXP 100, W7LG 98, KJ7SI 93, N2YBB 91, KA1GWE 90, KA1RMV, W7ZIW 90, WB7WOW 85, K1FP 82, AB7AN 80, K7MQF 80, W7DPW 70.

Section Traffic Manager Reports
April 2004

he following ARRL Section Traffic Managers reported: AK, AL, AR, CO, DE, EB, EMA, EPA, EWA, GA, KS, KY, LA, MDC, ME, MI, MO, MS, NC, NFL, NH, NLI, NNJ, NNY, NTX, NV, OH, OK, OR, ORG, SB, SC, SDG, SJV, SNJ, STX, VA, VT, WCF, WI, WNY, WPA, WV, WWA, WY.

Section Emergency Coordinator Reports
April 2004

The following ARRL Section Emergency Coordinators reported: AK, AZ, CO, EWA, IL, IN, KY, LA, MI, MDC, MN, MO, NC, NFL, NLI, NNJ, NV, SD, SFL, SJV, SNJ, STX, SV, WMA, WPA, WTX, WV, WWA.

Brass Pounders League
April 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*
W4EAT	1	3556	4042	2	7601
W1GMF	0	1716	2722	11	4449
W4ZJY	0	1957	2275	0	4132
N1UAN	0	132	3759	0	3895
KK3F	41	1782	1728	54	3605
N1IQI	0	629	2003	0	2634
WB5ZED	48	1257	1233	21	2559
KA5KLU	0	955	1218	51	2224
KW1U	1	1133	939	21	2093
AK6DV	0	1047	995	34	2076
N2LTC	0	934	915	53	1902
W4DAC	5	864	844	25	1738
WX4H	0	501	953	12	1466
AB0WR	0	626	611	0	1237
K7BDU	12	579	563	6	1160
W6JPH	1	540	343	27	1002
K9JPS	0	495	31	460	986
KF4WIJ	1	455	424	50	930
W7ARC	1	360	352	17	730
N8IXF	—	–	–	–	715
KB5JBV	16	341	347	6	710
WD4LSS	0	319	324	2	645
W9CBE	0	338	278	4	620
WB5NKD	27	23	560	0	610
WB4GGS	0	291	280	6	577
N5SIG	8	291	203	40	542
N3SW	0	320	216	0	536
KA8WNO	0	240	291	0	531
W7TVA	41	173	216	84	514
W4TJM	248	8	248	6	510
W6DOB	0	202	272	35	509

BPL for 100 or more originations plus deliveries: N9VE 192, KK5GY 141, and W9IHW 105. The following station qualified for BPL in previous months, but was not recognized in this column: (March) W6JPH 841.

Road Warriors

We all think of rovers in terms of contests. But they are really much more than that. Physical location is perhaps more important to station performance than almost any other factor on the VHF+ bands and many interested people live in a location that just will not support an effective station—like a mountain valley or a location more than a few hundred km from a population center that would require enhanced propagation to reach. Worse yet are the large numbers of us who live in homes covered by CC&Rs that prevent us from erecting outside antennas. As I have said in a previous column, the old wire out the window can be made to work at these frequencies—especially on 6 and 2 meters—but it is far from the optimal way to do business. RFI either to consumer devices or from electric power lines or commercial sources may degrade our ability to hear and be heard. One solution is to take to the road.

Roving can be a valuable asset to the VHF+ community well beyond contests. All of the rovers in this month's column have microwave capabilities of one kind or another. In some places, like the Washington, DC area, rovers have taken to going out to nearby mountaintops on weekend mornings or occasionally after work during the long daylight hours in the summer to put new grids on the microwave bands. Some rovers like John, WZ8D/R, have put many rare grids in Canada on the air on 6 and 2 meters while on vacation. John even has *WSJT* capabilities to work meteor scatter.

So let's now look at these road warriors and some of their fascinating stations.

Wayne Overbeck, N6NB

N6NB (ex-K6YNB) has been a long time participant in contests both as a portable operator and from his Tehachapi Mountain QTH in southern California. Those of you with long memories will remember Wayne's big scores from Mt Equinox and Spruce Knob more than a decade ago as well as his more recent activities as a rover including a score in excess of 1 million points in the January 2004 VHF SS. You may also remember Wayne as the developer of the VHF quagi, an antenna with a quad driven element and reflector, and Yagi directors.

Wayne's most recent rover is built around a Ford E350 15-passenger Supervan (Figure 1). He uses an ICOM IC-706 as the 6 meter driver, a Yaesu FT-736R as the driver on 144, 222, 432 and 1296 MHz, and a Yaesu FT-100D as the IF strip for 33 cm and the microwave bands at 13 cm and above. In motion, he uses a loop antenna on 6 meters and a 3 element quad on the roof of the van on 2 meters with TE Systems 350 W solid state amplifiers. 222 MHz uses a Mirage 120 W amplifier to a 3 element quad. When the rover is stopped, Wayne can switch to a homebrew pair of 3-500Zs to a 3 element beam 10 meters high on 6 meters, a pair of 4CX250Rs to a 4 element quad 8 meters high on 2 meters, and another pair of 4CX250Rs on 222 MHz. All the tube amplifiers are powered by a Honda EB-3000 generator. On 432 is a Teletec 150 W amp to an 8 element quagi antenna and 23 cm uses an 80 W DEM solid state amplifier to a 13 element Yagi.

Figure 1—The N6NB rover wagon with antennas fully deployed.

More recently Wayne has added all the microwave bands up through 3 cm by integrating a group of DEM transverters with an FT-100D. The state-of-the-art has improved to the point where almost any relatively experienced VHFer can expand his station into the microwave region, particularly if there is someone geographically nearby who has test equipment that can do measurements at the particular frequency. Transverters built by DEM and by sources in Europe are reliable and effective. Wayne uses DEM transverters on 33, 13, 9, 5 and 3 cm. On 13 cm he has a 15 W DEM solid state amplifier. His antennas are a mix, a 10 element linear Yagi on 33 cm, a 21 element loop Yagi on 13 cm, a 27 element loop Yagi on 9 cm and extended W5LUA type horns on 5 and 3 cm.

Figure 2—N6NB at the operating position. Notice the banks of transverters near the rear window and the 6 and 2 meter amplifiers to their right.

This Month

June 17-18	CQ World Wide VHF Contest—Saturday 18Z until Sunday 21Z
July 22-25	Central States VHF Society 2004 Conference—Toronto, Ontario

There are no weekend days with good EME conditions in June*

*Moon Data from W5LUU

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) ♦ w3zz@arrl.org

Figure 3—The NØDQS view from the front seat. All the equipment is readily at hand.

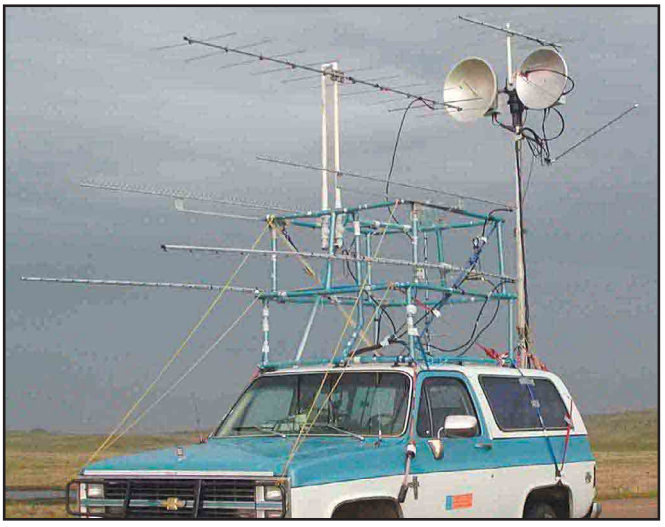


Figure 4—The NØDQS rover. Notice the PVC pipe mounts.

Gene Mitchell, NØDQS

Gene uses a diesel 1983 Chevy Blazer as a dedicated vehicle for his elaborate rover. Equipped with two batteries, it is ideal for traveling up dirt roads and farmers' fields. Inside the cabin (Figure 3), the main radio is a Yaesu FT-897 for 6, 2 and 432. It runs 100 W on 6 meters, drives a TE Systems 2 meter brick to 300 W and a 100 W RF Concepts brick on 432. An FT-736R handles 222 and 1296 with 120 W out from an RF Concepts brick on 222 and 10 W on 1296. The other microwave bands all use a Yaesu FT-817 as an IF strip with transverters/amplifiers—a 50 W DEM system for 902, and DB6NT systems for 2.3 (25 W), 3.4 (Toshiba amplifier—40 W), 5.7 (12 W) and 10 GHz (14 W). 24 GHz is a tripod-mounted DB6NT transverter driving a 2 W mm-Tech amplifier and the laser system is a modified Ramsey Electronics kit.

Most of the antennas are cleverly mounted on a 4 cm PVC pipe frame (see Figure 4). To the front there is a pair of stacked HO loops and a 10 element Cushcraft Yagi for 2 meters and a 19 element Cushcraft Yagi for 432. Also mounted on that frame are a single M^2 linear Yagi for 33 cm a pair of M^2 linear Yagis for 23 cm as well as Directive Systems loop Yagis, a blowtorch for 13 cm and a super blowtorch for 9 cm. In the rear is a 3-section 5-meter homebrew crank-up tower that nests down to 3 meters. This holds a V-shaped dipole for 6 meters, a Yaesu az-el rotator for the 5.7 and 10 GHz dishes and an M^2 7 element Yagi for 222.

How do you put all this together? Gene credits Mike, KMØT, with providing a lot of help, especially on the microwaves. Band changing is no longer a real problem because the transverters are all controlled through an integrated box and coax switches, and a DB25 dataswitch box is used to handle headsets, keyer and PTT lines. Gene estimates that he has visited some 35 grids with this rover and he does between 16 and 18 different grids during a contest. Look for him as he runs some grid expeditions to the DN squares in Nebraska and South Dakota.

Owen Wormser, K3CB (ex-K6LEW)

To call Owen's station merely a rover is a misnomer. This is truly an all band mobile station that goes from 160 meters to 76 GHz. Owen's best known rover effort in a contest came in the January 1999 VHF SS where he made 827,372 points, many of them with fixed stations on the microwave bands. Owen houses all this in a 1995 $^3/_4$-ton Dodge Ram diesel truck with a custom cab (see Figure 5). The core of operations is an ICOM IC-706MKIIG, which acts as an HF rig and a driver on 6 and 2 meters. A Yaesu FT-790 is the driver on 70 cm and an SGC2020 is used as a transverter IF strip. These rigs and two triband FM radios that

COURTESY K3CB

Figure 5—K3CB and the big red truck. Weak signal antennas are mounted on the tripod and a telescoping pole mounted off the right bumper.

Figure 6—*Under the cap.* The business end of the K3CB rover showing 23 cm, 70 cm and 6 m amps to the left, a 2 m amp on the ceiling and a 222 MHz amp in the rear. Not shown are the two 1500 W inverters mounted on the right side.

Owen uses to keep tabs on some FM repeaters that he is associated with are placed on a modified W9IIX mount.

A view of the front seat of Owen's truck appeared in the January 2003 column. The transverters are in an integrated box mounted in a small rack that sits on a palette under the cap in the back of the truck. Six meters through 70 cm uses the higher-powered TE Systems solid state amplifiers. 222 MHz and 33 cm through 9 cm are DEM transverters, and 5 and 3 cm are DB6NT transverters. A variety of amplifiers ranging from 250 W on 33 cm to 10 W on 3 cm round out the microwave RF. 24, 47 and 76 GHz are transceivers affixed to ground mounted tripods with small commercial dishes.

The HF station runs the '706 barefoot at 100 W and uses a modified ICOM AH3 antenna tuner and a Texas Bug Catcher antenna — big, ugly and one of the most efficient HF antennas ever made. The 6 meter antenna is a Saturn 6 three-ring halo and the homebrew 7 element 2 meter and 5 element 222 MHz Yagis are mounted on a small tripod permanently affixed to the center of the roof of the cab and are turned by a Create dc rotator. Microwave antennas mounted on an H frame above the roof tripod include C3I linear Yagis on 23 and 33 cm, and Directive Systems loop Yagis with 2.5 m booms on 13 and 9 cm.

Several Diamond vertical whips are available for the FM radios that cover 28, 50, 144, 222, 432 and 1296 MHz. The homebrew 70 cm 7 element Yagi is mounted on a 7 meter telescopic pole at the rear corner of the truck that is turned by another Create rotator along with a 0.7 m dish with a dual feed for 5.7 and 10 GHz.

As you may have guessed it's a lot of work putting a mobile like this together and keep it running. Some of the extensive wiring is visible in Figure 6. Other accoutrements are a second power source, a 600 Ah marine battery (not cranking amps, power); and a 200 A alternator in addition to the standard alternator. For direction finding, there is a Garmin Mapping GPS and a 2 meter FM radio and HP laptop dedicated to APRS.

ON THE BANDS

Slow, slow, slow was the word for April. With the exception of a fine tropo opening in midmonth in the middle of the country, I think we are all ready for May.

6 meters. The magic band certainly had no magic in April. A weak auroral event occurred after 20Z on April 3 and was confined mostly above the 40th parallel except for a few contacts from N3DB (FM18). DX reports were scarce with K4RX (EM70) working HC3AP, he and Jon, NØJK (EM18), hearing the HC8GR beacon and W4SO (EL96) hearing LU1DMA/B on TE. Al, K7ICW (DM26), reports considerable backscatter on April 5 and heard contacts between TI4DJ and southern US stations from CA to FL. The only really good E_s opening was a double hop event on April 28 that was confined mostly to the northern tier of states. According to the propagation logger at dxworld.com contacts early on that day (GMT) occurred between the north/northeast and VE1, 2, 3, and WA, OR, ID, WY, BC, SK as well as some points in MN and WI in the middle. For instance K3KYR (FN24) reported contacts with CN85 and 96, and DN07, 76 and 89. The following day K5CM (EM25) worked V31RR around midday.

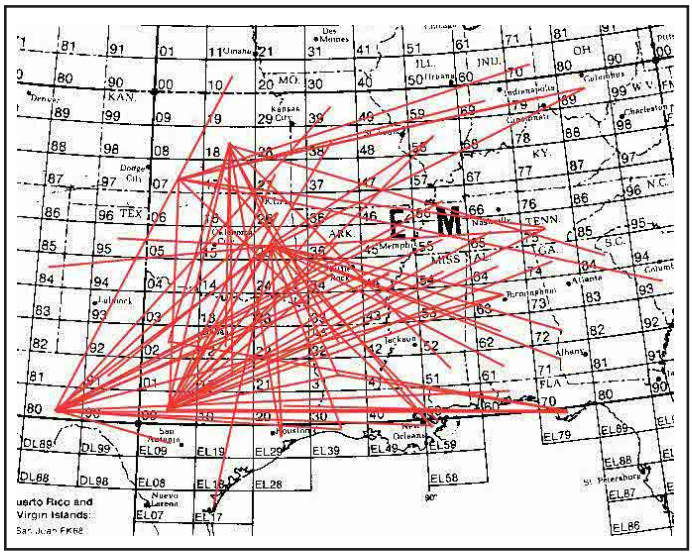


Figure 7—"Wave cyclonic" tropospheric opening of April 16-18, 2004.

Tropospheric ducting. April 16-18 featured the first really big Central US tropo opening of the spring. This one began fairly far west in Texas (DM80 and 84 were the farthest west reported) and spread eastward first toward FL and then north into GA, TN and finally as far northeast as central Ohio and westward into IN, IL, IA and MO (see Figure 7). As Jon, NØJK, points out, this opening is a good example of a "wave cyclone" tropospheric enhancement described by my predecessor Emil Pocock, W3EP, in his excellent May 1983 article in *QST*. Emil notes that the inversion layer develops at the intersection of mild, moist air at the surface flowing north and a rapidly moving warm, dry jet stream above 1500 meters coming from the southwest. The Hepburn maps [**www.globalserve.net/~hepburnw/tropo.html**] clearly delineated the extent of the opening but the hint that it might expand to reach my area came to pass even though I had 32°C temperatures on April 19.

Jon, NØJK, notes contacts due south with EM12 and EM00 early in the opening, expanding southeastward along the Gulf coast and finally reaching W4WA (EM84) his ODX at 1260 km. Sam, K5SW (EM25), was often on the edge of the opening but still worked deep south into Texas (EM17), west into NM (DM84) and west Texas (DM95, DM80) and then along the coast and northeastward into TN and finally Ohio (K8TQK—EM89). Sam worked from DM80 to EM89 on 222. David, KE4YYD, in a rare grid (EL79) in the FL panhandle made a number of TX stations happy on 2 meters in DM80, EM00, 02 and 20 while working K5QE (EM31) on 70 cm.

Steve, KØUO (EM07), reports excellent results on 23 cm making contacts with EM 00, 12, 18, and EM 29, 49, 59, and even better on 70 cm as far as EM 59, 69, 79, 85, 89 and 93, and EN70. Steve says his 2 m and 70 cm beacons were being heard up and down the SE coast and to the Great Lakes. Bill, W3XO (EM00), sent me an extensive report with 2 meter contacts into EN31 (the farthest northwest I saw), EN50 and 70, DM96, 95 and 80 to the west, and EL87 to the east. On 222 he worked from DM80 north to EM55, on 70 cm EM35, 44 and 54, on 23 cm EM31 and on 13 cm W4ZRZ (EM63) at a distance of 1262 km. Tropo openings often do not quite reach Ron, NNØDX, in DM80 in (real) West Texas, but not this time. He was solidly in the opening, reporting 43 contacts as far as EN10 and EM39 to the north and EL79 to the east on 2 meters, EM55 and EL59 on 222 and 432 and EM13 on 902.

HERE AND THERE

Herb Spoonts, W3BO SK. Herb Spoonts, well-known and accomplished 6 meter DXer, became a Silent Key April 9. Herb was truly a prince. He was always ready with a helpful hand and a kind word for all his 6 meter brethren. We will all sorely miss him.

W6PO Remembrance Web site. Dave, K1WHS, reports that Bob Sutherland's (W6PO) daughter has started a remembrance Web site for her dad at **sutherland.blogs.com**. Bob assisted many of us in the '70s and '80s (see this column for April 2004). You can add your comments at this site.

CQ World Wide VHF Contest. This is a 6 and 2 meter contest for stations anywhere in the world. The contest runs from 18Z July 17 to 21Z July 18. Last year the conditions were terrific. Details, rules and log sheets can be found in the June issue of *CQ* or at **www.cq-amateur-radio.com/World%20Wide%20VHF%20Contest.html**.

Central States VHF Society 2004 Conference. The CSVHFS annual conference moves east this year to Toronto, Ontario from July 22-25, a good chance for east coast VHFers to attend the largest and one of the most interesting of the VHF meetings. More details can be found at **www.csvhfs.org/**.

Rebuilding the Iraqi Amateur Radio Society

By Teemu S. Korhonen, SMØWKA

Ham radio in Iraq under the rule of Saddam Hussein was never fun. The few who were active during the regime were always afraid to say the wrong things. They were monitored at all times, and were only authorized to operate from a handful of club stations. To use any equipment from home was strictly forbidden. Many still hoped for better times.

Just one week before the Swedish midsummer festivities in June 2003, I received a phone call from the Swedish Rescue Services Agency asking if I could travel to Baghdad to help the United Nations World Food Programme (WFP) with their radio communications. Without hesitating, despite the obvious risk, I decided to go. One week later, I stepped out of the aircraft onto Iraqi soil. The first weeks were tough, with average daily temperatures around 130°F and dry air.

A ham's true calling is to operate during as adverse conditions as possible, so one of the first things I thought about when touching down in Baghdad was, Could I operate from here? The next day I started my research and actually found what I was looking for on the ARRL Web site. A short article about Iraq mentioned that Fred Matos, W3ICM, was in charge of spectrum affairs for the Coalition Provisional Authority (CPA). I e-mailed him saying that I was in town and needed to obtain a proper ham license. In just a few hours, Fred responded to my e-mail and we exchanged information. Shortly thereafter, I received my license and was now authorized by the CPA to do any ham activities I wanted.

SMØWKA

The Canal Hotel in downtown Baghdad served as the UN Headquarters in Iraq.

No VFO

Unfortunately, I did not have have time to take any ham equipment along. I had barely had time to pack my clothes before leaving Sweden. What was available in Baghdad were lots of Codan and Barret vehicle shortwave radios. These are the non-VFO type transceivers; you have to pre-program all frequencies on channels with a computer, and the receiver is also fixed with no RIT and a bandwidth of 3.5 kHz! I set up one Barret 40 W radio in my tent and operated with a homebrew two-element wire beam outside the tent. Boy, was it tough to operate CW with that wide filter.

Leaving in August, I made only about 2000 QSOs, not having much "quality op-

SMØWKA

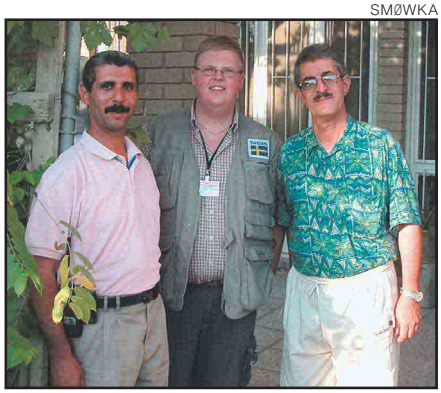
Here are some of the founding members of the Iraqi Amateur Radio Society (IARS) standing in front of an ancient Babylonian wall sculpture. From the left: Raid; Mohammed, YI1MD; Ryiadh, YI1RNU; Emad, YI1EYT; Omar, YI1OM; Diya, YI1DZ; Ali, YI1AL; Mazin, YI1MAR, and Azhar, YI1AZ.

YI1DZ

Qusay, YI1QEA, helps Diya, YI1DZ, put up a tribander on a new tower on top of his apartment complex in Baghdad. Note the many satellite dishes on the rooftops. These showed up right after the Iraqi liberation as satellite antennas were forbidden during the Saddam regime.

Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org

SMØWKA



Mohammed, YI1MQ (right), one of the Iraqi microwave experts, once worked as a chief designer for the Iraqi space program. He was really proud to explain that they had once put a satellite in orbit, with Amateur Radio included. From the left: Diya, YI1DZ, and Teemu, SMØWKA.

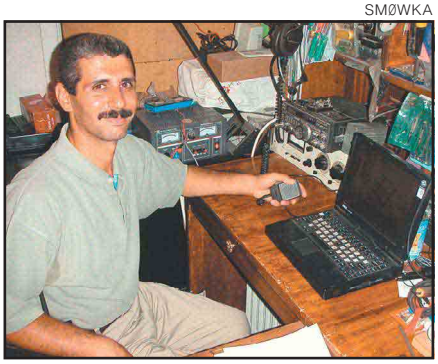
YI1DZ

Here are just a few of the IARS members (standing l-r) Najah, YI1NHR; Laith, YI3SRA; Esam, YI1EM; Qusay, YI1QEA; Ahmed, YI1AHM; Ryiadh, YI1RNU; Azhr, YI1FLY; Kareem, YI1AK; Sarmed, YI1SN; Mazin, YI1MAR and Omar, YI1OM.

YI1MAR

Mazin, YI1MAR, shown here at his home QTH, was truly happy to finally be able to use his equipment from his home.

SMØWKA



Diya, YI1DZ, president of the newly founded IARS, at his home QTH. Diya is fascinated with PSK31 and can also be found on SSB. WA4JTK is his QSL manager.

erating time" left over during the days. A few days after my departure Ghis, ON5NT, also came down to Baghdad and used my homebuilt antenna during his short stay. All UN activities were aborted in the middle of August, due to the truck bombing of the UN Headquarters at the Canal Hotel.

Amateur Radio is True Friendship

After a few weeks of aiming all energy at my work, I started to discuss Amateur Radio matters with a local UN colleague, Diya, YI1DZ. After gaining an understanding of the full situation about the earlier Amateur Radio activities and the old Iraqi Amateur Radio society, I suggested to Diya that I could help the Iraqi hams to get started on a new one.

Diya accepted this offer without even blinking once. He was very eager to get under way, and this was a very good omen for the project. I spent a couple of evenings figuring out the best way to proceed, remembering that we were still in the midst of a severe turmoil and that Iraq was still under military law.

The first step was to gather as many ham operators as we could find in order to establish a new amateur society. Diya agreed on this and spent his day off driving all over Baghdad asking everybody he could find to attend a meeting to be held at the Canal Hotel. We decided to have the meeting within one week to get going quickly. Diya proposed that we should meet beforehand with Mohammed, YI1MQ, to discuss society matters; he might have some good ideas, he said. Therefore, we met Mohammed one evening at his lovely house in downtown Baghdad to discuss both the past and the future. Mohammed was as excited as Diya and we shared many good ideas.

Finally, one Friday afternoon, all the hams Diya had managed to gather came to the UN HQ. I chaired the meeting and explained the situation to the Iraqi hams. Many of those attending still thought it was forbidden to operate from home, and when the news broke that they were indeed authorized to use their amateur equipment from home, many big smiles filled the room. On July 25, 2003, the Iraqi Amateur Radio Society (IARS) was established, and we elected Diya, YI1DZ, as its first president.

The next step was for me to meet with Fred, W3ICM/YI3DX, of the CPA. I made a phone call to Fred and broke the news that we had finally started IARS; he was delighted and shortly after we met at the CPA HQ to discuss what would be proper at this stage. Fred said we should now create new amateur regulatory rules. Wow—what an opportunity to make ham radio in Iraq as open and easy as possible!

I sat down again for a few evenings and composed brand new regulatory rules, which would go straight to Fred's office after approval by the IARS. This would guarantee Amateur Radio privileges, including that hams would be the primary users of all frequencies according to the International Amateur Radio Union (IARU) Region 1 band plans. I spoke to Diya and he passed the document on to the other board members who were elected at our initial meeting. All agreed to the draft rules, and having received the official blessing of the Society, the document would now be turned over to the CPA. The CPA accepted the brand new rules, and they are now the valid ones in Iraq.

What Next?

An important task stands in front of the Iraqi hams. The old regime-controlled Iraqi amateur society is still registered at the IARU as the official one for Iraq. This has to be changed, and the wheels of that process have already been put in motion. I continue to support the IARS in practical matters from home, and am confident that shortly the IARS will be accepted by the IARU as a full national member-society. Fred Matos, W3ICM, has done a tremendous amount of good for Amateur Radio in Iraq.

The IARS has had a very good start to their organization, and the Iraqi hams have developed the society with a true democratic foundation pillars. Democracy has been restored to the ham community in this vast desert country, once the place where our saga began, thousands of years ago. By the riverbanks of the Tigris and Euphrates, the first early communities sprang up, using other means of communication. When looking back at last summer's events, I feel proud. Amateur Radio *is* true friendship! QST

Push to Talk

Whether you're using your 2 meter handheld transceiver while hiking or sitting in front of your brand new transceiver at home, you're probably pushing a button when you want to talk. It feels so natural and everybody does it. But have you ever wondered when this was invented?

My first memory of seeing push to talk was the old 1955 *Highway Patrol* TV show starring Broderick Crawford. It would always seem that he would have to stand next to his police car and pull the microphone out the open window to talk back to headquarters. My dad and I watched this show on our 7 inch Motorola TV. He loved police stories. I was more interested each week to see how radio would become the important part of the story that helped capture the bad guy. It always did.

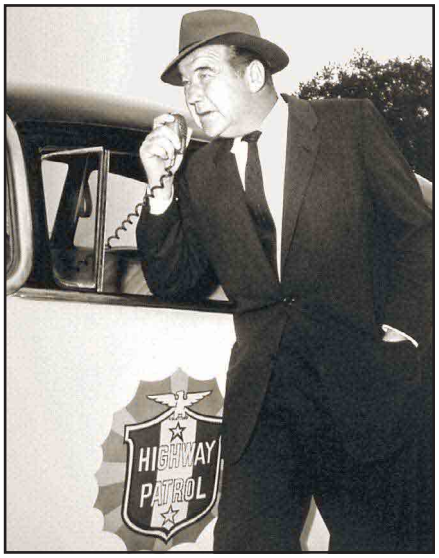
Push to talk goes back, way back, to the early days of ham radio. I don't know of any specific "first event," but the early magazines show photos of many stations with lots of switches and push buttons controlling the switching over from transmit to receive.

Before push to talk, the operator manually threw several switches in an exact sequence, such as: switch off the B+ to the transmitter, switch the antenna over to the receiver and then turn on the B+ to the receiver. With practice, operators could do all of this in a few seconds. Then to switch back to transmit, the process would be reversed.

When DX started to come in and it got exciting on the air, every so often a tired operator would throw the switches out of sequence. This sometimes created a problem—the equipment could become damaged or expensive tubes could burn out.

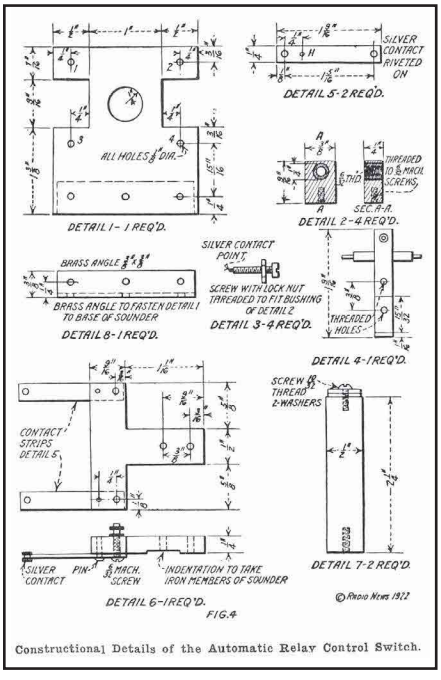
Today we know about relays and how they are used to switch just about everything. And of course everyday computer controlled solid-state devices turn things on and off all over our homes and at work. But in the early 1920s when telephony (voice over radio) became the rage, a better switching method was needed. Relays of the day were expensive and not well suited for switching high voltages and RF antenna circuits.

Relays had been around since the Civil War, when telegraph circuits stretched across the country. Later as the telephone industry started to grow, relays became a part of their system, too, but they only switched low voltages and were very expensive.

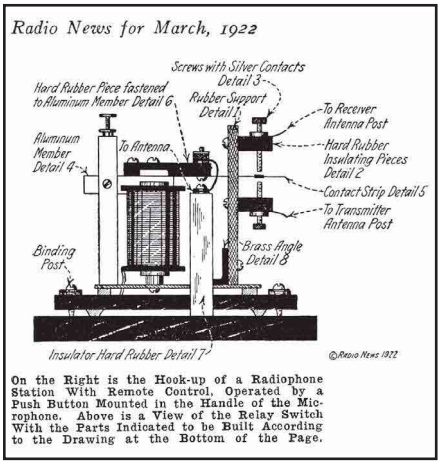


In March 1922 Louis Gerard Pacent, a member of the prestigious *Radio Club of America*, from as early as 1914, and a member of the *Institute of Radio Engineers* (IRE), wrote an interesting article for the *Radio News* magazine. It was titled "The Relay Antenna Transfer Switch." In it, he detailed how to modify a common telegraph sounder into a multi contact relay, and he also showed how to connect it to a transmitter, receiver and an antenna.

FROM *RADIO NEWS*, MARCH 1922



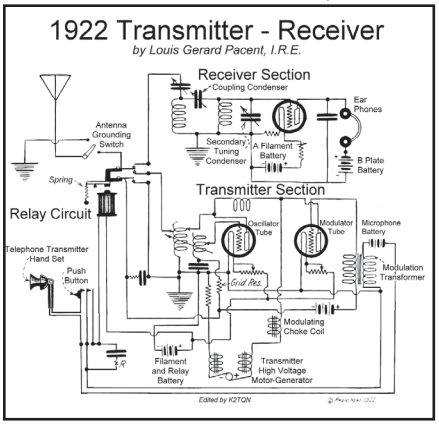
Constructional Details of the Automatic Relay Control Switch.



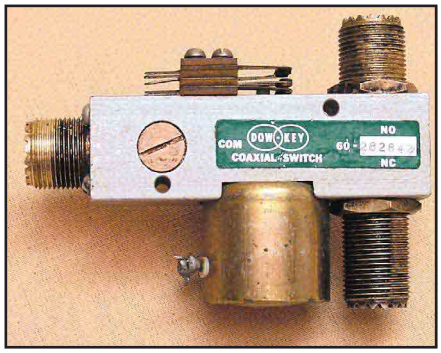
On the Right is the Hook-up of a Radiophone Station With Remote Control, Operated by a Push Button Mounted in the Handle of the Microphone. Above is a View of the Relay Switch With the Parts Indicated to be Built According to the Drawing at the Bottom of the Page.

W2FZT homemade relay.

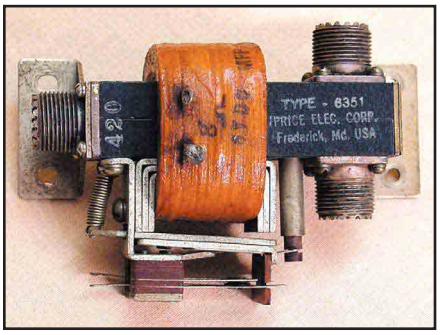
BASED ON ILLUSTRATION IN *RADIO NEWS*, MARCH 1922



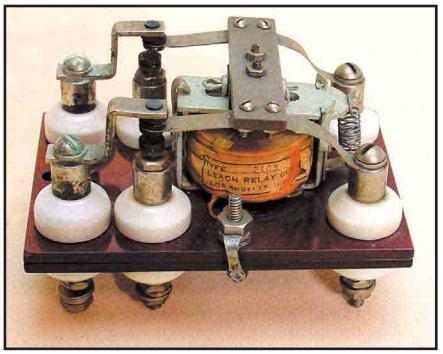
John Dilks, K2TQN ♦ 125 Wharf Road, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org



The Dow-Key relay with external contacts.



A 1950s 6-volt look-alike to the Dow-Key relay, with external contacts.


A war-surplus double-pole double-throw antenna relay for 600-ohm tuned feeders.

The Pacent Relay

By comparing the photo of a 20 Ω sounder and the drawing of Pacent's modified sounder, you can see just how it works. Essentially the sounding member was removed and the aluminum bar shortened. Then the new pieces were attached and aligned as shown. When completed the relay became a single pole double throw antenna relay, with an additional single set of contacts that could be used to control a part of the circuit.

In the article, Pacent included step-by-step instructions and detail drawings for making each piece that would be needed to change it into a working relay. Industrious hams could build these at home, because only a drill and metal hacksaw would be required to make the pieces.

Using the Relay

To demonstrate the proper use of a relay, Pacent provided three examples in the article. This schematic shown is the one for phone transmission. By pushing the button attached to a microphone, the button circuit connects the microphone to its battery and provides a ground to operate the relay. The relay in turn switches the antenna from the receiver to the transmitter and, with the single contact, switches the added biasing resistance out of the circuit allowing the oscillator to start up. Used this way, the relay avoided having high voltages on its contacts.

Two other schematics were also provided to show relay applications for CW use. One cleverly used the relay to allow break-in operation. The hand key operated the relay and the single contacts were used for keying the transmitter.

Homemade Relay

I have one early homemade relay in my collection. Stan Staniloff, W2FZT, built this relay in the 1930s when he was a teenager. He used it successfully for several years in his homebrew transmitter. The coils were from an early piece of equipment rescued from the local telephone company's trashcan. He machined the necessary pieces to make it into a relay on his lathe, in his cellar shop. The relay was used for keying his transmitter, thereby keeping the lethal voltages off the hand key.

Collecting Relays

There are collectors and collections of relays. The nicest collection I ever saw was the one belonging to SK Phil Catona, W2JAV, a retired RCA engineer. He built dozens of 2 foot square, by 6 inch deep, picture frame-type displays. In them he displayed relays by category. He had just about every relay that could be found. Of course he started collecting in the 1950s, and this is one reason his collection was so large.

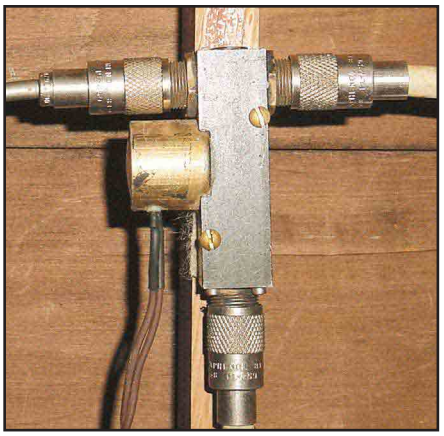
You can gather a nice collection this summer, certainly enough relays for a display case or two. They would look great on the wall of your shack. You can do this inexpensively, too, by picking through the junk boxes that usually show up at hamfests. Old relays can usually be bought for a few cents to a buck apiece.

There are some exceptions on cheap, though. These are the antenna change over relays that are still used today with Boat Anchor stations, the best known being the Dow-Key series, and its look-alikes. They tend to go in the $10 to $30 range. I've included several photos of relays you might want to look for at your next hamfest.

W2JAV carried the picture frame-type displays through with other themes. He had displays of tubes, keys, resistors, potentiometers, capacitors and other radio related items. He often took them to ham club meetings and gave interesting talks to the members.

Summer Visits to Museums

One of my favorite museums is the New England Wireless and Steam Museum in East Greenwich, Rhode Island, just 10 minutes from I-95. This is a must-see for fans of early radio.


Dow-Key relay, without external contacts, shown as used, under the operating table, for the Collins AM station in K2TQN's Old Radio museum.

There are working spark transmitters and early ship radios as well. One noteworthy exhibit, put together for a TV documentary, is the replica 1910-1912 Marconi wireless station. It is displayed just as it would have looked on a ship back then. Another is the original Massie spark transmitter from the 1907 Massie shore station, which is also there. All of the original equipment is in the station except the changeover switch, which was assembled by Radio Historian Alan Douglas from original parts. The pump handle key, Massie Resonaphone tuner and operator call box are on the original table. The helix and straight spark gap are on top of the condenser cabinet. And on the wall above the helix is a hot wire ammeter and anchor gap.

To visit, you should call ahead of time for an appointment, as it's not open every day: 401-885-0545. You can also see much of their display on their Web page at **users.ids.net/~newsm/**.

And yes, there are working steam engines there too; some of them are quite large. It's an interesting mix of history. You will have no trouble spending an entire day there.—*K2TQN* QST

The IF Rig

For most of the microwave bands, certainly those above 1296 MHz, we use a transverter and a transceiver to make QSOs. The transceiver is the real "rig" in that it performs the transmit and receive functions of modulation/demodulation, frequency and bandwidth control, provides receive gain and metering of signal levels. The transverter converts the transceiver's RF output up to the microwave frequency, and converts the received microwave RF down to the transceiver's frequency (see Figure 1). A typical transverter is a set-and-forget device, with no need for adjustments during operation.

On the lower frequencies, generally from those above HF up to 1296 MHz, transverters are typically used with transceivers operating at either 28 MHz or 144 MHz. It is this frequency that microwavers call the intermediate frequency or "IF," because it is intermediate between the microwave operating frequency and the modulation systems. So, we microwavers call our transceivers *IF Rigs*.

What makes a transceiver good as a microwave IF rig?

As with many things in amateur radio, different types of operation lead us to make different decisions. Although often we have to consider cost, there are many good affordable choices for our IF rig. Perhaps the most important consideration is whether one is building a home station, rover system or hill-topping microwave radio. In some circumstances, an IF rig has to be subjected to some minor internal modifications. Not everyone is willing to make these changes, especially when they may potentially void warrantees, so choices that require little or no modification are attractive.

The Home Station

Years ago, many middle and high-end HF radios had transverter inputs and outputs. These were usually designed to provide 1 mW (0 dBm) during transmit, and have a fairly sensitive input. Some radios provided additional support by displaying frequency based on the expected transverter operation. A few amateur radios made today still provide this capability. Often, the application of a voltage on an accessory terminal activates internal circuits, which in some cases use separate RF connections and in others reuse standard antenna connections. Power levels vary between rigs. Some radios produce a few watts, while others drop to 1 mW (0 dBm), which is the typical input power for a transverter. If yours has greater power output than your transverter's input, you will need a fixed attenuator in the transmit circuit.

In most home stations, space and weight do not constrain the choice of radio. Larger radios often have more features and performance than compact versions. Easy control of bandwidth, memories, noise removal, CW and voice memory, and spectrum scopes are examples of features that can aid in microwave operation, especially during contesting at home. Often the home station will operate several microwave transverters from the same IF rig. To accomplish this, microwavers develop multi-port relay and switching systems that direct TR and IF signals to the appropriate transverter, while simultaneously controlling mast-top preamplifiers, TR relays and antenna selection.

The Rover Station

Rovers create stations within their vehicles to operate as many bands as they can with minimum setup time. Usually, these stations are meant to operate effectively in contests, where activating many maidenhead grid squares during the limited hours of the contest yields a high score.

The primary source of electricity is vehicle power, so an IF rig that runs from that source is most desirable. Although most rovers are in family vehicles, some all-out efforts are constructed in specialized vehicles, such as heavy-duty trucks with ac generators. Each situation dictates its own constraints, but smaller IF rigs that have a fairly simple operating layout are preferred. Some of the newer rigs have detachable front panels so that the bulk of the radio can be placed nearby the transverters. With a thin control panel at the operating position one has more space for the essentials: a GPS, microwave transverter switching control, laptop computer, microphone, key and a cup of coffee.

Much like a home station, a rover

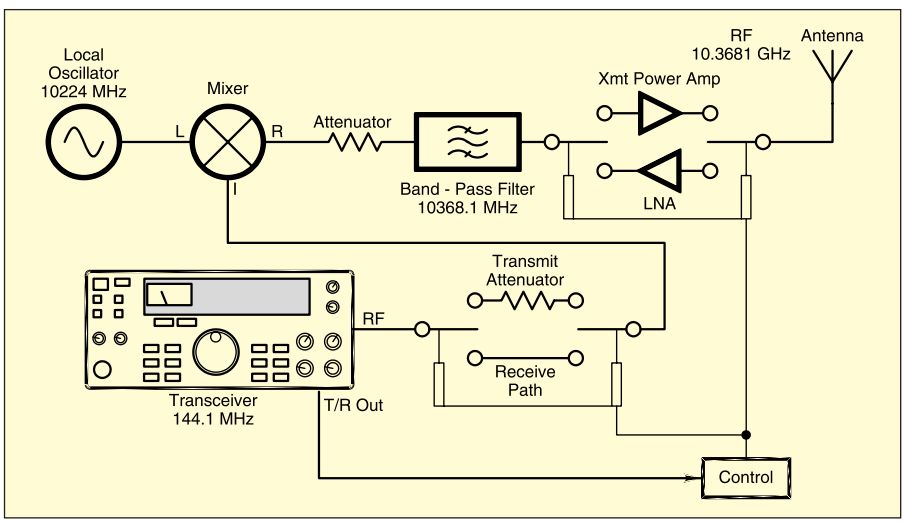


Figure 1—The function of a transverter is frequency conversion, thereby allowing the use of an HF or 2 meter radio on a microwave band.

Figure 2—The Yaesu FT-817 portable.

Figure 3—The Kenwood TS-2000.

Tom Williams, WA1MBA ♦ wa1mba@arrl.org

often runs as many bands as possible, and therefore has the same concerns with easily switching bands while using the same IF rig and a control system that selects transverter, preamp and antennas.

Hilltopping

When you go hilltopping, you may need to carry your equipment, at least a short distance, but perhaps a long hike, and operate with battery power. Emphasis is on portability, so both weight and size matter. Most IF radios for hill-topping stations are 2 meter all-mode rigs designed for truly portable or mobile operation. These usually do not develop much RF power which is fine, considering that anything over 1 mW usually has to be attenuated down to that level anyway, and because power modules are naturally heavy.

Don't forget that when hilltopping you will also need a liaison radio, also usually a 2 meter SSB radio, but hopefully delivering 25 W or more. Some hams try to use the same radio as the IF and the liaison rig, but soon learn that this approach seriously interferes with efficient operation, and find a second radio.

Interfacing

Your IF rig has to be properly connected to your keying circuits. The transverter, and other circuits such as amplifiers and relays, must react to your intent to switch into transmit mode in a manner that protects all components. For instance, you do not want any transmitted RF to accidentally enter an open relay (or one in the process of being switched) or the back end of a preamplifier (LNA). To accomplish these functions amateurs have developed solutions for several popular HF and 2 meter all-mode radios. They consist of sequencers that assure the correct order of operation of each component and provide sufficient delay for relay closure.

QSK-only HF radios are generally problematic, because the transverter and relays cannot be switched between receive and transmit and back again during CW keying. Therefore, one has to defeat break-in so that a sequencer can key the rig, transverter, and microwave relays at the beginning and end of the transmission, based on a footswitch or other manual TR switch.

Two Transverters?

Note that many transverters for the higher microwave bands will start with a 2 meter IF. This is necessary because an IF as low as 28 MHz puts the transverter's LO too close to the RF for effective filtering. Unfortunately, many of the desirable rigs are strictly HF or HF+6 meters and so cannot operate at 2 meters. To overcome this, some amateurs, notably for home will convert the HF radio to 2 meters with a high quality transverter. Then the 2 meter signals will be routed to the microwave transverters.

This multiple conversion setup can work well, but it can also lead to problems. Most problems with any transverter system arise from not having signal levels set correctly, resulting in insufficient dynamic range. More often than not, excessive gain is the problem.

Figure 4—The ICOM IC-756PROII.

Figure 5—The Ten-Tec Model 562 "6N2."

Figure 6—The Elecraft K2.

Choices

It would be difficult if not impossible to list all the HF and 2 meter radios that play well with transverters and interfacing circuits. However, here is a sampling of some radios that either claim to have transverter support, or that a number of microwavers have successfully adapted. My apologies in advance to microwavers or VHF operators if I have left out your favorite IF rig, or have included your least favorite. Before purchasing a radio for this purpose, get a copy of the user manual (many are on-line) and talk to other amateurs who have had experience with the radio you are most interested in using. E-mail lists and reflectors are a good place to start if no one in your club has the experience to help you.

These are in no particular order, are not recommendations, and don't guarantee success. See Figures 2 through 5 for photos of some of these radios.

Vertex-Standard/Yaesu

Mark V Field FT1000 and Mark V FT1000MP provide separate RX and TX transverter connections and appear to provide built-in support for transverter operation. The FT-897 HF, 6, 2, 70 cm has built in transverter function with ability to change the display. The FT-857 HF, 6, 2, 70 cm mobile has a transverter function. The FT-817 portable HF, 6, 2, 70 cm has no transverter function, but one can attenuate the relatively low output level externally. **www.vxstdusa.com/**

Kenwood

The TS-2000 HF, 6 and 2 m, 70 and 23 cm has built-in transverter support, a menu to set display frequency, and transmit power drops to lowest power for that frequency (several watts). The TS-570D HF radio in transverter mode provides 5 W output, has built-in support circuitry allowing the display to show 6 and 2 meter and 70 cm bands. **www.kenwood.net/**

ICOM

The new IC-7800 HF + 6 m, delivers full capability, transverter in/out with proper levels (0 dBm), and is very expensive. The IC-756-PRO-II has built in transverter functions with TX/RX on the same jack, proper transmit level of 0 dBm and provision for an external switch to set it into the transverter mode. **www.icomamerica.com/**

Ten-Tec

The Orion has a built-in transverter function, with low-level output. It operates QSK only, so it requires an external system to fool the rig to operate in a way that defeats break-in during CW operation. The Model 562 "6N2" is a 6 and 2 meter radio that has internally supported transverter outputs. It also operates QSK. **www.tentec.com/**

Elecraft

The Elecraft K2 is an HF transceiver kit, available in a QRP version. It is often interfaced to transverters, having some internal support including frequency display control. **www.elecraft.com/**

Down East Microwave

These folks have interfacing kits and products including some with the ability to match to rigs running up to a few watts. They have RF sensing models, and models specific to certain radios as well. **www.downeastmicrowave.com/**

COMING CONVENTIONS

OKLAHOMA STATE CONVENTION

July 16-17, Oklahoma City

The Oklahoma State Convention ("Ham Holiday 2004"), sponsored by the Central Oklahoma Radio Amateurs, will be held at the Oklahoma State Fair Park, (Made in Oklahoma Building), NW 10th and May Ave; NE of the intersection of I-40 and I-44. Doors are open for setup Friday noon to 4 PM, Saturday 7-8 AM; public Friday 5-9 PM, Saturday 8 AM to 3 PM. Features include Hamfest/Computer Show, flea market, dealers (contact Ron McCubbin, KC5QCV, **kc5qcv@cox.net**), technical and non-technical programs, WAS card-checking, VE sessions (visit **www.w5nor.org/vereg** to pre-register). Talk-in on 146.82. Admission is $7 in advance, $10 at the door; under 16 free with paying adult. Tables are $15 in advance (pre-registration only), $20 at the door (if available); electrical hookup $10. Contact Chuck Kanach, KC5EZS, c/o "CORA Ham Holiday 2004," Box 265, Ft Supply, OK 73841-0265; 405-390-2231; **kc5ezs@arrl.net**; **www.qsl.net/coranews/index.html**.

MONTANA STATE CONVENTION

July 16-18, East Glacier

The Montana State Convention (70th Glacier-Waterton International Peace Park Hamfest), sponsored by the Glacier-Waterton Directors, will be held at the Three Forks Campground, 13 miles W of East Glacier on Hwy 2. Features include flea market, tailgating, vendors, dealer displays, old equipment auction, meetings (QCWA, ARES, annual hamfest), transmitter hunts, contests, seminars and programs, VE sessions, BBQ lunch and supper (Saturday, bring your own meat, plates and utensils), breakfast (Sunday), camping (406-226-4479). Talk-in on 146.52. Admission is $13 in advance, $16 at the door; under 6 free. Tables are $5 (for craft sale). Contact Ron Rueter, K7PA, 2113 108th St SE, Everett, WA 98208; 425-210-3911; **k7pa@k7pa.com**; **www.gwhamfest.org**.

PACIFIC NORTHWEST DX CONVENTION

July 16-18, South Everett, WA

The Pacific Northwest DX Convention, sponsored by the Western Washington DX Club, will be held at the Quality Inn, 101 128th St SE; Exit 186 off I-5, 22 miles N of Seattle. Features include Hospitality Suite (Friday and Saturday eves), programs (Saturday, 9 AM to 4 PM), DXCC card checking, banquet (Saturday eve, $30), buffet breakfast (Sunday, $12), free RV parking (on N side of hotel, no hookups). Talk-in on 147.0, 146.92 (123.0 Hz). Admission is $20 in advance, $25 at the door. Contact Joe Gregory, W7QN, 509 N 71st St, Seattle, WA 98103; 206-784-1089; **w7qn@msn.com**; **www.wwdxc.org**.

June 17-20
YLISSB, Nashville, TN*

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*

August 13-15
New England Division, Boxboro, MA

August 15
Kansas State, Salina

August 20-21
New Mexico State, Albuquerque

August 21
Missouri State, Columbia

August 21-22
Alabama State, Huntsville

August 27-29
Southwestern Division, Phoenix, AZ

August 28-29
West Virginia State, Weston

***See June *QST* for details.**

3905 CENTURY CLUB CONVENTION

July 30-August 1, Wilsonville, OR

The 3905 Century Club Convention (27th Annual Eyeball), sponsored by the 3905 Century Club, will be held at the Pheasant Ridge RV Park, 8275 SW Elligsen Rd; located just a few minutes S of Portland, easily accessible from I-5 (Exit 286). Features include face-to-face contacts, annual awards, antenna shootout, Friday Lunch, Saturday Banquet, Sunday Breakfast, RV parking (with full hookups; 800-532-7829; **service@pheasantridge.com**). Admission is $25 (non-licensed teens $15; pre-teens $5). Contact Dean Davis, KL7OR, 3596 Karen Ave S, Salem, OR 97302; 503-540-3270; **deandavis@alpinesoft.com** or **eyeball@alpinesoft.com**; **www.alpinesoft.com/eyeball**.

TEXAS STATE CONVENTION

August 6-7, Austin, TX

The Texas State Convention (Austin Summerfest 2004), co-sponsored by the Austin ARC, the Austin Repeater Organization, and the Texas VHF-FM Society, will be held at the Red Lion Hotel, 6121 North IH 35; NE corner of the intersection of IH-35 and US Hwy 290 N. Doors are open Friday 6-9 PM, Saturday 8 AM to 3:30 PM. Features include indoor and outdoor swapfest, tailgating, dealers, exhibits, forums and technical sessions (ARRL, DX and contest, packet, weather, emergency communications, QRP, AMSAT, microwave, satellites, digital linking), Texas VHF-FM Society annual meeting (Saturday, 9-11 AM), VE sessions. Talk-in on 146.94. Admission is $8 in advance, $10 at the door; under 18 free. Tables are $10 (6-ft, electricity $5 additional through advance registration only; limit of 3 tables to a customer; first-come, first-served). Contact Joe Makeever, W5HS, 8609 Tallwood Dr, Austin, TX 78759; 512-345-0800; **w5hs@arrl.net**; **www.austinsummerfest.org**.

INTERNATIONAL EME CONFERENCE

August 6-8, Ewing Township, NJ

The International EME Conference (11th Annual Conference), sponsored by The College of New Jersey and Linearizer Technology, will be held at The College of New Jersey, 2000 Pennington Rd (for directions visit **www.tcnj.edu**). Features include VHF, UHF, and microwave techniques; weak signal communications; technical presentations; noise figure calculation; workshops (where you can use test equipment to tune your LNA, transverter, etc); banquet ($30 or 25 Euros); plenty of parking; refreshments. Conference fee is $80 or 70 Euros. Contact Marc Franco, N2UO, c/o Linearizer Technology, Inc, 3 Nami Ln, Unit C-9, Hamilton, NJ 08690; 609-584-8424; **eme2004@qsl.net**; **www.qsl.net/eme2004**.

WESTERN NEW YORK SECTION CONVENTION

August 7-8, Williamsville

The Western New York Section Convention (Greater Buffalo Hamfest), sponsored by the Lancaster ARC, will be held at the Main Transit Fire Department Recreation Grounds, 6777 Main St; NYS Thruway (I-90) to Exit 49 (Depew/Lockport), take Rte 78 (Transit Rd) N to Rte 5 (Main St), turn left (W) on Rte 5, proceed approximately 0.2 miles, grounds on left (S) side of street. Doors are open at sunrise for outdoor flea market, 8 AM for indoor activities. Features include huge outdoor flea market, tailgating ($5 per space plus admission), commercial vendors, WNY Section Club Championship Competition, contests, demos, ARRL talks, forums, foxhunt, VE sessions (Main Building, 9:30 AM, walk-ins accepted, but pre-registration is encouraged; Hal, NH7R, 716-832-0031), all-you-can-eat pancake breakfast (6 AM), lunch, overnight parking. Talk-in on 147.255 (107.2 Hz). Admission is $7. Tables are $15 (8-ft). Contact Luke Calianno, N2GDU, 1105 Ransom Rd, Lancaster, NY 14086; 716-634-4667 (days); **luke@towncountryflorist.com** or **n2gdu@arrl.net**; **gbhamfest.hamgate.net**. QST

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 **July 1** to be listed in the **September** 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.)**

†**California (Goleta)—Aug 8**, 9 AM to 2:30 PM. *Spr:* Santa Barbara ARC. Santa Barbara Elk's Lodge, 150 N Kellogg Ave; Hwy 101 N to Patterson Ave, go N .1 mile to Calle Real, go W .5 mile to Kellogg Ave, right turn to entrance; or Hwy 101 S to Fairview Ave, go N .2 mile to Calle Real, go E .5 mile to Kellogg Ave. Displays, bookstore, VE sessions, Santa Barbara-style BBQ. *TI:* 146.79 (131.8 Hz). *Adm:* Free. Marvin Johnston, KE6HTS, 408 Grove Ln, Santa Barbara, CA 93105; 805-687-8881; **KE6HTS@sbarc.org**; **www.sbarc.org**.

†**Colorado (Loveland)—Jul 17**; set up 5 AM; public 8 AM to 2 PM. *Spr:* Northern Colorado ARC. The Ranch and Budweiser Events Center, Larimer County Fairgrounds, 5280 Arena Circle; take Exit 259 off I-25, go E on Crossroads Blvd, go N on Fairgrounds Ave to main entrance for "The Ranch." Swapmeet, commercial exhibitors, vendors, radio and computer gear, VE sessions (8-10 AM), free parking, refreshments. *TI:* 145.115 (100 Hz), 146.52. *Adm:* $5, under 12 free. Tables: $15 (includes 1 admission). Willis Whatley, WA5VRL, 2920 Bassick St, Fort Collins, CO 80526; 970-407-6599; **willis.whatley@aei.com** or **n0rqv@arrl.net**; **home.earthlink.net/~ncarc/index.htm**.

†**Florida (Milton)—Jul 23-24**; set up Friday noon, public 5-9 PM; set up Saturday 7 AM, public 8 AM to 2 PM. *Spr:* Milton ARC. Santa Rosa County Auditorium, 4530 Jimmy's Way; I-10, Exit 22, go N 7 miles toward Milton; just before intersection of Hwy 90 and Avalon Blvd bear right onto 191 (old Bagdad Hwy), go 3 short blocks, turn right at Auditorium Marquee onto Spikes Way, Auditorium on left. Air-conditioned, vendors, tailgating ($3 per spot; first-come, first-served), VE sessions (Saturday, 8:30-11:30 AM; Larry Busbee, WX4B, **lbusbee@bellsouth.net**), refreshments. *TI:* 145.49, 146.7 (100 Hz). *Adm:* $3. Tables: $8. Walter Yarbrough, WA4TFR, 4301 Bell Ln, Pace, FL 32571; 850-994-7335; **wa4tfr@worldnet.att.net**; **home.att.net/~k4ozl/marc.htm**.

†**Illinois (Aurora)—Jul 11**; set up Saturday 7 PM, Sunday 6-8 AM; public 8 AM. *Spr:* Fox River Radio

†ARRL Hamfest

League. Aurora Central Catholic High School, 1255 N Edgelawn Dr; located on the NE corner of Edgelawn Dr and W Indian Trail Rd, between Orchard Rd and N Randall Rd. Flea market, commercial dealers, computer vendors, VE sessions (10 AM), free parking, refreshments. *TI:* 147.21 (103.5 Hz). *Adm:* advance $5, door $7. Tables: 8-ft, advance $10, hamfest weekend $15. Maurice Schietecatte, W9CEO, c/o FRRL, Box 673, Batavia, IL 60510; 815-786-2860; **scat42@msn.com**; **www.frrl.org**.

Illinois (Carlinville)—Aug 7. Tim Jones, KA9VIV, 217-627-2355.

Illinois (Elgin)—Aug 5-7. Art Bilski, 630-739-1060.

†**Illinois (Peotone)—Aug 8**, 6 AM to 3 PM. *Spr:* Hamfesters RC. Will County Fairgrounds; I-57 to Peotone Exit 327, go E 1 mile to Fairgrounds, approximately 45 minutes S of downtown Chicago. Flea market, Amateur Radio and computer equipment, commercial vendors, VE sessions (on site, 8-10:30 AM), free parking, refreshments. *TI:* 146.52. *Adm:* advance $6 (double-stub), door $8 (single stub); under 12 free. Tables: $15. Robert Morrow, KB9YRE, 4312 W 109th St, Oak Lawn, IL 60453; 708-636-0963; **kb9yre@aol.com** or **hamfest@hamfesters.org**; **www.hamfesters.org**.

†**Illinois (Quincy)—Aug 7**, 8 AM to 2 PM. *Spr:* Western Illinois ARC. Eagles Alps Grounds, 3737 N 5th St; 4.5 miles N of downtown Quincy with easy access from US Hwy 24. Ham Radio/Computer Swapfest; indoor flea market; tailgating (free with paid admission); VE sessions (12:30 PM, all classes; Mike Nowack, NA9Q, 217-224-8526; **na9q@arrl.net**); WAS, DXCC, and VUCC Card Checking (**k0ca@arrl.net**); plenty of convenient parking; refreshments. *TI:* 147.03 (103.5 Hz). *Adm:* advance $4, door $5; under 12 free. Tables: $10 (first table), $16 (2 tables), $21 (3 tables), $5 each (after the first 3 tables). Jim Funk, N9JF, 2742 N 230th Ave, Liberty, IL 62347; 217-336-4191; **jfunk@adams.net**; **www.qsl.net/w9awe**.

Indiana (Angola)—Aug 1, Sharon Brown, WD9DSP, 260-475-5897.

†**Indiana (Greentown)—Aug 8**, 7:30 AM to 1 PM. *Sprs:* Kokomo, Grant County, and Miami County ARCs. Lions Club 4-H Fairgrounds; from the E go W on Hwy 22/35 to Greentown, turn N on N Maple St, go N for 6 blocks; from the W go E on Hwy 22/35 to Greentown, turn N on N Meridian St, go N for 6 blocks. VE sessions. *TI:* 147.24, 146.79. *Adm:* advance $4, door $5. Tables: $8. Nick Nickerson, K9NQW, 517 N Hendricks Ave, Marion, IN 46952; 765-668-4814 or 765-517-1581 (cell); **k9nqw@arrl.net**; **www.greentownhamfest.com**.

†**Iowa (Amana)—Aug 8**; gates 6 AM, hall 8 AM. *Spr:* Cedar Valley ARC. Amana Visitor's Center and RV Park, 39 38th Ave (Hwys 220 and 151); from I-80 take Exit 225, go N on Hwy 151, E on Hwy 6, N on Hwy 151 to Hwy 220, W on Hwy 220 to 38th Ave, turn right. Air-conditioned, commercial vendors, flea market, tailgating (free with paid admission), computer hardware and software, forums, VE sessions (Darrel Peterson, WAØKHH, 319-393-8667; **wa0khh@juno.com**), refreshments. *TI:* 146.745, 146.52. *Adm:* $5. Tables: $10. Dave Franks, KCØEZL, 620 1/2 1st Ave NW, Cedar Rapids, IA 52405; 319-241-0719; **paid2prowl@hotmail.com**; **www.cvarc.rf.org**.

†**Louisiana (Slidell)—Jul 17**. *Spr:* Ozone ARC. Slidell Municipal Auditorium, 2056 2nd St, corner of 2nd and Bouscaren; from I-12 take US 11 Exit, go S, turn left on Bouscaren, go 2 blocks; from I-10, take US 190 Exit, go W to junction with US 11, go left on US 11 to Bouscaren, take left, go 2 blocks. Flea market, VE sessions, QLF contest, forums. *TI:* 147.27 (114.8 Hz). *Adm:* $3. Tables: 8-ft $20 (commercial), $15 (flea market). Jerry Finnegan, KC5WLA, Box 553, Slidell, LA 70459; 985-639-9690 (after 5 PM, local time); **kc5wla@arrl.net**; **www.w5sla.org**.

†**Maryland (Timonium)—Jul 25**; set up Saturday 2 PM; public Sunday 8 AM to 4 PM. *Spr:* Baltimore RA Television Society. Timonium Fairgrounds, York Rd; take I-695 (Baltimore Beltway) to Exit 24 (I-83 N); from I-83 take Exit 17 (Padonia Rd) E, turn right at 3rd traffic light onto York Rd, (MD Rte 45), continue S on York Rd to Fairgrounds entrance. Hamfest/Computerfest, giant flea market (opens 6 AM), vendors, electronics, equipment, tailgating ($10 per space; first-come, first-served basis; no advanced reservations), VE sessions (check in 8:30 AM, free exams 9 AM; pre-registration required; John Creel, WB3GXW, 301-572-5124, 6-9 PM; **creewb3gxw@aol.com**), card checking (DXCC, WAS, VUCC), handicapped accessible, refreshments. *TI:* 147.03, 224.96, 448.325. *Adm:* $6, under 12 free. Tables: $60 each (in air-conditioned Main Exhibit Hall). Mayer Zimmerman, W3GXK, c/o BRATS, Box 5915, Baltimore, MD 21282-5915; 410-786-6839 or 410-461-0086 (phone/fax); **w3gxk@arrl.net** or **hamfest@bratsatv.org**; **www.bratsatv.org**.

Massachusetts (Cambridge)—Jul 18. Nick Altenbernd, KA1MQX, 617-253-3776.

Massachusetts (Swansea)—Jul 31, Roland Daignault, N1JOY, 508-678-6331.

†**Michigan (Escanaba)—Aug 7**, 9 AM to 4 PM. *Spr:* Delta County ARS. Bay de Noc Community College, 2001 N Lincoln Rd; N side of Escanaba on US Rtes 2 and 41 at Danforth Rd. Swap tables, forums and speakers. *TI:* 147.15. *Adm:* $5. Tables: $10. John Anderson, WD8RTH, Box 923, Escanaba, MI 49829-0923; 906-789-6950; **wd8rth@arrl.net**.

†**Michigan (Tawas City)—Aug 7**; set up 6 AM; public 8 AM to Noon. *Spr:* Iosco County AR Enthusiasts. Tawas Area High School, 255 M-55; 1½ miles W of US 23 on S side of M-55 Hwy. Trunk sales in parking lot, VE sessions. *TI:* 146.64. *Adm:* advance $4, door $5. Tables: $7. Ray Knuth, KB8ZYY, Box 252, Oscoda, MI 48750; 989-739-2896; **kb8zyy@webtv.net**; **www.w8icc.org**.

†**Minnesota (Brainerd)—Aug 7**, 9 AM to 2 PM. *Spr:* Brainerd Area ARC. National Guard Armory, 1115 Wright St, S side of Brainerd; 4 blocks E of Business 371 (S 6th St). Commercial vendors, Amateur Radio and computer equipment, free parking, refreshments. *TI:* 147.225. *Adm:* $5, under 12 free. Tables: $10 (plus admission; first-come, first-served basis). Al Doree, WØRC, 3876 E Shamineau Dr, Motley, MN 56466; 218-575-2404; **w0rc@arrl.net**; **www.brainerdham.org**.

†**Missouri (Warrensburg)—Jul 17**, 8 AM to 1 PM. *Spr:* Warrensburg Area ARC. Johnson County Fairgrounds, 4 miles W of Warrensburg on N side of Hwy 50. Air-conditioned building, Red Cross Communications Van on display, VE sessions, refreshments. *TI:* 146.88. *Adm:* $3. Tables: $10. Keith Raihala, NØVJ, Box 1364, Warrensburg, MO 64093; 660-422-7273; **n0vj@arrl.net**.

†**Missouri (Washington)—Jul 18**, 6 AM to 2 PM. *Spr:* Zero Beaters ARC. Bernie E. Hillerman Park, 1400 N Park Dr; take Hwy 47 to W 5th St to Grand Ave to N Park Dr. Ham Radio/Computer Flea market, commercial vendors, VE sessions (9 AM; walk-ins accepted), technical sessions, ham radio demonstrations, free parking, refreshments. *TI:* 147.24. *Adm:* Free. Tables: $20. Jim Glasscock, WØFF, Box 1305, Washington, MO 63090; 636-584-8888; **jimfoxfox@aol.com** or **w0ff@arrl.net**; **www.wa0fya.org**.

Montana (East Glacier)—Jul 16-18, Montana State Convention. See "Coming Conventions."

†**Nebraska (Chadron)—Jul 10-11**; Saturday 6-9:30 PM (Wilson Park), Sunday 9 AM to 4 PM (National Guard Armory). *Spr:* Pine Ridge ARC. Wilson Park, 10th and Morehead, SW corner of city; National Guard Armory, 455 E 12th, Chadron State College Campus. Picnic (Saturday night), swapfest (Sunday), pot luck dinner. *TI:* 147.36. *Adm:* $5. Tables: Free. Lynn Bilyeu, KØODF, 406 Henkens Dr, Chadron, NE 69337; 308-432-2297; **lynnb@bbc.net**.

†**Nebraska (North Bend)—Jul 17**, 9 AM to 1 PM. *Spr:* Pioneer ARC. St Charles Parish Center, 811 Locust St; 2 blocks N of US Hwy 30 or 2 blocks E of NE Hwy 79. Air-conditioned building, flea market, free parking, refreshments. *TI:* 146.67. *Adm:* $2. Tables: advance $5, door $7 (electricity available). Rich Mehaffey, KBØARZ, 1525 County Rd 5, North Bend, NE 68649; 402-652-3410; **mehaffey@dtnspeed.net**; **home.alltel.net/~jlhoffman/index.htm**.

†**New Jersey (Augusta)—Jul 11**; set up Saturday after 6 PM; public Sunday 8 AM. *Spr:* Sussex County ARC. Sussex County Fairgrounds, Plains Rd, off Rte 206; Rte 80 to Rte 15, Rte 15 turns into Rte 206, turn right onto Plains Rd. Large indoor selling area in Exhibition Building, acres of tailgating ($16 per space), DXCC card checking, handicapped accessible, overnight camping ($15), unlimited free parking, refreshments. *TI:* 147.3. *Adm:* $6, nonham spouses and children free. Tables: $15 (indoor, limited basis). Dan Carter, N2ERH, 8 Carter Ln, Branchville, NJ 07826; 973-948-6999; **hamfest@scarcnj.org**; **www.sussexhamfest.org**.

†**New Jersey (Bayville)—Aug 8**. *Spr:* Jersey Shore ARS. Bayville Firehouse, 445 Rte 9; Garden State Parkway to Exit 80, S Toms River, stay in far right-hand lane, follow ramp back under Parkway keeping to right (US Rte 9), stay on Rte 9 S to Bayville. All indoor air-conditioned, VE sessions. *TI:* 146.91 (127.3 Hz). *Adm:* $5. Tables: $15. Ed Genoino, WA2NDA, 1429 Island View Dr, Forked River, NJ 08731; 609-971-2792; **wa2nda@aol.com**; **www.jsars.org**.

New Jersey (Ewing Township)—Aug 6-8, International EME Conference. See "Coming Conventions."

†**New York (Alexander)—Jul 17,** 6:30 AM to 4 PM. *Spr:* Genesee Radio Amateurs. Fireman's Recreation Center, 10708 Rte 98; NYS Thruway Exit 48 (Batavia), go S on Rte 98 for approximately 10 miles to Alexander, Center is just S of the Village of Alexander. Batavia Hamfest/Computer Show, free indoor/outdoor flea market, vendors, foxhunt (10:15 AM), card checking (DXCC, WAS, VUCC), Hospitality Tent (Friday, Jul 16, 4 PM, free food), Chicken BBQ, camping ($15). *TI:* 147.285, 146.52. *Adm:* $5. Tables: Free. Harold Hay, W2ABQ, 5066 Clinton State Rd No 10, Batavia, NY 14020; 585-343-1330; **wa2abq@localnet.com**; **www.hamgate.net/~gram/**.

†**New York (Frankfort/Utica)—Jul 24**; set up 6 AM; public 8 AM to 2 PM. *Spr:* Utica ARC. Herkimer County Fairgrounds, Cemetery St; NYS Thruway to Exit 30 (Herkimer), at traffic light after exit turn left and bear right, go over bridge, take NYS 5S W, proceed 5 miles to Frankfort Fairgrounds Exit. Flea market, vendors, VE sessions (9 AM), refreshments. *TI:* 145.45. *Adm:* $4. Tables: $5 (plus admission and inside space fee of $3 per space or outside space fee of $2 per space; must be reserved in advance). Bob Decker, AA2CU, 4 Forest Rd, Utica, NY 13501; 315-797-6614; **tbd2626@yahoo.com**.

†**New York (Ithaca)—Aug 7,** 7 AM to 2 PM. *Spr:* Tompkins County ARC. Tompkins County Airport, 68 Brown Rd; from I-81 take Cortland Exit, follow signs to Rte 13 and Ithaca, turn right on Warren Rd, go N 1/4 mile to Brown Rd, go past airport terminal. Flea market, vendors, seminars, VE sessions, refreshments. *TI:* 146.97 (103 Hz). *Adm:* advance $4, door $5. Tables: $10. Doug Reid, NE2T, 105 Sheldon Rd, Ithaca, NY 14850-2501; 607-257-6066; **jdreid@lightlink.com**; **www2.compcenter.com/~tcarc**.

New York (Williamsville)—Aug 7-8, Western New York Section Convention. See "Coming Conventions."

†**North Carolina (Cary)—Jul 17**; set up Friday 6:30-9:30 PM, Saturday 6-8 AM; public 8 AM to 2 PM. *Spr:* Cary ARC. Herbert Young Community Center, 404 N Academy St; corner of N Academy St and Chapel Hill Rd; Exit 290 off I-40 towards Cary, stay on Chapel Hill Rd to N Academy (approximately 2 miles), turn left. Indoor air-conditioned swapfest, outside covered flea market (on lower level of new parking deck, 8-ft height limitation; first-come, first-served basis, NOT before 6 AM; $5 per space plus admission), trading/selling/buying, vendors, dealers, VE sessions (10 AM, walk-ins only; $12 fee), refreshments. *TI:* 146.88. *Adm:* advance $4, door $5. Tables: $10 (6-ft, reserve early). Herb Lacey, W3HL, c/o Cary ARC, Box 53, Cary, NC 27512; 919-467-9608; **w3hl@arrl.net** or **n4nc@arrl.net**; **www.qsl.net/n4nc**.

†**North Carolina (Waynesville)—Jul 24,** 8 AM to 4 PM. *Spr:* Western Carolina ARS. Haywood County Fairgrounds, Hwy 209, near Waynesville and Lake Junaluska; approximately 25 miles W of Asheville; I-40 to Exit 24, S on Hwy 209 for 2½ miles, hamfest on left. Covered flea market, tailgating (free with paid admission), vendors, VE sessions (2 PM, Clyde Fire Department; Norman Harrill, N4NH, 828-253-1192; **normanharrill@worldnet.att.net**), forums, limited on-site camping (Friday night, $10), free parking, refreshments.

TI: 146.76, 146.91 (91.5 Hz), 147.39, 145.19. *Adm:* advance $5, door $6. Tables: $10. Dean Blair, K2JB, 20 Coffey Pl, Asheville, NC 28806; 828-423-3082; **k2jb@arrl.net**; **wcars.org/hamfest/**.

†Ohio (Bowling Green)—Jul 11; set up 6 AM; public 8 AM to 1 PM. *Spr:* Wood County ARC. Wood County Fairgrounds, Junior Fair Building, 13800 W Poe Rd, easy access from State Rtes 64 or 25; take I-75 to Exit 181, turn W onto State Rte 64 for 3.2 miles to W Poe Rd. Trunk sales ($5 per space), VE sessions (9 AM), pancake breakfast (8 AM, $5). *TI:* 147.18 (203.5 Hz). *Adm:* Free. Tables: $5. Bill Wilkins, WD8JWJ, Box 534, Bowling Green, OH 43402; 419-353-9165; **wd8jwj@wcnet.org**.

†Ohio (Cincinnati)—Jul 24; set up Friday 4-7 PM, Saturday 6-8 AM; public 8 AM to 2 PM. *Spr:* OH-KY-IN ARS. Diamond Oaks Career Development Center, 6375 Harrison Ave; located just E of I-275 and I-74; take I-74 to the Rybolt Rd/Harrison Ave Exit, (Exit 11), go E on Harrison Ave to Center on right (S side) of Harrison Ave. All indoors, all air-conditioned flea market (6 AM); vendor area (8 AM; Lynn Ernst, WD8JAW, 859-657-6161; **wd8jaw@arrl.net**); special seminars; transmitter hunts; VE sessions (8 AM, walk-ins accepted); free parking; handicapped accessible; refreshments. *TI:* 146.67. *Adm:* advance $5, door $6, under 13 free. Tables: $10 (6-ft, with free electricity). Bruce Vanselow, N8BV, 4309 Skylark Dr, Cincinnati, OH 45238-5535; 513-251-1555; **n8bv@juno.com**; **www.ohkyin.org**.

†Ohio (Columbus)—Aug 7, 8 AM to 2 PM. *Spr:* Voice of Aladdin ARC. Aladdin Shrine Complex, 3850 Stelzer Rd; exit I-270 at Easton Exit, proceed W to first light, turn right onto Stelzer Rd, Complex is located on right. HAM"OH"RAMA, Code by Toe Contest, VE sessions. *TI:* 147.24. *Adm:* advance $4, door $5. Tables: $10. James Morton, KB8KPJ, 6070 Northgap Dr, Columbus, OH 43229-1945; 614-846-7790; **kb8kpj@arrl.net**; **www.qsl.net/w8fez**.

†Ohio (Randolph)—Jul 25; set up 6 AM; public 8 AM to 3 PM. *Spr:* Portage ARC. Portage County Fairgrounds, 4215 Fairgrounds Rd, between Akron and Youngstown; located off State Rte 44, 1 mile N of US 224 or 4 miles S of I-76. Huge outside flea market ($5 per space), indoor vendors, computers and electronics, VE sessions (bring original and copy of license, photo ID, and fee), ARRL officials, unlimited free parking, restaurant on grounds serving breakfast and lunch. *TI:* 145.39. *Adm:* advance $4, door $5. Tables: $12 (indoor with electricity). Joanne Solak, KJ3O, 9971 Diagonal Rd, Mantua, OH 44255; 330-274-8240; **ljs@config.com**; **www.parc.portage.oh.us**.

†Ohio (Van Wert)—Jul 18; set up 6 AM; public 8 AM to 3 PM. *Spr:* Van Wert ARC. Van Wert County Fairgrounds, on State Rte 127 S; S side of Van Wert. Outside trunk sales (free with paid admission ticket), new and used equipment (radios, computers, software, antennas, power supplies, accessories), VE sessions, overnight parking ($10), free parking during event. *TI:* 146.85. *Adm:* $5. Tables: 8-ft $10 (inside, electricity available; includes 1 free ticket). Stephen Kouts, WA8WKF, Box 347, Van Wert, OH 45891; 419-238-5560; **skouts@bright.net**; **www.w8fy.org**.

†Ohio (Wellington)—Jul 17; set up Friday afternoon; public Saturday 8 AM to Noon. *Spr:* Northern Ohio ARS. Lorain County Fairgrounds, 23000 Fairgrounds Rd (Rte 18); Rte 58 to Rte 18 in Wellington, W on Rte 18, 1 mile to Fairgrounds entrance on S side of Rte 18, next to Brothers Chevrolet/GEO. VE sessions. *TI:* 146.7 (110.9 Hz). *Adm:* $5. Tables: $15. Al Morarity, N8CX, 2140 McKinley Ave, Lakewood, OH 44107; 216-221-3682; **n8cx@mindspring.com**; **www.apk.net/noars/hamfest.htm**.

Oklahoma (Oklahoma City)—Jul 16-17, Oklahoma State Convention. See "Coming Conventions."

Ontario (Mississauga)—Jul 22-25, Central States VHF Society Conference. Peter Shilton, VE3AX, 905-772-8938.

†Oregon (Bandon)—Jul 24, 9 AM to 3 PM. *Spr:* Coos County RC. "The Barn" (Bandon's Community Bldg), SW Eleventh St; 20 miles S of Coos Bay on Hwy 101. Flea market, vendors, programs, VE sessions, refreshments. *TI:* 146.61, 146.52. *Adm:* $3. Tables: $15. Paul Andersen, K7AIA, Box 3009, Coos Bay, OR 97420; 541-888-2050; **k7aia@arrl.net**; **www.coosradioclub.org**.

Oregon (Wilsonville)—Jul 30-Aug 1, 3905 Century Club Convention. See "Coming Conventions."

†Pennsylvania (Kimberton)—Jul 11; sellers 7 AM, buyers 8 AM to 1 PM. *Spr:* Mid-Atlantic ARC. Kimberton Fire Company Fairgrounds, Rte 113, S of the intersection with Rte 23. Valley Forge Hamfest and Computer Fair, Amateur Radio and computer gear dealers, electronics, demonstrations, tailgating ($6 per space, plus admission; no reserved tailgate spaces), refreshments. *TI:* 145.13, 147.06 (131.8 Hz). *Adm:* $6, nonham spouses and children free. Tables: with electricity $10 each (1-4 tables), $8 each (5 or more tables), plus admission. Rick Miskinis, N3AGS, c/o MARC, Box 2154, Southeastern PA 19399-2154; 610-825-9590; **reservations@marc-radio.org** or **hamfest-info@marc-radio.org**; **www.marc-radio.org/hamfest.html**.

†Pennsylvania (Lewistown)—Aug 7; set up 6:30 AM; public 8 AM. *Spr:* Juniata Valley ARC. Decatur Fire Co, 4277 US Hwy 522 N; 8 miles E of Lewistown, in the town of Alfarata, look for signs. Vendors, tailgating ($5, includes admission), refreshments. *TI:* 146.91. *Adm:* $3, nonham spouses and children free. Tables: $10 (electricity $2 extra; bring your own power cords). Cliff Bell, WB3IVX, c/o JVARC, Box 73, Yeagertown, PA 17099; 717-248-2616; **wb3ivx@localnet.com**.

†Pennsylvania (Mountain Top)—Jul 18; set up 6 AM; public 8 AM to 1 PM. *Spr:* Jonestown Mountain Repeater Assn American Legion Post 781, 1550 Henry Dr; I-81 N and S, take Nuangola Exit 159, turn onto Church Rd, go 1.7 miles to American Legion. Hamfest/Computer Show, flea market, electronics, new and used equipment, tailgating, VE sessions (10 AM), Chinese Auction, handicapped accessible, refreshments. *TI:* 146.805 (82.5 Hz), 146.52. *Adm:* advance $4, door $5 (nonham spouses and children free). Tables: advance $8, door $10 ($5 per 8-ft space if you bring your own table). Frank Wolfe, KB3ETK, 453 N Washington St, Wilkes-Barre, PA 18705; 570-825-8856; **n3tsv@arrl.net**.

†Pennsylvania (Pittsburgh)—Aug 8, 8 AM to 2 PM. *Spr:* North Hills ARC. Northland Public Library, 300 Cumberland Rd; McKnight Rte (US Rte 19, truck) to W onto Cumberland Rd, Library on left. Old-fashioned hamfest, tailgating ($5 per space). *TI:* 147.09. *Adm:* Free. Tables: $20. Joseph Springer, AA3TA, 2601 Clare St, Glenshaw, PA 15116; 412-486-1681; **aa3ta@verizon.net**; **nharc.pgh.pa.us**.

†Pennsylvania (Wilkes-Barre)—Jul 3; set up 6 AM; public 8 AM to 3 PM. *Spr:* Murgas ARC. Luzerne County Fairgrounds, Rte 118 (Lehman); from I-81 take Exit 170 B to Rte 309 N to Rte 415 to Rte 118 W for ½ mile, watch for sign on left. Hamfest/Computer Flea Market, dealers, equipment, computer hardware and software, tailgating (1 free 10-ft space per vehicle), VE sessions (10 AM, walk-ins accepted; **jcaffrey@verizon.net**). *TI:* 146.61 (82.5 Hz), 146.52. *Adm:* advance $4, door $5, nonham spouses and under 16 free. Tables: $14 (8 ft, indoors, with electricity). Make check or money order payable to Murgas ARC and send to Ray Gusher, KB3ACO, 29 Eroh Rd, Wapwallopen, PA 18660; 570-379-3934 or 570-574-2294 (cell); **dena6@epix.net** or **n3rn@arrl.net**; **www.qsl.net/k3ytl**.

†South Dakota (Clear Lake)—Jul 24-25; Saturday 6 PM (grilled meal and ragchew only), Sunday 8 AM to 3 PM (all other activities). *Spr:* Deuel County ARC. Clear Lake City Park, N end of 3rd Ave; from junction of Hwys 15 and 22 go N through Clear Lake 1 mile to City Park, on W side of Hwy 15. Flea market, VE sessions, camping. *TI:* 147.18 (146.2 Hz), 145.39. *Adm:* $5. Tables: Free. Dan Kelly, WAØYIN, Box 742, Clear Lake, SD 57226; 605-874-2701; **dkelly@itctel.com**; **www.qsl.net/dcarc/**.

†Tennessee (Clinton/Norris)—Jul 17, 7:30 AM. *Spr:* Appalachian ARS. Old Stuckey's, beside Shoney's Restaurant, 2401 Andersonville Hwy (State Rte 61); from Knoxville take I-75 N to Exit 122 (Oak Ridge/Clinton/Norris Exit), turn right onto SR 61, get into left lane, turn left into Shoney's, then left to Old Stuckey's. Free Swapmeet. *TI:* 147.195 (100 Hz). *Adm:* Free. Christopher George, KU4LV, 104 Joe Owen Rd, Clinton, TN 37716-6878; 865-494-4068; **ku4lv@comcast.net**; **www.meters.org/html/a_a_r_s.htm**.

†Tennessee (Dayton)—Jul 17, 6 AM. *Spr:* Rhea County ARS. Cedar Point Park; located at the junction of Hwys 27 and 30. Tailgating. *TI:* 147.39. *Adm:* Free. Tommy Mize, KO4SY, 433 Magnolia Ave, Dayton, TN 37321; 423-570-0840; **ko4sy@arrl.net**; **rcars.net**.

Texas (Austin)—Aug 6-7, Texas State Convention. See "Coming Conventions."

†Virginia (Berryville)—Aug 1, 6 AM. *Spr:* Shenandoah Valley ARC. Clarke County Ruritan Fairgrounds, located on Rte 7 between Winchester and Leesburg; from I-81, take Exit 315 heading E towards Washington, DC, go approximately 8 miles to flashing yellow traffic light, turn onto Business Rte 7 at traffic light, Fairgrounds on left. Winchester Hamfest/Computer Show, electronics flea market, tailgating ($7 per space, plus admission), commercial dealers, free VE sessions (all classes, walk-ins accepted, registration at noon, exams promptly at 1 PM; Cooley School, across from hamfest; Bill, K3UEZ, 301-729-2544; **K3UEZ@qsl.net**), country ham and egg breakfast, Chicken and Beef BBQ. *TI:* 146.82 (146.2 Hz). *Adm:* $5, under 16 free. Tables: $20 (in air-conditioned building), $15 and $12 (in other buildings). Steve Stewart, W4ARZ, 732 Marple Rd, Winchester, VA 22603; 540-662-7675; **steve732@adelphia.net**; **www.svarc.us/hamfest/index.html**.

†Virginia (Vinton)—Jul 31, 8 AM to 3 PM. *Spr:* Roanoke Valley ARC. William Byrd High School, 2910 Washington Ave; from I-581 take Exit 6, follow Rte 24 E to high school on left, approximately ¼ mile past E Vinton Plaza. Hamfest/Computer Show, flea market, tailgating ($5 per space), forums, VE sessions (11 AM), free parking, refreshments. *TI:* 146.985. *Adm:* $5. Tables: $10 (electrical hookups $10). Phil Roark, K4WFO, 5358 Glenvar Heights Blvd, Salem, VA 24153; 540-387-4487; **k4wfo@arrl.net**; **w4ca.host4www.com**.

†Washington (Chehalis)—Jul 31; set up for commercial vendors only on Friday 6-8:30 PM, Saturday 6-7 AM; public 7 AM to 1 PM. *Spr:* Chehalis Valley ARS. Southwest Washington Fairgrounds, 255 N National Ave; from I-5 take Exit 79, go E to the "T" and turn left, stay on this road for 3 miles, turn left onto Exhibitor St, go 1 block to stop sign, turn left and go 100 ft, turn right into Fairgrounds, follow signs for parking. Tailgate Swapmeet, commercial vendors ($10 for car and 1 space; $5 for each additional space), radio gear, computers, electronics, VE sessions (10:30 AM, by reservation). *TI:* 147.06 (110.9 Hz), 146.46. *Adm:* $5 (at 7 AM), $4 (at 8 AM), $3 (at 9 AM), free (after 10 AM). Tables: advance $6, door $8. John Ellingson, K7OSK, c/o CVARS, Box 304, Chehalis, WA 98532; 360-273-5929; **k7osk@boatanchor.com**; **www.cvars.org/**.

Washington (South Everett)—Jul 16-18, Pacific Northwest DX Convention. See "Coming Conventions."

Attention All Hamfest Committees!

Get official ARRL sanction for your event and receive special benefits such as donated ARRL publications, handouts, and other support.

It's easy to become sanctioned. Contact the Convention and Hamfest Branch at ARRL Headquarters, 225 Main St, Newington, CT 06111. Or send e-mail to **giannone@arrl.org**.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to advertise your event in *QST* at special rates. Make your hamfest a success by taking advantage of this great opportunity. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

W1AVO, Harry V. Rockwell, Riverside, RI
WA1CTQ, Philip J. MacDonald, Westfield, MA
W1DX, Byron Goodman, E Hartford, CT
N1LVH, Walter E. Davis, Henderson, NV
WA1OEI, Mildred L. Smith, Thompson, CT
W1RII, Robert S. Townend, Pittsfield, MA
NB1R, Edwin H. Carpenter, Wilbraham, MA
W1SIP, John L. Brain, Salem, NH
KD1TK, Thomas F. Hayden, Athol, MA
W2AWD, Jaime E. Smith, Belen, NM
*W2DX, Julius J. Altman, Deer Park, NY
KE2FZ, Eugene Harrington, Hackensack, NJ
N2GUT, Andrew M. Johnston, Toms River, NJ
WB2HWK, Frank E. Brown Sr, Fishkill, NY
W2KHL, Frederick Boenig, Millington, NJ
KD2PP, Carl P. Erhorn, Patterson, NY
W2UAS, Edwin A. Goldberg, New Bern, NC
WA2UDV, Fred S. Greenbaum, Marlton, NJ
N3DFM, Irving J. Mock, Wallingford, PA
WB3FUJ, Rotha Kent, Brooksville, FL
AA3LF, Jerome A. Burstein, Havertown, PA
K3LUW, Audley T. Lloyd Jr, White City, OR
KA3MVJ, Carl F. Luppold, Bernville, PA
W3NBR, George H. Wilmot, Stuart, FL
KC3YE, Seth J. Ward, Pittsburgh, PA
KF4AQJ, Herman L. Wheeler, Bristol, VA
WB4CDS, Hargis Flanary, Gate City, VA
KA4CPT, Stanford S. Lane, Kingsport, TN
N4DZX, Ernest C. Bivens, Delano, TN
KD4EWW, Edward W. Blackford, Nashville, TN
KI4FE, Porter F. Chambers, Mobile, AL
WA4FHG, William T. Webb, Bay Minette, AL
W4GB, George W. Ball Jr, Washington, NC
W4HCN, S. A. Llewellyn, Winter Park, FL
K4JND, John J. Gordon Jr, Panama City, FL
KD4JYL, Joseph S. Northup, Nicholasville, KY
KW4LA, Ralph E. Small Jr, Palm Bay, FL
*N4NE, James R. Buckler, Melbourne Beach, FL
WA4PMN, Lawrence E. Harris, Mobile, AL
NB4P, Paul D. Steiner, Gloucester, VA
KA4REE, Loraine F. Schoenfelder, North Augusta, SC
WA4UHP, Herbert L. Murdock, Chattanooga, TN
KC4UPU, Margaret H. Slipsager, Charlotte, NC
W4VOS, John H. Jensen Jr, Kingsport, TN
KK4XE, Ray T. Jones Sr, Owensboro, KY
WB5FHA, Donald C. Castle, Coldwater, MS
W5GHP, Robert P. Schmidt, Slidell, LA
WD5HCB, Leo H. Bressan, Albuquerque, NM
W5IJ, Scott Young, Alva, OK
K5IQZ, Dan Whelchel Jr, Westlake, LA
K5JJO, Cecil M. Powers Sr, Whitney, TX
W5JNT, Erich W. Schwartze, Waco, TX
K5KVT, Cecil F. King, Waco, TX
WG5L, Friedrich J. Isermann, Dallas, TX
W5MEB, Clyde J. Burt, Ruidoso, NM
WB5PXH, Reba P. Chumley, San Augustine, TX
W5QCB, Milton Haines, San Antonio, TX
KB5RQK, David Farmer III, Vidalia, LA
KC5RUS, Scott A. VanOmen, San Fidel, NM
WB5VFF, Joe D. Spikes, Port Arthur, TX
K5ZEP, Frank W. Bishop, Muskogee, OK
*W5ZY, Frank R. Stockton, Mena, AR
KJ6AK, Michael L. Bowman, Riverside, CA
WB6BPT, John R. Thompson, Camarillo, CA
K6BTY, Edward Y. Ching, San Leandro, CA
W6BWZ, Joseph A. Strazzarino, Sacramento, CA
WB6DJK, Alan V. Anslinger, Bakersfield, CA
N6ECH, John J. Rosa, Hanford, CA
KN6EC, Kenneth L. Newkirk Jr, Long Beach, CA
KI6GV, Ted Tarr, Poway, CA
K6HAE, Alexander J. Evangelista, La Canada, CA
KO6HH, Don W. Hayden, Los Gatos, CA
WB6KGB, Robert D. Igou, Florida City, FL
WB6NOP, John D. Light, Penryn, CA
*WA6OCI, Adam Quandt, Palmdale, CA
KG6PD, Clifford Hudson, Hesperia, CA
*KH6PF, Kinji Kanazawa, Honolulu, HI
KE6QHH, Michael Gentle, Kanab, UT
K6QWH, Howard W. Barnes, Sun City, AZ
W6TZD, Eugene C. Dvorak, Running Springs, CA
KA7BLG, Lloyd L. Connell, Kennewick, WA
WA7BMY, Howard C. Light, Yakima, WA
K7CIN, John W. Leger, Phoenix, AZ
KC7EEZ, Floyd P. Rollins, Tacoma, WA
N7ESJ, Charles P. Krause, Myrtle Beach, SC
WG7E, Robert N. Stanfield, Boise, ID
KI7EY, Harvey L. Welsh, Henderson, NV
WB7EZI, Fairylee Dedrickson, Bandon, OR
KC7GCQ, Michael R. Adams, Leavenworth, WA
W7GIP, Joseph K. Swank, Tacoma, WA
KD7GTR, Gerald L. Boaglio, Longview, WA
*K7PO, Donald B. Sturtevant, Billings, MT
KC7TFR, Deanna L. Ash, Nampa, ID
W7UPS, Andreas J. Norgaard, Winnemucca, NV
KB7VAN, Joyce E. Smith, Boise, ID
K7ZGD, Michael E. Donnelly, Phoenix, AZ
K8AXV, Willard F. Hibbard II, Battle Creek, MI
K8BOL, William T. Mackay Sr, Grand Haven, MI
WD8BWD, Robert L. Mc Million, Belpre, OH
KC8CKN, Jerry G. Beavers, Kincaid, WV
KC8GIW, Donald E. Hartley, W Alexandria, OH
N8JRM, Jose R. Martinez, Fayetteville, WV
KC8KFW, William M. Wilt, Monroe, MI
*N8ML, Melvin M. LaGrone, Lake City, MI
WA8PCT, Frederick Barnes, Parma, OH
W8UWO, Milton E. Ludwig, Chelsea, MI
N8VTX, Donald L. Cecil, Piqua, OH
W9CFS, Clifford R. Sprague, Stevens Point, WI
W9FJE, Allois F. Geiersbach, Milwaukee, WI
*W9HDR, Philip B. Nesty, Concord, CA
WA9IMF, Leo C. Rogers, Necedah, WI
ex-W9JQK, Raymond E. Hill, Helenville, WI
N9JVN, Beverly Offutt, Cloudcroft, NM
N9PUR, Ivan D. Fry, Tomahawk, WI
KB9QJN, Eddie W. Degner, Merrill, WI
W9RCJ, Joseph L. Blahunka, Lockport, IL
KD9RH, John E. Hodel, Columbus, IN
WA9RSO, Paul M. Wall, Mount Vernon, IL
*WA9ZDC, Raymond L. Swartwout, Downers Grove, IL
KØCKX, Eugene V. Weiner, Woodinville, WA
WØENG, James H. Neal, Monument, CO
*KØFPC, Robert V. Davis, Overland Park, KS
AAØHF, Florence R. Schneider, Arvada, CO
WØKNF, Royal D. Beilsmith, Slater, MO
NØOSH, Martha L. Phoenix, Macomb, IL
WØOY, Del J. Rairigh, Sandia, TX
WØSEG, William L. Lukehart, Cedar Rapids, IA
KBØTDT, John L. Steege, Minneapolis, MN
WØWLN, Robert N. Jensen, Racine, WI
NØXUM, Donald A. Limoges, Urich, MO
WBØZQD, Rosemary Powers, Fort Collins, CO
DK9HZ, Peter G. Zielke, Drage, Germany
G4GKO, Ronald Roden, Hassocks, Great Britain
V51C, Ian N. Sutherland, Walvis Bay, Namibia

*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

AMSAT-UK SPACE SYMPOSIUM 2004

◊ AMSAT-UK will be holding a Space Symposium at the University of Surrey in Guildford, England, from July 30-August 1. This event, which attracts radio amateurs from across Europe as well as North America, Africa, Asia and the Pacific, provides a unique opportunity to rub shoulders with the designers of the latest amateur satellites and find out the latest news.

As in previous years there will be special beginner's sessions to teach newcomers how to get started in the fascinating world of Amateur Radio space communications. An antenna testing range will be available to enable you to check out the gain of your latest antenna. Microwave experts will be on hand with test equipment covering up to 24 GHz.

There will be guided tours of the Surrey Space Centre with the satellite mission control centre and the satellite assembly facility. These tours provide a unique opportunity to see satellites in various stages of construction. The RSGB GB4FUN van, which has a fully equipped satellite station, will be available during the event for visitors to work the satellites.

Throughout the event there is an extensive lecture program ranging from highly professional technical presentations to basic down to earth "how to do it" type talks.

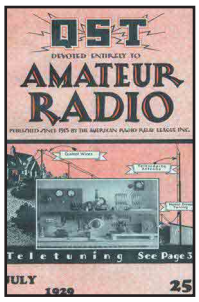
Guildford is 40 miles from Central London and easily reached from both London-Heathrow and London-Gatwick airports. Details of packages covering meals and accommodations are available from Jim Heck, G3WGM, tel +44 1258 453959; **g3wgm@amsat.org**; **www.uk.amsat.org**.

QST congratulates...

◊ ARRL West Gulf Division Vice Director Dr David Woolweaver, K5RAV, who has been named vice president of the 7900-member Texas Dental Association.

75, 50 AND 25 YEARS AGO

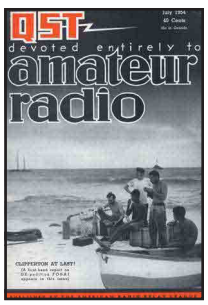
July 1929



♦ The cover illustration shows the high-tech, modern station of W8CEO, which features "Teletuning." The editorial discusses the upcoming international meeting to discuss radio regulations and uniformity thereof among the various countries.

Ed Braddock, W3BAY, tells about "The Lunch-Kit Portable Receiver and Monitor," a miracle of miniaturization that he built into a lunchbox. League President Hiram Percy Maxim, W1AW, discusses "DX Dreaming," tantalizing the reader with the thought that we have now investigated the radio spectrum pretty thoroughly, but have not yet found any signals that came from other intelligent life forms. He then asks the questions, "Is ours the sole intelligence in all the cosmos? Will it be an amateur who first answers this great question?" J. M. Grigg analyzes and compares methods of "Radio Frequency Couplings." Don Wallace, W6AM, tries "High-Frequency Reception on Trains" as he travels from Washington, DC, to California. William Lee, W1BCY/W8AKE, tells about his professional involvement in testing RF treatment on tumors in small animals, in "QRH Rats, Mice and Bacteria." The article "W8CEO" tells about a ham station with remotely tuned antennas and modern equipment. This issue features a photograph of The Old Man submitted to the Headquarters gang by TOM himself! Is he is pulling our legs…or is it *really* him?

July 1954



♦ The cover photo shows a bunch of tired hams who just made shore, "Clipperton at last!" The editorial, "Mail Exam Procedures," continues to discuss the recent changes in exam procedures, with hams now administering the exams instead of the FCC.

Bob Denniston, WØNWX, tells about the "DXpedition to Clipperton," one of the great DXpeditions to date. John Simon, W5SCE, tells about his "813s in a High-Power Linear." Vern Chambers, W1JEQ, describes how to build and use "Single-Ended Multiband Tuners," and R. W. Johnson, W6MUR, offers "Multiband Tuning Circuits." Roger Peters, WØWHZ, gives tips on receiver design and construction, in "Invading Never-Never Land." F. E. Ladd, W2IDZ, presents Part II of "50 Mc. TVI: Its Causes and Cures." John Morris, W3IFS, discusses "Communications in Civil Defense." In "The World Above 50 Mc.," Ed Tilton, W1HDQ, reports on the first attempt at a transcontinental relay on 2 meters; it wasn't successful, but a last-minute sidebar reports that the second attempt met with success during the weekend of May 29-31. In the World Radio Laboratories ad, Leo I. Meyerson, WØGFQ, proudly announces the new 500-watt, completely bandswitching Globe King AM/CW transmitter, available for $675.

July 1979

♦ The cover montage promotes the 1979 National Convention, to be held in Baton Rouge, Louisiana. The editorial reminds League members to cast their vote in the election of their division's director.

"Amateur Radio, A Light in the Darkness" tells about ham nets supplying up-to-date propagation data during the February solar eclipse. The compilation of articles was written by Dave Baysinger, WBØBAE; Allen Lefohn, KA7CBV; Bill Standing, AC7G; Phil Bondurant, WA7ZWD; Ken Johnson, W7LIX; Marvin Johnston, W7ACP; and Roy Smith. Dana Atchley, W1CF, writes about "Putting the Quarter-Wave Sloper to Work on 160." Leaving the theoretically perfect world of theory behind, Stan Gibilisco, W1GV, explains "The Imperfect Antenna System and How It Works." Vincent Quaresima, K2NE, and Steve Houck, WA3RKM, show and describe "The Cornwall Collinear," a 12-bay array for 6 meters. Roy Usher, VE6EA, puts on "Slippers for a QRP Transceiver," to produce 20 watts output. Roger Blood, WA4HBZ, tells us how to build "A Digital Morse Code Clock" that generates Morse audio signals for hours and minutes—our wife will love it! Ken Powell, WB6AFT, describes "The Weekender: A Simple Crystal Calibrator." "WARC Countdown" explains the WARC possibilities that exist for ham radio. In the "Public Service" column, WB1BZR presents "Some thoughts on BPL," opining that perhaps the Brass Pounders League should be done away with. 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

A Response to "Reconstituting the Packet Network"

By Carl R. Stevenson, WK3C

In the March 2004 issue of *QST* [Op-Ed, page 94], John Clifford, KD7KGX, spoke about the decline in the use and, by implication at least, the geographical coverage and connectivity of our packet radio network: *"... in the past decade we have let one of our primary assets, the packet radio network, waste away to a point where it is more of a plaything than a valuable nationwide communications network. I believe that we need to change this, and reconstitute the amateur packet radio network quickly ... and make it better than it ever was*."

I agree to a large extent with some of Mr Clifford's assertions and goals, but I differ with his views on a solution.

"Fixing Packet Radio"

Mr Clifford goes on to say: *"...Our goal should be to create a national network of packet radio nodes that allows transferring messages between every community in the country without using non-Amateur Radio infrastructure (like the Internet)."*

While this sounds on the surface like an admirable goal (and it is), I believe that it is, and will likely remain, largely unrealizable. We are simply too "thin on the ground" in much of the country to provide truly ubiquitous connectivity via packet radio. We can provide coverage on a community or regional basis, but to span many of the huge areas of this country in between those centers of population density will almost certainly continue to be a problem because of the number of relay nodes required to interconnect the areas where there is activity.

On Data Rates

Mr Clifford correctly recognizes: *"First, we need to increase the rate at which data is transferred. After using the Internet at 56k or running DSL, the current VHF-based 1200 baud packet radio network is excruciatingly slow."*

On this point, I agree wholeheartedly. But he goes on to say, *"However, being text-based, it doesn't have to be that much faster to feel a whole lot faster,"* ultimately concluding that *"9600 baud is fast enough."*

On this point I must respectfully, but vigorously, disagree in several respects. Any system that lacks the speed and capacity to support a much wider variety of services to users than text-based packet radio à la the heyday of the "BBS" will not be viable today (and increasingly so in the future). Here's my first cut list of applications that need to be supported:

- E-mail
- Interactive keyboard-keyboard "chat," including 1 to 1 and 1 to many
- Efficient file transfers, including distribution of files to many recipients (files may be data, programs, pictures—whatever)
- "SMS"-like text messaging to portable devices with limited display capability
- Voice over IP
- Video for conferencing and disaster scene assessment
- Personal "Web pages"

We Need a Paradigm Shift

What has driven the decline in interest in, and use of, packet radio are the limitations associated with the paradigm of interfacing to an existing (FM voice) radio via the mike and speaker jacks (or some sort of user-installed "kluge" into the modulator/discriminator circuits).

What we need for amateur digital communications to flourish today and in the future are true RF modems—*entire radios that are purpose-designed from the start to transmit data efficiently and at high rates*—that interface directly with our computers via Ethernet or USB interfaces and have an antenna connector on the other end.

TCP/IP would be the protocol of choice, because of its ubiquity and the fact that virtually all of the necessary application software already exists on our computers.

Summary

To quote Mr Clifford, *"Let's fast-forward to the near future, when the High Speed Amateur Packet Radio Network is fully functional."—indeed*—but a 9600 baud text-based system is *not* "the future"; it is a failure from the past.

I would assert that the minimum user data rate we should target should be on the order of 384 kB/s—the minimum sufficient for near-full-motion video. That rate will also allow time-multiplexing of multiple user data streams with sufficiently low latency to provide a satisfying "user experience" on applications that are far less demanding than video, such as e-mail, interactive messaging and file transfers.

If we can field *that* widely, we'll have something useful enough to be worth doing and that will stand a chance of being widely accepted and lasting for a while.

A 9600 baud text-based system won't "cut it." If it would, it would have happened already, as that technology has been readily available for many years.

Licensed since the mid-'70s, Carl R. Stevenson, WK3C (ex-WA6VSE, ex-WT6NAB) holds an Extra Class amateur license and a Commercial Radiotelephone license. He has spent over 32 years in the RF communications industry, mostly as an RF circuits and systems engineer, working from HF through the microwave region, and holds a number of patents in the area. His main interests are new technology, regulatory affairs and public service communications. He's a Life Member of the ARRL, a Fellow of the Radio Club of America, a Senior Member of the IEEE, a Member of QCWA and Executive Director of No-Code International. You can reach the author at 4991 Shimerville Rd, Emmaus, PA 18049; **wk3c@wk3c.com**.

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.

CONTEST CORRAL

W1AW Qualifying Runs are 10 PM EDT Wednesday, July 7 (0200Z July 8) (35-10 WPM QRSR), and 9 AM Friday, July 23 (1300Z July 23). The K6YR West Coast Qualifying Run will be at 9 PM PDT Wednesday, July 14 (0400Z July 15). Check the W1AW Schedule elsewhere in this issue for details.

Abbreviations

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

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.

July 1-4

Canada Day Contest—CW/Phone—sponsored by the Radio Amateurs of Canada (RAC) from 0000Z-2359Z Jul 1. Frequencies: 160-10, 6 and 2 meters. Categories: SOAB (HP (>100 W), LP, QRP (<5 W), SOSB, MS (LP, HP), MM. Exchange: VE1-9 send RS(T) and province or territory, VEØ and non-VE send RS(T) and serial number. QSO points: VE and VEØs—10 pts, non-VE—2 pts, RAC official stations (suffix of –RAC)—20 pts. Score: QSO points × Provinces/Territories counted once per band and mode. For more information: **www.rac.ca/opsinfo/infocont.htm**. Logs due Jul 31 to **ve5cpu@rac.ca** or Radio Amateurs of Canada, 720 Belfast Rd, Ste 217, Ottawa, ON K1G 0Z5, Canada.

MI QRP Jul 4th CW Sprint—2300Z Jul 2-0300Z Jul 3 (see Jan *QST*, p 98, or **www.qsl.net/miqrpclub**).

Bahia Independence Contest—SSB/CW—sponsored by LABRE from 2100Z Jul 2-2100Z Jul 3 (SSB) and from 2100Z Jul 3-2100Z Jul 4 (CW). Frequencies: 160-10 meters. Categories: SO (SSB, CW, Mixed). Exchange: RST and serial number. QSO points: with non-Bahia stations—1 pt, with Bahia stations (PY6)—4 pts, with PY6AA—30 pts. Total score: QSO points × PY prefixes counted once per band. For more information: **www.labreba.org.br**. Logs are due Jul 31 to **labreba@cdl.com.br** or LABRE BA, Rua dos Radioamadores 73, Parque Pituaçu, CEP 41700-000, Caixa, Brasil.

Venezuelan Independence Day Contest—CW/SSB—sponsored by the Radio Club Venezolano from 0000Z Jul 3-2400Z Jul 4. Frequencies: 160-10 meters. Categories: SOAB and SOSB (CW, SSB and mixed), MS (mixed mode). Exchange: RS(T) plus serial number. Work any station—not just YV. QSO points: Own country—1 pt, different country, same continent—3 pts, different cont—5 pts. Score: QSO points × YV call areas + DXCC entities counted once per band. For more information: **radioclubvenezolano.org/concurso.htm**. Logs due Aug 31 to **contestyv@cantv.net** or Radio Club Venezolano, Concurso, Independencia de Venezuela, PO Box 2285, Caracas 1010-A, Venezuela.

DL-DX-RTTY-Contest—RTTY/PSK—sponsored by the DL DX RTTY Contest Group (DRCG) from 1100Z Jul 3 -1059Z Jul 4. Frequencies: 80-10 meters. Categories: SOAB and SO-Dipole/Ground-Plane (full-time, 6 hour), MS. Exchange: RST + serial number. QSO points: own country—5 pts, diff country—10 pts, diff continent—15 pts, with DL station add 3 pts from EU, 5 points elsewhere. Score: QSO points × DXCC entities + VK/VE/JA/W call areas from each band. For more information: **www.dl-dx.de**. Logs due Aug 10 to **logs@dl-dx.de**.

DARC 10-Meter Digital "Corona"—RTTY/AMTOR/PACTOR/PSK31/Clover—sponsored by Deutscher Amateur Radio Club from 1100Z-1700Z Jul 4 (see Nov *QST*, p 110, or **www.darc.de/referate/dx/**).

July 10-11

IARU HF World Championship—1200Z Jul 10 to 1200Z Jul 11 (see Apr *QST*, p 109, or **www.iaru.org/contest.html**).

FISTS Summer Sprint—CW—1700Z-2100Z Jul 10 (see Feb *QST*, p 103, or **www.fists.org**).

QRP ARCI Summer Homebrew Sprint—CW—2000Z-2400Z Jul 11 (see Dec *QST*, p 84, or **2hams.net/ARCI/sumhom.htm**). Add the following bonus points for each band on which homebrew gear is used; 2000 pts for homebrew transmitter, 3000 pts for homebrew receiver, 5000 pts for homebrew transceiver.

UK DX Contest—RTTY, sponsored by the Scottish-Russian ARS from 1200Z Jul 10-1200Z Jul 11 (see June *QST*, p 98, or **www.srars.org/ukdxcruleseng.pdf**).

July 16-18

World-Wide Mid Summer Six Club Contest, sponsored by the Six Club from 2300Z Jul 16-0300Z Jul 18 (see June *QST*, p 98, or **6mt.com/contest.htm**).

North American RTTY QSO Party—sponsored by the *National Contest Journal* from 1800Z Jul 17-0600Z Jul 18. Frequencies: 80-10 meters, 100 W max power. Categories SOAB and M2, SO stations operate 10 hours max with off times of at least 30 min. Exchange: Name and SPC. QSO points: 1 pt/QSO. Score is QSO points × SPC (NA entities only) counted once per band. DX QSOs count for QSO points, but not as multipliers. For more information: **www.ncjweb.com**. Logs due 14 days after the contest to **rttynaqp@ncjweb.com** or Wayne Matlock, K7WM, Rte 2 Box 102, Cibola, AZ 85328.

CQ WW VHF Contest—all modes—sponsored by *CQ Magazine* from 1800Z Jul 17-2100Z Jul 18. Frequencies: 50 and 144 MHz bands, except 146.52 MHz (and other national simplex calling frequencies) and repeater frequencies. Please avoid the DX windows and international calling frequencies. Categories: SOAB, SOSB, MM, Rover, QRP (<10 W). Exchange: Call sign and four-digit Maidenhead grid. Work Rover stations in each grid. QSO points: 50 MHz—1 pt, 144 MHz—2 pts. Score: QSO points × grids counted once per band (Rovers count grids from each activated grid). For more information: **www.cq-amateur-radio.com**. Logs in Cabrillo format due Sep 1 to **cqvhf@cqww.com** or CQ VHF Contest, 25 Newbridge Rd, Hicksville, NY 11801.

CQC Great Colorado Gold Rush—CW—sponsored by the Colorado QRP Club, from 2000Z-2200Z Jul 18. Frequencies: 20 meters only. Categories: Wire, Vertical, Beam or Portable. Exchange: RST + SPC + Category + CQC member number or power output. Work stations up to three times during the contest, with at least 30 min between QSOs. QSO points: 1st QSO—3 pts, 2nd QSO—2 pts, 3rd QSO—1 pt. Score: QSO points × SPC + CQC members. For more information: **www.cqc.org/contests**. Logs are due 30 days after the contest to **contest@cqc.org** or Colorado QRP Club, PO Box 17174, Golden, CO 80402-6019.

July 24-25

RSGB Islands-On-The-Air Contest—CW/SSB—sponsored by the RSGB from 1200Z Jul 24-1200Z Jul 25. Frequencies: 80-10 meters. Categories: SOAB (SSB/CW/Mixed), SOAB-Limited (SSB/CW/Mixed, 12 hours max), MS. All categories Island or World (non-Island). Exchange: RS(T) and serial number, Island stations add IOTA reference number. QSO points: Contacts with own IOTA—3 pts, with other IOTA—15 pts, non-island—3 pts. Score: QSO points × IOTA refs, counted once per band and mode. For more information: **www.contesting.co.uk/hfcc/iota.shtml** or **iotacontest@rsgbhfcc.org**. Logs due Sep 1 to **iota.logs@rsgb.org** or RSGB IOTA Contest, PO Box 9, Potters Bar, Herts EN6 3RH, England.

Russian RTTY WW Contest, sponsored by *Radio* from 0000Z Jul 24-2400Z Jul 25. Frequencies: 80-10 meters. Categories: SOAB, SOSB, MO, SWL. Exchange: RST + CQ Zone number + Russian oblast. QSO points: 5 pts—own continent, 10 pts—diff cont. Total score: QSO points × DXCC entities and oblasts counted once per band. For more information: **www.radio.ru**. Logs due Sep 1 to **contest@radio.ru** or Russian RTTY WW Contest, Radio Magazine, Seliverstov per 10, Moscow 107045, Russia.

Flight of the Bumblebees—CW—sponsored by the Adventure Radio Society, 1700Z-2100Z Jul 25. Bumblebees are low power portable stations that walk, bike or boat to their sites and sign /BB after their calls. Frequencies (MHz): 7.040, 14.060, 21.060, 28.060. Exchange: RST, S/P/C and Bumblebee Number or power (5 W max). Score: QSOs × number of different Bumblebees contacted ×3. For more information: **www.arsqrp.com/ars/pages/bumblebees/bb_rules.html**. Logs due 14 days after the contest via the ARS Web site. QST

FEEDBACK

◊ In "A Q&D Multiband Antenna" [June 2004], Note 1 at the bottom of page 59 should read: "…it will present a 50 Ω load to the transmitter…" rather than "…it will present a 50 W load to the transmitter…"

◊ The following corrections need to be made to "The Ten-Tec 6 Meter Transverter on 12 or 17 Meters" [June 2004, Table 1, page 41]. Change the following parts values: C8, 12 meters—1500 pF; add C10, C11—150 [100] pF; change C15, 12 meters—100 pF; C16, 12 meters—100 pF; C40, 17 meters—[100] pF; L7, 12 meters—0.68 µH. The part number for L15, 17 meters, should be [M8033-ND]. In addition, L3 is no longer available as a Toko part. It is now wound on an L43-2 Amidon core and Reference 1 should now read: "Wind 25T [19T] close spaced 36 gauge enameled wire on an Amidon L43-2 form. Use a drop of Q-Dope to secure the winding. Cut off the three pins not used." The schematic diagram [Figure 1, pages 42-43] should be likewise corrected.

◊ In Figure 13, page 38, and the text on page 39 of "A 75 foot Top Loaded Vertical Antenna" [June 2004] the 3.51 MHz impedance should read 64.7 + *j*76.6 Ω. The 765 pF capacitor should be shown at the right edge of the 3.2 µH inductor.

◊ In Figure 5 (schematic), page 30, of "Give That Drake Receiver a New Lease on Life" [June 2004] U2 should have its "+" and "–" symbols reversed. The pinout is correct, however. In the parts list on page 32, relay K1 is manufactured by Omron, not Orion.

◊ The large photo on the cover of the June 2004 issue was taken by Brenda Diamond-Rose, KB3ATI.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

SPECIAL EVENTS

Green Bay, WI: Green Bay Mike and Key Club, K9EAM. 0100Z **Jun 19**-1800Z **Jul 2**. In celebration of Green Bay's Sesquicentennial. 21.245 14.245 7.245 3.845. QSL. Green Bay Mike and Key Club, PO Box 13351, Green Bay, WI 54307.

La Crosse, WI: Riverland Amateur Radio Club, W9L. 1500Z-2200Z **Jul 2**. The Grand Excursion recreating the 1854 steamboat expo. 21.280 14.280 7.280. Certificate. Roger Reader, KA9BKK, 526 13th Ave N, Onalaska, WI 54650.

Ashland, OH: Ashland Area Amateur Radio Club, W8O. 1400Z **Jul 2**-2200Z **Jul 3**. Ashland BalloonFest 2004. 7.275 7.235 3.975 3.935. Certificate. W8RPS, 834 CR 30A, Ashland, OH 44805.

Brookings, SD: Brookings Amateur Radio Research Club, WØBXO. 1400Z **Jul 2**-0001Z **Jul 3**. The 125th Anniversary of the City of Brookings, SD. 28.450 21.350 14,260 7.260. QSL. WØXO, 307 Third Ave, Brookings, SD 57006. **www.qsl.net/brrc/**.

Leavenworth, KS: Pilot Knob Amateur Radio Club, KSØLV. 1700Z **Jul 2**-2400Z **Jul 11**. Lewis & Clark/Leavenworth, KS, Sesquicentennial Celebration. 21.370 14.240 7.262 3.902. QSL. The Pilot Knob Amateur Radio Club Inc, PO Box 632, Leavenworth, KS 66048.

Hannibal, MO: Hannibal Amateur Radio Club, WØMTL. 1400Z-2300Z **Jul 3**. National Tom Sawyer Days. 21.350 14.250 7.250. Certificate. Robert G. Mitchell, 816 Long Dr, Quincy, IL 62305.

Smithville, TN: DeKalb County Amateur Radio Club, KC4GUG. 1400Z-2200Z **Jul 3**. 33rd Annual Smithville Fiddlers Jamboree & Crafts Festival. 28.425 21.325 14.280 7.275. QSL. Wm Freddy Curtis, 288 Dogwood Cir, Smithville, TN 37166. **www.geocities.com/kg4bto1/dekalb_club.html**.

Kingsville, TX: Wild Horse Desert Hams ARC, K5WHD. 0000Z **Jul 3**-0000Z **Jul 4**. 100th anniversary of the founding of Kingsville, TX. 28.350 21.350 14.250 7.250. QSL. Pat Allison, KD5TXD, 295 E FM 1118, Kingsville, TX 78363.

Lake Kiowa, TX: Lake Kiowa ARC, K5L. 0001Z **Jul 3**-2359Z **Jul 4**. Lake Kiowa July 4th Celebration. 21.250 14.250 14.170 7.072. Certificate. Jim Innis, K5SP, 1005 Kent Dr, Gainesville, TX 76240.

Fort Missoula, MT: Hellgate Amateur Radio Club, W7PX. 1500Z **Jul 3**-0000Z **Jul 5**. Lewis and Clark Expedition and Independence Day. 28.365 21.365 14.265 7.265. QSL and Certificate. HARC, POB 3811, Missoula, MT 59806-3811. **pweb.amerion.com/k7vk**.

Beecher, IL: Hams of Beecher, W9B. 1600Z-2300Z **Jul 4**. 4th anniversary Welcome Home Beecher Train Depot. 28.340 14.270 14.040 7.270 146.49. Certificate. Gene Backlin, 26811 Greenbriar Dr, Monee, IL 60449.

Thompson, OH: Lake County Amateur Radio Association, N8GB. 1400Z **Jul 4**-0200Z **Jul 5**. Heritage of Our Country—Happy Birthday America. 2.1320 7.248. Certificate. George R. Bair, 386 Cedarbrook Dr, Painesville, OH 44077.

Van Wert, OH: Van Wert Amateur Radio Club, W8FY. 1400Z-2000Z **Jul 5**. Holiday at Home—Van Wert County Historical Museum. 14.250 7.250 7.050. Certificate. Van Wert Amateur Radio Club, PO Box 602, Van Wert, OH 45891.

Austin, TX: Naturist Amateur Radio Club, NU5DE. 0000Z **Jul 8**-2400Z **Jul 11**. Annual Nude Awareness Celebration—Nude Recreation Week. 28.465 21.365 14.265 7.265. Certificate. Naturist Amateur Radio Club, PO Box 200812, Austin, TX 78720. **www.nu5de.org**.

Trenton, MI: Motor City Radio Club, W8MRM. 1600Z **Jul 9**-2359Z **Jul 11**. 29th Annual Trenton Mid-Summer Festival. 14.244 14.044 7.244 7.044. Certificate. Motor City Radio Club, W8MRM, Trenton Mid-Summer Festival Station, PO Box 337, Wyandotte, MI 48192. **www.W8MRM.org**.

Alexandria, VA: Alexandria Radio Club, W4HFH. 1600Z **Jul 10**-0300Z **Jul 11**. Alexandria Radio Club's 50th anniversary (1954-2004). 14.250 14.050 7.250 7.050. QSL. Alexandria Radio Club, W4HFH, PO Box 30721, Alexandria, VA 22310.

Morris Canal, NJ: Nutley Amateur Radio Society, W2GLQ. 1300Z **Jul 10**-2200Z **Jul 11**. First Historic Morris Canal Special Event, from several locations along the canal. General portions of the bands. QSL. Nutley ARS, c/o American Red Cross Building, 169 Chestnut St, Nutley, NJ 07110. QSL for each location; certificate for all. **hometown.aol.com/kc2aup**.

Westchester, IL: Chicago Suburban Radio Association, N9BAT. 1700Z **Jul 10**-0100Z **Jul 12**. Celebrating at Westchester Fest, CSRA's 80th anniversary. 147.225 21.330 14.290 7.260. Certificate. Ray Good, 855 S Kenilworth, Oak Park, IL 60304.

Perkasie, PA: RF Hill Amateur Radio Club, W3AI. 1600Z-2000Z **Jul 11**. Pennridge Community Day. 14.250 7.250. Certificate. Special Event Station, RF Hill Amateur Radio Club, PO Box 336, Perkasie, PA 18944. **www.rfhill.ampr.org**.

Kane, PA: Kane Amateur Radio Operators, AA3GM. 1800Z **Jul 16**-1300Z **Jul 18**. Celebrating the annual Kanefest Festival. 28.355 21.355 14.255 7.255. Certificate. Kenneth T. Frankenbery, 5111 Glenwall Dr, Aliquippa, PA 15001.

Wapakoneta, OH: Reservoir Amateur Radio Association, K8QLY. 1300Z-1900Z **Jul 17**. Celebrating the 35th anniversary of landing on the moon. 14.250 7.260. Certificate. Walter Vogel, WB8FNB, 14455 CR 66A, St Marys, OH 45885.

Birmingham, AL: Birmingham Amateur Radio Club, W4CUE. 1500Z **Jul 17**-2300Z **Jul 18**. Birmingham Amateur Radio Club's 78th anniversary. 28.480 21.360 14.050 14.260 7.250 3.850. QSL. W4CUE, PO Box 603, Birmingham, AL 35201-0603. **www.w4cue.com**.

Baton Rouge, LA: USS *Kidd* ARC/Baton Rouge ARC, W5KID. 0001 **Jul 17**-2359 **Jul 18**. Museum Ships Weekend Event. 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. **www.lsu.edu/brarc/USS_Kidd.htm**.

Boston, MA: Raytheon Portsmouth SubSig Amateur Radio Club, K1WEW. 0001Z **Jul 17**-2359Z **Jul 18**. USS *Constitution* Special Event Station for Museum Ships 2004. 14.275 7.225 3.850 146.46. QSL. Eric K. Jamieson, KO1K, 60 Norman Dr, Tiverton, RI 02878. **www.qsl.net/k1usn/event.html**.

Quincy, MA: USS *Salem* Radio Club, K1USN. 0001Z **Jul 17**-2359Z **Jul 18**. Museum Ships Radio Event. 14.260 7.260 14.039 7.039. Certificate. Robert Callahan, W1QWT, 56 Acorn St, Scituate, MA 02066. **www.qsl.net/k1usn/event.html**.

Fremont, MI: Amateurs of Newaygo County, W1B. **Jul 20-Jul 24**. 14th Annual National Baby Food Festival. General portions of 80, 40, 20, 15 and 10 meter bands. Certificate. Leo Woodward, WD8DCA, 304 N Stone Rd, Fremont, MI 49412.

Various, England: Royal Signals Amateur Radio Society, GB6LOG. 0700Z **Jul 21**-2359Z **Aug 18**. 60th anniversary of the liberation of Guam 1944. 21.070 21.056 14.070 14.056. QSL. Mike Humphrey. GØSWY/KF4OFR, 4 Bluebell Rd, Bassett Southhampton, Hampshire, England SO16 3LQ. **www.rsars.org.uk**.

Corinth, MS: Alcorn County Amateur Radio Emergency Service, W5I. 1800Z **Jul 23**-1800Z **Jul 25**. Civil War Interpretive Center, Shiloh National Park. 14.280 7.280. Certificate. ACARES—Area Promotion Council, PO Box 2158, Corinth, MS 38835-2158. **www.arrlmiss.org**.

Henlopen State Park, DE: WA3WSJ. 1400Z **Jul 23**-0000Z **Jul 25**. Activation of four lighthouses and one lightship in Delaware. 14.270 14.030 7.270 7.030 PSK31 14.070. QSL. Edward R. Breneiser, 775 Moonflower Ave, Reading, PA 19606.

Collingwood, ON, Canada: CERTS/CARC, VE3BPQ. 1200Z-2200Z **Jul 24**. 10th anniversary of Elvis Festival in Collingwood. 28.360 14.180 7.180 3.780. Certificate. VE3BPQ, 248 Birch St, Collingwood, ON L9Y 2V6, Canada.

DeSmet, SD: Lake Area Radio Klub and Huron Amateur Radio Club, WØWTN. 1600Z **Jul 24**-2200Z **Jul 25**. Annual Little House on the Prairie Pageant. 28.465 21.365 14.265 7.265. Certificate. LARK, PO Box 642, Watertown, SD 57201. **www.w0wtn.org**.

Warren, OH: Warren Amateur Radio Association, W8P. 1200Z **Jul 24**-1000Z **Jul 25**. National Packard Auto Show. 10 20 40 m. Certificate. Gail Wells, 708 Delaware SW, Warren, OH 44485.

Port Colborne, ON, Canada: Welland County Amateur Radio Club, VE3WCD. 1300Z **Jul 31**-2100Z **Aug 1**. Canal Days Marine Heritage Festival. 28.350 21.250 14.250 7.250. QSL. Doug Frame, VE3JDF, 895 Lakeshore Rd E, Port Colborne, ON L3K 5V3, Canada.

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 **Sep** *QST* would have to be received by **Jul 1**. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (**events@arrl.org**) to ARRL HQ. QST

STRAYS

QST congratulates...

◊ Curtis W. Robb, NT5E, of Newnan, Georgia, who has been named a "Top Vet" by Veterans Advantage, Inc. Robb, who is chief information officer for Delta Airlines, was cited for his achievements in enhancing Delta's use of technology and, according to Veterans Advantage, "transforming the way Delta conducts business."

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

By Steve Ewald, WV1X

2003 Simulated Emergency Test Results

Hillsborough County Florida ARES/RACES After-Action Review

By Gary Sessums, KC5QCN
ARRL Emergency Coordinator

Introduction

On October 4, 2003, Hillsborough County Amateur Radio Emergency Service (ARES)/Radio Amateur Civil Emergency Service (RACES) participated in the ARRL Simulated Emergency Test. The SET enables local ARES groups to determine the strengths and weaknesses of the local organization, provides a public demonstration to served agencies of the value to the public that Amateur Radio provides in times of emergency, and enables Amateur Radio operators to gain experience in communications using standard operating procedures and a variety of modes under simulated emergency conditions. This was the first time in the history of the West Central Florida Section that a formal SET exercise has been held. It was also the first time the ARRL Northern Florida (NFL), Southern Florida (SFL), and West Central Florida (WCF) Sections have participated in a joint statewide SET exercise in conjunction with the State Emergency Operations Center in Tallahassee.

Specific goals of the Hillsborough County SETest included:

- Test activation of the Hillsborough County ARES/RACES using an emergency activation alert on local Amateur Radio repeaters that operate on emergency power.
- Allow ARES participants to gain experience in formal emergency net procedures.
- Demonstrate Amateur Radio communication capabilities that exist in the county and to promote its use as a resource in a disaster situation.

Scenario

A simulated statewide power outage due to a domino effect failure of the power grid left the entire state blacked out. The State Emergency Operations Center as well as local county Emergency Operations Centers were activated. The State EOC requested local Amateur Radio assets be activated for statewide communications support through the three Florida ARRL sections. After notification from WCF Section officials, a local Hillsborough County ARES net was initiated at 8 AM on the primary ARES/RACES 147.105+ MHz N4TP repeater. The emergency activation alert was relayed to all other Hillsborough County Amateur Radio repeaters that were able to operate on emergency power.

Participation

Fifty-three Amateur Radio operators participated in the event, and all ARES stations checking into the net had emergency power capabilities. The majority of participants were from Hillsborough County, with a few participants coming from the surrounding counties. Several newly licensed Amateur Radio operators also participated in this event. The net ran from 8 AM until 11 AM. Stations checking in were asked for their call sign, name, ZIP code, assignment availability and emergency power status.

Results

Backup/auxiliary communications were successfully tested and messages were exchanged between the Hillsborough County EOC, the American Red Cross, the Hillsborough County Sheriff's Office and local Amateur Radio clubs. Communications were also tested with the State of Florida EOC in Tallahassee. Formal written traffic was passed using the National Traffic System. A message was sent from the Hillsborough County EOC to the State Warning Point via the SEDAN packet radio network. While not really a point-generating contest, the SET is an important indicator of each local ARES group's commitment to community service. Hillsborough County's 406 points was the

2003 SET Top Ten

Section	*Points*
ARES Activity	
Michigan	4624
Ohio	3559
Western New York	2745
Virginia	2383
Mississippi	2195
North Texas	1955
Connecticut	1899
Eastern Pennsylvania	1343
New Hampshire	1333
South Texas	1094
Section/Local Nets	
North Carolina	3863
Connecticut	1682
Michigan	1279
Virginia	1026
Western New York	972
Mississippi	827
Ohio	610
South Texas	607
Louisiana	607
Western Pennsylvania	429

SET Scorecard

The points for ARES activity were awarded in the following manner:

Category	*Points*
A) Number of amateurs participating	2 (each)
B) Number of new amateurs (licensed since 1999)	3 (each)
C) Number of formal third party messages originated on behalf of served agencies	1 (each)
D) Tactical communication was conducted on behalf of served agencies: (<0.5 hour, 5 points; 0.5-1 hour, 10 points, >1 hour, 20 points)	
E) Number of stations on emergency power during test	2 (each)
F) Number of emergency-powered repeaters used in test	10 (each)
G) Dual membership in ARES and RACES is encouraged	10
H) Liaison was maintained with an NTS section/local net	10
I) Digital modes were used during test	10
J) Number of different agencies for which communication was provided.	5 (each)
K) Number of communities in which agencies were contacted	10 (each)
L) Press release was submitted	10

The points for net activity were awarded in the following manner:

A) Total number of messages handled.	1 (each)
B) Number of different stations participating	2 (each)
C) Number of different stations checking-in on emergency power	2 (each)
D) Number of new amateurs (licensed since 1999) in test	3 (each)
E) Number of net control stations	5 (each)
F) Number of different stations performing NTS liaison	5 (each)

top SET score in the WCF Section, and certainly demonstrates the continued dedication of the members of our local Hillsborough County ARES/RACES program to provide backup/auxiliary communications support to the community in disaster situations.

TRAIN DERAILMENT SCENARIO

By Steve Hilberg, N9XDC
Champaign County ARES EC

A simulated train derailment occurred in Champaign County (Illinois) west of U.S. 45 in Tolono. There was a derailed tank car containing potentially hazardous cargo, and required evacuation of surrounding residents. A lightning strike knocked out phone service in Champaign-Urbana shortly after ESDA notified the Red Cross of the derailment. News reports indicated that phone service is out at least for several hours.

Prior to the exercise, the Champaign County EC contacted the Piatt County EC to notify them of our drill. We also informed them that depending on response from Champaign County ARES, mutual aid may be requested.

Response

Per American Red Cross (ARC) protocol, ARC and ARES personnel are to report to ARC headquarters when phone service is out in an emergency. At 11:10 AM, an ARES net was activated. ESDA activated the county EOC.

W5XX

John Crawford, KD5CQX (with headset on) and Russell Tillman, K5NRK, operate from the Mississippi Red Cross Disaster Lead Headquarters in Vicksburg during the 2003 SET on October 4.

The Illini Prairie Chapter of the American Red Cross was contacted by ESDA to set up a shelter.

The net check-in procedure concluded about 11:15, at which time all responding ARES personnel were told to report to ARC Chapter headquarters in Urbana. The first person arrived at ARC at 11:32 AM. The first person to arrive was told to obtain a blue envelope containing instructions from the ARC disaster Services coordinator. The instructions informed them to make a list of everyone reporting to ARC as they arrived and to handle any net traffic until the EC arrived on scene.

Twelve ARES members responded. When the EC arrived, he briefed the participants on the situation and what resources would be needed. One operator was dispatched to the Champaign County EOC. A team of two operators was sent to the designated shelter location to set up communications there. Operators were also dispatched to the Champaign and Urbana fire and police departments, and to the two area hospitals (in this exercise, all phone communications were down).

2004 SET on the Horizon

Thank you to everyone for taking part in the annual Simulated Emergency Test! The above reports are representative of the many reports and scenarios that were received. It shows the great efforts by radio amateurs across the country who are active in public service through radio clubs, ARES, RACES, SKYWARN, the ARRL National Traffic System and other public service groups. Those ARES groups and nets from around the country that reported scores for SET-related activity in 2003 are noted in the following results.

October 2 and 3, 2004, is the main weekend for this year's SET. Please contact your local ARRL Field Organization leaders to find out specific dates, times, and places for the Simulated Emergency Test in your area.

ARES Activity

Area	Reporter	Points	Section Points
Atlantic Division			
Eastern Pennsylvania			**1343**
Montgomery Co	W3ZQN	1063	
York Co	KA3KAR	193	
Sullivan Co	K3BM	87	
Maryland-DC			**1033**
Washington Co	KD3JK	319	
Frederick	N8AAY	292	
Anne Arundel Co	N3SEO	245	
Carroll Co	WX3F	177	
Southern New Jersey			**245**
Cape May Co	N2NGW	125	
Mercer Co	KB2EGI	120	
Western New York			**2745**
Otsego Co	N2NQH	860	
Chenango Co	K2DAR	555	
Delaware Co	AA2RM	421	
Herkimer Co	N2ZWO	344	
Onondaga Co	WA2PUU	293	
Cayuga, Seneca Co	W2QYT	116	
Tioga Co	KC2JZL	88	
Seneca Co	KC2BHX	68	
Western Pennsylvania			**1300**
Erie Co	N3HPR	832	
Blair Co	KA3EJV	377	
Bedford Co	KA3CUA	91	
Central Division			
Illinois			**1221**
Lake Co	K9DRW	457	
Schaumburg	N9MYC	231	
DeKalb Co	W9ICU	181	
Champaign Co	N9XDC	124	
McHenry Co	W9ZE	120	
Macon Co	WT9J	108	

Area	Reporter	Points	Section Points
Indiana			**1282**
Monroe Co	KB9RVB	255	
Lake Co	WN9Z	226	
Whitley Co	WB9UNL	189	
Bartholomew Co	N9MUS	171	
Clinton Co	W9PC	164	
St Joseph Co	W3GQJ	100	
Jefferson Co	N9UNM	73	
Pike Co	WB9NCE	66	
Gibson Co	N9LJA	38	
Wisconsin			**150**
Racine Co	N9PMO	150	
Delta Division			
Arkansas			**1277**
Benton Co	KJ5YD	368	
Statewide RACES	W5AUU	324	
Cross Co	W5WPN	279	
Pope Co	K5NRC	161	
Washington Co	K1ARK	95	
Nevada Co	KB5ILY	50	
Louisiana			**380**
Ouachita Parish	K5ER	270	
Lafayette	KN5GRK	58	
Forrest Co	AG5Z	52	
Mississippi			**2195**
Lee Co	KD6JYL	288	
Itawamba Co	AD5IS	217	
Jones Co	N5NQ	185	
Hinds, Madison, Rankin	AC5SU	178	
S, SW Mississippi	N5ZNT	175	
Monroe Co	AD5DO	127	
Golden Triangle	KD5FUO	149	
Lauderdale, Clarke Co	KD5GWM	108	
Warren Co	N5JGK	107	
Tippah Co	WA5TMC	95	

Area	Reporter	Points	Section Points
Harrison Co	W4WLF	92	
Jackson Co	NN5AF	90	
DeSoto Co	KD5CKP	90	
Union Co	W5LMW	69	
George Co	KA5PMK	62	
Lafayette	K5DSG	52	
Forrest Co	AG5Z	52	
Chickasaw Co	KA5ICO	33	
Alcorn Co	WB5CON	22	
Hancock Co	K5DMC	4	
Tennessee			**978**
Dickson Co	KG4HDZ	334	
Davidson Co	K1YJ	153	
McMinn Co	NA4IT	171	
Rhea Co	KO4SY	111	
Montgomery Co	N3ORX	108	
Stewart Co	WD4DBJ	101	
Knox Co: Written report by AG4XO received.			
Great Lakes Division			
Kentucky			**216**
Fayette Co	N4MOM	216	
Michigan			**4624**
Oakland Co	W8HIU	1010	
Kent Co	K8SN	970	
Ausable, Iosco, Oscoda	W8SZ	672	
Muskegon Co	N8YJT	247	
Tuscola Co	N8XTN	235	
Genesee Co	N8HQX	208	
Benzie Co	K8BTE	206	
Saginaw Co	N8VDG	182	
Monroe Co	KB8AIZ	176	
Washtenaw Co	N8ZLR	156	
Allegan Co	N8KQS	146	
Ontonagon Co	W8UXG	111	
Livingston Co	N8WWX	95	
Jackson Co	KC8JJT	85	
Manistee Co	WA8V	70	

Area	Reporter	Points	Section Points
Branch Co	W8SST	53	
Presque Isle Co	WB8TQZ	2	
Ohio			**3559**
Butler Co	N8TVU	921	
Summit Co	K8EIO	484	
Montgomery Co	KA0AZS	275	
Lorain Co	N8VUB	254	
Franklin Co	KI8GW	243	
Licking Co	W5UHQ	222	
Shelby Co	N8KZL	217	
Erie Co	K8HLH	182	
Adams Co	N8YWX	181	
Seneca Co	KC8BUJ	133	
Clark Co	N8NSD	120	
Stark Co	WD8AYE	94	
Jefferson Co	N8MGW	93	
Ross Co	KC8FPU	73	
Lake Co	WB8ZQH	48	
District 6	KC8GNL	19	
Hudson Division			
Eastern New York			**242**
Dutchess Co	KC2DAA	161	
Orange Co	N2UBP	81	
New York City-Long Island			**919**
Nassau Co	WA2WKV	356	
Huntington	WB2LUA	201	
Southold	N2QHV	182	
New York City, Queens	KC2IXE	130	
Islip	KB2SCS	50	
Northern New Jersey			**523**
Hunterdon Co	WB2AZE	193	
Chatham Township	W2UH	126	
Bergen Co	WA2MWT	79	
Englewood	W2CC	65	
Middlesex Co	AA2ZJ	60	

Area	Reporter	Points	Section Points
Midwest Division			
Iowa			**476**
District 9	N0SPP	258	
Lee Co	WB0VYG	218	
Kansas			**566**
Johnson Co	K0WEQ	566	
Missouri			**545**
Jackson Co	K0UAA	260	
St Charles Co	KB3HF	146	
Stone Co	K0PHI	139	
Nebraska			**142**
Lancaster Co	K0GND	142	
New England Division			
Connecticut			**1899**
Section wide	W1AGP	761	
Area 4	KA1WTS	300	
Area 3	W1FYM	258	
Wallingford	WA1VXH	137	
Danbury	N1GS	133	
American Red Cross	K1BRF	117	
Enfield	NM1K	111	
East Haven	K1WMQ	82	
Maine			**147**
Penobscot Co	K1ONY	147	
New Hampshire			**1333**
Central District	N1RCQ	363	
Cheshire	N1NCI	186	
Section wide	N1SKZ	161	
Hillsborough Co	KA1GOZ	135	
S Grafton	AA1KL	122	
Capitol Area	KB1FAE	103	
East Rockingham Co	KA1GJV	94	
West Rockingham Co	K1WX	91	
Sullivan Co	AA1XC	76	
Rhode Island			**224**
Section wide	N2NCL	224	
Vermont			**114**
Bennington Co	NI5P	114	
Western Massachusetts			**968**
5 counties combined	K1VSG	968	
Northwestern Division			
Oregon			**249**
Linn Co	WB9HZT	129	
Clastsop Co	KD7NNQ	120	
Western Washington			**1190**
W WA Medical	N7LSL	840	
Lewis Co	AC7SR	156	
Grays Harbor	N7UJK	129	
Thurston Co	KB7DFL	65	
Pacific Division			
East Bay			**198**
Tri-Valley	WB6ETY	198	
Nevada			**523**
Clark Co	AA5QJ	261	
Churchill Co	KE6QK	137	
Elko Co	N7JEH	125	
Pacific			**198**
State of Hawaii RACES	AH6CP	374	
Maui Co	KH6H	95	
Sacramento Valley			**183**
Plumas Co	KR6G	139	
Placer Co	WB6AGR	44	
San Joaquin Valley			**86**
East Kern Co	KK6PA	86	
Santa Clara Valley			**644**
Monterey Co	W6FDO	235	
Santa Clara Co	KE6AGJ	181	
Cupertino	KN6PE	135	
Sunnyvale	N6IH	93	
Roanoke Division			
North Carolina			**6948**
Charlotte Area SKYWARN	WB4HRR	963	
Guilford Co	KE4IAF	890	
Pitt Co	K4ROK	720	
Eastern Branch	W9EF	584	
Carteret Co	KR4NU	570	
Twelve Co Piedmont	KB1G	541	
Mecklenburg Co	W4OH	448	
Gaston Co	KC4YOT	275	
Alamance Co	N4MIO	241	
Union Co	K4RLD	233	
Orange Co	W4SAR	209	
Cabarrus Co	KA4ATT	206	
James City Co	KC4CMR	169	
Henderson Co	W4DK	160	
Wilson Co	KF4OFP	158	
Stanly Co	K4HTJ	132	
Durham Co	KB4WGA	131	
Moore Co	N4YYL	121	
Alexander Co	W4AW	86	
Greene Co	KE4NQP	68	
Currituck Co	KD4ATK	43	
South Carolina			**671**
Greenville Co	N4ENX	172	
Spartanburg Co	KA2CLX	162	
Calhoun Co	KF4UOR	124	
Pickens Co	W5UGD	110	
Florence Co	KG4BZK	103	
Virginia			**2383**
Carroll, Grayson Co	W4GHS	755	
Gloucester Co	KE4NBX	302	
Virginia Beach	WA4TCJ	248	
Mobile Unit, Dist 13	K4KHZ	211	
Montgomery Co	K4FCP	210	
Prince William Co	KG4GIY	179	
Franklin Co	W4BOT	118	
York Co	WB4UHC	114	
Wythe Co	KB6KLO	101	
Floyd Co	KE4UGF	61	
Pulaski Co	KC5EJR	42	
Botetourt Co	KQ4NW	42	
West Virginia			**457**
Raleigh Co	KC8PMI	320	
Cabell Co	WD8AGH	137	
Rocky Mountain Division			
Colorado			**426**
District 22	KB0UBZ	179	
District 25	KI0KY	159	
District 24	KA9ODE	88	
Southeastern Division			
Alabama			
Written report by KR4TZ received on statewide exercise.			
Georgia			**636**
Gwinnett Co	WA4DYD	208	
Dekalb Co	N4SEG	191	
Coweta Co	KD4SHK	111	
Spaulding Co	KU4TP	82	
Wayne Co	KE4ZFR	44	
Northern Florida			**173**
Orange Co	KG4CWV	173	
West Central Florida			**406**
Hillsborough Co	KC5QCN	406	
Southwestern Division			
Arizona			**626**
Cochise Co	N7INK	416	
Ft Huachuca,Yuma	K0LOB	210	
West Gulf Division			
North Texas			**1955**
Wichita Co	W5GPO	1115	
Nacogdoches Co	KK5BE	250	
Coppell, Carrollton	KA1CWM	228	
Irving	KA5OZC	173	
Mesquite	KA5SNM	155	
Rockwall Co	KC5FED	34	
Oklahoma			**121**
Ponca City	KD5FX	121	
South Texas			**1904**
Harris Co	KK5CA	546	
Williamson Co	WA0YVQ	336	
SE Harris Co	N5DCC	311	
Galveston Co	KD5FPU	281	
NW Harris Co	KK5CA	168	
SW Harris Co	AD8A	140	
NE Harris Co	W5FM	122	
West Texas			**8**
Pecos Co	N5DLX	8	

Section/Local Nets

Area/Net Name	NM	Points	Section Points
Atlantic Division			
Maryland-DC			**202**
CARET	WX3F	112	
Anne Arundel Co ARES	N3SEO	90	
Northern New York			**118**
NY State CW/Early	WB2QIX	118	
Southern New Jersey			**34**
New Jersey Phone Net	W2CC	34	
Western New York			**972**
OCTEN	KA2ZNZ	396	
CNYTN/OCREN	WA2PUU	250	
W District Net	KA1IWK	208	
NY State CW/ Early	WB2QIX	118	
Western Pennsylvania			**429**
Blair ARES Net	KA3EJV	237	
WPA Phone & Traffic	N3HPR	192	
Central Division			
Illinois			**296**
Lake Co RACES/ARES	W9FUL	296	
Indiana			**358**
Clinton Co ARES/RACES	W9PC	109	
Whitley Co ARES	WB9UNL	79	
LaPorte Co	KC9DJP	70	
Clifty ARS	N9XVB	60	
Pike Co ARC	WB9NCE	40	
Delta Division			
Arkansas			**164**
Cross Co ARES/RACES	W5WPN	164	
Louisiana			**607**
West Gulf ARES	W5XX	415	
NTS Region Net 5, Cycle 1	WB5ZED	192	
Mississippi			**827**
West Gulf ARES	W5XX	415	
Magnolia ARC	AD5HM	85	
Central MS SKYWARN	N5XXX	82	
Metro Jackson ARES	AC5SU	53	
NTS Region Net 5, Cycle 1	WB5ZED	192	
Great Lakes Division			
Michigan			**1279**
Ausable Valley ARES/RACES	W8SZ	332	
Oakland Co ARPSC	KC8SZR	186	
Monroe Co ARPSC	KB8AIZ	149	
SEMTN	WI8K	142	
Benzie Co	K8BTE	115	
Saginaw ARPSC	N8VDG	95	
Tuscola Co ARES	KC8TXE	89	
Ontonagon Co ARES	AA8YF	76	
Genessee Co		55	
Jackson Co	KC8JJT	40	
Ohio			**610**
COTN	KC8RXL	496	
Shelby Co ARES	NO8C	114	
Hudson Division			
Eastern New York			**370**
Hudson Valley Net	N2JBA	210	
NY State CW/Early	WB2QIX	118	
Rensselaer Co	K2ZP	42	
NYC-Long Island			**209**
NY State CW/Early	WB2QIX	118	
Queens Co ARES	WA2GUG	78	
Southampton	WB2ZIE	13	
Northern New Jersey			**34**
New Jersey Phone Net	W2CC	34	
Midwest Division			
Iowa			**38**
Lee Co	WB0VYG	38	
Kansas			**176**
Kansas Sideband	N0FKS	176	
Missouri			**229**
Jackson Co	K0UAA	229	
Nebraska			**92**
E Nebraska ARES	KB0MTT	92	
New England Division			
Connecticut			**1682**
HF SET Net	W1AGP	567	
ARES SET Management	N1FNE	331	
BEARS of Manchester	NM1K	262	
New Haven, Middlesex SKYWARN	N1HAW	125	
WESCON	KA1GWE	115	
LEPC	AB1ER	103	
Hartford/Tolland Co SKYWARN	K1PAI	50	
Red Cross	K1BRF	46	
Windham Co SKYWARN	KB1DGY	45	
N Fairfield SKYWARN	KB1HQE	38	
New Hampshire			**299**
Central NH	N1RCQ	133	
W Rockingham	N1PJZ	56	
Hillsborough Co	KA1GOZ	40	
S Grafton ARES	AA1KL	37	
Capital Area ARES	KB1FAE	33	
Vermont			**69**
Bennington Co ARES	NI5P	69	
Northwestern Division			
Oregon			**406**
Multnomah Co	KD7EYN	406	
Western Washington			**30**
Auxiliary Emergency Comm	KB7EQW	30	
Pacific Division			
Nevada			**151**
Clark Co ARES/RACES	AA5QJ	151	
Pacific			**202**
HI State RACES/ARES	KH6HPZ	202	
Sacramento Valley			**151**
Plumas ARES/RACES	KR6G	151	
Roanoke Division			
North Carolina			**3836**
Charlotte Area SKYWARN	WB4HRR	813	
Guilford Co ARES	KG4IYH	635	
Triad SKYWARN	KB1G	541	
Tar Heel Emergency Net	K4CWZ	418	
Lincoln Co	KE4RCO	248	
Metrolina 2 M	N4JBP	313	
Gaston Co ARES	KG4TQE	215	
Union Co ARES	K4RLD	153	
Stanly Co ARES	K4HTJ	138	
Cabarrus Co ARES	KA4ATT	128	
Alamance Co ARES	N4MIO	121	
Wilson Co	KF4OFP	113	
Virginia			**1026**
James City Co	KC4CMR	904	
VA Beach ARES	WA4TCJ	122	
Southeastern Division			
Alabama			**312**
Calhoun Co	AG4AC	140	
AL Emerg Net J	WA4JPK	64	
AL Section CW	W4ZJY	63	
Franklin Co ARES	WB4BHH	45	
Georgia			**358**
DeKalb Emergency	N4SEG	172	
Gwinnett ARES	WB9JSW	161	
Wayne EMA	KI4ATE	25	
Southwestern Division			
Arizona			**102**
Yuma Co	N7ACS	102	
West Gulf Division			
North Texas			**227**
Nac Amt Net	KK5BE	144	
Irving RACES/ARES	KA5OZC	83	
South Texas			**607**
West Gulf ARES	W5XX	415	
NTS Region Net 5, Cycle 1	WB5ZED	192	

By **Dan Henderson, N1ND**
Contest Branch Manager

2003 ARRL 10 Meter Contest Results

Where have all the sunspots gone?

For some reason, the 2003 ARRL 10 Meter Contest conjured nostalgic images in my head. Some of the great songs of our history seemed to flash into my mind's eye as I read Soapbox comments, score reports, and prepared to report the results for 2003. So, with apologies to folk musicians and rock-n-roll artists…

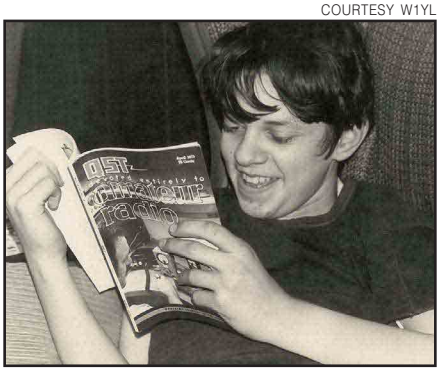
Where Have All the Sunspots Gone?

Being on the downside of Cycle 23, it would have been next to impossible to follow up on the 2002 contest, which set an all time record for the number of participants submitting logs. So we don't worry too much about the number of participants being down about 25% from the previous year. NOAA gave the total number of sunspots for the 2003 contest as 28 for December 13 and 31 for December 14. Compare those numbers to the count of 124 and 119 for the two days of the 2002 contest. Add to that the SFI of 92 and 88 for 2003 and one can almost hear the pensive longing of days past.

There are certain locations that have an advantage in years of lower solar activity. The closer you got to the equator the better in 2003. So it is no wonder that comment after comment in the Soapbox submissions reflected that conditions were fair to poor. The bad news is that we haven't hit the bottom of Cycle 23. The good news is that we will see a turnaround in a couple of years. Guess we will all be singing along with *The Byrds* as we wait for the cycle to "Turn, Turn, Turn."

So, since it was not a great weekend for those used to *Steppenwolf's* "Born to be Wild" on the bands, how did the avid 10 Meter contesters challenge themselves? Some, like Nigel, G3TXF, Chris, W1JCJ, and David, VK2CZ, reported testing out new antennas. Knowing they would be facing difficult conditions or "real life" obligations limited the time many operators were on the bands, such as Mike, W1JQ, or myself. Jim, N3AWS, used his limited operating schedule to do some radio comparisons between his ICOM IC-706MKIIG and Yaesu FT-817. Dave, VO1AU, used the contest to do a quasi-"DXpedition" from VO2AAA.

COURTESY W1YL



The joyful love of our hobby was evident very early in the life of WA1NNC, as this photo shows. WA1NNC grew up to be our great friend and fellow competitor K4OJ, Jim White. The 2003 10 Meter Contest was Jim's last ARRL Contest. Thanks, Jim... You are missed….

The 10 Meter contest is famous for, as *The Beatles* might have put it, "I Want To Hold Your Hand," or as we know it in amateur circles—Elmering. Joe, KB4QLZ, took time to share the fun when Bradley, KB4FWN, and Perry, KG4RTA, visited his shack. Eric, W3DQ, spent time with his 9 year old son in the shack during the weekend (while handing out the sometimes rare DC multiplier in this contest). Stories like these abound in shack after shack, and a few are found in the On-Line Soapbox on the ARRLWeb at **www.arrl.org/contests/soapbox/**, where you will find our version of *Jim Croce's* "Photographs and Memories."

"We Are The Champions"—W/VE

When it comes down to it, the motivation for participation is different. But for a few, the real challenge lies in living up to this *Queen* title. Be they overall, continental, national, regional or sectional winners, it is an accomplishment to finish first.

With declining propagation, scores were not quite as high, and only one overall or continental record was set. Congratulations to Alex, YO9HP, operator at A45WD, who set a new Single Operator Mixed Mode Low Power record for Asia.

Among W/VE stations, the winning station in each of the ten contest categories enjoyed a relatively easy victory. However, that doesn't mean that there wasn't tight competition along the way.

Leading the victory parade (of course to *Uriah Heep's* "Celebrate") are the three W/VE Single Operator QRP winners. Larry, W7YA, picked up a win in Phone Only in the closet W/VE overall finish, beating WR6WR, operated by Armond,

Affiliated Club Competition

	Score	Entries
Unlimited Category		
Potomac Valley Radio Club	17,812,020	79
Florida Contest Group	16,988,204	53
Northern California Contest Club	9,832,036	61
Society of Midwest Contesters	7,343,450	62
Medium Category		
Central Texas DX and Contest Club	4,858,336	14
Yankee Clipper Contest Club	4,129,304	41
Frankford Radio Club	3,839,964	23
Contest Club Ontario	3,476,136	24
Minnesota Wireless Assn	3,242,568	49
South East Contest Club	3,200,368	19
Southern California Contest Club	2,646,182	14
Tennessee Contest Group	2,590,334	31
Hudson Valley Contesters and DXers	2,507,858	13
Grand Mesa Contesters of Colorado	2,286,540	13
Kentucky Contest Group	2,059,772	9
Central Arizona DX Assn	1,919,344	6
Texas DX Society	1,533,198	5
Mad River Radio Club	1,514,960	14
Southwest Ohio DX Assn	1,409,196	4
North Texas Contest Club	1,157,856	5
Willamette Valley DX Club	1,069,528	8
Kansas City DX Club	1,045,066	6
Oklahoma DX Assn	1,044,232	6
Carolina DX Assn	1,041,148	8
North Coast Contesters	1,037,548	6
Western Washington DX Club	966,858	8
Florida Contest Group—Panhandle	953,940	5
Order of Boiled Owls of New York	856,678	6
Spokane DX Assn	499,072	3
Northern Arizona DX Assn	270,020	4
Mother Lode DX/Contest Club	255,342	3
Hampden County Radio Assn	212,070	6
Rochester (NY) DX Assn	206,382	4
Loudoun ARG	136,474	4
Franklin County ARC	135,602	3
Bergen ARA	125,252	6
West Park Radiops	102,298	3
Six Meter Club of Chicago	52,346	4
Local Category		
CT RI Contest Group	718,888	8
Columbia-Montour ARC	589,304	4
Livermore ARK	556,170	10
Medina 2 Meter Group	384,206	6
Redmond Top Key Contest Club	365,668	4
Sterling Park ARC	238,546	4
American Red Cross Emergency	209,540	4
Northern New York Contest Club	127,108	4

Top Ten, W/VE

Mixed Mode, QRP

K9OM	427,120
WA8ZBT	203,432
K8BL	179,826
W6AQ	135,240
N2TM	110,340
K3TW	105,728
NK6A	78,300
WA0VBW	70,798
WA6FGV	64,064
NY6DX	62,964

Mixed Mode, Low Power

K8IA	745,752
KG9X	603,230
WD5K	566,650
K2Z	566,368
(KD2RD, op)	
W3EP	553,280
N8II	548,800
K4GKD	525,888
WO4O	524,472
WQ5L	498,996
K4MM	489,896

Mixed Mode, High Power

WC4E	1,624,722
K6AM	1,380,600
K3ZO	1,264,562
K5KG	1,245,692
N5AN	1,238,274
(W5WMU, op)	
K1XX	1,037,694
NU4Y	990,888
K4EA	957,940
WE3C	948,060
N3OC	929,660

Phone Only, QRP

W7YA	70,560
WR6WR	56,576
KS4GW	36,480
W1KLM	32,400
W0ETC	27,548
KK0Q	27,000
N1BQ	25,864
W5GZ	24,072
KR1ST	21,672
WD5FGZ	19,470

Phone Only, Low Power

W4IX	387,030
K4VUD	255,360
NJ2F	170,424
W7UPF	162,830
W7ZR	139,836
WB2ZTH	136,344
W8DD	121,540
KT3RR	115,566
AB6GS	115,416
KE5OG	113,238

Phone Only, High Power

W5PR	682,440
K5TR	549,672
(WM5R, op)	
N4OX	493,374
K4WI	474,500
NQ4I	398,332
(W4DD, op)	
N3HBX	324,500
N8RA	313,200
NA5S	303,960
N2EOC	291,648
K7RL	271,980

CW Only, QRP

N5TW	164,436
W7RAB	101,716
(KH7YDW, op)	
AA1CA	77,824
N8AP	65,268
N9NE	60,480
N0UR	57,024
K7MM	53,600
K4CNW	52,704
N6WG	52,360
NU4B	32,208

CW Only, Low Power

WD4AHZ	372,072
WB4TDH	309,996
NY3A	294,112
N4GM	288,960
N5DO	257,920
W5TM	232,848
(W5AO, op)	
N7KA	227,520
W5EKF	224,280
VE7UF	215,232
KJ9C	204,120

CW Only, High Power

N4BP	834,768
K4OJ	774,144
KD4D	741,272
N2NT	685,640
W5KFT	666,576
(K5PI, op)	
N2OW	612,260
(@K1TTT)	
K0LUZ	597,800
K3CR	539,496
(LZ4AX, op)	
K5GO	539,136
N9RV	536,712

Multioperator

NE4AA	2,347,370
NX5M	1,752,912
KM4M	1,614,660
N4GN	1,327,168
K1SE	1,211,580
W6YX	1,177,648
W2IX	990,216
AA1JD	912,288
KH7U	886,440
K6KM	758,450

Top Ten, DX

Mixed Mode, QRP

JA1BPA	29,890
PY3YD	27,264
RX9AM	22,914
SP4GFG	17,572
UR6QS	7,380
VU2UR	7,040
SV1XV	5,504
DL1DQY	5,476
YY5AFD	3,900
RW3VZ	3,880

Mixed Mode, Low Power

ZF2NT	1,378,580
EA7RM	786,060
XE2AC	701,008
EA8/DJ1OJ	562,744
CQ0T	493,506
(CT1ILT, op)	
EA5AER	480,192
HI8/JA6WFM	457,728
LU2EE	424,196
(LW5EE, op)	
PR2F	406,196
(PY2NDX, op)	
WP4LNY	379,692

Mixed Mode, High Power

3D2YU	1,006,500
(YZ1AU, op)	
OK1RI	732,290
LT1A	663,120
(LU3CT, op)	
YP3A	456,374
(YO9GZU, op)	
UT7QF	394,254
5U7JB	372,600
(N4HX, op)	
RG9A	300,404
(UA9AM, op)	
F5NBX	271,964
EM3J	271,694
(UU2JZ, op)	
RF4R	248,192
(UA4RC, op)	

Phone Only, QRP

WP4EDD	302,498
TI2KAC	248,064
LU1VK	51,620
CT1DYV	15,004
T94DO	13,818
EA1BZ	9,984
LU5EVK	9,768
SQ9UM	8,400
LU8EGS	8,360
UA3BL	4,840

Phone Only, Low Power

LU4DX	365,304
CN8KD	341,406
ZX2B	298,820
(PY2MNL, op)	
XE1CT	242,708
HI3NR	208,620
CT1EAT	195,264
YY5YMA	194,880
CM8WAL	187,800
PS8HF	170,856
EA7FTR	170,280

Phone Only, High Power

FY5KE	1,106,000
(FY5FY, op)	
WP2Z	920,970
(K8MJZ, op)	
ZX5J	801,724
(PP5JR, op)	
ZF2AH	801,090
TI5A	714,816
(AC8G, op)	
LU6ETB	438,016
(IC8WIC, op)	
LS1N	406,608
(LU1NDC, op)	
CT8T	391,644
(CT1ESV, op)	
HP3XBS	381,562
AY8A	344,968
(LU8ADX, op)	

CW Only, QRP

CX2AQ	95,116
EA4BF	44,640
YT7TY	30,576
GW4ALG	27,224
EA8/SM6CUK	25,740
G4EDG	24,480
G3YMC	21,736
LW5DR	16,296
EA7AAW	15,040
9A3GU	14,112

CW Only, Low Power

LU1EWL	421,568
CO8ZZ	368,988
TI3M	338,624
(TI3TLS, op)	
ZL2BR	188,496
9A2SD	181,800
EA8CN	175,812
SV0XAI	167,640
4N1N	165,184
PY1NX	158,752
ZL/W3SE	152,928

CW Only, High Power

ZY3X	654,360
(IV3NVN, op)	
CX7BY	484,000
XE1MM	456,320
G3TXF	414,816
DL1IAO	411,740
EA4KA	400,608
F5IN	302,596
ZA1UT	293,296
(Z36W, op)	
T96Q	252,000
VR2BG	202,584

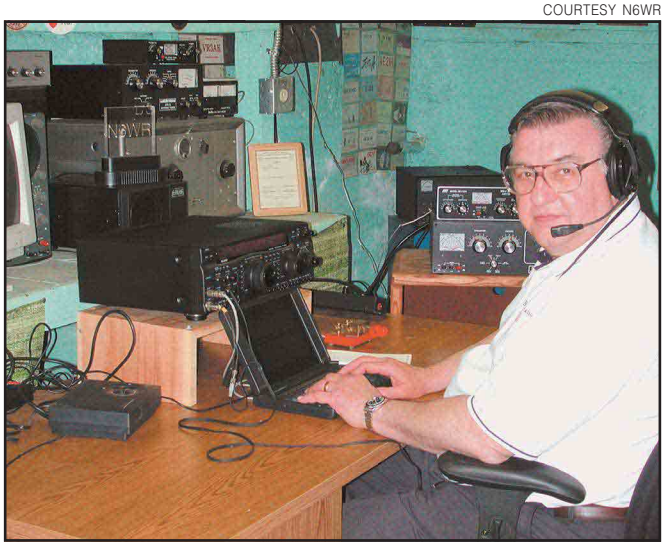
Multioperator

LT1F	2,313,000
PJ2T	2,103,948
P40K	2,042,092
LR1F	1,908,568
J8DX	1,751,680
OA4O	1,144,124
ZL6QH	1,017,632
TK5KP	920,238
9H6A	778,392
EA1FDI	759,238

N6WR, by a mere 14k points. They finished only 4 QSOs apart but Larry picked up 16 additional multipliers to snag the win. In Single Operator CW Only, Tom, N5TW, maintained a comfortable margin over Eugene, KH6YDW, who operated W7RAB. Single Operator Mixed Mode, Dick, K9OM, used the advantageous QTH in Florida to beat back the challengers, who were led by Dennis, WA8ZBT, competing from North Texas.

Single Operator Low Power always seems to be one of the most popular categories, and 2003 was no different, as 58% of all entries received were in the Low Power categories. In the Phone Only category, John, W4IX, proved too much for Charlie, K4VUD, to overcome. The CW Only winner, Ron, WD4AHZ, was able to take a victory lap after holding off Andy, WB4TDH. The Mixed Mode winner was Bob, K8IA, who fended off a challenge from Fred, KG9X, operating from the mystical "Black Hole"

COURTESY N6WR



Armond, N6WR, at his shack. He was the operator for WR6WR, placing second among W/VE QRP Phone Only entries.

COURTESY N4BP

Bob, N4BP, took home the win in the W/VE CW Only High Power Category.

Region Leaders

Tables list call sign, score, class (A = Mixed Mode, B = Phone only, C = CW Only, D = Multioperator), and power (A = QRP, B = Low Power, C = High Power).

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

N2TM	110,340	A	A
K3TW	105,728	A	A
NY6DX	62,964	A	A
K5GMX	55,616	A	A
WB2AMU	52,984	A	A
K2Z	566,368	A	B
(KD2RD, op)			
W3EP	553,280	A	B
KC2LLM	370,940	A	B
AI3M	258,400	A	B
K1HTV	253,656	A	B
K3ZO	1,264,562	A	C
K1XX	1,037,694	A	C
WE3C	948,060	A	C
N3OC	929,660	A	C
VY2TT	825,010	A	C
(K6LA, op)			
N1BQ	25,864	B	A
WB0IWG	10,710	B	A
N2MH	8,988	B	A
N2NHN	6,396	B	A
WB2ZTH	136,344	B	B
KT3RR	115,566	B	B
W1KT	64,034	B	B
WB2KHO	63,008	B	B
K2LV	56,496	B	B
N3HBX	324,500	B	C
N8RA	313,200	B	C
N2EOC	291,648	B	C
N3ME	271,264	B	C
W1SJ	184,164	B	C
AA1CA	77,824	C	A
WO2N	30,000	C	A
W2ENY	22,932	C	A
W2BVH	18,408	C	A
N2JNZ	14,800	C	A
NY3A	294,112	C	B
W3BGN	196,044	C	B
K2UF	150,840	C	B
W3CB	136,196	C	B
WB2AA	134,460	C	B
KD4D	741,272	C	C
N2NT	685,640	C	C
N2OW	612,260	C	C
(@K1TTT)			
K3CR	539,496	C	C
(LZ4AX, op)			
K3FT	414,288	C	C
W2IX	990,216	D	
AA1JD	912,288	D	
N3II	536,836	D	
K3WW	421,260	D	
WX3B	388,692	D	

Southeast Region (Delta, Roanoke and Southeastern Divisions)

K9OM	427,120	A	A
WB6BWZ	55,104	A	A
N4HH	31,150	A	A
N2UM	25,216	A	A
AI2P	12,684	A	A
N8II	548,800	A	B
K4GKD	525,888	A	B
WO4O	524,472	A	B
WQ5L	498,996	A	B
K4MM	489,896	A	B
WC4E	1,624,722	A	C
K5KG	1,245,692	A	C
N5AN	1,238,274	A	C
(W5WMU, op)			
NU4Y	990,888	A	C
K4EA	957,940	A	C
KS4GW	36,480	B	A
W1KLM	32,400	B	A
KR1ST	21,672	B	A
KQ4YY	5,624	B	A
KC4ATU	5,530	B	A
W4IX	387,030	B	B
K4VUD	255,360	B	B
NJ2F	170,424	B	B
N5KGY	76,986	B	B
WB4JFS	65,136	B	B
N4OX	493,374	B	C
K4WI	474,500	B	C
NQ4I	398,332	B	C
(W4DD, op)			
NX9T	175,824	B	C
K4JNY	116,768	B	C
K4CNW	52,704	C	A
NU4B	32,208	C	A
K8OWL	21,216	C	A
WN4M	20,800	C	A
K4GT	8,640	C	A
WD4AHZ	372,072	C	B
WB4TDH	309,996	C	B
N4GM	288,960	C	B
W5EKF	224,280	C	B
KN4Y	195,548	C	B
N4BP	834,768	C	C
K4OJ	774,144	C	C
K0LUZ	597,800	C	C
K5GO	539,136	C	C
W9WI	389,648	C	C
NE4AA	2,347,370	D	
KM4M	1,614,660	D	
K1SE	1,211,580	D	
W4MYA	707,250	D	
K1PT	545,020	D	

Central Region (Central and Great Lakes Divisions; Ontario Section)

K8BL	179,826	A	A
N8IE	62,244	A	A
N8XA	39,840	A	A
N8NM	38,160	A	A
W8VE	28,072	A	A
KG9X	603,230	A	B
NE9U	355,926	A	B
VE3DZ	346,112	A	B
W9AU	318,546	A	B
VE3XD	176,730	A	B
N9AG	837,790	A	C
VE3AT	812,322	A	C
W9XT	639,498	A	C
VE3KZ	573,420	A	C
W9IU	486,720	A	C
KC8QAE	13,630	B	A
KC8PKY	2,500	B	A
N9KT	2,184	B	A
AB8ND	1,710	B	A
KC8UDV	1,406	B	A
W8DD	121,540	B	B
WA1MKE	46,136	B	B
KF9US	45,260	B	B
K4TXJ	40,630	B	B
N9ISN	31,122	B	B
VA3KA	225,108	B	C
W9NY	124,568	B	C
KE9S	116,112	B	C
N8OL	56,316	B	C
W8JWN	52,260	B	C
N8AP	65,268	C	A
N9NE	60,480	C	A
KB9ZUV	7,280	C	A
W4AMW	1,560	C	A
VE3IGJ	288	C	A
KJ9C	204,120	C	B
W8MJ	153,792	C	B
K2AAW	136,800	C	B
N9BX	101,088	C	B
KB9S	94,984	C	B
N9RV	536,712	C	C
W8AV	396,168	C	C
N8BJQ	199,864	C	C
W9YYG	190,960	C	C
W8CAR	150,920	C	C
N4GN	1,327,168	D	
KI9A	620,490	D	
N2BJ	532,688	D	
K9IZ	474,320	D	
KC9ARR	441,792	D	

Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

WA8ZBT	203,432	A	A
WA0VBW	70,798	A	A
W5GAI	14,336	A	A
WD5AGO	2,700	A	A
KI0II	2,160	A	A
WD5K	566,650	A	B
WQ5C	341,310	A	B
W0ETT	276,924	A	B
AC0W	270,900	A	B
W0VX	249,920	A	B
K5NZ	733,920	A	C
K1NT	616,896	A	C
K0TT	593,280	A	C
K0YW	557,120	A	C
K5ZO	467,856	A	C
W0ETC	27,548	B	A
KK0Q	27,000	B	A
W5GZ	24,072	B	A
WD5FGZ	19,470	B	A
N0VMW	15,190	B	A
KE5OG	113,238	B	B
W5ES	76,180	B	B
(WB5QLR, op)			
W5SXD	60,514	B	B
WA5IYX	56,316	B	B
KC5PKA	53,286	B	B
W5PR	682,440	B	C
K5TR	549,672	B	C
(WM5R, op)			
NA5S	303,960	B	C
K5NA	217,248	B	C
(KI5DR, op)			
K0RH	211,200	B	C
N5TW	164,436	C	A
N0UR	57,024	C	A
K5IC	20,992	C	A
K5AM	15,312	C	A
K7IA	13,248	C	A
N5DO	257,920	C	B
W5TM	232,848	C	B
(W5AO, op)			
N7KA	227,520	C	B
N5AW	166,320	C	B
N5CHA	135,196	C	B
W5KFT	666,576	C	C
(K5PI, op)			
W0SD	387,504	C	C
(W0DB, op)			
N6ZZ	384,272	C	C
W5VX	349,056	C	C
K2BA	329,360	C	C
NX5M	1,752,912	D	
K0DU	696,924	D	
KR0B	591,624	D	
KD0S	524,560	D	
W0NO	506,506	D	

West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

W6AQ	135,240	A	A
NK6A	78,300	A	A
WA6FGV	64,064	A	A
W6YRA	52,268	A	A
(WA6AYI, op)			
W7CD	22,960	A	A
K8IA	745,752	A	B
N7LOX	423,192	A	B
WN6K	333,330	A	B
W6OA	207,774	A	B
ND2T	163,500	A	B
K6AM	1,380,600	A	C
W0YK	845,000	A	C
K6RB	636,852	A	C
N6NF	612,900	A	C
KF6T	497,092	A	C
W7YA	70,560	B	A
WR6WR	56,576	B	A
WA9NBU	1,632	B	A
AH6RH	384	B	A
W7UPF	162,830	B	B
W7ZR	139,836	B	B
AB6GS	115,416	B	B
KC6SEH	112,858	B	B
KH6GMP	58,370	B	B
K7RL	271,980	B	C
K7ZSD	254,656	B	C
K6HNZ	218,762	B	C
WA0KDS	163,030	B	C
W7WW	157,360	B	C
W7RAB	101,716	C	A
(KH7YDW, op)			
K7MM	53,600	C	A
N6WG	52,360	C	A
N7YY	16,132	C	A
KL7FDQ	10,672	C	A
VE7UF	215,232	C	B
KG6ERO	198,560	C	B
N6JV	179,712	C	B
W7UQ	177,216	C	B
(KL9A, op)			
KA7T	166,160	C	B
N6RO	432,256	C	C
KC7V	316,992	C	C
WT6G	313,632	C	C
K7BG	267,948	C	C
W7YS	221,120	C	C
W6YX	1,177,648	D	
KH7U	886,440	D	
K6KM	758,450	D	
KY7M	633,000	D	
K6XX	423,440	D	

Africa

EA8/DJ1OJ			
	562,744	A	B
5U7JB	372,600	A	C
(N4HX, op)			
CN8KD	341,406	B	B
EA9GW	6,536	B	B
EA8AJO	5,120	B	B
CT3FQ	45,640	B	C
EA8/SM6CUK			
	25,740	C	A
EA8CN	175,812	C	B
CN8YR	50,400	C	B
EA8NQ	42,380	C	B
5X1X	25,576	C	B
(K3JT, op)			
ZS1EL	47,040	C	C

Asia

JA1BPA	29,890	A	A
RX9AM	22,914	A	A
VU2UR	7,040	A	A
JJ4CDW	1,080	A	A
B4TB	240	A	A
A45WD	294,196	A	B
(YO9HP, op)			
UA9SP	54,280	A	B
E21EIC	45,210	A	B
9M2TO	31,280	A	B
RV9AZ	28,910	A	B
RG9A	300,404	A	C
(UA9AM, op)			
HS0ZDG	118,534	A	C
UA9CDC	102,718	A	C
UA9MA	100,960	A	C
4X1VF	82,536	A	C
JH7RTQ	2,888	B	A
RV9BI	2,100	B	A
JA2MWV	1,184	B	A
UA9JRF	8	B	A
4X6DK	29,700	B	B
4Z5LZ	13,440	B	B
4Z5FL/M	6,882	B	B
JA1SWB	3,744	B	B
JA1KK	3,168	B	B
A61AJ	259,166	B	C
(S57CQ, op)			
JA7OWD	34,200	B	C
TA5FA	7,540	B	C
JT1DA	7,280	B	C
JH1OCC	7,200	B	C
JA2IU	4,104	C	A
JR1NKN	2,580	C	A
RV9COI	2,520	C	A
JH1NXU	640	C	A
RA0LQ	600	C	A
TA2ZF	125,692	C	B
RV9WZ	75,920	C	B
TA3DD	50,172	C	B
HS0ZDZ	43,516	C	B
RA9FLW	34,768	C	B
VR2BG	202,584	C	C
5B4AHA	186,000	C	C
RA9MA	64,024	C	C
4Z5FW	58,560	C	C
RA9SG	58,400	C	C
JY9QJ	103,076	D	
JE1ZWT	82,142	D	

Europe

SP4GFG	17,572	A	A
UR6QS	7,380	A	A
SV1XV	5,504	A	A
DL1DQY	5,476	A	A
RW3VZ	3,880	A	A
EA7RM	786,060	A	B
CQ0T	493,506	A	B
(CT1ILT, op)			
EA5AER	480,192	A	B
LZ9W	333,250	A	B
SV1BJW	292,336	A	B
OK1RI	732,290	A	C
YP3A	456,374	A	C
(YO9GZU, op)			
UT7QF	394,254	A	C
F5NBX	271,964	A	C
EM3J	271,694	A	C
(UU2JZ, op)			
CT1DYV	15,004	B	A
T94DO	13,818	B	A
EA1BZ	9,984	B	A
SQ9UM	8,400	B	A
UA3BL	4,840	B	A
CT1EAT	195,264	B	B
EA7FTR	170,280	B	B
EA7HBP	151,708	B	B
CT7BOP	144,060	B	B
IZ8EPX	104,368	B	B
CT8T	391,644	B	C
(CT1ESV, op)			
F6CTT	262,250	B	C
TM7F	231,836	B	C
(F6GLH, op)			
DL2ARD	210,916	B	C
IK4MGP	195,780	B	C
EA4BF	44,640	C	A
YT7TY	30,576	C	A
GW4ALG	27,224	C	A
G4EDG	24,480	C	A
G3YMC	21,736	C	A
9A2SD	181,800	C	B
SV0XAI	167,640	C	B
4N1N	165,184	C	B
LZ2PL	120,020	C	B
F8BPN	110,952	C	B
G3TXF	414,816	C	C
DL1IAO	411,740	C	C
EA4KA	400,608	C	C
F5IN	302,596	C	C
ZA1UT	293,296	C	C
(Z36W, op)			
TK5KP	920,238	D	
9H6A	778,392	D	
EA1FDI	759,238	D	
RM6A	642,610	D	
9A5Y	637,512	D	

North America

ZF2NT	1,378,580	A	B
XE2AC	701,008	A	B
HI8/JA6WFM			
	457,728	A	B
WP4LNY	379,692	A	B
KP2/K2ZZ	168,054	A	B
HI3TEJ	65,910	A	C
WP4EDD	302,498	B	A
TI2KAC	248,064	B	A
XE1CT	242,708	B	B
HI3NR	208,620	B	B
CM8WAL	187,800	B	B
CO2TK	124,168	B	B
KG4WW	108,388	B	B
WP2Z	920,970	B	C
(K8MJZ, op)			
ZF2AH	801,090	B	C
TI5A	714,816	B	C
(AC8G, op)			
HP3XBS	381,562	B	C
TI1Z	224,424	B	C
CO8ZZ	368,988	C	B
TI3M	338,624	C	B
(TI3TLS, op)			
HP1AC	115,972	C	B
XE1NW	44,200	C	B
XE1MM	456,320	C	C
J8DX	1,751,680	D	
V47UY	141,750	D	
XE1KK	82,260	D	

Oceania

YB2EMK	6,336	A	B
YB0WWW	1,088	A	B
3D2YU	1,006,500	A	C
(YZ1AU, op)			
VK4UC	47,940	A	C
DU1EV	1,386	A	C
VK4FJ	11,618	B	B
VK4EJ	7,800	B	B
KH6HE	3,038	B	B
VK3GK	1,400	B	B
DZ71DX	1,128	B	B
(DU1SAN, op)			
VK2CZ	150,144	B	C
VK4JSR	40,992	B	C
ZL1ANJ	37,672	B	C
DU7/N7ET	3,520	C	A
ZL2BR	188,496	C	B
ZL/W3SE	152,928	C	B
ZL1BYZ	147,000	C	B
VI8NT	109,032	C	B
(VK8AV, op)			
VK4TT	69,120	C	B
ZL1ALZ	99,552	C	C
DU3NXE	7,392	C	C
ZL6QH	1,017,632	D	

South America

PY3YD	27,264	A	A
YY5AFD	3,900	A	A
LU2EE	424,196	A	B
(LW5EE, op)			
PR2F	406,196	A	B
(PY2NDX, op)			
LU5FZ	294,560	A	B
HK3AXY	123,904	A	B
YV7QP	115,206	A	B
LT1A	663,120	A	C
(LU3CT, op)			
CE3BFZ	34,020	A	C
LU1VK	51,620	B	A
LU5EVK	9,768	B	A
LU8EGS	8,360	B	A
LW7DQW	1,368	B	A
LU4DX	365,304	B	B
ZX2B	298,820	B	B
(PY2MNL, op)			
YY5YMA	194,880	B	B
PS8HF	170,856	B	B
LV0N	169,952	B	B
(LU2NI, op)			
FY5KE	1,106,000	B	C
(FY5FY, op)			
ZX5J	801,724	B	C
(PP5JR, op)			
LU6ETB	438,016	B	C
(IC8WIC, op)			
LS1N	406,608	B	C
(LU1NDC, op)			
AY8A	344,968	B	C
(LU8ADX, op)			
CX2AQ	95,116	C	A
LW5DR	16,296	C	A
LU7DW	6,336	C	A
PY2QA	3,072	C	A
PY2FRW	352	C	A
LU1EWL	421,568	C	B
PY1NX	158,752	C	B
LW6DKW	32,400	C	B
PY3AU	27,664	C	B
PP2JT	14,664	C	B
ZY3X	654,360	C	C
(IV3NVN, op)			
CX7BY	484,000	C	C
LT1F	2,313,000	D	
PJ2T	2,103,948	D	
P40K	2,042,092	D	
LR1F	1,908,568	D	
OA4O	1,144,124	D	

known as the upper Midwest.

Sometimes the Single Operator High Power categories look like a version of *The Beatles* "Helter Skelter" by the time all is said and done. But in 2003, there was a comfortable margin of victory for each of the W/VE winners at this power level. Bob, N4BP was involved in the closest contest, CW Only, but pulled out the win. In a bittersweet twist, this was the last ARRL Contest for one of contesting's shining lights, and someone I was personally honored to call my friend, Jim White, K4OJ. Jim's second place finish to Bob in this category will be remembered, not because of the score of the place, but as another reminder of the skill and talent of an exceptional man. Thanks OJ and 73.

In the Single Operator High Power Phone Only, the "battle of the bands" was in Texas, where Chuck, W5PR, was able to prevail over Ken, WM5R, who was operating from the continually developing K5TR station. Jeff, WC4E, brought home top honors in the Mixed Mode category by a substantial margin over John, K6AM, who was one of the few West Coast stations to make a Top Ten Box appearance.

The W/VE Multioperator category was won by NE4AA—the club call for the Sarasota Emergency Radio Club. Runner-up in the category NX5M led a crew of eight top-flight operators against NE4AA, whose "secret weapon" is no secret—the operators of K1TO and K6AW are considered among the absolute best in the world. Makes me think of *Billy Joel's* "Pressure" when you see these titans go head-to-head.

While they may not have won overall categories, there are a lot of stations not ready to start singing *Elton John's* "I Guess That's Why They Call It The Blues." In many cases, only a few contacts or multipliers separated outstanding efforts in Top Ten Boxes or in various regions. It didn't get much closer than the fight for 3rd place in the Single Operator Mixed Mode Low Power category, where Tom, WD5K, edged John, KD2RD, operating as K2Z, by a mere 282 points or the finish for 8th place in Single Operator Phone Only Low Power, where Robert, KT3RR, squeezed by Mike, AB6GS, by only 150 points. Another great finish was Larry, WØETC, hanging on to 5th place in the Single Operator Phone Only QRP category by a scant 548 points over Dennis, KKØQ.

"We are the World"—DX Competition

Some of the winners repeated in 2003; some changed. Exciting QTHs such as ZD8, P4 and D4 were replaced by interesting locales like 3D2, CX and PY. A study of the DX competition becomes an interesting exercise in geography. The Americas, Africa, Asia, Europe, Oceania —no matter where you look, it seems they had representatives in the non-W/VE top scores. The lower latitudes definitely seem to hold an advantage during the waning years of sunspot activity. The competitions for the overall DX winners featured one close finish, a few tight contests, as well as a couple with large margins of victory. And even though no new overall records were set and sunspots were few, as always, the DX stations seemed to enjoy the competitive nature of the event.

The Single Operator QRP categories evoked images of "The Limbo Rock" sung by *Chubby Checker*, with the power mantra of "How low can you go?" Well, with 5 W or less on CW Only, Parva, CX2ZQ, brought home a win to Uruguay by more than doubling the score of runner-up Enrique, EA4BF. The Phone Only winner emerged from Puerto Rico as Jose, WP4EDD, topped the 300K-point level to hold off the challenge from Carlos, TI2KAC. The closest overall finish on the DX side was Icko, JA1BPA, beating Freddy, PY3YD, by a scant 2626 points.

While several groups "Heard It Through The Grapevine," our grapevine source on the Single Operator Low Power categories apparently ran through Argentina, as two of the three winners hailed from the Southern Hemisphere. Hugo, LU1EWL, scored a 52k point victory over Raul, CO8ZZ in the CW Only category. Hugo's countryman, Juan, LU4DX, held off a tighter challenge from Mohamed, CN8KD (23k) in the Phone only category. In the Mixed Mode category, we find Bruce, ZF2NT, as a repeat winner, posting a substantial margin of victory over Manuel, EA7RM.

For the Single Operator High Power operators, the song might just be *Belinda Carlisle's* "Heaven Is A Place On Earth," since they truly rose to the top of the crop of contesters in the 2003 event. Simone, IV3NVN, operated the ZY3X station to first place in the CW Only category with Raul, CX7BY, placing second in the standings. Using the call FY5KE, Didier, FY5FY, managed to be a repeat champion, this time in the Phone Only category. Placing second was Stan, K8MJZ, guest operator at WP2Z. Oceania was the locale for the final Single Operator champion as Boban, YZ1AU, grabbed his slice of "heaven" operating as 3D2YU in the Mixed Mode category. Jiri, OK1RI, placed second to Boban in the category.

The DX Multioperator competition seemed to be a mix of *The Beach Boys* "Fun Fun Fun" and *The Eagles* "Take It To The Limit" as three groups broke the 2Meg point threshold and vied for top honors. In the end, the operators at LT1F brought home first place, with the crews at PJ2T and P4ØK close on their heels.

As in the W/VE competitions, not all of the really close races were found at the top of the box score. Consider the CW Only QRP scores, where only 8840 points separated YT7TY, GW4ALG, EA8/SM6CUK, G4EDG and G3YMC between 3rd and 7th places overall. Only 216 points separated EA1BZ and LU5EVK in the Phone Only QRP category, while 279 points separated F5NBX and EM3J (UU2JZ, op) in the Mixed Mode High Power arena.

"Copacabana"—A Red-Hot Affiliated Club Competition

About one-third (773) of the total entries participated in the ARRL Affiliated Club Competition. Remember that in order for your club to compete, it must be a current, full ARRL affiliated club. Also, DXpeditions are not eligible for inclusion in this club competition event.

The Unlimited category ended up as a duel between the Potomac Valley Radio Club and the Florida Contest Group. PVRC used a 26-log advantage to beat FCG by 823k points. Want to bet the FCG develops a strategy to increase submissions for 2004? The Central Texas DX and Contest Club had only a few logs (14) but big scores (average score of 347,024) to win the Medium category. The Yankee Clipper Contest Club held on to second place over a group of hungry clubs in the category, including the Frankford Radio Club, the emerging Contest Club Ontario, and the Minnesota Wireless Association. The Local category saw the CT RI Contest Group hold off stiff challenges from the Columbia-Montour ARC and the Livermore ARK to win a coveted club gavel. Congratulations to all of the participants upholding the honor of their clubs!

The Sunspots, My Friend, Will Come Back Once Again

Expanded coverage of the 2003 ARRL 10 Meter Contest can be found on the ARRLWeb at **www.arrl.org/contests**. There you will find some interesting sidebars, expanded soapbox comments, and photographs recounting the experiences of the 2003 participants. We haven't reached the end of Cycle 23, so the odds of outstanding conditions for the 2004 ARRL 10 Meter Contest are, shall we say, similar to the title of the great *Moody Blues* album "Days of Future Passed." We will have to wait and see what the weekend of December 11-12 holds as far as propagation for this year's event. But we will also all anxiously bide our time, waiting for, as *Tracy Chapman's* song declares, "New Beginnings."

2004 ARRL August UHF Contest Announcement

Date: 1800 UTC Saturday August 7-1800 UTC Sunday August 8

How to participate: Any amateur station on any band above 222 MHz may be worked. The entry classes for Single Operator are high power and low power. A Rover is a 1 or 2 person station that moves and operates from two or more grid squares. Lastly, there is the Multioperator category. You may rework a rover station each time they move to a new grid square. Use of a spotting network makes your station a Multioperator entry.

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 on-line at **www.arrl.org/locate/gridinfo.html**.

Special interest: During the contest some tropospheric propagation may occur. It is also a good time to make sure all equipment is in proper order for upcoming contests.

Quirks: It can be a great time of year for hilltopping while the lower elevations may present a greater challenge during the summer months.

Rule changes this year: None for 2004.

Best reason to participate: This contest is a good way to build up totals for the ARRL UHF operating awards such as VUCC.

Relative challenge: 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. The more bands you are able to utilize the better your results. Rovers are very important during this contest, as they activate as many grid squares as possible.

Scoring: QSOs count 3 points on 222 and 432 MHz, 6 points on 902 and 1296 MHz and 12 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.

Rovers Only: The final score consists of the total number of QSO points from all bands times the sum of unique multipliers (grids) worked per band (regardless of which grid they were made in) plus one additional multiplier for every grid activated.

How to report your score: You must send in your entry by September 7, 2004. E-mail your Cabrillo format log to **AugustUHF@arrl.org** or send paper logs and complete summary sheet to August UHF Contest, 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 2 units of postage to August UHF Contest Rules, ARRL, 225 Main St, Newington, CT 06111.

For more information: e-mail **contests@arrl.org** or phone 860-594-0232. QST

NEW PRODUCTS

LOBOY UNIVERSAL MOUNT

◊ Pro.Fit International has announced the introduction of a new model of their LOBOY universal suction mount for small radios and control heads. The new design incorporates the addition of a 90° "L" bracket. The integrated swivel allows for adjustment in any direction, while maintaining its position without tightening or locking levers. The LOBOY attaches to vehicles with a flexible mounting pad along with a 3M adhesive that is said to be removable without damage or residue. For more information, contact Pro.Fit International, 1335 Eagandale Ct, Eagan, MN 55121 or see **www.pro-fit-intl.com**; tel 651-688-3588. Note that the 25% corporate discount is available to ARRL members. Just type ARRL in the "coupon code" window during on-line checkout.

EAR VIBRATION SPEAKER MICROPHONE

◊ MFJ offers the MFJ-283 speaker microphone using a piezoelectric accelerometer element to allow microphone pickup from within the ear based on vibration. Since it does not pick up acoustical energy directly, it is said to be effective in noisy environments. A Velcro-attached push to talk switch allows discreet communication. The separate speaker element is designed to operate from 40 mW to a maximum of 80 mW. Price: $39.95.

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.

STRAYS

EMCOMM EVENT JULY 24 IN KANSAS

◊ A full day Amateur Radio Emergency Communications Program will be offered July 24 at The Salvation Army, 420 E Santa Fe, Olathe, KS 66061 (15 miles SW of Kansas City). The day begins with New Ham Orientation at 9 AM, sponsored by the Johnson County ARES. All interested hams will see and learn about ARES and the many facets they can get involved in. Following lunch, which will be provided, Kansas SATERN will host an ARRL Emergency Communications seminar from 1 PM to 5 PM. Geared to all emcomm volunteers, this interactive 4 hour seminar will discuss the latest concepts and improvements in Amateur Radio emergency communications, describe the ARRL on-line emergency communications courses, utilize disaster scenarios for group discussions and offer a self-preparedness examination. Seats are limited so please pre-register by contacting Dan Miller, K3UFG, **k3ufg@arrl.org**, tel 860-594-0340. For more information, contact June Jeffers, KBØWEQ, **KSSATERN@att.net**, tel 913-856-8674.

PERSISTENCE RESULTS IN CLEAN SWEEP

◊ ARRL Life Member Gurnee Bridgman, W9NT, of Bemidji, Minnesota, started collecting "NT" contacts in 1969 and didn't snag the last one, W8NT, until recently. Over the years, he had worked them all, save for Phil Sickinger, W8NT, who reactivated his station to allow Gurnee to achieve his goal. Interestingly, the original 9NT belonged to Gurnee's father when he lived in Chicago. The NT suffix has thus been in the family for nearly eight decades.

By Jay Townsend, WS7I
ws7i@arrl.net

2004 ARRL RTTY Roundup Results

A regional look at a premier digital contest.

That was some fun! RTTY contests make you improve your equipment, your operating skills, and yes, you still get bloodshot eyeballs and painful cramps in your shoulders.

This year's propagation dictates that the results be examined on a regional basis. What we saw on the bands in the Pacific Northwest was much different from the picture in the Northeast or Southeast. All 50 States plus DC were available in fairly easy supply this time for those chasing the RTTY WAS award. Even North Dakota became a hot spot with NWØL melting the ice off the antennas.

Interest in the Roundup increased again with 22% more logs submitted over last year. This increase makes it an all-time high of 910 logs received. The RTTY community obviously loves this contest.

DX Perspective

DX contest entries help to make the Roundup very interesting. European DX usually starts the contest on the low bands. ZX2B operated by Wanderly, PY2MNL, took the honors in the Low Power division, setting a new DX Low Power record. He was followed in the standings by Mark, P4/K6UFO, and Mohamed, CN8KD. HI3TEJ, 9A3ZI, FK8HN and OK2CLW also had high scores. High Power Single Operator honors went to Nikola, 9A5W, in a tight race with KH7X operated by Mike, KH6ND. ON4GG, S54E, EO6F (UXØFF, op) and LX9SW (LX1RQ, op) stood next in line.

Repeating in the Low Power Multioperator class again this year was the KP2D crew, followed by LU5EML, then Europe represented by IK1TWC, UTØH and F6FJE. The Japanese were led by JM1NKT.

High Power Multi was won this year by MW2I followed by UZ4E and SP5ZCC.

National W/VE Perspective

The competition for the W/VE categories boiled down to a couple of runaway wins and a couple of interesting races. Don, AA5AU, has been long recognized as a dominant force in this event. And in 2004, his dominance continued, as he won the Single Operator Low Power category for the 13th time in the 16 RTTY Roundups. Steve, N9CK, edged out Tom, WX4TM, by fewer than 4000 points for runner-up honors. Rick, KI1G, was another repeat winner in the W/VE national scene as he easily outdistanced a valiant effort by runner-up George, W1ZT, in the Single Operator High Power category.

The Multioperator categories showed much closer competition. In Low Power, the stalwarts of N2WK fought back a stiff challenge from K4WW for top honors. The crew at K9NS brought home the High Power title, beating the W4RM effort by about 15,000 points.

Regional Highlights

Northeast Region

Propagation favored New England again this year. They had the advantage of the great stateside rate coupled with the big European runs on 10 and 15 meters. When the A and K rose during the rest period the contest was over for most of the rest of the guys and gals. The 1200Z slot, when the East Coast owns Europe, again gave the East Coast the edge in the contest. Rick, KI1G, repeated as the High Power winner, soundly defeating George, W1ZT, who burned up his amplifier during the contest. May, WA1EHK, notched the Single Operator Low category. The N2WK crew took the Low Power Multi and W2YC the High Power category.

Southeast Region

From the warmer parts of the country Bob, N4BP, took the Southeast Region Single Operator High Power victory from Florida while Don, AA5AU, repeated as the contest Low Power winner again this year. K4MM took the Multi Low Power setting a new Southeastern Division record. The guys from Virginia took the W4RM call to victory in the High Power Multi category setting a new Roanoke Division record.

Central Region

The Central Region saw Steve, N9CK, repeat as winner in the Single Operator Low Power category. Another Steve, AI9T, and took the honors in the region in the High Power. My old buddy from Kentucky, Shelby, K4WW, along with his packet

Top Ten Scores

Single Operator

W/VE—Low Power

AA5AU	211,932
N9CK	124,696
WX4TM	120,922
AD6WL	100,492
KC4HW	97,002
NØAT	91,758
KR6E	83,622
WØLSD	83,340
WA1EHK	78,960
K9MUG	77,518

W/VE—High Power

KI1G	230,656
W1ZT	167,343
W7WW	133,734
AI9T	133,634
N4BP	133,001
K3MM	124,584
W5AP	124,300
WØYK	123,578
WA2ETU	122,304
W4UK	118,899

DX—Low Power

ZX2B (PY2MNL, op)	133,400
P4/K6UFO	95,546
CN8KD	75,499
9A3ZI	57,800
FK8HN	57,521
OK2CLW	57,421
LZ9R (LZ3YY, op)	56,640
YV5AAX	56,232
GØMTN	56,112
S57NRO	54,201

DX—High Power

9A5W	152,964
KH7X (KH6ND, op)	140,154
ON4GG	134,328
S54E	121,220
EO6F) (UXØFF, op)	119,325
LX9SW (LX1RQ, op)	97,515
OH2BP	80,100
EA1AKS	74,195
F6IRF	70,798
CX7BY	64,263

Multioperator

W/VE—Low Power

N2WK	104,082
K4WW	100,687
W6OAT	97,092
N5TW	92,820
K4MM	89,650
N5ZM	82,818
WS7I	81,627
KGØQG	64,792
W5VZF	62,112
KOØZ	59,605

W/VE—High Power

K9NS	174,225
W4RM	159,408
W6YX	149,295
N8NR	134,780
W7RN	129,164
AB5K	118,107
KJ7TH	108,252
KE7AJ	103,828
WØMA	103,576
NWØL	100,485

DX—Low Power

KP2D	88,504
LU5EML	57,123
IK1TWC	42,480
UTØH	34,968
F6FJE	25,530
JM1NKT	23,450
UR4CU	8,528
RU6MM	6,118
MMØBQI	4,932
UAØLKD	4,374

DX—High Power

MW2I	106,182
UZ4E	70,616
SP5ZCC	51,744
DL4MFP	48,024
OH4RH	44,712
JA1BWA	37,228
OL5Q	28,548
OH2K	11,858
KL7CQ	9,331
SV1XV	3,483

Region Leaders

The tables list call sign, score, class (S = Single Operator, M = Multioperator) and power (A = Low Power, B = High Power).

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)			
WA1EHK	78,960	S	A	AA5AU	211,932	S	A	N9CK	124,696	S	A	NØAT	91,758	S	A	AD6WL	100,492	S	A
N1MGO	74,800	S	A	WX4TM	120,922	S	A	W4LC	74,134	S	A	WØLSD	83,340	S	A	KR6E	83,622	S	A
N2DBI	73,790	S	A	KC4HW	97,002	S	A	N8IS	63,936	S	A	KE5OG	74,733	S	A	N6OJ	68,450	S	A
K1PY	73,098	S	A	K9MUG	77,518	S	A	K8IR	57,120	S	A	KTØDX	68,809	S	A	W7LD	56,376	S	A
W1ECT	72,556	S	A	AD4EB	71,070	S	A	W8UL	55,936	S	A	NA5U	66,352	S	A	N7UVH	54,568	S	A
KI1G	230,656	S	B	N4BP	133,001	S	B	AI9T	133,634	S	B	W5AP	124,300	S	B	W7WW	133,734	S	B
W1ZT	167,343	S	B	W4UK	118,899	S	B	VE3NZ	113,848	S	B	K5AM	117,312	S	B	WØYK	123,578	S	B
K3MM	124,584	S	B	N2XD	103,550	S	B	KE9S	94,605	S	B	N5TY	94,905	S	B	WX5S	110,344	S	B
WA2ETU	122,304	S	B	N5PA	91,665	S	B	AB8K	94,160	S	B	WØHW	62,775	S	B	(@N6RO)			
AC1O	115,881	S	B	W4GKM	90,825	S	B	K3GP	84,802	S	B	VE5CPU	61,390	S	B	WK6I	105,696	S	B
																K6XX	98,418	S	B
N2WK	104,082	M	A	K4MM	89,650	M	A	K4WW	100,687	M	A	N5TW	92,820	M	A	W6OAT	97,092	M	A
N3XLS	45,346	M	A	N5ZM	82,818	M	A	N8LRG	57,321	M	A	KGØQG	64,792	M	A	WS7I	81,627	M	A
KD6NA	23,550	M	A	W5VZF	62,112	M	A	K8VT	40,764	M	A	KOØZ	59,605	M	A	N7PWZ	37,060	M	A
N3RN	19,760	M	A	WC4DC	33,939	M	A	K9OSH	3,080	M	A	WV7T	3,534	M	A	WA6OEC	23,870	M	A
WB3LGC	12,934	M	A													K6OWL	19,278	M	A
W2YC	35,604	M	B	W4RM	159,408	M	B	K9NS	174,225	M	B	AB5K	118,107	M	B	W6YX	149,295	M	B
W3FV	21,528	M	B	K3KO	69,328	M	B	N8NR	134,780	M	B	WØMA	103,576	M	B	W7RN	129,164	M	B
				W4NF	47,094	M	B	KE4YVD	77,100	M	B	NWØL	100,485	M	B	KJ7TH	108,252	M	B
				AA4V	32,676	M	B	N2BJ	56,112	M	B	KØKO	85,540	M	B	KE7AJ	103,828	M	B
								WT8C	53,606	M	B	KDØS	74,424	M	B	N6RC	82,710	M	B

helpers repeated as Low Power Multi winner. The top-notch crew at K9NS was down nearly 50,000 points from 2003 but still managed to take the overall honors in the Multioperator High Power class. Finally, a new Division Record was set in the Great Lakes by the crew at N8NR.

Midwest Region

Ron, NØAT, dug out of the cold Minnesota winter to win the Low Power honors in the Single Operator class. Jim, W5AP, in Texas took High Power. Setting a new West Gulf Division record and winning Low Power Multioperator was N5TW. AB5K won the High Power Multi class.

West Coast Region

The West Coast region covers a huge area and its length causes propagation in the northern part to be vastly different from the southern end. 2004 saw a real lack of openings on any of the high bands into Europe. Yet the Northern California Contest Club guys were out in force and competed very well.

This region had new division records fall in its Southwestern Division as Jim, AD6WL, set a new Single Operator Low Power record. Despite missing only DC and DE multipliers, Ed, WØYK, set a new Single Operator High Power record for the Pacific Division. The W6YX crew set a new Multioperator High Power record. And up in the Northwestern Division Lamar, WA7LT, and WS7I managed a new Multi Low Power record.

David, W7WW, who has been perfecting his SO2R "stuff" won the High Power Single Operator and Rusty, W6OAT, used packet as his second operator to win the Low Power Multi for the region.

Club Competition Results

Medium Club	No.	Score
Northern California Contest Club	35	1,439,443
Potomac Valley Radio Club	16	826,158
Society of Midwest Contesters	14	562,788
Tennessee Contest Group	15	512,040
Florida Contest Group	7	441,171
Minnesota Wireless Assn	10	366,882
Central Texas DX and Contest Club	6	327,370
Contest Club Ontario	8	279,753
Yankee Clipper Contest Club	6	275,514
Frankford Radio Club	9	245,422
Rochester (NY) DX Assn	3	180,820
North Texas Contest Club	3	172,756
Southern California Contest Club	3	161,920
Willamette Valley DX Club	3	142,644
Mad River Radio Club	6	112,053
Carolina DX Assn	4	84,318
Western Washington DX Club	3	41,483
South East Contest Club	3	29,690
Local Club	**#**	**Score**
Dauberville DX Assn	3	125,534
Boeing Employees ARS - St. Louis	3	112,738
Columbia-Montour ARC	3	92,431
Sterling Park ARC	3	12,662

Canada

Only two Canadian Multioperator entries were received, but boy did they stage a battle! When the smoke had cleared, the VE3FJB team emerged with a victory over the VE6AO operators by a mere 130 points.

Andy, VE9DX, made off with top honors in the Single Operator Low Power category. Not too far off his heels was a spirited battle between Paul, VA3PC, who edged Richard, VE3IAY, by only 421 points for second place. The final Canadian champion was George, VE3NZ, who fairly easily outdistanced runner-up Scott, VE1OP, in the Single Operator High Power contest.

Affiliated Club Competition

When the RTTY reflector announced a test, run the Friday night before the contest, I knew that there was serious interest in the Contest Club competition. Kudos to the NCCC for setting up the test run. The club's reflector listed a series of RTTY tips and a team of RTTY operators worked personally with club members to bring them up for the contest. At least one club meeting included a RTTY presentation.

The Northern California Contest Club defeated the Potomac Valley Radio Club in the Medium Club category. On the local level, the Dauberville DX Association beat out the Columbia-Montour ARC for local club pride. Remember that the club rules require three entries for a club to be recognized.

Short & Crisp

Higher rate requires shorter messages. Use short and crisp exchanges for higher efficiency. Many operators send their call twice while in the Search and Pounce mode. Everyone has removed the K from the end of nearly all messages. An exception to "short and crisp" is the need for carriage returns and spaces to make your exchange pop out on the receiving station's screen.

The quality of RTTY operators in the ARRL RTTY Roundup gets better every year. Congratulations all around!

Next Year

Spirited club competition is bound to increase. Can the NCCC continue to beat out the PVRC? Will AA5AU move to High Power for the first time? Will the next winner exceed 2000 contacts? Use the rest of the year to plan strategy for the next Roundup. 2005 is unique as January 1 falls on the first weekend and RTTY Roundup moves to the second weekend. January 8-9 will be the contest dates. QST

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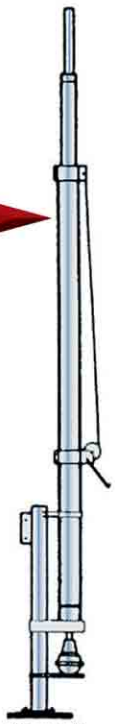

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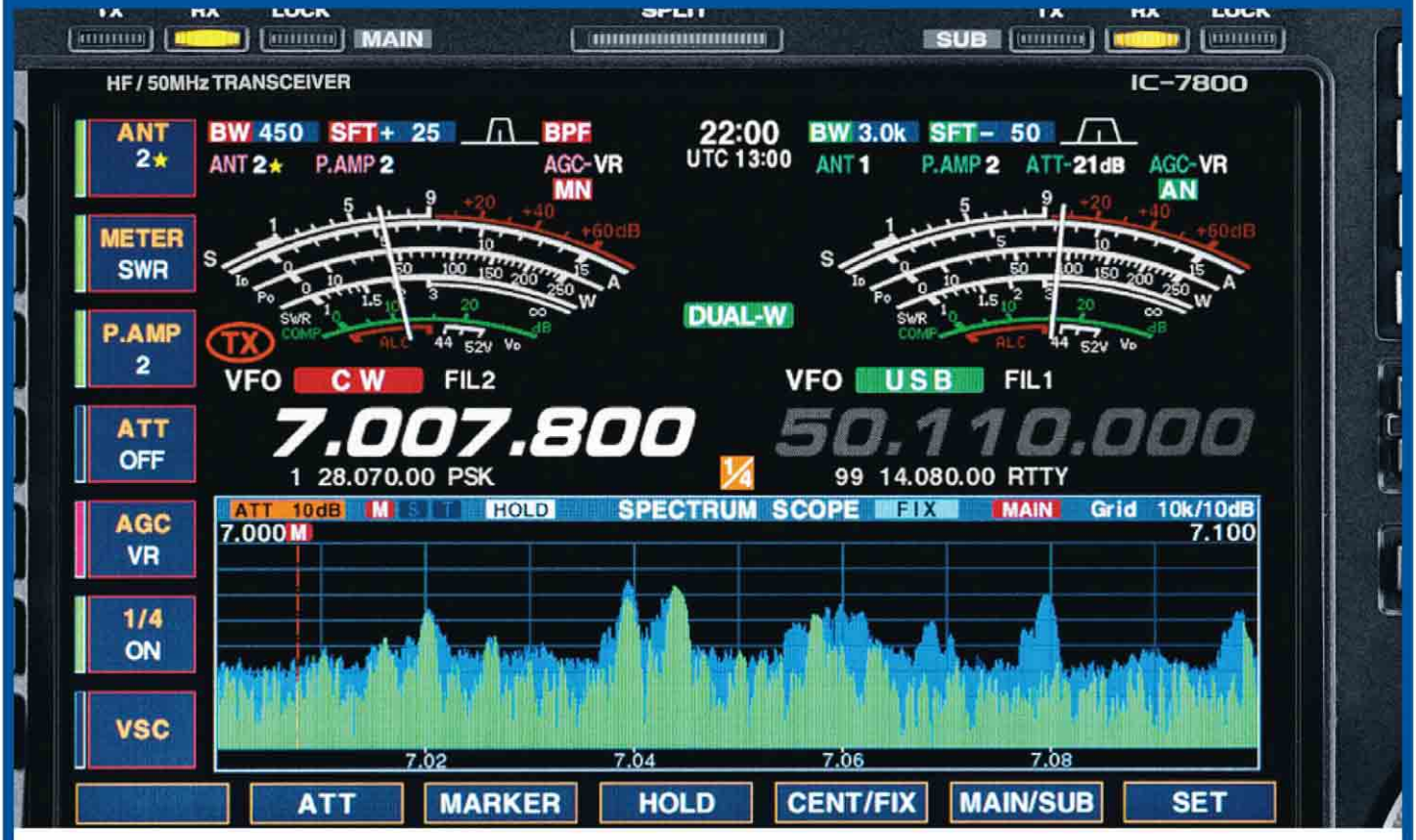

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Dig down deep in that DX pileup to capture your prize QSL. The IC-7800 is here. There's never been a more advanced amateur rig, ever. The band scope, with its own dedicated 32 bit CPU, offers commercial test equipment responsiveness. Seven steps ranging from +/-2.5kHz to +/-250kHz deftly represent up to 500kHz of spectrum. Once you've visually targeted the pileup you want to break through, swoop in with the 7800's unmatched DSP filtering to claim your prize. There's so much more to this rig, we'd have to take out a poster-sized ad to describe it! So call us, instead.

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6814

Choosing Your Spring Roster

AES is the place to start when building a "play-off bound" amateur radio shack. Our team makes sure that your "team" has all the top draft picks from the top manufacturers including Icom, Yaesu and Kenwood. We make every free agent's stats available for your educated team selection.

picks from AES and the Ham radio manufacturers

Build your ultimate radio dream team just like the Sluggers using the sound advice of AES' seasoned staff; (inset) IC-7800, the number one draft pick out of Icom America (rookie picture courtesy of Icom America)

AES

1-800-558-0411

The biggest thing in the spring draft! Icom launches the hottest rig with the most bells and whistles. It's going as the number one draft pick for those teams that have the resources and the drive for the championship win. The 200W, HF/50MHz IC-7800 (pictured at left) is an artistic fusion of over 40 years of analog RF circuit development expertise with cutting-edge digital technology. Built-in power supply and automatic antenna tuner, four 32-bit floating DSPs, internal distortion reduction, improved blocking, less internal phase noise, "build your own" digital IF filter, TWO identical receivers with 110dB dynamic range…the kitchen sink! Be one of the first to own this incredible rig, making your squad a shoe in for the pennant race. 16.6"w x 5.9"h x 17.1"d, 55 lbs. (IC-7800, $10599.99)

Another hard-hitter making a digital leap into the majors is the all-mode, HF, 50MHz IC-756 PROII; adding customer suggestions and the most advanced DSP to your batting order. The PROII (pictured to the right) offers a 32-bit floating DSP, 24-bit AD/DA converter, over 100 built-in IF filters and selectable IF shape, dual watch, SSB/CW synchronous tuning, manual and automatic notch functions, digital voice recorder, adjustable noise blanker and much more. The PROII also comes with a FREE PS-125 power supply.

13.38"w x 4.38"h x 11.2"d, 21 lbs, 1 oz. (IC-756PROII, © $2299.99)

Boosting any team higher in the ranks is the IC-746PRO with its 32-bit DSP technology. 100W, 102 memories, and a multi-function LCD command the HF/50/144 MHz 746PRO. 24-bit AD/DA converter, digital twin passband tuning, manual notch filter, digital RF speech compression, RTTY demodulator and decoder, memory keyer, built-in antenna tuner, ample CW functions and digital noise reduction make this rig a ringer for team captain. Receive a FREE PS-125 when you sign this rig. 11.3"w x 4.7"h x 12.5"d, 19 lbs, 13 oz. (IC-746PRO, © $1379.99)

The HF all-band IC-718 finds contact between bat and ball easy with wide dynamic range, high C/N ratio and full duty operation.This unit also brings RF gain control, VOX operation, flexible filter selection and high frequency stability to the game. The 718 also comes with a FREE UT106 DSP unit. 9.44"w x 3.75"h x 9.41"d, 8 lbs, 6 oz. (IC-718, $569.99)

With base station features and mobile unit size, the IC-706MKIIG takes up minimal room on your roster. This 160-10M + 6M, 2M, 70cm rig is constructed for stable, quality output with low IMD and spurious emissions. Tone squelch, DSP, auto repeater, simple band scope function and 107 memories make the Mark II G a power hitter. A FREE RMK706 separation kit comes with purchase. 6.56"w x 2.28"h x 7.88"d, 5 lbs, 6 oz. (IC-706MKIIG, $769.99)

When you get the IC-703 twins on the field you'll see the family resemblence to their brother, the 706MKIIG (all similar in looks). They all have a head for the game with the 703 and 703PLUS geared toward QRP enthusiasts. The 160-10M 703 is capable of 5/10W and features a relay-type antenna tuner, low current consumption, DSP, memory keyer and 105 memories. Ideal long distance communications. The IC-703PLUS is the brother with 6M in his repetoir. Both 6.56"w x 2.28"h x 4.88"d, 4.4 lbs. (IC-703, © $519.99; IC-703PLUS, © $649.99)

The 100/75W IC-910H is a veteran of stable output. This 2M/440MHz base provides a high performance receiver, 9600bps and satellite support. With 99 memories and simultaneous receive, it rounds out any team. 9.5"w x 3.69"h x 9.4"d, 9.9 lbs. (IC-910H, $1099.99)

Twice the versatility, twice the fun on the field and off! The 2M/440MHz, 50/35W 2720H offers simultaneous receive capability, independent controls for each band, and DMS with 212 memories. It also features CTCSS and DTCS, wideband receive, weather alert, auto repeater, remote control microphone, and compact remote control head. Mount controller to main unit with the optional MB-85. Main: 5.5"w x 1.56"h x 7.38"d, 3 lbs. (IC-2720H, $369.99)

The IC-208H is a high power batter with wideband reach. This 2M/70cm mobile provides 55/50W, plus reduced power for local. The 208H covers 118-173, 230-549 and 810-999MHz (cell blocked) receive as standard. With improved DMS, detachable front, and 500 memories. 5.56"w x 1.56"h x 7.31"d, 2.65 lbs. (IC-208H, $299.99)

75W of "base" hitting power. The V8000 also offers 25/10/5W. With the operator-facing speaker, audio is clear even when mobile. The 2M rig features CTCSS/DTCS, standard DTMF, 207 memories, FM narrow and remote mic. 5.9"w x 1.97"h x 5.9"d, 2.22 lbs. (IC-V8000, $189.99)

65W and new digital features are packed into this super draft pick. With a familiar 2100H interface, the 2M IC-2200H adds optional digital capability providing modulated and demodulated clear voice and data. This mobile also offers 207 alphanumeric memories with DMS, standard CTCSS and DTCS encode/decode, 24 DTMF autodial memories, weather channel with alert, and FM narrow mode switchable. 5.5"w x 1.56"h x 5.75"d, 2.75 lbs. (IC-2200H, $229.99)

The durable 2M older brother of the IC-2200H with superior RX IMD and ultimate pitching performance. The IC-2100H-25N offers 50W on transmit, extending its batting range. It features CTCSS encode/decode, tone scan and 100 alphanumeric memories. It can be remote controlled using the backlit mic and continues to produce awesome stats. 5.5"w x 1.56"h x 7.09"d, 2 lbs, 10 oz. (IC-2100H-25N, $169.99)

Compact, full featured; the IC-T90A will lead your team to the pennant. The 50/144/440 MHz T90A offers wideband receive with 5W. It features 555 alphanumeric memories with Icom's DMS scanning technology. The T90A also provides DTCS/CTCSS, DTMF encode, PC programmability and weather resistance. 2.53"w x 3.44"h x 1.16"d, 8.47 oz. (IC-T90A, $259.99)

When choosing your line-up and batting order, make sure to consult AES' knowledgeable staff and do some homework online at www.aesham.com. (picture courtesy of the AES coaches)

Quality, simplicity, anywhere in the outfield. The IC-V8 polycarbonate and die-cast aluminum 144MHz FM transceiver is constructed for durability in any position. The 5.5W V8 offers 16-button keypad and 100 alphanumeric memories. CTCSS, DTCS and DTMF encoder standard. 2.13"w x 5.19"h x 1.38"d, 12.3 oz. (IC-V8, $124.99)

Powerful output and ample receive audio, the IC-T7H (pic below left) racks up an impressive ERA. A 6W amp circuit provides superior transmit on VHF/UHF with 13.5 V DC. In addition, 500mW of AF is output from the speaker – easy to copy. Separate CTCSS tone encoder and enc/decoder standard. This 2M/440MHz meets MIL SPEC. 2.25"w x 4.34"h x 1.06"d, 10 oz. (IC-T7H, $179.99)

The user-friendly IC-W32A fits into the team seemlessly while offering independent band controls. The full-function, 5W, 2M/440 W32A meets demands of both novice and experienced users. Separate tune/volume controls per band, simultaneous receive, 200 memories, and tone en/decode. Rookie picture at far right. 2.25"w x 5.41"h x 1.31"d, 1 lb. (IC-W32A, $259.99)

More than enough pitching power. The 6W IC-T2H Sport meets MIL SPEC for shock and vibration and is more than enough for far distances. The 2M HT boasts tone squelch, DTMF encode, 40 memories, 10 weather channels and doning. 2.3"w x 5.5"h x 1.3"d, 14.8 oz. (IC-T2H SPORT, $99.99)

High performance, easy fit to the team. The 2M IC-T22A provides 3W of talk power. It's packed with 40 memories (expandable to 80), memory back up, alphanumeric pager, CTCSS encode, and mic remote control. 2.25"w x 4.81"h x 1.12"d, 10.9 oz. (IC-T22A, Closeout $179.99)

ICOM®

Looking to slide into home during that major amateur contest? AES' sales staff can make sure your roster includes the very best rigs to assure you are competitive in the race for the pennant!

Kenwood's stylish TS-2000 and 2000X all-mode multibanders are packed with top-end features yet compact enough to play home, short stop (in your car), or far left field (on DX'pedition). These HF, 2M, 6M, 70cm (1.2GHz on the 2000X) rigs' advanced digital technology converts analog waveforms into digital data in real time. This enables such digital processing as IF filtering, slope tune, auto notch and AGC. The twin 2000 ball players also feature CW auto tune, noise reduction, TX audio shaping, DX cluster tune, dual watch, satellite communications, 300 memories, multiple scan functions and auto antenna tuner. 10.6"w x 3.8"h x 12.5"d, 17.2/18 lbs (TS-2000, © $1499.99; TS-2000X, © $1899.99)

The TS-B2000 is the ball-playing brother of the 2000 and the 2000X with the addtion of PC control software. The B2000 is a smart veteran, wearing a face mask at all times (black box version for exclusive computer control or remote head control in a vehicle, RC-2000 needed) 10.63"w x 3.75"h x 12.5"d. (TS-B2000, © $1349.99)

Beef up your roster by signing a 570 twin offering your team affordable DSP. High-end technology doesn't mean high-end budget, especially for a smaller major league team. With 16-bit DSP, untouchable filtering and central frequency control, the TS-570D(G) and TS-570S(G) provide powerful 160-10M operation (additional 6M with the S version). Both of these units also offer adjustable transmit sound quality, packet and FSK, CW auto tune, extensive memory functions and automatic antenna tuners. 10.63"w x 3.75"h x 11"d, 15 lbs. (TS-570D(G), © $939.99; TS-570S(G), © $1049.99)

Investing in a new player is a serious decision that defines the core of your team. The choice to sign the TS-870S won't be regreted come game day. The all-mode, HF 870S incorporates DSP at the IF stage with a full range of features including 100W of power, 100 memories, built-in keyer, interactive menu function, automatic antenna tuner, noise blanker, multi-function alphanumeric sub display, 4-stage attenuator and K1 LogiKey electronic keyer. 13"w x 4.75"h x 13.13"d, 25.35 lbs. (TS-870S, © $1699.99)

The rookie compact all-modes from Kenwood don't perform like rookies. These all-stars will surely lead your team to the play-offs. The HF/50MHz 100W TS-480SAT and 200W TS-480HX are equipped with transmit/receive AF DSP, PSK31 compatibility, twin cooling fans, RX dynamic range and CW support. Both sluggers also feature optional IF filters, memory name function, multiple scan functions, separate LCD control panel with speaker (playing multiple positions on the field), 100 memories and antenna tuner (SAT version only). They can be controlled from a PC and are PSK31 compatible. In addition, the 480HX boasts two power terminals for separate supply to each half of the twin final section. Don't wait. They are destined to go in the first round. (TS-480SAT, © $919.99; TS-480HX, © $1029.99)

Harnessing APRS®, GPS and SSTV; the TM-D700M FM 144/440MHz mobile features a built-in TNC offering options including simple packet and fail-proof fly ball grab. The brightest spot of the 50/35W D700A is its ability to enable APRS® without a PC. It also has 200 memories, dual receive on same band for voice and data, built-in CTCSS/DCS, 10 programmable memory banks, DTMF memory and remote control, detachable panel with extra-large back lit LCD, cross-band and fixed-band repeater operation, and DX cluster monitoring. 5.5"w x 1.58"h x 7.68"d, 3 lbs. (TM-D700A, © $494.99)

From the extra-large panel to Kenwood's Easy Operation mode, the TM-G707A is extraordinarily user-friendly and really moves in the far outfield. In addition to its regular profile, it can store four others for instant recall. This 50W/35W, FM dual-band (144/440MHz) offers 180 multi-function memories with name function to identify each. Other features that make the TM-G707A the ball player to have on your team include multi-scan functions, priority scan, built-in CTCSS encoder/decoder, cross-band repeater access and an optional quick-release detachable front panel (to stretch for those fly balls). 5.5"w x 1.56"h x 7.44"d, 2.65 lbs. (TM-G707A, $269.99)

The TM-V7A has the look of mobile communication in its Cool Blue home team uniform. This 144/440MHz FM transceiver marks a departure in ergonomic design with its easy-to-operate control panel, reversible LCD, and optional quick-release detachable front panel – conforming to any team's rules and standards. The "5-in-1" programmable memory, 50/35W, DTSS and pager functions, auto simplex checker, built-in CTCSS encoder/decoder, visual scan with pause, memory name function, multi-scan functions, up to 280 multi-function memory channels and dual receive on one band make it a pace-setting base runner. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs. (TM-V7A, © $349.99)

You're guaranteed a triple-play advantage in mobile communications with the 144/440MHz,

WITH THESE DRAFT PICKS, THERE ARE

50W (35W on 440) TM-742AD and its 144/220MHz, 50W (25W on 220) partner, the TM-642AD. These high performance FM multibanders offer triple receive and display capabilities. With optional band units, they can even receive three bands simultaneously – rounding out the inning in minutes. The user can mount the controls and display separately (with optional kit) for unique 3-way convenience. The 742AD and 642AD have built-in DTSS selective calling with page, 101 memories and memory bank system, flexible scan and scan stop modes, tone alert with elapsed time indicator, triple repeater functions, selectable frequency step and S meter squelch. 5.88"w x 1.94"h x 6.88"d, 3.3 lbs. (TM-742AD, $639.99; TM-642AD, $739.99)

You get all-terrain performance with the TM-271A – grass or artificial turf, it performs. On or off road, the 144MHz, 60W 271A delivers powerful mobile performance and other features such as multiple scan functions, 200 memories and memory names, NOAA weather, emergency alert reception, DTMF microphone, high quality front speaker, high frequency stability, and CTCSS/DCS encoder/decoder. This MIL-STD transceiver also provides high quality audio, illuminated keys and large alphanumeric LCD with adjustable green backlighting for easy operation day or night. 6.3"w x 1.69"h x 5.39"d, 2.6 lbs. (TM-271A, © $169.99)

Lightweight, perfect 1200MHz mobile for outfield positioning and bringing in lofty fly balls. The 10W TM-541A offers enhanced night time operation with illuminated keys, easy-to-read large LCD display and multi-function backlit microphone with DMTF. It also features 20 multi-function memory channels plus call channel, multi-scan function, built-in selectable (38 sub-tone frequencies) CTCSS tone encoder, automatic lock tuning function and tone alert system with elapsed time indicator. 5.5"w x 1.5"h x 6.3"d, 2.4 lbs. (TM-541A, $449.99)

The fully equiped, supremely user-friendly TM-461A 440MHz mobile has the ability to play any position on the field. The 35/10/5W 461A offers a built-in CTCSS encoder, tone scan and wireless cloning function. For quick access, essential data can be stored in 61 "memory name function" memory channels. Other features include DTSS selective calling, multi-scan capability, and a case built to military standards. 5.5"w x 1.5"h x 6.3"d, 2.2 lbs. (TM-461A, $439.99)

The unique features of the palm-sized TH-F6A will leave the other team scratching their heads. The FM 144/220/440MHz F6A is an expert at the triple play and offers dual-channel RX capability, 0.1-1300MHz (cell blocked) high-frequency range receive, 16-key pad, multi-scroll key, special weather channel receive, multiple scan functions, built-in CTCSS/DCS, 1750Hz tone burst, internal VOX, automatic simplex checker, and 435 memories. Other attractive features include built-in ferrite bar antenna for AM, backlit LCD, 7.4V 1550mAh lithium-ion battery for 5W output and extended operation, external 1200/9600bps TNC compatibility, and MIL-STD design. 2.3"w x 3.44"h x 1.18"d, 8.8 oz. (TH-F6A, © $309.99)

The TH-D7A(G) is never in danger of losing a fly ball in the farthest outfield when its strength is in its APRS capabilities! This 5W FM dualband (2M, 440MHz) is equipped with a TNC and provides the radio enthusiast with a wide range of data communications options. Along with simple packet, use the D7A(G) along with APRS and a GPS unit to send positioning data. Transmit coordinates to a friend to pinpoint your location. The D7A(G) will display current time, speed, heading and altitude. Choose from 3 position memory settings, 3 types of status text for transmission, and 4 data band settings. An automatic response function is provided, as is display of time passed since transmission and reception. The D7A(G) will surely reduce time spent communicating at the pitcher's mound. And, let's not forget all the other popular features including dual receive on same band, large LCD, multi-scroll key, 200 memories, 8-character memory name, built-in CTCSS and 1750MHz tone burst, DTMF memory and remote control, built-in 1200/9600bps TNC, monitoring DX cluster, auto repeater offset, and MIL-STD design. 4.75"h x 2.25"w x 1.5"d, 12 oz. (TH-D7A(G), © $334.99)

It only takes a glance to see that the TH-G71A is definitely the brighter side of handy communications. This free agent keeps its spirit up even when the team is down in the 7th inning. The FM, 144/440MHz handheld boasts illuminated keypad and LCD, high-performance antenna, and ergonomic design. The 5W G71A (6W with direct 13.8V supply) also offers convenience with menu mode and DTMF remote control, giving you full control over all operating settings. This player would never dream of getting in the ump's face. The G71A also packs PC compatibility (allowing memorization of pitching stats), multi-scan functions, CTCSS encoder/decoder, 200 multi-function memory channels with memory name function, and rugged MIL-STD reliability for body-breaking slides into home. 2.31"w x 4.44"h x 1.44"d, 11.6 oz. (TH-G71A, © $209.99)

The TH-K2AT is a triumph of advanced engineering and design – and is a smart looking rookie in its navy blue uniform. This 2M 5W HT is equipped with internal VOX, NOAA weather reception with audible alert, auto simplex checker, auto repeater offset, large LCD panel and back lit keys, 6-character memory names for the 100 available memory channels, multiple and priority scans, and PC programmability. Its high-capacity NiMH battery gives it the stamina to pitch a no-hitter. 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 – perfect for baseball fields at the mercy of mother nature. 2.44"w x 4.38"h x 1.13"d, 12.5 oz. (TH-K2AT, © $139.99)

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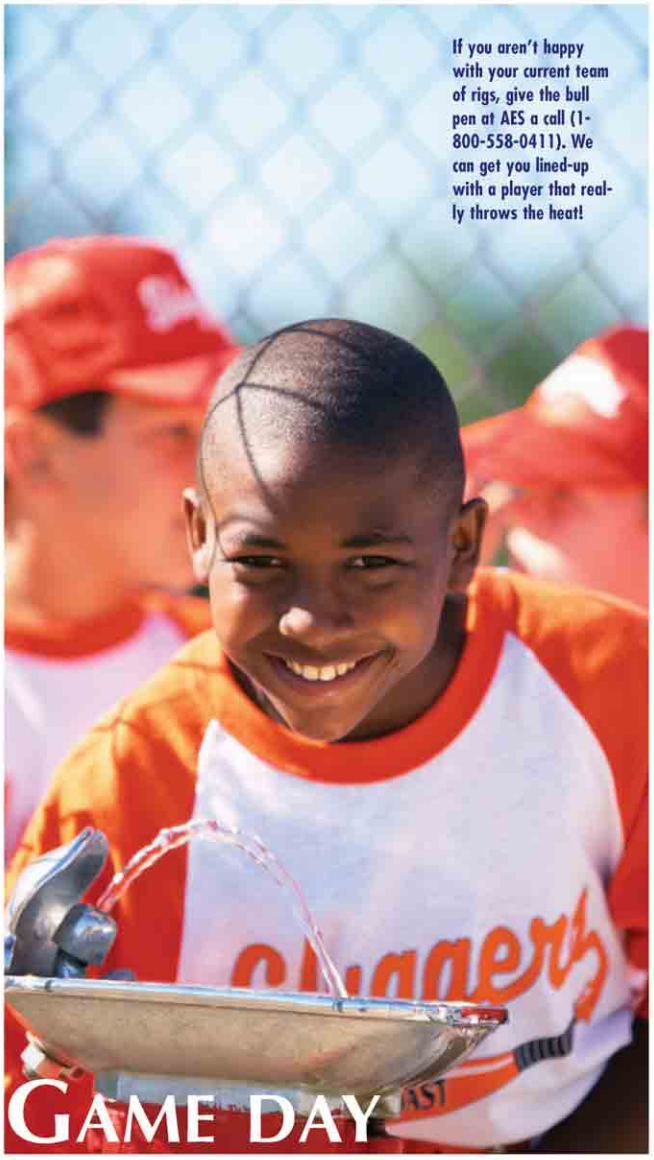


NO REGRETS COME GAME DAY

The bull pen can't contain the heat thrown by the amazing FT-1000MPMKV which builds on the success of the 1000 series by offering 5 new developments. This HF all-mode adds 200W of power and features Class-A (75W) PA operation, interlocked digital bandwidth tracking, a variable RF front-end filter, and enhanced ergonomics. The Mark V maintains its no-hitter streak with a high speed automatic antenna tuner, revolutionary heat sink design for contest and DX environments, enhanced DSP, dual receive with independent AGC systems, outstanding IF filter chain, a full set of CW features, versatile scanning capability, feature customization menu, multi-function display, enhanced Shuttle Jog™, a large high quality speaker, included external power supply, and built-in VOX. 16"w x 5.3"h x 13.7"d, 31 lbs. w/out supply. (FT-1000MPMKV, $2049.99)

The Mark V Field brings the technology of the 1000D and Mark V to you in a 100W, self-contained design. The Mark V has taught its little-leaguer brother well and the Field is ready for the majors. 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 automatic antenna tuner and internal switching-regulator power supply. The high-performance, all-in-one Field is ready to be drafted into the big leagues with a full set of the same functions and features as the Mark V. 16"w x 5.3"h x 13.7"d, 33 lbs. (MKVFIELD, $1739.99)

"The Leagues best. Hitting it WAY out of the Park!"

This all-in-one portable base is a sure bet base runner with the ability to beat the ball home. The all-mode, multi-band FT-897D features high output 100W (HF/6M), 50W (2M), 20W (70cm) using a 13.8V power supply; rugged construction; 200 alphanumeric memory channels; TCXO and optional internal supply and external antenna tuner. The fleet-of-foot 897D also offers outstanding CW features, easy receive offset tuning, scrolling front panel keys, multi-color display, 2 antenna connectors, versatile scan and ARTS™. 7.87"w x 3.15"h x 10.3"d, 8.6 lbs. (FT-897D, $889.99)

The world's smallest HF/VHF/UHF multimode – perfect draft pick for the team in need of a short-stop. The 100W (HF/6M), 50W (2M), 20W (70cm) FT-857D provides wide frequency coverage, outstanding receive, and convenient remote-head use (optional). It also includes 200 memory channels, ease of access to features, advanced DX features, enhanced transceiver performance through the built-in DSP, IF shift and noise blanker, easy data-mode set up, and CW operating flexibility. 6.1"w x 2"h x 9.2"d, 4.6 lbs. (FT-857D, $779.99)

A masterpiece of high-tech design and packaging, the FT-847 is ready for action on SSB, CW, HSCW, AM, FM, Packet, SSTV, RTTY, and at the diamond. It expands your operating horizon beyond HF to 6M, 2M and 70cm, featuring DSP and full-duplex satellite operation. Advanced DSP enhances signal-to-noise ratio via sophisticated bandpass, noise reduction, and auto notch filters. The 847 also features exclusive push-pull cooling, Alaska emergency channel, quick navigation Shuttle Jog™, "Split" operation for DX'pedition and pile-up, high-contrast multi-function blue liquid crystal LCD, 10-key direct frequency entry keypad, and high-speed direct computer control interfacing. 10.2"w x 3.4"h x 10.6"d, 14.4 lbs. (FT-847, $1569.99)

A veteran on the field, blending high performance digital frequency synthesis techniques with operating convenience, the FT-840 is a base station for new clubs and seasoned teams. In addtion to 100W on 160-10M, it adds a choice of 2 optional remote auto antenna tuners. Perfect for home or away. 9.4"w x 3.7"h x 9.6"d, 12 lbs. (FT-840, $579.99)

Self-contained, battery-powered, multi-mode portable waiting for any pitch from the mound, the 5W (choose from four levels) FT-817ND is designed for operation on HF, plus 6M, 2M, and 70cm. Whether you perfer SSB, CW, AM, FM, Packet, or SSB-based digital modes, it is ready to catch anything you throw its way. The 817ND gives you big-league features, such as IF shift and noise blanker, IPO, and ATT, in a little-league package. It also includes 1400mAh NiMH battery and charger, multi-function control keys, 2 antenna connectors, portable CW operation, and CTCSS/DCS. 5.3"w x 1.5"h x 6.5"d, 2.6 lbs. (FT-817ND, $629.99)

Hitting a grand slam in FM mobile design is the 29/50/144/440MHz FT-8900R. It has no peer among mobiles. This quad bander offers leading edge features like VHF/UHF full duplex, cross band repeat, independent operation on two bands, and six "Hyper Memory" keys to store complete configuration settings. The 8900R also provides 50W (35 on 440MHz), access to internet linking systems, over 800 memory channels, CTCSS/DCS,versatile scanning, cross-band repeat capability, ARTS™, and built-in duplexer. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs. (FT-8900R, $419.99)

The hard-hitting sibling of the 8900R, the FT-8800R 144/430MHz 50/35W mobile, offers simultaneous monitoring of one band while operating the other. Besides extended receive, the 8800R provides 1000 memory channels, cross-band repeat, versatile scanning and CTCSS/DCS. Looks run in the family (similar to the 8900R above). 5.5"w x 1.6"h x 6.6"d, 2.2 lbs. (FT-8800R, $369.99)

Get "back to basics" with the FT-7800R FM, 144/430MHz mobile and delete the egos from the team equation. This rig boasts 50 and 40 Watts 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. (FT-7800R, $279.99)

Cool and quiet play is what you get when you draft the FT-2800M. The most rugged 2M transceiver ever provides 65/25/10/5W with an extensive 221 memories, alphanumerics and CTCSS/DCS. No lip, just great game. The 2800M also features NOAA with weather alert, WIRES™ internet linking access, SmartSearch™, and excellent receive performance. With a bullet-proof front end and direct keypad entry, it's a dream come true for the frustrated coach. 6.3"w x 2"h x 7.3"d, 4 lbs. (FT-2800M, $159.99)

Setting water resistance standards, the VX-5R and 5RS play rain or shine. Offering 5W (4.5W/430MHz), the 5R/5RS cover 50/144/430MHz while providing short to microwave reception. Great for outdoors with optional barometric pressure unit. They also provide high-capacity play with extensive battery conservation and lith-ion battery pack, dual watch, Spectra-Scope™, 220 alphanumeric memories, and Smart Search™. Black or silver uniforms for home or away play. 2.3"w x 3.4"h x 1.1"d, 8.9 oz. (VX-5R/VX-5RS, $219.99)

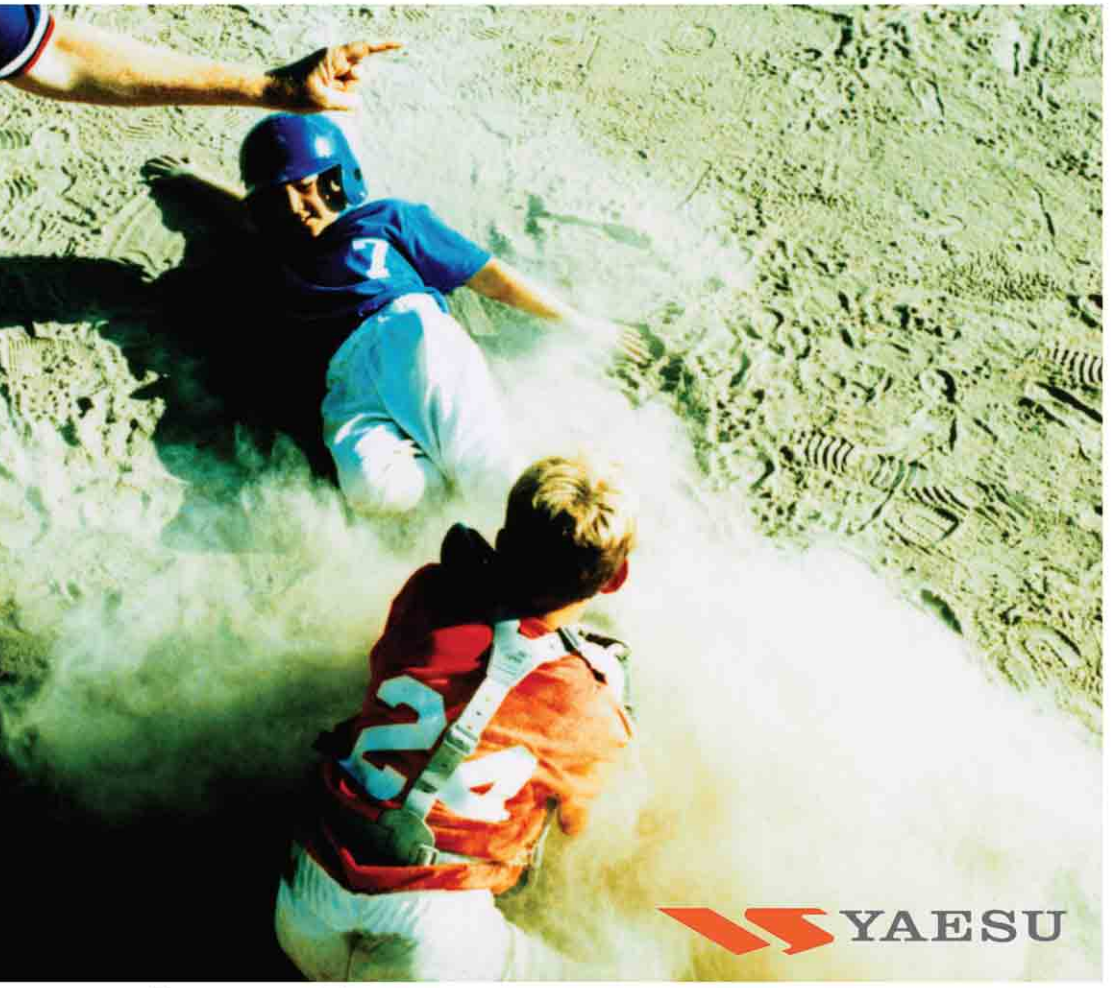
The first submersible amateur HTs, VX-7R and VX-7RB, are ready for game day even in a downpour. (left) Water protected, the 50/144/430MHz, 5W 7R/7RB are rated for 30 minutes of submersion at up to a 3 foot depth. Magnesium bodies make them ideal for outdoors, in catching position. So tough no one makes it to home plate. They both include dual/wide-band receive, status strobe, 450 main (plus 10 one-touch, 10 weather) memories, optional barometric pressure unit, long battery life from a lith-ion, Spectrum Scope™, and WIRES™ internet linking key. Silver or black uniforms for home or away games. 2.4"w x 3.5"h x 1.1"d, 9.2 oz. (VX-7R/VX-7RB, $309.99)

Smallest HT dualband, the VX-2R fits perfectly in any corner of the playing field! (right) This 1.5/1W dualband (144/440MHz) offers VHF, UHF, shortwave, marine and aircraft bands, and 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 1300 memories (20 groups), CTCSS/DCS encode/decode and auto repeater shift. So user-friendly, even the coach has nothing to scream about. 1.9"w x 3.2"h x 0.9"d, 4.6 oz. (VX-2R, $179.99)

Commercial-grade, military spec, the FT-50RD/41B is bulked up for powerful play. (below left) It's rugged, reasonably priced, and simple to operate, taking the headache out of coaching a first rate team. Boasting 5W, the 50RD covers 144 and 430MHz while also offering the "widest" band receive allowable. Perfect for outdoor activities. Built with 112 memory channels, DCS/CTCSS encode, high-speed scanning, alphanumeric display, dual watch, digital voice record, battery savers, PTT thumb switch, and ARTS™. 2.2"w x 3.9"h x 1.2"d, 11.5 oz. (FT-50RD/41B, Closeout $209.99)

Designed to perform under the most difficult conditions, the VX-150 won't choke when you're down by three in the 9th inning. This 2M 5W HT (pictured at the far left) provides exceptional receiver performance with clean, clear transmit. Built to withstand outdoor use, the 150 is also outfitted with commercial-grade speaker and Omni-Glow™ keypad. It also offers 209 alphanumeric memory channels, direct keypad frequency entry, 2 user-definable function keys, automatic repeater shift, 9 DTMF auto-dial memories, ARTS™, battery savers and Smart Search™. 4.3"h x 2.3"w x 1"d, 11.5 oz. (VX-150, $119.99)

Power out of the pocket, the VX-1R is a veteran in throwing for speed. This 500mW dualband (144/430MHz) HT is in its last season, but still performs in the field with wide receiver coverage. The 1R offers 291 memories, ARTS™, internal speaker, SmartSearch™, and dual watch. It provides one-touch emergency, built-in CTCSS/DCS and 11+ hours use on a single charge. 1.9"w x 3.2"h x 1"d, 4 oz. (VX-1R, Closeout $129.99)



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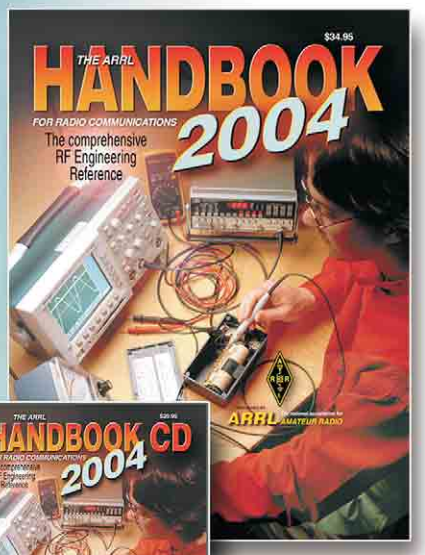

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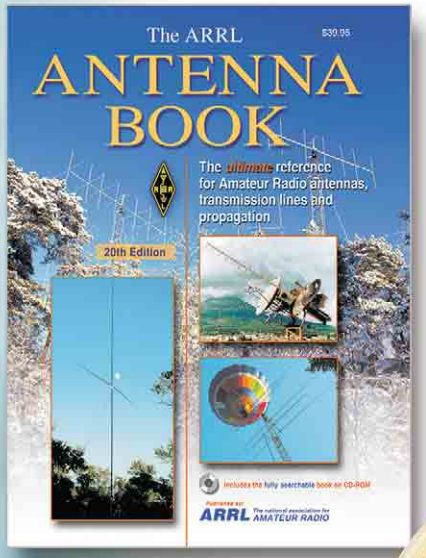

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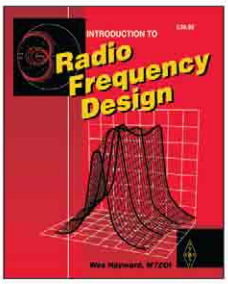

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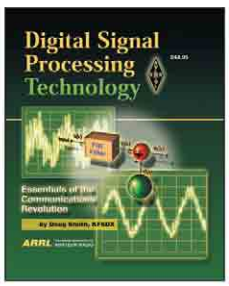

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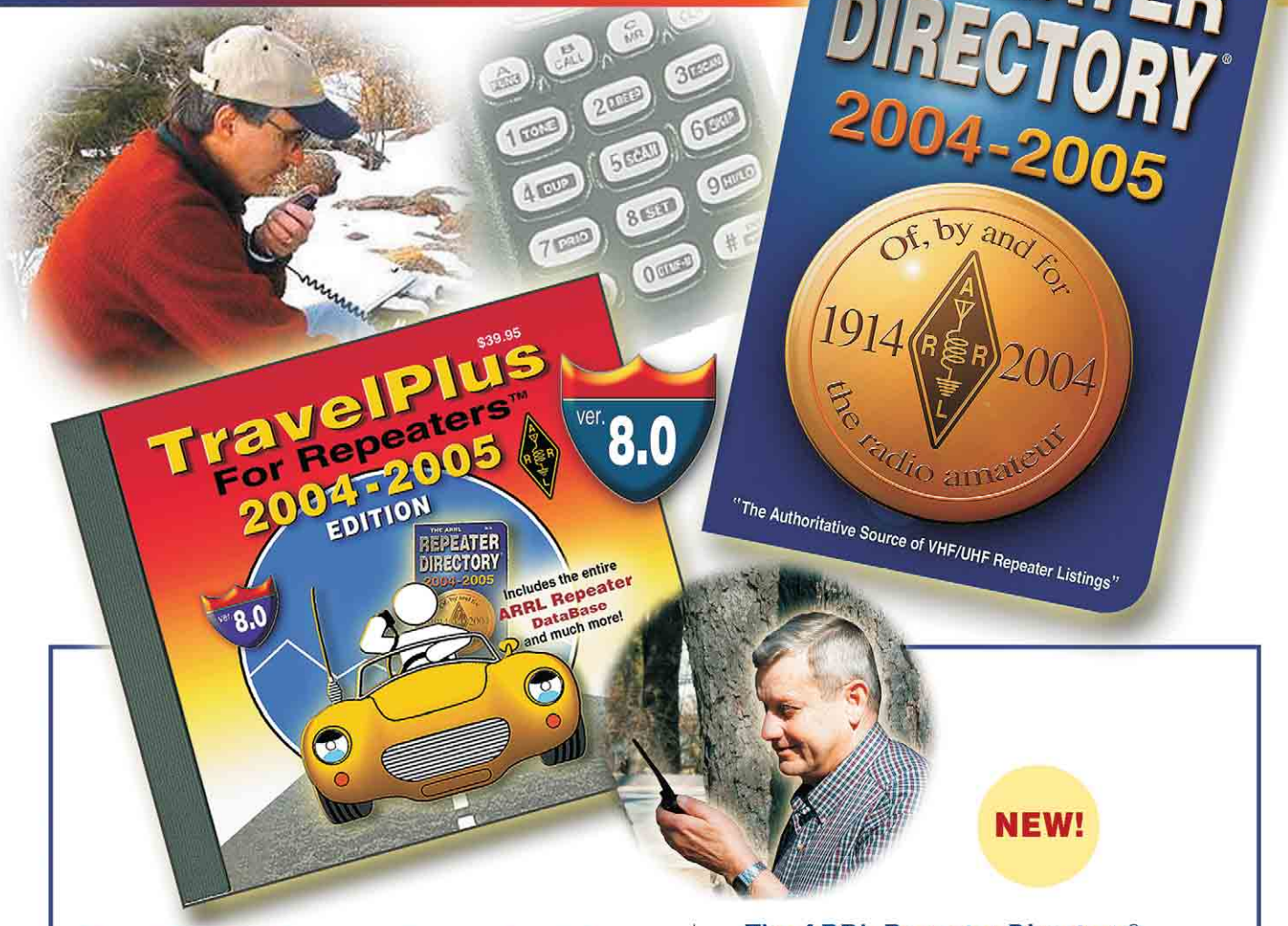

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Every HFT-1500 aluminum cabinet is carefully crafted with a super durable paint that won't scratch or chip.

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 variable capacitors and a massive roller inductor gives 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, longwires, 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.

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- 35-question Technician test (Element 2)
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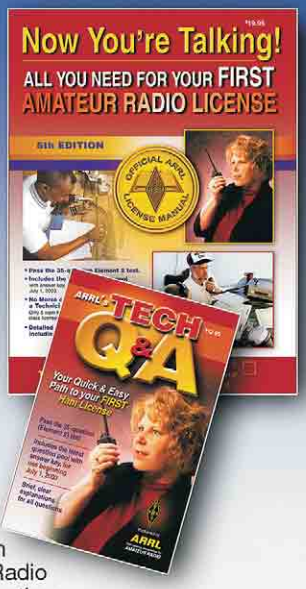

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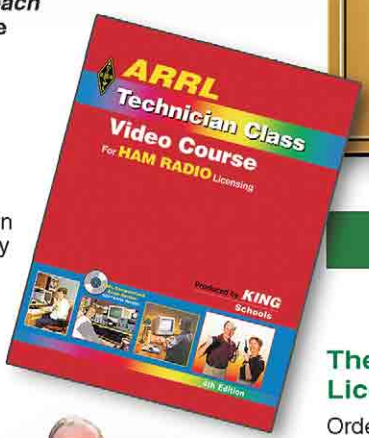

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- 35-question General test (Element 3)
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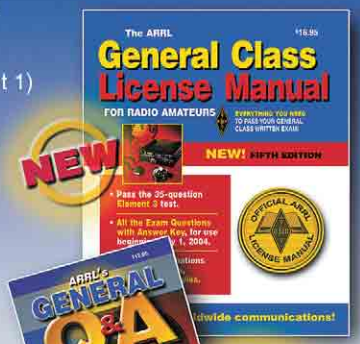

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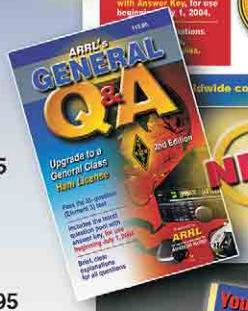

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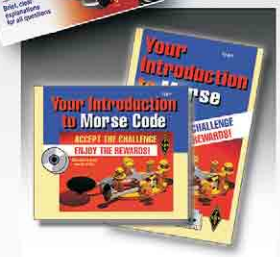

Pass the 5 WPM Code Test!

Ham University

Quiz yourself using this feature-packed easy-to-use software (for *Microsoft Windows 95-XP*).

Technician Edition.
Order No. 8956 ..... **$24.95**

Complete Edition (Tech, Gen, Extra, and Morse code).
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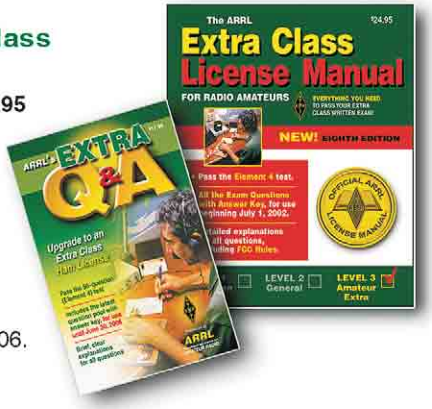
LEVEL 3 – EXTRA

Upgrade from General

- 50-question Extra test (Element 4)



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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.

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MFJ . . . the World Leader in Ham Radio Accessories!

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.

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MFJ Dummy Load/Wattmeter

1.5 kW Dry Dummy Load has built-in precision, true peak-reading SWR/Wattmeter switchable to external antenna!

MFJ-267
$149.95

World's most versatile 1.5 kW dummy load has a *built-in* true peak reading SWR/Wattmeter that you can switch and use independently!

You'll find tons of uses!

Tune up your transceiver, linear amplifier or antenna tuner into a safe 50 Ohm dummy load at *full power*. Then instantly switch to your antenna and monitor SWR, forward and reflected power.

Use for testing/tuning transmitters, transceivers, amplifiers, antenna tuners, baluns, transformers, filters, matching networks, coax, stubs, transmission lines and antennas.

The 50-Ohm dry dummy load works DC to 60 MHz. SWR is below 1.3:1 at 30 MHz. Can handle 100 Watts for ten minutes or 1500 Watts for ten seconds. Comes with power derating curve.

Extra-large three-inch lighted Cross-Needle meter reads SWR (1:1 to 8:1), forward and reflected power *simultaneously*.

Reads *true peak* PEP or average power on 300/3000 Watts forward and 60/600 Watts reflected power ranges 1.8-54 MHz.

High accuracy comes from a carefully designed directional coupler, an accurate active-peak reading circuit and a precision d'Arsonval meter movement.

RF tight perforated aluminum cabinet. 4½Wx3½Hx10½D inches. Uses 12 VDC or 120 VAC with MFJ-1312D, $14.95.

Find Power Line Noise Fast!

MFJ-852
$99.95

Walk or drive around with this *handheld power line noise meter* to search out leaky insulators, loose hardware and corroded ground lines quickly. Track noise source right down to the pole, transformer or insulator. Sensitive .3 uV, 135 MHz superhet AM receiver has 70 dB range noise field-strength meter. Telescopic, direction-finding dipole is optimized and balun-isolated to give sharp, clearly defined null. Plug in headphones or tape recorder.

Field Strength Meters

MFJ-802
$39.95

Shows radiated antenna relative field strength. Determine radiation pattern. **MFJ-802** has huge 3 inch meter. Telescoping dipole reduces influence of surrounding objects and is more reliable, repeatable than monopole. Sensitivity control. Jack for remote sensor, MFJ-802R, $24.95.

MFJ-801
$19.95

MFJ-801 has 1¼ inch meter, sensitivity control, 20 inch extended telescoping monopole antenna.

81 dB Step Attenuator

MFJ-762
$69.95

81 dB Attenuator in 1 dB steps. 50 Ohms. Usable to 500 MHz. 250 milliwatt maximum input. BNC connectors. Shielded stages. Connect between receiver and antenna and use S-meter as a precision calibrated field strength meter. Prevent receiver blocking, cross-modulation. Determine gain/loss, ideal for fox hunting. Evaluate linearity. Isolate circuits. Extend range of sensitive equipment. Measure input/output level differences.

MFJ Frequency Counters

MFJ-886
$119.95

MFJ-886 covers 1 MHz to 3 GHz with 300 MHz direct count, 0.1 Hz resolution. 4 gate times. 10-digit high-contrast 3/4 inch LCD display. Lock display button. Bargraph shows RF field strength. Includes rechargeable Ni-Cad batteries, charger, telescopic antenna. Black anodized aluminum. 2¾x2¼x1¼ in.

MFJ-888
$184.95

MFJ-888, like MFJ-886, but covers *10 Hz*-3 GHz. Measures frequency/period, has 50/1M Ohm input, auto hold, LED backlight, beeper. 2¾x4¼x1¼ in.

MFJ Wireless Weather Station . . . $59.95!

MFJ-192
$59.95
New!

Display *Remote Sensor*

You're ragchewing with a G3 in England . . . *"Temperature outside is a cool 53 degrees with falling barometric pressure -- looks like a rainstorm may be coming. Humidity here is 73%."* . . . while noticing it's 1900 hours GMT.

This informative MFJ Wireless Weather Station receives and displays outside temperatures from up to 3 remotes every 30 seconds up to 100 feet away.

You'll get barometric pressure trends, weather forecasting, severe storm detection with visual and audible alarms -- great for severe weather nets.

You can read inside and outside F/C degrees, relative humidity, forecast icons, pressure trend, hour, minutes, seconds, day, date and month *simultaneously*.

Has upper/lower temperature limit alarms, backlight. Read time in two zones -- local and GMT or other -- in 12/24 hour format.

Display (4x7x1") uses 2 AA, remote (2¼x3½x1") uses 2 AAA batteries, not included. *Includes one remote*, extra **MFJ-192S** remotes are $19.95 each.

MFJ CW Reader/Keyer

MFJ-464
$179.95
(Keyboard, paddle not included.)

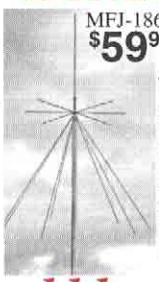
Plug MFJ's CW Reader with *built-in* Keyer into your transceiver's phone jack and key jack. Now you're ready to compete with the world's best hi-speed CW operators -- and *they won't even know you just passed the code test!* Sends and reads 5-99 WPM. Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use paddle or computer keyboard. Easy menu operation. Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

MFJ Atomic Wrist Watch

MFJ-186RC
$29.95

Receives atomic time signal WWVB and sets your watch automatically -- always accurate to milliseconds. Select 12/24 hour format and pacific, mountain, central, eastern time zones. Displays hour, minutes, seconds, day and date. Displays year, month and day in calendar mode. Alarm, stopwatch functions. Brilliant blue backlight. Water-resistant.

25-1300 MHz Discone Antenna



MFJ-1868
$59.95

Ultra wide-band antenna receives 25-1300 MHz. Perfect for scanners. Transmit 50-1300 MHz. Handles 200 Watts. Ideal for 6/2/1¼ Meters, 70/33/23 CM ham bands. Excellent for testing various transmitters on single coax. SO-239, 50 feet coax, stainless steel elements.

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Sign up my family members, residing at the same address, as ARRL members too! They'll each pay only $8 for a year's membership, have access to ARRL benefits and services (except QST) and also receive a membership card.

Family Member Name _____ Call Sign (if any) _____

Family Member Name _____ Call Sign (if any) _____

❑ Sign up _____ family members @ $8 each = $ _____ .

❑ Total amount enclosed, payable to ARRL $ _____ .

❑ Enclosed is $ _____ ($1.00 minimum) as a donation to the Legal Research and Resource Fund.

❑ Charge to: ❑ VISA ❑ MasterCard ❑ Amex ❑ Discover

Card Number _____ Expiration Date _____

Cardholder's Signature _____

❑ If you do not want your name and address made available for non-ARRL related mailings, please check here.

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- ❑ **Age 65 or older rate, $36 in US.**
- ❑ **Age 21 or younger rate, $20 in US** (see note*).
- ❑ **Canada $49.**
- ❑ **Elsewhere $62.**

Please indicate date of birth _____ .

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[1] 1-year membership dues include $15 for a 1-year subscription to QST. International 1-year rates include a $10 surcharge for surface delivery to Canada and a $23 surcharge for air delivery to other countries.

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QST 7/2004

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 unit *(at our option)* for 1 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.

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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 in.

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.

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MFJ-906/903 6 Meter Tuners

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MFJ-921 or MFJ-924 **$69.95**

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

MFJ-922 144/440 MHz Tuner

MFJ-922 **$79.95**

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

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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.

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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!

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Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

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Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

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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!

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Take the guesswork out of building and adjusting matching networks and baluns.

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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**

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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?

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More MFJ SWR Analyzers™

MFJ-249B, $229.95. Like MFJ-259B, but reads SWR, true impedance magnitude and frequency only on LCD. No meters.

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MFJ-219B, $99.95. UHF ***SWR Analyzer***™ covers 420-450 MHz. Jack for external frequency counter. 7½x2½ x2¼ inches. Use two 9 volt batteries or 110 VAC with MFJ-1312D, $14.95. *Free* "N" to SO-239 adapter.

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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.

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

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

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

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$74.95
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New!
MFJ-1117
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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.

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Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

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Full size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

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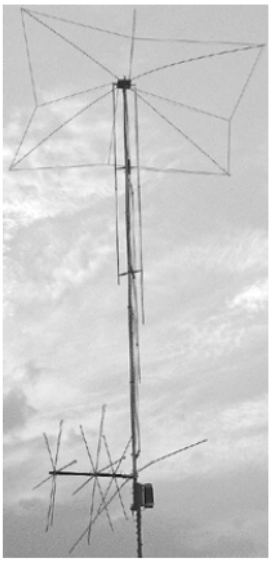
It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.



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Ship Code F

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Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. *In phase* antenna current flows in all parallel radiators.

This forms a very large equivalent radiator and gives you incredible bandwidths.

Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

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On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands.

Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

No Ground or Radials Needed

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation.

You can mount it from ground level to roof top and get awesome performance.

No Feedline Radiation to Waste Power

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

Built to Last

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ's Super High-Q Loop™ Antennas

MFJ-1786
$379.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes.

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Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

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MFJ Portable Antenna

MFJ-1621 **$89.95**

MFJ-1621 lets you operate in most any electrically free area -- apartment, campsite, hotel, the beach, etc. DXCC, WAZ, WAC, WAS have been won with MFJ-1621! Work 40, 30, 20, 17, 15, 12 and 10 Meters with a telescopic whip that extends to 54 inches. Mounted on a sturdy 6x3x6 inch cabinet. Built-in antenna tuner, field strength meter, and 50 feet of RG-58 coax cable. Handles 200 Watts.

MFJ's G5RV Antenna

$39.95
MFJ-1778

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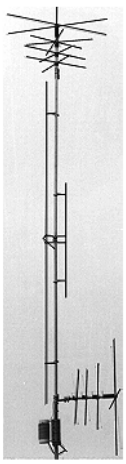
MFJ halfwave vertical

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed



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Efficient end-loading, no lossy traps. Entire length is always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting 1 band has minimum effect on others.

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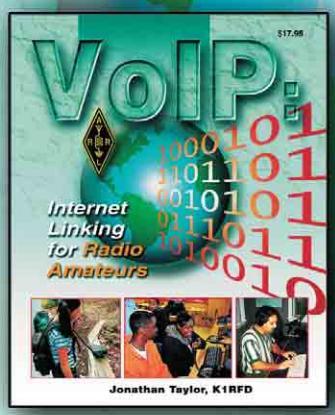

by Jonathan Taylor, K1RFD

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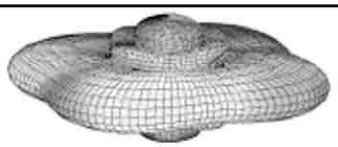

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The Icom IC-746PRO is an all mode HF/6m/2m XCVR with 32-bit IF level DSP. The radio features a built-in auto tuner, built-in RTTY demodulator and decoder (reads out on the radio's LCD display), auto notch, digital twin PBT, and more. Supplied hand 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 automatic antenna tuner, digital signal processing, 200 Watts RF output, and more! With external AC power supply.

FT-1000MP-V Field..... Special!
Lower power (100W) version of the FT-1000MP-V, with built-in power supply.

Quadra System..... In Stock!
Solid state, no tune linear amplifier, offers 1000 Watts RF output on 160-15m (easy user mod adds 10/12m operation) and 500 Watts RF output on 6m.

FT-897D..... 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-857D..... 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.

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